ASANSOL INSTITUTE OF ENGINEERING AND MANAGEMENT - POLYTECHNIC

(AIEM-P)

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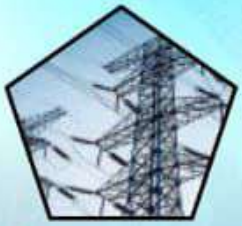
"LEADING YOU TOWARDS A BRIGHT FUTURE"

TECHNICAL MAGAZINE

Mechanical Engineering

Mining Engineering



Electrical Engineering

Civil Engineering

Computer Science & Technology

SPARKLE ' 2021

Message from Director

“We want that Education by which character is formed, strength of mind is increased, the intellect is expanded, by which one can stand on one’s own feet.”

By Swami Vivekananda

It is a noble task on the part of the Asansol Institute of Engineering and Management-Polytechnic to once again make it with their frequent issue of their Technical Magazine “Sparkle’2021”. I wish that this “Sparkle’2021” establishes to be a flint to fire the enthusiasm and excite their minds for many intrusive innovations among the students and inspire passion among the members of the faculty of AIEM-P committee. The efforts taken by Dr. Lisha Misra, Principal, Mr.C.R.Rout,Dean Academic and all the HODs and HODs Incharge to bring about innovative content is appreciable.

My greeting to the editorial board to keep the good work.

With Best Wishes

H.N Misra
Director
Asansol Institute of Engineering and Management-Polytechnic

Message from the Principal

"Education is the most powerful weapon which you can use to change the world."

Nelson Mandela.

It is a matter of great pride and satisfaction for Asansol Institute of Engineering and Management –Polytechnic to bring out the Technical Magazine **"SPARKLE'2021**". The College has made tremendous progress in all areas academic, non-academics, capacity building relevant to staff and students.

I am confident that this issues of Technical Magazine "SPARKLE'2021 will send a positive signal to the staff, students and the person who are interested in the Technical education and Technology based activities. The Technical Magazine "SPARKLE'2021 is like a mirror which reflects the clear picture of all sorts of activities undertaken by all Department and develops writing skills among students in particular and teaching faculty in general.

I congratulate the Editorial Board of this Technical Magazine "SPARKLE'2021 who have played wonderful role in accomplishing the task in Record time. I express my deep sense of gratitude to Mr. C.R.Rout, Dean of Academic and all the HODs and HODs In-Charge under whose guidance this Technical work has been undertaken and completed within the stipulated time.

Also my heartfelt Congratulations to staff members and Students for their fruitful effort.

With Best Wishes.

Dr.Lisha Misra
Principal
Asansol Institute of Engineering & Management-Polytechnic

Message from the Academic Advisor

We make technocrats, who proudly can say 'I am an AIEM-Pian Engineer; I serve mankind, by making dreams come true.'

It gives me an immense pleasure to note that the Asansol Institute of Engineering and Management –Polytechnic is bringing out the Technical Magazine "Sparkle'2021".

Learning is a continuous process from the minute we are born, until we die." AIEM-P provides a platform for every student to develop his learning skills through this magazine.

It will foster our budding talents who have expressed their thoughts, ideas, hopes, feelings, aspirations and convictions in a creative way to reach the goal called "Sparkle'2021". The student's articles contributed for the Technical Magazine "Sparkle'2021" has shown their intellectual insight and their excellent command on Technical Knowledge

This magazine should be a good source of guidance for faculty and coming batches of students in choosing activities of their choice in their future for building their carrier.

I congratulate all the HODs and HODs Incharge, Teaching and non teaching staff, editorial board members and students of the AIEM-P for bringing this edition of Technical Magazine "Sparkle'2023" within the stipulated time.

Wish you all the best.

C.R.Rout
Academic Advisor
Asansol Institute of Engineering & Management-Polytechnic

Chapter-1

Technical Magazine

Sparkle'2021

Electrical Engineering Department

Name of the Editors:

1. **Mrs. Trupti Mayee Pujhari (HOD)**
2. **Mr. Pranabesh Mukhopadhyay (Lecturer)**

Index

1. INFRARED THERMOGRAPHY

Author Name: **Shivam Yadav, 6th SEM**

Infrared (IR) thermography is the science of acquisition and analysis of thermal information from non-contact thermal imaging devices. IR thermography detects emitted radiation in the infrared range of the electromagnetic spectrum. This corresponds to wavelengths longer than the visible light portion of the spectrum. Thermal imaging can therefore be utilized to detect defects in the CFRP installation that may not be visible. Voids or delaminations in the CFRP installation are shown with a unique thermal signature due to entrapped air between the CFRP composite and the concrete substrate. CFRP delaminations exhibit a dark thermal signature in comparison to well bonded CFRP applications. As such, defects were marked and subsequently repaired after thermal inspection.

Infrared thermography can be carried out using two different approaches:

Active infrared thermography: This technique employs an external source to add extra energy to the study object, generating internal heat-flow that increases the temperature. The most important types of active infrared thermography include

a) *Pulsed thermography* is the most common type of thermal stimulation due to its easy and rapid application. A body is heated with a heat pulse and the temperature data are collected when temperature decreases. Heat sources that can be used include lamps, heating gun, flashes.

b) *Lock-In thermography* employs an oscillating temperature field to heat the object. In case of internal failure, the waves alter. A synchronisation between the input signal (thermal source) and the output signal (thermographic signal) is required.

c) Long-Pulse (Step Heating) thermography, employs a continuous low power heat source. The main different with respect to pulsed thermography is the target. Long-pulse is focused on the cooling process whereas pulse thermography evaluates the heating process.
d) Vibrothermography uses mechanical vibrations to generate hot spots in the areas where cracks, voids, or other defects are located. The mechanical energy is converted into thermal energy inside of the material.

Passive Infrared Thermography: This infrared technique does not need an external source of heat. The infrared radiation emitted by the object already is collected instead.

2. SATELLITE COMMUNICATION

Author Name: **Azizul Islam, 6th SEM**

Satellite communication, in telecommunications, the use of artificial satellites to provide communication links between various points on Earth. Satellite communications play a vital role in the global telecommunications system. Approximately 2,000 artificial satellites orbiting Earth relay analog and digital signals carrying voice, video, and data to and from one or many locations worldwide.

Satellite communication has two main components: the ground segment, which consists of fixed or mobile transmission, reception, and ancillary equipment, and the space segment, which primarily is the satellite itself. A typical satellite link involves the transmission or uplinking of a signal from an Earth station to a satellite. The satellite then receives and amplifies the signal and retransmits it back to Earth, where it is received and reamplified by Earth stations and terminals. Satellite receivers on the ground include direct-to-home (DTH) satellite equipment, mobile reception equipment in aircraft, satellite telephones, and handheld devices.

Working of a Satellite

A satellite is basically a self-contained communications system with the ability to receive signals from Earth and to retransmit those signals back with the use of a transponder—an integrated receiver and transmitter of radio signals. A satellite has to withstand the shock of being accelerated during launch up to the orbital velocity of 28,100 km (17,500 miles) an hour and a hostile space environment where it can be subject to radiation and extreme temperatures for its projected operational life, which can last up to 20 years. In addition, satellites have to be light, as the cost of launching a satellite is quite expensive and based on weight. To meet these challenges, satellites must be small and made of lightweight and durable materials. They must operate at a very high reliability of more than 99.9 percent in the vacuum of space with no prospect of maintenance or repair.

The main components of a satellite consist of the communications system, which includes the antennas and transponders that receive and retransmit signals, the power system, which includes the solar panels that provide power, and the propulsion system, which includes the rockets that propel the satellite. A satellite needs its own propulsion system to get itself to the right orbital location and to make occasional corrections to that position. A satellite in geostationary orbit can deviate up to a degree every year from north to south or east to west of its location because of the gravitational pull of the Moon and Sun. A satellite has thrusters that are fired occasionally to make adjustments in its position. The maintenance of a satellite's orbital position is called "station keeping," and the corrections made by using the satellite's thrusters are called "attitude control." A satellite's life span is determined by the amount of fuel it has to power these thrusters. Once the fuel runs out, the satellite eventually drifts into space and out of operation, becoming space debris.

A satellite in orbit has to operate continuously over its entire life span. It needs internal power to be able to operate its electronic systems and communications payload. The main source of power is sunlight, which is harnessed by the satellite's solar panels. A satellite also has batteries on board to provide power when the Sun is blocked by Earth. The batteries are recharged by the excess current generated by the solar panels when there is sunlight.

Satellites operate in extreme temperatures from −150 °C (−238 °F) to 150 °C (300 °F) and may be subject to radiation in space. Satellite components that can be exposed to radiation are shielded with aluminium and other radiation-resistant material. A satellite's thermal system protects its sensitive electronic and mechanical components and maintains it in its optimum functioning temperature to ensure its continuous operation. A satellite's thermal system also protects sensitive satellite components from the extreme changes in temperature by activation of cooling mechanisms when it gets too hot or heating systems when it gets too cold.

The tracking telemetry and control (TT&C) system of a satellite is a two-way communication link between the satellite and TT&C on the ground. This allows a ground station to track a satellite's position and control the satellite's propulsion, thermal, and other systems. It can also monitor the temperature, electrical voltages, and other important parameters of a satellite.

Communication satellites range from microsatellites weighing less than 1 kg (2.2 pounds) to large satellites weighing over 6,500 kg (14,000 pounds). Advances in miniaturization and digitalization have substantially increased the capacity of satellites over the years. Early Bird had just one transponder capable of sending just one TV channel. The Boeing 702 series of satellites, in contrast, can have more than 100 transponders, and with the use of digital compression technology each transponder can have up to 16 channels, providing more than 1,600 TV channels through one satellite.

Satellites operate in three different orbits: low Earth orbit (LEO), medium Earth orbit (MEO), and geostationary or geosynchronous orbit (GEO). LEO satellites are positioned at an altitude between 160 km and 1,600 km (100 and 1,000 miles) above Earth. MEO satellites operate from 10,000 to 20,000 km (6,300 to 12,500 miles) from Earth. (Satellites do not operate between LEO and MEO because of the inhospitable environment for electronic components in that area, which is caused by the Van Allen radiation belt.) GEO satellites are positioned 35,786 km (22,236 miles) above Earth, where they complete one orbit in 24 hours and thus remain fixed over one spot. As mentioned above, it only takes three GEO satellites to provide global coverage, while it takes 20 or more satellites to cover the entire Earth from LEO and 10 or more in MEO. In addition, communicating with satellites in LEO and MEO requires tracking antennas on the ground to ensure seamless connection between satellites.

A signal that is bounced off a GEO satellite takes approximately 0.22 second to travel at the speed of light from Earth to the satellite and back. This delay poses some problems for applications such as voice services and mobile telephony. Therefore, most mobile and voice services usually use LEO or MEO satellites to avoid the signal delays resulting from the inherent latency in GEO satellites. GEO satellites are usually used for broadcasting and data applications because of the larger area on the ground that they can cover.

Launching a satellite into space requires a very powerful multistage rocket to propel it into the right orbit. Satellite launch providers use proprietary rockets to launch satellites from sites such as the Kennedy Space Center at Cape Canaveral, Florida, the Baikonur Cosmodrome in Kazakhstan, Kourou in French Guiana, Vandenberg Air Force Base in California, Xichang in China, and Tanegashima Island in Japan.

Satellite communications use the very high-frequency range of 1–50 gigahertz (GHz; 1 gigahertz = 1,000,000,000 hertz) to transmit and receive signals. The frequency ranges or bands are identified by letters: (in order from low to high frequency) L-, S-, C-, X-, Ku-, Ka-, and V-bands. Signals in the lower range (L-, S-, and C-bands) of the satellite frequency spectrum are transmitted with low power, and thus larger antennas are needed to receive these signals. Signals in the higher end (X-, Ku-, Ka-, and V-bands) of this

spectrum have more power; therefore, dishes as small as 45 cm (18 inches) in diameter can receive them. This makes the Ku-band and Ka-band spectrum ideal for direct-to-home (DTH) broadcasting, broadband data communications, and mobile telephony and data applications.

