

# VOLTAFFAIR

2019

DEPARTMENT OF ELECTRICAL ENGINEERING

*Departmental Journal of Electrical Engineering*

Technique Polytechnic Institute

Hooghly - 712102





# VOLTAFFAIR - 2019

## ~EDITOR~

*Mr. Snehashis Das*

## ~EDITORIAL BOARD~

*Miss Anjana Sengupta*

*Mr. Shamik Chattaraj*

*Mr. Kaustav Mallick*

## ~GRATITUDES TO~

*Mr. Tapas Kumar Saha, Chairman, GB*

*Mr. Soumendra Nath Basu, ED*

*Mr. Avijit Karmakar, Principal*

*Mr. Partha Sarathi Bhattacharya, Co-ordinator*

## ~PUBLISHER~

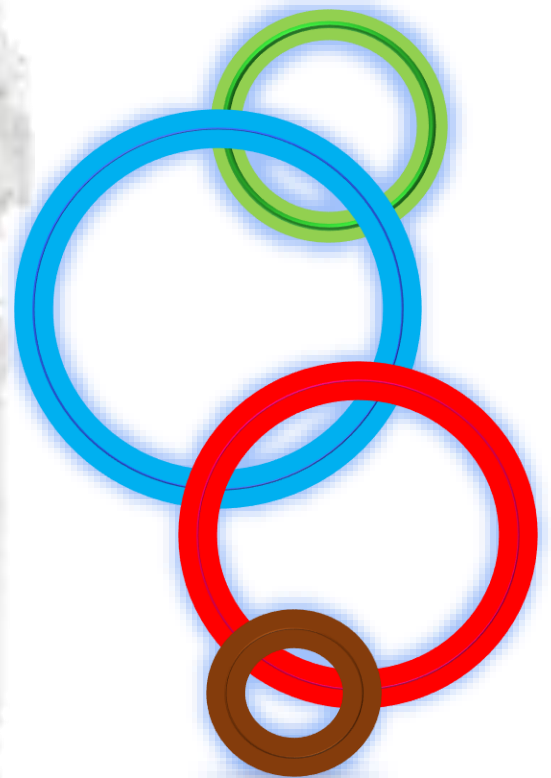
©VOLTAFFAIR - 2019

*Department of Electrical Engineering*

*Technique Polytechnic Institute*

*Panchrokhi, Sugandhya, Hooghly*

*West Bengal - 712102*

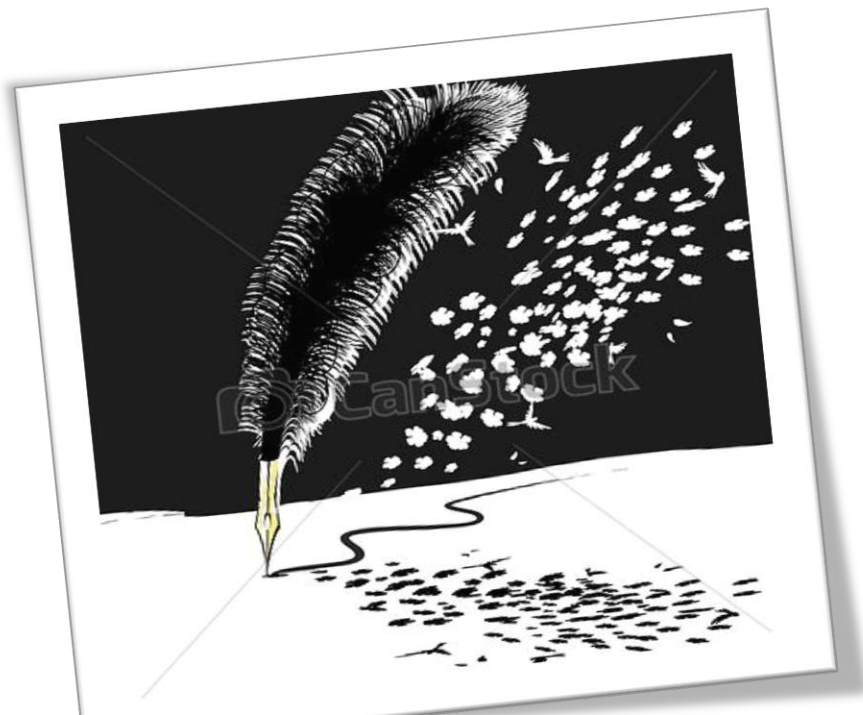




## *From the Editor's Nib*

Hitherto, the aim of this yearly release was confined to regular prod rather as in metaphor than literal to students for their involvement. This edition elated me as an intense engrossment from the pupils was seen. The phase of this inclination will sustain, will be a too early statement but the objective of the magazine is heading towards fulfilment for sure.

We now dare to reverie of cent percent student involvement in near future when they will be approaching us for articles and we shall have to make time out of our busy schedule and accomplish their claim. With all such prospects we, The Department of Electrical Engineering pompously presents Voltaffair – 2019.



## **VISION**

TO BECOME A NATIONALLY RECOGNIZED CENTRE OF EXCELLENCE IN  
ELECTRICAL ENGINEERING

## **MISSION**

M1. 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

M2. To prepare students with the capability to meet ever growing socio economic necessity of the industry and society

M3. To create opportunity to encourage self learning leading to competence of lifelong learning

## **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 equipments/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

# CONTENTS

1. COST ESTIMATION AND FABRICATION OF OCCUPANCY SENSOR

Page 1 - 2

2. RFID BASED SMART ATTENDANCE SYSTEM

Page 3 - 4

3. ULTRASONIC PIEZOELECTRIC MOTOR

Page 5 - 6

4. PROTOTYPE DEVELOPMENT OF SMART DOOR LOCK USING FINGERPRINT SENSOR AND ARDUINO UNO

Page 7

5. COST ESTIMATION AND FABRICATION OF SINGLE PHASING PREVENTER FOR THREE PHASE MOTOR PROTECTION WITH THERMAL OVERLOAD PROTECTION

Page 8

6. SMART IRRIGATION

Page 9 - 10

7. VOICE CONTROLLED HOME AUTOMATION USING ARDUINO

Page 11 - 13

8. COST ESTIMATION AND FABRICATION OF FOOT STEP POWER GENERATION

Page 14 - 15

9. COST ESTIMATION AND FABRICATION OF TRANSFORMER PARAMETERS MONITORING USING SENSORS AND ARDUINO UNO

Page 16 - 17

10. FREE ENERGY GENERATOR

Page 18 - 19

11. COST ESTIMATION AND PROTOTYPE DEVELOPMENT OF AUTOMATIC ENGINE LOCKING SYSTEM FOR INTOXICATED AUTOMOBILE

Page 20 - 22

12. C·E & P·D OF SMART HOME AUTOMATION SYSTEM

Page 23

13. BASIC OF WIND TURBINE

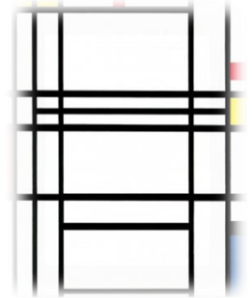
Page 24 - 29

14. REGULATED DC POWER SUPPLY

Page 30 - 31

15. TECHNOLOGICAL ADVANCEMENTS OF EMUS AND INTRODUCTION OF HIGH-SPEED TRAINS ON INDIAN RAILWAYS

Page 32 - 38





# COST ESTIMATION AND FABRICATION OF OCCUPANCY SENSOR

DIPANKAR GHOSH

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

## 1. INTRODUCTION

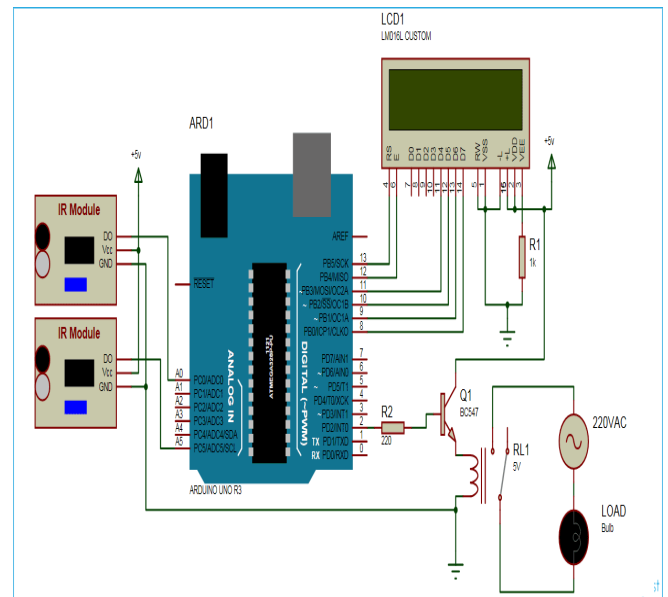
The model of Human Occupation (MOHO) was first developed in the 1980s by Gary Kielhofner. Since then other occupational therapists have also been involved in its further development, revision and refinement of the concepts. The distance from the object is very important and in some cases the IR sensor is not suitable for these applications. If the distance from the object is greater than 20-30cm, the ultrasonic sensor can be a better choice.

We need to know when the IR sensor changes its state from HIGH to LOW and count how many times this transition happens: this is called *state change detection*. A counter can be made not only with IR technology but also with thermal imaging systems that use an array of sensors which detect heat sources or using machine vision which usually requires complex image processing algorithms.

## 2. OBJECTIVE

The purpose of the project this project is used to count the number of persons entering and exit from room. And whenever the person enters in the room lights turn on and when nobody in the room all light is turn off. And it should be used in a large seminar hall. The lights are on only where the human is presence in the room.

Figure 1. Circuit diagram



## 3. WORKING PRINCIPLE

The IR transmitter sends an infrared signal that, in case of a reflecting surface (e.g. white colour), bounces off in some directions including that of the IR receiver that captures the signal detecting the object.

When the surface is absorbent (e.g. black colour) the IR signal isn't reflected and the object cannot be detected by the sensor. This result would occur even if the object is absent.

- **IR transmitter and IR receiver**

The IR transmitter is a particular LED that emits radiation in the frequency range of infrared, invisible to the naked eye. An infrared LED just works as a simple LED with a voltage of 3V DC

and a current consumption of about 20mA. The IR receiver, such as a photodiode or a phototransistor, is capable of detect infrared radiation emitted from the IR transmitter. Aesthetically it is similar to a LED but the external capsule can be wrapped by a dark colour film.

There are some sections of whole visitor counter circuit that are sensor section, control section, display section and driver section.

- **Sensor section**

In this section we have used two IR sensor modules which contain IR diodes, potentiometer, Comparator (Op-Amp) and LED's. Potentiometer is used for setting reference voltage at comparator's one terminal and IR sensors sense the object or person and provide a change in voltage at comparator's second terminal. Then comparator compares both voltages and generates a digital signal at output. Here in this circuit we have used two comparators for two sensors. LM358 is used as

comparator. LM358 has inbuilt two low noise Op-amp.

#### **4. ADVANTAGES**

1. Our project is to implement a counter which will count the number of persons entering the room and leaving the room so that when any person enters the room, lights turn on and when nobody is present in the room the lights turn off, both the process being automatic.
2. This project will decrease the electrical power consumption.
3. It can also count how many people are entered or leaved on that particular room.

#### **5. LIMITATIONS**

1. The IR sensor can't receive the radiation from the dark surface.
2. If a group of people entered in the room together then sometimes it can't count the number.



