Departmental Journal on Electronics and Telecommunication Engineering

Department of Electronics and Telecommunication Engineering

TECHNIQUE POLYTECHNIC INSTITUTE

Panchrokhi, Sugandhya, Hooghly, West Bengal Pin-712102

TECHNOTRONICS

VOLUME: 6

PUBLISHER

Department of Electronics & Telecommunication Engineering

Technique Polytechnic Institute

E-mail: *detce@techniqueedu.com*

Departmental Journal on Electronics and Telecommunication Engineering

Department of Electronics and Telecommunication Engineering

TECHNIQUE POLYTECHNIC INSTITUTE

Panchrokhi, Sugandhya, Hooghly, West Bengal Pin-712102

Departmental Vision

To be a centre of excellence in Electronics and Telecommunication engineering for development of technical man power capable of facing new challenges in industry and society at large.

Departmental Mission

- *To implement quality learning teaching process for developing skilled technological man power.*
- *To impart value based education through structured programme and industrial training resulting wages earning capability with entrepreneur initiatives.*
- *To inculcate critical thinking for solving technological problem, professional skill in engineering practices with the attitude of life-long learning.*

AIM & SCOPE

Technotronics Volume 6 is a departmental magazine to publish significant technical information in all areas of Electronics and Tele-communication Engineering. Published articles in this magazine will address important research topics and new technological advancements in this field. The main aim is to motivate students and faculty members in research works and to increase their knowledge domain. It will give them an opportunity to express their ability of writing technical papers and documentations. The intended audience may submit their research documents yearly in the community of scholars, interested in social impact of new advanced technologies. This Magazine was initiated by the department of Electronics & Tele-communication Engineering. Students and faculty members are cordially supported by the students and faculty members of all other departments.

SUBMISSION OF PAPERS

Manuscripts are invited from academician and students of this institution for publication in this magazine. Papers are accepted for editorial considerations through e-mail detce@techniqueedu.com with the understanding that they have relevant and logical issues regarding the new trends in technology.

FREQUENCY OF PUBLICATION

One volume of this journal will be published yearly.

EDITORIAL MEMBER

Faculty Member

Antara Banerjee Bhowmick, Lecturer, Department of Electronics and Tele-communication Engineering

Faculty Members

of

Department of Electronics and Tele-communication Engineering

Mr. Sibasis Bandyopadhyay, Lecturer, In-Charge

Mr. Abhishek Dey, Lecturer, Course In-Charge

Miss. Madhurima Santra, Lecturer

Miss. Antara Banarjee (Bhowmick), Lecturer

Mr. Vivek Das, Technical Assistant

Our Sincere Thanks

to

Sri T.K .Saha, Chairman, Governing Body, Technique Polytechnic Institute

Mr. Avijit Karmakar, Principal, Technique Polytechnic Institute

Mr. Partha Sarathi Bhattacharya, Coordinator, Technique Polytechnic Institute

CONTENTS

AGRICULTURE 4.0: AGRICULTURE AND ENVIRONMENT MONITORING

Sibasis Bandyopadhyay, In-Charge, Electronics & Tele-communication Engineering
Technique Polytechnic Institute

Global population growth, global warming, climate change and food security are among the most challenging problems around the world. Farmers need to increase their yields by about 50 per cent by 2050 to be able to feed the world, says Food and Agriculture Organization (FAO) of the United Nations (UN).
As population grows, the amount of cultivable land shrinks. To increase agricultural output from available arable land, one option is to invest in technology to meet the global demand for food. Various stages of the agricultural revolution are aimed at developing ne Sensors and digital imaging technologies give farmers a better picture of their fields and crops. Data collected using these prove useful in improving crop yields and efficiency. Development of connectivity with various agricultural tools and sensor technologies lead to important progress in agricultural practice.w ideas around sustainability, food production, energy and agriculture technologies.

Sensors for agriculture include optical devices, sensors for crop health status determination, seed monitoring, detection of microorganisms and pest management, yield estimation and prediction, detection of crops, weeds and fruits, and airborne, soil, wearable, weather and Internet of Things (IoT) sensors, electronic noses and tongues, sensor networks and so on. This article covers some modern sensor systems used in the agriculture industry, smart farming and environment monitoring systems.

Agriculture 4.0

Agriculture has, for many years, been ignored and remained without modern technology. Now, it is making a big comeback with the use of different technologies. With connectivity gaining ground, we have GPS precision-guided tractors, sensor-based water irrigation systems, pest surveillance from air, smart livestock monitoring along with farmers hooked up to Big Data. We are witnessing agricultural innovation and adapting to a changing world and new settings including digital precision and smart farming.

Agriculture 4.0 is a new approach towards farm management and precision agriculture using technology, including sensors, smart tools, satellites, the IoT, remote sensing and proximal data gathering. It is about connectivity, smart agriculture or digital farming, in addition to the integrated internal and external networking of farm operations.

Agriculture 4.0 is said to have started around early 2010s, with low-cost and improved sensors, actuators, microprocessors, nanotechnology, high-bandwidth cellular communication, cloud computing and artificial intelligence (AI).

Smart farming

While precision farming was mainly based on the use of GPS sensors for auto-steering of tractors and harvesters, the focus of smart farming has now shifted towards smart treatments like deciding the amount of fertilizer that should be applied, or using plant protection resources for optimal crop development in a particular area in the field.

Data- and information-driven agriculture is a general trend in smart farming. Earth observation (EO) and navigation satellites use data collected from ground sensors to help farmers decide how, when and where to allocate resources for best results.
Satellites are mounted with multiple sensors. Information on current growth status and development of crops at each location in the field is obtained from the satellite(s) through various plant conditions and parameters such as biomass and chlorophyll content during growing season. Such data help farmers update crop status for specific plant protection and fertilisation measures. Farmers can also monitor various parameters on smartphones or tablets on-the-go.

Virtual reality system for chickens

Cognitive sensing technology

Precision farming can be enhanced using cognitive sensing technology. For example, IBM Watson can adapt to consider new parameters and uncover correlations between various parameters, using machine learning.
A cognitive system with advanced sensor technology provides real-time feedback like temperature, humidity, light, soil pH, precipitation, irrigation timing and so on. It can help identify actual problems affecting the crops. Cloud-based services with a cognitive system learn from results all around the world in real time, so that each season brings better insights, solutions and recommendations for better yields.

Smart spraying technology

To combat weeds and undesired plants that affect crops, herbicides are applied over large surface areas, covering crops and fields. Bosch and Bayer are developing smart spraying technology that uses camera sensors to distinguish between weeds and crops. This way only weeds are targeted, and crops and the environment are protected.
Plant-specific herbicide application requires sensor systems for plant recognition and differentiation. However, it is not easy to recognise small weeds in the early stages of development. With modern technology, programmable true-colour sensors can be used for real-time recognition and identification of individual weeds and crops. This can be achieved by collecting data based on the reflection properties of plants, and natural and

artificial backgrounds. Crops and weeds are recognised using mathematical algorithms and decision models based on such data.

The IoT for agriculture

The IoT for agriculture, or IoT4Ag, is a new area of technology that holds tremendous potential for improving global food production. IoT sensors can be deployed on the ground or in water to collect data on target inputs, such as soil moisture and crop health. Collected data are stored on a server or cloud system wirelessly, and can be easily accessed by farmers via the Internet on tablets and cellphones.

IoT applications include farm vehicle tracking and livestock monitoring, and in arable farming, agri-food supply chain, green house monitoring and other farm operations. Farmers can remotely control activities in the farm through connectivity options like Nano Ganesh, which is a mobile-based remote controller for water pumps.

There are IoT devices from Smart Elements, wherein a variety of sensors are deployed in a farm that report back to an online dashboard. Farmers need not visit the farm, thus saving time and money by making fast and informed decisions based on real-time conditions.

Adoption of IoT solutions for agriculture is constantly growing. Cellular companies are seeking business opportunities in farm IoT applications. They are developing integrated systems that combine sensors and communication systems. IoT sensors and cloud computing will drastically improve the quality of data flow, which will, in turn, help farmers make better decisions.

Digital livestock farming

As population increases, demand for milk and meat also increases. Digital and sensor technologies are being deployed in livestock management. Precision livestock farming uses advanced technologies, such as micro fluidics, sound analyzers, image-detection techniques, sweat and saliva sensing, serodiagnosis and others, to optimize the contribution of each animal.

Smarter production, proper nutrition as well as increased animal welfare have the potential to decrease the impact of livestock farming on resources. Many companies are working on the welfare of livestock animals, while others are working on animal health management.

With such technology, livestock such as chickens are treated as humanely as possible. Computer interfaces and virtual environments are combined to meet the needs and desires of each animal species. Enclosures are built to provide a comfortable and healthy home. The system provides livestock with the freedom to move freely in the virtual world, providing them with better treatment than they would be in the real world. Each enclosure is filled with independently filtered air to keep communicable diseases and parasites from spreading throughout the facility.

Biosensors are being used for animal health management. New wearable technologies, such as tracking collars and electronic saddles, are being used in animals, pets and livestock for their healthier upbringing. With the help of IoT-based movement sensors and microphones, farm owners can check the well-being and location of their livestock through smart phones.

Agricultural drones

Drones with such sensors as thermal, camera, lidar and multispectral are bringing major benefits to the agricultural industry. Agricultural drones with sensors allow farmers to see their fields from the sky. Information and data collected from the drones reveal such issues as irrigation problems, soil variation, and pest and fungal infestations. The difference between healthy and unhealthy plants is sometimes difficult to

detect with naked eyes. Multispectral images can assist in differentiating between healthy and unhealthy plants, and enable farmers to take timely actions.

Many companies are manufacturing drones for agricultural applications. For example, advanced autopilot drone from Drotek features advanced processors and latest sensor arrays working with a real-time operating system that can deliver incredible performance.

DJI manufactures a variety of high-tech drones. Agras MG-1S, also called the wonder drone, from DJI is a highly-advanced drone spraying system that has GPS, flow sensors, triple radar sensors and fully-programmable flight paths. Agras octocopter is designed for precision variable rate application of liquid pesticides, fertilizers and herbicides with good efficiency and manageability.

Multispectral sensors collect visible (red, green and blue) wavelengths as well as infrared (IR) radiation and ultraviolet (UV) light. These are used to monitor plant health, identify deficiencies and pest damage, optimize fertilization and assess water quality.

Sentera manufactures sensors to capture precise, radiometrically-accurate plant-level vegetative indices. The double 4K sensor from Sentera can easily integrate onto drones. The sensor collects visual-band imagery, multispectral images as well as vegetation indices, including normalized difference vegetation index (NDVI) or normalized difference vegetation red edge (NDRE) data. It helps agronomists and farmers identify crop health issues with greater precision.