The International Telecommunication Union (ITU), a specialized agency of the United Nations, regulates satellite communications. The ITU, which is based in Geneva, Switzerland, receives and approves applications for use of orbital slots for satellites. Every two to four years the ITU convenes the World Radiocommunication Conference, which is responsible for assigning frequencies to various applications in various regions of the world. Each country's telecommunications regulatory agency enforces these regulations and awards licenses to users of various frequencies. In the United States the regulatory body that governs frequency allocation and licensing is the Federal Communications Commission.

Applications of Satellite

Advances in satellite technology have given rise to a healthy satellite services sector that provides various services to broadcasters, Internet service providers (ISPs), governments, the military, and other sectors. There are three types of communication services that satellites provide: telecommunications, broadcasting, and data communications. Telecommunication services include telephone calls and services provided to telephone companies, as well as wireless, mobile, and cellular network providers.

Broadcasting services include radio and television delivered directly to the consumer and mobile broadcasting services. DTH, or satellite television, services (such as the DirecTV and DISH Network services in the United States) are received directly by households. Cable and network programming is delivered to local stations and affiliates largely via satellite. Satellites also play an important role in delivering programming to cell phones and other mobile devices, such as personal digital assistants and laptops.

Data communications involve the transfer of data from one point to another. Corporations and organizations that require financial and other information to be exchanged between their various locations use satellites to facilitate the transfer of data through the use of very small-aperture terminal (VSAT) networks. With the growth of the Internet, a significant amount of Internet traffic goes through satellites, making ISPs one of the largest customers for satellite services.

Satellite communications technology is often used during natural disasters and emergencies when land-based communication services are down. Mobile satellite equipment can be deployed to disaster areas to provide emergency communication services.

Disadvantages of Satellites

One major technical disadvantage of satellites, particularly those in geostationary orbit, is an inherent delay in transmission. While there are ways to compensate for this delay, it makes some applications that require real-time transmission and feedback, such as voice communications, not ideal for satellites.

Satellites face competition from other media such as fibre optics, cable, and other land-based delivery systems such as microwaves and even power lines. The main advantage of satellites is that they can distribute signals from one point to many locations. As such, satellite technology is ideal for "point-to-multipoint" communications such as broadcasting. Satellite communication does not require massive investments on the ground—making it ideal for underserved and isolated areas with dispersed populations.

Satellites and other delivery mechanisms such as fibre optics, cable, and other terrestrial networks are not mutually exclusive. A combination of various delivery mechanisms may be needed, which has given rise to various hybrid solutions where satellites can be one of the links in the chain in combination with other media. Ground service providers called “teleports” have the capability to receive and transmit signals from satellites and also provide connectivity with other terrestrial networks.

3. INFRARED PLASTIC SOLAR CELLS

Author Name: **Dipta Nandy, 4th SEM**

It is time to switch to a cleaner, renewable energy source and make the most of the gigantic power station in the sky above, the Sun.The Sun has enough fuel to drive our energy systems for another billion years, and a solar cell can help you capture this energy into an endless, convenient electricity supply.

Scientists have been coming up with various solar cells to maximise utility, and an infrared plastic solar cell is one such innovation. This type of solar cell has the capability to transform the Sun's power into electric energy even on a low-light, cloudy day. The infrared plastic solar cell uses nanotechnology that enables it to harness the Sun's invisible infrared rays.

Usually, top companies use Acrylonitrile Butadiene Styrene (ABS), Acrylic/Plexiglass, or Polypropylene plastics to make solar panels. An infrared plastic solar cell has the potential to be five times more efficient than regular solar cells.

Although the work is similar to other solar cells, these plastic solar cells come in small sizes. Yet, they capture almost all the rays from the Sun's radiation. Their small size and lightweight impart them unusual and interesting properties. Unlike conventional solar cells, an infrared plastic solar cell can turn the Sun's rays into electric energy even on a cloudy day. An infrared plastic cell is made up of nanoparticles called quantum dots and a polymer capable of detecting energy in the infrared region.

The plastic material uses nanotechnology. It has first-generation solar cells for harnessing power from the Sun's invisible infrared rays.The plastic solar cell is a hybrid comprising tiny nanorods that lie dispersed in an organic polymer–P3HT (poly-3hexylthiophene). The nanorods are composed of cadmium selenide.

A layer of approximately 200 nm of nanorods stays sandwiched between electrodes, and the electrodes are aluminum-coated. Thus, conducting plastic (a polymer with conjugated double bonds) is required to allow electrons to move through the nanorods.

Working of an Infrared Plastic Solar Cell

The nanorods of the infrared plastic solar cell behave like wires when they absorb the Sun's light rays of a specific wavelength. These nanorods generate an electron as well as an electron-hole. The generated electron travels the length of the rod unless the aluminium electrode collects it. The electron-hole gets transferred to the plastic and conveyed to the electrode in order to create a current.

The closely packed nanorods transfer the electrons more directly to the electrolyte. The energy capture and the transmission process are quick. Moreover, suitability for cloudy days and shady areas makes infrared plastic solar cells an ideal option for solar power generation.

Usually, the infrared plastic cell price is high due to the involvement of the latest technology. However, several companies offer reasonable prices. They have made plastic solar cells flexible enough to adhere to any surface; thereby, increasing the vastness of applications of these cells.

The average price of a 10 Watt plastic solar panel ranges from Rs. 800-1200. The price for a 100 Watt plastic solar panel falls in the range of Rs. 4000-5000.The price for a 200 Watt plastic solar panel goes up to Rs.10,000. A general rule of thumb: as the wattage increases, the prices soar higher.

Advantages

Efficiency: These solar cells are 30% more efficient than conventional solar cells.
Lightweight: Traditional solar panels are bulky, while infrared plastic solar panels are compact and lightweight.
Consistency: These infrared plastic solar cells turn the Sun's power into a clean and consistent energy source. They are suitable for cloudy and low light days too.
Usability: Conventional solar cells are suitable for large applications. On the other hand, plastic solar cells are feasible and can be used on window panes too.

Disadvantages

High cost is the biggest hurdle in the path of the popularity of infrared plastic solar cells. However, brands are working on reducing costs.
These solar cells have a shorter life when exposed to sunlight for long durations.
They often require constant monitoring.

Conclusion

The cost of solar energy is falling at a fast pace as newer technologies step in. It is estimated that solar energy is on course to provide 20% of the world's energy needs by 2027.
Using an infrared plastic solar cell ensures a low maintenance cost and long-lasting energy. It is a non-polluting, silent electricity source with a sustainable power supply.
Nanotechnology in infrared plastic solar cells makes them far more cost-effective than conventional solar cells.

4. WIRELESS ELECTRICITY

Author Name: **Prince Kumar Singh, 4th SEM**

Wireless electricity is quite literally the transmission of electrical energy without wires. People often compare the wireless transmission of electrical energy as being similar to the wireless transmission of information, for example, radio, cell phones, or wi-fi internet. The major difference is that with radio or microwave transmissions, the technology focuses on recovering just the information, and not all the energy that you originally transmitted. When working with the transport of energy you want to be as efficient as possible, near or at 100 percent.

Wireless electricity is a relatively new area of technology but one that is rapidly being developed. You may already be using the technology without being aware of it, for example, a cordless electric toothbrush which recharges in a cradle or the new charger pads that you can use to charge your cell phone. However, both of those examples while technically wireless do not involve any significant amount of distance, the toothbrush sits in the charging cradle and the cell phone lies on the charging pad. Developing methods of efficiently and safely transmitting energy at a distance has been the challenge.

Working of Wireless Electricity

There are two important terms to explain how wireless electricity works in, for example, an electric toothbrush, it works by "inductive coupling" and "electromagnetism". According to the Wireless Power Consortium, "Wireless charging, also known as inductive charging, is based on a few simple principles. The technology requires two coils: a transmitter and a receiver. An alternating current is passed through the transmitter coil, generating a magnetic field. This, in turn, induces a voltage in the receiver coil; this can be used to power a mobile device or charge a battery."

To explain further, whenever you direct an electrical current through a wire there is a natural phenomenon that occurs, that a circular magnetic field is created around the wire. And if you loop/coil that wire that wire's magnetic field gets stronger. If you take a second coil of wire that does not have an electrical current passing through it, and place that coil within the magnetic field of the first coil, the electric current from the first coil will travel through the magnetic field and started running through the second coil, that's inductive coupling.

In an electric toothbrush, the charger is connected to a wall outlet that sends an electric current to a coiled wire inside the charger creating a magnetic field. There is a second coil inside of the toothbrush, when you place the toothbrush inside of its cradle to be charged the electric current passes through the magnetic field and sends electricity to the coil inside the toothbrush, that coil is connected to a battery which gets charged.

Chapter-2

Technical Magazine

Sparkle'2021

Mechanical Engineering Department

Name of the Editors:

1. **Mr. Sushobhan Ghosh (HOD in-Charge)**
2. **Mr. Abhisek Mitra (Lecturer)**

Index

1. ANTILOCK BRAKING SYSTEM

Author Name: **Aayush Kumar Singh, 6thSEM**

Short for Antilock Braking System, ABS is a braking technology that prevents the tires from locking during emergency braking. Invented by Mario Palazzetti in 1971, the Antilock Braking System is an old safety standard when compared to newer automated vehicle safety technologies, but according to a US Department of Transportation study of accidents between 1995 and 2007, ABS was estimated to have reduced non-fatal accidents by six percent in cars.

When the car is moving at a high velocity, it has a lot of kinetic energy, and the same needs to be converted into another form of energy to stop the vehicle. When you apply the brakes on your vehicle, this kinetic energy converts into heat, and once all the kinetic energy is consumed, the car comes to a stop. In normal braking conditions, this process happens over a prolonged time frame, and the wheels don't lock as the brakes are applied gradually.

In the case of emergency braking, a lot of pressure is applied to the moving tires in a very small duration. Due to this, a high stopping force is applied to the tires causing them to lock. This locking prevents the loss of energy through the brakes. Therefore, to lose the kinetic energy, the vehicle starts to slip. This slipping phenomenon prevents the driver from maneuvering the car, making tire locking extremely dangerous.

To solve this problem, cars are equipped with the Antilock Braking System. The main job of this system is to get the wheels into motion in emergencies helping the driver regain control of the car.

Working of ABS

Now that we understand the various moving parts of an Antilock Braking System, we can look at how the system works. It all starts with the wheel speed sensor. This sensor continuously monitors the tires' speed and sends this data to the ECU. The ECU analyzes this data and tries to understand if the car's wheels have locked. If the tires have locked, the Antilock Braking System comes into the picture and tries to get the wheels spinning again. To do this, the ECU starts controlling the hydraulic system and varies the pressure applied on the tires to ensure that they don't lock. This variation in pressure is based on the speed of the tires. So if the tires are locked, the ECU reduces the pressure on the wheels, and if the wheels are spinning at a high velocity, the ECU increases the pressure applied to the tires. The above-mentioned procedure of varying the pressure is performed several times in a second, ensuring that the vehicle stops in a controlled manner.

Most people are under the impression that ABS makes their cars stop in a shorter duration of time, but it's not always true. As ABS applies breaks repeatedly to prevent the tires from locking, it can increase the braking distance. The critical thing to understand here is that an Antilock Braking System provides control to a driver rather than stopping the vehicle faster. Antilock Braking Systems combine state-of-the-art sensor technologies with algorithms working on ECUs. These technologies help drivers in regaining control of their vehicles in dire situations. Therefore, the next time you hit the brakes hard, remember that the brains of the car and your reflexes worked together to save your life.

