

Design of GSM Based Smart Garbage Monitoring System

SONARGAON UNIVERSITY (SU)

Supervised By

Sharmina Rahman

Lecturer
Department of EEE
Sonargaon University (SU)

Submitted By

Md. Oazid Khan	**ID: EEE1602008159**
Partho Adhikari	**ID: EEE1601007130**
Nazir Ahmed	**ID: EEE1503006383**
Nitish Chandraw Barman	**ID: EEE1602008155**
Md. Mokshudul Momin	**ID: EEE1602008166**

Department of Electrical & Electronic Engineering (EEE)
Sonargaon University (SU)
147/I, Panthapath,
Dhaka-1215, Bangladesh

Date of Submission: January 2020

Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

.....	….....
Md. Oazid Khan	**Partho Adhikari**
.....	….....
Nazir Ahmed	**Nitish Chandraw Barman**

.....

Md. Mokshudul Momin

Under Supervision of

.....

Sharmina Rahman

Lecturer

Department of EEE

Sonargaon University (SU)

Certification

This is to certify that this project entitled "**Design of GSM Based Smart Garbage Monitoring System.**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

Supervisor

.....

Sharmina Rahman

Lecturer

Department of Electrical and Electronic Engineer (EEE)

Sonargaon University (SU)

ACKNOWLEDGEMENT

The report titled as on "**Design of GSM Based Smart Garbage Monitoring System.**" has been prepared to fulfill the requirement of our practicum program. In the process of doing and preparing our practicum report, we would like to pay our gratitude to some persons for their enormous help and vast co-operation.

At first, we would like to show our gratitude to the University authority to permit us to do our practicum. Specially, we would like to thank to our honorable teacher **Sharmina Rahman,** Lecturer, Department of Electrical & Electronics Engineering, SU– Sonargaon University, Dhaka, for his valuable and patient advice, sympathetic assistance, co-operation, contribution of new idea. Deep theoretical and hardware knowledge & keen interest of our supervisor in this field influenced us to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

Finally, we would like to thanks again to the respected **Vice- Chancellor of SU, Professor Dr. Md. Abul Bashar** also thanks to **Head of Department of SU , Electrical & Electronics Engineering, Professor Dr. M. Bashir Uddin** because they are designated such an environment for learning through which we got the opportunity to acquire knowledge under Bsc in EEE program, and that will be very helpful for our prospective career.

We are, indeed, grateful to all those from whom we got sincere cooperation and help for the preparation of this report.

ABSTRACT

The idea is driven by the fact that dustbins require very frequent cleaning, which is not always
possible.Piles of rubbish are one of the major problems faced by most people in Bangladesh, especially those who live in flats, as the number of bins is limited and shared among all residents. It may cause pollutions, which may lead to sanitary issues and diseases. This project presents the development of a smart garbage monitoring system in order to measure waste level in the garbage bin in real-time and to alert the municipality, in particular cases, via SMS. The proposed system is consisted by the ultrasonic sensor to measure the waste level, the GSM module to send the SMS, and an Arduino nano which controls the system operation. It supposes to generate and send the warning messages to the municipality via SMS when the waste bin is full or almost full, so the garbage can be collected immediately. Furthermore, it is expected to contribute to improving the efficiency of the solid waste disposal management.

TABLE OF CONTENTS

Topics	Page No
ACKNOWLEDGEMENT	IV
ABSTRACT	V
CHAPTER NAME	VI
LIST OF FIGURES	IX
TABLES	11
LIST OF ABBREVIATIONS	12

CHAPTER I: INTRODUCTION

TOPICS		Page No.
1.1	Introduction	13
1.3	Objectives	13
1.4	Project Organization	13

CHAPTER II: THEORY OF THE PROJECT

2.1	Introduction	14
2.2	Theory	14
2.2.1	Arduino Nano Microcontroller	14
2.2.2	Ultrasonic Sensor	17
2.2.3	IR Sensor	19
2.2.4	SIM 800L GSM Module	20
2.2.5	LCD Display 16x2	20
2.2.6	12v DC Power Supply(Rectifier)	22
2.2.7	Buzzer	23
2.2.8	Capacitor	23

2.2.9	Resistor	24
2.2.10	Diode	24
2.2.11	LED	25
2.2.12	L7805 Voltage Regulator	26
2.2.13	Power Switch	27
2.2.14	LED Street Light	27
2.2.15	Light Dependent Resistor(LDR)	28
2.2.16	Battery	29
2.2.17	Connecting Wire	30
2.2.18	Strip Board or Vero Board	30

CHAPTER III: DESIGN OF PROJECT

3.1	Introduction	31
3.2	Block Diagram of the Project	31
3.3	Circuit Diagram	32
3.4	Overview of smart garbage monitoring system	33
3.5	Working Principle	34
3.6	Image of the Project	34
3.7	Flow Chart	35
3.8	Used Materials	36
3.9	Conclusion	36