AI for farming

China and India are speeding up efforts in artificial intelligence (AI) innovation and development to assist farmers in planting decisions and crop protection. AI holds the promise of driving the agricultural revolution to produce more food using fewer resources. An AI system using Big Data management technologies and cloud computing aims to provide effective decision making for farmers.

Sensors monitor a fruit's progress in terms of perfect ripeness, adjusting light to accelerate or slow down the pace of maturation. This kind of farming requires considerable processing power. Intel's Xeon processors are being used to power AI algorithms.

Smart algorithms are applied to agricultural technologies to enable them to learn and teach themselves. AI and smart algorithms can analyze massive amounts of data on weather, environmental and historical information to make increasingly accurate predictions on what, where, when and how to plant crops for optimal performance and yields. There is great potential of AI combined with IoT4Ag.

Some smart agricultural sensors

Flux IoT Eddy robot built with wireless sensors and image processing technology tells farmers specifics about their hydroponics and other indoor growing systems. It can monitor variables such as pH levels, temperature and relative humidity. It can also detect contaminants and provide information on how to resolve such problems. Pycno's plug-and-play sensors with solar panels are fully-autonomous, having a simple dashboard. These allow seamless data collection and transfer from the farm to the Smartphone.

Amber Agriculture smart sensor technology provides analytic solutions for the grain industry. Wireless pellet sensors distributed with the grain in storage bins or containers monitor such internal conditions as temperature, humidity and volatile compounds.

Acuity Agriculture wireless field sensors allow farmers to monitor soil conditions and pest development, schedule irrigation events, track climate conditions and predict harvest timings. Phytech smart sensors placed directly on plants and crops can monitor the micro-variations of stem diameters to provide stress indications. Slantrange sensor and analytic systems are used on drone aircraft to measure crop and weed densities, stress from pest infestations, nutrient deficiencies and dehydration levels.

Environmental monitoring sensors

Climate and weather are the top influencing factors in the production of crops. Sensors are getting ubiquitous and playing an important role in sensing the environment. These include sensors for monitoring water, air, weather and soil.

Barometric sensors are used in weather networks. Infineon Technologies manufactures barometric pressure sensors for mobile and wearable devices having high precision and low power consumption. For example, their DPS310 barometric pressure sensor is recommended for applications where power consumption is critical and highest precision in pressure metering is required.

Double 4k Sensor

With an IoT-enabled weather monitoring system, farmers can determine the optimum time for plantation, irrigation and harvesting. Predictive weather models are constructed using sensors in IoT applications. Based on sensor data, farmers can plan and change harvest and irrigation times to improve the crops. By organising and analysing collected data, they can take pre-emptive actions for healthy harvest of their crops.

To sum up

We are entering the era of Agriculture 4.0, which is a new phase of the agriculture revolution. We are witnessing precision, smart and digital farming using various modern technologies. Recent technology trends include sensors for connected livestock, satellites, the IoT and GPS sensors, among others, to measure a variety of essential soil and plant properties on-the-go.

Scanning from the sky using drones attached with camera sensors to monitor the fields, and also monitoring from anywhere using the Internet and IoT sensors, farmers can access various information related to real-time sensing of soil and crops.

AI with modern sensors can be used to adapt strategies to the changing conditions of the field and environment. Sensors empower farmers to react quickly and dynamically maximize crop performance, resulting in better yields and higher food productivity.

ENERGY STORING BRICKS

Abhishek Dey, Lecturer of Electronics & Tele-communication Engineering
Technique Polytechnic Institute

Boring old bricks might not seem like something that can really be made high-tech, but researchers keep proving us wrong. Now, a team has found a way to turn bricks into energy storage devices, using them to power a green LED in a proof of concept study. A brick wall doesn't exactly do much – sure it holds up the roof and keeps the cold out, but maybe the bricks could pull their weight a bit more. That was the goal for a team of scientists at Washington University in St Louis, who wanted to test whether bricks could be used to store electricity.

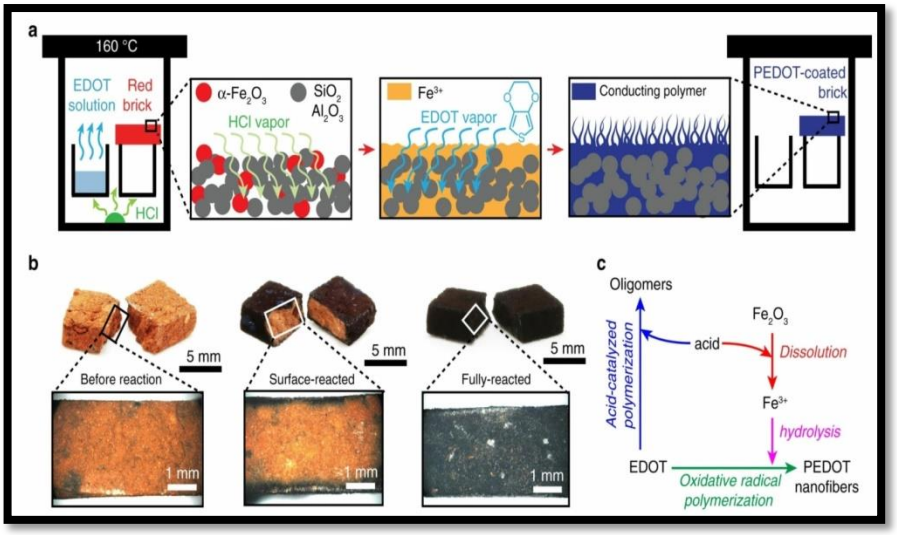


Fig: Deposition of a nanofibrillar PEDOT coating on brick

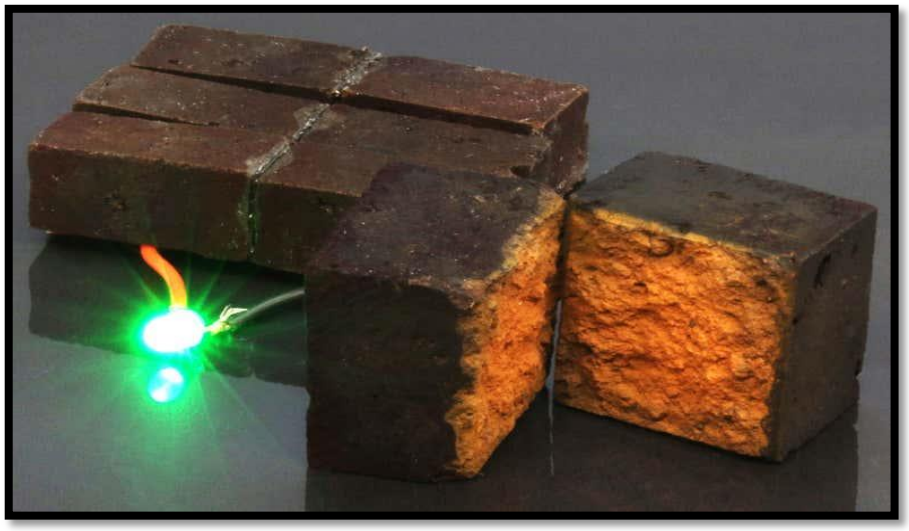
Red brick is a universal building material produced by thousand-year-old technology that has seldom served any other purpose throughout history. Typically used for construction and architectural esthetics, red bricks are one of the most durable materials. The bricks comprised of fused particles of silica (SiO2), alumina (Al2O3) and hematite (α-Fe2O3). The red color of a brick originates from hematite. State-of-the-art energy storage materials are also produced from hematite. Regular house bricks could be used to power electronics after a major breakthrough in energy storage technology.

Red bricks are used to put up nearly every building on the planet. In addition to being the cheapest construction material on Earth, red bricks may also have the potential to serve as long-lasting batteries. A new use-case presented by researchers at Washington University shows how red bricks can be turned into energy storage units that can be charged to hold electricity, like a battery. It's not a new kind of brick, and it's not a unique creation from some lab. These red bricks are ordinary, run-of-the-mill, red bricks that are available at any construction site. This means all the large amounts of space already occupied by walls, buildings and multiplexes could be utilized better if it has an additional purpose for electricity storage. If implemented on a large scale, this means every wall, staircase and fireplace could essentially serve as a power bank.

Super capacitors are electrical devices that are used to store a large amount of electrical charge. Although the research is at its early stages, the bricks are found to have far-reaching potential. Since bricks are the building blocks of any construction, a large amount of space it occupies can be utilized for storing energy. The research team developed a conducting polymer poly (3, 4-ethylene-dioxythiophene), called- PEDOT- and coated the bricks with it. The nano fibers in the polymer seep into the porous brick where the coating is trapped. This coating stores and conducts electricity. The research focuses on red bricks as it contains iron oxide (rust), which triggers the polymerization reaction. The red color of a brick originates from hematite, a pigment, and serves as a low-cost naturally abundant inorganic precursor for catalysts, magnets, and alloys. The bricks can also be made waterproof by using a five-minute epoxy which enables the operation of the

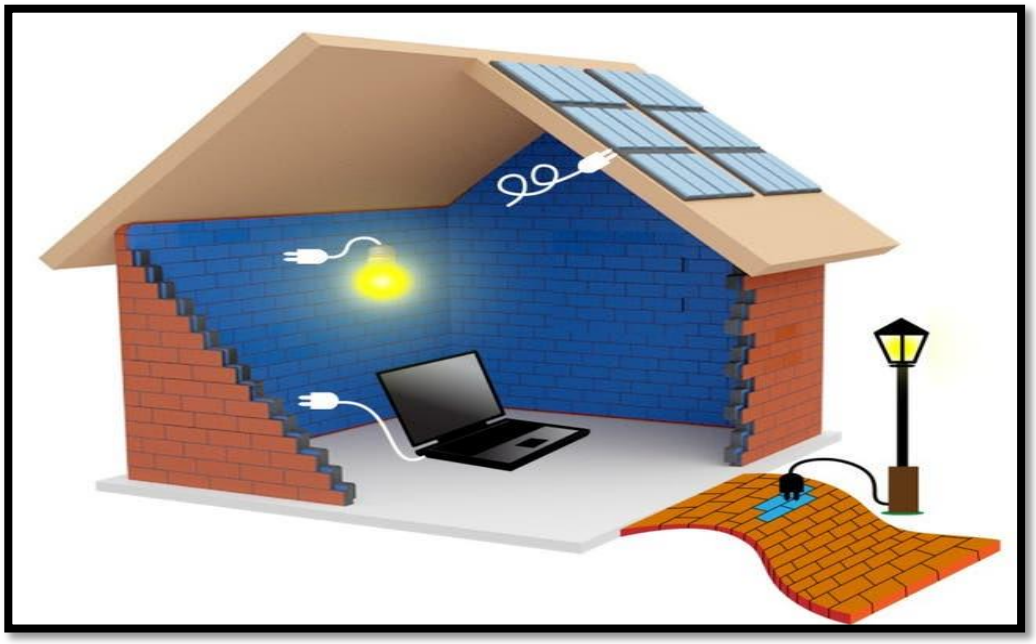
super capacitors while submerged underwater and a gel electrolyte extend cycling stability to 10,000 cycles with ~90% capacitance retention.

