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DEPARTMENT OF ELECTRICAL ENGINEERING

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TECHNIQUE POLYTECHNIC INSTITUTE

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DEPARTMENT OF ELECTRICAL ENGINEERING
TECHNIQUE POLYTECHNIC INSTITUTE
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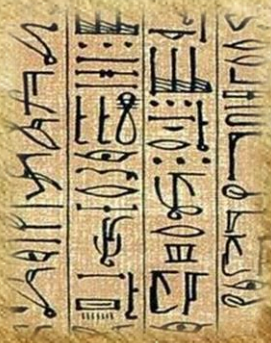

As a combatant succumbs to a long soothing slumber after a conflict ages long, we behold settling down of all turbidity to lead an anticipated limpid boulevard ahead. What we are left with in our fist is enthusiasm to move forward and what we aim is – The Journey.

The voyage that will edify us with whatever newer technologies are being introduced in our everyday lives, the expedition that will enlighten us with all the prospects to ponder beyond.

- The Editor

"There Is No Wrong Decision, Only A Better One"

Vision

To become a nationally recognized centre of excellence in Electrical Engineering

Mission

- To provide training to the students by promoting active learning, critical thinking and engineering judgment coupled with business and entrepreneurial skills to succeed as leading engineers
- To prepare students with the capability to meet ever-growing socio-economic necessity of the industry and society
- To create opportunity to encourage self-learning leading to competence of lifelong learning

Programme Educational Objectives (PEOs)

PEO.1. To produce Electrical engineers having strong foundation in mathematics, science, basic engineering & management for providing solution to industrial problem

PEO.2. To train students with good practical exposure to test & verify the characteristics of common electrical equipment/machines/control system & to develop the skill to analyse, appreciate & interpret the data for engineering applications

PEO.3. To inculcate professional & ethical attitude, communication & team work skills

PEO.4. To inculcate the ability to relate engineering issues from social perspective for truly contributing to the needs of society

PEO.5. To develop attitude to deal with multidisciplinary approach in self-learning

Programme Outcomes (POs)

1. Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

2. Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

3. Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

4. Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

5. Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

6. Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

7. Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

PROGRAM SPECIFIC OUTCOMES

PSO-1. (Engineering knowledge and analysis)

Analyse specific technological problem relevant to electrical engineering by applying knowledge of basic science, engineering mathematics and engineering fundamentals

PSO-2. (Maintenance and technological development)

Ability to fabricate maintenance and system operation of electrical engineering devices using significant technical skills, analytical ability and uses of modern tools

PSO-3. (Application of the knowledge on society/environment)

Apply the acquired knowledge of electrical engineering assess societal, health, safety, legal and cultural issues with professional ethics and function effectively as an individual or a leader in a team to manage different projects in multidisciplinary industrial environment

CONTENTS

E-WASTE

AKASH GANGULY
Student of Electrical Engineering Department
Technique Polytechnic Institute, Hooghly, West Bengal, India

1. INTRODUCTION

We all know that electronic devices are very useful and plays a very essential role in our environment. But, as we all know, every machine, human or any kind of material has two sides. One is positive and the other one is known to all. So, in this article I will discussing the negative sides of e-waste. The harmful and poisonous materials of e-waste that may involve significant risk to the health of humans and nature.

2. WHAT IS E-WASTE?

First of all we have to know what E-Waste actually means. Electronic Waste or E-Waste basically describes the discarded electrical or electronic devices. That means in childhood when we threw that remote control car or that small automatic plane when they were destroyed, that was the E-Waste we created not knowing it or sometimes by knowing it.

3. E-WASTE NEGATIVITY

E-waste contains some very harmful elements like lead, cadmium, beryllium etc. While recycling these waste products, there harmful materials makes a very bad effect in workers' health, that causes diseases like lung cancer, miscarriage and many more. As because they are not biodegradable they accumulates in the environment, in the soil, air, water and living things. For example, open-air burning and acid baths being used to recover valuable materials from electronic components release toxic materials leaching into the environment. These practices also expose workers and they lead to this above-mentioned harmful diseases.

4. LACK OF RECYCLING

Recycling rates globally are low. Even in the EU, which leads the world in e-waste recycling, just 35% of e-waste is officially reported as properly collected and recycled. Globally, the average is 20%; the remaining 80% is undocumented, with much ending up buried under the ground for centuries as landfill. According to the UN, in 2021 each person on the planet will produce on average 7.6 kg of e-waste, meaning that a massive 57.4 million tons will be generated worldwide. Many initiatives are undertaken to tackle this growing concern, but none of them can be fully effective.

So what to do? How to stop this? Let's check.

5. DONATING ELECTRONIC PRODUCTS

If you have electronics in perfectly fine condition, a good way to get rid of it is to donate it. There are numerous organizations, even the companies that sell the devices that will take your old devices and sell them at a reduced price. Or they'll send them to an electronics recycler to have the components separated for their raw materials. Companies like HP, Dell, Best Buy, and Goodwill accept donated devices.

6. MAKING ART OF IT

If you're an artist, one fun way of repurposing your old device is by incorporating it into your artwork. This has a dual purpose: 1) create awesome art and 2) raising awareness about e-waste. For example, according to the EPA, recycling one million laptops saves the energy equivalent to the electricity used by more than 3,500 US homes in a year. Additionally, for every million cell phones recycled, 35 thousand pounds of copper, 772 pounds of silver, 75 pounds of gold and 33 pounds of palladium can be recovered and used to create new cell phones. This may not seem like much but it stops, or at least slows down, the mining of raw materials, which can be detrimental to the environment and African gorillas.

7. RECYCLED PRODUCTS

Only 17.4% of documented e-waste was recycled in 2019. This can be partially ascribed to the fact that many electronic devices today are not designed to be recycled. Smartphones are becoming lighter and slimmer, and their batteries are no longer removable, making recycling much more difficult and labour-intensive.

Another problem the recycling industry is dealing with is that, currently, only 10 out of 60 chemical elements present in e-waste can be recycled through mechanical processing: gold, silver, platinum, cobalt, tin, copper, iron, aluminium, and lead.

8. CONCLUSION

So, we have to be careful with is problem. This is a big problem for our nature and we can only fix it. So it will be my earnest request to all of the readers, as well as the teachers be concerned about this and advice others to make the same, think the same.

MAGNETIC LEVITATION, ITS PRINCIPLE AND APPLICATION

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1. INTRODUCTION

The term magnetic levitation has come to be used in a wide variety of different contexts ranging from suspending a small laboratory-scale stationary object so that it is isolated from vibrations of its surroundings to large-scale mobile applications such as maglev vehicles capable of carrying people and materials up to speed of several hundred miles per hour or the proposed assisting in the launch of space vehicles. Depending on the nature of application, some degree of physical contact maybe required. However if physical contact is to completely eliminated, as in case of very high speed vehicles, then in addition to suspension, the function of lateral guidance, propulsion, braking, energy transfer and system control must be provided by noncontact means alone. Faced with a wide variety of options, maglev system designers must decide how the system should be configured and which components should be placed on board the vehicle and which should be mounted on the guide way.

For maglev vehicles applications, two basic maglev suspension system designs have been widely used. The first employs the attractive force between magnets and ferromagnetic metals and is preferred to as an electromagnetic suspension system. The other uses repulsive force generated by magnets moving relative to electrical conductors and is referred as an electrodynamic suspension system.

2. WORKING PRINCIPLE

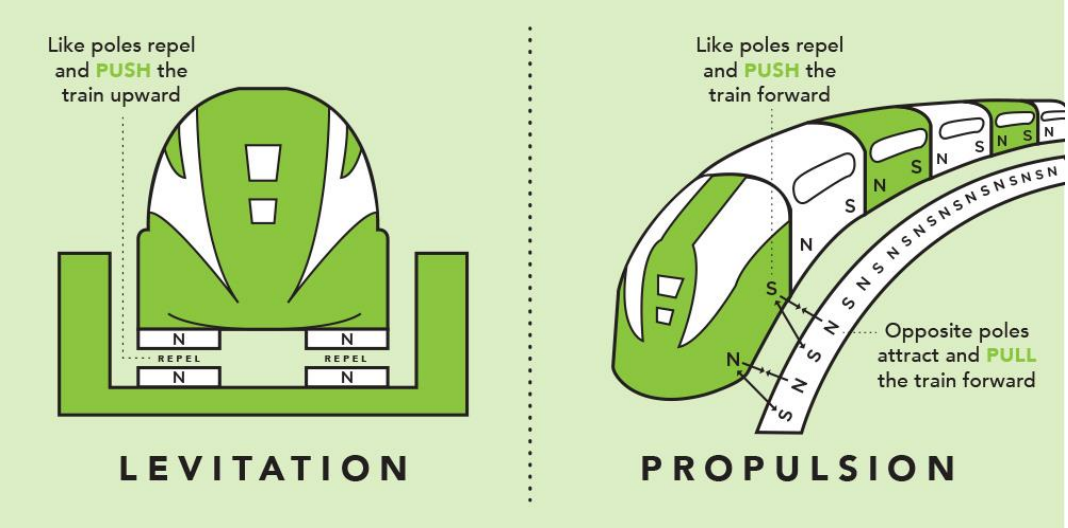
The magnetic fields interact with simple metallic loops set into the concrete walls of Maglev guide-way. The loops are made of conductive materials, like aluminium, and when a magnetic field moves past, it creates an electric current that generates another magnetic field. Three types of loops are set into guide way at specific intervals to do three important tasks: one creates a field that makes the train hover about a 5 inches above the guide way; a second keeps the train stable horizontally. Both loops use magnetic repulsion to keep the train car in the optimal spot; the further it gets from the centre of the guide-way or the closer to the bottom, the more magnetic resistance pushes it back on track.

The third set of loops is a propulsion system run by alternating current power. Here both magnetic attraction and repulsion are used to move the train car along the guide-way. The front corners have magnets with north poles facing out, and the back corners have magnets with south poles outwards. Electrifying the propulsion loops generates magnetic fields that both pull the train car forward from the front and push it forward from behind.

This floating magnet design creates a smooth trip. Even though the train car can travel up to 375 miles per hour, a rider

experiences less turbulence because the only source of friction is air.

bearings and for product display purpose.



