MICROCONTROLLER BASED HOME APPLIANCES

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ABSTRACT

In today's scenario all applications are automatic type like touch screen based. Starting from morning to night we are implementing many applications using Touch screen e.g. Mobile Phone. In this project we interface Bluetooth module and Microcontroller. for example when you want to switch 'on' like giving speech as command using an android app and type of mode such that ON (or) OFF the machine . This is interfaced with the Microcontroller in company or home. After input from the android app, it sends the data signal to the Microcontroller through the bluetooth. Level converter gives the signal in the form of 0 and 5V pulse to the Microcontroller.

A relay is an electrically operated switch. Current flowing through the coil of their lay creates a magnetic field which attracts a lever and changes the switch contacts. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it

Can be as much as 100mA for relays designed to operate from lower voltages.

The Microcontroller is the embedded device which has on chip program memory in which the machine control program is stored. Then the Microcontroller activates the relay which is connected to corresponding Machine. Now the Machine 1 is switched ON by relay. Relay is activated through Relay Driver Circuit which is controlled by Microcontroller.

1. INTRODUCTION

Automation system has announced its arrival on big stage and the world is going automated. We want to control everything and without moving an inch. This remote control of appliances is possible through Embedded Systems. The use of "Embedded System in manufacturing" has given rise to many interesting applications that ensures comfort and safety to human life.
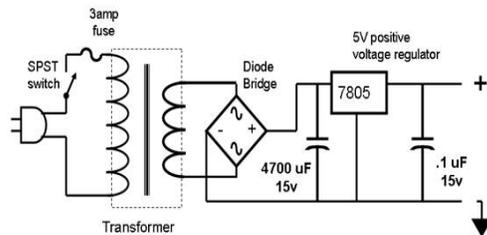
2. COMPONENTS

Figure 2.1 5 Volt Power supply

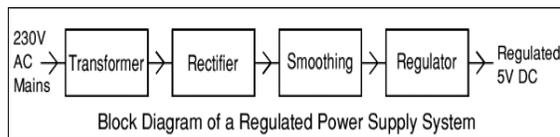A 5V regulated supply is taken as followed:

Figure 2.2 Block Diagram of a Regulated Power Supply System

Each of the blocks is described in more details below:

- Transformer - steps down high voltage AC mains to low voltage AC.

- Rectifier - converts AC to DC, but the DC output is varying.

- Smoothing - smoothes the DC from varying greatly to a small ripple.

- Regulator - eliminates ripple by setting DC output to a fixed voltage.

2.1.2 Component Details of Power Supply

2.1.2.1 Transformer

Figure 2.3 Transformer

Transformer is the electrical device that converts one voltage to another with little loss of power. Transformers work only with AC. There are two types of transformers as Step-up and Step-down transformer. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage to a safer low voltage.

Here a step down transformer is used to get 5V AC from the supply i.e.230V AC. Step down transformers are designed to reduce electrical voltage. Their primary voltage is greater than their secondary voltage. This kind of transformer "steps

down" the voltage applied to it. For instance, a step down transformer is needed to use a 110v product in a country with a 220v supply. Step down transformers convert electrical voltage from one level or phase configuration usually down to a lower level. They can include features for electrical isolation, power distribution, and control and instrumentation applications. Step down transformers typically rely on the principle of magnetic induction between coils to convert voltage and/or current levels. Step down transformers are made from two or more coils of insulated wire wound around a core made of iron. When voltage is applied to one coil (frequently called the primary or input) it magnetizes the iron core, which induces a voltage in the other coil, (frequently called the secondary or output). The turn's ratio of the two sets of windings determines the amount of voltage transformation.
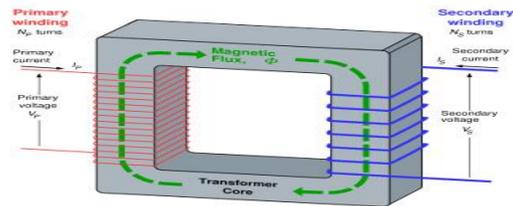
OPERATING PRINCIPLE:

Figure 2.4 Operating Principle of Transformer

The transformer is based on two principles: first, that an electric current can produce a magnetic field (electromagnetism) and second that a changing magnetic field within a coil of wire induces a voltage across the ends of the coil (electromagnetic induction). Changing the current in the primary coil changes the magnetic flux that is developed. The changing magnetic flux induces a voltage in the secondary coil.

