A

Project Report

on

"Smart Agriculture Control System"

Submitted in partial fulfillment of the requirements

of the degree of

Bachelor Of Engineering In Electrical Engineering

Submitted by

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CERTIFICATE

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During the Academic year 2016-2017 submitted in partial fulfillment for the award of Degree of **'Bachelor of Engineering in Electrical Engineering from AIKTC-School of Engineering affiliated to University of Mumbai'**.

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DECLARATION

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included; I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

In India, agriculture is one of the influential sectors which affects the masses and has direct consequences towards the growth of our country. Farmers in our country, have to go through a lot of hardships to meet the demands of high yield. Conventional ways of watering have led to loss of soil nutrient, leaching, under/over irrigation, severely affecting the crop yield. Further, due to numerous issues such as resource management, changes in environmental conditions, etc., a need for efficiently managed Agriculture Control system is created. Thence, to address these issues, through this endeavor we present a design for automated setup which operates on GSM network and hence can be remotely controlled. To implement this, information is collected from the field through sensors and the inputs of the controller. To save the effort of the farmer just to check electricity status a status check feature is also added. The design provides a user friendly and reliable system which automatically intimates the user if any change of soil moisture transpires. Lastly, an attempt is made to streamline the system to in an economical way.

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Chapter 1

Introduction

As INDIA is Agricultural country, a lot of water required in Agricultural. At same time there are many areas where water scarcity problem is going on. To face this problem proper management of water control is required. Thus we prepared Farming system' project and it have three main purposes as below. To control water to farms as per soil moisture,We have used soil moisture sensor to check moisture content in soil continuously. And used micro controller to make automatic ON-OFF of pump according to moisture in soil.We have used Temperature sensor, Humidity sensor to sense temperature and humidity. These sensors sense the parameters and gives corresponding voltage output.

SMS/GSM based Water Pump Controller is a device which can control and monitor electric motors, agriculture pump sets through mobile phone. This is a GSM based remote controller to switch ON and OFF pump sets or any electric motor from remote location. It will only accept the message from the authorized User and not from anybody else. This SMS/GSM remote controller helps the farmer to handle agricultural pump sets easily. Farmer can set running time of pump set after it gets ON. It also helps the farmers to save life from snake bite in night time, saves water, time and electricity. One SIM Card is required for its operation.

In GSM based,the GSM Pump Controllers (Mobile Pump Starter) are specifically design to operate remote located submersible pumps and motors for benefit of farmers, agriculture people and industries where wireless pump and motor control required. Our GSM based mobile pump controller can manufactured with advanced micro controller technology and quality process. Yet these devices will affordable to customer.

1.1 Motivation

The objective of this project is to build system for benefit of farmers and Gardens where Automatic watering to farm or garden and prevention of crops and plants from rain is required. Water is so important thing today and also for future we need to do proper use and planning of water, thus proper care of farms and Gardens is required.

So we used our electronics and engineering concepts to manage not only water supply to farms.

Chapter 2

Literature Survey

In the project of V. Bhaskar et. Al. proposed GSM Based Motor Monitoring and Speed Control which was based on GSM technology based automatic control system. It contains speed controller for an Induction motor/DC motor and it perform the operations like start, stop, reverse the motor. [1]

In the project of G.Ulaganathan,AzhaPeriasamy, E. Muruganm ,n Embedded System Based Submersible Motor Control for Agricultural Irrigation Using GSM is presented .it is helpful to prevent over loading, dry running and single phasing automatically. [2]

In the project of Kamrul Hassan,Raziul Islam Siddiqui,Md. Takdirul Islam, NahidAlam Siddique," GSM Based Automatic Motor Control and Protection System", IJART Volume-2, Feb 2013 which states that control system is a system where we can shut down the machine whenever we want. That's the difference between controlled and uncontrolled machine. Our project is about make this control system efficient and dynamic. As the name suggested the automatic control is for controlling the motor from remote place, look over it's operating conditions, get feedback from the motor itself. Our target is to control the motor from distant place by mobile DTMF tone and also get feedback by SMS while it is in ON or OFF condition. We also ensure the safe operation of the motor by detecting the voltage of the source and ensure feedback from system while it is over or under voltage.

Again we also get these feedbacks by SMS as well. GSM network is everywhere in our country that's why we choose GSM network to operate our motor also transfer feedback information through it. We also use GSM network because if we use it then we don't need to establish extra equipment for net- working. To transmit feedback signals we use GSM modem at the motor end also generate control signal by mobile DTMF be- cause it is very easy to generate DTMF by mobile station and send feedback SMS by Modem as well. In industrial sector we hope our project is become handy and cost effective to operate motor and give it's protection.[3]

Venkata NarayanaEluri, K. Madhusudhana Rao, A. Srinag, "Wireless Solution for Water Saving In Agriculture Using Embedded System" proposed wireless solution for water saving in agriculture using embedded system. This paper presented a system which shows, how mobile communication can benefit millions of farmers in rural India by providing a solution for the irrigation problems caused by intermittent electrical power supply. Information is exchanged in form of messages/miscalls between the system and the user cell phones. The system is based onATMEGA32 micro-controller and includes protection against fluctuations in power supply. For measuring time and temperature.[4]

In the project of S.Sumeetha , D.Sharmila,"Embedded based Remote Control Application using Mobile

Phone in Irrigation" IJPCSC, Volume 3, March 2013 which states Agriculture is a subsistence of majority Indians and has great effect on the economy of the country. In a country like India, where climatic conditions change sustainably and irrigation facilities are poor. The main source for irrigation process is ground water. Nowadays ground water level is reduced drastically. In order to compensate this problem farmers are using both well and bore well to utilize ground water. This paper describes the automatic control of motor pumps by checking the level of well and bore well as a source for irrigation process. It prevents motor from dry running, single phasing and over loading. This paper presents the controlling and monitoring the level in well and bore well using GSM network. Level sensor is used to check the level in well and bore well. After checking the level controller sends the information to the user, depends on the level in the both well and bore well the user sends the message to the controller to turn on/off the motor by using GSM network.[5]

Ejiofor Virginia Ebere and Oladipo Onaolapo Francisca proposed a Micro controller based Automatic Water level Control System, The system used microcontroller to automate the process of water pumping in an over-head tank storage system and has the ability to detect

the level of water in a tank, switch on/off the pump accordingly and display the status on an LCD screen. This research has successfully provided an improvement on existing water level controllers by its use of calibrated circuit to indicate the water level and use of DC instead of AC power thereby eliminating risk of electrocution.[6][7]

Chapter 3

Block Diagram

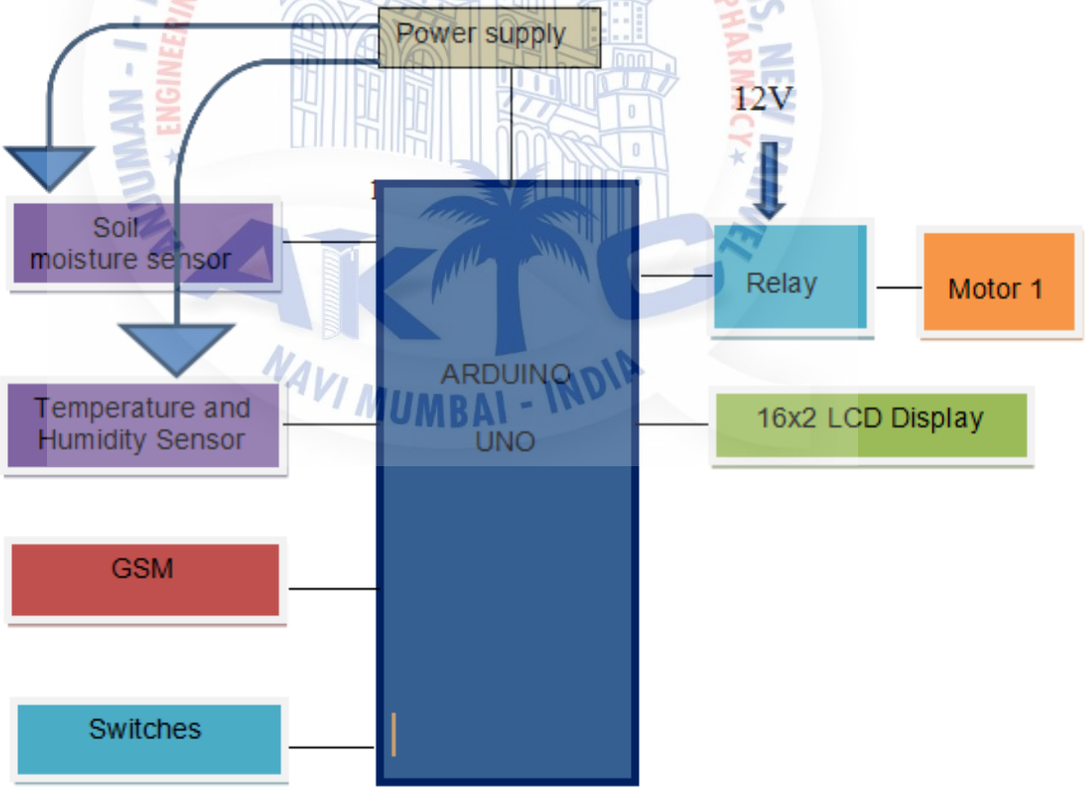

Figure 3.1 Block diagram of Agriculture Control System

Explanation of Block diagram of Farming System is as below:

3.1 Power supply unit

This section needs two voltages viz., +12 V & +5 V, as working voltages. Hence specially designed power supply is constructed to get regulated power supplies.