CHAPTER IV: RESULT & DISCUSSION

4.1	Introduction	37
4.2	Result	37
4.3	Advantages of smart garbage monitoring system	37
4.4	Disadvantages of smart garbage monitoring system	37
4.5	Discussion	38

4.6	Cost Estimation	38
4.7	Application	39
4.8	Conclusion	39
	CHAPTER V: CONCLUSION	
5.1	Conclusion	40
5.2	Future Work	40
References		41
Appendix		42-48

LIST OF FIGURES

FIGURE NO.	FIGURE NAME	PAGE NO
2.2.1.1	Arduino NANO Pin Diagram	14
2.2.1.2	Arduino Architecture	15
2.2.1.3	Arduino Nano Pinout Diagram	16
2.2.2.1	Ultrasonic Sensor	17
2.2.2.2	Ultrasonic Wave	17
2.2.2.3	Distance Measurement Equation	18
2.2.3.1	IR Module	19
2.2.4.1	GSM Module	20
2.2.5.1	LCD Display 16x2	21
2.2.6.1	220/12V Transformer & rectifier.	22
2.2.6.2	Output Waveforms of 220V/12V Fullwave rectifier.	22
2.2.7.1	Piezo Buzzer	23
2.2.8.1	Capacitors & Capacitor symbols.	23
2.2.9.1	Resistor	24
2.2.10.1	Diode & Simble	24
2.2.10.2	IV-Characteristics of Diode.	24
2.2.11.1	LED & Simble of LED	25
2.2.12.1	L7805 voltage regulator & pin diagram.	26
2.2.13.1	Ship type power Switch. And Symbol of Open & Close.	27
2.2.14.1	LED Street Light.	27
2.2.15.1	Light dependent resistor (LDR).	28

2.2.15.2	Typical LDR resistance vs light intensity graph	28
2.2.15.3	LDR controlled Transistor	28
2.2.16.1	Lithium Ion Battery	29
2.2.16.2	Lithium ion battery Charging & Discharging time.	29
2.2.17.1	Connecting Wire.	30
2.2.18.1	Strip board (Vero board).	30
3.2.1	Block Diagram of GSM based Smart Garbage Monitoring system.	31
3.3.1	Circuit Diagram of GSM based Smart Garbage Monitoring system.	32
3.4.1	Overview of Smart Garbage Monitoring Technology	33
3.6.1	Real image of the project	34
3.7.1	Flow Chart of the Project	35

LIST OF TABLE

Table.2.1	Technical specifications of Arduino NANO	15
Table.2.2	Pin Details of 7805 IC	26
Table.4.1	Cost Estimation	38

LIST OF ABBREVIATIONS

DC	Direct Current
AC	Alternating Current.
LCD	Liquid Crystal Display
ADC	Analog-to-Digital Converter
IR	Infrared Receiver
IC	Integrated Circuit
LED	Light Emitting Diode
PCB	Printed Circuit Board
LCD	Liquid Crystal Display

CHAPTER I

INTRODUCTION

1.1 Introduction

This project GSM based Smart Garbage Monitoring system is a very innovative system which will help to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a SMS. For this the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system makes use of arduino nano board, LCD screen, GSM modem for sending data. The system is powered by a 12V transformer. The LCD screen is used to display the status of the level of garbage collected in the bins. Whereas GSM is built to show the status to the user, monitoring it with SMS. The SMS consists of text related to all garbage bins. The LCD screen shows the status of the garbage level. The system puts on LCD screen continuously monitoring of garbage with arduino board. Thus this system helps to keep the city clean by informing about the garbage levels of the bins by providing SMS to the respective person.

1.2 Objectives

The main objective is to maintain the level of cleanliness in the city and form an environment which is better for living. By using this system we can constantly check the level of the garbage in the dustbins which are placed in various parts of the city. If a particular dustbin has reached the maximum level then the employees can be informed and they can immediately take certain actions to empty it as soon as possible. This can prove to be a very useful system if used properly. This is a smart Waste monitoring and waste collection system is needed to design and develop to reduce the cost and the time of waste collection as well as to protect both public environment and public health and provide a safe life.

1.3 Project Organization

In this report, Chapter one covers introduction, objectives. Chapter two represents theory, description of the microcontroller, LCD display and other components. Chapter three describes and working principle of the project. In chapter four we have discussed result and discussion, cost estimation, future modification, conclusion.

CHAPTER II

THEORY OF THE PROJECT

2.1 Introduction

This chapter includes the total over view of the device. In this chapter we have followed-up the theory of Arduino nano,Ultrasonic sensor,IR Sensor, Resistor, Diode (IN 4007),7805 regulator, briefly describe of Microcontroller (ATMEGA 328), Crystal LCD display (16x2), Vero board, and other components. Here we can know that the total system overview of the projects. And we will also know that how the equipment are working with each other.