2.1.2.2 Rectifiers

A rectifier is a circuit that converts AC signals to DC. A rectifier circuit is made using diodes. There are two types of rectifier circuits as Half-wave rectifier and Full-wave rectifier depending upon the DC signal generated.

Half-wave Rectifier: It is the rectifier circuit that rectifies only half part of the AC signal. It uses only a single diode. It only uses only positive part of the AC signal to produce half-wave varying DC and produce gaps when the AC is negative.
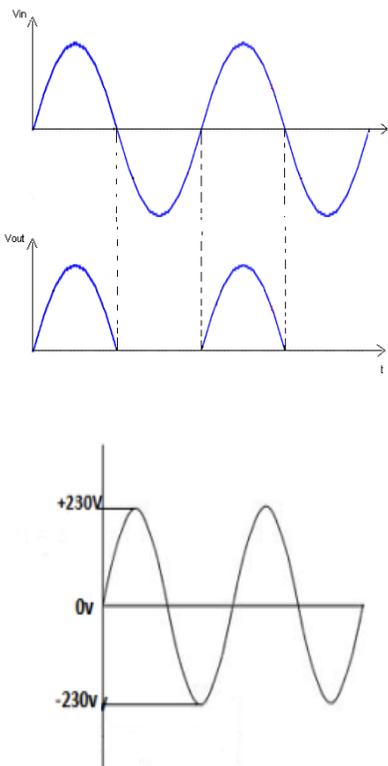

Figure 2.5 Half Wave Rectifier

Full-wave Rectifier: It is also called as Bridge Rectifier. A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called a full-wave rectifier

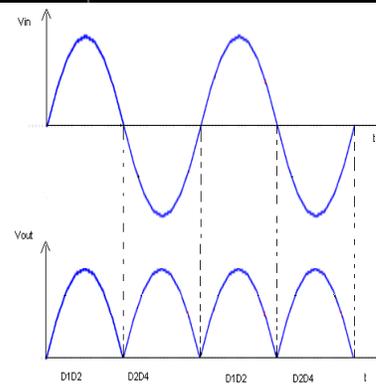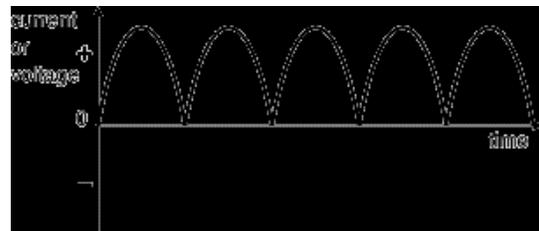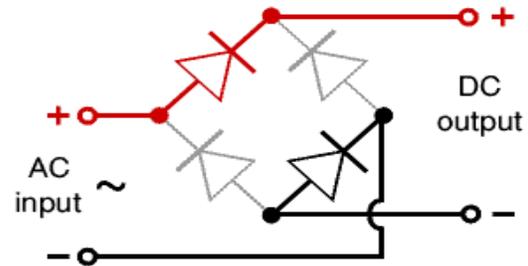because it uses the total AC wave (both positive and negative sections).

Figure 2.6 Full Wave Rectifier

2.1.2.3 Smoothing

Smoothing is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The diagram shows

the unsmoothed varying DC (dotted line) and the smoothed DC (solid line). The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output. Here a capacitor of 330uF is used as a smoothing circuit.
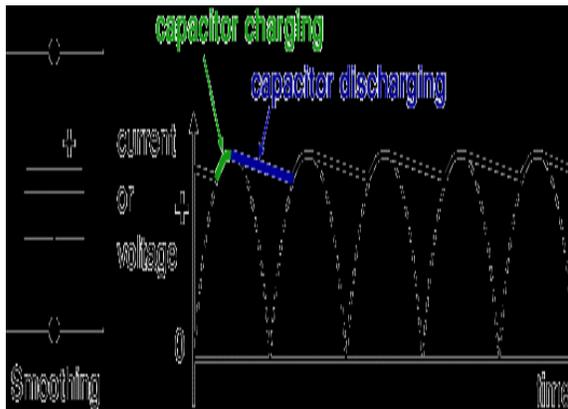