3.2 Micro controller ARDUINO UNO

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically [4]. The Arduino Uno is a microcontroller board based on the ATmega328, which is shown in Fig.5. Fig 5. ARDUINO Hardware . External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

3.3 Indicator

This stage provides visual indication of which relay is actuated and deactivated, by glowing respective LED.

3.4 LCD Display

We have used 16×2 alphanumeric Liquid Crystal Display (LCD) which means it can display alphabets along with numbers on 2 lines each containing 16 characters. This display should be placed outside the room. It displays various messages.

3.5 Soil moisture sensor

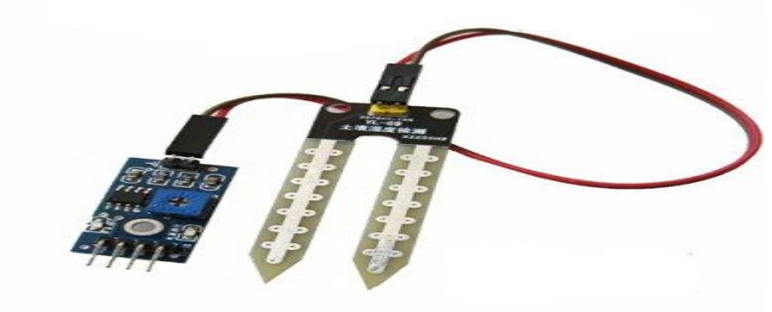

Fig. 3.2 Soil Moisture Sensor

Soil moisture is a key variable in controlling the exchange of water and heat energy between the land surface and the atmosphere through evaporation and plant transpiration.

As a result, soil moisture plays an important role in the development of weather patterns and the production of precipitation.

3.6 Temperature and Humidity Sensor

We are going to use Temperature sensor, Humidity sensor to sense temperature and humidity. These sensors sense the parameters and gives corresponding voltage output.

3.7 Relay

Fig. 3.3 Relay

A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. It has one common terminal and 2 contacts in 2 different configurations: one can be Normally Closed and the other one is opened or it can be Normally Open and the other one closed. It requires 5V Dc supply for working. When it get signal at input pins, it changes state of contacts from open to close or vice versa.

3.8 Pump(Motor)

12V motor used as pump.

Fig. 3.4 DC Motor

3.9 GSM

GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

Chapter 4

Principle of Working

4.1 Working Principle

Soil moisture sensor will sense moisture contents in soil. When moisture contents reduced than required sensor will send signal to micro-controller and micro-controller will send signal to relay or driver to make pump/ motor ON. And so moisture in water will increase, once it reached required level sensor will again send signal and micro-controller will make motor OFF. We have used Temperature sensor, Humidity sensor to sense temperature and humidity. These sensors sense the parameters.

Remotely control motor operation happens with Micro-controller and GSM. Whenever user gives a message through GSM as 'Yes', micro-controller will receive that signal. Then micro-controller will give outputs according program. For 'Yes' message, it will give signal to relay so that relay will give signal to motor to get ON and LCD and indicators will display output as motor ON. Similar operation will happen for motor OFF operation.

4.2 Flow Chart

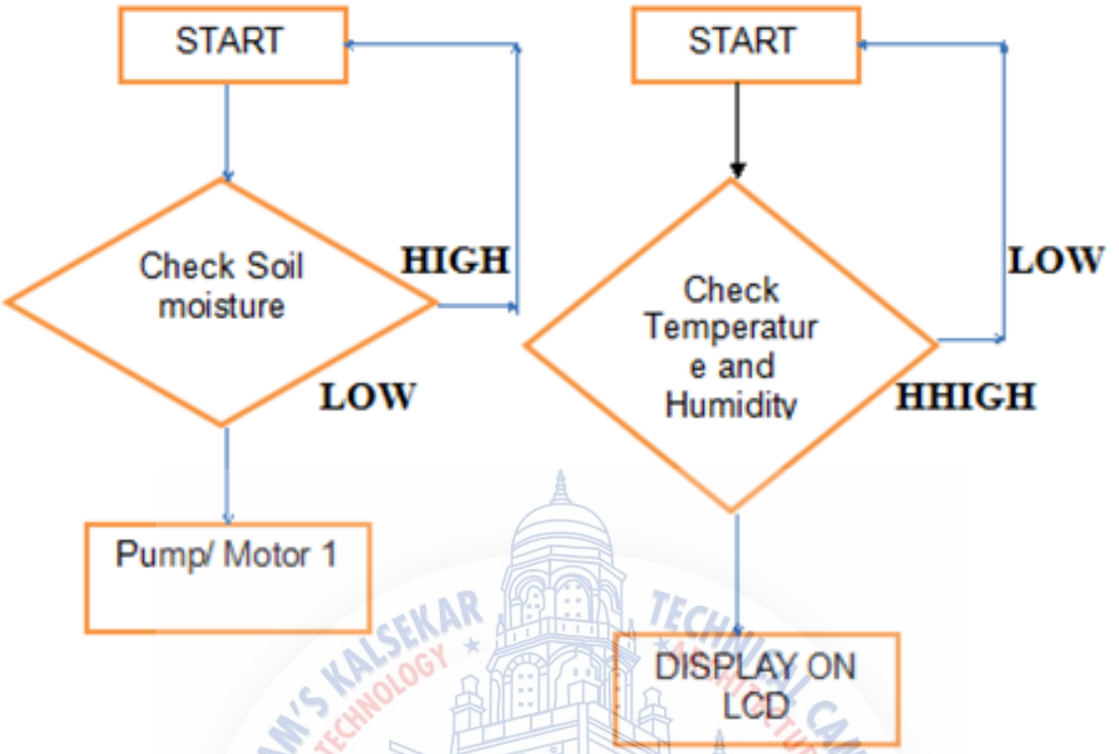

Fig. 4.1 Flowchart

For soil moisture sensor, first it will check the moisture in the soil, if the value is HIGH, then it will again check it and it goes in loop. Under abnormal condition, if the value is LOW, it goes to the pump/motor 1 and the abnormal value is printed on the LCD.

For Temperature and Humidity Sensor, if the value is LOW, then it will check the condition and it goes in loop. Under abnormal condition that is if it is HIGH it will print the abnormal values on the LCD.

Chapter 5

Hardware Implementation

5.1 Microcontroller

Arduino board is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform.

Our Arduino board does two jobs in this project. Firstly it controls the motor of Soil Moisture sensor and the Temp and Humidity sensor. Secondly it collects data s from GSM , Soil Moisture sensor and Temp and Humidity sensor and then the microcontroller shows the output on the 16x2 LCD Display

Arduino board is connected to GSM modem in which transmitter of Arduino is connected to the receiver of GSM modem and receiver of Arduino is connected to the transmitter of GSM modem. GSM modem is working simply like a mobile phone when we message on the number of GSM modem it replies back and can be operated according to the coding which we have done in microcontroller. The soil moisture sensor and temperature sensor are connected to analog pins of an Arduino board. 5v power supply is generated from USB cable which is connected to Arduino board. First of all GSM/GPRS

module is initialized and waits until it connects to the network.12v power supply is scheduled to the GSM module through adapter. The red light indicator illustrates GSM is ON. The data sensed by soil moisture sensor and temperature sensor is transmitted to micro-controller. Threshold values are programmed into an Arduino board initially. So, the values which are received from sensors are compared with threshold values. If the readings from the temperature sensor are more than the threshold value and the soil moisture reading is lesser than the threshold value. Then a SMS alert is sent to the user by GSM module. Then the motor pump is switched ON by the user as soon as the message ON is received.

