K S R Institute for Engineering and Technology

Department of Electrical and Electronics Engineering

BEES Magazine

August 2022

Department of EEE

BEES

Together We make the Difference

Program Outcomes (POs)

PO1	**Engineering Knowledge:**Applythe knowledge of mathematics, science, and engineering fundamentals to solve thecomplex electrical engineering problems.
PO2	**Problem Analysis:**Identify, formulate, reviewresearchliterature, andanalyzecomplex Electrical and Electronics Engineering problems enabling attainment of conclusions usingfirst principles of mathematics, natural sciences,andengineering sciences.
PO3	**Design/Development of Solutions:**Designsolutions, components or processforcomplexElectricalEngineeringproblemsto meet thespecifiedneedsconsideringpublichealth, safety and environmental considerations.
PO4	**Conduct Investigations of complex problems:** Exerciseresearchknowledge and technical methodology for design,analysisandinterpretationof data to converge to a suitable solution.
PO5	**Modern Tool Usage**: Use modern engineering tools, softwares and equipments to predict, analyze and model engineering problems.
PO6	**The Engineer & Society:** Apply reasoning skills toassesssocietal,health,safety,legalandculturalissuesrelevanttotheprofessional engineering practice and take consequent responsibilities in the society
PO7	**Environment and Sustainability:** Realize theimpactoftheprofessionalengineering solutions anddemonstrate the knowledgeforsustainable developmentin environmental context
PO8	**Ethics:** Apply and realize theprofessionalethicsandresponsibilities in Electrical engineering practice.
PO9	**Individual and Team Work:** Exhibit Individuality, Leadership and Team spirit in multidisciplinarysettings.
PO10	**Communication:** Communicate, comprehend, write reports, design documentation and presentation effectivelyoncomplexengineeringactivities
PO11	**Project Management & Finance:** Demonstrate the Electrical engineeringandmanagementprinciples adhering to financial strategies to manage projects as a member or leader in a team
PO12	**Life Long Learning:** Inculcate independent and life-long learning inthebroadest context oftechnological change.

Program Specific Outcomes (PSOs)

PSO 1: Electrical drives and control: Graduates will Analyze, design and provide Engineering solutions in the field of Power Electronics and Drives

PSO 2: Embedded system: Graduates will Simulate, experiment and solve complex problems in Embedded System.

KSR INSTITUTE FOR ENGINEERING AND TECHNOLOGY

VISION

To become a globally recognized Institution in Engineering Education, Research and Entrepreneurship.

MISSION

- ❖ Accomplish quality education through improved teaching learning process.
- ❖ Enrich technical skills with state of the art laboratories and facilities.
- ❖ Enhance research and entrepreneurship activities to meet the industrial and societal needs.

Department of EEE

VISION

To produce world class Electrical and Electronics Technocrats and Entrepreneurs with social responsibilities.

MISSION

- ❖ Impart quality education in the field of Electrical and Electronics Engineering through state of the art learning ambience.
- ❖ Enrich interdisciplinary skills and promote research through continuous learning.
- ❖ Enhance professional ethics, entrepreneurship skills and social responsibilities to serve the nation.

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Together We Make Difference

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SMART WATCH

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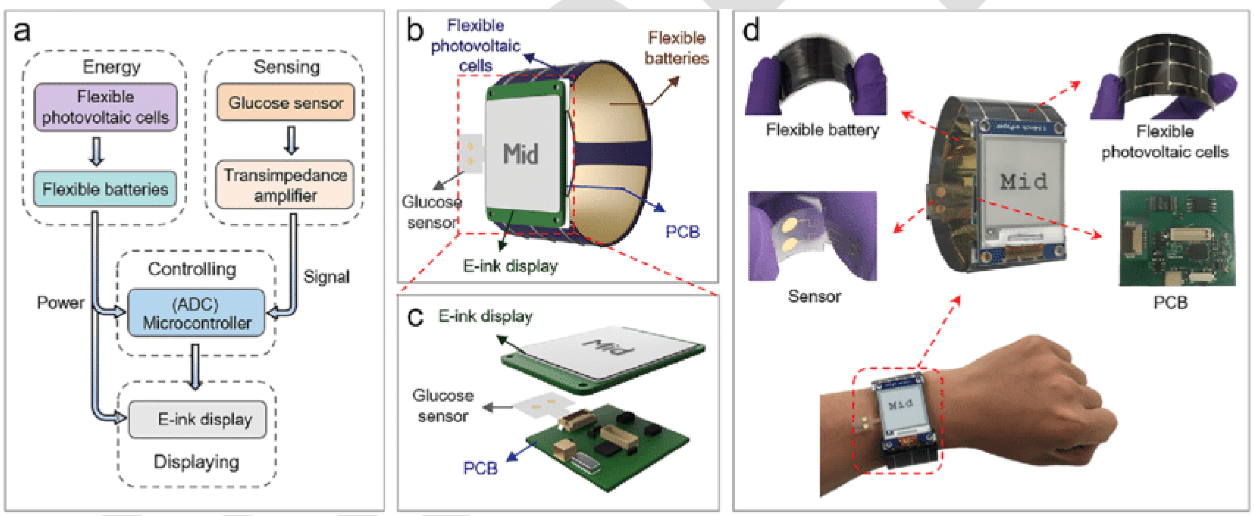
III-EEE

SIVASANKAR M S
III-EEE

Introduction:

Wearable smart devices are already amongst us. Smartwatches are one of the key factors of the wearable technology and are being used by alarge population of consumers. Smartwatches are trending devices that give its users the ability to be connected, send/receive emails and messages, andeven make calls on the go. Given the phone has been picked out from pocket and now is on hands, a person still needs to do some steps such as unlocking the phone, finding the app. The numbers of steps involved in checking notifications in smart phone are high and thus a smart watch device is helpful. Smart watches that are already in this market are advanced and costly.The system we are developing is very small size and low cost. This watch is programmed using Arduino'sopen-source libraries and functions. It provides the user another way to interact with the smart phone.

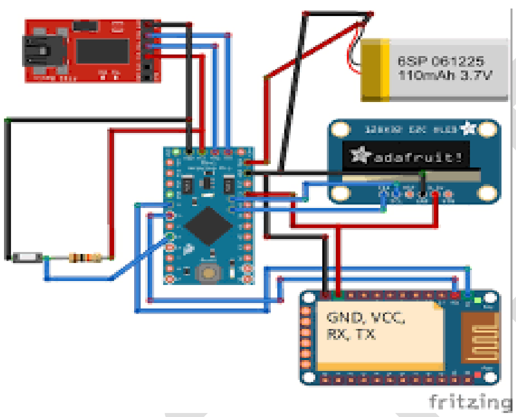


Features of Smart Watch:

The smart watch is developed with minimum cost. The watch will perform all the normal watch stuff such as showing day, date, time. It will also have an alarm and a stopwatch. Along with this the watch will be able to read data from mobile and display it on the watch screen using Bluetooth. It will display all the notifications on the smart phone and will also notify user if they receive phone calls. This will make easy for user to read their messages, emails, and receive phone calls.

With the increasing demand in the market for smart devices, the demand for smart watch is increasing. As the new technology is being invented, it is getting cheaper as the time progresses. With this we can say that with time cheap products are getting good and good products are getting cheap. Even the smart watch developed is cheap when considered with other watches in the market. This smart watch can displaydate, day and time. Along with this basic feature it can also be connected to the smart phone using a Bluetooth which will be helpful to display notifications received on the mobile device on the watch. Along with this it can also store three to seven messages in the memory.

It can store small number of messages because of the limited memory space it had. Finally we can say that the watch can perform functions which will help the user from not constantly checking their phones intern they can check their watch to see if they have received any important message or not which will save the users time as they won't waste time checking unwanted messages on the mobile



Applications:

1. Heart rate, Blood oxygen level, Blood pressure, Temperature monitoring.
2. Contactless Payment.
3. Digital wallet applications.
4. Messaging and calling.
5. Emergency calls for Assistance.
6.social media and notifications.
7. Games, Music, Photos.
8. GPS Tracking.
9. Location features.

Market Survey:

According to Allied Market Research, the smart watches segment is predicted to rise at the highest pace, with a CAGR of 19.9%. The health & sports segment led the wearable technology trends with over 39 % market share in 2015, and this is expected to continue during the forecast period (2015-2022). During the projected span, however, the entertainment market is expected to expand at the fastest rate of 35.7%.

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ELECTRIC VEHICLE TECHNOLOGY

KAVIMANI K
III-EEE

NITHISH KUMAR P
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Vehicle Overview:

Electric vehicle technology has advanced rapidly since its introduction, and today there are many plug-in hybrid and battery electric vehicle options available on the market. But how, exactly, do electric vehicles work and what are their advantages?