# RFID BASED SMART ATTENDANCE SYSTEM

ANISH RAI, SUPRATIM DIG, SANJEEV KUMAR, SOUMYAJIT BHATTACHARJEE

Students of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

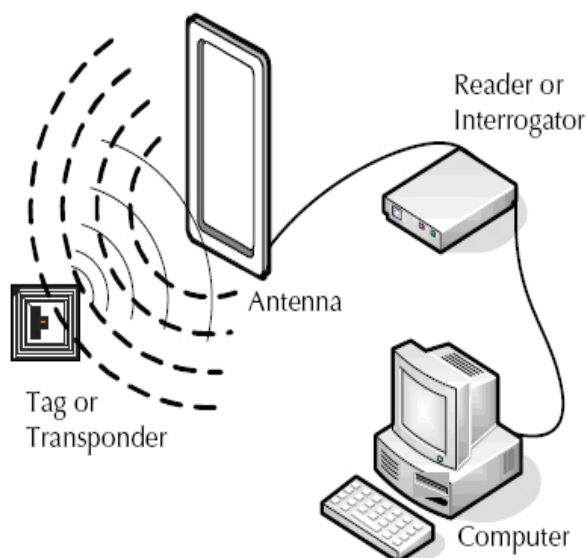
## 1. INTRODUCTION

The term RFID refers to Radio Frequency Identification, a technology which uses radio waves to automatically identify items or people. Most commonly this involves the use of an RFID tag and a reader device.

Most educational institutions' administrators are concerned about student irregular attendance. Truancies can affect student overall academic performance. The conventional method of taking attendance by calling names or signing on paper is very time consuming and insecure, hence inefficient. Radio Frequency Identification (RFID) is an interesting solution in such cases. RFID based attendance system is one of the solutions to address this problem.

## 2. WORKING OF RFID BASED ATTENDANCE SYSTEM

Figure 1. Block Diagram 1



When a person with RFID tag or transponder enters in the range of RFID reader, the RF field induces voltage in the coils of tag. The range can be set by using the appropriate reader of appropriate frequency. This induced field supplies the voltage in case of passive tags and act as a battery in that case. If active tags are used then the case will be different as they have battery of their own.

Due to interaction of tag with reader 12 characters from tag are sent to controller. These 12 characters are sent to controller via serial communication. Before this controller is loaded with a program. In controller data of employee are saved. In our case data 's of two employees are saved i.e. tag number and name. When we provide power supply to the circuit, the circuit switches on and "RFID BASED ATTENDANCE SYSTEM" is displayed on LCD.

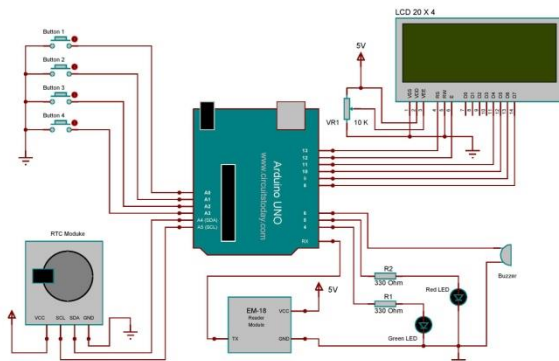
## 3. COMPONENT REQUIRED

- Printing PCB
- ATmega32 Microcontroller
- Crystal Oscillator
- 3v Lithium Battery
- DS1307 RTC IC
- MAX232
- ISP CONNECTOR
- RFID Tags
- RFID Reader
- SD card
- SD card module
- Capacitor

- Voltage Regulator IC 7805
- LED
- Connecting wires
- LCD 16×2
- Resistors

#### 4. CIRCUIT DIAGRAM

Figure 2. Block Diagram 2



#### 5. APPLICATIONS OF RFID

This system can be used to take attendance for student in school, college, and university. It also can be used to take attendance for workers in working places. Its ability to uniquely identify each person based on their RFID tag type of ID card make the process of taking the attendance easier, faster and secure as compared to conventional method.

The system can be connected to the computer through RS232 or Universal

Serial Bus (USB) port or external SD card and store the attendance taken inside database. An alternative way of viewing the recorded attendance is by using HyperTerminal software. A prototype of the system has been successfully fabricated. Radio frequency technology is used in many applications. RFID tags are containing 13- or 11-digit number tag inbuilt in it.

#### 6. CONCLUSION

As RFID technology evolves, more sophisticated applications will use the capability of RFID to receive, store and forward data to a remote sink source. The versatility of RFID can be used in implementing functional and automatic student course attendance recording system that allows students to simply fill their attendance just by swiping or moving their ID cards over the RFID reader which are located at the entrance of lecture halls with a considerable degree of success and acceptability of usage in our faculty. Such an RFID based attendance system can shift the paradigm of student 's lecture attendance monitoring in classroom and provide a new, accurate, and less cumbersome way of taking student attendance in school.

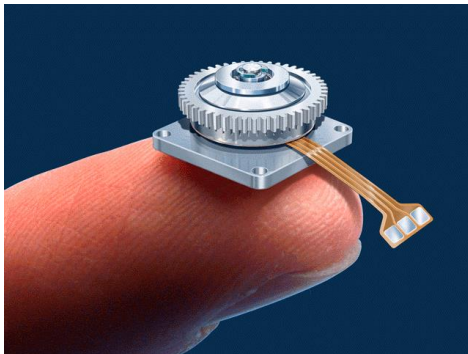
## ULTRASONIC PIEZOELECTRIC MOTOR

SOUMYAJIT BHATTACHARJEE

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

A piezoelectric motor or piezo motor is a type of electric motor based on the change in shape of a piezoelectric material when an electric field is applied. Piezoelectric motors use the converse piezoelectric effect of piezoelectric sensors, in which deformation or vibration of the piezoelectric material produces an electric charge. An electrical circuit makes acoustic or ultrasonic vibrations in the piezoelectric material, which produce linear or rotary motion. In one mechanism, the elongation in a single plane makes a series of stretches and position holds, analogous to the way a caterpillar moves.

**Figure 1. Motor view**



One drive technique uses piezoelectric ceramics to push a stator. These piezoelectric motors use three groups of crystals—two *locking*, and one *motive* that permanently connects to either the motor's casing or stator (not both). The motive group, sandwiched between the other two, provides the motion. These piezoelectric motors are fundamentally stepping motors, with each step comprising either two or

three actions, based on the locking type. These motors are also known as inchworm motors. Another mechanism uses surface acoustic waves (SAW) to generate linear or rotational motion.

A second drive type, the squiggle motor, uses piezoelectric elements bonded orthogonally to a nut. Their ultrasonic vibrations rotate a central lead screw. This is a direct drive mechanism.

### Locking mechanisms

The non-powered behaviour of the first type of piezoelectric motor is one of two options: *normally locked* or *normally free*. When no power is applied to a normally locked motor, the spindle or carriage (for rotary or linear types, respectively) does not move under external force. A normally free motor's spindle or carriage does move freely under external force. However, if both locking groups are powered at rest, a normally free motor resists external force without providing any motive force.

A combination of mechanical latches and crystals can do the same thing, but would restrict the maximum stepping rate of the motor. The non-power behaviour of the second type of motor is locked, as the drive screw is locked by the threads on the nut. Thus, it holds its position with the power off.

**Figure 2. Stepping actions**

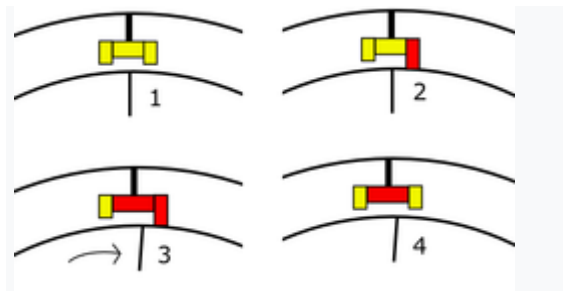
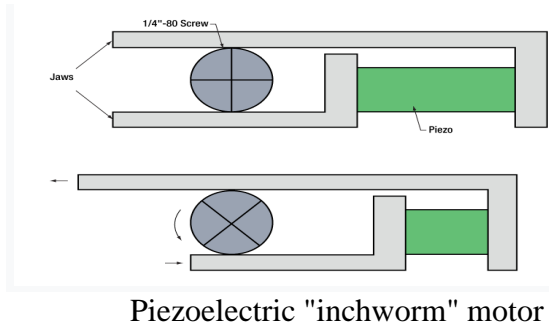


Fig. 1: Stepping stages of Normally Free motor

Regardless of locking type, stepping type piezoelectric motors—linear and rotary—use the same mechanism to create movement:

1. First, one group of *locking* crystals is activated to lock one side and unlock other side of the 'sandwich' of piezo crystals.
2. Next, the *motive* crystal group is triggered and held. The expansion of this group moves the unlocked *locking* group along the motor path. This is the only stage where the motor moves.
3. Then the *locking* group triggered in stage one releases (in *normally locking* motors, in the other it triggers).
4. Then the *motive* group releases, retracting the 'trailing' *locking* group.
5. Finally, both *locking* groups return to their default states.

### Direct drive actions

The direct drive piezoelectric motor creates movement through continuous ultrasonic vibration. Its control circuit applies a two-channel sinusoidal or square wave to the piezoelectric elements that matches the bending resonant frequency of the threaded tube—typically an ultrasonic frequency of 40 kHz to 200 kHz. This creates orbital motion that drives the screw.

### Speed and precision

The growth and forming of piezoelectric crystals are a well-developed industry, yielding very uniform and consistent distortion for a given applied potential difference. This, combined with the minute scale of the distortions, gives the piezoelectric motor the ability to make very fine steps. Manufacturers claim precision to the nanometre scale. High response rate and fast distortion of the crystals also let the steps happen at very high frequencies—upwards of 5 MHz. This provides a maximum linear speed of approximately 800 mm per second, or nearly 2.9 km/h.

A unique capability of piezoelectric motors is their ability to operate in strong magnetic fields. This extends their usefulness to applications that cannot use traditional electromagnetic motors—such as inside nuclear magnetic resonance antennas. The maximum operating temperature is limited by the Curie temperature of the used piezoelectric ceramic and can exceed +250C

# **PROTOTYPE DEVELOPMENT OF SMART DOOR LOCK USING FINGERPRINT SENSOR AND ARDUINO UNO**

JOYDEEP SINHA, SANKHADEEP SANTRA, SOUMYADEEP KARAR, ANIRBAN KAR  
Students of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

## **1. INTRODUCTION**

**S**ecurity has always been a major concern for the households and the office environment, and for this concern various approaches are in place to address the problem. Most of the major door lock security systems have several loopholes which could be broken down to gain access to the desired places, and it creates a concern for a secure lifestyle and proper working environment. Additionally, terrorism and unauthorized access to places have become a major issue now-a-days, and there is a need for a secure system to prevent unauthorized access especially in shared access environment. With this consideration, a design and prototype of a biometric fingerprint-based door lock system has been presented in this paper. Biometric systems such as fingerprint provide tools to enforce reliable logs of system transactions and protect an individual's right to privacy. The RFID or password-based door lock mechanisms can easily be compromised when the RFID card or passwords are shared or stolen, thus for facilities with shared access require biometric-based secure system.

## **2. WORKING PRINCIPLE**

The circuit shown in Fig. operates using a 12V power supply. An Arduino microcontroller (MCU) requires only 5V but the solenoid electric lock requires 12V.

