Discovering the Potential

Computer Society of India

A National Publication Dedicated to IT Education, Research and Student Community

www.csi-india.org
ABOUT CSI

The seed for the Computer Society of India (CSI) was first shown in the year 1965 with a handful of IT enthusiasts who were a computer user group and felt the need to organize their activities. They also wanted to share their knowledge and exchange ideas on what they felt. Today the CSI takes pride in being the largest and most professionally managed association of and for IT professionals in India. The purposes of the Society are scientific and educational directed towards the advancement of the theory and practice of computer science and IT. The organisation has grown to an enviable size of 100,000 strong members consisting of professionals with varied backgrounds including Software developers, Scientists, Academicians, Project Managers, CIO's, CTO's & IT vendors to just name a few. It has spread its branches all over the country. Currently having more than 500 student branches and rooted firmly at 73 different locations, CSI has plans of opening many more chapters & activity centres in smaller towns and cities of the country. The idea is to spread the knowledge, and provide opportunities to as many interested as possible.

The CSI Vision: "IT for Masses"

Keeping in mind the interest of the IT professionals & computer users CSI works towards making the profession an area of choice amongst all sections of the society. The promotion of Information Technology as a profession is the top priority of CSI today. To fulfill this objective, the CSI regularly organizes conferences, conventions, lectures, projects, awards. And at the same time it also ensures that regular training and skill updating are organized for the IT professionals. Education Directorate, CSI helps physically challenged citizens by providing training. CSI also works towards a global approach, by seeking out alliances with organizations overseas who may be willing to come forward and participate in such activities. CSI also helps governments in formulating IT strategy & planning.
## Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilization Of Bio-Sensors In Smart Textiles For Smart Diagnostics</td>
<td>5</td>
</tr>
<tr>
<td>Amoled Display Technology</td>
<td>17</td>
</tr>
<tr>
<td>Surface Computing</td>
<td>20</td>
</tr>
<tr>
<td>Blue Eye Technology</td>
<td>25</td>
</tr>
<tr>
<td>Computer Based Numerical And Statistical Techniques (CBNST) And Its applications</td>
<td>28</td>
</tr>
<tr>
<td>Introduction Of BCI Based On Electroencephalogram</td>
<td>37</td>
</tr>
<tr>
<td>3-D Printing</td>
<td>48</td>
</tr>
<tr>
<td>Machine Learning For Data Analytics</td>
<td>54</td>
</tr>
<tr>
<td>Entertainment Robot</td>
<td>57</td>
</tr>
<tr>
<td>How The Internet Is Destroying Our Brain</td>
<td>60</td>
</tr>
<tr>
<td>MANET ~ &quot;MOBILE AD HOC NETWORK&quot;</td>
<td>63</td>
</tr>
<tr>
<td>Medical Robots</td>
<td>66</td>
</tr>
<tr>
<td>Military Robots</td>
<td>68</td>
</tr>
<tr>
<td>Nano Robots</td>
<td>70</td>
</tr>
<tr>
<td>Nanotechnology: The Future Medicine</td>
<td>72</td>
</tr>
<tr>
<td>Socket Programming With Java</td>
<td>75</td>
</tr>
<tr>
<td>5G-2020D2D</td>
<td>82</td>
</tr>
<tr>
<td>Information And Communication Technology (ICT) For Digital India</td>
<td>88</td>
</tr>
<tr>
<td>The Rise Of The Dark Net</td>
<td>92</td>
</tr>
<tr>
<td>White Space Technology</td>
<td>94</td>
</tr>
</tbody>
</table>
Disclaimer: CSI Adhyayan contains information about new technologies useful for students. The information contained in this newsletter is not advice, and should not be treated as such. You must not rely on the information in the newsletter as an alternative to information from research journals.

We do not represent, warrant, undertake or guarantee:

- that the information in the newsletter is original, correct, accurate, complete or non-misleading
- that the use of guidance in the newsletter will lead to any particular outcome or result; or

We will not be liable to you in respect of any losses arising out of any event or events beyond our reasonable control. We will not be liable to you in respect of any business losses, including without limitation loss of or damage to profits, income, revenue, use, production, anticipated savings, business contracts, commercial opportunities or goodwill. We will not be liable to you in respect of any special, indirect or consequential loss or damage.
UTILIZATION OF BIO-SENSORS IN SMART TEXTILES FOR SMART DIAGNOSTICS

Compiled by:
Pranavi Jalapati and Satya Naraparaju

INTRODUCTION:

The role of technology in improving the care and understanding of dementia was prominent, as demonstrated by the need for the day. Much discussion focused on how the potential uses of technology can be harnessed in research and clinical care settings and the facilitators and barriers to this. Smart Textiles (or) Smart Fabrics play key role in the development of the technologies that can be used to track or observe the patients in a non-obtrusive methodology.

SENSORS

In addition, fabrics with embedded biosensors have now been developed that permit continuous remote physiologic monitoring of multiple vital functions. These “smart garments” are capable of alerting family and professional caregivers of aberrations from a prior baseline and incident medical conditions that may otherwise escape detection until complications are evident and unavoidable.

Thermodynamic laws state that energy can neither be created nor destroyed but can only be transformed from one form to the other. A transducer is a modern day device that accomplishes this task at signal level and the process of conversion is called transduction. Their most common application is in automation, measurement and control systems where electrical signals are converted into physical signals. A sensor is one such transducer which responds to stimulus. Sensors can broadly be classified as active and passive sensors depending on their functionality.

Passive sensors technologies gather target data through the detection of vibrations, light, radiation, heat or other phenomena occurring in the subject’s environment. Examples of passive sensor-based technologies are Photographic, thermal, electric field sensing, chemical, infrared and seismic. They contrast with active sensors, which include transmitters that send out a signal, a light wavelength or electrons to be bounced off the target, with data gathered by the sensor upon their reflection. Examples of active sensor technologies are LIDAR and radar.
numerous genera of sensors are available in the market, each having a varied application. Some such sensors are listed below:

1. Pressure sensor
2. Humidity sensor
3. Gas sensor
4. PIR sensor
5. Acceleration sensor
6. Force measurement sensor
7. Gyro sensor
8. Chemical sensor
9. Bio-sensor

biosoNSORS:

A biosensor is a combination of a device for the detection of a biological component called an analyte and a physicochemical detector component to detect the analyte. The later component is what is primarily called the sensor. In the presence of an analyte, the sensor perceives it and generates an electric signal which is transmitted. At the receiving end, these signals are amplified and projected. Thus, it can be generalized that a biosensor is a device which reads and converts a chemical flow of information into a transferable electric signal. the biological materials used in biosensors are mostly enzymes, lectins, nucleic acids, antibodies, a cell as a whole etc.
COMPONENTS AND MECHANISM OF A BIOSENSOR:  
A BIOSENSOR MAINLY CONSISTS OF TWO PARTS

Biological part: This constitutes of enzymes, antibodies etc., which interact with the analyte particles and depending on the type of sensor, induce a physical change in these particles.

Transducer part: It is the processing part which collects the information from the biological part, converts, amplifies and displays them at the receivers end. In order to form a biosensor, the biological particles are immobilized on the transducer surface which acts as a point of contact between the transducer and analyte.

CLASSIFICATION:

Based on the mode of interaction, biosensors can be classified into two types as follows:

- Catalytic biosensor: These biosensors modify the analyte resulting in a new chemical molecule. The primary analyte used is mostly an enzyme.
- Affinity biosensor: Here, upon interaction, the analyte binds to the biomolecule on the biosensor. These are mainly composed of antibodies, nucleic acids etc.

ESSENTIAL PROPERTIES OF A BIOSENSOR:

- Specificity: A biosensor should be specific to the analyte which it interact.
- Durability: It should withstand repeated usage.
- Independent nature: It should not be affected by variations in the environment like temperature, pH etc.
- Stability: The results produced by interaction should be corresponding to the concentration of analyte.
- Ease of use and transport: It should be small in size so that it can be easily carried and used.

TYPES OF BIOSENSORS:

- Calorimetric biosensor: These sensors are based on the principles of heat exchange. Some enzyme-analyte reactions are exothermic and releases heat into the sample which is detected using a transducer. This is the most common and applicable biosensor used. 80% of the heat generated in the reaction is calculated as enthalpy change using transistors.
- Potentiometric biosensor: These sensors are based on electric signals. Any electric potential produced as a result of interaction between the analyte and component is detected by the transducer. The three main ion-selective electrodes used in such type of biosensors are glass electrodes for cations, glass pH electrodes and solid-state electrodes.
- Amperometric biosensor: These sensors work using the redox reactions between the analyte and component. In some cases, when an analyte comes in contact with biological material, it induces a redox reaction. This results in movement of electrons which is picked up by transducer. The most common type of electrode used in amperometric biosensors is the Clark Oxygen electrode.
- Optical biosensors: These sensors work on the principles of light energy. When the change produced by the interaction of an analyte is in the form of light energy, it is picked up by the
transducer which in turn transmits it. The results are recorded using the colorimetric test strips. These biosensors are mostly used for whole-blood monitoring in diabetic patients.

- **Acoustic wave biosensors:** When the biological component of biosensor undergoes a biomass change, it is ascertained by a transducer. Acoustic wave sensors are a class of MEMS (micro-electro-mechanical systems). They sense physical phenomenon based on modulation of surface waves.

## WEARABLE BIOSENSORS

Wearable Biosensors often refer as WBS has gained great importance in recent times as they promise significant applications and advancements in the field of health sciences. Wearable monitoring devices constantly monitor the physiological signals which help in diagnosis of disease and can further be enhanced for treatment. The data obtained by these sensors can be logged and can be used as the patient’s health record. They have added advantages like cost efficient, ease of use, etc. Wearable Biosensors is structurally a wearable such as a smart watches, clothes, bandages, tattoos, patches, spectacles, rings etc. which houses a biosensor. Gwent Biotechnology Systems, Rapid Labs and PalmSens are some of well known manufacturers of biosensors.

## FUNCTIONING OF A WBS:

The wearable components of the biosensors such as shirts, watches, bandages, etc are very advantageous as they are closely placed to the target and can constantly monitor the blood-glucose levels, blood pressure, heart beat rate and other biometric data. The stimuli generates is perceived, interpreted by the biosensor which in turn transfers the information wirelessly. The transmitted data is logged and can be remotely accessed by the doctors who can provide health support as required.

![Figure 3: Process Flow of Wearable Sensors.](image)

## RECENT DEVELOPMENTS ON WEARABLE BIOSENSORS

The biosensors market has numerous and significant applications in cardiac monitoring, diabetes monitoring, bio-defense practices and drug discovery. According to the statistics put forth by Transparency Market Research, the market value of biosensors is expected to reach $18.9 billion by 2018. Some recent developments of WBS are discussed below.
1. Google Smart Lens

Google smart lens designed by Google is a contact lens which analyses tears and measures the amount of glucose. The sensor used is a glucose sensor and is combined with a wireless chip. The entire setup is embedded between the layers of a lens. A small hole in the lens allows the tear fluid to come in contact with the sensor which measures the blood glucose levels. The lens is placed externally and hence does not affect the eyeball.

2. Healthpatch Biosensor

Healthpatch developed by the company Vital Connect is a wearable biosensor for effective diagnosis of chronic diseases and uses Bluetooth as a mode of wireless transmission. It is a disposable patch designed to be placed on the chest. It tracks various biometric data like Pulmonary (sleep duration, Respiratory rate, sleep quality, sleep actigraph/sub-posture), Neurologic (Gait analysis, fall detection/severity), and Cardiovascular (heart rate variability, heart rate, Single-lead ECG, contextual heart rate).

4. Q™ Sensor

MIT has launched a wearable biosensor named Affective Q™ which can track human emotions. This WBS measures the physiological responses such as Galvanic Skin Response or skin conductance, temperature and motion. Later the results are wirelessly transmitted over Wi-Fi. The motto behind this sensor is to analyze, measure and communicate emotions.

5. Simband Wearable Biosensors

Simband brought out by Samsung is a wristband with a display. It monitors body in real time. The data collected from the user is reported to the SAMI (Samsung Architecture Multimodal Interaction) cloud. The band projects light beams of varied intensities onto the skin. These beams penetrate through the skin to gather data both on the surface and deep inside. The screen displays metrics like blood pressure and heart rate. The band is
powered by a 1GHz and 28nm ARM Cortex-A7 chip and wirelessly connects using both Wi-Fi and Bluetooth.

6. Biosensor tattoos

A sensitive and fairground WBS tattoos help to monitor electrolytes and metabolite levels in sweat. The tattoo uses electrochemical sensors which monitor sweat for pH and lactate levels. The amount of ammonia, sodium and electrolytes in sweat are directly proportional to the physical activity of the. The tattoo can either be applied onto the skin or on clothing.

7. Ring Sensor

Ring Sensor is a wearable ring which houses a pulse oximetry sensor. This sensor monitors the heart rate and oxygen saturation. The ring has a single processor and is embedded with red LED, Infra-red LED and a photodiode which transmit waves to the server through a digital wireless communication link. The heart beat pulses obtained by sensor are noise free which makes it way more efficient than the other sensors.

8. Smart Shirt

Georgia tech has developed a smart shirt which uses optical fibers to detect wounds. It also uses special sensors and interconnects to monitor the vital signs like heart rate, respiratory rate and temperature in a systematic way. It is a two way wearable technology equipped with T-connectors. These connectors are attached to optical fibers and act as data bus to transmit data from the sensors to the body.

SMART TEXTILES

When the term smart textile is referred, it is a textile platform that senses and reacts to human body or external environment without electronic control. The first generation of e-textiles contain a similar range of materials as today’s commodity electronic products. In other words, it is composed of off-the-shelf technology such as arrays of small light-emitting diodes.

The development of smart textiles mainly focuses on three areas:

- Conductive materials
- Miniaturized electronics(integration of electronics into textiles and products)
- Wearable technologies with the use of wireless communication (to allow both people and device communication).
Bluetooth Low Energy (BLE) has been one of the most important breakthroughs in the Smart-Textile industry allowing wearable devices to connect to smart phones as hub devices and transmit/receive high volumes of data over higher ranges with a much lower amount of power than previous versions. Moreover, it cut the need for frequent re-charging from hours or days to weeks.

TECHNOLOGIES USED FOR SMART TEXTILES

Body worn systems endowed with sensing, processing, actuation, communication and energy harvesting and storage abilities are emerging as a solution to the challenges of ubiquitous monitoring of people in application such as healthcare, lifestyle, protection and safety. Accordingly, the new generation of clothing will be able to sense, communicate data and harvest energy in a nonintrusive way. The different technologies used in smart textiles are follows:

- Fibre and thread production
- Extrusion, spinning, plying and coating
- Textile Production
- Knitting, weaving, braiding, embroidering and sewing
- Construction and connection Technology
- Soldering, adhesive bonding, crimping

Among the fabrics used in the textile industry, three are elected for the fabrication of textile-based wearable devices. These include Polymer-based, carbon-based, and metallic materials.

Polymer-Based Conductive Textiles

Conductive polymers has various applications such as chemical and biological sensors, drug delivery, biomedicine, etc. experiments have proved that conjugate polymer polypyrrole(PPy) has high conductivity paired with chemical and environmental stability. PEDOT (poly-(3, 4-ethylenedioxythiophene) also exhibits high electrochemical stability in oxidized form due to its planar structure. It is described with its high conductivity and good electrical, thermal and chemical stability compared to PPy.

Carbon-Based conductive Textile

Carbon-based materials including carbon nanotubes (CNTs), carbon fibres, carbon nanoparticles and graphene present extraordinary properties such as high mechanical strength, light weight, environmental stability, superior thermal and electrical conductivity. Among the materials, CNT is majorly used due to its low density, higher tensile and compressive strength. The fibres such as cellulose or polyester yarns are coated with CNT with dipping and drying method.

Metal Textiles

Metal textiles conductive fabric provides excellent shielding effectiveness and surface conductivity which can be designed to modify the shape and profiles for architectural and die-cut requirements. Micro fabrication process mainly includes vacuum deposition apart from sputtering or evaporation methods. However these techniques have huge drawbacks including expensive instruments, limited sample size, and non-compatibility for batch process. Hence, electroplated or electro less plated metals, metallic nano-materials, liquid materials are opted over the metal textiles. For instance, yarn
is coated with conductive material. The electronic components are integrated into textiles by adoption, seamless integration and combination.

**Adoption:** Distinct electronic devices are embedded into a textile platform.

**Seamless integration:** The devices are incorporated throughout the textile materials.

**Combination:** Textile materials and structures with inherent electronic functionality.

Various textiles are available in the market depending upon the chemical factors such as tensile strength, conductivity, etc.

---

**FABRICATION OF E-TEXTILES**

Conductive yarns which are highly durable, flexible, and even washable multilayer electronic circuitry can be constructed on textile substrates. Electrically conductive textiles are produced by means of conventional textile processes such as knitwear, woven narrow fabrics, 3d Textiles, braids, etc. e-broidery is used to stitch patterns that define circuit traces, component connection pads, or sensing surfaces. However yarns and threads used in high speed embroidery process have to be considered with respect to their electrical and mechanical properties. It must be made sure that they are flexible and strong enough to be sewn at high speeds without any breaks in either the thread or the electrical continuity.

The properties must sustain through washing, dry-cleaning, etc. Circuits with low power consumption and high input impedances are given higher preference. Many methods that exist to fabricate circuits on flexible substrates rely on the metallization of flexible polymer substrate. The fibre can withstand the temperatures of conventional soldering process. For instance, Kapton (polyimide) is typically used in cameras, printer.

---

**FIBRE OPTIC SENSORS**

Mainly three different varieties of optical sensors and splices are utilized in the woven fabric. These include Extrinsic Fabry-Perot Interferometer (EFPI), Long Period Grating(LPG), and Fibre Bragg Grating(FBG). When an optical fibre consists of a splices, then it introduces discontinuities in the fibre.

---

**FBG**

FBG sensors are used to measure the temperature or strain of the host material. Fibre Bragg grating (FBG) is based upon the principle of distributed Bragg reflector that can be used as an inline optical filter effectively blocking certain wavelengths. Fibre Bragg Grating Sensors play a major role in biomechanics and rehabilitation applications due to their small size, light weight, biocompatibility. They have wide range of applications in measuring a variety of physical parameters or for performing high-sensitivity biochemical analysis. FBG-based sensors can be used for detecting strain in bones, chest wall deformation, etc. Hence such sensors can be used for in vivo measurement as they offer high-performance alternative when compared to ESG, piezoelectric, etc.
Researchers have proposed a wearable system based upon an FBG sensor that allows simultaneous detection of both heart and respiratory cycles. The sensor is embedded to a PVC laminate that is stress sensitive.

**LPG**

LPG is another sensor where germina-doped fused-silica glass is photosensitive. Thus the refractive index can be varied thereby modulating optical fibre.

**EFPI**

EFPI is mainly used as pressure sensors that find various applications in industrial and biomedical fields. EFPI are employed in the textile industry as Fibre-tip FPI sensors which combines the advantages of both optical fibre and the Fabry-Perot interferometer sensors. Polymer films are fabricated onto the fibre tip which is few micrometers thick. On the other hand, the film's chemical and thermal instability are unfavourable.

Optical MEMS pressure sensor is based upon the principle of Fabry-Perot interferometry. Artificial hair cells measure the flow of air or liquids can be used on polymer substrates.

**PRESSURE SENSORS AND HEAT FLOW SENSORS**

Pressure sensors can be used to measure the activity of different muscles that can help sportsmen train specific muscles or give feedback.