5.2 Circuit diagram

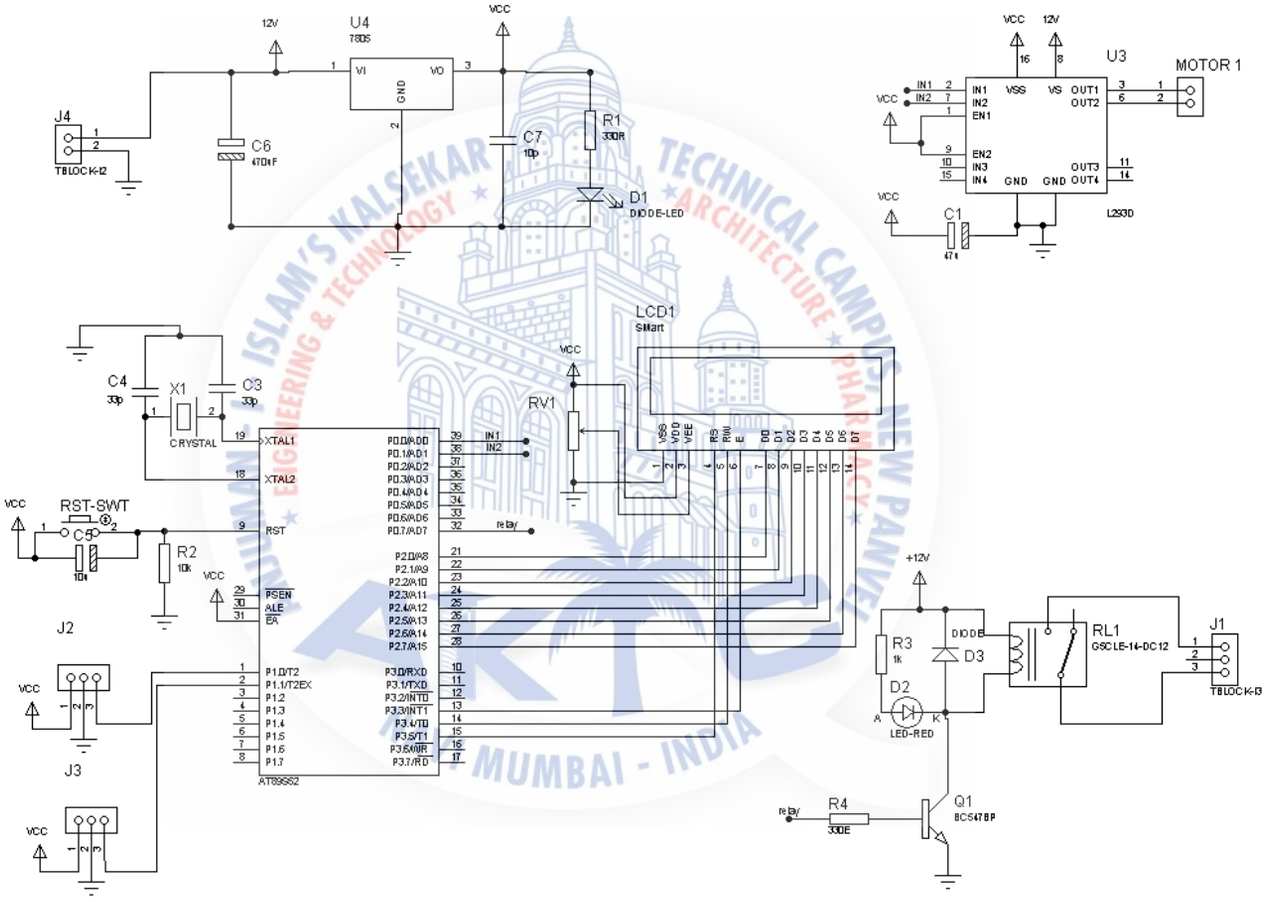

Fig 5.1 Circuit Diagram

Power supply is of 12V supply has taken from adapter. 7805 regulator used to get regulated 5V. 5V has used for sensors and 12V used for motor driver and relay. Capacitors used for filtration of supply.Crystal oscillator of 11.0592MHz used to give clock pulse to microcontroller.Reset circuit used to reset microcontroller as shown in circuit diagram. Soil moisture sensor and Temperature and Humidity sensor has connected at input of microcontroller. Module to reach the threshold value is set in the soil moisture, DO port

output high, when the soil humidity exceeds a set threshold value, the module D0 output low. The digital output D0 can be connected directly with the microcontroller to detect high and low by the microcontroller to detect soil moisture. We have used Temperature sensor, Humidity sensor to sense temperature and humidity. These sensors sense the parameters and gives corresponding voltage output. GSM is connected to give message to the user . Whenever user gives a message through GSM microcontroller will give signal to relay to make motor ON/OFF. At output pins of microcontroller LCD connected to show status of circuit and system. Microcontroller will give signal to relay according to sensor signal. Microcontroller will work according to program loaded in it. When soil moisture sensor give HIGH signal, microcontroller will give signal to relay/ to make motor ON and when sensor is LOW microcontroller will give signal to make motor OFF. Similarly when Temperature sensor, Humidity sensor sensor HIGH, microcontroller will give signal to send a message to the user.

5.3 PCB Designing & Soldering Techniques

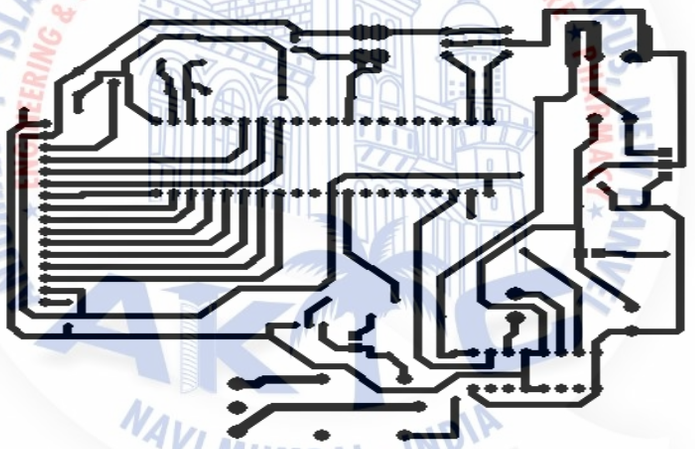

Fig. 5.2 PCB Layout

5.3.1 PCB Designing

Design your circuit board. Use PCB computer-aided design (CAD) software to draw your circuit board. You can also use a perforated board that has pre-drilled holes in it to help you see how your circuit board's components would be placed and work in reality. Buy a plain board that is coated with a fine layer of copper on one side from a retailer. Scrub the board with a scouring pad and water to make sure the copper is clean. Let the board dry.

Print your circuit board's design onto the dull side of a sheet of blue transfer paper. Make sure the design is oriented correctly for transfer. Place the blue transfer paper on the

board with the circuit board's printed design against the copper.Lay a sheet of ordinary white paper over the blue paper. Following the transfer paper's instructions, iron over the white and blue paper to transfer the design onto the copper board. Iron every design detail that appears near an edge or corner of the board with the tip of the iron.Let the board and blue paper cool. Peel the blue paper slowly away from the board to see the transferred design.

Examine the transfer paper to check for any black toner from the printed design that failed to transfer to the copper board. Make sure the board's design is oriented correctly. Replace any missing toner on the board with ink from a black permanent marker. Allow the ink to dry for a few hours. Remove exposed parts of the copper from the board using ferric chloride in a process called etching.

Put on old clothes, gloves and safety goggles. Warm the ferric chloride stored in a non-corrosive jar and sealed with a non-corrosive lid, in a bucket of warm water. Do not heat it above 115 F (46 C) to prevent toxic fumes from being released. Pour only enough ferric chloride to fill a plastic tray that has plastic risers in it to rest the circuit board on. Be sure to do this in a well-ventilated space. Use plastic tongs to lay the circuit board face down on the risers in the tray. Allow 5 to 20 minutes, depending on the size of your circuit board, for the exposed copper to drop off the board as it etches away. Use the plastic tongs to agitate the board and tray to allow for faster etching if necessary. Wash all the etching equipment and the circuit board thoroughly with plenty of running water.

Drill 0.03 inch (0.8 mm) lead component holes into your circuit board with high-speed steel or carbide drill bits. Wear safety goggles and a protective mask to protect your eyes and lungs while you drill. Scrub the board clean with a scouring pad and running water. Add your board's electrical components and solder them into place.

5.3.2 SOLDERING TECHNIQUES:

Soldering is the only permanent way to ‘fix’ components to a circuit. However, soldering requires a lot of practice as it is easy to ‘destroy’ many hours preparation and design work by poor soldering.

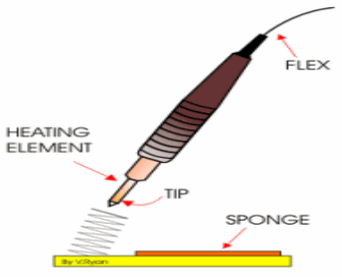

Fig. 5.3 Solder

Use a soldering iron in good condition. Inspect the tip to make sure that it is not past good operation. If it looks in bad condition it will not help you solder a good joint. The shape of the tip may vary from one soldering iron to the next but generally they should look clean and not burnt.

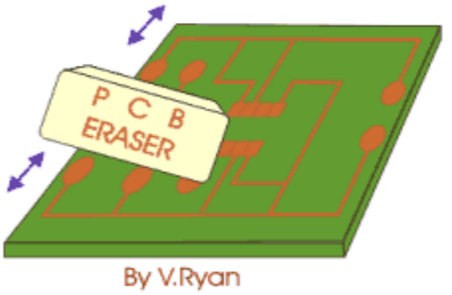

Fig. 5.4 PCB Eraser

A PCB eraser is used to remove any film from the tracks. This must be done carefully because the film will prevent good soldering of the components to the PCB. The track can be checked using a magnified glass. If there are gaps in the tracks, sometimes they can be repaired using wire but usually a new PCB has to be etched

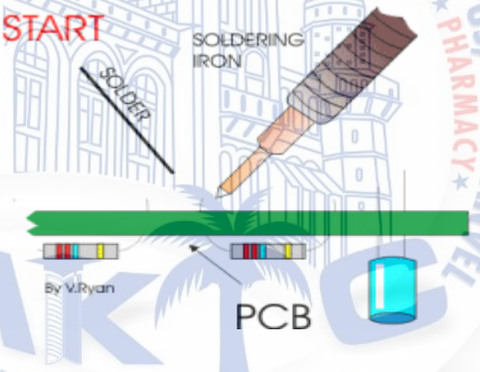

Fig. 5.5 PCB Soldering

The heated soldering iron should then be placed in contact with the track and the component and allowed to heat them up. Once they are heated the solder can be applied. The solder should flow through and around the component and the track. Having completed soldering the circuit the extended legs on the components need to be trimmed using wire clippers. The circuit is now ready for testing.

