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Editorial

"In the depth of Winter, I finally learned that within me there lay an invincible Summer", said an eminent person of repute from West. The same West for which once John Masefield said, "It's a warm wind"; that he desired. The harshness of the freezing cold as of Masefield may be thought of as the hard times one run into, with an optimism that alteration of fate is just a matter of time.

What is all that I am trying to imply is, present time is not at all in one's favour. Successive lockdowns, financial crisis, social discontent, modification in teaching-learning process, all sums up to a situation where everything has turned topsy-turvy.

Among all the commotion, what is exhilarating is the active participation of our students towards all the curricular related activities. In this edition we have got quite an appreciable share of participation from them. Isn't it the sound of the footfall of "the warmth from the old brown hills?"

Keeping our finger crossed we hope for things to get back normal and present all of us VOLTAFFAIR-2020.
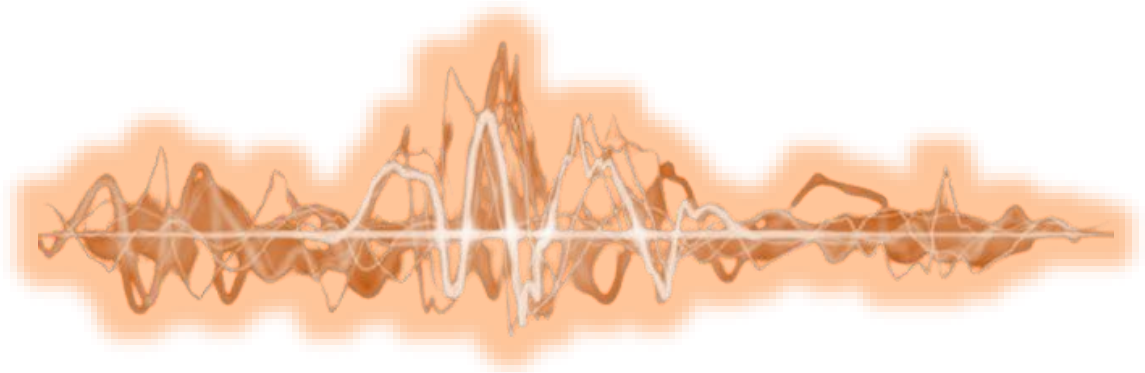
Vision

To become a nationally recognized centre of excellence in Electrical Engineering

Mission

- To provide training to the students by promoting active learning, critical thinking and engineering judgment coupled with business and entrepreneurial skills to succeed as leading engineers

- To prepare students with the capability to meet ever-growing socio-economic necessity of the industry and society

- To create opportunity to encourage self-learning leading to competence of lifelong learning

Programme Educational Objectives (PEOs)

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

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

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

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

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

Programme Outcomes (POs)

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES

PSO-1. (Engineering knowledge and analysis)

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

PSO-2. (Maintenance and technological development)

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

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

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

AUTOMATIC POWER FACTOR CORRECTION

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1. INTRODUCTION

In the present technological revolution power is very precious. So we need to find out the causes of power loss and improve the power system. In some cases the amount of reactive power consumed might even exceed the amount of active power it generates. This undesirable characteristic place an undue burden on the power network. Due to industrialization the use of inductive load increases and hence power system losses its efficiency. So we need to improve the power factor with a suitable method. The Automatic Power factor Correction (APFC) device is a very useful device for improving efficient transmission of active power. If the consumer connect inductive load, then the power factor lags, when the power factor goes below 0.97(lag) then the Electric supply company charge penalty to the consumer. So it is essential to maintain the Power factor below with in a limit. Automatic power factor correction (APFC) device reads power factor from line voltage and line current by determining the delay in the arrival of the current signal with respect to voltage signal. This time values are then calibrated as phase angle and corresponding power factor. Then the values are displayed in the LCD module. Then the motherboard calculates the compensation requirement and accordingly switches on different capacitor banks. This is developed by using PIC microcontroller. These values of voltage, current, power factor send to PC by using serial interface cable (RS232). PC saves the record of the power factor values, voltage and current values. Automatic power factor correction techniques can be applied to the industries, power systems and also households to make them stable and due to that the system becomes stable and efficiency of the system as well as the apparatus increases. The use of microcontroller reduces the costs.

2. HOW AUTOMATIC POWER FACTOR CONTROLLER WORKS?

Power factor is a ratio of real power and apparent power. Ideal power factor is unity. Pure resistive loads have unity power factor. But there is no such load exist. So we always try to make power factor close to unity. reactive power is also reason of low power factor. Inductive loads absorb reactive power and capacitive loads provides reactive power. So capacitor banks are used to improve power factor in power factor correction circuit. By connecting capacitor banks parallel to load, power factor is increased. capacitor provides reactive power locally to load instead of getting from generators or power system which in return induces burden in power system. This is main objective of automatic power factor controller.

3. AUTOMATIC POWER FACTOR CONTROLLER CIRCUIT DIAGRAM

Circuit diagram of automatic power factor controller is given below. In this circuit diagram of automatic power factor controller two capacitors are connected parallel to load to improve power factor. In this project, pic microcontroller is used to measure power factor and to adjust power factor automatically. Whenever power

factor falls below 0.9, microcontroller switch on relays. By turning on relays, capacitor bank connects automatically to load and improve power factor close to unity.
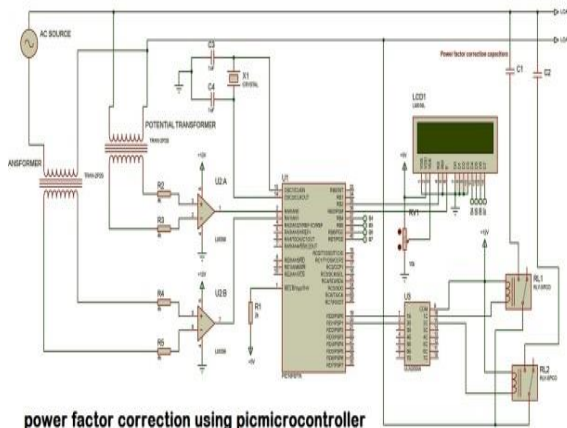
power factor correction using picmicrocontroller

automatic power factor controller circuit diagram

In above circuit diagram of automatic power factor controller, current transformer is used to get current wave form from of load current and current transformer also step down ac current. LM358 is used as a comparator in this circuit. similarly voltage transformer is used to get current wave form and fed this wave to LM358 comparator. LM358 is used as zero crossing detector in this project. After LM358 both current and voltage waveforms are fed to PIC16F877A microcontroller. PIC16F877A microcontroller measures zero crossing detection and power factor by measuring time difference between current and voltage wave form. Time difference between current and voltage waveform is used to measure power factor using pic microcontroller. For more details on how pic microcontroller measures power factor and done power factor measurement calculation.

PIC16F877A microcontroller calculate power factor and take necessary actions based on power factor. relay driver IC UNL2003 is connected with microcontroller and which is used to drive relays. Microcontroller sends high signal to relay driver IC whenever power factors falls less than 0.9. ULN2003 turn on relays which in return connects capacitor banks with the load.First of all the phase difference between voltage and current waveforms are measured and then power factor is calculated. In case of low power factor capacitors are added to improve it.

Automatic power factor controller circuit operation

Step 1 of automatic power factor controller
Alternating voltage of 220 volts is applied to the input of a step down voltage transformer. The output of step down transformer is connected to the diode which act as a rectifier and clips negative part of the sinusoidal waveform as microcontroller cannot detect negative cycle of the waveform.

Microcontrollers cannot operate upon voltages which are greater than 5 volts. If microcontroller is made to be operated upon the voltage greater than 5 volts, it will burn out and damage immediately. For microcontroller to be operated upon the circuits of high voltages we have to make use of step down transformers. Alternating voltage has to be step down such that peak value of voltage is less than 5 volts. Two different methods are usually used to convert 220 volts alternating voltage in to low voltage of 5 volts alternating voltage.

- Potential Transformer.
- Difference amplifier.

The proposed work uses transformer to step down voltage.The process of electromagnetic induction is used by

the transformer to transfer electrical energy from one circuit to another circuit or within same circuit. Time varying magnetic fields in a conductor produces force for electromagnetic induction. Transformers can be used to step up a voltage or step down a voltage depending upon its composition for the use in different electrical circuits.

In primary windings of a transformer, varying current produces a magnetic flux which is varying and this travels to the secondary of the transformer's winding. This produces a varying magnetic field which in turn produces electromotive force in secondary windings because of electromagnetic induction. Faraday's law can be used to understand the phenomenon.To reduce electrical voltages a special type of transformers is used known as step down transformer. In step down transformer the voltage in primary windings is greater than secondary windings. Such a type of transformer is used for example for converting 220 volts in to 110 volts.

Step down transformer can be used for isolation in electrical circuits, for power distribution to convert electrical voltage from one level to the other and many other control and power applications. Step down transformers use principle of electromagnetic induction between coils for conversion of voltages.Step down transfer are consists of two coils of wire which are insulated. The coils are made to wind upon the core. The core composition is of iron. A transformer has two coils. Primary coil has turns which are greater in number than number of turns in secondary. When a voltage is applied at primary side of the transformer, the core is magnetized as it is made up of iron. This induces voltage in

secondary coil of the transformer. The primary side of transformer is called as input side and secondary side of the transformer is known as output of the transformer.

The voltage which is step down in a transformer depends upon the number of turns in primary and secondary side of the transformer.An example can be given as:If there are 100 turns in primary coil of the transformer and 50 turns in secondary side then voltage ratio will be 2:1. Step down transformer can be also known as voltage ratio device.

Step 2 of automatic power factor controller:-

Same input signal is connected to the step down current transformer.A step down current transformer is used to convert high current in to low current for the use of different electrical circuits. The amount of current which is step down depends on the number of turns in primary coil and number of turns in secondary coil and also on the step down ratio.

If current transformer has ratio of 1000:10, then it means that such a step down transformer can convert current of 1000 amperes to 10 amperes. Step down transformers can be used in circuits where circuits are required to be operate on low currents and available currents are high in value. For example if a relay is to be operated or a microcontroller is to be operated in a circuit. One has to use intelligent techniques to step down the current value for the use of circuits and for this purpose step down transformers can be used.In proposed work a microcontroller is used that is why we have to step down the value of current for the microcontroller and

step down current transformer or potential transformer can be used for this purpose.

