K S R Institute for Engineering and Technology

Department of Electrical and Electronics Engineering

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Together We Make Difference

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Contents

BIRD DETECTION SYSTEM

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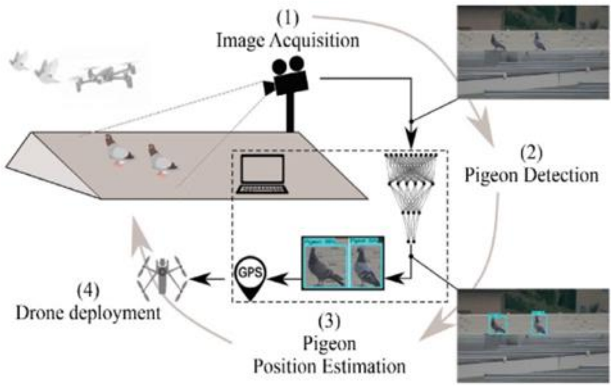
Introduction

The damage caused by birds includes direct and indirect effects on agricultural crops, livestock, and infrastructure, which have serious economic and human implications Specifically, feral pigeons also known as city doves, city pigeons, or street pigeons, are considered as nuisances and pests because of their large amounts of excrement, which piles upon property and serves as a reservoir and vector of diseases. Among all birds, this persistent and invasive species is considered the most serious pest bird in terms of economic loss in the United States, with an annual damage estimate of $ 1.1. In addition, the acidic droppings of pigeons deteriorate and damage different materials such as cars, valuable buildings, and cultural objects. Pigeons also tend to gather in locations that make human intervention difficult, dangerous or expensive besides their economic impact, health risks are associated with feral pigeon

Computational power, limiting the detection of target objects that are far away and therefore small. In this study, we could let the drone move through the environment to search for pigeons actively to address this limitation.

zootomic pathogens, such as *Chlamydia* pittance (causative agent of human psittacosis) and Salmonella. Among all pigeon species, feral pigeons are responsible for the highest infection rates of zoometric agents.



Camera:

Multiple sensor modalities could be used to perceive the environment. Recently, the acoustic detection of birds was proposed. However, this method was deemed unreliable given the possible high levels of environmental noise in urban scenes. Moreover, light detection and ranging data have been used for object detection with high success rates according. In addition, camera-based approaches have been proposed as alternatives, which have similar performance with liter-based approaches and apparent advantages in terms of hardware. Therefore, our proposed system favors a solution that leverages computer vision.

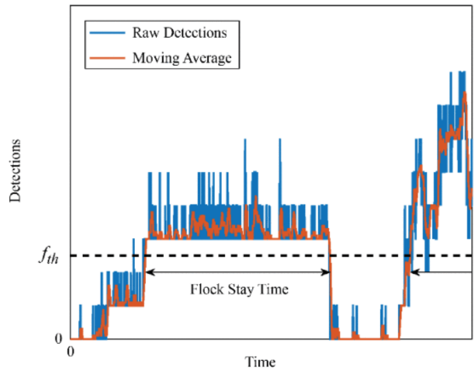
Currently, several UAVs use onboard cameras. However, state-of-the-art computer vision algorithms require dedicated hardware. An autonomous drone recharging station would only mitigate this problem and would not allow drones to detect pigeons during recharging. A straightforward solution to this issue is the use of a camera system that is set up on the ground and scans the environment. A simple monocular camera and scale ambiguity). However, installing multiple cameras, which is the solution to this issue, is expensive, requires more complex installation, and involves handling an increased amount of data. Pan-tilt-zoom (PTZ) cameras can be a good compromise because of their flexibility in orientation and zoom, covering vast areas. Thus, the proposed system relies on a PTZ camera, which is weather-resistant and can oversee its full surroundings using a 360° pan, mounted at a fixed position in the environment. The combination of a 12× optical zoom and 4 MP resolution enables detailed representation of the environment

Pigeon Detection:

Next, pigeons were detected within these camera images. Some scholars have proposed the detection of birds using traditional computer vision methods, such as analyzing the pixel changes between two consecutive images using features from accelerated segment test or detecting moving objects via background. In recent years, learning-based methods have also been applied. Hong *et a* compared different object detectors used for detecting birds with an aerial view, and they concluded that a Faster region- based convolution neural network was the most accurate approach. Meanwhile, Brutal ET proposed a detector model with pre-trained weights and only fine-tuned it with specifically collected images to counteract over fitting. In this study, we combined these two ideas.

Flock Stay Time

This section explains the method used to evaluate the ability of the proposed system to chase away pigeons from the environment. If the system is successful, the pigeons leave earlier than they initially intended. Thus, the time that pigeons stay on the roof, denoted as the stay time, is a valid metric for evaluating the impact of the proposed solution. We leverage the architecture proposed in Section III-A to analyze the behavior of pigeons. In our system, the camera records a video of the environment, and the detector is used to detect pigeons. Assigning the time each individual pigeon stays in an environment would be a time- intensive task. Although research in this direction is topical.



Experimental Setup

Based on the metric introduced in Section III-B, we assessed the pigeon behavior with two experiments: one in which we observed the natural behavior of pigeons without the deterring system in place (this experiment served as a baseline) and another in which we observed the behavior of pigeons in the presence of the drone. We refer to the former as the without drone experiment and the latter as the with drone experiment. Both experiments covered a multitude of flocks and stay times.

We hypothesized that the interference of the drone would force flocks (of any size) to leave earlier thanthey preferred, resulting in a significant reduction of the flock stay time compared to the without drone experiment pigeons present and detected at the same time on the roof. Then, we consider a certain flock to be different from another if there is a period between the two groups of pigeons.

Moreover, we filtered the pigeon count using a moving average on the number of pigeons with a time window of size tw , as the count may suffer from some noise

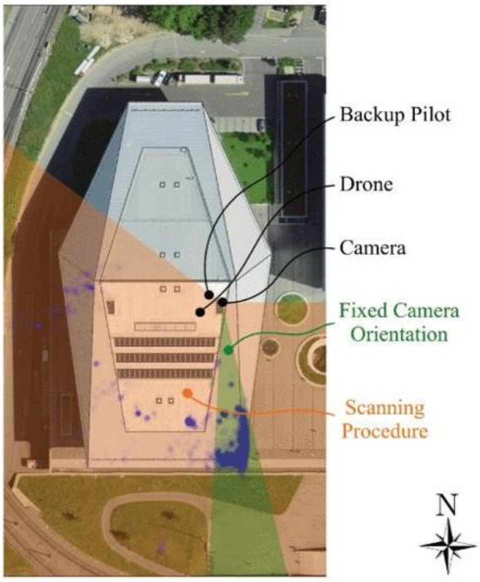
Explanation of the flock stay time by a qualitative example. The object detector looks for pigeons in each camera frame. The number of detections per frame can be plotted over time (blue). To reduce the effect of noise, the moving average (MA) is calculated (orange). The intersection of the MA with a threshold fetch allows the determination of the arrival (MA crosses fetch from below) and departure (MA crosses fetch from above) of a flock. The time between these two events is the flock staytime. pigeons occluding each other occasionally).Each time the moving average intersects .the from the bottom up, we consider that a flock has arrived on the roof. Accordingly, we assume that a flock leaves the roof each time the moving average intersects the threshold from above. The time between arrival and disappearance of the flock is the time the flock stays in the environment (i.e., the flock stay time).

Test Environment

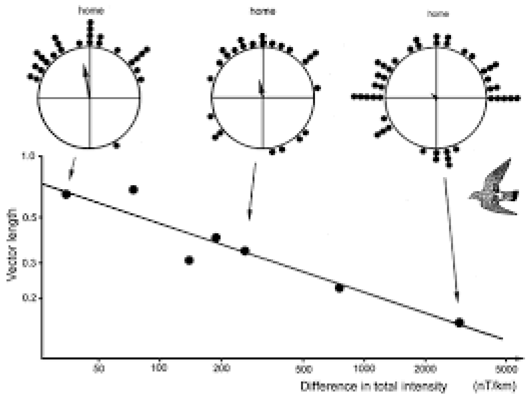
The applicability of the system was evaluated on the roof of the Swiss Tech Convention Center, a building located in an urban area in Switzerland in which pigeons are spotted almost every day.

Pigeon HEATMAP

A satellite image of the building where the system was tested.



The horizontal ridge in the middle of the roof splits it into two halves: an upper half that is inclined toward the north and a lower half that is inclined towards the south. During initial observations, pigeons were reported to stay mostly in the southern half of the roof. Therefore, we focused on this part of the roof in our experiments.



Explanation of the flock stay time by a qualitative example. The object detector looks for pigeons in each camera frame. The number of detections per frame can be plotted over time (blue). To reduce the effect of noise, the moving average is calculated (orange).

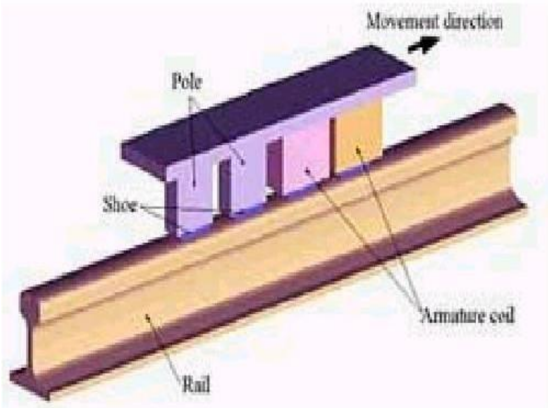
EDDY CURRENT BRAKES

KARTHIKEYAN SP *ATHIF L*

Introduction

Many of the ordinary brakes, which are being used now days, stop the vehicle by means of mechanical blocking. This causes skidding and wear and tear of the vehicle. And if the speed of the vehicle is very high, the brake cannot provide that much high braking force and it will cause problems. m. The advantages such as it can reduce the wear of brake pad, vibration and it is environmental friendly. Eddy current braking was said as environmental friendly because it can reduce the pollution of wear debris from brake pad itself. Realizing the importance of a new braking system that could lead into environmental friendly and reduce common problems mentioned above, this experiment was conducted to study the behavior of eddy current braking system which uses an electromagnet and aluminum as the brake disc material. In electromagnetic induction, eddy current is one of the most important phenomena which can be applied in various kinds of research and application. by a simple and effective mechanism of braking system 'The eddy current brake'. It is an abrasion-free method for braking of vehicles including trains. It makes use of the opposing tendency of eddy current .Eddy current is the swirling current produced in a conductor, which is subjected to a change in magnetic field. Because of the tendency of eddy currents to oppose, eddy currents cause energy to be lost. More accurately, eddy currents transform more useful forms of energy such as kinetic energy into heat, which is much less useful. In many applications, the loss of useful energy is not particularly desirable. But there are some practical applications

According to this law, whenever a conductor cuts magnetic lines of forces, an emf is induced in the conductor, the magnitude of which is proportional to the strength of magnetic field and the speed of the conductor. If the conductor is a disc, there will be circulatory currents i.e. eddy currents in the disc. According to Lenz's law, the direction of the current is in such a way as to oppose the cause, i.e. movement of the disc.