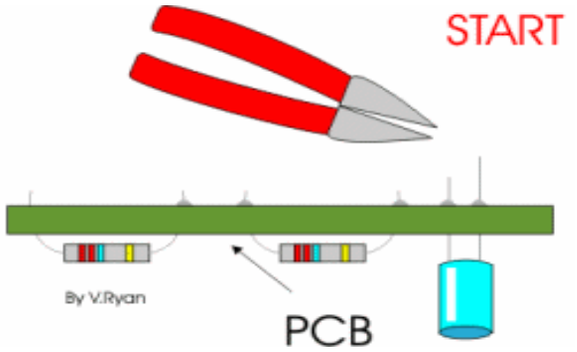

Fig. 5.6 PCB Finishing

5.4 Component list

Arduino Uno

Voltage regulator - IC 7805

Capacitor - 470uf, 10uf, 33pf

Resistor - 330Ω, 10k, 1k

LED – Red

Soil Moisture Sensor

Temperature and Humidity Sensor

LCD

GSM

Motor

Crystal oscillator

5.5 Arduino Uno

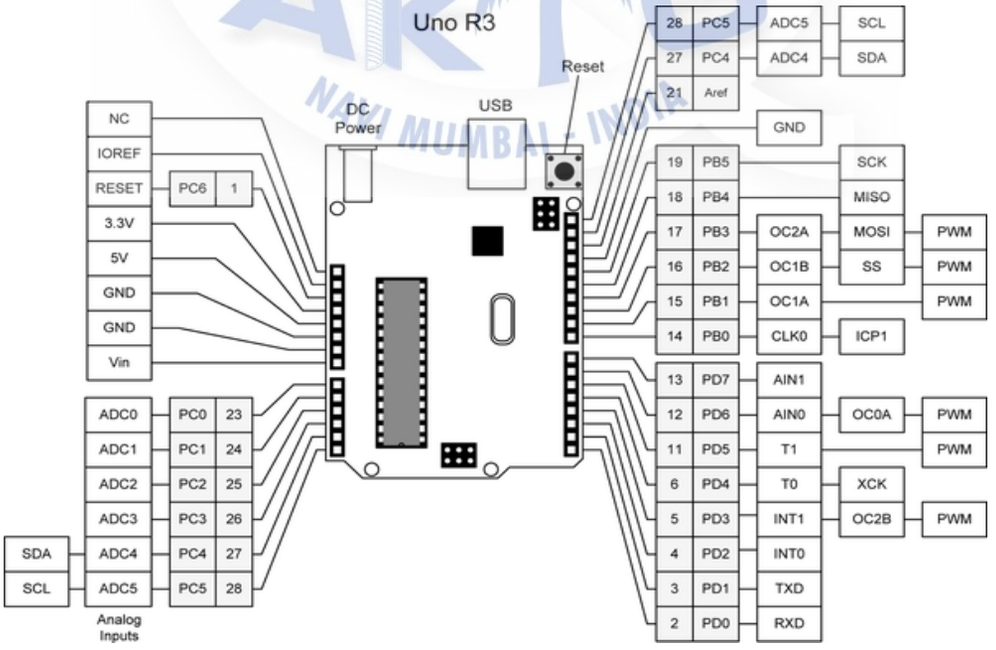

Fig. 5.7 Arduino UNO Pin Configuration

The Atmel® picoPower® Atmega328/P is a low-power CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328/P achieves through puts close to 1MIPS per MHz. This empowers system designer to optimize the device for power consumption versus processing speed.

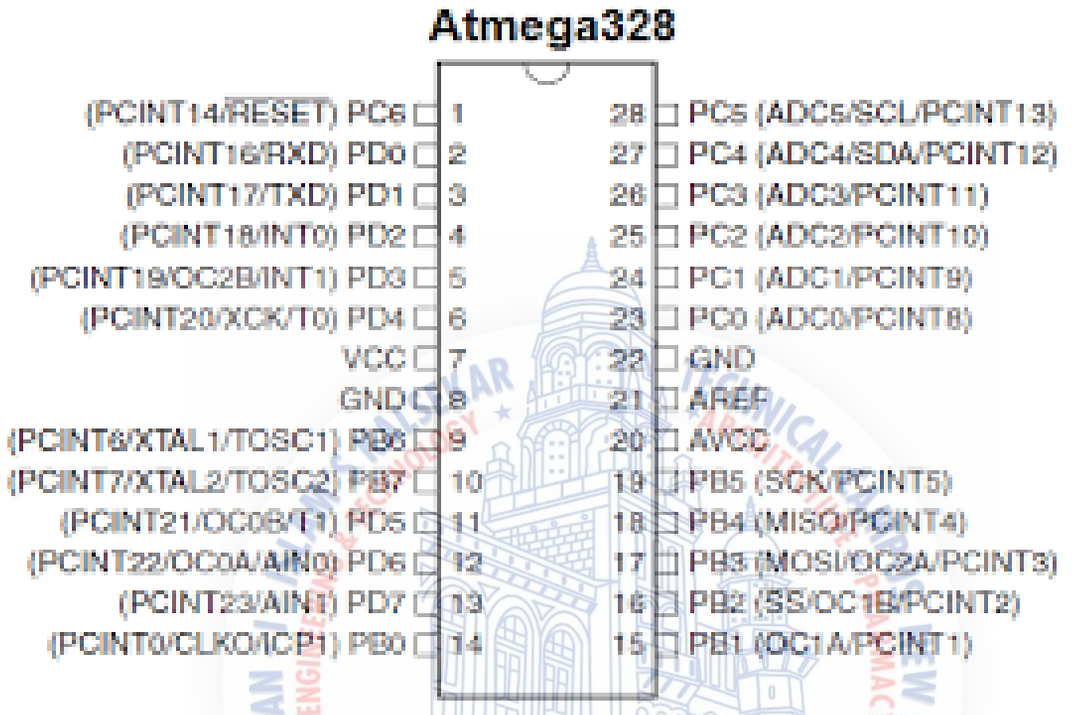

Fig. 5.8 Atmega 328 Microcontroller

5.6 Features:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

5.7 Power supply

Many electronic circuits need a direct current (DC) voltage source, but what we commonly find are voltage sources of alternating current (AC).In order to achieve a direct current voltage source, the alternating current input must follow a conversion process called AC to DC conversion.

In our project instead of designing AC to DC conversion circuit we have used the 12 volt adapter for simplification. An adapter is a device that converts attributes of one electrical device or system to those of an otherwise incompatible device or system. An electric power adapter may enable connection of a power plug, An AC adapter, also called a "recharger", is a small power supply that changes household electric current from distribution voltage (in the range 100 to 240 volts AC) to low voltage DC suitable for consumer electronics.

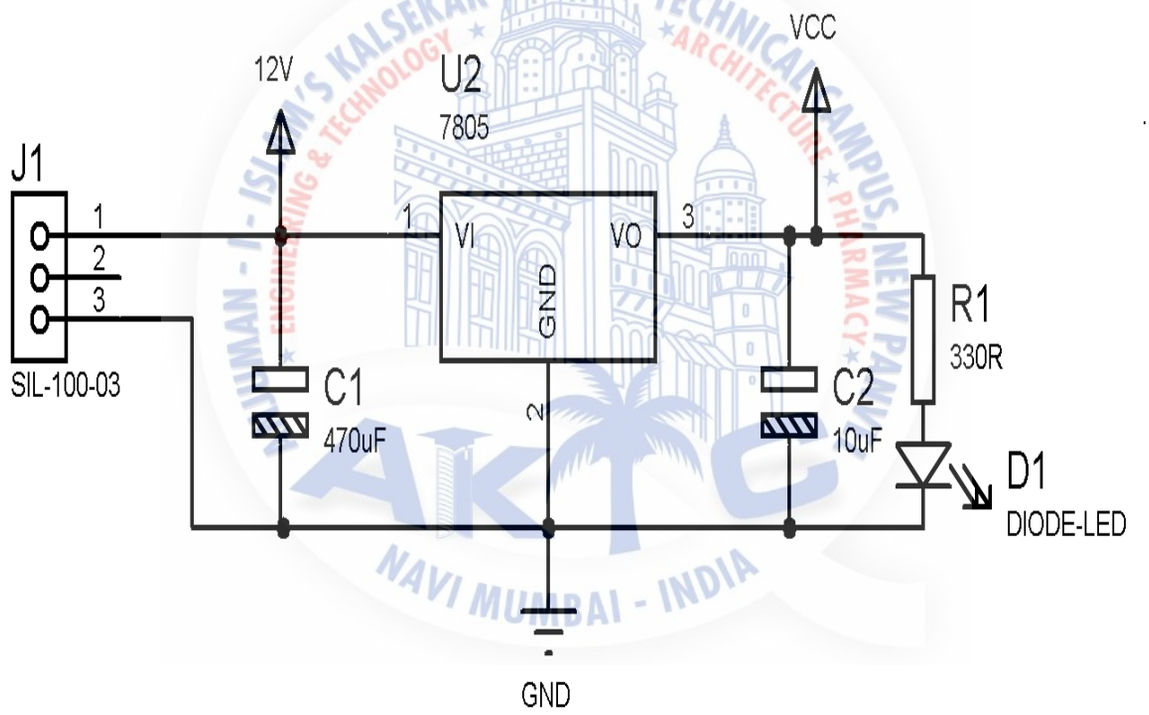

Fig. 5.9 Circuit Diagram of Power Supply

Part list for power supply:

IC 7805 Voltage regulator

Capacitor

C1 - 470uf

C2 - 10uf

Resistor –R1 330 ohm

LED-red

5.8 IC 7805

7805 is a voltage regulator integrated circuit. A voltage regulator is necessary to maintain a constant output dc voltage by providing line regulation and load regulation. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

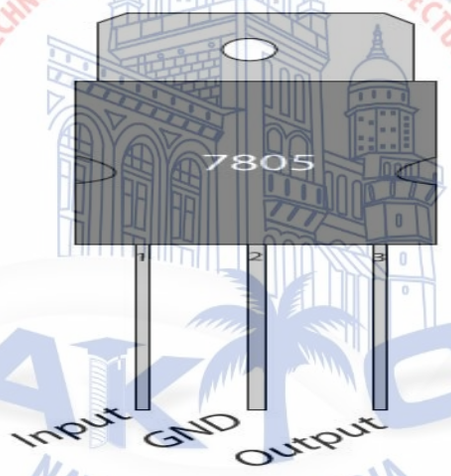

Fig. 5.10 Voltage Regulator

5.9 Pin Description:

Table 5.1 Pin Description

Pin No	Function	Name
1	Input voltage (5V-18V)	Input
2	Ground (0V)	Ground
3	Regulated output; 5V (4.8V-5.2V)	Output

5.10 Battery

The most common form of nine-volt battery is commonly called the transistor battery which was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in pocket radios and other small electronic devices. They are also used as backup power to keep the time in certain electronic clocks. This format is commonly available in primary carbon-zinc and alkaline chemistry, in primary lithium iron di-sulfide, and in rechargeable form in nickel-cadmium, nickel-metal hydrode and lithium-ion. Mercury oxide batteries in this form have not been manufactured in many years due to their mercury content. This type is designated NEDA 1604, IEC 6F22 and "Ever Ready" type PP3 (zinc-carbon) or MN1604 6LR61 (alkaline).