The research team claims that a brick wall super capacitor can be charged several times within an hour. According to the team, when 50 bricks are connected with solar panels, it can provide emergency lighting for five hours. To allow the bricks to store electricity, the researchers pumped a series of gases through the maze of pores inside the brick. The gases react with the brick's chemical components, coating them with a web of plastic nanofiber known as a PEDOT, which is a good conductor of electricity, he said. A brick wall can also be a battery. Thanks to the red pigment they contain, bricks can be turned into efficient energy storage devices.



Julio D'Arcy at Washington University in St. Louis, Missouri, and his colleagues used a special conductive polymer called PEDOT to make their energy-storing bricks. First they took regular red bricks of the sort that are often used in constructing houses and heated them with acid vapour. This dissolved the haematite in the bricks, the mineral that gives them their red colour. The researchers then added other compounds, which reacted with the dissolved haematite. The end result was bricks riddled with a network of tiny, conductive PEDOT fibres. After treatment, the bricks are a dark brownish-blue colour instead of red.
The researchers then coated the bricks in epoxy to make them waterproof. These polymer-coated bricks could be hooked up to a power source to charge up. They store enough energy that three small bricks, each about 4 x 3 x 1 centimeter in size, could power a green LED light for about 10 minutes on a single charge. They could be charged 10,000 times without losing more than 10 per cent of their storage capacity. "A brick would have more energy than a AA battery, but a AA battery is incredibly inexpensive," says D'Arcy. Each brick costs about $2 to $3 to make, he says. If the bricks can be made viable as a building material and we can figure out a way to make them cheaply, then we may eventually have brick walls that our electronics can plug right into. In order to tap the energy-storage potential, the scientists developed a coating made from a polymer called Pedot, which is made up of nanofibres capable of penetrating the porous bricks.

"Pedot-coated bricks are ideal building blocks that can provide power to emergency lighting. We envision that this could be a reality when you connect our bricks with solar cells – This could take 50 bricks in close proximity to the load," said Dr D'Arcy.



"These 50 bricks would enable powering emergency lighting for five hours. Advantageously, if a brick wall serving as a super capacitor can be recharged hundreds of thousands of times within an hour." There is still a long way to go before the technology can be commercialized, according to some energy experts.

CLOUD COMPUTING

Madhurima Santra, Lecturer of Electronics & Tele-communication Engineering
Technique Polytechnic Institute

ABSTRACT— Cloud Computing is a versatile technology that can support a broad-spectrum of applications. The low cost of cloud computing and its dynamic scaling renders it an innovation driver for small companies, particularly in the developing world. Cloud deployed enterprise resource planning (ERP), supply chain management applications (SCM), customer relationship management (CRM) applications, medical applications and mobile applications have potential to reach millions of users. In this paper, we explore the different concepts involved in cloud computing. Leveraging our experiences on various clouds, we examine clouds from technical, and service aspects. We highlight some of the opportunities in cloud computing, underlining the importance of clouds and showing why that technology must succeed. Finally, we discuss some of the issues that this area should deal with.

➢ INTRODUCTION

This section gives an introduction to Cloud computing. "Cloud computing is a model for enabling convenient, ondemand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Cloud computing has emerged as a popular solution to provide cheap and easy access to externalized IT (Information Technology) resources. An increasing number of organizations (e.g., research centres, enterprises) benefit from Cloud computing to host their applications. Through virtualization, Cloud computing is able to address with the same physical infrastructure a large client base with different computational needs. In contrast to previous paradigms (Clusters and Grid computing), Cloud computing is not application-oriented but service-oriented; it offers on demand virtualized resources as measurable and billable utilities. Fig. 1 shows a basic cloud computing environment. The remainder of this paper deals with characteristics, opportunities, issues and challenges of cloud Computing. At the end we discuss about the future scope of Cloud.

➢ ESSENTIAL CHARACTERISTICS

In this section we describe the essential characteristics that a cloud must possess. Any cloud is expected to have these five characteristics that are being described below.

A. On-demand self-service

A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.

B. Broad network access

Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and personal digital assistants (PDAs).

C. Resource pooling

The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the subscriber generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or data centre). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.

D. Rapid elasticity

Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

E. Measured Service

Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported providing transparency for both the provider and consumer of the utilized service.

➢ CLOUD DEPLOYMENT STRATEGIES

This section explains the basic cloud deployment strategies. A cloud can be deployed using any of the below mentioned strategies

A. Public Cloud: In simple terms, public cloud services are characterized as being available to clients from a third party service provider via the Internet. The term "public" does not always mean free, even though it can be free or fairly inexpensive to use. A public cloud does not mean that a user's data is publicly visible; public cloud vendors typically provide an access control mechanism for their users. Public clouds provide an elastic, cost effective means to deploy solutions.

B. Private Cloud: A private cloud offers many of the benefits of a public cloud computing environment, such as being elastic and service based. The difference between a private cloud and a public cloud is that in a private cloud-based service, data and processes are managed within the organization without the restrictions of network bandwidth, security exposures and legal requirements that using public cloud services might entail. In addition, private cloud services offer the provider and the user greater control of the cloud infrastructure, improving security and resiliency because user access and the networks used are restricted and designated.

C. Community cloud: A community cloud is controlled and used by a group of Organizations that have shared interests, such as specific security requirements or a common mission. The members of the community share access to the data and applications in the cloud.

D. Hybrid Cloud: A hybrid cloud is a combination of a public and private cloud that interoperates. In this model users typically outsource non business-critical information and processing to the public cloud, while keeping business-critical services and data in their control.

➢ CLOUD DELIVERY MODELS

This section of the paper describes the various cloud delivery models. Cloud can be delivered in 3 models namely SaaS, PaaS, and IaaS.

A. Software-As-A-Service (Saas): In a cloud-computing environment. SaaS is software that is owned, delivered and managed remotely by one or more

B. Platform-As-A-Service (Paas): This kind of cloud computing provides development environment as a service. The consumer can use the middleman's equipment to develop his own program and deliver it to the users through Internet and servers. The consumer controls the applications that run in the environment, but does not control the operating system, hardware or network infrastructure on which they are running.

C.Infrastructure-As-A-Service (Iaas): Infrastructure as a service delivers a platform virtualization outsourced service. The consumer can control the environment as a service. Rather than purchasing servers, software, data center space or network equipment, consumers instead buy those resources as a fully operating system, storage, deployed applications and possibly networking components such as firewalls and load balancers, but not the cloud infrastructure beneath them.

➢ OPPORTUNITIES

In this section we explain the vast opportunities the cloud computing field offers to IT industry. Cloud Computing is concerned with the delivery of IT capabilities as a service on three levels: infrastructure (IaaS), platforms (PaaS), and software (SaaS). By providing interfaces on all three levels, Clouds address different types of customers :

A. End consumers

These consumers mainly use the services of the SaaS layer over a Web browser and basic offerings of the IaaS layer as for example storage for data resulting from the usage of the SaaS layer.

B. Business customers

These consumers access all three layers - the IaaS layer in order to enhance the own infrastructure with additional resources on demand, the PaaS layer in order to be able to run own applications in a Cloud and eventually the SaaS layer in order to take advantage of available applications offered as a service.

C. Developers and Independent Software Vendors

Independent Software Vendors that develop applications that are supposed to be offered over the SaaS layer of a Cloud. Typically, they directly access the PaaS layer, and through the PaaS layer indirectly access the IaaS layer, and are present on the SaaS layer with their application. In general, for all different kinds of Cloud customers, a Cloud offers the major opportunities known for X-as-a-Service offerings. From the perspective of the user, the utility-based payment model is considered as one of the main benefits of Cloud Computing. There is no need for up-front infrastructure investment: investment in software licenses and no risk of unused but paid software Thus, capital expenditure is turned licenses, and investment in hardware infrastructure and related maintenance and staff. into operational expenditure. Users of a Cloudservice only use the volume of IT resources they actually need, and only pay for the volume of IT resources they actually use. At the same time, they take advantage of the scalability and flexibility of a Cloud. Cloud computing enables easy and fast scaling of required demand computing resources on demand.

➢ CHALLENGES & ISSUES

In this section we explain the challenges & issues cloud computing has to face. As a lot of economics is tied to this field it will be better that these issues are resolved as early as possible. Fig. 2 depicts the summary of the survey conducted by us on the basic issues of the cloud computing. The client's primary concern is taken in to account. Hence only the percentage of 4, 5 is being shown. The following are the issues that a cloud computing environment has to still resolve:

A. Security

When using cloud-based services, one is entrusting their data to a third-party for storage and security. Can one assume that a cloud-based company will protect and secure ones data (Cloud computing presents specific challenges to privacy and security. back it up, check for data errors, defend against security breaches) if one is using their services at a very low cost? Or often for free? Once data is entrusted to a cloud based service, which third-parties do they share the information with? Cloud-sourcing involves the use of many services, and many cloud based services provide services to each other, and thus cloud-based products may have to share your information with third parties if they are involved in processing or transferring of your information. They may share your information with advertisers as well. Security presents a real threat to the cloud.

B. Performance

Cloud computing Suffers from severe performance issues. The cloud provider must ensure that the performance of the service being provided remains the same all through. There may be peak time break downs, internal flaws, and technical snags arising. Load balancer, data replicators, high end servers must me installed when needed.

C. Availability

Even though cloud promises to be a 24X7X365 service, cloud outages occur frequently. Outages can be scheduled or unscheduled. Table 1 provides details about the downtime in hours and the economic impact of cloud outages of various cloud providers from 2007 to 2012.

D. Cost:

Cloud computing can have high costs due to its requirements for both an "always on" connection, as well as using large amounts of data back in-house.

E. Regulatory requirements

What legislative, judicial, regulatory and policy environments are cloud-based information subject to? This question is hard to ascertain due to the decentralized and global structure of the internet, as well as of cloud computing. The information stored by cloud services is subject to thelegal, regulatory and policy environments of the country of domicile of the cloud service, as well as the country in which the server infrastructure is based. This is complicated by the fact that some data in transit may also be regulated.

F. Bandwidth, quality of service and data limits

Cloud computing requires "broadband of considerable speed" Whilst many websites are usable on non-broadband connections or slow broadband connections; cloud-based applications are often not usable. Connection speed in Kilobyte per second (or MB/s and GB/s) is important for use of cloud computing services. Also important are Quality of Service (QoS); indicators for which include the amount of time the connections are dropped, response time (ping), and the extent of the delays in the processing of network data (latency) and loss of data (packet loss).

G. Major suppliers

Only handful providers are available in the market which is still holding back many SME's to join a cloud.