Figure 2.7 Smoothing

2.1.2.4 Voltage Regulators

Voltage regulators produce fixed DC output voltage from variable DC (a small amount of AC on it). Normally we get fixed output by connecting the voltage regulator at the output of the filtered DC. It can also used in circuits to get a low DC voltage from a high DC voltage (for example we use 7805 to get 5V from 12V). There are two types of voltage regulators

1.   Fixed voltage regulators (78xx, 79xx)

2.   Variable voltage regulators (LM317)

In fixed voltage regulators there is another classification

1.   Positive voltage regulators

2.   Negative voltage regulators

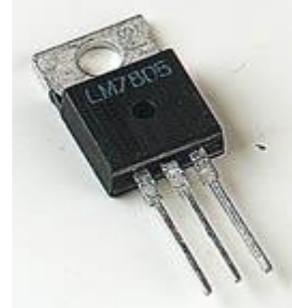**Figure 2.8 Regulator**

Many of the fixed voltage regulators have 3 leads and look like power transistors, such as the 7805 (+5V 1A) regulator shown on the above. If adequate heat sinking is provided then it can deliver up to maximum 1A current. For 7805 IC, for an input of 10v the minimum output voltage is 4.8V and the maximum output voltage is 5.2V. The typical dropout voltage is 2V. . These

ICs have internal thermal shutdown and short circuit current limiting

2.2 Microcontroller

Microcontroller can be termed as a system on chip computer which includes number of peripherals like RAM, EEPROM, Timers etc., required to perform some predefined task.
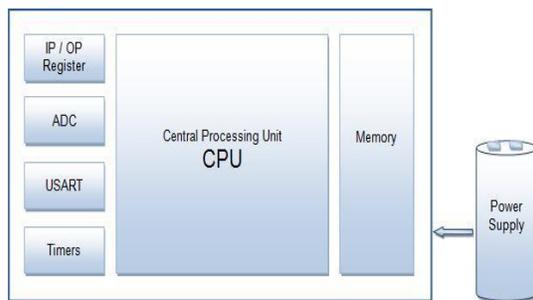

Figure 2.9 Microcontroller

Does this mean that the microcontroller is another name for a computer…? The answer is NO!

The computer on one hand is designed to perform all the general purpose tasks on a single machine like you can use a computer to run a software to perform calculations or you can use a computer to store some multimedia file or to access internet through the browser, whereas the microcontrollers are meant to perform only the specific tasks, for

e.g., switching the AC off automatically when room temperature drops to a certain defined limit and again turning it ON when temperature rises above the defined limit.

There are number of popular families of microcontrollers which are used in different applications as per their capability and feasibility to perform the desired task, most common of these are 8051, AVR and PIC microcontrollers. In this article we will introduce you with **AVR** family of microcontrollers.

2.2.1 History of AVR

AVR was developed in the year 1996 by Atmel Corporation. The architecture of AVR was developed by Alf-Egil Bogen and Vegard Wollan. AVR derives its name from its developers
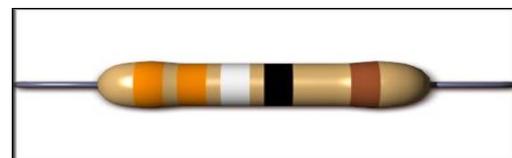
2.3 Resistors

Figure 2.10 Resistors

Resister is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resisters can also be used to provide a specific voltage for an active device such as transistor. It is a two terminal component that produces a voltage across its terminals that is proportional to the electric current through it in accordance with Ohm's law:

$$V = IR$$

Resistors are elements of electrical networks and electronic circuits and are ubiquitous 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).The primary characteristics of a resistor are the resistance, the tolerance, maximum working voltage and the power rating. Resistors can be integrated into hybrid and printed circuits, as well as integrated circuits. Size, and position of leads (or terminals) are relevant to equipment designers; resistors must be

physically large enough not to overheat when dissipating their power.