Step 3 of automatic power factor controller:-

Zero crossing detection is used to detect sine wave zero crossing from positive half cycle to negative half cycle or negative half cycle to positive half cycle. Zero crossing of two waves must be detected to measure the phase difference between two waves. Zero crossing detector circuit basically converts the sinusoid wave to square wave.The outputs from step down current and voltage transformers are fed in to zero crossing detector circuit which convert the sinusoid waveform in to square waveform to be used by microcontroller.

Op-amp is used as a comparator for the purpose of zero crossing detector circuit. Two analogue voltage levels are compared with one another using Op-amp circuit and output depends upon the comparison of these voltage levels. The voltage which is higher in magnitude appears at the output.

In zero crossing detector circuit one input (inverting) of Op-amp is set at zero reference and second input (non-inverting) is fed with sinusoidal wave to be converted in to square wave. Whenever the sinusoidal signal has value greater than zero reference, the output of Op-amp has positive value. As soon as the sinusoidal signal falls below zero reference, the output of op-amp falls to zero. In this way zero crossing detector circuit converts a sinusoidal signal to a square waveform.

The LM358 operational amplifier is equivalent to half of the LM324. Such amplifiers are preferable over usual operational amplifiers for several applications. Such type of amplifiers can operate upon low voltages such as only 3.0

volts and also high voltages up to 32 volts. The input which is common mode includes negative power supply, therefore it eliminates the necessity of external biasing components for many applications. Output voltage includes negative part of the supply voltage.

Following are the main features of LM358:-

- Output protected from short circuit.
- Input is truly differential.
- Supply operation ranging from 3.0 volts to 32 volts.
- Input bias currents are low.
- Internal compensation.
- Common mode extends to negative supply.
- Split and single supply operation.
- Clamps connected on inputs are ESD causes increase in ruggedness of the device and its operation is not affected.
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable.
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant.

In proposed circuit LM358 is used as zero crossing detector. When AC signal is applied to LM358, the output of LM358 is high that is '1' when sinusoid signal is positive and in case of negative value of sinusoid waveform the output of the LM358 is low that is '0'. Finally the zero crossing detector circuits converts both the

voltage and current sinusoid waveforms in to square signal or PWM.

Step 4 of automatic power factor controller:-

The paper utilizes and applies PIC microcontroller. The microcontroller is a cheaper solution for computational work in portable devices like this. PIC microcontroller is an advance microcontroller with many advance features low power utilization, high performance, high frequency, multiple special functions and vast memory space.

PIC 18F family has a RISC architecture with standard on chip features like RAM, ROM, ADC, Timers, Interrupts, I/O ports, EEPROM and USART. The PIC 18F devices have diverse interrupt sources and interrupt priority customization as well. It consists timer interrupts, serial interrupts, external interrupts, peripheral interrupts, watch dog timer interrupt. It has a 10- bit ADC with 13 channels. With the use of external interrupt or timer interrupt the high pulse time can be calculated and thus the phase angle can also be calculated. Since the PIC has multiple oscillator and clock frequency options, the controller can be operated faster and slower depending on the application. With such advance features and low cost, PIC is the best option for this project. The data collected from the zero detectors can be logged in the EEPROM as a record as well. External peripherals and POM extension help to diversify the features. The USART allows serial communication to pass on the data to the computer or the wireless systems that work on serial protocol. The microcontroller consists of 4 timers with each having interrupt as well. The calculation for phase

angle through such a powerful controller is the ideal choice.

The output from the zero crossing detectors are now fed to the pins of PIC of microcontroller separately which uses its internal timers to measure the time duration of signals in which their value is high or '1'.Timer is a register which counts from 0 to 255 and then start from 0 again. 0, 1, 2, 3, 4…255….0,1, 2, 3……etc. Timers are available in all PIC microcontrollers and when timer overflows it generates interrupt. Timer can use external clock or external clock to calculate time and it depends upon programmer how to use it.

PIC microcontroller has following timers.

- Timer 0
- Timer 1
- Timer 2
- Watch Dog Timer

TIMER0 is 8 bit timer and has prescalar of 8 bit. This timer can run 2 to 256 times slower than normal. TIMER1 is 16 bit timer and has two 8 bit registers having 1:1 and 1:8 prescalar and also has some other useful features. TIMER2 is an 8 bit timer having prescalar of 1:1 to 1:16 and postscalar of 1:1 to 1:16. It also has a period register. It can be used to control motors with PWM.

The time difference between two waves can be easily measured using external interrupts. Whenever interrupt is received on the pin of microcontroller, timer starts and as soon as another external interrupt is received time stops counting. One interrupt is generated with the help of current signal and other interrupt will be generated with the help voltage signal zero crossing. Timer value will be stored for further use. This variable value is basically a time difference between two waves. For good results take

20-30 values and then calculate their average.

In proposed work software program works in a similar manner such that as soon as the output of one zero crossing detector becomes high the timer start incrementing from 0 to 255 and then starts from 0 again. Timer continue to measure time period until the output of second zero crossing detector becomes high. By using simple and basic calculations of timer and it's prescalar, the time difference at which the outputs of zero crossing detectors become high can be calculated easily.

Step 5 of automatic power factor controller:-

Microcontroller then uses its abilities and program to calculate the phase angle and phase difference between two waveforms. Time difference between two waveforms can yield phase difference easily using following formula.Time difference = average values of timer /1000

In above equation 1000 is used to convert time into seconds because half of the sine wave is about 10us and there will 1000 counts per second.

θ = time difference * 2π

Power factor = Cos (θ)

2π is multiplied to time difference value to convert it in to radians as phase angle is to be expressed in radians. Phase difference which is expressed as an angle is known as phase angle. Now using information power factor can be calculated easily. These calculations are done by writing software program in microcontroller.

Step 6 of automatic power factor controller:-

The pins of microcontroller are connected to the relay IC and then to relays.When a low voltage circuit is used to derive a load which is connected to high voltage an IC is used which is known as Relay driver IC. A relay coil require more current as compared to other devices. Integrated circuits such as Op-amp circuits cannot supply such larger currents to derive relays. Relays are unique in properties and have taken the place of solid state switches and are stronger than solid state devices. Relays have high current capacities. They are capable to stand ESD and can also drive circuit isolation. There are many ways to drive relays. Some of the Relay Driver ICs are as follows:

- High side toggle switch driver
- Low side toggle switch driver
- Bipolar NPN transistor driver
- N-Channel MOSFETdriver and
- Darlington transistor driver
- ULN2003 driver

ULN2003 IC is a high current and voltage darlington pair IC, 7 common emitter and open collector darlington pairs are connected in it. One darlington pair compromises of two bipolar transistors. This ULN2003 IC is for 5V TTL and CMOS logic devices. This IC is used to drive loads of various loads, line drivers etc. This IC is used to drive motors. The pair of darlington can drive loads of current 500mA to 600mA. Each driver also has a suppression diode to dissipate voltage spikes while driving inductive loads.

An electrically operated switch is known as relay. Relays can be divided in to different categories depending upon the different

mechanisms on which is designed. For examples some relays uses electromagnets to mechanically operate switch. There are other mechanisms on which relays works such as solid state relays etc. Relays can be used to control a circuit using low power signals and also provides complete circuit isolations between control signals and circuits. It can also be used in circuits where one signal is used to control many circuits.

First time the relays were used in telegraph circuits in long distances as amplifiers. They repeat the signals which are coming in to the circuits and again transmit it to another circuit. Relays were also used in computers to perform different algebraic and logical operations and also in telephone exchanges.

Electromagnetic relay is simply consists of a coil which is wrapped around an iron core. An iron core is a source of providing low reluctance path to pass magnetic flux. Relay also includes moveable iron armature and one or more contacts. The armature is connected to the yoke and is mechanically connected to the contacts of the relays. A spring is used to place the contacts in place so that whenever relay is de-energized there is an air gap in magnetic circuits.In this work relays are used to connect and disconnect capacitors in the circuits.

Step 7 of automatic power factor controller:-

Microcontroller program calculates the phase difference between two sinusoid waves and then power factor using this information and displays on LCD. Liquid Crystal Display screen is very basic module and is used very commonly in various circuits for display purpose. It finds a wide range of applications. LCD display is preferred over LED display and seven

segment display. LCD's are easily programmable, economical and can easily display characters, animations and so on.16×2 LCD has 2 lines and each line can display 16 characters. In this LCD 5×7 pixel matrix is used to display each character. LCD has two registers which are named as command and data.

A command is an instruction which is fed to LCD, commands are used to execute some tasks which are predefined already such as initialize LCD, clear its screen, controlling display and brightness and setting cursor position etc. Command register stores such predefined instructions.Data register in LCD stores data which is to be displayed on screen. The data is in the ASCII form of the character which is to be displayed.

To display values on LCD hex values are converted in to decimal and then each decimal value is converted to respective ASCII code and finally send to LCD display.

Step 8 of automatic power factor controller:-

If the power factor is less than a prescribed value then microcontroller generate command to turn on the relay. Turning on relay will add capacitor in to the circuit which will help to improve power factor. Capacitors add reactive load in the circuit which will help to increase power factor. Number of capacitors which are to be added depends upon the power factor of the circuit. As soon as the power factor drops from a specific value, the relay will act to add capacitor to the circuit. If power factor value drops a little to the prescribed value then one capacitor is added. In case of power factor drops much more than prescribed value then second capacitor is

also added and the system goes on this way. The circuit will continue to add capacitor in parallel to the load until a good value of power factor is achieved.

4. ADVANTAGES OF CORRECTED POWER FACTOR

1. Reactive power decreases
2. Avoid poor voltage regulation
3. Overloading is avoided
4. Copper loss decreases
5. Transmission loss decreases
6. Improved voltage control
7. Efficiency of supply system and apparatus increases

5. THE DISADVANTAGES OF A LOW POWER FACTOR

1. Increases heating losses in the transformers and transmission equipment.
2. Voltage levels will not be stable.
3. Increased power losses.
4. Upgrade costly equipment
5. Decreased energy efficiency
6. Increase electricity costs by paying factor surges.

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6. EXPECTED OUTCOME OF THE PROJECT

The expected outcome of this project is measuring the power factor value and to improve power factor using a capacitor bank and reduce current drawn by the load using a controller as the brain and proper algorithm to turn on capacitors automatically, determine the trigger

sufficient switching of capacitor in order to compensate excessive reactive components thus bringing power factor near to unity and remove harmonics in the system thus improving efficiency of the system and reducing electricity bill.

7. CONCLUSION

The Automatic Power Factor Detection and Correction provides an efficient technique to improve the power factor of a power system by an economical way. Static capacitors are invariably used for power factor improvement in factories or distribution line. However, this system makes use of capacitors only when power factor is low otherwise they are cut off from line. Thus, it not only improves the power factor but also increases the life time of static capacitors. The power factor of any distribution line can also be improved easily by low cost small rating capacitor.