3. ADVANTAGES OF MAGNETIC LEVITATION

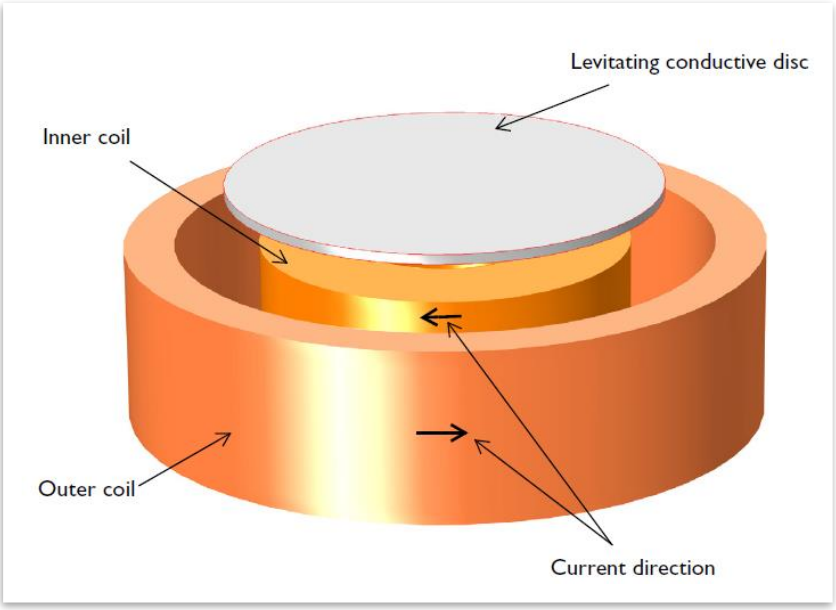
- It increases efficiency.
- It reduces maintenance costs.
- It increases the useful life of the system.

4. DISADVANTAGES OF MAGNETIC LEVITATION

- Expensive to build, not least because it's new and largely untried technology.
- Expensive to operate, both to maintain the new technology and because the energy consumption is high.
- Not immune from the problems of needing a straight route with shallow bends.

5. APPLICATION OF MAGNETIC LEVITATION

- Magnetic Levitation is mainly used for Maglev Trains, which is currently running in Japan and it has a top speed of 603 kilometres per hour. Beside it can be used for contactless melting, magnetic


Levitating conductive disc
Inner coil
Outer coil
Current direction

CONCEPT OF DC MACHINE AND NEW DEVELOPMENT

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1. INTRODUCTION

A DC machine is an electromechanical energy alteration device. The working principle of a DC machine is when electric current flows through a coil within a magnetic field, and then the magnetic force generates a torque that rotates the dc motor. The DC machines are classified into two types such as DC generator as well as DC motor.

2. INVENTION HISTORY

The invention of the DC motor came about in the early 1800s, with initial developments made in 1832 by British scientist William Sturgeon. Sturgeon created the very first commentator DC motor, with the ability to turn machinery.

However, Sturgeon's idea was developed and built upon by Thomas Davenport, an American inventor. Davenport is more widely known to have officially invented a working DC motor, which he went on to patent a few years later in 1837. Initially, Davenport struggled with issues surrounding the expensive costs of battery power while running the motors, which made the very first DC motor fairly incapable of withstanding the test of time. Learn more about how the electric motor was invented.

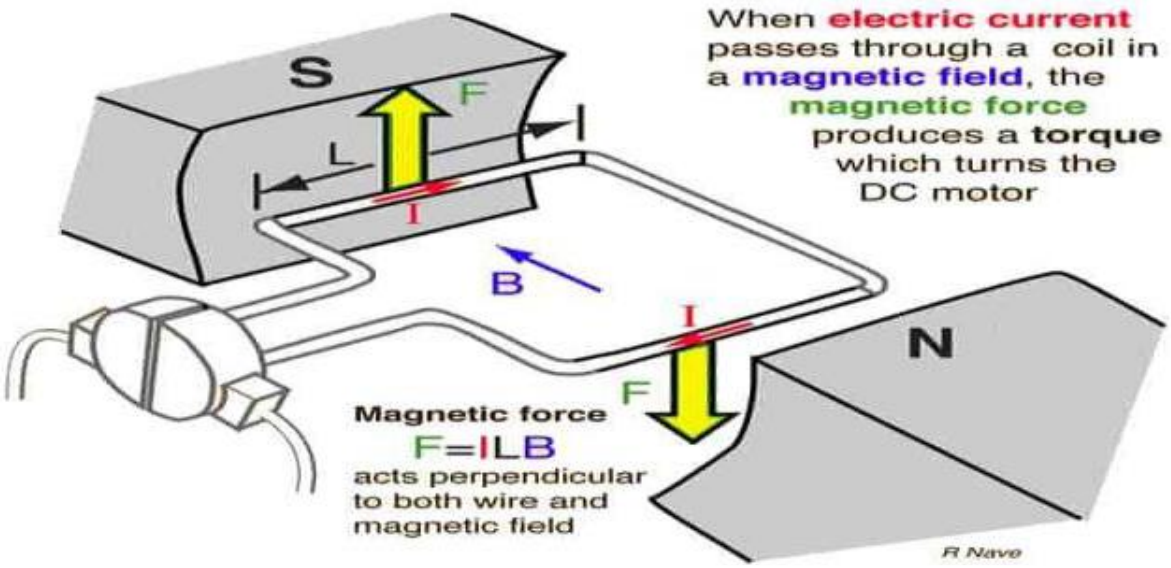
3. WORKING PRINCIPLE

A machine that converts DC electrical power into mechanical power is known as a Direct Current motor.

DC motor working is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force.

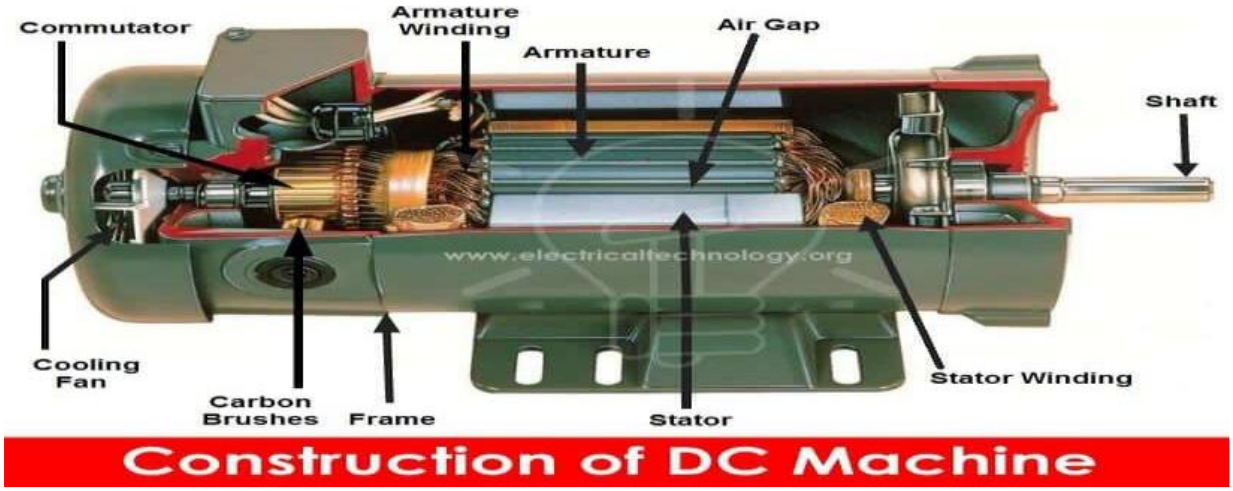
According to Fleming's left-hand rule when an electric current passes through a coil in a magnetic field, the magnetic force produces a torque that turns the DC motor.

The direction of this force is perpendicular to both the wire and the magnetic field.



4. CONSTRUCTION

The construction of the DC machine can be done using some of the essential parts like Yoke, Pole core & pole shoes, Pole coil & field coil, Armature core, Armature winding otherwise conductor, commentator, brushes & bearings etc.



5. APPLICATION OF DC MACHINE

DC machines are also used in applications where high starting torque and accurate speed control over a wide range are important. Major applications for DC motors are: elevators, steel mills, rolling mills, locomotives, and excavators. Like other rotating machines, DC motors result from the interaction of two magnets.

6. RECENT DEVELOPMENT

BRUSHLESS DC MOTOR (BLDC) continue to increase in popularity in industrial applications because of the numerous of advantages they offer over their brushes dc motor. Counter parts. BLDC motors are used in **computer hard drives and DVD players**. These motors are used in fans, washing machines, dryers, pumps, blowers, and compressors.

7. ADVANTAGES OF BRUSHLESS DC MOTORS

- With excellent linear mechanical characteristics of DC motors, wide speed range, step less speed regulation can be realized, and the speed range is wide.
- Excellent torque characteristics, good medium and low speed torque characteristics, large starting torque and small starting current; strong overload capacity.
- High reliability, good stability, strong adaptability, simple maintenance.
- Small size, light weight, high output.

8. DISADVANTAGES OF BRUSHLESS DC MOTORS

- Cost: Rare-earth permanent magnets are much more expensive than other permanent magnets, which leads to an increase in motor costs.
- Limited constant power range: A large constant power range is critical to achieving high vehicle efficiency.
- Safety: During the manufacturing process of the motor, it may be dangerous because the large rare earth permanent magnets can attract scattered metal objects. In the event of a vehicle crash, if the wheels spin freely and the motor is still excited by permanent magnets, high voltages will appear at the motor terminals, which may endanger passengers or rescuers.
- High-speed performance: Surface-mounted motors of permanent magnets cannot achieve high speeds because this is limited by the mechanical strength of the assembly between the rotor yoke and the permanent magnets.