2. AIR BEARING

Author Name: **Ayush Prasad, 6th SEM**

Unlike contact roller bearings, air bearings utilize a thin film of pressurized air to provide a frictionless, loadbearing interface between two surfaces which would otherwise contact each other. Since air bearings are a non-contact technology, they avoid long-standing tribological problems like friction, wear and the necessity for lubrication. This set of traits provides air bearings with unique advantages for precision positioning. An autonomous car is a vehicle capable of sensing its environment and operating without human involvement. A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all. An autonomous car can go anywhere a traditional car goes and do everything that an experienced human driver does. Autonomous cars rely on sensors, actuators, complex algorithms, machine learning systems, and powerful processors to execute software.

Autonomous cars create and maintain a map of their surroundings based on a variety of sensors situated in different parts of the vehicle. Radar sensors monitor the position of nearby vehicles. Video cameras detect traffic lights, read road signs, track other vehicles, and look for pedestrians. Lidar (light detection and ranging) sensors bounce pulses of light off the car's surroundings to measure distances, detect road edges, and identify lane markings. Ultrasonic sensors in the wheels detect curbs and other vehicles when parking.

Sophisticated software then processes all this sensory input, plots a path, and sends instructions to the car's actuators, which control acceleration, braking, and steering. Hard-coded rules, obstacle avoidance algorithms, predictive modeling, and object recognition help the software follow traffic rules and navigate obstacles.

Benefits of Autonomous Cars

The scenarios for convenience and quality-of-life improvements are limitless. The elderly and the physically disabled would have independence. If your kids were at summer camp and forgot their bathing suits and toothbrushes, the car could bring them the missing items. You could even send your dog to a veterinary appointment.

But the real promise of autonomous cars is the potential for dramatically lowering CO2 emissions. In a recent study, experts identified three trends that, if adopted concurrently, would unleash the full potential of autonomous cars: vehicle automation, vehicle electrification, and ridesharing. By 2050, these "three revolutions in urban transportation" could:

- Reduce traffic congestion (30% fewer vehicles on the road)
- Cut transportation costs by 40% (in terms of vehicles, fuel, and infrastructure)
- Improve walkability and livability
- Free up parking lots for other uses (schools, parks, community centers)
- Reduce urban CO2 emissions by 80% worldwide speed applications, such as their positive relationship between stiffness and damping.

Air bearings are far from a new technology, with their roots tracing all the way to Robert Wills in 1812 and his paper "On the Pressure Produced on a Flat Surface When Opposed to a Stream of Air Issuing from an Orifice in a Plane Surface." Their history winds through the paths of engineering luminaries like George Westinghouse, and into the modern era. They've been used by DOE National Labs and IBM, who saw value in their often incomparable set of operational characteristics.

The air bearing's fluid film is achieved by supplying a flow of air through the bearing face and into the gap between the bearing and the guide surface. This is typically accomplished by pushing the air through the

bearing face, which acts to restrict or meter the flow of air into the gap. This restriction is designed such that the outflow of air through the gap is equal to the inflow through the bearing surface, and thus creating a constant fluid film layer.

This same restriction maintains pressure under the bearing and acts as the load bearing surface. If air were introduced into the gap without restriction, fly height and air consumption would both be higher than necessary, and stiffness would be lower than that which could be achieved with proper restriction. This restriction is referred to as air bearing compensation, and is used to optimize the bearing with respect to load, lift, and stiffness for each individual application.

In the past, air bearings have made use of drilled orifices or slots in the bearing face to produce their fluid film. However, with orifices or slots, the bearing face experiences a highly uneven pressure distribution. New Way Air Bearings makes use of our proprietary Porous Media Technology. Our perforated graphite surface allows for an even force on the guide surface, producing a far more stable, resilient product.

3. AUTOMATIC EMERGENCY BRAKING

Author Name: **Pradipta Das, 4th Sem**

Manufacturing processes have undergone numerous advancements over the past few decades, driven by technological advancements and the need for more efficient and sustainable production methods. One of the most significant advancements in manufacturing processes is the integration of automation and robotics. Automation has been a game-changer in manufacturing, making production processes more efficient and cost-effective Robotics, in particular, have played a critical role in advancing manufacturing processes. They are used in many manufacturing processes, such as welding painting and assembly, to name a few. Robotics can perform tasks with precision and accuracy, which can increase production speed while reducing the risk of errors.

Another major advancement in manufacturing processes is the use of additive manufacturing, also known as 3D printing. This technology allows manufacturers to produce complex components and parts that were previously difficult or impossible to produce using traditional manufacturing methods. With 3D printing manufacturers can create parts layer-by-layer, allowing them to create intricate designs with ease Furthermore, advancements in material science have also contributed to the improvement of manufacturing processes. For example, the development of lightweight materials such as carbon fiber has allowed manufacturers to produce more fuel-efficient vehicles and aircraft, reducing their environmental impact.

Lastly the use of the Internet of Things (IOT) in manufacturing has also proved manufacturing Processes. TOT devices can be used to monitor equipment and collect data, allowing manufacturers to identify potential issues before they become major problems. This can reduce downtime and increase overall efficiency.

In conclusion, manufacturing processes have come a long way in recent years, thanks to advancements in automation, robotics, 3D printing material science, and lol. These technologies have enabled manufacturers to produce higher quality products more efficiently with reduced environmental impact, and at lower costs. As technology continues to evolve, we can expect even more exciting advancements in manufacturing processes in the future.

4. AUTONOMOUS CAR

Author Name: **Indrajit Chand, 4th Sem**

An autonomous car is a vehicle capable of sensing its environment and operating without human involvement. A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all. An autonomous car can go anywhere a traditional car goes and do everything that an experienced human driver does.

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- Cut transportation costs by 40% (in terms of vehicles, fuel, and infrastructure)
- Improve walkability and livability
- Free up parking lots for other uses (schools, parks, community centers)
- Reduce urban CO2 emissions by 80% worldwide

Chapter-3

Technical Magazine

Sparkle'2021

Computer Science & Technology

Name of the Editors:

1. Mr. Rana Chakraborty (HOD)

2. Mr. Sakya Sarkar (Sr. Lecturer)

Index

1. INTRODUCTION OF CLOUD COMPUTING

Author Name: **Abhijeet Sen ,6th Sem**

Cloud computing provide us a means by which we can access the application as utilities over the Internet it allows us to create configure and customize applications online

With cloud computing users can access database resources via the Internet from anywhere for as long as the need without worrying about any maintenance or management of actual resources.

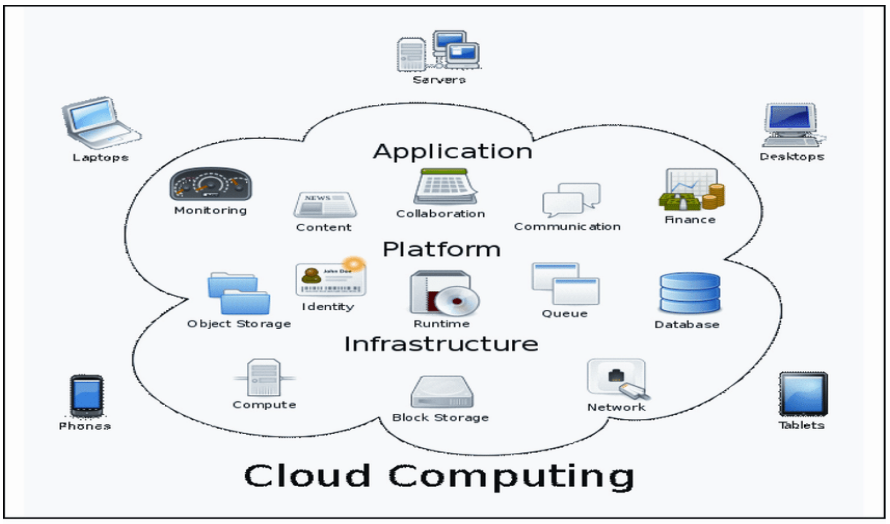
What is cloud?

The term cloud refers to a network or Internet.
in other words, we can say that cloud is something, which is present at remote location. cloud can provide services over network, i.e., on public networks or on private networks i.e.,
WAN, LAN or VPN.

Applications such as e-mail web conferencing customer relationship management CRM all run in cloud.

What is cloud computing?

Cloud computing refers to manipulating, configuring and accessing the application online.
It offers online data storage infrastructure and application.
Cloud computer is both of combination of software and hardware-based computing resources delivered as a network service.



Basic concepts: -

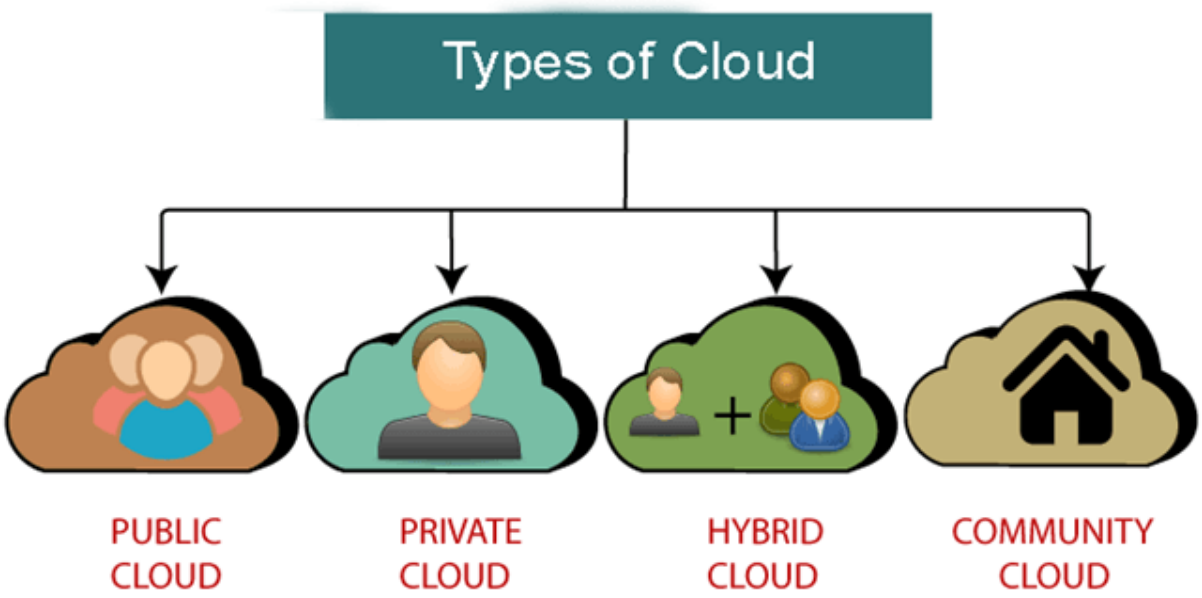
There are certain services and models working behind the key scene making the cloud computing feasible and accessible to end users. Following are the working models for cloud computing:

1. Deployment model
2. Service model

1.Deployment models

Deployment models define the type of access to the cloud, i.e.,

How the cloud is located? Cloud can have any of the four types of the four types of access: public, private, hybrid and community.



Public cloud

The public cloud always systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness.
Example: email

Private cloud

The private cloud allows system and services to be accessible within an organization. it offers increased security because of its private nature.

