+

**A**

**PROJECT REPORT**

**ON**

# "Smart Energy Management and Overload Control Of Hostel Room Using IOT"

Submitted in partial fulfillment for Degree Of

FINAL YEAR

Of

**BACHELOR OF ENGINEERING**

Submitted By:


| | |
|---|---|
| **MR. AVHAD SANKET SURESH** | **ROLL NO.4103** |
| **MR. GATKHANE VIKAS HARISHCHANDRA** | **ROLL NO. 4118** |
| **MS. KAKAD SRUSHTI BALU** | **ROLL NO.4133** |
| **MS. KANAWADE RASIKA RAJHANS** | **ROLL NO.4135** |


Under the Guidance of

**PROF. JOSHI A. A.**


**(BE ELECTRICAL ENGINEERING 2019 COURSE)**

**AMRUTVAHINI COLLEGE OF ENGINEERING SANGAMNER-422 608**


**2022-23**

Amrutvahini Sheti And Shikshan Vikas Sanstha's

**AMRUTVAHINI COLLEGE OF ENGINEERING, SANGAMNER**

**Department Of Electrical Engineering**

# CERTIFICATE

This is to certify that,

**MR.AVHAD SANKET SURESH**

**MR.GATKHANE VIKAS HARISHCHANDRA**

**MS.KAKAD SRUSHTI BALU**

**MS.KANAWADE RASIKA RAJHANS**

In partial fulfillment of Project work for Final Year of Bachelor of Engineering in Savitribai Phule Pune University for academic year 2022-23

Date:

Place:

| | |
|---|---|
| **Prof. Joshi A. A.** | **Dr. Kadlag S. S.** |
| **(Guide)** | **(HOD)** |
| **Prof. Rokde J. R.** | **Dr. Venkatesh M. A.** |
| **(Project Co-ordinator)** | **(Principal)** |

# SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

## CERTIFICATE

This is to certify that,

| | |
|---|---|
| **MR. AVHAD SANKET SURESH** | **72018935H** |
| **MR. GATKHANE VIKAS HARISHCHANDRA** | **72019061E** |
| **MS. KAKAD SRUSHTI BALU** | **72019163H** |
| **MS. KANAWADE RASIKA RAJHANS** | **72019174C** |

**Student Of Final Year Electrical Engineering Were Examined In The Project Work Entitled**

**"Smart Energy Management and Overload Control Of Hostel Room Using IOT"**

**INTERNAL EXAMINAR** **EXTERNAL EXAMINAR**

**DEPARTMENT OF ELECTRICAL ENGINEERING**

**AMRUTVAHINI COLLEGE OF ENGINEERING, SANGAMNER**

**2022-23**

# ABSTRACT

In current situation, some students of hostel room's uses excess device like geyser, Electric Iron which are not allowed to use in hostel room. In that case, MCB trips only in the short circuit condition. But rectors are not known that which room's student uses a heavy load. So we are developing one smart devices which will detect the extra load consumed by consumer and get notified consumer as well as hostel rector via message. Generally we are developing a system which detects the extra consumption of electricity using IOT. Whenever extra electricity is consumed by consumer system shows extra load consumed by user with the help of sine waveform, and send notification of extra consumption of load via SMS to student as well as hostel rector. And after third notification the electricity supply get automatically cut.

# ACKNOWLEDGEMENT

It gives us immense pleasure and sense of satisfaction to this report on And expressing sincere and deep appreciation towards our guide **Prof. Joshi A. A.** of AVCOE, SANGAMNER for priceless execution of steering this contribution all the way through this work with soft suggestion embedded supervision and invisible advocacy.

We are thankful to **Dr. Kadlag S. S.** (HOD) OF **ELECTRICAL ENGINEERING** department of Amrutvahini college of Engineering, Sangamner for his guidance and encouragement. We would also like to thank my all teachers for their encouragement and good co-operation .

We are thankful to everyone who directly or indirectly contributed to make our project submitting this report in time.

**MR.AVHAD SANKET SURESH**

**MR.GATKHANE VIKAS HARISHCHANDRA**

**MS.KAKAD SRUSHTI BALU**

**MS.KANAWADE RASIKA RAJHANS**

# INDEX

## LIST OF FIGURES

## LIST OF TABLES

## LIST OF ABBREVIATION

| Sr. No | Abbreviation | Definition |
|---|---|---|
| 1 | IoT | Internet of Things |
| 2 | LCD | Liquid crystal Display |
| 3 | GSM | Global System for Mobile Communication |
| 4 | CT | Current Transformer |
| 5 | PT | Potential Transformer |
| 6 | VDD | Virtual Device Driver |
| 7 | VSS | Voltage Symmetrical System |
| 8 | GND | Ground |

# 1. INTRODUCTION

In this project we introduce energy management and automatic controlling system for hostel Rooms using IOT technology. We see in hostel user needs to utilizes common load. But many times, some student may use extra power for their unnecessary uses like ironing, water heater, home theaters, induction etc. [3] so common load & respective light bill may increase due to use extra load . So, to overcome this scenario we introduce a smart energy system which place on each room to monitor load consumption. And units of all rooms will be monitor on IOT web server.

When any one uses overload equipment's then 2 warning SMS send on respective room owner mobile number. & After 3rd warning supply automatically breaks and automatically send message to the Hostel Control Room . Smart Power Monitoring and Analysis is aimed at developing a solution to keep track of every electrical appliance and monitor the energy used consumed by an Users. As mentioned, this study's main problem statement is that most of the power meters installed in any hostel showed the total consumption of the electricity used. So with the upcoming of machine to machine communication where devices can be connected wireless leading to IoT [5] , we here have developed an IoT based Smart Energy system.

## 1.1 AIM AND OBJECTIVES

Aim of our project creates an opportunity for consumers to control their power consumption practices and help them manage their power and energy usage.

It also creates an opportunity for the consumers to practice energy saving and to keep track of their household appliance's performances and current behavior to prevent over-current.

## 1.2 NEED OF PROJECT

Hostel Rooms Students are banned to used a unnecessary overload electrical devices.But some student are used the heavy load devices, in that situation MCB is automatically trip . Which rooms student are used a heavy electrically load does not recognized .so we developed smart energy system device which will monitoring rooms and also detect the which rooms student used heavy load .Therefore, energy consumption can be done by energy management system to reduce the energy consumption.

And this smart energy management system is also beneficial for government guest house, Schools, Colleges. We are seen that most of people are theft the electricity from the govt.Schools. So, we used the smart energy system to avoid theft of electricity. So our project is really beneficial for society.

## 1.3 EXISTING SYSTEM

Some student of hostel rooms uses excess device like geyser, Electric Iron which are not allowed to use in hostel room. In that case, MCB trips only in the short circuit condition. But rector are not known that which rooms student uses a heavy load.


**Fig 1.1: Photo of Existing System and Site Visit**

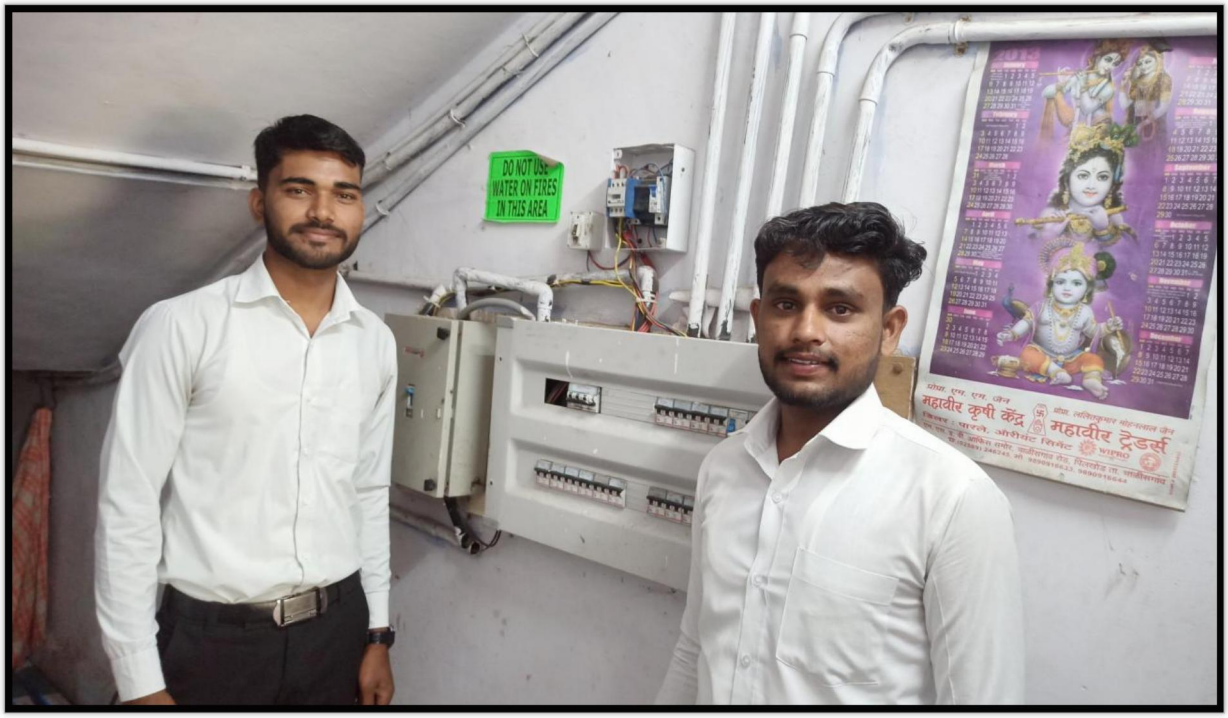


**Fig 1.2: Photo of Site Visit**

## 1.4 PROPOSED SYSTEM

In proposed system we are developing one smart devices which will detect the extra load consumed by consumer/hostelers, and get notified consumer as well as hostel rector via message. Generally we are developing a system which detects the extra consumption of electricity using IOT. Whenever extra electricity is consumed by consumer system shows extra load consumed by user with the help of sine waveform, and send notification of extra consumption of load via SMS to student as well as hostel rector. And after third notification the electricity supply get automatically cut.

We are creating a smart gadget that will identify the additional load consumed by consumers and hostel guests and send a message to both the customer and the hostel director. In general, we are working on designing a system that uses iot to identify additional electricity consumption. When a consumer uses more electricity than necessary, the system displays this additional load using a sine waveform and notifies the student as well as the rector of the hostel through SMS. And following the third notification, the energy is immediately turned off.