LIGHT EMITING DIODE (LED)

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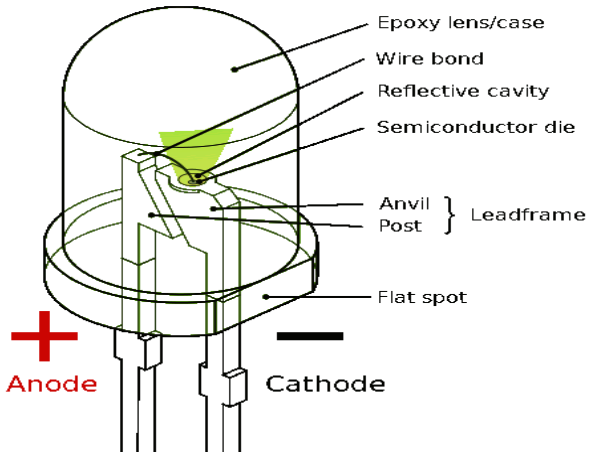
1. INTRODUCTION

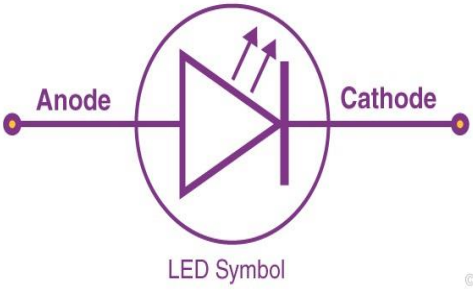
The Light-emitting diode is a two-lead semiconductor light source. In 1962, Nick Holon yak has come up with the idea of a light-emitting diode, and he was working for the general electric company. The LED is a special type of diode and they have similar electrical characteristics to a PN junction diode. Hence the LED allows the flow of current in the forward direction and blocks the current in the reverse direction. The LED occupies a small area which is less than **1 mm^2**. The applications of LEDs used to make various electrical and electronic projects. In this article, we will discuss the working principle of the LED and its applications.



2. CONSTRUCTION OF LED

The construction of LED is very simple because it is designed through the deposition of three semiconductor material layers over a substrate. These three layers are arranged one by one where the top region is a P-type region, the middle region is active and finally, the bottom region is N-type. The three regions of semiconductor material can be observed in the construction. In the construction, the P-type region includes the holes; the N-type region includes elections whereas the active region includes both holes and electrons.

When the voltage is not applied to the LED, then there is no flow of electrons and holes so they are stable. Once the voltage is applied then the LED will forward biased, so the electrons in the N-region and holes from P-region will move to the active region. This region is also known as the depletion region. Because the charge carriers like holes include a positive charge whereas electrons have a negative charge so the light can be generated through the recombination of polarity charges.



3. WORKING PRINCIPLE OF LED

The working principle of the Light-emitting diode is based on the quantum theory. The quantum theory says that when the electron comes down from the higher energy level to the lower energy level then, the energy emits from the photon. The photon energy is equal to the energy gap between these two energy levels. If the PN-junction diode

is in the forward biased, then the current flows through the diode.

The flow of current in the semiconductors is caused by the flow of holes in the opposite direction of current and the flow of electrons in the direction of the current. Hence there will be recombination due to the flow of these charge carriers.

The recombination indicates that the electrons in the conduction band jump down to the valence band. When the electrons jump from one band to another band the electrons will emit the electromagnetic energy in the form of photons and the photon energy is equal to the forbidden energy gap.

For example, let us consider the quantum theory, the energy of the photon is the product of both the Planck constant and frequency of electromagnetic radiation. The mathematical equation is shown

Eq = hf

Where his known as a Planck constant, and the velocity of electromagnetic radiation is equal to the speed of light i.e c. The frequency radiation is related to the velocity of light as an f= c / λ. λ is denoted as a wavelength of electromagnetic radiation and the above equation will become as a

Eq = he / λ

From the above equation, we can say that the wavelength of electromagnetic radiation is inversely proportional to the forbidden gap. In general silicon, germanium semiconductors this forbidden energy gap is between the condition and valence bands are such that the total radiation of electromagnetic wave during recombination is in the form of infrared radiation. We can't see the wavelength of infrared because they are out of our visible range.

The infrared radiation is said to be as heat because the silicon and the germanium semiconductors are not direct gap semiconductors rather these are indirect gap semiconductors. But in the direct gap semiconductors, the maximum energy level of the valence band and minimum energy level of the conduction band does not occur at the same moment of electrons. Therefore, during the recombination of electrons and holes are migration of electrons from the conduction band to the valence band the momentum of the electron band will be changed.

4. LIGHT WAVELENGTHS

Light, of course, is a form of electromagnetic radiation, and as such, it can be measured in wavelengths. In the context of LED color mixing, it makes sense to focus on light wavelengths that are visible to humans, which typically range from about 400 nanometers (nm) to about 700 nm. Light wavelengths below 400 nm are considered to be ultraviolet, while light wavelengths above 700 nm are known as infrared.

Color perception then depends on a given light's brightness, more accurately described as luminance, and chromaticity (or color) in terms of the dominant wavelength seen. For example, the color white and the color gray may have the same or similar wavelength, but a different luminance. Likewise, the colors pink, red, and brown may have the same or similar chromaticity, but rather different luminance.

The CIE 1931 colour space provides mathematical accuracy for colour definitions. The colour space can also be

used to predict how blends of variously coloured LEDs will be perceived.
For example, the color white is a bright color, while the color grey is considered to be a less bright version of that same white. In other words, the chromaticity of white and grey are the same while their brightness differs.

To complete our review of the basics that effect LED color mixing, it is helpful to remember that light has an additive property. Often, when someone thinks about color mixing, they are reminded of blending paints, wherein various colors of paints, dyes, or inks are produced by absorbing some wavelengths and reflecting others — often called color's subtractive property. Color mixing in light, however, is instead an additive process: Simply put, when red, green, and blue light — the relative colors for which the chromaticity-sensitive cones in the human retina tend to show an affinity — are combined in equal portions, they produce white light. Changing the relative luminance of any of the three primary light sources results in a change of the combined color of light produced and perceived, and, therefore, conceptually repositions the perceived light's color on the CIE 1931 color space.

ELECTRICAL VEHICLES

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1. INTRODUCTION

"Electric cars" generally refers to road going automobiles powered by electricity. Propelled by one electric motor or more using batteries. Electric motors give instant torque, and smooth acceleration. The rechargeable batteries can be charged by common household electricity.

2. NEED OF ELECTRIC VEHICLE

- Contributes to cleaner air
- To preserve the fossil fuels
- Less maintenance
- More efficient
- Cost effective

3. PARTS OF ELECTRIC VEHICLE

There are 3 main components

- Electric motor
- Battery
- Controller

4. WORKING

- The driver presses the accelerator which in turns sends the signal to the controller.
- When fully accelerated, maximum voltage is supplied to the motor.
- On releasing the accelerator, no voltage is supplied.
- Two potentiometers are connected.
- When both potentiometer shows same deviation, voltage is supplied further and car moves.

5. TYPES OF ELECTRIC CARS

1. Plug in hybrid Electric car
   - Both the electric motors and internal combustion engine needed to run the car.
   - Combustion engine is used only to charge the battery.
   - Rechargeable batteries- recharged by internal combustion and regenerative braking.
   - It has a larger battery pack that is plugged into the electric grid for charging, increasing the share of electric power used by the car.
2. Hybrid electric car
   - Uses a small electric battery to support the internal combustion engine.
   - Provides increased fuel efficiency.
   - The battery is recharged by both the gasoline engine and regenerative braking.
   - Regenerative braking captures kinetic energy to charge the batteries when the driver pushes the brakes.
3. Battery electric car
   - Battery electric vehicles are all electric.
   - No internal combustion engine.
   - Needs large recharge time (7-8 hours).
   - Car halts when the battery dies.
   - In order to run 80 plus mils, it requires a large battery i.e., 18kwh to 36kwh.

6. WHY IS THERE A PUSH FOR ELECTRIC VEHICLE

- Currently, cars and trucks add up to 25% of the world carbon dioxide emission.
- With the limited amount of petroleum gas price are always going to rise.
- There is greater awareness about the effect of carbon dioxide in today's society
- The world leaders are trying to reduce the carbon dioxide emission by half by 2030.

7. ADVANTAGES

- Cheaper to run because of low rates of electricity than petrol.
- Zero harmful emission, better for environment
- Nearly 100% recyclable batteries.
- Reduce noise pollution.
- Low maintenance

8. DISADVANTAGES

- Time required to recharge the batteries is more.
- Lesser charging stations.
- More expensive than the combustion engine cars.
- The batteries provided are quite heavy increasing the net weight of the car.

9. FUTURE OF ELECTRIC VEHICLES

- Electric cars could give power back to the grid. About 5 million electric will be on the road by 2025.
- Creating building codes that make it easier to construct new charging stations.
- Creating incentives to promote-zero emission vehicles.
- Currently working to create more efficient and lighter batteries.
- There are also researches being done on fuel cell(smaller, lighter, faster)

VIRGIN HYPERLOOP USING ELECTROMAGNETIC FIELD

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1. INTRODUCTION

Virgin Hyperloop made history On November 8, 2020 as it completed its first successful passenger tests. But what's the technology behind hyperloop and how does it work?

Hyperloop is a new form of mass transportation that will change how we travel. It is set to cut journey times between cities from hours to minutes.

Virgin Hyperloop uses a 'near-vacuum' environment within a tube, which enables high speeds, low power consumption, and almost completely removes aerodynamic drag. Inside the tube, battery-powered pods glide at speeds of up to 670mph or (1200km). For passengers on board, it's a comfortable, quiet and safe experience.

After successfully building the world's first hyperloop test system, Virgin Hyperloop is now focused on its commercial product. It has made changes to the design, moving levitation, power and propulsion onto the pod. The levitation engines contain electromagnets that lift and guide the pod within the track, making it 10 times more efficient than the world's fastest maglev trains.

Pods travel in convoys. Unlike trains, the pods are not connected to one another, meaning each one can have a different destination. Pods take an exit similar to a highway off-ramp, while the rest of the convoy continues on its route.

With no moving parts on the track and levitation and guidance on the top of pods, they can switch directions at high speeds and join and leave convoys seamlessly. These innovations not only allow pods to travel at ultra-fast speeds but also provide on- demand, direct-to-destination service. Hyperloop will carry tens of thousands of passengers per direction per hour at aero plane speeds, with zero direct emissions

2. WORKING

It works meanly Electromagnetic Force & uses a 'near – Vacuum' environment within a tube, which enables high speeds, low power consumption, & almost completely removes aerodynamic drag. Inside the tube, battery-powered pods glide at speeds of up to 670mph or (1200 km).

3. HOW DOES THE HYPERLOOP GO FAST?

A hyperloop is able to reach extreme speeds because it addresses one of the most basic rules of physics—friction slows things down.