Essentially the eddy current brake consists of two parts, a stationary magnetic field system and a solid rotating part, which include a metal disc. During braking, the metal disc is exposed to a magnetic field from an electromagnet, generating eddy currents in the disc. The magnetic interaction between the applied field and the eddy currents slow down the rotating disc. Thus the wheels of the vehicle also slow down since the wheels are directly coupled to the disc of the eddy current brake, thus producing smooth stopping motion braking, as opposed to friction brakes which simply waste away energy to slow the vehicle by turning the kinetic energy into thermal energy members, a stationary magnetic field system and a solid rotary member, generally of mild steel, which is sometimes referred to as the secondary because the eddy currents are induced in it. Two members are separated by a short air gap, they're being no contact between the two for the purpose of torque transmission. Consequently there is no wear as in friction brake.Stator consists of pole core, pole shoe, and field winding. The field winding is wounded on the pole core. Pole core and pole shoes are made of east steel laminations and fixed to the state of frames by means of screw or bolts. Copper and aluminum is used for winding material the arrangement is shown in this system consists

1) Stator
2) Rotor

Stator:-

It is supposed frame members of the vehicle chassis. It has introduced magnetic poles energized by windings. Current is supplied to the winding from the battery.

Rotor:-

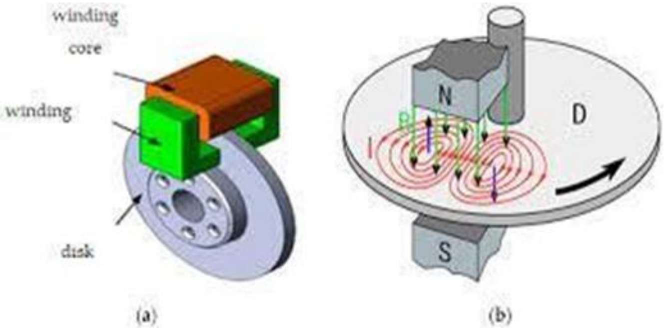
It is a rotating disc, which is fitted on the line of crankshaft with small air gap to stator. When disc rotates a flux change occur in the section of the disc passing the poles of stator. Due to the flux change there is a circulatory or eddy current in the disc around the magnetic lines of force. The effect of this eddy current induces „N" and „S" poles at the surface of the disc. Then there will be a „drag" or braking effect in between eddy current induced poles and magnetic poles in the stator. By changing current from the battery we can change the braking force. In this breaking system kinetic energy of the vehicle is converted to heat and this heat is dissipated through the rotating disc shaft, which is placed very near to the stator with small air gap (1 mm to 2 mm). Rotating disc may be one or both side of stator.

The two units have common ring member, poles cores on which winding are provided being fixed to ring number. If a malleable casting is employed, then the pole core could be cast integrally with the right. After fitting the windings on the cores, poles shoes are fitted to provide pole faces of appropriate shape and area. The rotor disc should be provided with properly designed fins for faster heat removal.

The magnetic circuits of the two units are substantially the same, non-undue and thrust would be imposed on the motor bearings. Slight axial displacement of rotor could however cause quite appreciable discrepancy, the air gap of two units. The effect would be to increase the magnetic pull in one air gap and diminish it on other which could give to rise to excessive and thrust on rotor bearing to overcome the inherent defect, the air gaps of both units could be put in series by making the central number non magnetic and providing a continues pole core for each pair axially opposite poles. This modification could possibly reduce the length of the combined pole course or permits a larger winding length.

Working

When the vehicle is moving, the rotor disc of eddy current brake which is coupled to the wheels of the vehicle rotates, in close proximity to stationary magnetic poles. When we want to brake the vehicle, a control switch is put on which is placed on the steering column in a position for easy operation



When the control switch is operated, current flows from a battery to the field winding, thus energizing the magnet. Then the rotating disc will cut the magnetic field. When the disc cuts the magnetic field, flux changes occur in the disc which is proportional to the strength of the magnetic field. The current will flow back to the zero field areas of the metal plate and thus create a closed current loop like a whirl or eddy. A flow of current always means there is a magnetic field as well. Thus instead of mechanical friction, a magnetic friction is created. In consequence, the disc will experience a "drag" or the braking effect, and thus the disc stops rotation. The wheels of the vehicle, which is directly coupled to the disc, also stop rotation. Faster the wheels are spinning, stronger the effect, meaning that as the vehicle slows, the braking force is reduced producing a smooth stopping action.

When the control switch is operated during the standby position of the vehicle, the magnet will be energized and magnetic field is created. But since the wheels are not moving, magnetic lines of force are not cut by it, and the brake will not work. However, a warning lamp is provided on the instrument panel to indicate whether the brake is energized. This provides a safe guard for the driver against leaving the unit energized. When control switch is put in any one of the operating positions, the corresponding conductor in the contractor box is energized and current flows from the battery to the field winding to the contractor box. This current magnetizes the poles in stator, which placed very near to the rotor. When rotor rotates it will cut magnetic lines and eddy current will set up in the rotor. The magnetic field of this eddy current produces a breaking force or torque in the opposite direction of rotation disc. This kinetic energy of rotor is converted as heat energy and dissipated from rotating disc to surrounding atmosphere. Current in the field can change by changing the position of the controls switch. Thus we can change the strength of the braking force.

Eddy current brake in trains

In the case of trains, the part in which the eddy current is induced is rail. The brake shoe is enclosed in a coil, forming an electromagnet. When the magnet is energized, eddy currents are induced in the rail by means of electromagnetic induction, thereby producing braking action.

Conclusion

Eddy current braking produce effective braking with low wear and tear. The maintenance cost of this braking system is very low. Eddy current braking is a non-contact breaking system and hence there is no friction and low wear and tear. Thus debris produced in braking is very low and hence is ecofriendly. Eddy current braking is a cleaner way of braking. Wheel skidding is avoided as the wheel does not get locked. It is highly suitable at high speed. It works on electricity and consumes very small amount of power for a tiny time period. It only Consumes small space therefore installation is easy.

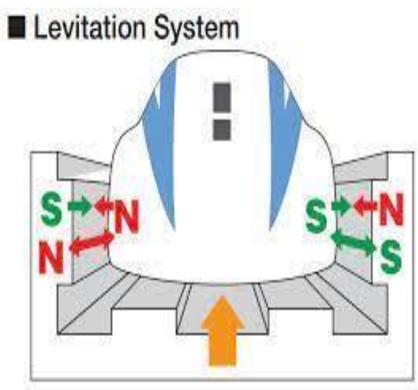
MAGLEV

SRIDHAR D *SASIKUMAR C*

Introduction

Maglev (from *magnetic levitation*) is a system of train transportation that uses two sets of magnets: one set to repel and push the train up off the track, and another set to move the elevated train ahead, taking advantage of the lack of friction. There are both high speed, intercity systems (Over 400 kilometres per hour (250 mph)), and low speed, urban systems (80 kilometres per hour (50 mph) to 200 kilometres per hour (120 mph)) being built and under construction and development.

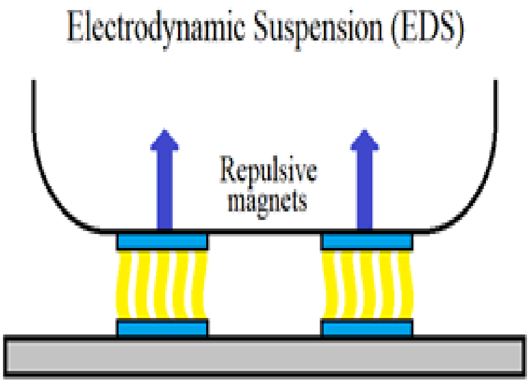
With maglev technology, the train travels along a guideway of magnets which control the train's stability and speed. While the propulsion and levitation require no moving parts, the bogies can move in relation to the main body of the vehicle and some technologies require support by retractable wheels at low speeds under 150 kilometres per hour (93 mph). This compares with electric multiple units that may have several dozen parts per bogie. Maglev trains can therefore in some cases be quieter and smoother than conventional trains and have the potential for much higher speeds.



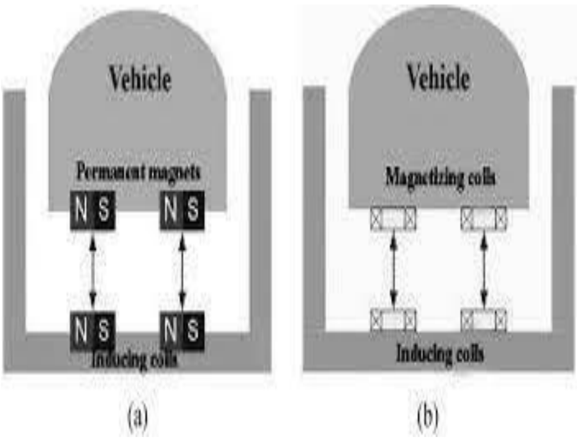
Maglev vehicles have set several speed records, and maglev trains can accelerate and decelerate much faster than conventional trains; the only practical limitation is the safety and comfort of the passengers, although wind resistance at very high speeds can cause running costs that are four to five times that of conventional high- speed rail (such as the Tokaido Shinkansen). The power needed for levitation is typically not a large percentage of the overall energy consumption of a high-speed maglev system. higher speeds, takes the most energy.

Electro dynamic suspension

In electro dynamic suspension (EDS), both the guide way and the train exert a magnetic field, and the train is levitated by the repulsive and attractive force between these magnetic fields. In some configurations, the train can be levitated only by repulsive force. In the early stages of maglev development at the Miyazaki test track, a purely repulsive system was used instead of the later repulsive and attractive EDS system. The magnetic field is produced either by superconducting magnets (as in JR–Maglev) or by an array of permanent magnets. The repulsive and attractive force in the track is created by an induced magnetic field in wires or other conducting strips in the track.



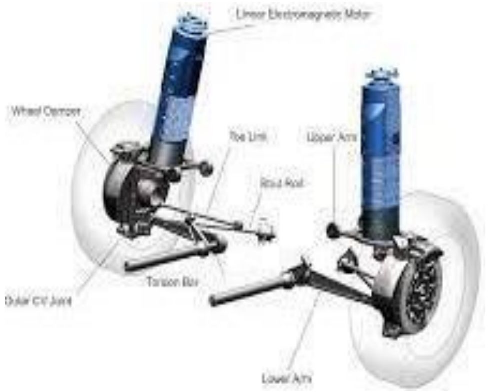
A major advantage of EDS maglev systems is that they are dynamically stable changes in distance between the track and the magnets creates strong forces to return the system to its original position. In addition, the attractive force varies in the opposite manner, providing the same adjustment effects. No active feedback control is needed.