➢ CONCLUSION

We've looked at the basics of cloud. There are interests and concerns in the cloud. From a technology point of view, there are interesting technical problems to solve. From a service or consumer point of view, there are essential usability, stability, and reliability problems to solve. We are at a crossroads with cloud technology. On one hand, there are many stories of problems with clouds, from data loss, to service interruption, to compromised sensitive data. To stay relevant, to remain meaningful, to grow in the service space, the cloud providers must step up their game and produce robust cloud implementations. On the other hand, the world is poised to explode with a billion new devices that will be desperate for the very technology that clouds almost offer today. It is possible that the wave of users, applications and demand will just wash over the cloud landscape, regardless of how robust they are. If the cloud providers are too slow to provide safe, secure, reliable data storage and application services, they may miss one of the greatest opportunities of this century.

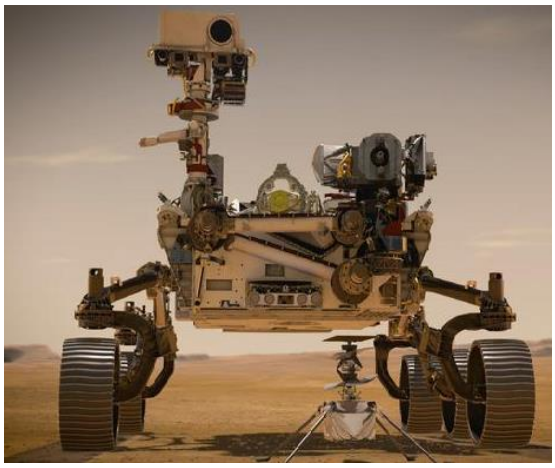
➢ FUTURE SCOPE

The issues that are highlighted in this paper will be a hot spot for researchers in future. Areas like security, Load balancing , Standardization will be the major research topics.

PERSEVERANCE

Antara Banerjee Bhowmick, Lecturer of Electronics & Tele-communication Engineering
Technique Polytechnic Institute

➢ Introduction



Perseverance, nicknamed Percy**,** is a car-sized Mars rover designed to explore the crater Jezero on Mars as part of NASA's Mars 2020 mission. It was manufactured by the Jet Propulsion Laboratory and launched on 30 July 2020 at 11:50 UTC. Confirmation that the rover successfully landed on Mars was received on 18 February 2021 at 20:55 UTC. As of 8 March 2021, Perseverance has been on Mars for 17 sols (18 Earth days). Following the rover's arrival, NASA named the landing site Octavia E. Butler Landing.

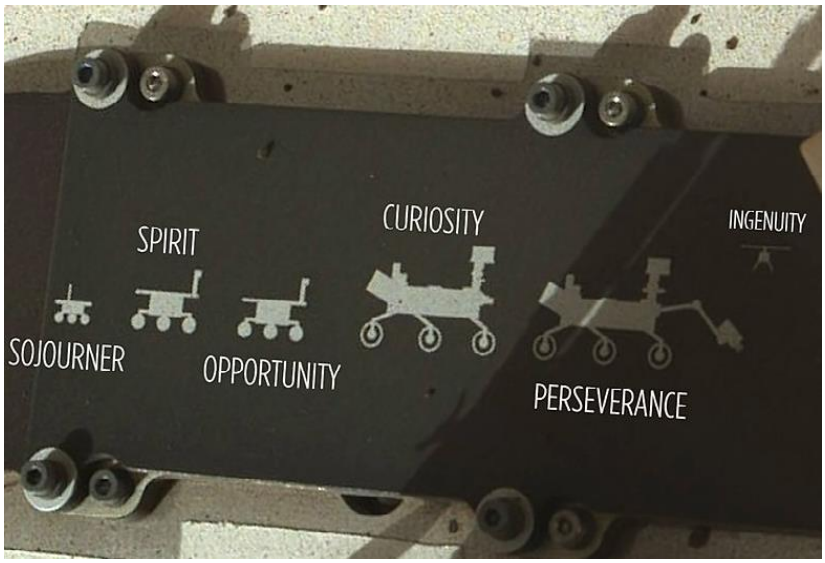
Perseverance has a similar design to its predecessor rover, Curiosity, from which it was moderately upgraded. It carries seven primary payload instruments, 19 cameras, and two microphones. The rover is also carrying the mini-helicopter Ingenuity, or Ginny, an experimental aircraft and technology showcase that will attempt the first powered flight on another planet.

The rover's goals include identifying ancient Martian environments capable of supporting life, seeking out evidence of former microbial life existing in those environments, collecting rock and soil samples to store on the Martian surface, and testing oxygen production from the Martian atmosphere to prepare for future crewed missions.

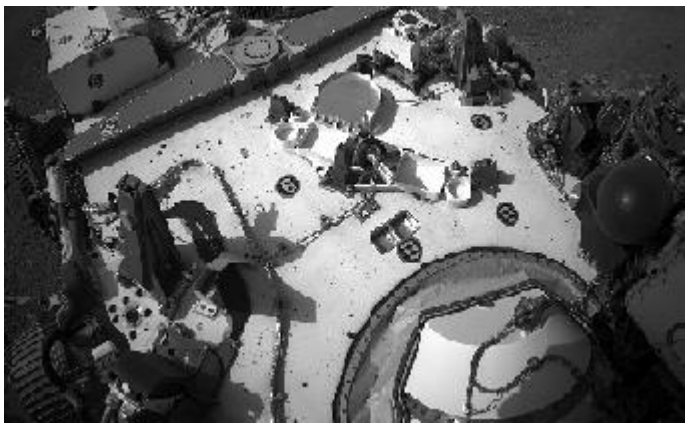
➢ Design

The Perseverance design evolved from its predecessor, the Curiosity rover. The two rovers share a similar body plan, landing system, cruise stage, and power system, but the design was improved in several ways for Perseverance. Engineers designed the rover wheels to be more robust than Curiosity's wheels, which have sustained some damage. Perseverance has thicker, more durable aluminium wheels, with reduced width and a greater diameter (52.5 cm (20.7 in)) than Curiosity's 50 cm (20 in) wheels. The aluminium wheels are covered with cleats for traction and curved titanium spokes for springy support. Like Curiosity, the rover includes a robotic arm, although Perseverance's arm is longer and stronger, measuring 2.1 m (6 ft 11 in). The arm hosts an elaborate rock-coring and sampling mechanism to store geologic samples from the Martian surface in sterile caching tubes. There is also a secondary arm hidden below the rover that helps store the chalk-sized samples.

The combination of larger instruments, new sampling and caching system, and modified wheels makes Perseverance heavier, weighing 1,025 kg (2,260 lb) compared to Curiosity at 899 kg (1,982 lb) a 14% increase.



The rover's radioisotope thermoelectric power generator (MMRTG) has a mass of 45 kg (99 lb) and uses 4.8 kg (11 lb) of Plutonium-238 oxide as its power source. The natural decay of plutonium-238, which has a half-life of 87.7 years, gives off heat which is converted to electricity, approximately 110 watts at launch. This will decrease over time as its power source decays.The MMRTG charges two lithium-ion rechargeable batteries which power the rover's activities, and must be recharged periodically. Unlike solar panels, the MMRTG provides engineers with significant flexibility in operating the rover's instruments even at night, during dust storms, and through winter.



The rover's computer uses the BAE Systems RAD750 radiation-hardened single board computer based on a ruggedized PowerPC G3 microprocessor (PowerPC 750). The computer contains 128 megabytes of volatile DRAM, and runs at 133 MHz. The flight software runs on the VxWorks Operating System, is written in C and is able to access 4 gigabytes of NAND non-volatile memory on a separate card. Perseverance relies on three antennas for telemetry, all of which are relayed through craft currently in orbit around Mars. The primary Ultra High Frequency (UHF) antenna can send data from the rover at a maximum rate of two megabits per second. Two slower X-band antennas provide communications redundancy.

JPL built a copy of the Perseverance that stayed on Earth. Called OPTIMISM (Operational Perseverance Twin for Integration of Mechanisms and Instruments Sent to Mars), it is housed at the JPL Mars Yard and is used to test operational procedures and to aid in problem solving should any issues arise with Perseverance.

- **Name**

Associate Administrator of NASA's Science Mission Directorate, Thomas Zurbuchen selected the name Perseverance following a nationwide K-12 student "name the rover" contest that attracted more than 28,000 proposals. A seventh-grade student, Alexander Mather from Lake Braddock Secondary School in Burke, Virginia, submitted the winning entry at the Jet Propulsion Laboratory. In addition to the honor of naming the rover, Mather and his family were invited to NASA's Kennedy Space Center to watch the rover's July 2020 launch from Cape Canaveral Air Force Station (CCAFS) in Florida.

Mather wrote in his winning essay:

Curiosity. In Sight. Spirit. Opportunity. If you think about it, all of these names of past Mars rovers are qualities we possess as humans. We are always curious, and seek opportunity. We have the spirit and insight to explore the Moon, Mars, and beyond. But, if rovers are to be the qualities of us as a race, we missed the most important thing. Perseverance. We as humans evolved as creatures who could learn to adapt to any

situation, no matter how harsh. We are a species of explorers, and we will meet many setbacks on the way to Mars. However, we can persevere. We, not as a nation but as humans, will not give up. The human race will always persevere into the future.

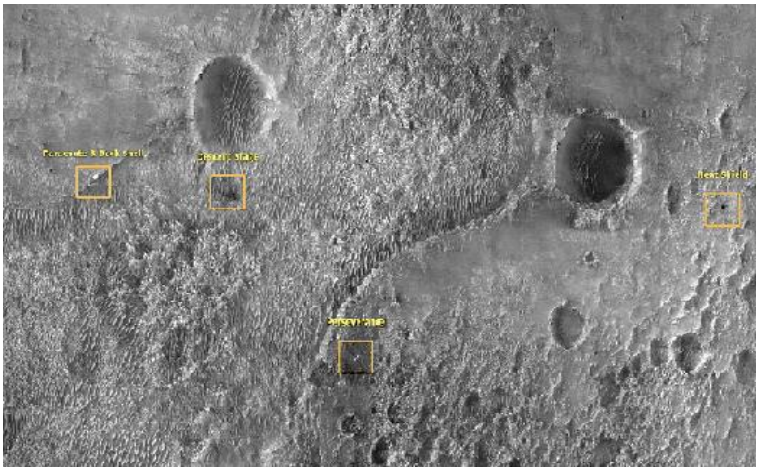
- **Mars transit**

The Perseverance rover lifted off successfully on 30 July 2020, at 11:50:00 UTC aboard a United Launch Alliance Atlas V launch vehicle from Space Launch Complex 41, at Cape Canaveral Air Force Station (CCAFS) in Florida.

The rover took about seven months to travel to Mars and made its landing in Jezero Crater on 18 February 2021, to begin its science phase.