Hybrid cloud

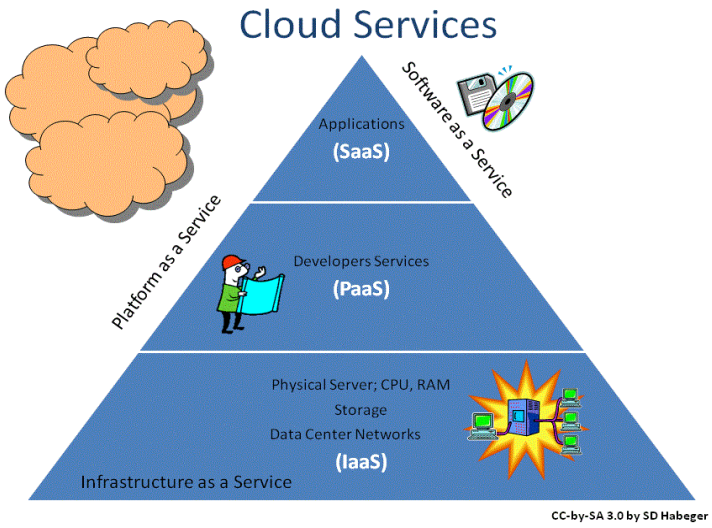
The hybrid cloud is a mixture of public and private cloud. However, the critical activities are performed using private cloud while the non-critical activities are performed using public cloud.

Community cloud

The community cloud allows systems and services to be accessible by group of organization.

2. Service models: -

Service models are the reference model on which the cloud computing is based These can be categorized into three basic service models as listed below.



1. **Infrastructure as a Service (IaaS)**

IaaS is the delivery of technology infrastructure as an on demand scalable service.

IaaS provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc.

•Usually billed based on usage

•Usually multi-tenant virtualized environment

•Can be coupled with Managed Services for OS and application support.

Example:- Rackspace, Amazon Web Services (AWS) Elastic Compute Cloud (EC2), Microsoft Azure, Google Compute Engine (GCE) and Joyent.

2. Platform as a Service (PaaS)

PaaS provides the runtime environment for applications, development & deployment tools, etc.

PaaS provides all of the facilities required to support the complete life cycle of building and delivering web applications and services entirely from the Internet.

Typically, applications must be developed with a particular platform in mind

•Multi-tenant environments

•Highly scalable multi-tier architecture.

3.Software as a Service (SaaS)

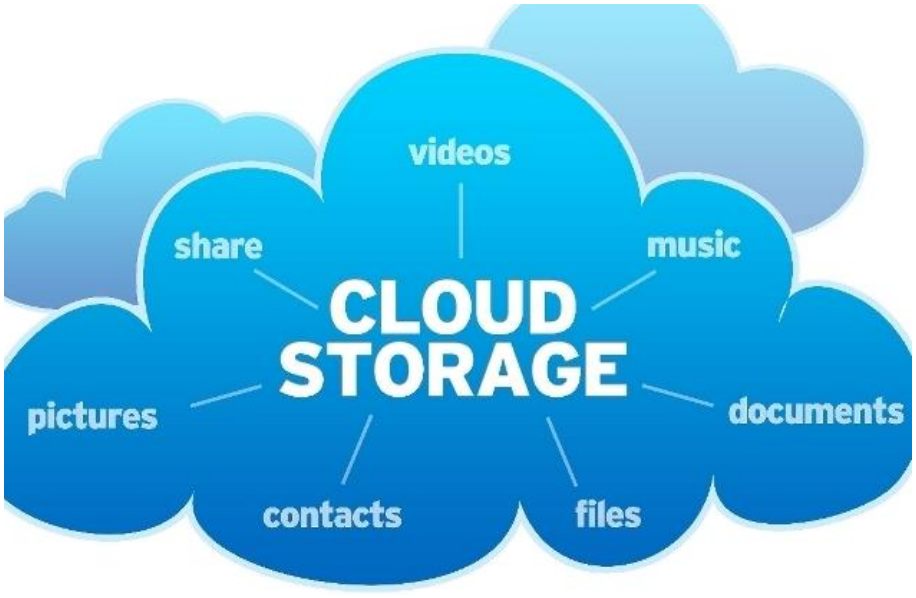
It provides a centrally hosted and managed software services to the end-users. It delivers software over the internet, on-demand, and typically on a subscription basis. E.g., Microsoft One Drive, Dropbox, WordPress, Office 365, and Amazon Kindle. SaaS is used to minimize the operational cost to the maximum extent.

- **<u>Advantages of cloud computing: -</u>**
  - Lower computer costs
  - Improved performance
  - Reduced software costs
  - Instant software updates
  - Improved document format compatibility
  - Unlimited storage capacity
  - Increased data reliability
  - Universal document access
  - Latest version availability
  - Easier group collaboration
  - Device independence

- **<u>Disadvantages of cloud computing: -</u>**
  - Requires a constant Internet connection.
  - Does not work well with low-speed connections.
  - Features might be limited.
  - Can be slow Stored data can be lost.
  - Stored data might not be secure.

Cloud storage: -Cloud storage is a service model in which data is maintained, managed and backed up remotely and made available to users over a network.

- Create an account username and password
- Content lives with the account in the cloud



- Log on to any computer with Wi-fi to find your content.

<u>Download for storage</u>

- Download a cloud-based app to on **<u>your computer.</u>**
- The app lives on your computer.
- Save file to the app.
- When connected to the network it will sync with the cloud.
- The cloud can be accessed from any Internet connection.

2. MOBILE COMPUTING

Author Name: **Lakhan Mahato, 6th Sem**

Introduction: Mobile Computing is a technology that allows transmission of data, via a computer, without having to be connected to a fixed physical link.

Mobile voice communication is widely established throughout the world and has had a very rapid increase in the number of subscribes to the various cellular networks over the last few years. An extension of this technology is the ability to send and receive data across these cellular networks. This is the principal of Mobile Computing.

Mobile data communication has become a very important and rapidly evolving technology as it allows users to transmit data from remote locations to other remote or fixed locations.

The emerging mobile industry expected to be characterized by increasingly personalised and location based services. The availability of user preferred information despite of location made Mobile Computing successful. The advancement of mobile technology has revolutionized the way people use mobile devices in their day-to-day activity.

CAUSE:

1.Saves Time – The time consumed or wasted while travelling from different locations or to the office and back, has been slashed. One can now access all the important documents and files over a secure channel and work as if they were no their computer. It has enhanced telecommuting in many companies. It has also reduced unnecessary incurred expenses.

2.Location Flexibility - This has enabled users to work from anywhere as long as there is a connection established. A user can work without being in a fixed position. Their mobility ensures that at the same time and perform their started jobs.

3.Ease of Research – Research has been made easier, since users earlier were required to go to the field and search for facts and feed them back into the system.

EFFECTS:

1.Dependence – Mobile Computing can lead to a dependence on technology, making it difficult to disconnect and enjoy life without constant digital distraction.

2.Cost – Mobile Computing can be expensive, with high costs for devices, data plans, and accessories.

3.Physical Damage – Mobile devices are small and fragile, making them susceptible to physical damage from drops, spills, and other accidents.

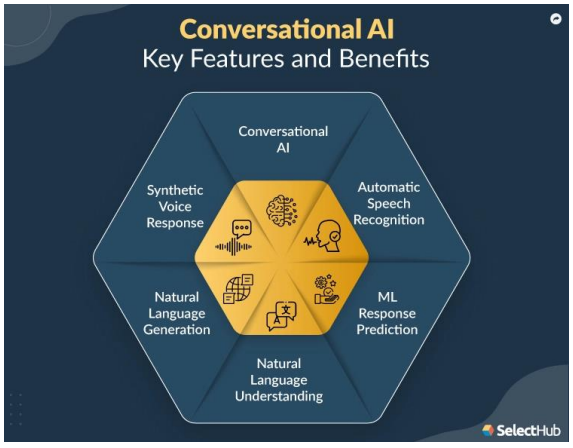
Conclusion: The mobile devices have captured the place of personal computers for the day-by-day activity. The widespread use of mobile devices now a day generates huge amount of revenues by reducing time and money needed for multiple purposes. The rapid development in Mobile Computing technology not only creates several opportunities for the business and also opens the door for doing disasters using misuse of technology. The information residing in the mobiles, integrity of the information and security of the information during its journey over the air security of the information with in the wireless network has to be given much importance, Because of Mobile Computing or Mobile networks.

3. THE ADVANTAGES OF ARTIFICIAL INTELLIGENCE

Author Name: **Azizul Islam, 6th SEM**

The general benefit of artificial intelligence, or AI, is that it replicates decisions and actions of humans without human shortcomings, such as fatigue, emotion and limited time. Machines driven by AI technology are able to perform consistent, repetitious actions without getting tired. It is also easier for companies to get consistent performance across multiple AI machines than it is across multiple human workers.

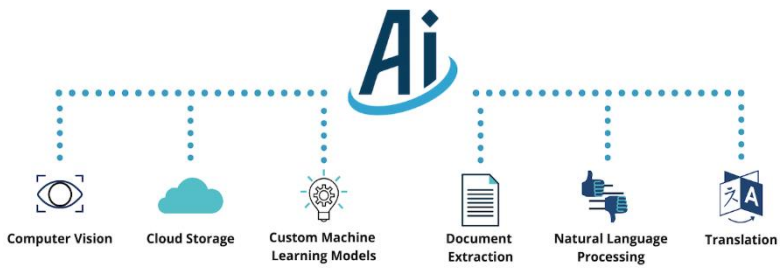
Companies incorporate AI into production and service-based processes. In a manufacturing business, AI machines can churn out a high, consistent level of production without needing a break or taking time off like people. This efficiency improves the cost-basis and earning potential for many companies. Mobile devices use intuitive, voice-activated AI applications to offer users assistance in completing tasks. For example, users of certain mobile phones can ask for directions or information and receive a vocal response.



The premise of AI is that it models human intelligence. Though imperfections exist, there is often a benefit to AI machines making decisions that humans struggle with. AI machines are often programmed to follow statistical models in making decisions. Humans may struggle with personal implications and emotions when making similar decisions. Famous scientist Stephen Hawking uses AI to communicate with a machine, despite suffering from a motor neuron disease.

Future Scope of Artificial Intelligence

In the future, intelligent machines will replace or enhance human capabilities in many areas. Artificial intelligence is becoming a popular field in computer science as it has enhanced humans. Application areas of artificial intelligence are having a huge impact on various fields of life to solve complex problems in various areas such as education, engineering, business, medicine, weather forecasting etc. Many labourers'work can be done by a single machine. But Artificial Intelligence has another aspect: it

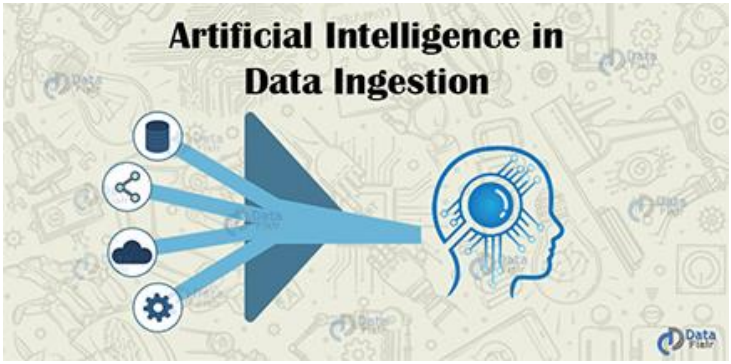


can be dangerous for us. If we become completely dependent on machines, then it can ruin our life. We will not be able to do any work by ourselves and get lazy. Another disadvantage is that it cannot give a human-like feeling. So machines should be used only where they are actually required.