However, at slow speeds, the current induced in these coils and the resultant magnetic flux is not large enough to levitate the train. For this reason, the train must have wheels or some other form of landing gear to support the train until it reaches take-off speed. Since a train may stop at any location, due to equipment problems for instance, the entire track must be able to support both low- and high-speed operation. Another downside is that the EDS system naturally creates a field in the track in front and to the rear of the lift magnets, which acts against the magnets and creates magnetic drag. This is generally only a concern at low speeds, and is one of the reasons why JR abandoned a purely repulsive system and adopted the sidewall levitation system.

Electromagnetic suspension

Electromagnetic suspension (EMS) is the magnetic levitation of an object achieved by constantly altering the strength of a magnetic field produced by electromagnets using a feedback loop. In most cases the levitation effect is mostly due to permanent magnets as they don't have any power dissipation, with electromagnets only used to stabilize the effect. According to Earnshaw's Theorem a paramagnetically magnetized body cannot rest in stable equilibrium when placed in any combination of gravitational and magneto static fields. In these kinds of fields an unstable equilibrium condition exists. Although static fields cannot give stability, EMS works by continually altering the current sent to electromagnets to change the strength of the magnetic field and allows a stable levitation to occur. In EMS a feedback loop which continuously adjusts one or more electromagnets to correct the object's motion is used to cancel the instability .Many systems use magnetic attraction pulling upwards against gravity for these kinds of systems as this gives some inherent lateral stability, but some use a combination of magnetic attraction and magnetic repulsion to push upwards.

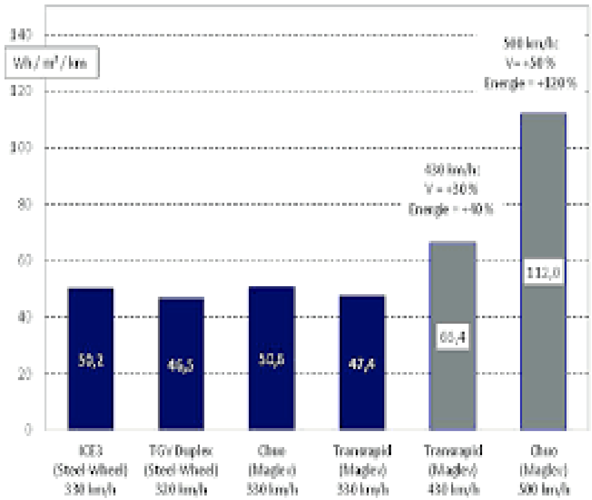


Magnetic levitation technology is important because it reduces energy consumption, largely reduces friction. It also avoids wear and has very low maintenance requirements. The application of magnetic levitation is most commonly known for its role in Maglev trains.

Energy usage

Energy for maglev trains is used to accelerate the train. Energy may be regained when the train slows down via regenerative braking. It also levitates and stabilises the train's movement. Most of the energy is needed to overcome air drag. Some energy is used for air conditioning, heating, lighting and other miscellany.At low speeds the percentage of power used for levitation can be significant, consuming up to 15% more power than a subway or light rail service For short distances the energy used for acceleration might be considerable.

The force used to overcome air drag increases with the square of the velocity and hence dominates at high speed. The energy needed per unit distance increases by the square of the velocity and the time decreases linearly. However power increases by the cube of the velocity. For example, 2.37 times as much power is needed to travel at 400 km/h (250 mph) than 300 km/h (190 mph), while drag increases by 1.77 times the original force.



Operational systems

High Speed

The Shanghai Maglev Train, also known as the Transrapid, has a top speed of 430 km/h (270 mph). The line is the fastest, first commercially successful, operational Maglev train designed to connect Shanghai Pudong International Airport and the outskirts of central Pudong, Shanghai. It covers a distance of 30.5 km (19.0 mi) in 7 or 8 minutes.

In January 2001, the Chinese signed an agreement with Transrapid to build an EMS high-speed maglev line to link Pudong International Airport with Longyang Road Metro station on the southeastern edge of Shanghai. This Shanghai Maglev Train demonstration line, or Initial Operating Segment (IOS), has been in commercial operations since April 2004 and now operates 115 daily trips (up from 110 in 2010) that traverse the 30 km (19 mi) between the two stations in 7 or 8 minutes, achieving a top speed of 431 km/h (268 mph) and averaging 266 km/h (165 mph). On a 12 November 2003 system commissioning test run it achieved 501 km/h (311 mph), its designed top cruising speed. The Shanghai maglev is faster than Birmingham technology and comes with on-time—to the second— reliability greater than 99.97%.

Low speed

The Hunan provincial government launched the construction of a maglev line between Changsha Huanghua International Airport and Changsha South Railway Station, covering a distance of 18.55 km. Construction started in May 2014 and was completed by the end of 2015. Trial runs began on 26 December 2015 and trial operations started on 6 May 2016. As of 13 June 2018 the Changsha maglev had covered a distance of 1.7 million km and carried nearly 6 million passengers. A second generation of these vehicles has been produced which have a top speed of 160 km/h (99 mph) In July 2021 the new model entered service operating at a top speed of 140 km/h (87 mph), which reduced the travel time by 3 minutes.

The Future of Maglev

Maglev technology holds great promise for the future. It has the potential to be a cheaper, faster, safer, and greener form of transportation than we have today. And with the help of some electrical engineers, it will become all of these things. There are possible applications for this technology in anything from intercity public transportation to cross-country trips.

There are even proposals to build long underground tubes, suck the air out of the tubes, and place maglev trains inside of them. In this setting there would be virtually no wind resistance, so a train could easily reach speeds exceeding the speed of sound (Thornton, 2007). While it may be a long time before this technology becomes prevalent, it is difficult to deny that it will at some point be prevalent. The advantages are too hard to ignore. As of now there is only one commercial maglev train in use, and it has already eclipsed everything that has come before it. How will this technology evolve and improve as we move into the future? Only time will tell. But it is highly plausible that we now stand at the precipice of a transportation revolution.

ELECTRIC SWITCH – A REVIEW

SARATHIVASAN J *MANISHA M*

Introduction

Electrical switches are electromechanical devices that are used in electrical circuits to control power, detect when systems are outside their operating ranges, signal controllers of the whereabouts of machine members and work pieces, provide a means for manual control of machine and process functions, control lighting, and so on. Electrical switches come in a variety of styles and are actuated by hand, foot, or through the detection of pressure, level, or objects. Switches can be simple on- off types or can have multiple

Types of Electrical Switches

There are many different types of electrical switches. Switch function is defined by the number of poles and throws the switch has. A Footswitch is a switching device which is operated by the user's foot. They are used throughout a whole host of industries to operate machines or devices giving the user full use of their hands positions that, for instance, can control the speed of a multi-speed fan. Switch operators can be found in various shapes and sizes, such as toggles or buttons, and can be furnished in a variety of colors. Footswitches can be either momentary or latching. And can use various operating principles.

"Poles" are individual circuits the switch controls (e.g., a "3-pole" switch has three circuits controlled by the same throw). "Throws" areunique positions or settings for the switch (e.g., a "double-throw switch" can operate in two different positions like on/off, high/low, etc.). Combining the number of poles and throws gives a succinct description of the switch's function, so the function of, for instance, a "single- pole, double-throw" switch is implicit. Switch types are commonly abbreviated for brevity, so a single-pole, double-throw switch would be referred to as an "SPDT" switch.

Foot Switches:

Foot Switches are electro-mechanical devices used to control power in an electrical circuit by foot pressure. They are often used on machines where an operator needs his or her hands to stabilize a workpiece.

Key specifications include the number of pedals, switching function, voltage rating, and current rating. Foot switches find use in many press applications where hand controls cannot be used to actuate a cycle. They are also commonly used in hospital equipment and office machines use about any pedal with a level or volume knob can be used as a kills witch, which is what you're talking about. just turn the knob down all the way. A limit switch is an electromechanical device operated by a physical force applied to it by an object. The simplest type of switch is a single-pole, single-throw (SPST) device that functions as an on-off switch. Double-pole, double- throw (DPDT) switches are commonly employed as internal polarity reversing circuits. Switches of up to four poles and three throws are common and some have break.

Limit switch

In electrical engineering, a limit switch is a switch operated by the motion of a machine part or the presence of an object. A limit switch can be used for controlling machinery as part of a control system, as a safety interlock, or as a counter enumerating objects passing a point.

Limit switches are used to detect the presence or absence of an object. These switches were originally used to define the limit of travel of an object, and as a result, they were named Limit Switch.

Level Switches

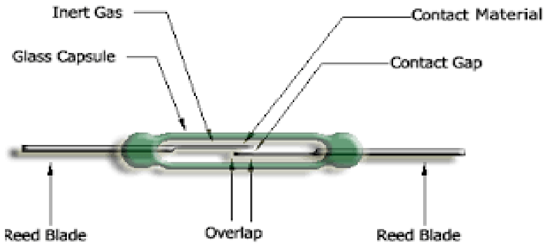
Devices used to switches are used extensively in the process industries to monitor tank and hopper levels. They are used in everyday applications as well. Level Switches are electro-mechanical detect the level of liquids, powders, or solids. They are mounted in tanks, hoppers, or bins, and can provide output to a control system. In some instances, they can be used to actuate a device directly, such as level switches used in residential sump pumps. Key specifications include measured media, output type, switch type, voltage and current ratings, and the materials used for the body, stem, and float.

Rocker Switches

Rocker Switches are hand operated electro mechanical devices used for switching circuits. The switch operator position, raised or depressed. Rocker Switches house a button for operation that can be pressed on either end like a seesaw to connect or disconnect an electrical circuit. They are often used as ON/OFF switches on the main power supplies for electronic devices quick visual indication of the circuit's on or off status. Key specifications include single-throw or double-throw switching function, mounting type, actuator type, and panel cut-out dimensions. Rocker switches are used for manual switching in many industrial controls as well as for control of consumer goods and office machines.

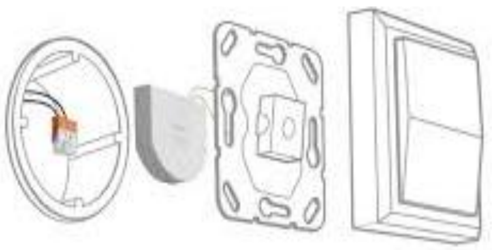
Magnetic Switches

Magnet or the coil of an energized Magnetic Switches, also known as reed switches, are a type of electrical switch in which the switch closure mechanism is operated by the presence or absence of a magnetic field. In a typical design, the switch contacts are normally open when a magnetic field is not in close proximity to the switch, but then the contacts close to complete the circuit when the magnetic field is applied or when the switch is in close proximity to a magnetic field from a per mane relay. One application for magnetic switches is to detect the opening and closing of doors and windows as part of a security system.