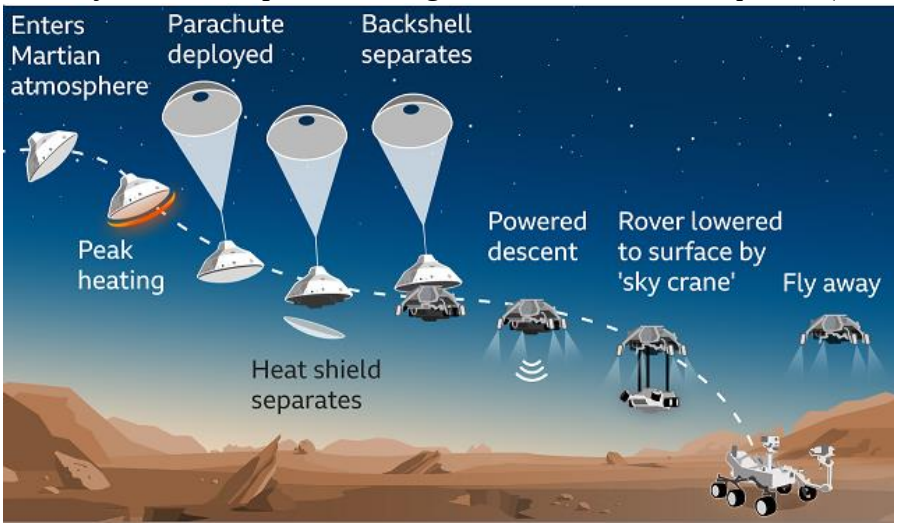
- **Landing**

The successful landing of Perseverance in Jezero Crater was announced at 20:55 UTC on 18 February 2021, the signal from Mars taking 11 minutes to arrive at Earth. The rover touched down at 18.4446°N 77.4509°E, roughly 1 km (0.62 mi) southeast of the center of its 7.7 × 6.6 km (4.8 × 4.1 mi) wide landing ellipse. It came down pointed almost directly to the southeast, with the RTG on the back of the vehicle pointing northwest. The descent stage ("sky crane"), parachute and heat shield all came to rest within 1.5 km of the rover (see satellite image). The landing was more accurate than any previous Mars landing; a feat enabled by the experience gained from Curiosity's landing and the use of new steering technology.



One such new technology is Terrain Relative Navigation (TRN), a technique in which the rover compares images of the surface taken during its descent with reference maps, allowing it to make last minute adjustments to its course. The rover also uses the images to select a safe landing site at the last minute, allowing it to land in relatively unhazardous terrain. This enables it to land much closer to its science objectives than previous missions, which all had to use a landing ellipse devoid of hazards.

The landing occurred in the late afternoon, with the first images taken at 15:53:58 on the mission clock (local mean solar time). The landing took place shortly after Mars passed through its northern vernal equinox (Ls = 5.2°), at the start of the astronomical spring, the equivalent of the end of March on Earth.



The parachute descent of the Perseverance rover was photographed by the HiRISE high-resolution camera on the Mars Reconnaissance Orbiteer (MRO).

Jezero Crater is a paleolake basin. It was selected as the landing site for this mission in part because paleolake basins tend to contain perchlorates. Astrobiology's Dr. Kennda Lynch's work in analogy environments

on Earth suggests that the composition of the crater, including the bottom set deposits accumulated from three different sources in the area, is a likely place to discover evidence of perchlorates-reducing microbes, if such bacteria is living or was formerly living Mars.

- **Traverse**

Perseverance is planned to visit the bottom and upper parts of the 3.4 to 3.8 billion-year-old Neretva Vallis delta, the smooth and etched parts of the Jezero Crater floor deposits interpreted as volcanic ash or aeolian airfall deposits, emplaced before the formation of the delta; the ancient shoreline covered with Transverse Aeolian Ridges (dunes) and mass wasting deposits, and finally, it is planned to climb onto the Jezero Crater rim.

In its progressive commissioning and tests, Perseverance made its first test drive on Mars on March 4, 2021. NASA released photographs of the rover's first wheel tracks on the Martian soil

Li-Fi

Vivek Das, Technical Assistant of Electronics & Tele-communication Engineering
Technique Polytechnic Institute

Li-Fi is a new way of wireless communication which uses LED lights to transmit data wirelessly. The data flow speed of this wireless data communication technology is quite high and has low cost installation. This post will discuss about what is Li-Fi technology, how it works, its applications, advantages, limitations and difference between Li-Fi and Wi-Fi.

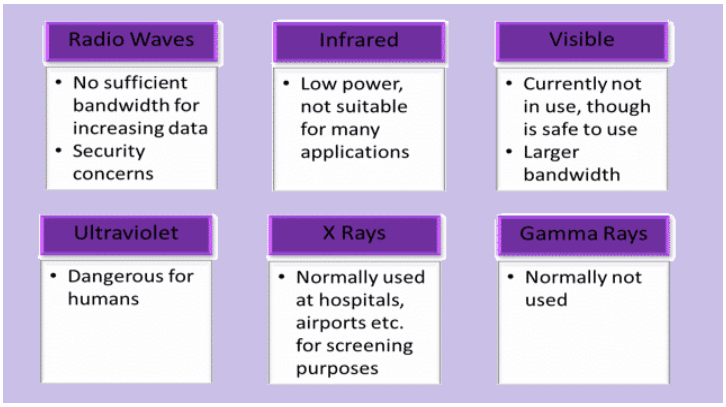
It is well accepted that transmission of data is one of the most important day to day activities in today's fast changing world. Some problems that is normally faced are:

Slow connection to the Internet when multiple devices are connected

Unavailability of fixed bandwidth due to overcrowding does not allow high data transfer rates.

This technology can be a solution to all these problems. Researches are going on to develop this technology on a broad scope.

➢ What is Li-Fi Technology



The term Li-Fi (Light and Fidelity) refers to Visible Light Communication (VLC) technology. This technology uses a part of the electromagnetic spectrum that is still not utilized generally i.e. the Visible Spectrum.

In simple terms, LiFi is a light-based Wi-Fi. This technology has a much broader spectrum for transmission compared to conventional methods of wireless communication which uses radio waves.

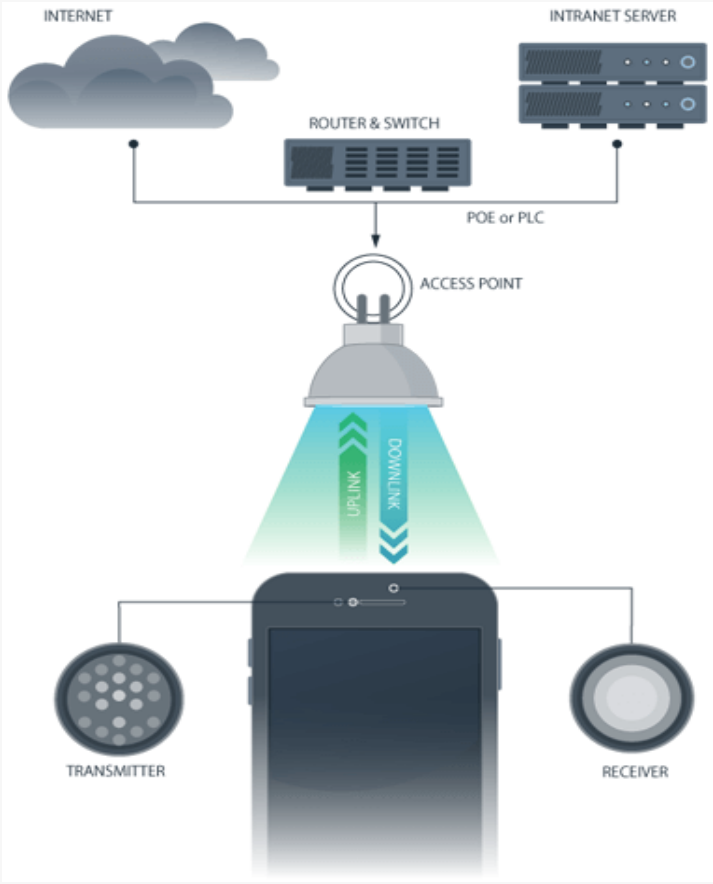
The basic ideology of this technology is transference of data using LED light of varying intensities. It uses transceivers fitted with LED lamps that can transmit and receive information. This results in adding new and unutilized bandwidth of visible light and may offer additional frequency band than those bands which are available for RF communication.

Since LiFi uses the visible spectrum, concerns of adverse effects of electromagnetic waves (associated with Wi-Fi technology) gets alleviated. Security concerns are also reduced as data or information on the Internet cannot be accessed in the absence of light.

How does Li Fi work

LiFi is high speed, bidirectional, and fully networked wireless communication of data using light. LiFi constitute of several lightbulbs that form a wireless network. When an electrical current is applied to a LED light bulb a stream of light (photons) is emitted from the bulb. LED bulbs are semiconductor devices, which means that the brightness of the light flowing through them can be changed at extremely high speeds. This means that the signal can be sent by modulating the light at different rates. The signal can then be received by a detector which interprets the changes in light intensity (the signal) as data. Also when the LED is ON, you transmit a digital 1 and when it is OFF you transmit a 0.

The intensity modulation cannot be seen by the human eye, and thus communication is just as seamless as other radio systems, allowing the users to be connected where there is LiFi enabled light. Using this technique, data can be transmitted from a LED light bulb and back at high speeds.



- **How data is transmitted over light**

To send data over light, LiFi systems require a strong, robust light source like LED bulbs. LEDs are different from halogen or filament bulbs as they do not need to warm up. As previously stated, they are semiconductors. They start up quickly and emit light according to the current passed through them.
Within the light, the intensity of the colors red, green, and blue (RGB) is finely modulated to embed data into the LED light. (Again, this process is undetectable to the naked eye.) This fine modulation of RGB can be better described as a form of code. Once the light is received by a photodiode, the light is demodulated. The

information received is either relayed to a cloud server or transcribed by the receiver itself. Content is then displayed according to the code obtained.

- **LIFI VS. WIFI**

LiFi technology is faster, cheaper and even more secure than wifi. Its main advantages include:

Faster: the current speed of wifi oscillates between 11 and 300 Mbit/s, while that of LiFi is also highly variable according to the last studies carried out. The most widely accepted speed is 10 Gbit/s, but it has been proven that it could reach 224 Gbit/s and that a 1.5 Gbit film could be downloaded in thousandths of a second.

Cheaper and more sustainable: it is up to 10 times cheaper than wifi, requires fewer components and uses less energy. All you have to do is turn on a light!

More accessible: any light fitting can easily be converted into an internet connection point, as only a simple LiFi emitter needs to be fitted.

More secure: light does not pass through walls like radio waves do, and this prevents intruders from intercepting LiFi communications through a wireless network.