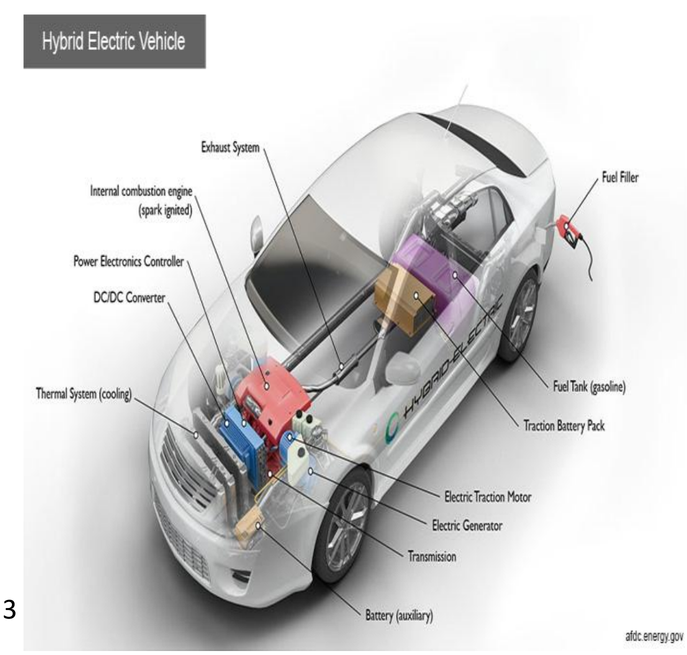
Let's start by considering the legacy vehicle technology: the internal combustion engine, or ICE. This vehicle is propelled by a combustion engine that can only be fueled by gasoline. The technology is conventional, well-established, and reliable, but it consumes large amounts of gasoline—which can be costly in many ways.

Enter the electric vehicle drive train! Unlike internal combustion technology—which uses combustion and pressure to propel a vehicle—electric vehicles, or EVs, are propelled by electromagnetism. These vehicles use electricity, typically stored in a battery, to power an electric motor. EV technology is used in hybrid electric vehicles, or HEVs; plug-in hybrid electric vehicles, or PHEVs; and battery electric vehicles, or BEVs.

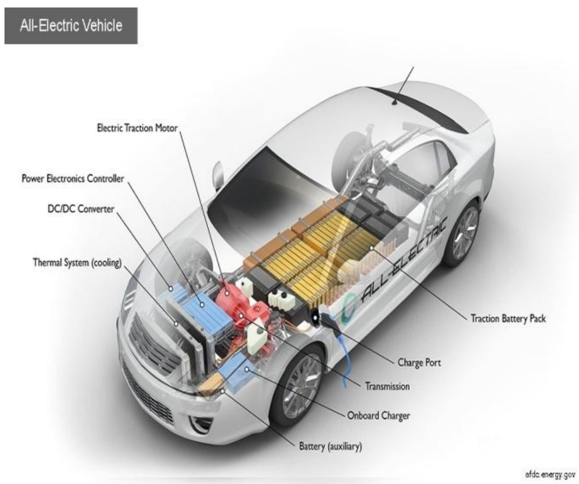
The hybrid electric vehicle was the first EV technology to reach the modern vehicle market. HEVs, such as the Toyota Prius and Lexus CT-200-H, are popular because of their increased fuel efficiency. These vehicles combine an internal combustion engine and an electric motor with a small battery for storing electricity. Although an HEV is only fueled by gasoline, the vehicle's battery is also used to power the electric motor. The electricity stored in the battery primarily comes from recapturing energy through regenerative braking. This use of recaptured energy is one of the reasons an HEV is more fuel-efficient than a typical ICE vehicle.

Like the original hybrid, the plug-in hybrid electric vehicle is propelled by an internal combustion engine and an electric motor. However, the PHEV has a much larger battery pack that can be charged using electric vehicle supply equipment, or EVSE. This enables the vehicle to operate in all-electric mode—in which the vehicle is propelled using only the electric motor—until the battery is mostly depleted. At this point the vehicle operates in hybrid mode until the fuel in the gas tank is depleted. Increasing the battery size and running the vehicle on electricity reduces tailpipe emissions and increases the vehicle's fuel- and energy-efficiency.

The final type of electric vehicle technology is the battery electric vehicle. This vehicle has no internal combustion



engine and is powered only by the battery and electric motor. BEVs don't use gasoline and are only charged by EVSE. A BEV has the largest battery of all the vehicle types. It's also the most energy efficient and produces zero tailpipe emissions.



Vehicle Ranges:

Because each vehicle type incorporates different technologies, the range these vehicles can travel differs as well. ICE vehicles—fueled only on gasoline—typically can travel 350 to 450 miles on a full tank of gas.

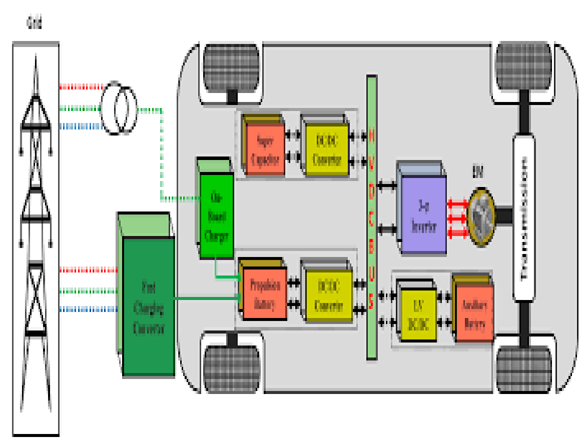
Hybrid electric vehicles are more efficient in their use of gasoline and typically can travel 550 to 700 miles. Although they do have a battery and electric motor, this battery is only fueled during a typical drive cycle and is not a primary source of propulsion. However, due to regenerative braking, this small battery is the primary reason for the hybrid's increased fuel efficiency and range.

The larger battery in a plug-in hybrid electric vehicle enables the vehicle to operate in all-electric mode, typically traveling 20 to 40 miles just on electricity. PHEVs are designed to support average daily commutes and easy overnight recharging using a standard outlet. After most of the energy in the battery is depleted, the vehicle can operate in hybrid mode for longer distances, running off gasoline and using a small portion of the battery to support the electric drive train, for a full vehicle range of 450 to 550 miles.

Finally, a battery electric vehicle has the simplest and most efficient drive train with a typical battery range of 150 to 300 miles. BEVs can be charged overnight using standard residential Level 2 EVSE.

EV Regenerative Braking Modes:

The most noticeable difference between driving an electric vehicle and a conventional ICE vehicle is regenerative braking. Regenerative braking means the electric motor is operated in reverse, thereby applying a braking force through electromagnetism. This recaptures some of the vehicle's kinetic energy by charging the battery. Some electric vehicle models have specific driving modes that incorporate



varying levels of regenerative braking.

Under normal driving conditions, an EV such as the Tesla Model S engages regenerative braking to slow the vehicle when the driver removes their foot from the accelerator. The “Standard” setting provides the maximum amount of regenerative braking power— it recaptures the most energy and reduces wear and tear on the brakes. Alternately, the “Low” setting incorporates a reduced regenerative braking force that recaptures less energy but allows the vehicle to coast farther than in the “Standard” mode.

An EV like the Tesla Model S also has specific settings for how the braking systems operate when the vehicle is stopped or moving at very low speeds. The “Creep” mode is designed to replicate the idling speed of an ICE vehicle. It disengages regenerative braking and applies a small amount of motor torque when stopped or at low speeds when the driver's foot is off the accelerator. This feature is most commonly used in a parking lot when searching for a place to park.

Alternately, the “Roll” setting also disengages regenerative braking at low speeds but does not apply motor torque. This allows the vehicle to roll freely, similar to a vehicle in neutral.

Finally, the “Hold” setting continues to engage regenerative braking until the vehicle comes to a complete stop, which helps reduce brake wear and produces the greatest amount of recaptured energy. This feature also automatically engages the friction brakes when the vehicle is completely stopped, holding the vehicle in place until the driver's foot is placed on the brake or the accelerator.

In all of these braking modes, the brake pedal is always available and operates the same way as in a conventional vehicle under emergency braking conditions.

Regenerative braking modes vary with each vehicle make and model. For example, the Nissan Leaf provides three levels of regenerative braking modes, and the Chevrolet Bolt's system involves depressing paddles next to the steering wheel to maximize regenerative braking and bring the vehicle to a complete stop.

EVSE Types:

All plug-in electric vehicles, including plug-in hybrids and battery electric vehicles, use electric vehicle supply equipment, or EVSE, to charge their batteries.