2.2 Theory

A Smart Dustbin proposed by , based on IoT in which the smart bin was built on a platform which was based on Aurdino nano board which was interfaced with a GSM modem and an ultrasonic sensor. The sensor was placed on the top of the bin. A threshold level was set as 10cm. As the garbage reaches the level of threshold, the sensor triggers the GSM modem which alerts the associated authority till the garbage in the bin is emptied.

2.2.1 Arduino Nano Microcontroller:

An Arduino is actually a microcontroller based kit which can be either used directly by purchasing from the vendor or can be made at home using the components, owing to its open source hardware feature. It is basically used in communications and in controlling or operating many devices. It was founded by Massimo Banzi and David Cuartielles in 2005.
To do so you use the Arduino programming language and the Arduino Software (IDE), based on Processing.

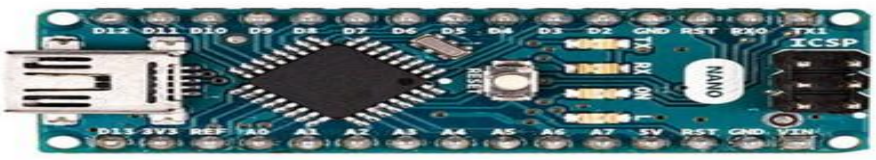


Fig: 2.2.1.1 Arduino Nano Pin Diagram

Technical specifications:

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	14 (Out of which 6 provide PWM output)
Analog Input Pins	8 (A0-A7)
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (Atmega328) of which 2 KB used for bootloader
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

Table 2.1: Technical specifications of Arduino NANO

Arduino Architecture:

Arduino's processor basically uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories- Program memory and the data memory.The code is stored in the flash program memory, whereas the data is stored in the data memory. The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the bootloader), 2 KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16MHz.

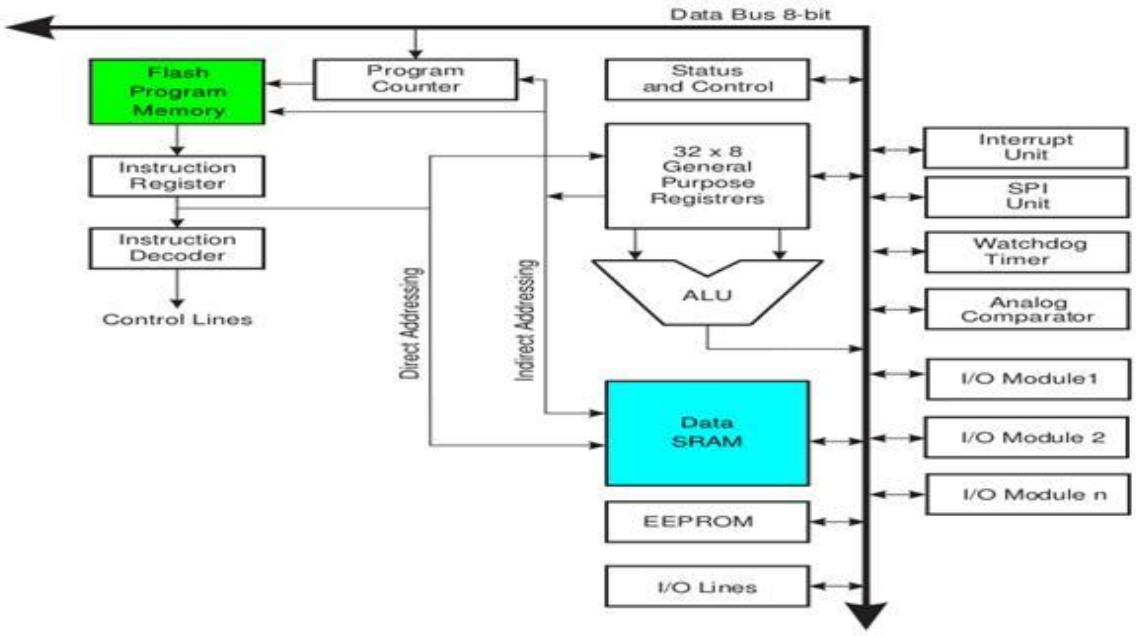


Fig : 2.2.1.2 Arduino Architecture.

Arduino Pin Diagram:

A typical example of Arduino board is Arduino nano. It consists of ATmega328- a 28 pin microcontroller.