More bandwidth: the light spectrum is 10,000 times wider than the radio spectrum, which increases the volume of data it can carry and transmit per second.

More reliable: LiFi transmits its signal without interruptions, making communication more stable than with wifi.

No interference: electronic light does not interfere with radio communications, interact with other systems or compromise transmissions from aircraft, ships, etc.

Wireless and invisible: LiFi takes advantage of lights and dispenses with the router, so it works without the need for cables. In addition, it can operate with infrared light, which is invisible to the human eye, or with visible LED light at very low intensity so as to avoid disturbance.

Applications

Hospital:

Many treatments now involve multiple individuals, Li-Fi systems could be a better system to transmit communication about the information of patients.[53] Besides providing a higher speed, light waves also have little effect on medical instruments. Wireless communication can be done during the use of such medical instruments without having to worry about radio interferences hindering the efficiency of the task.

Vehicles:

Vehicles could communicate with one another via front and back lights to increase road safety. Street lights and traffic signals could also provide information about current road situations.

Industrial automation:

Anywhere in industrial areas data has to be transmitted, Li-Fi is capable of replacing slip rings, sliding contacts and short cables, such as Industrial Ethernet. Due to the real time of Li-Fi (which is often required for automation processes) it is also an alternative to common industrial Wireless LAN standards. Fraunhofer IPMS, a research organisation in Germany states that they have developed a component which is very appropriate for industrial applications with time sensitive data transmission.

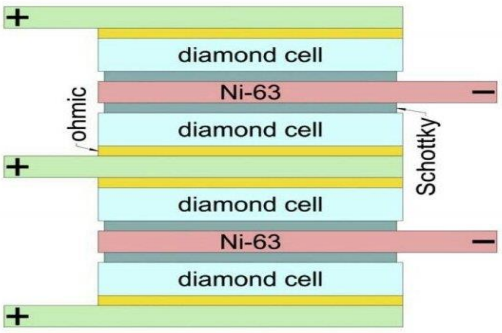
DIAMOND BATTERY

Srayani Aon, 3rd year, Student of Electronics & Tele-communication Engineering
Technique Polytechnic Institute

Diamond battery is the name of a nuclear battery concept proposed by the University of Bristol Cabot Institute during their annual lecture held on 25 November 2016 at the Wills Memorial Building. This battery is proposed to run on the radioactivity of waste graphite blocks which is previously used as neutron moderator material in graphite-moderated reactors and would generate small amounts of electricity for thousands of years. The battery is a beta voltaic cell using carbon-14 (14C) in the form of diamond-like carbon (DLC) as the beta radiation source, and additional normal-carbon DLC to make the necessary semiconductor junction and encapsulate the carbon-14.

- **Prototype:-**

Currently no known prototype uses 14C which is produced at least 2volt as its source, there are however some prototypes that use nickel-63 (63Ni) which produces close to 1.9 volt as their source with diamond semiconductors for energy conversion which are seen as a stepping stone to a possible 14C diamond battery prototype.

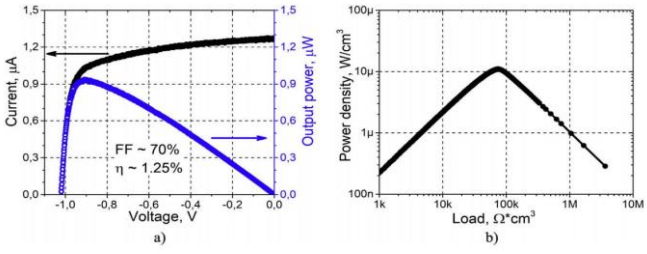


- **University of Bristol prototype:-**

In 2016 researchers from the University of Bristol claim have constructed one of those 63Ni prototypes however no proof is provided. Details about the performance of this prototype have been provided, however they are not self-consistent, contradicting other details and figures for performance exceed theoretical values by several orders of magnitude.

- **Moscow Institute of Physics and Technology prototype:-**

In 2018 researchers from the Moscow Institute of Physics and Technology (MIPT), the Technological Institute for Super hard and Novel Carbon Materials (TISNCM), and the National University of Science and Technology (MISIS) announced a prototype using 2-micron thick layers of 63Ni foil sandwiched between 200 10-micron diamond converters. It produced a power output of about 1 μW at for power density of 10 μW/cm3, at those values its energy density would be approximately 3.3 Wh/g over its 100 year half-life, about 10 times that of conventional electrochemical batteries. This research was published in April of 2018 in the Diamond and Related Materials journal.



- Carbon-14:-

Researchers are trying to improve the efficiency and are focusing on use of radioactive 14C, which is a minor contributor to the radioactivity of nuclear waste.

14C undergoes beta decay, in which it emits a low-energy beta particle to become Nitrogen-14, which is stable (not radioactive).

$$^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}\beta$$

These beta particles, having an average energy of 50 keV, undergo inelastic collisions with other carbon atoms, thus creating electron-hole pairs which then contribute to an electric current. This can be restated in terms of band theory by saying that due to the high energy of the beta particles, electrons in the carbon valence band jump to its conduction band, leaving behind holes in the valence band where electrons were earlier present.

- capability of the Diamond Battery versus a normal battery:-

Standard alkaline AA batteries are designed for short timeframe discharge: one battery Weighing about 20g has an energy storage rating of 700J/g. If operated continuously, this Would run out in 24 hours In comparison, a diamond beta-battery would be designed to last longer. The actual amount Of C14 in each battery has yet to be decided but as a rough guide, one battery, containing 1g of C14 will deliver 15J per day (based on calculations extrapolated from Ni63 Prototype). On the face of it, this is less than an AA battery. However, it will continue to Produce this level of output for 5,730 years, so its total energy storage rating is very high (2.7TeraJ aka million Joules)

- Proposed manufacturing:-

In graphite-moderated reactors, fissile uranium rods are placed inside graphite blocks. These blocks act as a neutron moderator whose purpose is to slow down fast-moving neutrons so that nuclear chain reactions can occur with thermal neutrons. During their use, some of the non-radioactive carbon-12 and carbon-13 isotopes in graphite get converted into radioactive 14C by capturing neutrons. Once the graphite blocks are removed during station decommissioning their induced radioactivity qualifies them as low-level waste requiring safe disposal.

Researchers at the University of Bristol demonstrated that a large amount of the radioactive 14C was concentrated on the inner walls of the graphite blocks. Due to this, they propose that much of it can be effectively removed from the blocks. This can be done by heating them to the sublimation point of 3915 K (3642 °C, 6588 °F) which will release the carbon in gaseous form. After this blocks will be less radioactive and possibly easier to dispose of with most of the radioactive 14C having being extracted. The approximate volume of the prototype diamond devices we are working on are 10 mm x 10mm with a thickness up to 0.5 mm. This is the ‘active’ device and does not include the Metallic contacts and wiring to complete the circuit.Those researchers propose that this 14C gas could be collected and used to produce man-made diamonds by a process known as chemical vapor deposition using low pressure and elevated temperature, noting that this diamond would be a thin sheet and not of the stereotypical diamond cut. The resulting diamond made of radioactive 14C would still produce beta radiation which researchers claim would allow it to be used as a beta voltaic source. Researchers also claim this diamond would be sandwiched between non-radioactive man-made diamonds made from 12C which would block radiation from the source and would also be used for energy conversion as a diamond semiconductor instead of convention silicon semiconductors.

- Proposed applications:-

Due to its very low power density, conversion efficiency and high cost it is very similar to other existing beta voltaic devices which are suited to niche applications needing very little power (microwatts) for several years in situations where conventional batteries cannot be replaced or recharged using conventional energy harvesting techniques. Due to its longer half-life 14C beta voltaic may have an advantage in service life when compared to other beta voltaic using tritium or nickel however this will likely come at the cost of further reduced power density. The company claims the battery can run for 28,000 years on a single charge. US-based company says that the battery can be used in electric vehicles, mobile phones, laptops, tablets, drones, watches, cameras, health monitors and even sensors.

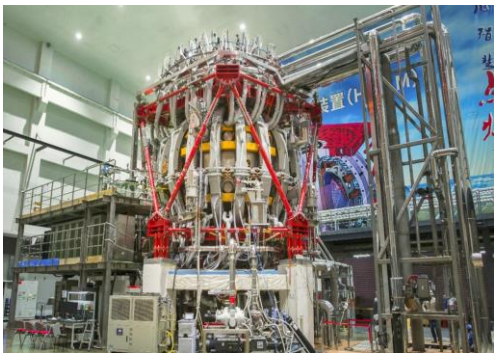
- Commercialization:-

In September 2020 Morgan Boardman, an Industrial Fellow and Strategic Advisory Consultant with the Aspire Diamond Group at the South West Nuclear Hub of the University of Bristol was appointed to be the CEO of a new company called Arkenlight which was created explicitly to commercialise their diamond battery technology, and possibly other nuclear radiation devices under research or development at Bristol University

FUTURISTIC WORLD: "ARTIFICIAL SUN PROJECT."

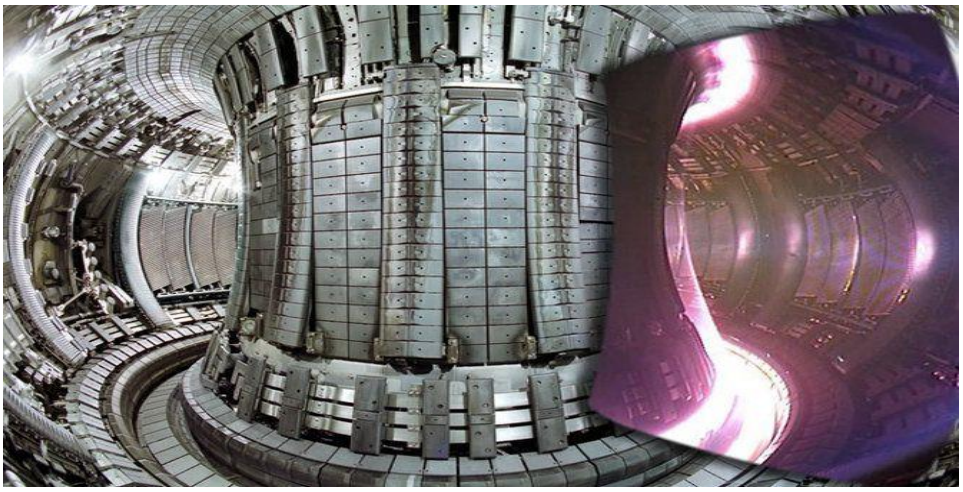
Suphal Das, Student of 3rd Year Electronics & Telecommunication Engineering
Technique Polytechnic Institute

China successfully powered up its "artificial sun" nuclear fusion reactor for the first time. Chinese scientists have been working on developing smaller versions of the nuclear fusion reactor since 2006.