There are eight resisters R1 to R8 are used in this circuit of different value. The resistance value can differ from one another by means of color coding technique. Color coding technique can be described as follows;

Figure 2.11 Color Coding

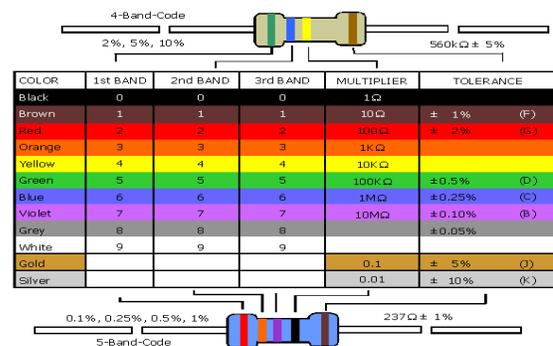Resistors are broadly classified into 3 types based on composition. These are described below.

Carbon Resistors are the most common type of Composition Resistors. Carbon resistors are a cheap general purpose resistor used in electrical and electronic circuits. Their resistive element is manufactured from a mixture of finely ground carbon dust or graphite (similar to pencil lead) and a non-conducting

ceramic (clay) powder to bind it all together.

The generic term "Film Resistor" consist of Metal Film, Carbon Film and Metal Oxide Film resistor types, which are generally made by depositing pure metals, such as nickel, or an oxide film, such as tin-oxide, onto an insulating ceramic rod or substrate.

Another type of resistor, called a Wire wound Resistor, is made by winding a thin metal alloy wire (Nichrome) or similar wire onto an insulating ceramic former in the form of a spiral helix similar to the film resistor above. These types of resistors are generally only available in very low ohmic high precision values due to the gauge of the wire and number of turns possible on the former making them ideal for use in measuring circuits and Whetstone bridge type applications.

2.4 Capacitors

Figure 2.12 Capacitors

A device used to store an electric charge consisting of one or more pairs of conductor separated by an insulator. The capacitance is the amount of electric charge stored in the capacitor at a voltage of 1volt.The capacitance is measured in the unit of farad. The capacitor disconnects current in dc circuit and short circuits current in ac circuit. In fire alarm circuit polarized and ceramic capacitor is used. There are three capacitors are used in this circuit. One is 10microfarad 16volt, means its capacitance is 10 microfarad at 16 volt. Similarly other two are .04microfarad and .01microfarad at 63volt.

2.4.1 Working of Capacitor

A capacitor consists of two metal plates which are separated by a non-conducting substance or dielectric. Take a look at the figure given below to know about dielectric in a capacitor.
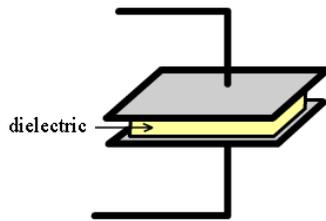
Figure 2.13 Capacitor Working

Though any non-conducting substance can be used as a dielectric, practically some special materials like porcelain, Mylar, Teflon, mica, cellulose and so on. A capacitor is defined by the type of dielectric selected. It also defines the application of the capacitor. According to the size and type of dielectric used, the capacitor can be used for high-voltage as well as low-voltage applications.

For applications in radio tuning circuits air is commonly used as the dielectric. for applications in timer circuits mylar is used as the dielectric. For high voltage applications glass is normally used. For application in X-ray and MRI machines, ceramic is mostly preferred.

The metal plates are separated by a distance "d", and a dielectric material is separately placed in between the plates.