These are the features of AI that make it unique:-

- Eliminate dull and boring tasks
- Data ingestion
- Imitates human cognition
- Futuristic
- Prevent natural disasters
- Facial Recognition and Chatbots

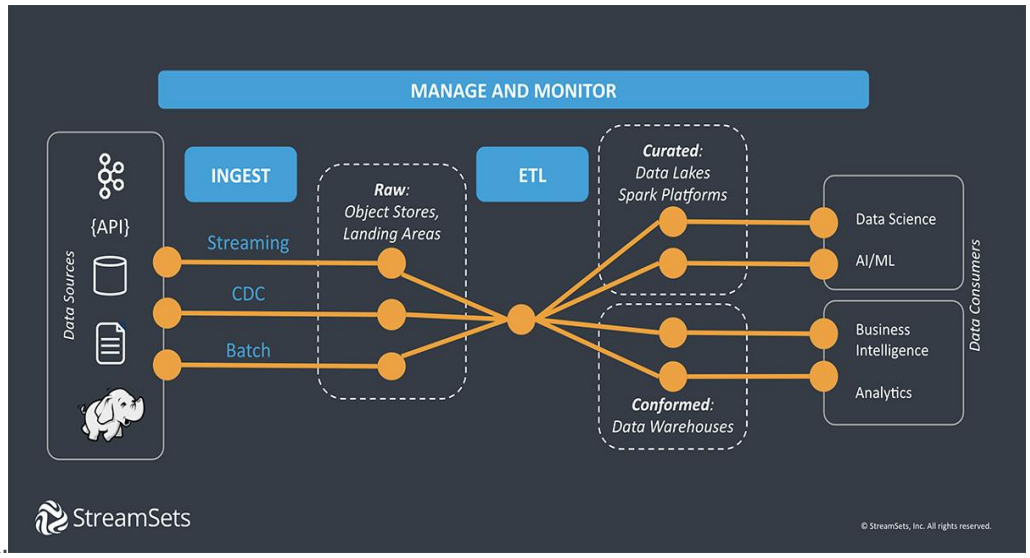
Data Ingestion



Data ingestion is one of the most important features of artificial intelligence. Artificially intelligent systems deal with huge amounts of data. Even a small company of about 50 employees has huge chunks of data to analyze, we can't even imagine the quantity of data that organizations like Facebook handle.

Also, an artificially intelligent system stores multiple information about multiple entities from multiple sources. All of this appears on the system in a synchronous, or a simultaneous manner.

The data that we are all producing is growing exponentially, which is where AI steps in. Such data is dynamically updated and it becomes difficult for regular database systems to ingest it all. So, AI-enabled systems have gone beyond and gathered and analyzed data that can prove to be useful for all.



One such, **example of artificial intelligence** would be **Elucify**, which is basically a database of multiple business contacts. Elucify works on a basic principle – give, to receive.
The user has to create an account here and sign in, after which the information of the user's contacts is accessible and shareable by the system. In return, the user gets relevant business contacts, which might be potential customers. In other words, Elucify is crowdsourcing this data.

This explains so much about the coaching centers that first call your friend, then you, and then other friends of yours belonging to the same batch.

4. WIRELESS TECHNOLOGY

Author Name: **Kishore Kumar, 4thSem**

Wireless technologies and the growth of popularity of portable devices such as smart phones and tablets have created a variety of opportunities in the modern world. Wireless communications are changing the world because wireless devices are convenient, easy to use and can provide interconnectivity in virtually any place. Among the segments which are assumed to change dramatically due to the use of wireless technology one can name environmental protection, entertainment, business communications, sales, news reporting and healthcare.

The purpose of this paper is to discuss current and emerging wireless medical technologies, to describe wireless components in healthcare that are required for creating added business value, assess the changes to staffing and training in healthcare associated with the increasing use of wireless technologies, analyze potential challenges pertaining to wireless networks in healthcare institutions and methods of addressing these challenges.

Current and emerging wireless medical technologies

The use of wireless technologies in healthcare has numerous advantages: medical information can be delivered and shared in any setting, medical information and guidelines can be quickly distributed; wireless devices create space for such interconnectivity that could never be provided by wired devices. Wireless healthcare devices can be used for more advanced diagnostics, can deliver information between the patient and the healthcare institution in a continuous way, etc. One wireless device can implement several functions (e.g. providing medical information, gathering healthcare records, delivering physician's recommendations, collecting statistics, etc.).

The integration of wireless technologies in healthcare is a very promising trend which might lead to a healthcare revolution. A notable invention are the Medical Body Area Network (MBAN) devices – special wearable sensors that collect various information about the patient, starting with respiratory functions and pulse and ending with ECG data (Information Week, 2012). Such a novel approach to monitoring health will help to collect accurate medical information, diagnose patients in a better way, provide timely help in critical situations, etc.

Wireless technologies might be used to develop in-house wireless devices that have the potential to enhance performance inside healthcare organizations; for example, wireless connections can help to synchronize actions and information for anesthesiologists, surgeons, etc. Along with sharing information and tracking the patient's state, wireless devices can be used to track provider care activities and data, to report the status of equipment and other devices, to integrate data from other devices into a global network, to perform drug tracking and other analytical functions (Cooper & Fuchs, 2013). Furthermore, wide use of smartphones and other WiFi enabled devices allows the creation of healthcare apps for exchanging healthcare information into one system. According to Terry (2012), the major growth of the healthcare wireless industry is expected when healthcare providers fully adopt this technology and master processing of patient data and acting instantly based on these data. Such interactivity might transform the whole approach to healthcare and turn it into a continuous process guided by healthcare institutions.

Wireless components needed for added business value

The technologies used for wireless healthcare devices include WiFi (IEEE 802.11x), Bluetooth, RFID et al. As a minimum, the components needed for added business value of healthcare wireless devices include wireless hardware, means of connecting this hardware to WLAN or WAN and software for handling the connections, measurements and data exchange. Additional components might include various sensors, assistive devices, wearable components, extensions, etc (Going wireless: five perspectives on the challenges in healthcare technology, 2013). In the case of data collection and processing on the provider's side, there is a need for access points for wireless connections and a server authenticating and/or processing wireless requests.

Additional staffing and support requirements

The integration of wireless technologies in healthcare is likely to change the requirements to staffing and training of healthcare professionals. Medical professionals will have to be able to connect wireless devices, to use them, to collect data and send these data to the server. Professionals in data processing and data analysis will be in need. Furthermore, the changes of healthcare infrastructure will require hiring more IT professionals who will manage the wireless network, maintain network security, establish proper controls to secure the delivery of patient care, etc.

The need for software developers with healthcare expertise is increasing as the evolving set of wireless technologies should be made live with the relevant software. Regular healthcare professions will have to receive additional training on wireless devices; healthcare professionals should also be prepared to explain the new methods to the patients and show the basics of working with wireless devices to them.

Potential technical and regulatory problems and methods of their mitigation

Active and prolonged use of wireless technologies might also create risks for the patients' health due to the novelty of wireless technologies and the lack of longitudinal research showing the impact of waves of the target spectrum on human beings. It is recommended to conduct studies on volunteers and/or laboratory animals in order to assess the long-term impact of radio frequencies.

According to Cooper and Fuchs (2013), the dependence of care delivery on wireless systems represents a significant threat to the healthcare itself as the errors or breaches in a wireless system might create an additional health risk for patients. In order to mitigate this risk, it is necessary to establish additional controls for wireless systems and include verification activities in the software handling data from wireless healthcare devices (Going wireless: five perspectives on the challenges in healthcare technology, 2013).

One of the potential problems is the regulation and use of different spectrum bands by wireless healthcare devices. Devices working on the same frequency might "crowd out" each other from the channel, while the devices working on too different frequencies might be unable to exchange information. One of the possible methods of addressing this challenge is the introduction of standards for the spectrum band use by healthcare wireless devices.

There exist several consensus groups which unite the manufacturers of medical devices, healthcare professionals and users is Institute of Electrical and Electronics Engineers (IEEE) (Witters, 2006). Another consensus group is the FCC that proposed rules for dedicating a specific band of frequency spectrum to wireless devices in healthcare (Information Week, 2012). Due to these regulations, it will be possible to enhance the reliability of such devices and their interconnectivity.

The risks of wireless network failure can be addressed with the help of quality of service (QoS) technology use, with the help of data integrity maintenance, using various means of reducing electromagnetic emission and its effects and enhancing wireless network security with the help of secure authentication, encryption and accountability policies (Witters, 2011). Overall, the field of wireless healthcare technology is rapidly evolving and it is likely that wireless devices will change the whole approach to care delivery in the future.

Chapter-4

Technical Magazine

Sparkle'2021

Mining Engineering Department

Name of the Editors:

1. Mr. G. D. Banerjee (HOD)

2. Mr. Subrata Mukherjee (Lecturer)

Index

1. DRONE TECHNOLOGY IN MINING

Author Name: **Swarup Sadhu, 4thsem**

MINE DRONES ARE IMPROVING SAFETY AND OPTIMIZING MINING OPEATIONS

A mine drone is an invaluable tool for work in underground and surface mining operations.

As drone technology continues to advance rapidly, the opportunities for integrating mine drones are endless.

What is a Mine Drone?

A mine drone is a drone that is specifically designed for or tailored for mining applications, like stockpile measurement, surveying, mapping, and inspections.

Mining is a hazardous profession, as worksite conditions can change instantly. Both underground and surface mining will present unique challenges and inherent risks.

While drones will not eliminate every danger associated with traditional mining practices, they can be deployed to collect data in areas where humans are not allowed to enter. A key aspect of a mine drone as compared to a typical consumer drone is that drones made for mining can fly without GPS, which is unavailable in most mining environments.

Aerial drone footage of a surface coal mine

Drones are being used in Mining in following ways:

The mining industry has quickly adopted drone technology due to its ability to improve data collection, increase safety, and reduce operational expenses.

Here are six ways drones are used in mining:

1. Volumetric Monitoring

Volumetric measurement is the science of calculating how much material is left in a stockpile of overburden, ore, or other mining materials. Due to the sheer size of stockpiles, it's challenging to get accurate volume reports using manual methods.

However, the integration of a mine drone allows for quick deployment with inexpensive and reliable volume data. Tracking variations in stockpiles is cost-effective and helps reduce unnecessary waste.

Using advanced volume measurement software, mine drone photos are compiled to create a 3D model. The algorithms behind these apps calculate based on the volume between the base layers to the surface.

Mining drones can also track how much material has been excavated from a particular area and approximate how much backfill would be needed to fill a stope. As more 3D models are obtained, it's easier to analyze data and see changes over time.

2. Identifying Hazards

Crumbling rocks, gas leaks, dust explosions, chemical byproducts, and underground environments challenge even the best equipment and miners.

By using Uncrewed Aerial Vehicles (UAVs) in mining, surveyors reduce these risks by removing humans from the inspection process. Remote monitoring improves on-site safety, saving time and reducing operational expenses.

In surface mining, stockpiles create sloped terrain that requires continuous stability monitoring. This data allows mine teams to detect early warning signs of instability and mitigate the issue to keep everyone safe while maintaining maximum efficiency with mining operations.

In underground mines, drones like the Elios can navigate dusty, wet, and rocky ore passes to locate blockages. In addition, the equipped sensors create 3D models to identify hang-ups, fractures, and other geological features.

3. Drilling and Blasting Assessment

3D models generated by mine drone collected data have multiple use cases, making them a cost-effective tool. Before drilling and blasting begins, a model can be created as a historical record check to analyze the after-effects of the work.

An updated version of the model allows miners to make data-driven decisions about potential hazards from drilling and blasting in the future.

4. Mine Monitoring and Planning

A mine consists of numerous moving components requiring systematic analysis and adjustments to achieve maximum efficiency and safety.

Mining drones are highly effective in the following areas:

Haulage road design. These roads are responsible for the transportation of mining materials from the worksite. The heavy traffic and equipment mean road conditions need to be assessed constantly. The data collected is also helpful in determining if improvements need to be made to the site infrastructure.