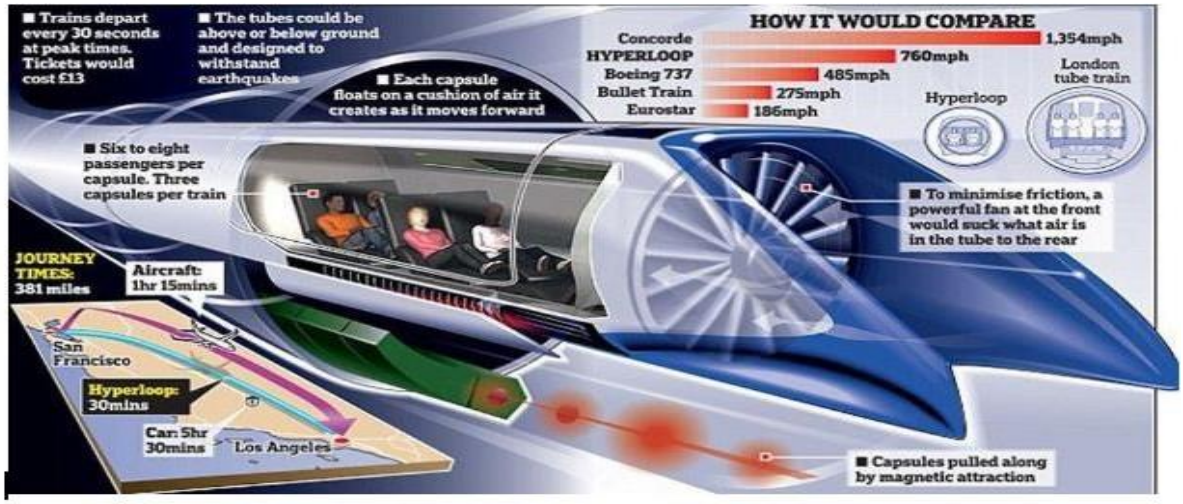
Hyperloop designs rely on creating a low-friction environment within a tunnel or tube. Individual pods seating a small group of people could then travel at extreme speeds through the tubes.

The hyperloop travels via an efficient electric motor, and friction is reduced in two ways:

Depressurized tunnels create a near-vacuum environment where almost all of the air has been sucked out. This creates an environment where extremely high speeds are possible because there's minimal aerodynamic drag or wind resistance.

Magnetic levitation (maglev) causes each pod to hover. This removed the ground friction of wheels or tires that occurs in other modes of ground transportation. This technology is already being used in high-speed bullet trains. In the image above, the magnets in red are for levitation and propulsion. The magnets in blue are for horizontal stabilization.

There are two maglev methods currently in development for hyperloop applications. Passive maglev uses a specific configuration of magnets that perpetually create current and keep the pod consistently hovering. No external power is needed. In another design, active maglev combines permanent passive-style magnets with electromagnetics. This makes it possible to adjust the current to smooth out the ride.



There was Two Liner motor use for rotted the propeller. And also usedElectromagnetic field.

4. WHICH COMPANIES ARE WORKING ON HYPERLOOP?

1. VIRGIN HYPERLOOP
2. HYPERLOOP TT
3. SPACEX ELON MUSK HYPERLOOP
4. JTC20

5. WHEY WE ARE USED OF HYPERLOOP TECHNOLOGY?

- High Speed is one of the advantages of Hyperloop Technology

The hyperloop pods reach speeds of more than 500 miles per hour up to 760 **mph**. That means it's the fastest mode of transportation ever. The hyperloop is said to take 30 minutes maximum to transport commuters from LA to SF and vice-versa. The same distance usually takes 8 hours by car depending on traffic.

- **Quick and Frequent Travel**

Vacuum trains will cut the time spent in travelling, which trains can cover more

distance in less time to reach point B from A and vice-versa. More cargo and passengers can go and return the same day.

This would also enhance business besides improving citizen's livelihood.

- **Major Hyperloop Advantages include Energy Efficiency**

Hyperloop technology will use Solar Energy and cut travelers' transportation emissions by 90 to 95%. According to Tesla Motor's founder Elon Musk, the Hyperloop pods will run on wind energy and solar-powered magnets, which control the pods' movement and stop them whenever necessary.

- **Hyperloop good for the environment**

The transportation system that will run through tubes at high speeds is expected to be fast and cheap. It will link major cities via a tube network, such as London to New York, in only 30 minutes. However, the environmental impact of high- speed rail would be far greater than that of Hyperloop because the closed system may be bored below or elevated above the ground.

OVERVIEW OF ELECTRIC TRAINS USED IN INDIAN RAILWAYS

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1. ABSTRACT

In the present state of electrical science and practice, electric traction must be considered as a branch of the electrical transmission of energy. We require, first of all, a natural source of energy, such as coal or other fuel, or water at a high elevation or in motion. In the next place, we require a prime mover to transform energy into work, such as a steam or gas engine, a turbine, or water- or tide-wheel. Then this work has to be transformed into electric current, by means of a dynamo or magneto-electric machine, the so-called primary machine. The electric current has then to be transmitted from the place where it is produced to the place where it has to be used, by means of a conductor or a storage battery. The current has next to be retransformed into work, by means of a motor carried by or attached to the vehicle which has to be moved. This work has then to be mechanically transmitted from the motor to the axle of the wheel of the car which travels along the line.

2. INTRODUCTION

Wheels running along the steel rails of a railroad track. The power to move a train usually comes from one or more locomotives at the head of the train pulling the cars behind it. There are two types of locomotives today: 1: Diesel Electric 2: Electric Locomotives in the US are usually powered by diesel but elsewhere (especially in Europe) many locomotives are electric and obtain electric power from an overhead wire strung above the track. In this paper the most relevant locomotive i.e. Electric Traction is analyzed. There is a wide variety of electric traction systems around the world, which have been built according to the type of railway, its location and the technology available at the time of the installation. Many installations seen today were first built up to 100 years ago. A major advantage of electric trains is that diesel trains may use a wide variety of fuels such as coal. It results in lower maintenance cost and lower energy costs. Electric traction reduce the haulage of heavier loads at higher speeds, thus increasing the output. It is a pollution free system and with use of modern high horse power locos having regenerative braking, it becomes vastly energy efficient. The chief disadvantage of electrification is the cost of infrastructure.

3. ELECTRIC LOCOMOTIVES

An electric train or an electric locomotive is a locomotive powered by electricity from an external source. External sources may include overhead lines, third rail, or an on-board electricity storage device such as a battery or flywheel system. There are two basic types of Railway Electrification:

A. DC (Direct Current):

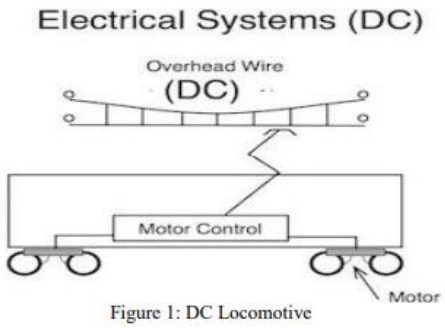

Figure 1: DC Locomotive

B. AC (Alternating Current):

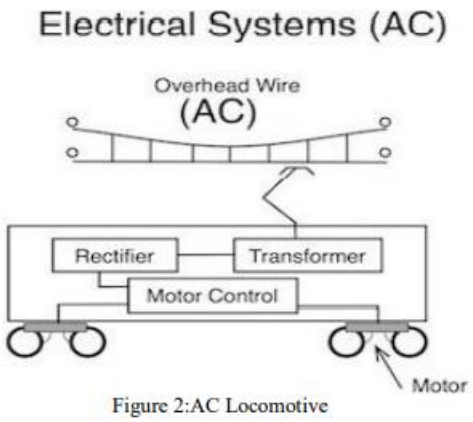

Figure 2:AC Locomotive

- Direct Current (DC) traction units use direct current drawn from either a conductor rail or an overhead line. AC voltage is converted into DC voltage by using rectifier.

- Alternating Current (AC) traction units draw alternating current from an overhead line.

4. TYPES OF VARIOUS ELECTRIC LOCOMOTIVES

- The most use wide gauge, AC current, passenger traffic engines are -

WAP-4: The Indian locomotive class WAP-4 is a class of 25 kV AC electric locomotives that was developed in 1993 by Chittaranjan Locomotive Works for Indian Railways. The model name stands for broad gauge (W), AC Current (A), Passenger traffic (P) engine, 4th generation (4). They entered service in late 1994. A total of 778 WAP-4 were built at CLW between 1993 and 2015, which made them the most numerous class of mainline electric passenger locomotive until the WAP-7.

WAP-5: The Indian locomotive class WAP-5 is the name of a class of "High Speed" electric locomotives produced and used by Indian Railways. The first 10 locomotives were imported from ABB in Switzerland in 1995. They are supposed to be a variant of the Swiss Lok 2000 (Design concept) and German DB Class 120 (mechanical chassis).

One of the notable features of WAP-5 is regenerative braking. Other notable features of this loco are the provision of taps from the main loco transformer for hotel load, pantry loads, flexible gear coupling,

wheel-mounted disc brakes, and a potential for speed enhancement to 200 km/h (120 mph). Braking systems include 160 kN (36,000 lbf) regenerative brakes, loco disc brakes, automatic train air brakes, and a charged spring parking brake.

WAP-7: The Indian locomotive class WAP-7 is a class of 25 kV AC electric locomotives that was developed in 1999 by Chittaranjan Locomotive Works (CLW) for Indian Railways. The model name stands for broad gauge (W), AC Current (A), Passenger traffic (P) engine, 7th generation (7). They entered service in 2000. A total of 1423 WAP-7 have been built, with more units being built at CLW, Banaras Locomotive Works (BLW) and Patiala Locomotive Works (PLW).

The WAP-7 is one of the most successful locomotives of Indian Railways serving passenger trains for over 22 years. It is a passenger variant of the WAG-9 freight locomotive with a modified gear ratio to pull lighter loads at higher speeds. With an output of 6,350 hp (4,740 kW), it is the most powerful passenger locomotive in the Indian Railways fleet, and the most numerous passenger locomotive in India. The WAP-7 is capable of hauling 24 coach trains at speeds 110–140 km/h (68–87 mph).

- ❑ The most use wide guage, AC current, goods traffic engines are –

WAG-7: The Indian locomotive class WAG-7 is a class of 25 kV AC electric locomotives that was developed in 1990 by Chittaranjan Locomotive Works for Indian Railways. The model name stands for broad gauge (W), alternating current (A), goods traffic (G) engine, 7th generation (7). They entered service in 1992. A total of 1970 WAG-7 were built at CLW and BHEL between 1990 and 2015, which made them the most numerous class of mainline electric locomotive till its successor the WAG-9.