The dielectric constant of the dielectric material is equal to the dielectric of air. The dielectric material is the main substance that helps in storing the electrical energy.
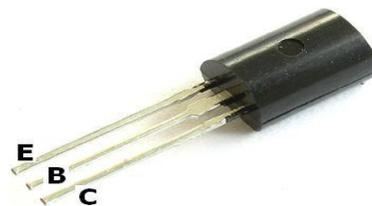
2.5 Transistors

Figure 2.14 Transistor

A transistor is a semiconductor device commonly used to amplify or switch electronic signals. A transistor is made of a solid piece of a semiconductor material, with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current flowing through another pair of terminals. Because the controlled (output) power can be much more than the controlling (input) power, the transistor provides   of a signal. Transistor can be

regarded as a type of switch, as can many electronic components. There are two main types NPN and PNP .In this fire alarm circuit we are used the NPN type transistor. A transistor have three leads mainly base, emitter, collector. The base lead mainly used to activate the transistor. The collector is the positive lead and the emitter is the negative lead. The below fig. shows a NPN transistor.
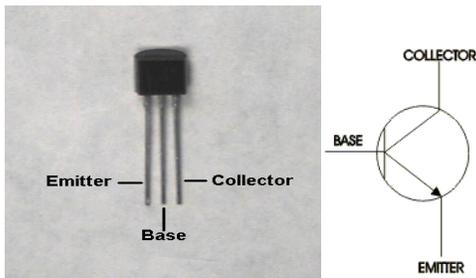

Figure 2.15 NPN Transistor

Some transistors are packaged individually but most are found in circuits. The transistor is the fundamental building block of modern electronic devices, and its presence is ubiquitous in modern electronic systems.

In this fire alarm circuit we are used three transistors BC548, BC558, SL100B. SL100B is a special type transistor.
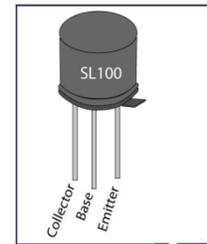
Figure 2.16 SL100B Transistor

SL100B is a general purpose medium power NPN transistor. It is mostly used as a switch in common emitter configuration .For switching application SL100 is biased in such a way that it remains fully on if there is a signal at its base .In the absence of base signal it gets turned off completely. The emitter leg of SL100 is indicated by protruding edge in the transistor case. The base is nearest to emitter while collector lies at other extreme of the casing.

2.5.1 Transistor Working

Figure 2.17 Working of Transistor

2.5.2 NPN Transistor Operation

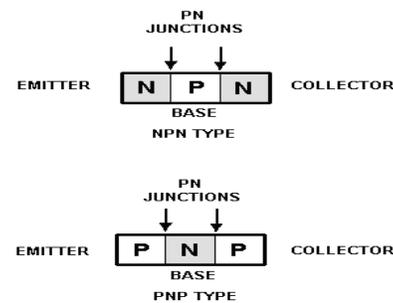Just as in the case of the PN junction diode, the N material comprising the two end sections of the NPN transistor contains a number of free electrons, while the center P section contains an excess number of holes. The action at each junction between these sections is the same as that previously described for the diode; that is, depletion regions develop and the junction barrier appears. To use the transistor as an amplifier, each of these junctions must be modified by some external bias voltage. For the transistor to function in this capacity, the first PN junction (emitter-base junction) is biased in the forward, or low-resistance, direction. At the same time the second PN junction (base-collector junction) is biased in the reverse, or high-resistance, direction. A simple way to remember how to properly bias a transistor is to observe the NPN or PNP elements that make up the transistor.
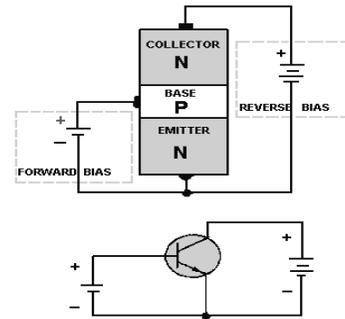