As Arduino Uno has an inbuilt 5V voltage regulator, a common 12V supply can be used for the whole system. The brain of the circuit is Arduino Uno MCU board (BOARD1). It is based on ATmega328/ATmega328P and has 14 digital input/output (I/O) pins, six analogue inputs, 32k flash memory, 16MHz crystal oscillator, a USB connection, power jack, ICSP header and reset button, among others. It can be programmed using Arduino IDE software. Fingerprint sensor module R305 (connected across CON2) has UART interface with direct connections to the MCU or to the PC through max232/USB serial adaptor. The user can store fingerprint data in the module and configure it in 1:1 or 1: N mode for identification. Pins TX and RX of R305 sensor are connected to Arduino digital pins 2 and 3, which are used for serial communication.

## **3. CONCLUSION**

In this guide we have demonstrated that it is indeed possible for the Arduino to enhance the security system. Arduino Fingerprint Door Lock, as the name suggests, is an electronic door lock that can be installed on almost any access point in your house. It uses a fingerprint scanner to grant a user access by controlling an electric door strike with a relay.

# COST ESTIMATION AND FABRICATION OF SINGLE PHASING PREVENTER FOR THREE PHASE MOTOR PROTECTION WITH THERMAL OVERLOAD PROTECTION

ABRADEEP DHOLEY, SURAJ DEBNATH, SUBHROJYOTI DAS, ANKIT MAJUMDAR  
Students of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

## 1. INTRODUCTION

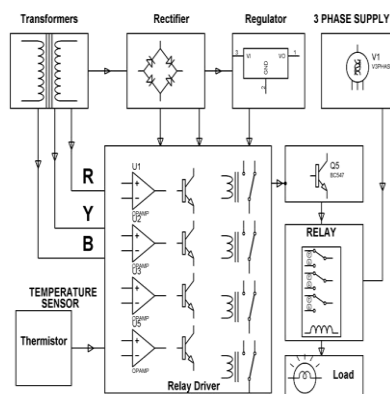
A preventer, or jibe-guard, is a mechanical device on a sailing vessel which limits the boom's ability to swing unexpectedly across the boat due to an unplanned accidental jibe. During an unplanned accidental jibe (or gybe), neither the crew nor the boat is set up properly to execute a planned jibe.

## 2. WORKING PRINCIPLE

Single phase preventer is used to protect the induction motor from single phasing fault. Single phasing is a very dangerous fault to the electrical motor and which damages the motor stator winding rapidly. Generally single phasing is nothing but a motor runs when one of the supply is disconnected due to open circuit or improper contact in switch or other electrical equipment failure. Normally, the motor runs with the three phase supply and which takes balance current in each phase winding. Consider one of the fuses has blown. But the motor still in rotating position which tries to rotate in the same speed. At that same time the absence phase current will be shifted to the remaining live phases. Therefore, the current in the other phases increases up to 3 times its normal value instantly. This is called single phasing fault. The single phasing leads to unbalanced current in the motor stator. The component which is present in this unbalanced current called negative

sequence component. These negative sequence component creates the magnetic flux opposite to the main flux. This results in double frequency currents to induce in the rotor to cause its heating.

## 3. BLOCK DIAGRAM



## 4. ADVANTAGES

1. Small device, Easy to install, Solid state PCB.
2. Prevents equipment from Single Phasing,
3. Reverse Phasing and Unbalance Supply
4. No Separate Auxiliary Supply Required.

## 5. DISADVANTAGES

1. It is not used for single phase motor.
2. We can't use for motor insulation braking.
3. We can't use for overload current.
4. It is not used for earth faulting.

## **6. CONCLUSION**

The single-phase preventer that has been designed for to protect the three-phase

motor from single phasing. The preventer has few components, covers a small area, and is very in simple in design.

## SMART IRRIGATION

SUBHODEEP ROY, BHASKAR DAS, DIBYENDU KOLEY, SUBHAJEET KOLEY

Students of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

### 1. INTRODUCTION

**A**im is to develop a wireless three level controlled smart irrigation system to provide irrigation system which is automatic for the plants which help in saving water and money. The main objective is to apply the system for improvement of health of the soil and hence the plant via multiple sensors. Appropriate soil water level is a necessary pre-requisite for optimum plant growth. Also, water being an essential element for life sustenance, there is the necessity to avoid its undue usage. Irrigation is a dominant consumer of water. This calls for the need to regulate water supply for irrigation purposes. Fields should neither be over-irrigated nor under-irrigated. The objective of this thesis is to design a simple, easy to install methodology to monitor and indicate the level of soil moisture that is continuously controlled in order to achieve maximum plant growth and simultaneously optimize the available irrigation resources on monitoring software LabVIEW and the sensor data can be seen on Internet. In order to replace expensive controllers in current available systems, the Arduino Uno will be used in this project as it is an affordable microcontroller. The Arduino Uno can be programmed to analyse some signals from sensors such as moisture, temperature, and rain. A pump is used to pump the fertilizer and water into the irrigation system. The use of easily available components reduces the manufacturing and maintenance costs. This makes the proposed system to be an

economical, appropriate and a low maintenance solution for applications, especially in rural areas and for small scale agriculturists.

### 2. OBJECTIVE

To improve and stabilize the crop yields of smallholder olive farmers through the implementation of sustainable irrigation systems. To promote water management practices that optimizes the volume and timing of water distribution. To generate positive economic consequences for farmers and their families. Minimize year to year yield fluctuations, leading to higher and more stable farm income.

### 3. IMPLEMENTATION

In India, agriculture in villages plays an essential role in developing the country. Basically, agriculture depends on the monsoons which have not enough water source. To overcome this problem, the irrigation system is employed in the field of agriculture. In this system, based on the soil type, the water will be provided to the agricultural field. In agriculture, there are two things, namely, the moisture content of the soil as well as the fertility of the soil. At the present time, there are several types of techniques available for irrigation to reduce the need for rain. This type of technique is driven by on/off schedule using electrical power. This article discusses the implementation of a smart irrigation system

### 4. AIM

Aim is to develop a wireless three level controlled smart irrigation system to provide irrigation system which is



automatic for the plants which help in saving water and money. The main objective is to apply the system for improvement of health of the soil and hence the plant via multiple sensors.

## **5. ADVANTAGES**

Three Advantages of Smart Irrigation Systems

1. Scheduling and Connectivity. One of the largest advantages associated with smart irrigation systems is the fact that their schedules are able to be updated from anywhere with an internet connection.
2. Weather Adjustments.
3. Zone Control.
4. Water Savings.

## **6. DISADVANTAGES**

Disadvantages include increased risk of plant disease due to wet foliage, although early morning watering reduces that risk. Also, winds often blow overhead sprays off target, wasting misdirected water and increasing evaporation. Runoff due to overwatering and nearby concrete add to water loss.

## **7. WORKING PRINCIPLE**

In the agriculture field, sensors are used like soil moisture. The information received from the sensors is sent to the Database folder through the Android device. In the control section, the system is activated using the application, this is finished using the ON/OFF buttons in the application. Also, this system is automatically activated when the soil moisture is low, the pump is switched ON based on the moisture content.

The application has a feature like taking some time from the user and water the agriculture field when the time comes. In this system, there is a switch used to turn off the water supply if the system fails. Other parameters such as the moisture sensor demonstrate the threshold price and the level of water in the soil.

## **8. CONCLUSION**

The smart irrigation system implemented is feasible and cost effective for optimizing water resources for agricultural production. This irrigation system allows cultivation in places with water scarcity thereby improving sustainability. The smart irrigation system developed proves that the use of water can be diminished for a given amount of fresh biomass production. The system is incredibly versatile and economical. It doesn't need individuals on duty it is so easy and reliable

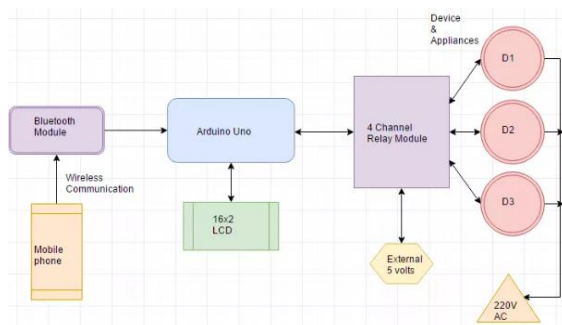
# VOICE CONTROLLED HOME AUTOMATION USING ARDUINO

SAIKAT RAY, SUPRIO SIL, PIYASA DAS, SOUMOJIT BAUR  
Students of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

## 1. INTRODUCTION

In this project, we are using a voice function to control home devices. This project is the part of my home automation series. This project is similar to home automation using Arduino. In that project we use one pin terminal application in this we use AMR application. This application is free and very easy to use. This project is very easy to use in real life. People of any age can control it by just speaking the commands. This Arduino based project has a larger range than in and pc-based ones. Before making this project, you should know how to interface HC 05 Bluetooth module with Arduino and should also know about Arduino programming basics.

## 2. BLOCK DIAGRAM



## 3. COMPONENTS REQUIRED FOR VOICE CONTROLLED HOME

Arduino UNO, Bluetooth module, Relay module, 16x2 LCD display, Zero PCB board, LED lights, Jumpers, Diode, Transistor.

## 4. AUTOMATION SYSTEM USING ARDUINO

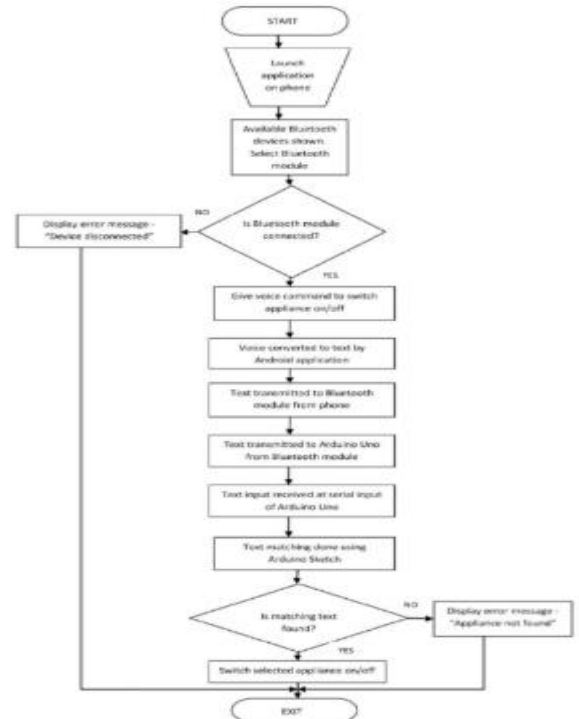
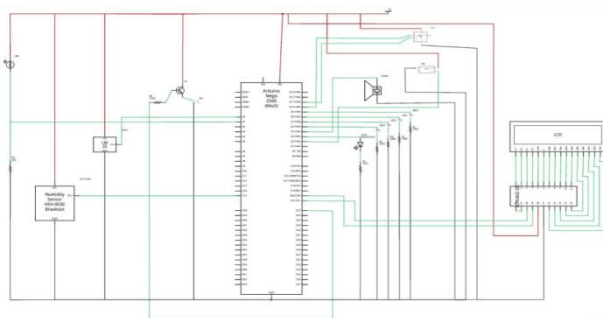
- **Arduino Uno:** We use Arduino due to its simplicity and it also provides the much digital pin to interface with LCD, Bluetooth module, and relay module at the same time.
- **HC-05 Bluetooth Module:** HC-05 is used to communicate with the mobile phone.
- **Relay Modules:** The module we use in this project is HL-54S. It switches on and off using a 5v logical signal from Arduino. It can bear up to 250VAC and 10A. These modules have 4 channels so we can control 4 AC devices at a time.
- **16x2 LCD:** LCD is used to display project name, a list of commands which can be entered then it asks to give any command and show the status of the command which is entered. We use 16x2 LCD because it is easy to interface with Arduino and very cheap in price. 10k potentiometer is used to control the contrast of display
- **AC LED Tubes:** AC bulbs are used to represent appliances. Because it is easy to handle and very useful when you are prototyping any AC project. In final product just replace with devices to control.