Wall Switches

Wall Switches are hand-operated electro-mechanical devices used in residential and commercial buildings most commonly for lighting control. They are also used to control ceiling fans and electrical outlets. Key specifications include combination device function, actuator type, and additional switch functions such as dimmer control, fan speed control, or timer-based switching.



Wall switches are specifically designed to operate on line voltage and fit inside standard electrical boxes. They are standard items in residential and commercial construction. A variety of decorator or designer styles can set these switches apart from industrial switches where aesthetics are less of a concern.

Toggle Switch

A toggle switch is manually actuated (or pushed up or down) by a mechanical handle, lever or rocking mechanism.

These are commonly used as light control switches. Most of these switches come with two or more lever positions which are in the versions of SPDT, SPST, DPST and DPDT switch. These are used for switching high currents (as high as 10 A) and can also be used for switching small currents.

These are available in different ratings, sizes and styles and are used for different type of applications. The ON condition can be any of their level positions, however, by convention the downward is the closed or ON position.

Conclusion

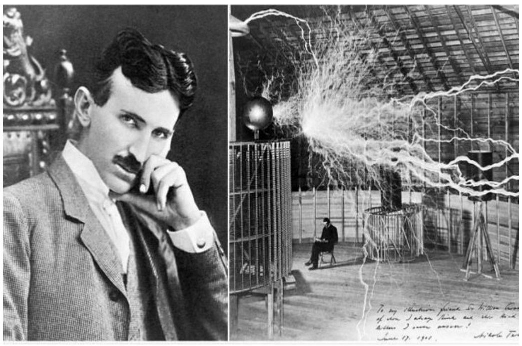
Switches are made in many different configurations; they may have multiple sets of contacts controlled by the same knob or actuator, and the contacts may operate simultaneously, sequentially, or alternately A common use is control of lighting, where multiple switches may be wired into one circuit to allow convenient control of light fixtures. electric switch**,** device for opening and closing electrical circuits under normal load conditions, usually operated manually.

WIRELESS ELECTRIC VEHICLE CHARGING SYSTEM

JEEVANANDAM T *DHEENADHAYALAN G*

Introduction

Nowadays the world is shifting towards electrified mobility to reduce the pollutant emissions caused by nonrenewable fossil-fueled vehicles and to provide an alternative to pricey fuel for transportation. But for electric vehicles, traveling range and charging process are the two major issues affecting its adoption over conventional vehicles. With the introduction of Wire charging technology, no more waiting at charging stations for hours, now get your vehicle charged by just parking it on a parking spot or by parking at your garage, or even while driving you can charge your electric vehicle. As of now, we are very much familiarwith wireless transmission of data, audio, and video signals so why can't we transfer power over the Air



Thanks to great scientist Nikola Tesla for his limitless amazing inventions in which wireless power transfer is one of them. He started his experiment on wireless power transmission in 1891 and developed the Tesla coil. In 1901 withthe primary goal to develop a new wireless power transmission system Tesla started developing the Wharncliffe Tower for large high-voltage wireless energy transmission station. The saddest part is to satisfy Tesla's debts, the tower was dynamited and demolished for scrap on July 4th, 1917.

Basic Principle

Wireless charging is the same as the transformer working principle. In wireless charging there are transmitter and receiver, 220V 50Hz AC supply is converted into High-frequency alternating current and this high-frequency AC is supplied to the transmitter coil, then it creates an alternating magnetic field that cuts the receiver coil and causes the production of AC power output in the receiver coil. But the important thing for efficient wireless charging is to maintain the resonance frequency between transmitter and receiver. To maintain the resonant frequencies, compensation networks are added at both sides. Then finally, this AC power at the receiver side was rectified to DC and fed to the battery through Battery Management System (BMS).

Static and Dynamic Wireless Charging

Based on the application, Wireless charging systems for EV can be distinguished into two categories,

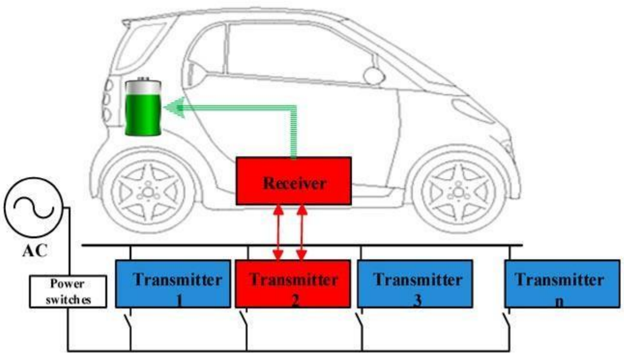
1. Static Wireless Charging
2. Dynamic Wireless Charging

1. Static Wireless Charging

As the name indicates, the vehicle gets charged when it remains static. So here we could simply park the EV at the parking spot or in the garage which is incorporated with WCS. A transmitter is fitted underneath the ground and the receiver is arranged in vehicles underneath. To charge the vehicle align the transmitter and receiver and leave it for charging. The charging time depends on the AC supply power level, the distance between the transmitter & receiver, and their pad sizes. This SWCS is best built in areas where EV is being parked for a certain time interval.

2. Dynamic Wireless Charging System (DWCS):

As the name indicates here the vehicle gets charged while in motion. The power transfers over the air from a stationary transmitter to the receiver coil in a moving vehicle. By using DWCS EV's traveling range could be improved with the continuous charging of its battery while driving on roadways and highways. It reduces the need for large energy storage which further reduces the weight of the vehicle. Dynamic wireless charging is based on induction technology (similar to the system used in the induction hotplates that have become an alternative to conventional cooker hobs in the last decade). In practical terms, coils connected to electric cables are put in the ground.



Types of EVWCS

Based on operating Techniques EVWCS can be classified into four types

1. Capacitive Wireless Charging System (CWCS)
2. Permanent Magnetic Gear Wireless Charging System (PMWC)
3. Inductive Wireless Charging System (IWC)
4. Resonant Inductive Wireless Charging System (RIWC)

Capacitive Wireless Charging System Wireless transfer of energy between transmitter and receiver is accomplished employing displacement current caused by the variation of the electric field. Instead of magnets or coils as transmitters and receivers, coupling capacitors are used here for wireless transmission of power. The AC voltage is first supplied to the power factor correction circuit to improve efficiency and maintain the voltage levels and reduce the losses while transmitting the power. Then it is supplied to an H-bridge for the High-frequency AC voltage generation and this high-frequency AC is applied to the transmitting plate which causes the development of the oscillating electric field that causes displacement current at the receiver plate employing electrostatic induction.

The AC Voltage at the receiver side is converted to DC to feed the battery through BMS by rectifier and filter circuits. Frequency, voltage, size of coupling capacitors, and air-gap between transmitter and receiver affect the amount of power transferred. Its operating frequency is between 100 to 600 kHz.

1. Permanent Magnet Gear Wireless Charging System

Here transmitter and receiver each consist of armature winding and synchronized permanent magnets inside the winding. At the transmitter, side operation is similar to motor operation. When we apply the AC to transmitter winding it induces mechanical torque on the transmitter magnet causes its rotation. Due to the magnetic interaction change in the transmitter, the PM field causes torque on receiver PM which results in its rotation in synchronous with the transmitter magnet. Now change in the receiver's permanent magnetic field causes the AC production in winding i.e., the receiver acts as a generator as mechanical power input to the receiver PM converted into electrical output at receiver winding. The coupling of rotating permanent magnets is referred to as magnetic gear. The generated AC power at the receiver side is fed to the battery after rectifying and filtering through power converters.

2. Inductive Wireless Charging System

The basic principle of IWC is Faraday's law of induction. Here wirelesstransmission of power is achieved by mutual induction of magnetic field between transmitter and receiver coil. When the main AC supply is applied to the transmitter coil, it creates AC magnetic field that passes through the receiver coil and this magnetic field moves electrons in the receiver coil causing AC power output. This AC output is rectified and filtered to Charge the EV’s energy storage system. The amount of power transferred depends on frequency, mutual inductance, and distance between transmitter and receiver coil. The operating frequency of IWC is between 19 to 50 kHz.

3. Resonant Inductive Wireless Charging System

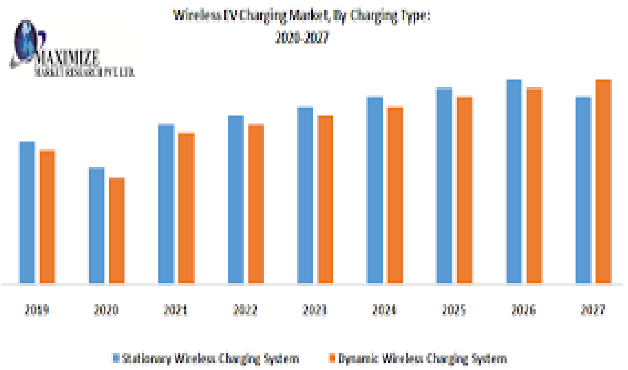
Resonators having a high-Quality factor transmit energy at a much higher rate, so by operating at resonance, even with weaker magnetic fields we can transmit the same amount of power as in IWC. The power can be transferred to long distances without wires. Max transfer of power over the air happens when the transmitter and receiver coils are tuned i.e., both coils' resonant frequencies should be matched. So, to get good resonant frequencies, additional compensation networks in the series and parallel combinations are added to the transmitter and receiver coils.

These additional compensation networks along with improvement in resonant frequency also reduce the additional losses. The operating frequency of RIWC is between 10 to 150 kHz.

Drawbacks

Wireless charging is rarely used due to the high inefficiencies involved. Charging cables allow for a near 100% energy transfer from the source to the battery, but a wireless charger can have efficiencies as low as 60%. Considering that a large proportion of electricity is generated from fossil fuels, this inefficiency would increase CO2 production.

The efficiency issue with wireless chargers is further compounded by the distance between the vehicle and the charging pad. Wireless chargers are most efficient when the distance between the two coils (transmitter and receiver) are as close to each other as possible. However, a charging pad on the floor and one on the car's base would see a significant separation. While a wireless charger in a parking lot or garage is somewhat plausible, it is unlikely to ever work on main roads. Such a charger would need to be embedded into the road instead of raised; otherwise, it would effectively behave as a speed bump. Wireless chargers, being a crude transformer, are also dependent on each coil's number of turns. Therefore, all manufacturers would have to conform to a specified coil size, turns, and power rating, which is the same issue that current manufacturers already face with charging cables.