Figure 2.18 NPN Transistor Operation

2.5.3 Working of PNP Transistor

The PNP transistor works essentially the same as the NPN transistor. However, since the emitter, base, and collector in the PNP transistor are made of materials that are different from those used in the NPN transistor, different current carriers flow in the PNP unit. The majority current carriers in the PNP transistor are holes. This is in contrast to the NPN transistor where the majority current carriers are electrons. To support this different type of current (hole flow), the bias batteries are reversed for the PNP transistor. A typical bias setup for the PNP transistor is shown in figure 2-8. Notice that the procedure used earlier to properly bias the NPN transistor also applies here to the PNP transistor. The first letter (P) in the PNP sequence indicates the polarity of the voltage

required for the emitter (positive), and the second letter (N) indicates the polarity of the base voltage (negative). Since the base-collector junction is always reverse biased, then the opposite polarity voltage (negative) must be used for the collector. Thus, the base of the PNP transistor must be negative with respect to the emitter, and the collector must be more negative than the base. Remember, just as in the case of the NPN transistor, this difference in supply voltage is necessary to have current flow (hole flow in the case of the PNP transistor) from the emitter to the collector. Although hole flow is the predominant type of current flow in the PNP transistor, hole flow only takes place within the transistor itself, while electrons flow in the external circuit. However, it is the internal hole flow that leads to electron flow in the external wires connected to the transistor.
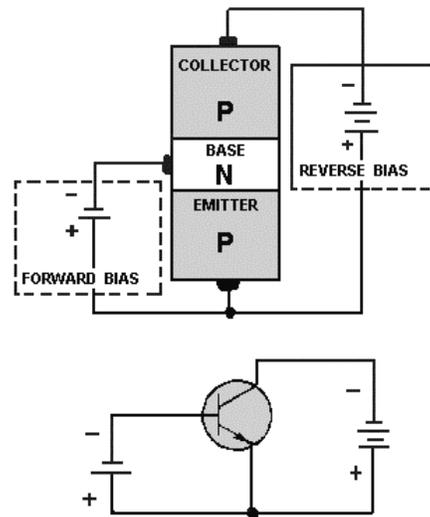
Figure 2.18 PNP Transistor Operation

The basic requirements for a biasing circuit are

1.   Establish the operating point in the centre of the active region of the characteristics, so that applying input signal the instantaneous Q point does not move.

2.   Stabilize the collector current against temperature variations.

3.   Make the operating point independent of the transistor parameters so that it does not shift when the transistor is replaced by another of the same type in the circuit.

Figure 2.19 Transistor

2.6 Diode

In this circuit one diode is present. A PN junction diode is formed by combining a p type semiconductor with n type semiconductor .It has the property of offering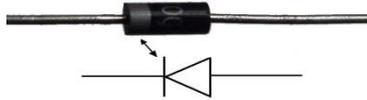 a low resistance to current flow in one direction and is the main component used in rectifying circuits. PN junction diodes are mainly manufactured using Germanium and silicon semiconductor material. It contains two mobile charge carrier holes and electrons. In electronics a diode is a two-terminal electronic component which conducts electric current asymmetrically or unidirectional; that is, it conducts current more easily in one direction than in the opposite direction. The term usually refers to semiconductor Diode.

The most common function of a diode is to allow an electric current in one direction (called the forward direction) while blocking current in the opposite direction (the reverse direction). Thus, the diode can be thought of as an electronic version of a check valve. This unidirectional behaviour is called rectification, and is used to convert alternating current to direct current, and remove modulation from radio signals in radio receivers.

2.6.1 Diode Working Principle

A p–n junction diode is made of a crystal of semiconductor. Impurities are added to it to create a region on one side that contains negative charge carriers (electrons), called n-type semiconductor, and a region on the other side that contains positive charge carriers (holes), called p-type semiconductor. When two materials i.e. n-type and p-type are attached together, a momentary flow of electrons occur from n to p side resulting in a third region where no charge carriers are present. It is called Depletion region due to the absence of charger carrier (electrons and holes in this case). The diode's terminals are attached to each of these regions. The boundary between these two regions,

called a p–n junction, is where the action of the diode takes place. The crystal allows electrons to flow from the N-type side (called the cathode) to the P-type side (called the anode), but not in the opposite direction.