**Fig 1.3:** Photo of Actual Prototype

# 2. LITERATURE SURVEY

In this section, we would be discussing briefly on various literature available pertaining to Energy Management and Smart Home System.

In one of the research reported, IoT Based Automated Temperature and Humidity Monitoring and Control system developed [1] using raspberry pi. Pi receives the temperature as well as humidity values sensed and the same sent to the internet. This project however has resulted in prototype development of automated temperature and humidity control with good feasibility.

Research also been carried out towards Smart Home Control and Monitor System using IoT [2] where an User Friendly GUI been developed which can be accessed globally from any device that has internet connectivity.

In addition to the above mentioned research, Smart Home Monitoring prototype developed by employing Android mobile handset and Wireless Sensor systems [3]. This system monitors the usage characteristics of electrical power at the socket outlet in real time. This system measures the Voltage Current and temperature of socket outlet periodically from each room and monitored data sent to the system towards computing the threshold violation for action by the user before circuit breaker gets tripped or fire breakout happens.

**Google form Survey :-** We created google form and took survey from hostel Rectors the survey is as shown below

| Timestamp | Hostel Name | Rector Name | Mail Id (Rector) | Does hostel authority allows following electrical or electronics appliances in hostel room? 1) Electric Kettle 2) Water Heater 3) Electric Iron | If no, Does hostel authority have control over excess use of above said appliances? | If Yes, how do you keep control over it ? Explain in brief. | If No, would you like to install any kind of system to get control over it? | Do you think, there should be energy management system for this? | If yes, How would you like to implement it? | Would you like to install energy management system kit for every room in hostel? | Do you find our BE project matches your requirement? | Any suggestions would you like to share? | How would rate our idea? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022/11/21 10:47:10 am GMT+5:30 | Krushnavanti | Pushpa Landge | - | No | No | - | Yes | Yes | To make such a device which would detect the overloading. | Yes | Yes | No | ***** |
| 2022/11/21 10:49:28 am GMT+5:30 | Kalsubai | Savita punekar | savitapunekar2@gmail.com | No | No | - | Yes | Yes | Using smart energy meter | Yes | Yes | - | ***** |
| 2022/11/21 1:24:52 am GMT+5:30 | Sajjangad | Arjun dighe | - | No | No | - | Yes | Yes | Using smart energy meatering system | Yes | Yes | No | **** |
| 2022/11/21 1:27:32 am GMT+5:30 | Sinhgad Hostel | Vishal Chauhan | vishalchauhan2017@gmail.com | No | Yes | If Overloaded condition happen ,then MCB gets trip. | Yes | Yes | By using Plc like software | Yes | Yes | No | ***** |
| 2022/11/21 1:32:14 am GMT+5:30 | Sajjangad Hostel | Vilas ubale | vilasubale2011@gmail.com | No | Yes | MCB | Yes | No | | Yes | Yes | No | ***** |

**Fig 2.1: Excel Sheet of Google Form**

When we finding that overloading problem in hostel, for confirming that problem is really genuine or not we conduct one survey about that problem , for that survey we created one Google form in which we include hostel rector name, mail id ,hostel name  which appliances they are allowed in hostels and which are not , after that in that Google form we asked  them about  whenever overloading is happen due to that appliances which are not allowed, is there any system is available to prevent this overloading .

At the end of this survey one thing is confirm, that in hostels there is no system available for reduce malpractices happened regarding to overloading.

# 3. SYSTEM DEVELOPMENT

## 3.1 (a) Block diagram :

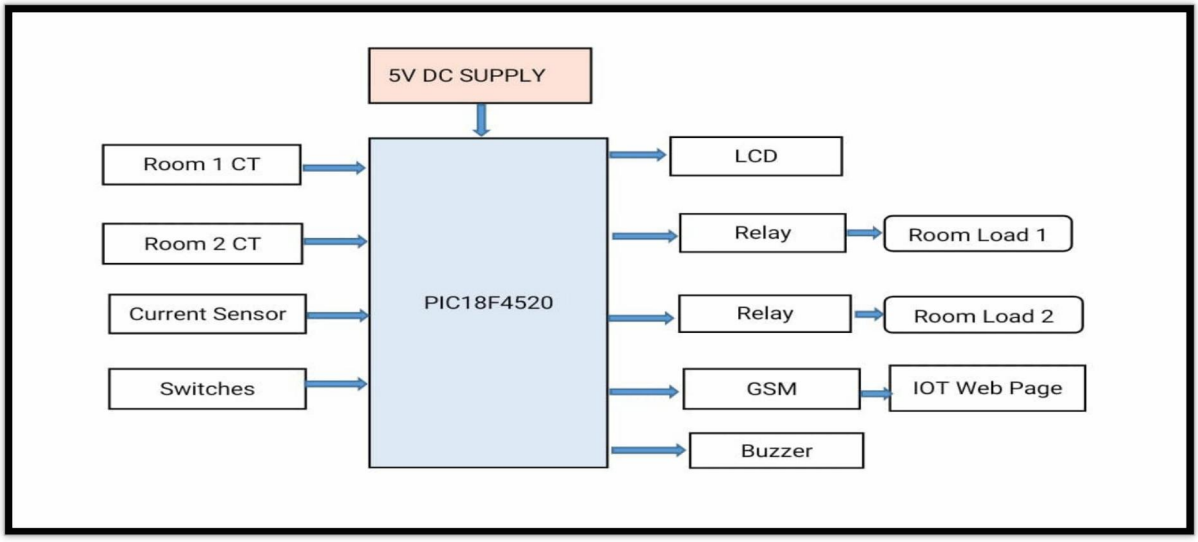


**Fig 3.1(a): Block Diagram of Overloading of Hostel Management System**

Generally,we have used the PIC18F4520 microcontroller. On the input side, a current sensor, switches, and two current transformers are connected. The current transformer measures the current in the particular room. Also, the live energy consumption data is displayed on an LCD. The manual switches are present for manual switching of loads. The GSM module is used for sending the SMS. The IOT Web page portal is used for monitoring the real-time data. The buzzer is used for indication purposes and to give alerts.

**(b) Flowchart:**

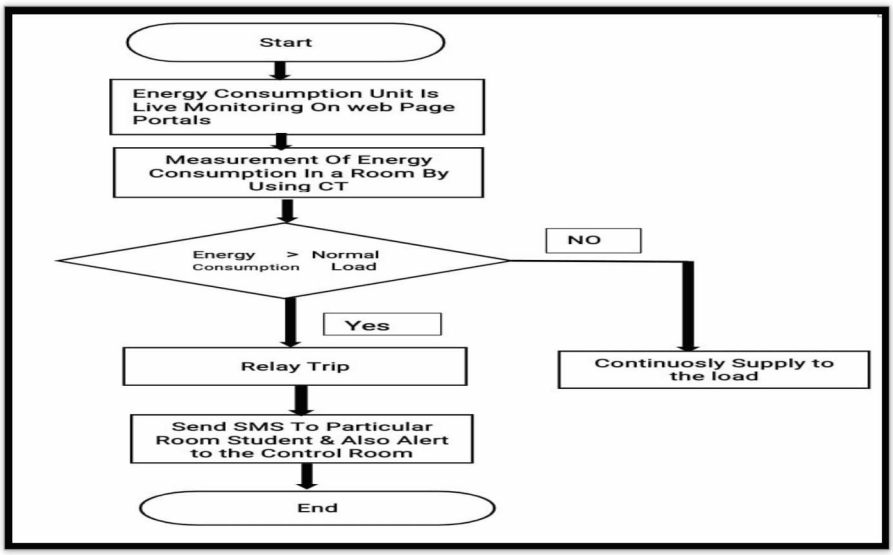


**Fig 3.1 (b) : Flowchart**

The graphical representation of the flowchart is shown in Fig. Firstly, the current is measured by CT and gives input to the microcontroller. When the current does not exceed the rated limit, it continuously supplies the load. If the current exceeds the rated limit, then relay trips and send SMS to the student as well as the control room simultaneously .