- **AC wire with plug:** I advise you to use good quality wire when working with higher voltages. It is always good to use electrical tape to protect connections.
- **External 5 Volt supply:** 5-volt dc supply is required to switch a relay on and off. Otherwise, it did not work. Also, do not supply 5v from Arduino.

We speak the predefined commands to AMR, Voice application. The application sends the command to Bluetooth which is then received by Arduino and performs the described task. At the same time, Arduino displays the status on LCD and write on the serial monitor. Each command has its unique operations which are defined in code. You can change the commands according to your ease. Below is the list of commands.

Commands: Following commands should be spoken by the user to turn on and turn off devices.

#### 4. INTERNAL CIRCUIT DIAGRAM



#### 5. CONCLUSION

The proposed project undertakes a viable solution the need of automation at the very basic level, that is, in our homes. The project will enable us to bring every appliance at every corner of our home under our control from a single.

The use of a Bluetooth module assists the use of this system from various locations in our house. The system is further simplified by allowing appliances to be controlled by our voice. The user need not have to have to immense knowledge over the language of English. Just by saying the appliance name and the corresponding number assigned to that particular appliance, and telling it to switch on or off will enable the user to have complete control over any appliance without any effort. Android applications are very simple and user friendly allowing the user to understand its functionalities in very little time. Hence, the use of android application in this system

allows a user to easily learn the process and get accustomed to the functions. Moreover, the entire system is very flexible and scalable. Any number of appliances can be added as and when required. Hence, the systems find use not only in houses but also in many offices where appliances such as fans or lights on multiple floors can be controlled by a person on any of the floors, saving manual labour and human effort to switch on or off the electronic appliances, thereby saving time. This system, though primarily aimed to reduce human effort, will be of much importance to old aged people and physically handicapped people. It will enable them to control their home devices with ease, without going through

much pressure or stress of moving about. Due to the inexpensive materials used in the construction and further cost optimization if the device is taken to the market, it finds application in a wide area. Scalability of the project would be considerably easier as the device can be used in every building using electrical appliances and devices. In addition, there have been many advertisements broadcasted by the Government of India promoting awareness to switch off household appliances when not in use and thus save electricity. Hence, such a project would assist the initiatives taken by the government, as most people forget to switch off home appliances and are too lazy to return and switch it off.

# **COST ESTIMATION AND FABRICATION OF FOOT STEP POWER GENERATION**

SOURAV CHAKRABORTY, SUSMITA BAG, KALYAN KUNTI, SUBHAJIT SENAPATI  
Students of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

## **1. INTRODUCTION**

**A**t present, electricity has become a lifeline for human population. Its demand is increasing day by day. Modern technology needs a huge amount of electrical power for its various operations. Electricity production is the single largest source of pollution in the whole world. At one hand, rising concern about the gap between demand and supply of electricity for masses has highlighted the exploration of alternate sources of energy and its sustainable use. On the other hand, human population all over the world and hence energy demand is increasing day by day linearly. Accordingly, it is an objective of the present invention to provide a method of electrical power generation from this ever-increasing human population that does not negatively impact the environment. This technology is based on a principle called the piezoelectric effect, in which certain materials have the ability to build up an electrical charge from having pressure and strain applied to them. Piezoelectricity refers to the ability of some materials to generate an electric potential in response to applied pressure. Harvesting of energy which means energy is already available, but is going to waste if not utilized. Embedded piezoelectric material can provide the magic of converting pressure exerted by the moving people into electric current.

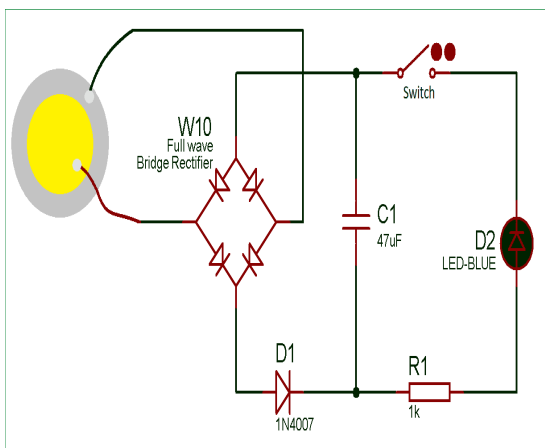
## **2. WORKING PRINCIPLE**

The piezoelectric material converts the pressure applied to it into electrical energy. The source of pressure can be either from the weight of the moving vehicles or from the weight of the people walking over it. The output of the piezoelectric material is not a steady one. So, a bridge circuit is used to convert this variable voltage into a linear one. Again, an AC ripple filter is used to filter out any further fluctuations in the output. The output dc voltage is then stored in a rechargeable battery. As the power output from a single piezo-film was extremely low, combination of few Piezo films was investigated. Two possible connections were tested - parallel and series connections. The parallel connection did not show significant increase in the voltage output. With series connection, additional piezo-film results in increased of voltage output but not in linear proportion. So here a combination of both parallel and series connection is employed for producing 40V voltage output with high current density. From battery provisions are provided to connect dc load. An inverter is connected to battery to provide provision to connect AC load. The voltage produced across the tile can be seen in an LCD. For this purpose, microcontroller PIC16F873A is used. The microcontroller uses a crystal oscillator for its operation. The output of the microcontroller is then given to the LCD which then displays.

The inverter used in this circuit uses the IC CD4047. It is used to convert the DC

voltage stored in the battery to AC voltage. IC CD4047 produces two pulse trains phase shifted by  $180^\circ$ . These pulse trains are used to switch transistors configured in common emitter mode producing pulse trains of 12V, which is capable of switching a MOSFET. The sources of the two MOSFETs used in the inverter circuit are supplied with a 12V supply. When the MOSFETs are switched on by the outputs of the transistors, two output pulses of 12V are obtained. These pulses are connected to a step-up transformer from whose high voltage side; we obtain the 220V AC supply.

#### 4. CIRCUIT DIAGRAM



#### 5. APPLICATION

- i. Foot step power generation can be used for emergency power failure situations.
- ii. Foot step generated power can be used for agricultural, Home Applications, Street lighting.
- iii. Metros, Rural Applications etc.

#### 6. ADVANTAGE

- i. Power generation is simply walking on step.
- ii. No need fuel input.

- iii. This is a non-conventional system.
- iv. No moving parts long life service.
- v. Self-generation-no external power required.
- vi. Compact yet highly sensitive
- vii. Reliable, Economical, Eco-Friendly
- viii. Less consumption of non-renewable energy.
- ix. Power also generated by running or exercising on the step.
- x. Battery is used to store the generated power.

#### 7. LIMITATION

- i. Only applicable for the particular place.
- ii. Initial cost of this arrangement is high.
- iii. Output effected by temperature variation.
- iv. Care should be taken batteries.

#### 8. CONCLUSION

- The project “**Cost Estimation and Fabrication Of Foot Step Power Generation**” is successfully tested and implemented which is the best economical affordable energy solution to common people
- This can be used many applications in rural areas where power availability is less or totally absence.

As India is a developing country where energy management is a big challenge for huge population. By using this project, we can drive both A.C. as well as D.C. loads according to the force we applied on the piezo electric sensor.

# COST ESTIMATION AND FABRICATION OF TRANSFORMER PARAMETERS MONITORING USING SENSORS AND ARDUINO UNO

SAYANTIKA MONDAL, ARPAN ROY, ANUPAM PATRA, SOURAV SHAW  
Students of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

## 1. INTRODUCTION

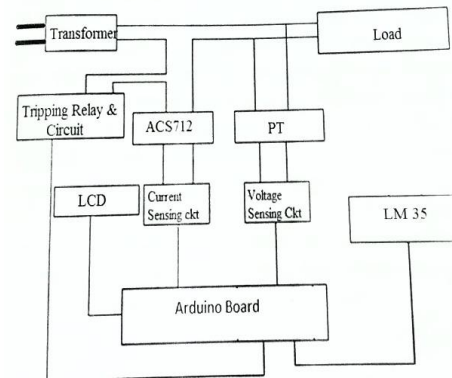
The Transformer is the static electrical equipment which works on the principle of electromagnetic induction. It is important in power system which directly transferring the electrical power from one circuit to another without any frequency. But certain unexpected condition such as overloading and ineffective cooling of transformers are the major cause of failure in distribution as well as their life span. The systems which are presently used for monitoring distribution transformers have some problem and deficiency.

For example:

1. Normal simple transformer measures detects a single parameter such as power, voltage, current while some ways could detect multi- parameter, time acquisition and operation parameters are too long and test speed is not fast.
2. Detection system itself is not reliable
3. Timely detection data will not send to monitoring centre in time, which cannot judge distribution transformers three- phase equilibrium.

4. A monitoring system can only monitor the operation state or guard.

## 2. BLOCK DIAGRAM OF CONSTRUCTION



It consists of current transformer, power transformer, temperature sensor LM35, Arduino, LCD display and relay. Normally in transformer, failure occurs due to voltage and current fluctuation, overheating etc. In this project, to sense these faults we have used current and potential transformer, temperature sensor LM35 respectively. All these sensors are connected to Arduino. LCD respectively. In this project a protection system has been designed in such a way that designed system the real time based, operating parameters of the transformer continuously and these parameters displayed on the LCD display. In this LCD display unit, we can view the continuous parametric information of transformer. In this project a P.T is used for a step down the line voltage for measuring purposes and for sensing the line currents a C.T is used. Sensor play a vital role in effective implementation of the project.

## 3. MERITS

1. System is totally independent i.e. having separate power supply to operate this total circuitry which is nothing but battery supplied.

2. Limit range of voltage level such as minimum and maximum can set which is our hand so that we can decide the range of voltages.

3. Similarly, we can set the maximum limit of current so that crossed limit is abnormal current range.

#### **4. DEMERITS**

1. This system is not applicable for these phase systems.

2. Maximum range of this system is depending upon the maximum value of sensors.

#### **5. USES**

This system can be used in Transmission line. This system is used in three phase Induction motor.

#### **6. CONCLUSION**

Transformers are among the most generic and expensive piece of equipment of the transmission and distribution system. Regular monitoring health condition of transfer not only is economical also adds to increased reliability. In the past, maintenance was done based on a pre-determined schedule. With the advancement of communication technology now it is possible to receive fault information of transformer through Arduino technology remotely to the operate and authorities so one can able to take possible solution before converting fault situation.

1. Calculate the current flowing through the circuit analysis it. The ACS712 is to use to measure the current and displayed on the LCD display.