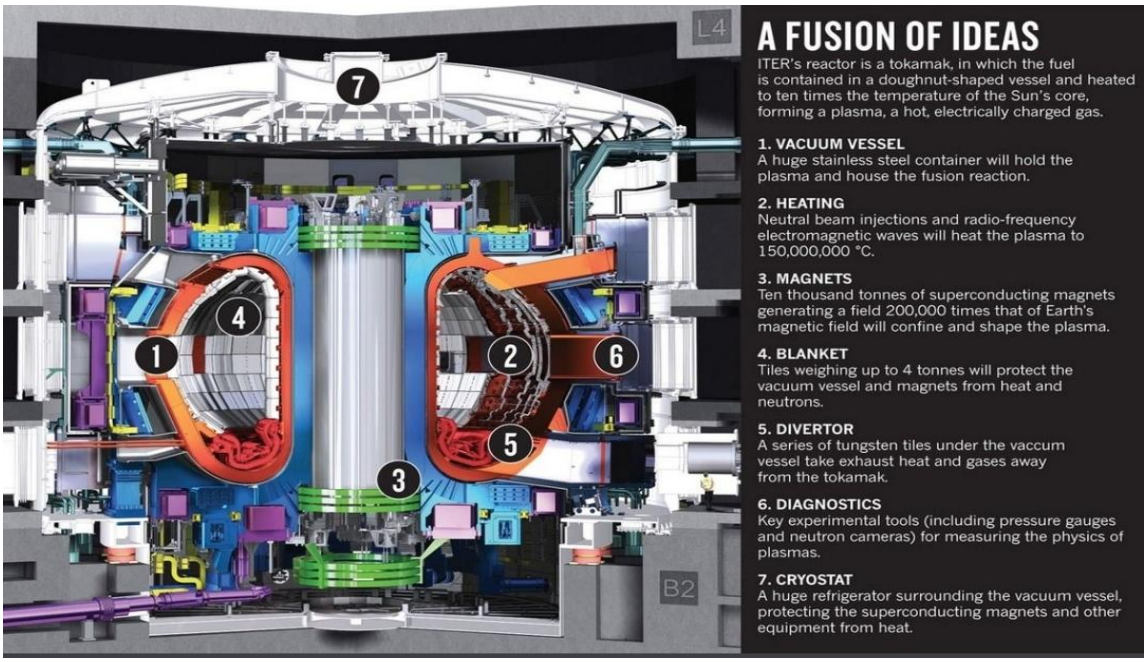


- **What is the use of artificial sun?**

It can be used to provide safer fuel amid a global crisis. The power in the reactor is generated by applying powerful magnetic fields to a contained loop of hot plasma. The plasma can reach temperatures of more than 150 million centigrades.The HL-2M Tokamak reactor is China's largest and most advanced nuclear fusion experimental research device, and scientists hope that the device can potentially unlock a powerful clean energy source. It uses a powerful magnetic field to fuse hot plasma and can reach temperatures of over 150 million degrees Celsius, approximately ten times hotter than the core of the sun. Located in southwestern Sichuan province and completed late last year, the reactor is often called an "artificial sun" on account of the enormous heat and power it produces. Development of nuclear fusion energy is not only a way to solve China's strategic energy needs, but also has great significance for the future sustainable. They plan to use the device in collaboration with scientists working on the International Thermonuclear Experimental Reactor – the world's largest nuclear fusion research project based in France, which is expected to be completed in 2025It merges atomic nuclei to create massive amounts of energy – the opposite of the fission process used in atomic weapons and nuclear power plants, which splits them into fragments.



➢ POWER PLANT REACTOR



➢ REACTOR LAYERS

Unlike fission, fusion emits no greenhouse gases and carries less risk of accidents or the theft of atomic material. “According to the World Nuclear Association’s most recent Nuclear Fuel Report there are 444 operating nuclear reactors, with 54 under construction, 111 planned, and 349 proposed," the report highlighted.

But achieving fusion is both extremely difficult and prohibitively expensive, with the total cost of ITER estimated at $22.5 billion.

It might sound like a concept straight out of a Hollywood science-fiction flick, but engineering an ‘artificial sun' is closer to reality than ever.

➢ *SOUTH KOREA IS ALSO SUCCESSFUL IN THIS AND CREATED A RECORD:*

South Korean artificial sun sets world record, runs for 20 seconds at 100 million degrees. The Korea Superconducting Tokamak Advanced Research or KSTAR has taken a major leap forward in the development of a working nuclear fusion reactor. Unlocking the power of nuclear fusion has been the dream of scientists since the early 20^{th} century but has proven a tough puzzle to crack. Nuclear fusion, which works by combining two atomic nuclei into a larger nucleus to release energy, promises to unleash more energy than it consumes.

Scientists in South Korea are now one step closer to realising this dream thanks to the KSTAR superconducting fusion device, which has been nicknamed Korea's artificial sun. Although not a working reactor, on November 24 this year the machine maintained a continuous stream of plasma for 20 seconds, while reaching an ion temperature of 100 million C.

For comparison, the core of the Sun reaches about 15 million C.In its 2020 experiment, the KSTAR improved the performance of the Internal Transport Barrier (ITB) mode, one of the next generation plasma operation modes developed last year and succeeded in maintaining the plasma state for a long period of time, overcoming the existing limits of the ultra-high-temperature plasma operation.

There are many countries to complete this project. The ITER is a large international scientific project that is a global collaboration of 35 countries, including China, Russia and the US.

TACTICAL VIRTUAL REALITY

Suvam Das, Student of 3rd Year Electronics & Telecommunication Engineering
Technique Polytechnic Institute

Virtual reality is one of the modern technologies which was introduced a few decades back and has taken an important place in the field of technology in a very short time. It makes use of an artificial environment generated by the computer in which simulates the real environment. Besides gaining an immediate acceptance in the world of computer games, it is now being used in many fields of life including architecture, medicine, military and aviation. Scientists and researchers are expecting to explore a lot in this modern technology than what we know about it today. It is a great leap in the field of 3D and a lot of work is still under progress. The discussion below is an insight into the details of this technology, its uses, advantages, disadvantages and social impacts.

The term virtual reality refers to refers to a modern technology providing an immersive, interactive experience using the three dimensional computer based graphic images. This technology creates an artificial environment with the help of computer hardware and software and is presented to the user in way which simulates the real world.

The equipment makes use of a pair of special gloves, ear phones and goggles, the three of them being controlled by the computer. In this way, three of the user's five senses are receiving and input from the computer. The goggles also act by detecting the eye movements of the user, thereby monitoring his actions.

The idea of virtual reality was first presented in 1930s, when the first flight simulator was invented by the scientists for the purpose of training the pilots. This was in an attempt to prepare them for the actual flight environment before being able to fly a real fighter plane.

The invention got improvement in 1965, when Ivan Sutherland, an American, presented his theory of developing a portable virtual world using two tiny television sets, one meant for each eye. His invention worked, but to a very basic level. The images were rough and not clear. Another problem was the weight of the helmet used. It was quite heavy and needed to be supported from the ceiling.

But the idea has actually got its base and now needed to be improved. Scientist continued working on this idea until in 1985, Michael McGreevy, from NASA introduced a much improved version of virtual reality. It was light weighted, using motorcycle helmet with mini display screens. It was also provided with the special sensors which were used to detect movements with the help of sensitive computer technology.

Finally, during 1986, the invention got its final touch when a computer games programmer named Jaron Lanier introduced a new glove for virtual reality. In this way took the modern form in which we look it today. (Virtual Reality, 2004)

It can cover the education and knowledge related to almost all fields of life. Even children as well as adults can get benefit from it. Virtual world is although quite close to the real world yet it is still unable to 'replace' the feelings of a real world. As an example, the virtual reality technology is now being used for military training as well. But a soldier actually knows that he is not going to get any harm from any bullet coming from an unknown origin or a surprising attack. These feelings can only be experienced while being in an actual war field where all of a soldier's instincts are fully active in order to prevent him from any unknown

danger, as he knows that it is real and he can even loose his life if he gets distracted from this actual environment. (Science Clarified, 2010)

Similarly, it was found many years back that the pilots trained by using the flight simulators make mistakes while flying the actual plane. This occurs because of the actual differences found between the virtual and the real world. As for example, a flight simulator is unable to present the effects of simulation that a pilot feels during an actual flight. Thus, when he gets into a real flight, he faces confusion while experiencing the new sensation. Yet, this is a temporary problem and is resolved by allowing the pilots trained by flight simulators to fly a plane, only after twenty four hours have passed.

These problems are although temporary, but they have raised questions about whether a long term use of virtual reality able to bring about permanent changes, especially in children, whose brains are still under developing stage and can easily be modified as compared to the grown-ups. Some psychologists believe that a long term and frequent use of virtual reality is going to change the way, people are used to perceive the real world.

According to some psychiatrists, a prolonged use of virtual world can make people avoid real life problems instead of trying to solve them.

Virtual reality can be described as one of the most important inventions of the modern world. Initially when computer was invented, it did not have much uses. With time, many improvements were made and computer started taking an important place at offices, homes and industries. Development of internet was a remarkable addition and it made the computer a necessity for every work place as well as homes. Likewise virtual reality was developed initially with a very basic knowledge. But now, it has started taking an important place at many work places especially those professions which are related to computer and technology. Still studies are being carried out in order to make further improvements in it, and we can predict its importance in the upcoming time mainly because of the reason that the virtual reality enables a person to visit any place or environment where it is sometimes practically impossible to go in person. One can visit the internal body, the space, the molecular structures, deep sea, buildings, sky, planets or whatever one can think of. Science is amazing and the computer world is giving the mankind an experience of a totally new world which could not be imagined some decades back.

Thus, virtual reality can be easily described as one of those inventions of science, which carry a great elasticity in them and with the research work going on in this field, we can hope to get even better results expected to bring great changes in almost every field using computer technology.

SOPHIA (ROBOT)

Muskan Singh, Student of 2nd Year Electronics & Telecommunication Engineering, Technique Polytechnic Institute

Sophia is a social humanoid robot developed by HONG KONG - based company SOPHIA ROBOTICS. Sophia was first turned on February 14, 2016, and made her first public appearance at south by south west festival (SXSW) in mid-March 2016 in Austin, Texas, United States. Sophia has been covered by media around the globe and has participated in many high-profile interviews. In October 2017, Sophia "became" a Saudi Arabian citizenship, the first robot to receive citizenship of any country. In November 2017, Sophia was named the United Nations Development Programme's first ever Innovation Champion, and is the first non-human to be given any United Nation title.

