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**ABSTRACT**

In the evolution of nanotechnology, manufactured nanomaterials are an important step towards a long-term vision of building objects atom-by-atom and molecule-by-molecule with processes such as self-assembly or molecular assemblers. Innovations in analytical and imaging technologies first paved the way for perceiving, measuring, and manipulating nanoscale objects, typically defined as those having a characteristic dimension <100 nm. The ability to design materials at the nanoscale is now leading to the rapid development of an industry that provides nanomaterials for a range of industrial and consumer products. Commercial applications of nanomaterials currently available or soon to appear. The rapid progress in development and use of nanomaterials is not yet matched by toxicological investigations. Epidemiological studies implicate the ultrafine (nanosized) fraction of particulate air pollution in the exacerbation of cardiorespiratory disease and increased morbidity. Experimental animal studies suggest that the increased concentration of nanoparticles and higher reactive surface area per unit mass, alongside unique chemistry and functionality, is important in the acute inflammatory and chronic response. Some animal models have shown that nanoparticles which are deposited in one organ (e.g. lung and gut) may access the vasculature and target other organs (e.g. brain and liver). The exact relationship between the physicochemistry of a nanoparticle, its cellular reactivity, and its biological and systemic consequences cannot be predicted. It is important to understand such relationships to enjoy the benefits of nanotechnology without being exposed to the hazards.

**Keywords:** Nanomaterials, hazards, toxicity, waste management, Fullerenes, physiochemistry

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**1. INTRODUCTION**

Nanotechnology has grown up as a broad interdisciplinary field of research. Specialized research disciplines, such as nanooptics, nanobiotechnology, nanomedicine, nanoelectronics, and nanomaterials research, have been established. Nanomaterials can be found in many products for everyday use, from sun cream to toothpaste with a repair effect, to wall paint which repels dirt, and to new materials for medical implants. This is no surprise, as nanomaterials have unusual properties and allow completely new applications to be found. But, responsible use of a technology with a promise for the future should be taken care by looking at the other end about potential health hazards stemming from these new technologies. “Nano” has become a buzz word which, stems from the Greek nanos, i.e. dwarf. Consequently, a nanometer is a tiny fraction of a meter or, more precisely: one billionth of a meter. All particles with at least one outer dimension, i.e. length, width or height, between 1 and 100 nanometers are referred to as nano-objects in the jargon of the field. “Nano” was nothing new. Long before the specific industrial production of nanoparticles, people made and even used such tiny particles. In one of its most important steps, the development of classical photographs is based on the formation of silver nanoparticles. Slash-and-burn techniques and transport give rise to soot nanoparticles. Nanoparticles are not exclusively manmade but also occur in nature. For instance, forest fires and the recurring fires of the savannah every year emit soot nanoparticles much like manmade combustion processes.

**1.1 Nanomaterials**

Engineered nanomaterials are materials designed at the molecular (nanometre) level to take advantage of their small size and novel properties which are generally not seen in their conventional, bulk counterparts. The two main reasons why materials at the nano scale can have different properties are increased relative surface area and new quantum effects. Nanomaterials have a much greater surface area to volume ratio than their conventional forms, which can lead to greater chemical reactivity and affect their strength. Also at the nano scale, quantum effects can become much more important in determining the materials properties and characteristics, leading to novel optical, electrical and magnetic behaviours. Nanomaterials have extremely
small size as their defining characteristic. The current working definition of nanomaterials is a material having at least one dimension 100 nanometres or less. Nanomaterials can be nanoscale in one dimension (e.g., surface films), two dimensions (e.g., strands or fibres), or three dimensions (e.g., particles). They can exist in single, fused, aggregated or agglomerated forms with spherical, tubular, and irregular shapes. Common types of nanomaterials include nanotubes, dendrimers, quantum dots and fullerenes.

1.2 Classification of nanomaterials
Nanoparticles are classified based on their morphology and the main categories to date include the following: [1]

1.2.1 Fullerenes
Discovered in the 1980s [2], these are comprised entirely of carbon and take the form of hollow spheres or tubes as shown in figure 1. These are similar in structure to graphite, forming a sheet of hexagonal carbon rings, but also contain pentagonal and heptagonal rings that allow the formation of three-dimensional structures. The smallest fullerene, a 60 carbon molecule termed buckminsterfullerene (familiarly referred to as “buckyballs”), is the most familiar and recognizable form of NP addressed in common and scientific literature. Fullerenes are produced naturally in small amounts through burning of carbon-containing fuels and can be manufactured in commercial quantities through arching and combustion of graphite, coal, and various other hydrocarbons.

1.2.2 Nanotubes
This class of NP is actually comprised of fullerene-like (carbon) particles that are elongated to form tubular structures having a diameter of 1 to 2 nanometers. Carbon nanotubes (Figure 2) have significant tensile strength, strength equaling or exceeding 100 times that of steel have been reported [3]. In addition to great tensile strength, nanotubes also have the advantage of much lower weight in comparison to steel and most other commonly used structural materials: Other highly useful properties exhibited by nanotubes includes capacity for high conductivity, high molecular absorption, and other unique electrical properties.

1.2.3 Nanowires
These are essentially tiny interconnecting wires (Figure 3) of a single crystalline structure that are constructed using approaches similar to semiconductor fabrication – template disposition.
1.2.4 Quantum dots
Sometimes referred to as artificial atoms, quantum dots are assemblies of materials between two to ten nanometers. They can be composed of metals, metal oxides, or semiconductor materials and typically exhibit unconventional electronic, magnetic, optical, or catalytic properties. These are constructed through chemical-colloidal disposition: a growth process that can be tuned to alter the structure’s final characteristics. These particles as shown in figure 4 are termed “quantum dots” because their final size (alone) can control their physical properties; irradiated fluorescent quantum dots for example, will emit different wavelengths of light depending on particle size.

2. APPLICATIONS OF NANOMATERIALS
Nanoparticles are already seeing application, taking advantage primarily of the high surface area of these fine powders. Nanoceramic powders, the most commercially important of which are simple metal oxides, constitute almost 90% of the total market. For example, nano-sized zinc oxide particles are in use in sunscreen. Nanostructured ceramic coatings are adding durability and toughness to hulls of U.S. Navy ships. Metal powders are important, as well. Iron nanoparticles have been used to treat groundwater contaminated with trichloroethylene while aluminium nanoparticles have been developed that, due to their increased surface area, have substantially greater “bang for the buck” as solid rocket propellant. Incremental nanomaterials also include polymer nanocomposites in which clay nanoparticles are incorporated to increase the hardness and reduce the permeability of the polymer. These have seen application in automotive panels and step assists in vans. Other examples of these types of applications are nanoparticles in tennis balls and carbon nanotubes in tennis racquets.

3. HAZARDS TO HUMAN HEALTH AND ENVIRONMENT
• The same properties that nanomaterials are designed to exhibit are also properties that may cause nanomaterials to present human health and environmental hazards. For example, with decreasing particle size, the surface area to mass ratio becomes greater. This means that there are potentially more atoms on the surface area to react with the environment and other substances. High reactivity is a desired property for many intended applications of nanomaterials, such as catalysts, however, this increased reactivity can lead to greater toxicity for cells and living organisms. The physicochemical properties of nanomaterials are determined by the chemical composition, surface structure (including surface coatings), small size and associated increase in surface to volume ratio, solubility, shape and aggregation.
• The influences of physicochemical properties on the toxicological and eco-toxicological profile of nanomaterials are not yet fully understood. Changes in physicochemical properties can also increase the potential for some nanomaterials to exhibit fire and/or explosion hazards or catalytic activity.
Concerns have been raised about potential health and environmental impacts of nanomaterials. This is principally because of their small size and novel properties and because research in experimental animals and in vitro systems on some nanomaterials has indicated potential environmental and health effects. Almost all concerns have related to free, rather than fixed nanomaterials. There has been little research into the potential hazards (health, safety and environmental effects) of these materials, their exposure, fate or persistence or the risks to people or the environment exposed to them. Due to this lack of information, there are many uncertainties as to whether nanomaterials pose or are likely to pose health and environmental risks. However, the body of data is increasing, as more organisations research the health and environmental aspects of nanomaterials.

Releases may come from point sources, such as factories or landfills, and from nonpoint sources, such as wet deposition from the atmosphere, storm-water runoff, and attrition from products containing nanomaterials. Biochemical cycling of nanomaterials may involve photochemical reactions in the atmosphere; aggregation; or uptake, accumulation, transformation, and degradation in organisms. Long-range atmospheric transport, as well as transport in saturated and unsaturated regions in the subsurface, are possible. Nanomaterials in groundwater and surface water used for drinking water will be subject to conventional treatment methods, such as flocculation, sedimentation, and sand or membrane filtration. Air filters and respirators will be used to remove nanomaterials from air. Human exposure to nanomaterials is most likely during nanomaterial manufacturing, but inhalation of nanomaterials released to the atmosphere and ingestion of drinking water or food (e.g., fish) that have accumulated nanoparticles may also be possible. Dermal exposure from sunscreens and cosmetics is also likely. However, the observed effects on human are dependent on the route of exposure and the particular nanoparticle to which the individual has been exposed. The following observations have been recorded following chronic exposure to nanoparticles.

### 3.1 Carcinogenicity
Carcinogenicity data on nanoparticles is limited. Studies have shown that certain nanoparticles cause lung tumor development in experimental animals following a lung particle overload [4, 5]. In particular, carbon nanotubes (CNTs) exhibit a direct relationship between length and particle deposition and their effects on lung irritation, chronic lung inflammations, exacerbation of asthma, and the formation of granulomas consisting of macrophage-like multinucleated cells [6, 7].

### 3.2 Genotoxicity
Radicals may form on the surface of some nanoparticles that may have toxicological consequences resulting in the formation of reactive oxygen species [8]. Reactive oxygen species have been shown to interact with DNA [9] resulting in DNA damage that causes fibrosis and lung cancer [8]. In addition, molecular components of the nanoparticles are likely to have aromatic ring systems which have the size and shape to interact with DNA, and thus have potential to promote DNA damage or cancer [10]. Many of the genotoxic effects associated with nanoparticles may be directly related to the characteristics of the nanoparticle surface: functionality, charge, and induced charge [11]. Theses characteristics create unique properties that may result in genotoxic interactions.

### 3.3 Cytotoxicity
Cytotoxicity depends upon the geometric shapes of the carbon nanomaterial [12]. Carbon nanotubes (CNTs) have been studied for their cytotoxic properties and have been shown to cause a time- and dose-dependent relationship resulting in apoptosis of various human cell lines [13]. The CNTs are thought to cause cellular toxicity by a non-specific association with hydrophobic regions of the cell surface and internalization by endocytosis, and accumulation in the cytoplasm of the cell. DNA then wraps around the CNTs resulting in cell death.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Nanomaterial</th>
<th>Effects Observed</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fullerene C60 water suspension</td>
<td>Antibacterial; cytotoxic to human cell lines; taken up by human keratinocytes; stabilizes proteins</td>
<td>14, 15</td>
</tr>
<tr>
<td>2</td>
<td>C60 encapsulated in poly(vinylpyrrolidone), cyclodextrins, or poly(ethylene glycol)</td>
<td>Damages eukaryotic cell lines; antibacterial</td>
<td>16, 17</td>
</tr>
<tr>
<td>3</td>
<td>Carboxyfullerene (malonic acid derivatives)</td>
<td>Bactericidal for Gram-positive bacteria; cytotoxic to human cell lines</td>
<td>18, 19</td>
</tr>
<tr>
<td>4</td>
<td>Fullerene derivatives with pyrrolidine groups</td>
<td>Antibacterial; inhibits cancer cell proliferation; cleave plasmid DNA</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Silicon dioxide (SiO2)</td>
<td>Pulmonary inflammation in rats</td>
<td>21</td>
</tr>
<tr>
<td>6</td>
<td>Anatase (TiO2)</td>
<td>Antibacterial; pulmonary inflammation in rodents</td>
<td>7, 22</td>
</tr>
<tr>
<td>7</td>
<td>Zinc oxide (ZnO)</td>
<td>Pulmonary effects in animals and humans</td>
<td>23, 24</td>
</tr>
</tbody>
</table>

**Table 1: Cytotoxicity studies of selected nanomaterials**
3.4 Toxicity
There is limited toxicological data in relation to nanoparticles. Most of the experimental work has involved a limited set of more common NPs, such as carbon black, titanium dioxide, iron oxide, and amorphous silica. Inhaled nanoparticles have the potential to aggravate existing respiratory condition, such as asthma or bronchitis [25], and cause lung inflammation or tumors [6]. Inhaled nanoparticles have been show to translocate from the lungs toward other organs within 24 hours after exposure. Specific consequences of the translocation are largely unknown. However, preliminary results indicated that affected organ systems may show inflammation, altered heart rate and functions, and oxidative stress [26]. Ingested nanoparticles may be absorbed through the intestinal lining and translocate into the blood stream where they undergo first pass metabolism in the liver. Again, the effects of this translocation are largely unknown. Dermal uptake is limited and does not appear to produce systemic effects [6].

4. SAFE WORK METHODS
Much of the toxicology of nanomaterials is currently uncertain or unknown. Some nanosized particles are more toxic than their respective micron sized material due to increased surface area and reactivity. There is a convergence of ideas regarding what are interim best practices until more is known about the hazards of nanomaterials. This document summarizes recommended practices so that laboratories can choose the practices appropriate for the materials worked with in their labs. Different levels of controls may be needed for different categories of nanomaterials and the likelihood that they can be dispersed during use. The stringency of the controls should match the potential for exposure. For example, the stringency of controls would be different for the following physical states of nanomaterials (from least to most control): solid materials with embedded nanostructures, solid materials with nanostructures bound to the surface, liquid suspensions of nanoparticles, free nanoparticles (dry, dispersible single particles or agglomerates).

The following are the best practices currently being recommended by a number of universities:

4.1 Know the existing toxicity information available for your nanomaterial
Be aware that many MSDSs currently shipped with nanomaterials refer to the bulk material toxicity information, which is inappropriate for the nanomaterial. If no information is available for your materials or the toxicity information is limited or uncertain, handle the material as if it is toxic. The best place to keep up to date is the International Council on Nanomaterials (ICON) database which collects toxicity and environmental information by nanoparticle type. Searches can be run on a specific nanomaterial for a particular time period, so only the most recent references are searched. You can also search Pub Med but the search results will be much broader than ICON.

4.2 Preplan the experiments and determine equipment and procedures needed
To factor in all the items discussed below. These include equipment and procedures to prevent inhalation, skin or ingestion exposures, to prevent laboratory contamination, and to properly dispose of all nanomaterial waste. Have appropriate spill materials on hand before beginning your work. Equipment setup may require additional exhaust ventilation and installation or the use of respirators.

4.3 Prevent Inhalation Exposure during All Handling of Nanomaterials
All free particulate nanomaterials should be worked with in exhausted enclosures which may include fume hoods, glove boxes, Class II Type A2, B1 or B2 biosafety cabinets, reactors and furnaces. Procedures involving manipulation of nanomaterials as free particles should be carefully conducted so that no release into the laboratory air occurs. Manipulation of free nanoparticulate on the lab bench should be avoided. Work with suspensions of nanoparticles that are subjected to processes that generate aerosols should be performed in exhausted enclosures.

4.3.1 Fume Hoods
When using a fume hood to contain dust or aerosols of nanomaterials, follow good fume hood use practices such as working 6” back from sash, working with sash below the chin, removing arms slowly from hoods to prevent dragging out contaminants, and not blocking the lower back slot with equipment. See your Chemical Hygiene Plan for a complete discussion of working with fume hoods.

4.3.2 Ventilation for furnaces and reactors
Should be provided to exhaust gasses generated by this equipment. If possible, the exhaust gasses should be run through a liquid filled bubbler to catch particulate before it enters the building ventilation system. Parts removed from reactors or furnaces for cleaning that may be contaminated with nanomaterial residue should be repaired or cleaned in a fume hood or other type of exhausted enclosure.
4.3.3 Ventilation for large equipment or engineering processes
Equipment that is too large to be enclosed in a fume hood can be set up such that specially designed local exhaust ventilation can capture contaminants at points where emission is possible. Also custom enclosures can also be designed by local vendors to contain potential emissions.

4.3.4 Nanomaterial Transport in the Lab
Nanomaterials removed from furnaces, reactors, or other enclosures should be put in sealed containers for transport to other locations. If nanomaterial product from a reactor is bound or adhered to a substrate, the substrate may be removed and put in a transport container. If the nanomaterials product is unbound and easily dispersible (such as in CNT synthesis using aerosolized catalyst), the removal from a reactor should be done with supplementary exhaust ventilation or a glove bag connected to a HEPA vacuum.

4.3.5 Prevent Dermal Exposure to Nanomaterials
The ability of nanoparticles to penetrate the skin is uncertain at this point, so gloves should be worn when handling particulate and suspensions containing particulate. If working with dry particulate, a sturdy glove with good integrity should be used. If the nanoparticulate is in suspension, a glove having good resistance to the solvent should be used. Nanoparticles suspended in liquid may be more easily absorbed through the skin and represent more of an exposure hazard, so choose gloves appropriate to the solvent. Disposable nitrile gloves commonly used in many labs would provide good protection from nanoparticles for most procedures that do not involve extensive skin contact. Two pairs of gloves can be worn if extensive skin contact is anticipated. Gloves with gauntlets or extended sleeve nitrile gloves are useful in preventing contamination of lab coats or clothing. Change gloves routinely when using nanomaterials or if contamination is suspected. Keep contaminated gloves in plastic bags or sealed containers in your Waste Satellite Accumulation Area until disposal. Wash hands and forearms thoroughly after handling nanomaterials. If contamination of clothing is a concern, use disposable labcoats and dispose of through hazardous waste pickup.

4.3.6 Use Eye Protection
Wear eye protection appropriate to the experimental conditions (for example, safety glasses, goggles, or face shields). Safety glasses or face shields alone cannot protect against aerosols released with pressure, so goggles may be necessary for some nanomaterial processes.

4.3.7 Signage and Labeling
In areas where easily dispersible nanoparticles are in use, post signs indicating the hazards, control procedures, and personal protection equipment that is required. Nanomaterial storage containers should have a designation that the material is “nanoscale” or a “nanomaterial”, such as “nanoscale titanium dioxide”.

4.3.8 Be Aware of Possible Fire and Explosion Hazards
Nanoparticulate can be anticipated to have a greater potential for explosivity than micron sized particles, because of their increased reactivity. They may also have greater catalytic potential. Fire and explosions may be expected to be of greatest concern when reactions are scaled up to pilot plant levels. Both carbonaceous and metal dusts can burn and explode if an oxidant such as air or an ignition source is present. Determination of lower flammability limits using standard test bomb protocols may be necessary before scale-up.

4.3.9 Prevent Contamination of Laboratory Surfaces
Fume hood or enclosure surfaces should be wet-wiped after each use or at the end of the day. Alternatively use of bench liners would also prevent contamination. Bench liners, if contaminated, must be disposed of as hazardous waste. Do not dry sweep or use compressed air for cleanup.

4.3.10 Spill Cleanup
Depending upon the quantity of nanomaterials in use in the lab, each lab should consider having the following items in a nanoparticle spill kit:

- barricade tape
- nitrile gloves
- disposable P100 respirators
- adsorbent material
- wipes
- sealable plastic bags
- walk-off mat (e.g. Tacki-MatTM)

Minor spills or small quantities of nanomaterial can be wiped up using wet wiping for solid material and absorbent wipes for suspensions. Larger spills can be cleaned using a vacuum cleaner specially fitted with a HEPA filter on the exhaust to prevent dispersion into lab air. A reliable model of HEPA vacuum is the Nilfisk GM80CR. A log of HEPA vacuum use should be maintained so that incompatible materials are not collected on the HEPA filter. HEPA filter change-out should be done in a fume hood.

4.4 Nanomaterial Waste Management
Universities are taking a cautious approach and handling nanomaterial waste as hazardous. The following waste management guidance applies to nanomaterial-bearing waste streams consisting of:
Pure nanomaterials (e.g., carbon nanotubes)
Items contaminated with nanomaterials (e.g., wipes/PPE)
Liquid suspensions containing nanomaterials

Solid matrixes with nanomaterials that are friable or have a nanostructure loosely attached to the surface such that they can reasonably be expected to break free or leach out when in contact with air or water, or when subjected to reasonably foreseeable mechanical forces.

The guidance does not apply to nanomaterials embedded in a solid matrix that cannot reasonably be expected to break free or leach out when they contact air or water, but would apply to dusts and fines generated when cutting or milling such materials. Nanomaterial – bearing waste streams should not be placed into the regular trash or down the drain.

4.4.1 Specific waste management guidance is as follows
Paper, wipes, PPE and other items with loose contamination are collected in a plastic bag or other sealable container stored in a laboratory hood. When the bag is full, close it, and place it into a second plastic bag or other sealable container. Label the outer bag with the hazardous waste red tag. The content section of the label must indicate that it contains nano sized particles and indicate what they are. Characterize the other hazards of the waste: currently the disposal requirements for the base materials are considered first when characterizing these materials. If the base material is toxic, such as silver or cadmium, or the carrier is a hazardous waste, such as a flammable solvent or acid, they should be identified on the red tag. Many nanoparticles may also be joined with toxic metals or chemicals. Bulk carbon is considered a flammable solid, so even carbon based nanomaterials should be collected for determination as hazardous waste characteristics.

CONCLUSION
Definitive answers on the risks posed by nanomaterials are perhaps years away and, in any event, are likely to emerge on a case-by-case basis. By comparison, growth in the nanomaterials industry is occurring rapidly. Some organizations (e.g., the National Science Foundation, the Nano Business Alliance) have estimated that, with forecast annual growth rates of 20–40%, the value of nanotechnology markets will rise to >$1 trillion by 2010. A critical challenge for the emerging nanomaterials industry is to ensure that the potential health and environmental impacts of nanomaterial fabrication are small. Although the rapid developments in these industries imply a short window of opportunity, even small adjustments to their early trajectories may produce large returns in terms of reduced impacts on human health and the environment.

Although many unknowns surround the fate of nanomaterials in the environment and their impacts, a great deal is known about the properties and effects of the materials used to produce them. For example, benzene is a feedstock in C60 production, CO is used to produce single-walled carbon nanotubes, and heavy metals are a component of QDs. Materials such as these require special handling to protect workers and avoid contamination or other legacy issues. As an instructive comparison, growth in the semiconductor industry created a series of groundwater contamination issues arising from the use of solvents and heavy metals. The toxicity of computer chips may not have been an issue, but the toxic materials used to make the chips presented important environmental risks. It is therefore appropriate to consider the risks of fabrication well before information on the risks of nanomaterials is available.

REFERENCES


ABSTRACT

In the transition period of corporate environment, companies seeking to tighten their focus on core competencies and to achieve considerable cost savings have embraced outsourcing as a strategic tool. For HR perspective, the functions are becoming increasingly complex and resource-intensive. So employers need to organize and deploy their workforces effectively if they are to be successful and meet the demands of national/international competitiveness. The challenge is to secure high levels of productivity and commitment to meet rapidly changing business, regulatory and technological circumstances, while meeting employees’ needs for fulfilling, creative and supportive working environments. As a consequence of these and other shifts in business strategy, employers are seeking greater performance and productivity improvements from their employees. The business contribution of HR management is therefore coming under the spotlight. In the light of the above discussions this paper tries to delve deep into the area of HR Outsourcing- the conceptual foundations, the broad gamut of HR outsourced services, role and relevance as a strategic business tool in cost reduction, enhancing employee effectiveness, risk protection, focus on core competencies and providing a value-based proposition to the organization. In addition to the stated benefits it also proposes to ponder as to whether to outsource or not. Further it discusses the flip side of HR Outsourcing and then steps for it. To an extent we have also analyzed the recent trends in HR Outsourcing. All in all the paper presents HR Outsourcing concepts, Analysis and challenges ahead for prospective organizations of tomorrow.

Keywords: core competencies, knowledge management, skills obsolescence, HR Outsourcing, employee effectiveness, risk protection

1. INTRODUCTION

HR OUTSOURCING

Human resources are the most critical assets of any organization, as the organization's success lies in their hands. But in order to ensure that its employees remain satisfied, the company has to have a specialized human resources department that most of the times proves to be a costly affaire. That is why most companies today, decide to outsource their human resources management functions to offshore destinations.

HR outsourcing is a process in which a company uses the services of a third party to take care of its HR functions. A company may outsource a few or all of its HR related activities to a single or combination of service providers located in offshore destinations like India, China, Philippines, etc.

In this sense the HR outsourcing service providing firms can be divided into four parts depending on the services they offer such as,

- PEOs (Professional Employer Organization),
- BPOs (Business Process Organization),
- ASPs (Application Service Providers), or
- E-Services.

In these categories the PEOs are assume full responsibility of a company's HR functions such as BPOs, ASPs and E Services provide web based HR solutions like database maintenance, HR data warehousing, records maintenance, developing and maintaining HR software's etc.

The basic services which are offered by HR outsourcing firms may include:

- Overseeing organizational structure and staffing requirements
- Recruiting, training and development
- Tracking departmental objectives, goals and strategies

*Corresponding Author
• Employee and manager training
• Benefits administration
• Employee’s orientation programs

Businesses that outsource HR basically small to midsize firms between 25 and 1,500 employees. These businesses view HR outsourcing as a strategic tool that relieves them of HR responsibilities and enables them to focus on what they do best[1].

2. OUTSOURCE OR NOT TO OUTSOURCE?

In the experts’ opinion, some Human Resources functions are administrative in nature and can be easily outsourced. But other functions are "strategic" and should be kept in house. The trick, of course, is deciding which is which. Here’s one way of analyzing the challenge [2].

<table>
<thead>
<tr>
<th>HR FUNCTIONS</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Administrative:</strong></td>
<td></td>
</tr>
<tr>
<td>Payroll</td>
<td>Cost Saving of upto 20 % through Workforce reduction.</td>
</tr>
<tr>
<td>Benefit Plan Mgt.&amp; Information System Mgt.</td>
<td>Freeing Up HR Staff to focus on Strategic Task</td>
</tr>
<tr>
<td>Employee Training</td>
<td>Service Improvement</td>
</tr>
<tr>
<td><strong>Strategic:</strong></td>
<td></td>
</tr>
<tr>
<td>Employee Recruitment</td>
<td>Use of Advanced Technology that would be difficult to develop in-house.</td>
</tr>
<tr>
<td>Compensation Planning</td>
<td>Additional Cost Savings</td>
</tr>
<tr>
<td>Performance Appraisal</td>
<td></td>
</tr>
<tr>
<td>Leadership Development</td>
<td>Solution to Hr Budget Crunches</td>
</tr>
</tbody>
</table>

**Table 1 Functions & benefits of HR outsourcing**


3. HR OUTSOURCING; DIFFERENT PERSPECTIVES

HR is certainly not the first business to be confronted with new competitors fueled by new technologies. *Clicks and Mortar (Jossey-Bass, 2001)* details discount brokerage Charles Schwab’s early recognition that technology would transform the investment business. What makes this book relevant to HR professionals is author and CEO *David Pottruck’s* dual focus on technology and people. From his perspective, technology is an essential tool in serving customers better, but it is the company’s culture—delivered through its people—that is essential to success. Under his leadership at Schwab, client assets have increased from $48 billion to $790 billion in just 10 years [3].

**A BRIEF CASE STUDY**

When Community Lending was planning a major expansion into new regions several years ago, company executives realized that employment regulations varied widely state to state, and that mastering them would be no small challenge. To make it easier, the Morgan Hill, Calif-based mortgage lender, which funded $4 billion in loans in 2003 and has about 1,500 employees, turned to someone else to handle everything from payroll to legal guidance on employment matters. "We came to the conclusion that HR was a specialty," says CEO W. Darryl Fry. "It was not one of our core competencies, and our culture is: ‘we stick with our core competencies.’"
4. ADVANTAGES OF HR OUTSOURCING

HR outsourcing including personnel outsourcing and case studies have indicated that managing human resources involves specialized activities such as training, payroll administration, employee database management, employee retention, employee benefits and a lot more that many companies either lack the proper resources or do not have the time to manage on their own. By outsourcing their HR functions, most of the companies can save huge amounts of money, time & other resources; made be freed of complications that are otherwise involved in maintaining an internal HR department; and concentrate on their core competencies.

Though technology simplifies the HR, it should be viewed for what it is—a delivery channel. In the same way, outsourced services aren’t a threat—they’re a tool. HR’s challenge is to effectively deploy all available resources, whether technical, external or in-house. These require understanding the possibilities and limitations of each service delivery option. In today’s business environment, where competition is fierce and talent is scarce, HR plays a critical role in creating outstanding products and services that create a shared experience of the company by employees.

To sum it up, human resources outsourcing that includes HR recruiting outsourcing helps cut costs, helps concentrate on core business and most importantly helps in ensuring employee satisfaction [4].

Some of the more visible benefits include:
- Control capital costs.
- Increase efficiency and effectiveness of various processes.
- Reduce labor costs.
- Start new projects quickly.
- Focus on core business.
- Level the playing field.
- Reduce risk.

5. RISKS INVOLVED IN HR OUTSOURCING

5.1 ADMINISTRATIVE
- Low risk
- Bad service attributable to the Company, and not HR provider

5.2 STRATEGIC
- Simplify an otherwise attractive compensation packages.
- Loss of control over hiring and work-force development

6. STEPS INVOLVED IN HR OUTSOURCING

Today, organizations realize they must reduce their HR costs while improving service. For many companies, outsourcing has become a key part of their HR strategies. However, determining what all HR functions should be outsourced can be challenging. To ensure the best HR strategy, companies should evaluate the potential benefits of outsourcing and consider business drivers, such as reducing costs, improving service delivery, and maximizing internal resources [4].

It is very important to find how will outsourcing:
- Impact the customer service to your employees?
- Limit the opportunity to develop the expertise and skills of the employees in anticipation of pending skill shortage by next ten years
- Be accepted or rejected by employees and even others in HR?
- Impact the organization’s culture
- Increase the amount of the time required for managing vendors / projects?
- Increase potential costs that haven’t been considered?

Once the decision is made that outsourcing some or all of the HR functions may be a solution for the organization. The following steps may be followed in outsourcing the HR activities.

Step 1: Create a Team

Begin by creating a project plan by completing the following:
- Desired results:—what does this team hope to accomplish?
- Potential barriers / obstacles:—what is going to prevent this team from reaching this result?
- Supports:—what resources, people, or organizations could help the team?
- Plan:—what are the steps the team needs to take?
- Evaluation:—how will the team know that it has reached its goal?
Step 2: Conduct a Process Review
To get a clear idea of what could be outsourced, the team will need to start by mapping all the HR processes from A-Z (i.e. recruitment, payroll, benefits, performance management, etc.) Determine what is done, by whom, and for how long. Just going through this process should identify some potential inefficiencies that could be addressed through outsourcing or simple improvements that will streamline your HR functions.

Step 3: Review Strategic Plan
Once HR processes to be outsourced have been mapped, compare those processes to the company’s strategic plan. It should address the questions such as:-
  - What activities support the plan?
  - What activities need to be done but do not have a direct connection to the plan?
  - What else can human resources do to help support the company strategic plan that may not even be identified yet?
Addressing the answers to these three questions will help organizations understand the link between HR and the business plan.

Step 4: Identify Core Areas
Based on findings in Step 2 & Step 3, it is required to identify the core areas HR needs to focus on because of in-house expertise. To determine the core areas, the following two questions must be answered:
  • What expertise does the current manpower possess that should be capitalized on internally?
  • What efforts can or should only be done internally?

Step 5: Decide What to Outsource
The team needs to use all the information gathered during steps 1 – 4 to decide whether or not and what to outsource. These are the critical issues to be considered in deciding to outsource and evaluating what to outsource.

Step 6: Strategic Alignment
Whether it is a few or all of the HR functions, it is required to create a business case to justify how the decision supports the company’s strategic plan. A great way to pull together the information for this “business case” is to complete the previous five, with a focus on outsourcing:

Step 7: Evaluate Vendors
The following questions will help organizations evaluate their Vendors.
  • How large the vendor is?
  • What is the size of the client?
  • What are the payment terms (i.e. travel, phone, email, emergencies)?
  • How do they stay up to date on new technologies and HR issues?
  • What is their specialty or expertise?
  • What recommendations or referrals do they offer and what do they say about their services?
  • How will the vendor’s culture mesh with your culture?

Step 8: Specify the terms of contract
One should be sure that the contract clearly maps out the scope and expectations. The contract should be very specific on the terms including fees and guarantees. It should also detail how to terminate the agreement and what must be done upon termination (i.e. what needs returned).

Step 9: Communicate
This step is probably the most important step to ensure the success of the outsourcing endeavor. This is one of those situations where the organization needs to communicate as often as one can & as much as one can. Caution exercised is not to underestimate how the change of outsourcing will impact each employee.
The firms need to prepare managers for- what to communicate and- how to handle the situation since they will be the front line and first resource for communication with the employees.

Step 10: Re-evaluate
Once the outsourcing begins with the chosen vendor, one has to be sure to set dates to re-evaluate how it is working. It is required to evaluate the decision of further outsource based on the actual costs, benefits, and return on investment.
  • Is outsourcing giving the results that one had anticipated during Step?
  • Is the vendor meeting the goals and expectations?
  • Is the organization receiving the feedback anticipated from employees on the service being provided?
  • Do the goals, expectations, and/or fees need adjustment in any way?
  • This re-evaluation is required as often as necessary to ensure the relationship and in order to stay on track.
7. DOWNSIDE OF HR OUTSOURCING

7.1 In source vs. Outsource HR
There are some definite drawbacks to not having an HR manager in-house. An in-house HR person handles perks that you can't necessarily count on an outsourcing service to carry out--like looking into group offerings, building employee incentive programs, even taking care of recognition for employees' birthdays. And employees may want someone in-house--an impartial co-worker they can trust and see daily--to turn to if they have a work-related problem or dispute with another co-worker.

Because an in-house HR person interacts daily with your employees, they will likely have more of an interest in your employees. For example, employees often appreciate having someone on staff that will help negotiate in their favor for certain benefits that are critical these days for employee retention (like 401(k) plans and vacation policies).

Also, in the case of using a PEO, giving up the right to hire and fire your employees may not be desirable for your particular business. Most PEOs insist that they have the final right to hire, fire, and discipline employees. While having the extra time and not having to deal with the stress of this may be appealing, you may not want this responsibility out of your hands. If one decides to use an e-service, the same issues would have with any ASP remained. When everything is stored and handled online, there are concerns about security as well as potential crashes, both of which can be detrimental to your business.

Common complaints about HR outsourcing range from payroll mix-ups to payroll not being deposited on time to denied medical claims [6].

7.2 Recent Trends in HR Outsourcing
HR outsourcing has grown more prevalent during the past decade, and the trend is continuing. According to HR Outsourcing Trends--a survey conducted by The Conference Board involving HR vice presidents, CFOs, and CEOs from 165 companies--the two most commonly outsourced activities were transactional and administrative HR functions. Ranking below those processes are employee communications, HR information systems (HRIS), assessment, and recruiting.

Companies worldwide are spending nearly a huge amount on human resources outsourcing. According to a recent Conference Board survey of 122 firms with revenue over $1 billion, companies are commonly outsourcing 401(k) programs, pension benefits, health benefits and stock option administration. David Dell, author of the study, says, “HR outsourcing is not a trend anymore, it’s the normal way companies do business.”

CONCLUSION
Information exchange between firms is continuing to become cheaper and easier. Further, technological advances are making it easier to integrate widely dispersed networks and make computers ‘talk’ to each other. As a result, it is becoming increasingly easier to trade some managerial control for significantly better monitoring. Firms can choose to relocate their process factories leaving a residue of critical, core processes inside the firm. Knowledge-intensive firms can place themselves at the nucleus of a cluster of process factories and orchestrate the system’s functioning through a combination of control and monitoring. Rapid advances in IT and Telecommunications are driving the move towards firms that set up supply chains of knowledge where the constituent members - the providers of services and the users - resemble an extended organization loosely connected to its federating units where common objectives are pursued through a combination of the price mechanism as in a market and managerial control as in an organization.

REFERENCES
HYPERTHERMIA FOR LIVER CANCER TREATMENT

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ABSTRACT

Thermal therapy is a minimally invasive procedure for destroying tumours using heat. The challenge in thermal therapy remains the localization of the thermal dose to the tumour while sparing nearby critical tissue. Hyperthermia was first employed as a treatment for malignant disease in the last century. It is only relatively recently that its mode of action and clinical application has been subjected to serious scientific scrutiny. From the early 1970’s a wealth of biological data has been accumulated from many institutions with the intention of elucidating the mechanisms of hyperthermia cell killing and of identifying optimum combinations of this rediscovered modality with the conventional approaches primarily of radiotherapy and chemotherapy. Since the latter part of the last decade, as the potential clinical benefit of hyperthermia became more apparent, Considerable effort has been devoted to the development of techniques which could be used for the production and monitoring of elevated temperatures within the cancer patient.

Keywords: Bio-impedance, heat, hyperthermia-treatment, temperature

1. INTRODUCTION

1.1 At the present time, many clinical institutions have embarked upon hyperthermia programs largely on the basis of the encouraging results which have accrued so far. It is slowly becoming clearer which anatomical sites can be effectively heated, the physiological and biochemical conditions which make tumors amenable to this form of therapy, and the combinations with radiotherapy and chemotherapy which are likely to meet with the greatest success. In spite of the high current level of interest in hyperthermia, it remains the case that our knowledge of its modes of action, either alone or in combination, and our experience in its application is rudimentary. Although there is strong evidence of a therapeutic benefit of hyperthermia under some circumstances at least, a cursory study of the literature indicates minimal uniformity in its clinical application [1]. When, as is typical, hyperthermia is applied in combination with radiotherapy or chemotherapy, variables such as dose (from radiation or drugs), sequencing, time delays and fractionation are all likely to significantly influence outcome. By analogy with conventional radiotherapy we wish to accumulate the relevant information to permit the decision making process known as treatment planning to take place. Due to the complexity of the interaction between the non-ionizing radiation beams frequently used for heating and the inhomogeneous human body, and due to the unpredictable physiological response to temperature elevation, many significant decisions have to be made during the treatment. This contrasts with conventional radiotherapy in which the major technical decisions, in almost all cases, are made in the absence of the patient.[2]

1.2 Conventional radiotherapy has now progressed to the stage where there is little room for ambiguity or error in a treatment plan. It should be the aim of the hyperthermia community to attain a similar degree of rigour and precision in the selection and specification of a hyperthermia treatment. Unfortunately, a major and fundamental difficulty is encountered at the outset of this Endeavour. Whereas in radiotherapy the basic parameter used to specify the treatment - the dose - has a clear physical definition, this is not the case in hyperthermia. Of course, dose in radiotherapy cannot alone fully describe a course of treatment, neither can it in general be used to predict outcome. However, the identification and definition of this basic parameter has probably contributed more to the success of radiotherapy than any other development in its history with the possible exception of super voltage machines. At the present, however, there is no consensus as to a unit of thermal dose of general applicability [3]. This being the case it is necessary to proceed on the basis of the existing information which indicates clearly that biological damage is a function of both time of exposure and temperature. As the functional relationship

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between these two parameters and dose remains unclear, treatment description at this stage requires specification of the time course of the tissue temperature distribution [4].

2. BASICS OF HYPERTHERMIA

Most clinical hyperthermia systems operate by causing a target volume of tissue to be exposed to electromagnetic (EM) fields or ultrasound (US) radiation. The EM or US power is supplied by a generator and delivered to the patient through an applicator. A diagram of the fundamental components of a hyperthermia system is shown in Fig. 1. Applicators in use today consist of implantable or external electrodes, antennas, waveguides, and transducers. These devices may deposit energy to only a small volume of tissue directly adjacent to the heating device, or they may be intended to deliver regional or whole-body hyperthermia [5].

![Fundamental elements of a hyperthermia system](image)

The clinical outcome of hyperthermia depends critically on the tissue temperatures obtained during the procedure. It is therefore important to have accurate information concerning the temperature throughout the treated region of the patient. Although non-invasive thermometry which could yield complete 3-dimensional temperature information would be most desirable, such equipment is not presently available. In the absence of such an ideal thermometer, clinicians use small implanted probes, and in some cases move the probes within implanted catheters to obtain one-dimensional temperature profiles [6]. To minimize the need for mechanical mapping, probes having multiple temperature sensors distributed along their length often are used. The basic idea behind this treatment is to create an artificial “fever” of 41-45°C in the body of the patient without damaging the benign tissue. It is also denoted thermal therapy or thermotherapy, and is a type of cancer treatment in which it is tried to reach cytotoxic temperatures (> 42°C) during approximately 60 minutes. Different studies have shown that moderate temperatures can damage and kill cancer cells, usually with minimal injury to normal tissues. By killing cancer cells and damaging proteins and structures within cells, hyperthermia may contract the tumors. Most of the research work being done on designing of microwave antennas for biomedical applications has focused on producing tumor ablation for medical treatments. Antennas may be used to provide heating by non invasive applicators and interstitial applicators. Internal and external heating hyperthermia techniques are shown in Fig 2.

![Internal and External heating techniques](image)

The word hyperthermia means elevated body temperature and in a medical context refers to the use of heat in the treatment of a disease. In hyperthermia treatment of cancer, the tissues or an organ are heat treated such that their temperature is increased to (41-45) ±C and the viability of cancerous cells is reduced. This is based upon the fact that the tumor cells are more sensitive to temperature and they are more affected by the excessive heat than normal cells [7]. Also, the tumors have an impaired ability to adapt their blood circulation to the effects of high temperatures. Therefore, hyperthermia can cause an actual reduction of blood flow within a tumor. This, coupled with the direct effects of heat on individual cells, can result in an accumulation of harmful metabolic byproducts and excessive acidity in the tumor tissue, which can contribute to a degree of self destruction of the abnormal growth.
3. TYPES OF HYPERTHERMIA

Clinical hyperthermia treatment can be divided into three almost separate domains:

3.1 Local hyperthermia
3.2 Regional hyperthermia
3.3 Whole body hyperthermia

3.1 Local Hyperthermia: This type of hyperthermia treats a defined region only, such as a tumor or some localized area. The affected area may be heated externally by aiming high frequency waves at a tumor from a device outside the body. For heating of a small area within the body, wire probes, hollow tubes filled with warm water, implanted microwave antennae, and radiofrequency electrodes may be used [8].

3.2 Regional Hyperthermia: In this case, heat is applied to a large area such as an organ, body cavity, or a limb. For the treatment of regional hyperthermia, magnets and devices that produce high energy are placed over the region to be heated, or some of the patient's blood is removed, heated, and then pumped back into the region to be heated. The later process is called profusion [9].

3.3 Whole Body Hyperthermia: Whole body hyperthermia is used to treat metastatic cancer that has spread throughout the body. Warm water blankets, hot wax, inductive coils, and thermal room or chambers are used to raise the body temperature to the desired level.

4. LIVER CANCER

The liver is the largest organ in the body and is located in the right upper quadrant of the abdomen. The liver creates, regulates, stores a variety of substances used by the gastrointestinal system, and it serves a number of important digestive functions, formation of certain blood proteins, and the metabolism of carbohydrates, fats, and proteins. The liver also plays an important role in blood circulation with approximately 25-30% of the resting cardiac output going to the liver. The liver receives oxygen-rich blood from the aorta through the hepatic artery, which accounts for 25% of the blood flow into the liver. The remaining 75% of the blood comes to the liver through the portal vein which carries nutrient-rich blood from the small intestine. Blood is removed from the liver through the hepatic vein [10]. Hepatocellular carcinoma (HCC), or primary liver cancer, accounts for 80-90% of all liver cancer. It occurs more often in men than women, and occurs mostly in people 50 to 60 years old. The disease has historically been more prevalent in parts of Africa and Asia, but becoming more common in the west recently due to an increase in hepatitis cases there. The cause of liver cancer is unknown, but contributing factors include chronic liver disease, viral hepatitis, carcinogens, and food toxins. The worldwide incidence is 4 out of 10,000 people. Fig 3 shows the blood supply to the liver and hepatic tumor. The tumor receives 95% of its blood supply from the hepatic artery, while the normal liver tissue receives 75% of its blood from the portal vein and the rest from the hepatic artery. HCC tumors usually grow in one or more focal nodules with typical doubling time of 30-200 days. The neovasculature that stems from the hepatic artery and surrounds the tumor is abnormal, and the endothelial lining of the newly formed vessels is fine and easily damaged.

Fig. 3: Blood supply to the liver and hepatic tumor. The large vessel is the portal vein, and the thin red vessel is the hepatic artery which feeds the tumor

5. THERMAL ABLATION

The methods of tumor ablation most commonly used in current practice are Thermal Ablation. Irreversible cell injury occurs when cells are heated to 460°C for 60 minutes. With increasing temperatures the time necessary to induce cell death is shortened and at 60-100°C cell death is immediate and irreversible. Coagulation necrosis denotes irreversible thermal damage to cells. Temperatures greater than 105°C result in tissue boiling, vaporization, and carbonization, which may retard optimal ablation [11]. Ablative treatments have started to become viable alternative methods to treat patients who cannot be
treated by surgery. Such ablative treatments include cryoablation, radiofrequency ablation (RFA), microwave ablation (MWA) or also called microwave coagulation therapy (MCT), and ethanol ablation, etc. According to Simon the main advantages of microwave technology, when compared with existing thermo ablative technologies, include consistently higher intratumoral temperature, larger tumor ablation volume, faster ablation times and improved convection profile. The basic principle of microwave hepatic ablation is to apply microwave power to the liver tissue through the microwave applicator (the antenna). The power of the EM wave is absorbed by the liver tissue and heats the tissue. Liver tissue is destroyed after the tissue is heated to a high enough for a long enough time. Figure 3 shows the basic devices to perform a MWA consist of a microwave generator, a microwave applicator (the antenna), and a section of flexible coaxial cable to connect the antenna to the microwave generator. Ultrasound scanners are often used in the MWA procedures to guide the placement of the applicator [12].