It can be concluded that power factor correction techniques can be applied to the industries, power systems and also households to make them stable and due to that the system becomes stable and efficiency of the system as well as the apparatus increases. The use of microcontroller reduces the costs. Due to use of microcontroller multiple parameters can be controlled and the use of extra hard wares such as timer, RAM, ROM and input output ports reduces.

THE FUNDAMENTALS OF POWER DENSITY

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1. INTRODUCTION

Power density is closely related to both size and efficiency. The more an engineer knows about power density, how it is estimated, its limitations, and how those limitations can be overcome, the better prepared he or she will be to leverage the latest in power-dense technology to meet the intense demands of modern power management systems.

2. WHY POWER DENSITY IS IMPORTANT

In the context of power management, power density serves as a measure of how much power can be processed in a given space or area. However, there is more to it than. Power density allows more power to be processed in a small space while enhancing the functionality of a system at reduced, not increased, system cost. In addition, power density and efficiency are closely coupled in power-delivery application and efficiency remains a driving force in modern engineering. In fact, to some, achieving higher power densities has become the ultimate achievement when designing power systems. The details of calculation power density correctly can be fairly detailed, but the basic concept behind estimating power density is quite straightforward. Most power density measurements are based on either volume or area. For volume, power density would be the output power processed (Vo x Lo) divided by the area formed by the rectangular area of the board (W) multiplied by the height of the tallest component on that board (xH). Power density in terms of area would simply be the power processed (Vo x Lo)by the rectangular area of the board (L x R). Power density is quantified as the amount of power processed per unit volume or unit area. The most typical units are Watts per cubic meter (W/in^3),Watt per square meter (W/m^2), or Watts per square inch (W/in^2).

3. LIMITATIONS AND TRADE – OFFS IN POWER DENSE SOLUTIONS

There are limitations and trade – offs involved in high power density solutions. In order to understand how progress can be made in achieving ever higher power densities, it is vital to be aware of these issues. Very specific limiting factors exist for how much power density can realistically be improved, including some of the following list:

- Conduction losses
- Turn-on and turn-off losses
- Reverse-recovery losses
- Thermal issues

With the exception of thermal issues, these factors are related to converter power losses.

4. EXAMPLES OF TI'S HIGH POWER DENSITY INNOVATIONS

TI has developed key technologies and innovations that implement the key design aspects that can overcome the limitations of higher power density.

- Less heat is generated because of excellent device switching performance made possible by advanced silicon and gallium-nitride technologies
- Increased efficiency is achieved by using smaller passive components.

DIAMONDS FROM THE SKY

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Finding a technology to shift carbon dioxide (CO_2), the most abundant anthropogenic greenhouse gas, from a climate change problem to a valuable commodity has long been a dream of many scientists and government officials. Now, a team of chemists says they have developed a technology to economically convert atmospheric CO_2 directly into highly valued carbon nanofibers for industrial and consumer products.

"We have found a way to use atmospheric CO_2 to produce high-yield carbon nanofibers," says Stuart Licht, Ph.D., who leads a research team at George Washington University. "Such nanofibers are used to make strong carbon composites, such as those used in the Boeing Dreamliner, as well as in high-end sports equipment, wind turbine blades and a host of other products."

Carbon nano-onions (CNOs), a less studied morphology of carbon nanomaterials, are exotic structures with extraordinary properties and numerous applications. The literature refers to this carbon morphology – nested concentric buckyballs – with various terms such as onion-like structures, carbon nano-onions, carbon onions, carbon spheres, or nested fullerenes.

"Carbon nano-onions have a range of remarkable applications, but these applications have been largely ignored due to their high synthesis cost, "Stuart Licht. "CNO applications often focus on the confined, high surface area of chargeable surfaces or symmetry of their morphology.

Examples include ultrahigh power super capacitors with unusually high charge storage; maximum anodic capacity lithium batteries; increased capacity gas, and energy storage materials; increased activity in heterogeneous catalysis; and solid lubricants in the form of ultra-strong 'mini ball bearings'." So far, the high cost and carbon footprint of producing CNOs – by treatment of commercially available nano-diamonds, by the combustion of naphthalene, or by Chemical Vapour Deposition – has been a considerable constraint on their applications.

Previously, the researchers had made fertilizer and cement without emitting CO_2, which they reported. Now, the team, which includes postdoctoral fellow Jiawen Ren, Ph.D., and graduate student Jessica Stuart, says their research could shift CO_2 from a global-warming problem to a feed stock for the manufacture of in-demand carbon nanofibers.

Licht calls his approach "*diamonds from the sky*." That refers to carbon being the material that diamonds are made of, and also hints at the high value of the products, such as the carbon nanofibers that can be made from atmospheric carbon and oxygen.

OUT OF THIN AIR

The method involves applying CO_2—either extracted directly from the air or captured from industrial smokestacks—to a vat of hot molten salt, a liquid solution called carbonate. As the CO_2 rapidly dissolves in

the carbonate, & nickel and steel electrodes are placed into the molten liquid.

Because of its efficiency, this low-energy process can be run using only a few volts of electricity, sunlight and a whole lot of carbon dioxide. At its root, the system uses electrolytic syntheses to make the nanofibers. CO_2 is broken down in a high-temperature electrolytic bath of molten carbonates at 750 degrees C. Atmospheric air is added to an electrolytic cell. Once there, the CO_2 dissolves when subjected to the heat and direct current through electrodes of nickel and steel. The carbon nanofibers build up on the steel electrode, where they can be removed.

The entire process, which is ignited by either a conventional power supply or a solar-energy system, is both earth-friendly and economical.
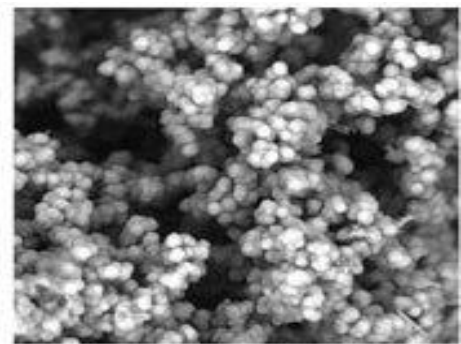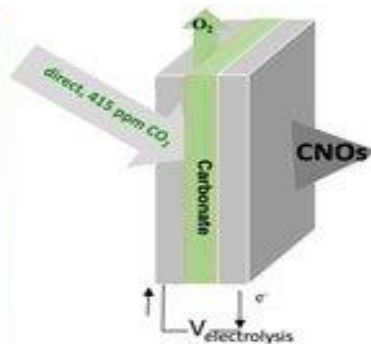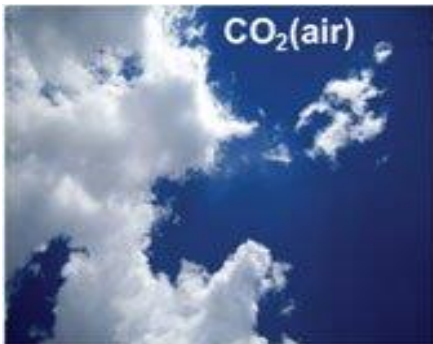
High yield electrolytic synthesis of carbon nano-onions from CO2, either directly from the air or from smoke stack CO2, in molten carbonate.

CONCLUSION

We are at the beginning of an explosion in the market for carbon nanofiber uses. It's at the same place as plastics were at beginning of World War II. By making (nanofiber production) inexpensive, the applications go far beyond airplane bodies. They could, for example, be used in building materials, and could one day replace steel.

HIGH VOLTAGE DC TRANSMISSION SYSTEM

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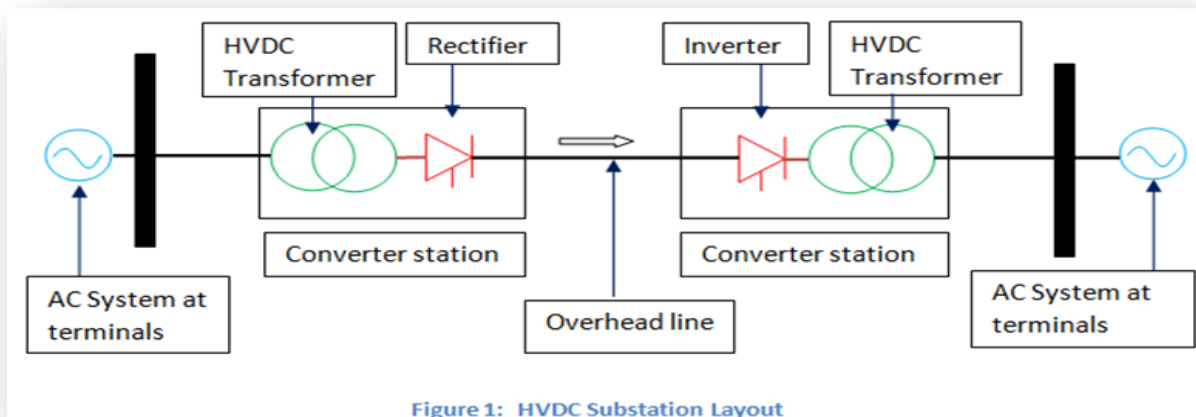
1. INTRODUCTION

The massive transmission of electricity in the form of DC over long distances by means of submarine cables or overhead transmission line is the High Voltage Direct Current Transmission. This type of transmission is preferred over **HVAC** transmission for very long distance when considering the cost, losses and many other factors. The names Electrical superhighway or Power superhighway are often used for **HVDC**.

2. HVDC TRANSMISSION SYSTEM

We know that AC power is generated in the generating station. This should first be converted into DC. The rectifiers are used for conversion. The DC power will flow through the overhead lines. At the user end, this DC has to be converted into AC. For that purpose, an inverter is placed at the receiving end.