Most nine-volt alkaline batteries are constructed of six individual 1.5V LR61 cells enclosed in a wrapper. These cells are slightly smaller than LR8D425 AAAA cells and can be used in their place for some devices, even though they are 3.5 mm shorter. Carbon-zinc types are made with six flat cells in a stack, enclosed in a moisture-resistant wrapper to prevent drying. As of 2007, 9-volt batteries accounted for 4% of alkaline primary battery sales in the US. In Switzerland as of 2008, 9-volt batteries consist 2% of primary battery sales and 2% of secondary battery sales. Other nine-volt batteries of different sizes exist, such as the British "Ever Ready" PP series and certain lantern batteries.

5.11 Temperature and Humidity Sensor

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

5.12 Soil Moisture Sensor

Soil moisture module is most sensitive to the ambient humidity is generally used to detect the moisture content of the soil.

5.13 Motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. The reverse of this would be the conversion of mechanical energy into electrical energy and is done by an electric generator.

Fig. 5.11 DC Motor

In normal motoring mode, most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force within the motor. In certain applications, such as in the transportation industry with traction motors, electric motors can operate in both motoring and generating or braking modes to also produce electrical energy from mechanical energy.

Found in applications as diverse as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and disk drives, electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as from the power grid, inverters or generators. Small motors may be found in electric watches. General-purpose motors with highly standardized dimensions and characteristics provide convenient mechanical power for industrial use. The largest of electric motors are used for ship propulsion, pipeline compression and pumped-storage applications with ratings reaching 100 megawatts.

Electric motors may be classified by electric power source type, internal construction, application, type of motion output, and so on. Electric motors are used to produce linear or rotary force (torque), and should be distinguished from devices such as magnetic solenoids and loudspeakers that convert electricity into motion but do not generate usable mechanical powers, which are respectively referred to as actuators and transducers.

5.14 Motor Construction

Stator

The stator is the stationary part of the motor's electromagnetic circuit and usually consists of either windings or permanent magnets. The stator core is made up of many thin metal sheets, called laminations. Laminations are used to reduce energy losses that would result if a solid core were used.

Air gap

The distance between the rotor and stator is the air gap. The air gap has important effects, and is generally as small as possible, as a large gap has a strong negative effect on the performance of an electric motor. It is the main source of the low power factor at which motors operate. The air gap increases magnetizing current. For this purpose, air gap should be small. Very small gaps may pose mechanical problems in addition to noise and losses.

Windings

Windings are wires that are laid in coils, usually wrapped around a laminated soft iron magnetic core so as to form magnetic poles when energized with current.

Electric machines come in two basic magnet field pole configurations: salient-pole machine and non-salient-pole machine. In the salient-pole machine the pole's magnetic field is produced by a winding wound around the pole below the pole face. In the non-salient-pole, or distributed field, or round-rotor, machine, the winding is distributed in pole face slots. A shaded-pole motor has a winding around part of the pole that delays the phase of the magnetic field for that pole.

Some motors have conductors which consist of thicker metal, such as bars or sheets of metal, usually copper, although sometimes aluminum is used. These are usually powered by electromagnetic induction.

Commutator

A commutator is a mechanism used to switch the input of most DC machines and certain AC machines consisting of slip ring segments insulated from each other and from the electric motor's shaft. The motor's armature current is supplied through the

stationary brushes in contact with the revolving commutator, which causes required current reversal and applies power to the machine in an optimal manner as the rotor rotates from pole to pole. In absence of such current reversal, the motor would brake to a stop. In light of significant advances in the past few decades due to improved technologies in electronic controller, sensorless control, induction motor, and permanent magnet motor fields, electromechanically commutated motors are increasingly being displaced by externally commutated induction and permanent-magnet motors.

5.15 LCD

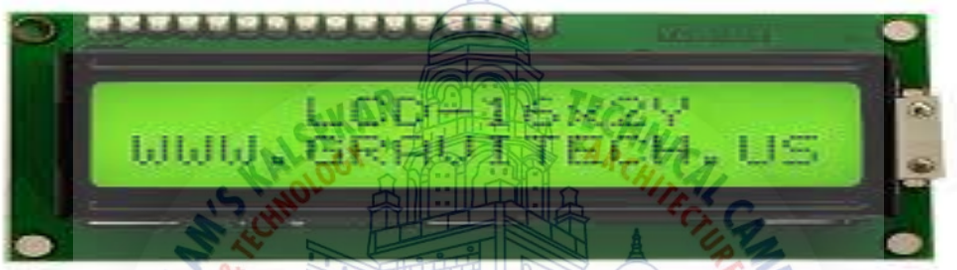

Fig. 5.12 LCD Display

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. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

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.

Table 5.2 Internal Structure of LCD

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

5.16 Interfacing LCD with Microcontroller

LCD initialization.

The steps that has to be done for initializing the LCD display is given below and these steps are common for almost all applications.

- Send 38H to the 8-bit data line for initialization
- Send 0FH for making LCD ON, cursor ON and cursor blinking ON.
- Send 06H for increment cursor position.
- Send 01H for clearing the display and return the cursor.

Sending data to the LCD.

The steps for sending data to the LCD module is given below. I have already said that the LCD module has pins namely RS, R/W and E. It is the logic state of these pins that make the module to determine whether a given data input is a command or data to be displayed.

Make R/W low.

Make RS=0 if data byte is a command and make RS=1 if the data byte is a data to be displayed.

Place data byte on the data register.

Pulse E from high to low.

Repeat above steps for sending another data.

5.17 Circuit diagram

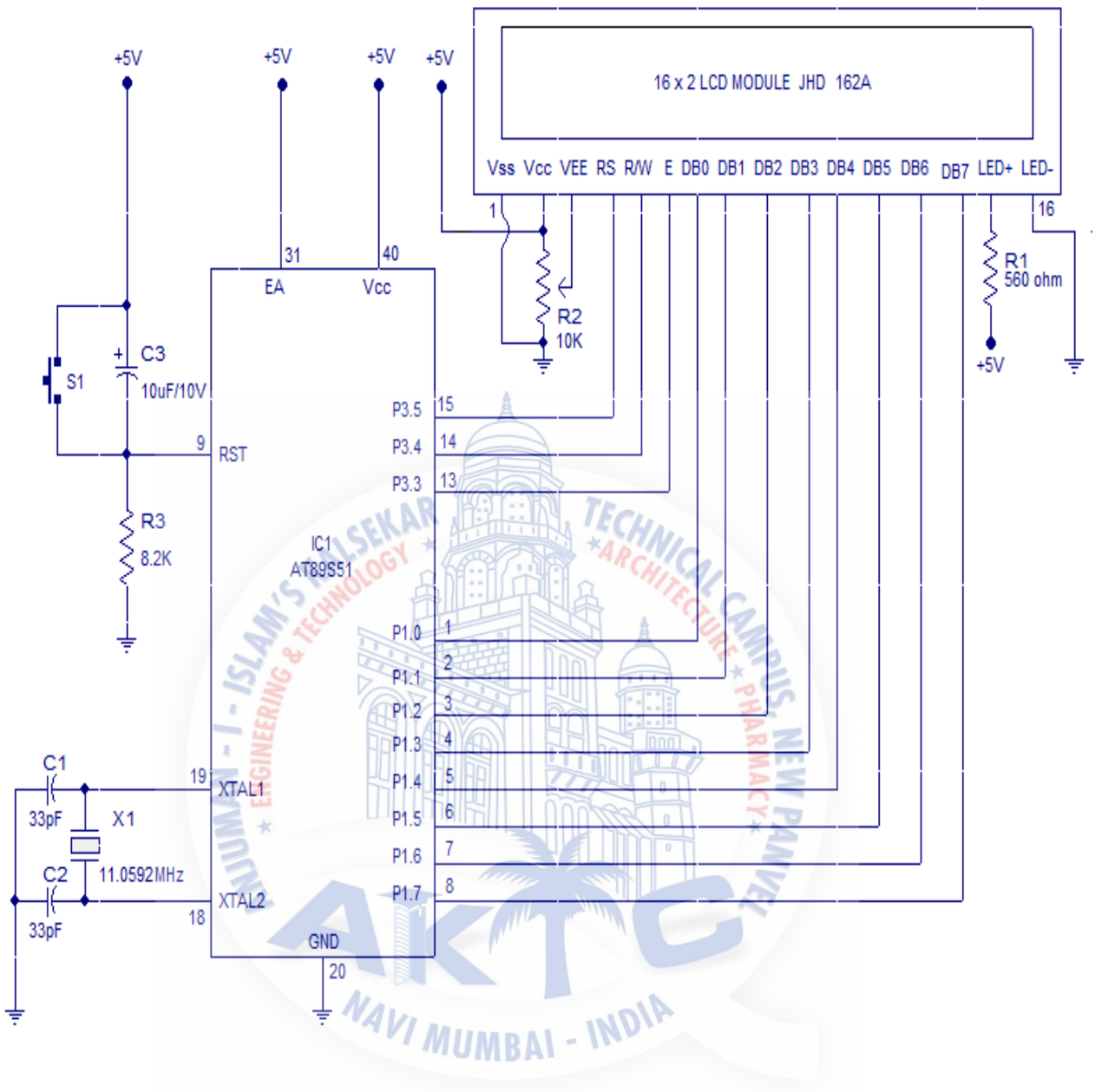

Fig. 5.13 Circuit Diagram

5.18 GSM

GSM, which stands for *G*lobal *S*ystem for *M*obile communications, reigns as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. The origins of GSM can be traced back to 1982 when the Groupe Spécial Mobile (GSM) was created by the European Conference of Postal and Telecommunications Administrations (CEPT) for the purpose of designing a pan-European mobile technology.