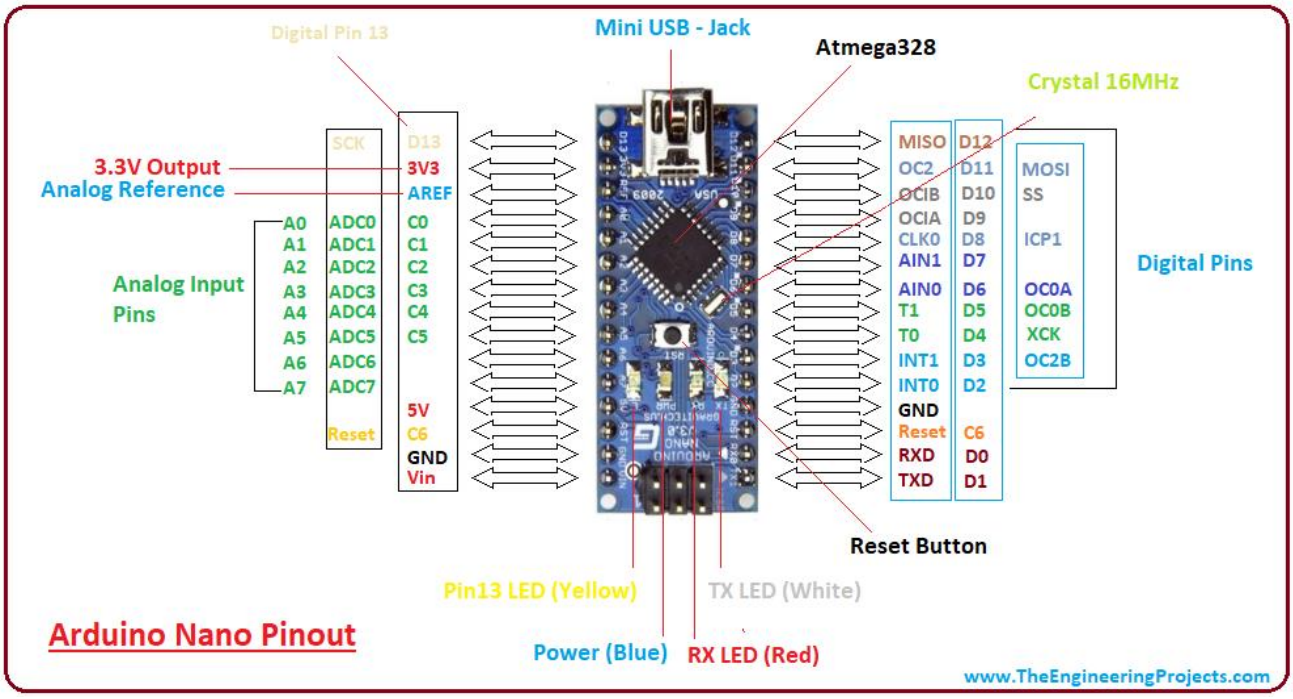


Fig : 2.2.1.3 Arduino Nano Pinout Diagram

Power Jack: Arduino can be power either from the pc through a USB or through external source like adaptor or a battery. It can operate on a external supply of 7 to 12V. Power can be applied externally through the pin Vin or by giving voltage reference through the IORef pin.

Digital Inputs: It consists of 14 digital inputs/output pins, each of which provide or take up 40mA current. Some of them have special functions like pins 0 and 1, which act as Rx and Tx respectively , for serial communication, pins 2 and 3-which are external interrupts, pins 3,5,6,9,11 which provides pwm output and pin 13 where LED is connected.

Analog inputs: It has 6 analog input/output pins, each providing a resolution of 10 bits.

ARef: It provides reference to the analog inputs

Reset: It resets the microcontroller when low.

2.2.2 Ultrasonic Sensor:

The ultrasonic sensor (or transducer) works on the same principles as a radar system. An ultrasonic sensor can convert electrical energy into acoustic waves and vice versa. The acoustic wave signal is an ultrasonic wave traveling at a frequency above 18kHz. The famous HC SR04 ultrasonic sensor generates ultrasonic waves at 40kHz frequency.Typically, a microcontroller is used for communication with an ultrasonic sensor. To begin measuring the distance, the microcontroller sends a trigger signal to the ultrasonic sensor. The duty cycle of this trigger signal is 10µS for the HC-SR04 ultrasonic sensor. When triggered, the ultrasonic sensor generates eight acoustic (ultrasonic) wave bursts and initiates a time counter. As soon as the reflected (echo) signal is received, the timer stops. The output of the ultrasonic sensor is a high pulse with the same duration as the time difference between transmitted ultrasonic bursts and the received echo signal.



Fig : 2.2.2.1 Ultrasonic sensor.