There are three common types of EVSE. The first is referred to as a Level 1 charger. Typically, these units are portable cord sets that run off a standard 120-volt household outlet, and provide approximately 2 to 5 miles of range per hour of charging. This is the most affordable type of charger, but it is limited in the daily range it can supply to a vehicle. Therefore, this application is most common for PHEVs with smaller batteries, or for BEV drivers with a short daily commute to work.

Level 2 chargers provide more energy per hour and run off 208 or 240 volts. These chargers are more expensive and are typically installed as permanent pedestal-style or wall-mounted units. They provide a vehicle with about 10 to 20 miles of range per hour of charging. This is the most common application for long-range BEVs, as well as workplace and public charging stations.

Finally, a DC Fast Charger is the most expensive type of charger, but it provides the most energy per hour to the vehicle. A standard DC Fast Charger can provide 60 to 80 miles of range in about 20 minutes. These chargers are most common along highways, and are only recommended to support occasional long-distance trips—because frequently charging the battery at such a high-power level can lead to battery degradation.

Reporting Energy Consumption:

For federal fleet vehicles, reporting energy consumption is a requirement of doing business. With ICE vehicles, fuel consumption is typically reported through the fuel card provider that records each fueling transaction.

However, electric vehicles can be charged on-site or off-site at wall outlets, simple EVSE units, and networked units. Therefore, the recommended method for measuring energy consumption—expressed in kilowatt-hours—is through telematics.

Telematics platforms commonly capture kilowatt-hours and display them in an online dashboard. A fleet manager can select a custom date range to find a vehicle's energy consumption in kilowatt-hours over a certain time period. This date range can be applied to all of the electric vehicles in a fleet, providing the information necessary for annual federal fleet reporting.

Networked or smart-EVSE units are another good source of energy consumption information. These units frequently have online dashboards, liketelematics, which capture energy consumption by vehicle. These dashboards are often accessible through smart phone applications as well. However, if the vehicle is occasionally charged on another network, the data from the primary EVSE unit may be incomplete. In this case, drivers should try to collect information from off-site charging stations to supplement the data from their primary EVSE unit.

The vehicles themselves also often display energy consumption or vehicle efficiency on their physical dashboard. Some vehicle models show lifetime energy consumption, so federal fleet managers will need to check the kilowatt-hours consumed annually to complete their FAST reports. However, if the vehicle displays the lifetime efficiency in miles per kilowatt-hour, fleet managers will need to divide the annual vehicle miles traveled by the vehicle efficiency to determine annual energy consumed.

(Annual miles)/ (miles/kWh) = annual kWh

Annual miles x kWh/mile = annual kWh

Conclusion:

Now that you know all about EV types, driving ranges, regenerative braking, drive trains, and charging, you are ready to drive your new electric vehicle.

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LITHIUM-ION BATTERY

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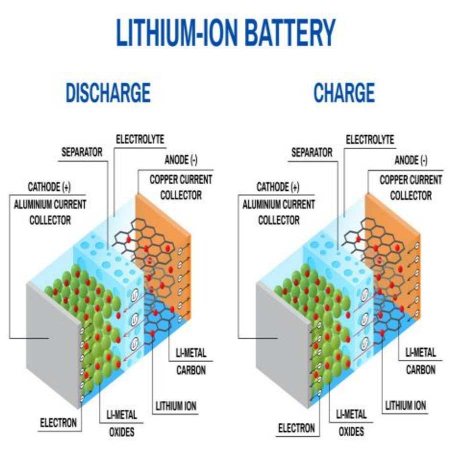
Introduction:

Lithium-ion batteries power the lives of millions of people each day. From laptops and cell phones to hybrids and electric cars, this technology is growing in popularity due to its light weight, high energy density, and ability to recharge.

So how does it work?

A battery is made up of an anode, cathode, separator, electrolyte, and two current collectors (positive and negative).



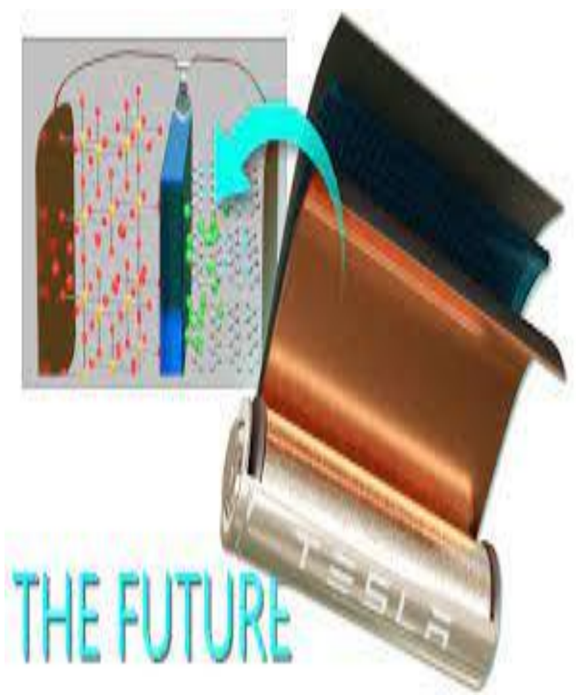
The anode and cathode store the lithium. The electrolyte carries positively charged lithium ions from the anode to the cathode and vice versa through the separator. The movement of the lithium ions creates free electrons in the anode which creates a charge at the positive current collector. The electrical current then flows from the current collector through a device being powered (cell phone, computer, etc.) to the negative current collector. The separator blocks the flow of electrons inside the battery.

Charge / Discharge:

While the battery is discharging and providing an electric current, the anode releases lithium ions to the cathode, generating a flow of electrons from one side to the other. When plugging in the device, the opposite happens: Lithium ions are released by the cathode and received by the anode.

Energy Density VS Power Density:

The two most common concepts associated with batteries are energy density and power density. Energy density is measured in watt-hours per kilogram (Wh/kg) and is the amount of energy the battery can store with respect to its mass. Power density is measured in watts per kilogram (W/kg) and is the amount of power that can be generated by the battery with respect to its mass. To draw a clearer picture, think of draining a pool. Energy density is similar to the size of the pool, while power density is comparable to draining the pool as quickly as possible.



Applications:

- ✓ Portable Electronic Devices
- ✓ Cellular Phones,
- ✓ Digital Cameras,
- ✓ Global Positioning devices,
- ✓ Tablets, and
- ✓ Laptops
- ✓ Pacemakers

Advantages:

- Durability
- Li-ion batteries store more power
- Lighter than most types of batteries
- Charging is easy
- Maintenance is low cost,
- When disposed lithium-ion battery cells cause almost no harm

Conclusion:

Whatever you need a Li-ion battery for, you can rely on its durability, recharge ability, safety, and long-lasting power supply. Lithium batteries have become a vital part of our everyday lives in so many ways.If you're looking to purchase lithium batteries for personal or commercial applications, you can rely on Eco Tree Lithium. The lithium-ion batteries they supply are designed in Europe and are the best and safest available.

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GPS (GLOBAL POSITIONING SYSTEM)

SWETHA T (07.04.2004)
II-EEE

SWETHA T (30.09.2004)
II-EEE

Global Positioning System:

The Global Positioning System was conceived in 1960 under the auspices of the U.S. Air Force, but in 1974 the other branches of the U.S. military joined the effort. The first satellites were launched into space in 1978. The System was declared fullyoperational in April 1995. The Global Positioning System consists of 24 satellites that circle the globe onceevery 12 hours, to provide worldwide position, time and velocity information. GPSmakes it possible to precisely identify locations on the earth by measuring distancefrom the satellites. GPS allows you to record or create locations from places on theearth and help you navigate to and from those places. Originally the System was designed only for military applications and it wasn't untilthe 1980's that it was made available for civilian use also.

Segments of GPS:

- Space segment
- Control segment
- User segment

How GPS Works?

When a GPS receiver is turned on, it first downloads orbit information of all theSatellites. This process, the first time, can take as long as 12.5 minutes, but oncethis information is downloaded; it is stored in the receivers' memory for future use.Even though the GPS receiver knows the precise location of the satellites in space,it still needs to know the distance from each satellite it is receiving a signal from.
That distance is calculated, by the receiver, by multiplying the velocity of thetransmitted signal by the time it takes the signal to reach the receiver. The receiveralready knows the velocity, which is the speed of a radio wave or 186,000 miles persecond (the speed of light).

To determine the time part of the formula, the receiver matches the satellitestransmitted code to its own code, and by comparing them determines how much itneeds to delay its code to match the satellites code. This delayed time is multipliedby the speed of light to get the distance.

The GPS receivers' clock is less accurate than the atomic clock in the satellite;therefore, each distance measurement must be corrected to account for the GPSreceivers' internal clock error.