It is approximated that 80 percent of the world uses GSM technology when placing wireless calls, according to the GSM Association (GSMA), which represents the interests of the worldwide mobile communications industry. This amounts to nearly 3 billion global people Cell phone carriers T-Mobile and AT&T use GSM for their cell phone networks. Sprint, Virgin Mobile and Verizon Wireless use the competing CDMA standard. For practical and everyday purposes, GSM offers users wider international roaming capabilities than other U.S. network technologies and can enable a cell phone to be a "world phone". More advanced GSM incorporates the earlier TDMA standard. GSM carriers have roaming contracts with other GSM carriers and typically cover rural areas more completely than competing CDMA carriers (and often without roaming charges, too). GSM also has the advantage of using SIM (*S*ubscriber *I*dentity *M*odule) cards in the U.S. The SIM card, which acts as your digital identity, is tied to your cell phone service carrier's network rather than to the handset itself. This allows for easy exchange from one phone to another without new cell phone service activation. GSM uses digital technology and is a second-generation (2G) cell phone system. GSM, which predates CDMA, is especially strong in Europe. EDGE is faster than GSM and was built upon GSM

What is GSM?

Mobile Communication System - Global system for mobile communication - GSM - is a wide area wireless communications system that uses digital radio transmission to provide voice, data, and multimedia communication services. A GSM system coordinates the communication between mobile telephones (mobile stations), base stations (cell sites), and switching systems.

Digital Media Formats - GSM is designed to transfer digital information. The initial version of GSM transmitted digital media in circuit switched (continuous transmission) form and later versions of GSM deliver data in packet data form.

Functional Sections - GSM system is composed of three key sections:

Mobile Stations (MS) - A device that converts media to and from GSM radio signals.

Base Station Subsystem (BSS) - Assemblies that convert digital signals to radio signals that can be sent to mobile devices and receive radio signals that can be converted back to their digital form. The BSS is divided into base station - BS - parts that are located at the cell site and base station controllers - BSC - that coordinate the distribution and reception of communication connections

Network and Switching System (NSS) - The NSS performs the interconnection between the base station parts and other networks such as the public switched telephone network - PSTN - and public Internet. The NSS is composed of circuit data and packet data switches, databases, and administrative control services.

A GSM network consists of several functional entities, whose functions and interfaces are defined. The GSM network can be divided into following broad parts.

- The Mobile Station (MS)
- The Base Station Subsystem (BSS)
- The Network Switching Subsystem (NSS)s
- The Operation Support Subsystem (OSS)

Following is the simple architecture diagram of GSM Network:

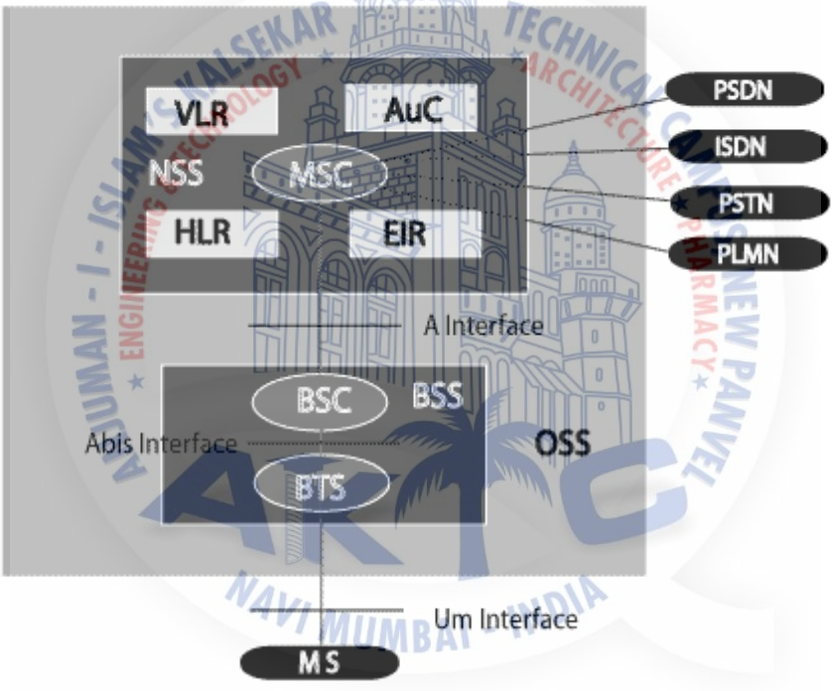

Fig. 5.14 Architecture of GSM Network

The added components of the GSM architecture include the functions of the databases and messaging systems:

- Home Location Register (HLR)
- Visitor Location Register (VLR)
- Equipment Identity Register (EIR)
- Authentication Center (AuC)

- SMS Serving Center (SMS SC)
- Gateway MSC (GMSC)
- Chargeback Center (CBC)
- Transcoder and Adaptation Unit (TRAU)

Following is the diagram of GSM Network along with added elements:

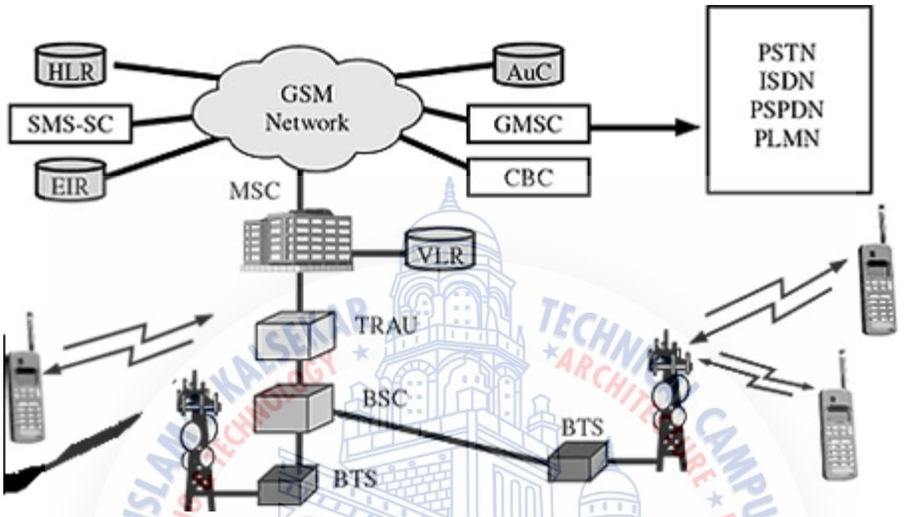

Fig. 5.15 Additional Elements of GSM Network

The MS and the BSS communicate across the Um interface, also known as the air interface or radio link. The BSS communicates with the Network Service Switching center across the A interface.

In a GSM network, the following areas are defined:

- **Cell:** Cell is the basic service area: one BTS covers one cell. Each cell is given a Cell Global Identity (CGI), a number that uniquely identifies the cell.
- **Location Area:** A group of cells form a Location Area. This is the area that is paged when a subscriber gets an incoming call. Each Location Area is assigned a Location Area Identity (LAI). Each Location Area is served by one or more BSCs.

- **MSC/VLR Service Area:** The area covered by one MSC is called the MSC/VLR service area.
- **PLMN:** The area covered by one network operator is called PLMN. A PLMN can contain one or more MSCs.

Chapter 6

General Components

6.1 Resistors

Fig. 6.1 Resistor

In many electronic circuit applications, the resistance forms the basic part of the circuit. The reason for inserting the resistance is to reduce current or to produce the desired voltage drop. These components which offer value of resistance are known as resistors. Resistors may have fixed value i.e., whose value cannot be changed and are known as fixed resistors. Such of those resistors whose value can be changed or varied are known as variable resistors.

There are two types of resistors available. They are:

1. Carbon resistors.

2. Wire wound resistors.

Carbon resistors are used when the power dissipation is less than 2W because they are smaller and cost less. Wire wound resistors are used where the power dissipation is more than 5W. In electronic equipment's carbon resistors are widely used because of their smaller size. All resistors have three main characteristics; Its resistance R in ohms (from 1 ohm to many mega ohms). Power rating (from several 0.1W to 10 W). Tolerance (in percentage).

+

6.2 Resistor Color Coding

The carbon resistors are small in size and are color coded to indicate their resistance value in ohms. Different colors are used to indicate the numeric values. The dark colors represent lower values and the lighter colors represent the higher values. The color code has been standardized by the electronic industries association.

The color bands are printed at one end of the resistors and are read from the left to right. The first color band closed to the edge indicates the first digit in the value of resistance .The second band gives the second digit. The third band gives the number of zero's after two digits . The resulting number is the resistance in ohms . A fourth band indicates the tolerance i.e., to indicate how accurate the resistance value is , the bands are shown in the figure 1.