Determination of heat flow between the human body and the environment can improve the comfort, efficiency, as well as the safety of the wearer. Henceforth, heat flow sensors are embedded by weaving a thermoelectric wire into the textile. The wire basically consists of two metals, preferably constantan and copper. It works on the principle of Seebeck effect, which states that the temperature difference between two different electrical conductors produces a voltage difference.

**INERTIAL SENSORS**

The physical activities of a person can be monitored with respect to the inertial measurement unit based devices. Sensors such as accelerometer and gyroscopes are considered as inertial sensors are mainly aimed at identifying initial contact and final contact instants. Upon the principle, wearable 3D IMU was developed to estimate countermovement jump height which is associated with lower limb force. Similar researches are being conducted using the accelerometer-based systems to obtain reliable results during the maintenance phase of sprint running. The studies portray the opportunity to collect information in different sport fields utilizing inertial sensors without constraining the athlete.

**RESEARCH AND SCOPE**
The unobtrusive integration on clothing will help the future research in the textile industry. The development of the textiles and their use in design greatly depends upon the extent to which technological advances. The leading companies such as Geneva are creating clothing that combines design along with sensory technologies to make the garments more interactive. Microencapsulation technology is being used in thermal clothing to reduce the impact of extreme variations in temperature. Moreover, the encapsulated glycerol state and silk protein moisturizers can be embedded into bandages and support hosiery. Extensive medical treatment is made available through the textiles which are in direct contact with skin. Research group like Medical Textiles/Biomaterials are trying to develop an optimization of a drug release system using the non-woven structures.

By 2050, the world population is anticipated to be around 9.7 billion –smart textile industries development will help meet the needs of the people. Further research in flexible electronics, like Bluetooth Low-Energy technology will help in growth and the living standards of human race. Assistive fibers will benefit the elderly population for more healthrelated advanced technologies. Along with the medical industry, smart textiles play a major role in the transportation market such as development of heated seats and inflatable seatbelts. It holds around 27 percent of the present market. Militaries such the U.S. Military (DARPA) are interested upon clothing that can be powered with solar powered electricity. The textiles should be water repellent and should be able withstand the harsh conditions testing upon their durability. A major component in this industry is MEMS. The MEMS market is expected to reach one trillion units per year in the coming decade due to its various applications and scenarios. They are being used in the biomedical field for research as well as industrial purposes. These devices developed represent non-invasive and effective solutions to detect falls in controlled environment. The development in sensors can result in a solution for the disabled.

Another on-going research, HARKEN (Hear and Respiration In-Car Embedded Non-intrusive sensors) is a European project developed for the interior of the car such as the car seat, seat belt, etc. The project focuses upon the drowsy drivers who are accident prone. Similarly, University of Illinois scientists have developed an ultrathin electronic patch that can monitor the brain as well as other muscle activity in a non invasive principle.

Several chemical and biochemical wearable sensors have been developed including pH sensors to detect seat, oximeter sensors, etc. However, the optimization and assessment in the clinical trials is necessary before they are exploited and released for mass production. Technologies such as Micro needle technology offers minimal invasive means of bio sensing the biocompatible devices. It is based upon the principle of fluid sampling by overcoming the skin barrier. An array of 38,000 active needles is utilized to determine the flow rate of the fluid.

Despite the advantages the smart textiles is facing major issues, the technical usability is considered regarding the number of sensors that can be placed on a body. As the sensors move along with the

<table>
<thead>
<tr>
<th>Application Segment</th>
<th>2006</th>
<th>2007</th>
<th>2012</th>
<th>CAGR% 2007-2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military</td>
<td>0.0</td>
<td>Negligible</td>
<td>4.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Biomedical</td>
<td>0.1</td>
<td>0.3</td>
<td>79.0</td>
<td>201.9</td>
</tr>
<tr>
<td>Homeland defense/public safety</td>
<td>Negligible</td>
<td>Negligible</td>
<td>3.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Vehicle safety and comfort</td>
<td>0.0</td>
<td>0.0</td>
<td>54.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Logistics and supply chain</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computing</td>
<td>1.3</td>
<td>3.3</td>
<td>17.9</td>
<td>88.5</td>
</tr>
<tr>
<td>Consumer products</td>
<td>80.5</td>
<td>76.0</td>
<td>139.3</td>
<td>20.5</td>
</tr>
<tr>
<td>Other</td>
<td>0.0</td>
<td>0.0</td>
<td>8.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>70.9</td>
<td>73.6</td>
<td>391.7</td>
<td>37.9</td>
</tr>
</tbody>
</table>

FIGURE 5: MARKET ANALYSIS.
body, the researcher should compensate for these movements. The minimization of the number of sensors used for reliable measurement of activities should also be considered.

CONCLUSION

The recent development in information technologies (ICT), wearable technologies and smart textiles has changing the way to conceive the world. Smart textiles are the results of a disciplinary approach that creates an intersection and overlapping of researches in different fields such as textile, design and technology, chemistry, physics, material science and computer science and technology. For example, invisible helmet is an example of how advanced wearable technology including sensor and airbag technologies and textile transforms this view of wearing a helmet. This is an example where technology is transferred into textile.

Several of the companies are focusing on tailor-made solutions for their customers. The research and development on smart textiles at EU levels have put the faith in technology as a solution to a number of problems. All of them are based on speculations rather than thorough fully investigations about the real need for technology and such approaches in smart textiles resulted in technology looking for a problem and in many cases an existence. In order to successfully introduce smart textiles in fashion there is a need for a multitude of methodologies such as in arts, technology, etc. The smart textile industries should create textile products that interact by combining smart materials and integrated computing power to such applications. This combination offers an opportunity to develop textiles with a new type of behavior and functionality.

Another issue arises, how the person utilizes the sensor. For example, what is the guarantee that the user will keep the sensor at the proper orientation? The integration of electronic hardware must be flexible. Cost-reduction and product-improvement must be encouraged for better market.

The biggest barriers to the growth lie in the lack of bulk manufacturing capability. Enterprising innovators should be encouraged to the bridge the gap between the creators and the public. Companies such as Fibertronic Ltd, Interactive Wear AG and Ohmatex are introducing new type of fabric connectors that can be adapted. Body sensors over time can help monitor levels of physical activity at baseline pre-intervention. The measures can be used to maintain statistical analysis and for traditional behavioral assessments. So far, there have been relatively few e-textile commercial successes and much of the sector remains niche. The development in sensors changes the ideology of one-size-fits-all to more subject-centric form of adaptive behavioural intervention.

REFERENCES

About the Authors:

Ms. Pranavi Jalapati [CSI:- 01355162] is studying in III year of B.Tech (CSE) at G. Narayanamma Institute of Technology and Science, Hyderabad (Telengana). Her areas of interest are Data Analytics, App Development, Network Security and programming etc. She can be reached at pranavi.jalapati@gmail.com.

Ms. Satya Naraparaju [CSI:- 01355180] is studying in III year of B.Tech (CSE) at G. Narayanamma Institute of Technology and Science, Hyderabad (Telangana). Her areas of interest are Data Analytics, App Development, Network Security, programming etc. She can be reached at satyanaraparaju@gmail.com.
AMOLED DISPLAY TECHNOLOGY

Compiled by:

Deepak Pandey

ABSTRACT

There have been several technologies invented for mobile and television displays. Active Matrix Organic Light Emitting Diode or AMOLED is one of them. In this display technology a very thin film has been used which was coated with several organic electroluminescent compounds. The whole technology is too dealt with the pixel quality of the displays. As of now this display technology has been implanted very successfully in small screens like in smart phones. This technology is not very affordable, but also available with improved quality picture. In very near future AMOLED will be used for bigger screens. The active matrix OLED in AMOLED technology produces a light after it is properly electrically activated. It requires a continuous flow of electricity and that is controlled by two TFTs. The benefit of this technology over others is immense. AMOLED technology consumes lesser power and also the refresh rate is very high than other counterparts. The response time of touch displays developed using this technology is far better compared to others. In future it is going to be used not only in portable electronic devices, but also in large screens such as more than 50 inches. Already several big names in the electronics and mobile world have started using an AMOLED including Samsung, Moto, etc.

AMOLED (ACTIVE MATRIX OLED): INTRODUCTION

OLED displays use organic materials that emit light when electricity is applied. OLEDs enable emissive, bright, thin, flexible and efficient displays. OLEDs are set to replace LCDS in all display applications – from small displays to large TV sets.

The term AMOLED means Active Matrix OLED. The ‘active-matrix’ part refers to the driving electronics, or the TFT layer. When you display an image, you actually display it line by line (sequentially) as you can only change one line at a time. An AMOLED uses a TFT which contains a storage capacitor which maintains the line pixel states, and so enables large size (and large resolution) displays.

COMPARISON TO OTHER DISPLAY TECHNOLOGIES

AMOLED displays provide higher refresh rates than passive-matrix, often reducing the response time to less than a millisecond, and they consume significantly less power. This advantage makes active-matrix OLEDs well-suited for portable electronics, where power consumption is critical to battery life.
The amount of power the display consumes varies significantly depending on the color and brightness shown. As an example, one commercial QVGA OLED display consumes 0.3 watts while showing white text on a black background, but more than 0.7 watts showing black text on a white background, while an LCD may consume only a constant 0.35 watts regardless of what is being shown on screen. Because the black pixels actually turn off, AMOLED also has contrast ratios that are significantly better than LCD.

AMOLED displays may be difficult to view in direct sunlight compared with LCDs because of their reduced maximum brightness. Samsung’s Super AMOLED technology addresses this issue by reduction the size of gaps between layers of the screen. Additionally, PenTile technology is often used for a higher resolution display while requiring fewer sub pixels than needed otherwise, sometimes resulting in a display less sharp and more grainy than a non-(pen tile) display with the same resolution.

### COMPARISON BETWEEN MULTIPLE AMOLED TECHNOLOGIES:

Below is a mapping table of marketing terms versus resolutions and sub-pixel types. Note how the pixel density relates to choices of sub-pixel type.

<table>
<thead>
<tr>
<th>TERM</th>
<th>RESOLUTION</th>
<th>SIZE (INCHES)</th>
<th>PPI</th>
<th>PIXEL LAYOUT</th>
<th>USED IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMOLED</td>
<td>240x320</td>
<td>2.6</td>
<td>154</td>
<td>RGBG Pen Tile</td>
<td>Nokia N85</td>
</tr>
<tr>
<td>AMOLED CAPACITIVE TOUCHSCREEN</td>
<td>640x360</td>
<td>3.2</td>
<td>229</td>
<td>RGBG Pen Tile</td>
<td>Nokia C6-01</td>
</tr>
<tr>
<td>FULL HD SUPER AMOLED</td>
<td>1920x1080</td>
<td>5.5</td>
<td>432</td>
<td>RGBG Pen Tile</td>
<td>Meizu MX5</td>
</tr>
<tr>
<td>FULL HD SUPER AMOLED</td>
<td>1920x1080</td>
<td>5.2</td>
<td>423</td>
<td>RGBG Pen Tile</td>
<td>Moto X</td>
</tr>
<tr>
<td>FULL HD SUPER AMOLED</td>
<td>1920x1080</td>
<td>5.1</td>
<td>401</td>
<td>RGBG Pen Tile</td>
<td>OnePlus3</td>
</tr>
<tr>
<td>FULL HD SUPER AMOLED</td>
<td>1920x1080</td>
<td>5.7</td>
<td>388</td>
<td>RGBG Pen Tile</td>
<td>OnePlus X</td>
</tr>
<tr>
<td>FULL HD SUPER AMOLED</td>
<td>1920x1080</td>
<td>5.1</td>
<td>441</td>
<td>RGBG Pen Tile</td>
<td>Samsung Galaxy S4</td>
</tr>
<tr>
<td>HD SUPER AMOLED</td>
<td>1280x720</td>
<td>5.0</td>
<td>295</td>
<td>RGB S-Stripe</td>
<td>Blackberry Z30</td>
</tr>
<tr>
<td>HD SUPER AMOLED</td>
<td>1280x720</td>
<td>5.3</td>
<td>285</td>
<td>RGBG Pen Tile</td>
<td>Samsung Galaxy Note</td>
</tr>
<tr>
<td>SUPER AMOLED</td>
<td>640x360</td>
<td>3.5</td>
<td>210</td>
<td>RGB S-Stripe</td>
<td>Nokia N8</td>
</tr>
</tbody>
</table>
WQHD SUPER AMOLED | 2560x1440 | 5.5 | 534 | RGBG Pen Tile | Moto Z Moto Z Force Samsung Edge

FUTURE SCOPE OF AMOLED TECHNOLOGY:

This is the new generation technology of active displays, with brighter and clearer images (full or scaled color). High color saturation, high contrast and high speed. Thin displays, low power consumption (mostly, Passive Matrix OLED displays) for high performance. Great viewing angle (+160 degrees) and impressive miniaturization.

COMMON APPLICATIONS:

- Fits for any tiny device that requires high resolution, mostly those battery powered ones.
- Military applications,
- Personal Digital Assistants (PDAs),
- Audio/Video Displays and,
- Smart Phones.

REFERENCES:

1. www.wikipedia.org/AMOLED
2. www.digitaltrends.com
3. www.google.com
4. www.gsmarena.com

ACKNOWLEDGEMENT

I, Deepak Pandey take this opportunity to thank almighty God for making this paper in proper manner. I am thankful to Ashish Pandey Sir (Assistant Professor), Computer Science Department for providing continuous help and guidance. I am also very thankful to my institute Shambhunath Institute of Engineering & Technology, for giving me such a wonderful opportunity to present myself. And finally I thank Computer Society of India for organizing such a great event.

About the Authors:

Mr. Deepak Pandey [CSI:- 01363463] is studying in IV year of B.Tech (CSE) at Shambhunath Institute of Engineering & Technology, Jhalwa, Allahabad (Uttar Pradesh). His areas of interest are Data Structure, Compiler Design, Database, Programming, PHP Web Development. He can be reached at deepakpandey190394@gmail.com.
INTRODUCTION

Since ancient times, simple manual devices like the abacus aided people in doing calculations. Early in the Industrial Revolution, some mechanical devices were built to automate long tedious tasks, such as patterns for looms. More sophisticated electrical machines did specialized analog calculations in the early 20th century. In the below picture we can see the timeline of computers.

The first digital electronic calculating machines were developed during World War II. The speed, power, and versatility of computers increased continuously and dramatically since then, to the point of possible artificial intelligence in the near future.

SURFACE COMPUTING:
Let us get into the subject of latest, trending and one of the most drastically growing technology- THE SURFACE COMPUTING. Most of us don’t know what exactly a surface computing is. Let us see the history of it.

**HISTORY OF SURFACE COMPUTING:**

- **2001:** the product idea for surface was initially conceptualized by Stevethiche.
- **2003:** 1st prototype (t1) was produced to bill gets for approval.
- **2004:** Microsoft built more than 85 prototypes for surface.
- **2005:** the final hardware design was completed.
- **2007:** interactive table top device was designed than scamlessly bring both the physical and virtual words into one.

Though we see that the developmental process is finished during way more early, we find this tech still not wide famous.

**FEATURES:**

A surface computer is exactly which communicates with user through normal surface rather than using a keyboard or monitor. The concept has seen some media attention, but there are few commercial surface products. The name of the category was first adopted by Microsoft with Surface (codenamed Milan), the surface computer from Microsoft which was based entirely on a Multi-Touch interface and using a coffee-table like design, and was unveiled on 30 May 2007. Below image is a Microsoft surface computer.

Users can interact with the machine by touching or dragging their fingertips and objects such as paintbrushes across the screen, or by setting real-world items tagged with special bar-code labels on top of it.

The Samsung SUR40 with Surface 2.0 shown here is only 4 inches (10.2 centimeters) deep. Its 1.0 ancestor, which housed cameras and projectors under the tabletop, sat on a full box unit full of component parts.

The Surface is a horizontal display on a table-like form. Somewhat similar to the iPhone, the Surface has a screen that can incorporate multiple touches and thus uses them to navigate multimedia content. Unlike the
iPhone, which uses fingers' electrical properties to detect touch, the Surface utilizes a system of infrared cameras to detect input.

Uploading digital files only requires each object (e.g. a Bluetooth-enabled digital camera) to be placed on the Surface. People can physically move around the picture across the screen with their hands, or even shrink or enlarge them.

**INTERNAL FEATURES:**

**SCREEN:** it has a 360-degree user interface, a 30-inch reflective surface with XGA DLP projector underneath the surface.

**CAMERAS:**

Uses cameras and image recognition in the infrared spectrum to recognize different types of objects such as fingers, tagged items etc..

**SYSTEM UNIT: TO PERFORM OPERATIONS**

**INFRARED:** 850-nanometer-wavelength LED light source aimed at the surface. When an object touches the tabletop, the light is reflected to multiple infrared cameras with a resolution 1024 x 768.

**PROJECTOR:** Projector is used for displaying a video, images or computer data on a surface.

**SURFACE COMPUTING SPECIAL FEATURES**

- Pen computing
- Direct communication
ADVANTAGES

- We can directly interact with the computer without using mouse and keyboard.
- Multiple user can interact at the same time.
- Any physical object can be directly recognized.
- It responds to many points of contact simultaneously.
- Design made easier and time-saving by eliminating many processes.
- Wireless communication between two objects is possible.

DISADVANTAGES:

- Not portable and very expensive.
- Barcode required for an object.
- This is an insecure system.

CONCLUSION

This technology is another revolution in the field of computing. This is a fast and wide spreading technology that can be introduced in many fields which can save time and components in a huge way.
About the Authors:

- Ms. V.S. Padmini Kumari BE Computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Ms. Thirupura Sundari BE Computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Ms. R. Jothi Praveena BE Computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr. S. Hemalatha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr. V. Subedha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr. T. Kalaichelvi, Professor/CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
BLUE EYE TECHNOLOGY

Compiled By:

Devishr, Swetha, Vedha, S. Hemalatha, V. Subedha and T. Kalaichelvi

Blue Eyes is a technology conducted by the research team of IBM at its Almaden Research Center (ARC) in San Jose, California since 1997. Blue eyes technology makes a computer to understand and sense human feelings and behavior and also enables the computer to react according to the sensed emotional levels. The aim of the blue eyes technology is to give human power or abilities to a computer, so that the machine can naturally interact with human beings as we interact with each other. All human beings have some perceptual capabilities, the ability to understand each other’s emotional level or feelings from their facial expressions. Blue eyes technology aims at creating a computer that have the abilities to understand the perceptual powers of human being by recognizing their facial expressions and react accordingly to them. The main objective of Blue eyes technology is to develop a computational machine having sensory and perceptual ability like those of humans. The Blue Eyes technology system is a combination of a set of hardware and software systems.

Blue eyes technology consists of

1. Data acquisition unit
2. Central system unit
3. Hardware

The steps involved for designing such type of computers are given below.

1. Process of giving sensing capacity.
2. Human Emotion detection or Affect Detection.
3. Respond appropriately and properly.

TYPES OF EMOTION SENSORS USED IN BLUE EYES TECHNOLOGY:
FOR HAND - EMOTION MOUSE

The major aim of Brain Computer Interface (BCI) is to develop a smart and adaptive computer system. These types of project must include speech recognition, eye tracking, facial recognition, gesture recognition etc. software and hardware. Similarly in Blue Eyes technologies, we need to build a system have the ability to identify all these perceptual abilities of human beings. In Blue Eyes, the machines have the ability to identify the minor variations in the moods of human beings. Say a person may strike the keyboard hastily or softly depends on his mood like happy or in angry. The Blue Eyes technology enables the machines to identify these minor emotional variations of human beings even by a single touch on the mouse or keyboard and the machines started to react with the users according to this emotional levels. This is done with the guidance of intelligent devices like “Emotion Mouse”. Actually this Emotion Mouse is an input device to track the emotions of a user by a simple touch on it. The Emotion Mouse is designed to evaluate and identify the user’s emotions such as fear, surprise, anger, sadness, happiness, disgust etc. when he/she is interacting with computer. The main objective of the Emotion Mouse is to gather the user’s physical and physiological information by a simple touch.