Sources of GPS Error:

User mistakes account for most GPS errors:

Incorrect datum and typographicerrors when inputting coordinates into a GPS receiver can result in errors up tomany kilometers. Unknowingly relying on less than four satellites for determiningposition coordinates can also result in unreliable position fixes that can easily be offby a distance in excess of a mile. Even the human body can cause signalinterference. Holding a GPS receiver close to the body can block some satellitesignals and hinder accurate positioning. If a GPS receiver must be hand held withoutbenefit of an external antenna, facing to the south can help to alleviate signalblockage caused by the body because the majority of GPS satellites are orientedmore in the earth's southern hemisphere. A GPS receiver has no way to identify andcorrecting user mistakes.

Satellite clock errors:

Caused by slight discrepancies in each satellite's four atomicclocks. Errors are monitored and corrected by the Master Control Station.

Orbit errors:

Satellite orbit (referred to as "satellite ephemeris") pertains to thealtitude, position and speed of the satellite. Satellite orbits vary due to gravitationalpull and solar pressure fluctuations. Orbit errors are also monitored and corrected bythe Master Control Station.

Ionospheric interference:

The ionosphere is the layer of the atmosphere from 50 to500 km altitude that consists primarily of ionized air. Ionospheric interference causesthe GPS satellite radio signals to be refracted as they pass through the earth's atmosphere – causing the signals to slow down or speed up. This results ininaccurate position measurements by GPS receivers on the ground. Even thoughthe satellite signals contain correction information for Ionospheric interference, it canonly remove about half of the possible 70 nanoseconds of delay, leaving potentiallyup to a But this works only to a point. Fortunately, error causedby atmospheric conditions is usually less than 10 meters. This source of error hasbeen further reduced with the aid of the Wide Area Augmentation System (WAAS), aspace and ground based augmentation to the GPS (to be covered later).

Tropospheric interference:

The troposphere is the lower layer of the earth'satmosphere (below 13 km) that experiences the changes in temperature, pressure,and humidity associated with weather changes. GPS errors are largely due to watervapor in this layer of the atmosphere. Tropospheric interference is fairly insignificantto GPS.Receiver noise is simply the electromagnetic field that the receiver's internalelectronics generate when it's turned on. Electromagnetic fields tend to distort radiowaves. This affects the travel time of the GPS signals before they can be processedby the receiver. Remote antennas can help to alleviate this noise. This error cannotbe corrected by the GPS receiver.

Multipath interference:

Multipath interferenceis caused by reflected radio signals from surfaces near theGPS receiver that can either interfere with or be mistaken for the true signal thatfollows an uninterrupted path from a satellite. An example of multipath is theghosting image that appears on a TV equipped with rabbit ear antennas. Multipath isdifficult to detect and sometimes impossible for the user to avoid, or for the receiverto correct. Common sources of multipath include car bodies, buildings, power linesand water. When using GPS in a vehicle, placing an external antenna on the roof ofthe vehicle will eliminate most signal interference caused by the vehicle. Using aGPS receiver placed on the dashboard will always have some multipathInterference.

Selective Availability:

(S/A) was the intentional degradation of the satellite signalsby a time varying bias. Selective Availability is controlled by the DOD to limitaccuracy for non - U.S. military and government users and was originally institutedfor security reasons. In May, 2000, bowing to pressure from business and the WhiteHouse, the Pentagon set Selective Availability to zero. The Pentagon did not turnS/A off, but rather merely reduced the amount of signal interference to zero meters,effectively eliminating intentional position errors. The Pentagon retains the ability to reactivate S/A without notice to non-governmentGPS users. So, it's important to understand what Selective Availability is, and to beaware that it could be reactivated by the U.S. military at any time without priornotification.

Number of satellites visible:

The more satellites the receiver can "see", the betterEarth's AtmosphereSolid StructuresMetalElectro-magnetic Fieldsthe accuracy. Signal reception can be blocked by buildings, terrain, electronicinterference and sometimes dense foliage. The clear the view, to the receiver, thebetter the reception.

Satellite geometry:

This refers to the relative position of the satellites at any giventime. Ideal satellite geometry exists when the satellites are located at wide anglesrelative to each other. Poor geometry exists when the satellites are located in a lineor in a tight grouping.

Applications:

- Agriculture
- Aviation
- Environments
- Marine
- Public Safety & Disaster Relief
- Surveying
- Mobile Phones
- Robotics
- Military purpose

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SMART GRID

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KARTHICK E
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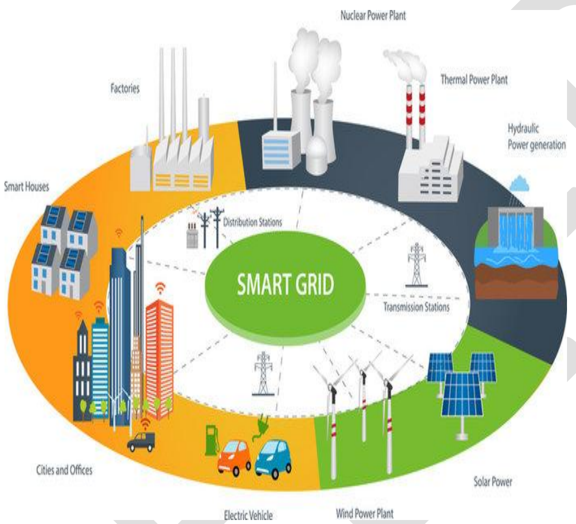
Introduction:

A Smart Grid is an electricity Network based on Digital Technology that is used to supply electricity to consumers via Two-Way Digital Communication. This system allows for monitoring, analysis, control and communication within the supply chain to help improve efficiency, reduce the energy consumption and cost and maximize the transparency and reliability of the energy supply chain.



Smart Grid & Need of Smart Grid?

A Smart Grid is an electricity network that can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic, and secureelectricity supplies.

- System (Generation, Transmission, Distribution) with an advanced two-way communications system
- Enables real-time monitoring and control
- Provide greater visibility and transparency
- Consequently, enables cost reduction and efficiency improvement

Smart Grid is based on Digital Technology that is used to supply electricity toconsumers via Two-Way Digital Communication. This system allows formonitoring, analysis, control and communication within the supply chain tohelp improve efficiency, reduce the energy consumption and cost andmaximize the transparency and reliability of the energy supply chain.

The flow of electricity from utility to consumer becomes a two-wayconversation, saving consumers money, energy, delivering more transparencyin terms of end-user use, and reducing carbon emissions.

Need for establishment of Smart Grid:

A smart grid distribution system, whose objective is to develop a power gridmore efficient and reliable, improving safety and quality of supply inaccordance with the requirements of the digital age.

- Higher Penetration of renewable resources or distributed generation

- Extensive and effective communication overlay from generation toconsumers
- Use of advanced sensors and high-speed control
- Higher operating efficiency.
- Greater resiliency against attacks and natural disasters

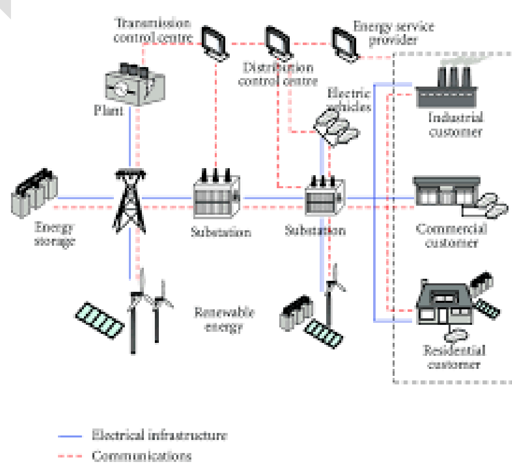
Automated metering and rapid power restorationprovided greater customer participationPresently the Indian Electricity System faces a number of challenges such as:

- Shortage of power
- Power Theft
- Poor access in rural areas
- Huge losses in the Grid
- Inefficient Power Consumption
- Poor reliability

To overcome these problems; smart grid is needed.

Application of SmartGrid:

The areas of application of smart grids include: smart meters integration, demand management, smart integration of generated energy, administration of storage and renewable resources, using systems that continuously provide and use data from an energy network.



Advantages of SmartGrid:

- ✓ Improved Reliability
- ✓ Higher asset utilization
- ✓ Better integration of (PHEVs)

- ✓ Reduced operating costs for utilities Increased efficiency and conservation
- ✓ Lower greenhouse gas and other emissions.

Pillars of Smart Grid:

I. Transmission Optimization
II. Demand Side Management
III. Distribution Optimization
IV. Asset Optimization
V. Five Key Aspects of Smart Grid

The Five Key aspects of smart grid development and deployment are, Computational Intelligence

- ➢ Power System Enhancement
- ➢ Communication and Standards
- ➢ Environment and Economics
- ➢ Test-bed
- ➢ Reliability Flexibility in Topology
- ➢ Efficiency
- ➢ Platform for advanced services.