### 3.2 CIRCUIT DIAGRAM:

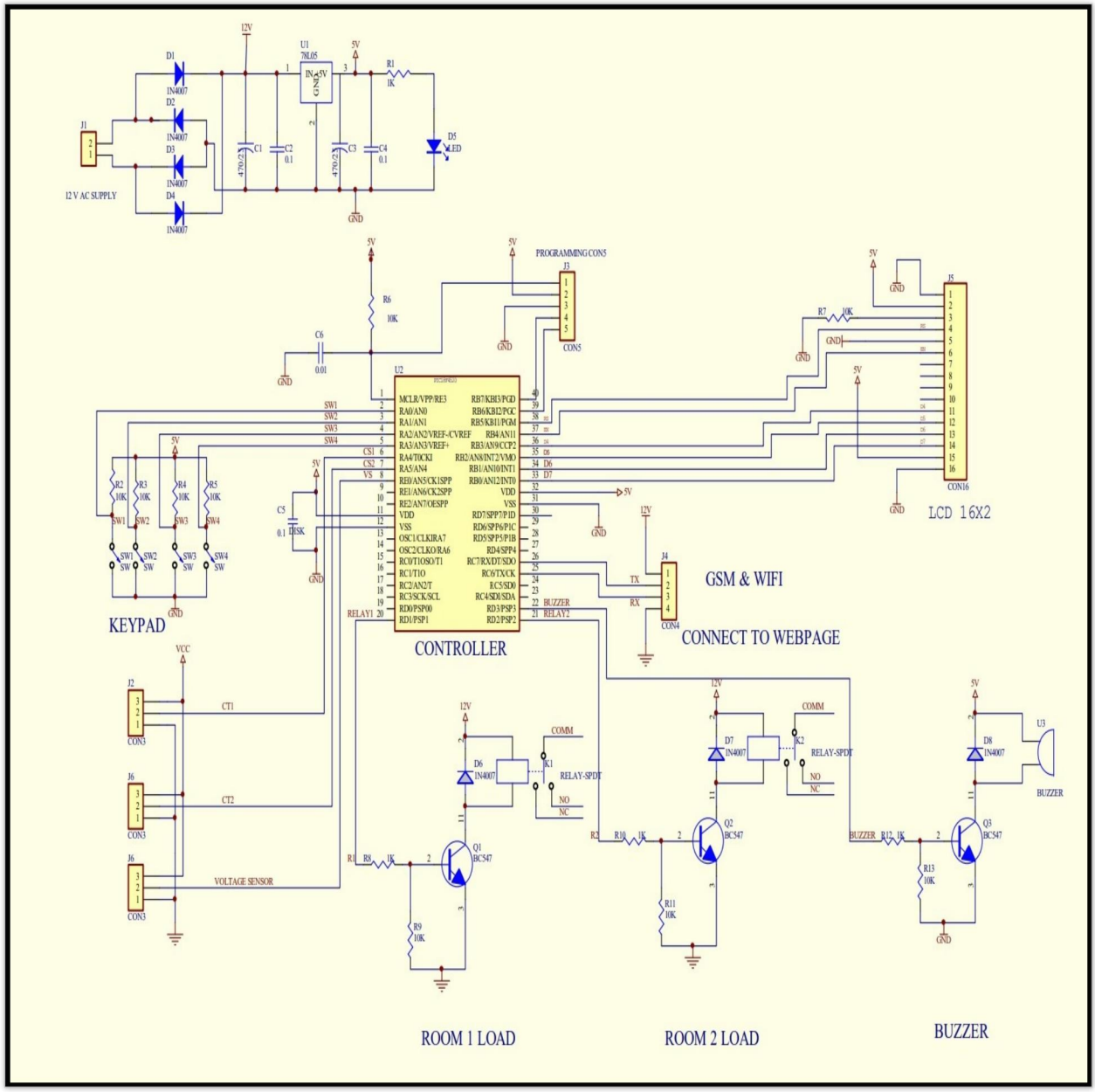


**Fig 3.2: Circuit Diagram of Overloading of Hostel Management System**

## 3.3 COMPONENT USED IN CIRCUIT:

**1)PIC18F4520 :** It is an 8-bit enhanced flash PIC microcontroller that comes with nano Watt technology and is based on RISC architecture. Many electronic applications house this controller and cover wide areas ranging from home appliances, industrial automation, and security system and end-user products. This microcontroller has made a renowned place in the market and becomes a major concern for university students for designing their projects, setting them free from the use of a plethora of components for a specific purpose, as this controller comes with inbuilt peripheral with the ability to perform multiple functions on a single chip.

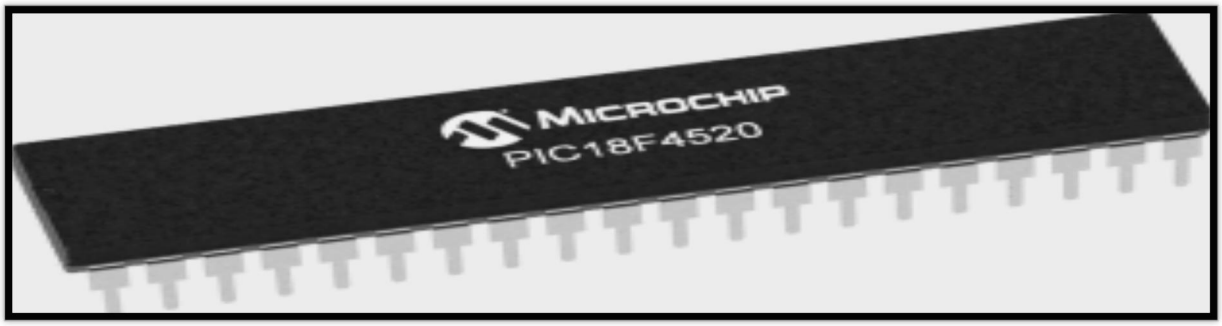


**Fig 3.3: PIC18F4520 Micro controller**

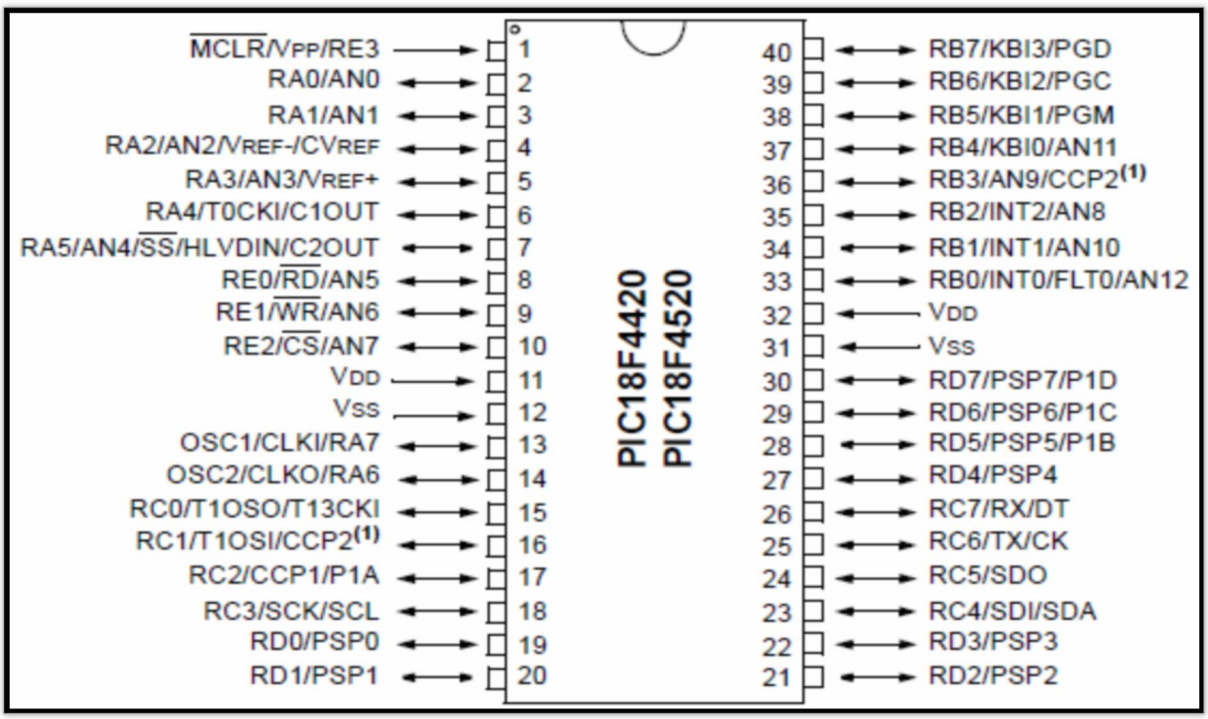


**Fig 3.4: PIC18F4520 Pin Diagram**

**2)16*2 LCD Display:** 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. These modules are preferred over seven segments and other multi segment LEDs.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD. The purpose of using 16x2 LCD in our project is to display all the parameters of electricity meter and is connected to the port 0 of ARM micro-controller.

**FEATURES:**

- 16x2 matrix
- Low power operation support: 2.7 to 5.5V.
- Duty cycle: 1/16
- Connector for standard 0.1-pitch pin headers.

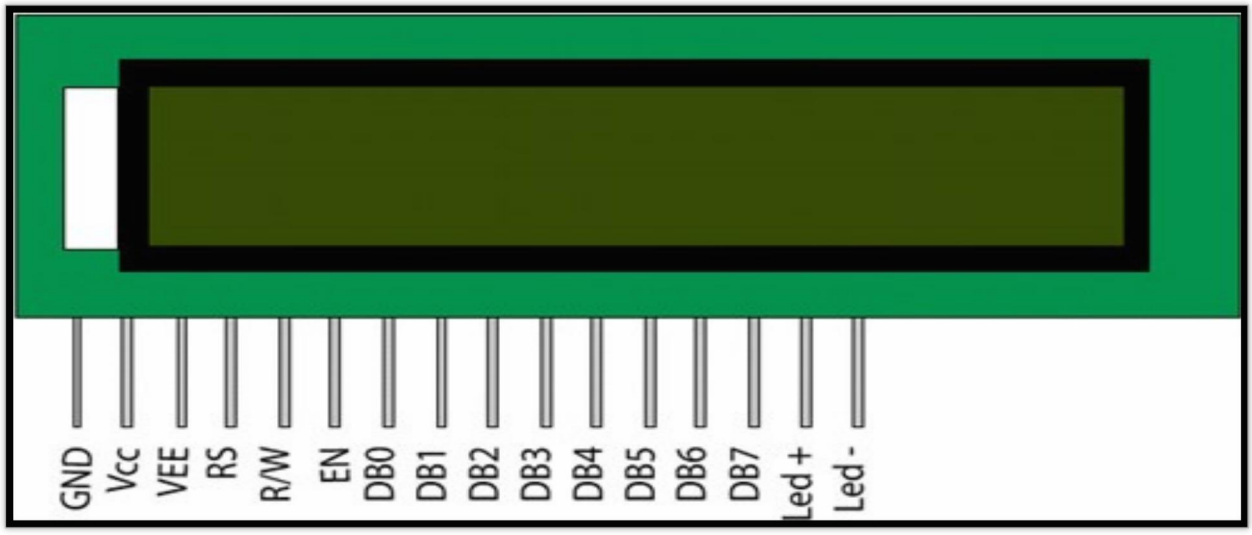


**Fig 3.5: 16*2 LCD Display**

**3) BUZZER :** A buzzer or beeper is an audio signal device,which may be mechanical, electromechanical, or piezoelectric.

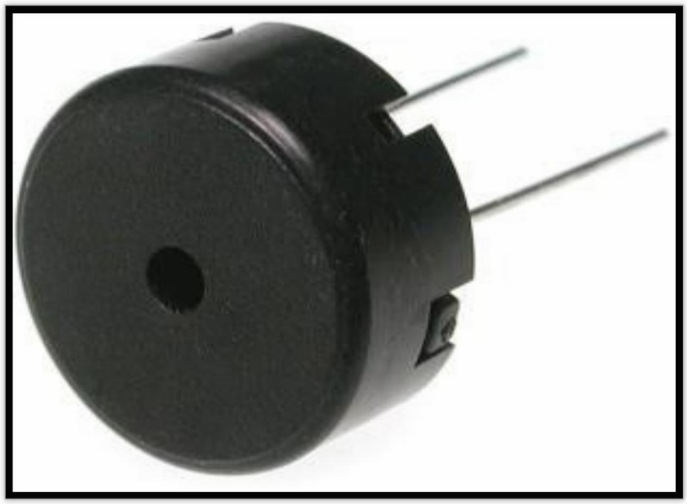

**Fig 3.6: Buzzer**

Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. If embedded system is misplaced from dashboard, the IR sensor becomes active. The signal is sent to ARM micro controller to ring the buzzer. It is connected to the port pin P0.21 via jumper J10 of micro controller.