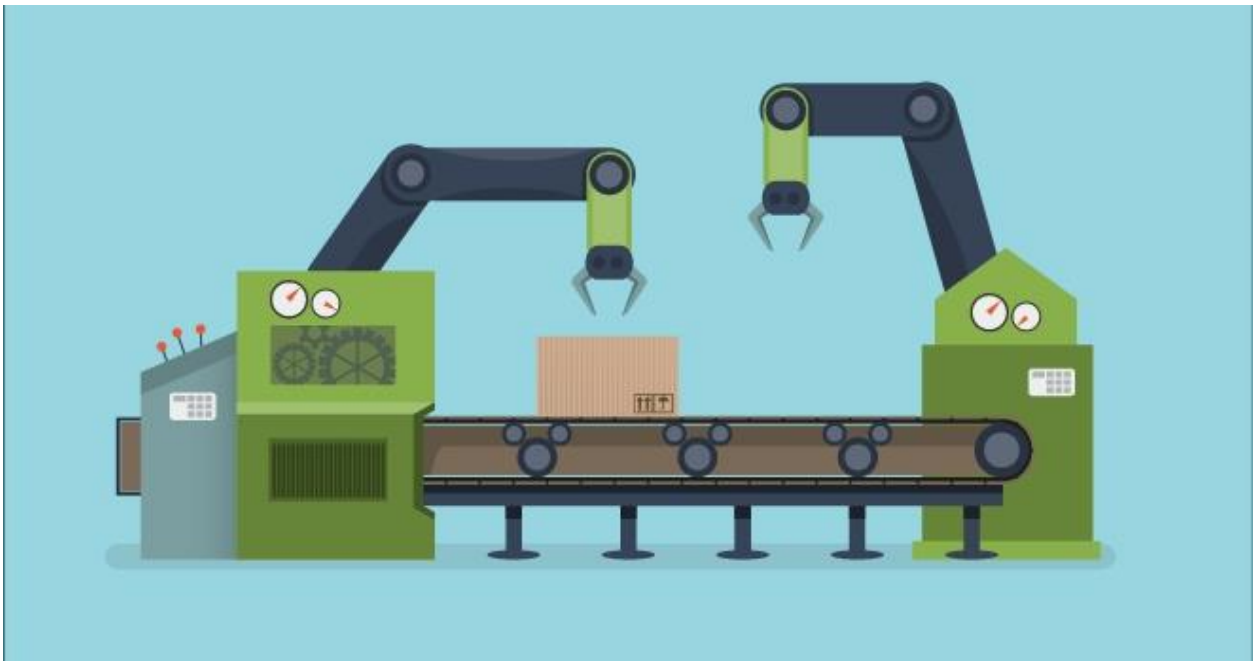
Cameras within Sophia's eyes combined with computer algorithms allow her to see. She can follow faces, sustain eye contact, and recognize individuals. She is able to process speech and have conversations using a natural language subsystem. Around January 2018, Sophia was upgraded with functional legs and the ability to walk. CNBC has commented on Sophia's "lifelike" skin and her ability to emulate more than 60 facial expressions.

Sophia is conceptually similar to the computer program ELIZA, which was one of the first attempts at simulating a human conversation. The software has been programmed to give pre-written responses to specific questions or phrases, like a chatbot. These responses are used to create the illusion that the robot is able to understand conversation, including stock answers to questions like "Is the door open or shut?." In 2017 Hanson Robotics announced plans to open Sophia to a cloud environment using a decentralized block chain marketplace.

David Hanson has said that Sophia would ultimately be a good fit to serve in healthcare, customer service, therapy and education. In 2019 Sophia displayed the ability to create drawings, including portraits.

SCADA

Suman Chatterjee, Student of 3rd Year Electronics & Telecommunication Engineering
Technique Polytechnic Institute

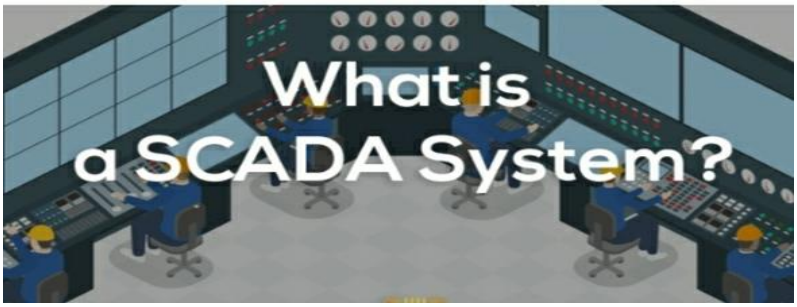


- **Introduction:-**

'SCADA' stands for "Supervisory control and data acquisition."

Supervisory means which is in the top level. Control means we are controlling something and data acquisition means we are reading data or acquiring the information.

In other word 'SCADA is a software which is used to control hardware.



'SCADA' is a common Industrial automation system which is used to collect data from instruments or sensors located at the remote site and to transmit data into center site for either monitoring or controlling purpose.

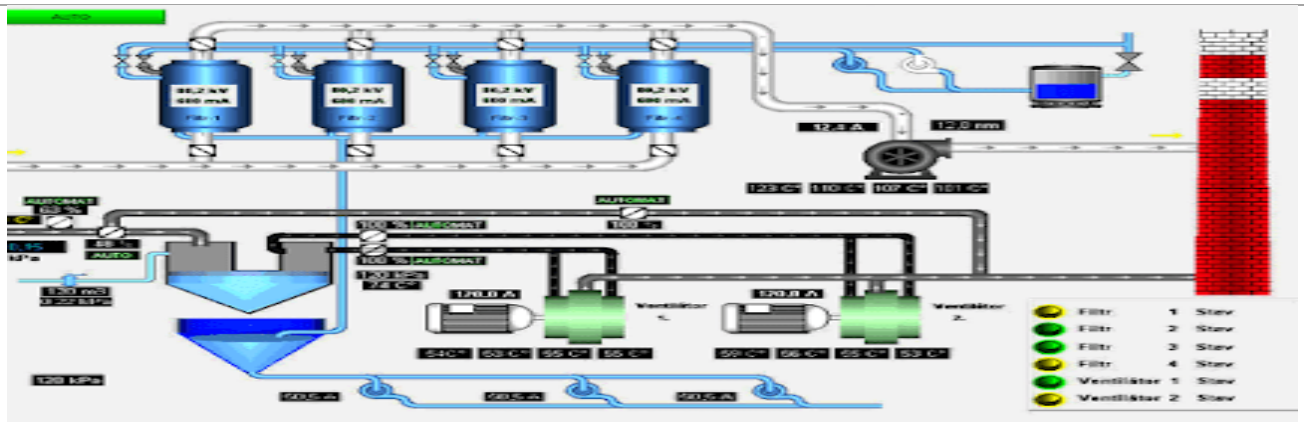


Fig: SCADA COMMUNICATION

➢ A Brief History Of The SCADA System

➢ The Beginning:

Before the introduction of SCADA, industrial organizations relied on manpower to control and monitor their equipment using analog dials and push buttons. When industrial floors began expanding, the need to control equipment over long distances surfaced. While attempts were made to find a solution to this problem, the answers that they initially came up with were inefficient. Eventually, they realized the need for full automation.

➢ Introduction of Computers :

In the 1950s, industries started utilizing computers. By the 1960s, automated communications were finally able to transmit pertinent data from remote sites to monitoring equipment through the use of telemetry. The term SCADA first came into prominence in the early 1970s, with a rise of microprocessors and PLCs paving the way to an increase in ways to control and monitor automated processes.

➢ Continued Evolution

Owing to the development of smaller computer systems, the Local Area Networking (LAN) technology, and even PC-based HMI software, SCADA continued a steady progress in the 80s and 90s. Due to these developments, SCADA systems began being connected to other systems.

Vendors were given control on how to optimize data transfer because of the propriety LAN protocols used in these systems which came to be known as distributed SCADA systems. The distributed model became the jump-off point for most of the changes that happened in the 1990s and early 2000s, including allowing systems from different vendors to communicate with each other and letting more devices to be connected to a network.

- **What are RTU & PLCs:-**

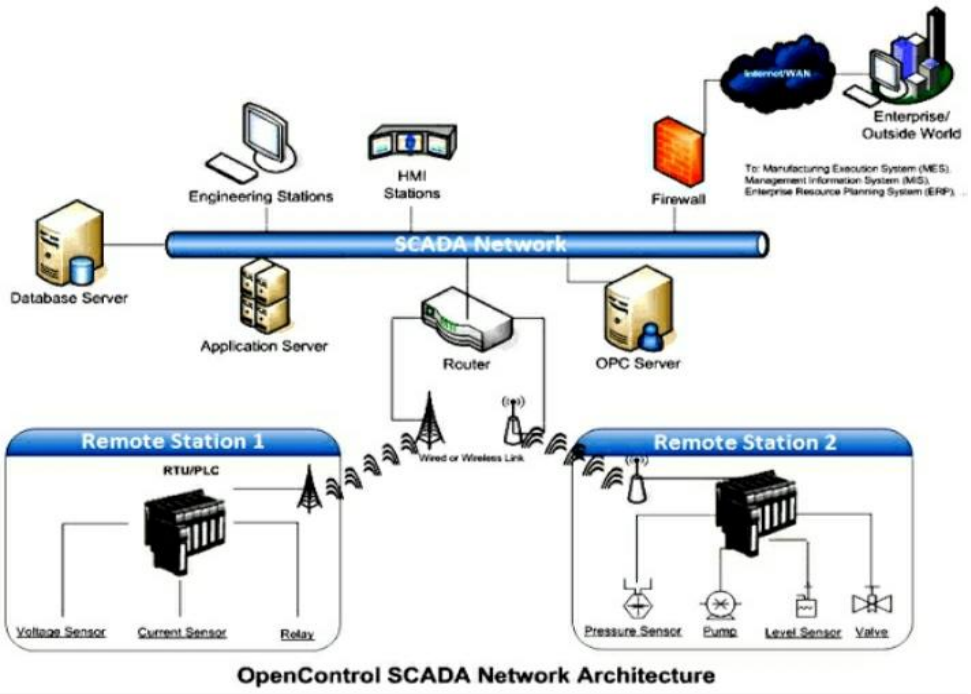
RTU:- 'RTU' stands for "Remote terminal unit." It is an electronic device controlled by microprocessor. Their main function is interface a SCADA. It is basically used in big plants.

PLCs:-'PLCs' stands for "Programmable logic controllers."

It is an industrial digital computer which has been ruggedized or adapted for the central of manufactory process, such as assembly lines or robotic

➢ Components of SCADA:-

a) Sensors, pumps, valves, motors etc.
b) Conversion units (RTU & PLCs)
c) Master units
d) Communications network (wireless, wired, LAN, VAN).
e) Servers, HMI, routers, firewall etc.



OpenControl SCADA Network Architecture

➢ Benefit of using SCADA system:-

a) Monitor the system.
b) To control the system and to click the required performance is always active.
c) Store data to all the operation for further use.
d) Visualization of all the operations by graphical representation.
e) It reduces operational staffing level by using automation or operation system by central location.