2.6.2 Light Emitting Diode

One red led is used in fire alarm circuit. A led is a semiconductor light source. LEDs are used as indicator lampsin many devices. LED's emitted low intensity red light, but modern versions are available across the visible ,ultraviolet and infrared wavelength with very brightness. When a led is forward biased,electrones are able to recombine with electron holes within the device, releasing energy in form of photons.The fig of one LED is shown below.
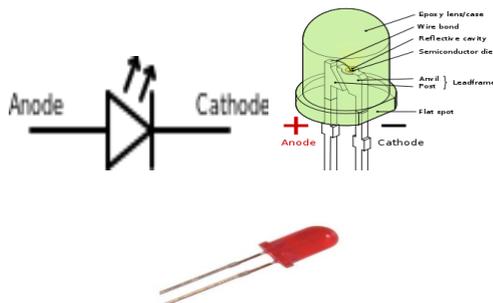

Figure 2.19 LEDs

2.7 Relay

A relay is an **electrically operated switch**. Current flowing 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 they are **double throw** (**changeover**) switches.

2.7.1 Protection Diodes for Relays

Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The diagram shows how a signal diode (e.g. 1N4148) is connected 'backwards' across the relay coil to provide this protection.
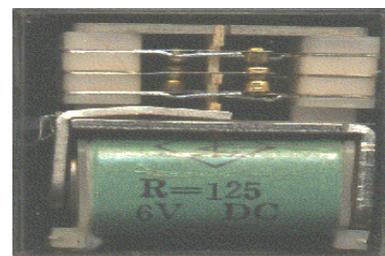

Figure 2.20 Relay

Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off. The sudden collapse of the magnetic field induces a brief high voltage across the relay coil which is very likely to

damage transistors and ICs. The protection diode allows the induced voltage to drive a brief current through the coil (and diode) so the magnetic field dies away quickly rather than instantly. This prevents the induced voltage becoming high enough to cause damage to transistors and ICs.
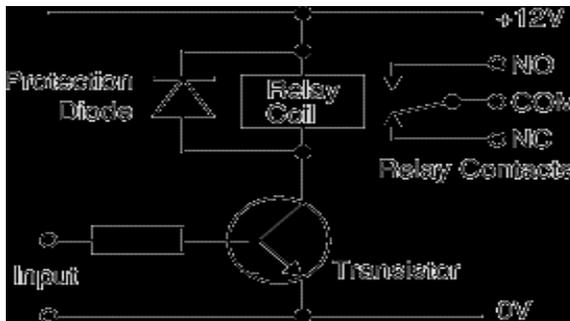

Figure 2.21 Working of Relay

2.7.2 Advantages of Relays

• Relays can switch **AC and DC**, transistors can only switch DC.

• Relays can switch **high voltages**, transistors cannot.

• Relays are a better choice for switching **large currents** (> 5A).

• Relays can switch **many contacts** at once.

3. HC-05 - BLUETOOTH TO SERIAL PORT MODULE

3.1 Overview

Figure 3.1 HC-05 Module

HC-05 module is an easy to use 3.3 Software features

• Default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity, Data control: has.

• Supported baud rate: 9600,19200,38400,57600,115200 ,230400,460800.

• Given a rising pulse in PIO0, device will be disconnected.

• Status instruction port PIO1: low-disconnected, high-connected;

Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.

Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

3.2 Hardware features

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector

3.3 Software features

- Default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity, Data control: has.

- Supported baud rate: 9600,19200,38400,57600,115200 ,230400,460800.
- Given a rising pulse in PIO0, device will be disconnected.
- Status instruction port PIO1: low-disconnected, high-connected;
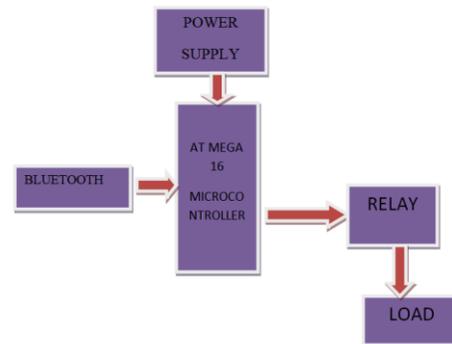
3.4 BLOCK DIAGRAM