**4) RELAY:** A relay is electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. A relay is an electrically operated switch. Current flowing

**Fig 3.7: Relay**

through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts as shown in the diagram. Normally Open (NO): Contacts connect the circuit when the relay is activated, the circuit is disconnected when the relay is inactive. Normally Closed (NC): Contacts disconnect the circuit when the relay is activated, the circuit is connected when the relay is inactive. Change Over (CO): It's the common contact. Coil: It's the electromagnet coil inside relay. Coil rating: It's the Voltage at which the coil gets fully activated. Some also have coil resistance mentioned on them. Relay coil voltage rated 6V and 12V are the most commonly available.

The figure shows a relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts.

**Applications of relays:**

Control a high-voltage circuit with a low-voltage signal, as in some types of modems or audio amplifiers. Control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile. Detect and isolate faults on transmission and distribution lines by opening and closing circuit breakers.

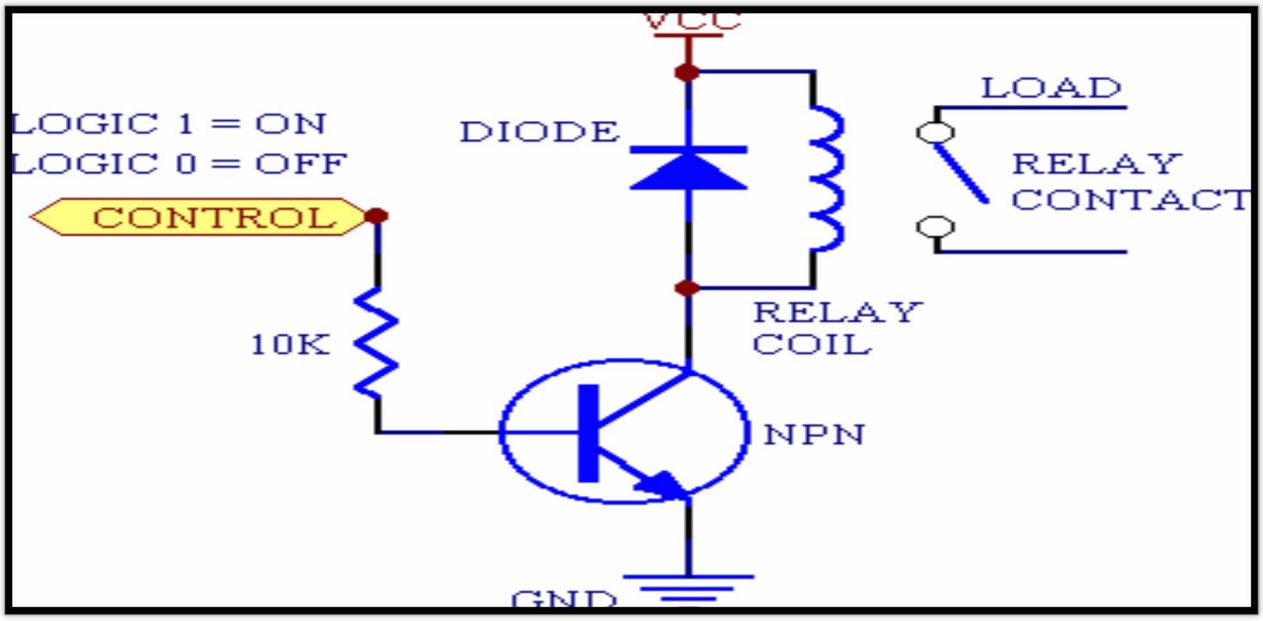


**Fig 3.8: Relay**

**5) Transformer:** A transformer makes use of Faraday's law and the ferromagnetic properties of an iron core to efficiently raise or lower AC voltages. It of course cannot increase power so that if the voltage is raised, the current is proportionally lowered and vice versa.

When current in the primary coil changes being alternating in nature, a changing magnetic field is produced This changing magnetic field gets associated with the secondary through the soft iron core. Hence magnetic flux linked with the secondary coil changes. This induces e.m.f. in the secondary.

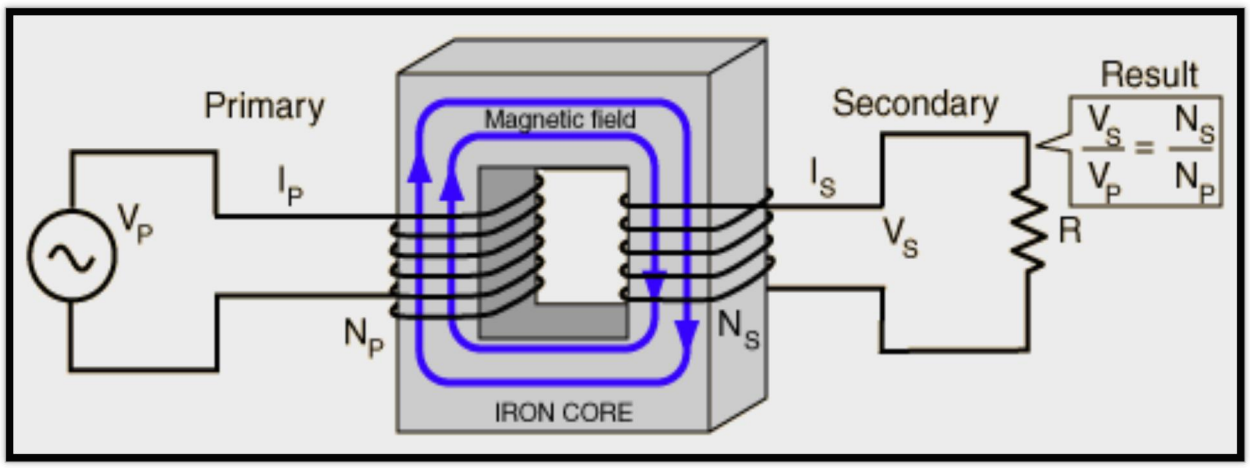


**Fig 3.9: Transformer**

**6) The Current Transformer:** Current Transformers produce an output in proportion to the current flowing through the primary winding as a result of a constant potential on the primary. The **Current Transformer** ( **C.T.** ), is a type of "instrument transformer" that is designed to produce an alternating current in its secondary winding which is proportional to the current being measured in its primary. Current transformers reduce high voltage currents to a much lower value and provide a convenient way of safely monitoring the actual electrical current flowing in an AC transmission line using a standard ammeter. The principal of operation of a basic current transformer is slightly different from that of an ordinary voltage transformer. Unlike the voltage or power transformer looked at previously, the current transformer consists of only one or very few turns as its primary winding. This primary winding can be of either a single flat turn, a coil of heavy duty wire wrapped around the core or just a conductor or bus bar placed through a central hole as shown.

Due to this type of arrangement, the current transformer is often referred too as a "series transformer" as the primary winding, which never has more than a very few turns, is in series with the current carrying conductor supplying a load.

The secondary winding however may have a large number of coil turns wound on a laminated core of low-loss magnetic material. This core has a large cross-sectional area so that the magnetic flux density created is low using much smaller cross-sectional area wire, depending upon how much the current must be stepped down as it tries to output a constant current, independent of the connected load.

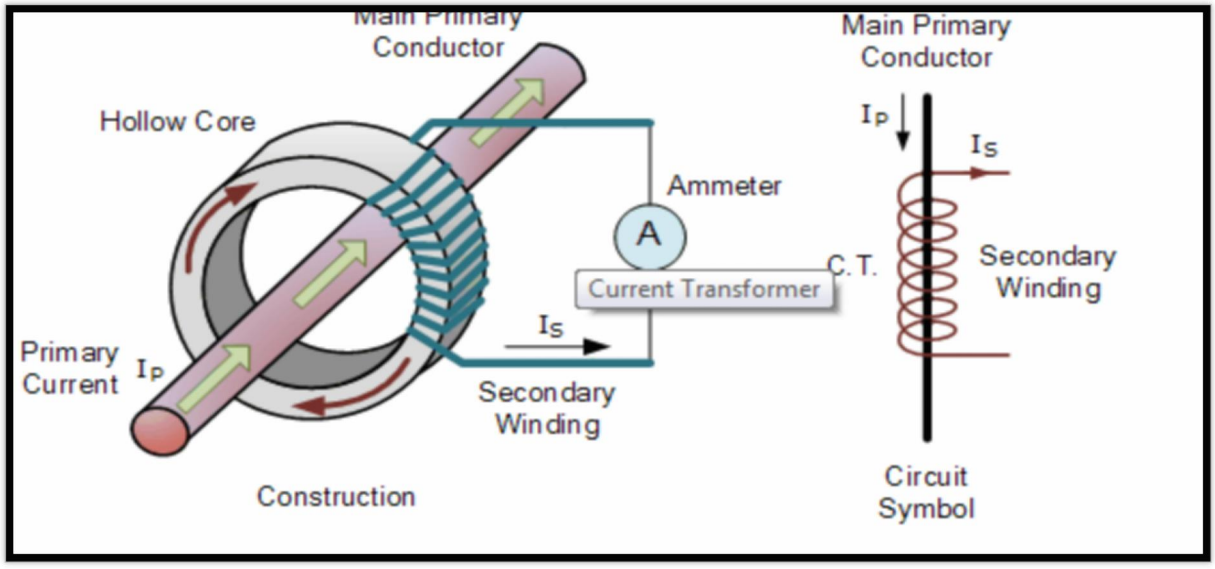


**Fig 3.10: Current Transformer**

7) **Printed Circuit Board (PCB):** PCB means printed circuit board PCB is one of the most important elements in any electronic system. They accomplish the interconnection the between component mounted on them in particular manner PCB consist of conductive circuit pattern which is applied to one or both sided of an insulating base copper is most widely used for conductor material. Aluminum nickel, silver, brass is used for same special application.
The thickness of conducting material depends upon the current carrying capacity of circuit. Thus a thicker conductor layer will have mare current carrying capacity once the PCB is manufactured the current carrying capacity is depends on which of conductor track.