The WAG-7 is one of the most successful locomotives of Indian Railways currently serving both freight and passenger trains for over 30 years. Even though with the advent of new 3-phase locomotives like WAG-9 and WAG-12, all WAG-7 locomotives except ones destroyed in accidents, rest are in service and doing all types of duties.

WAG-9: The Indian locomotive class WAG-9 is a class of 25 kV AC electric locomotives that was developed in 1995 by ABB Group (ABB) for Indian Railways. The model name stands for broad gauge (W), AC Current (A), Goods traffic (G), 9th generation (9) locomotive. They entered service in 1996. A total of 3488 WAG-9 have been built at Chittaranjan Locomotive Works (CLW), with more units being built at Banaras Locomotive Works (BLW), Bharat Heavy Electricals Limited (BHEL) and Patiala Locomotive Works (PLW). It was the most powerful freight locomotive of its fleet until the formal introduction of the WAG-12.

The WAG-9 is one of the most successful locomotives of Indian Railways serving freight trains for over 26 years. A passenger variant of the WAG-9 was developed namely the WAP-7 locomotive by modifying the gear ratio to pull lighter loads at higher speeds. Nowadays, It is a common

locomotive used in freight trains.

WAG-12: The Indian locomotive class WAG-12B is a class of 25 kV AC electric locomotives that was developed in 2017 by Alstom with technological collaboration with Indian Railways. The model name stands for broad gauge (W), Alternating Current (AC), Goods traffic (G) locomotive, 12000 hp (12). They entered trial service in 2019. A total of 260 WAG-12B have been built at Electric Locomotive Factory, Madhepura, Bihar, India.

With a power output of 12,000 HP, the WAG 12 is twice as powerful as its immediate predecessor, WAG-9, and is among the most powerful freight locomotives in the world. The locomotive is being developed for deployment on the Dedicated Freight Corridors, where it will be used to haul freight trains weighing more than 6,000 tonnes (5,900 long tons; 6,600 short tons) at speeds of 100 km/h (62 mph) to 120 km/h (75 mph), essentially doubling the average speed of freight trains in the sector.

5. MAINLINE ELECTRIC MULTIPLE UNIT (MEMU) TRAINS

The recent development of the Mainline EMU (MEMU), manufactured by ICF was intended to address precisely this, to allow EMU operations in more areas. They have a width of 10’8’’. MEMUs run on 25kV AC power. MEMU driving motor coaches seat 76 and the trailer coaches seat 108. They have a rated speed of about 105km/h and are equipped with electro -pneumatic brakes, the trailer coaches weigh about 33.6 tonnes and the motor coaches weigh about 60 tonnes. Earlier versions of MEMUs have a top speed of 60km/h. RDSO improved on these by increasing the horsepower of the traction motors and providing a weak field arrangement in them for higher speeds.

6. ELECTRIC MULTIPLE UNIT (EMU)

Electric trains in big cities are called EMU, electric multiple unit trains. The term multiple unit is used to describe a self-propelling train unit capable of coupling with other units of the same or similar type and still being controlled from one cab. In the year 1893, the first EMUs were used on the elevated Liverpool Overhead Railway. It had two carriages and later got extended to three carriages, with the front and rear carriages powered .Majority of EMUs have nine or twelve coaches and sometimes even fifteen to handle rush hour traffic. In EMU's

1 power car is required for 3 coaches so for an EMU 12 coaches in length will have 4 power cars. Most EMUs are used as passenger trains, but some are also specialized for non-passenger roles, such as carrying mail or luggage. EMUs are popular in railways because of their fast acceleration and pollution-free operation

7. NEW TECHNOLOGY USED IN INDIAN RAILWAYS

- VANDE BHARAT EXPRESS: The Vande Bharat Express, previously known as Train 18, is a semi-high-speed, electric multiple unit train operated by the Indian Railways on 4 routes as of October 2022. It was designed and manufactured by the Integral Coach Factory (ICF) at Perambur, Chennai under the Make in India initiative. Construction of the first train took 18 months. The unit cost of the first train was estimated at ₹100 crore (equivalent to ₹114 crore or US$14 million in 2020)]and of the first set of second-generation trains at ₹115 crore (US$14 million). The train was launched on 15 February 2019, by which point a second unit was expected to have been produced and readied for service.The service was named 'Vande Bharat Express' on 27 January 2019. Vande Bharat Express has a maximum commercial speed of 160 km/h. It exceeded 180 km/h during testing,but its tracks are not capable of supporting such high speeds; thus the train is operated at a maximum speed of 130 km/h (81 mph). In this context, it can be said that the Gatimaan Express is the fastest train of India as per its maximum permissible speed of 160 km/h (99 mph) during the Tughlakabad to Agra part of its route; and that the Habibganj–New Delhi Shatabdi Express is the second fastest train of India as per its maximum permissible speed of 150 kmph during the Tughlakabad to Agra Cant part of its route.
- HYPERLOOP PROJECT: A hyperloop is a proposed high-speed transportation system for both public and goods transport. The term was popularized by Elon Musk to describe a modern project based on the vactrain concept (first appearance in 1799). Hyperloop systems comprise three essential elements: tubes, pods, and terminals.

The tube is a large, sealed and low-pressure system (usually a long tunnel). The pod is a coach pressurized at atmospheric pressure that runs substantially free of air resistance or friction inside this tube using magnetic propulsion (in some cases augmented by a ducted fan). The terminal handles pod arrivals and departures. The Hyperloop, in the initial form proposed by Musk, differs from vactrains by relying on residual air pressure inside the tube to provide lift by aerofoils and propulsion by fans. The hyperloop has its roots in a concept by George Medhurst in 1799 and subsequently developed under the names pneumatic railway, atmospheric railway or vactrain.Elon Musk renewed interest in hyperloop after mentioning it in a 2012 speaking event. Musk further promoted the concept by publishing a white paper in August 2013, which conceived of a hyperloop route running from the Los Angeles region to the San Francisco Bay Area, roughly following the Interstate 5 corridor.His initial concept incorporated reduced-pressure tubes in which pressurized capsules ride on air bearings driven by linear induction motors and axial compressors. Transportation analysts challenged the cost estimates included in the white paper, with some predicting that a realized hyperloop would be several billion dollars over budget. Hyperloop Transportation Technologies were considering in 2016 with the Indian Government for a proposed route between Chennai and Bengaluru, with a conceptual travel time for 345 km (214 mi) of 30 minutes.HTT also signed an agreement with Andhra Pradesh government to build India's first hyperloop project connecting Amaravathi to Vijayawada in a 6-minute ride. On 22 February 2018, Hyperloop One entered into a memorandum of understanding with the Government of Maharashtra to build a hyperloop transportation system between Mumbai and Pune that would cut the travel time from the current 180 minutes to 20 minutes. Indore-based Dinclix Ground Works' DGW Hyperloop advocates a hyperloop corridor between Mumbai and Delhi, via Indore, Kota, and Jaipur. The Ministry of Railways will collaborate with IIT Madras for the development of an "indigenous" Hyperloop system and will help set-up a Centre of Excellence for Hyperloop Technologies at IIT.

8. CONCLUSION

We are hoping that this article will revolutionize Rail Travel experience in INDIA and will write a new chapter in History of India. It will provide word class amenities and experience to our Indian customers at a price of A/C first class and but reducing travel time by more than half.

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WIRELESS POWER TRANSMISSION

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1. INTRODUCTION

Wireless power transmission has been attracting a wide range of subjects in various fields and also become a highly active research area because of their potential in providing high technology to our daily lives. The wireless power transmission will be mandatory to use in the near future because the technology enables the transmission of an electrical load across an air gap without interconnecting wires. Electricity energy needs to be transported to the distribution lines through cords. One of the major issue in power transmission is the losses occurs during transmission and distribution process of electrical power due to the energy dissipation in the conductor and equipment used for transmission. As the demand increase day by day, the power generation and power loss are also increased. Therefore reducing transmission loss is very crucial because the saved power can be used as an alternative to minimize the cost. However, the concept of wireless power transfer even for charging batteries is not a new idea. It has been invented by researchers but not widely implemented yet. Wireless power transmission is revolutionizing the mode of electricity transmission to enable the reliable and efficient wireless charging of millions of everyday electronics devices with integrating a power source to an electrical load without the aid of wires. Such a transmission used in cases where interconnecting wires hazardous or inconvenient. In the early period different scientist proved different approaches to transfer power without physical connection between the source and appliance. Each type of wireless power transfer has its own

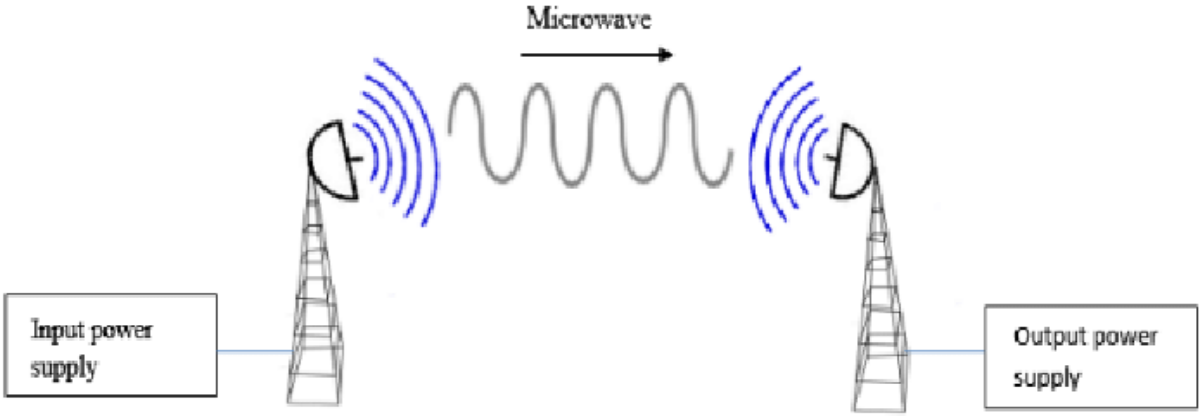
characteristics and applications. To make this idea for familiarize for new researchers we reviewed the background histories, recent technologies and future advances.