# FREE ENERGY GENERATOR

SNEHASHIS DAS

Lecturer of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

## 1. INTRODUCTION

**M**ore than 90% of world's power is being generated using electromagnets based on Faraday law of electromagnetic induction (M Grover et.al. 2014). Many new technology were discovered which leads a drastic change in the perception of electric energy but at the same time there is a misconception of free energy (Nieper Hans et.al.1985).Energy becomes free only at a point after which we don't have to pay for it .But using the magnetic force which helps in providing the rotation motion for the rotor to generate energy with the help of dynamo(Kelly D et.al. 1866).

## 2. PRINCIPLE OF ENERGY

Energy can be transformed from one form to another form. The electric energy which we get from solar cell, wind mill, tidal, geothermal, hydraulic etc. is free only after applying some initial capital in it (Hp Singh et.al.2015). Without the initial investment we cannot fetch fruits. The concept of using magnets for generation of electricity has been around us from a long time ago. Here we are using Neodymium magnets which is one of the powerful magnets on the earth are placed on the stator and the rotor part of the generator. As there is no such thing called Free Energy. As we know that when a conductor is rotated in a magnetic field a voltage is induced in that conductor due to the variation of flux in it but there are huge losses in the core and winding of rotor and stator like iron loss, copper loss by the use of this V-guard

magnetic rotor these losses are very negligible. Here we are using permanent ND magnets to generate the required rotating force to rotate the V-guard rotor. We are using ND magnets here because these are the most powerful magnets on the earth (S I Shahi et.al .2015). Due to this magnetic force, V-guard rotor starts up to rotate and attain a proper speed for the generation of electricity. As it is further connected with dynamo, the dynamo produces an energy which is further store in the battery and we utilise it for commercial purposes.

## 3. WORKING

Basic principle of generator is to convert mechanical energy or rotational motion converts into electrical energy. Here, we install or engrave the ND magnets in V-shape on rotor. It is also called V-guard rotor and the magnets on the stator part is connected in series .As the rotor rotates after every 360° rotation the reed switch cuts the magnetic field and generates a signal which is further send to the relay and relay gives the signal to the electromagnet relay is used which is connected to the stator part to pull it up and down after 360° rotation for maintaining the continuous motion of the rotor . Due to which it will continue to rotate. And the rotor is further connected to a dynamo which is used to generate the power as it reaches up to proper RPM and there is LED is also connected with gives the proper indication of the flowing of current. The power which is generated by this system is further stored

in batteries and ready to use for our purpose.

#### **4. CONCLUSIONS**

This free energy generator described in this paper doesn't require any electrical supply. It is basically a prototype which runs at 100 rpm and generates a voltage near about 12 volt and current near about 0.8 amp which is further stored in batteries and utilize for

charging mobile batteries, lightning lamps, and many more. On bigger scale we can create large amount of power which can be utilize for our domestic purposes. If we do more focus and research on this project then this became the face of tomorrow. This is the replacement of renewable or alternate source of energy in future.

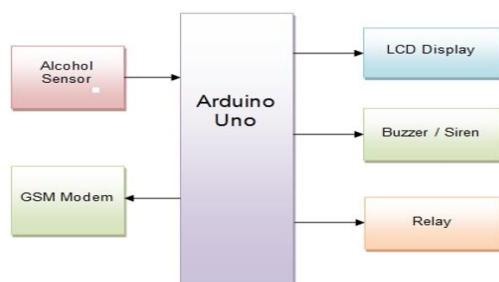
# COST ESTIMATION AND PROTOTYPE DEVELOPMENT OF AUTOMATIC ENGINE LOCKING SYSTEM FOR INTOXICATED AUTOMOBILE

SAJIDUR RAHMAN, SWARNENDU KAR, KAUSTAV PAUL, RITVIK SINGH  
Students of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

## 1. INTRODUCTION

One major reason of deaths on Indian roads is accidents due to drunken driving. This happens because of drunk people being able to take control of vehicle even after being drunk. In our project, we propose to solve this problem by designing a system which automatically switches off the vehicle's engine whenever alcohol of certain quantity is detected in the driver's breath. As soon as the presence of alcohol is detected, the microcontroller stops the engine of the vehicle and a siren is blown to alert nearby people to convey that something is wrong with the vehicle and a message "Alcohol Detected" is flashed on the LCD screen which is installed in the system, so that nearby people can interpret gravity of the situation and inform the concerned authorities to avoid any kind of incident. This system when implemented in vehicles will not only avoid the deaths and property loss due to drunken driving, but will also help in reducing the total number of accidents which occur due to this. Moreover, people in other vehicles or pedestrians will be much safer because of the vehicle being stopped right away.

## 2. BLOCK DIAGRAM



## 3. PROPOSED SYSTEM

In this proposed system uses MQ3 alcohol sensor with Arduino along with GSM module to send message notification for users' numbers and LCD Display to identify the alcohol is detected or not and DC motor to sense by the alcohol and it automatically stop the motor. And the system checks the permissible limit then the sensor will be triggered the processor about the respective voltage. Thus, the system will automatically stop the motor and it send message to the users.

1. 9V Battery: Rechargeable battery, storage battery, secondary cell or accumulator is a type of electrical battery which can be charged, discharged into a load and recharged many times USES: Common example are lithium-helium battery.

2. Battery holder: A battery holder is one or more compartments or chambers for holding a battery.

3. Adafruit Motor shield (L293D): Arduino is the great starting point for electronic and the motor shield can drive up to 4 DC Motors bi-directionally. They can drive forward and backward. The speed can be varied at 0.5% increments using high quality built in PWM. To connect motor simply solder two wires to the terminals and connect M1, M2, M3 and M4. #include<AFmotor .h> is the library used , create the object and motor 1 and 2 are used for high speed.

4. Arduino UNO: Arduino UNO R3 is an open source micro controller board based on the AT mega 328 chip. This board has 14 digital input/output pins, 6 analog input pins, Onboard 16 MHz ceramic resonator, Port for USB connection, Onboard DC power jack, An ICSP header and a micro controller reset button.

5. Buzzer: A Buzzer or beeper is an audio signalling device. It may be A mechanical, electromechanical, magnetic, electromagnetic, electro – acoustic or piezoelectric audio signalling device. A piezoelectric buzzer can be driven by an oscillating electronic circuit or other audio signal source. A click, beep or ring can indicate that a button has been pressed.

6. Jumper Wire: A jumper wire is a conducting wire. It is used to transfer electrical signals between two points in a circuit. The wires can either be used to modify circuits or to diagnose problems within circuit. In electronics and particularly computing, a jumper is a short length of a conductor used to close, open or bypass part of an electronic circuit. They are typically used to setup or configure printed circuit boards, such as the mother boards of a computers.

7. DC Motor: A motor is a electrical machine which converts electrical energy into mechanical energy. The principle of working of a DC motor is that “whenever a current carrying conductor is placed in a uniform magnetic field, it experiences a mechanical force “The end of the wire windings is connected to a commutator. The commutator allows each coil to be energized in turn and connects the rotating coils with the external power supply through brushes.

LCD(16\*2): LCD (Liquid Crystal Display) screen is an electronic display module and

find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines.

#### **4. RESULT**

Whenever a drunk person tries to take control of vehicle, the alcohol sensor will detect the presence of alcohol and if presence of alcohol is detected by the sensor, it will shut down the vehicle’s engine and sound an alarm thereby alerting the nearby people. The LCD screen present in the vehicle will display “Alcohol Detected” so that people are aware of the situation and hence can take the necessary action that may be required. Therefore, by using this system on a vehicle, any kind of loss of life or damage to property can be avoided. Simulation of the system has been done in Proteus software. All the components have been tested and connected as required thereby providing us with the desired result as shown in the above image.

#### **5. CONCLUSION**

In this project, we have developed an efficient system to tackle the menace of drunken driving. Our main aim is to minimize the loss of lives and property which happen due to drunken driving. This system once implemented on a large scale will prove to be really helpful by shutting down the vehicle’s engine and alerting the nearby people before any mishap takes place. The sensor used in the project is very accurate and can be configured according to the requirements thereby increasing the efficiency.

# C.E & P.D OF SMART HOME AUTOMATION SYSTEM

AVIJIT DAS, DEBANJAN SARKAR, NILLOHIT DEY, PRATIK DAS

Students of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

## 1. INTRODUCTION

Home automation system achieved great popularity in the last decades and it increases the comfort and quality of life. In this paper an overview of current and emerging home automation systems is discussed. Nowadays most home automation systems consist of a smart-phone and microcontroller. You can save energy in areas other than the heating and cooling systems of your home. Devices that draw energy even when in a standby mode or just when plugged in can be completely shut down when not in use, reducing your home's electrical load.

A home automation system typically connects controlled devices to a central hub or "gateway". The user for control of the system uses either wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface, that may also be accessible off-site through the Internet.

Home automation or domestics is building automation for a home, called a smart home or smart home. A home automation system will control lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems.

## 2. ADVANTAGES

- Managing all of your home devices from one place. The convenience factor here is enormous.
- Flexibility for new devices and appliances.
- Maximizing home security.
- Remote control of home functions.
- Increased energy efficiency.
- Improved appliance functionality.

## 3. FUTURE SCOPE

- Save Money. This is the biggest advantage of home automation. With the ability to control the light, whether dimming or turning on/off on specific time will saves homeowner a great ton of money. You can save money through household temperature, with proper automation in window shades and automated thermostat.
- Future scope for the home automation systems involves making homes even smarter. Homes can be interfaced with sensors including motion sensors, light sensors and temperature sensors and provide automated toggling of devices based on conditions.
- Televisions have become part of a centralized entertainment and can also be used for social media. The refrigerator has been upgraded to sense the temperature outside and operate accordingly. The washing machine will wash the clothes according to the clothes material and switch off after drying. They will keep on advancing as the technology evolves.

# BASIC OF WIND TURBINE

SHAMIK CHATTARAJ

Lecturer of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

## 1. INTRODUCTION

A **wind turbine** is a device that converts the wind's kinetic energy into electrical energy.

Today's wind turbines are huge compared to those of even a decade ago, and the trend is toward manufacturing still larger machines. Although it may not appear so, wind turbines are complicated machines to control, particularly if high performance and good efficiency are needed. The safe and high performance of these machines is possible only through technological progress in control systems, electronics, communications, and the like, and their integration with the laws of mechanics that govern the behaviour of such machines. Understanding the rules of nature and the behaviour of a wind turbine, and the ways its operation can be regulated as desired, is called "wind turbine technology." This is a topic that requires a number of types of specialized knowledge, which one needs to know in order to understand how wind turbines operate, to work on them, and to carry out further research and development on their functionality.

## 2. BACKGROUND

Before the invention of steam engines and conversion of energy from burning coal and later oil, energy from wind was probably the only way long distance sea transportation could be made possible. Early reports and ruined remains of vertical-axis (its axis of rotation is vertical) Persian windmills can be traced back 1000

years. The famous Dutch windmill, with a horizontal axis (its axis of rotation is horizontal), existed since the twelfth century. In ancient days when the number of people was small and they did not move around so much, pollution was limited and burning wood and coal did not lead to noticeable changes. Despite that factor, the forests in the more populated areas gradually vanished and today more forests are destroyed every year. Added to that, the pollution from burning coal, oil, and gas for heating, transportation, and manufacturing is slowly destroying the environment, making the air and water dirty, raising the temperature of the planet, and disturbing our health. Eventually humans will be suffocated by this pollution, if it continues to grow in the way that it has over the past 50 years. Now alarms have started sounding a wake-up call for action before it is too late. Plants absorb CO<sub>2</sub> and deliver oxygen. This is how nature balanced all the CO<sub>2</sub> produced by people and animals, and by people's burning of wood, coal, and later oil and gas. But, gradually we have fewer and fewer plants and more and more CO<sub>2</sub> and other pollutants. We have to work with nature to keep the balance. Man needs energy for living: for heating and for cooling as well as for transportation, and manufacturing. Energy can come from coal, oil, and other sources. But we also have an abundance of wind, sunshine, and other natural sources of energy that do not result in pollution.