Thus, there will be a rectifier terminal in one end of HVDC substation and an inverter terminal in the other end. The power of the sending end and user end will be always equal (Input Power = Output Power).
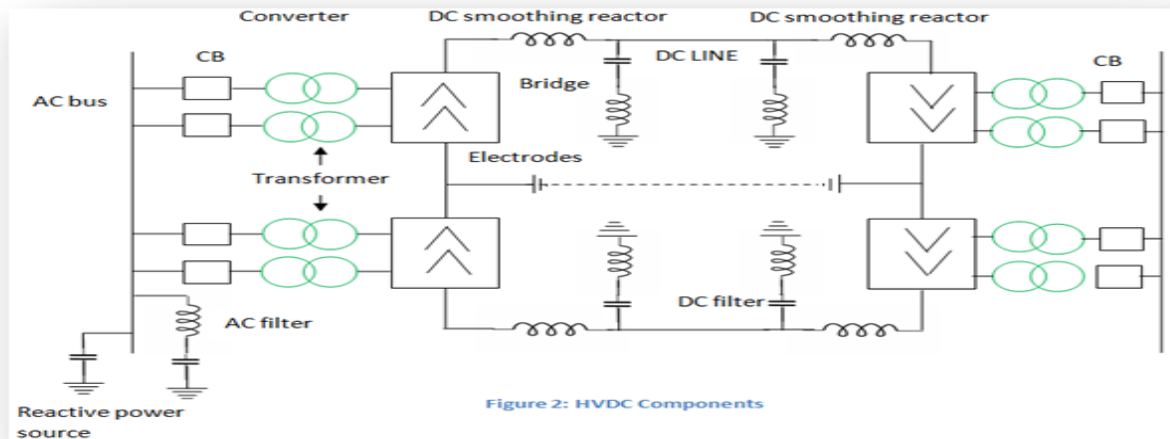

Figure 1: HVDC Substation Layout

When there are two converter stations at both ends and a single transmission line is termed as two terminal DC systems. When there are two or more converter stations and DC transmission lines is termed as multi-terminal DC substation.

Figure 2: HVDC Components

The components of the **HVDC Transmission** system and its function are explained below:

Converters: The AC to DC and DC to AC conversion are done by the converters. It includes transformers and valve bridges.

Smoothing Reactors: Each pole consists of smoothing reactors which are of inductors connected in series with the pole. It is used to avoid commutation failures occurring in inverters, reduces harmonics and it also helps to avoids discontinuation of current for loads.

Electrodes: They are actually conductors which are used to connect the system to the earth.

Harmonic Filters: It is used to minimize the harmonics in voltage and current of the converters used.

DC Lines: It can be cables or overhead lines.

Reactive Power Supplies: The reactive power used by the converters could be more than 50% of the total transferred active power. So the shunt capacitors provide this reactive power.

AC Circuit Breakers: The circuit breakers are used to clear any type of faults in the transformer. It also used to disconnect the DC line.

HVDC System Configurations

The classification of HVDC links are as follows:

Mono Polar Links

Single conductor is required on water or ground which acts as the return path. If the earth resistivity is high, metallic return is used.
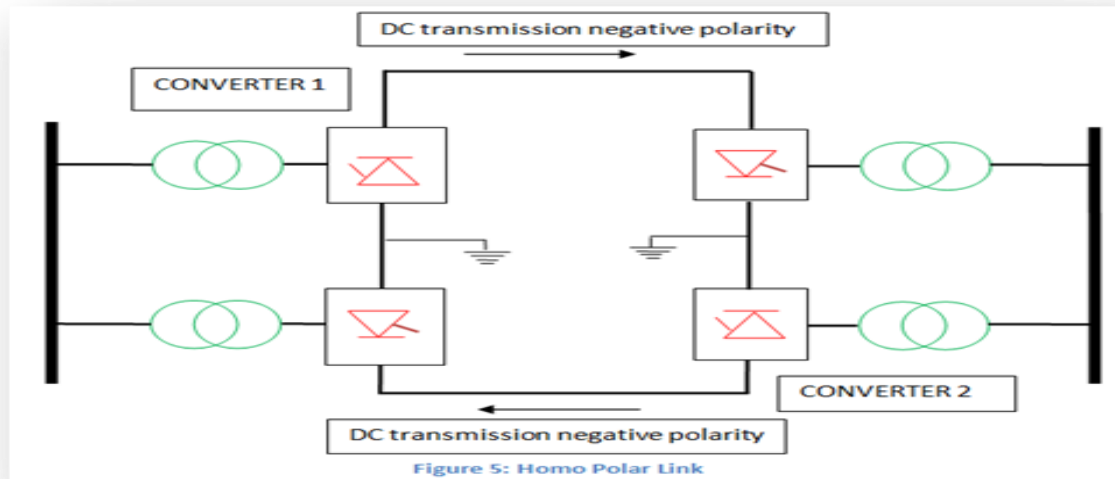
Figure 3: Mono Polar Link
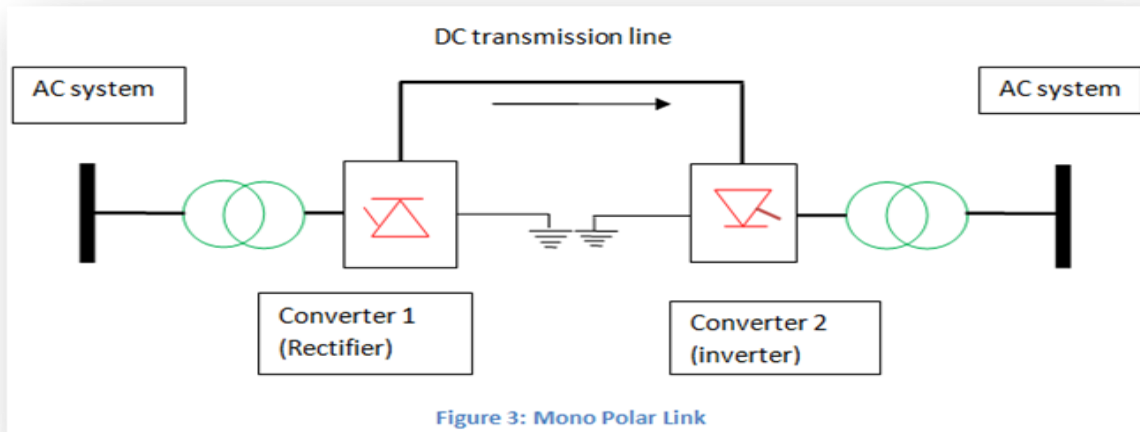
Bipolar Links

Double converters of same voltage rating are used in each terminal. The converter junctions are grounded.

Figure 4: Bipolar Link
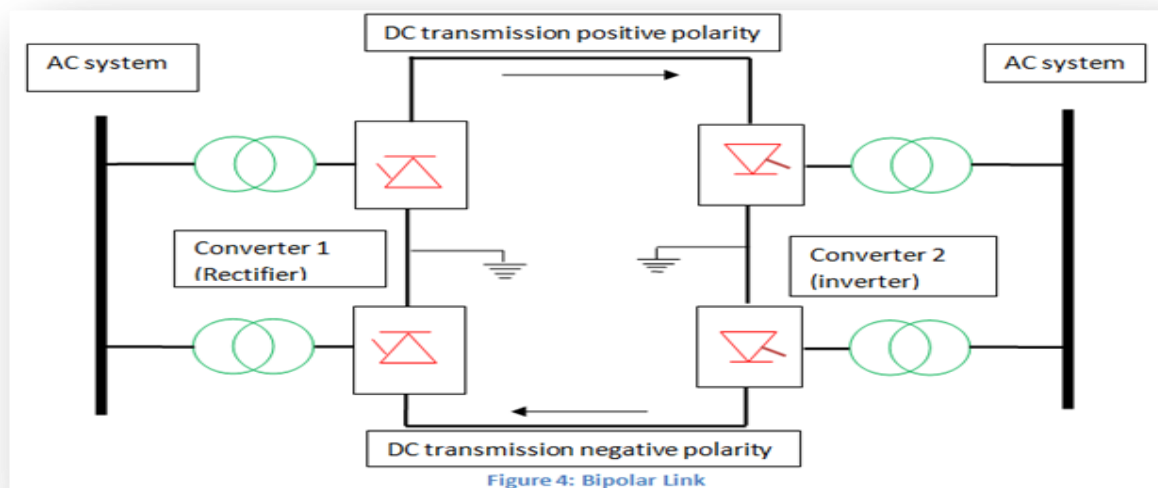
Homopolar Links

It consists of more than two conductors which is having equal polarity generally negative. Ground is the return path.

Figure 5: Homo Polar Link

Multi Terminal Links

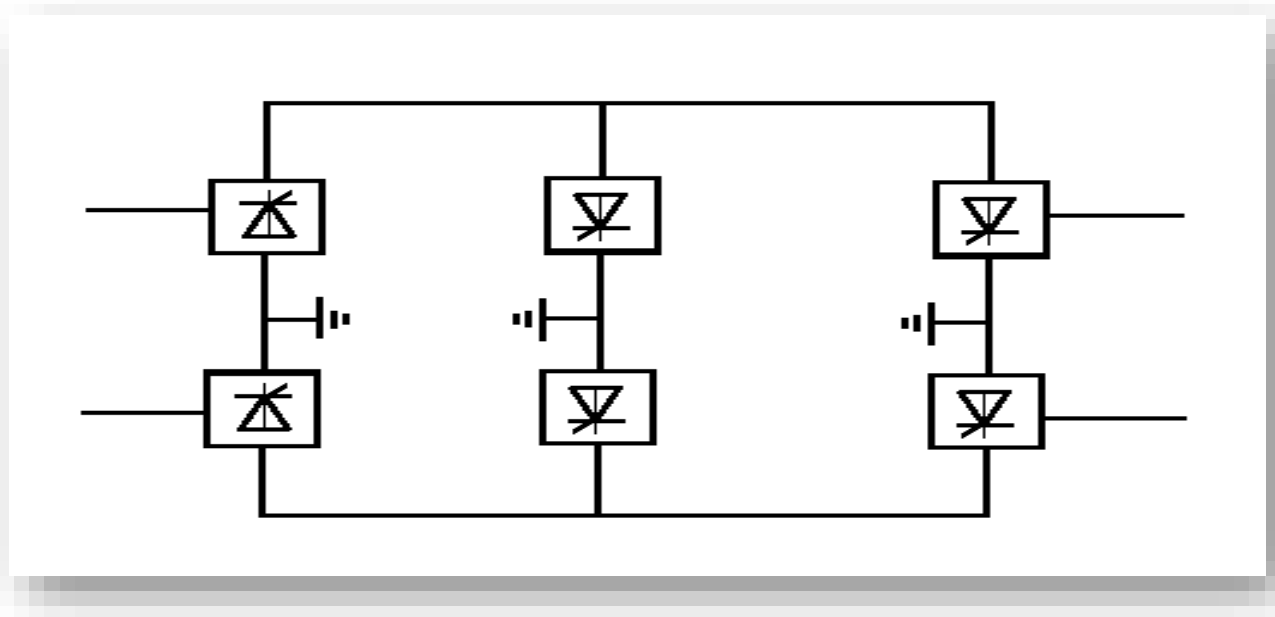It is used to connect more than two points and is rarely used.