**FUNCTION: -**

- The printed circuit board usually serves there distinct functions are as follows:
- It provides mechanical support for the component mounted on it.

- It provides necessary electrical interconnections.
- It acts as a heat sink i.e. it provides a conduction path leading to removal of most of the heat generate in the circuit.

**Advantage of PCB: -**

- Over the conventional wire method:
- PCB's have controllable and predicable electrical mechanical properties.
- Rapid production is possible.
- Time is saved since it avoids wiring connections production to another
- Weight is reduced.
- Soldering is done in one operation instead of individual connection between component and wires.
- Cost is less.

**Types of PCB:**

- Single sided PCB.
- Double sided PCB.

➢ **Single Sided PCB:** This type of PCB consists of a natural coil of a copper on only one side of the base material. This type of PCB frequently used when the manufacturing cost has to be kept at minimum.

➢ **Double Sided PCB:** Double sided PCB is used when there is more number of jumpers. This type of PCB has copper fail on both side of base material. The double-sided PCB's are used when insulation of PCB is very complicated i.e. if jumpers are more in number and when it is difficult to fabricants the PCB ON a single sided PCB.

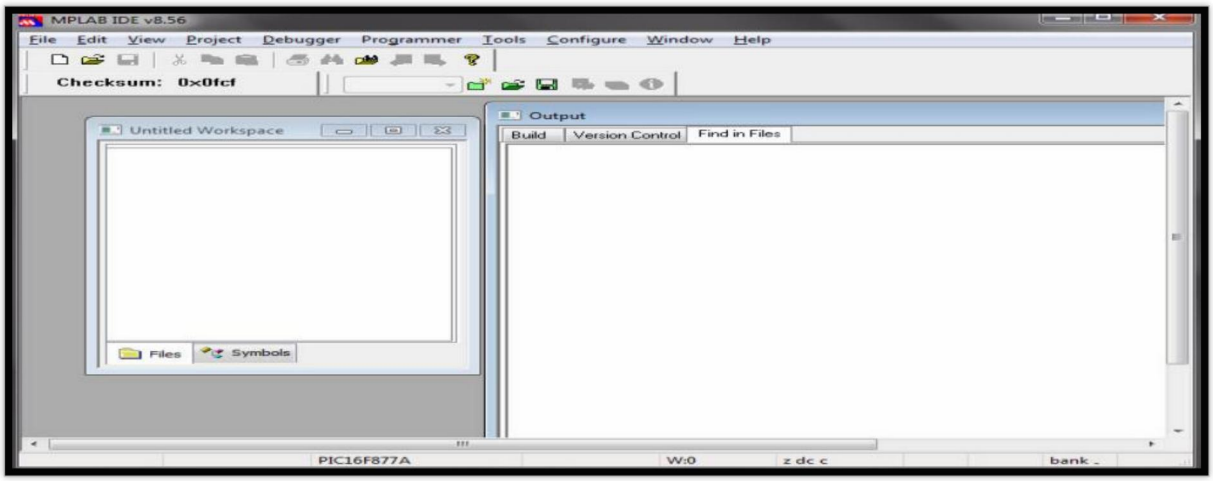


**Fig. 3.11 Software window**

**8) Internet of Things** : "The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction." Things are either sensors or actuators. A sensor is something that tells us about our environment. Think of a temperature sensor, or even the GPS receiver on your mobile phone. Actuators are something that you want to control, things like thermostats, lights, pumps, and outlets. The "Internet of Things" brings everything together and allows us to interact with our things. For example, you could have your thermostat control itself based on where you're located.

**9) PCB Designing :**

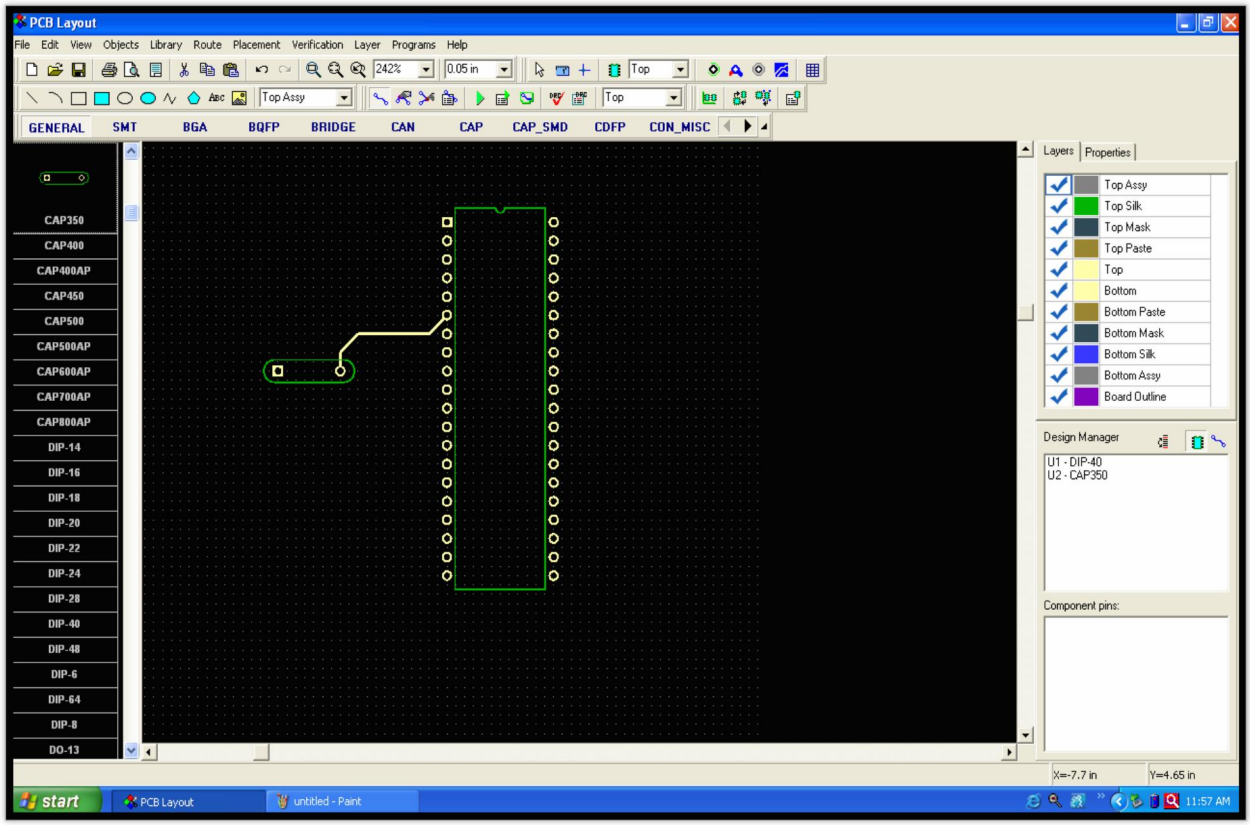


**Fig 3.12: Window of PCB Design**

**10) Software development:** MPLAB X IDE is a software program that runs on a PC (Windows®, Mac OS®, Linux®) to develop applications for Microchip microcontroller and digital signal controllers. It is called an Integrated Development Environment (IDE), because a much more extensible architecture to bring you even more new features in the future. it

provides a single integrated "environment" to develop code for embedded microcontrollers. MPLAB X Integrated Development Environment brings many changes to the PIC® microcontroller development tool chain. Unlike previous versions of the MPLAB IDE which were developed completely in-house, MPLAB X IDE is based on the open source NetBeans IDE from Oracle. Taking this path has allowed us to add many frequently requested features very quickly and easily, while also providing us with

1. Open MPLAB IDE v8.56
2. From the 'Projects' tab, select the first option 'Project Wizard'
3. Click on 'Next' in the welcome window that appears.
4. Select the desired PIC which you need to program or build your project on and click on 'Next'
5. Select the active tool suite you require; among the list of tool suites given (Usually the HI-TECH Universal tool suite is preferred,if installed)
6. Check if the ToolSuite contents listed contains a compiler suiting your programming needs("HI-TECH ANSI C Compiler" in the case of a HI-TECH Universal tool suite) and click 'Next'
7. Create a new project file at your desired location in the desired name.
8. Take care that the project file is saved in the '*.mcp' format and click 'Next'
9. In the next window , add any files you desire to add to your new project,if required. else just skip this step by clicking 'Next'.
10. Now click 'finish' and your new project is created.
11. Now select the 'New' option from the 'File' tab.v

**11) POWER SUPPLY:**

REQUIRED REGULATED POWER SUPPLY 5V/1A

REQUIRED REGULATED POWER SUPPLY 12V/1A

Almost all electronic circuits require a DC source for power supply unit may be defined as a piece of equipment, which converts the alternating waveform from the power lines (A C supply) into an essentially direct voltage A rectifier with filter gives out unregulated supply An unregulated power – supply consists of a transformer, a rectifier, and filter circuit .There are three reasons why such a simple system is not good enough for same.

**12) RESISTER :** resistor is a two-terminal electronic component designed to oppose an electric current by producing a voltage drop between its terminals in proportion to the current, that is, in accordance with Ohm's law

$$V = IR$$

Resistors are used as part of electrical networks and electronic circuits. They are extremely commonplace in most electronic equipment. Practical resistors can be made of various compounds and films, as well as resistance wire (wire made of a high-resistivity alloy, such as nickel/chrome).

**13) GSM :**

This GSM modem has a **SIM800A chip and RS232** interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open an connection to that COM port at 9600 baud rate, which is the default baud rate of this modem.Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands. When you send AT commands for example: "AT\r" you should receive back a reply from the SIM800 modem saying "OK" or other response depending on the command send.