![Fig. 4: Schematic experimental setup of microwave liver tissue ablation.](image)

Fiber-optic thermometers can be used to measure tissue temperature. MRI scanners can be used to examine lesion size after the procedures. In a clinical MWA procedure, position of the tumor is determined in advance with medical imaging devices, including MRI, CT or ultrasound devices. A MWA probe is placed into the tumor with an open surgery or a percutaneous procedure, guided by ultrasound or other medical imaging device as shown in Fig.5. The probe is connected to the microwave power generator. Microwave power level and heating duration are selected in advance according to the shape and size of the tumor. Microwave power is then applied for the selected duration. A thermal lesion of predicted volume is created by the applied microwave heat to cover the entire tumor with 1 cm margin [13].

![Fig. 5: MWA probe placed into the tumor with surgery](image)

The MWA probe is then safely retrieved. Before the clinical procedure finished entirely, imaging devices can be used to verify the lesion size and shape the ultimate goal of ablation technology, including MWA, to kill the liver tumor while preserving healthy liver tissue effectively.

**6. MAGNETIC HYPERThERMIA**

In magnetic hyperthermia, the body tissues are heated by using magnetic materials that act as heat sources in the presence of an applied magnetic field. These materials are inserted inside the body in the form of thermoseeds, ferrofluids, and nanoparticles. Magnetic hyperthermia is based upon the principle that the magnetization process determines the magnetic energy losses. These losses, depending upon the thermal conductivity and heat capacity of the surrounding medium, can be dissipated in the form of the heat raising the temperature of the surrounding [14]. The losses are of different kinds, which are determined by both intrinsic and extrinsic properties and size of the material used. The dominant mechanisms for magnetic losses are: hysteresis losses, eddy current losses, and relaxation losses. Magnetic hyperthermia treatment can be made through implants (thermoseeds) or using nanoparticles. In the first method, known for several decades, finite size magnetic
implants are surgically placed within the tumor site, which absorbs energy from externally applied a.c. magnetic field and dissipates it in the form of heat to the surrounding cells. A large number of biocompatible glasses and glass ceramics have been exploited for such applications. The alternative approach is to use fine particles as heat mediators instead of needles and rods so that hyperthermia treatment becomes noninvasive [15]. When fluids containing submicron sized magnetic particles are injected, these particles are easily incorporated into the cells. These magnetic particles selectively heat up tumor cells by coupling with the externally applied magnetic field. As a result the whole tumor can be heated up uniformly. This is also called intracellular hyperthermia. Gilchrist was the first to use magnetic materials for hyperthermia treatment of cancer. In 1957, he used Fe2O3 nanoparticles in a size range of 20-100 nm to heat various tissues in 1.2 MHz magnetic field. Since then there is a large number of publications describing a variety of schemes, employing different magnetic materials, different field strengths and frequencies, and different methods for encapsulation and delivery of particles.

7. NUMERICAL METHODS

The numerical methods used to predict the induced fields in biological bodies of realistic shape and composition are enlisted below:

- Quasi-Static Impedance Method
- Methods of Moments (MoM)
- Finite Difference Time Domain Method (FDTD)

The quasi-static impedance method is restricted to lower frequencies, but the MoM, the FDTD and the FEM methods may be used for any frequency of interest. In addition, both the Finite Difference Time Domain Method and Finite Element Methods involve solving Maxwell’s equations in the differential form for the computation of induced fields.

7.1 Finite Element Method (FEM): The FE method originally used by P. Silvester for electromagnetic field problems and has been preferred numerical algorithm in many fields of applications. However, its use and popularity in predicting field intensities in biological systems have been modest until recent progress in mesh generation, boundary conditioning and large matrix solvers. Aside from the low memory requirement (on the order of N), an inherent attraction of FEM is its adaptability in modeling inhomogeneities and complex geometries. The basic approach of FEM method for predicting EMF distributions inside the biological bodies starts by subdividing the physical space and biological body of interest into meshes of small volumes or cells of tetrahedral elements. Each cell element and node location will have to be systematically numbered and described. Once the volume has been subdivided, labeled, and appropriate property values ascribed, the unknown field with in each element is then approximated using linear extrapolation. A major step in FEM is the formulation of the system of linear equations with proper boundary conditions that can produce an approximate solution to unknown field intensity with a prescribed accuracy. The procedure of calculation of SAR distribution and temperature distribution using bioheat transfer equation [16].

7.2 Why FEM? The finite element method (FEM) is generally used to simulate hepatic microwave ablation, because it is a powerful tool to transform differential equations over a volume to algebraic equation at the points, called nodes. These represent the solution to the governing equations and the boundary conditions in an average sense by piece wise simple functions. The volume to be solved is divided into elements, if sufficient continuity conditions are met, solution converges to the exact solution as a number of element increases. By exact solution we mean the solution to the mathematical model which in turn often is an idealization of reality. COMSOL. Multiphysics is an excellent tool for FEM solver [17]. The COMSOL Multiphysics simulation environment facilitates all steps in the modeling process - defining the geometry, specifying the physics, meshing, solving and then post-processing the results.

Fig. 6: Procedure of calculation
CONCLUSION

The ultimate goal of the current research on microwave ablation technique is to develop technologies to increase the coagulation volume while reducing the treatment time and making the therapy more straightforward by reducing its complexity. To study, investigate, and develop new techniques and to improve those currently employed, research can make use of experimental studies, phantom and theoretical models. The later is the powerful tool in this kind of investigation, since they are rapidly economically provides an understanding of the electrical and thermal behavior involved in the microwave ablation. The COMSOL Multiphysics is the complete package to achieve the goals of the current research for the benefit of all the humanity.

REFERENCES


A Review of Routing Protocols and Simulators for Ad hoc Networks

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ABSTRACT
Mobile Adhoc Networks are infrastructure less wireless network. Due to the random movement of nodes adhoc network does not have fixed topology. Hence routing is always poses a challenge in the wireless network. Moreover all the mobile nodes are working on the batteries and hence energy of the node is a scarce resource. Therefore some special protocols are developed that reduces the energy consumption of the node. In section 2 the traditional protocols are discussed. Section 3 explained the energy efficient routing approach. Section 4 contains the details of the available simulator for the Adhoc Network. In section 5 the factors that affect the performance of adhoc network are discussed.

Keywords: DSDV, DSR, AODV, Routing Protocol, Mobile Adhoc Network (MANET).

1. INTRODUCTION
1.1 Mobile Adhoc networks are self organizing, multihop & autonoums system of wireless mobile nodes that form a temporary network without the aid of base stations. Ad hoc networks are dynamic in nature. The nodes are free to move anywhere and are able to leave or join the network anytime. Due to this random movement adhoc network do not have a fixed topology.

1.2 The rapid deployment nature of ad hoc network finds its application in disaster recovery, military application, undersea operation and in lot of other application where the establishment of infrastructure is difficult.

1.3 Wireless Nodes in adhoc network are working on batteries of limited power. A mobile node in the ad hoc network not only performs the function of host but also act as a intermediate router. These networks allow direct communication between the nodes if they are in radio range of each other. Generally this radio range is small as compared to the total span of the network. Since ad hoc network has dynamic topology therefore routing is a challenge in adhoc network. Mobile nodes in adhoc network are the intermediate routers and hence shutdown of a node due to the battery power will affect the network lifetime and may result in network partitioning. Routing protocols are designed or modified to extend the network lifetime. Therefore a lot of research is going on in energy management in ad hoc network. Energy efficient routing protocols are designed and developed in such a way that reduces the consumption of energy during communication.

2. CONVENTIONAL ROUTING PROTOCOLS
Conventional routing protocols are classified in three groups proactive, reactive and hybrid. These protocols are differentiated on the basis of routing table updation.

2.1 Proactive Routing Strategy
In proactive type routing protocols routes are decided in advance or prior to the communication. Each node maintains the path information of every other node in the network. Hence periodic exchange of routing information is required with the immediate neighbor. Any change in topology will be communicated by the periodic exchange of the routing table entries. Destination Sequenced Distance Vector (DSDV)[1] is an example of proactive routing and is based upon the shortest path algorithm and this algorithm always provide the loop free path. ‘Incremental” & “full dump” packets are used to reduce the overhead. Incremental packets are sent only when the information is changed and full dump are utilized for conveying all the

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available routing information. DSDV protocols not fit for the large networks, because the fast periodic updating is required. The biggest disadvantage of proactive routing is its requirement of periodically flashing of the routing table. This periodic updation consumes a major proportion of the available bandwidth. This exchange of information also drains the battery power. The characteristic of various routing protocols in these categories are listed below: [Mehram et al[19]].

<table>
<thead>
<tr>
<th>Defined Protocol</th>
<th>RS</th>
<th>Number of tables</th>
<th>Frequency of updation</th>
<th>HM</th>
<th>Critical nodes</th>
<th>Characteristic feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSDV</td>
<td>F</td>
<td>2</td>
<td>Periodic and as required</td>
<td>Yes</td>
<td>No</td>
<td>Loop free</td>
</tr>
<tr>
<td>WRP</td>
<td>F</td>
<td>4</td>
<td>periodic</td>
<td>Yes</td>
<td>No</td>
<td>Loop freedom</td>
</tr>
<tr>
<td>GSR</td>
<td>F</td>
<td>3 &amp; LIST</td>
<td>Periodic and local</td>
<td>No</td>
<td>No</td>
<td>Localised updates</td>
</tr>
<tr>
<td>FSR</td>
<td>F</td>
<td>3 &amp; LIST</td>
<td>Periodic &amp; local</td>
<td>No</td>
<td>No</td>
<td>Controlled updates</td>
</tr>
</tbody>
</table>

Table 1: Routining table

RS=Routing structure, HM= Hello Message

2.2 Reactive Routing Strategy

Reactive routing protocol or on demand routing protocols determines the route only when demand is being generated by nodes in the network. These protocols maintain the routing table entries only for the links which are active. Hence these protocols reduce the overhead burden of the mobile nodes. Reactive routing is performed either by source routing or by hop-to-hop routing. In source routing protocols, data packets header contains the address of the destination and hence there is no need to maintain the routing table at the intermediate nodes. This type of protocols is not suited for large scale networks because as the size of the network grows, the header information of the data packets grows significantly. In hop to hop routing or point to point routing only the destination and next hop address is present in the data header. Therefore it is necessary for the intermediate nodes to maintain the routing table. The main disadvantage of this kind of routing is its inadaptability to dynamically changing topology of the network. AODV [3] is an improvement over DSDV. AODV minimizes the periodically flashing routing information. AODV utilizes the sequence number for determining the status of the route. Routes are discovered & established using the flooding of RREQ packets. If the routes to the destinations are available then the intermediate nodes will generate RREP packets. Routes are maintained using the RRER packets. The failure links are erased by the RREP packets along its way.

In DSR [4] protocol the sender knows the complete path to the destination. Each node maintains the routes information in the cache. The cache will be updated whenever there is a change in the network structure. DSR is ineffective in determining the expired routes.

2.3 Hybrid Protocols

Hybrid protocols are the amalgamation of the reactive and proactive routing protocols. Hybrid protocols combine the basic features of the two approaches and enhance the routing efficiency. Hybrid routing protocols utilizes the benefit of proactive routing protocols in small networks and the reactive routing in large network. ZRP is an example of the hybrid routing protocol. ZRP divides the network in to subsection wherein each subsection the proactive routing is employed, where as the intersection communication is carried out using on demand routing. LAR is a more complex protocol as compared to the ZRP. It is more suitable for network with large number of the nodes that require hierarchical structur e. Maintenance of hierarchical networks are very difficult while determining the level of the node.

3. ENERGY EFFICIENT ROUTING PROTOCOLS

Providing a correct and efficient route is the main aim of the traditional protocols. In case of MANET selecting the energy efficient path is also a matter of great concern. A lot of research has been done in this area but still this is in its infancy stage. Chan su et.al [2] divided the energy efficient routing in to two categories. First category belongs to those protocols which minimizes the active communication energy. Other category reduces the energy requirement of a node during inactivity period [Chansu Yu et al]. Active communication energy can be reduced either by controlling the transmission power of a node to a minimum required level or energy can also be saved using the balancing of the load in such a way that the total load of the network be divided equally among all the nodes. Mobile nodes not only consume power when they are communicating, they also consume energy during the period of inactivity. This energy can be saved by turning it off. This approach will be helpful in saving the battery power but it will also affect the data delivery of the network.

<table>
<thead>
<tr>
<th>Minimize active communication energy</th>
<th>Minimize inactive communication energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Power Control Approach</td>
<td>Load Distribution Approach</td>
</tr>
<tr>
<td>• FAR</td>
<td>• LEAR</td>
</tr>
<tr>
<td>• OMM</td>
<td>• SPAN</td>
</tr>
<tr>
<td>• MER</td>
<td>• GAF</td>
</tr>
</tbody>
</table>

Table 2: chansu yu et al
3.1 Transmission Power Control Method
In this strategy the node power is made adjustable. Direct communication is possible between the two nodes with large transmitting radio power. High power radiation reduces the requirement of intermediate nodes. But high power radiation reduces the life time of node. Low power radiation will utilizes the large number of intermediate nodes. Hence topology becomes sparse [Chan su et. al] and the network partitioning may be possible.

3.2 Load Distribution Approach
In this approach the route selection is based upon selecting the nodes with greatest residual energy. The protocols belongs to this category will always utilizes the fresh nodes & may results in longer routes. Hence the shortest path algorithm will not work in this approach. Over utilized nodes are avoided to increase the network life time.

3.3 Power Down Mode Approach
In this approach the nodes power will be kept off during the idle period. Since all the nodes performs the dual function of host as well as that of router. Hence it is not possible to keep all the mobile node in off position, because this will affect the connectivity of the network. To avoid this one node may be assign the function of the master mode, whereas other nodes become slave of the master. Master node will coordinate the activities of the networks. [Chan su et. al].

Previous work based on the above approaches
- Mukul C Dutt [5] has proposed a new energy based algorithm which utilizes the high energy and high throughput node for routing. This results in reduced average power consumption.
- A modified DSR protocol PMADSR (power aware adaptive dynamic source routing protocol is proposed by Xu Li et al. in [6]. PMADSR balance the load inside the network by considering the mobility pattern and the battery capacity of the nodes.
- In [7], Kichen proposed a energy efficient scheme based on priority based scheduling. The propose scheme provides better way to deliver data than existing routing protocol which uses the fixd power approach.
- Node location information is utilized to simplify the routing strategy in [8]. Small number of the nodes are utilized in the routing which results in the less overhead. Proposed algorithm shows remarkable improvement over the LAR protocol.
- Vinay Rshiwal et al [9] proposes a new algorithm which maximize network lifetime by minimizing the power consumption during route selection.
- In [10] multi-cost routing approach is adopted. In this approach the various parameters like number of hops, residual energy and the transmission power of the nodes are assigned to each links. Author concluded that energy related parameter increases the network life time and achieve better performance than other approaches.
- Ishyan et al [11] proposed a new clustering technique for multicast routing protocol. In approach each node utilizes the weight cost factor like node speed, power level & residual power to form a cluster.
- Gossip based sleep mode (GSP) is discussed in [12]. Gossiping node utilizes the random variable to determine the appropriateness of entering in sleep modes.

4. MOBILE ADHOC NETWORK SIMULATORS
In this section various simulators for the Adhoc network are discussed. C.R. Dow et.al in [16] presented the usage rate of the of the available simulator for ad hoc network. The three most popular simulators are NS-2 (39%), GloMosim (21%) & OPNET (9%).

![Graph of % Usage Rate of Different Simulators](image.png)

**Table 3:** Data is taken from C.R Dow et.al [16]*

All the above simulators are event based simulators. The basic features of these simulators are given below:
4.1 OPNET [13]
OPNET (Optimized Network Engineering Tool) is developed by the OPNET technologies. This simulator is commercially being used by the companies. It supports all kinds of networks. This simulator is divided into the several parts. OPNET Modeler, OPNET Planner, model library & analysis tools are the main parts of the simulators. OPNET is organized in the hierarchical structure. The lowest level contains the process models. Various topologies are constructed using network editor. The performances of wireless networks are determined using OPNET Planner. OPNET software provides all the necessary features for the Adhoc network. The development of new models requires defining a new finite state machine.

4.2 GloMoSim/QualNet [14]
This simulator is developed by the UCLA computing laboratory. GloMoSim supports wireless networks. GloMoSim is based on the OSI model. GloMoSim is based on the PARSEC language which is a event based simulation language. Therefore PARSEC compiler is needed. Application layer supports the Telnet, ftp, CBR, HTTP protocols whereas the transport layer supports the TCP & UDP. AODV, DSR, FishEye, flooding protocols are developed at the network layer. GloMoSim is freely available software. But the documentation with this free version is very poor. QualNet is derived from the GloMoSim and we can say that QualNet is a commercial version with the additional features. QualNet supports both the wireless as well as the wired networks. GloMoSim is widely accepted for research activities.

4.3 NS-2[15]
Network simulator is a discrete event based simulator. This simulator is developed by the Network research group at Lawrence Berkeley National laboratory USA. NS-2 is highly suitable simulators for simulation as well as for emulation. This simulator is mostly utilized for research activities in the field of adhoc network. NS-2 is based upon two languages C++ and O Tcl. Compiled class hierarchy is written in C++, whereas the interpreted class of objects are defined O Tcl. Implementing a new protocol requires modification in the C++ code, also changes are required in the O Tcl configuration files to recognize the new protocol and the default parameter. NS-2 is a complex software. Modification in the protocols requires extensive modification the existing modules. Documentation is poor and out of date for available latest version simulator. Graphical tools are not up to mark as compared to the QualNet. Scalability of the NS-2 is poor when thousands of nodes are considered for simulation.

5. FACTORS AFFECTING THE PERFORMANCE OF ADHOC NETWORK
In [17] Dmitri et. al has established five factors which affect the performance of the Adhoc Network:
The author concluded that energy consumption in the MANET is decreased when the size of the network grows. In the same way increasing number of traffic source increase the energy consumption. The result in [17] proves that factor number 4 has the strongest impact on the performance. Node speed i.e mobility of the nodes & the network size are also the principal factors in determining the performance of the MANET.

5.1 Performance Analysis of traditional Routing protocols
Proactive routing protocols have higher control overhead than reactive routing protocols. This is because in proactive routing protocol each node has to maintain a list all of its destinations. Therefore as far as control overhead is concerned DSR and AODV is better than the DSDV protocols. P Chenna Reddy et al in [18] has compared the performance of DSDV, AODV, TORA & DSR protocols & found that DSDV protocol is not usable for Adhoc network. Performance of DSR is best among all the traditional protocols.

CONCLUSION
Routing is a challenging task in Adhoc networks. The speedy and randomly movements of the nodes makes it more difficult. Hence algorithms of the traditional routing are not sufficient enough to provide smooth communication. Moreover the proactive routing protocols like DSDV is not suitable for MANET. DSR & AODV performs better than DSDV. Therefore routing and power management are the core research area in the MANET. Hence energy efficient techniques are developed to minimizing the energy consumption and for increasing the life of the network. In this paper we have discussed the three major approaches of energy efficient routing. It is quite difficult to say that which of these techniques is better. Protocols based on these approaches are general & are not application specific. These protocols are designed and developed for different purpose. For small networks it is not possible to control the inactive energy because sometimes it will not be possible to connect the source with destination if the intermediate nodes will not available for communication. On the other hand increasing the transmitted power will results in to large interference. Hence a mixed strategy which combines the three approaches of energy saving will be more effective as compared to the individual approach. Cross layer design will be more effective in increasing the network lifetime. Three simulators Glomosim, OPNET and NS2 are reviewed with their pros and
cons. Ns-2 is utilized largely by the research community because it is freely available. QualNet is generally considered better than among all the available simulators because it is easy to use, easy to modify and easy to extend.

REFERENCES


COMPUTER AIDED S/W ENGINEERING (CASE) TOOL
- A ROLE IN FORMAL SPECIFICATION FOR CRITICAL SYSTEMS

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ABSTRACT
The main benefits of formal methods stem from their use early in the software development lifecycle. So, we need to find ways of making them more accessible to end users. The uses of prototypes and of domain-specific notations are examples of how we might do this. In this paper we try to examine what industry really needs from formal specification techniques. Firstly, the background is portrayed to the use of formal techniques showing how formality is integrated into the process. We subsequently look at the role of formal specifications in critical development and analyze the important questions. Finally, conclude with some lessons learned about for formal specification techniques and the tools which support them in reducing risks, costs and helping to foster fruitful relations in situations which are often fraught with confrontation.

Keywords: change-phobia, programming by contract, function’s signature, brittle design, performance tuning, formal methods, Z-fonts, schemas, naïve set theory, Russell’s paradox, low-level specifications, end-user programming.

1. INTRODUCTION
The use of formal specification with the object-oriented approach to system construction is a subject of increasing interest. A recent book [1] outlines several approaches to using the formal notation Z [2] and related notations for object-oriented specification. The object oriented (OO) approach offers one of the most promising ways of structuring a system in a way which increases cohesion within its parts and reduces coupling between them. It is therefore important that the specification should be able to reflect this structuring. The punch line is “Formally engineered software is the quality software”: whose production requires time and expertise.

2. BACKGROUND
In today’s rapidly changing business environment, users demand more from software and economics dictate better paradigms leading to a paradigm shift. The initial paradigm, structured or procedural undoubtedly enabled the design and construction of huge software systems. However, these systems lacked the “flexibility” required to meet the demands placed on software. Thus the old paradigm died of its own success: it created demand that it could not satisfy. Thus was the advent of OO-paradigms. OO has become the paradigm of choice for building industrial-strength applications. The ability to formally specify systems using the object-oriented specification language Object-Z, and then to use that formal specification as a basis for testing the implementation is the thrust area to improve the quality of computational science & engineering (CS&E) software. It is noted that most CS&E developers do not have formal software engineering training.

2.1 Critical Systems
Some software engineering companies make foray into the development of critical systems, where the cost of failure is high. Some of the main markets are aerospace sectors including avionics and air traffic control, railways, finance, medicine and similar applications. Software safety assurance standards, such as DO178B demand formal methods at the highest level of categorization (Level A).Selective use of formal methods to define critical requirements can, however lead to a significant decrease in lifecycle costs. For highly critical applications there is evidence [3] that this approach actually reduces the cost of critical code because of its ability to find obscure errors early in the development process.

To develop systems with the high integrity needed for these applications they need to deploy a strong quality management system, the best technical methods and a comprehensive risk management approach. Formal methods (FM) are among the powerful engineering techniques used in such day to day work.

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3. OBJECTIVE

In recent years, a community of researchers and practitioners has facilitated the exchange of ideas to improve the quality of CS&E software [4]. It is noted that many CS&E projects do not use software engineering techniques. So, there is a need for people who understand both the software engineering and CS&E domain.

End-User programming (EUP) is the practice by which end users write computer programs to satisfy a specific need, but programming is not their primary job function. The software engineering discipline that is required to make end user programming more effective and less error prone is referred to as “End-User Software Engineering (EUSE).” Familiar examples of end-user programming include the use of shell scripts and Excel Spreadsheets to allow users to quickly automate tasks specific to their needs. It is important to recognize the software engineering discipline that needs to be in place enable such “flexibility”, and to protect against the potential problems that can arise from such flexibility [5]. There is a growing impact and substantial cost in business resulting from errors in end-user programs.

Our objective is to develop conventions and, where necessary, new notation so that we have a calculus of specifications, which parallels the calculus of implementations which an object-oriented programming language gives us. We want to be able to define classes, and build up specifications of complex systems from simpler specifications. In particular, we want to develop Z analogues of the two main structuring techniques of object-oriented systems:

- The partitioning of the specification into specifications of individual objects, and their subsequent combination
- The definition of one class of objects in terms of other classes with which it shares behaviour.

Methods of defining objects and of combining object definitions into a system specification have been developed and the definition of classes and their relationships have also been discussed [1].

4. SPECIFICATION

Whenever a software system is large enough, most programmers cannot remember all the nuances of every member function of every class. However, other programmers bank on this specification rather than digging into code and relying on the implementation. So, specification plays a vital role in the overall success of any development effort. For highly critical applications, where the cost of error is quite high, there is a dire need for writing precise and unambiguous specifications which captures the essential service that the member function provides to its users in an implementation-independent fashion. There are considerable evidences showing that formal methods are vastly effective. Overall there is considerable evidence that use of formal techniques can greatly reduce defect rates in delivered products [3].

Specification is to provide a practical technique that reduces the ripple effect during both development and maintenance. This technique is sometimes called *programming by contract*.

A member function’s specification unambiguously defines its externally observable behaviour across all possible implementations. The specification of a member function is more than simply the member function’s signature. The specification captures the essential service that the member function provides to its users in an implementation-independent fashion. An ill-specified system typically suffers from *change-phobia*. It’s called maintenance cost and it eats software organizations alive.

5. HIGH PERFORMANCE SOFTWARE

Is bad performance a result of bad design or bad coding? All too often, bad performance is due to bad design. When bad performance is due to bad coding practices, the correction is relatively inexpensive. However, when OO has been used improperly, the design is usually broken and performance problems are not easily repaired.

Improper Inheritance is a common cause. When inheritance is used improperly, the design often becomes brittle and performance-related changes are prohibitively expensive. These costs are manageable in a small toy-project, but in a larger, more sophisticated application or system, the costs of improper inheritance become unbearable.

If abstractions are properly designed, the answer to “would it disturb user code if we changed this particular DS from a linked List (LL) to an array”? is “No”. This means that the abstraction allows *late life-cycle performance tuning*. Workshops are held focusing on software engineering for high-performance computing [6].

5.1 Techniques For Improving Performance

The first step is to know where the bottleneck is and then trying some of the following techniques:

For instance, if the bottleneck is CPU cycles, the application is said to be CPU-bound; if the bottleneck is the network, the application is said to be network-bound; applications can also be database-bound, I/O-bound, memory space-bound(thrashing) and so on. The important insight is that the techniques that work in one situation will either be a waste of time or perhaps even make performance worse in another situation. Measure, measure, measure and then make your changes.

One technique that sometimes helps is reducing the number of expensive operations by using more CPU-cycles.
6. FORMAL SPECIFICATION (FS)

Formal methods are mathematical approaches to solving software (and hardware) problems at the requirements, specification and design levels. Examples of formal methods include the B-Method, Petri nets, RAISE\(^a\) and VDM\(^b\). Specifications form the groundwork on which software is built. Software specifications form a kind of contract between the developer and purchaser. Thus the specification stage is vital to the overall success of a development effort.

Various formal specification notations are available, such as the Z notation. Z, a formal notation has been developed at the programming research group at the Oxford University Computing Lab (OUCL) since the late 1970’s. Z-Fonts for MS-Widows are available online through which the manuals for computer based systems are documented. Z is primarily a formal notation for modeling and specifying software’s handling safety critical systems. It has recently undergone International ISO standardization. There are considerable evidences that this is going to be a futuristic Computer Aided S/W Engineering (CASE) tool for object modeling.

Performance degradation caused by bad design is minimized through formal specification of the project at the development process.

7. SOFTWARE(S/W) CRISIS

When we talk about software-engineering, this very discipline did not exist before 1967. The first S/W-crisis was instrumental in the emergence of S/W Engineering. In 1968, North Atlantic Treaty Organization (NATO) held a conference where in the concerns regarding S/W-development mismanagement were raised and the “quality S/W” became the mantra (baseline). Technical groundwork for methodical S/W-development was incorporated in S/W-Engineering. The period 1968-1980s did beget the formation of Software Lifecycle Concept. It initialized programming and design methodologies, requirement engineering and description technologies, and project management. A S/W-development process goes through the phases of traditional S/W-development life cycle (SDLC), which generally include conceptualization, requirements and cost analysis, specifications, design, coding, testing, technical training and maintenance. The goal is high software reliability and productivity with easy-to-test and easy-to-change structure.

7.1 There are various lifecycle models available for software development. We further take a brief look at some of the SDLC models with particular emphasis on verification in each model. A conventional waterfall model is given in Fig-1. The waterfall model derives its name due to the cascading effect from one phase to the other. It maintains a Top-Down progression as exhibited below. This model is sometimes referred to as the linear sequential model or the software life cycle.

![Waterfall Model Diagram](source: http://www.anhui.edu)

There are many variations to this model. A popular variation of this model is the sequential Verification & Validation (V&V) model is shown in Fig-2:

\(^a\)RAISE - Rigorous Approach to Industrial Software Engineering.
\(^b\) Vienna Development Method (VDM) along with Z and B-tools are various specifications using formal methods. B-Tools are for software development. Also, Petri Nets specifications are other kinds and can be created automatically from UML models.
7.2 Sequential Life Cycle Models

This is a fairly linear model where specifications are made use of as inputs to the testing phases. After coding and integration of the program and the components, the validation and verification steps carried out are: Unit Testing- Testing individual components of the program. Specifications used are derived from the ‘Program Specification’ document written; Integration Testing checks integrated working of components till the software can be termed as having a successful execution; System Testing- Testing of the software with the entire product; Acceptance Testing- Testing against user requirements. Fixing requirement problems at later stages of the SDLC is expensive. Facts manifest that many problems in S/W -development can be traced back to poor requirement analysis [7]. Conflicting requirements hinder the S/W-development process.

7.3 Relative Cost /Effort Of the Phases

A bar-chart depicting relative cost /effort of these phases with corresponding effort percentage [7] is shown in Fig-3.

Fig. 3: As shown, 67% of the effort is spent on maintenance that is, fixing problems and enhancements. Some rough rules- of-thumb indicate that requirements analysis and design takes twice as long as coding.
8. REQUIREMENTS

Requirements are usually written informally in English. Because of the inexactness of the language, be it English or any natural language, software requirements are not sufficiently precise to serve directly as a contractual basis for developer-user understanding. So, there is a need to have a level playing field with our prime contractor.

These big contractors are always in the right spirit for achievement in different CMM-c-levels for software. There are five levels of CMM ranging from least mature to most mature. As part of CMM level-initiative our process capabilities focus on defect analysis, defect prevention, technology incorporation tools, methods and processes. These are primarily to facilitate improvement in S/W quality and productivity. Specification is based on the S/W requirements and which preceded it. So, to combat the inconsistency caused by imprecise requirements selective formal methods are used that can lead to a significant decrease in lifecycle costs.

A situation where very high reliability is expected wherein applications contain millions of lines of code, writing a Formal Specification (FS) allows us to model key aspects clearly and unambiguously. This approach actually reduces the cost of critical code because of its ability to find obscure errors early in the development process. It is found that developing code from FS in VDM or Z is a straightforward activity and leads to exceptionally well-structured code.

8.1 Z

The language Z is a notation for writing specifications. It is based on typed set theory and first order predicate calculus (FOPC). In addition it contains a number of constructs for structuring specifications, notably the schema. The use of schemas offers a calculus of specifications, whereby specifications of large systems can be built up from smaller parts. These are non executable languages. Z is named after Zermelo-Frankel set theory.

8.1.1 Set theory is a branch of Mathematics created principally by the German Mathematician George Cantor at the end of 19th century. Initially, what is now known as “naïve” or intuitive set theory was developed. As it turned out, assuming that one could perform any operation on sets without restriction led to paradoxes such as Russell’s paradox. To address these problems set theory had to be re-constructed, using an axiomatic approach. Ernst Zermelo and Abraham Fraenkel independently proposed the first axiomatic set theory. In set theory, axiomatic set theory is a rigorous reformulation of set theory, which in its traditional form has now become described as naïve set theory.

8.1.2 Jean-Raymond Abrial (born 1938) a French computer scientist is the inventor of the Z and B formal methods; two leading formal methods for software engineering. J.R. Abrial invented Z during his time at the Programming Research Group within the Oxford University Computing Laboratory (OUCL), and later the B-Method.

The language has been developed over a number of years largely through case studies and industrial experience, and during this development a number of conventions have been developed for using the schema calculus to build up specifications. Most of these case studies have used a common paradigm: the system has been viewed as a state machine. The schema calculus has been used to build up a model of the internal state in terms of more or less separate components; operations have been defined in terms of changes to the overall state, and again the schema calculus has been used to specify these operations by merging operations on the components of the state.

8.1.3 In the Z notation, first component is the axiomatic set theory (FOPC) and the second component is the schema language. This is displayed below as schemas in horizontal and vertical forms:


**Notation**

We may write schemas in horizontal form:

```
[ declaration | constraint ]
```

or in vertical form:

```

- declaration
- constraint
```

In the vertical form, we may elide the semicolons between declarations and the conjunctions between predicates.

---

**Examples**

- **Example 1**

  - Vertical form:

    ```
    a : Z;  
c : \not\emptyset |
    a \in c
    ```

  - Horizontal form:

    ```
    [a : Z;  
c : \not\emptyset | a \in c]
    ```

- **Example 2**

  The positive rational numbers, in the form \( \frac{p}{q} \), can be expressed as a pair of integers with the constraint that \( q \) is not zero.

<table>
<thead>
<tr>
<th>Positive Rational</th>
</tr>
</thead>
<tbody>
<tr>
<td>a : Z;</td>
</tr>
<tr>
<td>b : Z</td>
</tr>
<tr>
<td>a \geq 0 \land b &gt; 0</td>
</tr>
</tbody>
</table>

The existence of this calculus is one of the main distinguishing features of Z and it is enormously important in the practical development of large scale specifications. First, it makes the job of the specifiers easier by allowing them to develop specifications incrementally. Second, it makes large Z specifications relatively easy to read, by structuring them into comprehensible units. Third, it helps with the development of proofs and possibly refinement steps in a structured way.

### 8.2 The Object-Oriented Approach

The object-oriented approach to system design is becoming increasingly popular, and we believe that this popularity is based on sound technical reasons. The fundamental characteristics of the object-oriented approach are:

- The structure of a system is based on the major objects which are of interest.
- The behaviour of each object is defined as a set of operations whose implementation is internal to the object.
- The behaviour of the system as a whole is defined in terms of the behaviour of its component objects.

In addition, a number of other techniques are commonly associated with the object oriented approach, although not a necessary part of it. These techniques are primarily concerned with classifying the objects in the system. Typically, objects are grouped into *classes*, where all instances of a class have a common behaviour. Commonly these classes themselves are related to each other in an inheritance hierarchy, whereby members of a particular class have all the properties of the superclass as well as any properties special to their own class.

The OO- approach offers one of the most promising ways of structuring a system in a way which increases cohesion within its parts and reduces coupling between them. It is therefore important that the specification should be able to reflect this structuring.
8.3 Z and Object-Orientation
In this section we summarize the similarities and differences between the conventional way of structuring Z specifications and the way that the object-oriented approach would suggest. This leads to our objectives in bringing the techniques together.

8.3.1 The conventional method of building up a Z specification has a lot in common with the object-oriented approach. For example, one of the well known case studies in Z is the CAVIAR\textsuperscript{6} system [8]. A system comprises a number of subsystems. Each sub system is concerned with one aspect of system. Each subsystem is an instantiation of a generic resource-user system. The specification proceeds by:
1. Identifying the basic sets with which the specification is concerned.
2. Identifying the basic operations which the system provides
3. Dividing the system into subsystems. The criterion for identification of subsystems is not made explicit, but the subsystems which are described are essentially encapsulations of some data and a collection of operations on that data.
4. Defining a resource-user system which is \textit{generic} in that it can describe any type of resource and any type of user, and \textit{general} in that it makes no restrictions on the number of resources per user or users per resource.
5. Specialising the resource user system to generate more restrictive subsystems, such as those which only allow one user per resource.
6. Instantiating the resource user subsystems so that they represent particular types of resource (for example a system in which resources are hotel rooms and users are visitors). These instantiations become the subsystems of the system.
7. Combining the instantiated, specialised subsystems into a complete system by including the subsystem state schemas in the total state schema and including the subsystem operation schemas in the total operation schemas.

8.3.2 These steps are very similar to those which would be taken when using an OO-approach.
1. The ‘basic sets’ of CAVIAR would be basic object classes in an object-oriented approach.
2. As far as possible each operation of the system would be treated as an operation on a single object class. This notion of ‘subsystem’ as an encapsulation of data and operations is very similar in this respect to the notion of ‘object’ in OO-systems.
3. The objects would be classified. In the course of this classification, the general resource-user system would be identified as a ‘superclass’ of the various resource user classes. The notion of a generic class, instantiable to refer to particular classes of contained objects, might also be identified. There is no generally accepted object-oriented approach to providing generic classes: some object oriented languages include this feature, while others use inheritance to achieve the same effect.
4. Inheritance would be used to define the specialised resource-user classes.
5. Instantiations of the classes would be created for each of the subsystems. The particular resources and users would be defined either by generic instantiation or by inheritance.
6. The complete system would be built up by creating instances of the various object classes. This is different from the way that CAVIAR is built up. In CAVIAR, subsystem definitions are simply merged. In an object-oriented approach, the system as a whole would contain an \textit{instance} of each object class. For example, if there were a schema HR-V for the hotel reservation subsystem and a schema M-V for the meeting subsystem, then the CAVIAR style would be to merge these in a composite schema.

9. SOME KEY QUESTIONS
Given the large number of competing formal methods it seems natural to ask “What is the best formal method”. Before we ask about the best solution, we need to understand what problem we are addressing. Much fruitless debate in this area, and some misguided exercises in formal specification, arises because there has not been a clear enough understanding of the problem to be solved.
It is recommended that before pursuing any FSs we need to ask, and answer, the following three questions:

- **What to specify?**
  Before we can write a specification, we need to know what is that we are trying to define. There are many possible answers to this question, and we suppose that failure to distinguish clearly between them can lead to much confusion.

\textsuperscript{6}CAVIAR (Computer Aided Visitor Information And Retrieval system) was developed using the Booch Method, supported by the tool Rational Rose, and implemented in C++.
Why to specify it?
Specification is not an end in itself. It is only a means to some other end, such as the deployment of a working system. We always need to ask whether specifying something will contribute to that end, furthermore, if so, whether it is the most effective means of doing so. Different formal notations are good at different things. For example, if we want to animate our specification we need an executable notation; if we want an easily readable specification by people, we may want an expressive notation which is less suitable for animation or proof. Therefore, just as with any document, we need to consider the intended audience for the specification and the use that will be made of it.

What is useful to describe?
When building a system we need to understand many different things, ranging from the environment that the system will be used in to the detailed code that performs critical functions. All of these are candidates for specification. Although there are no universally agreed artifacts that are relevant to all systems, we find it useful to distinguish the following things to be specified.

10. DOMAIN KNOWLEDGE

Parnas [9] and Jackson [10] have both pointed out that understanding the behaviour of the system’s environment is a crucially important part of building any system. If we are building an air traffic control system, for example, we certainly need to understand the behaviour of aircraft.

Facts about the environment of a system are traditionally the subject of “systems analysis”. Techniques such as context diagrams are used to identify the relevant actors in the domain and their interactions with the system. Important facts about entities in the domain are typically captured in entity-relationship diagrams (ERD) and in domain specific notations such as acceleration and braking formulae. Formal notations can be used to supplement ERD since they are, of course, much richer notations and can express far more complex properties than simple cardinalities. Typically these properties are expressed as state invariants in notations like VDM and Z. It is crucial to appreciate that what is being specified here is knowledge about the real world, not desired behaviour. Failure to appreciate this point can lead to serious errors. For example in specifying the state of an air traffic control system people are tempted to write an invariant that states that aircraft separations are maintained. This is a dangerous confusion between what is true and what one would like to be true. Specifying domain knowledge can be very beneficial provided it is done accurately. Knowledge of the behaviour of the real world is frequently used to justify preconditions on operations and to show that only certain event sequences are feasible. Such restrictions can greatly simplify the implementation of the system.

10.1 User Requirements

Systems are built with a purpose: to achieve some effect in the real world. The purpose of an air traffic control system, for example, is to prevent aircraft from colliding with each other while maintaining a swift flow of traffic. As seen, these requirements are often not directly related to the system at all – they describe desired behaviour in the system’s environment. User requirements for systems are typically couched in very high-level terms, and usually there is no great need for them to be precise. The most important characteristic of a user requirement statement is that it should be comprehensible to the end users. These requirements are frequently quantitative (“increase traffic by 10 %”) and often involve time (“land an aircraft every 90 seconds”). The best way of defining user requirements is usually by scenarios describing how the world should look when the system is working, and by quantified changes in real world measures. For all these reasons formal methods are not found to be useful or necessary in specifying user requirements.

10.2 System Requirements

In order to achieve the desired effects in the real world, the system must itself exhibit certain behaviour. For example an air traffic control system must be able to track aircraft and manage flight plans. System requirements differ qualitatively from user requirements in that they define only behaviour which the system itself must exhibit: they can be given to suppliers as a definition of what they must provide.

As we move towards characterising the system to be built, precision becomes more important. The requirements for a system need to draw a sharp distinction between those systems which are acceptable and those which are not. They need to define all the properties which are important to the user. These typically include:

- State transitions; allowable histories; the transfer function of a control system; a Formal Security Policy Model (FSPM); critical safety properties.  
  All of these are in principle specifiable mathematically. However, there are some problems in using conventional formal methods for carrying out such specifications.

- One issue is modality: typically system requirements are prioritised in some way such as mandatory versus desirable. This sort of modality is not easily expressible.

- A second issue is to do with the way that system behaviour is characterised.
For example, recently an FSPM for a highly secure system as well as a formal top level specification (FTLS) has been developed [11]. While the FTLS was readily expressible in Z, since it defined a set of operations on the system, the FSPM was more difficult to express. Rather than defining particular operations, it was necessary to characterise certain properties of all operations (for example that they should not display secret material) without saying exactly what the operations were. This can be done in Z, but not by using the established strategy, and the relationship between the FSPM and the FTLS is fairly subtle [11].

10.3 System Specification
Typically, system requirements do not prescribe every detail of what the system is to do. In response to the requirements the supplier may provide a more detailed specification of the system’s behaviour. This specification should be free of any design information – that is not of interest to the system’s users – and it differs only in degree of detail from the system requirements. There is no hard and fast line between them.

There is no difference in principle between a system specification and a statement of system requirements, but in practice they are at very different levels of detail. Broadly speaking, system requirements say what a system must do; the specification says what it will do. However, the specification is never complete, it still permits a variety of different behaviours all of which satisfy the specification. The main aspects of system behaviour which are typically specified include: abstract functionality; concrete interfaces; concurrency; performance; availability, reliability and maintainability.

Notations used in a specification must offer precision: this, of course is one of the main reasons for using formal notations.

- Expressiveness: all the different aspects need to be expressible, and the specification should be as close as possible to the “natural” way of defining what is wanted.
- Complexity management: any realistic system has a specification running to several hundred pages, and it is essential to structure it in a manageable way.
- Verifiability: it must be possible to show that the specification is well formed and that a system which satisfies the specification will also satisfy the system requirements.

There are three different audiences for a system specification:
- Users, so they can evaluate what they are going to get;
- Implementers, so they know what they have to build;
- Testers, so they know what the system should do.

10.3.1 Rationale
The reasons for using formality in a system specification are: to achieve clarity; to achieve expressiveness; in particular to allow the specification to be written in user oriented terms, stating what the system will do rather than how it will do it also to allow the use of logical constructors such as “and” rather than programming constructors such as - to allow for analysis.

In particular, it allows formal demonstration that the requirements are met and allow for refinement into design and code. In practice, clarity and visibility are designated as the most important characteristics. The specification should make it absolutely obvious to the users what they are going for in delivered products.

10.4 Design Structure
The design structure of a system is entirely different from its specification. It defines the components of the system and how they interact. It is of direct interest only to the supplier and should not be relevant to the system’s users. Some rough rules-of-thumb indicate that requirements analysis and design takes twice as long as coding.

10.5 Subsystem Specifications
Subsystem specifications define the external behaviour of each of the system’s components. If the subsystem is a code module, it defines exactly what behaviour the code must achieve. In some cases the subsystems are large developments in their own right which are contracted to another supplier.

10.6 Process Behaviour and Interactions
One particularly complex kind of component in a software-based system is a process: a component which has its own autonomous behaviour. Different processes work concurrently, often on different machines, and it can be particularly difficult and important to characterise their interactions.

10.7 CODE
One way of showing that a module meets its specification is to characterise the behaviour of the code mathematically. Such low-level specifications are used in critical systems for development and assurance of code.

It is found that developing code from Formal module specifications in VDM or Z is a straightforward activity and leads to exceptionally simple and well-structured code. King [12] gives rules for translating Z-specifications into Morgan’s refinement calculus after which the laws of the calculus can be used to develop the specifications to code. For highly critical
applications there is evidence that this approach actually reduces the cost of critical code because of its ability to find obscure errors early in the development process [13].

11. EFFECTIVENESS OF FORMAL METHODS

We have found the use of formal methods highly effective. The key benefits come from their application early in the lifecycle, where the cost of errors is high. Formal methods do not eliminate errors, but they do highlight them and make them easier to find in reviews and tests. It is noted that using formality retrospectively, to validate developments that have been carried out informally is less effective than using proper methods from the outset. Formal methods are only appropriate for some aspects of development, and they have to be used in conjunction with other methods. Where formal methods are appropriate, they are not just effective but they also reduce costs. In a recent project [4], it is found that proving properties of the Z specification was an effective and efficient method of detecting errors: it found more errors, at a lower cost per error, than unit testing for example. On the other hand proofs later in the lifecycle, based on the code, were less effective. Overall there is considerable evidence that use of formal techniques can greatly reduce defect rates in delivered products [4].