FOR EYE - EXPRESSION GLASS

Expression Glass is an alternative for the usually available machine vision face or eye recognition methods. By analyzing pattern recognition methods and facial muscle variations, the glass senses and identifies the expressions such as interest or confusion of the user. The prototype used for this glass uses piezoelectric sensor.
BLUE EYES technological approach assure a convenient technique, that simplifies the life by supporting more elegant and user friendly provision in computing devices. The day is very near, that this Blue Eyes technology will advance its way towards your house hold devices and makes you lazier. In future, even this Blue Eyes will reach as your hand held mobile device.

About the Authors:

- Ms. Devishri, BE Computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Ms. Swetha, BE Computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- VEDHABE Computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr.S.Hemalatha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr.V.Subedha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr.T.Kalaichelvi, Professor/CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES (CBNST) AND ITS APPLICATIONS

Compiled by:
Deepak Singh Rana, Meenakshi Pandey and Sushil Kumar

ABSTRACT

Main purpose of the use of computer based numerical analysis is to optimize performance and minimize error in problem-solving applications. It is the area of both mathematics and computer science that creates, analyzes, and implements algorithms for solving problems of continuous mathematics. This research article provides clear and broad applications of numerical analysis in precise form. General methods like bisection, interpolation, extrapolation and information related to numerical analysis have been given in the beginning.

The applications of CBNST are everywhere like in business, finance, weather forecasting, scientific research etc and now numerical techniques have become indispensible tools for engineers and scientists. Analytical methods fail most of the time then Numerical techniques give the solution to applied problems.

Computer Based Numerical and Statistical Techniques mainly used in data science, Forecasting, Computer Software, Modern Applications & Business. Estimate results can be find out easily using numerical & statistical techniques.

INTRODUCTION

Computer based numerical analysis and statistical (CBNST) is a combination of two subject numerical analysis methods and statistical methods.

Numerical analysis is the study of algorithms that use numerical approximation for a problem of mathematics. The main aim of the field is the design and analysis of techniques to give approximate but accurate result to a hard problem, like numerical weather prediction. Numerical analysis provides constructive methods for obtaining estimate results of problems in a numerical form, demand for numerical solutions to various problems increasing with the advancement of computer. We can find out approximate result from these types of methods, can determine the solution of a problem.

Statistical methods are used for collecting, summarizing, analyzing and interpreting variable numerical data.

In applied mathematics, the problem related to find the solution of an equation has a great importance.
Numerical analysis is used to approximate the problem satisfactorily so that an approximate solution, within a desired degree of accuracy is obtained, insight into the process and resulting error is essential.

Three main steps to develop and evaluate method & then generate estimate result from given data are incorporated in the process. Here, processing is done according to the method.

**Figure 1: Information Process Cycle**

---

**SOME METHODS IN CBNST**

**BISECTION**

The bisection method is used to find out the approximate root of transcendental equation. It is a very simple but very slow process. This method is based on the repeated application of intermediate value theorem for continuous functions. This method is also called the binary search method, or Bolzano or dichotomy method.

Let the function $f(x)$ be continuous between $a$ and $b$ and root of $f(x)$ lies in the interval $[a, b]$. First root will be $m = (a + b)/2$. Then find next interval for the new root for that check if $f(a)f(m) < 0$ or $f(b)f(m) < 0$, new interval will be either $[a, m]$ or $[b, m]$, continue this process and find roots until a desire accuracy. Bisection method is given below.

**Figure 2: Bisection Method Graph**
**ALGORITHM - BISECTION METHOD**

Step 1: Start
Step 2: Define a function \( F(x) \), \( D=0.00001 \) as accuracy.
Step 3: Find out the initial interval such that at lower limit the value of function \( F \) is positive and at upper limit it is negative and vice versa.
Step 4: Repeat steps from 5-9
Step 5: Calculate \( x \leftarrow \frac{a+b}{2} \), print the value of \( x \)
Step 6: Check if \( F(x) = 0 \) then print the value of \( x \) as root and go to step 9.
Step 7: Check if \( F(a) * F(x) < 0 \) then \( b = x \) else \( a = x \) and print the value of \( x \).
Step 8: Check if (difference between two consecutive roots) \( \leq D \)

Then display the value of \( x \), go to step 9
else go to step 5
Step 9 : Stop
This method is also called as method of False Position or method of linear interpolation. It's the old method of finding the roots of transcendental equations and closely resembles the bisection method.

Let the function $f(x)$ be continuous between $a$ and $b$. And root of $f(x) = 0$ lies in the interval $[a,b]$. Check if $f(a)\cdot f(b) < 0$ since graph of $y = f(x)$ crosses $X$-axis between these two points the root must be lie in between these points.

**Figure 3: Flow Chart Bisection Method**

---

**REGULAFALSI**

This method is also called as method of False Position or method of linear interpolation. It’s the old method of finding the roots of transcendental equations and closely resembles the bisection method.

Let the function $f(x)$ be continuous between $a$ and $b$. And root of $f(x) = 0$ lies in the interval $[a,b]$. Check if $f(a)\cdot f(b) < 0$ since graph of $y = f(x)$ crosses $X$-axis between these two points the root must be lie in between these points.
ALGORITHM – REGULA FALSI METHOD

Step 1: Start
Step 2: Define a function F(x), D=0.00001 as accuracy.
Step 3: Find out the initial interval such that at lower limit the value of function F is positive and at upper limit it is negative and vice versa.
Step 4: Repeat steps from 5-9
Step 5: Calculate 
\[ x = a - \frac{(b-a)}{f(b)-f(a)} f(a) \]
Display the value of x
Step 6: Check if F(x)==0 then print the value of x as root and go to step 9.
Step 7: Check if F(a)*F(x)<0 then b=x else a=x and print the value of x.
Step 8: Check if (difference between two consecutive roots) ≤ D
Then display the value of x, go to step 9
   Otherwise go to step 5
Step 9: Stop

INTERPOLATION

Interpolation is a method to find out the approximate value of any data point within the range of data set. Let us consider we are given the following values of any function f(x).
Interpolation method is used to find out the value of any Y corresponding to any value of X within the range given or where X lies in between X0 to Xn. Suppose we are given the temperature of a city in the following given Table 1, we can calculate the temperature at given X with the help of interpolation methods.
It is very useful in science, business, research or any time when there is a need to predict values that fall within two existing data points.

Table 1: Population Data

| xi | X0 | X1 | | Xn-2 | Xn-1 | Xn |
|----|----|----| |      |      |    |
| yi | y0 | y1 | | yn-2 | yn-1 | yn |

<table>
<thead>
<tr>
<th>Time</th>
<th>11.00</th>
<th>12.00</th>
<th>13.00</th>
<th>14.00</th>
<th>...</th>
<th>15.00</th>
<th>16.00</th>
<th>17.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>10.00</td>
<td>11.4</td>
<td>13.43</td>
<td>13.56</td>
<td>...</td>
<td>...</td>
<td>16.46</td>
<td>17.65</td>
</tr>
</tbody>
</table>

In above given table data we can find out temperature at any given point (X) between 11.00 - 17.00 with the help of interpolation methods.

Another example of interpolation is to fill the gas into the cylinder; we can predict the time to fill the number of cylinders in a filling station based on the given data.
Table 2: Cylinder filling process data

<table>
<thead>
<tr>
<th>Number of cylinders</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>....</th>
<th>....</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to fill (Celsius)</td>
<td>20</td>
<td>35</td>
<td>49</td>
<td>55</td>
<td>....</td>
<td>....</td>
</tr>
</tbody>
</table>

It can be clear to manager that how much approximate time will be taken to fill 150 cylinders or 350 cylinders.

INTERPOLATION METHODS

Assume that data set is given in a table of x and y column for the following:

1. Newton forward interpolation method
   Use forward difference table, have equal interval in x column.
2. Newton Backward Interpolation method
   Use backward difference, have equal interval in x column.
3. Lagrange’s Interpolation method
   Use cubic, have unequal interval in x column.

EXTRAPOLATION

Extrapolation methods are similar to interpolation but the difference is extrapolation estimate or predicts the value at any new data point beyond the actual range of data set. Let us consider we are given the following values of a function f(x):

Table 3: Election data

<table>
<thead>
<tr>
<th>xi</th>
<th>x0</th>
<th>x1</th>
<th>.................</th>
<th>....</th>
<th>x0+2</th>
<th>x0+3</th>
<th>x0+4</th>
</tr>
</thead>
<tbody>
<tr>
<td>yi</td>
<td>y0</td>
<td>y1</td>
<td>.................</td>
<td>....</td>
<td>y0+2</td>
<td>y0+3</td>
<td>y0+4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2003</th>
<th>2005</th>
<th>2007</th>
<th>....</th>
<th>....</th>
<th>2019</th>
<th>2021</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (in million)</td>
<td>10</td>
<td>16</td>
<td>25</td>
<td>28</td>
<td>....</td>
<td>....</td>
<td>54</td>
<td>63</td>
<td>72</td>
</tr>
</tbody>
</table>

In above given table we can predict the population of a country, say in year 2030 based on given data with the help of extrapolation methods. So these methods are very useful to predict the future
value of a business, resources in any organization, traffic control or the length of the roads, medical facilities for a city etc.

APPLICATION AREA OF CBNST

- **Demography**: “Demography” is the statistical study of any kind of dynamic population that changes over a time or space. For example we have to find out the population of the year 1910? We can apply interpolation here

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880</td>
<td>300</td>
</tr>
<tr>
<td>1890</td>
<td>398</td>
</tr>
<tr>
<td>1900</td>
<td>426</td>
</tr>
<tr>
<td>1910</td>
<td>?</td>
</tr>
<tr>
<td>1920</td>
<td>476</td>
</tr>
<tr>
<td>1930</td>
<td>510</td>
</tr>
</tbody>
</table>

Table 4: Demography Data

Here, we’ve given 5 tabular points X (Year) and those values Y (Population). Let us assume that Y is polynomial of degree four.

\[
\begin{align*}
(E - 1)^5 Y_0 &= 0 \\
E^5 - 5 E^4 Y_0 + 10 E^3 Y_0 - 10 E^2 Y_0 + 5 E Y_0 - 1 Y_0 &= 0
\end{align*}
\]

Now, put the value from the given table:

\[
Y_3 = 4440/10 = 444 \text{ (Estimate out the population of year 1910)}
\]

- **Data Science**: Data science is an interdisciplinary field where we generally deal with either structured or unstructured data, which is a continuation of some of the data analysis fields such as statistics, big data mining etc.

- **Signal Processing**: In signal processing, dealing with their statistical properties e.g.: mean, covariance. It uses numerical analysis, statistical, computational, and linguistic and some other techniques for synthesis, sensing, analysis, learning of signals.
• **Modern Applications and Computer Software:** Sometimes numerical analysis of very sophisticated problems is very hard in software so now some of software’s are embedded in popular software packages e.g. spreadsheet is very simple example. In reliability engineering, to measure the ability of a system to perform for its intended functions CBNST can be used.

• **Evaluating integrals, Differential Equations:** Numerical analysis also concerned with computing the solution of integrals and differential equations. The functional analysis reduces the problem.

• **Actuarial Science:** In actuarial Science to access the risk in finance and insurance is the one of the application of the CBNST where future value can be predicted with the numerical methods.

• **Quality Control System:** In quality control system for inspection, testing and analysis to ensure that the quality of product is as per laid down quality standard.

• **Modern Business and Commercial Application:** To decide resource allocation in a business is efficient or not, investment strategies in any business and scheduling of task using optimizing techniques.

• **Safety Measurements:** Car companies can improve the crash safety of their vehicles by using computer simulations of car crashes.

---

**CONCLUSION**

All of the methods for modeling functions that we have considered so far corresponding to fitting elementary functions using data points in computer system is possible by using computer based numerical analysis. In some situations it is difficult to know the estimate value of any function but is still possible to derive reasonable & estimate result using Computer based numerical & statistical Techniques.

**REFERENCES**

3. nptel.ac.in/courses/122106033/
4. nptel.ac.in/courses/111101003
5. Numerical Methods in Engineering & Science, Dr. B.S.Grewal, Khanna Publishers
6. Computer Based Numerical and Statistical Techniques, Manish Goyal, Laxmi Publication

---

Mr. Deepak Singh Rana [CSI: 1161723] has done M.Tech (Computer science and Engineering), currently working as Assistant Professor, Department of Computer Science and Engineering, Graphic Era Hill University Dehradun, Uttarakhand. His research interests are Numerical Computation, Cyber Security, Malware Analysis and Design, Open Source Technology & ICT applications in Education. He can be reached at deepakranageu@gmail.com.
Ms. Meenakshi Pandey is student of B.Tech (Computer Science and Engineering) Graphic Era Hill University Dehradun, Uttarakhand. Her research interest includes Numerical Analysis, computer networks, computer programming. She can be reached at meenakshipandey@gmail.com.

Mr. Sushil Kumar has done M.Tech (Computer Science and Engineering), Currently working as assistant Professor, Department of Computer Science and engineering, Graphic Era University Dehradun, Uttarakhand. He is UGC-NET and GATE Qualified in Computer Science. His Research interests are mobile adhoc network, operating system, Cloud computing. He can be reached at sushilchamoli@gmail.com.
INTRODUCTION OF BCI BASED ON ELECTROENCEPHALOGRAM

Compiled by:

Gopal Chandra and Prasant kumar pattnaik

ABSTRACT

Over many years, researchers are trying to theorize that electroencephalographic (EEG) activity or other Bio-signal influences responsible for a new non-muscular communication pathway for transferring messages signal and commands to the adjacent device by computing of neural system activity – referred as Brain Computer Interface. BCI research activity has ascended and encouraged by new comprehension of brain activity or function, by the improvement of robust, relatively inexpensive computer apparatus, and by considering of the prerequisites and potentials of people having disabilities. Current BCI research activity focuses on emerging novel technology behind control and communication for persons with having different neuromuscular disorders. The foremost goal of BCI researcher is to make available advance communication proficiencies for those users, who may be completely paralyzed, or ‘locked in’, so that user can share their thoughts or feeling with neighbor and operate external devices without the help of other persons.

INTRODUCTION

Brain computer interface, occasionally refer as Brain or Mind machine interface, and Direct Neural Interface, is an advance communication module in the middle of the brain and a BCI appreciative external device [1]. Aspect of communication traffic, in one-way BCIs: no feedback mechanisms available only single way processing. So user and device not able to give-and-take information at a time. Two-way BCIs: would agree to brain and BCI appreciative devices to follow give-and-take manner to transfer information in both directions. So the term BCI indicating, B: Brain, where from we obtain electroencephalogram; C: Computer, where we process or analyze acquired brain signal using an algorithmic process; I: Interface, the combinations of overall setup. In 1970s, BCI research began, but experimental implant in animal brain. In the mid of 1990s first BCI research experiment implants in human brain and within few decades, many mankind BCI systems designed for persons with disability. With advance technology and strong fundamental knowledge, researchers now trying to implement BCIs that becomes real-time in nature to implement smart environment with cognitive study.

TRADITIONAL DEFINITIONS OF BCI

Definition 1: BCI is an appreciative combination between a brain function and adjacent device that facilitates signaling from the brain to straightly perform some peripheral activity, like a cursor and prosthetic limb control [2].
Definition 2: BCI system provides a high potential for effectively study about human mental state and intentions in their daily life [2].

Definition 3: The Interface enables a straight advance communication channel between the neural system and the object to be controlled [3].

1.2 BCIS FULFILL THESE AXIOMS:

1. Input comes directly from the brain.
2. Signals are processed real time.
3. Commands that are executed must be completely intentional.

BRAIN ELECTRICAL SIGNALS:

Brain electrical signal is the leading entity of BCI system. Brain is a complex network having approximately 100 million neurons. The brain activity can be easily detected by observing the electroencephalogram generated in the neural system. Using electrode sensor brain activity can be acquired easily in the signal form and can be displayed on a computer screen, these signals are roughly less than 100 $\mu$V and 100 Hz.

Figure 1: Electrode located on the scalp on the human brain

Figure 2: EEG signal view on Computer screen

ELECTRODE PLACEMENT

Electrode placement is one of the most significant steps of the signal acquisition technique. Electrode placement method categories into three ways Invasive, noninvasive, Partially invasive.
Invasive: In invasive method electrode are placed straightly into a human or animal brain by a perilous operation; it might be placed on a single area or multiple area respectively refer as single unit or multi-unit [3]. BCI implemented using Invasive method referred as Invasive BCIs. Basically an invasive method responsible for recording Electrocardiogram (ECoG). Shown in Figure-3.

Noninvasive: In a non-invasive method number of electrodes is located on the scalp of the human brain. BCI implemented using Noninvasive method named as a Noninvasive BCI system. Basically a Noninvasive method responsible for recording Electroencephalographs (EEG) [3]. Shown in Figure-1 and Figure-2.

Partially Invasive: Partially invasive method same as invasive method, but in this method not only electrodes other device also placed in the skull on the top of the human brain. Shown in Figure-4.

Electrode Types: Different types of electrodes are often used in the EEG signal acquisition systems, such as:
- Not reusable electrodes (without gelled, or with gelled types).
- Reusable electrodes (gold, silver, or other metal).
- Electrode caps. (e.g. NeuroSky)
- Needle electrodes.

All are commercially available.

Electrode Location on Scalps: In BCI research noninvasive methods massively use. As we know in non-invasive method number of electrodes placed on the scalp of brain for sensing brain electrical activity. Brain scalp size very person to person, so placement of electrodes on the right location on the scalp of the brain is a key factor for getting a robust brain signal.

10/20 System: The 10-20 system is an internationally accepted technique describe to identify the location of scalp electrodes. The system is constructed on the basis of correlation between the location of an electrode and the latent area in the brain of the cerebral cortex on the human scalp. The numbers ‘10’ and ‘20’ mention to the circumstance that the distances between adjacent electrodes are either 10% of the total front- back or 20% of the total right-left distance of the skull. Each denoted by a letter to recognize the lobe and a number to recognize the hemisphere location describe in below Table-1, Figure-5, Figure-6.
Electrode Location | Lobe
--- | ---
F | Frontal
T | Temporal
C | Central
P | Parietal
O | Occipital

<table>
<thead>
<tr>
<th>10-20 System Electrode Distances</th>
</tr>
</thead>
</table>

Figure-5: placement of Electrode on scalp (Left hemisphere)

Figure-6: Internationally accepted electrode to electrode distances

Hear the ‘C’: letter is used for central lobe identification purposes only, ‘Z’: (zero) indicating to an electrode located on the mid line. Electrodes located on the right hemisphere refer by even numbers (2, 4, 6, 8) and left hemisphere refer by odd numbers (1, 3, 5, 7).

TRADITIONAL BCI SYSTEM:

Figure-7 (source: [4]): schematic diagram of traditional BCI system.
KEY ACTIVITY OF THE TRADITIONAL BCI SYSTEM

According to the works of Mason and Birch, the BCI system can be divided into various functional components.

1. **Signal acquisition:** Electrodes are taking in to collect the electrical signal, generated due to neural activity in the brain, and then amplify and analog filter happens in the acquisition system.

2. **Feature Extraction:** Feature extraction means simply extracting specific signal features, i.e., renovates the electroencephalogram into significant feature component. Then by a digital band-pass filter raw signals are filtered. Then, the amplitude samples are squared to bring the power samples.