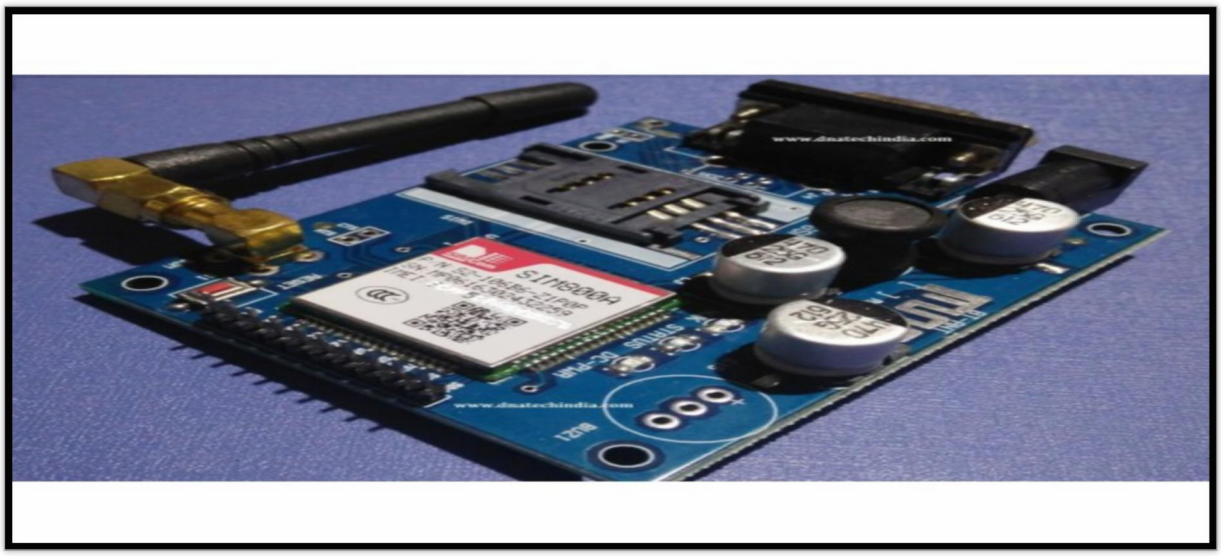

**Fig 3.13: GSM**

### 3.4 Cost Sheet and specification

| COMPONENT | SPECIFICTION | QUANTITY | Cost(for 1) | Total cost |
|---|---|---|---|---|
| Micro-controller | PIC 18F4520 | 1 | 1630 | 1630 |
| Transistor | BC547 | 3 | 5 | 15 |
| Buzzer | 5VDC | 1 | 35 | 35 |
| Resistors | 1k,10k, Random | 8 | 1 | 8 |
| Capacitor | 0.1uf,0.01uf | 7 | 3 | 21 |
| Regulator IC | LM 7805 | 1 | 20 | 20 |
| Diode | 1N4007 | 7 | 3 | 21 |
| CT | 5A | 2 | 350 | 700 |
| LCD Display | 16*2 | 1 | 320 | 320 |
| GSM module | GSM 800 12V AC OR DC | 1 | 1550 | 1550 |
| Tact switches | 5V DC | 4 | 8 | 32 |
| Temp sensor | LM35 V DC | 1 | 80 | 80 |
| CAPACITOR | 450uf/25V | 1 | 10 | 10 |
| CAPACITOR | 1000uf/25v | 1 | 15 | 15 |
| TRANSFORMER | 12VDC 2A | 1 | 120 | 120 |
| LED | UPTO 3V 1ma | 1 | 5 | 5 |
| PCB | 120*80MM | 1 | 100 | 100 |

**Table 3.1: Cost Sheet of Component**

### 3.5 Graphical Presentation of Data :

Internet of Things (IoT) describes an emerging trend where a large number of embedded devices (things) are connected to the Internet. These connected devices communicate with people and other things and often provide sensor data to cloud storage and cloud computing resources where the data is processed and analyzed to gain important insights. Cheap cloud computing power and increased device connectivity is enabling this trend.

IoT solutions are built for many vertical applications such as environmental monitoring and control, health monitoring, vehicle fleet monitoring, industrial monitoring and control, and home automation. At a high level, many IoT systems can be described using the diagram below:

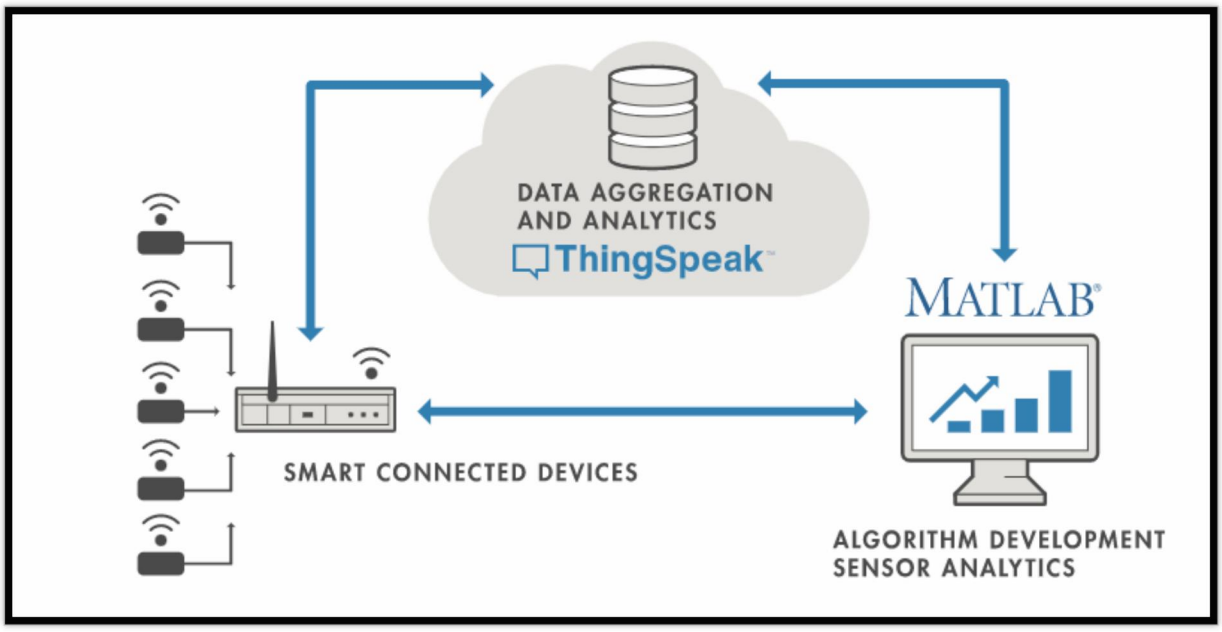


**Fig 3.14: Conversion of Data in Graphical Form**

On the left, we have the smart devices (the "things" in IoT) that live at the edge of the network. These devices collect data and include things like wearable devices, wireless temperatures sensors, heart rate monitors, and hydraulic pressure sensors, and machines on the factory floor.

In the middle, we have the cloud where data from many sources is aggregated and analyzed in real time, often by an IoT analytics platform designed for this purpose.

The right side of the diagram depicts the algorithm development associated with the IoT application. Here an engineer or data scientist tries to gain insight into the collected data by performing historical analysis on the data. In this case, the data is pulled from the IoT platform into a desktop software environment to enable the engineer or scientist to prototype algorithms that may eventually execute in the cloud or on the smart device itself.

An IoT system includes all these elements. ThingSpeak fits in the cloud part of the diagram and provides a platform to quickly collect and analyze data from internet connected sensors.

**ThingSpeak Key Features:**

ThingSpeak allows you to aggregate, visualize and analyze live data streams in the cloud. Some of the key capabilities of ThingSpeak include the ability to:

- Easily configure devices to send data to ThingSpeak using popular IoT protocols.
- Visualize your sensor data in real-time.
- Aggregate data on-demand from third-party sources.
- Use the power of MATLAB to make sense of your IoT data.
- Run your IoT analytics automatically based on schedules or events.
- Prototype and build IoT systems without setting up servers or developing web software.
- Automatically act on your data and communicate using third-party services like Twilio® or Twitter®.

# 4.Software Development

## 4.1 Software Requirement

### MPLAB IDE

MPLAB Integrated Development Environment (IDE) is a comprehensive editor, project manager and design desktop for application development of embedded designs using Microchip PIC micro and PIC micro-controllers. The initial use of MPLAB IDE is covered here. How to make projects, edit code and test an application will be the subject of a short tutorial. By going through the tutorial, the basic concepts of the Project Manager, Editor and Debugger can be quickly learned. The complete feature set of MPLAB IDE is covered in later chapters. This section details the installation and uninstall of MPLAB IDE. It is followed by a simple step-by-step tutorial that creates a project and explains the elementary debug capabilities of MPLAB IDE. Someone unfamiliar with MPLAB IDE will get a basic understanding of using the system to develop an application.

## 4.2 Algorithm

**Step 1:** Start the program

**Step 2:** Interface the switches , GSM module , LCD display , to the PIC Micro-controller

**Step 3:** Compile Program to PIC Micro-controller

**Step 4:** Turn on supply

**Step 5:** Live data monitoring with the help of IOT Technology.

**Step 6:** Electricity consumption within limit system run normally.

**Step 7:** Over-consumption of electricity detected .

**Step 8:** With the help of GSM module and IOT technology Alert notification sent to user and hostel rector through SMS.