12. TRAINING FOR TOOLS

Tools are very important, but they should be subservient to methods and not vice-versa. It is more important to develop expressive notations than to have good tools for handling obscure specifications.
Tools should be seen as aids to analysis, more than as methods of assurance. The real benefit of a model checker or proof tool is not when it tells you that your specification is correct, rather it demonstrates the flaws in your thinking. This is an important consideration for tool writers: they need to think far more about the error cases than the correct ones. This is similar to situation with compilers: there are far more compilations of incorrect programs than there are of correct ones, and good error reporting is an important requirement of compilers.
If formal methods tools are to be used in mainstream development they have to be fully automatic. Model checking can be applied by ordinarily capable engineers, but it is not reasonable to expect most engineers to carry out sophisticated proofs. Unfortunately real systems are too big for the current generation of tools. We need huge improvements in the capacity of tools like model checkers if they are to be used routinely in real system development.
Despite this, the specification-based testing part of the assignments is such that, given the restriction on students’ available time and effort, it can only be applied to the smaller examples from the specification part of the course. While this is unfortunate, we believe that in any case it is a reality of many of the current state-of-the-art formal methods tools.

13. OTHER WORK & SHORTCOMINGS

Specifications using formal methods are difficult to learn and represent a significant “cultural shock” for some software practitioners. Z has been designed to be read by suitably trained persons and as such may be included and is being included in academic curricula which are oriented to tailor software students to professional software engineers. It is unrealistic to expect widespread use of formal methods by attending a short course in Z or VDM. Undoubtedly, formally engineered software is quality S/W whose production requires time and expertise.

13.1 Formal methods are becoming more accepted predominantly in both academia and industry in Europe, USA and only sparingly in India as a catalyst to help improve the quality of both software and hardware systems. Software Specification and Testing, is a fourth-year course that aims to develop the students’ ability to formally specify systems using the OO-specification language Object-Z, and then to use that formal specification as a basis for testing the implementation.

13.2 Object-oriented formal specification has the advantage of a well understood semantics, but the disadvantage that some object-oriented constructs are awkward to express in standard Z. Given the large number of competing formal methods it seems natural to ask “what is the best FM”. Just as with any documents, the intended audiences for the specification need to be considered.

There are however several related topics which have been addressed. If we want to carry out development formally, we need to find much more powerful methods of refinement [14].

CONCLUSION

Selective use of formal methods to define critical requirements can, however lead to a significant decrease in lifecycle costs. Formal methods are not a panacea, they do not eliminate errors but they do highlight them and make them easier to find in reviews and tests. It’s rather one more weapon in the armory against making design mistakes. For this reason it is likely that formal, mathematical specification techniques will form the foundation of a future generation of CASE tools.
Since the main benefits of formal methods stem from their use early in the lifecycle, we need to find ways of making them more accessible to end users. We found that using formal methods in this way gave benefits in accuracy and testability of the software, reduced the number of errors in the delivered product and was a cost-effective way of developing high integrity software.

This approach has the benefits that it shows students both how formal methods can support other software processes such as V&V(Fig-2) and how traditional techniques such as software testing can be applied to formal specifications; to validate the specification.

An Ill-specification incurs heavy maintenance cost and it eats software organization alive!

We conclude that this use of a formal specification can reduce risks and costs for all concerned and can help foster fruitful and co-operative relations in situations which are often fraught with confrontation.

REFERENCES


PHOTOCATALYTIC DEGRADATION OF 2-NITROANILINE: A MAJOR WATER POLLUTANT

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ABSTRACT
Photo catalytic degradation of 2-nitroaniline was performed in specially designed reaction vessel in the photo reactor equipped with UV tubes and constant stirring of solution was ensured at constant temperature. The degradation of 2-nitroaniline compound has been investigated parameters like catalytic addition, catalyst dose, effect of UV/solar and their effects have been analyzed. 2-nitroaniline (25ppm), TiO$_2$ dose was optimized to be 4g/l, at operating pH of 2.0 with UV intensity of 25 W/m$^2$. Degradation 89.5% and 98.9% was achieved in UV at 282nm and 411nm and 93% and 99.3% at 282nm and 411nm in solar light under the optimized parameters. at 411nm was observed. The results of photo degradation of 2-nitroaniline showed that heterogeneous photo catalytic could be used as efficient and environmental friendly technique for the complete degradation of recalcitrant organic pollutants which will increase the chances for the reuse of wastewater.

Keywords: Photocatalysis, catalyst TiO$_2$, 2-nitroaniline, oxidation

1. INTRODUCTION

1.1 Pollutant
Water pollution is a major cause of concern in most of the countries such as India and other developing nations. Several methods of water purification have been practiced since many decades. Many Industries discharge pollutants into the environment include oil refineries, tanneries, textile plants, pharmaceutical, paint, and coal processing industries. Many of these pollutants from industrial and municipal waste are toxic, persistent, and not readily biodegradable. Photo catalysis is a promising technique of various hazardous chemicals that are encountered in waste waters [1]. The application of photo catalysis for water treatment is a comparatively recent development as it offers certain advantages over the preceding oxidation processes. The objective of the paper is to degrade a model compound 2-nitroaniline which is a persistent, non biodegradable priority pollutant present in textile effluent and cannot be treated by conventional treatment processes to optimize different parameters such as use of Solar light, catalyst addition, catalyst dose (TiO$_2$), comparison of UV/Solar and mineralization of n-nitroaniline.

1.2 Priority pollutants
Priority pollutants refer to a list of specific pollutants that include heavy metals and specific organic chemicals. The priority pollutants are a subset of "toxic pollutants" as defined in the Clean Water Act (USA). These pollutants were assigned a high priority for development of water quality criteria and effluent limitation guidelines because they are frequently found in wastewater. The Black list of chemicals substances selected by the E.U. (Harrison, 1992) is also given in table1.

*Corresponding Author
Table 1: Black list of chemicals substances selected by the E.U. (Harrinson, 1992)

<table>
<thead>
<tr>
<th>Group</th>
<th>Included substances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloride Hydrocarbons</td>
<td>Aldrin, dieldrin, chlorobenzene, dichlorobenzene, chloronaphthalene, chloroprene, chloropropene, chlorotoluene, endosulfane, endrin, hexachlorobenzene, hexachlorobutadiene, Hexachlorocyclo-hexane, hexachloroethane, PCBs, tetrachlorobenzene, trichlorobenzene.</td>
</tr>
<tr>
<td>Chlorophenol</td>
<td>Monochlorophenol, 2, 4-dichlorophenol, 2-amino-4-chlorophenol, pentachlorophenol, 4-chloro-3-methylphenol, trichlorophenol.</td>
</tr>
<tr>
<td>Pesticides</td>
<td>Cyanide chloride, 2,4-dichlorophenoxyacetic acid and derivatives, 2,4,5 trichlorophenoxyacetic acid and derivatives, DDT, demeton, dichloropropene, dichlorovos, dimethoate, disulfoton, phenitrothion, phenthion, linuron, malathion, MCPA, mecoprope, monolinuron, omethoate, parathion, phoxime, propanil, pirazole, simazine, triazofos, trichlorofon, trifluralin and derivatives.</td>
</tr>
<tr>
<td>Chloroanilines and nitrobenzenes</td>
<td>Monochloroanilines, 1-chloro-2,4 dinitrobenzene, dichloroaniline, 4-chloro-2-nitrobenzene, chloranilbenzene, chloronitrobenzene, dichloronitrobenzene.</td>
</tr>
<tr>
<td>Polycyclic Aromatic Hydrocarbons</td>
<td>Antracene, biphenyl, naphthalene, PAHs</td>
</tr>
<tr>
<td>Inorganic substances</td>
<td>Arsenic and its compounds, cadmium and its compounds, mercury and its compounds.</td>
</tr>
<tr>
<td>Solvents</td>
<td>Benzene, carbon tetrachloride, chloroform, dichloroethane, dichloroethanone, dichloromethane, dichloropropene, dichloropropanol, dichloropropene, ethyl benzene, toluene, tetrachloroethylene, trichloroethane, trichloroethylene.</td>
</tr>
<tr>
<td>Other</td>
<td>Benzidine, chloroacetic acid, chloroethanol, dibromomethane, dichlorobenzidine, dichloro-diisopropyl-ether, diethylamine, dimethylamine, isopropyl benzene, Tributylphosphate, trichlorotrifluoroethane, vinyl chloride, xilene.</td>
</tr>
</tbody>
</table>

Many of these are heavy metals, pesticides, and other chemicals listed here are on the priority pollutant list:

**Heavy Metals (Total and Dissolved)** "Heavy Metal" in the water treatment field refers to heavy, dense, metallic elements that occur only at trace levels in water, but are very toxic and tend to accumulate. [2]

**Pesticides** Pesticides comprise a large class of compounds of concern. Typical pesticides and herbicides include DDT, Aldrin, Chlordane, Endosulfan, Endrin, Heptachlor, and Diazinon. Surprisingly, concentrations of pesticides in urban runoff may be equal or greater than the pesticides in agricultural runoff.[3]

**Polycyclic Aromatic Hydrocarbons (PAHs)** Polycyclic Aromatic Hydrocarbons include a family of semi-volatile organic pollutants such as naphthalene, anthracene, pyrene, and benzo (a) pyrene. There are typically two main sources of PAHs: spilled or released petroleum products (from oil spills or discharge of oil production brines) and combustion products that are found in urban runoff.

**Polychlorinated biphenyls (PCBs)** Polychlorinated biphenyls are organic chemicals that formerly had widespread use in electrical transformers and hydraulic equipment. This class of chemicals is extremely persistent in the environment and has been proven to bio-concentrate in the food chain, thereby leading to environmental and human health concerns in areas such as the Great Lakes.

1.3 Treatment Methods for priority pollutants

The treatments processes for different types of effluents to be used must guarantee the elimination of the pollutant in order to reach the strict authorized levels for the discharge of these effluents. The levels of pollutants allowed in discharge water are directly related with the type of pollutant present in the effluent. In general, the elimination of organic pollutants in aqueous solution needs one or various basic treatment techniques [4] [5]: chemical oxidation, air desorption, liquid-liquid extraction, adsorption, inverse osmosis, and ultra-filtration and biological treatment. But now days the most promising techniques are photochemical process, advanced oxidation process etc.
1.3.1 Advanced oxidation process (AOP)
In the last 15 years, a lot of research projects have been addressed to a special class of oxidation techniques defined as Advanced Oxidation Processes (AOP’s), pointing out its potential prominent role in the wastewater purification (Ollis and Ekabi, 1993). All AOP’s are characterized by the same chemical feature: the production of hydroxyl radical OH \([\cdotOH]\) [6]. These radicals are extremely reactive species and attack mainly every organic molecule. These radicals also characterized by a low selectivity of attack which is a useful attribute for an oxidant used in wastewater treatment for solving pollution problems. The versatility of AOP’s is also enhanced by the fact that they offer different possible ways for OH radicals’ production, [7] thus allowing a better compliance with the specific treatment requirements. The oxidation reactions involving hydroxyl radical and organic substrates (RH or PhX) in aqueous solutions may be classified with respect to their character (Boossmann et al., 1998):

- abstraction of hydrogen
- addition reactions
- electron transfer

\[
\cdotOH + RH \rightarrow R. + H_2O \\
\cdotOH + PhX \rightarrow HOPhX. \\
\cdotOH + RH \rightarrow [R − H]^+ + HO^-
\]

1.3.2 Photocatalysis
The word photocatalysis is composed of two parts. The prefix photo, defined as "light", Catalysis is the process where a substance participates in modifying the rate of a chemical transformation of the reactants without being altered in the end [8]. Heterogeneous photocatalysis is a technology based on the irradiation of a catalyst, usually a semiconductor, which may be photoexcited to form electron-donor sites (reducing sites) and electron-acceptor sites (oxidizing sites), providing great scope as redox reagents. The process is heterogeneous because there are two active phases, solid and liquid. The most effective photocatalyst is titanium dioxide. Photocatalytic destruction of organic compounds is based on semiconductor photochemistry. The titania catalyst is illuminated by UV radiation with a wavelength sufficient to displace electrons from the valence band of the catalyst; for titanium dioxide this is below 387.5 nm. An electron/hole pair is produced on the semiconductor surface [9]. The photocatalytic oxidation of an organic species often proceeds via adsorption of the pollutant on the surface of the catalyst, followed by direct subtraction of the pollutant’s electrons by positively charged holes.

![Fig. 1: Principle of photo catalysis](image)

2. MATERIALS

2.1 TiO\(_2\) as a catalyst
There are many types of catalyst, some act on very few substrates while some act on many substrates. The best way to cleanse a wastewater would be to use a photo catalysis process that can be effective on a many contaminants or in other words a heterogeneous environment of contaminants. Metal oxides work well in this case. It is true that many oxides work well like: WO\(_3\), and ZnO but in scientific studies it has been proven that TiO\(_2\) has an advantage over the others. Results observed from TiO\(_2\) proves better compared to others & remediation of wastewater are based on several factors:

1. The process occurs under ambient conditions. 2. The formation of photocyclized intermediate products, unlike direct photolysis techniques, is avoided. 3. Oxidation of the substrates to CO\(_2\) is complete. 4. The photocatalyst is inexpensive and has a high turnover. 5. TiO\(_2\) can be supported on suitable reactor substrates
2.2 2-Nitroaniline as priority pollutant
2-Nitroaniline, also known as ortho-nitroaniline and o-nitroaniline, is aniline carrying a nitro functional group in position 2. It is present in the form of orange yellow crystals. Properties of 2-nitroaniline are given in Table 2.

<table>
<thead>
<tr>
<th>PROPERTIES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular formula</td>
<td>C₈H₈N₂O₂</td>
</tr>
<tr>
<td>Molar mass</td>
<td>138.14 g/mol</td>
</tr>
<tr>
<td>Appearance</td>
<td>Solid</td>
</tr>
<tr>
<td>Boiling point</td>
<td>284°C</td>
</tr>
<tr>
<td>Melting point</td>
<td>71°C</td>
</tr>
<tr>
<td>Density</td>
<td>1.44 g/cm³</td>
</tr>
<tr>
<td>Solubility in water, g/100 ml at 25°C</td>
<td>0.126</td>
</tr>
<tr>
<td>Vapour pressure, Pa at 20°C</td>
<td>4</td>
</tr>
<tr>
<td>Flash point</td>
<td>168°C</td>
</tr>
<tr>
<td>Auto-ignition temperature</td>
<td>521°C</td>
</tr>
<tr>
<td>Structure</td>
<td><img src="image" alt="Structure" /></td>
</tr>
</tbody>
</table>

Table 2: Properties of 2-nitroaniline

3. EXPERIMENTAL

3.1 Photocatalytic Treatment
Photocatalytic treatment was done for 2-nitroaniline compound solution. The compound solution was treated and the various parameters catalyst dose, concentration of oxidant were varied and optimized [10].

3.1.1 Degradation of 2-nitroaniline compound
2-nitroaniline solution of 25 ppm was prepared by single distilled water. The reactions are done in both solar & UV conditions. Single distilled water was used for all dilutions. Initial pH of sample was checked and all the parameter are varied to optimize the value of catalyst dose, oxidant concentration and comparison of photocatalytic activity with solar light. The sample (200ml) taken in glass bowl (1000ml quantity) and was covered with transparent thin foil; air is also supplied by the aerator during experiment. Compound sample was treated in the presence of UV light in photo reactor for about 5 or 6 hours. Sample was withdrawn in every 30 min. or 1 hour, filtered through the syringe filter and absorbance was taken in spectrophotometer. COD of samples was measured as per the standard methods. All tests were repeated for getting the reproducibility of results. The photocatalytic treatment using TiO₂ catalyst was employed for the effective degradation of 2-nitroaniline solution. The experimental variables were developed in which the TiO₂ addition, catalyst dose, UV exposure time, solar exposure time, and use of oxidant were varied and applied to compound solution.

4. RESULT & DISCUSSION

4.1 Effect of catalyst addition
The catalyst dose is an important parameter which has strong influence on the degradation kinetics of 2-nitroaniline solution. Degussa P-25 TiO₂ catalyst was used in slurry mode. The experiments were carried out in solar and UV with catalyst and without catalyst in order to determine the effect of catalyst presence or. It was observed that 63% and 80% degradation at 2pH and 44% and 55% at 10pH at 282nm and 411nm in UV and 53% and 56% at 2pH and 35% and 72% at 10 pH at 282 and 411nm was observed in solar without catalyst. The experiments with catalyst show that 89.5% and 98.9% degradation at 2pH and 73% and 92% at 10pH at 282 and 411nm in UV and 93% and 99.3% at 2pH and 85% and 97.3% at 10 pH at 282 and 411nm was observed in solar. So on the basis of results; one can clearly say that better results were obtained in presence of catalyst in both UV as well as solar light. This can be better shown in figure 4.1, table 2.

4.2 Effect of catalyst dose
The catalyst dose is another important parameter which has strong influence on the degradation kinetics of 2-nitroaniline solution. Degussa P-25 TiO₂ catalyst was used in slurry mode. In order to determine the optimal amount of catalyst concentration, a series of experiments were carried out using different concentrations of TiO₂ catalyst varying from 2 to 5g/L.
at optimized pH of 2.0 with 25 ppm 2-nitroaniline solution. And it was observed that as the concentration of catalyst increases from 2g/L to 5g/L, the percentage degradation varies. So maximum degradation 89.5% and 98.9% has been observed at 282nm and 411nm respectively in UV and 93% and 99.3% has been observed at 282nm and 411nm respectively in solar with catalyst dose of 4g/L and it was considered as the optimum dose for the degradation of 2-nitroaniline solution (25 ppm) for subsequent analysis. This can be shown in figure 4.2

**4.3 Comparison of UV/Solar light**

The effect of UV light on the degradation of 2-nitroaniline compound solution by photocatalytic process has been investigated. The comparative study has been carried out for the degradation of compound solution in Solar/UV light. The aqueous suspensions of TiO$_2$ (4g/L) containing 2-nitroaniline compound solution (25 ppm) was exposed to Solar & UV at pH 2.0 and pH10. The rate of degradation was found to be slightly more in the solar light in comparison to UV light. After 3hrs of reaction time the percentage degradation was 98% in solar light and 91% in UV light at 411nm and 72% in UV and 87% in solar was observed after 3hrs at 282nm. It is evident from the graph that percentage degradation of UV is also close to solar light degradation so because of that there is not so much difference on degradation in UV light so solar light can be efficiently used for the photocatalytic degradation of wastewater or different type of priority pollutants.(shown in Figure 4.3)

**4.4 Mineralization of 2-nitroaniline**

COD is again an important parameter to be analysed for any compound. Here COD from 80 to 8.4 mg/l in UV and 80 to 5.6mg/l in solar at 282nm and 60 to 2mg/l in UV and 60 to 1mg/l in solar at 411nm was observed.(shown in Figure 4.4)
<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>With catalyst (% age degradation)</th>
<th>Without catalyst (% age degradation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pH2</td>
<td>pH10</td>
</tr>
<tr>
<td>UV(282)</td>
<td>89.5</td>
<td>73</td>
</tr>
<tr>
<td>UV(411)</td>
<td>98.9</td>
<td>92</td>
</tr>
<tr>
<td>Solar(282)</td>
<td>93</td>
<td>99.3</td>
</tr>
<tr>
<td>Solar(411)</td>
<td>85</td>
<td>97.3</td>
</tr>
</tbody>
</table>

Table 2: effect of catalyst addition

CONCLUSION

Photocatalysis is a promising technique, for the photodegradation of various hazardous chemicals that are present in industrial wastewater and it mineralize the organic contaminants into final end product. Heterogeneous photocatalysis is eco-friendly way to reduce the pollutants load of wastewater. It has been found that results obtained in solar light are better than UV light so the solar light can be efficiently used for treatment of priority pollutants which will reduce cost of operation. 2-nitroaniline compound has been successfully degraded in the presence of TiO$_2$ photocatalyst. TiO$_2$ dose was optimized to be 4g/l, at operating pH of 2.0 with UV intensity of 25 W/m$^2$. In case of 2-nitroaniline, 89.5% and 98.9% degradation was achieved in UV at 282nm & 411nm and 93% and 99.3% degradation was achieved in solar light at 282nm & 411nm at the optimized parameter. It is evident from the results that solar light can be effectively used for the degradation and decolourization of compound solution. Hence, it can be concluded from the observations that solar photocatalysis can be suitably and cost effectively employed for the degradation of priority pollutants.

REFERENCES

ABSTRACT
This paper reports for the first time new findings about the concept of aura. It is creating interest all over the world among the researchers, scholars, scientists and spiritual leaders. There is nothing “paranormal” in the Universe, except our limited understanding of Nature. Our know-how on Earth is just a tiny drop in the ocean of knowledge. Long ago people were able to see Auras, advanced spiritual people such as Lord Krishna, Lord Rama, Buddha, Christ and Gurunanak dev ji were painted with golden haloes around their heads. All we need to see Auras. All is required is the knowledge how to use your senses together with your conscious efforts. Every one is surrounded by an electromagnetic field, and this field is called an Aura. A field of energy surrounds us all. With scientific developments, the Aura can now be photographed. The various colors seen in the aura can give us clues to our emotional & physical well-being, it may one day be used for medical diagnosis. Energy surrounding us can be photographed with special field cameras. Aura Colors changed frequently depending on our emotions, physical activity, health etc. Aura is live sustaining energy force that characterizes every Human being. The negative mental state such as anxiety, hostility, anger, hatred, frustration etc. assert negative and bad affect on body and drain the aura system. A genuine concern for others all contribute to the Aura system and replete with radiant energy. Aura shows our true nature and intentions and becomes spiritual signature. In the history of science, developing of new instruments has resulted a new understanding of reality. Moreover we can send and receive the signals through Aura.

Keywords: Paranormal, Golden Haloes, conscious efforts, electromagnetic field, Aura Colors, radiant energy

1. INTRODUCTION AND SURVEY OF LITERATURE

1.1 Everything in the universe seems to be just a vibration, every atom, every part of an atom, every electron, every “elementary particle”, even our thoughts and consciousness are just vibrations. Hence, we may define the aura as a electromagnetic vibration surrounding the human body. The most important property of the aura seems to be the fact that it contains the information about the object aura around living (conscious) objects (people, plants etc.) changes with time, sometimes very quickly. Aura around nonliving objects (stones, crystals, water etc.) is essentially fixed. These facts have been observed by scientists in Russia who have been using Kirlian effect to study aura for the last 50 years.[4]

1.2 Our aura is a part of universe. It is connected to Universal cosmic energy. Aura is an energy field around human body or to say any living thing. It enfolds the physical body protecting it from negative vibrations. This energy or universal life force or prana manifests our existence. Aura is the antennae of consciousness, a treasure trove of knowledge, a storehouse of our karma-our thoughts actions and reactions. And if tapped in right direction, have chances of limitless growth possibilities. Aura is described as divine illumination or light of God radiating in the form of electromagnetic vibrations from within the human body.

1.3 The aura around human is partly composed from EM radiations, spanning from microwave, infrared (IR) to UV light. The low frequency microwave and infrared part of the spectrum (body heat) seems to be related to the low levels of the frequency (UV part) is more related to our conscious activity such as thinking, creativity, intentions, sense of humor and emotions etc.[3]

*Corresponding Author
1.4 The human aura is life sustaining energy force that characterizes every human being. It is sensitive to inner and outer environment mental physical spiritual and emotional factors constantly interact and influence the aura. Personality traits, health status, personal interests, social factors and emotional states surrounding conditions can have immediate and critical effect on aura.

1.5 The negative mental states such as anxiety, hostility, anger, hatred, frustration etc. assert negative and bad effect on body and drain the aura system. Similarly, low self esteem, poor self concept and negative social interaction can deplete energy supply. On the other hand, Love the most powerful force in Universe, expands, illuminates and energizes the aura. Positive self concept, inner state of balance, and attunement with cosmic force, a genuine concern for others all contribute to the aura system and replete with radiant energy.

1.6 The human aura is never without color. Although intensity and distribution of colors vary extensively, the aura is characterized by its dominant color with relatively stable structure. The aura is visible manifestation of life force that energizes the total well being. Without this energizing life force, the physical body cannot function. Aura is therefore in manifesting life force underlining our existence, also manifests our immortality as spiritual being. We are temporary residents of this planet but permanent citizens of this cosmos. Aura is never stationary it keeps changing with our thoughts and beliefs while in non living things aura is stationery.

2. EVIDENCES

2.1 Evidence from those who see Auras
Russian scientist is quite ahead of everyone else in Aura research, make experiments suggesting that our DNA can be altered, by influencing its microwave aura. The high frequency UV part is very important and most interesting but largely unexplored. And this part can be seen with naked eyes.

2.2 Children and the Aura
Very young children (upto 5 years of age) see auras naturally. Infants frequently look above a person in front of them. When they do not like the color of the aura above the head, or if this color is much different from their parent’s aura, they cry, no matter how much smiling the person does. In my opinion children should learn to see and read Auras in a primary school, so they never lose this natural ability.

2.3 Our eyes
- With our eyes we can sense (perceive) a very narrow range of vibration frequencies of Electro Magnetic (EM) vibration corresponding to wavelengths from 0.3 to 0.7 micrometers – from purple to red. A mix of the vibration frequencies in the above range we perceive with our eyes as color. We can measure this mix precisely by recording a spectrum of light, but using special instruments, called spectrophotometers.
- When we want to do a photo of a dark scene, we need to increase the time of exposure of the film. We can accomplish this for our eyes by concentrating exactly on ONE spot for a while (30-60 seconds).
- When our eyes are moving, or a scene moves in front of our eyes, images are averaged by our eye. (25 TV frames per second seems a fluent motion). When we concentrate on one spot, we increase our sensitivity because we average the incoming light, cumulating its effect.
- Our photosensitive cells (Red Green and Blue) operate as vibration sensors, much like 3 radio receivers tuned to 3 “colors” RGB. When you need to achieve a large vibration of, say, a swing – you can accomplish it using a very week excitation force, but persist with it. Concentrating with your eyes on one spot you achieve a very similar effect: with a very small stimulation you can gradually swing your photo sensitive cells into large vibration, and this result in a visual sensation perceived by the brain.

3. HOW TO SEE AND READ THE AURA

3.1 Observing Aura of other people
The best is to look directly at someone’s brow chakra (third eye or wisdom eye, which is located @1.5 cm above the nose, between eyes) and aim to achieve the state of mind similar to the concentration technique described above for at least 30-60 seconds. I have tried also looking at throat and hearts chakras with similar results. However, if you concentrate on someone’s chest it looks so unusual that the person concerned is usually very uneasy about it. Again, very softly illuminated background, with no shadows is best. With practice, any uniformly illuminated background (such as a blue sky for example) will suffice.
3.2 How to see your own Aura
Stand about 1.5 m in front of a good size mirror. In the beginning it is best if the background behind you is plain white and there are no shadows. Illumination should be VERY soft and uniform not bright. Follow instructions above for seeing Auras. PRACTICE for at least 10-15 minutes each day to increase your sensitivity and develop Auric sight. Remember that practice is required to develop Auric sight.

3.3 Auric sight
Light sensors in our eyes (Red, Green and Blue) are vibration sensors which are highly non-linear and they have memory. The consequence of memory is that they can oscillate for up to several seconds after the visual stimulation has been discontinued.

3.4 True nature of a person
Our True Nature is what is left when we recognize and discard all our habits, stereotypes, manners, and pretending, superficial behavior and become fully conscious, truly natural and spontaneous. Note that some people are so attached to their manners and habits that it is very hard, if not impossible, to discover who they really are. The only way to get an instant insight into their personality seems to be by watching their Aura, because the Aura shows their True Nature, behind any façade of superficial behavior.[6]

3.5 What you will see
You will see a bright haze around the subject's body. This is particularly easy to see around the subject's head and shoulders. Some in the group may see colors but don't worry if you can't. Help others by describing what you see. Take turns as the subject and notice the differences between the auras. Some people's auras are easier to see than others.

3.6 How to see it
Look slightly above and between the subject's eyebrows. Let your eyes relax and don't try to see the aura. It is very much like looking at magic eye pictures. You will not see it the first time if you look directly where it is. The aura will just seem to appear around the subject. This can take from 10 seconds to 2 minutes depending on the viewer. When this happens don't look directly at it or it will 'disappear'. Instead, train your eyes to see it by keeping your focus on the subject as described above. After you have trained your eyes you can look directly at the aura without losing it.

3.7 If you have difficulty
While looking at the subject, think of something or someone that makes you feel good (your small child, for example). The aura is particularly easy to see around the head, shoulders and hands. With conditions the same as described above, put a potted house plant at eye level in the subject's place. Use a fast growing plant if possible. When looking at the plant open your heart to the wonder of its creation. How simple, yet beautiful, it is. When your heart connects with this you will see the plant's aura. When you have succeeded at this step you can look at your own aura using a mirror in place of the plant. The distance in the mirror is doubled so don't sit so far away. Look at yourself just as described above for looking at the subject. [5]

Fig 1 Tirupati Balaji Temple
Fig 2 Lord Krishna
Fig 3 Golden Temple                                                                                               Fig 4 Guru Nanak Dev

Good will happen in everyone's life who soever visits these temples where the energy is surrounded & continuously emanating which has cured millions of people.

4. HUMAN AURAS WIRED TO THE UNIVERSE

Fig. 3 Energy field encompasses the human body

The aura is an energy field that encompasses the human body, it is described by clairvoyants and healers as an egg-shaped area of light that extends beyond the skin. Auras are thought to be caused by the vibrations that surround every material object. The human aura is both an energy field and a reflection of the body’s subtle life force. These energies make you what you are, in turn, affected by your lifestyle and environment. Your aura reflects your health, character, and physical and psychological well-being. It also acts as an indicator of disease long before the onset of actual symptoms. To the trained eye, a human aura appears blue; however, a type of imaging called Kirlian photography (aura photography) reveals all the colours of an auric field.[2]
4.1 Auras are real
The hard wiring of patients to instruments we find in critical care hospitals may someday be eliminated by tuning in to a patient aura. Scientists in UK can measure electrical emissions from a person breathing and heartbeat utilizing sensors a foot away from the patient even with electromagnetic energy blasting through the room from various electrical devices. Each of our brains and bodies broadcast unique signals into space and we are affected by energy from our world.

4.2 Energy gluing all of us together
Our sense of feeling deceives us to believe each of us is separate from each other and the world out there. Our senses pick up but a trillionth of the energy from our environment. Light enters our eyes and informs us what the light interacted with. Sounds are but movement of air, taste and smell and are means of capturing a few molecules, and touch is electrostatic push on nerve receptors. Our senses are continually monitoring minute energy signals. If somehow it was possible to completely shield a person from the energy of our world, catastrophe would strike. A UCLA researcher demonstrated clarity of consciousness and emotions are triggered or impeded by various types of electromagnetic frequencies from our environment.[7] We not only require the energy of the universe we continually emit energy into our surroundings. Each of us
emits unique energy patterns. While the typical electrical frequency in brain activity is between about zero to 30 cps (cycles per second), muscle energy frequencies are about 225 cps, and the heart clocks in at about 250 cps. There is weaker yet verifiable human electrical field outside the body, with frequencies ranging between a hundred and 1,600 cps. Although faint, the energy from every person who ever lived is still radiating through the universe. These are frozen dreams, laughter, sadness, joy, and memories buzzing through the cosmos.

5. WE ARE ONE WITH OUR WORLD

The Earth is moving about the Sun, the Sun whirling around the Milky Way, and our galaxy zipping through the universe resulting in our traveling a million miles an hour. In our wake we broadcast at the speed of light a report of our physical health, our thoughts, and our presence. We are also incorporating information from the universe at every instant. We are one with our world and every aspect of our being will forever mingle with the energies of others and the universe. Do you sense this connection?[6]

We are Energy or Spiritual Beings in a human body with our Aura as this spiritual side of us. Using our Aura we can communicate with anyone anywhere in the Universe and have access to all the knowledge of the Universe. Our physical bodies are a manifestation of our Aura so problems or blocks to our Aura programs, causes problems in our physical bodies.

![Energy in a human body](image)

5.1 Vibrations transmitting from the body

In human aura, our human body transmits various kinds of positive and negative energies and vibrations. When other persons come in contact with our vibrations of aura, they get influenced by our original ideas and thinking processes.

6. REASON TO SEE AND STUDY AURA

Aura shows our true nature and intentions. We cannot fake aura. Aura is our spiritual signature. When you see a bright clean aura, you can be sure that such person is good and spiritually advanced even if he or she is modest or not aware of it. When you see a grey or dark aura you can be certain that such person has bad and negative intentions regardless how impressive, eloquent educated, good looking or well dressed he/she seems to appear. Especially colors above the head suggest the motives, thoughts and intentions as of now. In the history of science, developing of new instruments has resulted in new understanding of reality Microscope telescope; camera laser computer etc. without these instruments modern science is powerless. Similarly, the invention of instruments and technology to see aura of human beings, other objects and environment- houses places land etc. and rectifying them will bring peace and harmony in one's life. This acceptance can bring revolution to mankind. One of the most significant applications of modern technique today is assisting health professionals in quick and accurate assessment of human state, stress on different organs and in comparing of effectiveness and treating with various therapies.[9]
6.1 How does the disease enter in human body?

First stage
Disease manifests into the aura can be seen as congestion or leak in the energy field. So long before the person feels any pain one can see blockages in auric body.

Second stage
When first stage is ignored, the imbalances then affect the chakras and human energy field and this slows down body's self healing mechanism.

Third stage
Imbalances are seen on organs in energy field that may be an affect of the disease takes its physical manifestation. Pathological tests if done will show abnormalities.

Forth Stage
Person suffering will now feel severe pain enough to go to a doctor who will cure his physical problems. Depending upon severity of the condition doctor will either put him to medication or operation may be the way of relieving the patient.

Last stage
It is a chronic stage when patient undergoes prolonged illness and slow degeneration takes the person to end of life.

Terminal stage
It is when the patient ultimately dies, may be of diseases like cancer etc.

CONCLUSION
An aura is the subtle energy field surrounding every living being. Every person has a unique aura that reflects their current condition. People who are sick or emotionally upset have weak shadowy auras, while healthy happy people have auras that are strong bright auras. A strong healthy aura is essential in blocking negative influences from draining energy and vitality from us. People with strong positive auras are naturally charismatic and attract others to them. They tend to be more successful in getting things done and getting support from other people. People with negative auras tend to be self-promoters that drive others away from them, and those with strong negative auras may be evil. It is possible that negative auras can become parasitic and literally steal energy from positive auras.

FUTURE SCOPE OF HUMAN AURA
- Deep study of Human Aura can establish the theory of oneness in the world.
- Further study of Aura can be used to change the minds of the students by the teachers/preachers.
- It can be used for creating the excellent governance of the world governments.
- It may be largely used to cure patients by doctors.
- Role of saints/gurus/thinkers to heal the suffering of human race in the universe.

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UTILIZING CLIENT CACHING FOR WEB NAVIGATION SYSTEM

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ABSTRACT
Researchers work hard to find ways to design better Information Architecture for websites. Navigation system is a part of information architecture. Wide research is done to find parameters which can be added in a navigation system so that navigation for any type of user becomes easier and user never gets frustrated. But due years of research for web navigation system led to navigational burden. This burden is mainly on web server. So we must find ways to reduce this burden from server and try to make use of under utilized client resources. This paper is about finding an intermediate path that uses both client resources as well as server resources for implementation of web navigation system.

Keywords: Web, Navigation, System, Bar, Cache, Browser, Implementation

1. INTRODUCTION
1.1 Navigation system is the core tool provided to the users so that they may navigate from one web page to another web page. Depending on the need the developers may use Global Navigation System or Local Navigation System or Global and Local Navigation System.

1.2 A ‘successful’ web system is one which achieves its mission and desired goals. One issue that contributes to failures in the development of Web based systems is poor or inappropriate development processes. Another issue that contributes to the failure of these web systems after the development is lack of ‘usability’ in these systems. A basic demand of any website is that its web application must work in the sense that it must be possible to use the website for its intended purpose-this is addressed by research into Web Engineering methods, models and tools. However, there is also the equally important demand that the web application must be usable by the visitors of the website and should not inflict heavy ‘navigational burden’ & ‘navigational stress’ on users [1].

1.3 Even if a website contains a few web pages its size may increases to hundreds of web pages with time. To maintain the links of hundreds of web pages the links have to be generated smartly. Different developers maintain the navigation system in different ways. Each type of implementation of a navigation system has its own advantages and disadvantages. A great amount of load can be reduced from the server by shifting the navigation system files from server to client site in the form of Client-side Scripting files.

2. WEB NAVIGATION
2.1 The vast information resources on the world wide web can be very beneficial to people all over the world. However, one big dilemma of the web is the difficulty in finding what you need among the abundant sources of information. Users frequently report being frustrated with the Web because they cannot find what they are looking for. When users navigate through a website, they desire to efficiently and exactly access the contents they are interested in without any difficulties [2].

2.2 Web navigation is the theory and practice of how people move from page to page on the Web [3]. Web navigation consist of links that may be presented with the help of anchored text, image. On clicking the anchored text or image an activity is initiated. In the earlier times, when AJAX and DHTML were not introduced such an activity would have taken the user to a new web page in most cases, but in current time things have changed, when a user click on a link the content on the same web page may be modified depending on the link that was clicked.

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2.3 Web navigation design is about linking and determining importance and relevance of the pages and content of the site. This requires judgment in establishing meaningful relationships between pages of information. For web sites hosting a small number of web pages navigation design will not be of much concern, they can place the link of each web page on every web page. But the real challenge is for web sites hosting hundreds of web pages, for such web site a proper web navigation design is very important.

2.4 A good web navigation design only ensures a good navigation system but the challenge lies in implementing the design. For websites hosting huge number of web pages, it will be a tough job to update the already implemented navigation system if the implementation procedures have already been decided without considering aspects like adding new links, removing irrelevant links etc.

2.5 Navigation system can be embedded within a web page or can be maintained remotely to provide complementary ways of finding content [4]. The navigation system present on the web pages which user browse for content is known as Embedded Navigation System while the navigation system maintained in the form of site map or indexes is known as Remote navigation system. Our focus will be on discussing embedded navigation system.

2.5.1 Embedded Navigation Systems These navigation systems are present on web pages and present along with the content on data. Every website developer uses this type of navigation system as embedded navigation systems give user a good idea where he is, where he might go. Embedded navigation systems are more complex to design as compared to remote navigation systems but are more important as these provide an easier way of navigation to the users. Now we can further classify the embedded navigation systems.

2.5.2 Global Navigation Systems Global website navigation shows the top level sections/pages of the website. It is available on each page and lists the main content sections/pages of the website [5]. Throughout the web site the links of global navigation system remains same. Although when a user moves from a web site to sub site the global navigation system might be different on that sub site. An example of a link used in the global navigation system is the home link which takes users to the home page of the web site.

2.5.3 Local Navigation System Local navigation would be the links with the text of your web pages, linking to other pages within the website. Usually the pages linked with the local navigation systems are related directly to the main pages of the web site. For example a user who visits a computer vender's site will see different links when he chooses the desktop computer and will see different links when he clicks the notebooks link.

2.5.4 Contextual Navigation System These links are not structured like global and local navigation. It consists of contextual navigation links which are specific to a particular page, document or object.

In the coming topics we will discuss how a navigation system can be implemented in a web site. Throughout the paper we will assume that a good navigation system exists for a web site and we are only concerned with the implementation of links for navigation system in horizontal/vertical navigation bar.

3. STRUCTURING OF NAVIGATION SYSTEM

Structuring of website navigation refers to how the navigation system links are arranged [5].

- **Text Links** Text links are words (text) which are surrounded by the anchor set of tags to create click able text which takes the visitor to another web page within your website, a downloadable document from your website, or to another website on the Internet.

- **Breadcrumb** Breadcrumb navigation shows the website visitor the path within your website to the page they are currently on.

- **Navigation Bar** A navigation bar is the collection of website navigation links all grouped together. A navigation bar can be horizontal or vertical.

- **Tab Navigation** Tab navigation is where the website navigations links appear as tabs, similar to the tabs you use in a binder to divide the contents into sections.

- **Site map** A site map is a page within your website that lists all the sections and web pages (if you don’t have too many) that are contained within the website. This is different from Google Site maps and Yahoo Site maps.

A traditional site map provides navigation for your website visitors should they get lost, a shorter path to the different areas of the website for those who know what exactly they are looking for and a means for the search engines to find all the pages within your website.
• **Drop down Menu** A drop down menu is a style of website navigation where when the visitor places their mouse over a menu item, another menu is exposed. A drop down menu can include a fly out menu.

A drop down menu system can create accessibility issues and a problem as far as the search engines not being able to read the links in the menu, but if constructed properly, these issues can be overcome.

• **Fly out Menu** A fly out menu is constructed similar to the drop down menu. When the visitor places their mouse over a link, another menu “fly out”, usually to the right, from the link where the mouse is placed. Fly out menus face the same challenges as drop down menus but if constructed properly, they can be accessible and readable by the search engines.

• **Named Anchors** Named anchors are the type of links that take you directly to a spot on the current page or on another web page.

### 4. IMPLEMENTATING WEB NAVIGATION SYSTEM

4.1 The links on a web page might be part of local navigation system or might be a part of global navigation system. The navigation system can be implemented in the form of horizontal navigation bar, vertical navigation bar and contextual links.

4.2 A horizontal navigation bar is for your main section links. The vertical navigation bar would then contain links for the subsections [6]. This is the most common methodology followed by most developers. Usually when a web site is talked about, most people know a single URL to the site which is its domain name. But large websites are usually divided into sub sites and these sub sites can be accessed by the sub domain of the website (for the availability of sub domain of any sub site the administrator must create one).

4.3 Some web sites contain a horizontal navigation bar that holds the links to the main/default/index page of site and its sub sites while the vertical navigation bar holds the links for the local navigation. The links in the horizontal navigation bar may remain same as it represent the global navigation system while the links in the vertical navigation bar changes depending on the sub site to which the current web page belongs. Horizontal and vertical navigation bars are not the only way links are structured on web pages. There are many more ways of structuring the links.

### 5. ASSUMPTION

We assume that for the navigation system the navigation bar structure is used and the horizontal navigation bar contains the links to main pages of the web site and the vertical navigation bar on represent the local navigation links for a particular section/sub site of the web site.

### 6. TECHNIQUES

Different developers may follow different techniques for implementing the navigation system. Here we will discuss three main implementation techniques. The first will be the technique that most beginners use, the second will be the professional technique used and the final will be the proposed technique.

6.1 Beginners’ Technique Most of beginners while designing the first few web pages for the website they develop use a very simple technique for implementation. They type the links on each and every web page that belong to the website. This approach is very simple but is applicable only to those web sites that have few web pages (less than 10). Although this technique can be used to any web site that may contain even hundreds of web pages, but as the number of web pages increase the complexity and cost of updating the links on every web page also increase.

Suppose a web site contains 10 web pages and only a vertical navigation bar is used which contain link to all the 10 pages. Now at a later stage if the company wants to add one more web page then the programmer will have to update the links on each web page. Updating links on ten different pages is not a problem but imagine another case when the website already contains hundreds of web pages. This time the web site contains horizontal navigation bar also which holds the links of global navigation system. Now this horizontal navigation bar contain same links on each web page and a new link is required to be added to the global navigation system. Despite being the fact that only a few links are present in horizontal navigation bar does not change the fact that it is present on hundred of web pages and if any link has to be added it must be added on each and every page manually.

Updating a link on 10 web pages is a different thing and doing such a change on hundreds of web pages is an entirely different matter. Therefore this technique is not used for web sites hosting even a few hundred web pages.
6.2 Professional Technique: In this technique templates are used. A single website may contain 1 or more templates. Each template contains the links that we see on web pages. These templates are included on each web page and when ever web server receives a request for a web page, compiler adds the content of the template in the web page and returns the web page as if these links were always a part of the web page.

So whenever we need to add new link to navigation system we do not need to add link to each and every web page we only need to modify the template file. This approach is fast, easy and reliable. Moreover, this is the most widely used technique.

But this technique adds overhead to the server computation as every time a new request is sent, web server will have to add the template data to each web page. Client might have requested WebPage1 and then navigates to WebPage2 using navigation bar, although these web pages contained the same navigation bar/links the web server will be forced to waste the computation in locating the template file and adding template's content to these pages each time a request is sent.

7. PROPOSED IMPLEMENTATION TECHNIQUE

In Professional Technique the web server is doing lot of computation due to use of templates. We can decrease this computation by storing the template file on client system and letting the browser access the template locally. This technique will make use of browser caching. If client visits a web page whose navigation bar is implemented using the proposed technique then first the browser will search the required template client system, if the browser fails to do so then the browser will send a request to web server for that particular template. Although the computation that is saved using this approach is very small but when the scale at which, web users are increasing and so are the client request, then the real advantage can be seen. This technique only decreases the load from web server but do not completely remove it, the load that is left on web server is in the form 2 operations. First, web server will receive additional requests for desired template that every browser will send to perform the caching of template. Second, web server will have to send the template file on every request received, although this transfer will be way less then as compared to the data transferred in the professional technique.

7.1 Implementation Client-side Scripting language can be used to implement the proposed technique. Client-side Scripting language being open source and easy to work with will provide ideal platform for proposed technique. For further discussion we will consider 2 web page, WebPage1 and WebPage2 that belongs to SubSite1. These pages may or may not be using any of the available Server Side technology. On these web pages rather than adding the link of template we will use Script tags linking to a Client-side Scripting file. When a client request WebPage1 for the first time then the server will send web page to the client without any computation for the navigation bar. The browser will check its cache for the Client-side Scripting file, as the client requested the WebPage1 for the first time; the browser will not be able to find it in cache and will request the web server to send this file. When user visits the WebPage2, as this web page also belong to SubSite1 it may also contain same navigation bar as that of WebPage1, so the browser will again check it's cache but this time if it find the Client-side Scripting file then no request will be sent to the web server. The browser will contact server only when it fails to locate the Client-side Scripting file, containing links, in its cache.