Figure 5.1: Multi Terminal Link

Comparison of both HVAC and HVDC Transmission System

HVDC Transmission System	HVAC Transmission System
Low losses.	Losses are high due to the skin effect and corona discharge
Better Voltage regulation and Control ability.	Voltage regulation and Control ability is low.
Transmit more power over a longer distance.	Transmit less power compared to a HVDC system.
Less insulation is needed.	More insulation is required.
Reliability is high.	Low Reliability.
Asynchronous interconnection is possible.	Asynchronous interconnection is not possible.
Reduced line cost due to fewer conductors.	Line cost is high.
Towers are cheaper, simple and narrow.	Towers are bigger compared to HVDC.

Figure 6: Comparison of Cost of HVDC and HVAC
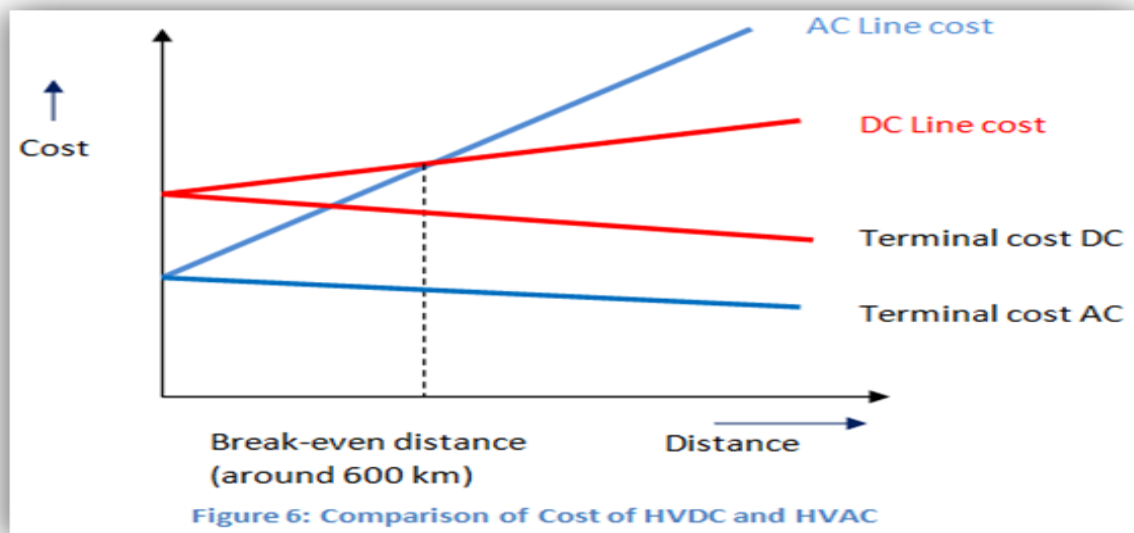
3. ADVANTAGES OF HVDC TRANSMISSION

- A lesser number of conductors and insulators are required thereby reducing the cost of overall system.
- Lesser corona loss is less as compared to HVAC Transmission lines of similar power.
- The HVDC system uses earth return. If any fault occurs in one pole, the other pole with 'earth returns' behaves like an independent circuit. This results in a more flexible system.
- The HVDC has the asynchronous connection between two AC stations connected through an HVDC link; i.e., the transmission of power is independent of sending frequencies to receiving end frequencies. Hence, it interconnects two substations with different frequencies.
- The very accurate and lossless power flows through DC link.

4.   DISADVANTAGES   OF   HVDC TRANSMISSION

- Converters with small overload capacity are used.

- Circuit Breakers, Converters and AC filters are expensive especially for small distance transmission.
- No transformers for altering the voltage level.
- HVDC link is extremely complicated.
- Uncontrollable power flow.

5.   APPLICATION   OF   HVDC TRANSMISSION

- Undersea and underground cables
- AC network interconnections
- Interconnecting Asynchronous system

6. CONCLUSION

Considering all the advantages of DC, it seems that HVDC line are more proficient than AC line. But, the initial cost of HVDC sub-station is very high and their sub-station equipment is quite complicated. Thus, for long distance transmission it is preferable that power is generated in AC, and for transmission it is converted into DC and then again converted that into AC for final use. This system is economical and also improves the efficiency of the system.

IR-BASED DETECTION OF ELEVATED BODY TEMPERATURE FOR CORONAVIRUS

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1. USE INFRARED CAMERAS FOR TEMPERATURE SCANNING

Major travel hubs like airports, seaports, railway stations and long-distance bus stations are one of the points on which the security measures of public authorities are aimed when infectious diseases such as

- Coronavirus (2019-nCoV, COVID-19, SARS-CoV-2)
- Severe Acute Respiratory Syndrome (SARS)
- Ebola Virus Disease (EVD)
- Middle East Respiratory Syndrome Coronavirus (MERS-CoV)

Cause global problems. From there, diseases can be effectively prevented from spreading further.

Infrared cameras can be used for a corresponding elevated body temperature scanning of passengers, employee scanning and workplace entrance screening.

Certainly, thermographic cameras can neither detect the virus itself nor a person carrying the virus! However, these cameras enable the precise non-reactive, contactless and planar recording of surface temperatures while using the technical temperature measurement technology known as thermography. Hence, they are highly suitable for the quick and easy detection of elevated body temperatures, which can be an indication of a possible virus infection of people subjected to screening.

The body temperature preferably is detected at the inner angle of the eye with the infrared camera. Slightest differences and thus abnormal body temperatures can

be displayed and will result in alarms. Performing such health screenings, e.g. via implementing temperature checkpoints for example for employee screening, enable the acquisition of important information as a basis for decision-making for subsequent medical examinations of the selected people and thus serve to secure public areas.

Such indications must, of course, always be followed by other examination methods that allow a reliable positive or negative statement about the disease and to initiate appropriate actions!

2. WHAT SOLUTIONS DOES OFFER TO DETECT ELEVATED BODY TEMPERATURE?

InfraTec provides complete, ready to use solutions tailored to the detection of elevated body temperature. Our cameras offer high thermal and spatial resolution making them faster and more reliable than those using low resolution. The camera combined with our application specific software, display and control computer and a tripod is all you need to get you started. Packages are based on the following core components depending on your choices:

Thermal cameras of the series
- Excellent thermal resolution up to 0.02 K
- Measurement accuracy in special HiPrec mode up to $\pm$ 0.8 K
- Geometric resolution up to (1,024 $\times$ 768) IR pixels (XGA) allowing for multiple-person screening

Thermography software THERMAL-CHECK

- Automatic optical and optionally acoustic alarm
- Algorithm-based accuracy up to $\pm$ 0.3 K
- In the selectable automatic mode the system will automatically detect if a person is facing the camera and take a measurement of the body temperature

Accessories for a direct start

- Tripod to mount the camera
- Laptop to configure and control the system and for reporting (with configurable privacy settings)
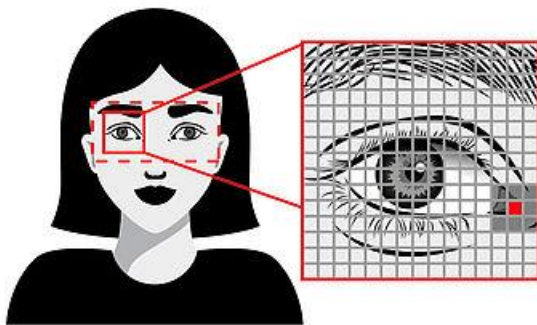
3. WHEN DETECTING ELEVATED BODY TEMPERATURE?
- Contactless and planar temperature measurement without external reference radiator
- Parallel checking of **multiple people** is possible, faces at different heights (children for example)
- Having the largest number of pixels our system can screen multiple people at the same time, faces at different heights (children for example) or distances from the camera. Only the high number of pixels gives you the same reliability over a larger field of view as required in the specifications for the size of the optimal measurement area according to IEC 80601-2-59
- Resolution also of smaller areas of the skin (angle of the eye) from a safe distance

- **Up to ± 0.3 K** measurement accuracy due to adjustable temperature difference thresholds using the reference image algorithm of the THERMAL-CHECK software
- Excellent thermal resolution of up to **0.02 K**
- Display and evaluation in real time
- Reliable temperature measurements based on low noise infrared detectors and precision calibration
- Alarming at surpassing temperature thresholds
- Storage of individual settings for detection of elevated body temperature
- Easily installable all-in-one unit for continuous monitoring of persons and groups of people
- Solutions for stationary and handheld use available
- Fitting to larger external digital displays via HDMI*

Achieve Reliable Measurement Results for Detection of Elevated Body Temperature

The thermographic temperature measurement for detection of elevated body temperature puts high demands on suitable thermal cameras: In addition to a high thermal resolution, which can make even the smallest temperature differences visible, there must be very good stability and measuring accuracy in order to be able to reliably distinguish a person with an elevated body temperature from a person without these symptoms using critical temperature thresholds and alarm values.

Another very important criterion is the required high geometric resolution, which is expressed in the number of so-called infrared (IR) pixels. This is necessary because the area that has been proven in several studies to be suitable for reliably detecting elevated body temperature at the inner eyelid angle has only a small surface area, but must be sharply mapped for error-free temperature measurement.

The measurement itself takes less than a second and is usually carried out in access areas, for example at the entry control at airports, where the people who are to be screened are already lined up. Largely determined by the wide-ranging requirements of the users, the evaluation of the measured data can range from simple manual use to select people with elevated body temperature for further examinations to automatic detection and storage.

How Is the Thermo graphic Screening Proceeded?

The thermal camera and software are ready for use in just a few steps. Here, measurement distances, which result from the device configuration, have to be kept exactly in order to avoid errors during

screening itself and thus to be able to achieve a reliable result.