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WIRELESS TRANSMISSION

SOUNDAR RAJAN S
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MAHALAKSHMI R
III-EEE

Introduction:

Unless you are particularly organized and good with tie wrap, you probably have afew dusty power cord tangles around your home. You may have even had to followone cord through the seemingly impossible snarl to the outlet hoping thatthe plug you pull will be the right one. This is one of the downfalls of electricity.While it can make people's lives easier, it can add a lot of clutter in the process. For these reasons, scientists have tried to develop methods of wireless powertransmission that could cut the clutter or lead to clean sources of electricity.

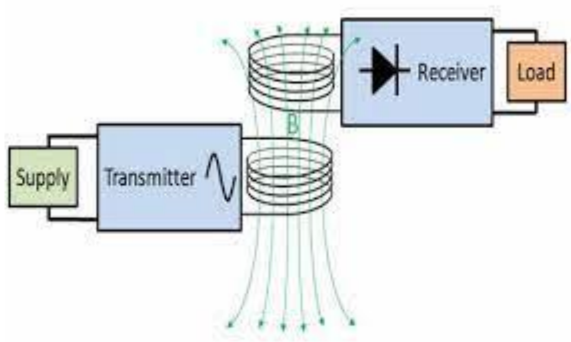
Researchers have developed several techniques for moving electricity over longdistances without wires. Some exist only as theories or prototypes, but others arealready in use.

These are:

- ➢ Short range,
- ➢ Moderate range,
- ➢ Long range.

Short Distance Induction:

`These methods can reach at most a few centimetersthe action of an electricaltransformer is the simplest instance of wireless energy transfer. The primary andsecondary circuits of a transformer are electrically isolated from each other. Thetransfer of energy takes place by electromagnetic coupling through a process knownas mutual induction. (An added benefit is the capability to step the primary voltageeither up or down.) The electric toothbrush charger is an example of how thisprinciple can be used.



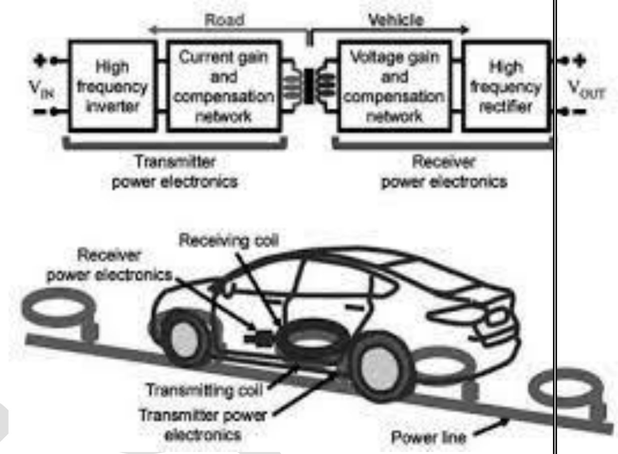
A toothbrush's daily exposure to water makes a traditional plug-in chargerpotentially dangerous. Ordinary electrical connections could also allow water to seepinto the toothbrush, damaging its components. Because of this, most toothbrushesrecharge through inductive coupling. You can use the same principle to recharge several devices at once.

Moderate Distance:

Household devices produce relatively small magnetic fields. For this reason, chargershold devices at the distance necessary to induce a current, which can only happen ifthe coils are close together. A larger, stronger field could induce current from fartheraway, but the process would be extremely inefficient. Since a magnetic field spreadin all directions, making a larger one would waste a lot of energy. An efficient way to transfer power between coils separated by a few meters is thatwe could extend the distance between the coils by adding resonance to the equation.A good way to understand resonance is to think of it in terms of sound. An object'sphysical structure -- like the size and shape of a trumpet -- determines the frequencyat which it naturally vibrates. This is its resonant frequency. Induction can take place a little differently if the electromagnetic fields around thecoils resonate at the same frequency. The theory uses a curved coil of wire as an inductor. A capacitance plate, which can hold a charge, attaches to each end of thecoil. As electricity travels through this coil, the coil begins to resonate. Its resonantfrequency is a product of the inductance of the coil and the capacitance of the plates. Electricity, traveling along an electromagnetic wave, can tunnel from one coil tothe other if they both have the same resonant frequency. In a short theoretical analysis, they demonstrate that by sending electromagneticwaves around in a highly angular waveguide, evanescent waves are produced whichcarry no energy. An evanescent wave is near field standing wave exhibiting exponentialdecay with distance. If a proper resonant waveguide is brought near the transmitter,the evanescent waves can allow the energy to tunnel (specifically evanescent wavecoupling, the electromagnetic equivalent of tunneling to the power drawingwaveguide, where they can be rectified into DC power. Since the electromagneticwaves would tunnel, they would not propagate through the air to be absorbed ordissipated, and would not disrupt electronic devices.

As long as both coils are out of range of one another, nothing will happen, sincethe fields around the coils aren't strong enough to affect much around them. Similarly,if the two coils resonate at different frequencies, nothing will happen. But if tworesonating coils with the same frequency get within a few meters of each other,streams of energy move from the transmitting coil to the receiving coil.One coil can even send electricity to several receiving coils, if theyall resonate at the same frequency.

"Resonant inductive coupling" has key implications in solving the two mainproblems associated with non-resonant inductive coupling and electromagneticradiation, one of which is caused by the other; distance and efficiency.Electromagnetic induction works on the principle of a primary coil generating apredominantly magnetic field and a secondary coil being within that field so a currentis induced within its coils.
This causes the relatively short range due to the amount of power required toproduce an electromagnetic field. Over greater distances the non-resonant inductionmethod is inefficient and wastes much of the transmitted energy just to increase range.This is where the resonance comes in and helps efficiency dramatically by "tunneling"the magnetic field to a receiver coil that resonates at the same frequency. Unlike themultiple-layer secondary of a non-resonant transformer, such receiving coils aresingle layer solenoids with closely spaced capacitor plates on each end, which incombination allow the coil to be tuned to the transmitter frequency therebyeliminating the wide energy wasting "wave problem" and allowing the energy used tofocus in on a specific frequency increasing the range.



Long-distance Wireless Power:

Whether or not it incorporates resonance, induction generally sends power overrelatively short distances. But some plans for wireless power involve movingelectricity over a span of miles. A few proposals even involve sending power to theEarth from space. In the 1980s, Canada's Communications Research Centre created asmall airplane that could run off power beamed from the Earth. The unmanned plane,called the Stationary High Altitude Relay Platform (SHARP), was designed as acommunications relay. Rather flying from point to point, the SHARP could fly incircles two kilometers in diameter at an altitude of about 13 miles (21 kilometers).Most importantly, the aircraft could fly for months at a time. The secret to the SHARP's long flight time was a large, ground-based microwavetransmitter. The SHARP's circular flight path kept it in range of this transmitter. Alarge, disc-shaped rectifying antenna, or rectenna, just behind the plane's wingschanged the microwave energy from the transmitter into direct-current (DC)electricity. Because of the microwaves' interaction with the rectenna, the SHARP hada constant power supply as long as it was in range of a functioning microwave array.

Need for Wireless Power Transmission:

Wireless transmission is employed in cases where instantaneous or continuous energytransfer is needed, but interconnecting wires are inconvenient. Number of household points receives electricity at the same frequency usingsingle transmitting coil if they all are at resonance. So, this setup couldrecharge all the devices in a room at once. The unmanned planes or robots which are run by the wireless power over an area, as theycould fly for months at a time, could be used for research as well as a mini satellite.

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ARTIFICIAL INTELLIGENCE

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Introduction:

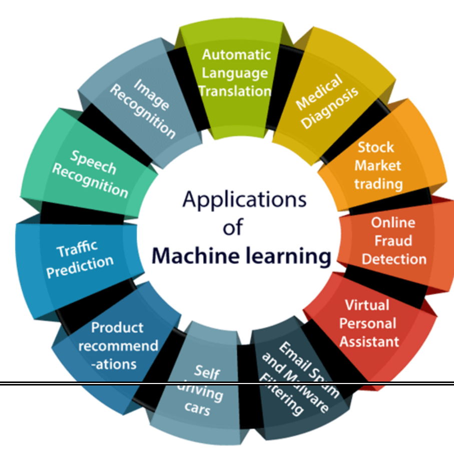
According to the father of Artificial Intelligence, John McCarthy, it is "The science and engineering of making intelligent machines, especially intelligent computer programs"

Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think.

AI is accomplished by studying how human brain thinks and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

Philosophy of AI:

While exploiting the power of the computer systems, the curiosity of human, lead him to wonder, "Can a machine think and behave like humans do?"Thus, the development of AIwith the intention of creating



similar intelligence in machines that we find and regard high in humans.