8. FUTURE WORKS

Most web sites' teams work hard on Search Engine Optimization. They want higher ranking, more web pages indexed. Although using proposed technique, user will not face any problem navigating from one page to another or from one section to another as the links will be displayed by browser as it would have for templates. But when search engine spiders or crawlers will visit the WebPage1 or WebPage2 they will see Client-side Scripting language functions in place of links. The spiders follow these links and index these links and may follow the links from these pages [8]. But in proposed technique the spiders will not be able to find the links, hence it may lead to poor indexing. So a protocol may be proposed that can be used to implement navigation system using Client-side Scripting language which can be read and understood by the search engine spiders. Presently we have such standards that support only text and XML format site maps.

Another problem is caching itself, although we are using the concept of caching in proposed technique it's giving birth to new problem. Each browser caches the data for a specific period of time during which the browser do not communicate with web server for that very data [9]. Now suppose the navigation system was updated after the client visited WebPage1 and now the client visits the WebPage2, as the caching was done so browser will use the older version of navigation bar until the cache expires or cache is explicitly deleted by user. This problem is even bigger than the previously discussed one. Neither user nor administrator will want to display stall navigation links. So a technique that may prompt the browser to update the cached file in cases where navigation system is updated will prove very useful.
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“BIO-GEL” A NATURAL SUBSTITUTE FOR BRAIN INJURIES

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ABSTRACT
The present paper discusses about the biomaterial gel which is made up of both synthetic and natural sources. It has the potential to spur the growth of a patient’s own neural stem cells in the body. The gel is injected in liquid form at the site of injury and stimulates the growth of stem cells. In a follow-up study, Dr. Zhang loaded the gel with immature stem cells, as well as the chemicals they needed to develop into full-fledged adult brain cells. When rats with severe brain injuries were treated with this mixture for eight weeks, they showed signs of significant recovery. The new gel could treat patients at varying stages following injury, and is expected to be ready for testing in humans in about three years. Some studies have demonstrated the reconstruction of a complete vascular network at the injury site as an initial step towards brain tissue regeneration.

Keywords: Bio-gel, Brain injury, Neural stem cell, Hematoma, Haemorrhage.

1. INTRODUCTION
Bio-gel represents a mixture of synthetic and natural chemicals. It stimulates neural stem cells which afterwards fixes damaged nerves. Researchers decided to test the bio-gel on humans shortly after the studies on rats showed promising results. Scientists presented detailed information of their studies at the Military Research Forum that took place in Kansas City, US, and which has the goal of informing about the latest inventions in medicine that can help military troops. "Hydro gels can provide a structural framework for brain tissue regeneration, act as delivery vehicles for growth factors, are biodegradable, and promote cell infiltration, growth, and axonal regeneration." The gel creates new blood vessels and in a later stage encourages the body to make its own stem cells to replace dead bone and/or brain cells.

2. BRAIN INJURY
2.1 Brain injury may refer to Brain damage, the destruction or degeneration of brain cells. Traumatic brain injury is the damage that occurs when an outside force traumatically injures the brain. Acquired brain injury, damage to the brain that occurs after birth, regardless of whether it is traumatic or non-traumatic, or whether due to an inside or external cause [1,2,3].

2.2 Traumatic brain injury (TBI) is a devastating event resulting in progressive cell loss with often lifelong impaired motor, cognitive, and behavioral function. No current therapeutic intervention alters the underlying pathological cell loss via salvage, support, repair, or replacement. The potential for self-repair of the cerebrum is now known to exist, but how to facilitate and augment reparative mechanisms when and how they are needed is poorly characterized. During the past decade, several cell types, including embryonic rodent and human stem cells, immortalized progenitor cells, bone marrow–derived cells, and postmitotic neurons derived from human teratocarcinoma cells, have been assessed for their potential to improve functional and behavioral outcome after transplantation into the experimentally injured brain. A number of studies indicate that cells engrafted into the injured brain can survive and may reverse behavioral dysfunction and cytologic damage. The detailed mechanisms of how these cells generate their mode of action (e.g., by integration into surviving neuronal circuits, local trophic support, or modification of the local microenvironment to enhance endogenous regeneration and protection) remain to be identified.

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3. CLASSIFICATION OF BRAIN INJURIES

Primary and secondary brain injuries are ways to classify the injury processes that occur in brain injury. In traumatic brain injury (TBI), primary injury occurs during the initial insult, and results from displacement of the physical structures of the brain. On the other hand, secondary injury occurs gradually and may involve an array of cellular processes. Secondary injury, which is not caused by mechanical damage, can result from the primary injury or be independent of it. The fact that people sometimes deteriorate after brain injury was originally taken to mean that secondary injury was occurring.

3.1 Primary

Primary brain injury results from the immediate mechanical forces that cause brain damage. These forces can result from:
- direct contact, such as a blow to the head (causing either a blunt head trauma or a penetrating injury)
- direct contact due to the brain striking against the internal surface of the skull
- Inertial forces originating from rapid acceleration/deceleration such as that experienced in a motor vehicle collision. Notably, contact forces can also induce acceleration of the brain commonly leading to a combination of focal and diffuse injuries.

3.2 Secondary

Secondary injury refers to the delayed pathophysiological consequences of TBI. This may include:
- Cerebral Oedema
- Increased Intracranial Pressure (ICP)
- Haemorrhage
- Seizures
- Ischaemia due to vasospasm, vascular/brain compression
- Infection.

The term secondary injury has also been used to encompass the multitude of complex neurobiological cascades altered or initiated at a cellular level following primary injury. An injury resulting from a blast, commonly seen in wartime, is emerging as a unique entity, necessitating separate classification. Although the injury mechanisms associated with a blast have yet to be elucidated, they may include a combination of contact and inertial forces, overpressure, and acoustic waves. Exposure of the thoracoabdominal cavity to blasts and their associated pressures may indirectly affect brain physiology and contribute to injury.

The primary clinical classification of severity for TBI is based on the Glasgow Coma Scale (GCS):
- Mild: GCS 13 to 15
- Moderate: GCS 9 to 12
- Severe: GCS <9.

Trauma patients with GCS of 15 are identified as having TBI if there is evidence suggesting transient cerebral compromise, such as LOC, post-traumatic amnesia (PTA) or seizure. Length of LOC or PTA have also been used to stratify severity.

4. CLASSIFICATION OF EXTENT OR LOCATION OF BRAIN INJURY

Focal and diffuse brain injuries are ways to classify the extent or location of injury in the brain:

4.1 Focal Brain Injuries

Focal injuries are typically large enough that they can be identified macroscopically and diffuse injuries are typically microscopic. Impact phenomenon can result in the following focal injuries:

4.1.1 Contusions on the surface of the brain;
4.1.2 Hematoma, (a localized area of blood as a result of vessel leakage or bleeding);
- Epidural (above the dura - a collection of blood between the dura and the skull);
- Subdural (below the dura - a collection of blood between the dura and the brain);
- Intracerebral (a collection of blood within the brain.)
- The dura is the protective sheath around the brain, between the brain and the skull

4.1.3 Hemorrhage;
- Epidural,
- Subdural
- Or intracerebral.

4.1.4 Edema; Excessive water accumulation resulting in swelling.

4.2 Diffuse Brain Injuries

More often than not, is misdiagnosed or NOT diagnosed because it is not revealed by a CT scan or magnetic resonance imaging (MRI). The diffuse damage on the cellular level can be seen only under a microscope which means it can only be seen during an autopsy. Diffuse axonal brain injury is one of four types of diffuse brain injury and has begun to receive more attention in the medical community. Concussions and whiplash injuries are major contributors to a person having diffuse axonal brain injury.
4.2.1 Figure 1(a) shows a brain cell, the arms protruding outward are axons. At the lower left of the photo you can see two of the arms almost touching with a bright flash of orange between them. The space between the two arms is called a synapse and that bright flash of light represents the electrical charge that passes information from one axon to the other.

4.2.2 Figure 1(b) shows a normal, healthy brain cell performing correctly. In other words, this is what a non-injured cell would look like when everything is performing like clockwork.

4.2.3 Now, let's throw in a whiplash or some other high-speed velocity change that throws the brain forward and back or side-to-side or a combination of the two. The "arms" of the octopus became stretched or, possibly, torn during the event. If you really like big words, the medical folks would refer to this as coup (forward), contracoup (backward) and centrifuglar (all around) movement of the brain. Isotropic stress is another big word for you, and it refers to the shockwave that flows through the brain at the time of the injury.

4.2.4 Imagine having in front of you a nice J-ello dessert that was molded to look like the top half of a ball. As long as you're imaging, be sure to get your favorite flavor like strawberry or cherry. If you lift up the plate and shake it, what happens? The J-ello shakes back and forth, doesn't it? If you shook it back and forth harder and harder, something else would happen. It would begin to stretch out of shape and tear. You supplied the coup, contracoup and centrifuglar movement; the waving of the J-ello as it rocked back and forth supplied a stronger and stronger shockwave inside the dessert (the isotropic stress). The mess you now have in front of you represents the brain cells. But it may not be a mess. The tears and deformity inside the dessert may not be noticeable. They may be so tiny that they cannot be seen. Actually, you could run a sharp knife through that J-ello about half-way down, withdraw the knife and not see the cut you just made.

4.2.5 The deformed, stretched or torn axons can no longer transmit electrical impulses correctly. In other words, the information that was passing from one brain cell to another is no longer passing along the route. Depending upon the severity of the event, you may experience a very brief period of unconsciousness or a more, prolonged one. You may not even know you were unconscious. Using a sports metaphor, you may feel like you've just had your bell rung and nothing more. Days, weeks or, perhaps, a month or two passes and you begin to notice things are not like they once were. You're having frequent headaches. You're having difficulty remembering things. You're having trouble sleeping. You may seem to be having problems remembering people's names...or forget what you were talking about in the middle of a sentence.

4.2.6 Concussions and whiplash injuries can be much more severe than they appear. If you are planning to seek advice from a personal injury attorney following such an event, you should think seriously about consulting one who has experience with brain injury cases.
5. WORKING OF BIO-GELS ON BRAIN INJURIES

5.1 Bio-gel represents a mix of synthetic and natural chemicals. It stimulates neural stem cells which afterwards fix damaged nerves. Researchers decided to test the bio-gel on humans shortly after the studies on rats showed promising results. Scientists presented detailed information of their studies at the Military Research Forum that took place in Kansas City, US, and which has the goal of informing about the latest inventions in medicine that can help military troops. According to Dr Ning Zhang, the lead researcher in the bio-gel development team at Clemson University in South Carolina, there has been an increasing number of brain injuries among soldiers and the bio-gel could help them all of them recover. The bio-gel is injected into the patient’s wound site in order to direct the reaction of neural stem cells. It is worth mentioning that stem cells are able to produce various types of tissue, thus, in the brain, they can generate nerve cells. Chemicals contained in the bio-gel make it possible for neural stem cells to restore normal brain tissue in the head wound. [4]

5.2 Current techniques for treating traumatic brain injury include hypothermia – or cooling – and protecting surviving nerve cells with chemical agents, but their success is limited. The gel is injected in liquid form at the site of injury and stimulates the growth of stem cells there. Brain injuries are particularly hard to repair, since injured tissues swell up and can cause additional damage to the cells. So far, treatments have tried to limit this secondary damage by lowering the temperature or relieving the pressure at the site of injury. However, these techniques are often not very effective. More recently, scientists have considered transplanting donor brain cells into the wound to repair damaged tissue. This method has so far had limited results when treating brain injuries. The donor cells often fail to grow or stimulate repair at the injury site, possibly because of the inflammation there. The injury site also typically has very limited blood supply and connective tissue, which might prevent donor cells from getting the nutrients they require. Dr. Zhang’s gel, however, can be loaded with different chemicals to stimulate various biological processes at the site of injury. In previous research done on rats, she was able to use the gel to help re-establish full blood supply at the site of brain injury. This could help create a better environment for donor cells. Dr. Zhang loaded the gel with immature stem cells, as well as the chemicals they needed to develop into full-fledged adult brain cells. When rats with severe brain injuries were treated with this mixture for eight weeks, they showed signs of significant recovery.

Fig 2 Four weeks after hydrogel treatment on a lesion in a rat’s brain [5]

5.3 Figure 2- four weeks after hydrogel treatment on a lesion in a rat’s brain, a well-structured vasculature network was rebuilt. In this mosaic image, green is neurofilament staining for neuritis and red is staining for blood vessels.

5.4 Better body armor and equipment has meant that soldiers in Iraq and Afghanistan often survive close-range explosions that might have killed them in previous wars. But even blasts that send no shrapnel into vital organs can hurl a pressure wave at the brain that slams it against the skull or damages soft tissue. Subsequent swelling can effect undamaged areas, pressing tissue against the skull interior and cutting of the blood supply. Poorly regenerating brain cells have difficulty bridging the empty space that results.

Fig 3 Hydrogel
5.5 Figure-3 is showing hydrogel. Zhang's hydrogel, composed of synthetic and natural polymers, is easily delivered to the wound without major surgery and conforms to the space, whatever its shape. It then acts as both scaffold and a stimulus for regrowth, said Zhang: "Hydrogels can provide a structural framework for brain tissue regeneration, act as delivery vehicles for growth factors, are biodegradable, and promote cell infiltration, growth, and axonal regeneration."

5.6 She explains that the hydrogel could be customized to be used in both an emergency—to protect the neural tissue of a fresh wound and halt inflammation—or to spur regrowth in old injuries after the removal of scar tissue. "There are no limitations on the time window for how soon the strategy would have to be deployed," she notes. Zhang expects the gel may be ready for clinical trials within 3 years. Meeting attendees responded to her findings with excitement, said Zhang, some even volunteering to be the first human test subjects.

5.7 Nigh Zang, a Clemson University scientist, used a controlled cortical impactor to strike the rats’ forehead, which destroys most of the cortex of the brain. Fluid fills the area around the damaged tissue. The fluid will be replaced with a liquid. This liquid contains three different neural growth factors, which are encased in different biodegradable nanoparticles. Due to the body temperature the liquid is turned into a gelatin scaffold which enhances the growth of blood vessels to feed the recovering tissue. In the following three to four weeks the three different types of nanoparticles brake open and release their contents. The first growth factors find neural stem cells and prepare them for travel. The second growth factors aid in the travel of the stem cells. The final growth factors turn the stem cells into neurons and glial cells (cells that protect the neurons in the brain). With a modified version this hydrogel could also heal scattered bones.

CONCLUSION

Recently it was announced that in the next three years the field of medicine will benefit from the latest invention of U.S. researchers - an injectable "bio-gel" that can cure brain injuries of car crash victims as well as wounded soldiers. In 3 years scientists look forward to test their latest invention on patients. The researcher says current approaches to traumatic brain injury have been focused on managing the primary injury using hypothermia or neuroprotection with pharmacological agents, all with limited success. With this new procedure, the hydrogel is injected into the lesion site to direct the response of neural stem cells in the brain to regenerate normal brain tissue at the lesion site. The current research is supported by a $220,000 grant from the U.S. Department of Defense. The scientists state that the goal of the project is to encourage neurological regeneration of damaged tissue. The gel is currently in a testing phase. The results from these tests show that almost all muscle and sensory functions from test rats had recovered twelve weeks after serious brain injury. This hydrogel could be customized to be used in both an emergency—to protect the neural tissue of a fresh wound and halt inflammation—or to spur regrowth in old injuries after the removal of scar tissue. "There are no limitations on the time window for how soon the strategy would have to be deployed." The new gel could treat patients at varying stages following injury, and is expected to be ready for testing in humans in about three years.[6]

REFERENCES


OFDM IMPLEMENTED BINARY PHASE SHIFT KEY-NEED FOR WIRELESS COMMUNICATION

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ABSTRACT

Digital wireless communication in the recent years increased the need for high-speed mobile data transmission. New modulation techniques are being implemented to keep up with the desired high communication capacity. Processing power has increased to a point where OFDM has become feasible and economical. Many wireless communication systems being developed use OFDM. Orthogonal frequency division multiplex (OFDM) modulation is being used more and more in telecommunication, wired and wireless has gained considerable attention in recent years Some examples of current applications using OFDM include DSL, DAB (Digital Audio Broadcasting), HDTV broadcasting, IEEE 802.11 (wireless networking standard). This paper is to highlights using a Matlab simulation of OFDM implementation in BPSK to see how the Bit Error Ratio (BER) of a transmission varies with modulation schemes, FFT length, no of sub carriers, channels and the, Inter Carrier Interference variation.

Keywords: BER, FFT, ISI, OFDM, BPSK.

1. INTRODUCTION

1.1 An Orthogonal Frequency Division Multiplexing (OFDM) system is a multi-carrier system which allows simultaneous transmission of data on many closely spaced, orthogonal sub-carriers using parallel processing technique. Inverse fast Fourier transforms (IFFT) and fast Fourier transform (FFT) in a conventional OFDM system are used to multiplex the signals together and decode the signal at the receiver respectively. The system adds cyclic prefixes (CP) before transmitting the signals to minimize inter-symbol interference (ISI) [1]. In the upcoming standard IEEE 802.20, which is targeted at achieving data rate of greater than 1 Mbps at a speed of 250 km/h, OFDM is one of the potential candidate. Thus there is a strong possibility that next generation wireless era belongs to OFDM technology.

Although OFDM has only recently been gaining interest from telecommunications industry, it had a long history of existence. It is reported that OFDM based systems were in existence during the Second World War [2]. Up to 34 parallel low rate channels using PSK modulation were generated by a frequency multiplexed set of sub channels. Orthogonal frequency assignment was used with channel spacing of 82Hz to provide guard time between successive signalling elements [3].

1.2 Background Robert W. Chang obtained the first US patent on OFDM in 1970 [4]. A major breakthrough in the history of OFDM came in 1971 when Weinstein and Ebert used Discrete Fourier Transform (DFT) to perform baseband modulation and demodulation focusing on efficient processing. This eliminated the need for bank of subcarrier oscillators, thus providing the way for easier, more useful and efficient implementation of the system. With the rapid research inclusion of FFT and CP in OFDM system and substantial advancements in Digital Signal Processing (DSP) technology made it an important part of telecommunications landscape. In the 1990s, OFDM was exploited for wideband data communications over mobile radio FM channels, High-bit-rate Digital Subscriber Lines (HDSL at 1.6Mbps), Asymmetric Digital Subscriber Lines (ADSL up to 6Mbps) and Very-high-speed Digital Subscriber Lines (VDSL at 100Mbps). Digital Audio Broadcasting (DAB) was the first commercial use of OFDM technology. Development of DAB started in 1987, was proposed by 1992 and the standard was formulated in 1994. DAB services came to reality in 1995 in UK and Sweden. The development of Digital Video Broadcasting (DVB) was started in 1993. DVB along with High-Definition Television (HDTV) terrestrial broadcasting standard was published in 1995. At the dawn of the 20th century, several Wireless Local Area Network (WLAN)

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standards adopted OFDM on their physical layers. Development of European WLAN standard HiperLAN started in 1995. HiperLAN2 was defined in June 1999 which adopts OFDM in physical layer. Recently IEEE 802.11a in USA has also adopted OFDM in their PHY layer. Perhaps of even greater importance is the emergence of this technology as a competitor for future 4th Generations (4G) wireless systems. These systems, expected to emerge by the year 2020, become the technology of choice in most wireless links worldwide [5].

1.3 Organisation of paper OFDM Transmitter and receiver used for the analysis are discussed in Section 2. Section 3 presents the MATLAB implementation of the OFDM using BPSK and represents the parameters which are evaluated for the comparative analysis of OFDM. In Section 4 the simulation results are presented, discussed and the typical BER plots are obtained for comparison as a function of various parameters FFT length, no of sub carriers, channels, inter carrier interference, etc. Finally the Section 5 concludes the paper.

2. ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING \( \Delta f = \frac{k}{T_U} \)

In OFDM, the sub-carrier frequencies are chosen so that the sub-carriers are orthogonal to each other, meaning that cross-talk between the sub-channels is eliminated and inter-carrier guard bands are not required. This greatly simplifies the design of both the transmitter and the receiver; unlike conventional FDM, a separate filter for each sub-channel is not required. The orthogonality requires that the sub-carrier spacing is Hertz, where \( T_U \) seconds is the useful symbol duration (the receiver side window size), and \( k \) is a positive integer, typically equal to 1. Therefore, with \( N \) sub-carriers, the total passband bandwidth will be \( B = N \cdot \Delta f \) (Hz). The orthogonality also allows high spectral efficiency, with a total symbol rate near the Nyquist rate for the equivalent baseband signal (i.e. near half the Nyquist rate for the double-side band physical passband signal). Almost the whole available frequency band can be utilized. OFDM generally has a nearly 'white' spectrum, giving it benign electromagnetic interference properties with respect to other co-channel users. OFDM requires very accurate frequency synchronization between the receiver and the transmitter; with frequency deviation the sub-carriers will no longer be orthogonal, causing inter-carrier interference (ICI) (i.e., cross-talk between the sub-carriers). Frequency offsets are typically caused by mismatched transmitter and receiver oscillators, or by Doppler shift due to movement. While Doppler shift alone may be compensated for by the receiver, the situation is worsened when combined with multipath, as reflections will appear at various frequency offsets, which is much harder to correct. This effect typically worsens as speed increases, and is an important factor limiting the use of OFDM in high-speed vehicles

A simple idealized OFDM system model suitable for a time-invariant AWGN channel is given as

![Fig 1 Idealized OFDM system model (Tx) for AWGN channel](image)

An OFDM carrier signal is the sum of a number of orthogonal sub-carriers, with baseband data on each sub-carrier being independently modulated commonly using some type of quadrature_amplitude_modulation (QAM) or phase-shift_keying (PSK). This composite baseband signal is typically used to modulate a main RF carrier. \( s(n) \) is a serial stream of binary digits. By inverse_multiplexing, these are first demultiplexed into \( N \) parallel streams, and each one mapped to a (possibly complex) symbol stream using some modulation constellation (QAM, PSK) etc.
An inverse FFT is computed on each set of symbols, giving a set of complex time-domain samples. These samples are then quadrature-mixed to passband in the standard way. The real and imaginary components are first converted to the analogue domain using digital-to-analogue converters (DACs); the analogue signals are then used to modulate cosine and sine waves at the carrier frequency, $f_c$, respectively. These signals are then summed to give the transmission signal $s(t)$.

The receiver picks up the signal $r(t)$, which is then quadrature-mixed down to baseband using cosine and sine waves at the carrier frequency. This also creates signals centred on $2f_c$ so low-pass filters are used to reject these. The baseband signals are then sampled and digitised using analogue-to-digital converters (ADCs), and a forward FFT is used to convert back to the frequency domain. This returns $N$ parallel streams, each of which is converted to a binary stream using an appropriate symbol detector. These streams are then re-combined into a serial stream, $\hat{s}[n]$, which is an estimate of the original binary stream at the transmitter.

3. MATLAB IMPLEMENTATION OF OFDM SYSTEM

The Matlab implementation of the OFDM system is used to evaluate the performance analysis of the system under different parameters such as modulation schemes, FFT length, no of sub carriers, channels, inter carrier interference etc. The BER plot can be easily obtained by varying the parameters in the m file that is used for the simulation in the Matlab.

The basic flow of the OFDM system is as follows

3.1 Transmitter side
- Generate the random signal having probability 0.5.
- Modulate the signal.
- Reshape the signal.
- Assigning modulated symbols to subcarriers.
- Taking IFFT.
- Appending cyclic prefix.

After this the signal is transmitted to different types of channel i.e AWGN and Rayleigh fading channel.

3.2 Receiver side
- Performing FFT.
- Equalization by the known channel frequency response.
- Extracting the required data subcarriers.
- Demodulation.
- Converting demodulated values into bits.

The no of error is counted to plot the BER plot for the various parameters.
4. RESULTS

The above fig shows that the increase in the length of FFT improves the performance of the system. The size of the FFT is increased the number of samples increases that makes the signal smoother and more accurate to demodulate hence it reduces the bit error rate but at the same time the memory requirement and the complexity increases. Hence must be trade off between FFT length and BER.

<table>
<thead>
<tr>
<th>Eb/No (dB)</th>
<th>AWGN Channel</th>
<th>Rayleigh Fading Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0791</td>
<td>0.1462</td>
</tr>
<tr>
<td>1</td>
<td>0.0560</td>
<td>0.1275</td>
</tr>
<tr>
<td>2</td>
<td>0.0376</td>
<td>0.1085</td>
</tr>
<tr>
<td>3</td>
<td>0.0230</td>
<td>0.0917</td>
</tr>
<tr>
<td>4</td>
<td>0.0127</td>
<td>0.0764</td>
</tr>
<tr>
<td>5</td>
<td>0.0058</td>
<td>0.0641</td>
</tr>
<tr>
<td>6</td>
<td>0.0023</td>
<td>0.0528</td>
</tr>
<tr>
<td>7</td>
<td>0.0009</td>
<td>0.0442</td>
</tr>
<tr>
<td>8</td>
<td>0.0002</td>
<td>0.0354</td>
</tr>
</tbody>
</table>

Table 1 BER for Different Channel

The above figure and table shows that the OFDM system shows the better performance in the AWGN channel as compared to Rayleigh fading channel. The wireless channel is mainly fading channel with the propagation delay in the channel. Hence it is very much important to obtain optimize result in case of Rayleigh fading channel by varying the modulation techniques.
Inter Carrier Interference occurs in OFDM when the frequency offset correction is not perfect and the residual error tends to accumulate oversamples. This residual error will cause orthogonality loss among sub-carriers. But this effect is minor since the accumulation is limited within a symbol. The accumulation is more prominent across symbols. There will be phase factor to each symbol due to the residual error.

**CONCLUSION**

The paper has presented a comparative analysis of Orthogonal Frequency Division Multiplexing (OFDM) techniques popularly used in digital wireless transmission. The effect of some important parameters for a specific channel type and modulation scheme shows the need to optimize the system performance in the light of the various parameters discussed. The various BER plots show that OFDM technique is one of the potential candidates for the next generation wireless era.

**REFERENCES**


EVALUATION AND ENHANCEMENT OF TIME MANAGEMENT SKILLS

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ABSTRACT

Time is one of the most precious resources today because it is limited. We cannot create time. A day has only 24 hours. Personal time management skills are essential skills for effective people. Those who use skills routinely are among the highest achievers in all walks of life from public service to sports to business. If one uses these skills well, he will be able to function exceptionally well, even under intense pressure. Goal setting, prioritizing, avoiding procrastination, managing interruptions, scheduling and saying no tactfully are considered as the fundamental skills of time management.

Keywords: Time management skills, goal setting, interruptions, procrastination, prioritization, scheduling.

1. INTRODUCTION

1.1 Men, materials and machines have always been regarded as main resources for any venture. Time has now also been added/recognized as one of the most precious resources because it is limited. We cannot create more time. There are and will always remain only 24 hrs in a day. Whenever and whatever time is lost it is lost forever. But our lives seem to get busier and busier and we are feeling we are short of time. This is causing considerable stress resulting into decline in one’s health and down turn in ones business/profession.

1.2 Our aim should be to keep on trying to achieve more in less time with less effort. We should remember that a busy activity is worse than doing nothing when the activity one is doing does not get one nearer to the ones desired outcome.

2. DEFINITION OF TIME MANAGEMENT

Time management has been defined in various ways by many authors. The definition which has now been accepted is given as under:

Time management refers to range of skills, tools and techniques used to manage time while accomplishing specific tasks, projects and goals. [1]

3. ADVANTAGES OF TIME MANAGEMENT

Time management if managed efficiently offers three major advantages [2]. They are:

- A much greater feeling of satisfaction results in one’s life.
- It makes us feel much less stressed resulting in significantly improved health.
- It significantly improves our relationships. So we see that since time management takes care of our well being, it is very essential and necessary that we should try all out and adopt those strategies/skills which result in optimum time management.

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4. TECHNIQUES/STRATEGIES FOR ENHANCING TIME MANAGEMENT SKILLS

Different people over different period of time have adopted various techniques/strategies to enhance their time management skills. We have gone through lives of number of successful people who have left a lasting impression in history. Based on the experience of authors and the survey of literature, we suggest that we should follow the following skills of time management [3]

- Goal setting
- Prioritization
- Managing distraction/interruption
- Procrastination
- Scheduling
- Tactfully saying “no”

4.1 Goal Setting  To start managing time effectively, one needs to set goals. Goals should be set remembering the SMART mnemonics [4]. The goal should be smart that is specific, measurable, attainable, relevant and time bound. Instead of having “to go from Srinagar to kanyakumari” as a goal, it is more powerful to say “to complete the trip from Srinagar to kanyakumari on bicycle from 01 nov 2010 to 30 march 2011. Obviously, this will be only attainable if a lot of preparation is done beforehand.

4.2 Prioritization  It means, we should do that which is especially important. The 80-20 rule and making ‘to do’ lists: should be remembered and practiced [5]. The 80-20 rule is a great time management technique because it gets you focused on the 20% of actions that will give you 80% impact on output. To implement the 80-20 rule, we should take a few minutes before we start doing any task or project to stop, think and ask our self is this task in the 20%(that is has impact ) or in the 80% (low impact). If we do not prioritise the work to be done then we will frequently feel overwhelmed by the amount of work we have to do. We will face a constant barrage of looming deadlines. We may at times forget to do something important and seniors have to chase to get things done. By keeping a to do list, we make sure that we capture all of the tasks we have to do in one place. This ensures that what is essential, one will not forget through prioritizing the work. By making to do list we feel much better organized and will ensure that we can be relied upon. Simple procedure to make to do list is as follows:

- Count down all the jobs.
- Start giving priorities to each job as “A” (very important, urgent) to F (unimportant or not at all urgent). If there are many tasks which get high priority then run through the list again and delete the less important ones. Having done this, rewrite the list in priority order. Prioritized to do list is fundamentally important and efficient work. This ensure that
  - One remembers to carry out all necessary tasks.
  - One tackles the most important jobs first and does not waste time on unimportant tasks.
  - One is not stressed by a large number of unimportant jobs.

4.3 Managing interruptions/distractions  The most common time wasters are [6]:

- Telephone interruptions
- Inefficient delegations
- Extended lunch or breaks
- Cluttered work space
- Poorly run meetings
- Socializing on the jobs
- Misfiled information
- Poor planning
- Procrastination
- Waiting/delays
- Too much paper work
- Junk mail
- Drop in visitors
- Not setting/sticking to priorities.

We should ensure that we try all out to avoid/ reduce the time wasters/ interruptions listed above. It will give us more time to remain focused on the job at hand as per goal set by us and not make us feel stressed to finish the job for lack of time.
4.4 **Procrastination**

We all procrastinate at times. We put off a task. We delay starting a project, we avoid making the call. Some people check their e-mail, instead of dealing with the poor performance of their team member. We choose to do the enjoyable task rather than the high priority challenging task that takes us out of our comfort zone, should not worry. It's normal. It is part of being human. Everybody naturally seeks comfort. But it has been seen that staying in less comfort zone dooms one to failure. We all can benefit from knowing how to stop procrastination. The following suggestions if one implements, can help to stop procrastinating.

- Find a small part of the task one can do right immediately.
- Identify the emotion associated with doing it.
- Finish an in complete
- Delete it and move on
- Face your fears and the risk head on

4.5 **Scheduling**

Much of time management comes down to effective scheduling of our time. When we know what our goals and priorities are, we then need to know how to go about. Creating a schedule that keeps us on track and protects us from the avoidable stress. This means we should understand the factors that affect the time we have available for work. We not only have to schedule priority tasks, but we have to leave room for interruptions and contingency time for those unexpected events that otherwise wreck chaos with our schedule. By creating a robust schedule that reflects priorities and as well as supports personal goals, we have a winning combination, one that will allow us to control our time and keep our life in balance [7].

4.6 **Tactfully saying no**

It has been seen that we feel very uncomfortable by saying no to a job which some one tells us to do because we feel that it will offend others. But we should be mentally be prepared also to say no when we feel that we can not accept the job or do their job because the job in hand having priority will be delayed [4]. So we should have the ability to say no. we can say “I am sorry, I cannot do its right now”. We shall use sympathetic, but firm tone. If pressured, as to why, say if does not fit with your schedule and change the subject. If one feels uncomfortable being so firm or is dealing with pushy people tan its better to say “let me think about it and I shall get back to you. This give a chance to review the schedule as well as feelings about saying ‘yes’ to another commitment. Do a cost benefit analysis, and then get back to them with a yes or no. Most importantly it is technique helps us to avoid ourselves, being pressured into over scheduling our life and taking on too much stress.

Still if we feel like doing what others are requesting, but we don’t have the time (or are having trouble accepting that we don’t), it’s fine to say “I cannot do this but I can” and mention a lesser commitment that you can make. This way we shall still be partially involved but it will be on our terms.

5. **Evaluation technique-How efficient/effective is your time management**

Every individual feels that he is more efficient as regard time management is concerned. He is not aware of that he can still do better, achieve more in less time with same/less effort. We have prepared questionary of 30 questions split into two parts of 15 questions each. These are given in appendix A and B respectively. In questionary given in appendix A, out of five possible answers one is to be ticked. The answers carry marks from 1 to 5 accordingly. In questionary given in appendix B, one of the four answers are to be ticked, based upon total score, you can guide yourself as to what type of improvements you require so as to optimize your time management. If your ansers get you majority of 5/4 marks in questionary of appendix A/B respectively its O.K as regard your time management skills are concerned .If your score is other way round (score is less than 40/30 ) you can then find/analyse as to where you lack in particular skills. It will thushelp you in improving the particular skill as mentioned earlier. With this you shall be able to manage your time not only efficiently but effectively also.

**CONCLUSION**

How well time management being practiced by individuals can be ascertained by evaluating over performance by answering the samples questions set in the questionnaire. Whenever one feel he is lacking in any of the skills namely goal setting, prioritizing the tasks at hand, managing distractions/ interruptions and proper scheduling, he should try to enhance them so as to attain optimum results in the time available to him. We must always remember that time is a limited resource and once it is lost it is lost forever and it cannot be recouped. Finally we should learn the techniques of saying no when we feel that we are already busy with an important work at hand and we cannot accept more.

**REFERENCES**


Appendix A

Questionary: Evaluation how good your time management skills are

<table>
<thead>
<tr>
<th>Part 1: for All Individuals</th>
<th>Very often (5)</th>
<th>Often (4)</th>
<th>Sometime (3)</th>
<th>Rarely (2)</th>
<th>Not at all (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal setting skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you use goal setting to decide what tasks and activities you should work on.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Are you stressed about deadlines and commitments.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you regularly discuss your priorities with your next senior (boss).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Before you take on task, do you check that there results will be worth time put in.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Managing interruptions</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• How often do you find yourselves dealing with interruption.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>• Do distractions often keep you from working on critical tasks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you find you have to take work home, in order to get it done.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procrastination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you find yourselves completing tasks at the last minute or asking for extension.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you set time for planning and scheduling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you leave contingency time in your schedule to deal with “the unexpected”.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prioritization skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Are the tasks you work on during the day are the ones with the highest priority.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you know how much time you are spending on the various jobs you do.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you know whether the tasks you are working on are high, medium or low value.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• When you are given a new assignment do you analyze it for importance and prioritize accordingly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do you prioritize your “to do” list or action program.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B
Questionary: Evaluation - How effective is your time management.

<table>
<thead>
<tr>
<th>PART 2: for senior executives/officers</th>
<th>(D) (1)</th>
<th>(C) (2)</th>
<th>(B) (3)</th>
<th>(A) (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often do you take work at home?</td>
<td>Every day</td>
<td>Three or more days a week</td>
<td>Twice a week</td>
<td>Once a week</td>
</tr>
<tr>
<td>2. How many people constantly interrupt you in the course of a day?</td>
<td>Six or more</td>
<td>Four to five days a week</td>
<td>Two to three weeks</td>
<td>One or less</td>
</tr>
<tr>
<td>3. How much time do you spend each week in other activities outside your jobs ex. Hobbies, excursing and cultural events etc.</td>
<td>Three hrs or less</td>
<td>Four to five hrs</td>
<td>Six to nine hrs</td>
<td>Ten or less hrs.</td>
</tr>
<tr>
<td>4. How much time do you spend each day “socializing” on the job (extended Coffee breaks, late launch hrs).</td>
<td>Two hrs or more</td>
<td>Sixty to ninety minutes</td>
<td>Fifteen to thirty minutes</td>
<td>Less than fifteen minutes</td>
</tr>
<tr>
<td>5. How many separate piles/ stack of work are usually on your table/ office desk during the day.</td>
<td>Three or more</td>
<td>Two</td>
<td>One</td>
<td>Desk is clear</td>
</tr>
<tr>
<td>6. How much of your work do you delegate</td>
<td>Very little</td>
<td>About 25%</td>
<td>40-50%</td>
<td>More than 50%</td>
</tr>
<tr>
<td>7. How often do you approach and discuss things with people on a one –on-one basis in the course of a day.</td>
<td>None</td>
<td>At least once</td>
<td>Twice</td>
<td>More than twice</td>
</tr>
<tr>
<td>8. How much time do you spend with your people in having and developing during course of a week.</td>
<td>None</td>
<td>Less than an hour</td>
<td>One to two hrs</td>
<td>Three hrs or more.</td>
</tr>
<tr>
<td>9. How often do you procrastinate- put off decision in the course of a day.</td>
<td>Fairly often</td>
<td>occasionally</td>
<td>seldom</td>
<td>Never</td>
</tr>
<tr>
<td>10. How many times you handle a piece of paper in the course of the day before doing something with it.</td>
<td>Four times or more</td>
<td>three times</td>
<td>twice</td>
<td>Only once</td>
</tr>
<tr>
<td>11. How often do you permit extension of your deadlines.</td>
<td>Fairly often</td>
<td>occasionally</td>
<td>seldom</td>
<td>Never</td>
</tr>
<tr>
<td>12. How do you approach detail work.</td>
<td>Do it all yourself-you love it</td>
<td>you do most of it</td>
<td>you delegate some of it</td>
<td>You delegate most of it</td>
</tr>
<tr>
<td>13. How often do you set communicate and review department/section and individual goals with your subordinates.</td>
<td>Twice a year</td>
<td>Quartly</td>
<td>Monthly</td>
<td>Weekly</td>
</tr>
<tr>
<td>14. How often do you prepare a “to do” list and set priorities.</td>
<td>Monthly</td>
<td>Bi-weekly</td>
<td>Weekly</td>
<td>Daily</td>
</tr>
<tr>
<td>15. How much of your work do you do because you “really want” to do.</td>
<td>About 5%</td>
<td>Less than 50%</td>
<td>about 75%</td>
<td>Almost all of it</td>
</tr>
</tbody>
</table>
GENERATIVE COMPUTER AIDED PROCESS PLANNING FOR ROTATIONAL PARTS

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ABSTRACT

Computer-Aided Process Planning (CAPP) is the link between design and manufacturing in a Computer-Integrated Manufacturing (CIM) environment. CAPP has evolved to simplify and improve process planning and achieve more effective use of manufacturing resources. CAPP forms an imperative connection between design and manufacturing operations in the Computer Integrated Manufacturing (C.I.M) environment plans so that functions, such as process selection, tool selection, featured sequencing, and machine tool selection can be performed without human intervention while the CAPP systems built using different approaches have been tackling process planning problems, they have achieved limited success towards performing as an intelligent process planning system. In the present work, a generative process planning system for machining of rotational parts is designed, developed and implemented. The system encompasses various process planning functions, sequencing of operations, selection of operations, machine tool selection, determination of cutting conditions and machine time calculations. An attempt has been made to develop CAPP system for rotational components.

Keywords: CAPP, Process Plan, Retrieval, Generative

1. INTRODUCTION

Process planning translates design information into the process steps and instructions to efficiently and effectively manufacture products. Process planning represents the link between design and manufacturing functions responsible for converting the design data into manufacturing information regarding sequence of operations, operation selections, machine tool selection, cutting tool selection, optimum cutting conditions and setting time standards for the operations. The planning begins with engineering drawings, specifications, parts or material lists and a forecast of demand. During the last decade or so, there has been much interest in automating the task of process planning by means of CAPP systems [1]. The Shop-trained people who are familiar with the details of machining and other processes are gradually retiring, and these people will be unavailable in the future to do process planning. An alternative way of accomplishing this function is needed and CAPP system is providing the alternative. Computer aided process planning (CAPP) is the link [2] between design and manufacturing in a CAD/CAM system. As the design process is supported by many computer-aided tools, computer aided process planning (CAPP) has evolved to simplify and improve process planning and achieve more effective use of manufacturing resources.

1.1 CAPP System

A CAPP system offers the potential for reducing the routine clerical work of manufacturing engineers. At the same time, it provides the opportunity to generate production routings which are rational, consistent, and perhaps even optimal. A CAPP system aims to automate the generation of process plans so that functions, such as process selection, tool selection, feature sequencing & machine tool selection can be performed without human intervention. Computer-aided process planning systems are designed around two approaches. These approaches are called Retrieval CAPP systems (also called variant systems) and Generative CAPP systems.

*Corresponding Author
1.1.1 Retrieval CAPP systems
Retrieval type computer-aided process planning systems, also called variant CAPP systems are based on the principle of group technology and parts classification and coding. With these systems, a standard process plan (route sheet) is stored in computer files for each part code number. The part for which the process plan is required is matched with the existing part families. The process plan of that part family to which the part belongs is retrieved and edited, if necessary.

![Diagram](image)

**Fig. 1 General Procedure for using the Retrieval Computer–Aided Process Planning System**

In retrieval type CAPP, parts are classified into family groups, such that each group has a standard plan. Some retrieval process planning systems are [3] CAPP, CAPSY, AUTOCAP, MIPLAN, MITURN, MIAPP.

1.1.2 Generative CAPP System
Generative CAPP systems represent an alternative approach to automated process planning. Instead of retrieving and editing an existing plan contained in a computer data base, a generative system creates the process plan based on logical procedures similar to a human planner would use. Some of the generative type CAPP system are [3] AAPAS, AUTOPLAN, AUTAP, PMPS, GAPP, GARI PROPALN, XPALNE etc. A number of generative systems such APPAS (Automated process planning and selection) and ACAPS (automated coding and process planning selection) have been developed. APPAS has been linked with interactive computer graphics terminal to demonstrate the concept of an integrated CAD and process planning system. ACAPS uses group technology concept to handle the geometric features of holes, slots or grooves etc.
2. DESIGN OF CAPP SYSTEM

The problem of designing a generative CAPP system is considered part of the field of expert systems, a branch of artificial intelligence [4]. In generative type CAPP, various process information such as knowledge geometry of the component, material of the component, specifications of the machine tool, cutting tools & work holding devices, operation sequencing and production costs are synthesized using computer to create a process plan. Thus the process planning systems enables the unskilled planner to prepare the operations sheet quickly and bridge the gap between computer-aided design and computer-aided manufacturing. This CAPP system is generative type and is developed using MATLAB. Machining components can be classified as rotational and prismatic. However, in the present work the emphasis is given on process planning for rotational components.

![Diagram of CAPP System Modules]

**Fig. 2 Various Modules of CAPP System**

<table>
<thead>
<tr>
<th>PROFILE ELEMENTS</th>
<th>SHAPE OF ELEMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constituting Elements</td>
<td>Plane Surface</td>
</tr>
<tr>
<td></td>
<td>Cylindrical Surface</td>
</tr>
<tr>
<td></td>
<td>Conical Surface</td>
</tr>
<tr>
<td></td>
<td>Hole Surface</td>
</tr>
<tr>
<td>Additional Features</td>
<td>Screwed Surface</td>
</tr>
<tr>
<td></td>
<td>Geared Surface</td>
</tr>
<tr>
<td></td>
<td>Splined Surface</td>
</tr>
<tr>
<td></td>
<td>Chamfered Surface</td>
</tr>
</tbody>
</table>

**Table 1 Shape of Elements in Rotational Part Description**

2.1 The system is designed to select the machining operations, sequence them, choose the machine tools, design optimum parameters to each operation, select the machine tools. Process planning is done according to the work component. The work component is distinguished according to feature elements. A CAPP system is prepared for rotational work parts using MATLAB. It is developed on the optimum cutting speed for various machining operation expressions that are mathematically derived. Test runs are conducted and validation of program is checked. The output of program is displayed in form of process sheet. The generative type CAPP system has significant benefits. Implementation of this system make reduction in process planning efforts, saving in direct labour, material, scrap, tools and work in process. Beside these there are also intangible benefits of this system as it reduced process planning and production lead-time, faster response to engineering changes. As discussed earlier, the process planning system presented in this work belongs fully to generative approach. An attempt is made to do the process planning of rotational components. The input to this system is similar to the output from CAD. Hence the system can be integrated with CAD. The system is developed to select the operations, sequence them to choose the machine tools, assign optimum parameters to each operation and to select the cutting tools. This system is implemented on Pentium 4 computer in MATLAB language. The system is developed to do the process planning of rotational-machined parts. This system is developed to reduce the process planning effort, direct labour, material, scrap and work in process. With this system process planning of rotational parts having a number of features can be done easily. For example a rotational component have a keyway to be milled and a hole to be drilled that can be done through the proposed CAPP system.
2.2 Depierurex [6] found that at high feed rates width of tool wear is no longer the controlling parameter of tool life, but plastic deformation of the cutting edge & oxidation of secondary cutting edge. According to him, the maximum feed rate to 0.8 mm/rev. depth of cut to be used as 2.5 mm for roughing operations & 0.5 mm for finishing operation. Thus, only cutting speed is the unknown variable. In the present system the above criteria is adopted for optimization.