### 3. THREE BLADE PROPELLER TYPE WIND TURBINES

when “wind turbine” is used, reference is made to the three-blade propeller-type wind turbine, which is always installed with a horizontal axis and is the most common commercial wind turbine. A wind turbine must grasp the mechanical energy from wind and convert it to electrical energy. So, it has both mechanical components and electrical components.

Wind turbine major components

Mechanical Primary Tower, nacelle, rotor, foundation

Secondary Gearbox, brake

Electrical Primary Generator, transformer

Secondary Anemometer, vane, rectifier, inverter

#### COMPONENT DESCRIPTION

- **Blades:** Extract kinetic energy from the wind and converts it into rotational mechanical shaft energy as a driving torque and wind turbine speed at a certain wind speed.
- **Pitch System:** Controls the angle of attack of the blades to the wind to control the extraction of kinetic energy and thereby the driving torque and speed.
- **Brake:** A disc brake to slow down and stop the rotor at cut-out wind speed or in over-speed emergencies.
- **Low-speed shaft:** Turned by the wind turbine rotor.
- **Gearbox:** Used to transfer rotational mechanical energy from the low speed shaft to the high speed shaft.

- **High-speed shaft:** Driven by the gearbox output coupled to the



generator and drives the generator.

- **Generator:** Converts the rotational mechanical shaft energy from the high speed shaft into electrical energy, developing a reaction torque to the high speed shaft.
- **Converter:** Controls the flow of electrical energy from the generator by adjusting its rotational speed and therefore its reaction torque on the gearbox and wind turbine.
- **Controller:** Starts up and shuts down the wind turbine at the cut-in and cut-out wind speeds, controls the pitch, converter and yaw system to point the wind turbine into the wind and develop the appropriate reaction torque to the wind turbine at the given wind speed.
- **Anemometer:** Measures the wind speed and sends the data to the controller to assist in the development of the reaction torque.
- **Wind Vane:** Measures the wind direction and sends the data to the controller to control the yaw system.
- **Nacelle:** Housing on the top the tower to yaw into the wind and protect the drive-train assembly, shafts, gearbox, generator and converter.
- **Yaw drive:** Used to control the nacelle to face the wind as wind direction changes.

- Yaw motors: Power the yaw drive.
- Tower: Supports the nacelle at an appropriate height, as wind speed increases with height, taller towers enable Watts to capture more energy and generate more electricity.

#### 4. WORKING PRINCIPLE AND CONTROL OF WIND TURBINE

Wind power is the conversion of wind energy into electricity or mechanical energy using wind turbines. The power in the wind is extracted by allowing it to blow past moving blades that exert torque on a rotor. The amount of power transferred is dependent on the rotor size and wind speed. Wind turbines range from small four hundred watt generators for residential use to several megawatt machines for wind farms and offshore. The small ones have direct drive generators, direct current output, aero elastic blades, lifetime bearings and use a vane to point into the wind; while the larger ones generally have geared power trains, alternating current output, flaps and are actively pointed into the wind.

Direct drive generators and aero elastic blades for large wind turbines are being researched and direct current generators are sometimes used. Since wind speed is not constant, the annual energy production of a wind converter is dependent on the capacity factor. A well sited wind generator will have a capacity factor of about 35%. This compares to typical capacity factors of 90% for nuclear plants, 70% for coal plants, and 30% for thermal plants. As a general rule, wind generators are practical where the average wind speed is 4.5 m/s or greater. Usually sites are pre-selected on the basis of a wind atlas, and validated with on site wind measurements.

Wind energy is plentiful, renewable, widely distributed, clean, reduces greenhouse gas emissions if used to replace fossil-fuel-derived electricity. The intermittency of wind does not create problems when using wind power at low to moderate penetration.

A wind turbine is a complicated system and its operation has to be continuously monitored and controlled in order that it functions as it should. It is expected from a wind turbine that

- (A) It adjusts itself to the wind.
- (B) It generates the maximum possible power under the operating condition.
- (C) It safely delivers the generated electricity to the grid.
- (D) It monitors its own safety and safe operation.

These four functions are for commercial wind turbines that are connected to a grid; that is, the large wind turbines. If a wind turbine is not connected to a grid, it is still required to perform the other three functions. Control of wind turbines covers monitoring and executing the required action for all the components in the turbine as a whole system

the turbine must mechanically adapt itself to the wind conditions, respecting the requirement for operational speed and power. On the other hand, the generator must conform to the requirements of grid (voltage, frequency, delivered power, and power factor), taking into account the available power in addition to its speed and voltage.

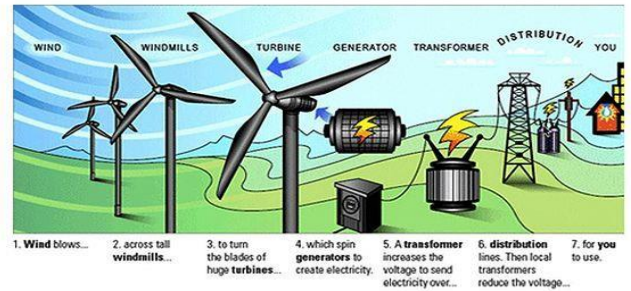
Since it is always preferred that the turbine catch the maximum possible power from wind based on the available wind, the pitch angle must be adjusted as required.



During operation, for any wind speed, the power that a particular turbine can provide, taking into account the cut-in and cut-out speeds as well as the maximum generator capacity, is determined from a look-up table, which is based on this curve. The necessary calculations are performed at the design stage to create a curve similar to that and its associated look-up table. A look-up table is the corresponding numbers in the form of a table, which resides in the onboard computer memory. It can be used for the set point of the blade pitch angle, based on which the pitch angle control mechanism adjusts the pitch angle at different stages of operation and different wind speeds.

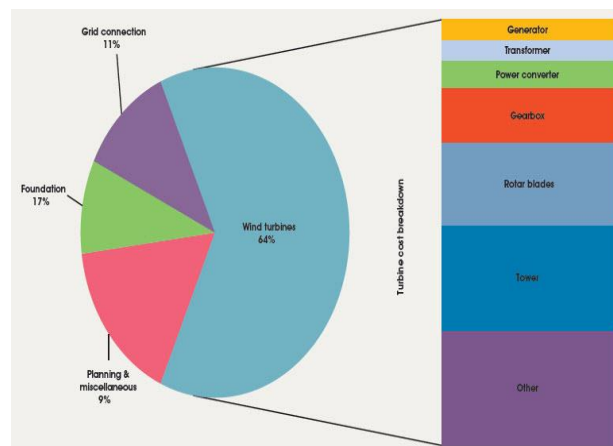
### 5. GRID CONNECTION

Except for small turbines that can power an isolated installation or community, the turbines in a wind farm, which are part of the generating force in a network or power production facility, must be connected to a grid. In this sense, a turbine is a member of the group of electricity sources that work together and must be in technical accord with each other. The role of each turbine when connected to a whole is to inject power into the grid without disturbing the system or becoming a load instead of contributing as a source. A turbine that is already connected may become disconnected, or a turbine may start working from rest. It can be reconnected to the grid only if it is ready, by satisfying some technical requirement. In this chapter, the requirements for a turbine to be connected to a grid are discussed. Before the main discussion, however, we need to describe “power” in electrical terms in a circuit.



### 6. OPERATING COST

The operating cost or running cost for any plant or business activity, including a wind farm, is the regular day-to-day expenditure for running the business. For a general plant, this is normally addressed as



operations and maintenance. For an activity that requires people, the building to accommodate them, heating, office supplies, and so on are to be also added. For a power plant, in addition to these there is a larger cost for fuel. Compared with gas, fossil, coal, and nuclear power generation plants, the fuel for a wind turbine is wind, which is free. With the others, one has to pay for gas, coal, oil, or uranium.

Compared with gas, fossil, coal, and nuclear power generation plants, the fuel for a wind turbine is wind, which is free. When a set of wind turbines are in production they work in open air in the land where they are installed. In many cases, this land does not belong to the developer of the

wind farm. It can belong to one or more owners.

## 7. ADVANTAGES OF WIND TURBINE AND WIND POWER

- **Wind power is cost-effective.** Land-based utility-scale wind is one of the lowest-priced energy sources available today, costing between two and six cents per kilowatt-hour, depending on the wind resource and the particular project's financing. Because the electricity from wind farms is sold at a fixed price over a long period of time (e.g. 20+ years) and its fuel is free, wind energy mitigates the price uncertainty that fuel costs add to traditional sources of energy.
- **It's a clean fuel source.** Wind energy doesn't pollute the air like power plants that rely on combustion of fossil fuels, such as coal or natural gas, which emit particulate matter, nitrogen oxides, and sulfur dioxide—causing human health problems and economic damages. Wind turbines don't produce atmospheric emissions that cause acid rain, smog, or greenhouse gases.
- **It's sustainable.** Wind is actually a form of solar energy. Winds are caused by the heating of the atmosphere by the sun, the rotation of the Earth, and the Earth's surface irregularities. For as long as the sun shines and the wind blows, the energy produced can be harnessed to send power across the grid.
- **Wind turbines can be built on existing farms or ranches.** This

greatly benefits the economy in rural areas, where most of the best wind sites are found. Farmers and ranchers can continue to work the land because the wind turbines use only a fraction of the land. Wind power plant owners make rent payments to the farmer or rancher for the use of the land, providing landowners with additional income.

## 8. DISADVANTAGES

Any means of energy production impacts the environment in some way, and wind energy is no different. Like every other



energy technology, wind power plants do have some effects on the environment. Wind turbines cause virtually no emissions during their operation and very little during their manufacture, installation, maintenance and removal. Compared to the environmental impact of traditional energy sources, the environmental impact of wind power is relatively minor. Wind farms are often built on land that has already been impacted by land clearing. The vegetation clearing and ground disturbance required for wind farms is minimal compared with coal mines and coal-fired power stations. If wind farms are decommissioned, the landscape can be returned to its previous condition. The major challenge to using

wind as a source of power is that the wind is intermittent and it does not always blow when electricity is needed. Wind energy cannot be stored (unless batteries are used); and not all winds can be harnessed to meet the timing of electricity demands . Good wind sites are often located in remote locations, far from cities where the electricity is needed. Wind resource development may compete with other uses for the land and those alternative uses may be more highly valued than electricity

generation . Although wind power plants have relatively little impact on the environment compared to other conventional power plants, there is some concern over the noise produced by the rotor blades, aesthetic (visual) impacts, and sometimes birds have been killed by flying into the rotors. Most of these problems have been resolved or greatly reduced through technological process.