Figure 3.2 Block Diagram

4. CIRCUIT DESCRIPTION

4.1. Power Supply

Power supply is the circuit from which we get a desired dc voltage to run the other circuits. The voltage we get from the main line is 230V AC but the other components of our circuit require 5V DC. Hence a step-down transformer is used to get 12V AC which is later

converted to 12V DC using a rectifier. The output of rectifier still contains some ripples even though it is a DC signal due to which it is called as Pulsating DC. To remove the ripples and obtain smoothed DC power filter circuits are used. Here a capacitor is used. The 12V DC is rated down to 5V using a positive voltage regulator chip 7805. Thus a fixed DC voltage of 5V is obtained.

4.2. Microcontroller Circuit

The output of the power supply is connected to the PIN-10(V_{cc}) & PIN-30(AV_{cc}) of the ATMega-16 microcontroller. The PIN-10&PIN-30 are connected by the wires.PIN-11 & PIN-31 is grounded. PIN-12 & PIN-13 are connected to the crystal oscillator. There are four ports in ATMega16 microcontroller. Here port-B is used for programming purpose, port-C is used for timer/counter purpose & port-D is used for serial communication. The microcontroller circuit is interfaced with the LCD, GSM-module & the relay driver. The microcontroller circuit is the heart of the system because it performs all the tasks and gives specific commands in order to control the devices. This happens due to the software burnt inside the microcontroller. When the microcontroller circuit powered on it gets the commands from the GSM module in SMS form. This SMS is decoded by the microcontroller .After decoding the SMS it sends the controlled instruction to the relay driver in order to operate the devices. One output is connected to the LCD to display the status of the devices whether it is in ON/OFF mode. After controlling the devices it sends its acknowledgement to the GSM module. Hence the overall control action is done by the microcontroller circuit without which the devices can't be controlled.

5. SOFTWARE LANGUAGE

5.1 Embedded C

5.1.1 What is an embedded system?

An embedded system is an application that contains at least one programmable computer and which is used by

individuals who are, in the main, unaware that the system is computer-based.

5.1.2 Which programming language should you use?

Having decided to use an AVR processor as the basis of your embedded system, the next key decision that needs to be made is the choice of programming language. In order to identify a suitable language for embedded systems, we might begin by making the following observations:

- Computers (such as microcontroller, microprocessor or DSP chips) only accept instructions in 'machine code' ('object codes'). Machine code is, by definition, in the language of the computer, rather than that of the programmer. Interpretation of the code by the programmer is difficult and error prone.

- All software, whether in assembly, C, C++, Java or Ada must ultimately be translated into machine code in order to be executed by the computer.

- Embedded processors – like the AVR – have limited processor

power and very limited memory available: the language used must be efficient.

- The language chosen should be in common use

5.1.3 Summary of C language Features

It is 'mid-level', with 'high-level' features (such as support for functions and modules), and 'low-level' features (such as good access to hardware via pointers).

- It is very efficient.

- It is popular and well understood.

- Even desktop developers who have used only Java or C++ can soon understand C syntax.

- Good, well-proven compilers are available for every embedded processor (8-bit to 32-bit or more).

5.1.4 Basic C program structure

```
//- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
//Basic blank C program that does nothing
// Includes
```

//- -
- - - - - - - - - -

#include <avr/io.h>

       // SFR declarations

Void main (void)

{

While (1);

{

Body of the loop   // Infinite loop

}

}   //

match the brace

5.1.5 Utility

This system is very useful in domestic applications to control the home appliances.

6. ADVANTAGES

- This is a very efficient and economical system.

- The control commands can be given easily through mobile.

- We can save our valuable time here.

- It can work on low power.

7. CONCLUSION AND FUTURE USE

Embedded system is a latest technology in now days which we used in our project for controlling our system with mobile.

Microcontroller is an overwhelming wireless technology launched which is working very efficiently in our project to Control all the working of the circuit. So no doubt that, in future this project will help in many functions of leading organisation.

By doing this project we have been acquainted with the controller working and their programming to make the system working.

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