1. Choosing a Suitable Screening Position

- The screening must be carried out in an indoor environment with constant room temperature
- The persons to be screened should stand in front of a homogeneous, matt surface at room temperature (for example panel wall or fabric)2. Setting Up the System
- The thermal camera is mounted on the tripod according to the maximum distances to be observed (see information on configuration)
- Determining the correct measurement distance to the person (placing a floor marker for orientation)
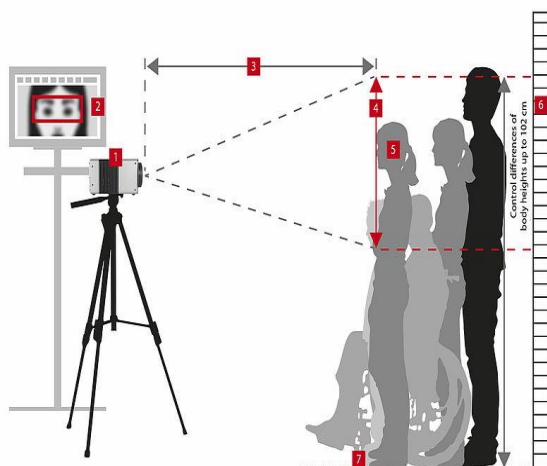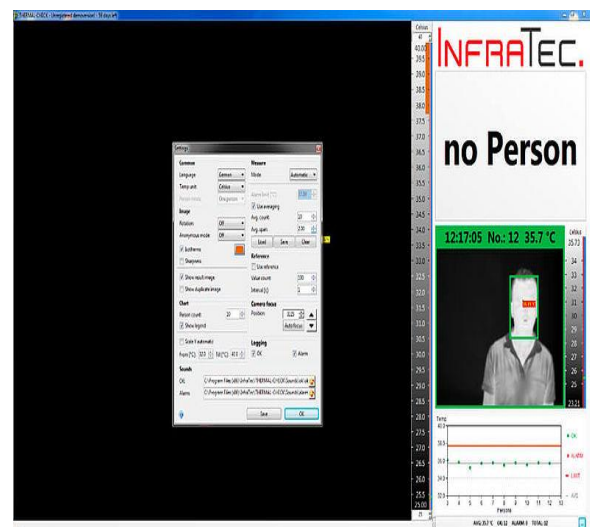

2. Powering Up the System

- Turn on the thermal camera approximately 30 minutes prior to use for optimal equilibrium

- Connect the thermal camera to the computer (included in the scope of delivery depending on the package) according to the instructions
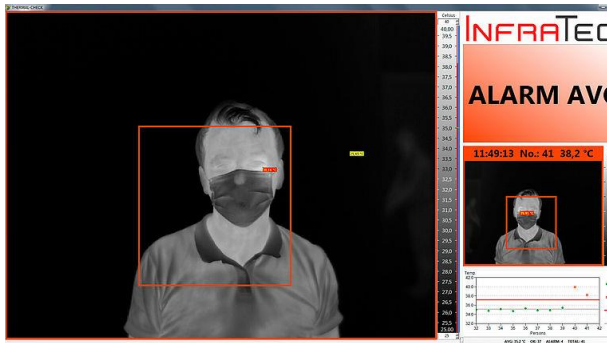- Start the THERMAL-CHECK software

3. Confirm or Configure the Alarm Set Points

4. Start of the Screening Process

5. If the Temperature is Above the Alarm Set Point

Thermo graphic Screening for the Detection of Elevated Body Temperatures in Detail

Certainly, thermal cameras can neither detect a virus itself nor whether a person is carrying a virus! However, these cameras enable the precise non-reactive, contactless measurement of surface temperatures while using the technical temperature measurement technology known as thermography or thermal imaging. Hence, they are highly suitable for the quick and easy detection of elevated body temperatures, which can be an indication of a possible virus infection. Such indications must, of course, always be followed by other examination methods that allow a reliable positive or negative statement about the disease and to initiate appropriate actions! The term "detecting a fever" in the sense of a (medical) fever diagnosis is actually not permitted as a designation for the above-mentioned thermographic recording of elevated body temperatures with thermal cameras under strict observation: One reason is that fever is a complex medical phenomenon. The other reason is that, from a purely formal point of view, the cameras used are "only" technical measuring devices and not medical diagnostic instruments.

Thermography systems measure surface temperatures based on the emitted heat radiation, for example the temperature of the human skin surface. However, this is different from the internal body temperature, the so-called body core temperature. The temperature of the skin surface depends on the ambient temperature (summer, winter, direct sunlight, and so on). In addition, a light film of water can produce evaporative cooling due to perspiration. Furthermore, beards, haircuts, face masks, etc. cause many areas of the skin on the face to be optically "covered" and the heat radiation cannot reach the camera unhindered. Thus, the skin surface in most parts of the face is rather unsuitable for reliable and repeatable thermographic temperature measurement.

Only a few regions on the head are really useful for thermographic screening
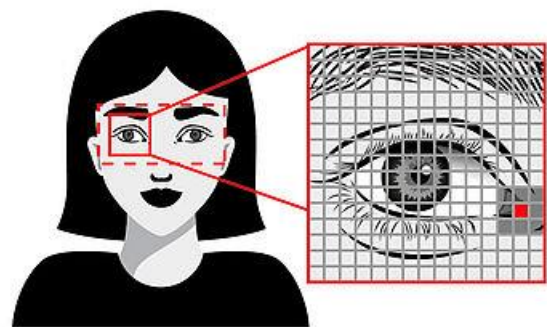
The auditory canal

It displays the body core temperature very well and is used for non-contact temperature measurement with manually

applied so-called ear thermometers, which are approved as medical diagnostic instruments. However, measurement by thermography is not practical, as the test person would have to be positioned very precisely in relation to the camera and, in addition, the ear canal is often covered by the hairstyle.

The oral cavity

It is in principle very suitable. In this case, however, the test persons would have to position themselves in front of the thermal camera with their mouths wide open, which is not effective in terms of hygiene.

The eye region

Especially that part where the tear ducts are located, just below these small areas, strong blood vessels ensure a temperature that is very close to the core body temperature. Their excellent suitability for detecting elevated body temperature by means of frontal thermography of the facial area has been proven in several studies. However, they are only a few mm2 in size, which means that high demands are placed on the geometric resolution of the camera. Furthermore, the eyes must not be covered by glasses.

InfraTec, therefore, consistently uses thermographic temperature measurement at the inner eyelid corner for the detection of elevated body temperature as the demonstrably safest and most reliable method for thermal screening.

COST ESTIMATION AND DEVELOPMENT OF SMART PREPAID ENERGYMETER USING ARDUINO UNO

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1. INTRODUCTION

Basically, like in a mobile phone recharging, the Consumer buys a recharge card and gets some Energy units in return for the balance amount. The balance amount will keep reducing for every unit of energy consumes and ones zero, the power supply would be automatically cutoff.

2. ABSTRACT

Power utilities in different countries especially in the developing once are incurring huge losses due to Electricity theft. In this system a smart energy meter is Installed in every consumer unit and a server in maintained In the service provider side. Both the meter and the server are equipped with GSM module which facilitates bidirectional Energymeter communication between the two ends using the existing GSM infrastructure. Consumers can easily recharge their energy meter by sending PIN no hidden in a scratch card to the server using and tempering. The paper bidirectional GSM communication using by a SMS ensures the effectiveness of these measures. Pilferage modem of electricity can be substantially reduced by incorporating the proposed measures along with the prepaid metering scheme. legal action against dishonest consumers can also be taken.

3. CIRCUIT DIAGRAM
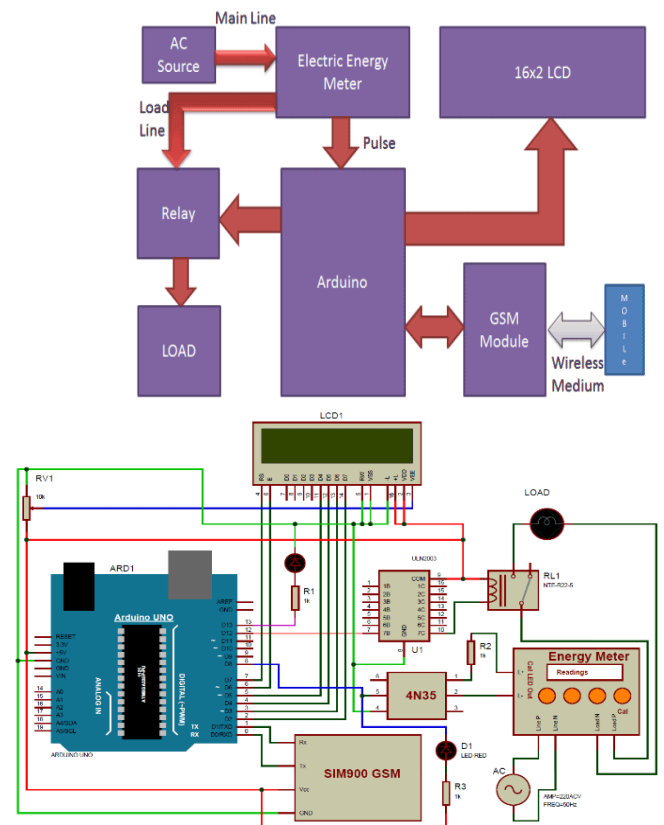
COMPONENTS USED

Arduino UNO R3	GSM Module
16x2 LCD	Analogue Electricity Energy Meter
Optocoupler 4n35	Resistors
POT	Connecting wires
Bulb and holder	Power supply
SIM card	Mobile Phone

4. FUTURE SCOPE

→Theft detection

→This will be help to recharge the meter from anywhere just by sending a simple message or through internet.

→For more efficient and fast system.

→Connect the keypad to change the number.

5. CONCLUSION

The IOT (Internet of Things) based energy meter for calculating consumed our displayed in LCD has been achieved. The consumed power is send through serial communication to virtual terminal constructed in proteus. This project can therefore enlighten management about wasted time, and unnecessary trips. Book keeping and billing because it gives an accurate accounting of unit driven because the prevention of malpractice.

DESIGN, CONTROL AND APPLICATION OF QUADCOPTER

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ABSTRACT

Quadcopter is an unmanned aerial vehicle, which can be implemented in different applications. In paper it will be represented a development of a quadcopter system and potential application in which it can be implemented. Quadcopter structure model, basic components with block diagram, hovering stability, dimensions, and description of basic movements will be represented and discussed. Control algorithms with steps in empirical methodology will also be presented. Current civil and military application will be examined, and future applications will be suggested.

Key words: *quadcopter, design, application, control*

1. INTRODUCTION

It is necessary to develop a system for defining evacuation / safe way in case of natural disasters and accidents. The system described in this paper consists of quadcopter equipped with cameras to capture different terrain (land or water) and a processing unit for processing the recorded state, which is placed on the vehicle / vessel or used as a handheld device.