Equipment inspections. Keeping conveyor belts, crushers, grinding mills, and other vital components of the mine operation is crucial for low operating expenses and increased worker safety. Remote visual inspections via mining drones are a low-cost and safe tool for preventive maintenance. Some equipment, such as conveyor belts, can be visually inspected without disturbing the operation or production.

Worksite security. Security drones are becoming increasingly popular because of their quick deployment and the ability to cover a large area at record speed. The hazardous conditions at quarries, aggregate, and underground mines make mine drones excellent for protecting your investment. Having an aerial view is also helpful with coordination with emergency services if they are on the scene.

Environmental monitoring. Mining drones are a powerful tool in mitigating the environmental impacts associated with mining. For example, tailing dams at worksites hold hazardous chemicals. In the event

these become unconfined, the effects could be devastating. Mine drones can monitor the stability of the dams to prevent leaks or runoff from the site.

5. Mine Development and Exploration

Developing mining operations is historically expensive and dangerous. Traditional methods required teams of miners to traverse into unknown conditions to conduct stability analysis, surface mapping, ventilation modeling, and detect hazardous gasses.

Instead of sending people into inaccessible areas, a mine drone can navigate tight spaces safely and more efficiently than any human could.

In underground mining, the Elios is the only drone that can handle confined spaces with reduced visibility, poor air quality, and signal interruptions.

6. Processing Plant Inspections

Drones are used in on-site mining processing plants to inspect machinery. The benefit here is that drones can collect this data without stoping processing operations, keeping mining operations profitable.

The Benefits of Drones in Mining

The benefits of UAVs in mining are increasing as drone technology advances. As the mining industry embraces mining drones, more use cases will become available, improving safety, reducing costs, and optimizing efficiency.

The following are key benefits of drones for mining:

1. Aerial data collection provides valuable data points used to build models and assessments.

2. Eliminates the need for manned aircraft to conduct aerial inspections and volumetric measurements.

3. Frequent inspections highlight potential issues before they become expensive and disruptive to production.

4. Reduce the margin of error in stockpile measurements.

5. Perform security patrols instead of having a large security team, saving time and money.

6. Surveys are easy to conduct and repeat on an as-needed basis.

7. Reduces the environmental footprint by monitoring all systems and potential threats

8. Mining drones are 30 times faster than ground-based inspections.

9. Using UAVs for mining improves accuracy due to a large set of data points.

10. The unique perspective of mining drones results in data point collection that is not feasible with traditional inspection techniques.

11. Advanced drone sensors capture high-resolution images and videos compared to ground-based sensing technology.

12. Remote monitoring, mapping, and inspections keep workers from dangerous working conditions.

2. ENVIRONMENTALLY SUSTAINABLE MINING PRACTICES

Author Name: **Ankur Verma, 4thsem**

New technologies, from more efficient energy sources and greater air and water quality management capabilities to more effective tailings reprocessing, are helping mines lower their environmental footprint while simultaneously reducing production costs and improving competitiveness. A sound, progressive governance strategy already invested in these technologies as a core pillar of the overall business is the blueprint for a sustainable mining industry in the future. We examine what the blueprint looks like below.

While many investors now consider the impact of environmental and social issues in a broader definition of an investment return, the understanding that companies that perform better on ESG measures, perform better financially, is also common knowledge amongst most global investors.

This has added even greater impetus for the case for sustainable mining.

Sustainable Mining: A Manifesto

How should mines measure their sustainability? A globally shared framework of concepts, consistent language, and metrics is required for transparency about the sustainability of organizational activities to stakeholders, which is critical in converting social and environmental sustainability aspirations to reality. The GRI Sustainability Reporting Guidelines & Mining and Metals Sector Supplement provides the leading determination methodology for defining a company's significant environmental, social and economic impacts, including:

•The control, use and management of land

•Contribution to economic and social development

•Community and stakeholder engagement

•Labor relations

•Environmental management

•An integrated approach to mineral use

How can sustainable mining be achieved?

A strong commitment to stewardship, investments in modern technologies, and embracing the circular economy shape the foundation of a sustainable mine site. Here are 6 key areas in which mining can become more environmentally sustainable:

1. Reduce, reuse, and rethink mining waste: from liability to profit

Across the world, mining produces over 100 billion tonnes of waste each year in the form of rocks and tailings. If not handled and managed correctly this can pose a significant environmental and social risk, through harmful dust and gas emissions and water leaching. In the most severe cases, failing to adequately

deal with waste can have catastrophic consequences, as happened in Brazil recently with the failure and collapse of two tailings dams in 2019 and 2015.

An integrated management approach combining the highest levels of operational safety and monitoring, and the utilization of modern storage facilities and dam linings is a minimum requirement in effective, responsible tailings disposal.

In the right conditions, leading sustainable miners can take it one step further. These miners actively re-treat tailings to recover minerals and trace elements left over from previous generations of processing technology and capabilities. By mining waste, significant economic value can be generated with minimal environmental footprint. Indeed, by transferring historical tailings to modern storage facilities operated with higher environmental standards, the liability of these massive waste bodies is reduced.

2. Water conservation

From dust suppression and slurry transport and storage to mineral processing, a significant volume of water is required for the day-to-day operations of any mine. Yet, in light of increasing concerns around water scarcity and long-term water security, mining companies face ongoing pressures to reduce their consumption of fresh and bulk water, and ensure discharge meets the highest environmental standards – or better yet be recycled for applications like agricultural irrigation.

By using modern water treatment technologies, from biological processes to desalination, evaporation and crystallization, miners can significantly optimize their water cycle by continuously reusing process water in a closed loop circuit, working towards zero liquid discharge. This not only reduces a mine's freshwater demand; it can also lower per-kilolitre water costs, as well as improve on-site availability of this operation-critical resource in the event of bulk supply interruptions.

Mines also need to ensure all risks of water pollution are managed to the highest safety and environmental standards. Not only is discharge strictly monitored; acid mine drainage (AMD), caused primarily by leeching oxidized sulphide minerals, can have severe negative impacts on aquatic life and overall riverine health. The potential for AMD needs to be identified and predicted through sampling, test work and modeling, and treated with heavy metals removal and alkalization.

3. Lower CO2 emissions by transitioning to renewable energy

Mining is a significant consumer of energy in its day-to-day operations, with global gold mining operations alone consuming an estimated 132 terawatt-hours per year (that's equivalent to the total national energy demand of Sweden!). With carbon emissions becoming an increasing environmental, financial and legislative liability, a transition to clean energy away from fossil fuels is becoming critical for a miner's overall sustainability.

Energy self-sufficiency utilizing alternative energy such as solar, wind and hydroelectric power isn't just enabling mines to reduce their carbon footprint, improving the overall sustainability of the industry in a more carbon-sensitive future. It also helps to improve efficiency, costs and reliability of power supply.

Though self-sufficient, clean-energy mines are still in their infancy in Africa, several exciting projects in various stages of development by the continent's leading sustainable miners are providing a roadmap that provides a glimpse of what the energy future of the industry will look like.

In addition, a host of other energy-saving initiatives are available to mines to help further optimize their energy usage profile by adopting modern technology across operations, such as high-efficiency motors, compressors and pumps.

4. Ensure communities thrive beyond the life of mine

Mines are often the single biggest providers of jobs in the surrounding communities, especially where mineral resources are extracted in more remote areas. However, finite ore bodies mean they cannot sustain these opportunities indefinitely. The long-term wellbeing of these communities therefore depends on diversifying economic activity and developing sustainable business and financial opportunities that aren't exclusively dependent on the nearby mine.

Miners with a strategic sustainable social license plan can often play a leading role in developing and incubating start-up, community-led businesses. Local supply chain-centered businesses can develop around the shorter-term service requirements of the mine and grow their geographic scope to supply customers in other regions in the long-term as their technical and capital resources expand. Other primary economic activities such as agriculture and forestry also provide potential economic opportunities if correctly managed and executed.

Allied to a strong local skills development and training philosophy, sustainable miners can proactively manage the economic transition of its host communities to ensure the completion of mining activities does not spell financial ruin.

5. Restore the land to its natural state

Extracting minerals scattered thinly in the earth can result in significant disruption to the natural environment. Surface mining, in particular, often requires vast areas of vegetation to be cleared, and huge quantities of topsoil and subsoil stripped. This can lead to loss of habitat and biodiversity, soil erosion, and, by removing these natural carbon sponges, exacerbate our efforts to fight climate change.

Sustainable miners practice responsible land use by limiting the impact of their operations on the natural ecosystem they work within, and then reverse this impact by rehabilitating the site once mining activities cease. The objective of these miners is to leave the land in the same or better ecological condition it was prior to operations. Using a variety of methods including reforestation and the removal of mining infrastructure and waste, mining companies can minimize their environmental impact on the land, and ensure its natural resources can be transferred to the next generation of use.

6. Combating illegal mining and its impact and communities and the environment

Poverty and unemployment in local communities gives rise to higher incidents of illegal mining and theft of infrastructure, especially at shafts that are no longer in operation. These syndicates mine for illicit profits with little respect for safety or the environment. On top of increased safety and security risks and a negative impact on production and revenue, illegal mining also increases water resource degradation and the risk of acid mine drainage.

While increased law enforcement and security presence is a necessary intervention, sustainable miners also develop solutions to address the systemic social and economic conditions that encourage illegal mining activities. This includes creating awareness of its dangers to communities, the environment and the impact of a reduced life-of-mine on the local economy.

Conclusion

Mineral consumption creates economic growth and provides jobs and prosperity. Historically, mining was often achieved at significant environmental cost, but today improved, lower impact mining practices, more efficient technologies and a sense of environmental stewardship is helping the mining sector lower its environmental footprint, as well as optimise its contributions to positive social change.

This isn't just borne of a need to meet compliance regulations and appease investors increasingly sensitive to a company's ESG credentials; sustainable mining is already providing a competitive business advantage. In the future, this early adoption will pay even greater dividends.

These are the foundations of a social and environmental policy that will drive the world towards sustainable mining operations.

3. VENTILATION SYSTEM IN UNDERGROUND MINES

Author Name: **Subham Rajak, 2nd sem**

Mine ventilation is the process of supplying sufficient fresh air to the underground mining ventilation system and working to achieve the purpose of ensuring proper distribution, use and controlling of the air that returns to the surface as contaminated air. Ventilation control of dust in coal mines is important in the different types of underground coal mining such as

(1) Room and pillar mining,

(2) Llongwall mining and

(3) Shaft mining.

Type (1) is done in an ore deposit where some of the ore is left behind to form columns in the mine that prevents it from collapsing and it is used for coal mining. Type (2) is a much more modern method of underground mining used to extract coal from coal beds and was implemented to remove the use of Type (1). Shaft mining is used to extract minerals such as coal directly from the earth. The shafts in Type (3) are vertically driven below the earth to get access to the minerals which are deeply embedded in the earth. Mine ventilation is very important because underground mining operations are often fraught with a lot of dangers as tunneling through the earth presents the miners with an unfamiliar environment and several issues which affect health as well as safety of the workers. A lack of ventilation could result in fatalities because of exposure to dust that is generated from underground coal mining activities.

What is a mine ventilation system?

Mine ventilation terms like mine ventilation system should be clearly define to understand ventilation control of dust in coal mines. A mine ventilation system provides fresh air flow into the underground mine and expels contaminated air out of the underground mine. The mine ventilation system is available in various choices and sizes; however, selecting the right one is important to achieve maximum benefits. So, what are the major considerations when installing a mine ventilation system?