2. WIRELESS POWER TRANSFER

Wireless power transmission, also known as inductive power transfer, can be used for short range or even long range without cords. This technology provides efficient, fast, and low maintenance cost as compared to previous technologies. It also allows portable electronics to charge themselves without ever being plugged in ubiquitous power wire. On the other hand, power loss of this technology is very less compared to wired electricity transmission. The main function of wireless power transfer is to allow electrical devices to be continuously charged and lose the constraint of a power cord. There are three main systems used for wireless power transfer such as microwaves, resonance, and solar cells. Microwaves would be used to send electromagnetic radiation from a power source to a receiver in an electrical device.

3. MICROWAVE

Microwave wireless power transmission is a technology that uses microwave devices to convert electrical energy into electromagnetic energy and wirelessly transmit microwave electromagnetic energy in space through a transmitting antenna, and converts electromagnetic



energy into electric load after rectification, filtering, and other transformations. Microwave wireless power transmission technology has the advantages of high transmission power, strong environmental adaptability.

4. MAGNETIC RESONANCE

Magnetic resonance based wireless power delivery provides a harmless way for powering implantable biomedical devices. This technique uses two coils operating at the same frequency and transfers power via resonance based inductive coupling. Considering the operating cost and safety, high power transmission efficiency is crucial.

5. SOLAR PANELS

Wireless solar panels make solar easy and affordable for you to get into for a fraction of the cost of traditional home solar. You can put your solar panels on another property and reap benefits like they were on your own home.

6. RECENT TECHNOLOGIES

A. QI TECHNOLOGY

This technology uses the small inductors to transmit power over higher frequencies and also support a charging distance of a few centimeters at most. As a result, portable devices have to be placed quite specifically on the dock for avoiding the shortage of a large magnetic field.

B. ALLIANCE FOR WIRELESS POWER TECHNOLOGY

A4WP is a next generation of wireless power transfer enabling the efficient transfer of power to electronic devices. This is based on reference power transmitting and receiving resonators without the use of interconnecting wires. This technology allows multiple devices to be charged with differing power requirements from a single transmitter at any one time.

C.PMA TECHNOLOGY

Another most recent technology is Power Matters Alliance. This is the organization with the aim of forward thinking in a global, on-for-profit, industry where better power paradigm for battery equipped devices using wireless charging technology has been working with a bunch of research group leaders.

7. APPLICATIONS OF WIRELESS POWER TRANSMISSION

A.FIELD OF ELECTRONICS

Electronics that is the largest application field of using .Wireless charging system is being implemented in electronic products such as laptop by using a wireless power source deployed behind the corkboard.

B. MEDICAL DEVICES

Wireless power transmission has been widely used for implanted medical devices including LVAD heart assist pumps, pacemakers, and infusion pumps. With using this technology, the power can be efficiently supplied to medical devices deeply implanted within the human body.

C.ELECTRICAL VEHICLES

Rechargeable hybrid and battery electric vehicles can be directly powered with wireless charging systems. These systems deliver 3.3kW at high efficiency over a distance of 20cm.With this technology, it enables the reliable and efficient power transmission to electric vehicles without the aid of wires.

D. LED LIGHTING

With using wireless power transmission in LED lights, we can directly charge our devices using wireless electricity so it can eliminate the need for batteries in under cabinet task lighting.

E. DEFENSE SYSTEM

To improve the reliability, ergonomics, and safety of electronic devices by wireless charging in the defense systems designers are creating new design for the future defense technology.

F. SOLAR POWER SATELLITES (SPS)

It is the largest applications of WPT by using satellites with giant solar arrays and placing them in geosynchronous earth orbit .These satellites play a pivotal role to generate and transmit the power as microwaves to the earth.

8. ADVANTAGES

- Need for grids, substations etc are eliminated
- Low maintenance cost.

9. DISADVANTAGES

- It is radioactive in nature
- Distance constraint, initial cost is high

DATA ACQUISITION SYSTEM

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1. INTRODUCTION

Data acquisition is the process of sampling signals that measure real-world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer. Data acquisition systems, abbreviated by the acronyms *DAS*, *DAQ*, or *DAU*, typically convert analog waveforms into digital values for processing. The components of data acquisition systems include:

- Sensors, to convert physical parameters to electrical signals.
- Signal conditioning circuitry, to convert sensor signals into a form that can be converted to digital values.
- Analog-to-digital converters, to convert conditioned sensor signals to digital values.

In 1963, IBM produced computers that specialized in data acquisition. These include the IBM 7700 Data Acquisition System, and its successor, the IBM 1800 Data Acquisition and Control System. These expensive specialized systems were surpassed in 1974 by general-purpose S-100 computers and data acquisition cards produced by Tecmar/Scientific Solutions Inc. In 1981 IBM introduced the IBM Personal Computer and Scientific Solutions introduced the first PC data acquisition products.

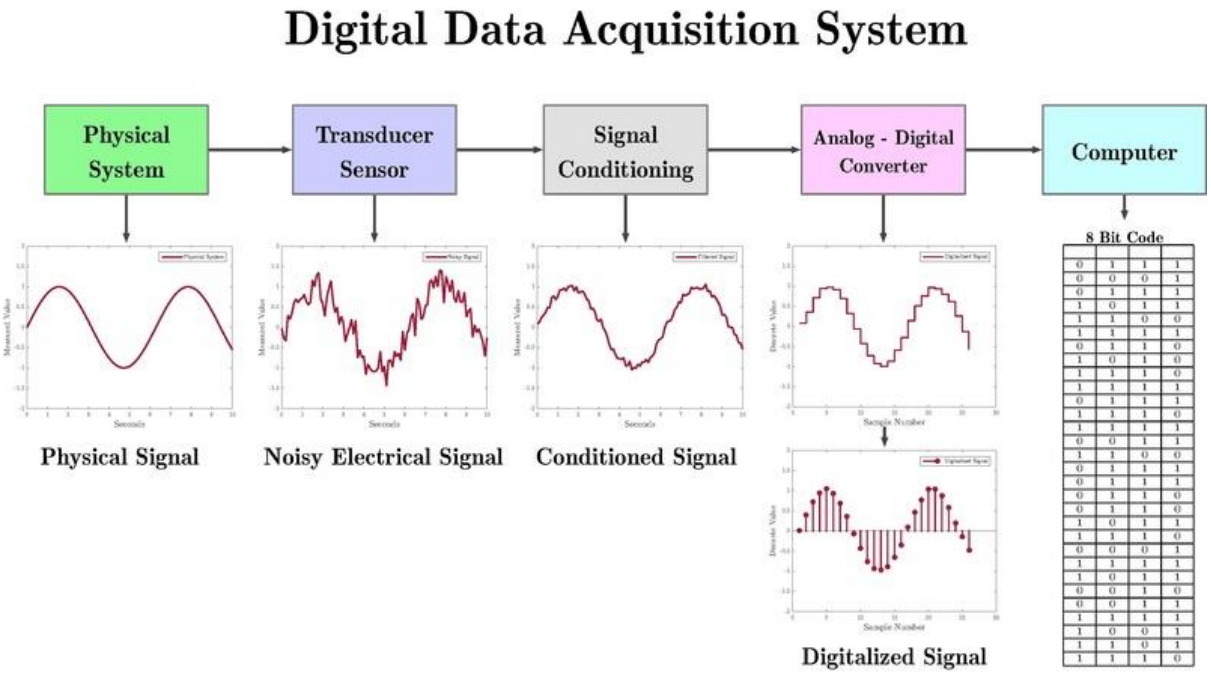
2. METHODOLOGY

A. SOURCES AND SYSTEMS

Data acquisition begins with the physical phenomenon or physical property to be measured. Examples of this include temperature, vibration, light intensity, gas pressure, fluid flow, and force. Regardless of the type of physical property to be measured, the physical state that is to be measured must first be transformed into a unified form that can be sampled by a data acquisition system. The task of performing such transformations falls on devices called *sensors*. A data acquisition system is a collection of software and hardware that allows one to measure or control the physical characteristics of something in the real world. A complete data acquisition system consists of DAQ hardware, sensors and actuators, signal conditioning hardware, and a computer running DAQ software. If timing is necessary (such as for event mode DAQ systems), a separate compensated distributed timing system is required.

A sensor, which is a type of *transducer*, is a device that converts a physical property into a corresponding electrical signal (e.g., strain gauge, thermistor). An acquisition system to measure different properties depends on the sensors that are suited to detect those properties. Signal conditioning may be necessary if the signal from the transducer is not suitable for the DAQ hardware being used. The signal may need to be filtered, shaped, or amplified in most cases. Various other examples of signal conditioning might be bridge completion, providing current or voltage

excitation to the sensor, isolation, and linearization. For transmission purposes, single ended analog signals, which are more susceptible to noise can be converted to differential signals. Once digitized, the signal can be encoded to reduce and correct transmission errors.



B. DAQ HARDWARE

DAQ hardware is what usually interfaces between the signal and a PC. It could be in the form of modules that can be connected to the computer's ports (parallel, serial, USB, etc.) or cards connected to slots (S-100 bus, AppleBus, ISA, MCA, PCI, PCI-E, etc.) in a PC motherboard or in a modular crate (CAMAC, NIM, VME). Sometimes adapters are needed, in which case an external breakout box can be used.

DAQ cards often contain multiple components (multiplexer, ADC, DAC, TTL-IO, high-speed timers, RAM). These are accessible via a bus by a microcontroller, which can run small programs. A controller is more flexible than a hard-wired logic, yet cheaper than a CPU so it is permissible to block it with simple polling loops. For example: Waiting for a trigger, starting the ADC, looking up the time, waiting for the ADC to finish, move value to RAM, switch multiplexer, get TTL input, let DAC proceed with voltage ramp.

Today, signals from some sensors and Data Acquisition Systems can be streamed via Bluetooth.

C. DAQ DEVICE DRIVERS

DAQ device drivers are needed for the DAQ hardware to work with a PC. The device driver performs low-level register writes and reads on the hardware while exposing API for developing user applications in a variety of programs.

3. TASKS PERFORMED BY DAS

In a data acquisition system (digital) the function of auxiliary equipment is performed by digital computer. A DAS utilizes a few basic capabilities of the computer to perform four major categories of task to be performed which are given below-

(i) Data acquisition

(ii) Data storage and retrieval

(iii) Data reduction and

(iv) Data presentation

(i) Data acquisition: The reading of data can be done automatically under control of the computer. This not only results in a substantial saving of time and effort, but also reduces number of errors in the data. When data are expected at irregular intervals, the computer can continuously scan all input sources and accept data when they are actually produced. If the data originate in analog form, the computer usually controls the sampling and digitizing process as well as identification and formatting of the data. In some cases, the computer can be programmed to reject unacceptable readings, sometimes the computer provides automatic calibration of each input source.