Goals of AI:

To Create Expert Systems − The systems which exhibit intelligent behavior, learn, demonstrate, explain, and advice its users.

To Implement Human Intelligence in Machines − Creating systems that understand, think, learn, and behave like humans.

What Contributes to AI?

Artificial intelligence is a science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering. A major thrust of AI is in the development of computer functions associated with human intelligence, such as reasoning, learning, and problem solving.

Out of the following areas, one or multiple areas can contribute to build an intelligent system.

Programming Without and With AI:

The programming without and with AI is different in following ways

Programming Without AI	Programming With AI
A computer program without AI can answer the specific questions it is meant to solve.	A computer program with AI can answer the generic questions it is meant to solve.
Modification in the program leads to change in its structure.	AI programs can absorb new modifications by putting highly independent pieces of information together.
Modification is not quick and easy. It may lead to affecting the program adversely.	Quick and Easy program modification.

What is AI Technique?

In the real world, the knowledge has some unwelcomed properties −

- Its volume is huge, next to unimaginable.
- It is not well-organized or well-formatted.
- It keeps changing constantly.

AI Technique is a manner to organize and use the knowledge efficiently in such a way that

- It should be perceivable by the people who provide it.
- It should be easily modifiable to correct errors.
- It should be useful in many situations though it is incomplete or inaccurate.
- AI techniques elevate the speed of execution of the complex program it is equipped with.

Applications of AI:

AI has been dominant in various fields such as

Gaming − AI plays crucial role in strategic games such as chess, poker, tic-tac-toe, etc., where machine can think of large number of possible positions based on heuristic knowledge.

Natural Language Processing − It is possible to interact with the computer that understands natural language spoken by humans.

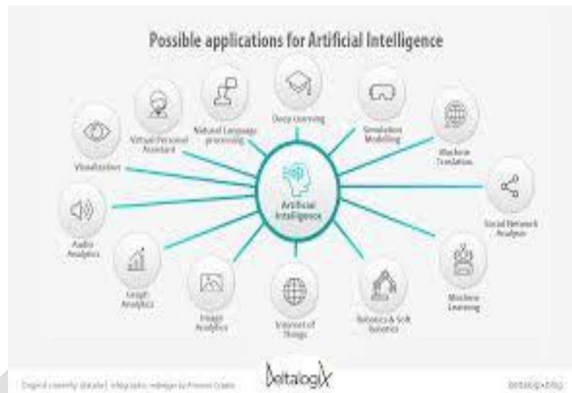
Expert Systems − There are some applications which integrate machine, software, and special information to impart reasoning and advising. They provide explanation and advice to the users.

Vision Systems − These systems understand, interpret, and comprehend visual input on the computer. For example,

Speech Recognition − Some intelligent systems are capable of hearing and comprehending the language in terms of sentences and their meanings while a human talks to it. It can handle different accents, slang words, noise in the background, change in human's noise due to cold, etc.

Handwriting Recognition − The handwriting recognition software reads the text written on paper by a pen or on screen by a stylus. It can recognize the shapes of the letters and convert it into editable text.

Intelligent Robots − Robots can perform the tasks given by a human. They have sensors to detect physical data from the real world such as light, heat, temperature, movement, sound, bump, and pressure. They have efficient processors, multiple sensors and huge memory, to exhibit intelligence. In addition, they are capable of learning from their mistakes and they can adapt to the new environment.



History of AI:

Here is the history of AI during 20th century

1923-Karel Čapek play named "Rossum's Universal Robots" (RUR) opens in London, first use of the word "robot" in English.

1943-Foundations for neural networks lay.

1945-Isaac Asimov, Columbia University alumni, coined the term Robotics.

1950-Alan Turing introduced Turing Test for evaluation of intelligence and published Computing Machinery and Intelligence. Claude Shannon published Detailed Analysis of Chess Playing as a search.

1956-John McCarthy coined the term Artificial Intelligence. Demonstration of the first running AI program at Carnegie Mellon University.

1958-John McCarthy invents LISP programming language for AI.

1964-Danny Bob row's dissertation at MIT showed that computers can understand natural language well enough to solve algebra word problems correctly.

1965-Joseph Weinbaum at MIT built ELIZA, an interactive problem that carries on a dialogue in English.
1969-Scientists at Stanford Research Institute Developed Shakey, a robot, equipped with locomotion, perception, and problem solving.
1973-The Assembly Robotics group at Edinburgh University built Freddy, the Famous Scottish Robot, capable of using vision to locate and assemble models.
1979-The first computer-controlled autonomous vehicle, Stanford Cart, was built.
1985-Harold Cohen created and demonstrated the drawing program, Aaron.
1990-Major advances in all areas of AI −Case-based reasoning
1997-The Deep Blue Chess Program beats the then world chess champion, Garry Kasparov.
2000-Interactive robot pets become commercially available. MIT displays Kismet, a robot with a face that expresses emotions. The robot Nomad explores remote regions of Antarctica and locates meteorites.

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INTERNET OF THINGS-AIDED SMART GRID

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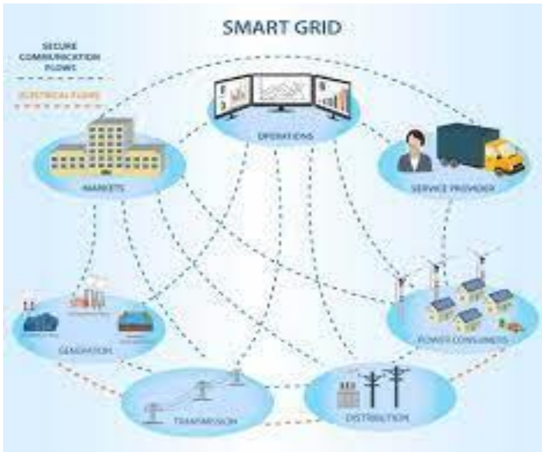
Introduction:

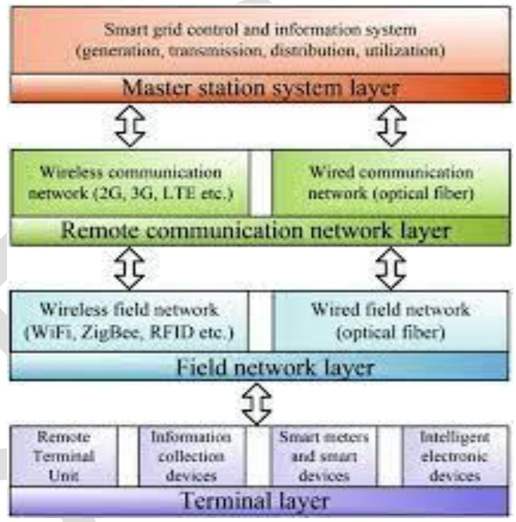
A traditional power grid consists of many loosely interconnected synchronous AlternateCurrent (AC) grids. It performs three main functions: generation, transmission, and distribution ofelectrical energy in which electric power flows only in one direction, i.e., from a service provider to theconsumers. Firstly, in power generation, a number of large power plants generate electrical energy, mostlyfrom burning carbon and uranium-based fuels. Secondly in power transmission, the electricity istransmitted from power plants to remote load centers through high voltage transmission lines. Thirdly inpower distribution, the electrical distribution systems distribute electrical energy to the end consumers atreduced voltage. Each grid is centrally controlled and monitored to ensure that the power plants generateelectrical energy in accordance with the needs of the consumers within the constraints of power systems.Nearly, all the generation, transmission and distribution of electrical energy is owned by the utilitycompanies who provide electrical energy to consumers and bill them accordingly to recover their costsand earn profit.

History of Power Grid:

The traditional power grid worked very well from its inception in 1870 until 1970. Eventhough the consumers' demand for energy grew exponentially, it was still rather predictable. However,there has been a dramatic change in electrical energy consumption since 1970, as the load ofelectronic devices has become the fastest growing element of the total electricity demand and new sourcesof high electricity consumption have been developed, such as electric vehicles (EVs).



The power gridsendure a significant wastage of energy due to a number of factors, such as consumers' inefficientappliances and lack of smart technology, inefficient routing and dispensation of electrical energy,unreliable communication and monitoring, and most importantly, lack of a mechanism to store thegenerated electrical energy. Furthermore, power grids face some other challenges as well, includinggrowing energy demand, reliability, security, emerging renewable energy sources and aging infrastructureproblems to name a few. In order to solve these challenges, the Smart Grid (SG) paradigm has appearedas a promising solution with a variety of information and communication technologies. Such technologiescan improve the effectiveness, efficiency, reliability, security, sustainability, stability, and scalability ofthe traditional power grid. SG solves the problem of electrical energy wastage by generating electricalenergy which closely matches the demand. SG helps to make important decisions according to thedemand of energy, such as real time pricing, self-healing, power consumption scheduling and optimizedelectrical energy usage. Such decisions can significantly improve the power quality as well as theefficiency of the grid by maintaining a balance between power generation and its usage. SG differs fromtraditional power grids in many aspects.