## REGULATED DC POWER SUPPLY

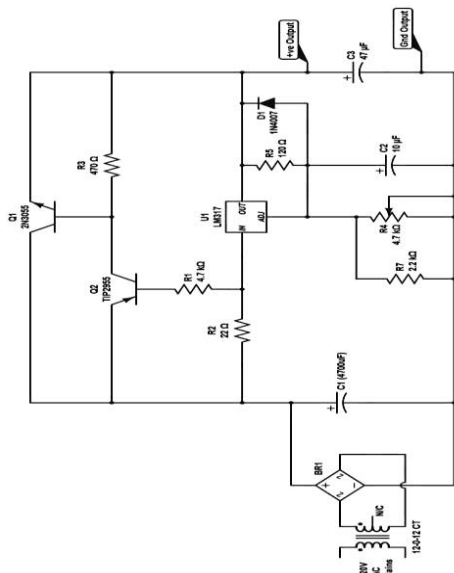
MD. NISARUDDIN SARKAR, INDRAJIT BISWAS, ABHIJIT BAG, SAIKAT KHAN  
Students of Electrical Engineering Department  
Technique Polytechnic Institute, Hooghly, West Bengal, India

### 1. INTRODUCTION

In general, electronic circuit using transistors require a source of dc power for example the emitter and collector bias in a transistor must also be dc. Batteries are rarely used for this purpose as they are costly and require frequent replacement. In practice, dc power for electronic circuits is most conveniently obtained from commercial ac lines by using rectifier -filter system. Called a dc power supply.

The rectifier filter combination constitutes an ordinary dc power supply. The dc voltage from an ordinary power supply remains constant so long as ac mains voltage or load is unaltered. However, in many electronics applications, it is desired that dc voltage should remain constant irrespective of changes in ac mains or load. Under such situations, voltage regulating devices are used with ordinary power supply.

### 2. CIRCUIT DIAGRAM



### 3. OPERATION OF REGULATED DC POWER SUPPLY

#### 3.1 Step Down Transformer

A step-down transformer will step down the voltage from the ac mains to the required voltage level. The turn's ratio of the transformer is so adjusted such as to obtain the required voltage value. The output of the transformer is given as an input to the rectifier circuit.

#### 3.2 Rectification

half wave rectifier could technically be used, its power losses are significant compared to a full wave rectifier. As such, a full wave rectifier or a bridge rectifier is used to rectify both the half cycles of the ac supply (full wave rectification). A bridge rectifier consists of four p-n junction diodes connected in the manner shown above. In the positive half cycle of the supply, the voltage induced across the secondary of the electrical transformer

#### 3.3 DC Filtration

The rectified voltage from the rectifier is a pulsating DC voltage having very high ripple content. But this is not what we wanted; we want a pure ripple free DC waveform. Hence a filter is used. Different types of filters are used such as capacitor filter, LC filter, Choke input filter,  $\pi$  type filter. The figure below shows a capacitor filter connected along the output of the rectifier and the resultant output waveform.

### **3.4 Regulation**

This is the last block in a regulated DC power supply. The output voltage or current will change or fluctuate when there is a change in the input from ac mains or due to change in load current at the output of the regulated power supply, a regulator will maintain the output constant, even when changes at the input or any other changes occur. With IC's like LM 317 we can adjust the output voltage to a required constant value. The output voltage can be adjusted by adjusting the values of resistances.

### **4. APPLICATIONS OF REGULATED POWER SUPPLY**

A regulated power supply (RPS) is an embedded circuit, used to convert unregulated alternating current into a stable direct current by using a rectifier. The main function of this is to supply a constant voltage to a circuit that should be functioned in a particular power supply limit.

- Mobile phone chargers

- Regulated power supplies in different appliances
- Oscillators & amplifiers
- Used in various industrial purpose

### **5. ADVANTAGES**

- Extremely low ripple and noise
- Tight regulation
- Fast transient response
- No RFI and EMI

### **6. DISADVANTAGES**

- Efficiency main regulator 45 %.
- Large heat sink required.
- Lower power supply density.
- Cost and efficiency are the limitation for high current applications.

### **7. CONCLUSION**

The power supply that has been designed provides a good alternative to more expensive power supply. The power supply has few components, covers a small area, and is very simple in design.

# TECHNOLOGICAL ADVANCEMENTS OF EMUS AND INTRODUCTION OF HIGH-SPEED TRAINS ON INDIAN RAILWAYS

KAUSTAV MALLICK

Lecturer of Electrical Engineering Department

Technique Polytechnic Institute, Hooghly, West Bengal, India

**E**fficient rail-based mass rapid transit system provides a sustainable transport model for large urban areas. Managing urban transport needs becomes more challenging in a city like Mumbai where the land mass is restricted and the city is growing vertically. Over a period of time, Electric Multiple Units (EMU) system has been extensively utilized and to cope with the increasing passenger demand, the system requires massive inputs for technological upgradation and better level of passenger comfort.

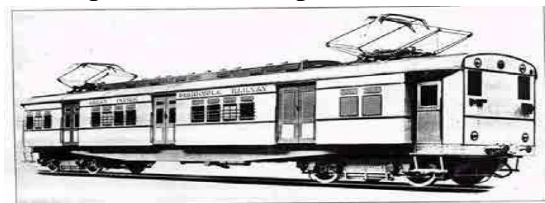
In the last two decades, there has been a significant development in power electronics leading to use of 3 phase AC propulsion equipment on EMUs. With the advent of Gate Turn-Off (GTO) power switching semiconductors, EMUs with 3 phase asynchronous motors were introduced in 2001, which had the feature of regenerative braking. This led to significant energy saving. The technology has since developed further and has switched over from GTO to the Insulated Gate Bi-polar Transistor (IGBT) devices. IGBT allows more compact converter designs with integrated drive control, lower weight and higher overall power efficiency.

As part of Mumbai Urban Transport Project (MUTP), involving major expansion of Mumbai Suburban Railway System, new

state-of-the-art EMU rakes are being introduced with 3 phase IGBT based

propulsion system resulting in the reduced maintenance. The paper outlines the brief history of EMU services since inception, growth of passenger traffic, various technological up gradation and passenger friendly features of the new EMUs leading to the improved energy efficiency, reduced power consumption, benefits of new technology and elucidates future challenges.

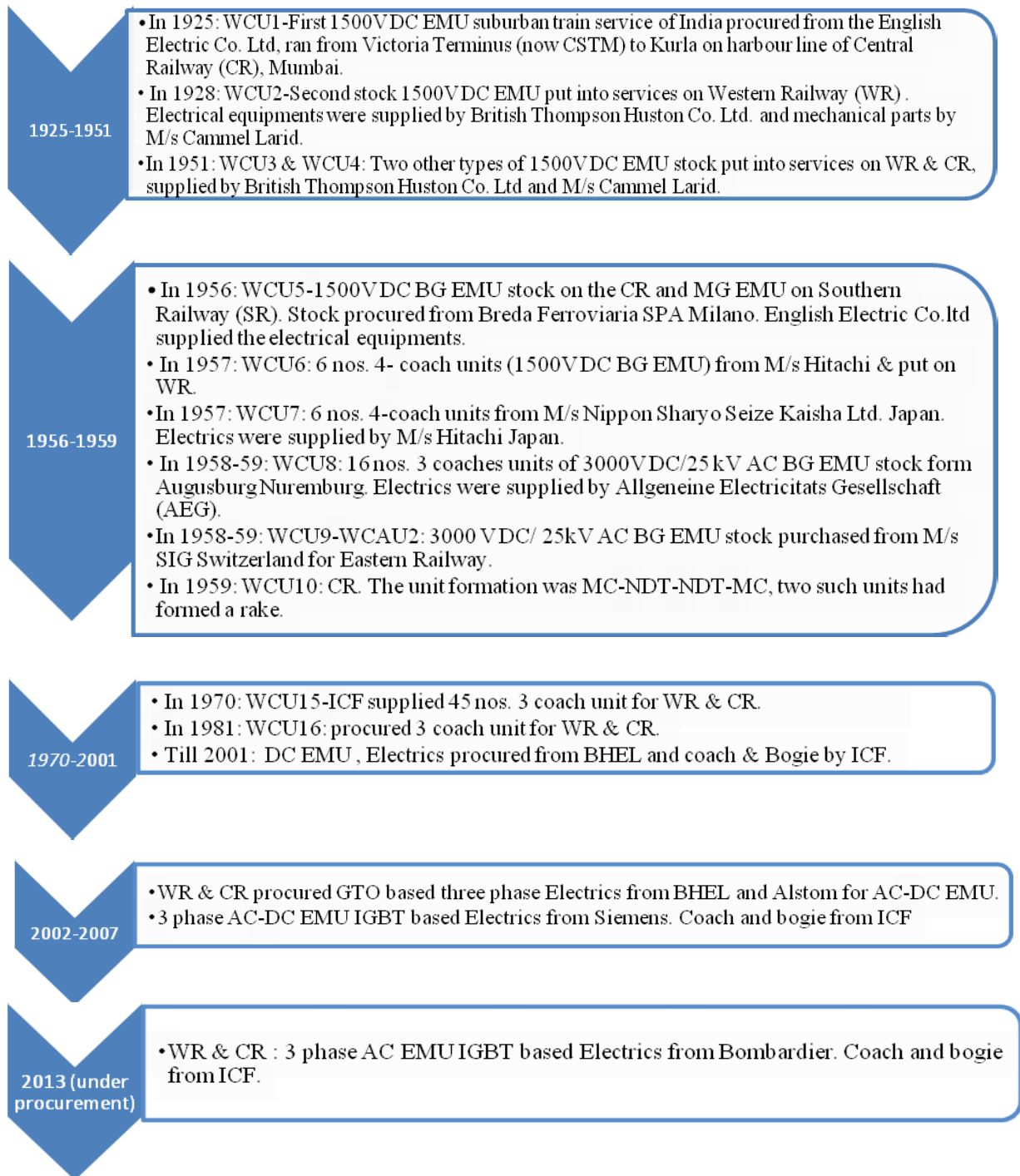
Introduction of the distributed traction system has several inherent advantages over loco hauled traction system. IR aims at raising the speed of passenger trains to 160-200 kmph, which will bring about a major paradigm shift in travelling by train. High speed passenger train operation would be necessary to meet the requirement of fast intercity travel between major cities. In the long run, however, genuine high speed trains with travel speeds up to 300 kmph would also be needed to keep pace with developments in other parts of the world



General view of Motor Coach ready for service.

WCU EMU STOCK





### Obsolete Design of the existing EMUs

The design of the DC EMU is obsolete and the following problems are being faced by the commuters:

At present 5,000 passengers (900 sitting plus more than 4,000 people in standing condition) are travelling during the peak hours in a nine car train against the original design offering a capacity of 1800

passengers (900 sitting plus 900 standing). This has resulted into Super Dense Crush Loading (SDCL) conditions in EMUs. Trains do not run smoothly and passengers experience jerks particularly while starting and braking. Inadequate illumination levels inside the coaches. Use of DC series motors and cumbersome design of bogies & traction equipment lead to excessive maintenance. Lack of ventilation is a major problem. Large numbers of standing passengers block the doors and windows of the suburban trains, thus creating difficult conditions inside the coaches. Apart from the above, in the existing trains, physical barriers in the form of semi-bulk head partitions have been provided which also obstruct free circulation of air from one end of the coach to another. Actual measurement during peak hours revealed that CO<sub>2</sub> level inside the coaches goes as high as 2500 ppm against the ambient level of 600 -700 ppm of CO<sub>2</sub> available in the open air. High energy consumption and inability of system to cater additional traffic Mumbai suburban railway system operates on 1500V DC traction system, which was introduced in 1925 on the lines of London Underground. With the increase in loading, each 12-car train draws 4,000 amps from the system. When two trains are leaving and two trains are approaching the terminal stations, approximately 10,000 to 15,000 amps of current is drawn from the system. Due to this large requirement of current, traction substations have been set up at a very short intervals e.g., there are 20 DC traction substations between CSTM and Kalyan for a distance of 54 kms. For increasing the suburban services and number of coaches per train, additional substations need to be set up, which is not considered to be economical. Due to large

amount of current drawn by the trains, it has become impractical to increase the number of trains and add additional number of coaches in each train. Therefore, the need for adoption of 25kV traction system was felt and conversion of traction has been undertaken accordingly.