Distance measurement of ultrasonic sensor:

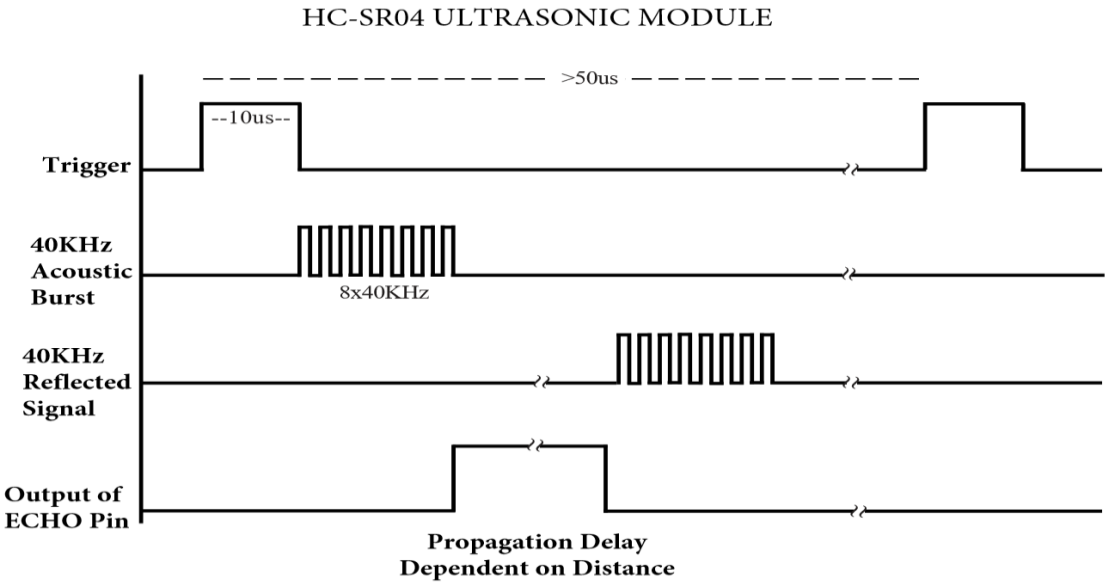


Fig : 2.2.2.2 Ultrasonic wave

The microcontroller interprets the time signal into distance using the following functions: Theoretically, the distance can be calculated using the TRD (time/rate/distance) measurement formula. Since the calculated distance is the distance traveled from the ultrasonic transducer to the object—and back to the transducer—it is a two-way trip. By dividing this distance by 2, you can determine the actual distance from the transducer to the object. Ultrasonic waves travel at the speed of sound (343 m/s at 20°C). The distance between the object and the sensor is half of the distance traveled by the sound wave.[iv] The following equation calculates the distance to an object placed in front of an ultrasonic sensor:

$$distance = \frac{time\ taken\ x\ speed\ of\ sound}{2}$$

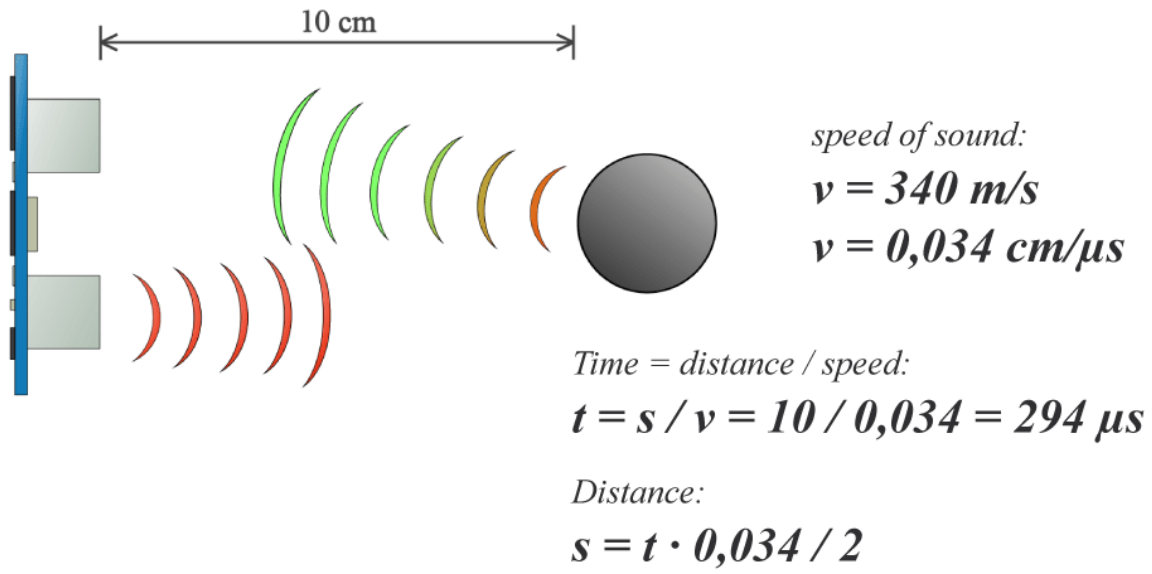


Fig : 2.2.2.3 distance measurement equation.