**Step 9:** After third notification electricity supply of specific room will be disconnected automatically.

## 4.3 Flowchart :

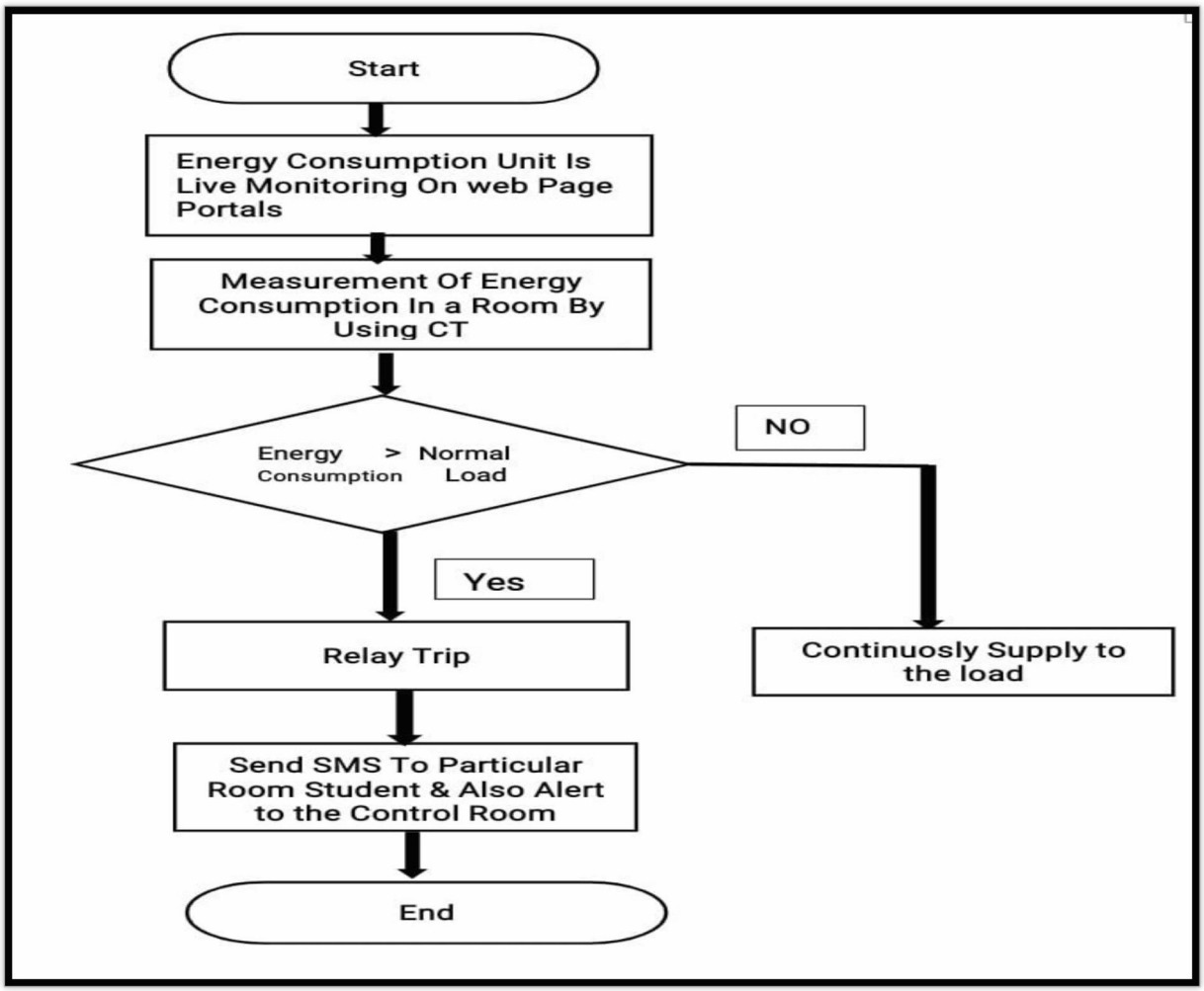


**Fig.3.15. Flowchart**

The graphical representation of the flowchart is shown in Fig. Firstly, the current is measured by CT and gives input to the microcontroller. When the current does not exceed the rated limit, it continuously supplies the load. If the current exceeds the rated limit, then relay trips and send SMS to the student as well as the control room simultaneously .

## 4.4 Program:

```
#include &lt;18f4520.h&gt;
#DEVICE ADC=10

#fuses
INTRC_IO,NOPROTECT,BROWNOUT,NOMCLR,NOCPD,NOWDT,NOPUT,FCMEN

#use delay(clock=8000000)//,restart_wdt)
#use rs232(baud=9600, xmit=PIN_C6, rcv=PIN_C7,errors)
#define BUZZ_ON OUTPUT_HIGH(PIN_A0);
#define BUZZ_OFF OUTPUT_LOW(PIN_A0);

#define RELAY_ON OUTPUT_HIGH(PIN_D1);
#define RELAY_OFF OUTPUT_LOW(PIN_D1);

#define RELAY2_ON OUTPUT_HIGH(PIN_D0);
#define RELAY2_OFF OUTPUT_LOW(PIN_D0);

#define RELAY3_ON OUTPUT_HIGH(PIN_C2);
#define RELAY3_OFF OUTPUT_LOW(PIN_C2);

#define RELAY4_ON OUTPUT_HIGH(PIN_C3);
#define RELAY4_OFF OUTPUT_LOW(PIN_C3);

#define RS_HI OUTPUT_HIGH(PIN_B5);
#define RS_LO OUTPUT_LOW(PIN_B5);

#define EN_HI OUTPUT_HIGH(PIN_B4);
#define EN_LO OUTPUT_LOW(PIN_B4);

#define D4_HI OUTPUT_HIGH(PIN_B3);
#define D4_LO OUTPUT_LOW(PIN_B3);
#define D5_HI OUTPUT_HIGH(PIN_B2);
#define D5_LO OUTPUT_LOW(PIN_B2);
#define D6_HI OUTPUT_HIGH(PIN_B1);
#define D6_LO OUTPUT_LOW(PIN_B1);
#define D7_HI OUTPUT_HIGH(PIN_B0);
#define D7_LO OUTPUT_LOW(PIN_B0);

#define sel_ON OUTPUT_HIGH(PIN_E2);
#define sel_OFF OUTPUT_LOW(PIN_E2);

int8 ui_R_vltg = 0;
int8 y = 0;
int16 ucplsef = 0;
int8 ucrvltgcnt = 0;
volatile int8 uchomelodonf = 0;
```

```
if(INPUT(PIN_D4) == 0)
{
delay_ms(2);
if(keypress4cnt &lt; 100)
{
keypress4cnt++;
}
else
{
//ucUpKCntr = 0;
}
if((keypress4cnt == 1))//||(ucUpKCntr == 80))
{
ucKeyPressed = 1;

}
}
else

{
keypress4cnt = 0;
}
if(INPUT(PIN_D5) == 0)
{
delay_ms(2);
if(keypress3cnt &lt; 100)
{
keypress3cnt++;
}
else
{
//ucUpKCntr = 0;
}
if(keypress3cnt &lt; 100)
{
keypress3cnt++;
}
else
{
//ucUpKCntr = 0;
}
if((keypress3cnt == 1))//||(keypress3cnt == 80))
{

ucKeyPressed = 4;

}
}
```

```
else
{
keypress3cnt = 0;
}

}

void main(void)
{

}

if(ucKeyPressed == 2)
{

if(ucrelay1cnt &lt; 2)
{
ucrelay1cnt++;
}
else
{
{

if(ucrelay2cnt == 1)
{
if(ucbreakf != 1)
{
RELAY3_ON;
}
// ucrelay2cnt = 0;
}
if(ucrelay2cnt == 2)
{
RELAY3_OFF;
}
delay_ms(100);
BUZZ_ON;

delay_ms(500);
BUZZ_OFF;

printf(&quot;AT+IFC=1,0\r\n&quot;);
delay_ms(1500);
printf(&quot;AT+CMGF=1\r\n&quot;);
delay_ms(1500);
printf(&quot;AT+CMGS=\&quot;+919730095733\&quot;\r\n&quot;);//919096350078
7020059114

delay_ms(1500);
```

```
printf(&quot;ROOM 1&quot;);
putc(&#39;\r&#39;);
putc(&#39;\n&#39;);

printf(&quot;YOUR ELECTRICITY LOAD EXCEED ITS LIMIT&quot;);
putc(&#39;\r&#39;);
putc(&#39;\n&#39;);
printf(&quot;YOUR ELECTRICITY SUPPLY IS BREAK NOW&quot;);
putc(&#39;\r&#39;);
putc(&#39;\n&#39;);

ucbreakf = 1;
uiunit= 0;
}

if((uiCurentadc1 &gt; 580))//&amp;&amp;(uiTEMP_ADC2 &gt; 450))
{
if(ui2minCNT == 1)
{
ui2minCNT = 150;
if(ucsmscount1 == 0)

{
ucsmscount1 = 1;
}
if(ucsmscount1 == 2)
{
ucsmscount1 = 3;
}
if(ucsmscount1 == 4)
{
ucsmscount1 = 5;
}
}
}

if(ucsmscount1 == 1)
{
BUZZ_ON;
delay_ms(1000);
BUZZ_OFF;
ucsmscount1 = 2;
printf(&quot;AT+IFC=1,0\r\n&quot;);
delay_ms(1000);
printf(&quot;AT+CMGF=1\r\n&quot;);
delay_ms(1000);
printf(&quot;AT+CMGS=\&quot;+919579812062\&quot;\r\n&quot;);//919096350078
7020059114
```

```
delay_ms(1000);

printf(&quot;ROOM 2&quot;);
putc(&#39;\r&#39;);
putc(&#39;\n&#39;);
}
if(ucsmscount1 == 3)
{
BUZZ_ON;

delay_ms(500);
BUZZ_OFF;

delay_ms(100);
BUZZ_ON;

delay_ms(500);
BUZZ_OFF;
ucsmscount1 = 4;
printf(&quot;AT+IFC=1,0\r\n&quot;);
delay_ms(1000);
printf(&quot;AT+CMGF=1\r\n&quot;);
delay_ms(1000);
printf(&quot;AT+CMGS=\&quot;+919579812062\&quot;\r\n&quot;);//919096350078
7020059114

delay_ms(1000);
printf(&quot;AT+HTTPINIT\r\n&quot;);
delay_ms(1000);
printf(&quot;AT+HTTPPARA=\&quot;URL\&quot;,api_key=ZU4Q3Q3UJDNWK4E9&am
p;field1=&quot;);

putc(&#39;&quot;&#39;);
putc(&#39;\r&#39;);
putc(&#39;\n&#39;);

delay_ms(100);
}

}
```

## 4.5 Results:

The circuit was successfully designed and simulated on PCB. Due to use of these circuit in Hostel rooms, we can easily monitoring the energy consumption data and also detect which rooms of student can use excessive load. The IOT Webpage result as shown in fig. How much energy consumption can utilize a particular room shown in web page portal in the form of Graphical structure. Also, sending three warning SMS to the particular students mobile number and after third warning sending SMS to the rector and also shows particular Room number.