3. **Feature Translation:** The resulting signal features component is then passed to the features translations algorithms, which covert the futures component into logical controls.

4. **Control Interface:** Coverts the logical controls into semantic controls.

5. **Device Controller:** Transform the semantic controls to physical device commands.

Finally, the command is executed by device interface of a particular device.

WORK FLOW OF THE TRADITIONAL BCI SYSTEM

Neural activity is discovered by electrodes as a signal form, located on the scalp or within the brain. After acquiring raw brain signals, it required to amplify and digitized. Features are extracted from the signal and then transformed into commands to control output devices, for example a cursor control, a wheelchair control. Feedback from the device facilitates the user to adjust the state of brain activity in order to keep up active device performance, mentions in the figure-8.

Work flow diagram:

![Figure-8: work flowchart of traditional BCI system](image-url)
The electroencephalogram study is a way to measure activity in our brain. Our brain is full of electrical activity. Change of mental activity happened due to the electrical firing of neurons. The electroencephalogram itself has several components separated by frequency mention below:

1. **Delta**: Delta has a frequency range \( 0 \leq f \leq 4Hz \), normal waveform is high amplitude in nature and indicating deep sleep state.
2. **Theta**: Theta has a frequency range \( 4Hz \leq f \leq 8Hz \) amplitude of this frequency is normal up to 13 years age and normal during sleep. Abnormal in awake adults.
3. **Alpha**: Alpha has a frequency range \( 8Hz \leq f \leq 14Hz \). It appears in time of relaxing mode with eye blinking. We can also split alpha waves form like alpha1 band and alpha2 band. Alpha1 band indicating frequency range \( 8Hz \leq f \leq 9Hz \) and relaxed, but not drowsy mental state. Alpha2 band indicating relaxed or normal, yet to focused mental state.
4. **Beta**: Beta has a frequency range \( 13Hz \leq f \leq 30Hz \), “fast” activity in nature. It’s characteristic of the user being alert or active. It is mostly seen on both edges in equal distribution and is most apparent frontally. It has brought out by sedative-hypnotic drugs. It may be absent or less in areas of cortical damage.
5. **Gamma**: Gamma has a frequency range approximately \( 30Hz \leq f \leq 100Hz \), occur during sensory processing of sound and sight. It is indicating higher mental activity.

**Signal processing**: Signal processing be made up of traditionally in two crucial parts, one is Feature extraction and another one is Feature translation. Before final processing primarily the raw signal preprocessing by converting it into a set of features, after that translates them into desired commands for the computer.

**Feature extraction**: Feature extraction is an important intermediate step to be taken if we want to compare two signals. The method that will be described transforms the time series of signal into a feature vector, then into a number and numbers can be compared. It is possible to distinguish signals that have more suitable properties form signals which do not. Feature extraction, which is basically a determination of moderate dimensions of measured data or data stream time of online processing in case of the real time BCI system. Aspect of comparing and classifying of signal feature extraction performed massive role. Another significant role of feature extraction is dropping the noise which also along with raw signal.

**Fourier transforms**: In the feature extraction phase Fast Fourier Transformation (FFT) massively use. FFT is a part of Fourier transforms and algorithm based on the discrete Fourier transform (DFT) [equation-1]. By applying FFT it possible to separate the EEG rhythms and analyze.
DISCRETE FOURIER TRANSFORM [5]:

DFT:

\[ X_k = \sum_{n=0}^{N-1} x_n e^{-i2\pi kn/N} \quad k=0,1,…N-1 \]

Inverse DFT:

\[ x_n = \frac{1}{N} \sum_{k=0}^{N-1} X_k e^{i2\pi kn/N} \]

The performance of the DFT is \( O(N^2) \), whereas FFT compute the same result in only \( O(N \log N) \). Where \( N \) is a number of data points in a sample [6]. This is one of the reasons to refer FFT method for analyzing EEG signal.

FFT also is an efficient algorithm for calculations of DFT.

\[ X_k = \sum_{n=0}^{N-1} x_n \left( \cos(-2\pi k n/N) + i\sin(-2\pi k n/N) \right) \quad k \in \mathbb{Z} \]

Inverse Fourier transforms

\[ x_n = \frac{1}{N} \sum_{k=0}^{N-1} X_k \left( \cos(2\pi k n/N) + i\sin(2\pi k n/N) \right) n \in \mathbb{Z} \]

\( N= \) Number of time samples we have

\( n= \) current samples we’re considering (0,1,… N-1)

\( x_n = \) Value of the signals at time \( n \)

\( K = \) current frequency we’re considering (0Hz to N-1 Hz )

\( X_k = \) Amount of frequency \( k \) in the signal (amplitude)

Properties:

- Completeness
- Orthogonality

EXAMPLE OF FFT:
**Feature Translation:** Having the goal of feature translation in mind, now trying to “translate” the feature vector of a certain sample to a useful command using LDA and Perceptron. Methods for feature translation some other algorithm also available, but here shortly mention only two.

**Linear Discriminant Analysis [7]:**

- LDA stands for Linear Discriminant Analysis.
- Its functionality can be simply imagined as a hyper plane in a space of features, that separates features of class A from class B by simply looking at the new feature vector and computing whether it is “over” or “under” the hyper plane.
- Applied to electromagnetic signal feature translation
- Discriminant function for to-be-classified feature vector $F$ is:

$$f_i = \mu_i C^{-1} F_k^T - \frac{1}{2} \mu_i C^{-1} \mu_i^T + \ln(p_i)$$

Where

$$C = \frac{1}{N} \sum_{i=1}^{g} n_i \, c_i$$, a pooled covariance matrix.

$$c_i = \frac{(x_i^0)^T \, x_i^0}{n_i}$$, a covariance matrix of class $i$.

$n_i$, a number of samples in group $i$.

g, a number of classes.

$N$, a number of samples.

$x_i^0$, a mean corrected data matrix, i.e. matrix row is a feature vector minus $\mu$

$x_i$, a class $i$ sample data matrix. Each contains a feature vector of a sample.

$\mu_i$, a mean of class $i$, usually an average value.

$\mu$, a global mean value.
$p_i$, a probability of occurrence of class $i$ feature vector.

Let $k$ be the number that satisfies, $f_k = \max_{i=1}^{g} (f_i)$

The resulting class number will be $k$.

The index of the group which discriminant function has highest result.

**Advantages of LDA**

- LDA as a two class separator can be denoted simpler.
- This method allows simple, quick, and often satisfactory classification.

**Drawback of LDA**

- However, linear discrimination might not be enough in many cases, so we mention few more classification and translation methods are
  - Perceptron
  - SVM,...etc.

---

**PERCEPTRON:**

- Perceptron as an adaptive linear discriminant gives us slightly more opportunities. We know that perceptron is a primitive model of a brain neuron. Neurons work in a following manner. Every neuron has a number of inputs (dendrites), but only one output (axon).
- Firing of a neuron can be modeled as

  $$f(x) = \begin{cases} 
  1, & w \cdot x + b > 0 \\
  0, & otherwise 
  \end{cases}$$

- Where $w \cdot x$ is a dot product of weight vector and the input vector. Which actually computes a weighted sum?
- $b$ is a fixed bias value.

**APPLICATIONS OF BCI**

In current decade’s lots of research going on about BCI applications in both areas medical as well as non-medical. Table-1 shows that medical application areas.

**BCI TECHNOLOGY IN MEDICAL FIELD:**

BCI research is a joint venture of neuroscience, electronic, and computer science. BCI research start from the medical domain in the sense fundamentals of BCI based human brain science, so we have lots of medical applications [8] like clinical care, drug detection etc.
Beyond medical applications lots of research contribution also have in non-medical applications [8] [9] where the BCI system connects with the real world. Lots of researcher is trying to build real time BCI system based on human brain signal to improve our modern daily life, here we mention a few BCI applications in non-medical field [10].

- Smart environment
- Security and authentication
- Neuro-marketing and Media
- Education and self-regulation
- Games
- Cognitive environment

Conclusion: Brain-Computer Interface (BCI) is an advanced communication based on intentional neural activity produced by the brain and self-regulating of its standard output pathways of peripheral nerves and muscles. The brain electrical activity used in BCI system can be acquired using invasive or noninvasive methods. The BCI system will improve massively in upcoming decade’s and would deliver smart environment based on Internet of Things.

REFERENCE

4. Dennis J. McFarland et al.,: “Brain computer interface signal processing at the Wadsworth Center: mu and sensorimotor beta rhythms” chapter-26, DOI: 10.1016/S0079-6123(06)59026-0, Neuper&Klimesch (Eds.)- Progress in Brain Research, Vol. 159:411-9, Feb 2016, ISSN 0079-6123, Copyright r 2006 Elsevier B.V. All rights reserved.
5. http://www.engineeringproductivitytools.com/stuff/T0001/PT01.HTM#Head132, “Definition of DFT and Inverse DFT (IDFT)”.

About the Authors:

Mr. Gopal Chandra Jana[CSI:- 01357983] is studying in II year of M. Tech (CSE) atKIIT University, Bhubaneswar (Odisha).His areas of interest Brain Computer Interface, Cloud Computing, Image Processing and soft Computing. He can be reached at 1550011@kiit.ac.in

Dr. Prasant Kumar Pattnaik, Ph.D (Computer Science), Fellow IETE, Senior Member IEEE is Professor at the School of Computer Engineering, KIIT University, Bhubaneswar. He has more than a decade of teaching and research experience. Dr. Pattnaik has published numbers of Research Papers in peer-reviewed International Journals and conferences. His areas of interest include Graph Theory, Mobile Computing and Cloud Computing. He can be reached at patnaikprasantfcs@kiit.ac.in
3-D PRINTING

Compiled by:

Bhagyashree Dhakulkar

3D printing is a process of making three dimensional solid objects from a digital file. It is also known as additive manufacturing.

A 3-D model should be created first by making a virtual design of the object. It is based on the general principles of modeling, printing and finishing. It can be created using a 3-D modeling application. Eg. A CAD file can be created using a 3-D Scanner or 3-D modeling Application.

3-D Modeling Software

Blender is one of the open source software. Beginners can start with a Tinker cad, a free version which supports Google chrome. License software are also available.

Steps in 3-D Printing

A 3-d model is created first. After the model is ready, it should be prepared for 3-D printing. This is called slicing. Slicing is dividing a 3D model into hundreds or thousands of horizontal layers. This is done with the help of software. This is fed to the printer via USB,SD or Wi-fi. When a file is uploaded in a 3D printer, the object is ready to be 3D printed layer by layer. The 3D printer reads every slice (2D image) and creates a three dimensional object.

Seven processes for 3-D Printing

Since 2010, the American Society for Testing and Materials (ASTM) group “ASTM F42 – Additive Manufacturing”, developed a set of standards that classify the Additive Manufacturing processes into 7 categories according to Standard Terminology for Additive Manufacturing Technologies. These seven processes are:

1. Vat Photo polymerization
2. Material Jetting
3. Binder Jetting
4. Material Extrusion
5. Powder Bed Fusion
6. Sheet Lamination
7. Directed Energy Deposition

Vat Photo polymerization
A 3D printer based on the Vat Photo polymerization method has a container filled with photopolymer resin which is then hardened with UV light source.

**Vat photo polymerization schematics. Image source: lboro.ac.uk**

The most commonly used technology in these processes is **Stereo lithography (SLA)**. This technology employs a vat of liquid ultraviolet curable photopolymer resin and an ultraviolet laser to build the object’s layers one at a time. For each layer, the laser beam traces a cross-section of the part pattern on the surface of the liquid resin. Exposure to the ultraviolet laser light cures and solidifies the pattern traced on the resin and joins it to the layer below.

After the pattern has been traced, the SLA’s elevator platform descends by a distance equal to the thickness of a single layer, typically 0.05 mm to 0.15 mm (0.002” to 0.006”). Then, a resin-filled blade sweeps across the cross section of the part, re-coating it with fresh material. On this new liquid surface, the subsequent layer pattern is traced, joining the previous layer. The complete three dimensional objects are formed by this project. Stereo lithography requires the use of supporting structures which serve to attach the part to the elevator platform and to hold the object because it floats in the basin filled with liquid resin. These are removed manually after the object is finished.

This technique was invented in 1986 by Charles Hull, who also at the time founded the company, 3D Systems. Other technologies using Vat Photo polymerization are the new ultrafast **Continuous Liquid Interface Production** or CLIP and marginally used older **Film Transfer Imaging** and **Solid Ground Curing**.

**MATERIAL JETTING**

**Material Jetting schematics. Image source: custompartnet.com**

In this process, material is applied in droplets through a small diameter nozzle, similar to the way a common inkjet paper printer works, but it is applied layer-by-layer to a build platform making a 3D object and then hardened by UV light.
**BINDER JETTING**

With binder jetting two materials are used: powder base material and a liquid binder. In the build chamber, powder is spread in equal layers and binder is applied through jet nozzles that “glue” the powder particles in the shape of a programmed 3D object. The finished object is “glued together” by binder remains in the container with the powder base material. After the print is finished, the remaining powder is cleaned off and used for 3D printing the next object. This technology was first developed at the Massachusetts Institute of Technology in 1993 and in 1995 Z Corporation obtained an exclusive license.

**MATERIAL EXTRUSION**

The most commonly used technology in this process is **Fused deposition modeling (FDM)**

![FDM Image](https://via.placeholder.com/150)

**Image source: Wikipedia, made by user Zureks under CC Attribution-Share Alike 4.0 International license.**

Fused deposition modeling (FDM), a method of rapid prototyping: 1 – nozzle ejecting molten material (plastic), 2 – deposited material (modeled part), 3 – controlled movable table. The FDM technology works using a plastic filament or metal wire which is unwound from a coil and supplying material to an extrusion nozzle which can turn the flow on and off. The nozzle is heated to melt the material and can be moved in both horizontal and vertical directions by a numerically controlled mechanism, directly controlled by a computer-aided manufacturing (CAM) software package. The object is produced by extruding melted material to form layers as the material hardens immediately after extrusion from the nozzle. This technology is most widely used with two plastic filament
material types: ABS (Acrylonitrile Butadiene Styrene) and PLA (Poly lactic acid) but many other materials are available ranging in properties from wood filed, conductive, flexible etc.

FDM was invented by Scott Crump in the late 80’s. After patenting this technology he started the company Stratasys in 1988. The software that comes with this technology automatically generates support structures if required. The machine dispenses two materials, one for the model and one for a disposable support structure.

The term fused deposition modeling and its abbreviation to FDM are trademarked by Stratasys Inc. The exactly equivalent term, fused filament fabrication (FFF), was coined by the members of the RepRap project to give a phrase that would be legally unconstrained in its use.

POWDER BED FUSION

The most commonly used technology in these processes is Selective laser sintering (SLS)

SLS system schematic. Image source: Wikipedia from user Material geeza under Creative Commons Attribution-Share Alike 3.0 Unported license

This technology uses a high power laser to fuse small particles of plastic, metal, ceramic or glass powders into a mass that has the desired three dimensional shape. The laser selectively fuses the powdered material by scanning the cross-sections (or layers) generated by the 3D modeling program on the surface of a powder bed. After each cross-section is scanned, the powder bed is lowered by one layer thickness. Then a new layer of material is applied on top and the process is repeated until the object is completed.

All untouched powder remains as it is and becomes a support structure for the object. Therefore there is no need for any support structure which is an advantage over SLS and SLA. All unused powder can be used for the next print. SLS was developed and patented by Dr. Carl Deckard at the University of Texas in the mid-1980s, under sponsorship of DARPA.
Sheet lamination involves material in sheets which is bound together with external force. Sheets can be metal, paper or a form of polymer. Metal sheets are welded together by ultrasonic welding in layers and then CNC milled into a proper shape. Paper sheets can be used also, but they are glued by adhesive glue and cut in shape by precise blades. A leading company in this field is Mcor Technologies.

Simplified model of ultrasonic sheet metal 3D printing.

Image source: Wikipedia from user Mmrjf3 shared under Creative Commons Attribution 3.0 Unported license.

DIRECTED ENERGY DEPOSITION

This process is mostly used in the high-tech metal industry and in rapid manufacturing applications. The 3D printing apparatus is usually attached to a multi-axis robotic arm and consists of a nozzle that deposits metal powder or wire on a surface and an energy source (laser, electron beam or plasma arc) that melts it, forming a solid object.

Direct Energy Deposition with metal powder and laser melting. Image source: Merlin project

Sciaky is a major tech company in this area.

APPLICATIONS OF 3D PRINTING

Applications include rapid prototyping, architectural scale models & maquettes, healthcare (3D printed prosthetics and 3D printing with human tissue) and entertainment (e.g. movie props).

Other examples of 3D printing would include reconstructing fossils in paleontology, replicating ancient artifacts in archaeology, reconstructing bones and body parts in forensic pathology and reconstructing heavily damaged evidence acquired from crime scene investigations.
MODELS CREATED BY 3-D PRINTING

A 3-D object printed by a 3-D printer

Image source: airwolf3d.com

FUTURE

It is predicted by some additive manufacturing advocates that this technological development will change the nature of commerce, because end users will be able to do much of their own manufacturing rather than engaging in trade to buy products from other people and corporations.

REFERENCES

1. www.3dprinting.com
2. airwolf3d.com

About the author:

Prof. Bhagyashree Dhakulkar. [CSI: F8000493] - is working as an Assistant Professor, Department of Computer Engineering, Dr. D. Y. Patil School of Engineering and Technology, Lohgaon, Pune, Maharashtra, India. She has 11 years experience in Teaching and her research area is Data Mining and Digital Forensics. She can be reached at bhagyashree.dhakulkar@gmail.com
INTRODUCTION

Data Analytics continues to be a driving force behind profound marketing and production strategies carried out presently; also with billions of user data piling up every second, this field deserves to look out for interesting research ideas. One such idea is teaching the machine to learn for itself from previously available records at hand, such as user’s personal info ranging from government records to his/her social presence. The machine when taught to understand this connection could assist in labor recidivism.

MACHINE LEARNING

Machine learning is an emerging field which is simply the science of teaching the computers to learn to distinguish between various aspects of information fed to them; and further learning from the data provided to them for predictions in the future. At this point teaching them to distinguish between info provided becomes important. This could be done by the following methods viz., supervised learning, semi-supervised learning, un-supervised learning. Supervised learning as the name implies is simply giving a bunch of similar examples to the machine which usually contains a similar attribute such as size, color, and style of language. Semi-supervised language provides few examples which may only belong to same domain and at times may not share whole properties. Unsupervised learning is done by assigning random variables and calculating relationships using current moments, this is particularly utilized in neural networks which mimic human brain networks. Machine learning is already utilized in various applications such as spam detection, recognition of pictures, etc.

FEASIBILITY FOR ANALYTICS

Analysis can be done for huge volumes of data. One such example is data from Centralized Public Grievances Redress and Monitoring System (CPGRAMS). Lakhs of grievances flow in from all over the country. These data cannot be analyzed by individual labors for a long time; this can be replaced by system which analyze the users intention and their scope towards the problem [1]. This is where machine learning comes into play, using NLP techniques the reviews or the grievances given out are broken up into parts which are then compared to specific stop words which identify the context of the sentence. These are then labeled with specific identifiers which will represent the nature of the problem. For example, a grievance involving water leakage is labeled as state & civic water councils, these constitute an individual cluster. When another grievance from another user is found relating to water problems, if the labels match one another the machine understands they represent a
common problem and provides the user with the solution. Further steps are documented so that archived records may help a problem in the future.