#### Lack of Investment

Traditionally, the suburban/metro network operation all over the world falls under the purview of the Central Government which also absorbs the operating losses. In suburban areas of Mumbai city, a large number of housing colonies has been set up and development charges collected by the State Government from the construction sector were not used for the expansion of suburban systems. As an outcome, expansion and modernisation of suburban system could not take place. Over the last fifty years (figure 3), it has been observed that even though, the number of passengers carried has grown by 893%, the number of trains has increased by 266% and average passenger loading per train per has increased by 171%.

#### ACTION PLAN TO ADDRESS THE ISSUES

Following steps have been taken to deal with the matter:

Formation of the Mumbai Railway Vikas Corporation (MRVC) to implement the railway projects with the assistance of World Bank.

MoU between MRVC and RDSO for technical consultancy involving preparation of specification, technical evaluation of design, approval of design, prototype test, system test, vehicle test and performance monitoring.

Introduction of new traction technology at 25 KV AC converting from old 1500V DC system.



Increasing the length of trains from 9 to 12 & 15 cars, thus generating 33% & 66% per cent extra carrying capacity, which will bring down the over-crowding in the trains during peak hours.

Introduction of rakes with new technology having IGBT-based three phase propulsion system with the advantages of lower specific energy consumption due to regeneration of energy during braking, low maintenance, higher acceleration/deceleration and improved reliability.

IR has gradually switched over from old DC traction technology to GTO and subsequently to IGBT based three phase propulsion technology along with usage of Train Control & Management System (TCMS) in view of the intrinsic advantages. Following are the main advantages of IGBT based Converter compared to GTO based Converter Technology:

Simplified heat sink design due to elimination of snubber circuits.

Simplified gate drive units.

Lower switching losses in IGBT enabling higher pulse frequencies, thus, leading to lower harmonic distortion.

Due to higher switching frequencies of IGBT, the signalling circuits operating at frequencies 1.7 kHz - 2.6 kHz and 5.0 kHz onwards are not affected. Higher power efficiency.

EMU stock fitted with Alstom, BHEL and Siemens three phase electricians are running on both, Western & Central Railways. Western Railway has now completely switched over to 25kV AC traction, whereas in Central Railway, except CSTM-KYN & CSTM-Panvel all other sections have been converted to 25kV traction and therefore, EMU stocks with DC propulsion (BHEL), AC-DC BHEL and AC-DC

Siemens having three phase electricians are working at present. Some of the DC EMU coaches having residual life are also being retrofitted with AC equipments by retaining the existing bogies for making them suitable to work on AC also. Seventy two new AC EMU trains fitted with IGBT based three phase propulsion equipments to be supplied by M/s Bombardier, will be inducted in Mumbai suburban in next two years.

New EMU stock has been provided with Train Control & Management System (TCMS), which has the following advantages:

- IP and MVB network for train communication
- Microprocessor based fault diagnostics and event recorder
- Control of major functions from Human Machine Interface (HMI)
- Reduction in cabling due to use of digital and analog I/O devices.
- Down loading of events and fault data at remote control centre
- Automatic train configuration
- Redundant drive & brake control unit
- Recording of energy regeneration and consumption data
- Diagnostics software tools for parametric changes & recording of environmental data for a specific event
- Emergency Brake Loop & Emergency Off Loop for safe operation of train
- Ventilation, tractive & braking effort control based on weight sensor feedback.

**IMPROVED FEATURES OF NEW EMUs**

Mumbai suburban system has received 173 nine-car rakes with passenger amenities in the past 5 years. In order to bring substantial improvements in EMU trains, the following additional features have been incorporated:

**Improved Ventilation**

ASHRAE standard has been adopted by restricting the CO2 levels inside the coaches to 700 ppm above the ambient levels outside the coaches. Approximately, 15,000 m3/hour of fresh air is pumped in to each coach, which results in reduction of CO2 level from 2500 PPM to 1500 PPM In addition, larger windows have also been provided to facilitate better air circulation



**Improved Illumination**

The lighting inside the coaches has been improved to 300 lux from the present 100 lux.

**Improved Seats**

In place of wooden seats, polycarbonate seats have been provided in the general coaches and seats with PU cushion have been provided in the First Class coaches.

**Passenger Information System (PIS)**

GPS based passenger information system has been provided in all coaches with the following facilities:

- Automatic announcement of approaching stations and destination in three languages, i.e. English, Hindi, and Marathi
- Platform indicator Emergency announcement LED based head code
- Head Code, internal displays and speaker

- Display of safety messages and advertisements.

**Pneumatic Suspension**

Air springs has been provided in the secondary .Suspension of bogies to improve the riding comfort.

**Interiors**

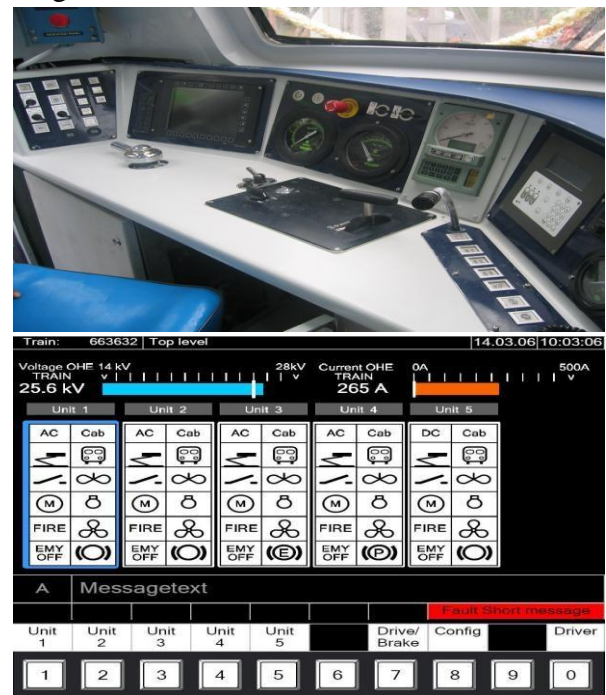
To give an aesthetic look and improve strength, stainless steel partitions, grab handles, and FRP interior panels have been used inside the coaches.

**Improved Colour Scheme**

The National Institute of Design (NID), Ahmedabad has designed the new exterior colour scheme using a combination of violet and white colour with red band. The commuters have highly appreciated this new colour scheme.

**Ergonomically designed driving cab**

The driving cab in the new AC-DC EMU rakes has been ergonomically designed having the crew friendly features including state-of-art Human Machine Interface (HMI) to provide current status of working equipments, messages and fault diagnostics etc.



### **Noise Control**

In DC EMU, lot of noise gets generated from DC traction motor while accelerating, from bogie during braking and also from DC driven compressors. The present level of noise inside the coach is more than 85 db. With the introduction of AC motor driven compressors and IGBT based step-less control system with regenerative braking, the noise level inside the coach has been reduced to 65-70 db.

### **Increase in the Number of Coaches per Trains**

When the traction system is changed from DC to AC, the operating current per train gets reduced from 4,000 ampere to approximately 200 ampere for 12 car train. With this, additional carrying capacity can be generated by increasing the number of coaches per train from nine to twelve/fifteen or eighteen. Number of traction substations in the Western and Central Railways will be reduced from the existing 66 to 22 after complete conversion.

### **Energy Efficiency**

In the existing 1,500V DC traction system, the speed control of traction motors is through resistance control. During braking, the rotational energy of trains is wasted due to the friction generated between the brake blocks and wheels. Since, the suburban trains are expected to stop frequently, not only a lot of noise is produced during braking but at the same time the unwanted dust is also generated. The brake blocks and wheels also have a limited life and require high maintenance inputs. In order to cater the need of ongoing traction conversion from DC to AC in Mumbai, dual voltage EMUs have been inducted in to service

which can operate on both 1500 V DC and 25KV AC. With the electronic equipments, 25kV is converted into Variable Voltage Variable Frequency AC supply, which is then fed to the 3-phase induction motors fitted in the motor coaches. During braking, traction motors work as generators and up to 35 per cent of the electric energy is fed back into the traction system due to the use of regenerative braking. With the introduction of new three phase EMUs in Mumbai area, a saving to the tune of Rs 1 billion per year due to regeneration feature has been achieved. The World Bank has already identified this project as Clean Development Mechanism (CDM) project to obtain carbon credit. To take advantage of the CDM framework, Indian Railways (IR) has processed, in association with the World Bank, a Project Design Document (PDD) for registration with UNFCCC. The project has already received Host Country Approval and is expected to result in annual reduction of approximately one million tonnes of CO<sub>2</sub> Emissions.

### **Cost Management: Reduction in Cost**

The cost of MRVC-I rake (nine-car) is approximately Rs 200 million. The cost of a fully imported nine-car rake of similar features would be around Rs 600 million. The cost reduction has been achieved by adopting the following strategies:

Out of the total quantity ordered, only 30 per cent of the equipments were manufactured abroad and the rest were manufactured in the facilities that were set up by the firms in India.

Improved features of passenger amenity items were developed indigenously at the Integrated Coach Factory (ICF) with the features matching the international standards. This also led to cost reduction,

by manufacturing the coach body and shell at ICF, which is a premier coach builder of IR.

*“Education is what remains after one has forgotten what one has learned in school”*

**Albert Einstein**

### **GRAVITY BLANKETS**

Gravity is here to help you combat your anxiety. Starting off as a Kickstarter campaign, the company Gravity has created a therapeutic weighted blanket engineered to be around 10% of your body weight.

### **ZIPLINE**

The California-based start-up Zipline intends to use drones to save lives. The company uses its drones in remote areas across the world to deliver vital supplies and even the delivery of blood.

### **PHILIPS SOMNEO**

The original inventors, Phillips has something to help you get up earlier in 2019. The Philips' Somneo is here to help you wake up better, without the very disruptive sounds of a traditional alarm clock. The Somneo simulates a natural sunrise each morning while assisting with your sleeping habits.

### **GRAVITY JET SUIT**

If you are planning to join the Avengers in their fight against Thanos, you are going to want to get your hands on this suit. Created by Gravity industries, the 1,050 horsepower system uses five mini-jet engines to help users soar through the sky at 80 kph.

### **NANO1**

NANO1 is the perfect invention for passionate stargazers who not only like to be awestruck by looking at the wonders of the sky but also want to capture these with their cameras. The inventors of NANO1 bill it as the smallest astronomy camera in the world which can capture 25 times lighter than the human eye and condense an hour-long recording into 3 minutes for a charming view of the sky as well as other phenomena like the Northern Lights.

### **SOLAR ROADWAYS**

Solar Roadways is exactly what you're thinking after reading the name. These are solar panels which can be used to pave roads, driveways, sidewalks, or any surface meant for walking. Solar wafers protected under thick layers of shatter-proof Gorilla Glass can be used to generate electricity from any surface.