It should help achieve the following:

1. Dilute and remove poisonous gases like NO2, SO2, CO and CO2.
2. Removes dusts and noxious gases.
3. Regulate the temperature in the mine.
4. Remove gases from diesel engines, explosives and ore bodies.
5. Ensures proper breathing of the workers.
6. Ensures there is sufficient ventilation flow, regardless of weather or season.
7. Helps efficiently clear blast fumes, particularly when mine is not occupied.

The mine ventilation system consists of interconnected airways, control devices, mine ventilation fans and other components to function well. It can also be represented as a network connecting the nodes, lines or the airways. The ventilation system that is installed should guarantee providing fresh air required maintaining human health and safety in the working area. Its sole mandate is to ensure the air quality standards in underground mining.

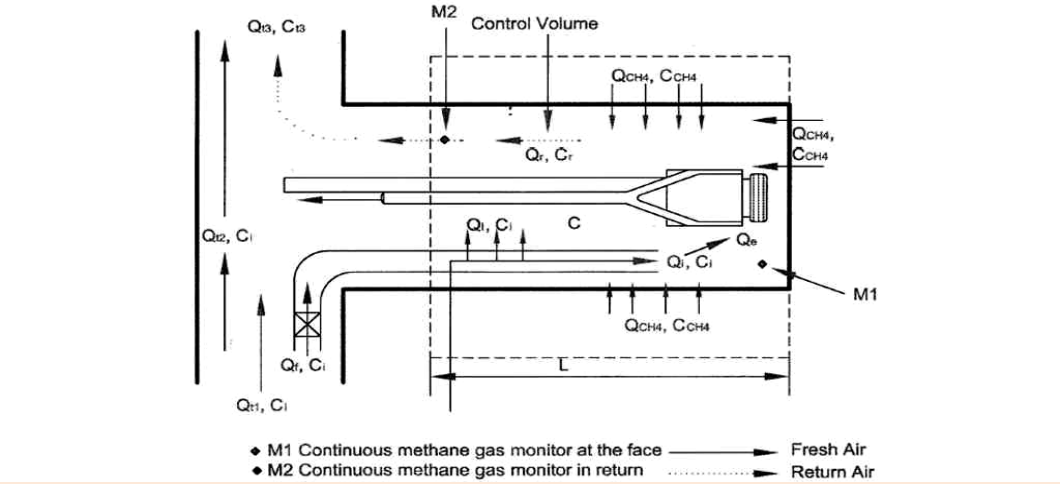
What are the different types of mine ventilation systems?

Flow-through ventilation system –

This is the main circuit for the mine. The air that enters the mine from the surface via an adit, ventilation raise, or shaft will be distributed through the mine. The air flow is controlled using regulators and mine ventilation fans that are permanently mounted.

Auxiliary ventilation systems –

This type of ventilation system will take air from flow-through system, and it will distribute to mine via a temporary mine ventilation fan. The auxiliary fan and duct will force pushing fresh air.



What are the types of mine ventilation?

There are two types of mine ventilation namely

(1) Natural ventilation

(2) Mechanical ventilation

Underground mine ventilation design plays a critical role in the types of mine ventilation. Natural mine ventilation is the process of supplying fresh air without using any mechanical systems. The external air moves into an enclose space because of pressure differences arising from natural forces. Natural mine ventilation distributes oxygen from fresh air which enhances pulmonary and heart function. Mechanical ventilation is used to supply air in areas where the miner operates, and this air is used to remove dust particles, noxious gases and regulation of temperature. Pressure difference is created by operating one or more mine ventilation fans in an airway. Each mine ventilation fan creates a certain amount of pressure, and that pressure is gradually lost as the air passes through the airway against its resistance. There are two main types of exhaust fans used in underground mine ventilation. These are the axial fan and the centrifugal fan. The axial fan looks like a propeller, and it draws air straight through the fan. The

centrifugal fans look more like squirrel cages and draw air into the centre of the fan and exhaust air at a perpendicular angle. Sufficient volume of air is required for proper ventilation which takes electric power to drive the fan.

How to improve mine ventilation?

There are several methods of improving mine ventilation through reducing dust exposure of longwall face and continuous mining workers. These methods include:

Installation and maintenance of a gob curtain:

Adequate ventilation of the longwall panel involves supplying the required volume of air to the head gate and maintaining that airflow along the face. Often, loss of air into the gob in the head gate area prevents the maximum utilization of the air intended to ventilate the longwall face.

Face ventilation:

Ventilation is the principal method of controlling respirable dust on the longwall face. Providing adequate amounts of air to dilute and carry airborne dust down the face and prevent it from migrating into the walkway has been and continues to be a goal for longwall operators. As air velocities increase, it is important to ensure sufficient wetting of the coal is provided to minimize the potential of increased entrainment with higher air velocities.

Ventilated cutting drums:

These designed to reduce the amount of dust from the cutting zone through water powered dust capture tubes build into the hub of the shearer drum. Dust control is achieved by capture and suppression at the source which improves mine ventilation through prevention of the dust from being airborne.

Blowing face ventilation:

Clean air is blown toward the face and sweeps the dust-laden air toward the return entries. This system allows the continuous miner operator to be positioned in the clean discharge air at the end of the blowing curtain or tubing.

Exhausting face ventilation:

Clean air sweeps the face, and the dust-laden air is then drawn behind the return curtain or through the exhaust tubing to the return entries. The system will keep mobile equipment in fresh air and affords the continuous miner operator more freedom of movement than a blowing ventilation system.

4. MOON MINING

Author Name: **Sumit Ghosh, 2nd sem**

The Moon could harbour more metals than had previously been believed beneath its surface, according to research conducted using NASA data. The new revelations about the Moon's geological composition may affect theories as to the celestial body's origin, but the news will also pique the interest of aspiring Moon miners. The US Government has recently floated the idea of mining the Moon, but what does this new development mean for a lunar gold rush?

New evidence that the Moon may be rich in metals such as iron and titanium was discovered using data from the US National Aeronautics and Space Administrations' (NASA) Lunar Reconnaissance Orbiter (LRO) spacecraft. The scientists were looking for ice at the bottom of craters around the Moon's North Pole but found evidence of metal oxides in large craters. The hypothesis is that large meteors hitting the Moon have excavated these metal oxides from beneath the Moon's surface – suggesting concentrations of the metal underground.

There is a substantial amount of evidence pointing to the Moon being the product of a Mars-sized planet colliding with a young planet Earth, which explains why the bulk of the Moon's chemical composition closely resembles the planet it orbits. The theory becomes muddled, however, when looking in closer detail. On the bright plains of the lunar surface, known as the lunar highlands, the rocks contain smaller amounts of metal-bearing minerals relative to Earth. That quality could be explained if Earth had fully differentiated into a core, mantle and crust before the impact that created the Moon – that would leave the body largely absent of metals. But in the Moon's maria – commonly known as the "seas" – the metal abundance is richer than many of the rocks on Earth.

It's a discrepancy that has puzzled scientists, with no clear explanation. But this new development, found by team members using the Miniature Radio Frequency (Mini-RF) instrument on the LRO, could help in drawing a clearer connection between the Earth and its natural satellite. It also means the Moon could be more prospective for mining than previously thought.

The Trump administration wants to mine the Moon

In April 2020, President Trump signed an executive order to encourage US companies to mine the Moon and other celestial bodies for resources. The order provided that commercial partners participate in an "innovative and sustainable" US-led programme to return humans to the Moon for long-term exploration and utilization, followed by manned missions to Mars and beyond. Expanding the resource sector deeper into space would, the document said, require commercial entities to recover and use resources in outer space.

The US and the rest of the world's space faring nations have not recognized the 1979 Moon Treaty – a document which stipulated that nations will not mine resources in outer space. Trump's executive order stated that the US does not view space as a "global commons". This would effectively pave the way for mining activities off planet Earth without the need for an international treaty to permit it.

While there are budding space mining companies, it's unlikely these companies would be able to get off the ground – literally – without this kind of state support or the assistance of larger private space enterprises such as SpaceX. In 2018, NASA announced plans to return astronauts to the Moon by 2024 to pave the way for eventual journeys to Mars in conjunction with private companies.

How would Moon Mining work?

Geological surveys have previously shown than the Moon contains three crucial resources: water, helium-3, and rare earth metals. Water is vital for supporting life and agriculture in space and can be converted into rocket fuel to propel mankind further toward the stars, and helium-3 is a rare helium isotope that could be used for innovations in the energy sector – namely nuclear fusion. Rare earth metals are vital in emerging technologies, as well as the technologies we make use of every day, from smart phones and computers to medical equipment.

One reason the US has taken such an interest in mining the Moon is to acquire and control a strong supply of rare earth metals – China controls around 95% of the world's production of rare earths. Escalating tensions between the US and China have seen the former look to alternate sources of the vital resources and has set its sights on the Moon as a means to claw back some control from China.

When it comes to the practicality of setting up feasible mining operations on the lunar surface, nobody has figured out an actionable plan. SpaceX is aiming to solve a significant cost barrier by developing reusable rockets, which could allow for cheaper transport of mined materials from the Moon back to Earth. Assuming the reusable rocket solution works, a lunar mining colony would have to make use of an unprecedented amount of innovative mining technologies, with automated or remote-control machinery and pumps that requires minimal human oversight a necessary component. While miners on Earth have been steadily taking on these kinds of technologies, developing, building and transporting machinery that could work on the Moon is no easy feat.

Before it can even begin, Moon mining would require existing infrastructure on the lunar surface. Given the presence of water on the Moon, there is the potential for some form of long-term human settlement. 3D printing could be the key to infrastructure, allowing material and equipment to be manufactured on the Moon itself.

What would the effects of Moon mining be, and is it even legal?

While no space faring nation recognizes the Moon Treaty, the 1967 United Nations Outer Space Treaty states that no nation can claim ownership of the Moon. However, it has been questioned as to whether that treaty could be used to prevent private ownership. That question has never been resolved, but it would have to be resolved one way or the other before miners could start drilling into the Moon. It's a potentially colossal legal battle, if the prospect of Moon mining continues to edge closer.

While mining the Moon wouldn't have any significant effects on our quality of life – the Moon has a mass of 73 quadrillion tons, even if we removed one metric ton from the Moon every day, it would take 220

million years to deplete 1% of the Moon's mass. Even that wouldn't be enough to cause a change of orbit or affect the gravitation that causes tides.
The bigger concern is environmental damage and ethical concerns, from the impact on future generations, the importance of the Moon in human culture and heritage, and the visual impact from Earth.

Chapter-5

Technical Magazine

Sparkle'2021

Civil Engineering Department

Name of the Editors:

1. Mrs. Munmun Roy (HOD in-Charge)

2. Mr. Jayanta Das (Lecturer)

Index

1. EARTHQUAKE RESISTANT BUILDINGS

Author Name: **Inisha Bhakat ,6th Sem**

Buildings made to withstand earthquakes may not look remarkable from the outside. However, numerous aspects make them more resilient during these disasters. Here are five of them:

1. An Appropriate Foundation

Creating a flexible foundation for a building could help it stay standing during an earthquake. One option is to build the structure on top of pads that separate the building from the ground. Then, the pads move, but the building stays still.

Another similar possibility, described in a 2019 research paper, is to place a solid foundation slab made of reinforced concrete and crisscrossing strips atop an intermediate cushion of sand.

This approach also included a trench around the foundation for further protection. Since this foundation design kept the building's base away from the soil, it was more resistant to seismic forces.

2. Seismic Dampers

Earthquake-resistant buildings also need features to help absorb shocks. People more commonly refer to them as seismic dampers. Engineers worked with NASA to develop damper systems for swing arms on its rockets in the 1960s. It chose a gas-driven shock isolation system first, then eventually progressed to a fluidics-based system that's still used today during space station launches and for earthquake-proofing buildings.