**HOW ML CAN BE IMPLEMENTED?**

So implementing machine such huge datasets with real time data requires the following technique: The real time data is routed to be stored in Hadoop, and other platforms where the operational data collected is stored for processing. The steps involved are as follows,

**Data collection & visualization:**
The initial step is the data collection which is obtained from the cloud storage facilities. These are then checked for discrepancies or duplicate values, this reduces almost one-quarter of the data. Then the data is converted to Comma separated or CSV values using data munging or data wrangling methods. These steps are collectively called as data cleaning. The data is converted to csv values because it is usually a product of merging different data sets. Now this can be used for detailed analysis.

**Predictive analysis using ML:**
Now with the data obtained immediate insights can be gained, like how many previous entries are given the user, at what time the entry was made, was the entry had a positive or a negative outcome, was it closed or still open. If it is open, does it have any connection with the present case: these are some of the insights which can be gained instantly using visualization. The data is suitably visualized using various toolkits. Nowadays this can be easily done with API’s such as Google’s prediction api, etc. Machine learning simply automates analytical model building. For this, it uses many algorithms such as Naïve Bayes, Linear Regression, K-means, Fuzzy logic. They help to iteratively learn from data, which basically means the code can learn from itself. Then the data is trained with a part of historical data and compared with a new one, this is further tried up different algorithms and data sets to improve the results.

Some of the languages utilized are as follows, python, R, etc with the corresponding packages.

**Figure: framework indicating ML process with ApI’s**

Some of the languages utilized are as follows, python, R, etc with the corresponding packages.
ISSUES

However the method mentioned above is not without any disadvantages. Initial outputs may not be accurate because the model improves and becomes more predictive only with increase in data sets and matures with more results. Therefore it is normal in the early stages to not to get 100% perfect results.
[1]. Also sometimes the user’s ignorance in description of the problem may trick the system to label with multiple identifiers. In case a single problem with a description having multiple key words or stop words may be labeled in both the categories. This may cause a mix up in providing solutions by the machine.

Even though sentiment analysis is done initially on the data to determine whether the given review is positive or negative, sometimes the users tend to give a sarcastic review which may prove to be unrecognizable by the machine at times. This can only be eliminated by teaching to recognize previous record of comments by the users.

CONCLUSION

Therefore it can be understood that machine learning will be able to help in a big deal when it comes to analytics. Very large enterprises have been already using machine learning for their business solution. It will not be long before even small companies will begin to use this new field which has dawned upon us!

REFERENCES


About the Author:

Mr. Rajkumar.S.B [CSI:-01324169] is studying in IV year of B.Tech (CSE) at Sri Sairam Engineering College, Chennai (Tamil Nadu). His areas of interest are Machine Learning, Big Data processing, programming etc. He can be reached at rajkumarbalakrishnan3@gmail.com.
ENTERTAINMENT ROBOT

Compiled by:
Hemalatha, V. Subedha and S. Hemalatha

ROBOTICS DEFINITION

Robotics is a branch of engineering that involves the operation, manufacture, design, and conception of robots. This field overlaps with electronics, computer science, mechatronics, nanotechnology and bioengineering, artificial.

ENTERTAINMENT ROBOT

Based on the successful hardware and software architecture of Care-O-bot, at Fraunhofer Institute of Manufacturing Engineering and Automation (IPA) a new generation of mobile robots has been designed. To communicate with and to entertain visitors in a museum three robots have been created. Their tasks include playing BAL, through the museum leading a guided tour or welcoming visitors. Since March 25th 2000 without noteworthy problems the robots have been running in this museum daily. The hardware platform of the robots and successfully the key technologies for applying mobile robots in public environments such as handling are outlined navigation and safety concept, and communication skills,

Hardware Platform

Each vehicle is equipped with two driven wheels (differential drive) including shaft encoders for motion tracking. At a speed of up to 1.2 m/s the robots are able to move for keeping the robots upright four castor wheels are used. A gyroscope is integrated in the robot platforms to track their current orientations. To the front of each robot 2D laser scanner is attached. The laser scanner is used for obstacle detection, navigation, and self localization. At the bottom of the robots safety sensors are a bumper attached and several infrared sensors which are integrated in the bumper facing upwards. To detect obstacles above the scanning level of the laser scanner these sensors are used. Activating one of the pressing either of the emergency stop buttons as well as safety sensors as well as results in an immediate stop. The allowed operation area restricting by besides software, to prevent the robots from leaving their assigned area a magnetic sensor facing towards the ground
is used as a secondary system. This area is bounded by a magnetic band lowered in the ground. For up to ten hours without interruption being equipped with several long lasting batteries the robots are able to move independently. For daily operation the robots can be recharged over night.

SOFTWARE ARCHITECTURE

The control software for the mobile robots is based on the software library ‘Robotics Toolbox’ and the object oriented ‘Real-time Framework’, both developed at Fraunhofer IPA. The Robotics Toolbox is which in several independent packages it is an extensive software library, for implementing all necessary service robot control functions contains modules. Furthermore, the use of rapid prototyping methods is being supported by adequate simulation and test environments for all modules. The Real-time Framework supports the software developer in designing a service robot application supports by Real-time Framework. It enables simple and fast integration of single Robotics Toolbox components to an application. The framework provides the structural integration of threads and components (error treatment, deinitialization automatic initialization etc.). The communication functions of the framework include mechanisms for real-time capable local communication and highly efficient as well as mechanisms for implementation of distributed communication, example for remote diagnosis. The Real-time Framework further presents an abstraction layer for operating system functions and the portability of the control software there by improves.

Entertainment Robot Application:
Display Animation, Animation of Exhibitions, Moving Sculptures

Advantages of K-Robots

- Our robots are use to simple and Simple to program. Our robots are very small and high-performance, well documented requiring very little area for use. Our robots are reliable and can be used by people with less experience in electronics and mechanics.
DISADVANTAGES

1. It costs money to make or buy a robot.
2. It needs a high supply of power.
3. People can lose jobs in factories.

About the Authors:

Hemalatha, final year B.E Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA.
Dr. V. Subedha, Professor and Head of Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA.
Dr. S. Hemalatha, Professor, Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA.
HOW THE INTERNET IS DESTROYING OUR BRAIN

Compiled by:


ABSTRACT

Internet, now-a-days it is the most important thing in the world. A single person did not create the internet. The initial idea of the internet is credited to leonard kleinrock. in the research at cern in Switzerland, by British computer scientist 'Tim berner lee' resulted in the world wide web, linking hyper text documents into an information system, accessible from any node on the network. since the mid 1990’s, the internet has had a revolutionary impact on culture, commerce and technology.

INTRODUCTION:

It has been known that that being online can make us seriously, clinically depressed. suppose when we are watching video in YouTube buffering will be done it make us really depressed due to slow speed of internet, it make us frustrate sometimes . Some critics postulate that heavy use of the internet more than doubles a person’s chance of being depressed by others say that the internet might not be depression’s trigger so much as it is its refuge Online Socializing Make us Insular
When communicating in person, the entire interaction is punctuated with body language, tone, inflexion, and other elements of voice, dress, etc that can totally displace the meaning of the words within it. Absent the conversation partner right in front of us to indicate his or her sincerity you have only your own filters through which to interpret the language. now a days if we have internet we are for getting the world by entering into our own island of internet

PRACTICAL HAPPINESS
If the opposite happens, and we are endowed with a ton of friends on Facebook or some other social media site, other studies have demonstrated that our stress levels will be high. The higher your friend count, they say, the more likely you are to be consumed with publishing socially acceptable aspects of your personality to the online public, which only increase the severity issues with your real-life relationships. The end result: the stress of maintaining online friends prevents you from making–and maintaining–any more real ones.

It Encourages Multitasking, Which Reduces us Ability to Task, Period
The Internet, with the aid of computer hotkeys, has given its users the incredibly easy ability to jump between tasks, subjects and ideas within a matter of seconds. Because there’s no wait, we make these jumps frequently–really frequently–about every two minutes. Except we may not utilize multitask .Instead, we get caught in between interrupting and restarting. And so, given that clear memories of single events are unattainable on the Internet, the brain attempts to compensate for that with blurry, multiple-exposure memories of everything that happened.
Multi-tasking in this sense can reduce one’s ability to pay attention at all, and in turn reduces our ability to think critically to solve those problems. Studies have shown that after a while, your ability to recall memories starts to decrease, including with our IQ. The more one multi-tasks, the greater damage becomes and the harder it is for you to recover. And if these habits begin in childhood, the risk of activities, as well as many other behavior problems downs the line.

**Google Is Replacing our Memory**

When you learn something, you don’t burn the information into your brain like a hard drive, but rather map the neural pathway of sensory, motor, and abstract activity occurring at that moment. Thus, in recalling a memory we are actually in an ideal state where we can't able to recall as when it was encoded, while at the same time adding new details from the present. And when you don’t recall a memory very often, your brain slowly scrubs off the older, more significance details as if de-fragging the whole system. This is a good thing, called quality, that the brain does anyway, allowing for more space to store information.

But when that process invariably starts with “Google it,” it initiates a problem when trying recall information found through the search engine. For one, the brain likes to conserve energy, and it’s much more likely to remember the spoils of a whole day in the library archives than an answer provided after mere seconds while delay as long as you never have to worry about Google being unavailable, you never have to dedicate brain space to remembering anything Google can tell you.

**It Encourages Addiction to Itself**

As the internet continues to act as your de facto brain, it becomes increasingly important for you to have handy at all times, which makes you use it more to compensate for our exhibiting brain matter, which makes you use your brain less, thus requiring you to rely on the internet even more. For their part, social media sites are setting the standard for digital nicotine (drug), employing all the bells and whistles to keep users coming back. Video game fans will be well aware of the thrill of leveling up: The screen flashes, the music plays, and the numbers go up; it’s all about to satisfy. And it makes you want to do it again and again, until…you don’t even know what, but you’ll do everything in your power to feel this way once more and more. If this sounds familiar to something you’ve been warned about, it should; this is same as when we addicted to drugs.

**It’s totally integrated in to Society**

Even if we wanted to get away from the Internet we can’t able to let it go, we will stuck to internet easily. As stated above, everyone has a Smartphone as well as Internet at work and home. More and more, manufacturers and media are switching to digital means of delivery, making Internet for a certain standard of living and replacing any devices like VCRs or boom boxes simply pertaining.

**CONCLUSION**

In this paper we have discussed about how the internet make humans to get depressed and frustrated. Don’t go panic just yet. Though, we probably aren’t addicted to the internet. The potential for new technology to be dangerous may always be present, but that doesn’t mean that it is impossible to get out from the over usage of internet, though we can get out from it since, the internet was also created by the human. Like anything that can become too much very quickly, the key word is moderation. We have to reduce the usage of internet for unnecessary things.
About the authors:

- Sharuk.K, Dept. of Computer Science & Engineering, Panimalar Institute of Technology, Chennai, Tamil Nadu, India.
- Dheena Prasad.J, Dept. of Computer Science & Engineering, Panimalar Institute of Technology, Chennai, Tamil Nadu, India.
- Manoj Krishna.K, Dept. of Computer Science & Engineering, Panimalar Institute of Technology, Chennai, Tamil Nadu, India.
- Dr.S.Hemalatha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA.
A MANET is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission.

Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet. For example, A VANET (Vehicular Ad Hoc Network), is a type of MANET that allows vehicles to communicate with roadside equipment. While the vehicles may not have a direct Internet connection, the wireless roadside equipment may be connected to the Internet, allowing data from the vehicles to be sent over the Internet. The vehicle data may be used to measure traffic conditions or keep track of trucking fleets. Because of the dynamic nature of MANETs, they are typically not very secure, so it is important to be cautious what data is sent over a MANET.

OUTLINE

- Topology change frequent
- No cellular infrastructure
- Data must be routed via intermediate nodes
- Do not need backbone infrastructure support – Are easy to deploy –
- Useful when infrastructure is absent, destroyed or impractical Many Applications
- Personal area networking
- Congestion and flow control Network
- New applications and adaptations Transport
- Media access and handoff Physical
- Transmission errors and interference Medium Access Control in MAN
- Search and Rescue – policing and fire fighting Challenges in Mobile Environments

**Ad-hoc Networks**

- Infrastructurless (ad-hoc) network or MANET (Mobile Ad-hoc NETwork)
ROUTING IN MANET
UNICAST ROUTING PROTOCOLS

Many protocols have been proposed
- Some specifically invented for MANET
- Others adapted from protocols for wired networks
- No single protocol works well in all environments
- Some attempts made to develop adaptive/hybrid protocols
- Standardization efforts in IETF
- MANET, MobileIP working groups

TRANSPORT IN MANET
USER DATAGRAM PROTOCOL (UDP)

Studies comparing different routing protocols for MANET typically
- Measure UDP performance several performance metrics are used
- Routing overhead per data packet – packet delivery delay – throughput/loss

Many variables affect performance
- Traffic characteristics – Mobility characteristics – Node capabilities
- Difficult to identify a single scheme that will perform well in all Environments
several relevant studies

TRANSMISSION CONTROL PROTOCOL (TCP)
RELIABLE ORDERED DELIVERY

- Reliability achieved by means of retransmissions if necessary  End to end semantics
- Receiver sends cumulative acknowledgements for insequence packets
- Window size is minimum of Receiver’s advertised window - determined by available buffer space at the receiver
- Congestion window determined by the sender, based on feedback from the network
Congestion window size bounds the amount of data that can be sent per roundtrip time

TCP IN MANET
SEVERAL FACTORS AFFECT TCP PERFORMANCE IN MANET:

WIRELESS TRANSMISSION ERRORS

may cause fast retransmit, which results in
- Retransmission of lost packet
• Reduction in congestion window – reducing congestion Window in response to errors is unnecessary Multi-hop routes on shared wireless medium
• Longer connections are at a disadvantage compared to shorter connections, because they have to contend for wireless access at each hop

CONCLUSION

✓ Issues other than routing have received much less attention.

About the Authors:

• Pavithra.D BE computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
• Prathyusha.C.V BE computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
• Sindhujaa.E.ABE computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
• Dr.S.Hemalatha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
• Dr.V.Subedha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
• Dr.T.Kalaichelvi, Professor/CSE Panimalar Institute of Technology, in Chennai, Tamil Nadu, INDIA
MEDICAL ROBOTS

Compiled by:

Hemalatha, V. Subedha, S. Hemalatha

Robotics definition

Robotics is a branch of engineering that involves the operation, manufacture, design, and conception of robots. This field overlaps with electronics, computer science, mechatronics, nanotechnology and bioengineering.

Medical robots

Robotics is having many exciting potential applications. It is also a field current realities do not match in which expectations of the public often the world. However, it is very difficult to build a mechanical device (e.g. a robotic arm) that has dexterity comparable to a human’s limbs. To build a computer system even more difficult that can perceive its environment, reason about the environment and the task at hand, and control a robotic arm with anything remotely approaching the capabilities of a human being.

Applications

Applications in Medicine Robots are enhancing patient safety in the hurried pace of clinics and hospitals where attention to details and where reliability are essential. In recent years, compared with their previous role robots are moving closer to patient care, as providing services in the infrastructure of medicine. Examples of past use are in repetitive activities of carrying hot meals to patients, cleaning floors and washing equipment “bedside. What is new is measuring blood, finding them in clinical laboratories identifying and other specimen for testing, and in pharmacies counting pills and delivering them to nurses on ICU’s. Or, bringing banked blood from the laboratory to the ED,surgery or medical surgery units or transfusions Robots for ICU are being used as very accurate, Robodoc” was designed an early active robot to mill perfectly round lumens in the shafts of fractured bones, the bonding of metal replacements to improve such as for femur heads and knee joints. About the ultimate beneficial outcomes the future of this system remains uncertain because of questions. The reasons behind the interest in the adoption of medical robots are multitudinous. Robots provide industry with something that is, compare to dedicated and hardworking employee, robot is more valuable than even dedicated and hard working employee the most namely cost-efficiency.
Advantages

There are lots of advantages having medical robots. One advantage is that quick of patient recovery. On average, patients leave the hospital two to five days earlier than patients who have had traditional surgery. Also, most patients 50% more quickly return to normal activity. Smaller recovery times are not only that less staff is needed it also means better for the patient, during surgery, before surgery, and after surgery. Because of that, lowered the cost of being in hospital. Another advantage is that robot-assisted surgery gives the surgeon better control over the better view and instruments. Because of this, surgeons during the surgery don't have to stand all of the time and as quickly do not get tired. Also, robots do not make the same mistakes that humans can make. More exact Robots are extremely more exact, and during the surgery they do not move by accident. Before surgery this could also make patients feel less worried.

Disadvantages

For surgery there are also having some disadvantages with using medical robots. One of these disadvantages is use a medical robot during surgery costs is more. Another disadvantage is that even to operate the system more training is needed.

The Future of Robotic Surgery

In future telemedicine can be used to operate from anywhere else in the world, Palese said. "I don't think that's far-fetched science fiction anymore. I think that I'll see that in my lifetime."

About the authors:

• Hemalatha, final year B.E Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA.
• Dr.V.Subedha, Professor and Head of Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA.
• Dr.S.Hemalatha, Professor, Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA
MILITARY ROBOTS

Compiled by:
Hemalatha, V. Subedha, S. Hemalatha

The word “robot” comes from the check word Robot a which means forced labor. Military robots are mobile robots which are remote controlled capable of taking surveillance photographs accurately specifically designed for various military applications right from transport to search/rescue & attack. Why do we need military robots? These robots can be used in a battle/war to do tasks. Deactivating bombs, clearing buildings, clearing minefields. In short risking money instead of human life which is more precious. Replacing these robots for humans in dangerous missions saves human life. There is one such robot called as Autonomous robots.

AUTONOMOUS ROBOTS

They are also known as killer robots which can be able to select and engage with targets without human. There is one such robot known as armed drones were developed in nations like US, UK, Russia, South Korea, Israel, and China. Various other autonomous robots are BIGDOG, CRUSHER.

HOW DOES THESE ROBOTS WORK?

The basic idea is to program robots to respond a certain way to outside stimuli. Most use stereo vision to see the world. To locate and classify objects robots use cameras which gives depth perception, image recognition software. More advanced robots analyze and adapt unfamiliar environments, even rough terrain areas. A rover robot can construct a map of the land in front of the land based on its visual sensors. If the map shows the area is very bumpy terrain pattern it takes another way. A general military robot includes cameras, video screens, force sensors, special grippers with these integrated systems they can do jobs easily and they have different shapes based on the purposes.

ROBOTS OF TODAY

Dragon runner-built for urban combat, designed for areas which are too dangerous for humans and main use it to relay information such as pictures of soldiers.

TALON-small tracked military robot designed for missions ranging from reconnaissance to combat. One of the fastest to travel in sand, water, snow as well as climb stairs.

ACER-it is a small bulldozer which is the largest terrestrial military robot which weigh 2.25 tons, speeds up to 6.3 mph used in clearing obstacles, hauling cargo and disabled vehicles, removing explosives.

Packbot-smaller and lighter then TALON controlled by Pentium processor specially designed to with stand rough treatment it is a GPS system, an electronic compass and temperature sensors built in Main use is to find hidden enemies, search for hidden bombs and other dangers.
ADVANTAGES

• The major advantage is life saving. they do jobs that are dangerous and
difficult for a soldier
• Capable of doing duties similar to humans
• Easily replaceable
• They come in various sizes which can used accordingly based on needs
• It can not only disarm bombs/weapons but also hold and fire.
• And last but not the least they do not get tired, do not know fear, do not
sleep

DISADVANTAGES

• They are powerful machines which are allowed to control things but if
something goes wrong terrible things happen.
• Expensive
• It needs a lot of maintenance to keep working. If one part of the robots
does not work they whole war spoils- say a camera don’t work a user cannot
find his own co soldier. If driver mechanism don’t rotate laser will not
operate accurately.
• Cant respond in case of emergencies.
• Replace human workers hence people lose jobs.