(ii) Data storage and retrieval: Computer has ability to store and retrieve large quantity of data. Without computer, the storage of large amount of information is space and time-consuming. Manual retrieval of the data is tedious, and for some types of information, almost impossible. The digital computer, however, can serve as an automated filling system in which information can be automatically entered as it is generated. These files can be stored and updated whenever necessary. Any or all of the information can be retrieved on command whenever desired and can be manipulated to provide output reports in tabular or graphic form to meet the needs of the user.

(iii) Data reduction and transformation: The sequence of numbers resulting from digitizing an analog signal such as scintillation would be quite useless if retrieved from the computer in raw form. To obtain meaningful information from such data, some form of data reduction or transformation is necessary to represent the data as a set of specific parameters. These parameters can then be analysed, compared with other parameters, or otherwise manipulated. For example, the scinti1lation signal can be subjected to Fourier transformation to obtain a frequency spectrum of the signal. Further analysis can then be performed using the frequency related parameters rather than the raw scintillation data. The size and complexity of the transformation and reduction problems are such that manual methods would be completely impractical.

(iv) Data presentation: An important characteristic of any data acquisition system and data-processing system is its ability to present the results of measurements and analysis to its user in the most meaningful. A computer based DAS can provide information m a number of useful forms. Table print outs, graphs and charts can be produced automatically, with features as clearly labelled using both alphabetic and numeric symbols. If the necessary computer peripherals are available, plots and cathode-ray-tube displays can also be generated. In addition the computer can be programmed to organize the data for presentation in the most meaningful form possible thus providing the user with a clear and accurate report of his results.

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HISTORY OF PV CELLS IN INDIA

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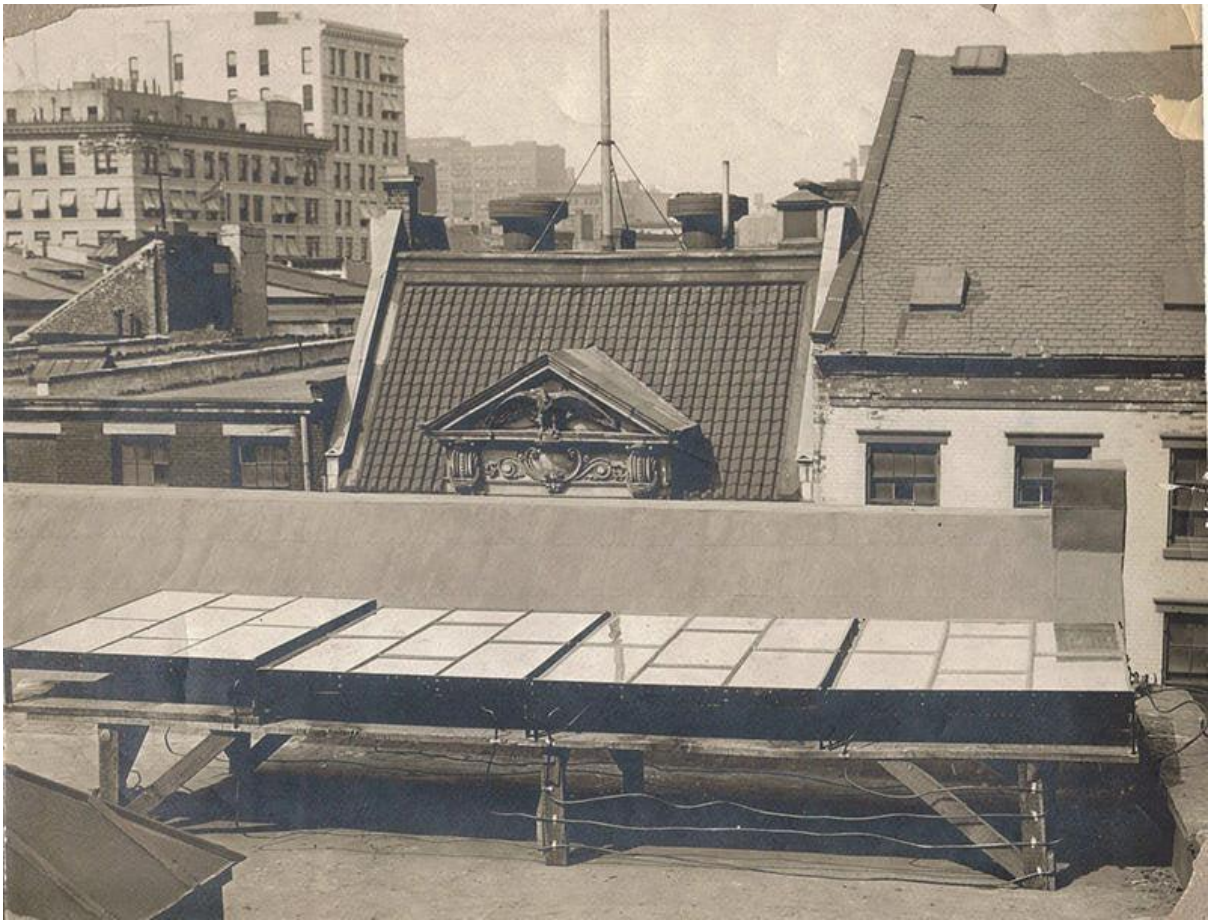

Long earlier than the primary Earth Day turned into celebrated on April 22, 1970, producing focus approximately the surroundings and guide for environmental protection, scientists have been making the primary discoveries in sun energy. It all commenced with Edmond Becquerel, a younger physicist operating in France, who in 1839 found and determined the photovoltaic effect— a technique that produces a voltage or electric powered present day while uncovered to mild or radiant energy. A few many years later, French mathematician Augustin Mouchot turned into stimulated via way of means of the physicist`s work. He commenced registering patents for sun-powered engines with inside the 1860s. From France to the U.S., inventors have been stimulated via way of means of the patents of the mathematician and filed for patents on sun-powered gadgets as early as 1888.

Take a quick trip back to 1883, when New York inventor Charles Fritts coated selenium with a thin layer of gold to produce the first solar cell. The selenium module reportedly generated a current that was "continuous, consistent, and of

enormous force," according to Fritts. An energy conversion rate of 1% to 2% was reached by this cell. The majority of contemporary solar cells operate at a 15–20% efficiency. Fritts therefore produced a low effect solar cell, but it nonetheless marked the start of American innovation in photovoltaic solar panels. The more scientific term for converting light energy into electricity, photovoltaic, is used interchangeably with the term photoelectric. It is named after the Italian physicist, chemist, and pioneer of electricity and power, Alessandro Volta.

Although photovoltaics (PV), which gave rise to the idea of solar energy, has a lengthy history, solar energy has found a vibrant and established place in today's clean energy economy. It's simple to forget that getting solar meant something entirely different even only 15 years ago given how much the cost of solar has dropped over the previous ten years. Let's examine the history of silicon solar technology and travel back a few centuries to the beginnings of solar PV. Solar Photovoltaic Cell Basics. A photovoltaic (PV) cell, also known as a solar cell, can either reflect, absorb, or pass through light that strikes it. The semiconductor material that makes up the PV cell can conduct electricity more effectively than an insulator but not as effectively as a good conductor like a metal. In PV cells, a variety of semiconductor materials are employed.

When a semiconductor is exposed to light, the light's energy is absorbed and transferred to the material's negatively charged electrons. The additional energy enables the electrons to move as an electrical current through the substance. This current may be utilised to power your house and the rest of the electric grid by extracting it through conductive metal contacts, which are the grid-like lines on a solar cell.

The bandgap of PV semiconductors, which describes what wavelengths of light the substance can absorb and convert to electrical energy, is a crucial feature. A semiconductor may efficiently utilise all of the available energy if its bandgap matches the wavelengths of the light shining on a photovoltaic cell.

An indicator of how well a PV cell converts energy from one form to another is the amount of electrical power it produces in relation to the energy from the light shining on it. This simple measurement is used to determine a PV cell's efficiency. The properties of the light source, including its intensity and wavelengths, as well as a number of cell performance variables, determine how much electricity is generated by PV cells.

The bandgap of PV semiconductors, which describes what wavelengths of light the substance can absorb and convert to electrical energy, is a crucial feature. A semiconductor may efficiently utilise all of the available energy if its bandgap matches the wavelengths of the light shining on a photovoltaic cell.

A solar cell is a photoelectric cell that converts light energy into electrical energy. Specifically known as a photovoltaic or PV cell, the solar cell is also considered a p-n junction diode. It has specific electrical characteristics, such as current, resistance, and voltage that change under light exposure.Users can combine individual solar cells to create modules commonly known as solar panels. The single-junction solar cell made of silicon can produce a maximum open-circuit voltage. This

voltage is approximately 0.5 to 0.6 volts.A Solar cell is small, and when combined with a large solar panel, large amounts of renewable energy are generated. A solar cell is made up of boules of silicon.A solar cell, referred to as a photovoltaic cell is used to convert light energy into electricity. The effect it uses is the photovoltaic effect, which is a physical and chemical phenomenon. Did you know that individual solar cell devices are the main parts of photovoltaic modules? They are also called solar panels in the local language. Solar cells are photovoltaic, whether the energy source is sunlight or artificial light. They are useful in producing energy and electromagnetic radiation, and measuring light intensity. The operation of PV cells needs three main things-

1. Excitons, absorption of light, and plasmons or unbound electron-hole pairs.
2. Charge carrier separation.
3. Extraction of carriers to an external circuit.

The most commonly-used semiconductor materials for PV cells:

Silicon

Silicon is the most common semiconductor material used in solar cells, accounting for approximately 95% of the modules sold today. It is also the second most abundant substance on earth (after oxygen) and the most common semiconductor used in computer chips. A crystalline silicon cell consists of silicon atoms bonded together to form a crystal lattice. This grid provides an organized structure that makes the conversion of light to electricity more efficient. Silicon solar cells now combine high efficiency, low cost and long life. The module is expected to last over 25 years and still produce over 80% of its original output.