2.2.3 IR Sensor:

IR detectors are little microchips with a photocell that are tuned to listen to infrared light. They are almost always usedfor remote control detection - every TV and DVD player has one of these in the front to listen for the IR signal from theclicker. Inside the remote control is a matching IR LED, which emits IR pulses to tell the TV to turn on, off or changechannels. IR light is not visible to the human eye, which means it takes a little more work to test a setup.

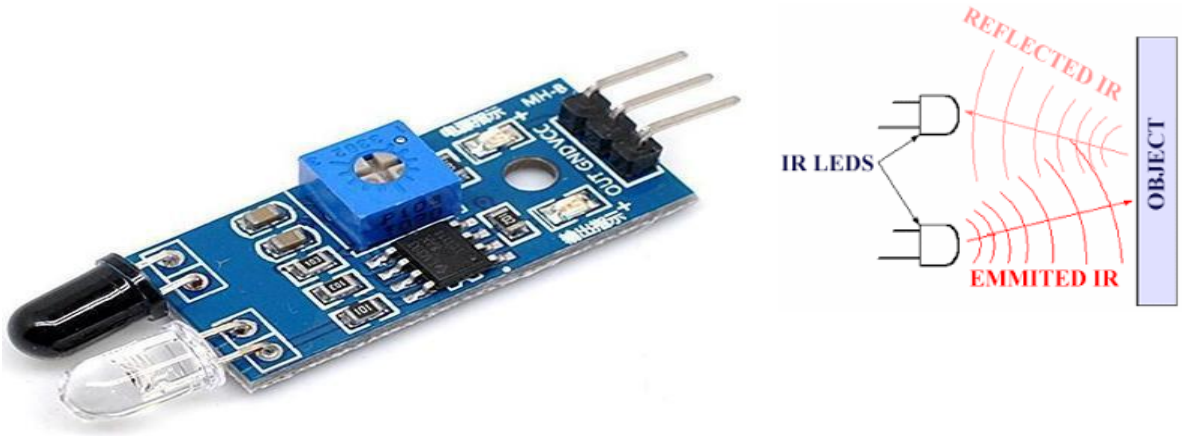


Fig : 2.2.3.1 IR Module

- There are a few difference between these and say a CdS Photocells IR detectors are specially filtered for Infrared light, they are not good at detecting visible light. On the other hand,photocells are good at detecting yellow/green visible light, not good at IR light
- IR detectors have a demodulator inside that looks for modulated IR at 38 KHz. Just shining an IR LED wont bedetected, it has to be PWM blinking at 38KHz. Photocells do not have any sort of demodulator and can detectany frequency (including DC) within the response speed of the photocell (which is about 1KHz)
- IR detectors are digital out - either they detect 38KHz IR signal and output low (0V) or they do not detect any andoutput high (5V). Photocells act like resistors, the resistance changes depending on how much light they areexposed to

In infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

Infrared technology is found not just in industry, but also in every-day life. Televisions, for example, use an infrared detector to interpret the signals sent from a remote control. Passive Infrared sensors are used for motion detection systems, and LDR sensors are used for outdoor lighting systems. The key benefits of infrared sensors include their low power requirements, their simple circuitry and their portable features.

2.2.4 SIM 800L GSM MODULE

SIM800LOverview: SIM800L is a quad-band GSM/GPRS module, that works on frequencies GSM850MHz, EGSM900MHz, DCS1800MHz and PCS1900MHz. SIM800L features GPRS multi-slot class 12/ class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.



Fig : 2.2.4.1 GSM module

With a tiny configuration of 15.8*17.8*2.4mm, SIM800L can meet almost all the space requirements in user applications, such as smart phone, PDA and other mobile devices.
SIM800L has 88pin pads of LGA packaging, and provides all hardware interfaces between the module and customers' boards.

- Support 5*5*2keypads
- One full modem serial port, user can configure two serialports
- One USB, the USB interfaces can debug, downloadsoftware
- Audio channel which includes two microphone input; a receiver output and a speakeroutput
- Programmable general purpose input andoutput.
- A SIM cardinterface
- Support FM
- Support onePWM

SIM800L is designed with power saving technique so that the current consumption is as low as 0.7mA in sleep mode.