FUTURE PROJECTS:

• EXOSKELETON robots are to be built which looks like humans and does work
as a soldier does in war/battle individually, there will be no humans.
• Military and civilian will become ubiquitous in peace.
• Agriculture robots, nano robots are future projects in an advanced level.
• Can be used to perform difficult task using effective sensors for mental
detection, PIR sensor to detect human living beings, video transmissions etc.

To conclude the development of military robots produces more effective robots which can help
battle fields. It is better to lose a robot than a human life but must be used in an appropriate and
useful way.

About the Authors:

▪ Hemalatha, Final year B.E Computer Science and Engineering at Panimalar Institute of
Technology in Chennai, Tamil Nadu, INDIA.
▪ Dr.V.Subedha, Professor and Head of Computer Science and Engineering at Panimalar Institute
of Technology in Chennai, Tamil Nadu, INDIA.
▪ Dr.S.Hemalatha, Professor ,Computer Science and Engineering at Panimalar Institute of
Technology in Chennai, Tamil Nadu, INDIA
WHAT IS NANO ROBOTICS?

Nano robotics is a technology used for creating robots which is theoretically large nano engineering technology of designing and building nano robots at a smaller size of about 9-10 meters. This technology is based on the controlling of atomic and molecular level. It can be useful in a variety of fields such as electronics, medicines etc...

TYPES OF NANO ROBOTS:

There are various types of nano robots which can be used:

- Blood swimming robots
- Nubots
- Nanoids
- Nano spiders

BLOOD SWIMMING ROBOTS:

In this picture is a blood swimming robot which can be used in medical field as a micro camera which takes pictures of human body which helps doctors to treat patients more accurately and cure diseases easily. It has a capacitor is used to control the nano robot and by using swimming tail it swims in an up and down motion and clicks images using the micro camera.
• They are less toxic.
• Better medical treatment
• Reduced energy size.
• Lower cost of computing.

Disadvantages of nano robots:
• Cost of installation in high
• A cluster of different robots with one another in so harmful
• Maintenance is difficult
• The development of nanorobotics is endless and can improve various advancements in future.

About the Authors:
• Hemalatha, final year B.E Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA.
• Dr.V.Subedha, Professor and Head of Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA.
• Dr.S.Hemalatha, Professor, Computer Science and Engineering at Panimalar Institute of Technology in Chennai, Tamil Nadu, INDIA.
NANOTECHNOLOGY: THE FUTURE MEDICINE

Compiled By:

S. Hemalatha, V. Subedha and T. Kalaichelvi

ABSTRACT

Nanotechnology is an exciting new area in science, with many possible applications in medicine. This article seeks to outline the role of different areas such as diagnosis of diseases, drug delivery, imaging, and so on.

INTRODUCTION

Nanotechnology can be defined as the science and engineering involved in the design, synthesis, characterization, and application of materials and devices whose smallest functional organization, in at least one dimension, is on the nanometer scale or one billionth of a meter. At these scales, consideration of individual molecules and interacting groups of molecules in relation to the bulk macroscopic properties of the material or device becomes important, as it has a control over the fundamental molecular structure, which allows control over the macroscopic chemical and physical properties. Nanotechnology has found many applications in medicine and this article outlines some such applications.

POSSIBLE MECHANISMS OF NANOTECHNOLOGY IN RELATION TO MEDICINE

These materials and devices can be designed to interact with cells and tissues at a molecular (i.e., subcellular) level, for applications in medicine and physiology, with a high degree of functional specificity, thus allowing a degree of integration between technology and biological systems not previously attainable. It should be appreciated that nanotechnology is not in itself a single emerging scientific discipline, but rather, a meeting of different traditional sciences, such as, chemistry, physics, materials science and biology, to bring together the required collective expertise needed to develop these novel technologies. The promise that nanotechnology brings is multifaceted, offering not only improvements to the current techniques, but also providing entirely new tools and capabilities.

By manipulating drugs and other materials at the nanometer scale, the fundamental properties and bioactivity of the materials can be altered. These tools can permit a control over the different characteristics of drugs or agents such as:
a. alteration in solubility and blood pool retention time
b. controlled release over short or long durations
c. environmentally triggered controlled release or highly specific site-targeted delivery

APPLICATIONS OF NANOMATERIALS IN MEDICINE

These applications include fluorescent biological labels, drug and gene delivery, bio-detection of pathogens, detection of protein, probing of DNA structure, tissue engineering, tumor detection, separation and purification of biological molecules and cells, MRI contrast enhancement and phagokinetic studies. The long-term goal of nanomedicine research is to characterize the quantitative molecular-scale components known as nanomachinery. Precise control and manipulation of nanomachinery in cells can lead to better understanding of the cellular mechanisms in living cells, and to the development of advanced technologies, for the early diagnosis and treatment of various diseases. The significance of this research lies in the development of a platform technology that will influence nanoscale imaging approaches designed to probe molecular mechanisms in living cells. Molecular imaging has emerged as a powerful tool to visualize molecular events of an underlying disease, sometimes prior to its downstream manifestation. The merging of nanotechnology with molecular imaging provides a versatile platform for the novel design of nanoprobe that will have tremendous potential to enhance the sensitivity, specificity and signaling capabilities of various biomarkers in human diseases.

Nanoparticle probes can endow imaging techniques with enhanced signal sensitivity, better spatial resolution and the ability to relay information on biological systems at molecular and cellular levels. Simple magnetic nano-particles can function as magnetic resonance imaging (MRI) contrast enhancement probes. These magnetic nano-particles can then serve as a core platform for the addition of other functional moieties including fluorescence tags, radio nuclides and other biomolecules, for multimodal imaging, gene delivery and cellular trafficking. An (MRI) with hybrid probes of magnetic nano-particles and adenovirus can detect target cells and monitor gene delivery and expression of green fluorescent proteins optically. Nuclear techniques such as positron-emission tomography (PET) potentially provide detection sensitivities of higher magnitude, enabling the use of nano-particles at lower concentrations than permitted by routine MRI. Furthermore, a combination of the high sensitivity of PET with the anatomical detail provided by computed tomography (CT) in hybrid imaging, has the potential to map signals to atherosclerotic vascular territories. Molecular imaging always requires accumulation of the contrast agent in the target site, and this can be achieved more efficiently by steering nano-particles containing the contrast agent into the target. This entails accessing target molecules hidden behind tissue barriers, necessitating the use of targeting groups. For imaging modalities with low sensitivity, nano-particles bearing multiple contrast groups provide signal amplification. The same nanoparticles can, in principle, deliver both the contrast medium and the drug, allowing monitoring of the bio-distribution and therapeutic activity simultaneously (referred to as theranostics). Such nanofiber-based scaffolds are available in a wide range of pore size distribution, high porosity and high surface area-to-volume ratio. Such a wide range of parameters are favorable for cell attachment, growth and proliferation, and also provide a basis for the future optimization of an electrospun-nanofibrous scaffold in a tissue-engineering application.
CONCLUSIONS

Thus, it is concluded that, nanotechnology or systems / device manufacture at the molecular level, is a multidisciplinary scientific field undergoing explosive development. The genesis of nanotechnology can be traced to the promise of revolutionary advances across medicine, communications, genomics and robotics.

About the Authors:

- Antony G BE computer Science and Engineering at Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr.S.Hemalatha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr.V.Subedha, Professor /CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
- Dr.T.Kalaichelvi, Professor/CSE Panimalar Institute of Technology, Chennai, Tamil Nadu, INDIA
A BIT OF HISTORY

The Unix input/output (I/O) system follows a paradigm usually referred to as Open-Read-Write-Close. Before a user process can perform I/O operations, it calls Open to specify and obtain permissions for the file or device to be used. Once an object has been opened, the user process makes one or more calls to Read or Write data. Read reads data from the object and transfers it to the user process, while Write transfers data from the user process to the object. After all transfer operations are complete, the user process calls Close to inform the operating system that it has finished using that object.

When facilities for Inter Process Communication (IPC) and networking were added to Unix, the idea was to make the interface to IPC similar to that of file I/O. In Unix, a process has a set of I/O descriptors that one reads from and writes to. These descriptors may refer to files, devices, or communication channels (sockets). The lifetime of a descriptor is made up of three phases: creation (open socket), reading and writing (receive and send to socket), and destruction (close socket).

The IPC interface in BSD-like versions of Unix is implemented as a layer over the network TCP and UDP protocols. Message destinations are specified as socket addresses; each socket address is a communication identifier that consists of a port number and an Internet address.

The IPC operations are based on socket pairs, one belonging to a communication process. IPC is done by exchanging some data through transmitting that data in a message between a socket in one process and another socket in another process. When messages are sent, the messages are queued at the sending socket until the underlying network protocol has transmitted them. When they arrive, the messages are queued at the receiving socket until the receiving process makes the necessary calls to receive them.

ADVANTAGE OF NETWORK PROGRAMMING

The main advantage of network Programming is sharing of data and resources, some more advantages are:

- Sharing resources like printer, Scanner.
- Centralize software management, Software install on only one system and used in multiple system.
- Sharing of data due to this reduce redundancy of application.
- Burden on the developer can be reduced.
- Wastage of memory can be reduced because no need to install same application on every system.
- Time consuming process to develop application is reduced.
Computer network programming involves writing computer programs that enable processes to communicate with each other across a computer network.

Java Socket programming is used for communication between the applications running on different JREs.

Java Socket programming can be connection-oriented or connection-less.

Socket and ServerSocket classes are used for connection-oriented socket programming and DatagramSocket and DatagramPacket classes are used for connection-less socket programming.

The client in socket programming must know three information:

1. IP Address of Server
2. Port number - It is unique identification value represents residing position of a server in the computer. It is a four digit positive number.
3. Port Name - It is a valid user defined name to know about client system, the default port name for any local computer is localhost. Port name should be the same value which is given at Server programming.

**SOCKET CLASS**

A socket is simply an endpoint for communications between the machines. The Socket class can be used to create a socket.

**Important methods**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>public InputStream getInputStream()</td>
<td>returns the InputStream attached with this socket.</td>
</tr>
<tr>
<td>public OutputStream getOutputStream()</td>
<td>returns the OutputStream attached with this socket.</td>
</tr>
<tr>
<td>public synchronized void close()</td>
<td>closes this socket</td>
</tr>
</tbody>
</table>

**Socket class**

A socket is simply an endpoint for communications between the machines. The Socket class can be used to create a socket.

**Important methods**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>public Socket accept()</td>
<td>returns the socket and establish a connection between server and client.</td>
</tr>
<tr>
<td>public synchronized void close()</td>
<td>closes the server socket.</td>
</tr>
</tbody>
</table>
When writing network applications, it's common to talk about clients and servers. The distinction is increasingly vague, but the side that initiates the conversation is usually the client. The side that accepts the request to talk is usually the server. In the case where there are two peer applications using sockets to talk, the distinction is less important, but for simplicity we'll use the above definition.

For our purposes, the most important difference between a client and a server is that a client can create a socket to initiate a conversation with a server application at any time, while a server must prepare to listen for incoming conversations in advance. The java.net.Socket class represents a single side of a socket connection on either the client or server. In addition, the server uses the java.net.ServerSocket class to wait for connections from clients. An application acting as a server creates a ServerSocket object and waits, blocked in a call to its accept() method, until a connection arrives. When it does, the accept() method creates a Socket object the server uses to communicate with the client. A server carries on multiple conversations at once; there is only a single ServerSocket, but one active Socket object for each client.

When two applications want to communicate with each other they should be on a machine which is uniquely identified by ip address and for identifying the program it should have Port Number. Using ip address & port number we can identify the program on net.

Rules for when two or more applications intend to communicate with each other.
1) One application has to play the role of Server and other will have to play the role of Client.
2) Server application need the Server Socket Object which has to be bound to the port number.
3) All the request of client are received by Server Socket.
4) To make the request client need SocketObject.

For making request Socket object need to know two things ip address of Server machine & port number of Server Socket Object.

Server Socket Object won’t communicate with Socket object, it will create one more object this will also the same type and bound to the same port.

So Server Socket Object creates the Socket Object on Server side on the request of client.

TCP Connection is full duplex Connection. It is a two way that is traffic and moving in both direction simultaneously.
Per Client there is one object on server side.

Trivial question is **how many socket object will be there on server side?**

Answer as many it has but only **one server socket** will be there.

---

**CODING FOR ABOVE DIAGRAM**

we have to create one project for each Socket.

```
System.out.println("Client/Server Signing on");
System.out.println("Client/Server Signing off");
```

this will be first and last line of the main method respectively.

make habit to run server first then client, don't use play button it will run default project.

Server socket class is in `java.net` so we have to import `java.net` package in server project.

port number is a 16 bit entity. from 0 to 1024 is reserved by **IETF - INTERNET ENGINEERING TASK FORCE** for local server we have to use above this number but when we are on internet and customers are live touching us then we can use between 0 to 1024 for standard services.

On client project : socket need to be given ip address and port number i.e. a special ip address if the server is on your machine

There are 2 possibility to get error

1. When we running the client project before server.
2. When we run server and it stuck and we run it again then it will give an error because port number is already gone. In such cases when we did lots of mistake like this and we want to kill everything then go to the **Run menu at the end stop the all existing program**

Establishing connection between Server and Client.

making in and out object in client project
creation of socket object in server
making in and out object in server project

```
iniclient
PrintWriteNos = new PrintWriter(  
newBufferedWriter(  
newOutputStreamWriter(  
soc.getOutputStream()
```

---
in server
printed the message on client side and server should receive it
BufferedReader nis = new BufferedReader(new InputStreamReader(soc.getInputStream()));

IN SERVER

How Server will read
so we have to use readLine there for we went up to BufferedReader
write:
String str = nis.readLine();
while (!str.equals("end"))
{
    System.out.println("leave server" + str);
    str = nis.readLine();
}

STAGE 1

we want to read data from the keyboard and send to the server.
to read from keyboard write:
BufferedReader kin = new BufferedReader(new InputStreamReader(System.in));
String str = kin.readLine();
while (!str.equals("end"))
{
    nos.println(str);
    str = kin.readLine();
}

now we have the arrangement like client will send something and server will get that.

divide whole thing in two machine (A & B)

machine B will start server and machine A will start client
Client will not connected to their Loopback ip address but this will use ip address of machine B
and if machine B changed the port number then it has to give port number also to machine A. so for this only change we will do
Socket soc = new Socket("127.0.0.1", 8089); here

now what machine A will type machine B can read and do the vice versa procedure with machine A & machine B

Now revert back to Loopback i.e. own server & own client and check. this was Console Client.

![GUI Client](image)

in main first establish socket connection then make all frame button and etc. nos(handle) should be visible to listener it has to be public and static.
and in Listener class write
```java
name_of_main_class.nos.println();
```
this will create client.
but when we type end server will end since it is event loop it won't get closed; so now we want when we say "end" this frame also should vanish so for this we have to do small change in handle, i.e. if it is "end" then send it to server because server has to stop
then write System.exit(0);
now make one frame in server side so that whatever client send show in the text area of sever side frame.
so just write in the loop of server project in the place of sout, ta.append().

---

**STAGE 2**

It is divided in the sub parts
a) don't touch server side code; use code of chat frame add socket code over the JFrame make nos(handle) public and add just one line into listener class
```java
name_of_main_class.nos.println();
```
b) on Server side make text area in JFrame and in while loop after sout write ta.append();
this all we will do in main of server.
Everything of JFrame of server side will come before Socket creation i.e. all code of Swing will come before Socket creation.
Explanation of Server side code.  
at the end of server side code write  
System.exit(0);  
so that when client will send end server side get closed.  
same in client side, in **listener class** add if condition to check whether the data is end or not.  
If it is end then also send it to the server then write System.exit(0); means at the time we type "end" everything should closed.  

**ECHO APPLICATION**

whole thing remains same but now Listener will not print on text area. It will send to server and server will take, print and then send that string return back to client.  

so before reading the second string we have to do three work 1. print on console 2. print on text area & 3. send back to client.  
So we have to add one line in server side  
nos.println();  
and then in client side we have to write nis.readLine();  
but this is the worst kind of programming.  
never keep the **event Dispatcher** blocking call means flow of control is block & it can't proceed until the event for which it is waiting is happen.  
if **event Dispatcher** is stopped that means GUI is stopped  
ever do the blocking calls in a event handler  
so we won't write nis.readLine(); i action performance

so write in the end of main  
nis.readLine();  
capture it in string;  
while(!="End")  
{
   ta.append();
}  
due to this work of server is increased now it has to send string back to client.  
**Client is sending and Receiving and Server is receiving and sending this is Echo Application.**

before sever is Signing off write nos.println("end");

About the Author:

Mr. Ravishankar Singh [CSI:-01366982] is studying in III year of B.E. (CMPN) at THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY, Mumbai (Maharashtra). His areas of interest are Java, Networking, Computer Hardware, Artificial Intelligence, Digital Forensic, programming etc. He can be reached at singhrv000@gmail.com / rviisingh000@gmail.com.
5G-2020D2D

Compiled by:

Robin Anant

ABSTRACT

In the near future, i.e., beyond 4G, some of the prime objectives or demands that need to be addressed are increased capacity, improved data rate, decreased latency, and better quality of service. To meet these demands, drastic improvements need to be made in cellular network architecture. This paper presents the results of a detailed survey on the fifth generation (5G) cellular network architecture and some of the key emerging technologies that are helpful in improving the architecture and meeting the demands of users. In this detailed survey, the prime focus is on the 5G cellular network architecture, massive multiple input multiple output technology, and device-to-device communication (D2D). Along with this, some of the emerging technologies that are addressed in this paper include interference management, spectrum sharing with cognitive radio, ultra-dense networks, multi-radio access technology association, full duplex radios, millimeter wave solutions for 5G cellular networks, and cloud technologies for 5G radio access networks and software defined networks. In this paper, a general probable 5G cellular network architecture is proposed, which shows that D2D, small cell access points, network cloud, and the Internet of Things can be a part of 5G cellular network architecture. A detailed survey is included regarding current research projects being conducted in different countries by research groups and institutions that are working on 5G technologies.

INTRODUCTION

Today and in the recent future, to fulfill the presumptions and challenges of the near future, the wireless based networks of today will have to advance in various ways. Recent technology constituent like high-speed packet access (HSPA) and long-term evolution (LTE) will be launched as a segment of the advancement of current wireless based technologies. Nevertheless, auxiliary components may also constitute future new wireless based technologies, which may adjunct the evolved technologies. Specimen of these new technology components are different ways of
accessing spectrum and considerably higher frequency ranges, the instigation of massive antenna configurations, direct device to-device communication, and ultra-dense deployments. Since its initiation in the late 1970s, mobile wireless communication has come across from analog voice calls to current modern technologies adept of providing high quality mobile broadband services with end-user data rates of several megabits per second over wide areas and tens, or even hundreds, of megabits per second locally. The extensive improvements in terms of potentiality of mobile communication networks, along with the initiation of new types of mobile devices such as smartphones and tablets, have produced an eruption of new applications which will be used in cases for mobile connectivity and a resultant exponential growth in network traffic. This paper presents our view on the future of wireless communication for 2020 and beyond. In this paper, we describe the key challenges that will be encountered by future wireless communication while enabling the networked society. Along with this, some technology routes that may be taken to fulfill these challenges. The imagination of our future is a networked society with unbounded access to information and sharing of data which is accessible everywhere and every time for everyone and everything. To realize this imagination, new technology components need to be examined for the evolution of existing wireless based technologies. Present wireless based technologies, like the 3rd Generation Partnership Project (3GPP) LTE technology, HSPA and Wi-Fi, will be incorporating new technology components that will be helping to meet the needs of the future. Nevertheless, there may be certain scenarios that cannot be adequately addressed along with the evolution of ongoing existing technologies. The instigation of completely new wireless based technologies will complement the current technologies which are needed for the long term realization of the networked society.