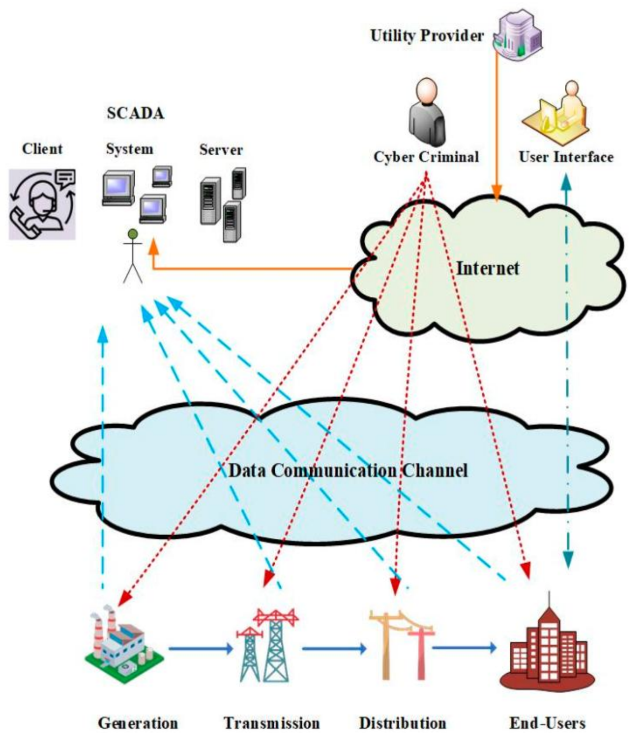
For instance, SG offers a bi-directional communication flowbetween service providers and consumers, while a traditional power grid only offers only unit-directionalcommunication from the service provider to the consumer. SG provides supervisory control and dataacquisition (SCADA), advanced metering infrastructure (AMI), smart meters, fault tolerance,unauthorized usage detection, and load balancing , as well as self-healing, i.e., detection and recoveryfrom faults.SG deploys various types of devices for monitoring, analyzing, and controlling the grid. Such monitoringdevices are deployed at power plants, transmission lines, transmission towers and distribution centers andconsumers premises. The numbers of such devices are large.

One of the main concerns for SG is theconnectivity, automation and tracking of such large number of devices, which requires distributedmonitoring, analysis and control through high speed, ubiquitous and two-way digital communications. Itrequires distributed automation of SG for such devices or “things”. This is already being realized in thereal world through the Internet of Things (IoT) technology

Big Data and Cloud for IoT-Aided SG Systems:

The integration of IoT technology with SG comes with a cost of managing huge volumes of data, withfrequent processing and storage. Such data includes consumers load demand, energy consumption,network components status, power lines faults, advanced metering records, outage management recordsand forecast conditions. This means that the utility companies must have hardware and software

Capabilities to store manage and process the collected data from IoT devices efficiently and effectively.Big data is defined as data with huge volume, variety, and velocity (three V’s). The high frequency ofdata collection by IoT devices in SG makes the data size very large. The variety is represented by thedifferent sensors that produce different data. The data velocity represents the required speed for the datacollection and processing. Hence, IoT-aided SG systems can apply the techniques of big datamanagement and processing (such as hardware, software and algorithms).



Conclusion:

Smart Grid (SG) is the future grid which solves the problems of uni-directional information flow, energywastage, growing energy demand, reliability, and security in the traditional power grid.

The Internet ofThings (IoT) technology provides connectivity anywhere and anytime. It helps SG by providing smartdevices or IoT devices (such as sensors, actuators, and smart meters) for the monitoring, analysis andcontrolling the grid, as well as connectivity, automation and tracking of such devices. This realizes theIoT-aided SG system which supports and improves various network functions at the power generation,transmission, distribution, and utilization.

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PIEZO ELECTRIC TRANSDUCER

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Introduction:

An Industrial Instrument - Instrumentation is the heart of industrial applications. Instrumentation is the art and science of measuringand controlling different variables such as flow, level, temperature, angle, displacement etc. A basicinstrumentation system consists of various devices. One of these various devices is a transducer.

Atransducer plays a very important role in any instrumentation system. An electrical transducer is a devicewhich can convert the physical quantity into a proportional electrical quantity such as voltageor electric current. It converts any quantity to be measured into usable electrical signal. This physicalquantity which is to be measured can be pressure, level, temperature, displacement etc. The output whichis obtained from the transducer is in the electrical form and is equivalent to the measured quantity.There are of many different types of transducers, they can be classified based on various criteria as types of Transducers based on

Quantity to be Measured:

- Temperature transducers (e.g.,a thermocouple)
- Pressure transducers (e.g., a diaphragm)

- Displacement transducers (e.g., LVDT)
- Flow transducers

Principle of Operation:
- Photovoltaic (e.g., a solar cell)
- Piezoelectric

Chemical:

- Mutual Induction
- Electromagnetic
- Hall Effect
- Photoconductors

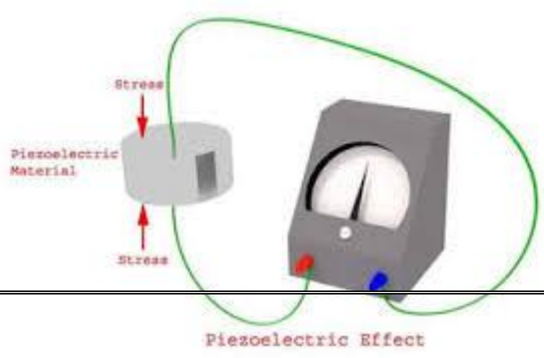
External Power Source

Active Transducer:

Active transducers are those which do not require any power source for their operation. They work onthe energy conversion principle. They produce an electrical signal proportional to the input (physicalquantity). For example, a thermocouple is an active transducer.

Passive Transducers:

Transducers which require an external power source for their operation is called as a passivetransducer. They produce an output signal in the form of some variation in resistance, capacitance orany other electrical parameter, which than has to be converted to an equivalent current or voltagesignal.

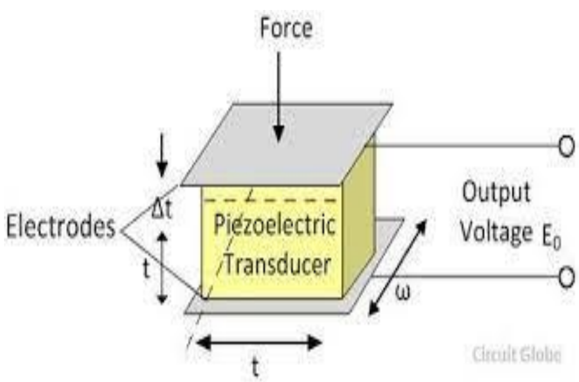


Piezoelectric Transducer:

Piezoelectric material is one kind of transducers. We squeeze this material or we apply force or pressureon this material it converts it into electric voltage and this voltage is function of the force or pressureapplied to it. The material whichbehaves in such a way is also known as piezoelectric Sensor. The electricvoltage produced by piezoelectrictransducer can be easily measuredby voltage measuring instruments,which can be used to measure stressesor forces. The physical quantity like mechanical stress or force cannot be measured directly. Therefore,piezoelectric transducer can be used.

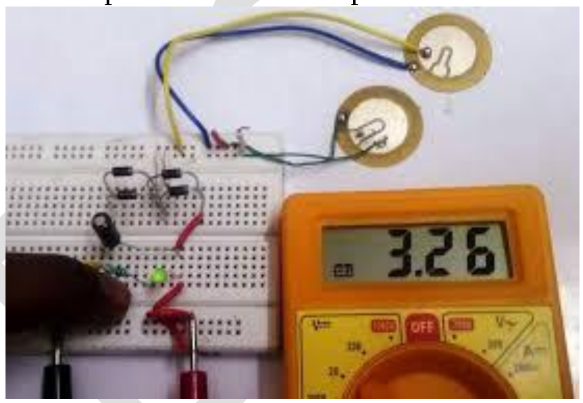
Piezoelectric Actuator:

Piezoelectric actuator behaves in reverse manner of piezoelectric sensor. It is the one in which theelectric effect will cause the material to deform i.e. stretch or bend. That means in piezoelectric sensor,when force is applied to stretch or bend it, an electric potential is generated and in opposite when on apiezoelectric actuator, an electric potential is applied it is deformed i.e. stretched or bend.Piezoelectric transducer has high sensitivity. So, it acts as sensor and used in accelerometer due to itsexcellent frequency of response.The piezoelectric effect is used inmany applications that involveproduction and detection of sound,electronic frequency generation. Itacts as ignition source for cigarettelighter and used in sonar,microphone, force, pressure and displacement measurement



Application of Piezoelectric Materials:

1. In microphones, the sound pressure is converted into electric signal and this signal is ultimatelyamplified to produce louder sound.
2. Automobile seat belts lock in response to a rapid deceleration is also done by piezoelectric material.
3. It is also used in medical diagnostics.
4. It is used in electric lighter used in kitchens. Pressure made on piezoelectric sensor creates an electricsignal which ultimately causes flash to fire up.
5. They are used for studying high speed shock waves and blast waves.
6. Used in fertility treatment.
7. Used in Inkjet printers
8. It is also used in restaurants or airports where when a person steps near the door and the door opensautomatically. In this the concept used is when person are near the door a pressure is exerted persons



weight on the sensors due to which the electric effect is produced and the door opens automatically.