Seismic dampers absorb destructive energy, protecting the building from sustaining it. Generally, the larger the damper's diameter, the more force it can handle. One manufacturer of these dampers sells products to withstand from 25 to 1,100 tons and sells customized options, too.

Another approach involves putting a thin layer of graphene on top of a natural rubber pad. Researchers believe this will be a low-cost damper option for commercial and residential buildings.

3. A Drainage Mechanism

Pooled water can create structural complications. That's why parking garages often have double-tee load-bearing structures with a twist that lowers one corner — a feature called warping. Engineers achieve positive drainage with 1.5 percent minimum slopes across the diagonal toward floor drains. Drainage is also crucial to help structures tolerate earthquakes.

When the disasters occur in places with loose, sandy soils, the shaking can result in a phenomenon called liquefaction. It makes buildings sink or move to one side, and sewage pipes may rise to the surface. When the soil solidifies again after an earthquake, the buildings stay in their sunken, tilted positions.

However, earthquake drains help collected water escape, preventing liquefaction. They are prefabricated pieces wrapped in a filtering fabric. Each drain measures between 3 and 8 inches in diameter. A successful installation requires a grid-style placement. Depending on the size of the area prone to liquefaction, a building may need hundreds or thousands of drains.

4. Structural Reinforcement

Engineers and designers have various methods for strengthening a building's structure against potential earthquakes. Many of those redirect seismic forces. For example, shear walls and braced frames transfer lateral forces from the floors and roof to the foundation.

Then, diaphragms are rigid horizontal planes that move lateral forces to vertical-resistant parts of the building, such as a building's walls or framework. There are also movement-resistant frames. Those possibilities make a building frame's joints rigid while letting the other parts move.

Shorter buildings have less flexibility than taller ones. Thus, engineers typically realize they must provide more structural reinforcement for structures that are only a few stories tall versus skyscrapers.

5. Material with Adequate Ductility

Ductility describes how well a material can tolerate plastic deformation before it fails. Thus, materials with high ductility can absorb large amounts of energy without breaking. Structural steel is one of the most ductile materials, while brick and concrete are low-ductility materials.

2. BAMBOO AS A BUILDING MATERIAL

Author Name: **Akash Kumar Sah,6th Sem**

Bamboo as a building material has high compressive strength and low weight has been one of the most used building material as support for concrete, especially in those locations where it is found in abundance. Bamboo as a building material is used for the construction of scaffolding, bridges and structures, houses.

Due to a distinctive rhizome-dependent system, bamboos are one of the fastest-growing plants in the world and their growth is three times faster than most other species of plants. They are renewable and extremely versatile resource with multi-purpose usage. Among many uses of bamboo, Housing is one of the major areas applications especially in the wake of residential shortages around the globe. Bamboo as a building material is conventionally associated with the region of Southeast Asia and South America where climate is best suitable for its cultivation. In many of the nations, bamboo is used to hold up suspension bridges or simply make places of dwelling.

Advantages of Bamboo as a Building Material

The various advantages of bamboo are as mentioned below:

Tensile strength: Bamboo has higher tensile strength than steel because its fibers run axially.

Fire Resistance: Capability of bamboo to resist fire is very high and it can withstand temperature up to 4000 C. This is due to the presence of high value of silicate acid and water.

Elasticity: Bamboo is widely preferred in earthquake prone regions due to its elastic features.

Weight of bamboo: Bamboos due to their low weight are easily displaced or installed making it very easier for transportation and construction.

Disadvantages of Bamboo

Bamboos come with their own set of drawbacks such as:

They require **preservation**

Shrinkage: Bamboo shrinks much greater than any other type of timber especially when it loses water.

Durability: Bamboo should be sufficiently treated against insect or fungus attack before being utilized for building purposes.

Jointing: Despite prevalence of various techniques of jointing, structural reliability of bamboo is questionable.

3. TEXTURED CONCRETE

Author Name: **Prasant Kumar,4th Sem**

Textured concrete finishes range from simple to elaborate and affordable to expensive. Some are easy to create, while others require special skills. Certain concrete textures serve functional purposes, while others are highly decorative.

1. Stamped concrete

Stamped concrete, commonly referred to as textured or imprinted concrete, is a type of concrete finish designed to resemble brick, natural stone such as slate or flagstone, tile and even wood. Color hardener is a popular way of coloring concrete that accentuates the stamped pattern.

2. Stenciled concrete

Stenciling concrete can be a great alternative to decorative stamping while permitting similar design flexibility. Stencils are typically used in conjunction with staining concrete or resurfacing. Concrete engraving can also be used to create similar effects.

3. Exposed aggregate

An exposed aggregate surface is obtained by placing concrete and then removing the top layer of cement paste to uncover coarse decorative aggregate. The most popular decorative aggregates are richly colored natural stones such as basalts, granite, quartz, or limestone. But you can also use materials such as recycled colored glass or seashells and other interesting objects seeded into the surface of the concrete.

4. Float and trowel finishes

Patterns can be made on the concrete, such as swirls, or different size arcs. The texture created can be coarse, medium, or smooth depending on the tool used to impart the pattern. Wood floats create coarser textures. Aluminum floats or steel trowels create medium or smooth finishes.

5. Broom finish

Broom finished concrete can be light or coarse depending on the bristles of the broom you choose. This is not a fancy finish but provides a non-slip surface which is important for safety around swimming pools.

6. Rock salt finish

Water softener salt crystals 1/8" to 3/8" in size are broadcast onto the fresh concrete. A roller is then used to press the salt crystals into the concrete. The surface is later washed, dissolving the salt and leaving small holes.

7. Colored finish

Concrete can be colored in a variety of ways, but integral color and color hardener are two popular options, especially outdoors. Integral color is added to the concrete mix before pouring, while color hardener is broadcast onto freshly placed concrete and finished into the surface. Both of these colored finishes can be used alone or combined with various texturing methods such as stamping, exposed aggregate, brooming and more.

8. Polished concrete

Polished concrete is the ultimate modern flooring material, where the surface of the concrete is ground to a high-gloss finish. Homeowners, retailers, big-box stores, educational and medical facilities are choosing

polished concrete for their floor finish because of the competitive advantage it offers over other types of floor coverings.

9. Stained concrete

Staining is the most popular method for enhancing both commercial and residential concrete floors. Stained concrete is a good finish for both new or existing floors and works equally well with concrete overlays. Colors can mimic marble, leather, natural stone or even wood.

10. Epoxy coatings

Epoxy concrete floor coatings are a great option if you are looking for tough and attractive flooring. They are popular in auto shops, restaurants, salons, retail stores and more. Customize your coating with metallic pigments, decorative chips, or mosaic-like terrazzo.

4. SOLAR BUILDINGS

Author Name: **Pradip Mondal,4th Sem**

The sector of solar building envelopes embraces a rather broad range of technologies—building-integrated photovoltaics (BIPV), building-integrated solar thermal (BIST) collectors and photovoltaic (PV)-thermal collectors—that actively harvest solar radiation to generate electricity or usable heat. The focus of this chapter is a critical review of the current knowledge and challenges of solar facades that actively generate electricity thanks to the use and integration of BIPV technologies.

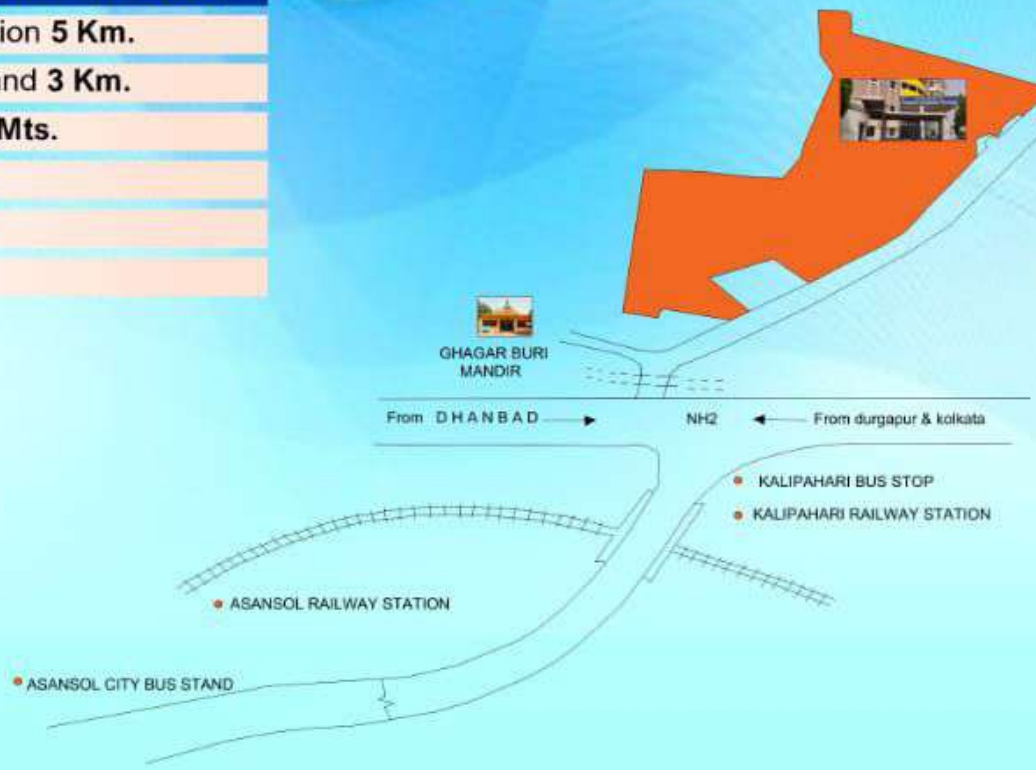
The transformation of buildings to solar buildings is a tangible 'cause' of innovation in both contemporary architecture and solar technologies, as the use of active facades is much more than a technical possibility: it is a true new opportunity in building skin aesthetics, ethics and technology. The influx of new materials and technologies in the building field has profoundly marked the history of construction with innovative archetypes: in our opinion, as happens with new materials, this 'solar' transformation will cause a profound change of perspective in design, building skin engineering and industrial approaches, as well as in the whole construction process.

BIPV will play an essential role in a new era of distributed power generation. BIPV systems (as both roof and façade applications) represent a powerful and versatile technology, able to produce renewable energy where the sun is available, to meet the ever increasing demand for zero- (or even positive-) energy or zero-carbon buildings in the coming years. While some critical policy challenges exist, the value of generating power directly where it is used today matches the twin values of aesthetic needs and high flexibility of design and manufacturing, which may help to mitigate the barriers inherent in BIPV applications in construction field.

A BIPV system serves as building envelope component and power generator simultaneously. BIPVs have a great advantage over nonintegrated PV plants in that since there is need neither for the allocation of land nor stand-alone PV systems. The on-site electricity produced by BIPV systems can reduce total building material costs by achieving cost competitiveness, for example, by optimizing end user costs (yielding compelling savings in terms of costs of mounting, especially since BIPV systems do not require additional specific assembly components such as brackets and rails) and creating new business models. A BIPV system simply makes zero-emission electricity out of sunlight. All these advantages have caused a worldwide growing interest in BIPV products and a dynamic market trend in recent years.

Distance from **AIEM-P** (Approx)

- Asansol Railway Station **5 Km.**
- Asansol City Bus Stand **3 Km.**
- Kalipahari More **600 Mts.**
- Durgapur **36 Km.**
- Kolkata **200 Km.**
- Dhanbad **75 Km.**



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Bagbandi Road, Kalipahari More, Near Ghagar Buri Mandir, Asansol-713339
Contact No. : 8001500263, 7076791501, 0341-6610306, 6610322
Email : admissionsaiem2015@gmail.com
Website : www.aiemp.in