Conclusion

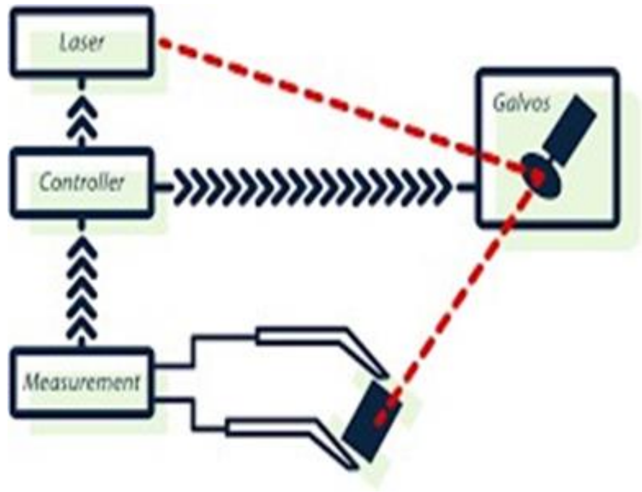
It is important to research different ideas and avenues that could turn up interesting facts that were not known previously. However, it is unlikely that wireless EV chargers' research will bring about anything new due to the many flaws inherent in wireless charging.

LASER TRIMMING OF AUTOMOTIVE ELECTRONICS

TAMILARASAN K *VICKRAMAN M*

Introduction

The use of lasers to adjust the performance of hybrid circuits has added a new dimension to the electronics industry and created a new production technology. No longer is hybrid technology reserved to the laboratory or small run production. Hybrid construction can be chosen on its own merits for such high volume products as automotive ignition modules and telephone active filters



As an example of functional laser trimming and its use in high volume production, we have chosen to talk about automotive modules but we could equally well have chosen active filters or d/a converters as other examples of extremely high-volume parts. In recent years, the hybrid circuit technique has been used in manufacturing electronic modules for the automobile that cover the range from voltage regulators and electronic ignitions to various sensors

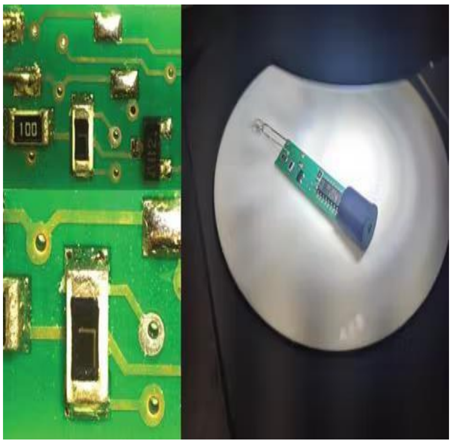
Trimming Potentiometers

Often designers use potentiometers, which are adjusted during end testing until the desired function of the circuit is reached. In many applications, the end user of the product would prefer not to have potentiometers, as they can drift, be misadjusted or develop noise. Therefore, manufacturers determine the needed resistance or capacitance values by measurement and calculation methods and afterwards solder the suitable component into the final PCB; this approach is called "Select on Test" (SOT) and is quite labor- intensive.

It is simpler to substitute the potentiometer or the SOT part with a trimmable chip resistor or chip capacitor, and the potentiometer adjusting screwdriver is replaced by the laser trimming. The achieved accuracy can be higher, the procedure can be automated, and the long-term stability is better than with potentiometers and at least as good as with SOT components. Often the laser for active trimming can be integrated in existing measurement systems by the manufacturer.

Separate Passive and Functional Trimming

The most economical way to trim automotive electronic modules is to first passively trim the resistors on a general purpose resistor-trim system and then actively trim them on a system specifically designed to recreate the actual automotive environment. Using two separate systems retains the high throughput advantages of passive trimming and permits more reliable active time.



The Teradyne W411 high- volume passive trim system and the A300 solid-state ignition adjust system offer the necessary capabilities for passive and active automotive trimming needs. The W411 utilizes a high speed galvanometer beam positioner a high-power YAG laser, a 77 in. step-and- repeat carrier, and specialized software to provide the throughput and reliability required for passive trimming. The A300, configured for active trimming of ignition modules, simulates actual operation in an automotive environment so that the trim is relevant. For example, specialized high-current and high-voltage sources supply the required currents and voltages, and detectors measure peak voltages and currents. A waveform generator allows users to program any waveform into the device under test, and a universal interface permits users to interchange loading coils, without system modification. A system such as the W411 first passively trims most of the resistors on a substrate to bring them within acceptable tolerances. Following this the remainder of the components such as capacitors, discrete diodes, and any silicon integrated circuits, are added to the device. The silicon integrated circuits are usually made on the ignition device in order to ensure the correct current mounted in a flip-chip manner, again allowing freedom from vibration effects. At this point, a system such as the A300 makes a final active trim to bring the unit into final specification

In the case of the voltage regulator, for example, an active trim is made for the final regulated voltage. During the past four or five years electronic voltage regulators have appeared in virtually all cars in the United States, Japan, and Europe. In the case of sensors such as manifold pressure, air flow, or temperature, the final active trim is made on the device in order to calibrate the output of the device with respect to the parameter being sensed. through clever design of the ignition coil, a more common technique is to employ a feedback clamp to the base of the output transistor. spurred on by the need for centralized engine processors to handle such functions as fuel Another requirement in addition to limiting the maximum energy that the device must switch is limiting the peak voltage to which the device is subject when the ignition coil is shut off, as this voltage can easily reach 500 or 600 V.

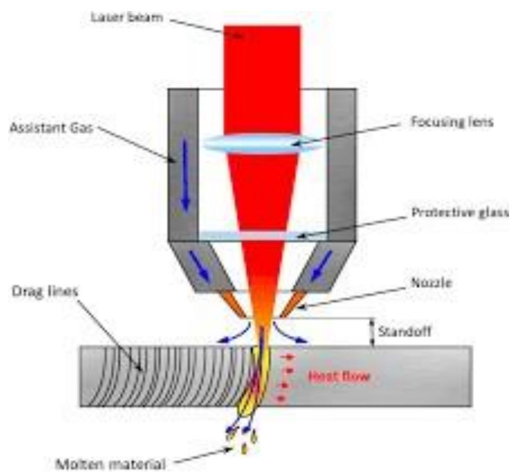
Function Mode:

- ✓ The LTCC is mounted in the contact unit.
- ✓ From the opposite side a rigid probe contacts the circuit.

- ✓ From the top side the chamber is pressurized to 1 to 4 bars, with a controlled exhaust port to achieve air flow through the chamber.
- ✓ As the resistance material is vaporized, the waste particles are removed in the air flow
- ✓ Laser cutting works by directing the output of a high-power laser most commonly through optics
- ✓ An optical resonator is needed to build up the light energy in the beam

Laser Trimming of Ignition Circuits

Trimming ignition modules is a bit more complex. In the current version of electronic ignitions, the contact points are replaced by a Darlington transistor that can take the on-current of the coil (about 7 A) and can also withstand the inductive kick when the current is turned off at spark time. The combination of 7 A and up to 400 V, in addition to the very high levels of reliability required, added to the heat and vibration present inside an automotive engine, tend to impose severe requirements on these output transistors. In order to limit the energy that the device must switch, a means of limiting the current in the output device must be found. This is accomplished by having the electronic module regulate the maximum current at some preset value usually in the range of 5 to 7 A. An active trim is the use of such sensors in automobiles is just beginning to come into widespread use. A second active trim is thus required to ensure that this peak voltage does not rise above allowable limits, usually in the neighborhood of about 400 V. A further problem with ignition devices occurs because most inductive or Hall-effect type pickups produce an ON signal that is a constant "dwell" or constant percentage of an engine revolution. If this signal is used directly to switch the output transistor, at low speeds the device would spend most of its time in current limit, thus dangerously raising its power dissipation.



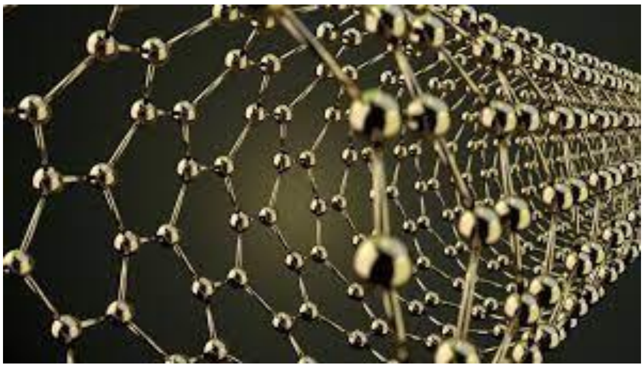
A variety of techniques are used to change the constant dwell of a pickup device into an ON signal which is of constant- time duration. For some of the latest ignition devices, an additional trim is required to ensure that the ON time specifications are met. The laser has proved indispensable in manufacturing low cost devices with the desired high precision.

NANO ELECTRONICS – THE FUTURE

ASHA R *HEMALATHA S*

Introduction

Nanoelectronics is the term used in the field of nanotechnology for electronic components and research on improvements of electronics such as display, size, and power consumption of the device for the practical use. This includes research on memory chips and surface physical modifications on the electronic devices. Nanoelectronics covers a diverse set of devices and materials, with the common characteristic that they are so small that physical effects alter the materials ‘properties on a nanoscale – inter- atomic interactions and quantum mechanical properties play a significant role in the workings of these devices. At the nanoscale, new phenomena take precedence over those that hold sway in the macro-world. Quantum effects such as tunnelling and atomistic disorder dominate the characteristics of these nanoscale devices.



Practical implementations of nanoscience and nanotechnology have great importance, and they depend critically on training people in these fields. Thus, modern education needs to address the rapidly evolving facets of nanoscience and nanotechnology. A new generation of researchers, technologists, and engineers has to be trained in the emerging nano disciplines. A principal goal of nanotechnology is to control and exploit these properties in structures and devices at atomic, molecular, and supramolecular levels. To realize this goal, it is essential to learn how to fabricate and use these devices efficiently. Nanotechnology has enjoyed explosive growth in the past few years. In particular, nanofabrication techniques have advanced tremendously in recent years. Obviously, revolutionary changes in the ability to measure, organize, and manipulate matter on the nanoscale are highly beneficial for electronics with its persistent trend of downscaling devices, components, and integrated systems.

History

The first transistors built in 1947 were over 1 centimetre in size; the smallest working transistor today is 7 nanometres long – over 1.4 million times smaller (1 cm equals 10 million nanometres). The result of these efforts are billion-transistor processors where, once industry embraces 7nm manufacturing techniques, 20 billion transistor-based circuits are integrated into a single chip.

The first ever concept was presented in 1959 by the famous professor of physics Richard P Feynman. Invention of the scanning tunnelling microscope in 1981 and the discovery of fullerene in 1985 leading to the emergence of nano technology. The early 2000s also saw the beginnings of commercial applications of nanotechnology, although these were limited to bulk application of nanomaterials.

The number of transistors on a chip will approximately double every 18 to 24 months (Moore's law).This law given chip designers ideas to incorporate new features on ICs. Moore's Law works largely through transistors that carry electrical signals, so the designers can squeeze more transistors into a chip, leading to the idea of nanoelectronics.