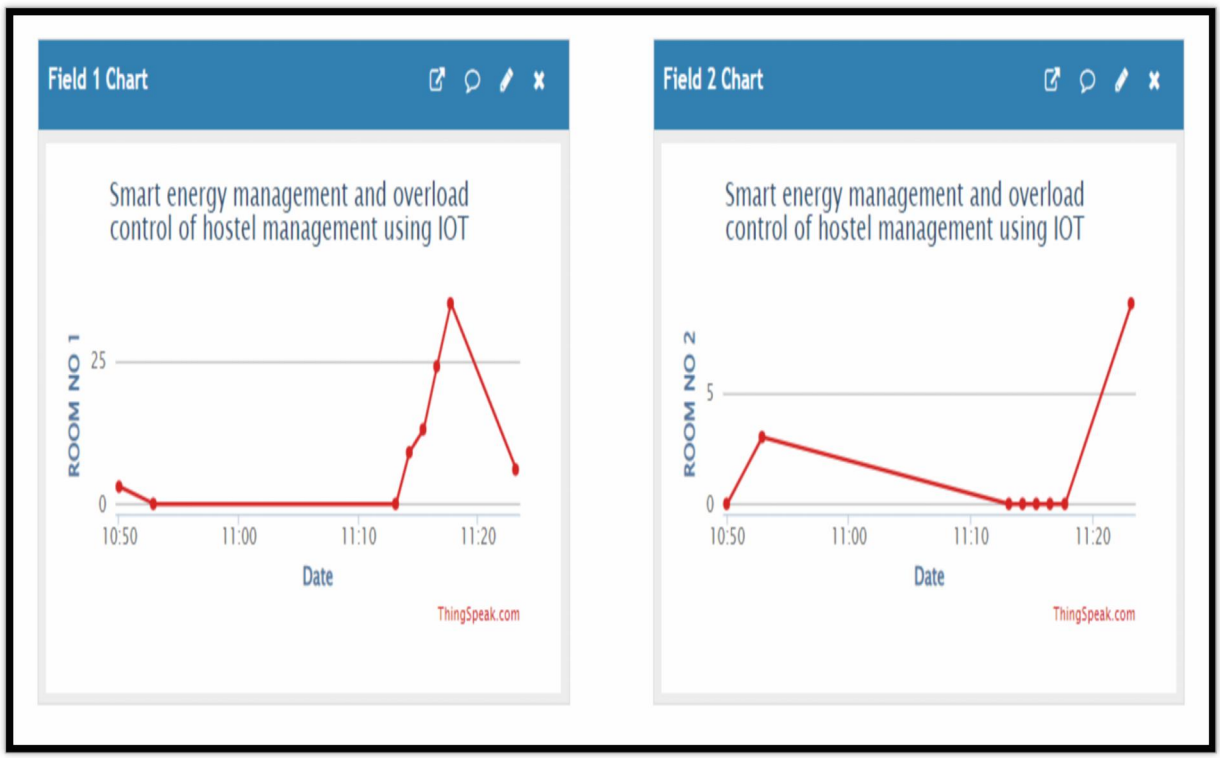


**Fig 4.1: IOT Webpage Results**

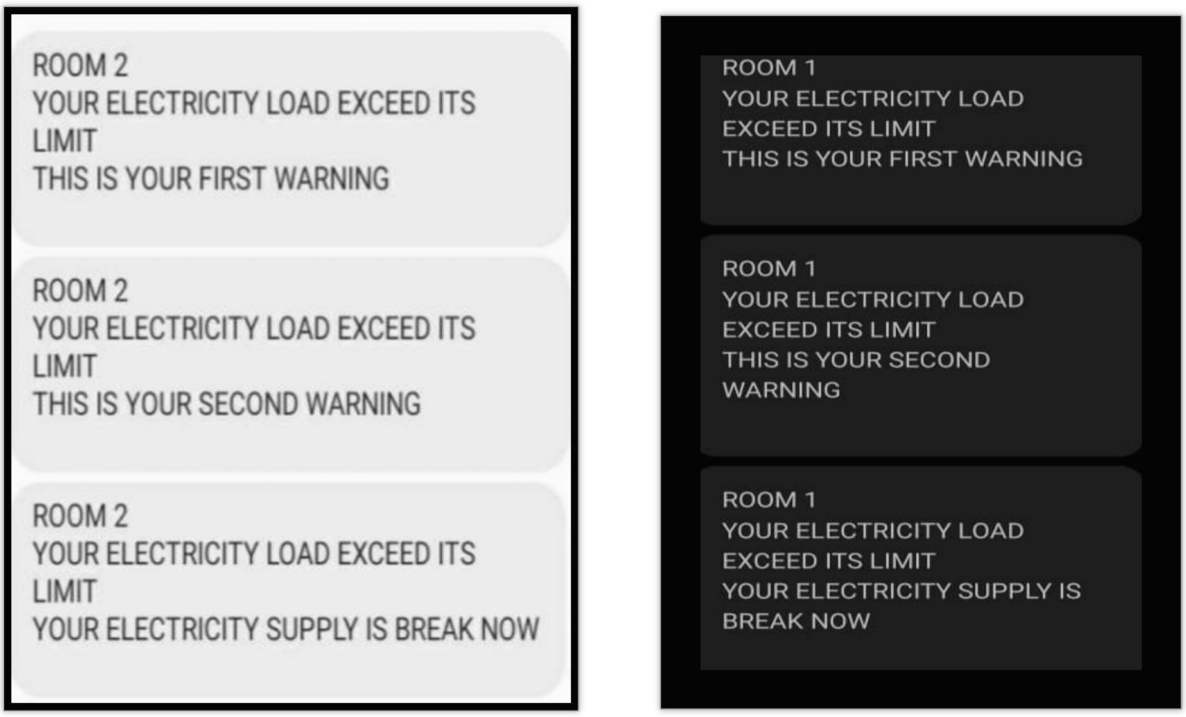


**Fig 4.2: SMS Notification**

If students use excessive loads beyond the current limit. With the help of IOT,it will send the three warning SMS to a particular room student. If the student does not disconnect the load,then the relay will trip. The SMS sent to the particular room student and also the SMS sent to the control room particular room student use excessive load.

## 5) ADVANTAGES

- Predict energy consumption patterns
- The problems of electrical theft we can easily avoid
- We can easily save the electricity.
- Effectively address outages and accidents.
- Minimize the carbon emission.
- Ensure green energy goals.

## 6) LIMITATIONS

- Transitioning to new technology and process.
- Making a long-term financial commitment to the new metering technology and related software.
- Verifying that the new meter is accurate
- Protecting the privacy of their personal data.
- Paying additional fees for the new meter.

# 7. FUTURE SCOPE

We have developed a prototype model that sends warning SMS at 120 watts. In the future, we can extend the limit as per requirements. By changing the limit in the program.e propose to extend the system for controlling appliances like Refrigerator, Air cooler, Television etc. The presence of human only will switch on the appliances. More amount of power can be saved based on the lesser usage of the appliances. There can be also a manual control over the appliances. We can implement algorithm that learns the change in the weather based on season and detect changes in season based on the temperature, humidity and brightness. So with all these work reported, we here have developed an better IoT system for Energy Management which takes the Humidity, Temperature and light intensity into consideration and accordingly interfaced with Arduino Microcontroller for controlling the usage of appliance like speed of fan, light intensity rather than just switch on or off. Also the prototype system computes the current drawn from each appliance based on appliance usage and send to Raspberry Pi3 where total power consumed of appliances computed against time. This information is computed all through the day and same uploaded in cloud server too. This ultimately achieves in energy consumption of every household resulting in Energy Management using IoT. The system so developed is not fully complete as we have developed a prototype only for controlling two appliances i.e. fan and light. In future, we propose to extend the system for controlling appliances like Refrigerator, Air cooler, Television etc. The presence of human only will switch on the appliances. More amount of power can be saved based on the lesser usage of the appliances. There can be also a manual control over the appliances. We can implement algorithm that learns the change in the weather based on season and detect changes in season based on the temperature, humidity and brightness.

# 8. CONCLUSION

Smart Home and Energy Management is current trend with the development of IoT. Lot of work been reported in regards to controlling the appliances of home and also on monitoring the electrical parameters towards hazard. Also work reporting in controlling the appliance for energy consumption. So with all these work reported, we here have developed an better IoT system for Energy Management

This project presents an integration of both hardware and software. The software is used to monitor power usage and the consumption of household appliances and control systems through over current relay and notification of any mismatches. The developed system consists of micro-controller, a GSM/WiFi module .a relay, a low current sensor breakout (ACS712), and a liquid crystal display (LCD). PIC is a micro-controller used to program customized coding for executing output at any instant time. It is also a very capable micro-controller that receives and sends information over the Internet with various modules and shield platforms.

The outputs are shown in 2 ways: LCD and IoT implementation based on the web server or mobile application (APPS). LCD is used to display the voltage, current, and power consumption where the web or mobile application is used to visualize the data and trigger alarm, when necessary, In the web and mobile application systems, the energy usage statistics of power consumption parameters are determined. It displays the detailed monitoring of electrical quantities such as voltage, current, power, and energy.

# REFERENCE


[1] M. Lavanya , P. Muthukannan, Y.S.S. Bhargav, V. Suresh, “IoT Based Automated Temperature and Humidity Monitoring and Control”, Journal of Chemical and Pharmaceutical Sciences . ISSN: 0974- 2115.

[2] Abhijeet Rajurkar, Onkar Shinde, Vinayak Shinde, Bhushan Waghmode,”Smart Home Control and Monitor System Using Power of IoT’s”, International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 5, May 2016.

[3] Suresh Sankaranarayanana , Au Thien Wanb , Aida Harayani Pusac ,” Smart Home Monitoring using Android and Wireless Sensors”, I.J. Engineering and Manufacturing, 2014, 2, 12-30.

[4] Suresh,S, Anusha, H.N.S, Rajath,T, Soundarya, P and Prathyusha, V (2016), "Automatic Lighting and Control System for Classroom", Proceedings of 2016 IEEE International conference on ICT in Business, Industry and Government, Indore, Madhyapradesh, pp.1-6

[5] Shamika Kshirsagar, Mr.D.E. Upasani, “Energy Management System for Smart Home”, International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 06 | June-2016.

[6] Vinay sagar K ,Kusuma S, ” Home Automation Using Internet of Things”, International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 03 | June-2015

[7] “Generation Of Electricity By Waste Material With Using Pollution Control Method” by Shaikh Adnan Hanif, Omkar Sanjay Ghatkar , Pathan Amankhan A. , Dhole Sanket & Prof. Atul. A. Joshi.

[8]“Solar Based Smart Electrical Shock Protection And Agriculture Kit For Farmers” by Swapnil S. Wayal , Pallavi . S. Pawar , Arti . S. Wayal , Gargi . B. Tayade & Prof. Atul.A.Joshi