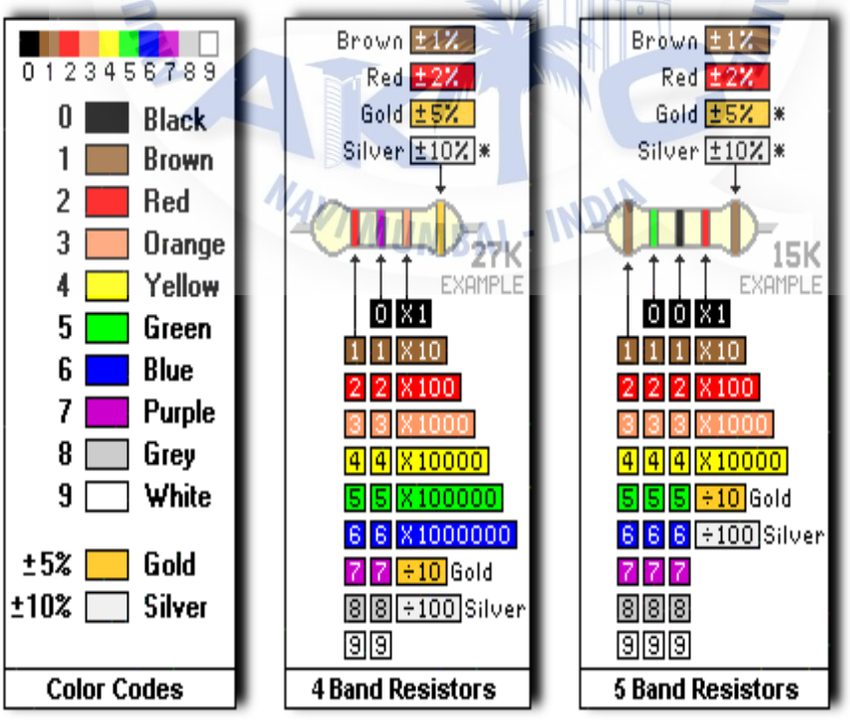

Fig. 6.2 Colour code for Resistor

6.3 Preset

Fig. 6.3 Preset

There are two general categories of variable resistors:

1. General purpose resistors.

2. Precision resistors.

The general purpose type can again be wire wound type and carbon type .These follows either linear or logarithmic law. The precision type are always wire wound and follow a linear law .The variable resistors can be broadly classified as potentiometer , rheostats , presets and decade resistance boxes.

The general purpose wire wound potentiometers are available in 1, 2, 3 and 4 watts. The usual tolerances ratings 10 % and 20% are available. The widely used potentiometers are of the standard diameters 19mm, 31mm, and 44mm. The temperature coefficient depends on the wire used and on the resistors values. The resolution of these wire wound resistors is proper than carbon resistors because the wiper has to move from one winding to the other, where as in carbon potentiometers it is continuous. These resistors are highly linear, the linearity falling with 1%.

6.4 Capacitors

Devices which can store electronic charge are called capacitors. Capacitance can be understood as the ability of a dielectric to store electric charges. Its unit is Farad, named after the Michael Faraday. The capacitors are named according to the dielectric used. Most common ones are air, paper, and mica, ceramic and electrolytic capacitors.

Physically a capacitor has conducting plates separated by an insulator or the dielectric. The plates of the capacitor have opposite charge, this gives rise to an electric field .In capacitor the electric field is concentrated in the dielectric between the plates.

Like resistors, capacitors are also crucial to the correct working of nearly every electronic circuit and provide us with a means of storing electrical energy in the form of an electric field. Capacitors have numerous applications including storage capacitors in power supplies, coupling of A.C. signals between the stages of an amplifier, and decoupling power supply rails so that, As far as A.C. signal components are concerned, the supply rails are indistinguishable from zero volts.

6.5 Types Of Capacitors

6.5.1 Disc Capacitors :

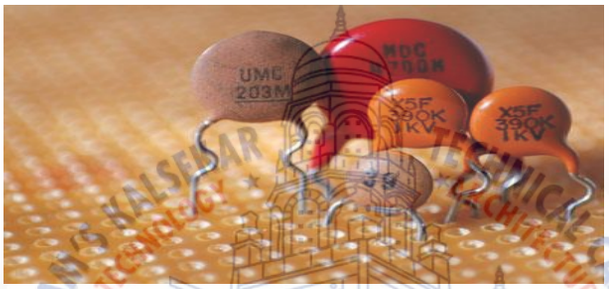

Fig. 6.4 Disc Capacitors

In the disk form, silver is fired on to both sides of the ceramic to form the conductor plates. The sheets are then baked and cut to the appropriate shape and size & attached by pressure contact and soldering . These have high capacitance per unit volume and are very economical. The disks are lacquered or encapsulated in plastic or Phenolic molding. Round disk are used at high voltages the capacitance of values upto 0.01F can be obtained. They have tolerance of +20% or –20%. In general these capacitors have voltage ratings up to 750 V D.C.

6.5.2 Electrolytic Capacitors :

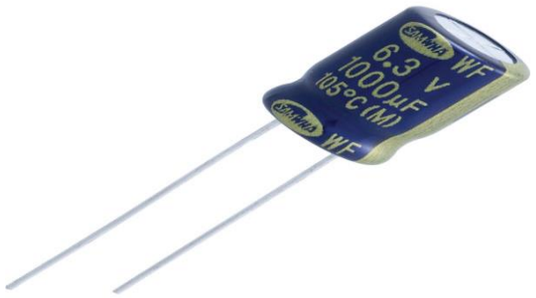

Fig. 6.5 Electrolytic Capacitors

These capacitors derive the name from electrolyte which is used as a medium to produce high dielectric constants. These capacitors have low value for large capacitance at low working voltages.

There are two types of Electrolytic capacitors:

1. Aluminum Electrolytic capacitors.

2. Tantalum electrolytic capacitors.

Electrolytic capacitors are used in circuits that have combination of D.C. voltage and A.C. The D.C. voltage maintains the polarity . They are used as 'ripple filter ' where large capacitance are required at low cost in small space . They are also used as 'biased capacitors ' and 'decoupling capacitors ' and even as 'coupling capacitors ' in R- C amplifier.

6.6 Color Coding

Mica and tubular ceramic capacitors are color coded to indicate a capacitance value . As coding is necessary only for very small sizes, color coded capacitors value is also in the pF.The colors are the same as for the resistor coding from black for '0' upto white for '9'. Mica capacitors use 'six dot code system'.

6.7 Six Dot Code

Here the top row is read from the left to right and the bottom from right to left .The dot indicates the following:

(1). White . (2). Digit . (3). Digit. (4) . Multiplier. (5) .Tolerance . (6) . Class.

White for the first dot indicates the coding. The capacitance value is read from the next three dots . If the first dot is silver it indicates paper capacitor. The white colored band indicates the left and specifies the temperature coefficient . The next three colors indicate the value of capacitance . For example Brown, Black, Brown = 100 pF.

6.8 Diodes

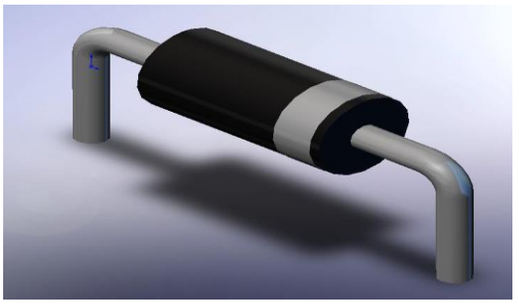

Fig. 6.6 Diode

To ensure unidirectional flow of liquid we use mechanical valves in its path. By properly arranging these valves in a system we get useful devices such as pumps and locomotives. In the field of electronics too we have a valve called semiconductor diode (a counterpart of thermionic valve) for controlling the flow of electric current in one direction. But we use these diodes in circuits for limited purposes like converting AC to DC, by passing EMF etc. a diode allows current to pass through it provided it is forward biased and the biasing voltage is more than potential barrier (forward voltage drop) of the diode.

6.9 Automatic Switchover to Battery

An uninterrupted power supply (UPS) is necessary for a main operated clock. This facility is very useful in transistors and two in ones for recording or listening to news programs. A relay can do this job with a battery backup. But the relay takes several milliseconds before it makes contact. Moreover, it is costly and occupies space.

The same task can be achieved with a single diode. Just connect a germanium diode DR50 (D1) as shown in fig 1.when the power is available form the eliminator or the external power source, the gadget will use the power from it. As points A and B are at same potential, the external power is remove, point B will be at higher potential that point A i.e. D1 is forward biased and current flows from the battery. In no case the voltage of the eliminator or the external power source should be less than the voltage of the battery. Otherwise, the current will flow from the battery during mains operation also and the battery will be drained quickly.