Nano electronic Devices

Spintronics

Spintronics is the study and exploitation in solid-state devices of electron spin and its associated magnetic moment, along with electric charge. Some consider the topic esoteric, given the conceptually challenging quantum physics and chemistry that underpins it, but the same was once said of what today is mainstream electronics. The reality is that spintronics is a maturing field of applied science and engineering, as well as fascinating pure science in its own right.

Optoelectronics

Electronic devices that source, detect and control light – i.e., optoelectronic devices – come in many shapes and forms. Highly energy-efficient (less heat generation and power consumption) optical communications are increasingly important because they have the potential to solve one of the biggest problems of our information age: energy consumption.

In the field of nanotechnology, materials like nanofibers and carbon nanotubes have been used and especially graphene has shown exciting potential for optoelectronic devices.

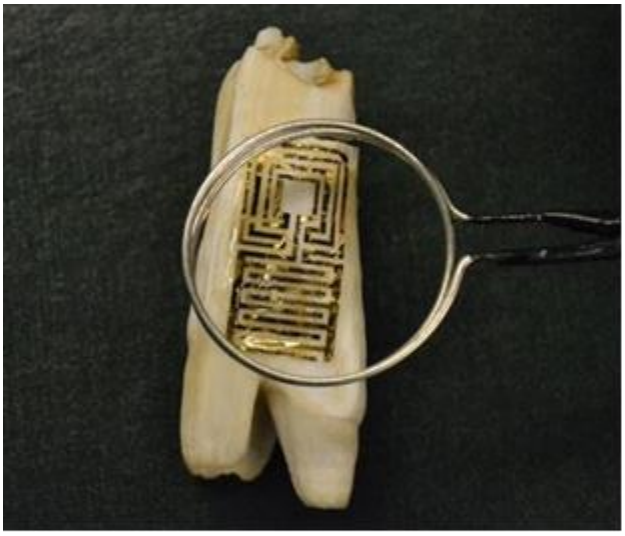
Resonant-tunneling diodes

Diodes or, in other words, two-terminal electrical devices, are the simplest active elements of electronic circuits. Some applications of diodes are based on their nonlinear current–voltage characteristics. Another important capability required of diodes is their operational speed. Such high-speed operation implies that the feature sizes of diodes should be as small as possible.

Wearable, flexible electronics

The age of wearable electronics is upon us as witnessed by the fast-growing array of smart watches, fitness bands and other advanced, next-generation health monitoring devices such as electronic stick-on tattoos.

If current research is an indicator, wearable electronics will go far beyond just very small electronic devices or wearable, flexible computers.



Not only will these devices be embedded in textile substrates but an electronics device or system could ultimately become the fabric itself. Electronic textiles (e-textiles) will allow the design and production of a new generation of garments with distributed sensors and electronic functions. Such e-textiles will have the revolutionary ability to sense, act, store, emit, and move – think biomedical monitoring functions or new man-machine interfaces – while ideally leveraging an existing low-cost textile manufacturing infrastructure.

Nano electronic Polymers (Nano polymers)

Nano polymers (sometimes called nanostructured polymers, nanoparticles-based polymers, or polymer nanocomposites), are nano-scaled, electrically conductive polymers or nano-scale sized polymers/copolymers containingdispersed nanoparticles. Compared with electronic and microelectronic polymers, nanoelectronics polymers are optimized for structuring nano-scale organic electronic systems due to their unique capability of building blocks for mounting complex and simple hierarchical nano systems. Regarding their attractive electronic properties, nanomaterials are used widely in the form of composites for structuring organic Nano electronics and nanostructured electronic systems. In addition, they can be used with π-conjugated polymers as electron acceptors in organic nano photovoltaics.

Nanotechnology for Wireless Devices

Visions of the wireless industry aims at ambient intelligence: computation and communication always available and ready to serve the user in an intelligent way. All these requirements combined lead to a situation which cannot be resolved with current technologies. Nanotechnology could provide solutions for these new technologies. SENSORS- Nanotechnologies will enable new materials and new sensing elements for sensors. Nano sensors will have applications in many industries, among them transportation, communications, building and facilities, safety, and national security, including both homeland defense and military operations.

MORE MEMORY- mobile phones will require up to 10 GB internal mass memory for short term and 50-100GB for mid and long terms. Today flash memory is dominant and has been most reliable for portable devices. But it is predicted that in near future nanotechnology will help increasing the memory storage capacity to a phenomenal level by inventions could be stored.

Nanotechnology for Molecular Devices Reducing size of electronics is the need of era and this can be achieved with the help of molecules that can be used in active devices. These molecules behave as diodes or programmable switches that make connections between wires and consume less current.

Thousands of molecules can be sandwiched between two crossing micro-scale wires to create an active devices. Since molecular devices fit between the wires, large area savings could be achieved.

Industrial Applications

The technology made the devices very light making the product easy to carry or move and at the same time it has reduced the power requirement.

Some Consumer Products which are using Nanotechnology are

- Computer Hardware
- Display Devices
- Mobile & Communication Products
- Audio Product
- Camera & Films

Nanotechnology in India

IIT Mumbai is the premier organization in the field of nanotechnology. Research in the field of health, environment, medicines are still on. Starting in 2001 the Government of India launched the Nano Science and Technology Initiative (NSTT). Then in 2007 the Nanoscience and Technology Mission 2007 was initiated with an allocation of Rupees 1000 crores for a period of five years. The main objectives of the Nano Mission are:

- Basic research promotion.
- infrastructure development for carrying out front-ranking research,
- development of nanotechnologies and their applications,
- human resource development and
- International collaborations.

Advantages

- Reduced size and scale of the machine.
- Advanced properties of semiconductors can be determined.
- Molecular scale Nano electronics is also known as "the next step in the miniaturization of electronic devices, with latest electronics theory and research in the field of Nano electronics". it is possible to explore the diverse properties of molecules.
- Extreme fabrication also supports the multiple use of single machine. Parallel processing is also empowered by Nano electronics.
- Increasing process variability and expected physical and reliability limitations of devices and interconnects Interface e and system integration technologies on a single chip and/or integration of different types of chips and devices in a single package.
- High speed and high capacity memory.
- Allows circuits to be more accurate on the atomic level.

Conclusion

Stretchable electronics or flexible electronics is likely to be the future of mobile electronics. Potential applications include wearable electronic devices, biomedical uses, compact portable devices, and robotic devices. In the future, it is likely that graphene will become a dominant material in flexible electronics. Graphene is nothing but an allotrope of carbon that has superb electrical conductivity, flexibility, and physical strength.

Flexibility is also a major breakthrough in the world of electronics, which will enable a new approach in design and functionality for the devices which our modern lives depend upon. Flexible devices have already begun to make their way into the commercial realm, and the next few years are bound to see huge changes brought on by this additional dimension which is now available to electronics.

AUTOMATIC POWER FACTOR CONTROL

PARAMASIVAM R *SUJITH S*

Introduction

Any inductive load that operates on alternating current requires apparent power, but apparent power is the addition of active power and reactive power. Active power is the power which is actually consumed by the load. Reactive power is the power demanded by the load and returned to the power source. The simplest way to specify.

Power Factor

Power Factor is the ratio between the useful (true) power whose unit is (KW) to the total (apparent) power is (KVA) consumed by A.C electrical equipment or inductive load. The power factor is a measure of how effectively electrical power is used to perform useful work. The ideal power factor is unity or one. If the power factor is less than one it means that excess power is required to perform or achieve the actual work.

Advantages of Power Factor Improvement:

Advantages which can be achieved by employing the proper power factor correction scheme are:

- Increase in efficiency due to Reduction of power consumption.
- Reduction in power consumption leads to a reduction in greenhouse gasses.
- Reduction of electricity bills.
- Availability of extra KVA from the same existing supply.
- Reduction of I^2R losses in transformers and distribution equipment.

An Idea to Improve Power Factor

The basic idea For Power factor correction of inductive circuits we have to connect a capacitor in parallel with the device which has a low power factor. One of the traditional methods for power factor correction is static type compensation in which static type capacitors are used for power factor correction. However, in this case, care should be taken when applying power factor correction star/delta type control so that the capacitors should not be subjected to rapid on-off conditions. Otherwise, back-to-back capacitor bank switching is usually associated with large inrush current and it may damage the equipment connected to the system

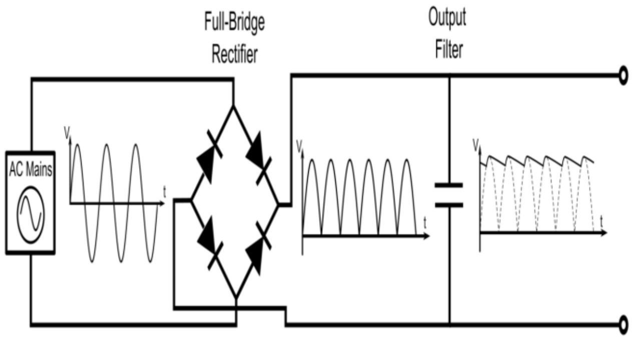
Need for Power Factor Correction (PFC) in AC/DC Power Supplies

An AC/DC power supply is made up of several circuits that transform an input AC voltage into a stable DC voltage at the output. The most essential of these circuits is the rectifier, which is responsible for transforming the AC voltage into a DC voltage; however, this circuit alone is not enough to ensure adequate operation.

In order for an AC/DC power supply to be efficient and safe, it needs to incorporate isolation, power factor correction (PFC), and voltage reduction. These elements protect the user, the grid, and any connected devices, and are each integrated to some extent in all switching power supplies.

The first step in any switching power supply is the rectification of the input voltage. Rectification is the process of converting a signal from AC to DC, and is done using a rectifier. The negative voltage in the AC wave can be either cut off using a half-wave rectifier, or inverted using a full-wave rectifier.

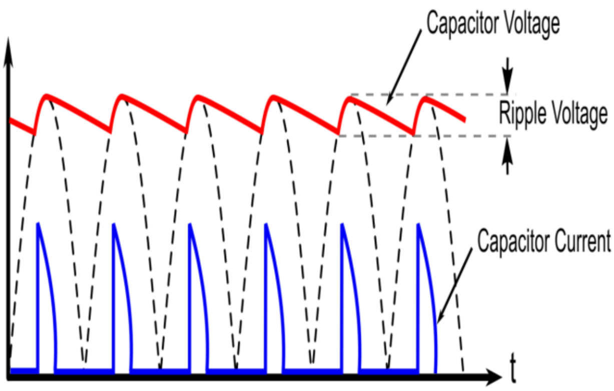
A full-wave rectifier is made up of four diodes connected in an arrangement called a Graetz bridge. These diodes switch on and off as the voltage from the power supply goes from negative to positive, inverting the negative half-wave's polarity and turning the AC sine wave into a DC wave.



Schematic of a Full-Bridge Rectifier

This wave has a large voltage variation, called ripple voltage, so a reservoir capacitor is connected in parallel to the diode bridge to help smooth the output voltage ripple.