This system can be used in different kind of applications for example in: advertisements when taking pictures of sightseeing (tourism), buildings, etc., scenes in movies, performances and air shows with lights, fireworks,

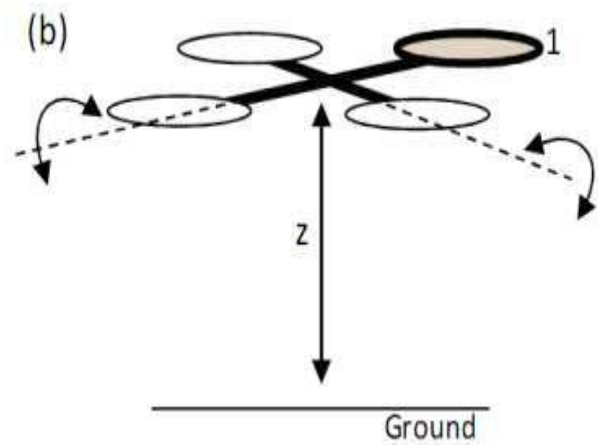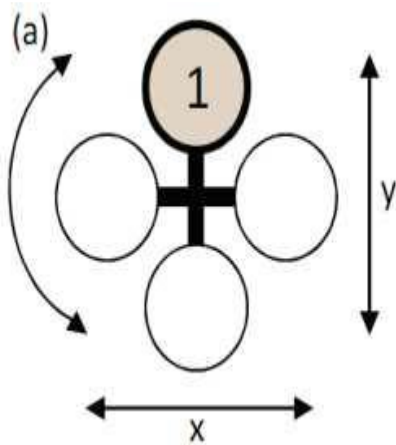aerobatics, etc. industrial applications for lifting tools and materials, diagnostics (observation of inaccessible places), finding missing persons, etc.

2. DESIGN OF QUADCOPTER

These devices are sometimes referred to as drones, which are programmed for autonomous flight, and remotely piloted vehicles (RPVs), which are flown remotely by a ground control operator. A quadcopter is a multirotor UAV that is lifted and propelled by four rotors. Quadcopters are classified as rotorcraft, as opposed to fixed-wing aircraft, because their lift is generated by a set of rotors. One of applications is in Amazon.com Inc., the world's largest online retailer.They announced their Prime Air service which is a new shipment system where a multi-rotor crashing in delivers packages to customers. A quadcopter uses four propellers for trust and has them configured in either a cross or plus format. The quadcopter robot can take off and land vertically which is a big advantage as it lowers the requirements for alanding platform. Also, it allows the quadcopter to hover in place with considerable stability. Hover stability prevents the quadcopter from the event of strong wind or due to its weight. Fig. 1 shows the six degrees of freedom of the quadcopter. In Fig. 1(a) (birds eye view), x and y represents the translational motion along the x- and y-axes respectively and $\square\square$represents yaw, the rotational motion about the z-axis, while in Fig. 1(b) (frontal view), $\square\square$represents roll, the rotational motion about the xaxis, $\square\square$represents pitch, the rotational motion about the y-axis and z represents the

translational motion in the direction per pendicular to ground.

The label '1' signifies the front propeller [8]. With a hover control unit, the quadcopter can hover at a constant height z (see Fig. 1(b)), with its roll and pitch angles stabilised by the gyroscope. The person at

the command base will only need to control the

quadcopter's motion along the x- and y-axes and also its rotation about the z-axis (to turn corners), reducing the degree of complexity from six to only three

.

Figure 1. The six degrees of freedom of the quadcopter [8]

2.1 **Quadcopter model**

Quadcopters use 2 sets of identical fixed pitched propellers; 2 clockwise (CW) and 2 counter-clockwise (CCW). These use variation of RPM to control lift and torque. Control of vehicle motion is achieved by altering
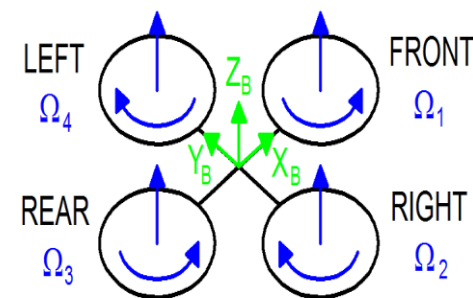
the rotation rate of one or more rotor discs, thereby changing its torque load and thrust/lift characteristis. The front and the rear propellers rotate counterclockwise, while the left and the right ones turn clockwise. This configuration of opposite pairs

directions re-moves the need for a tail rotor (needed instead in the standard helicopter structure). Fig. 2 shows the structure model in hovering condition, where all the propellers have the same speed

Figure 2. The quadcopter structure model in hovering Condition

In Fig.2 a fixed-body B-frame of quadcopter is shown (XB, YB, ZB). Also the angular speed of the propellers is represented. In addition to the name of the velocity

variable, for each propeller, two arrows are drawn: the curved one represents the direction of rotation, th other one represents the velocity. This last vector always points upwards hence it doesn't follow the right hand rule (for clockwise rotation) because it also models a vertical thrust and it would be confusing to have two speed vectors pointing upwards and the other two

pointing downwards. All four propellers rotate at the

same speed which is represented as ▯▯[rad s-1] to counterbalance the acceleration due to gravity [9]. Even though the quadcopter has 6 DOF, it is equipped

just with four propellers. Thanks to its structure, four best controllable variables can be chosen related to the four basic movements which allow the quadcoper to

reach a certain height and attitude. It follows the description of these basic movements:

▯▯Throttle (U1 [N]) - increasing (or decreasing) all the propeller speeds by the same amount. It leads to a vertical force which raises or lowers the quadcopter. If the quadcopter is in horizontal position, the vertical direction of the inertial frame coincide.

▯▯Roll (U2 [N m]) - increasing (or decreasing) the left propeller speed and by decreasing (or increasing) the right one. It leads to a torque with respect to the XB axis (Fig. 2) which makes the quadcopter turn.

▯▯Pitch (U3 [N m]) - similar to the roll and is provided by increasing (or decreasing) the rear propeller speed and by decreasing (or increasing) the front one. It leads to a torque with respect to the YB axis (Fig. 2) which makes the quadcopter turn.

▯▯Yaw (U4 [N m]) - increasing (or decreasing) the frontrear propellers' speed and by decreasing (orincreasing) that of the left-right couple. It leads to a torque with respect to the ZB axis (Fig. 2) which makes the quadcopter turn. The yaw movement is generated thanks to the fact that the left-

right propellers rotate clockwise while the front-rear ones
rotate counter clockwise.

2.2 **Control algorithms**

The PID (Proportional-Integral-Derivative) control algorithm has been considered and implemented in literature to control the hover altitude of the quadcopter.
The PID algorithm is popularly used mainly because :
▯▯It has a simple structure
▯▯It provides good performance
▯▯It can be tuned even if the specific model of the
controlled plant or system is not available

The PID algorithm consists mainly of three control parameters, P – Proportional,
I – Integral and D – Derivative. Here P determines the reaction to the current error, I determines the reaction based on a sum of recent errors while D responds to the rate at which the error has been changing. PID control may return a control input gain
which may be too high for the quadcopter system. This results in a large control input magnitude which may be out of the limits recognisable by the system. To solve
this problem, the linear quadratic regulation (LQR) method can be employed.
The LQR algorithm is used to obtain the parameter settings that will minimise the undesired deviations while at the same time limiting the energy expended by the control action by using a mathematical algorithm that minimises a cost function or performance index with weighting factors. The cost function or performance index refers to the sum of deviations of measured values from its desired values.
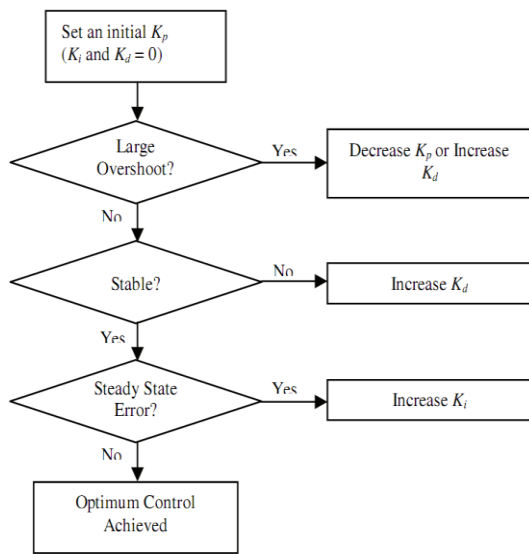
Figure 3. Steps in empirical methodology

3. HARDWARE COMPONENTS OF QUADCOPTER

Each quadcopter can have a very different hardware component which mostly depends on application in which it will be implemented. Standard components are: microcontroller, sensors, motors, Global Positioning System (GPS) power supply and telemetry devices.
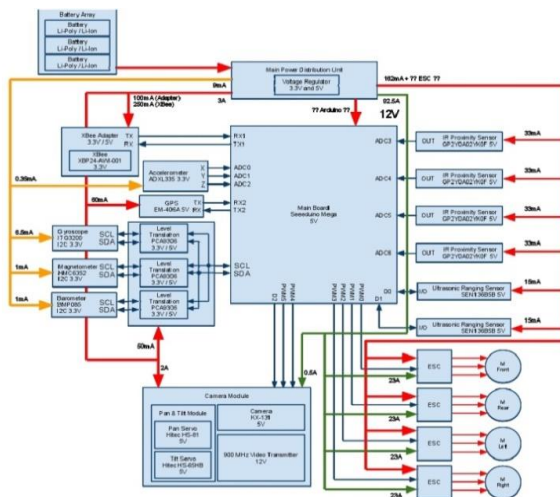
Figure 4. Quadcopter block diagram

Basic component of each quadcopter is frame. The arms and centre plate of the quadcopter frame is in most cases are made of carbon fiber. Connections between the centre plates and arms, as well as the motor mounts can be made of aluminium. The modular integration of the frame allows components to be replaced easily if necessary. The frame, illustrated in Fig.5, is 485 cm long from motor to motor and weighs approximately 450 g. The propulsion system is mounted directly onto this frame.
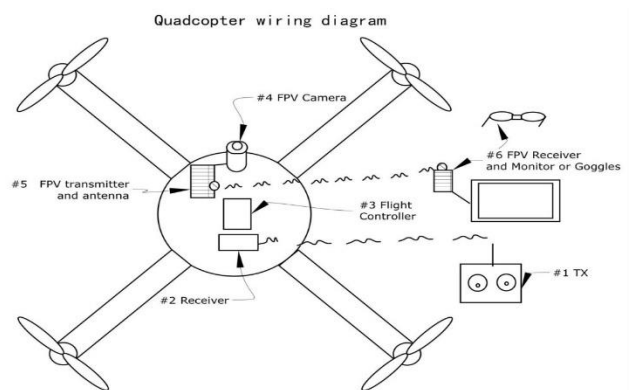
Another important part of quadcopter is propulsion unit. The propulsion unit for the quadrotor consists of four brushless DC motors and four electronic speed controllers. The power source for the system can be cell lithium polymer battery Beside microprocessor and inertial measurement unit with accelerometers, magnetometer and gyroscopes there is a need for external sensors. In most cases, as external sensor, infra-red sensors and ultrasonic sensor can be used. They can be used for the collision avoidance schemes and for altitude control. GPS modul is another type of equipment which is mandatory for navigation.