STARDOM OF WIRELESS TECHNOLOGIES

G. Marconi, an Italian inventor, unlocks the path of recent day wireless communications by communicating the letter ‘S’ along a distance of 3Km in the form of three dot Morse code with the help of electromagnetic waves. After this inception, wireless communications have become an important part of present day society. Since satellite communication, television and radio transmission has advanced to pervasive mobile telephone, wireless communications has transformed the style in which society runs. The evolution of wireless begins here. The evolving generations of wireless technologies in terms of data rate, mobility, coverage and spectral efficiency. As the wireless technologies are growing, the data rate, mobility, coverage and spectral efficiency increases. It also shows that the 1G and 2G technologies use circuit switching while 2.5G and 3G uses both circuit and packet switching and the next generations from 3.5G to now i.e. 5G are using packet switching. Along with these factors, it also differentiate between licensed spectrum and unlicensed
spectrum. All the evolving generations use the licensed spectrum while the WiFi, Bluetooth and WiMAX are using the unlicensed spectrum.

An overview about the evolving wireless technologies is below:

**A. 1G**: The 1st generation was announced in initial 1980’s. It has a data rate up to 2.4kbps. Major subscribers were Advanced Mobile Phone System (AMPS), Nordic Mobile Telephone (NMT), and Total Access Communication System (TACS). It has a lot of disadvantages like below par capacity, reckless handoff, inferior voice associations, and with no security, since voice calls were stored and played in radio towers due to which vulnerability of these calls from unwanted eavesdropping by third party increases.

**B. 2G**: The 2nd generation was introduced in late 1990’s. Digital technology is used in 2nd generation mobile telephones. Global Systems for Mobile communications (GSM) was the first 2nd generation system, chiefly used for voice communication and having a data rate up to 64kbps. 2G mobile handset battery lasts longer because of the radio signals having low power. It also provides services like Short Message Service (SMS) and e-mail. Vital eminent technologies were GSM, Code Division Multiple Access (CDMA), and IS-95.

**C. 2.5G**: It generally subscribes a 2nd generation cellular system merged with General Packet Radio Services (GPRS) and other amenities doesn’t commonly endow in 2G or 1G networks. A 2.5G system generally uses 2G system frameworks, but it applies packet switching along with circuit switching. It can assist data rate up to 144kbps. The main 2.5G technologies were GPRS, Enhanced Data Rate for GSM Evolution (EDGE), and Code Division Multiple Access (CDMA) 2000.

**D. 3G**: The 3rd generation was established in late 2000. It imparts transmission rate up to 2Mbps. Third generation (3G) systems merge high speed mobile access to services based on Internet Protocol (IP). Aside from transmission rate, unconventional improvement was made for maintaining QoS. Additional amenities like global roaming and improved voice quality made 3G as a remarkable generation. The major disadvantage for 3G handsets is that, they require more power than most 2G models. Along with this 3G network plans are more expensive than 2G. Since 3G involves the introduction and utilization of Wideband Code Division Multiple Access (WCDMA), Universal Mobile Telecommunications Systems (UMTS) and Code Division Multiple Access (CDMA) 2000 technologies, the evolving technologies like High Speed Uplink/Downlink Packet Access (HSUPA/HSDPA) and Evolution-Data Optimized (EVDO) has made an intermediate wireless generation between 3G and 4G named as 3.5G with improved data rate of 5-30 Mbps.

**E. 3.75G**: Long-Term Evolution technology (LTE) and Fixed Worldwide Interoperability for Microwave Access (WIMAX) is the future of mobile data services. LTE and Fixed WIMAX has the potential to supplement the capacity of the network and provides a substantial number of users the facility to access a broad range of high speed services like on demand video, peer to peer file sharing and composite Web services. Architecture and Emerging Technologies Along with this, a supplementary spectrum is accessible which accredit operators manage their network very compliantly and offers better coverage with improved performance for less cost.

**F. 4G**: 4G is generally referred as the descendant of the 3G and 2G standards. 3rd Generation Partnership Project (3GPP) is presently standardizing Long Term Evolution (LTE) Advanced as...
forthcoming 4G standard along with Mobile Worldwide Interoperability for Microwave Access (WIMAX). A 4G system improves the prevailing communication networks by imparting a complete and reliable solution based on IP. Amenities like voice, data and multimedia will be imparted to subscribers on every time and everywhere basis and at quite higher data rates as related to earlier generations. Applications that are being made to use a 4G network are Multimedia Messaging Service (MMS), Digital Video Broadcasting (DVB), and video chat, High Definition TV content and mobile TV [2], [4]–[6]. G. 5G With an exponential increase in the demand of the users, 4G will now be easily replaced with 5G with an advanced access technology named Beam Division Multiple Access (BDMA) and Non- and quasi-orthogonal or Filter Bank multi carrier (FBMC) multiple access. The concept behind BDMA technique is explained by considering the case of the base station communicating with the mobile stations. In this communication, an orthogonal beam is allocated to each mobile station and BDMA technique will divide that antenna beam according to locations of the mobile stations for giving multiple accesses to the mobile stations, which correspondingly increase the capacity of the system [8]. An idea to shift towards 5G is based on current drifts, it is commonly assumed that 5G cellular networks must address six challenges that are not effectively addressed by 4G i.e. higher capacity, higher data rate, lower End to End latency, massive device connectivity, reduced cost and consistent Quality of Experience provisioning [22], [23]. These challenges are concisely shown in Fig. 2 along with some potential facilitators to address them. An overview of the challenges, facilitators, and corresponding design fundamentals for 5G is shown in Fig. 2 [20]. Recently introduced IEEE 802.11ac, 802.11ad and 802.11af standards are very helpful and act as building blocks in the road towards 5G.

G. 5G: With an exponential increase in the demand of the users, 4G will now be easily replaced with 5G with an advanced access technology named Beam Division Multiple Access (BDMA) and Non- and quasi-orthogonal or Filter Bank multi carrier (FBMC) multiple access. The concept behind BDMA technique is explained by considering the case of the base station communicating with the mobile stations. In this communication, an orthogonal beam is allocated to each mobile station and BDMA technique will divide that antenna beam according to locations of the mobile stations for giving multiple accesses to the mobile stations, which correspondingly increase the capacity of the system. An idea to shift towards 5G is based on current drifts, it is commonly assumed that 5G cellular networks must address six challenges that are not effectively addressed by 4G i.e. higher capacity, higher data rate, lower End to End latency, massive device connectivity, reduced cost and consistent Quality of Experience provisioning. Recently introduced IEEE 802.11ac, 802.11ad and 802.11af standards are very helpful and act as building blocks in the road towards 5G.

5G ARCHITECTURE

To contemplate 5G network in the market now, it is evident that the multiple access techniques in the network are almost at a still and requires sudden improvement. Current technologies like OFDMA will work at least for next 50 years. Moreover, there is no need to have a change in the wireless setup which had come about from 1G to 4G. Alternatively, there could be only the addition of an application or amelioration done at the fundamental network to please user requirements. This will provoke the package providers to drift for a 5G network as early as 4G is commercially set up. To meet the demands of the user and to overcome the challenges that have been put forward in the 5G system, a drastic change in the strategy of designing the 5G wireless cellular architecture is
needed. A general observation of the researchers has shown in that most of the wireless users stay inside for approximately 80 percent of time and outside for approximately 20 percent of the time. In present wireless cellular architecture, for a mobile user to communicate whether inside or outside, an outside base station present in the middle of a cell helps in communication. So for inside users to communicate with the outside base station, the signals will have to travel through the walls of the indoors, and this will result in very high penetration loss, which correspondingly costs with reduced spectral efficiency, data rate, and energy efficiency of wireless communications. To overcome this challenge, a new idea or designing technique that has come in to existence for scheming the 5G cellular architecture is to distinct outside and inside setups. With this designing technique, the penetration loss through the walls of the building will be slightly reduced. This idea will be supported with the help of massive MIMO technology, in which geographically dispersed array of antenna’s are deployed which have tens or hundreds of antenna units. Since present MIMO systems are using either two or four antennas, but the idea of massive MIMO systems has come up with the idea of utilizing the advantages of large array antenna elements in terms of huge capacity gains. To build or construct a large massive MIMO network, firstly the outside base stations will be fitted with large antenna arrays and among them some are dispersed around the hexagonal cell and linked to the base station through optical fiber cables, aided with massive MIMO technologies. The mobile users present outside are usually fitted with a certain number of antenna units but with cooperation a large virtual antenna array can be constructed, which together with antenna arrays of base station form virtual massive MIMO links. Secondly, every building will be installed with large antenna arrays from outside, to communicate with outdoor base stations with the help of line of sight components. The wireless access points inside the building are connected with the large antenna arrays through cables for communicating with indoor users. This will significantly improves the energy efficiency, cell average throughput, data rate, and spectral efficiency of the cellular system but at the expense of increased infrastructure cost. With the introduction of such an architecture, the inside users will only have to connect or communicate with inside wireless access points while larger antenna arrays remained installed outside the buildings. For indoor communication, certain technologies like Wi-Fi, Small cell, ultra wideband, millimeter wave communications, and visible light communications.

CONCLUSION

In this article, a brief discussion has been done on the performance requirements of 5G wireless cellular communication systems that have been defined in terms of capacity, data rate, spectral efficiency, latency, energy efficiency, and Quality of service. A 5G wireless network architecture has been explained in this paper with massive MIMO technology, network function virtualization (NFV) cloud and device to device communication. Certain short range communication technologies, like WiFi, Small cell, Visible light communication, and millimeter wave communication technologies, has been explained, which provides a promising future in terms of better quality and increased data rate for inside users and at the equivalent time reduces the pressure from the outside base stations. Some key emerging technologies have also been discussed that can be used in 5G wireless systems to fulfill the probable performance desires, like massive MIMO and Device to Device communication in particular and interference management, spectrum sharing with cognitive radio, ultra dense networks, multi radio access technology, full duplex radios, millimeter wave communication and Cloud Technologies in general with radio access networks and software defined networks. This
article may be giving a good platform to motivate the researchers for better outcome of different types of problems in next generation networks.

REFERENCES


About The Author:

Mr. Robin Anant [CSI :- 01366183 ] is Student of Haldia Institute of Technology Pursuing Bachelor of Engineering in Computer Science and Engineering 2\textsuperscript{ND} year. Being CSI Member I played an active role in taking participate in various workshops, seminars etc. throughout the year across the college.
“INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) FOR DIGITAL INDIA”

Compiled by:
Sweta Prakash

INTRODUCTION

The splendid beauty of the cultural heritage of India has been best described by the words of Mark Twin: “India is the cradle of human race, the birthplace of human speech, the mother of history, the grandmother of legend, and the great grandmother of tradition. Our most valuable and most artistic materials in the history of mankind are treasured up in India only.”

But, at present in the 21st century, along with a sound cultural heritage, our country has also moved forward and has exponentially developed in the technical field to stand at the world front. And needless to say that, the effective technology has now become like oxygen for the Indian masses, which is both ubiquitous and necessary. The need of the hour is the multi-dimensional development of our country, so that the systems can function effectively at the global stage and this is possible only with the effective use of the latest technologies. Even the Government of India, has recently undertaken several initiatives with this regard and the “Digital India Program”, is one such major initiative. This initiative is being supported by the Ministry of Communications and Information Technology. The Digital India initiative is focused to integrate the government departments and the people of India, thereby focusing on good governance, digital infrastructure, digital service delivery and digital literacy. And according to me, this is an initiative, which can act as a platform to support and fulfill the other initiatives such as the ‘Clean India Campaign’ and ‘Make in India’.

When such a program is being introduced to the entire nation, we obviously need some guiding body, which can make the people aware of the activities taking place under such a program. And, obviously the Information and Communication Technology (ICT) can fulfil this role to the fullest extent. As the name symbolizes ICT encompasses of the Information Technology sector and the Communication sector. ICT also converges the audio-visual and telephone network with the Computer networks. Thus, we can say that, ICT is a single governing body, which plays major roles in all the disciplines of Engineering and Communication Technology.

Therefore, ICT can act as a driving force, in order to fulfill the goals of the Digital India initiative.

THE ‘DIGITAL INDIA’ INITIATIVE:

‘Digital India’, as soon as we hear this phrase, the only impression that forms in our mind is that of a digital country, fully equipped with all the latest digital technologies. But many of us may also
perceive that digitization is concerned with an increase in the Global Warming levels, the melting of ice glaciers, increasing levels of ocean water and an overall deplorable situation. Thereby, at this juncture of time we must understand that, this initiative is for the betterment of the society and the country at large along with The Conservation of Environment. This initiative aims at helping all the people with the technologies such as the computer, which are available in various Indian languages, availability of the cell phones in the Indian languages, etc. This initiative can also support the other recent initiatives. For instance,

- With the ‘Digital India’ initiative and the help of ICT tools can be developed to monitor the environmental pollution status and immediate actions can be taken for the threatened sites. Thus playing a role in the ‘Clean India Campaign’.

- It can also play a major role in the ‘Make in India’ Campaign. As this campaign is mainly concerned with the foreign investments in India, it is a well known fact that any country would like to invest and set up companies, in a technologically advanced and digital India, with the world class facilities and the ever latest infrastructure at each corner.

THE INFORMATION AND COMMUNICATION TECHNOLOGY:

In our country, ICT has been a driving force for our economic development. It also plays major roles in several fields such as Manufacturing, Banking and Finance, Telecom, Healthcare, eLearning, Management, eCommerce, eGovernance, Defence and an endless list of departments and technical fields. Now, ICT has also got to play the major roles in these recent initiatives. ICT is the only tool which provides the “Communication, Collaboration and Creativity” for the successful implementation of the ‘Digital India’ initiative. The major goal of the ‘Digital India’ program is to provide high-speed internet at all 2.5-lakh villages in India, in order to provide the people with services like education, health and digital literacy and this is possible with an ICT infrastructure only.

ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN THE ‘DIGITAL INDIA’ INITIATIVE:

With ICT as a governing tool, the Digital India initiative can fulfilled with all the innovative and technical ideas, thus helping to make India, a truly digital country at the world front. According to me, the following are a few innovative ideas, which can be used with the help of ICT for ‘Digital India’:

1. The Digital India initiative seeks to connect the entire India, through some advanced connectivity devices. This can be done with the help of ICT enabled Internet Of Things, a service which can offer the connectivity of devices, beyond the machine-to-machine connectivity. It can help to connect India digitally, thus helping for an all round development of India.

2. Another challenge before us would be the internet connectivity to the rural area of India. And we all have heard about the Project Loon, which is a research project developed by
Google, with the initiative of providing Internet access to the remote areas, through Balloon-Powered Internet with a desirable speed. Therefore, in India also with the help of ICT we can develop devices which provide wireless Internet connectivity to the remote areas of the country.

3. An issue of great concern, with regard to the Digital India initiative is that, even if we introduce the latest technologies at each and every step of development, the Indian masses should know to use these devices. This is because, although in the urban part of India, majority of the people are comfortable with the use of these technical devices; the maximum population of India resides in the rural part of India and here not many people are comfortable with these devices. And the ICT can play a very significant role with this respect. It can launch several programs for teaching the people, so that they get ease with the technical devices. Thus, here ICT plays an important role of ‘Making People Digital’.

4. The ‘Mobile Revolution’ as well as the ‘National Optic Fiber Network’ are two important initiatives of the ‘Digital India’ Program, which can be fulfilled only with the help of the ICT innovations.

5. We all may agree with the fact that, the villages or the Rural India is the backbone of Indian Economy, as it is the center for agricultural activities. So, according to me, the ‘Digital India Initiative’, would not be complete if it does not play its significant role in the enhancement of the Agricultural India. Therefore, with the help of ICT, several apps can be developed and taught to the farmers, which can help them to increase their crop production. This can also teach the farmers about the crop to be grown in a particular season and the other important measures that are to be taken for a high and productive yield.

6. The filth, garbage heaps and open drainages in our streets, city and country are the factors that cause a lot of diseases and epidemics in the country. Therefore, an overall area monitoring system should be developed by the use of ICT in order to monitor the areas such as streets, parks, cities and the country at large, and to take quick action against the people involved in spreading garbage around the places. The concerned authorities can also work for making the proper garbage bins and upon the open drainages in such places. And this is how the Digital India initiative helps for the Clean India Campaign too.

7. Environment is the key for the survival of the human beings. Therefore, we must make sure that the development of a Digital India does not create any adverse environmental impacts and it must also remain a Sustainable Development Project. In this regard, I would like to mention about the application of one of the most recent developments in the field of Computer Science and Engineering, which is the ‘Cloud Computing’ and the application of this Technology is also possible only with the help of ICT. The concept is ‘CLASlite’ software, which has been recently developed and it gives high resolution images of the forest cover, and the concerned authorities can take quick action if there are signs of deforestation occurring at a certain place.

8. A country becomes prosperous and more and more people are employed, if there are business and the investment opportunities in the country. Therefore, a digital India is the best place for the people from other countries, to invest at. Thereby, with the help of ICT
we can develop centers that provide the investors the details about the land availability and the other related factors, for setting up the companies. This is also significant because the world is looking at India with great expectations, at present.

9. Another very important task that ICT must do is to keep track and thus, to ensure that the ‘Digital India’ initiative does not produce the more of e-wastes. These e-wastes should be recycled and it should not cause any environmental impacts.

10. The Digital India initiative is also a tool which can help for the compulsory education of all children throughout the country. In this regard, ICT can support the mission by developing the Tablets / Laptops with the most user friendly Operating System, and uploading the related curriculum for the students, in the language that they are comfortable with. So, in this way even the child in the extreme corner of India can be connected to India and can have the access to his birth right, “Education”.

11. ICT is already playing a very major role in e-Governance, the need of the hour is to enable e-Governance through the wireless communication, so that it becomes integrally, linked and knitted, even for the rural masses. This is also possible with the help of the ICT and it is a major leap forward in the ‘Digital India’ initiative, which would mainly help the rural India.

CONCLUSION

On the horizons of conclusion, I would like to say that, the Information and Communication Technology (ICT), can support the Digital India initiative with the following aphorism:

“Go to the people, Live with them, Learn from them, Start with what they know, Build with what they have.”

Therefore, a developed and a successful India, would not be only digitally developed, but would also be sustainably developed. The digital development in India must support all the life forms and should unite the people of India, without any discrimination. And ICT is the only tool which can help to abolish the digital divide in India and can give a ray of hope to the India masses. By the Digital India initiative, we can develop the 21st century India and can take it to the world stage.

Hence, the ‘Digital India Program’, initiated by the Government of India is like an engine for the development of the modern India and the ‘Information and Communication Technology(ICT)’ is like a fuel to run this engine smoothly.

About the Author:

Ms. Sweta Prakash [CSI:- 01358832] is studying in IV year of B.E. (CSE) at Sri Sai Ram Institute of Technology, Chennai (Tamil Nadu). Her areas of interest are Big Data Analytics, Cloud Computing and Operating Systems. She can be reached at swetaprakash11@gmail.com.
THE RISE OF THE DARK NET

Compiled by:
K. Vinitha, T. Kalai Chelvi, V. Subedha and S. Hemalatha

There’s a part of the Internet that lies beneath the one you access every day. It’s a place that you can only access via specially designed anonymizing software. While it’s a place where political dissidents and whistle blowers can hide their true identities, it’s also a place where a lot of illicit transactions take place.

This place is called the DARK NET, and it’s a lawless land.