However, if you observe the waveform of the rectifier's reservoir capacitor, you'll see that the capacitor is charged during a very short time, from the point where the voltage at the input of the capacitor is greater than the capacitor's charge, to the rectified signal's peak. This creates a series of short current spikes in the capacitor, which look nothing like a sinusoid.

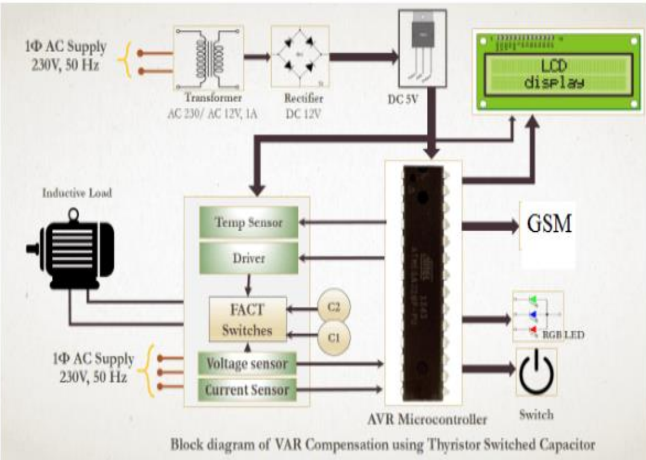


Voltage and Current Waveforms at the Rectifier Output

This is a very big problem, not only for the power supply, but for the entire power grid. To understand the magnitude of this problem, we must first have a handle on the concept of harmonics.

Parts of APFC – Automatic Power Factor Control

1. Auxiliary power Supply
2. Microcontroller(AT-mega328P)
3. LCD Display
4. Capacitor Bank
5. Potential transformer
6. Current transformer



Block Diagram of APFC

Working of APFC with GSM

A 220 Volts 50 Hz AC supply is given to transformer .Transformer steps down 230 Volts to 12 Volt AC. Output of transformer get converted to 5 Volts DC using IC 7805. The 5 Volts DC supply is given to microcontroller. Load voltage and load current are sensed by CT/PT. Such sensed Voltage and Current samples are given to the microcontroller and then microcontroller inbuilt comparator act as Zero Crossing Detector and determine power factor and output displayed on 16X2 LCD display. For given load if power factor is less than desired power factor capacitor bank 1 is switched on. After switching on bank l 27 desired power factor is not achieved, capacitor bank 2 is switched by using microcontroller to get desired power factor (> 0.95).

Capacitor Bank Calculation for APFC Panel

Features:

Ø High Performance, Low Power Atmel®AVR® 8-Bit Microcontroller Family

Ø Advanced RISC Architecture

- 131 Powerful Instructions – Most Single Clock Cycle Execution
- 32 x 8 General Purpose Working Registers
- Fully Static Operation
- Up to 20 MIPS Throughput at 20MHz

Ø Peripheral Features

- Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, andCapture Mode
- Real Time Counter with Separate Oscillator
- Six PWM Channels
- 6-channel 10-bit ADC in PDIP Package

Ø Special Microcontroller Features

- Power-on Reset and Programmable Brown-out Detection
- Internal Calibrated Oscillator
- External and Internal Interrupt Sources 32
- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

Ø Operating Voltage: 1.8 – 5.5V

Ø Temperature Range:- 40 0C to 850C

Advantages of APFC

- Increase in efficiency due to Reduction of power consumption.
- Reduction in power consumption leads to a reduction in greenhouse gasses.
- Reduction of electricity bills.
- Availability of extra KVA from the same existing supply.
- Reduction of I^2R losses in transformers and distribution equipment.

Disadvantages of APFC using Capacitor

1. They have a short service life ranging from 8 to 10 years
2. They are easily damaged if the voltage exceeds the rated value
3. Once the capacitors are damaged, their repair is uneconomical

Conclusion –

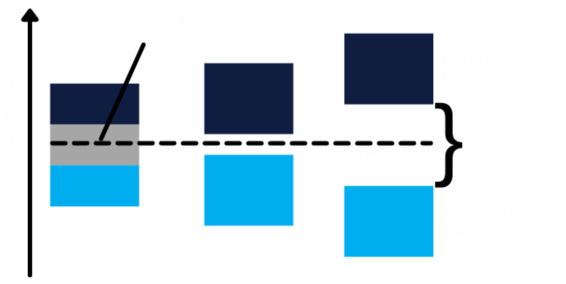
This Automatic Power Factor Control provided one of the techniques used to overcome power losses due to low power factor associated with common household and small industrial units. To add value to the regular product (APFC), proposed GSM based APFC.

WIDE BAND GAP DEVICES

RANJITHKUMAR N NAVVEN S

Introduction

Physicists define the bandgap of a material as the difference in energy between the highest occupied state of the valence band (the band of electron orbits from which electrons jump when excited by the application of energy) and the lowest unoccupied state of the conduction band (the band to which those electrons can jump). The band gap dictates the energy required for electrons to move from the valence band to the conduction band.



Legacy silicon, which has been the primary material for semiconductors since the 1950s, has a bandgap of 1.1 eV. The latest wide bandgap (WBG) semiconductors are those based on new and emerging materials that have bandgaps typically in the region of two to three times that of silicon.

Benefits of WBG Semiconductors

Silicon has been dominant for many years but is reaching its performance limits in a growing number of existing and emerging applications. Because WBG semiconductors can withstand higher electric fields they can sustain higher voltages. They can also operate at higher switching frequencies. The latter not only supports improved performance but also minimizes filtering requirements and allows the use of smaller external components (faster switching means energy is delivered in smaller packets and, therefore, less energy needs to be stored in the circuit's passive and inductive devices).

When compared to legacy silicon these factors translate into a number of benefits including smaller, faster, more efficient and more reliable operation. Higher voltage capabilities open up opportunities in higher power designs while dramatically improved efficiencies enable the same performance in smaller form factors or allow improved performance in the same form factor. Efficiency also has an impact on weight and, ultimately, the carbon emissions associated with the operation of the target application.

Many devices based on WBG technologies also offer the benefit that they can operate at higher maximum temperatures than their legacy silicon counterparts.

WBG Materials are Used for Semiconductors

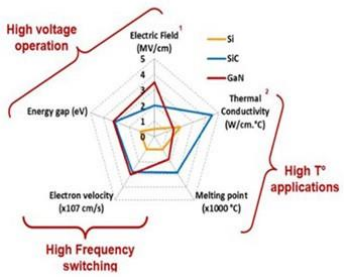
A number of materials including boron nitride, silicon dioxide and even diamond are all defined as WBG materials.

GaN and SiC are the two most prevalent WBG technologies in use today

However, the most prevalent WBG semiconductors today are those based on gallium nitride (GaN) and silicon carbide (SiC). The bandgaps of these materials are around three times greater than that of silicon, at 3.2 eV and 3.4 eV respectively.

Differences Between GaN and SiC

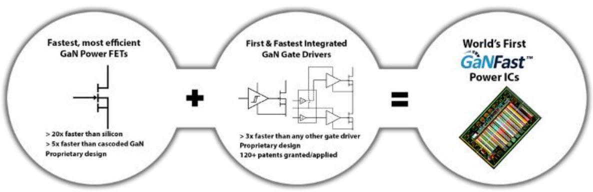
While GaN and SiC are compound semiconductors with similar bandgaps and both can support higher voltages and higher frequencies, there are a number of differences between the two technologies that impact how they work and where they are used.



Application design parameters for Si, GaN and SiC

The key differentiator between GaN and SiC is speed in terms of electron mobility – how quickly electrons can move through the semiconductor material. At 2,000 cm^2/Vs, GaN's electron mobility is 30% faster than that of silicon and 300% faster than SiC, which makes it much more suitable for high-performance, high-frequency applications. With GaN, a very, very small percentage of the chip is actually consumed by the gate electrode. This ensures very low capacitance meaning it is very easy to get high frequencies. In fact, GaN semiconductors are widely used in RF devices that switch in the gigahertz range. Silicon carbide, on the other hand, has a lot of gate area, requires a very much higher gate charge to switch and is, therefore, slower.

GaN's wide band gap allows power applications with voltages between 100 V and 600 V to use smaller, more efficient chips, reducing costs and carbon emissions. SiC, with higher thermal conductivity and lower frequency operation is more suited for the highest power applications such as rail traction and wind turbines that require slower switching speeds and large heat dissipation.



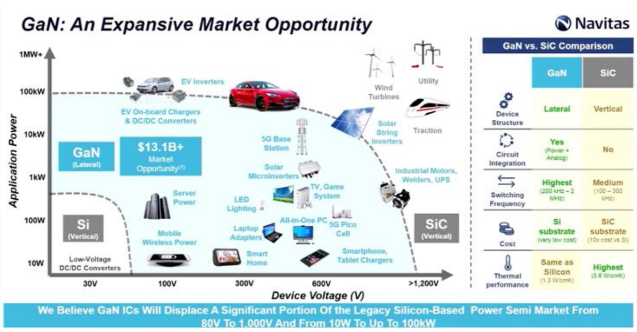
GaN structure supports monolithic integration

One other factor is the potential for integration, which depends on the current flow within the WBG semiconductor material. SiC is a 'vertical' device that is optimized for high power only, while

Navitas' GaN, for example, has a 'lateral' structure. The latter makes monolithic ('same chip') integration possible, enabling GaN power ICs to integrate power FETs with drive, logic, protection, sensing and control in a single chip.

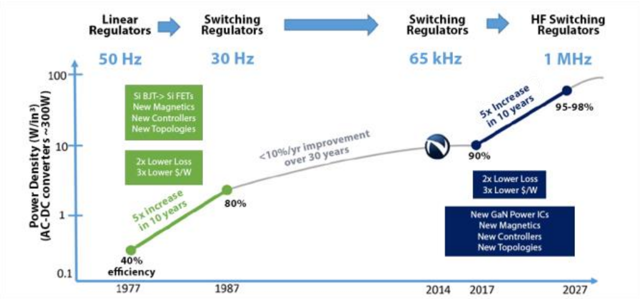
WBG Semiconductor Applications

The following diagram illustrates the existing and potential applications for GaN and SiC in power applications.



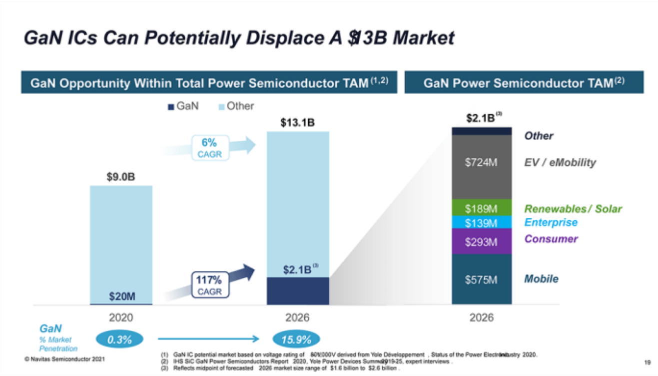
GaN – The Second Revolution

In 1977, two major events changed the lives of many engineers: the movie "Star Wars" was released, and there was a revolution in power electronics. Since then we have had many Star Wars movies, many more new engineers and a new performance revolution, with wide bandgap materials, enhanced high-frequency magnetics, new controllers, enabled topologies and device integration.