**Total Cost**

$$C = xT_L + xT_C + T_d + y(T_{ac}/T)$$  
(1)

Where  
$x$= Cost Rate of labour and overhead  
$T_L$ = Non-productive time (min)  
$T_C$ = Machining Time/component (min)  
$T_d$ = Time required to change cutting edge  
$T_{ac}$ = Actual cutting time (min)  
$y$ = Cost per cutting edge (Rs.)

**Kronenberg’s Tool Life Equation**

**Total time required to produce one component (min.)**

$$T_t = T_L + T_C + T_d (T_{ac}/T)$$  
(2)

**Kronenberg’s Tool life Equation**

$$T = \frac{C_v^{1/n} \times 0.60}{(1000A)^{2/n} \times V^{1/n}}$$  
(3)

$C_v$, $n$ and $Z$ are constants for work materials.

**Optimum value of Tool life equation for the Max. production rate**

$$V_{max \ prod} = \frac{C_v}{(T_{ac}/60)^n \times (1000A)^{2/n}}$$  
(4)

**Machining Time calculation for Turning and Boring**

$$T_C = \frac{l}{(f \times N)}$$  
(5)

where, $l$ is length of cylinder being turned  
$f$ is feed  
$N$ is RPM
Machining Time calculation for Drilling

\[ T_C = \frac{60 \, P}{(f \, N)} \]  

where,
- \( P \) is Depth of Drilling (mm)
- \( f \) is feed
- \( N \) is RPM

\( T_C \) is Machining Time

Machining Time calculation for Milling

\[ T_C = \left[ l + \sqrt{(d \, (D - d) + 6)} \right] \, u / (f_t \cdot K_t \cdot N) \]  

where,
- \( u \) is number of cut
- \( K_t \) is number of teeth in cutter
- \( l \) is the length of job to be machined
- \( d \) is depth of cut
- \( D \) is diameter of cutter
- \( f_t \) is feed per tooth

3. DEVELOPMENT OF CAPP SYSTEM

The computer aided process planning (CAPP) system is developed and implemented on core2duo based computer operating on Window-2003 version and above, in MATLAB. This system is well in developed to be interactive and user friendly and receives inputs from the user in form of menu options [5]. The user is not required to have very detailed technical knowledge about machining operations. The various data are managed through different kinds of data structures in MATLAB like menus, records, and sets. To develop this CAPP system the governing parameters, criteria that are used are based on certain facts.
3.1 Selection of Tool Material on Basis of Facts

Selection of tool material is not only based on hardness of work material, but also on type of machining operation & other work-part material properties. Tool material selection criterion is shown on Table 2 and selection of cutting fluids based combination of work-materials, tool materials & machining operations. Cutting fluid selection criterion is based on Table 3.

<table>
<thead>
<tr>
<th>Machining Operations</th>
<th>WORK MATERIAL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steels</td>
<td>Cast Iron</td>
<td>Bronze Brass Al. Cu</td>
</tr>
<tr>
<td>Turning &amp; Boring</td>
<td>CERAMICS</td>
<td>CEMENTED CARBIDE</td>
<td>CERAMICS</td>
</tr>
<tr>
<td>Milling</td>
<td>HSS</td>
<td>CEMENTED CARBIDE</td>
<td>CERAMICS</td>
</tr>
<tr>
<td>Drilling &amp; Tapping</td>
<td>HSS</td>
<td>CEMENTED CARBIDE</td>
<td>CERAMICS</td>
</tr>
</tbody>
</table>

Table 2 Tool Material Selection for various combinations of work materials and the machining operations.

<table>
<thead>
<tr>
<th>WORK MATERIAL</th>
<th>TOOL MATERIAL</th>
<th>MILLING</th>
<th>OPERATIONS</th>
<th>DRILLING &amp; REAMING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steels</td>
<td>HSS</td>
<td></td>
<td>WPO-MO/EPO-EM</td>
<td>EPO-MO/EPO-EM/WBCS/EPO-EM</td>
</tr>
<tr>
<td></td>
<td>Cemented carbide</td>
<td>EPO-EM/WBCS</td>
<td>EPO-MO/EPO-EM/DRY</td>
<td>EPO-WBCS/EPO-EM</td>
</tr>
<tr>
<td>Cast Iron</td>
<td>HSS</td>
<td></td>
<td>EPO-EM/WBCS</td>
<td>EPO-EPO-EM/WBCS/DRY</td>
</tr>
<tr>
<td></td>
<td>Cemented carbide</td>
<td>EPO-EM/WBCS</td>
<td>EPO-MO/EPO-EM/DRY</td>
<td>EPO-EM</td>
</tr>
<tr>
<td>Al</td>
<td>HSS</td>
<td></td>
<td>MO/KO</td>
<td>EPO-EM/DPO-WBCS/DRY</td>
</tr>
<tr>
<td></td>
<td>Cemented carbide</td>
<td>MO-EM/WBCS/FO-EM</td>
<td>MO/KO</td>
<td>EPO-EM/FAA-MO</td>
</tr>
<tr>
<td>Brass Cu</td>
<td>HSS</td>
<td></td>
<td>MO-EM/CP-EM/WBCS</td>
<td>SO/FO/KO</td>
</tr>
<tr>
<td></td>
<td>Cemented Carbide</td>
<td>MO-EM/FO-MO/WBCS</td>
<td>MO-EM/FO-MO/WBCS</td>
<td>SO/FO/KO</td>
</tr>
<tr>
<td>Bronze</td>
<td>HSS</td>
<td></td>
<td>MO-EM/CP-EM/WBCS</td>
<td>MO/FO</td>
</tr>
<tr>
<td></td>
<td>Cemented Carbide</td>
<td>MO-EM/FO-MO/WBCS</td>
<td>MO-EM/FO-MO/WBCS</td>
<td>MO/FO</td>
</tr>
</tbody>
</table>

EPO - Extra Pressure Oil (S, C1, P) EM- Emulsion FO-Fatty oils (synthetic oils)
SO-Soluble Oils MO-Mineral Oil FAA- Fatty Acids & Alcohol
WCS- Water Based Chemical Solutions KO-Kerosene Oil CP-Chlorinated oils Paraffin

Table 3 Cutting fluid selection for various combinations of work materials, tool materials and machining operations.
3.2 Selection Criteria which are used as guidelines for the Implementation of this CAPP system are:

- On cylindrical surface, for 0<X dimension <6mm, turning operation, is to be done.
- For holes of diameter larger than 40mm boring operation is suggested. For holes up to 40 mm diameter, drilling operation is suggested.
- On machining external surface, larger dimensions are machined before smaller dimensions.
- For machining of holes, smaller holes are machined followed by larger holes.
- Milling for slots of depth more than 30 mm end milling is suggested else peripheral milling to be done. For width of cut greater than 30 mm, face milling is recommended else peripheral milling is suggested.
- In milling cutter diameter is taken as 1.67 times the width of cut.

These facts & rules are used as a basis on which MATLAB based CAPP System is designed.

4. RESULTS AND DISCUSSION

![Fig. 5 Drawing of Rotational Workpart](image)

The fig. shows the drawing of the part for the process plan is to be generated. The reference surface consists of 18 profile elements.

For this part:

Work piece material: Hard steel

Optimization criterion : Minimum cost

The input data entered for the profile elements is shown below:
<table>
<thead>
<tr>
<th>Element</th>
<th>z-Coordinate (mm)</th>
<th>x-Coordinate (mm)</th>
<th>Surface roughness (micron)</th>
<th>Shape of the element</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>0</td>
<td>12</td>
<td>Plane</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>-15</td>
<td>10</td>
<td>Hole</td>
</tr>
<tr>
<td>3</td>
<td>-5</td>
<td>0</td>
<td>6</td>
<td>Plane</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>-10</td>
<td>15</td>
<td>Hole</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>0</td>
<td>5</td>
<td>Plane</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>20</td>
<td>4</td>
<td>Cylindrical</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0</td>
<td>11</td>
<td>Plane</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>25</td>
<td>10</td>
<td>Cylindrical</td>
</tr>
<tr>
<td>9</td>
<td>-7</td>
<td>0</td>
<td>16</td>
<td>Plane</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>20</td>
<td>7</td>
<td>Cylindrical</td>
</tr>
<tr>
<td>11</td>
<td>15</td>
<td>0</td>
<td>8</td>
<td>Plane</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>18</td>
<td>10</td>
<td>Cylindrical</td>
</tr>
<tr>
<td>13</td>
<td>-20</td>
<td>0</td>
<td>9</td>
<td>Plane</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>-7</td>
<td>12</td>
<td>Hole</td>
</tr>
<tr>
<td>15</td>
<td>-4</td>
<td>0</td>
<td>14</td>
<td>Plane</td>
</tr>
<tr>
<td>16</td>
<td>0</td>
<td>-6</td>
<td>16</td>
<td>Hole</td>
</tr>
<tr>
<td>17</td>
<td>-9</td>
<td>0</td>
<td>9</td>
<td>Plane</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>-45</td>
<td>10</td>
<td>Axis</td>
</tr>
</tbody>
</table>

Table 4 Input Data for Profile Elements

With the below data for machining above work part the output in form of process plan will be generated.

- Constant depending on tool & work material, \( n = 0.15 \)
- Cost rate (include labour & overhead charges), \( x = 0.4 \)
- Cost per cutting edge, \( y = 1.0 \)
- Time required to change cutting edge, \( T_d = 6.0 \)
- Kronenberg’s equation constants: \( C_v = 200, \ A = 1.0, \ z = 0.2 \)
- Feed \( f = 0.8 \) mm/rev.
- Length of work part \( L = 36 \) mm
- Diameter of work part \( D = 72 \) mm

PROCESS PLAN

WORK MATERIAL: HARD STEEL

LENGTH OF BLANK: 115 MM

DIAMETER OF BLANK: 75 MM

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CONCLUSION
The new work part description method of CAPP system is found to be helpful in process planning. Automatic sequencing of operations is made possible. Selection of operations is achieved automatically based upon the geometrical and technical data given by the user. With this CAPP system machine tool and cutting fluid selection is done automatically as per the data given by the user. Mathematical expressions for optimum cutting speed are derived for turning, boring, facing, peripheral milling, face milling, and drilling machining operations for both the optimization criteria viz. minimum cost and maximum production. Lastly, the output containing the details of machining operations, sequence of operations, optimum cutting speed and feed, machine to be used, cutting tool material and machining time are displayed to the user in form of process sheet using MATLAB.

CUTTING FLUIDS
EPO: Extra Pressure Oil (S, C1, P)   FO: Fatty oils (synthetic oils)
EM: Emulsion                      KO: Kerosene Oils
CP: Chlorinated Paraffin          SO: Soluble Oil
WBCS: Water Based Chemical Solutions
REFERENCES


AUTOMATIC AUTOMOTIVE AIR REFILLING SYSTEM (AAARS)

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ABSTRACT
Automatic Automotive Air Refilling System is designed to cater to safety requirements during driving of automobiles when its wheel gets deflected owning to puncture of tube. In Today’s life delay of fraction of seconds may lead to serious accident causing damage to vehicle and injury/death to passengers. If we are going to any unknown place on family tour than puncture in tire gives unpleasant taste to our journey that we never want. Sometimes we drive and feel automobile is under load conditions but we have not loaded/over loaded our automotive. We presume that there may be some defects in engine but actually engine is not faulty. Our automobile is under load conditions because the pressure of air in tires are less than required due to which engine seems to be not properly working. Automatic Automotive Air Refilling System design is aimed at not only to fill the air in the punctured tires automatically but also maintain the pressure of air in the running automotive. It also avoids damages in tires. This system ensure that air pressure in the punctured tires will be maintained in such a way that punctured particle is sealed (locked) in between tire and tube i.e. layers of tire , tube and punctured particle are coupled due to internal force in the tube.

Keywords - cater to safety, Air Refilling, deflected, sealed.

1. INTRODUCTION
Admire the delight to experience the performance of new assent “Automatic Automotive Air Refilling System”. A revolutionary prototype and a multipurpose creation is designed for catering to the ever-growing needs and requirements of our society. This will be gem to the modern safety equipment for automotive. We have fully recognized the needs of our society and offer them answers, answer to those numerous questions hording them since ages. We take great pride with responsibility to present before you to “Automatic Automotive Air Refilling System”. A small size contraption ever builds to enhance the driving safety conditions and provides regular maintenance to automotive. “Automatic Automotive Air Refilling System” proves to be one solution to a number of problems faced by the society.

The AAARS pursuit against which
• Causes Fatal Accidents
• Causes Traffic jam
• Reduces Unbalanced Vibrations of vehicles
• Reduces the forces efforts vehicles
• Increases efficiency and performance of vehicles
• Increases tires life
• Provides Smoother driving
• Decreases maintenance cost of vehicles
• Eco-friendly

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2. PROBLEM IDENTIFICATION
As the name of research indicates such a system which is able to fill the air in the Automotive (Automobile) automatically during running of the vehicle. Statistical data’s show importance of correct air pressure. Here discussion show how’s it important? “Not enough drivers are taking proper care of their tires and that can have an effect on vehicle safety,” said Donald B. Shea, Rubber Manufacturers Association (RMA) President and CEO. “Properly inflated tires promote safety, help tires last longer and maximize fuel efficiency.”

“It’s really all about maintaining air pressure — that’s how you get the best wear, fuel economy and performance out of your tires,” Edmonds said.

2.1 Air Pressure in Tires Ensures:
• Protection from accidents
• Maximum efficiency and performance
• Maximum tire life
• Smooth driving
• No unbalanced forces/stresses
• No unbalanced vibrations
• Less maintenance cost

2.2 Every automotive owner wishes to remove all these factors, But it is not easy job for automotive owner’s because: “It’s pretty incredible when you think about it,” Edmonds at the Tire Rack. “Typically, people come out of the winter under-inflated, and you might not have checked your tire pressure since the 30 degree weather,” he said. For every 10 degrees of temperature change you see about 1 pound of pressure change, and a tire loses about 1 pound every 60 days in natural depletion.

• But tires do lose pressure, slowly but surely everyday, through the process of permeation.
• Generally, a tire will lose up to one or two psi (pound per square inch) of air per month in cool weather and even more in warmer weather.
• Tires is subjected to flexing and impacts that can diminish air pressure.
• The space-saver type spare requires a much higher air pressure level than other tires and is virtually useless (due to overloading) at lower air pressure levels.
• We can’t check air pressure by visualizing.

If tire pressure is less or above the mentioned in automotive manual than its dangerous for Automotive Passengers and for Automotive. i.e.

2.3 If air less than required pressure than.
• Than automotive behaves as over loaded.
• Tires are under inflations.
• Overall efficiency reduces
• Reduces tire life i.e. increase wear and tear of tire
• Unbalanced forces on automotive
• Tire damage/Failure

2.4 If air is more than required pressure than
• Tire are in Over inflation condition
• Reduces tire life
• Driving is not smooth
• Unbalanced vibrations in automotive
• Efficiency increases but performance decreases
3. INTERNATIONAL SURVEYS

In Automobile maintaining air pressure in tires are very important but its not easy job for automotive owner as shown by some international automobile surveys:-

- AAA (American Automobile Association) reports that each year they receive about 4 million roadside assistance calls due to tire-related incidents. Not surprisingly, a 2006 RMA survey found that more than 80 percent of drivers do not know how to properly check their tire pressure.

- According to the Department of Energy properly inflated tires can also improve gas mileage by around 3.3 percent and save 9 cents per gallon at the gas pump.

- An Rubber Manufacturers Association (RMA) nationwide survey conducted in February, found:
  Only 19 percent of drivers properly check their tire inflation pressure. Properly checking tires means checking at least once a month before tires have been driven even a mile and inflating them to the vehicle manufacturer’s recommended pressure, not the pressure listed on the tire sidewall.

- 28 percent of drivers wrongly believe that the best time to check their tires is when they are warm after being driven at least a few miles.

- Less than half of drivers know where to find the correct tire pressure - on a sticker in their vehicle that's usually found on the driver's door or in the owner's manual. 53 percent wrongly believe that the correct pressure is found on the tire sidewall.

- 73 percent of drivers do not check the tire pressure in their spare tire.

- Each month, three out of four drivers wash their car while only about one in five correctly checks their tire pressure.

As shown in surveys real view of maintenance given to automotive by automotive owner/Driver.

3.1 Industry highlights

- The first automobile in India rolled in 1897 in Bombay.
- India is being recognized as potential emerging auto market.
- Foreign players are adding to their investments in Indian auto industry.
- Within two-wheelers, motorcycles contribute 80% of the segment size.
- Unlike the USA, the Indian passenger vehicle market is dominated by cars (79%).
- Tata Motors dominates over 60% of the Indian commercial vehicle market.
- 2/3rd of auto component production is consumed directly by OEMs.
- India is the largest three-wheeler market in the world.
- India is the largest two-wheeler manufacturer in the world.
- India is the second largest tractor manufacturer in the world.
- India is the fifth largest commercial vehicle manufacturer in the world.
- The number one global motorcycle manufacturer is in India.
- India is the fourth largest car market in Asia - recently crossed the 1 million mark.

As shown Indian Automotive industry is one of largest industry in world. But till that problem exists. Tire pressure effects on automotive fuel efficiency, reduced maintenance and has potential for improvement.

4. DESCRIPTION

As our research was on major problem that exists in Automotive industry “How to maintain Correct Air Pressure in tires?” After a long research finally we find out the solution of mentioned problem. Here we share a case of assembly process for four wheeler to overcome this problem.

Brief description of components used in assembly for four wheeler.

4.1 Compressor

Compressor is used to compress the air. Air is taken from environment and after compression send to reservoir. Compressor automatically stops when critical pressure achieved for reservoir. Similarly, compressor automatically starts when air pressure in reservoir at lowest level. Compressor is directly powered by Automotive Engine.
4.2 Reservoir
Reservoir is used to store the compressed air. Stored air is used to maintain the air pressure in tires. Reservoir must contain minimum pressure that can maintain required air pressure in tires. If pressure in reservoir goes blow the required air pressure than compressor automatically starts and automatically stops when critical pressure achieved.

4.3 Distributor & F.R.L.
Distributor is used to distribute one pipe to multi pipe. FRL is used as air filter & moisture remover for compressed air & also perform the function of pressure controller. In FRL we set manually air pressure as required in tires. If we have to maintained equal air pressure in all four tires than use FRL and adjust pressure as we want to maintain in tires. Now, use four pin distributer in which one pipe is converted in four pipes and those four pipes goes to each tire. If we have to maintain different air pressure in front tires and rear tires than use two pin distributer in which one pipe is converted in two pipes. Each pipe contains different FRL which helps to maintain different air pressure in front and rear tires. Now, adjust required air pressure in FRLs for front and rear tires. Here again apply two pin distributer to each pipe that converts two output pipes from one input pipe than connects supply to each tire. Now, we have maintained different air pressure in all four tires. If we have to maintained different air pressure in all four tires than use four pin distributer in which one pipe is converted in four pipes. Each pipe contains different FRL which helps to maintain different air pressure in both front tires as well as rear tires. If we have to maintain different air pressure in all four tires than use four pin distributer in which one pipe is converted in four pipes. Each pipe contains different FRL which helps to maintain different air pressure in all four tires. Now, adjust required air pressure in FRLs for different tires. FRL output pipe is connected to each tire. Now, we have maintained different air pressure for different tires.

4.4 Tube & Connector
There are different types of connectors available in market. Purposes of connectors are to connect different joints or different pipes and machine parts according to our requirements. Generally, steel or nylon pipes/ tubes are used connecting different parts according to given procedure.
Different connectors are used to connect pipe and pipe or pipe and metal. These connectors and tubes/ pipes available with different diameter we can take size of these according to case consideration.

5. DESIGN OF OUTER ROTARY COUPLING
Outer rotary wheel is specially designed component and novel work / design by us. Main function of outer rotary wheel to allow/ pass air pressure during rotary motion. As below shown different components of rotary wheel and after assembly diagram.

Different parts of rotary wheel consist

5.1 Back part
- Rectangular Plate
  Used to connect on automobile wheel
- Circular part with outlet hole
  Outlet used as input for tire /outlet for rotary wheel

5.2 Front part (circular)

5.3 Circular bearing
Used to provide fix input during rotating of circular part.

5.4 Seal
Used to make leak proof bearing.

5.5 Circular inlet
It provides inlet to rotary wheel

6. ASSEMBLY PROCESS FOR 4 WHEELER (LIGHT MOTOR VEHICLE)
Assembly process for 4 wheeler (LMV) consists following parts:
- Compressor
- Reservoir
- Distributer & FRL
- Outer rotary wheel

All above components are assembled in sequence as shown in fig. to maintain air pressure in tires of 4 wheelers (LMV). Compressor is powered from engine and air is stored in reservoir. Set required air pressure in FRL than reservoir is connected
with FRL, FRL is connected with distributor and further to rotary wheel. In such an arrangement we can maintain the required air pressure in tires. If there is puncture/leakage in tire than air comes from reservoir, through FRL and rotary wheel filled in tire. As pressure goes below in reservoir than compressor automatically starts and set pressure in tires are maintained. Tubes are used to connect these components.

Fig. 1 Assembly overview of four wheeler

7. ENVIRONMENT IMPACT

How can routine air pressure maintenance impact our environment? Consider that fewer tires per year would end up in the landfills and scrap heaps that trouble our ecology. How many tires are we talking about? We estimate that most drivers lose from 10% to as much as 50% of tire tread life due to under inflation. That's a significant statistic. Now consider the extra fuel we burn to push cars along on soft, underinflated tires. Tires do require extra energy to roll if they are underinflated. While the statistics vary widely and can be somewhat inconclusive, the implications are staggering. Maintaining tire pressure may seem like a low priority in our busy daily routines, but it adds up to big environmental consequences. We must all take action to do the right thing. After implementing AAARS in your automotive you increase safety, efficiency as well as become eco saver.

8. WORKING

First of all arrange all the components according to vehicle than as air is decreased / increased (below/ above) the mentioned pressure than air automatically come in/out to/from the tire and air pressure of tire is maintained as we set in digital FRL. Digital FRL is used to filter the air moist text, dust particles and to maintained required air pressure as we set. As air pressure in the reservoir below the mentioned pressure than compressor started automatically from automobile engine. Arrangement of compressor and engine is done by auto start clutch mechanism as we use in the air-conditioner. If there is continuously running of the compressor than we get regular beep. That indicates your compressor is running continuously. Hence, we can say if air decreases in the any tire below mentioned air pressure than air automatically fill and if air pressure goes below in reservoir than mentioned pressure then clutch of compressor engaged with engine shaft and compressor automatically start and fill the reservoir up to mentioned pressure then auto stop/cut or auto disengaged from engine shaft and only pulley will rotates.
9. RESULTS
While checking the proposed AAARS System in four Wheeler Automobile, it has found out that the vehicle run satisfactorily during puncture at various speed. This AAARS system will bring a revolution in field of automobiles. It is hoped that when its production will be done in large scale it will cost approximately Rs. 5000/- with installation.

CONCLUSION
We may conclude that the research on “Automatic Automotive Air Refilling System” will be a boom to the passengers as it will avoid serious accident and also save the tire and tube from being totally damaged. This system will also ensure the proper air pressure in tires and thus saves minimum 5% of the fuel consumed. This system will be very handy in cases of automobiles are being driven by a lady or only one passenger as the driver. This system will be eco-friendly.

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ABSTRACT

There is a very thin line which discriminates between living organisms and machines which has blurred over the passing time. “Biochips”-The most exciting future technology is an outcome of the fields of Computer science, Electronics & Biology. Its a new type of bio - security device to accurately track information regarding what an organism is doing, to accurately track information regarding them. With the invention of Biochips, the good old idea of remembering PINs, Passwords, & Social security numbers will soon be history. Also, carrying medical records to a hospital becomes immaterial. No more cash/credit card carrying to the market place; everything goes embedded in the digital neuro chips.

In nearby future we aim to develope "neuro-chips" in which living brain cells and silicon circuits are coupled together. To create the neuro-chip, researchers squeezed more than 16,000 electronic transistors and hundreds of capacitors onto a silicon chip just 1 millimeter square in size. This achievement could one day enable the creation of sophisticated neural prostheses to treat neurological disorders, or the development of organic computers that crunch numbers using living neurons. Special proteins found in the brain to glue brain cells, called neurons, can be artificially clubed together onto the chip. However, proteins can be used to act as more than just a simple adhesive.

Keywords: Bio-chips, neuro-chips, neural prostheses, organic computers

1. INTRODUCTION

• Biochips are any microprocessor chips that can be used in Biology [1]. The biochip technology was originally developed in 1983 for monitoring fisheries, it’s use now includes, over 300 zoos, over 80 government agencies in at least 20 countries, pets (everything from lizards to dogs), electronic “branding” of horses, monitoring lab animals, fisheries, endangered wildlife, automobiles, garment tracking, hazardous waste, and humans. Biochips are "silently" inching into humans. For instance, at least 6 million medical devices, such as artificial body parts (prosthetic devices), breast implants, chin implants, etc., are implanted in people each year. And most of these medical devices are carrying a "surprise" guest-a biochip..

• The really powered biochip systems can replace cash, passports, medical & other records! It’s no more required to carry wallet full cash, credit/ATM cards, passports & medical records to the market place. Payment system, authentication procedures may all be done by the means Biochips. Medicinal implementations of Biochips: A New Era Proposed by us Biochip as Glucose Detector: The Biochip can be integrated with a glucose detector. The chip will allow diabetics to easily monitor the level of the sugar glucose in their 6 blood. Diabetics currently use a skin [censored] and a hand-held blood test, and then medicate themselves with insulin depending on the result. The system is simple and works well, but the need to draw blood means that most diabetics don't test themselves as often as they should.

• Biochip as Oxygen sensor : The biochip can also be integrated with an oxygen sensor. The oxygen sensor will be useful not only to monitor breathing in intensive care units, but also to check that packages of food, or containers of semiconductors stored under nitrogen gas, remain airtight. Proposed principal of Oxygen sensor in Biochip: The oxygen-sensing chip sends light pulses out into the body. The light is absorbed to varying extents, depending on how much oxygen is being carried in the blood, and the chip detects the light that is left. The rushes of blood pumped by the heart are also detected, so the same chip is a pulse monitor.

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• Biochip as an Blood Pressure sensor: In normal situations, The Blood Pressure of a healthy Human being is 120/80 mm of Hg. A Pressure ratio lower than this is said to be “Low BP “ condition & A Pressure ratio more than this is “High BP” condition. Serious Effects will be reflected in humans during Low & High BP conditions; it may sometimes cause the death of a Person. Blood Pressure is checked with BP Apparatus in Hospitals and this is done only when the patient is abnormal. However, a continuous monitoring of BP is required in the aged people & Patients.

2. MICROCHIP IMPLANTS MIND CONTROL AND CYBERNATICS

• Cybernetics, defined as a neurological communication and control theory already in use in small circle sat that time [2]. Yoneji Masuda, "Father of the Information Society," stated his concern in 1980 that our liberty is threatened Orwellian-style by cybernetic technology totally unknown to most people. This technology links the brains of people via implanted microchips to satellites controlled by ground-based supercomputers.

Fig 1 Cybernetics (neurological communication)

• Today's microchips operate by means of low-frequency radio waves that target them. With the help of satellites, the implanted person can be tracked anywhere on the globe. Such a technique was among a number tested in the Iraq war, according to Dr. Carl Sanders, who invented the intelligence-manned interface (IMI) biotic, which is injected into people. (Earlier during the Vietnam War, soldiers were injected with the Rambo chip, designed to increase adrenaline flow into the bloodstream.) The 20-billion-bit/second supercomputers at the U.S. National Security Agency (NSA) could now "see and hear" what soldiers experience in the battlefield with a remote monitoring system (RMS). When a 5-micromillimeter microchip (the diameter of a strand of hair is 50 micro millimeters) is placed into optical nerve of the eye, it draws neuroimpulses from the brain that embody the experiences, smells, sights, and voice of the implanted person. Once transferred and stored in a computer, these neuroimpulses can be projected back to the person’s brain via the microchip to be experienced. Using a RMS, a land-based computer operator can send electromagnetic messages (encoded as signals) to the nervous system.

• The Washington Post reported in May 1995 that Prince William of Great Britain was implanted at the age of 12. Thus, if he were ever kidnapped, a radio wave with a specific frequency could be targeted to his microchip. The chip’s signal would be routed through a satellite to the computer screen of police headquarters, where the Prince’s movements could be followed. He could actually be located anywhere on the globe.

3. MICROCHIP “TALKS” TO HUMAN BRAIN

• Researchers have created Biomedical Microdevices (a microchip) that "communicates" with brain cells, a discovery that could help patients with Alzheimer's and Parkinson's diseases. The neurochip is able to monitor the electrical and chemical dialogue between brain cells, and to track subtle changes in brain activity. Accessing those areas means researchers could test drugs to treat several neurological conditions accurately and quickly.
• Laurine Fillo, who was diagnosed with Parkinson’s disease eight years ago, takes medication to manage her symptoms but has always hoped for a better solution. “I told my husband probably five years ago: ‘Oh, one day they’ll develop a microchip that they can implant in my brain and it’ll control the symptoms and help me manage this disease,’” she said. This research gives her something to look forward to.

• In the coming months, the team from the faculty of medicine plans to begin testing drugs using the tiny silicon device, embedded with a network of brain cells surgically removed from patients with epilepsy.

4. HUMAN BRAIN ON A MICRO-CHIP WILL CONTROL TECHNOLOGY

• By the year 2020, you won’t need a keyboard and mouse to control your computer, say Intel researchers [3]. Instead, users will open documents and surf the web using nothing more than their brain waves. Scientists at Intel’s research lab in Pittsburgh are working to find ways to read and harness human brain waves so they can be used to operate computers, television sets and cell phones. The brain waves would be used to operate them all. “I think human beings are remarkable adaptive,” said Andrew Chien, vice president of research and director of future technologies research at Intel Labs. “If you told people 20 years ago that they would be carrying computers all the time, they would have said, ‘I don’t want that. I don’t need that.’ Now you can’t get them to stop. There are a lot of things that have to be done first but I think [implanting chips into human brains] is well within the scope of possibility.”

• Today, Intel’s Pomerleau said various research facilities are developing technologies to sense activity from inside the skull. "If we can get to the point where we can accurately detect specific words, you could mentally type," he added. "You could compose characters or words by thinking about letters flashing on the screen or typing whole words rather than their individual characters."

5. BRAIN CELLS FUSED WITH COMPUTER CHIP

• Scientists created neuro-chip with more than 16,000 electronic transistors and hundreds of capacitors onto a silicon chip just 1 millimeter square in size. They used special proteins found in the brain to glue brain cells, called neurons, onto the chip. However, the proteins acted as more than just a simple adhesive. "They also provided the link between ionic channels of the neurons and semiconductor material in a way that neural electrical. The proteins allowed the neuro-chip's electronic components and its living cells to communicate with each other. Electrical signals from neurons were recorded using the chip's transistors, while the chip's capacitors were used to stimulate the neurons.

![Brain Cells](Fig 2)

• It could still be decades before the technology is advanced enough to treat neurological disorders or create living computers, the researchers say, but in the nearer term, the chips could provide an advanced method of screening drugs for the pharmaceutical industry.” Pharmaceutical companies could use the chip to test the effect of drugs on neurons, to quickly discover promising avenues of research. The researchers are now working on ways to avoid damaging the neurons during stimulation. The team is also exploring the possibility of using a neuron's genetic instructions to control the neuro-chip.

6. CHIP COPIES BRAIN SECTION RESPONSIBLE FOR MEMORY MOOD

• LONDON, England (Reuters)-Scientists have developed the first artificial region of the brain - a silicon chip that mimics an area that controls memory, mood and awareness. The chip is designed to carry on the functions of the region known as the hippocampus and could one day be used to help people with brain damage to help people who have suffered brain damage due to stroke, epilepsy or Alzheimer's disease.
First they devised a mathematical model of how the hippocampus performs under all conditions. The next step involved building the model into a silicon chip and then interfacing the chip with the brain in laboratory studies. “If you lose your hippocampus you only lose the ability to store new memories.

7. BRAIN CELL MICRO-CHIP LETS SCIENTISTS ‘LISTEN’ AS NEOURO ‘TALK’

- Microchip embedded with brain cells that allow them to “listen in” as the neurons communicate with each other [4-5]. This brain-on-a-chip will make it possible to test drugs for a number of neurological conditions in a much quicker, efficient and accurate way. And what it meant was that you could now have brain cells that could talk to an electronic device and then the electronic device could talk back to the brain cells.

- Brain cells communicate with each other through electrical and chemical messages that cause them to either be excited or to relax. Electrical messages, for instance, take a pathway on the neuron’s surface known as an ion channel — a component of the brain cell that is critical when it comes to drug testing. Drug testing using their tiny device embedded with a network of brain cells surgically removed from patients with epilepsy.

- Now when we can get this cell, we can put it on our chip and then we can record ion-channel activity, but also find the best drug that will block seizures in that particular individual’s cells. This can also speed up the search for drugs to treat such neurological diseases as Alzheimer’s and Parkinson’s. The brain-on-a-chip could also help drug companies more easily isolate compounds that would provide the next generation of pain killers or medications that could control addictions.

8. NEUROCHIP TECHNOLOGY OPENS BRAIN TO DEEPER INSPECTION

- The Government is preaching that the chip will serve good. It will help with locating kidnapped children, medical records for emergencies, even prove people innocent with alibi evidence. There is no mention of malicious practices which we all know over-powers the good. Surely one can’t believe good intentions are the top priority.
9. PROBLEM AND LAWS

- There are both potential problems and benefits associated with human microchipping. One problem is that a person's privacy could be severely infringed upon. This could happen because the person's movements, both physically and financially, could be tracked. Personal data about a person could be sold or hacked into. A third potential problem could be who would have access to the information, and who stores the information [7].

- There are potential health problems as well. For example, Non-ionizing Radiation from microwave radio frequency and magnetic fields could cause various health issues. A potential benefit could include storing a person's complete medical history, or at the bare minimal the drugs that they are taking or are allergic to.

- There are legal and legislative issues as well dealing with RFID [7-8] technology. Even though the scanner that reads the sensor has to be close to the body to read the chip, there still is the possibility of identity theft. Having the chip implanted has been compared to carrying your Social Security Number under your skin.

- Issues lawmakers would have to keep in mind could include:
  a. What information should be placed on a device to be able to identify the person
  b. Who would have access to the personal information
  c. Who would be able to read the information with a scanner
  d. What would be a punishment with people stealing the information with a scanner
  e. At what level of government should the laws should be enact

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Molecular MRI of Tumor Angiogenesis Using cNGR-Labeled Paramagnetic Quantum Dots

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ABSTRACT
The objective of this study was to develop and apply cyclic Asn-Gly-Arg (cNGR)-labeled paramagnetic quantum dots (cNGR-pQDs) for the noninvasive assessment of tumor angiogenic activity using quantitative in vivo molecular magnetic resonance imaging (MRI). cNGR was previously shown to colocalize with CD13, an aminopeptidase that is highly overexpressed on angiogenic tumor endothelium. Because angiogenesis is important for tumor growth and metastatization, its in vivo detection and quantification may allow objective diagnosis of tumor status and evaluation of treatment response. I.v. injection of cNGR-pQDs in tumor-bearing mice resulted in increased quantitative contrast, comprising increased longitudinal relaxation rate and decreased proton visibility, in the tumor rim but not in tumor core or muscle tissue. This showed that cNGR-pQDs allow in vivo quantification and accurate localization of angiogenic activity. MRI results were validated using ex vivo two-photon laser scanning microscopy (TPLSM), which showed that cNGR-pQDs were primarily located on the surface of tumor endothelial cells and to a lesser extent in the vessel lumen. In contrast, unlabeled pQDs were not or only sparsely detected with both MRI and TPLSM, supporting a high specificity of cNGR-pQDs for angiogenic tumor vasculature.

Keywords: Quantum dots, Angiogenesis, Nano-Particles, pQD (paramagnetic quantum dot).

1. INTRODUCTION

1.1 Semiconductor quantum dots (QDs) are nanoparticles that have attracted widespread interest in biology and medicine due to their unique optical and electronic properties. These properties, especially their reduced tendency to photobleach and the dependence of their fluorescence wavelength on their size, make them suitable for fluorescent probing applications to detect cancer biomarkers in vitro and in vivo in cells/tissues/whole body [1]. There is considerable interest among researchers due to the recent developments in QD technology. QDs have been encapsulated in amphiphilic polymers and bound to tumour-targeting ligands and drug delivery vesicles for targeting, imaging and treating tumour cells. Present efforts are focussed on exploring the massive multiplexing capabilities of the QDs for the simultaneous detection of multiple cancer biomarkers in blood assays and cancer tissue biopsies. These advances in the QD technology have unravelled a great deal of information about the molecular events in tumour cells and early diagnosis of cancer.

Fig. 1 The size of the quantum dots can be tuned to produce several different colours.

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1.2 Angiogenesis, the formation of new capillaries from existing blood vessels, is key to tumor growth and metastatization by providing proliferating tumor cells with oxygen and nutrients [Marlies Oostendorp (1),2]. Moreover, angiogenic activity is related to tumor malignancy [3,4]. Noninvasive detection of angiogenic activity is therefore highly relevant for adequate tumor diagnosis. Quantification of angiogenesis may furthermore allow objective monitoring of tumor progression, for instance in response to treatment. Currently, molecular imaging techniques are being developed that allow direct visualization and characterization of cellular or molecular activation of angiogenesis-related pathways [5]. More specifically, molecular imaging uses contrast agents that home to up-regulated biomolecules (e.g., receptors, enzymes) via interaction with high-affinity ligands coupled to the contrast agent. Ideally, this results in altered signal intensity at the location of these molecules. Of the different imaging modalities, magnetic resonance imaging (MRI) may be the most desirable for molecular imaging due to its excellent spatial resolution and soft tissue contrast. Moreover, molecular MRI potentially allows direct covisualization of tumor angiogenic activity with anatomy. However, the inherently low sensitivity of MRI is a problem due to the typically low abundance of up-regulated biomolecules. This can be overcome by large molecular weight constructs carrying a high payload of gadolinium or iron, and multiple targeting ligands to enhance the relaxivity and targeting efficacy, respectively, of the particle [6].

1.3 One of the best-defined ligands for molecular imaging of angiogenesis is the cyclic Arg-Gly-Asp (cRGD) peptide, which binds specifically to the αβ3-integrin [7,8]. However, for the cyclic Asn-Gly-Arg (cNGR) motif, the tumor-homing capability was shown to be 3-fold higher compared with cRGD. The clinical applicability of cNGR as a tumor-homing ligand was previously shown by conjugating cNGR to tumor necrosis factor α (TNFa). Compared with unlabeled TNFa, cNGR-TNFa displayed a significantly increased antitumor activity with similar systemic toxicity [9,10]. The vascular address of cNGR is a specific isofrom of CD13 (aminopeptidase N), a trans membrane glycoprotein involved in cancer angiogenesis, tumor invasion, and metastasis, which is overexpressed by activated endothelial cells (ECs) of tumor vasculature [11,12]. CD13 is not required for vessel growth during embryonic development and normal adult function, as shown in CD13-null mice. In a model of retinal neovascularization, these mice had significantly decreased vessel growth, suggesting that CD13 is important in pathologic neovascularization. In addition, fluorophore-conjugated cNGR allowed detection of the in vivo expression of CD13 in tumors and infarcted myocardium. Competition with unconjugated cNGR significantly decreased the fluorescence signal, indicating high specificity of cNGR for CD13 [13].

1.4 Despite the aforementioned high tumor-homing capability of cNGR, its potency as a targeting ligand for molecular imaging of tumor angiogenesis is currently unknown. Therefore, the objective of this study was to explore cNGR-labeled paramagnetic quantum dots (cNGR-pQDs) for the noninvasive and selective in vivo detection of tumor neovascularization using quantitative molecular MRI. QDs were chosen as contrast agent scaffolds because of their excellent photophysical properties, i.e., broad excitation, small emission spectra, and limited photobleaching [14,15]. Furthermore, QDs enabled binding of multiple targeting ligands and gadolinium chelates. The bimodal nature of the particle (i.e., paramagnetic and fluorescent) allowed validation of the results with ex vivo two-photon laser scanning microscopy (TPLSM). With TPLSM, three-dimensional contrast agent localization can be obtained at subcellular resolution with a penetration depth reaching 250 µm in tumors.

MRI data were analyzed via absolute quantification of contrast agent induced changes in the longitudinal relaxation rate 1/T1 of the tissue, which is proportional to contrast agent concentration, and proton visibility. The latter expectedly decreases at high densities of paramagnetic contrast material. Quantitative analysis requires acquisition of a series of images and may provide improved sensitivity of molecular MRI. Theoretically, the used inversion recovery (IR) technique has an inherent 2-fold higher sensitivity than spin echo pulse sequences and by measuring a series of images it potentially allows detection of smaller changes in 1/T1 than a single image [16]. Both MRI and TPLSM showed specific binding of cNGR-pQDs to ECs in the angiogenic tumor rim but not in tumor core or muscle tissue. Furthermore, a significantly lower quantitative contrast was found with unlabeled pQDs, indicating a high specificity of the cNGR-labeled contrast agent for angiogenic ECs. To our knowledge, this is the first noninvasive in vivo application of cNGR as a targeting ligand for molecular MRI of tumor angiogenesis.

2. MATERIALS AND METHODS

2.1 Preparation of cNGR-labeled paramagnetic Quantum Dots

NAC-Cys(4MeBzl)-Asn(Xanthyl)-Gly-Arg(Tosyl)-Cys(4MeBzl)-Gly-Gly-Lys(Fmoc)-peptide was synthesized by tBoc solid phase peptide synthesis, as described previously [16,18]. On the resin, the lysine side chain was selectively deprotected by treatment with 20% piperidine/dimethylformamide (4 × 3 min). After covalent coupling of biotin-succinimidyl ester (Molecular Probes) to the lysine ε-amino group to obtain biotinylated peptide-resin, the peptide was deprotected and cleaved from the resin using anhydrous hydrogen fluoride for 1 h at 0°C with 4% p-cresol as scavenger and lyophilized. Electrospray ionization mass spectrometry (ESI-MS) revealed a mass of 1,287.4, corresponding well to the theoretical average mass
(1,288.7) of the reduced biotinylated Nac-Cys-Asn-Gly-Arg-Cys-Gly-Gly-Lys (biotin)-NH2 peptide. Oxidative folding of the crude product in 0.1 mol/L Tris (pH 8), 1 mol/L guanidin at 4°C for 16 h yielded the internal disulfide bridged biotin-cyclic NGR, which was high performance liquid chromatography (HPLC)-purified (C18 RP-HPLC) and lyophilized. ESI-MS confirmed a mass decrease of 2, representing the loss of 2 protons from the cystein side chains due to the generation of 1 disulfide bond (S-S). Biotinylated poly (lysine) dendritic wedge, a construct comprising 8 Gd-diethylenetriaminepentaacetic acid (DTPA) moieties, was synthesized and purified similarly[17-19].

Curnis and colleagues [20] previously showed that cNGR spontaneously converts into isoDGR by asparagine deamidation at slightly basic pH, generating an αβ3-integrin ligand. Using a combination of HPLC and mass spectrometry up to 24 h after dissolving cNGR in water (pH 6.0) and 1 μmol/L borate buffer (pH 8.3; supplemented with 0.05% NaN3), respectively, it was found that this process did not occur in the time-period of the experiments.Bimodal, multivalent contrast agent was prepared as follows. Streptavidin-conjugated QDs [1 μmol/L in borate buffer (pH 8.3), emission at 585 nm] were purchased from Invitrogen. QDs were composed of a CdSe core with a ZnS shell and covered with polyethyleneglycol-2000. Each QD holds 10 surface-bound streptavidins, allowing 30 biotinylated compounds to bind on average. 8 For each experiment, cNGR-pQDs were prepared freshly at room temperature by sequential mixing of 100 μL QD solution with biotin-cNGR and biotin-poly(lysine) dendritic wedge, both dissolved in HBSS (pH 7.4; Invitrogen), in a molar ratio of 1:6:24 to a total volume of 120 μL. Samples were mildly vortexed during each preparation step to ensure a homogeneous distribution of biotin-cNGR and biotin-poly(lysine) dendritic wedge over the QD surface. Overall, each QD carried a maximum of 192 Gd ions and 6 cNGR peptides. Unlabeled pQDs carried the same number of Gd constructs but no cNGR. A schematic representation of the cNGR-pQD particle is shown in Fig.3.

**Fig. 2** Schematic representation of the synthesis of QDs with a paramagnetic micellar coating. QDs and lipids in chloroform are slowly infused in hot water that, via chloroform-in-water emulsions, swiftly form micelles when chloroform evaporates, some of which have a QD core.

**Fig. 3** Schematic representation of a cNGR-labeled paramagnetic quantum dot. Each particle carries streptavidin moieties to which 6 cNGR groups and 24 dendritic gadolinium constructs were bound. The total number of gadolinium ions per particle was maximally 192.
2.2 Animal Model
All animal studies were approved by the institutional animal welfare committee. Human colorectal adenocarcinoma cells (1.5 to 3·10^6; LS174T; American Type Culture Collection CL-188) were unilaterally injected on the flank of 15-wk-old male Swiss nu/nu mice (Charles River). Mice were subjected to the MRI examination when the tumor diameter was >1.0 cm, which was 16 d after LS174T injection.