UNDERSTANDING THE DARK NET

The dark net is actually part of the Deep Web, which is a bunch of Internet connected material that isn’t searchable by normal search engines. Most of what is part of the Deep Web is unintentional castoff material, such as database queries and strange file types.

But the dark net is different, in that it masks itself with specially designed software that both encrypts and anonymizes everything. On the dark net, a lot of dirty things are taking place, such as buying credit card numbers, purchasing weapons, gambling sites, hacker forums, illegal drug sales, and many other things that would get you into serious trouble if you would do them on the normal Internet. The dark net began around 2004, which is when hidden websites started appearing. These sites could only be accessed on the TOR network (TOR stands for The Onion Router, and was
originally developed by the US military to keep military information encrypted). The TOR network was released as open source freeware to the public. Out of this, the dark net was born.

Experts estimate that there are between 200,000 and 400,000 websites operating exclusively on the dark net.

---

**THE BRIGHT SIDE OF THE DARK NET**

While dark net is a lawless place, it also has a positive side. There are many countries that do not allow free speech, and the dark net allows these people to speak freely without fear of censorship. The dark net can also be used by whistle blowers to reach out to the media without fear of government persecution. Jamie Bartlett, the director of Demos, a UK think tanks, said in a recent TED talk that “[the dark net is] a censorship-free world visited by anonymous users.” He went on to say he believes that the dark net will become more main stream, because “the customer is king.” The user experience on dark net sites is really good. These sites must do everything they can to satisfy customers, or they quickly go out of business.

More than that, dark net sites are concerned about privacy, do not track you, and have no pop up ads. Many of us concerned about our privacy and being tracked online would most likely welcome a marketplace that puts the consumer first.

---

**GETTING TO KNOW THE DARK NET**

It’s no secret that we are being tracked by both advertisers and possibly the government when we use the Internet. The dark net gives us the ability to be fully anonymous when we use the Internet, which after all, is simply a form of communication and knowledge sharing. So while the dark net has a sinister side, it also has a positive side, and perhaps may even play a pivotal role in the way we use the Internet in years to come.

---

**About the Authors:**

2. Dr. T.KALAI CHELVI, ( Professor), Computer Science and Engineering, Panimalar Institute Of Technology, Chennai.
3. DR.V.SUBEDHA (HOD and Professor), Computer Science and Engineering, Panimalar Institute Of Technology, Chennai.
4. Dr.S.Hemalatha professor), Computer Science and Engineering, Panimalar Institute Of Technology,Chennai.
ABSTRACT

The internet which is a marvel of technology has revolutionized the communication methods today around the world. The amalgamation of the computer and communication technologies have resulted in the integration of data, sound, and video on the internet which in turn has made it a powerful tool for engineering and business processes all around the world. The several ways to connect the internet existing till date have succeeded in bringing the world closer to some extent but they have failed in providing the last mile connectivity to remote and rural areas. Here comes the need for the new technology that fills up this space and takes the fruits of internet into the hands of the common man.

The “White Space Technology” about which my paper speaks of truly serves this purpose. Initiated by tech giant Microsoft, the white space technology is the best alternative to provide affordable and perhaps faster connectivity in the remote areas of the country. While the Face book is developing drones, Google is working on the Internet beaming balloons or the internet carrying balloons, under the project called Project Loon, the tech giant Microsoft has come up with a very interesting idea of the “White Space Technology”. The present paper covers the introduction, infrastructure and methodology used, advantages and practical real time implementations of the White Space Technology as had taken place for the first time in India at four selected schools in the remote district of Srikakulam, Andhra Pradesh by Microsoft and as had been implemented as a project by IIT-Bombay across seven districts of Maharashtra. Meeting the objectives of our theme “Digital India: For a better tomorrow”, the White Space Technology, surely gives us the availability of cheap and affordable internet to remote and inaccessible areas of the world where even the optical fiber cables fail to reach.

INTRODUCTION

Though we boast today of the technological achievements that have been achieved by us to cope up with the digitalization of the world, still there are many people living in the nook and corners of the world who don’t have the full time access to all the technological advancements. Although there has been a significant growth in cellular mobile communications, the broadband penetration in rural areas still lags behind. Coming to the point, today, more than half of the population of the world living in rural areas hardly has any access to the internet. The variations in the topography and some other geographical factors prevent the fine access of broadband internet in some remote areas across the world. Moreover, for any government, it is expensive to lay fiber / cable in rural and remote areas as most of them have low population density. For such areas opting for wireless technology is the only solution which seems optimal. But today, most of the wireless carriers have focused on urban areas with high population density which typically results in the faster “Return on
Investment” using the licensed spectrum. Traditional technologies have been unable to provide large area wireless coverage under non-line-of-sight (NLoS) conditions present in rural area to build successful and viable business models. This has resulted in a digital divide and this situation tends to be worse in developing countries like India and most of the under-developed countries of the world. The “White Space Technology” is the only option which has the potential to convert Digital Divide into a Digital Opportunity by leveraging un-used or under-utilized TV spectrum to provide broadband wireless access.

**WHAT IS WHITE SPACE?**

TV white spaces are the portions of spectrum which are left unused in the process of TV broadcasting, and are also often referred to as interleaved spectrum. The frequencies of white space range from 470 MHz to 790 MHz’s. Simply, white space refers to the unused broadcasting frequencies in the wireless spectrum. Television networks leave gaps between channels for buffering purposes, and this space in the wireless spectrum is similar to what is used for 4G and so it can be used to deliver widespread broadband internet.

It may be used by other services on a secondary basis, i.e. on the condition of not disrupting broadcasting services and not claiming protection from them. In a spectrum band that is licensed to primary users, the part of spectrum that is unused by the primary user at specific locations and sometimes at specific time. Example: Television Channels – not every channel is used in every town. The TV White Space technology utilizes the unused space in terrestrial TV spectrum to provide cheap or very low cost internet connectivity to the remote areas. Originally, spectrum describes the range of frequencies that can be used by wireless devices to transmit and receive the required information. In telecommunication, the white spaces refer to the frequencies made available for unlicensed use at locations where the spectrum is not being used by licensed services such as television broadcasting.

**HOW DOES WHITE SPACE WORK?**
Access Point is installed and it is powered on. Then the access point registers with Data Base and it sends the Channel List Request, including location and gets the Channel List. Now the main server scans and finds the access point and it associates with Access Point. Then the access point assigns channel (which must be on Channel List from Data Base). Finally, the Main Server connects to internet via the Access Point and hence we can access the internet. Tablets, phones, and computers can all access this wireless internet using White Space through fixed or portable power stations. If you want to use TV White Space with your existing laptop you would need a separate device. The TV White Space devices in use now do not serve computers (towers, laptops or tablets) directly. They provide a link to a receiver that is connected to a regular Wi-Fi hub. Research is going on in this area to develop some devices that can make it possible to access the internet directly.

ADVANTAGES OF WHITE SPACE TECHNOLOGY

1. It is a cheaper alternative to fibre and wireless technology.
2. Numerous tests have proved that TV band white space devices operate without causing interference to existing licensees entitled to interference protection.
3. TV white spaces technology can be used to provide connectivity to rural areas that may not have essential services such as electricity
4. The network gear is solar powered
5. TV white space signals can also penetrate physical obstacles like trees, buildings, and rugged terrain, and can transmit wireless Internet over long distances. This technology hence can also reduce the data costs to a really impressive level when permitted by the government
6. This revolutionary TV White Space technology was nicknamed “Super Wi-Fi” due to its superior coverage, wide network range, and non-line-of-sight signal. Not only does this “Super Wi-Fi” boast long-distance propagation with low power consumption, but it also provides strong signals and increased data rates even in rural areas. While traditional Wi-Fi technology has a limited range, about 100 meters, and weakens in rugged terrain, a TV White Space network has the ability to penetrate foliage, hills, and other barriers while covering an area about 10 kilometers in diameter utilizing minimal equipment and infrastructure. TV White Space delivers an affordable high-speed broadband solution for extending existing networks to these rural last-mile communities.

DEPLOYMENTS, PILOTS AND FIELD TRIALS

There are many deployments and field trials or what we can say as the research works done across the world in the field of White Space Technology.

PILOT PROJECT OF MICROSOFT IN ANDHRA PRADESH:

Microsoft has spent many years investigating new technologies that can increase productive use of spectrum, through development of technology, trials and innovative solutions. For example, the Microsoft Spectrum Observatory was created with the purpose of providing an intuitive presentation of the usage of the wireless spectrum – allowing us to demonstrate that there is a lot of unused, but usable spectrum.
With this view, Microsoft has launched for the first time in India, its Pilot Project on White Space Technology. The first of its kind pilot project experimented with white space broad band in the state of Andhra Pradesh. In this first-of-its-kind project, Microsoft, Department of Telecommunications (DOT) and IT, and Education and Research Network (ERNET) are working with the Government of Andhra Pradesh to bring low cost broad band internet connection to four government educational institutions (KGBV’s) in the district of Srikakulam which had no internet facility earlier. With Zilla Parishad High School at Voppangi as the base station, the other three schools were receivers located at distances of 10kilometres or more from the base station.

Microsoft has also conducted and supported trials and commercial pilots in the countries: Singapore, the UK and the US.

**RESEARCH DONE BY IIT BOMBAY:**

The Department of Telecommunications (DOT) and the Government of India granted experimental license to IIT-Bombay to conduct tests on TV White Space under the guidance of Professor & Project In charge, Abhay Karandikar of Indian Institute of Technology, Bombay, experimented on white space to provide broad band access to rural areas. The Pilot test bed has been deployed by the IIT Bombay team in 7 villages of Palghar district in Maharashtra- Khamloli, Bahadoli, Dhuktan, Ganje, Paragaon, Haloli and Maswan—spread over an area of 30 square kilometers and the project achieved good results.

**BRAZIL’S PILOT PROGRAM SANTA RITA DO SAPUCAI:**

This project was done in the country of Brazil, at a place called Santa Rita do Sapucai. The main aim of choosing this place is to prove that White Space Technology works in areas of uneven land terrain too. The 45 meter height receiving tower was placed on a hill and internet signals were given to the village on the other side.

**HOW IS THE TV BAND UTILIZATION IN INDIA?**

There are a few salient points in this regard. They are listed as follows:

1. Unlike in the US and the UK, there is only ONE terrestrial TV broadcaster in India—the Doordarshan.
2. Doordarshan transmits only two channels (namely, DD1 and DD2) at any given location in the country. These channels occupy either a bandwidth of 7MHz in the VHF band or a bandwidth of 8MHz in the UHF band.
3. Doordarshan has 1415 TV transmitters operating in India. Out of these, 8 transmitters operate in the VHF Band-I, 1034 transmitters operate in the VHF Band-III and the remaining 373 transmitters operate in the UHF Band-IV. IIT Bombay’s research is to map and connect the 373 TV transmitters operating in the UHF TV band in India.
4. Thus, a majority of the TV transmitters in India operate in the VHF band. A detailed quantitative assessment of spectrum in 470-585 MHz has revealed that, unlike in the developed countries, major portion of the UHF TV band is unutilized in India.
5. Digitization of broadcasting services in India by Doordarshan is under progress. The frequency band 585-698 MHz, has been exclusively earmarked for digital TV broadcasting in India. This will free up even the full spectrum of 470-585 MHz for other applications.

Hence, if both the Government and the Department of telecommunications work hand in hand then we can use the freely available band space with the help of White Space Technology, to achieve our aim of making India into Digital India.

**DIGITAL INDIA**

In the past year, Indian Prime Minister Narendra Modi has been backing a plan called Digital India, which is a sprawling $1.2 billion program with many aims, but one of its primary concerns is providing high-quality internet connections in the most remote parts of the country. Internet access by everyone, however, is considered to be the key to the programme of attaining Digital India. Digital India’s vision is to make even the remote place get into up light and to connect 640,000 villages to broadband internet connectivity. This is possible only if all the people of our nation irrespective of their economic background and the place in the country they live in (i.e. even if the people live in remote areas) can access internet broadband services at a reasonable cost. This can be possible only by using the White Space Technology.

**SOME SHORT COMINGS OF TV WHITE SPACE BAND**

There are some minor shortcomings with using White Space Technology. Antenna needs to physically large to capture signals in case of demand. There will be occurrence of Impulse noise in the low VHF 54 to 88 MHz areas. Weather ducting can occur occasionally in VHF. The White Space Technology can help to provide Internet Connectivity only within a range of 10 Kilometres.

**LATEST INITIATIVE IN THE FIELD OF TV WHITE SPACE TECHNOLOGY**

[Dated 28-10-2015]: Prithvi

**Prithvi:**

‘Prithvi’ is a chip developed by a Bangalore based company named Saankhya, which helps to provide Internet to Rural areas using the TV Spectrum. This chip transfers the data using the unused White Space of conventional TV Spectrum. The chip that they developed is of the size of a small postal stamp. This chip has the potential to provide internet in rural areas across a radius of around 15 kilometers. This chip would surely boost up the pilot project by Microsoft in Andhra Pradesh. Presently, the company is making contacts with Microsoft to make utilization of their chip in the Microsoft’s pilot project.

**FUTURE APPLICATIONS**

The future applications of White Space Technology are marvelous. If the possible usage of White Space Technology is made across a country, then the following applications become possible:
1. Every house becomes a smart home where triple play access of internet is done by using White Space Broad band. A single user can at a time operate his telephone, television, Laptop and Mobile with the same signals at low cost.

2. Environmental Monitoring, Critical Infrastructure monitoring can be done with the help of White Space Technology at the times of disasters and natural calamities where all other possible sources of internet access are cut down.

3. This Technology can be applied for the nation’s security along the borders and rugged terrains for military communication and border protection.

**CONCLUSION**

Hence, we can say that the White Space Technology is clearly an edge of a technology over the presently existing ones. With the world aiming at NET NEUTRALITY, it would be for sure that the whole world accepts this technology. Our aim will be fulfilled when the advancements in the Information and Communication Technology reaches and is made used by even the common man or the poorest section of our society.

**REFERENCES**

4. https://www.digit.in/internet/microsoft/

**About the Author:**

Mr. Ch. Naveen[CSI: 01363249] is a student of III rd year Computer Science at Aditya Institute of Technology and Management, Tekkali. He is the winner of Paper Presentation Contests in TECHNOZION-2015 held at NIT Warangal and winner of Paper Presentation Contest at State Level CSI Student Convention held at GVP Vishakhapatnam. He is always interested to participate in various multidisciplinary competitions. He can be reached at: Naveen.Chintalapudi637@gmail.com.
Call for Contributions in CSI Adhyayan
(A National Publication dedicated to IT Education, Research and Student Community)

India’s IT sector continues to a trajectory of high growth since 1990s. Our education system, the prime mover of industrial growth and modern development, has seen a phenomenal growth in terms of quantity and quality - making it the third largest education system in the world after the US and China. With double digit economic growth demanding a sustained supply of knowledge workers, India has emerged as one of the world’s largest consumer of education services. India has the potential to provide the best education services with strong relationships among education, research and industry sectors. Today, IT is a trillion dollar opportunity – so is higher education. We can proudly say that both the Indian IT and Indian ‘guru’ are now revered globally. Both have potential and ability to scale up with global mindset. With regard to emerging technologies, they typically follow a strategy ‘Start small, Grow real fast and Attempt to conquer’. In the backdrop of the above and with a view to consolidate the achievements of more than four decades of Computer Society of India (CSI) and new found vitality in education and research community, we have revived our publication of CSI Adhyayan after a gap.

CSI Adhyayan is being positioned as a nation publication dedicated for IT education, research and student community. This quarterly electronic publication performs the functions of a newsletter, a magazine and journal. We take this opportunity to invite the contributions in this venture. Your invaluable contributions, suggestions and wholehearted support will be highly appreciated. We appeal to all our Chapters, Student Branches and member academic institutions for encouraging and motivating the students in terms of contributing innovative ideas, exploring new vistas of knowledge and new findings through CSI Adhyayan.

We especially invite news and updates from our member institutions and student branches. Please send your article to csi.adhyayan@csi-india.org. For any kind of information, contact may be made to Dr. Vipin Tyagi via email id dr.vipin.tyagi@gmail.com.

Prof. A. K. Nayak
Chief Editor
Executive Committee (2016-17/18)

President
Dr. Anirban Basu
309, Ansari Forte, 16/2A, Rupena Agrahara, Bangalore
Email: president@csi-india.org

Hon. Treasurer
Mr. K. K. Vyas
70, Sanskrit Nagar Society, Plot No-3, Sector -14, Rohini, Delhi
Email: treasurer@csi-india.org

Vice-President
Mr. Sanjay Mohapatra
Dr/204, Kanan Tower, Patia Square, Bhubaneswar
Email: rvp@csi-india.org

Imml. Past President
Prof. Bipin V. Mehta
Director, School of Computer Studies, Ahmedabad University, Ahmedabad
Email: ippi@csi-india.org

Hon. Secretary
Prof. A. K. Nayak
Indian Institute of Business Management, Budh Marg, Patna
Email: secretary@csi-india.org

Nomination Committee (2016-2017)
Chairman
Mr. Ved Parkash Goel
DRDO, Delhi

Dr. Santosh Kumar Yadav
New Delhi

Mr. Sushant Rath
SAIL, Ranchi

Regional Vice-Presidents
Region - I
Mr. Shiv Kumar
National Informatics Centre, Ministry of Comm., & IT, New Delhi
Email: rvp1@csi-india.org

Region - IV
Mr. Hari Shankar Mishra
Doranda, Ranchi, Jharkhand
Email: rvp4@csi-india.org

Region - VII
Dr. K. Govinda
VIT University, Vellore
Email: rvp7@csi-india.org

Region - II
Mr. Devaprasanna Sinha
738, Ekdalia Road, Kolkata
Email: rvp2@csi-india.org

Region - V
Mr. Raju L. Kanchibhotla
Shramik Nagar, Mouli, Hyderabad, India
Email: rvp5@csi-india.org

Region - III
Dr. Vipin Tyagi
Jaypee University of Engineering and Technology, Guna - MP
Email: rvp3@csi-india.org

Region - VI
Dr. Shirish S. Sane
Vice-Principal, K K Wagh Institute of Engg Education & Research, Nashik
Email: rvp6@csi-india.org

Division Chairpersons
Division-I: Hardware
Prof. M. N. Hoda
Director, VITICAM, Rohtak Road, New Delhi
Email: div1@csi-india.org

Division-IV: Communications
Dr. Durgesh Kumar Mishra
Prof. (CSE) & Director-MIC, SAIT, Indore
Email: div4@csi-india.org

Division-III: Applications
Mr. Ravilkor Manikkar
Jai Villa, 3rd Row(TPS 3), Santacruz
East Mumbai
Email: div3@csi-india.org

Division-II: Software
Prof. P. Kalyanaraman
VIT University, Vellore
Email: div2@csi-india.org

Division-V: Education and Research
Dr. Suresh C. Satapathy
ANITS, Vishakhapatnam
Email: div5@csi-india.org

Important Contact Details
For queries, correspondence regarding Membership, contact helpdesk@csi-india.org

CSI Headquarter:
Sarvadhik Venture Park, Unit No. 3, 4th Floor, MIDC, Andheri (E), Mumbai-400093
Maharashtra, India
Phone: 91-22-29267100
Fax: 91-22-28305210
Email: info@csi-india.org

CSI Education Directorate:
CIT Campus, 4th Cross Road, Taramani, Chennai-600 113, Tamilnadu, India
Phone: 91-44-22541102
Fax: 91-44-22541103
Email: director.education@csi-india.org

CSI Registered Office:
302, Archana Arcade, 10-3-190, St. Johns Road, Secunderabad-500025,
Telengana, India
Phone: 040-27821998