Potential for WBG Semiconductors

The potential market for WBG semiconductors is already significant and growing rapidly as companies look to replace legacy silicon in existing applications and to harness the power of GaN and SiC in new and emerging designs where silicon cannot compete. At Navitas we believe there is a $13 billion electrification opportunity for GaN by 2026.



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Conclusion

SiC and GaN are known to be the next generation materials for high performance power conversion and electric vehicles. Highest reliability is offered by employing WBG based devices that provide superior robustness for harsh environmental conditions. Robustness and ruggedness are also achievable by use of WBG based devices [5]. In summary, compared to silicon the crucial benefits offered by WBG materials include lower on resistance, higher breakdown voltage, higher thermal conductivity, operation at higher temperatures, greater reliability, near zero reverse recovery time and excellent high frequency performance.

INTERNET OF ENERGY (IoE)

MONISA B *BASKAR S*

Introduction

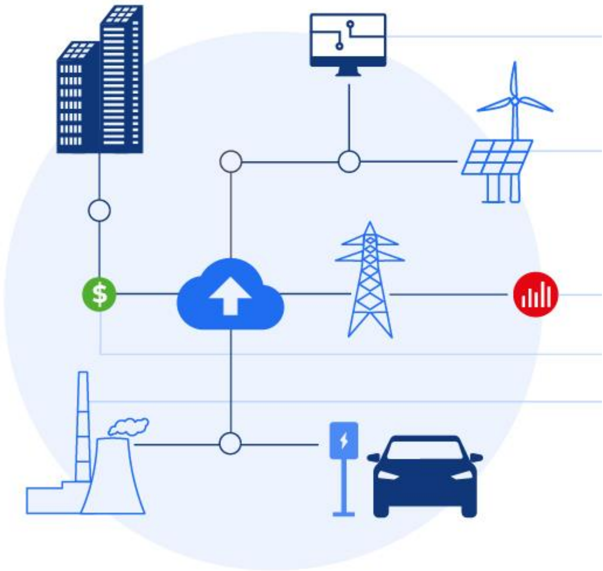
The internet is a worldwide array of servers and communication lines that allow us to access data and communications from our various devices: desktop, laptop, tablet, and smartphones. Information is constantly flowing from one point to another. Imagine an infinite army of tiny file clerks running from point to point with information files — that's a good visualization of what the internet is and does.

While you might have a vague grasp of the internet, how it's configured, and its different sectors, it can still be quite a confusing space to truly understand. To help clear any confusion, this guide will spell out all the details you need to know, including how the Internet of Energy (IoE) differs from the Internet of Everything and why it's important to you and the planet.

Internet Of Energy (IoE)

If you imagine the internet as a cyber universe, then the Internet of Energy (IoE) is a corner of that universe dedicated to all things energy-related. While the Internet of Everything encompasses how people interact with smart objects as well as one another, IoE specifically refers to the automation and upgrading of our energy infrastructure: the power grid from grid operators to energy producers and distribution utilities.

The IoE allows for the exchange of energy information, called big data. Big data analytics provide grid operators, energy producers, and distribution utilities with real-time energy consumption trends, allowing them to forecast where and when energy demand or energy consumption will peak. Grid operators, who manage and track energy production and delivery, can direct adjustments in the energy supply as needed with that data.



The IoE includes energy infrastructure in energy production and delivery by using artificial intelligence (AI) at power plants and power delivery systems. It also means upgrading and automating our appliances and metering at the point of delivery — our homes. Smart meters and intelligent appliances or devices help optimize our energy supply, energy management, and energy use.

So, within the IoE, we have smart grid technology, or the Internet of Things (IoT), which helps power producers and distributors monitor and deliver power on a more efficient basis. Each segment can "talk" to the others about the most energy-efficient ways to provide power from the point of power generation to your home.

Difference between the IoE and the IoT

The Internet of Energy builds on the principles of the Internet of Things to provide people with the data necessary to optimize and manage the power grid. The goal is to increase the autonomous operation of the power grid. Using IoT devices, such as smart sensors and communication technologies, the energy industry is creating the Internet of Energy to manage energy generation and energy resources.

The IoE is a smart energy infrastructure system that incorporates the IoT to connect every point within the power grid: generation, load, distribution, storage, smart meters. As a result, the IoE supports the power grid's ability to operate with more efficiency, resiliency, and reliability. Not limited to a two-way flow of information, the IoE allows for a multi-directional flow of information.

Uses of IoT in Energy Systems

While the current smart grid allows grid operators to manage traditional energy generation sources (fossil fuels and hydropower, for example), it doesn't easily allow for the inclusion of renewable energy sources, such as solar power or wind power. Using the IoT will help with improved energy data management and optimize most processes within the grid.

As climate change drives the development of clean energy and sustainability, the IoT will help incorporate renewable energy sources, like wind farms and solar panel arrays, into the smart grid. Such incorporation will further expand the Internet of Energy. The goal is sustainable and renewable energy delivered seamlessly to the point of use. In other words, smart power.

Uses of Internet of Energy

The Internet of Energy has numerous uses, and its utilization ranges from grid operators to commercial, residential, and industrial consumers. Suppose a catastrophic event, such as California's Dixie Fire or Texas's February 2021 storm, disrupts power generation and distribution networks. In these extreme cases, the IoE helps grid operators manage the grid in real-time to diagnose which lines need to be de-energized and reroute power along different power lines.

The IoE also allows local utilities to pinpoint trouble spots within their microgrids, such as a blown transformer, and identify and communicate with affected customers. That ability to identify a trouble spot allows utilities to send repair crews where they are needed without tracking down the problem point.

Daily, the Internet of Energy helps grid operators and the energy industry plan for and meet the energy demands of residential, commercial, and industrial consumers. Real-time monitoring shows where demand increases or diminishes, allowing energy generation to be adjusted accordingly.

The IoE means more tools to manage their energy consumption and increased energy efficiency for consumers. For example, smart homes equipped with digital controls for lighting, heating, and appliances help homeowners control their energy consumption using a combination of voice commands, remotes, and switches, apps, or AI.

Four Pillars of the Internet of Energy?

Like the internet, the Internet of Energy depends on four central pillars: people, data, things, and processes. Energy infrastructure (generators, transmission lines, pipelines, etc.) needs to be controlled by people who rely on real-time data to inform their actions.

With the energy data received from various IoT technology points, the people involved in the energy industry can make informed decisions about the processes they manage.

Working of Internet of Energy

The Internet of Energy uses IoT technology to collect data and manage operations at many points in the power grid's infrastructure. Sensors within the energy industry's IoT support the diagnostic, analytic, optimization, and integration processes. The result is increased energy efficiency for the energy sector players and residential, commercial, and industrial buildings and plants.

Smart meters, such as those used in your home or business, are an example of how the IoE works. Smart meters use two wireless networks to communicate with your utility company. The Home Area Network (HAN) connects your appliances and lights to the meter itself, while the Wide Area Network (WAN) submits the data to the utility. Gas and electric utilities use smart meters.

Similar information from neighboring homes and businesses helps your utility determine real-time energy demand in your area. Communicating data upline, power utilities can adjust power generation and get power from other power systems on the power grid, if necessary, because of data exchanges happening throughout the IoE.

Purpose of the IoE

The Internet of Energy can optimize efficiency in the generation, transmission, and utilization of electricity through the digital tools that are the Internet of Things: sensors, actuators, computers, etc. As a result, energy optimization will reduce costs and increase reliability in delivering power to homes and businesses.

It will also help eliminate wasted power generation by informing energy producers when the systems are at peak capacity or in low demand. In addition, operators can direct excess energy to energy storage in the form of complex battery arrays, which hold power in reserve for a time when energy demand increases or to balance energy loads.

Internet of Energy Sources

Because the Internet of Energy relies on the Internet of Things, the access points are in the thousands, if not millions. Power plants, transmission lines, substations, and delivery networks each have many smart sensors — from smart meters and actuators to pressure gauges and voltage regulators — that feed into the IoE.

Challenges for the Internet of Energy

The Internet of Energy has several valuable features, and it incorporates flexible technology platforms. However, coordination and cooperation between technologies, networks, and entities are essential. The sheer complexity of the interconnections and system security and standardization issues is the greatest challenge for producers and consumers alike.

The Importance of the Internet of Energy

The Internet of Energy aims to upgrade and automate energy production and delivery processes fully. With millions of data points to monitor, the Internet of Energy can provide energy producers, grid operators, and utilities with the necessary information to balance energy production and energy demand.

What's more, IoE will enable the incorporation of renewable energy sources into the existing grid. Climate change is driving renewable energy development, but currently, there is no easy way to bring that energy into the grid on a broad scale. As fossil fuel resources diminish, that inability brings an ever-increasing urgency to get renewable energy online.

The IoE builds on the Internet of Things — devices we already use, such as smartphones and smart speakers like Amazon's echo, Google Nest, or the Apple Home Pod. All of these devices are used to connect lighting, security systems, HVAC systems, and appliances for homes and businesses. For example, the use of Wi-Fi, smartphone, and remotes helps energy consumers improve their home energy efficiency by managing the lights or "telling" the air conditioner when to turn on or up.

Overcoming the challenges facing the continued development of the Internet of Energy means more efficient energy production and a more reliable energy supply that includes all energy sources. It also means lower energy development and production costs across the industry, resulting in more affordable energy for consumers

Program Outcomes (POs)

PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, and engineering fundamentals to solve the complex electrical engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex Electrical and Electronics Engineering problems enabling attainment of conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions, components or process for complex Electrical Engineering problems to meet the specified needs considering public health, safety and environmental considerations.
PO4	**Conduct Investigations of complex problems:** Exercise research knowledge and technical methodology for design, analysis and interpretation of 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 to assess societal, health, safety, legal and cultural issues relevant to the professional engineering practice and take consequent responsibilities in the society
PO7	**Environment and Sustainability:** Realize the impact of the professional engineering solutions and demonstrate the knowledge for sustainable development in environmental context
PO8	**Ethics:** Apply and realize the professional ethics and responsibilities in Electrical engineering practice.
PO9	**Individual and Team Work:** Exhibit Individuality, Leadership and Team spirit in multidisciplinary settings.
PO10	**Communication:** Communicate, comprehend, write reports, design documentation and presentation effectively on complex engineering activities
PO11	**Project Management & Finance:** Demonstrate the Electrical engineering and management principles 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 in the broadest context of technological 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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