![Fig. 4 Human colorectal adenocarcinoma cells](image)

For in vivo MRI, mice were anesthetized using 1.5% to 2.0% isoflurane (Abbott Laboratories Ltd) in medical air and were placed prone in a dedicated animal holder with built-in mask for anesthesia gas supply. An infusion line was placed in the jugular vein for contrast agent administration during the MRI experiment. A heating pad was placed over the mice to maintain normothermic conditions. Respiration rate and body temperature were continuously monitored via a balloon sensor and rectal temperature probe, respectively, interfaced to an MR compatible small animal monitoring system [21]. Mice were randomly selected for injection with either cNGR-labeled or unlabeled pQDs. Seven mice were included for each contrast agent group. Mice were kept inside the magnet during the entire MRI experiment to preserve their position.

2.3 MRI Protocol
All MRI experiments were performed on a 7 T Bruker Biospec 70/30 USR MRI system, interfaced to an AVANCE II console (Bruker Biospin GmbH). The BGA12-S mini imaging gradient (maximum gradient strength, 720 mTm⁻¹; slew rate, 6,000 Tm⁻¹s⁻¹) and a 3.5-cm inner diameter quadrature volume resonator were used [22].

2.3.1 Molecular MRI: Tumors were localized using T₂-weighted anatomic images (TR, 4,200 ms; TE, 37.4 ms). Next, precontrast R₁ values were determined using a series of IR measurements with increasing inversion times (TR, 4,000 ms; TE, 8.4 ms; TI, 500, 1,000, 1,500, 2,000, 2,500, and 3,500 ms; total scan time, 18 min). Subsequently, mice were injected with 120 µL of cNGR-labeled or unlabeled pQDs, followed by a 50 µL saline flush. IR experiments were repeated 30 min postcontrast to ensure adequate contrast agent circulation and a reduced level of intravascular contrast agent. Images were recorded using a field of view (FOV) of 4.0 × 4.0 cm², a 192 × 192 acquisition matrix interpolated to 256 × 256 by means of zero-filling, and a slice thickness of 1.2 mm, resulting in 0.16 × 0.16 × 1.2-mm³-sized voxels. On average, 15 contiguous slices were recorded in multislice mode (range, 11–22 slices; depending on tumor size and orientation). After MRI, mice were euthanized by cervical dislocation.

2.3.2 Competition experiment
Four tumor-bearing mice were randomly selected for a competition experiment of cNGR-pQDs with unconjugated cNGR, i.e., nonbiotinylated, nonparamagnetic, and nonfluorescent. Imaging was performed as described above, except that 525 µg per mouse of unconjugated cNGR, i.e., a 1,000-fold excess compared with QD-bound cNGR, was injected i.v. 10 min after administration of cNGR-pQDs.

2.3.3 Biodistribution
Healthy Swiss mice (Charles River) were injected with either cNGR-pQDs, unlabeled pQDs, or no contrast agent. After 1 hr. circulation time, mice were sacrificed and whole body T₁-weighted spin echo images were recorded (TR, 1,100 ms; TE, 8.5 ms; FOV, 4.0 × 6.0 cm²; matrix, 256 × 512; resolution, 0.16 × 0.12 × 1.2 mm³). Two mice were included per group.

2.3.4 Tissue harvesting
After MRI, tumor, spleen, liver, kidney, hind limb muscle, heart, and lung were excised and embedded in optimal cutting temperature (OCT) compound (Sakura Finetek Europe). Next, tissues were snapfrozen in cold 2-methylbutane (Acros Organics) for 2 min and subsequently transferred to liquid nitrogen. Tissues were stored at −80°C until TPLSM measurements.
2.3.5 Contrast agent relaxivity

\( T_1 \) relaxivity \((r_1)\) was determined by diluting cNGR-pQDs in HBSS in 9 steps to concentrations of 0 to 0.001 mmol/L (corresponding gadolinium concentrations, 0–0.192 mmol/L). The \( R_1 \) of each sample was determined using the IR series as described above. Absolute gadolinium concentrations were measured using Inductively Coupled Plasma Mass Spectrometry. Longitudinal relaxivity was determined by the slope of a linear fit of \( R_1 \) versus gadolinium concentration [Marlies Oostendorp (1)].

3. MRI DATA ANALYSIS

3.1 All data processing was performed in Matlab (The Mathworks), unless stated otherwise. IR images were first spatially coregistered using the mutual information algorithm in the MIRIT software package[22] to correct for possible animal motion in the images with different \( T_1 \) contrast, and smoothed with a three dimensional Gaussian kernel with a full-width-at-half-maximum of 0.4 x 0.4 x 3.0 mm\(^3\). Regions of interest (ROI) were drawn manually in MRIcro [23] to define tumor and muscle tissue. Both \( T_1 \)- and \( T_2 \)-weighted images were used to accurately delineate tumors from surrounding tissue and edema. Precontrast and postcontrast \( R_1 \) values were determined on a voxel-by-voxel basis by nonlinear curve fitting of the IR signal intensity function[24]:

\[
S = S_0 (1 - 2 e^{-\frac{1}{T_1 R_1 + e^{TR R_1}}})
\]

using the Levenberg-Marquardt optimization algorithm. \( S_0 \) is a scaling factor including proton density, excitation pulse profile, echo time, and preamplifier gain. The detection limit for changes in \( R_1 \) (\( \Delta R_1 = R_{1 \text{post}} - R_{1 \text{pre}} \)) was determined with a Monte Carlo simulation using Eq. 1, in \textit{in vivo} relaxation rates, and representative noise levels as derived from the \textit{in vivo} experiments. A voxel was considered significantly enhanced when \( \Delta R_1 \) was >1.96 (i.e., 95% confidence interval) times higher than the detection limit of 0.005 s\(^{-1}\). We defined the Quantitative Contrast derived from the \( \Delta R_1 \) measurements \( (QC_{R1}) \) as the product of the mean \( \Delta R_1 \) and the percentage of significantly enhanced voxels for each tissue type, i.e., tumor rim and core, and muscle tissue. \( QC_{R1} \) indicates both the level and spatial extent of contrast agent binding. Changes in \( S_0 \) (\( \Delta S_0 = S_{0 \text{post}} - S_{0 \text{pre}} \)) were also evaluated, and the Quantitative Contrast from \( S_0 \) \( (QC_{S0}) \) was defined analogously to \( QC_{R1} \) to yield a quantity that reflects proton visibility [23].

3.2 Tumor rim / Core analysis

To investigate the differences between tumor rim, i.e., the region with the highest expected angiogenic activity, and core, the tumor rim was first defined as a 1-mm thick peripheral zone with the strongest \( R_1 \) enhancement, in accordance with the approach taken by others [23–26]. Using this thickness, the difference between cNGR-labeled and unlabeled pQDs was maximal (Fig. 5C). The rim comprised 29.0% ± 5.8% and 31.6% ± 3.5% of all tumor voxels for mice injected with cNGR-labeled and unlabeled pQDs, respectively. The tumor core was defined as the difference between who tumor and tumor rim ROIs. Second, a contour was drawn to calculate the number of voxels with a significantly increased \( \Delta R_1 \) as a function of the distance to the tumor rim. As an empirical measure of spatial heterogeneity in angiogenic tumor activity, the half-value-depth was defined as the distance from the rim at which the percentage of enhanced voxels has decreased by 50% compared with its value at zero distance, i.e., the rim. The half-value-depth was calculated by fitting the group-averaged data presented in Fig. 5C with a mono-exponential decay function.

3.3 Biodistribution

ROIs defining the spleen, liver, kidney, heart, lung, and aorta were drawn manually in MRIcro. Signal intensities were averaged over the entire tissue and normalized to hind limb muscle.

3.4 Statistical analysis

Statistical analysis of paired samples was performed using a nonparametric Wilcoxon signed-rank test in SPSS 14.0 (SPSS). As both \( QC_{R1} \) and \( QC_{S0} \) represent contrast agent presence, \( QC_{R1} \) and \( QC_{S0} \) were combined to a summary value according to O’Brien and Läuter, which is more sensitive to contrast effects than the individual measures. Therefore, \( QC_{R1} \) and \( QC_{S0} \) were first standardized by \( z = [QC - \text{mean (QC)}/\text{sd (QC)}] \). Subsequently, the absolute values of \( z_{QC_{R1}} \) and \( z_{QC_{S0}} \) were averaged per animal. The resulting summary measure was tested using a nonparametric Mann-Whitney \( U \) test. \( P < 0.05 \) was considered statistically significant [24].

4. TPSL DATA ACQUISITION

4.1 Tissue samples were thawed and washed with HBSS to remove OCT compound. Except for the spleen and liver, tissues were incubated with 25-fold diluted aCD31-FITC (0.5 mg/mL; BD Biosciences PharMingen) to fluorescently label ECs. Next, tissues were embedded in 2 w% agarose gel (Invitrogen), with their rim upwards. For measurements in the tumor core, tumors were cut transversally to resemble the slice orientation of the MRI measurements.
4.2 TPLSM imaging was performed using a Nikon Eclipse E600FN upright microscope, incorporated in the Bio-Rad Radiance 2100MP imaging system and operated by Lasersharp2000 V6.0 (Bio-Rad). Tissue samples were excited by the Tsunami Tisapphire laser (Spectra-Physics), which was pumped by a Millennia Vs 5 W pump laser (Spectra-Physics) and mode locked at 800 nm, with an 82.5 MHz repetition rate and 100 fs pulse width. Tissues were observed through a water dipping 60 × fluor objective with a 1.00 numerical aperture (Nikon). Photomultiplier tubes (PMTs 9108B02 and 9136B05; Electron Tubes Limited) were used to acquire fluorescence photons in three spectral regions: 420 to 470 nm (autofluorescence), 520 to 560 nm, (FITC) and 570 to 600 nm (QD). Each PMT was tuned for minimal bleed through of the fluorescent markers to adjacent PMTs. Images, color coded blue, green, and red, respectively, and were subsequently merged into a single image. The in-plane pixel dwell time was 11.8 µs, which, together with a 2-fold Kalman averaging, resulted in an imaging speed of 0.16 Hz. The FOV was 179 × 179 µm² with a matrix size of 512 × 512, resulting in 0.35 × 0.35 µm² sized pixels.

5. TPLSM DATA ANALYSIS

Data were analyzed with Image-Pro Plus 6.0 (Media Cybernetics) and Image J 1.35 (NIH). Image quality was improved by convolution with a 1.05 × 1.05 µm² Gaussian filter. Spatial distribution of pQDs was classified into four groups: intravascular, intracellular, colocalized with the EC membrane, or extravasated to the interstitium.

6. RESULT

6.1 In vivo targeting of activated tumor endothelium. The ability of cNGR to target angiogenic tumor ECs was evaluated in tumor-bearing nude mice by injecting them with cNGR-labeled or unlabeled pQDs. Tumor volumes of cNGR and control groups did not differ on MR images (mean ± SD, 1.0 ± 0.7 cm³ and 1.0 ± 0.6 cm³, respectively). For both cNGR-labeled and unlabeled pQDs, changes in $R_1$ ($\Delta R_1$) were spatially heterogeneous throughout the tumor and were most pronounced at the tumor rim (Fig. 5A). Averaged over all mice, the $\Delta R_1$ induced by cNGR-pQDs ranged upto 0.3 s⁻¹, which was considerably larger than the intrinsic variation in precontrast tumor $R_1$ of 0.1 s⁻¹. Furthermore, the range in $\Delta R_1$ was relatively large compared with the precontrast tumor $R_1$ of 0.8 s⁻¹. Administration of unlabeled pQDs resulted in a 3-fold lower response range ($\Delta R_1 < 0.1$ s⁻¹) compared with cNGR-pQDs.

Fig. 5: $T_2$-weighted anatomic images with color overlay of $\Delta R_1$ (A) and $\Delta S_0$ (B) for tumor (T) and muscle (M) tissue of mice injected with cNGR-labeled or unlabeled pQDs ($n = 7$ for both groups). Changes in $R_1$ were most pronounced at the tumor rim for cNGR-pQDs. Although an $R_1$ increase in the tumor rim was also observed for unlabeled pQDs, the average response was 3-fold lower when compared with cNGR-pQDs, indicating a high specificity of cNGR for angiogenic tumor endothelium. This is further supported by the low changes in $R_1$ found in muscle tissue. Changes in $S_0$ (B) colocalized almost completely with changes in $R_1$ (A). Representative TPLSM images of tumor (C) and muscle tissue (D) showing pQD signal (red) and EC-specific αCD31-FITC (green). cNGR-pQDs accurately colocalized with tumor ECs, indicating binding of the
contrast agent to the tumor endothelium (C). cNGR-pQDs were also detected in muscle tissue with TPLSM (Fig. D, arrows), although to a much lesser extent than in tumor tissue. cNGR-pQDs did not display any colocalization with muscle ECs and were only found intraluminally. Unlabeled pQDs were not or only sparsely detected in both tumor and muscle tissue. Bar, 50 μm.

Subsequent investigation by TPLSM allowed localization of cNGR-labeled and unlabeled pQDs at a subcellular resolution. cNGR-pQDs were found to colocalize approximately thrice more often with tumor ECs than unlabeled pQDs (Fig.5). cNGR-labeled and unlabeled pQDs were also found in the vessel lumen, albeit that cNGR-pQDs were approximately thrice more prevalent than unlabeled pQDs. Both contrast agents were only sparsely found to have extravasated into the tumor interstitium. Although cNGR was previously reported to be an internalizing peptide, cNGR-pQDs were not detected inside ECs with TPLSM [25]. Further evidence for the specificity of cNGR was provided by ΔR₁ in hind limb muscle. Here, average ΔR₁ upon administration of cNGR-pQDs was considerably lower than in the tumor and ranged up to 0.05 s⁻¹. TPLSM did not display colocalization of cNGR-pQD with ECs of muscle vasculature. However, the incidence of cNGR-pQDs in the muscle vascular lumen was almost 2-fold higher than for unlabeled pQDs (Fig. 5D).

6.2 $S_0^*$ effect
For both cNGR-labeled and unlabeled pQDs, changes in the scaling factor $S_0$ colocalized strongly with ΔR₁ (Fig. 5B). The $S_0^*$ effect is likely caused by field inhomogeneities ($T_2$-effect) in the vicinity of the contrast agent, induced by the magnetic properties of QDs and the dense gadolinium concentration on the particle. Analogous to iron oxide particles, such properties result in locally reduced transverse relaxation times $T_2$ and $T_2^*$, a shift in local resonance frequency and a broader water resonance line, which is reflected by a decrease in $S_0^*$, i.e., a reduced proton visibility [26]. Therefore, ΔR₁ and ΔS₀ both represent contrast agent presence.

6.3 Spatial heterogeneity
To explore the absolute differences between tumor rim, tumor core, and muscle, QCₐ₁ and QCₐ₀ were determined for each tissue type for cNGR-labeled and unlabeled pQDs (Fig. 6A and 6B). Administration of cNGR-pQDs resulted in an 50-fold increase in QCₐ₁ in the angiogenic rim compared with tumor core or muscle tissue. For unlabeled pQDs, significant differences were also found between tumor rim and core, and tumor rim and muscle tissue, although the net increase in QCₐ₁ was lower than for cNGR-pQDs [16-18]. The decreases in $S_0$ showed the same trend as the increases in $R_1$(Fig.6A and B).

![Fig. 6: Spatial distribution of angiogenic activity. A and B, Quantitative Contrast as derived from changes in $R_1$ (QCR1; A) and from changes in $S_0$ (QCS0; B) for tumor rim, tumor core, and hind limb muscle tissue. Data are shown for cNGR-pQDs (n = 7), unlabeled pQDs (n = 7), and the competition experiment of cNGR-pQDs with excess unconjugated cNGR (n = 4). C,](image)
percentage of enhanced voxels at a certain distance versus distance from the tumor rim for cNGR-labeled and unlabeled pQDs. Although enhanced voxels were mostly found at the tumor rim for both contrast agents, more than twice as many rim voxels were enhanced for cNGR-pQDs than for unlabeled pQDs. In the tumor core, similar values were found for both cNGR-labeled and unlabeled pQDs. This resulted in a statistically significant difference between cNGR-labeled and unlabeled pQDs for the tumor rim only (Fig. 6A and B). To further investigate the spatial distribution of angiogenic activity in the tumor, the percentage of significantly enhanced voxels was calculated as a function of the distance to the tumor rim (Fig. 6C). Although the highest signal increase was found at the tumor rim for both contrast agents, more than twice as many rim voxels were enhanced for cNGR-pQDs than for unlabeled pQDs [27]. In the tumor core, similar enhancements were found for both contrast agents. These findings qualitatively concur with previous findings showing that angiogenic activity is most pronounced at the tumor rim for this tumor model. Subsequently, half-value-depths were calculated for both cNGR-labeled and unlabeled pQDs. High values indicate a more homogeneous distribution of enhanced voxels over the entire tumor and thus a low spatial heterogeneity, whereas low values indicate a high spatial variation. For cNGR-labeled and unlabeled pQDs, the half-value-depths were 0.6 and 1.1 mm, respectively, indicating a stronger contrast between tumor rim and core for cNGR-pQDs, which suggests that cNGR-pQDs allow a better differentiation between tumor rim and core than unlabeled pQDs.

### 6.4 Competition experiment

I.v. injection of a 1,000-fold excess of unconjugated cNGR 10 min after administration of cNGR-pQDs resulted in a statistically significant decrease in QC$_{R1}$ and QC$_{S0}$ for the tumor rim (Fig. 6A and B). With TPLSM, cNGR-pQDs were barely detected in the tumor rim, which confirmed the MRI results (data not shown). These results therefore indicate that binding of cNGR-pQDs to tumor ECs is specific, reversible, and can be competed with unconjugated cNGR.

### 6.5 Biodistribution

Figure 6 shows the relative MRI signal intensities for the blood and major organs recorded 1 hour after the administration of cNGR-pQDs, unlabeled pQDs, or no contrast agent. No differences were found between cNGR-labeled and unlabeled pQDs. Both contrast agents accumulated mainly in the spleen, liver, and kidneys (Fig. 7), which was confirmed by TPLSM and corresponds to previous findings. Due to the i.e. administration, pQDs were also expected to accumulate in the lung. However, MRI has only limited signal sensitivity in the lung due to the inherently low signal intensity and air-tissue interfaces. With TPLSM, pQDs could be clearly detected in the lung (Fig. 7), although microscopic imaging was hampered by tissue movement caused by heating of the sample during excitation, resulting in expansion of air in the pulmonary alveoli.

![Fig. 7: Biodistribution of cNGR-labeled and unlabeled pQDs (n = 2 for each group). A, postmortem $T_1$-weighted MRI results. Signal intensities were normalized to hind limb muscle signal and subsequently averaged. No CA, no contrast agent](image-url)
administration \( (n = 2) \). Both cNGR-labeled and unlabeled pQDs were found to accumulate mainly in the spleen, liver, and kidneys. Columns, median; bars, SE. \( \beta \), representative TPLSM images of spleen, liver, lung, and kidney. Because a similar biodistribution was found for cNGR-labeled and unlabeled pQDs, no differentiation was made for the TPLSM results. Red, pQDs; green, αCD31-FITC; blue, autofluorescence; bar, 50 µm.

### 6.6 Contrast agent relaxivity.
The ionic \( T_1 \) relaxivity of cNGR-pQDs, i.e., per Gd ion, was \( 7.1 \pm 0.4 \ \text{mmol/L}^{-1} \text{s}^{-1} \) at 7 T and 20°C, which lies in the expected range for macromolecular contrast agents and is in correspondence with previously reported values for Annexin A5 conjugated pQDs.

### 7. CONCLUSION

#### 7.1 Regarding the potential clinical applicability, quantitative molecular MRI with a suitable contrast agent has a number of advantages over the currently used immunohistochemical methods to quantify tumor angiogenic activity. First, molecular MRI is noninvasive and does not interfere with tissue integrity. Second, it can probe the entire tumor, whereas immunohistochemistry requires biopsies at one or multiple selected locations. Third, it allows c/o visualization of angiogenic activity with local anatomy. Fourth, tumor status or therapeutic response may be objectively monitored over time due to the absolute quantification methodology. Finally, molecular MRI allows direct detection of activated endothelium in functional vasculature, whereas immunohistochemistry measures both perfused and nonperfused vessels.

#### 7.2 With respect to the applied tumor model, a human colorectal adenocarcinoma, MRI is clinically important for local T-staging of rectal cancer and for the identification of tumors close to or invading the mesorectal fascia. On diagnostic \( T_2 \)-weighted images, however, it remains difficult to differentiate between fibrotic tissue and viable tumor cells. Molecular MRI of angiogenesis may facilitate this demarcation because only viable tumor cells induce angiogenesis, which may be visualized upon administration of the targeted contrast agent.

#### 7.3 Besides the availability of suitable contrast agents, clinical implementation of quantitative molecular MRI requires rapid imaging techniques. Possible sequences that allow fast quantification of relaxation times are Look-Locker, IR-true-FISP, and the recently described QRAPTEST. However, these methods are relatively sensitive to subject movement and field inhomogeneities, although the Look-Locker method was recently modified to allow in vivo \( T_1 \)-mapping of the heart. Thus, the development of fast quantification of relaxation rates seems to support future clinical application of quantitative molecular MRI.

In summary, we have shown that cNGR-labeled paramagnetic quantum dots are suitable for the noninvasive visualization and quantification of tumor angiogenic activity using in vivo molecular MRI. These results provide a promising basis for further developments in contrast agent design and synthesis, data acquisition, and postprocessing techniques, which may be valuable for future clinical applications to pathologies in which abnormal vessel growth plays a pivotal role.

### REFERENCES


AUTOMATION METHODOLOGY FOR SUBSYSTEM IN COMPONENT BASED SOFTWARE SYSTEM

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ABSTRACT
Subsystem test automation refers to the activities and efforts that intend to automate engineering tasks and operations in a software test process using well-defined strategies and systematic solutions. Subsystem test automations are speed up a component testing process, and to reduce component testing cost and time during a component life cycle. Subsystem test automation (STA) methodology describes the different steps that implement on any software to evaluate the reusability of component in component based software system. Automation of component testing elaborates the effective utilization of component in component based software system (CBSS). Systematic performance testing ensure the component to processing speed, throughput, reliability, availability, scalability, and system resource usage. It free engineers from tedious and redundant manual testing operation. To increase the quality and effectiveness of a component test process by achieving predefined adequate test criteria in a limited schedule. In past years, many businesses and organizations spent much effort on automating component test processes.

Keywords: Automation, Component, Subsystem, Software System.

1. INTRODUCTION
In traditional unit testing and module testing, software engineers are responsible for performing black-box and white-box testing of software modules before integration testing of the software. During unit testing, software engineer create, update, modify and maintain diverse types of unit test information in different aspects. Since these software modules are not considered as final products, in many cases, engineers are used to managing and maintaining the unit test information. Since components in component-based software engineering become reusable products now, they will be changed and reused later by many component users in different aspects. It is mandatory for component developers as well as engineer and testers to manage and maintain component test information in a systematic way to reuse. The essential requirements of software test automation are summarized below based on recently published books [1, 2,4]

1.1 An enthusiastic effort for subsystem test automation (STA)
Subsystem test automation is not easily carried out unless there is a keen team or group who plays as a driving force of software test automation in an organization. This team is responsible for planning, designing, implementing, and deploying test automation solutions by working with developers and test engineers. This group has five major tasks. The first is to identify the essential needs and objectives of test automation. The next is to plan and design test automation solutions. The third is to select and develop necessary tools. The fourth is to introduce, deploy, and evaluate test automation solutions into a project, a production line, and an organization. The last task is to train engineers and maintains the developed tools. Without a dedicated work force, test automation efforts and activities may result in ad hoc ineffective solutions that are poorly reused and highly expensive to maintain.

1.2 The obligation from leading manager and engineers
The obligation of senior managers and engineers is essential for software test automation in a different way. In addition to the committed budget and schedule for software test automation, they must be committed the efforts into the following areas:

1.2.1 Understanding software test automation, including its issues, solutions, difficulties, and complexity;

1.2.2 Establishing a well-designed and practice-oriented test automation plan, strategy, and infrastructure for Projects, production lines, and organizations;

1.2.3 Developing and maintaining test automation solutions;

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1.3 The committed budget and project plan
Software test automation costs money, although it could shorten a software testing cycle, improve testing quality, and reduce manual testing efforts. A dedicated budget and a well-planned schedule are needed to consider test tool evaluation, development, deployment, and training. In addition, the maintenance cost for automated tests and tools must be included.

1.4 A distinct plan and stratagem:
It is not viable to achieve the objectives of software test automation without a good plan and a cost-effective strategy. A good plan usually is practical-oriented with reachable goals and incremental deliverables. An organization-oriented plan should include the following items:

1.4.1 The ranked test automation objectives and goals;
1.4.2 A well-defined test tool selection scheme and evaluation policy [2,5];
1.4.3 Well-defined quality control, standards test criteria, and test information formats;
1.4.4 A test automation plan for a software project (or a product line) should be developed as soon as the software requirement specification is available. An ideal plan should address the test automation focuses and needs, specify the required tools, and the implementation schedule. It is a systematic retest selection solution that identifies reusable component tests and the affected tests due to software changes. G. Rothermel et al. in [12] presents a good plan and comparison of various test selection techniques based on various program models. They are useful to define systematic test selection methods for software components. T. L. Graves et al. in [6] reported an empirical study of different test selection techniques. The last is the systematic test execution solution for component retests.

1.5 Talent engineers and cost-effective testing tools
The engineers of a test automation team need a solid knowledge background on software testing and test automation, tool development skills, and working experience on software testing and tool usage. All test tools should be evaluated before they are deployed. In [2], E. Dustin, J. Rashka, and J. Paul provided the details about how to select and evaluate test tools.

1.6 Preservation of automated software tests and tools
In most cases, we easily ignore the fact that all automated software tests and tools (or facilities) must be updated and maintained for the reuse for future product releases and other projects. Every now and then the maintenance cost of automated tests is not cheap. Whenever the maintenance cost is higher than the manual testing cost, these tests should be abandoned. On the road to software test automation, there are a number of common issues. To overcome this difficulty, M. J. Harrold et al. [7] proposed a testing technique based on analysis of component based systems from component-provider and component-user perspectives. They are summarized here.

1.6.1 Poor manually performed software test process
A common issue in software test automation is to automate a poor, manually performed software test process. In a poorly managed manual test process, there are no well-defined quality control procedures and test information standards. Engineers use ad hoc test design methods and test coverage criteria. Software development costs and schedules are constraints on quality in most software development processes, often requiring difficult trade-offs [11, 12]. Deciding between budget, schedule, and quality is a practical and difficult software-management task. Automate such a test process usually is costly, ineffective, and inefficient for the following reasons:

1.6.1.1 Engineers are not ready to involve test automation because of their lack of understanding of software test automation.
1.6.1.2 Tests from the current test process are not effective in discovering errors. Thus, automating these tests is not effective to uncover errors.

1.6.2 Behind schedule date of software test automation in a software product life cycle
This is another common mistake in the practice of software test automation. In many cases, people do not pay attention to test automation until they found that there is not enough time to conduct software testing manually when software design and implementation has been completed. Engaging software test automation activities in the later phases of a software development processes have two serious problems. First, it is too late for engineers to plan and implement a cost-effective test automation plan. For example, it is too late for engineers to build well-structured testable components and develop supporting facilities for component-based software testing after software implementation. Second, it is too late to think about project budgeting and scheduling for test automation.

1.7 Unfeasible goals and irrational expectations
Engineers and managers involved in test automation frequently set up unrealistic objectives and goals in test automation. This not only affects the proper evaluation of the effectiveness of test automation efforts, but also results in an unrealistic test
automation plan that is not easy to be implemented with a limited budget and schedule. In many cases, engineers may come out unrealistic goals that are very hard and costly to achieve. For example, achieving 100% automatic regression tests for functional validation is an unreachable goal. Senior managers may have unreasonable expectations to the effectiveness of software test automation.

1.8 Business issue
In many cases, a test automation project fails due to the business issue. A common problem is the lack of a dedicated workforce for test automation. This implies that personnel teams with very limited resources carry out their own test automation efforts and activities without an overall test automation strategy and infrastructure for a project or a product line. These activities focus on a specific part of a project, such as a subsystem, without concerning the future use and sharing of the results of test automation efforts across projects and teams. Hence, the automated tests and developed tools may be poorly maintained, reused, and integrated due to the lack of good collaboration and coordination among different teams.

1.9 Be deficient in a good understanding of subsystem test automation
One of the worst situations in which to begin software test automation is one that lacks good engineers and managers. This could result in a poor test automation plan, ineffective test automation solutions, and low-quality test tools because engineers do not understand software test automation issues, problems, and methods. Our suggestion is to find experienced engineers and managers or train them before starting software test automation.

2. TEST AUTOMATION METHODOLOGY
To achieve software test automation, a cost-effective process is needed to support engineers to carry on various test automation activities and develop required test automation solutions. As shown in Figure 1, a test automation process must consist of the following steps:

![Test Automation Methodology (TAM)](image)

**Step #1 Subsystem planning for test automation case**
This is the initial step in subsystem test automation (STA). The major task here is to develop a plan that specifies the identified test automation focuses, objectives, strategies, requirements, schedule, and budget. In the real world, a test automation plan is usually developed for a specific project or a product line at the earlier phase of a software development process.

**Step #2 Test automation strategies design & its solution**
The primary objective of this step is to draw out the detailed test automation solutions to achieve the major objectives and meet the given requirements in a test automation plan. There are two basic tasks. The first is to identify and select the available tools (such as commercial and in-house tools) to support the automation of a test process. To conduct this task,
engineers need detailed guidelines and evaluation criteria for selecting test tools. E. Dustin et al. in [2] discussed a set of selection guidelines and criteria. The other task is to design the required automated solutions.

**Step#3 Implement test automation solution**
This step is not mandatory in Test Automation Methodology (TAM). It is actually find out the available testing tools for evaluation of component in component based software System (CBSS).

**Step #4 Deployment in different case test automation solutions**
At this step, the designed test automation solutions are developed and tested as quality tools and facilities. The key in this step is to make sure that the developed tools are reliable and reusable with good documentation. Many test automation projects failed due to its low quality and poor documentation.

**Step #5 Select & evaluate available software testing tools**
Similar to commercial tools, the developed test tools and facilities must be introduced and deployed into a project or onto a product line. At this step, basic user training is essential, and proper user support is necessary. This refers to a systematic facility that assists engineers in selecting reusable tests for regression testing based on software change information. A requirement-based program test selection method is discussed to select reusable black-box program tests in [8].

**Step #6 Review and evaluate subsystem test automation**
Whenever a new tool is deployed, a review should be conducted to identify its issues and limitations, and evaluate its provided features. The review results will provide valuable feedback to the test automation group for further improvements and enhancements.

### 3. CHALLENGES IN SUBSYSTEM FOR TEST AUTOMATION

Fortunately, many existing tools are available for engineers to manage component test information. However, there are a number of issues and challenges.

**3.1** Computerizing all types of component testing information for a component test process is an essential key to the success of component test automation. Achieving this goal requires the support and commitments from engineers and managers.

**3.2** Having enterprise-oriented standards and formats for diversified component test information is the necessary foundation in component test automation. This is not only important to vendor-oriented component testing, but also critical to user-oriented component validation, integration, and system testing.

**3.3** Because test suite management systems are strongly dependent on component technology, it is not easy for component users to deal with components comprised of different technologies.

<table>
<thead>
<tr>
<th>Areas of Test Automation for subsystem development in component based software system</th>
<th>Challenges questions relating to Test Automation for subsystem development process (STA)</th>
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</thead>
<tbody>
<tr>
<td>Test information management for subsystem (TIMS)</td>
<td>How does one keep and manage component-oriented test information in a systematic way to support subsystem evolution? It supports engineers to create, update, and manage all types of test information, such as testing requirements, test cases, data, procedures, and results. A Web-based test management system is reported in [5].</td>
</tr>
<tr>
<td>Test generation cases of software (TGCS)</td>
<td>How does one generate tests systematically for customized software components? How does one generate cost-effective black-box tests for software subsystem?</td>
</tr>
<tr>
<td>Subsystem test coverage analysis (STCA)</td>
<td>How does one monitor and analyze component test coverage in a systematic way? What are the adequate test coverage criteria for components and customized subsystems?</td>
</tr>
<tr>
<td>Subsystem performance measurement (SPM)</td>
<td>How does one track and measure subsystem performance in a systematic manner?</td>
</tr>
<tr>
<td>Different subsystem retesting (DSR)</td>
<td>How does one identify component element changes and their impacts on subsystem tests in a systematic manner?</td>
</tr>
</tbody>
</table>
4. SYNCHRONIZED IMPROVEMENT TESTING FOR COMPONENTS

In the component-based software system (CBSS), both component vendors and users must carry on component retesting from one release to another. Component performance testing and measurement is very important for component vendors and users. The scope of component performance validation includes the measurement of the processing speed, throughput, reliability, availability, scalability, and system resource usage. In the real world, engineers must spend a lot of time to prepare performance tests, collect performance measures, and analyze performance test results. To support these activities, systematic solutions are needed in these areas. They can be used to measure system loads, resource utilization, and functional process speed in a black-box view. Many of them do not provide functional features to allow engineers to measure software reliability, availability, and scalability [9,10]. There are a number of issues and challenges in automating performance validation and evaluation for components. Systematic performance testing for component can be represented as queue flow graph (QFG). Here we list major challenges:

4.1 Current components (including COTS components) are developed without consideration of how to facilitate component performance validation and measurement. This not only increases the difficulty and complexity in component performance validation and measurement, but also results in a much higher cost.

4.2 There is a lack of cost-effective performance testing tools and evaluation solutions that enable component users to validate and measure component performance in a plug-in-and-measure approach.

4.3 There is a lack of cost-effective performance testing tools and evaluation solutions that enable component users to validate and measure component performance in a plug-in-and-measure approach.

This queue flow graph (QFG) [3] actually show the flow of component through different queue. It Building measurable components that facilitate component performance validation and measurement. It is Well-defined component performance models and measurement metrics, which can be used to implement component performance evaluation solutions. Based on call graphs, to test newly integrated components, data flow--based [7] and coupling-based [7] approaches can be adopted. Systematic component performance validation and evaluation environments and tools that enable engineers and users to measure component performance in a simple plug-in-and-measure approach.

CONCLUSION

In this paper we first make another study of the basic concept of software test automation in terms of objectives, common issue challenges, and routine steps. According to our observation, a software test process can be evaluated to check its current maturity level in test automation. In addition, we classify and summarize the existing test tools and list different examples. This paper discussed the different area as Test information management for subsystem (TIMS), Test generation cases of
software (TGCS), subsystem test coverage analysis (STCA), Subsystem performance measurement (SPM), and Different subsystems retesting (DSR). In our view, test automation of subsystem is not only useful for component vendors, but also necessary for component users to support subsystem validation and selection.

REFERENCES


THE ECONOMIC MELTDOWN: AN ECONOMIC ANALYSIS FOR INDIA

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ABSTRACT
The Indian economy has withstood the adverse global economic situation and posted a growth rate of 6.7 per cent in 2008-09 and is expected to record a higher growth in the year 2009-10. However, the economy continues to facing wide-ranging challenges from improving its social and physical infrastructure to enhancing the productivity in economic environmental concerns. Meeting these challenges will be critical for improving India’s social and human development indicators and the quality of life. The financial crisis has not only affected United States of America, but also European Union, U.K and Asia. The Indian Economy too has felt the impact of the crisis to some extent. Though it is difficult to quantify the impact of the crisis on India but it is felt that certain sectors of the Indian economy would be affected by the spill over effects of the financial crisis. The study attempts to research the continuing effect of economic meltdown on Indian economy regarding the different sectors.

Keywords: Recession, depression, GDP, downsizing, inflation, FDI, BPO, MDA, CRR

1. INTRODUCTION

1.1 Global economic meltdown has affected almost all countries. Strongest of American, European and Japanese companies are facing severe crisis of liquidity and credit. India is not insulated, either. However, India’s cautious approach towards reforms has saved it from possibly disastrous implications. The truth is that Indian economy is also facing a kind of slowdown. The prime reason being, world trade does not functions in isolation. All the economies are interlinked to each other and any major fluctuation in trade balance and economic conditions causes numerous problems for all other economies.

1.2 According to official data, industrial growth in August has plummeted to mere 1.3% compared to the same month in 2007. That definitely is cause of concern for policy makers and industries. This data also raised fear of low GDP growth of India. It is being suspected that, our country will face the vast problems in achieving even 7.5% growth rate in this fiscal. 1.3 percent industrial growth is the lowest IIP (index of industrial production) data ever registered since last ten years. April-August industrial growth rate is 4.9% which is also the lowest for the first five months of a financial year in 14-year period except 1998 and 2001[3].

1.3 Some crucial sectors of Indian economy have faced serious problems. Foremost among them is real estate sector. The demand for houses have reduced significantly and property prices across India has registered 15-20% fall. Things are likely to get worst as another 20 percent drop in prices is quite possible in coming six months. The woes of real estate have spread to construction industry as well. Because of less demand for houses, construction companies are going to suffer big time [4]. Financial services sector is also likely to be a major victim of economic slowdown because of less demand for credit and reduced liquidity in market.

1.4 These three sector account for almost one third of services GDP and because of their current and impending plight, attaining 7.5% GDP growth in this current year is quite improbable. Industrial slowdown will also affect transport services. Transport companies are likely to witness drastic fall in their business and profits. Global recession will also cause to less tourists coming to India. That will negatively affect tours and travels industry.

1.5 The IT sector will be the worst hit as 75 per cent of its revenues come from the US. Low demand for services may force most Indian Fortune 500 companies to slash their IT budgets. During a full recession, US companies in health care, financial services and all consumers demand driven firms are likely to cut down on their spending. Among other sectors, manufacturing and financial institutions are moderately vulnerable [6].

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2. WHAT IS A RECESSION?

A drastic slowing of the economy when the gross national or domestic product has fallen in two consecutive quarters. A recession would be indicated by a slowing of a nation's production, rising unemployment and falling interest rates, usually following a decline in the demand for money [2]. A popular distinction between recession and depression is that 'Recession is when your neighbours lose his job; depression is when you lose yours.

2.1 What causes it?

A recession normally takes place when consumers lose confidence in the growth of the economy and spend less. This leads to a decreased demand for goods and services, which in turn leads to a decrease in production, lay-offs and a sharp rise in unemployment [2].

Investors spend less as they fear stocks values will fall and thus stock markets fall on negative sentiment. The Impacts in India are:

- Reduced liquidity in the Indian economy
- Reduced industrial output
- Reduced job opportunities
- Stock Market is lingering in the bottom
- Real estate market has started to take a beating
- Inflation has increased
- GDP has come down and the GDP forecast for the next two quarters are only average.
- Change in consumer behaviours and purchasing power.

3. BUSINESS CYCLES: BASIC SYSTEMS

3.1 Based on 'Solar Functional Energy' Cycle Model

The Basic principle of physics tells us about the gravitational force applicable on an object thrown up. The gravity of earth reduces the acceleration on the thrown object and reverses it to decelerate after the zero acceleration point and makes the object fall on the ground. In business cycles in economics the similar situation of up trends and downtrends in the economic activities exists. Economy does not have uniform and unidirectional trends. After movements upward economic activities come downwards, may move on a level for sometime but never for long. As gravity of earth pulls down the upward going object to fall on ground some unknown force pulls economic activities down [1].

According to Dharmakirti Joshi, director and principal economist of CRISIL, along and severe recession will seriously affect the portfolio and fixed investment flows. Corporate will also suffer from volatility in foreign exchange rates. The export sector will have to devise new strategies to enhance productivity [8].

3.2 Counter Business strategies

Karthik Ananth, senior consultant, business development, Zinnov, says that there is already a shift in business strategies of corporate India. Large IT and BPO firms have started looking at other markets places like Europe, and even the domestic market, to spread their risks and reduce the impact of the rising rupee. This can be best seen with Infosys setting up an India centric team [26].

K. Ramachandran, head, advisory desk, BNP Paribas Private Banking, says Indian companies will have to adopt a multi-pronged strategy, which includes diversification of the export markets, improving internal efficiencies to maintain cost competitiveness in a tight export market situation and moving the product portfolio up in the value chain to impart resilience [26].

The IT sector is also keen to defend its position. R.S. Rethinasamy, vice-president, Finance Aditi Technologies, says that in case of a full-blown US recession, the onsite staffing business will see a decline in sales and profit. "At the same time, it can increase the offshore work. Recessions at this juncture may not last for more than two to three years. Smart companies will continue to make investments so that they can be ahead of the competition when the US economy comes out of recession", [25] he says.

This means corporate India will have to spend a lot more to develop market and supply chain links in alternate markets like Asia and Europe. Experts say the export dependent sectors of the economy need to re-focus on local demand and income from non-dollar economies. BPOs, for example, will have to re-negotiate with their clients and fix appropriate price for their services.

4. CONSEQUENCES OF US RECESSION ON INDIA JOB MARKET

4.1 In the age of globalization, no country can remains isolated from the fluctuations of world economy. Heavy losses suffered by major International Banks is going to affect all countries of the world as these financial institutions have their
investment interest in almost all countries. Under service industries come BPO, KPO, IT, ITes etc. Service industry contributes about 52% to India's GDP growth. Now if this is going to get hurt then it will also hurt India's overall growth but very slightly. India is not going to face a major impact due to US recession. People may say that there is going to be a huge job loss due to recession and will cite the example of TCS firing about 500 employees but these were employees who didn’t perform and for cost cutting one have to reduce Non performing asset and that exactly what has been done. There is no threat to the skilled people. According to NASSCOM India will have a shortage of about 5 million skilled people in IT/ITeS. So there are lots of opportunities [10].

4.2 Apart from this India's travel, tourism and power industry is going to grow at a better rate. This is again a good sign. India has a huge population and a huge consumer base so we don’t have to ‘always depend on US for our growth. India's GDP is expected to grow again above the growth rate of US and only second highest in the world after China.

5. IMPACT OF GLOBAL RECESSION: CHALLENGES & OPPORTUNITIES GALORE

5.1 This is the fact that Indian economy 'faces slowdown not recession' India is a different economy and known as one of the most promising economies in terms of growth and investment. India, with $1.1 trillion or the second largest GDP among the world’s developing economies is going on the right path of sustained progress and development. While most Western economies are heading toward recession, the Indian GDP growth is likely to witness a slowdown from 9 percent last year to 6.5 to 7.5 percent by the year-end. The Indian economy is immune to the global mortgage crisis, failures of banks in the West and liquidity crisis [20]. "Indian economy is based on robust fundamentals and enjoys the status of one of the most dynamic and growing economies in the world with over 9 percent GDP last year." India itself is a biggest consumer market with 300 million of middle class and the lowest debt ratio of 22 percent of the GNP. The country enjoys the highest savings rate of 28 percent of the GDP [9]. "Recessions are the result of reduction in the demand of products in the global market. Recession can also be associated with falling prices known as deflation due to lack of demand of products [2]. Again, it could be the result of inflation or a combination of increasing prices and stagnant economic growth in the west.

5.2 Recession in the West, especially the United States, is a very bad news for our country. Our companies in India have most outsourcing deals from the US. Even our exports to US have increased over the years. There is a decline in the employment market due to the recession in the West. There has been a significant drop in the new hiring which is a cause of great concern for us. Some companies have laid-off their employees and there have been cut in promotions, compensation and perks of the employees. Companies in the private sector and government sector are hesitant to take up new projects. And they are working on existing projects only. Projections indicate that up to one crore persons could lose their jobs in the correct fiscal ending March. The one crore figure has been compiled by Federation of Indian Export Organisations (FIEO), which says that it has carried out an intensive survey.

The textile, garment and handicraft industry are worse affected. Together, they are going to lose four million jobs by April 2009, according to the FIEO survey. There has also been a decline in the tourist inflow lately. The real estate has also a problem of tight liquidity situations, where the developers are finding it hard to raise finances [11]. Recession has taken its wings on the Indian economy that has led to multi-crore loss in business and export orders, tens of thousands of job losses, especially in key sectors like the IT, automobiles, industry and export-oriented firms. It has also shaken up the investment regime, which is being restructured, with the telecom sector likely to be declared off-limits for foreign investors.

5.3 This sector has been adversely affected by the global crisis—a fact acknowledged by Bangalore-based Infosys Technologies Co-Chairman, Nandan M. Nilekani. He believes that even though the tech sector would see the impact of the economic slowdown in terms of growth rate, the IT industry will continue to grow and recruit manpower [8]. Interestingly, his observation finds support from the Manpower Employment Outlook Survey which ranks India second after Peru in terms of the recruitment programme. The survey, which covered 33 countries, reveals that although the global slowdown will certainly impact the hiring plans of employers in India, it has the second strongest hiring capacity globally. This outlook represents a sharp decrease of 24 percentage points quarter-over-quarter and 27 percentage point year-over-year. Of the 33 countries covered by the survey, employers in Peru have been found to be the most upbeat with Net Employment Outlook of 24 per cent. Peru is followed by India, Costa Rica, Canada, Romania, Colombia, South Africa, Australia, Poland, the United States and China [12]. The lowest hiring activity is expected in Singapore and Taiwan.