In Fig. 6. and Fig. 7. a primer of the quadcopter with all necessary components is represented.

in the USA since 2002. The US is one of the most well documented users of UASs in this capacity along the US/Mexico border and the US/Canada border. In 2002, a US Marine operated Pioneer quadcopter intercepted people who were attempting to smuggle 45 kg of marijuana from Canada into the USotograph a homicide scene in 2007.

5. CONCLUSION

Quadcopter is a special kind of vehicle, which can be implemented in different applications. In this paper basic principles of quadcopter design as well as current applications are represented. In the future applications, quadcopter could be used for a variety of new policing functions. Quadcopter could be used for safety inspections, perimeter patrols around prisons and thermal imaging to check for cannabis being grown in roof lofts and other not easy to access locations. The police could use them to capture number plates of speeding drivers, for detecting theft from cash machines, railway monitoring, combat fly-posting, flytipping,

abandoned vehicles, waste management. Future research will be in field of search and rescue. In future an effort will be directed to development of a system for defining evacuation/safe path in case of natural disasters and accidents. In addition to the situations of natural disasters and accidents it is possible to use this system in cases of climatic changes that affect the safety and health of the population, or in cases where it is endangering the functionality of different economic system.

4.   APPLICATIONS   OF QUADCOPTER

Quadcopters have been used, are being used or are actively being considered for different applications all over the world. prevent or detect crime and assist in incident responses. UK police have used quadcopters to monitor festivals, to monitor protests and to monitor the Olympic ceremony. In 2007, quadcopters were reported over political rallies in New York and Washington, DC.

A North Carolina county is using quadcopters with infrared cameras to monitor gatherings of motorcycle riders and to detect marijuana fields. In this deployment, the quadcopters flies a few hundred feet in the air, which is close enough to identify faces. Six police departments in Canada are using quadcopters in populated areas to record crime scenes and Canadian police are responsible for the first photographs taken by a quadcopters being admitted as evidence in court after the local police force used a quadcopters to phQuadcopters have been used in border surveillance operations

SOLAR POWERED VEHICLE

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Abstract

The renewable energy is vital for today's world as in near future the non renewable sources that we are using are going to get exhausted. The solar vehicle is a step in saving these non renewable sources of energy. The basic principle of solar car is to use energy that is stored in a battery during and after charging it from a solar panel. The charged batteries are used to drive the motor which serves here as an engine and moves the vehicle in reverse or forward direction. The electrical tapping rheostat is provided so as to control the motor speed. This avoids excess flow of current when the vehicle is supposed to be stopped suddenly as it is in normal cars with regards to fuel. This idea, in future, may help protect our fuels from getting extinguished.

All recent electric vehicles present drive on AC power supplied motor. The setup requires an inverter set connected to battery through which DC power is converted to AC power. During this conversion many losses take place and hence the net output is very less and lasts for shorter duration of time. Although this is cheaper the setup and maintenance required is much more in AC drive than DC drive. The vehicle designed is controlled by ELECTRICAL means and not by ELECTRONIC means.

1. INTRODUCTION

Energy is one of the most vital needs for human survival on earth. We are dependent on one form of energy or the other for fulfilling our needs. One such form of energy is the energy from FOSSIL FUELS. We use energy from these sources for generating electricity, running automobiles etc. But the main disadvantages of these FOSSIL FUELS are that they are not environmental friendly and they are exhaustible. To deal with these problems of FOSSIL FUELS, we need to look at the NON-CONVENTIONAL SOURCES of energy. With regard to this idea we have designed an Electrical vehicle that runs on solar energy. The vehicle designed is a three-wheel drive and can be used for shuttle and short distances. As these vehicles form the future of the automotive industry, we need to concentrate on improving their design and making them cost effective. This vehicle is an initiative in this direction.

2. BASIC FUNCTIONAL DIAGRAM
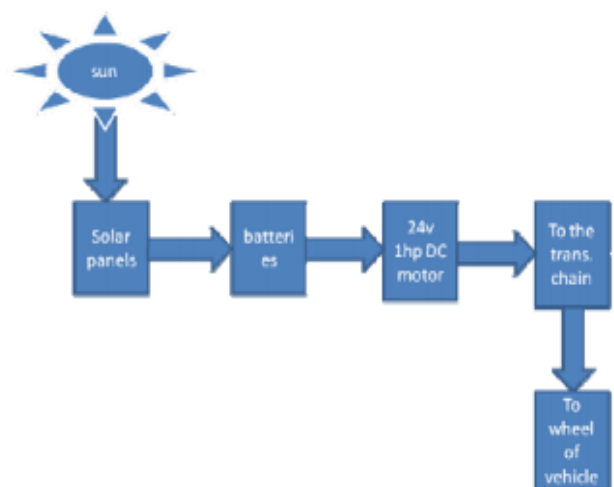
Basic block Diagram Representation of Solar vehicle

The above diagram gives an overview of the working of solar vehicle. Sun is the main source of energy for the vehicle. Energy from Sun is captured by the solar panels and is converted to electrical energy. The electrical energy thus formed is being fed to the batteries that get charged and is used to run 24 V DC high torques DC series motor. The shaft of the motor is connected to the rear wheel of the vehicle through chain sprocket. The batteries are initially fully charged and thereafter they are charged by panels. This helps in completing the charging-discharging cycle of the batteries, which is very important for proper working of batteries.

3. SPEED CONTROL SWITCH

The speed control of the DC motor is the essential part of the vehicle. For controlling speed of the motor, a switch was designed with 8 tapping, giving different values of resistance at each tapping, hence limiting the current that flows in the motor. The switch uses pure Nichrome wire for resistances. It uses a 8 tapping DC switch. The switch has been provided with two terminals; one for the motor connections and the other for the battery connections. The arrangement of the switch is more or less like a rheostat. The different tapping act as resistance points. With each increase in the tapping value the value of resistance decrease, thus at the last tapping the motor will run at the highest speed as the limiting resistance will be minimum whereas the high torque condition of the motor will arise when the minimum tapping will be used, since the limiting resistance will be maximum.

4. WORKING OF THE VEHICLE

The solar module mounted on the top of car is used to charge the batteries via charge controller. A 140 WP solar module is used with output ranging from 24V to 25V at STC. The batteries are initially fully charged and then they are connected to solar module for charging. This helps to keep the battery charged always. This is also done as the efficiency of solar module is only 15%.Thus under this condition the battery gets fully charged again within 3hrs-3.5hrs. Thus to keep the full sine wave of charging this time lap is made. The maximum solar radiations are obtained between morning 10am to evening 3:30pm. Hence the panel is so mounted that maximum output may be obtained. As the supply is given through DPDT switch the motor takes a high starting current to propel the wheel to move in forward direction. On start the load on motor is nearly 250kg including the weight of person driving it. The motor after start acquires the maximum speed of 20kmph to 30kmph. The batteries get charged always from the solar panel and so it provides the continuous run for the vehicle. Motor must be started on top most gear so as to get maximum torque and speed to lift the full load. The speed may be varied later according to the driver's requirements. As the speed varies the load current also varies. So the speed variation must be low to keep battery alive for maximum duration of time. For stopping the motor, the speed control switch should be brought to minimum gear and then switch should be open; thereafter the mechanical brakes should be applied. The mechanical brakes can be applied instantly during emergency but this should be avoided as this could damage the motor and also produce unnecessary back emf. The average battery back-up is around four hours. The batteries are continuously charged by the solar panel

but to increase their rate of charging three dynamos each of 24 V can be connected to the wheels of the vehicle. As the vehicle moves these dynamos will generate EMF and will charge the batteries. Hence the charging and discharging cycle of the batteries will be complete.

5. ADVANTAGES OF THE VEHICLE

The solar vehicles are the future of the automobile industry. They are highly feasible and can be manufactured with ease. The main advantages of a solar vehicle are that they are pollution less and are very economical. Since they cause no pollution they are very eco-friendly and are the only answer to the increasing pollution levels from automobiles in the present scenario. By harvesting the renewable sources of energy like the solar energy we are helping in preserving the non-renewable sources of energy. The other main advantages of the solar vehicle are that they require less maintenance as compared to the conventional automotives and are very user friendly.

6. CONCLUSION

The solar vehicle solves many problems related to the environment and is the best pollution free method. We need to make use of them so that we can reduce our dependence on fossil fuels. Solar vehicles do have some disadvantages like small speed range, initial cost is high. Also, the rate of conversion of energy is not satisfactory (only 17%). But these disadvantages can be easily overcome by conducting further research in this area; like the problem of solar cells can be solved by using the ultra efficient solar cells that give about 30-35% efficiency. As this field of automobiles will be explored the problems will get solved. The solar automobiles have

a huge prospective market and we should start using them in our day to day life. We have already completed making a solar vehicle prototype as our project and the vehicle is running successfully on solar power.

Spotted Lake, British Columbia, Canada

Spotted Lake has long been revered by the native Okanagan (Syilx) people and it's easy to see why they think of it as sacred. In the summer the water of the lake evaporates and small mineral pools are left behind, each one different in colour to the next. The unique lake can be viewed on Highway 3, northwest of the small town of Osoyoos, although visitors are asked not to trespass on tribal land.

The Giant's Causeway, Northern Ireland

Sixty million years ago a huge volcanic eruption spewed out a mass of molten basalt, which then solidified and contracted as it cooled, creating the cracks that can be seen today. There are an estimated 37,000 polygon columns at **this World Heritage Site**, so geometrically perfect that local legend has it they were created by a giant.

Thor's Well, Oregon, USA

In rough conditions at Thor's Well in **Oregon**, also known as Spouting Horn, the surf rushes into the gaping sinkhole and then shoots upwards with great force. It can be viewed by taking the Captain Cook Trail from the Cape Perpetua Scenic Area visitor centre - but for your own safety stay well back, especially at high tide or during winter storms.

Pamukkale, Turkey

A remarkable UNESCO World Heritage Site in southwest Turkey, a visit to **Pamukkale** (Cotton Palace) also takes in the ancient ruins of Hierapolis, the once great city that was built around it. Water cascades from natural springs and down the white travertine terraces and forms stunning thermal pools perfect for a quick dip.

Lake Hillier, Western Australia

This remarkable lake was discovered in 1802 on the largest of the islands in **Western Australia's** Recherche Archipelago. The lake keeps its deep pink colour year-round, which some scientists say is down to high salinity combined with the presence of a salt-loving algae species known as Dunaliella salina and pink bacteria known as halobacteria.