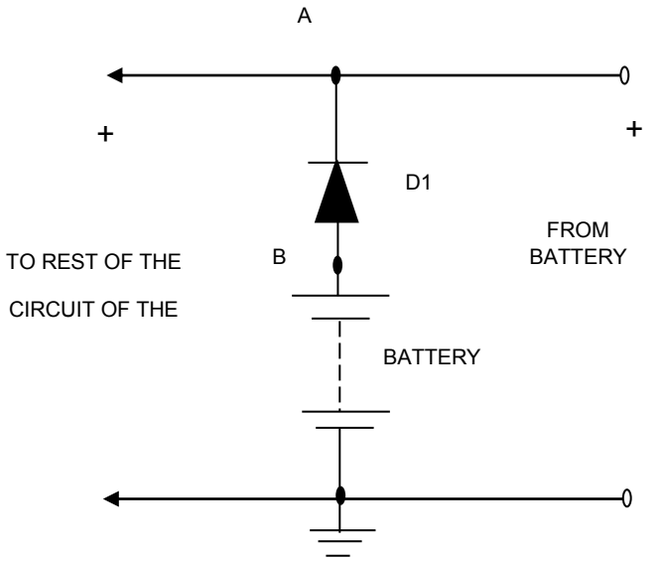

Fig 6.7 Automatic switchover to battery

6.10 Transistor

Fig. 6.8 Transistor

The transistor an entirely new type of electronic device is capable of achieving amplification of weak signals in a fashion comparable and often superior to that realized by vacuum tubes. Transistors are far smaller than vacuum tube, have no filaments and hence need no heating power and may be operates in any position. They are mechanically strong, hence practically unlimited life and can do some jobs better than vacuum tubes. Invented in 1948 by J. Bardeen and W.H.Brattain of Bell Telephone Laboratories, a transistor has now become the heart of most electronic appliance. Though transistor is only slightly more the 45 years old, yet it is fast replacing vacuum tubes in almost all applications.

A transistor consists of two pn junction formed by sand witching either p-type or n-type semiconductor between a pair of opposite type. Accordingly, there are two types of transistors namely:

1. n-p-n transistor

2. p-n-p transistor

An n-p-n is composed of two n-type semiconductors separated a by thin section of p-type. However, a p-n-p is formed by two p-section separated by a thin section of n-type.These are two pn junctions. Therefore, a transistor may be regarded as a combination of two diodes connected back to back.There are 3 terminals, taken from each type of semiconductor.The middle section is very thin layer. This is the most important factor in the functioning of a transistor.

Origin of the name "transistor ": When new devices are invented, scientists often try to device a name that will appropriately describe the device. A transistor has two pn junctions. As the discussed later one junction is forward biased and the other is reversed biased. The forward biased junction has low resistance path whereas the reverse biased junction has low resistance path whereas the reverse biased junction has a high resistance path. The weak signal is introduced in the low resistance circuit and output is taken from the high resistance circuit. Therefore, a transistor transfers a signal from a low resistance to high resistance. The prefix 'tans' means the signal transfer property of the device while 'transistor' classifies it as a solid element in the same general family with resistors.

6.11 Naming The Transistor Terminals

A transistor (pnp or npn) has three sections of doped semiconductors. The section on one side is the emitter and the section on the opposite side is the collector. The middle section is called the base and forms two junctions between the emitter and collector.

- **Emitter: -** The section on one side that supplies charge carriers (electrons or holes) is called the emitter. The emitter is always forward biased w.r.t base so that it can supply a large number of majority carriers.
- **Collector: -** The section on the other side that collects the charge is called the collector. The collector is always reversing biased. Its function is to remove charges from its junction with the base.
- **Base: -** The middle section, which forms to pn junctions between the emitter and collector, is called base. The base emitter junction is forward biased, allowing low resistance for the

emitter circuit. The base-collector junction is reversed biased and provides high resistance in the collector circuit.

6.12 Characteristics Of Transistors

Whenever we have to decide about the applications of a transistor certain question arises. Some of these are – how much amplification gets from it? What is the highest frequency upto which it can be used? How much power output could we get from it? And what should be the values of different components used in the circuits? The answers to these entire questions lie in the electrical properties of the transistor. These properties depend on the size, manufacturing techniques and materials used in the manufacturer of transistor and are know as characteristics. Transistor manufacturers give these characteristics in the data sheets published by them.

Current gain factor 'alpha' (I_α)

Current gain factor 'beta' (I_β)

Input resistance (R_{in})

Output resistance (R_{out})

Cut-off frequency (F and F・)

Leakage current (I_o)

Maximum permissible limits:

Maximum collector voltage (V_{ceo})

Maximum emitter current (I_{Emax})

Maximum Power dissipation (P_{max})

6.13 Relay

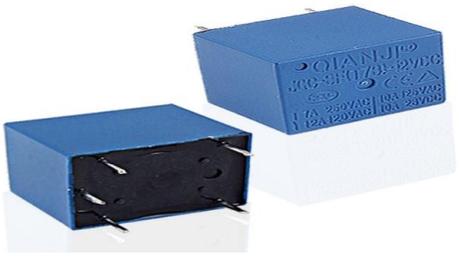

Fig. 6.9 Relay

A relay is an 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. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

6.14 Basic Design And Operation

A simple electromagnetic relay consists of a coil of wire surrounding a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board (PCB) via the yoke, which is soldered to the PCB.

When an electric current is passed through the coil it generates a magnetic field that attracts the armature, and the consequent movement of the movable contact(s) either makes or breaks (depending upon construction) a connection with a fixed contact. If the set of contacts was closed when the relay was de-energized, then the movement opens the contacts and breaks the connection, and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly. In a low-voltage application this reduces noise; in a high voltage or current application it reduces arcing.

When the coil is energized with direct current, a diode is often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a voltage spike dangerous to semiconductor circuit components. Some automotive relays include a diode inside the relay case. Alternatively, a contact protection network consisting of a capacitor and resistor in series (snubber circuit) may absorb the surge. If the coil is designed to be energized with alternating current (AC), a small copper "shading ring" can be crimped to the end of the solenoid, creating a small out-of-phase current which increases the minimum pull on the armature during the AC cycle.[1]

A solid-state relay uses a thyristor or other solid-state switching device, activated by the control signal, to switch the controlled load, instead of a solenoid. An optocoupler (a light-emitting diode (LED) coupled with a photo transistor) can be used to isolate control and controlled circuits.

Chapter 7

Result Conclusion

7.1 Result

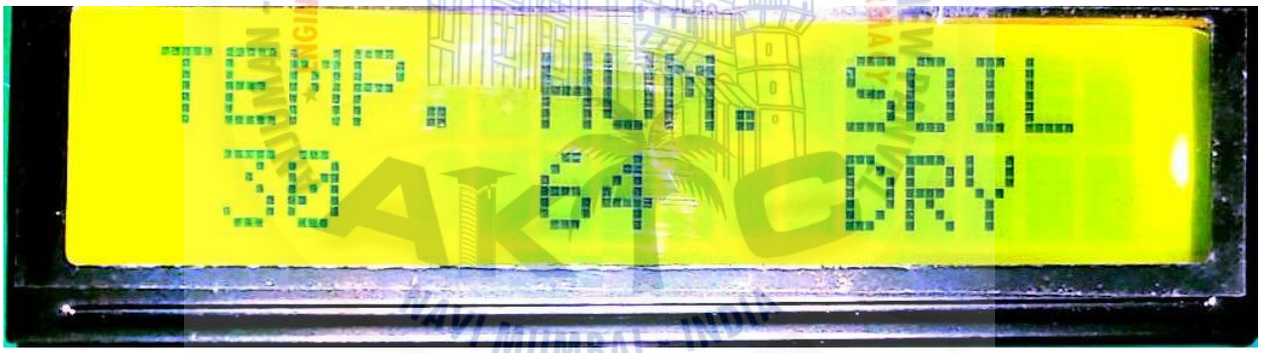

Fig. 7.1 Normal Condition (Motor ON)

Fig. 7.2 Abnormal Condition (Motor OFF)

7.1.1 Reference Values

Moisture Value: Dry

Value: 40 degree celsius

Humidity Value: 60 %

7.1.2 Observation

Table 7.1 Observation Table

Sr. No.	Temperature	Humidity	Message Received
1	36	50	NO
2	38	70	YES
3	44	58	YES
4	50	68	YES

7.2 Conclusion

Thus, this project and its concept is very useful in farming and gardening. Just by installing this small circuit we can save a lots of water. Apart from this electrical energy will also get save indirectly as pumps will become ON only when its necessary and then will get OFF automatically. Also farmers time will save and efficiency of farming will improve.

Because of design and implementation of this project, we gather great practical experience. We tried to implement our theoretical knowledge successfully. This course teaches us about the far difference between theoretical and practical knowledge.

This project is useful in like agriculture, Public and home applications. It will help the farmers to save time, reduce efforts and improve efficiency of farming. It is easy to use, time and water saving with cost effective.

REFERENCES

[1] V. Bhaskar& T. GowriManohar, "GSM Based Motor Monitoring and Speed Control", IJMIE Volume-1, April 2011.

[2] G.Ulaganathan,AzhaPeriasamy, E. Murugan, "Embedded System Based Submersible Motor Control for Agricultural Irrigation Using GSM and To Prevent It Against Over Loading, Dry Running and Single Phasing Automatically", IJSRE Volume-2 2014.

[3] Kamrul Hassan,Raziul Islam Siddiqui,Md. Takdirul Islam, NahidAlam Siddique," GSM Based Automatic Motor Control and Protection System",IJART Volume-2, Feb 2013.

[4] VenkataNarayanaEluri, K.Madhusudhana Rao, A. Srinag,"Wireless Solution for Water Saving In Agriculture Using Embedded System",IJCSBI, Volume 2, June 2013.

[5] S.Sumeetha , D.Sharmila,"Embedded based Remote Control Application using Mobile Phone in Irrigation" IJPCSC, Volume 3, March 2013.

[6] A. P. Bagade, S. L. Haridas, P. R. Indurkar,"Development of a Mobile Based Device Remote Control with Voice Acknowledgment",NCIPET&IJCA, March 2012.

[7] Ejiofor Virginia Ebere and OladipoOnaolapo Francisca, "Microcontroller based Automatic Water level Control System", NnamdiAzikiwe University,International Journal of Innovative Research in Computer and Communication Engineering Vol. 1, Issue 6, August 2013.Pg. 1390- 1396.