2.2.5 LCD Display 16x2

A liquid-crystal display (LCD) is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

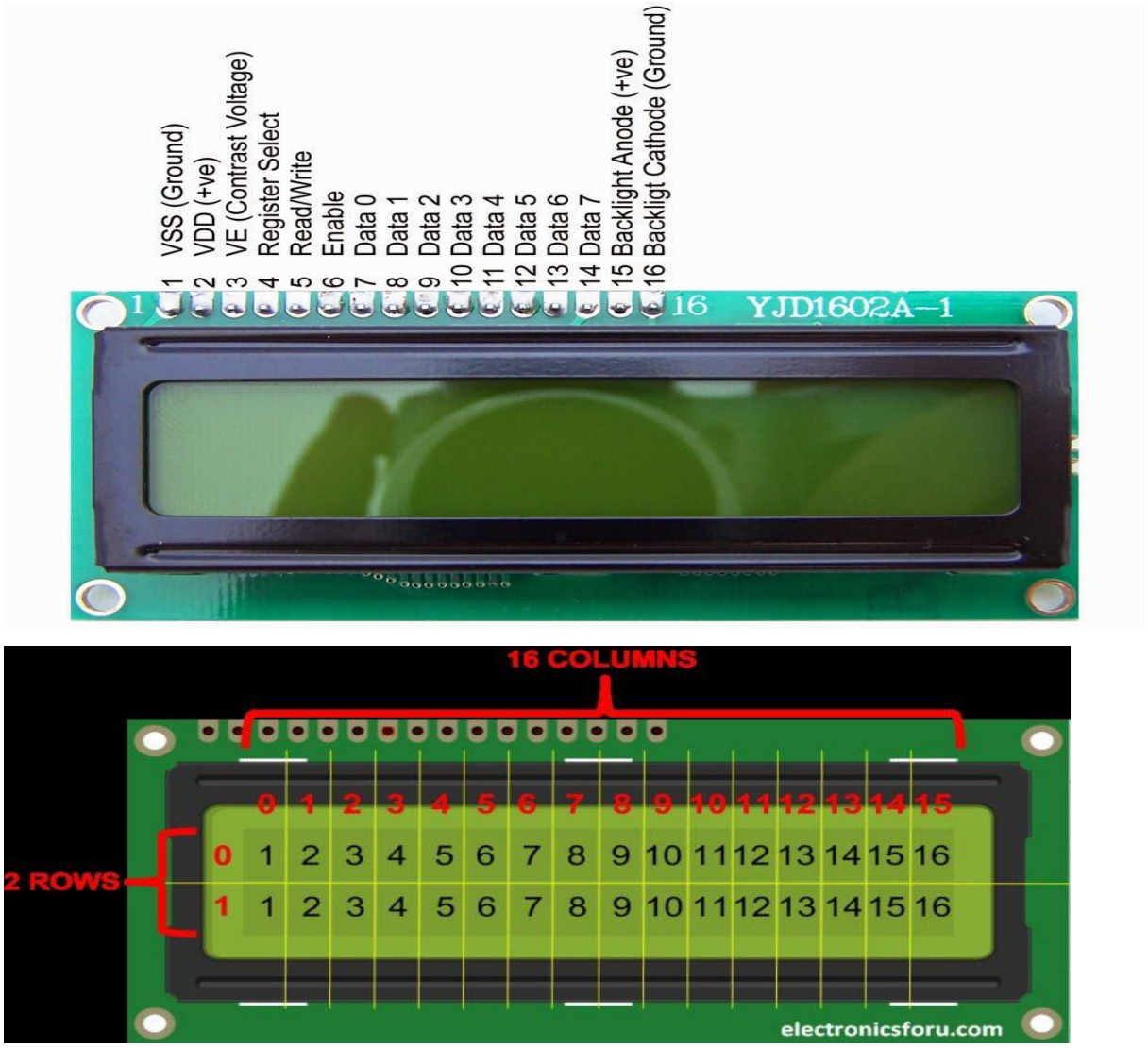


Fig : 2.2.5.1 LCD Display 16x2

Features of 16×2 LCD module :

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backligh.

16x2 Display Equivalents :

Dot Matrix LED Display, 7-Segment LED Display, OLED Display, TFT LCD Screen Display.

2.2.6 12V DC Power supply (Rectifier)

A bridge rectifier circuit is a common part of the electronic power supplies. Many electronic circuits require rectified DC power supply for powering the various electronic basic components from available AC mains supply. We can find this rectifier in a wide variety of electronic AC power devices like home appliances, motor controllers, modulation process, welding applications, etc.

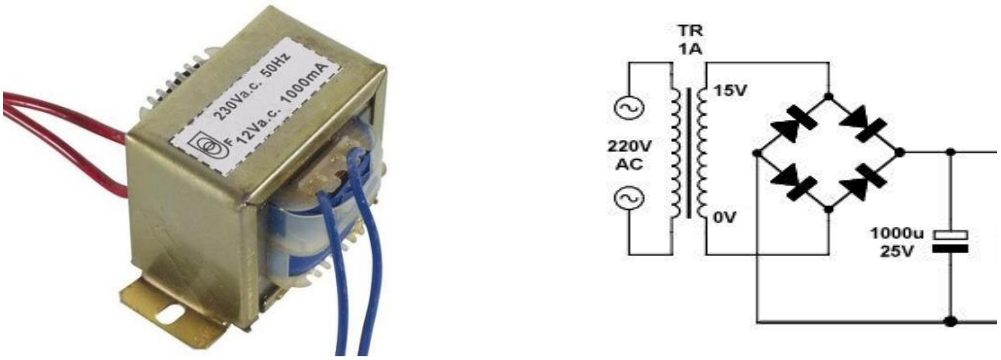


Fig : 2.2.6.1 220/12V Transformer & rectifier.