5.4 But for now heads continue to roll in the IT sector. Tata Consultancy Services (TCS) had asked about 500 employees to leave due to non-performance. Patni Computer Systems (PCS) has already laid off around 400 employees, or nearly 3% of its 14,800 workforce, on the same ground, while IBM Corp. followed suit in the case of 700 fresher. Wipro, the country’s third largest IT exporter, is considering firing 3,000 employees over performance-related issues. However, this is yet to be confirmed by the company [18]. Nasscom has said that the proposed legislation by the US House of Representatives to restrict the use of L1 visas by Indian companies will affect the Indian IT industry in the long term, as about 10 per cent of Indian software professionals in the US avail themselves of L1 visas.
5.5 Away from IT firms, the IT-Enabled Services sector may also face the crunch, since a majority of Indian IT firms derive 75% or more of their revenues from the US. Thus, if the Fortune 500 companies slash their IT budgets, Indian firms could feel the heat. The sector should review its priority and focus on product innovation (as opposed to merely providing services). If this is done, India can emerge as a major player in the IT products category as well. As a result of putting all their eggs in one basket, developers, consultants, trainers, team leaders have all become victims of the recession facing the IT/ITes sector. Fresh entrants—the bloggers—are in for trouble as well. With corporate budgets getting trimmed, professional bloggers may be the next to come under the hatchet. However, business process outsourcing firms believe they will be less impacted by the global crisis than their IT counterparts, since they are involved in facilitating day-to-day operations. Avinash Vashistha, MD of technology consultancy firm, Tholona, says the slowdown impact on BPOs will be limited. “BPOs are about core transactions and day-to-day functioning and clients will find it tough to delay these projects or make cuts in them,” adding that applications support and maintenance and project implementation services of IT may be slashed by over 30 percent [4].

5.6 Industry-wide indications after September are also uniformly gloomy. There are reports of significant declines in output of automobiles, commercial vehicles, steel, textiles, petrochemicals, construction, real estate, finance, retail activity and many other sectors. Exports fell by 12 percent in dollar terms in October, while core industries slowed to 3.4% during the same month from 4.6% a year ago. Giving his assessment, Jasjit Sawhney, CEO, net4 India Ltd., told the SME Times: “The major impact of recession or economic slowdown is with the small exporters and importers in the country as most of them are facing the problem of heavy duties.” Continuing further, he observed: “The US slowdown will immensely hit the mid-sized IT companies and also the big players to some extent. On the higher end, you have scenarios where people are cutting back on contracts. They are reducing the fees per manpower in their contracts.”

5.7 A survey of 125 companies by the commerce department in New Delhi has revealed that Indian companies lost export orders worth Rs.1,792 crores during August-October 2008 and were forced to lay off 65,000 workers [14]. The manufacturing sector, especially the auto industry, has also sustained a severe hit. As a result, the global credit rating agency, Standard & Poor’s (S&P) has downgraded Tata Motors rating for the foreign market. The company witnessed a 30% drop in sales in India compared to last year. The manufacturing sector had been calling for action in this regard to cushion the recessionary impact. In the meantime, it has impacted the entire spectrum of the automobile industry. Dunlop India Ltd, for instance, asked all 1,171 permanent employees at its Sahagunj unit and 917 staffers at Ambattur (in West Bengal) “not to report for work” for an indefinite period [15].

What’s strange about this management move is that it is an ‘informal directive’ with neither suspension of work (mandating a notice period) nor a lay-off that obliges the management to pay the basic salary and a portion of the dearness allowance. The Dunlop management, meanwhile, will pay each employee a monthly allowance to support their families.

5.8 As the company’s senior executive Pawan Kumar Ruia put it: “The tyre market is facing a slump due to the global meltdown, forcing us to take the decision. The Tatas have left Singur. We do not want to ruin our chances by operating the factory now. We could have announced a shutdown. But we didn’t take that route. Instead, we are working on a revival package and have asked the workers to stay away for the time being.” The textile giant, VF-Arvind, has started releasing employees, especially from the imported brands section, as there are few takers. Around 80 employees have been pink-slipped under its downsizing programme. An offshoot of this impact is being felt on warehouses, which are being vacated due to inventory control. Along with warehouses, other sectors of the real estate market have also tumbled, with property prices dropping by 10-15% in addition to various incentives that are being offered. For NRIs, this is the prime time to invest in the real estate market, which is bound to rally once it gets over the hump. On the educational front, bank officials point out that there is no impact yet on the grant of loans for higher education. Students of IIM, IIT, medicine, engineering and other professional courses continue to receive educational loans repayable after the student has completed his/her course. In line with this policy, the Singapore government issued a temporary travel ban on schoolchildren coming to Bangalore for a leadership conclave. The Malaysian government has also cautioned its citizens against travelling to India for the time being. However, new educational projects could be on hold for a while, since the banks’ lending rates continue to be high despite the stimulus package. The tourism sector has been affected, too. Hotels have already reported 20-25% cancellation from international tourists who were booked to visit over the next one year. Airlines, including low cost carriers (LCCs), may lower their fares by 10-12% to extend the benefit of lower fuel prices to the customers and rein in the sagging demand [14].

5.9 With hotel occupancy levels and room rates dipping by 20% and 50% respectively in just two weeks, the sector is clamoring for a substantial cut in luxury tax slabs. The industry also wants that the luxury tax on rooms be charged on the actual rates rather than on the printed rack rates. According to market sources, guests are paying 20-25% higher room rates because of this tax structure. The reduced purchasing power of Indian consumers in the current situation has revved up competition among shopping malls. They now have to step up their ad spend along with discounts to lure consumers who have restricted their shopping list to essentials, such as food and other consumables.
After all, the purchasing power of 350 million Indians cannot be glossed over. Together with the package of incentives offered by the government to kick-start the economy, good management practices and self-imposed check on profiteering, the retail sector can hold its own [20]. However, for the time being, the growth of this sector will be stunted as overseas investors will be on guard for two reasons. The financial meltdown has burnt a hole in millions of Indian pockets. With their shopping budget on a tight leash, one should not expect overseas malls to make forays into the Indian market anytime soon. The second important factor is that overseas retailers, especially from the US and other western countries, would not like to take the plunge given the fact that the terrorist attacks in Mumbai on selected targets were politically motivated [19].

5.10 All these factors will have to be weighed in by an overseas investor till the economic and security situation improves. Prior to the terrorist attacks, India was in a comfortable position with Foreign Direct Investment flows shooting up by a whopping 124% during the first five months of 2008-09 to $14.6 billion. Despite the global financial turmoil, it is set to surpass the FDI target of $35 billion during 2008-09. “The country will achieve about $35-40 billion in the current fiscal. The first quarter has crossed $10 billion. Last year, it was $24 billion for the entire fiscal year,” a senior official in Department of Industrial Policy and Promotion (DIPP) said. The sectors that attracted maximum FDI inflows in 2007-08 were services, telecom, housing, construction activities, real estate, electrical equipment, computer software and hardware. The year before, India ranked fourth after China, Hong Kong and Singapore as a major investment destination in Asia. This amount is to be spent on revitalizing stake holders such as exporters, housing, infrastructure and textiles. A four-percent cut in Value Added Tax has also been announced to help the corporate sector in general. This apart, additional allocation has been made towards various incentives for exporters, guarantee of export credit, full refund of service tax to foreign agents and refund of service tax under the duty drawback scheme. Relief for exporters includes a 2% interest subvention up to March 2009 for pre- and post-shipment export credit for all exports. Additionally, a Rs.350-crore booster for schemes like Market Development Assistance (MDA) and Market Assessing Scheme has been granted to help exporters develop new markets. This will be applicable to all exporters. As a result of these measures, the Centre’s direct tax collection in November was Rs.10,347 crore against Rs.16,189 crore in the same month last year, a fall of 36% [16]. Given the market turbulence that will grip the world economy in 2009, there is no prospect of a quick turnaround in India. Broadly, the 4% relief on ex-factory cost is likely to result in ex-showroom price reduction in the range of Rs.8,000 to Rs.45,000 for different passenger vehicles (cars and SUVs). Similarly, prices of cars, two-wheelers and commercial vehicles are set to come down by around 3.5 percent due to duty cut announced by the government. Almost all the major manufacturers, including Maruti, Hyundai, M&M, Tata Motors, Ford, Skoda and TVS said they would be passing on the benefits of the reduced duty to customers immediately.

5.11 The techno-savvy group will also benefit as the IT hardware industry has decided to pass on the 4% across-the-board excise duty cut to consumers which will help bring down the prices of IT products like TFT monitors, printers and projectors as well as computers and notebooks. With this, desktops and notebooks will attract 8% excise duty, while all other hardware equipment would attract 10%, according to MAIT executive director Vinnie Mehta. In the construction sector, ACC Ltd., the country’s biggest cement manufacturer, slashed prices by up to Rs.5 on account of reduction in cement prices by 4%. The demand for appliances, consumer electronics, apparel, and other products is still huge and can be tapped by adopting appropriate pricing strategies. This should be possible thanks to the 4% cut in excise duty and subsidy on export credit. Other measures in the offing include easy access to the credit market for exporters, textile manufacturers and farmers collectively to the tune of Rs.9,000 crore. Of the total outlay, a Rs.4,000 crore line of credit will be extended to the National Housing Bank (NHB) and a similar allocation for the Exim Bank. The remainder of the rescue package will be utilized for the relief of farmers and infrastructural projects. Besides these measures, a public-private partnership (PPP) could be launched to tap the investment potential in various sectors. Health tourism is one of them.

5.12 As for overseas investment, the remittance channels are beginning to diversify. Apart from FDI, third countries like Mauritius and Cyprus are serving as conduits for channeling foreign investment into India. Mauritius thus emerged as the top investing country in India during 2007-08, with inflows from there more than doubling to $1.6 billion from $578 million in 2006-07. The total FDI inflows into the country in April-June period amounted to $10.073 billion, nearly $1 billion more than the total in 2005-06 [16]. Another major player was Cyprus, which became the eighth-largest FDI contributor to the Indian economy, up from the 14th slot in the list of top source countries a year ago. It has benefited from the European tax regime by becoming the favoured destination for facilitating FDI into India. According to the Executive Summary of Angel Broking’s “India Education Sector Report 2008”, “India’s GDP has grown at a compounded rate (CAGR) of around 8.5% over FY 2003-08, growing at over 8% in four of the five fiscals. GDP growth in FY 2007 accelerated and came in at an impressive 9.6%. Even for FY 2008, India logged in GDP growth of 9%, commendable by any standards. This makes it a hat-trick for India’s GDP, which has now recorded in excess of 9% GDP growth in each of the last three fiscals.[26]” Yet, the report expresses dismay over India’s literacy rate of just 61%, ranking the country “a disappointing 172nd. In fact, there is a huge requirement of talent in the field of hospitality; IT services, retail, financial services and aviation, to name a few. We believe India will have to significantly gear up its educational infrastructure to meet this demand.”

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In this context, an Indian Institute of Technology survey points out that every IIT alumnus has created 100 jobs and that every rupee spent on an IIT-ian has “created an economic impact of at the global level, half of which is India’s share.” The study is a global Internet-based survey that attempts to gauge the impact of IIT-ians on the global economy across areas like entrepreneurship, scientific and technological achievement, social transformation, and research, educational and business leadership [18]. But challenges still remain. One of these is the massive scale of corruption that has diverted crores of tax payer’s money into the pockets of corrupt politicians and officials. This has strained the economy, tarnished India’s image abroad, and sapped the investor’s confidence.

5.13 Another problem is the sluggish bureaucracy that taxes an investor’s patience to the hilt. There is no active single window clearance mechanism in place where business decisions could be expedited. Therefore many potential investors have been moving away to greener pastures in the country or outside. Bangalore, which once served as a magnet for investors due to its operational efficiency, among other factors, has nose-dived on several counts, including poor infrastructure, traffic bottlenecks, culture of corruption and casteism. It is losing out to Andhra Pradesh and Tamil Nadu as the country’s IT hub [19]. If these challenges represent one side of the coin, there are opportunities galore on the other. The stimulus package that the Centre is offering to the state governments presents an exciting opportunity to the private sector to resume exports to the Gulf States as Indian exporters are being offered credit facilities. Right now, the growth areas are real estate, renewable sources of energy, especially solar, and seasonal market like pilgrimage, when nearly 2.5 million pilgrims become consumers of electronic, household and food items that are available at cheap prices.

The immense market potential of the Haj season should not be underestimated, since the impact of recession will be felt at least over the next two years or more. On the export front, Indian businessmen might be interested to note that Alshoula Holding and Bayt Al-Mal Investment, two major Saudi investment companies, signed in October this year an agreement with Awan Real Estate Investment & Development Company to execute an ambitious $ 2 billion real estate project in Riyadh for setting up a shopping complex in the Saudi capital [13].

5.14 Similarly, in the non-oil energy sector, new windows of opportunity are opening in the Sun Belt countries like Saudi Arabia which are among the sunniest of the lot, with temperatures shooting up to 50 degrees C during summer. Surana Ventures Ltd of Hyderabad, the city’s new kid on the block in the field of solar energy, should stay tuned to new developments on the anvil. The company has begun production of solar modules in the 3 watt to 220 watt range with an installed capacity of 20 MW per annum. Set up in Hyderabad in February this year with an investment capital of around Rs.300 crores, the company is a joint venture between Surana Telecom & Power Ltd and Bhagyangar India Ltd. The export-oriented facility is coming up in a SEZ-designated area and will enjoy fiscal benefits. Around 10 acres of land will be utilized initially with the remaining area allocated for future expansion. Its joint venture partner, Eco Progetti from Italy, will supply a 19-mw solar photovoltaic cell production line, while a 38-mw module facility will be sourced from P. Energy SRL. As for dealers in food and consumer items, Haj is the right time to export their goods to the Kingdom. This is an exciting time of challenges and opportunities. Only those with a strong will, sound technological base and innovative solutions can ride out the crisis [20].

6. RECESSION AND INDIA’S PRESENT ECONOMY

6.1 The Reserve Bank has painted a grim picture of the Indian economy in the coming months. A day after scaling down the economic growth to 7.5-8.0 percent in the credit policy, RBI Governor Duvvuri Subbarao says that if the global recession continues, growth will fall further in next financial year. However, he says India is not in a recessionary mode, and the steps taken by RBI to boost liquidity are adequate. Subbarao also says weak rupee is contributing to inflation. He says the RBI and the government will take more measures to ensure financial stability. CRR is the minimum balance a commercial bank must maintain against deposits. "In this policy financial stability has been the main priority. RBI has taken aggressive measures already. So now they would wait and watch depending on the market volatility [21]."

6.2 A lot of activity has to take place in the states, particularly in terms of ensuring that there is greater lending by the banks in terms of ensuring that there is more spending. So these things will actually have to be energized by the states and really we hope that combined activity by the center and the states will deliver very strong results," he said. The Indian economy is expected to grow in next financial year. The global downturn has pushed economic growth in India down to a six-year low of 7.1 percent estimated for the year to March, from over nine percent in the previous three years [20].

6.3 An interim budget presented by de facto Finance Minister Pranab Mukharjee projected higher spending in the next fiscal year to shield the economy from a global slump and stem job losses. Cement and steel are seen as key drivers with the construction sector seen to have a significant impact on the growth sentiment. Similarly, the gloom over the automobile sector seems to be lifting, with the January 2009 figures in the passenger vehicles sector showing a 32 percent rise over December 2008 while the increase for commercial vehicles is 23 percent over a similar time frame. The FMCG sector is also growing again [9]. The Government feels its efforts to pump money into the rural economy and the public sector is paying off
even though the export sector remains a worry due to a fall in orders. Special emphasis was laid on increasing the pace of implementation of major projects and schemes.

7. CONCLUSION

7.1 Unlike the rest of Asia, India is a strong domestic demand story, so any slowing in the US is likely to have a more muted impact on India. Strong growth in domestic consumption and significant spending on infrastructure are the two pillars of India’s growth story. No sector has a dominant influence on earnings growth and risks to our estimate are limited. Corporate India is also learning to master the art of efficient capital management, reduction in costs and delivery of value-added services to sustain profit margins. Further, interest rates are expected to be stable primarily due to control over inflation and proactive measures undertaken by the RBI.

7.2 With India entering the growth cyclical phase Indian industries have grown fast and high to attain world scale. Many industries are becoming multinationals ready to spread far and wide. This the typical sign of a growing economy in the economic cycle phase. The advanced economy enters into declining phase and may not be able to maintain its status quo and may give in to the nascent economies, which have entered in to the growth phase. Several industries in India such as Telecommunication, automobile, oil and Gas are growing gigantic to create opportunities for domestic BPO that may gradually compensate the loss the outsourcing industries are suffering.

7.3 Almost everybody today seems to be discussing about the US Recessionary trend and its impact on emerging countries, more particularly India Economists, Industrialists and the common man on the streets seem to have been horrified by the very thought of recession in India and that too due to US. Decreasing industrial production, inflation, decreasing job opportunities, cost cutting, reducing purchasing power parity, et al are the aspects discussed among them through every possible mode like articles, talks & walks and places like washrooms, canteens, etc. But to me the reality is very different! Yes...... India will not be impacted largely by the US recession, simply because India is not which it was in the '80s-'90s. Although it will be immature on my part to say that India will not be impacted by the US recession at all, but the truth is that it will not get impacted adversely in the magnitude of what everyone feels. Since the United States dominates the global economy, any slowdown there would have an impact on most of the global economic variables. For India, it could mean a further appreciation in the rupee vis-a-vis the US dollar and a darkening of business outlook for sectors dependent on US companies. The overall impact of a US slowdown on India would, however, be minimal as the factors driving growth here are more local in nature.

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A Financial Look on Selected Software Companies in India

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ABSTRACT
The Indian Software Industry is the uncrowned king in the outsourcing of software services now. Despite the current recession, which was always in the offing, once the boom got going, most software companies are facing the crisis head-on. They have shifted emphasis to off-shore projects since the on-site software development has virtually come to a standstill. They have started to scout for newer markets, improve on the per capita efficiency, concentrate on future technologies, and revamp their organizational and marketing structure. From very humble beginnings, the Indian IT Industry has grown at an exponential rate over the past 10 years doing Rs.10000 crore of export, fetching for India valuable foreign exchange, propping up the Indian Stock Market with its share prices reaching dizzying heights before the scam, and employing over 2 lakh professionals with this number poised to rise to around 20 lakh in another 3 years. With the recession, most companies have drastically revised their organizational and marketing strategies. The objective of the paper is to evaluate profit position and liquidity position of selected software companies. The findings of the paper that EPS of HCL, Infosys, Mastek, OFSS showed an increasing trend and InfoTech, NIIT, TCS, Wipro showed decreasing trend. On an average Infosys has generated EPS of 78.91, highest among all. Infosys is the most efficient company in the terms of generating earning per share.

Keywords: uncrowned, outsourcing, recession, exchange, capita efficiency

1. SURVEY OF LITERATURE

1.1 A Financial Look on Selected Software Companies in India
The Indian Software Industry is the uncrowned king in the outsourcing of software services now. Despite the current recession, which was always in the offing, once the boom got going, most software companies are facing the crisis head-on. They have shifted emphasis to off-shore projects since the on-site software development has virtually come to a standstill. They have started to scout for newer markets, improve on the per capita efficiency, concentrate on future technologies, and revamp their organizational and marketing structure. From very humble beginnings, the Indian IT Industry has grown at an exponential rate over the past 10 years doing Rs.10000 crore of export, fetching for India valuable foreign exchange, propping up the Indian Stock Market with its share prices reaching dizzying heights before the scam, and employing over 2 lakh professionals with this number poised to rise to around 20 lakh in another 3 years. With the recession, most companies have drastically revised their organizational and marketing strategies. The share of onsite work has come down as most foreign companies prefer to sustain as much of their own employees rather than outsiders. Companies in India have now shifted gears doing off-shore development which is much cheaper. They have started looking at the European and Japanese markets which have not yet been affected by the slowdown. Other markets which they are tentatively eyeing are the Australian, South American and Middle East markets. Most companies have decided to tide over the problem of reduced profits by resorting to layoffs and cutting down heavily on fresh recruitment. These are measures to bring down the numbers on the bench which have been increasing for some time now.

1.2 Reasons behind Success of Indian software companies
There are a number of reasons why the software companies in India have been so successful. Besides the Indian software companies, a number of multinational giants have also plunged into the India IT market. India is the hub of cheap and skilled software professionals, which are available in abundance. It helps the software companies to develop cost-effective business solutions for their clients. As a result, Indian software companies can place their products and services in the global market in the most competitive rate. This is the reason why India has been a favorite destination for outsourcing as well. Many multinational IT giants also have their offshore development centers in India.

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1.3 Indian Software: Potential and Prospects Supplying programmers or doing simple coding or code conversion does not require a great deal of knowledge about the customer’s business domain or specialization in specific technologies. Lacking such expertise and experience, Indian firms have been willing to adapt to any new domain. The most important determinant of competitive success appears to have been the ability to provide trained software programmers at low cost upon demand. The expertise levels of Indian firms on UNIX and WinNT platforms are considered to be on par with other US firms. There is evidence of long-term relationships. Of the firms we surveyed, over 93% said that their most important export contract involved work for a company they knew earlier or was part of an ongoing relationship with the client. The existing software service exporters face two major challenges that are closely related. First, the difficulty in attracting and retaining talented software professionals, and second, the challenge of developing beyond competing on low costs alone in an environment with rapidly rising labor costs. Firms are moving up the value chain by accumulating knowledge about the industry segments for which they currently develop software. At present, Indian firms provide services for the lower portion of the waterfall model and “moving up the value chain” involves providing conceptualization, requirement analysis and design services as well.

2. OBJECTIVES OF THE STUDY
The objectives of the study are as follows:
• To know about software industry in India.
• To evaluate profit position of selected software companies.
• To evaluate liquidity position of selected software companies.
• To know how well fixed assets of selected software companies are utilized.

3. HYPOTHESIS
The following hypotheses are taken to put on test:

H1: The Earning Per Share (EPS) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, Infotech does not differ significantly.
H2: The Current Ratio (CR) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, Infotech does not differ significantly.
H3: The Quick Ratio (QR) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, Infotech does not differ significantly.
H4: The Net Profit Margin (NPM) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, Infotech does not differ significantly.
H5: The Return on Capital Employed (ROCE) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, Infotech does not differ significantly.
H6: The Return on Net Worth (RONW) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, Infotech does not differ significantly.
H7: The Price Earning Ratio (PER) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, Infotech does not differ significantly.
H8: The Fixed-Asset Turnover Ratio (FATR) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, Infotech does not differ significantly.

4. RESEARCH METHODOLOGY
4.1 Sample Size: The sample size of eight software companies has been selected for the purpose of study. They are Tata Consultancy Services Limited (TCS), Wipro Limited (Wipro), Infosys Technologies Limited (Infosys), Oracle Financial Services Software Limited (OFSS), Mastek Limited (Mastek), National Institute of Information Technologies Limited (NIIT), Hindustan Computers Limited Technologies Limited (HCL), Infotech Enterprises Limited (Infotech).

4.2 Sample Design
• Sampling Technique The study is done with special reference to selected software companies. The reason being that data on financial statements are readily available for them.
• Sample Size Eight Software Companies are chosen as sample size for the study.

4.3 Data Collection Financial Statements are the raw data collected from PROWESS Software.

4.4 Period of the study Study has been conducted during Mar 2005 to Mar 2009.

4.5 Tools for Analysis
4.5.1 Ratio Analysis  Ratios have been calculated for the past five years for the purpose of analysis. Ratios being designed are named as:

- Earning Per Share (EPS)
- Current Ratio (CR)
- Quick Ratio (QR)
- Net Profit Margin (NPM)
- Return On Capital Employed (ROCE)
- Return on Net worth (RONW)
- Price Earning Ratio (PER)
- Fixed-Asset Turnover Ratio (FATR)

4.6 Analysis Of Variance (ANOVA)  The statistical tool that is used for testing hypothesis is one-way Analysis of Variance (ANOVA). ANOVA is performed by using software known as SPSS.

5. DATA ANALYSIS AND INTERPRETATION

5.1 Earnings Per Share (EPS) Ratio:  Earnings per share ratio (EPS Ratio) is a small variation of return on equity capital ratio. Earnings per share (EPS) Ratio = (Net profit after tax − Preference dividend) / No. of equity shares.

<table>
<thead>
<tr>
<th>Year</th>
<th>HCL</th>
<th>Infosys</th>
<th>Infotech</th>
<th>Mastek</th>
<th>NIIT</th>
<th>OFSS</th>
<th>TCS</th>
<th>Wipro</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>9.48</td>
<td>70.38</td>
<td>15.15</td>
<td>30.94</td>
<td>8.26</td>
<td>26.4</td>
<td>44.36</td>
<td>21.25</td>
</tr>
<tr>
<td>2005-2006</td>
<td>18.15</td>
<td>87.21</td>
<td>18.64</td>
<td>16.64</td>
<td>14.23</td>
<td>32.08</td>
<td>55.53</td>
<td>14.17</td>
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<tr>
<td>2006-2007</td>
<td>11.3</td>
<td>59.33</td>
<td>11.87</td>
<td>22.14</td>
<td>16.06</td>
<td>41.94</td>
<td>35.04</td>
<td>18.37</td>
</tr>
<tr>
<td>2007-2008</td>
<td>17.82</td>
<td>76.03</td>
<td>11.23</td>
<td>27.68</td>
<td>1.85</td>
<td>50.49</td>
<td>42.48</td>
<td>20.96</td>
</tr>
<tr>
<td>2008-2009</td>
<td>11.81</td>
<td>101.58</td>
<td>12.91</td>
<td>37.82</td>
<td>2.86</td>
<td>88.65</td>
<td>43.46</td>
<td>20.3</td>
</tr>
<tr>
<td>Average</td>
<td>13.71</td>
<td>78.91</td>
<td>13.96</td>
<td>27.04</td>
<td>8.65</td>
<td>47.91</td>
<td>44.17</td>
<td>19.01</td>
</tr>
</tbody>
</table>

Table 1  EPS (in Rs.) of selected companies

5.2 Interpretations  As shown in Table 1, the EPS of HCL, Infosys, Mastek, OFSS showed an increasing trend and InfoTech, NIIT, TCS, Wipro showed decreasing trend. The EPS of Infosys is substantially higher than that of HCL, InfoTech, Mastek, NIIT, OFSS, TCS, Wipro every year as per the data taken from year 2004-04 to 2008-09. On an average Infosys has generated EPS of 78.91, highest among all, followed by OFSS (47.91), TCS (44.17), Mastek (27.04), Wipro (19.01), InfoTech (13.96), HCL (13.71) and then NIIT (8.65), the lowest among the eight sample companies. The analysis reveals that Infosys is the most efficient company in the terms of generating earning per share.

5.3 Hypothesis Testing  
**Ho:** The Earning Per Share (EPS) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, and InfoTech does not differ significantly. 

**H₁:** The Earning Per Share (EPS) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech differ significantly.

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
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<th>Mean Square</th>
<th>F-ratio</th>
<th>5% F-limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between People</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within People</td>
<td>19995.150</td>
<td>7</td>
<td>2856.450</td>
<td>1.665</td>
<td>F (7,32)=2.30</td>
</tr>
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<td>815.329</td>
<td>4</td>
<td>203.832</td>
<td></td>
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<tr>
<td>Residual(a)</td>
<td>3427.475</td>
<td>28</td>
<td>122.410</td>
<td></td>
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<tr>
<td>Total</td>
<td>4242.804</td>
<td>32</td>
<td>132.586</td>
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</tr>
<tr>
<td>Residual(a)</td>
<td>4242.804</td>
<td>32</td>
<td>132.586</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>24237.953</td>
<td>39</td>
<td>621.486</td>
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</tr>
</tbody>
</table>

Table 2 One-way ANOVA for EPS

5.4 Inference  Since the calculated value of is 1.665- which is lesser than the table value of 2.30 (CV<TV at 5% significance level), the null hypothesis is accepted and the alternative hypothesis is accepted. Hence, it is concluded that the EPS position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, and InfoTech does not differ significantly.
5.5 Current ratio (CR) It is a measure of general liquidity and is most widely used to make the analysis for short term financial position or liquidity of a firm. An ideal current ratio is 2:1, which denotes that the current ratio of a business should at least be twice of its current liabilities. Current Ratio = \[\text{Current Assets / Current Liabilities}\]

<table>
<thead>
<tr>
<th>Year</th>
<th>HCL</th>
<th>Infosys</th>
<th>Infotech</th>
<th>Mastek</th>
<th>NIIT</th>
<th>OFSS</th>
<th>TCS</th>
<th>Wipro</th>
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<tbody>
<tr>
<td>2004-2005</td>
<td>0.6</td>
<td>2.53</td>
<td>3.06</td>
<td>1.23</td>
<td>1.69</td>
<td>3.16</td>
<td>1.59</td>
<td>1.45</td>
</tr>
<tr>
<td>2005-2006</td>
<td>0.77</td>
<td>2.47</td>
<td>2.9</td>
<td>1.09</td>
<td>2.04</td>
<td>3.06</td>
<td>1.93</td>
<td>1.31</td>
</tr>
<tr>
<td>2006-2007</td>
<td>0.9</td>
<td>4.81</td>
<td>2.75</td>
<td>1.11</td>
<td>1.43</td>
<td>3.2</td>
<td>1.83</td>
<td>1.48</td>
</tr>
<tr>
<td>2007-2008</td>
<td>1.24</td>
<td>2.9</td>
<td>3.04</td>
<td>1.22</td>
<td>1.25</td>
<td>4.38</td>
<td>1.75</td>
<td>1.43</td>
</tr>
<tr>
<td>2008-2009</td>
<td>1.02</td>
<td>4.28</td>
<td>2.74</td>
<td>1.02</td>
<td>1.07</td>
<td>4.08</td>
<td>1.56</td>
<td>1.2</td>
</tr>
<tr>
<td>Average</td>
<td>0.91</td>
<td>3.4</td>
<td>2.90</td>
<td>1.13</td>
<td>1.50</td>
<td>3.60</td>
<td>1.73</td>
<td>1.37</td>
</tr>
</tbody>
</table>

Table 3 Current Ratio (in times) of selected companies

5.6 Interpretations As shown in Table 2, the current ratio of HCL (0.91), Mastek (1.13), NIIT (1.5), TCS (1.73), Wipro (1.73) are less as compared to ideal current ratio which indicates lack of liquidity and working capital whereas, current ratio of Infosys (3.4), Infotech (2.9), OFSS (3.58) are more as compared to ideal current ratio and this indicates poor investment policies of the management. The current ratio of Infotech (2.90) is better than that of HCL, Infosys, Mastek, NIIT, OFS, TCS, Wipro; this ratio is also not satisfactory because this ratio signifies that in future this situation can create a problem for company. The highest current ratio is of OFSS (3.58) and the lowest current ratio is of HCL (0.91).

The CR position of sample companies is compared and tested using the following hypothesis.

5.7 Hypothesis Testing

H₀: The Current Ratio (CR) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, InfoTech does not differ significantly.


<table>
<thead>
<tr>
<th>Between People</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-ratio</th>
<th>5% F-limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within People</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Items</td>
<td>39.380</td>
<td>7</td>
<td>5.626</td>
<td>0.525</td>
<td>F(7,32)=2.30</td>
</tr>
<tr>
<td>Residual(a)</td>
<td>.503</td>
<td>4</td>
<td>.126</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6.708</td>
<td>28</td>
<td>.240</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.211</td>
<td>32</td>
<td>.225</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>46.591</td>
<td>39</td>
<td>1.195</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7.211</td>
<td>39</td>
<td>.225</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4 One-way ANOVA for Current Ratio

5.8 Inference Since the calculated value of F is 0.525 is less than the table value of 2.30 (CV>TV at 5% significance level), the null hypothesis is accepted and hence it is concluded that the CR position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

6. Quick Ratio (QR)

The true liquidity refers to the ability of a firm to pay its short term obligations as and when they become due. These ratios are used to assess short-term financial position of the concern. An ideal quick ratio is said to be 1:1. Quick Ratio = \[\text{Liquid Assets / Current Liabilities}\]

<table>
<thead>
<tr>
<th>Year</th>
<th>HCL</th>
<th>Infosys</th>
<th>Infotech</th>
<th>Mastek</th>
<th>NIIT</th>
<th>OFSS</th>
<th>TCS</th>
<th>Wipro</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>0.48</td>
<td>2.2</td>
<td>2.93</td>
<td>1.2</td>
<td>1.03</td>
<td>2.42</td>
<td>1.54</td>
<td>1.3</td>
</tr>
<tr>
<td>2005-2006</td>
<td>0.75</td>
<td>2.33</td>
<td>2.53</td>
<td>1.08</td>
<td>1.27</td>
<td>2.28</td>
<td>1.78</td>
<td>1.04</td>
</tr>
<tr>
<td>2006-2007</td>
<td>0.8</td>
<td>4.59</td>
<td>2.39</td>
<td>1.11</td>
<td>0.77</td>
<td>2.12</td>
<td>1.68</td>
<td>1.2</td>
</tr>
<tr>
<td>2007-2008</td>
<td>1.14</td>
<td>2.77</td>
<td>2.76</td>
<td>1.2</td>
<td>0.68</td>
<td>3.22</td>
<td>1.58</td>
<td>1.17</td>
</tr>
<tr>
<td>2008-2009</td>
<td>0.89</td>
<td>4.1</td>
<td>2.55</td>
<td>1.01</td>
<td>0.63</td>
<td>3</td>
<td>1.34</td>
<td>0.97</td>
</tr>
<tr>
<td>Average</td>
<td>0.81</td>
<td>3.20</td>
<td>2.63</td>
<td>1.12</td>
<td>0.88</td>
<td>2.61</td>
<td>1.59</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Table 5 Quick Ratio (in times) of selected companies
6.1 Interpretations As shown in Table 5, the quick ratio of Infosys (3.20), Infotech (2.63), Mastek (1.12), OFSS (2.61), TCS (1.59), Wipro (1.14) is more as compared to ideal quick ratio and this reveals that these companies are in position to pay its current liabilities instantly whereas quick ratio of HCL (0.81), NIIT (0.88) is less as compared to ideal quick ratio these companies are not in position to pay its current liabilities instantly. The **highest ratio is of Infosys (3.20)** and **the lowest ratio is of HCL (0.81)**.

The QR position of sample companies is compared and tested using the following hypothesis.

6.2 Hypothesis Testing

**Ho:** The Quick Ratio (QR) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

**H_a:** The Quick Ratio (QR) position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, InfoTech differ significantly.

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-ratio</th>
<th>5% F-limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between People</td>
<td>30.279</td>
<td>7</td>
<td>4.326</td>
<td></td>
</tr>
<tr>
<td>Within People</td>
<td>.329</td>
<td>4</td>
<td>.082</td>
<td></td>
</tr>
<tr>
<td>Between Items</td>
<td>6.166</td>
<td>28</td>
<td>.220</td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td>6.496</td>
<td>32</td>
<td>.203</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36.775</td>
<td>39</td>
<td>.943</td>
<td></td>
</tr>
</tbody>
</table>

**Table 6:** One-way ANOVA for Quick Ratio

6.3 Inference Since the calculated value of F is 0.374 is less than the table value of 2.30 (CV>TV at 5% significance level), the null hypothesis is accepted and hence it is concluded that the QR position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

7. **Net Profit Margin (NPM)**

It is expressed as percentage. NPM measures the overall profitability. This ratio indicates that how much a company is able to earn after accounting for all the direct and indirect expenses to every rupee of revenue. **Net Profit Ratio = [(Net profit / Net sales) × 100]**

<table>
<thead>
<tr>
<th>Year</th>
<th>H C L</th>
<th>Infosys</th>
<th>Infotech</th>
<th>Mastek</th>
<th>NIIT</th>
<th>OFS</th>
<th>TCS</th>
<th>Wipro</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>28.86</td>
<td>27.76</td>
<td>14.51</td>
<td>10.35</td>
<td>5.64</td>
<td>21.89</td>
<td>22.74</td>
<td>20.54</td>
</tr>
<tr>
<td>2007-2008</td>
<td>29.22</td>
<td>28.57</td>
<td>13.46</td>
<td>20.58</td>
<td>7.01</td>
<td>22.92</td>
<td>24.65</td>
<td>17.35</td>
</tr>
<tr>
<td>2008-2009</td>
<td>16.91</td>
<td>28.67</td>
<td>12.51</td>
<td>17.01</td>
<td>8.65</td>
<td>31.44</td>
<td>20.96</td>
<td>13.76</td>
</tr>
</tbody>
</table>

**Table 7** Net Profit Margin (in %) of selected companies

7.1 Interpretations The data in Table7 reveals that **Infosys Company outperformed other companies in terms of net profit margin.** The NPM position of Infosys is 26.82% in 2005, which of TCS, HCL, OFSS, Wipro, Mastek, Infotech, and NIIT are 24.17%, 22.75%, 20.87%, 19.69%, 18.55%, 13.28%, and 7.99% respectively. On an aggregate basis, the mean of Infosys is 28.12%, the highest, followed by OFSS (23.99%), HCL (23.76%), TCS (23.53%), Wipro (18.40%), Mastek (15.85%), Infotech (14.53%), and NIIT (7.55%), the lowest among the eight companies. Thus, it can be concluded that **Infosys is the most efficient company in controlling indirect expenses** in comparison to HCL, InfoTech, Mastek, NIIT, OFS, TCS and Wipro. The NPM position of sample companies is compared and tested using the following hypothesis. The details are shown in Table 8.

7.2 Hypothesis Testing

**Ho:** The Net Profit Margin (NPM) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

**H_a:** The Net Profit Margin (NPM) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech differ significantly.
### Table 8 One-way ANOVA for Net Profit Margin

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-ratio</th>
<th>5% F-limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between People</td>
<td>1554.864</td>
<td>7</td>
<td>222.123</td>
<td>0.330</td>
<td>F(7,32)=2.30</td>
</tr>
<tr>
<td>Between Items</td>
<td>15.063</td>
<td>4</td>
<td>3.766</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td>319.170</td>
<td>28</td>
<td>11.399</td>
<td>0.426</td>
<td>F(7,32)=2.30</td>
</tr>
<tr>
<td>Total</td>
<td>334.233</td>
<td>32</td>
<td>10.445</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between People</td>
<td>1889.097</td>
<td>39</td>
<td>48.438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within People</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Items</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7.3 Inference
Since the calculated value of F is 0.330 is less than the table value of 2.30 (CV>TV at 5% significance level), the null hypothesis is accepted and hence it is concluded that the NPM position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

### 8. RETURN ON CAPITAL EMPLOYED

Establishes the relationship between the profit and the capital employed. It indicates the percentage of return on capital employed in the business and it can be used to show the overall profitability and efficiency of the business. Return on Capital Employed = \[(\text{Adjusted net profits/ Capital employed}) \times 100\] *Net profit before interest and tax minus income from investments.

### Table 9 Return On Capital Employed (in %) of selected companies

<table>
<thead>
<tr>
<th>Year</th>
<th>HCL</th>
<th>Infosys</th>
<th>Infotech</th>
<th>Mastek</th>
<th>NIIT</th>
<th>OFSS</th>
<th>TCS</th>
<th>Wipro</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>13.82</td>
<td>44.8</td>
<td>13.31</td>
<td>9.66</td>
<td>4.15</td>
<td>18.85</td>
<td>108.15</td>
<td>35.31</td>
</tr>
<tr>
<td>2005-06</td>
<td>12.28</td>
<td>39.46</td>
<td>14.11</td>
<td>31.97</td>
<td>5.1</td>
<td>19.5</td>
<td>59.83</td>
<td>34.99</td>
</tr>
<tr>
<td>2006-07</td>
<td>22.97</td>
<td>40.51</td>
<td>25.37</td>
<td>26.26</td>
<td>7.06</td>
<td>19.09</td>
<td>54.88</td>
<td>36.1</td>
</tr>
<tr>
<td>2007-08</td>
<td>36.38</td>
<td>33.91</td>
<td>12.22</td>
<td>41.62</td>
<td>7.3</td>
<td>14.44</td>
<td>43.18</td>
<td>26.92</td>
</tr>
<tr>
<td>2008-09</td>
<td>23.32</td>
<td>35.9</td>
<td>10.41</td>
<td>30.74</td>
<td>7.98</td>
<td>22.04</td>
<td>33.97</td>
<td>21.38</td>
</tr>
<tr>
<td>Average</td>
<td>21.75</td>
<td>38.92</td>
<td>15.08</td>
<td>28.05</td>
<td>6.318</td>
<td>18.78</td>
<td>60.00</td>
<td>30.94</td>
</tr>
</tbody>
</table>

### Table 9 Return On Capital Employed (in %) of selected companies

#### 8.1 Interpretations
The data in Table 9 reveals that TCS outperformed other companies by achieving highest ROCE whereas; Table 9 indicates that NIIT has registered the lowest ROCE. On an aggregate basis, the ROCE of TCS is 60.00%, the highest, followed by Infosys (38.92%), Wipro (30.94%), Mastek (28.05%), HCL (21.75%), OFSS (18.78%), InfoTech (15.08%), and NIIT (6.318%) the lowest among the eight companies. Thus, it can be concluded that the management of TCS has used the investment made by owners and creditors most efficiently into the business whereas; the management of NIIT is not efficient in utilizing funds invested by owner and creditors. The ROCE position of sample companies is compared and tested using the following hypothesis. The details are shown in Table 10.

#### 8.2 Hypothesis Testing

**H₀:** The Return On Capital Employed (ROCE) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

**Hₐ:** The Return On Capital Employed (ROCE) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech differ significantly.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-ratio</th>
<th>5% F-limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between People</td>
<td>9553.288</td>
<td>7</td>
<td>1364.755</td>
<td>0.426</td>
<td>F(7,32)=2.30</td>
</tr>
<tr>
<td>Between Items</td>
<td>266.764</td>
<td>4</td>
<td>66.691</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td>4378.858</td>
<td>28</td>
<td>156.388</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4645.622</td>
<td>32</td>
<td>145.176</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between People</td>
<td>14198.910</td>
<td>39</td>
<td>364.075</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within People</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Items</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** One-way ANOVA has been performed in SPSS
8.3 **Inference** Since the calculated value of F is 0.426 is less than the table value of 2.30 (CV>TV at 5% significance level), the null hypothesis is accepted and hence it is Concluded that the ROCE position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

**9. RETURN ON SHAREHOLDERS INVESTMENT OR NET WORTH RATIO**

This ratio reveals how well the resources of the firm are being used, higher the ratio, better are the results. The inter firm comparison of this ratio determines whether the investments in the firm are attractive or not as the investors would like to invest only where the return is higher. **Return on share holder's investment = ([Net profit (after interest and tax) / Shareholder's fund] × 100)**

<table>
<thead>
<tr>
<th>Year</th>
<th>HCL</th>
<th>Infosys</th>
<th>Infotech</th>
<th>Mastek</th>
<th>NIIT</th>
<th>OFSS</th>
<th>TCS</th>
<th>Wipro</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>14.12</td>
<td>44.8</td>
<td>13.32</td>
<td>9.71</td>
<td>4.69</td>
<td>18.84</td>
<td>120.5</td>
<td>35.51</td>
</tr>
<tr>
<td>2005-2006</td>
<td>12.74</td>
<td>39.46</td>
<td>14.13</td>
<td>32.11</td>
<td>6.64</td>
<td>19.48</td>
<td>59.96</td>
<td>35.1</td>
</tr>
<tr>
<td>2006-2007</td>
<td>23.42</td>
<td>40.51</td>
<td>26.18</td>
<td>26.34</td>
<td>9.75</td>
<td>18.88</td>
<td>54.95</td>
<td>36.09</td>
</tr>
<tr>
<td>2007-2008</td>
<td>36.7</td>
<td>33.91</td>
<td>12.81</td>
<td>41.7</td>
<td>9.11</td>
<td>14.33</td>
<td>43.22</td>
<td>28.76</td>
</tr>
<tr>
<td>2008-2009</td>
<td>23.55</td>
<td>35.9</td>
<td>10.63</td>
<td>30.78</td>
<td>9.94</td>
<td>22.04</td>
<td>34.04</td>
<td>24.35</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>22.106</strong></td>
<td><strong>38.916</strong></td>
<td><strong>15.414</strong></td>
<td><strong>28.128</strong></td>
<td><strong>8.026</strong></td>
<td><strong>18.714</strong></td>
<td><strong>62.534</strong></td>
<td><strong>31.962</strong></td>
</tr>
</tbody>
</table>

**Table 11 Return On Net Worth (in %) of selected companies**

9.1 **Interpretations** The data in Table 11 reveals that **TCS outperformed other companies by achieving highest RONW** whereas; Table 11 indicates that **NIIT has registered the lowest RONW**. On an aggregate basis, the RONW of TCS is 62.53%, the highest, followed by Infosys (38.92%), Wipro (31.96%), Mastek (28.13%), HCL (22.11%), OFSS (18.71%), InfoTech (15.41%) and NIIT (8.03%) the lowest among the eight companies. Thus, it can be concluded that the **investments in TCS is attractive** as the investors would like to Invest only where the return is higher and management of TCS is utilizing the resources of the firm efficiently. The RONW position of sample companies is compared and tested using the following hypothesis. The details are shown in Table 12.

9.2 **Hypothesis Testing**

**H_0:** The Return on Net worth (RONW) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, and InfoTech does not differ significantly.