Examples of Piezoelectric Material:

1. Barium Titanate.
2. Lead zirconate titanate (PZT).
3. Rochelle salt.

Advantages of Piezoelectric Transducer:

1. No need of external force.
2. Easy to handle and use as it has small dimensions.

3. High frequency response it means the parameters change very rapidly.

Disadvantages :

1. It is not suitable for measurement in static condition.
2. It is affected by temperatures.
3. Output is low so some external circuit is attached to it.
4. It is very difficult to give desired shape to this material and desired strength.

Conclusion:

A transducer can be used in industry for various purposes by which the physical, mechanical, or opticalquantity to be measured is transformed directly by a suitable mechanism into an electrical voltage orcurrent proportional to the input measured.

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SUPER CONDUCTING GENERATORS

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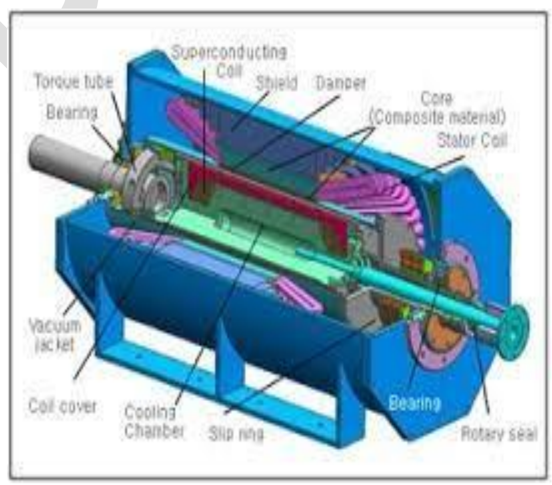
Introduction:

Superconducting elements are the most important part of electromechanical systems because of theirfunctioning and these systems form the superconducting electric machines. Lack of DC resistance insuper conductors contributes much to its greater efficiency.In a super conducting machine very high magnetic field is produced otherwise impossible in aconventional machine and is the main characteristic of super conductors.



Working:

High magnetic field results inlesser motor volume and ultimately more power density.Cryogenics are highly used in super conductors to maintain a specific temperature which is less than theroom temperature up to hundred degrees, super

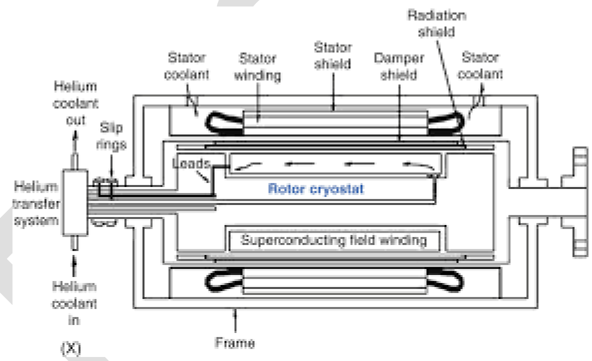
conducting transition temperature (Tc), at which thesuperconductors reach the zero

resistanceSuperconducting AC synchronous electric machines which include alternators and synchronous motorshave become more common nowadays than before.The rotor or the rotating member of the machines has an electromagnetic field winding on itself for directcurrent which employs superconductors.The stationary member or stator of the machines however utilizes the same old conductors constituting ofcopper conductors which undergo normal conduction.

An attempt to reduce the resistive loss of the stator conductors they are cooled but the loss is notpermanently removed.

Principle:

The working principle previously used in old electric generators which included synchronous permanentmagnet generators or motors and the induction machines is also being used nowadays in thesuperconducting generators. The only difference between the two is the windings of thesuperconducting generator. These windings are able to support a more powerful magnetic field ascompared to that of conventional generators. Using this coil in other various rotating machines will alsoimprove their efficiency; make them more compact and eco-friendlier. The superconducting generatorshave a coilcover for the coil to support it when under centrifugal force and a damper for protection against high frequency magnetic field. A cooling chamber to maintain ultra-low temperature is alsopresent along with a rotary seal which is a rotary room to provide the cryogenic coolant from.



The core ismade of non-magnetic stator core plus a stator coil made of copper. The current is applied to the superconducting coil, made of superconducting material, through the slip ring.Three insulations are also present, first is the shield to protect the release of magnetic field to thesurrounding, second is the vacuum jacket which forms the vacuum insulation layer and last is the torquetube which is the insulating structure.

Industrial Revolution in Energy:

Superconductivity technology is not without benefits and its scope and ability is now much understood.The magnetic resonance imaging techs in medicine and super-colliders or particle physics analysis donein research are a few beneficial outcomes of this technology which clearly are upgrading different areas ofour society.

The size, cost and efficiency of the production and usage of electricity will also be greatly affected bysuper conductors.

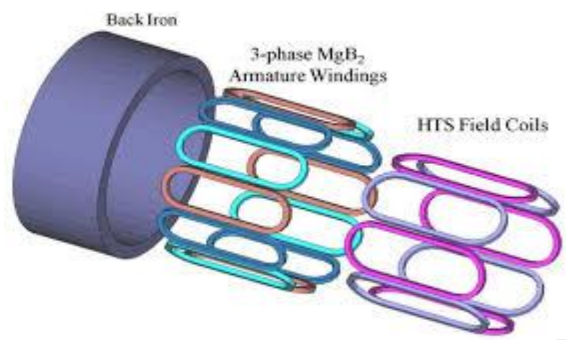
Comparison between super conductor and conventional tech generators:

Cost comparison is done between the generators working on super conducting technology and thoseworking on conventional tech and is shown in the “Superconducting Generator Cost Comparison” chart.The results obtained from the comparison show that the conventional technology costs cheaper when dealing with low power levels. This is so because the cost of copper cable used in the conventionalmachines is much less than that of the superconducting cable.

The cost of superconducting generators alsoincreases because of the use of cryogenics to cool the machine up to a specific temperature while thecooling cost of old generators is much less. The case is reverse when talking about high power levels. Super conductors become more cost effectiveat this point because the power per unit of increase becomes more favorable. The break-even point forboth generators come out to be between the ranges of 4-6 MW. It is expected in future that furtherresearch and improvement in superconductor production tech and the cooling method through cryogenicswill decrease the cost a great deal. The cost utilized for superconducting power generation will alsodecrease. The break-even point mentioned earlier will also reduce.If it decreases up to 2 MW, competition for superconducting generators will also decrease

Positive And Negative Points of Superconducting Electric Machines:

First a few of its positive points as compared to conventional tech are being highlighted. The rotorelectromagnet is subject to less resistive loss. The size and weight per power capacity is also decreasedregardless of the cooling equipment. Some negative points of this machine are as follows:The cooling system has greater cost, size, weight and complications. Once the superconductors exittheir superconductive state the generator at once stops working. Chances for instability of the rotor speedare also greater. Lack of the characteristic damping usually found in conventional generators may causethe synchronous speed of the superconductor generator to fluctuate. Either the motor bearings should beseparate from the cold rotor or it should be able to tolerate the decreased temperature. To operate asynchronous machine such as the superconductor generator practically, it is important to have access toelectronic control. This electronic control leads to harmonic loss in the super cooled rotor of the generatorto great extent. The coils used in the superconducting generators or motors have electric resistance to azero unlike that of the copper coil used in old generators leading to less loss of electrical resistance and sogreater efficiency.



As the electrical resistance loss is decreased so the heat produced by the machine isalso less. This reduces the size and the quantity of the material used for production. Advanced heat andelectric insulation along with cryogenic refrigeration technology is required by the superconductinggenerators plus motors to maintain the low temperature requirement and the functionality of thesuperconducting coil.Leading future market is expected from superconducting generators and motors because of itscharacteristic high energy efficiency and better resourceUtilization ability. It has much resemblance to today's demand of high efficiency and eco-friendly plant.

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