A NEW METHOD OF NETWORK SOLUTION: COMPLEX NETWORK THEORY

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ABSTRACT: - Due to rapid increase of load in the real world the total system may become unbalanced sometime and it causes the failure of the electrical grid. To overcome this drawback complex network theory is introduced. This is a new ongoing research process by which we can increase the vulnerability and reliability of an interconnected network. Sometime in a complex network system there may occur a cascade failure or blackout. To prevent this cascade failure we use complex network theory. It is basically a network graph. In this article we will discuss how we can implement this method in real supply system.

Index Terms: - Cascading failure, Complex network, Efficiency, Cascading failure

1. INTRODUCTION

In 1735 Leonhard Euler solved the famous Konigsberg bridge problem i.e the introduction of graph theory. The progress of this graph theory leads to the research of complex network. We know, National grid is the grid which is the most complicated grid. Loads are increased day by day which increases the edges of grid system in present time. To solve that complex grid and improve the system stability we use complex network method.

2. EFFICIENCY IN POWER GRID

The basic function of power grid is to transmit the energy from generator to the customers. The power is distributed uniformly in whole network, so that we can say that power grid is a parallel system, where all the nodes in the network concurrently exchange packets of information (in power grid, the packet of information means electric power). However, the parameters, such as Capacitance(C) and Inductance (L) can only describe the sequential system, where only one packet of information goes along the network. In order to more precisely describe the topology, performance and function of the power grid, the concept of efficiency is introduced in the study of power grid.

3. MECHANISM OF CASCADING FAILURE

The simple mechanism of cascading failure can be described as: If one or more components (vertex or edge) overloaded and hence failed after a disturbance, the load of failed components will be transferred and redistributed to other normal ones, and the equilibrium of the load flow will consequently change. If more than one component will fail when load on them exceeds their maximum capacity, then this mechanism can result in a cascading failure, and finally brings the network's collapse and a large blackout.

4. POSSIBLE DIRECTION IN FUTURE STUDY

Although the development and advances in complex network theory in the past few years are really fruitful and amazing, there is much to be done in this area in the future. And the application of this theory in the research of power grid is still in its infancy. Several directions are proposed here to be conducted further study. The complex network theory and the real-world power system need to be combined more compactly. These two disciplines have been developed respectively for a long time, and a relatively integral and comprehensive knowledge system has already been created and verified. But the application of complex network theory in power grid has only experienced a short period of a few years. Many of the unique features in power industry are not clearly and exactly reflected and simulated by this original theory.

5. CONCLUSION

Complex network theory provides a totally original perspective for us to study the power grid in a new way. The discussion of the conceptions, which are introduced from complex theory to power grid, can help us better understood the topology, performance and process in power system from a global network level. This is of significant sense for analysing the interconnected large-scale power grid in the interactive wide area system.

STAND-BY GENERATOR MAINTENANCE PROGRAM FOR DIESEL

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1. INTRODUCTION

Today's electrical grid delivers reliable electricity to millions of homes and businesses. However, electrical failures that affect large geographic areas do happen on a recurring basis due to hurricanes, floods, or major equipment failures. Local outages that affect smaller numbers of people happen much more often. For individual households, such power outages are often just an inconvenience. But for hospitals and other healthcare facilities, however, they can be life threatening. For businesses like data centers, these outages can be extremely costly. Having a well-designed and well maintained standby power system is the best protection against utility power outages. Diesel powered generators provide the most reliable form of emergency backup power, and can start/assume full rated load in less than 10 sec. While backup generators typically can go 30,000 hr or more between major overhauls, even the best system needs to be exercised and maintained on a regular basis to make sure it operates properly when needed. When standby Generators fail to start or perform as designed; it is usually due to faulty maintenance procedures or neglect.

2. MAIN REASON OF FAILURE

In fact, the top three reasons standby generators fail to automatically start or run are:

• The generator START switch was left in the OFF position instead of AUTO.

• Starting batteries were dead or insufficiently charged.

• The fuel filter was clogged due to old or contaminated fuel.

All of these common issues can be eliminated with a regular generator maintenance routine performed by properly trained personnel.

3. PREVENTIVE MEASURES

Because of the durability of diesel engines, most maintenance is preventive in nature and consists of the following operations:

• General inspection
• Lubrication service
• Cooling system service
• Fuel system service
• Servicing and testing starting batteries
• Regular engine exercise

It is generally a good idea to establish and adhere to a schedule of maintenance /service based on the specific power application and the severity of the environment.

4. GENERAL INSPECTION

When the generator set is running, operators need to be alert for mechanical problems that could create unsafe or hazardous conditions. Following are several areas that should be inspected frequently to maintain safe and reliable operation.

• ***Exhaust system***: With the generator set operating, inspect the entire exhaust system, including the exhaust manifold, muffler, and exhaust pipe. leaks at all

connections, welds, gaskets, and joints should be checked and it is to be made sure that the exhaust pipes are not heating surrounding areas excessively. Repair any leaks immediately. Immediate checking for excessive smoke upon starting should be done: It can indicate possible performance and air quality issues that may require immediate
Attention.

• ***Fuel system*:** With the generator set operating, inspect the fuel supply lines, return lines, filters, and fittings for cracks or abrasions. It is to be made sure the lines are not rubbing against anything that could cause an eventual failure. Instant Repairing of any leaks or altering line routing is required to eliminate wear immediately.

• ***DC electrical system***: Check the terminals on the starting batteries to make sure the connections are clean and tight. Loose or corroded connections create resistance, which can hinder starting.

• ***Engine***: Monitor fluid levels, oil pressure, and coolant temperatures frequently. Most engine problems give an early warning. Look and listen for changes in engine performance, sound, or appearance that will indicate that service or repair is needed. Be alert for misfires, vibration, excessive exhaust smoke, decreases in power, or increases in oil or fuel consumption.

• ***Control system***: Inspect the control system regularly, and make sure it is logging data properly during engine exercise. Be sure to return the control system back to normal automatic standby (AUTO) when testing and maintenance are completed.

5. LUBRICATION SERVICE

Check the engine oil level when the engine is shut down at the interval.. For accurate readings on the engine‘s dipstick, shut off the engine and wait approximately 10 min. to allow the oil in the upper portions of the engine to drain back into the crankcase. Follow the engine
manufacturer‘s recommendations for API oil classification and oil viscosity. Keep the oil level as near as possible to the ―full‖ mark on the dipstick by adding the same quality and brand of oil. Change the oil and filter at the intervals. Check with the engine manufacturer for procedures for draining the oil and replacing the oil filter. Used oil and filters must be disposed of properly to avoid environmental damage or liability.

6. COOLING SYSTEM SERVICE

Check the coolant level during shutdown periods at the interval. Remove the radiator cap after allowing the engine to cool, and, if necessary, add coolant until the level is about 3/4 in. below the radiator cap‘s lower sealing surface. Heavy duty diesel engines require a balanced coolant mixture of water, antifreeze, and coolant additives. Use the coolant solution recommended by the engine manufacturer. Inspect the exterior of the radiator for obstructions, and remove all dirt or foreign material with a soft brush or cloth. Use care to avoid damaging the fins. If available, use low pressure compressed air or a stream of water in the opposite direction of normal air flow to clean the radiator. Check the operation of the coolant heater by verifying that hot coolant is being discharged from the outlet hose.

7. FUEL SYSTEM SERVICE

Diesel is subject to contamination and deterioration over time, and one reason for

regular generator set exercise is to use up stored fuel before it degrades. In addition to other fuel system service recommended by the engine manufacturer, the fuel filters should be drained. Water vapour accumulates and condenses in the fuel tank — and also must be periodically drained from the tank along with any sediment present. Bacterial growth in diesel fuel can be an issue in warm climates. Consult the generator set manufacturer or dealer for recommendations on treating stored fuel with a biocide. Regular testing and fuel polishing may be required if the fuel is not used and replenished in three to six months. The charge air cooler piping and hoses should be inspected regularly for leaks, holes, cracks, or loose connections. Tighten the hose clamps as necessary. In addition, inspect the charge air cooler for dirt and debris that may be blocking the fins. Check for cracks, holes, or other damage. The engine air intake components should be checked at the interval. The frequency of cleaning or replacing air cleaner filter elements is primarily determined by the conditions under which the generator set operates. Air cleaners typically contain a paper cartridge filter element that can be cleaned and reused if not damaged.

8. CONCLUSION

Generator sets on continuous standby must be able to go from a cold start to being fully operational in a matter of seconds. This can impose a severe burden on engine parts. However, regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts, uses up fuel before it deteriorates, and, in general, helps provide reliable engine starting. Periods of no load operation should be held to a minimum because unburned fuel tends to accumulate in the exhaust system.

SMART POWER GENERATION (Towards a new low carbon power system)

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Electricity demand fluctuates depending on the time of day, the day of the week, and the season of the year Current power systems have been designed to handle these variations. ut it is becoming increasingly problematic to match power generation with the ever growing demand. Wind and solar power are by nature intermittent. As wind conditions change, the output of wind power varies accordingly. This has to be balanced by other power plants. For example, when the wind speed calms from 10 m/s to 7 m/s - which can happen many times a day and within a time frame of less than 15 minutes - the output of modern large wind turbines is reduced by 60%. Imagine a fleet of e.g. 100 GW of wind power, which is being planned in many regions of the world, reducing the output with 60 GW in 15 minutes! How will the power system handle this? Obviously, current power systems have not been designed for such variations. This type of operation would cause serious sub-optimisation, increased generation costs. And insufficient C02 reductions. Forecasting the magnitude and speed of wind and solar power variations is complicated and the inaccuracy just an hour ahead is considerable. Therefore, the low carbon power system of the future must be capable of continuously balancing such rapid, large scale variations. Wind-based electricity production does not follow power demand. In a power system with a high share of wind power, nights with high wind are particularly challenging since the major part of the thermal power production would have to be stopped. Furthermore, weather conditions In Europe, for example, are such that low pressure fronts arriving from the west result in high winds simultaneously across the continent. Therefore, wind power cannot balance itself over larger geographical regions. And thus is a problem that cannot be solved by any grid solution. The current power systems. Which consist mainly of non-flexible steam power plants, need to be complemented with dispatchable, dynamic capacity to overcome this problem. There must be the capability for frequent system balancing on a large scale in the form of fast starts, stops and load ramps. The low carbon power system of the future will require a capacity which corresponds to - 50% of the installed intermittent power capacity.

Human Bodies Glow — We Just Can't See It

They tell you to shine bright like a diamond, but that's challenging when the human body doesn't actually shine — or does it? Scientists found that people have their own kind of bioluminescence. It's just not visible to the naked eye.