**H_a:** The Return on Net worth (RONW) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech differ significantly.

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-ratio</th>
<th>5% F-limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within People</td>
<td>10027.011</td>
<td>7</td>
<td>1432.430</td>
<td>0.414</td>
<td>F(7,32)=2.30</td>
</tr>
<tr>
<td>Between Items</td>
<td>330.153</td>
<td>4</td>
<td>82.538</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td>5579.454</td>
<td>28</td>
<td>199.266</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5909.607</td>
<td>32</td>
<td>184.675</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td>15936.618</td>
<td>39</td>
<td>408.631</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 12 One-way ANOVA for Return on Net Worth**

9.3 **Inference** Since the calculated value of F is 0.414 is less than the table value of 2.30 (CV>TV at 5% significance level), the null hypothesis is accepted and hence it is concluded that the ROCE position of TCS, Wipro, Infosys, OFS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

**10. PRICE EARNINGS RATIO (PE RATIO)**

Price earnings ratio helps the investor in deciding whether to buy or not to buy the shares of a particular company at a particular market price. Generally, higher the price earning ratio the better it is. If the P/E ratio falls, the management should look into the causes that have resulted into the fall of this ratio. **[Price Earnings Ratio = Market price per equity share / Earnings per share]**
10.1 Interpretations
The data in Table 13 reveals that PE ratio of HCL is continuously showing decreasing trend and that of Infosys is increasing for years 2004-05 to 2006-07 and thereafter, it is falling for year 2007-08 to 2008-09. PE ratio of Infotech, OFSS, TCS are showing same trend as that of Infosys. PE ratio of Mastek, Wipro increased for years 2004--05 to 2005-06 and thereafter, its PE ratio is showing decreasing trend. Change in PE ratio of NIIT has shown huge change, as in previous years 2005 to 2008 its PE ratio was increasing but in year 2009 it falls enormously. The PER position of sample companies is compared and tested using the following hypothesis. The details are shown in Table 14.

10.2 Hypothesis Testing
Ho: The Price Earning Ratio (PER) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.
H_1: The Price Earning Ratio (PER) position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech differ significantly.

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-ratio</th>
<th>5% F-limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between People</td>
<td>1017.225</td>
<td>7</td>
<td>145.318</td>
<td>9.354</td>
</tr>
<tr>
<td>Within People</td>
<td>2989.171</td>
<td>4</td>
<td>747.293</td>
<td></td>
</tr>
<tr>
<td>Between Items</td>
<td>2236.897</td>
<td>28</td>
<td>79.889</td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td>5226.068</td>
<td>32</td>
<td>163.315</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6243.293</td>
<td>39</td>
<td>160.084</td>
<td></td>
</tr>
</tbody>
</table>

11. FIXED-ASSET TURNOVER RATIO
The fixed-asset turnover ratio measures a company’s ability to generate net sales from fixed-asset investments – specifically property, plant and equipment (PP&E) - net of depreciation. A higher fixed-asset turnover ratio shows that the company has been more effective in using the investment in fixed assets to generate revenues.

<table>
<thead>
<tr>
<th>Year</th>
<th>HCL</th>
<th>Infosys</th>
<th>Infotech</th>
<th>Mastek</th>
<th>NIIT</th>
<th>OFSS</th>
<th>TCS</th>
<th>Wipro</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>3.48</td>
<td>4.59</td>
<td>3.45</td>
<td>2.46</td>
<td>3.75</td>
<td>6.42</td>
<td>7.83</td>
<td>6.28</td>
</tr>
<tr>
<td>2005-2006</td>
<td>3.35</td>
<td>4.23</td>
<td>3.22</td>
<td>4.08</td>
<td>3.54</td>
<td>5.21</td>
<td>7.75</td>
<td>5.93</td>
</tr>
<tr>
<td>2007-2008</td>
<td>4.27</td>
<td>3.98</td>
<td>2</td>
<td>4.98</td>
<td>3.87</td>
<td>5.76</td>
<td>6.46</td>
<td>4.88</td>
</tr>
<tr>
<td>2008-2009</td>
<td>4.04</td>
<td>4.6</td>
<td>2.12</td>
<td>5.34</td>
<td>2.79</td>
<td>6.55</td>
<td>6.68</td>
<td>4.81</td>
</tr>
<tr>
<td>Average</td>
<td>3.91</td>
<td>4.33</td>
<td>2.76</td>
<td>4.25</td>
<td>3.46</td>
<td>5.91</td>
<td>7.09</td>
<td>5.42</td>
</tr>
</tbody>
</table>

11.1 Interpretations
The data reveals that only TCS achieved the highest fixed assets turnover ratio for each year from 2005-2009. Even the five years fixed assets turnover ratio TCS is significantly higher (3.91) than that of OFSS (5.91), Wipro (5.42), Infosys (4.33), Mastek (4.25), HCL (3.91), NIIT (3.46), and Infotech (2.76), the lowest among eight companies. Thus, it is inferred that TCS Company has been more effective in using the Investment in fixed assets to generate revenue.
The FATR position of sample companies is compared and tested using the following hypothesis. The details are shown in Table 16.

11.2 Hypothesis Testing

H₀: The fixed assets turnover ratio position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

H₁: The fixed assets turnover ratio position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech differ significantly.

Table 16: One-way ANOVA for Fixed Assets Turnover Ratio

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F-ratio</th>
<th>5% F-limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between People</td>
<td>69.706</td>
<td>7</td>
<td>9.958</td>
<td>0.151</td>
<td>F(7,32)=2.30</td>
</tr>
<tr>
<td>Between Items</td>
<td>.279</td>
<td>4</td>
<td>.070</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual(a)</td>
<td>12.961</td>
<td>28</td>
<td>.463</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13.240</td>
<td>32</td>
<td>.414</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>82.946</td>
<td>39</td>
<td>2.127</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11.3 Inference

Since the calculated value of F is 0.151 is lesser than the table value of 2.30 (CV>TV at 5% significance level), the null hypothesis is accepted and hence it is concluded that the ROCE position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

12. FINDINGS

12.1 The EPS of HCL, Infosys, Mastek, OFSS showed an increasing trend and InfoTech, NIIT, TCS, Wipro showed decreasing trend. On an average Infosys has generated EPS of 78.91, highest among all, followed by OFSS (47.91), TCS (44.17), Mastek (27.04), Wipro (19.01), Infotech (13.96), HCL (13.71) and then NIIT (8.65), the lowest among the eight sample companies. The analysis reveals that Infosys is the most efficient company in the terms of generating earning per share.

12.2 The current ratio of HCL (0.91), Mastek (1.13), NIIT (1.5), TCS (1.73), Wipro (1.73) are less as compared to ideal current ratio which indicates lack of liquidity and working capital whereas, current ratio of Infosys (3.4), Infotech (2.9), OFSS (3.58) are more as compared to ideal current ratio and this indicates poor investment policies of the management. The current ratio of Infotech (2.90) is better than that of HCL, Infosys, Mastek, NIIT, OFS, TCS, Wipro, this ratio is also not satisfactory because this ratio signifies that in future this situation can create a problem for company. The highest current ratio is of OFSS (3.58) and the lowest current ratio is of HCL (0.91). The CR position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

12.3 The quick ratio of Infosys (3.20), Infotech (2.63), Mastek (1.12), OFSS (2.61), TCS (1.59), Wipro (1.14) is more as compared to ideal quick ratio and this reveals that these companies are in position to pay its current liabilities instantly whereas quick ratio of HCL (0.81), NIIT (0.88) is less as compared to ideal quick ratio these companies are not in position to pay its current liabilities instantly. The highest quick ratio is of Infosys (3.20) and the lowest quick ratio is of HCL (0.81). The QR position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

12.4 The NPM position of Infosys is 26.82% in 2005, which of TCS, HCL, OFSS, Wipro, Mastek, Infotech, and NIIT are 24.17%, 22.75%, 20.87%, 19.69%, 18.55%, 13.28%, and 7.99% respectively. On an aggregate basis, the mean of Infosys is 28.12%, the highest, followed by OFSS (23.99%), HCL (23.76%), TCS (23.53%), Wipro (18.40%), Mastek (15.85%), Infotech (14.53%), and NIIT (7.55%), the lowest among the eight companies. Thus, it can be concluded that Infosys is the most efficient company in controlling indirect expenses in comparison to HCL, Infotech, Mastek, NIIT, OFS, TCS and Wipro. The NPM position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.

12.5 TCS outperformed other companies by achieving highest ROCE whereas; Table 9 indicates that NIIT has registered the lowest ROCE. On an aggregate basis, the ROCE of TCS is 60.00%, the highest, followed by Infosys (38.92%), Wipro (30.94%), Mastek (28.05%), HCL (21.75%), OFSS (18.78%), InfoTech (15.08%), and NIIT (6.32%) the lowest among the eight companies. Thus, it can be concluded that the management of TCS has used the investment made by owners and creditors most efficiently into the business whereas, the management of NIIT is not efficient in utilizing funds invested by owner and creditors. The ROCE position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, InfoTech does not differ significantly.
12.6 TCS outperformed other companies by achieving highest RONW whereas; Table 11 indicates that NIIT has registered the lowest RONW. On an aggregate basis, the RONW of TCS is 62.53%, the highest, followed by Infosys (38.92%), Wipro (31.96%), Mastek (28.13%), HCL (22.11%), OFSS (18.71%), InfoTech (15.41%) and NIIT (8.03%) the lowest among the eight companies Thus, it can be concluded that the investments in TCS is attractive as the Investors would like to invest only where the return is higher and management of TCS is utilizing the resources of the firm efficiently. The RONW position of TCS, Wipro, Infosys, OFSS, Mastek, NIIT, HCL, Infotech does not differ significantly.

CONCLUSION

- Infosys is the most efficient company in the terms of generating earning per share.
- The current ratio of OFSS is 3.58 (expressed in times) which is highest among the Companies under study and this highest ratio signifies that OFSS is financially stable and technically solvent.
- The quick ratio of Infosys is highest and from this it is inferred that the firm has the capacity to pay off its current obligations immediately.
- Infosys is most efficient in controlling its indirect expenses.
- Return on Capital Employed of TCS is 60% which is highest and this reveals that the funds of TCS are efficiently utilized.
- TCS Company is more attractive for investors to invest in because its Return on Net worth of TCS is 62.53% which is highest.
- TCS is more efficient in using the investment in the fixed assets to generate revenue as it is having highest Fixed Assets Turnover Ratio.

REFERENCES

ABSTRACT

Autonomous robot navigation with the capability to perceive the surrounding environment of the robot enhances the efficiency and safety of the robot. To enable autonomous navigation on natural unknown terrain, the traversal difficulty must be evaluated initially. This is accomplished by real-time assessment and classification of terrain for traversability analysis. Three competing techniques for terrain classification from visual sensing of terrain data using co-occurrence matrix is presented in this paper. These techniques include: Crisp rule based (CRB), K Nearest Neighbor (KNN) and Support Vector Machine (SVM) Classifier. Each classifier detects the navigable terrain by extracting the textural features from visual imagery of terrain data. And further we have presented a fast and optimum algorithm for path planning of robot on the assessed navigable terrain. Images from NASA’s Mars exploration rover have been tested to validate the proposed approach. We have conducted the performance evaluation of each of the classifier and presented the comparative results.

Keywords: Terrain classification, Traversability assessment, Autonomous robot, Co-occurrence matrix, Path planning Navigation (PPN)

1. INTRODUCTION

1.1 Autonomous navigation in natural unknown terrain is an emerging technology as natural terrain is unpredictable and intricate. For safe autonomous operation, a robot should possess onboard intelligence and capability to perceive the terrain ahead so that it can optimize its speed; avoid hazardous areas by discriminating the negotiable regions for traversal. Embedding terrain knowledge in autonomous robot requires traversable assessment of the terrain. Terrain classification to detect derivable ground for robot provides adaptability to control by optimizing its speed and planning strategies to avoid hazardous areas thereby improving its efficiency and safety.

1.2 Terrain classification is fundamentally employed in Department of Defense for military surveillance, target tracking applications and in particular in NASA and ISRO for robotic planetary space explorations in the areas such as object recognition, detection of changes in terrain, local obstacle avoidance navigation and path planning by traversability assessment. A robot able to classify the terrain ahead can optimize its speed for the terrain (drive slower on rough terrain and faster on smooth terrain) or avoid potentially hazardous areas, such as stretches of sand in which a ground-based robot could become stuck. Lack of terrain knowledge suspends reliable navigation and traversal to the goal successfully as exemplified by the NASA’s Mars exploration rover in 2006 which became entrenched in loose drift material and remained stationary for several weeks [1]. Terrain classification to detect derivable ground for robot provides adaptability to control by optimizing its speed and planning strategies to avoid hazardous areas thereby improving its efficiency and safety.

1.3 This paper presents terrain classification using visual sensing of the terrain data using three different classifiers. We have used statistical texture analysis technique to compute the salient feature of the terrain for classification. Furthermore, we have developed an optimum and shortest path planning algorithm for mobile robot in natural terrain similar to Mars surface terrains.

1.4 The rest of the paper is organized as follows. A review of the related research work in the area of terrain classification is given in section 2. Section 3 describes the methodology and details of the three classifiers Section 4 describes the path planning based on classified terrain. Section 5 presents the results of terrain assessment by all the three classifiers followed by section 6 which deals with the comparison of the performance of terrain classifiers and finally Section 7 deals with conclusion and our future work.

*Corresponding Author
2. PROLOGUE ASSESSMENT

2.1 Terrain classification for derivable path for robot has been addressed by many researchers based upon the features like range, color, image texture and vibration derived from different sensors such as laser range finder, ultrasonic range finder, vision sensor, tactile sensors. Iagnemma et al. [1] classified terrain based on analysis of vibrations arising from robot wheel terrain interaction. Ayanna Howard et al. [2] used fuzzy logic framework to develop terrain based navigation system coupled with obstacle avoidance and goal based navigation strategy. Olson et al. [3] proposed a method based on visual terrain mapping for Mars rovers. Using a visual stereo imaging fusion technique, they have demonstrated a reliable method for high fidelity terrain mapping and robot world perception modeling. Vandapel et al. [4] categorized ladar data points as either clutter, linear or surface using range feature. In [5] Manduchi used a combination of color camera images and ladar data to detect and classify obstacles, with the detection done via ladar and classification using camera. Shirkhodaie et al. [6] used visual terrain modeling using soft classifiers like rule based and neural networks. Machine learning methods were employed by Denis Wolf [7] using 2D laser range finders. Range information generates point clouds which are classified into navigable and not navigable area using hidden markov models (HMM).

2.2 Color based classification has yielded accurate results in natural terrain. Kelly et al.[8] utilized multispectral imaging, different color spaces and their distribution statistics is used by Dima et al.[9] because many major terrain types possess distinct color signatures. Andreas et al. [10] processed the range data obtained from Laser Range Finder by a Hough transform with three dimensional parameter spaces for representing planes and classified the terrain by Decision tree. Jackie et al. [11] used local point statistics features extracted from 3-D point cloud generated by ladar scans and enabled Naïve Bayes Decision Tree to learn to distinguish between different classes of terrain

3. METHODOLOGY

3.1 System Overview Terrain classification method extracts the relevant features which should be easily computed, robust, insensitive to various distortions and variations in the sensor data. Our features are based on imaging surface texture analysis (STA). Texture is a measure of the local spatial variation in image intensity. The attributes of texture include contrast, variance, energy, and entropy. Terrain classifiers provide semantic descriptions of the physical nature of a given terrain region. The texture quantitative statistics enable classifier to distinguish navigable region. Once trained, the developed classifier module can be used to classify sample terrain image to be classified. After the classification, terrain assessment is done for planning the navigation strategy of autonomous robot.

![Architecture Of The Terrain Classification System](image)

Fig 1: Architecture Of The Terrain Classification System

3.2 Feature Extraction Initially we divide the terrain image into finite number of sub frames. Each frame represents a small portion of the actual terrain called the sub terrain region [12]. Image texture features are extracted from the statistical means on each region using second order gray level co-occurrence matrix. Several texture measures are directly computed from the grey level co-occurrence matrix such as contrast, entropy, variance and energy. An image is a matrix of pixel intensities, I(i,j). We can define co-occurrence of image matrix as P_{d(i,j)} such as every entry in co-occurrence matrix, P_{d(i,j)}, is difference in intensity between a pair of image pixels(i and j), that are distance d pixels apart in original image in a given direction. Energy associated with an image that is a measure of textural uniformity of an image is defined by equation (1.1)
Energy $= \sum_{i} \sum_{j} P_d(i, j)^2$ \hfill (1.1)

Furthermore, Image Entropy is a measure of disorder of an image. Entropy is inversely proportional to Energy and is defined by equation (1.2)

$$\text{Entropy} = -\sum_{i} \sum_{j} P_d(i, j) \log P_d(i, j)$$ \hfill (1.2)

The image texture contrast measures the amount of local pixels intensity variation within an image.

$$\text{Contrast} = \sum_{i} \sum_{j} (i-j)^2 P_d(i, j)$$ \hfill (1.3)

We compute these features for all the sub terrain regions which serve as feature vector to train the classifier. In order to minimize the computation requirement, we chose the contrast and entropy as main attributes to obtain reliable statistical assessment of terrain surface textures.

### 3.3 Classifiers

#### 3.3.1 CRB Classifier

CRB classifier is knowledge based model which has set of predefined thresholds for classification of different terrain like rocks, sand and smooth terrain. These thresholds were determined by examining several such terrains. Training is done on images of Mars surface terrain image for: navigable and not navigable regions [13]. Using this classified traversable image path planning is performed to navigate the robot from start to goal location in specified safe area.

#### 3.3.2 KNN Classifier

In the KNN classifier, the k nearest neighbor approach is used to measure the distance of the test vector to every training sample [14]. Training is done on known samples which are assigned the respected class labels. The test vector is then assigned to the class, which has the shortest distance with that training sample. The test vector consists of feature vectors of the image to be classified.

#### 3.3.3 SVM Classifier

The SVM [16] framework builds a binary classifier for each pair of classes and consists of linear combination of similarity measures between the test and training points. Thus it finds the optimal hyper plane that has the maximum margin of separation between the classes.

### 4. PATH PLANNING ON ASSESSED TRAVERSABLE TERRAIN

Path planning algorithm developed for the classified terrain obtains optimally shortest path for the robot. A four connected flood fill algorithm is developed in order to start at the goal and assign the lowest value- zero (0) to that cell of the grid. The not navigable regions are assigned the highest values-infinity ($\infty$). All the four connected cells, starting from the goal, are filled with the values just one more than its smallest neighbor till the obstacle is met or end of the grid is reached. After filling the grid the path is planned starting from source cell and following the values downhill to the goal. Moreover it optimizes the path by incorporating diagonal movement also. For example the path is 5(source)-3-2-1-0(goal) as shown in Fig 2. The algorithm determines the most suitable way point towards the goal in the navigable region that minimizes the number of traveling cells thereby giving the shortest path.

![Fig 2: Path Planning With Diagonal Movement](image-url)
5. RESULTS

Our terrain traversability assessment method was tested on images obtained from NASA’s Mars exploration rover mission [17]. The images were of the size 320 x 320. We chose a sub window frames of size 32 x 32 for terrain sampling. For Mars surface scenes, primary terrain types that are believed to possess distinct traversability characteristics are: rocky terrain, composed of outcrop or large rocks; sandy terrain, composed of loose drift material and smooth mixed terrain. Examples of these terrains are shown in Fig 3.

![Fig 3: Class Distinction Of Mars Terrain](image)

Fig 4(a) shows the result analysis of the martial terrain. As shown in Fig 4(b) terrain image is divided into sub terrain frames. KNN Classified terrain is shown in Fig 4(c) where white color corresponds to non navigable region and black indicates the traversable region. Fig 4(d) path planning is shown as developed by the MATLAB code where yellow cell indicates the source and red indicates the goal positions. The path followed is shortest grid based path for the robot. Fig 5 and 6 shows the results of the SVM and CRB classifier for the same test image.

![Fig 4: (a) A Martial Terrain (b) Sampled Terrain (c) Classified Terrain (d) Generated Free Path](image)

![Fig 5: (a) A Martial Terrain (b) SVM Classified Terrain (c) Generated Free Path](image)
6. COMPARISON OF TERRAIN CLASSIFIERS

The performance of a classifier can be measured by classification accuracies and speed. Accuracy is evaluated using Receiver Operating Characteristics (ROC) curve. It summarizes how well the classifier has performed for that problem at different thresholds. It allows us to show graphically the trade off of each classifier between its true positive rate (the number of correct positive cases divided by the total number of positive cases) and its false positive rate (the number of incorrect positive cases divided by the total number of negative cases).

![ROC Curve](image)

**Fig 7: ROC Curve For (a) CRB Classifier (b) KNN Classifier (c) SVM Classifier**

Fig 7(a) shows the ROC curves for CRB classifier. Here horizontal axis indicates the percentage of false positives and the vertical axis indicates the percentage of true positives and the plot is shown in blue. Fig 7(b) and 7(c) are ROC for KNN and SVM classifier applied to the same test image. Table 1 shows the comparative results of the three classifiers. CRB had the least performance characteristic of all three. KNN achieved better classification rate than SVM and CRB. SVM performed better than CRB though the computational time was greater. CRB is fast and takes 3 sec. to classify the terrain. KNN is quick to train and classify as compared to SVM and takes around 7 sec for a 320 X 320 image.

<table>
<thead>
<tr>
<th></th>
<th>CRB</th>
<th>KNN</th>
<th>SVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct rate</td>
<td>81.50</td>
<td>95.00</td>
<td>89.50</td>
</tr>
<tr>
<td>% TP (sensitivity)</td>
<td>59.00</td>
<td>89.00</td>
<td>83.00</td>
</tr>
<tr>
<td>Positive Likelihood</td>
<td>3.68</td>
<td>8.61</td>
<td>2.97</td>
</tr>
</tbody>
</table>

**Table 1: Performance Evaluation of Three Classifiers**

CONCLUSION

Mobile robots adaptability in the natural terrain is the fundamental requirement for safe autonomous navigation. This paper has presented terrain traversability analysis using terrain classification using three different classifiers: CRB, KNN and SVM. The KNN and SVM classifiers have shown remarkable capability for terrain traversability assessment. All three employ visual imagery technique for the detection of terrain textural features. For path planning we have used a flood filling algorithm that is both fast and shortest in generating free path in classified sampled terrain. The Classifier and path planning is developed using MATLAB. Future work would mainly focus on expanding the classifier to be able to differentiate more than two classes (navigable or non-navigable) and should identify sandy and muddy terrain in addition to rocky and smooth terrain. Also, additional features such as homogeneity, correlation and angular central moment (ASM) could be used to improve the classification accuracy. Size of the sub terrain frames can be altered for better precision of assessable terrain.
REFERENCES


CLOUD COMPUTING: THE PRESENT AND THE ROAD-MAP AHEAD

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ABSTRACT

This paper describes cloud computing, a next generation technology that uses the Internet and central remote servers to maintain data and applications. The paper provides an overview of cloud, its architecture, characteristics and advantages. Some applications of this new computing paradigm are presented. The future prospects of cloud computing are also discussed in the paper.

Keywords: Cloud, IaaS, PaaS, SaaS, public cloud, private cloud, cloud services.

1. INTRODUCTION

1.1 Cloud Computing is the way of accessing files, software and computing services through the Internet rather than accessing on the desktop computer. It is an emerging computing technology that uses the Internet and central remote servers to maintain data and applications. The idea although still in its infancy stage has permeated to a number of fields. It's called cloud computing because the data and applications both exist on a “cloud” of Web servers [8]. Simply, if the software or the files are "somewhere out there" instead of on the computer's hard drive, then one is using Cloud Computing services. The primary benefits of Cloud Computing include the ability to create, update and store the files through any computer that has access to the web.

1.2 Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with Internet access [1]. This technology allows for much more efficient computing by centralizing storage, memory, processing and bandwidth. It is a general term for anything that involves delivering hosted services over the Internet. The name cloud computing was inspired by the cloud symbol. “The need for computation to be organized as a public utility” was the genesis around which the theory of cloud computing evolved [3].

1.3 It has passed through a number of phases which include grid and utility computing, application service provision (ASP), and Software as a Service (SaaS). The first step for cloud computing was the arrival of Salesforce.com in 1999, which pioneered the concept of delivering enterprise applications via a simple website. The next development was Amazon Web Services in 2002, which provided a suite of cloud-based services including storage, computation and even human intelligence through the Amazon Mechanical Turk.

1.4 In 2006, Amazon launched its Elastic Compute Cloud (EC2) as a commercial web service that allows small companies and individuals to rent computers to run their own computer applications. Next big milestone came in 2009, as Web 2.0 hit its stride, and Google and others started to offer browser-based enterprise applications, through services such as Google Apps. Cloud adoption is expected to grow incessantly.

2. THE ARCHITECTURE, CHARACTERISTICS AND SERVICES OF CLOUD:

The success of cloud computing is largely based on the effective implementation of its architecture. It has two sections: the front end and the back end.

2.1 Front end includes the client's computer (or computer network) and the application required to access the cloud computing system. Not all cloud computing systems have the same user interface. Services like Web-based e-mail programs leverage existing Web browsers like Internet Explorer or Firefox. Other systems have unique applications that provide network access to clients.

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2.2 Back end of the system are the various computers, servers and data storage systems that create the "cloud" of computing services. In theory, a cloud computing system could include practically any computer program you can imagine, from data processing to video games. Usually, each application will have its own dedicated server. The data center could be considered as the backbone of cloud computing architecture. An online application is just a simple application that could be launched in different servers but when the application is considered with cloud computing, it will require massive data centers that will ensure the processes are done as expected and timely. Data centers for cloud computing architecture is composed of different servers with optimal storage capacity and processing speed. They work together to ensure that the application will be operating as expected. The area is usually in a highly controlled environment where it would be constantly monitored through various applications and manually checked for actual physical problems.

3. THE CLIENT-THE END USER

Everything ends with the client. The hardware components, the application and everything else developed for cloud computing will be used in the client. Without the client, nothing will be possible. The client could come in two forms: the hardware component or the combination of software and hardware components. Although it’s a common conception that cloud computing solely relies on the cloud, there are certain systems that requires pre-installed applications to ensure smooth transition. The hardware on the other hand will be the platform where everything has to be launched.

Cloud computing is broken down into three segments:

3.1 Applications: The applications segment of cloud computing is the only segment that has proven useful as a business model. By running business applications over the Internet from centralized servers rather than from on-site servers, companies can cut some serious costs. Furthermore, while avoiding maintenance costs, licensing costs and the costs of the hardware required running servers on-site, companies are able to run applications much more efficiently from a computing standpoint.

3.2 Platforms: The platform segment of cloud computing refers to products that are used to deploy applications. Platforms serve as an interface for users to access applications provided by partners or in some cases the customers. Examples are Salesforce.com's platform force.com, which allows subscribers to access their applications over the Internet. NetSuite, Amazon, Google, and Microsoft have also developed platforms that allow users to access applications from centralized servers. and

3.3 Infrastructure: It is the backbone of the entire concept. Infrastructure vendors provide the physical storage space and processing capabilities that allow for the all the services described above. The products in this segment are slightly more varied than those in the other areas of cloud computing but include ones such as managed hosting, and development environments (such as Google gears) that allow users to build applications.
Each of these segments serves a different purpose and offers different products for businesses and individuals around the world.

4. CHARACTERISTICS

4.1 Cost  Cost is greatly reduced and capital expenditure is converted to operational expenditure

4.2 Device and location independence  It enables users to access systems using a web browser regardless of their location or what device they are using.

4.3 Reliability  Reliability improves through the use of multiple redundant sites, which makes it suitable for business continuity and disaster recovery.

4.4 Scalability  Scalability via dynamic provisioning of resources.

4.5 Security  Security typically improves due to centralization of data.

4.6 Services  A cloud service has three distinct characteristics that differentiate it from traditional hosting.

• It is sold on demand (by the minutes or hours)
• It is elastic -- a user can have as much or as little of a service as they want at any given time;
• The service is fully managed by the provider (the consumer needs nothing but a computer and Internet access).

Services are broadly divided into three categories:

![Fig. 2: Services](image)

5. SOFTWARE-AS-A-SERVICE (SAAS)

5.1 In the past, the end-user would generally purchase a license from the software provider and then install and run the software directly from on-premise servers[6]. Using an On-Demand service however, the end-user pays the software provider a subscription fee for the service. The software is hosted directly from the software providers' servers and is accessed by the end user over the Internet. While this is the most common platform for On Demand software services, there are also some slightly different offerings which can be described as a hybrid of these two platforms. For instance, a program through which the end user pays a license fee, but then accesses software over the Internet from centralized servers is considered a hybrid service. The vendor supplies the hardware infrastructure, the software product and interacts with the user through a front-end interface.

5.2 Services can be anything from Web-based email to inventory control and database processing. Because the service provider hosts both the application and the data, the end user is free to use the service from anywhere. This types of cloud computing delivers a single application through the browser to thousands of customers using a multitenant architecture. On the customer side, it means no upfront investment in servers or software licensing; on the provider side, with just one application to maintain, costs are low compared to conventional hosting.
6. PLATFORM-AS-A-SERVICE

It is defined as a set of software and product development tools hosted on the provider's infrastructure. Developers create applications on the provider's platform over the Internet. PaaS providers may use APIs, website portals or gateway software installed on the customer's computer. Force.com and GoogleApps are examples of PaaS. Developers need to know that currently, there are no standards for interoperability or data portability in the cloud.

7. INFRASTRUCTURE-AS-A-SERVICE

It (like Amazon Web Services) provides virtual server instances with unique IP addresses and blocks of storage on demand. Customers use the provider's application program interface (API) to start, stop, access and configure their virtual servers and storage. In the enterprise, cloud computing allows a company to pay for only as much capacity as is needed, and bring more online as soon as required. Because this pay-for-what-you-use model resembles the way electricity, fuel and water are consumed; it's sometimes referred to as utility computing.

8. CATEGORIES

A cloud is known as pool of virtualized computer resources. Storing data through the Cloud makes it easy for all concerned to be able to retrieve the information they need. This is a necessary process in most businesses, since this makes communication and exchange of information more efficient, and allows remote access to everyone. A cloud can be private or public.

8.1 Public cloud

A public cloud sells services to anyone on the Internet. Currently, Amazon Web Services is the largest public cloud provider. Often depicted as being available to users from a third party provider, "public" clouds are typically made available via the Internet and may be free or inexpensive to use. There are many examples of these types of clouds, providing services across open, public networks today. One example is Amazon Web Services.

8.2 Private cloud

A private cloud is a proprietary network or a data center that supplies hosted services to a limited number of people. "Private" clouds offer many of the same benefits as "public" clouds but are managed within the organization. These types of clouds are not burdened by network bandwidth and availability issues or potential security exposures that may be associated with public clouds. Private clouds can offer the provider and user greater control, security and resilience.

When a service provider uses public cloud resources to create their private cloud, the result is called a virtual private cloud.

9. BENEFITS

9.1 Cloud Computing is one way to save space on your computer, and eliminate the headache of installing and maintaining software [2]. Cloud Computing will someday eliminate the need to store software on your computer. The computer of the future might only need a web browser, and a hard drive could become an optional feature.

9.2 An interesting side effect might be that your choice of operating system becomes almost irrelevant. Who cares if your computer is running Mac OS X, Linux or Windows under the hood, when everything is happening inside the web browser?

9.3 Cloud Computing would make it easier for software companies to provide access to their software, instead of having customers worry about installation, operating systems and computer requirements. People would no longer have to worry about whether a piece of software would work on their computer. Companies delivering software as a service would also save money by eliminating CD-ROMs, paper documentation and packaging. Revenue generating applications may be rated higher than research and development or innovation pilots. For several months IBM has been running a cloud infrastructure that adjusts computer resources appropriately and automatically according to business policies.

9.4 Cloud computing infrastructures can allow enterprises to achieve more efficient use of their IT hardware and software investments. They do this by breaking down the physical barriers inherent in isolated systems, and automating the management of the group of systems as a single entity.

10. AFFECT OF CLOUD COMPUTING

"Cloud computing" has surpassed "virtualization" in terms of search popularity. Companies a few different sub-industries including software companies, Internet service providers and hardware manufacturers will face significant change if cloud computing is to be the next step for the industry[4]. While it is relatively easy to see how the main software and Internet companies will be affected by such a shift, how companies in the Internet and hardware industries will be affected is slightly more difficult.
Companies that are gaining from a shift towards cloud computing include:

- **Yahoo! (YHOO)**
- **Microsoft (MSFT) – windows Live**
- **Google (GOOG) - Apps engine**
- **NetCustomer(NC) - ($35bn approx)**
- **Amazon.com(AMZN)**

![Bandwidth Consumed by Amazon Web Services](image)

**Fig. 3**: Graph shows Amazon Web Services now consume more bandwidth than do the entire global network of Amazon.com retail sites [5].

11. **PRACTICAL ILLUSTRATION OF CLOUD**

Very common example of it, is web-based email, some online services have started expanding their offerings by providing word processing and other office applications online.

**11.1 Google Docs** It is another example, which offers web-based word processing, spreadsheets, presentations, and calendaring functions. You need only access to the Internet, and you can create and store files in these Cloud-based applications. Documents and presentations can be uploaded from your hard drive and stored on the Web. In Cloud-based computing, there's no software to download, and you can even store your documents online. Everything happens in the Cloud, via your web browser.

**11.2 Flicker or Photo bucket** If you're uploading your photos online via Flicker or Photobucket, it means you're in the Cloud.

**11.3 Amazon "EC2"** Amazon Elastic Compute cloud is a web service interface that provides resizable computing capacity in a cloud. It is designed to make web-scale computing easier for developers. It allows developers to only pay for capacity that they actually use.

**11.4 Amazon.com (AMZN)** Amazon.com (AMZN) - Cloud storage
12. CONCLUSION AND FUTURE ROAD-MAPS

12.1 Cloud-computing increases profitability by improving resource utilization. Cloud computing has enabled teams and organizations to streamline lengthy procurement processes. Cloud computing infrastructures are next generation platforms that can provide tremendous value to companies of any size. They can help companies achieve more efficient use of their IT hardware and software investments and provide a means to accelerate the adoption of innovations.

12.2 In early years barriers like bandwidth, perception, loss of control, trust and feasibility all played a role in reasons for not considering a cloud service. Today most of these challenges have been overcome, or countermeasures are in place to resolve the challenges. Faster bandwidth and more particular skills around cloud type technologies enhance the offering.

12.3 Cloud computing is in its early days. If mainframe computing was driven by governments and client-server computing by enterprises, then cloud computing has risen from consumer applications. Enterprises are only now learning how to do things that consumers have been doing for years. Clouds promise to change not only how we compute, but how we play, work, and interact.

12.4 In the future, more cloud adoption is certain, this year alone the move to the cloud by many business has been phenomenal, so much so that some cloud business have grown by over 200%. Large vendors see this as the growing model for software and services in the future so more focus by the vendors is afforded. Do not be surprised if the cloud bursts with offerings over the next 24 months.

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CLI: NEW EVOLUTION OF NEXT GENERATION FIREWALL
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ABSTRACT

“FIREWALLS” are essential aspects of all networks. However they are complex and if not correctly configured and managed may result in security breaches. A Firewall is a combination of hardware and software used to implement a security policy governing the network traffic between two or more networks, some of which may be under your administrative control (e.g., your organization's networks) and some of which may be out of your control (e.g., the Internet). A firewall commonly serves as a primary line of defense against external threats to your organization's computer systems, networks, and critical information. Firewalls can also be used to partition your organization's internal networks, reducing your risk from insider attacks. These firewalls establish a security perimeter that aims to block (or heavily restrict) both incoming and outgoing network communication. The practices in this module will address Designing, Installing, Deploying firewalls. The traditional text-based Command Line Interface (CLI) is a powerful but difficult tool to use. It is inherently sequential requiring multiple commands. With features such as AutoSecure it is possible to automatically generate device configuration code. Furthermore firewall implementation is relatively simple with configuration code again being automatically generated. This project deals with the setting up of firewall, configuring it as per requirements along with STATE TABLE, NAT, RELAY, DHCP, PORT FORWARDING and RRD GRAPHS to secure various scenarios in order to implement the security of the network.

Keywords: User Interfaces, State Model Diagrams, Security Device Manager – ZBF configuration, Command Line Interface – ZBF configuration

1. INTRODUCTION

1.1 “SECURITY” is an essential aspect of network configuration and management. However, a network will typically consist of many different user applications all of which represent potential security breaches. Furthermore there are numerous protocols such as:

- Packet assembler/disassembler (PAD)
- Internet Control Message Protocol (ICMP)
- Simple Network Management Protocol (SNMP)

1.2 They are enabled by default and must be explicitly disabled. Whilst other protocols such as HTTP and HTTPS must be allowed but restricted using access control lists.

- It is essential therefore to disable a potentially wide range of services and devices interfaces that are not being used but selectively restrict other protocols with an appropriate firewall configuration.
- After identifying potential security breaches a router must be configured by means of a firewall.

2. INTRODUCTION TO VARIOUS SUBPARTS OF FIREWALL

2.1 FIREWALL

A FIREWALL is a device that filters TCP/IP packets based on a set of rules. As each packet passes through the system, the rules are processed to determine a “pass” (forward the packet) or “no pass” (drop the packet) decision. Depending on the security policy required, different kinds of rules may be constructed. The Firewall blocks unwanted traffic from a server before the traffic ever reaches the server. The main advantage to having a Hardware Firewall is that a server only has to handle 'good' traffic and no resources are wasted dealing with the 'bad' traffic.
Fig 1: Configuring a Firewall is as simple as creating a set of rules to allow access to certain IP addresses and ports from specific internet addresses
A firewall's complexity is known to increase with the size of its rule set. Empirical studies show that as the rule set grows larger, the number of configuration errors on a firewall increases sharply, while the performance of the firewall degrades. When designing a security-sensitive network, it is critical to construct the network topology and its routing structure carefully in order to reduce the firewall rule sets, which helps lower the chance of security loopholes and prevent performance bottleneck.[1]

2.2 STATE TABLES
The firewall's state table maintains information on open network connections, by default all rules are statefull. Most firewalls lack the ability to finely control state table. As per-rule basis:
- Limit simultaneous client connections
- Limit states per host
- Limit new connections per second
- Define state timeout
- Define state type

2.2.1 NAT
NAT is a router function where IP addresses (and possibly port numbers) of IP datagrams are replaced at the boundary of a private network.
(i) NAT is a method that enables hosts on private networks to communicate with hosts on the Internet.
(ii) NAT is run on routers that connect private networks to the public Internet, to replace the IP address-port pair of an IP packet with another IP address-port pair[3].

2.2.2 DHCP
- The Dynamic Host Configuration Protocol (DHCP) is an auto configuration protocol used on IP networks. Computers that are connected to IP networks must be configured before they can communicate with other computers on the network.
- DHCP allows a computer to be configured automatically, eliminating the need for intervention by a network administrator.
- It also provides a central database for keeping track of computers that have been connected to the network. This prevents two computers from accidentally being configured with the same IP address [5].
- The BOOTP protocol itself was first defined in RFC 951 as a replacement for the Reverse Address Resolution Protocol RARP. The primary motivation for replacing RARP with BOOTP was that RARP was a data link layer protocol. This made implementation difficult on many server platforms, and required that a server be present on each individual network link. BOOTP introduced the innovation of a relay agent, which allowed BOOTP packets to be forwarded off of the local network using standard IP routing, so that one central BOOTP server could serve hosts on many IP subnets[2]

2.2.3 PORT FORWARDING
- Port forwarding or port mapping[1] is the technique of forwarding a TCP/IP packet traversing a network address translator (NAT) gateway to a predetermined network port on a host within a NAT-masqueraded, typically private network based on the port number on which it was received at the gateway from the originating host.
- The technique is used to permit communications by external hosts with services provided within a private local area network.
3. FINDINGS

- The stateful protocol filtering and limited application awareness offered by 1st generation firewalls are not effective in dealing with current and emerging threats.
- Using separate firewalls and intrusion prevention appliances results in higher operational costs and no increase in security over an optimized combined platform [4].
- Next generation firewalls are emerging that can detect application-specific attacks and enforce application-specific granular security policy, both inbound and outbound.
- Next generation firewalls will be most effective when working in conjunction with other layers of security controls.

CONCLUSION

The CLI is a powerful method of device configuration but is syntactically demanding. Furthermore it is not possible to monitor device status in real-time. The CLI represents one extreme of the HCI-S criteria i.e. high trust and minimalistic but difficult to learn. However fault diagnosis for an experienced CLI user will be much simpler. Some of the problems associated with the complex text based CLI can be addressed by using web-based GUIs such as the Security Device Manager (SDM).

- The SDM Wizard is easy to use and can automatically generate device configuration code.
- However the SDM Wizard decouples the administrator from the detail necessary to understand the interaction between protocols and the protocol states.
- Furthermore using this option substantial configuration code is generated even for the simplest level of firewall security.

The Manual SDM provides greater granularity of control. Whilst this represents a more complex configuration option the user is more directly responsible for configuration code generation. The SDM therefore provides different configuration modes ranging from almost entirely automatic with minimal input from the user to one in which the user is able to make menu based selections for each of the five steps in firewall configuration. Furthermore SDM provides options to monitor both device status and firewall operation in realtime.

Finally, it can be concluded that, in the context of the HCI-S criteria, each method has relative strengths and weaknesses.

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ABSTRACT

An emerging trend is what has become commonly known as ‘Medical Tourism’ where patients travel to overseas destinations for specialized surgical treatments and other forms of medical care. With the rise of more affordable cross-border travel and rapid technological developments these movements are becoming more commonplace. Developing a central system that will help management of a group of hospitals from a central authority. This web site will be owned by a Any Group of national or international repute. The web site will provide information about all hospitals. This provides a brief overview of the most recent development in Medical Tourism and examines how this is linked to the emergence of specialized internet web sites. It produces a summary of the functionality of medical tourist sites, and situates Medical Tourism informatics within the broader literatures relating to information search, information quality and decision-making.

Keywords : Cross Border, Informatics, RAD, Surgical medical tourism

1. INTRODUCTION

Medical Tourism is not a new phenomenon. In terms of cross-border travel for health care there is a long history including the use of spas and wellness tourism that gained a mass market throughout eighteenth and nineteenth century Europe. Traditionally, consumers from all continents and forms of health systems have travelled abroad for their healthcare to avoid waiting lists or access state-of-the-art techniques and receive better aftercare services. With the rise of more affordable cross-border travel, rapid technological developments (encompassing both surgical techniques as well as the increased volume and access to ‘quality’ medical information on the internet) these transactions are becoming more frequent and potentially serve as a wide consumer market. The lack of health resources has been cited in the past as encouragement for students to go and operate in these underserved areas. The operative principle seems to be that some surgery, however expert, is better than none. Raja and Levin disagree and counter that the lack of available resources in a society makes a greater imperative for getting surgery done right the first time. Poor surgical outcomes will burden the health system with increased iatrogenic morbidity. “[2]

In this project we will create the website that will that will allow client from all over the world to get the details of various hospitals across INDIA. The site will contain various information such as:

- Number of specialized hospitals for specific diseases.
- Information about the specialist.
- Facilities provided by the hospital like Number of Beds available.
- Room facilities.
- Online Booking.
- Number of hospitals in a specific location.

Information regarding location of particular hospital.

2. NEED

Provision of ‘cost effective' private medical care in collaboration with the tourism industry for patients needing surgical and other forms of specialized treatment. This process is being facilitated by the corporate sector involved in medical care as well as the tourism industry-both private and public. Medical tourism (also called medical travel, health tourism and global health) is a term initially coined by travel agencies and the media to describe the practice of rapid growth in travel abroad for health care. It also refers disparagingly to the practice of medical professionals travel the world to deliver health [1] [3].
The idea of a healthy holiday is to offer you an opportunity to get away from your daily mundane routine and get into a relaxing ambience. Medical tourism provides an avenue to enjoy the beach and the mountains and also improve your quality of life in terms of health and general well being. It is like rejuvenation on all levels-physical, mental and emotional. Let us now get into a specific area, which is in great demand in India

Few Problem can’t be tackled by traditional techniques:

- The basic problems with the existing systems are the non-interactive environment they provide to the users.
- The use of traditional user interfaces which make continuous post backs to the server; each post back makes a call to the server, gets the response and then refreshes the entire web form to display the result. This scenario adds an extra trade off causing a delay in displaying the results.
- A search engine that would display the results without allowing the users to further filter the results based on various parameters.
- Use of traditional and non user friendly interfaces that are hard to use
- Even the best trained western physicians will face challenges adapting to a new medical environment. Bioethicist Ross Upshur and Andrew Pinto of the University of Toronto Faculty of Medicine point out that “medical training in a developed world context does not translate to competence in all settings. Rather one should recognize that being in a different setting puts one at a disadvantage, especially in clinical medicine.”[5]

Problems exist in medical tourism is existing system can’t update the recent information to the clients.

3. HOW IT WILL WORK?

![Overview of Cross Border Medical Tourism System](image)

3.1 Pseudo Algorithm
- Gather the information from various resources.
- Convert this information in web forms, XML pages.
- Store the above mentioned information in database.
- Access through server
4. SCOPE

- It would be beneficial for patients.
- It would be beneficial for those people who are unfamiliar or new to a particular area and unknown to the various hospitals in that area.
- Beneficial for government to spread information regarding medical centers that provides medication for epidemics.

4.1 In Society

- Providing opportunities to patients who want to better understand and manage their treatment (overseas).
- Making improvement for NHS’ patients’ chronic waiting list.
- Providing lower cost medical treatment via medical tourism.

4.2 In Industry

Business opportunities for organisations which provide medical support services, including both overseas and local organizations

4.3 In Academic

A self-help model that can increasingly be adopted by the UK as the planned/expected changes are implemented and the system moves to a more open free market model similar to the medical tourism model. In Europe Belgium, Poland and Slovakia are also breaking into the business. South Africa taking the term "medical tourism" very literally by promoting their "medical safaris" [4].

CONCLUSION:

In a nutshell we conclude that this portal will provide many advantage to the patients such as:-

- One –point solution for patients
- It would provide the relevant response of client query or information regarding location of hospitals in unfamiliar place and information about rates ,facilities of various hospitals according to area.
- The response time would be small.
- This project/website would be easy to maintain and update by some third party also.
- It would endure the overload as we are using such technologies which create light weight process.
- As per the security is concern over the internet, this website would not allow the virus/worms to be executed or access the resources.

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