The bridge rectifier circuit diagram consists of various stages of devices like transformer, Diode Bridge, filtering and regulators. The first stage of the circuit is a transformer which is a step-down type that changes the amplitude of the input voltage. Most of the electronic projects uses 230/12V transformer to step-down the AC mains 230V to 12V AC supply. Next stage is a diode-bridge rectifier which uses four or more diodes depending on the type of bridge rectifier. Choosing a particular diode or any other switching device for a corresponding rectifier needs some considerations of the device like Peak Inverse Voltage (PIV), forward current If, voltage ratings, etc. It is responsible for producing unidirectional or DC current at the load by conducting a set of diodes for every half cycle of the input signal.

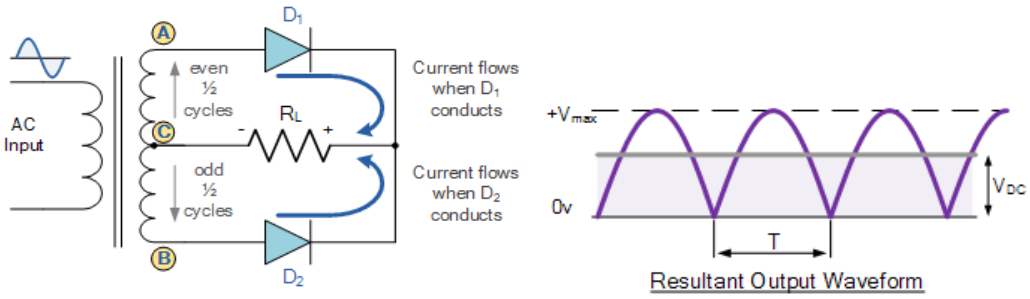


Fig : 2.2.6.2 Output Waveforms of 220V/12V Fullwave rectifier.

2.2.7 Buzzer:

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). This module is a low cost alarm bazzer called piezo Buzzer. This device is the alarm for this system. It starts ringing when temperature increases very high and smoke is detected. It also starts ringing when PIR sensor is high.



Fig : 2.2.7.1 Piezo Buzzer

2.2.8 Capacitor:

Capacitor is a passive two-terminal electrical component used to store energy in an electric field. The forms of practical capacitors vary widely, but all contain at least two conductors separated by a non-conductor. Capacitors used as parts of electrical systems, for example consist of metal soils separated by a layer of insulating film. A capacitor is passive electronic component consisting of a pair of conductors separated by a dielectric (insulator) when there is a potential difference (voltage) across the detected on one plate and negative charge on the other plate. Energy is stored in the electrostatic field and is measured in farads. An ideal capacitor is wholly characterized by a constant capacitance C, defined as the ratio of charge ±Q on each conductor to the voltage V between them. Equation: $\boldsymbol{C}=\boldsymbol{QV}$.



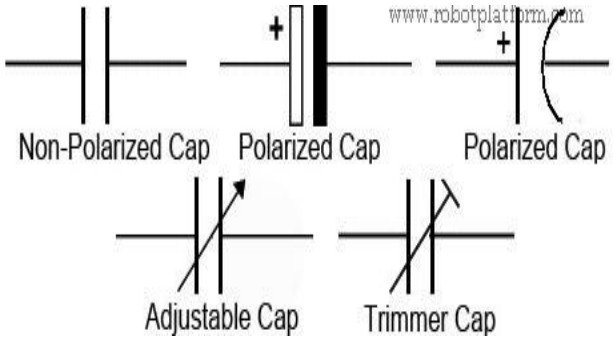


Fig : 2.2.8.1 Capacitors & Capacitor symbols.

2.2.9 Resistor:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.



Fig : 2.2.9.1 Resistor

2.2.10 Diode:

A diode is an electronic device with two transmitting terminals that allows electric current to flow in one direction while blocking current in the opposite direction.The diode usually implies a small signal device with current typically in the milliamp range. A semiconductor diode consists of a PN unction and has two (2) terminals, an anode (+) and cathode (-) current flows from anode to cathode within the diode. Diodes are semiconductor device that might be described as passing current in one direction only. The latter part of that statement applies equally vacuum tube diodes. Diodes however are far more extremely versatile in fact. Diode can be used as rectifier, voltage regulators, turning devices in radio frequency tuned circuit, frequency multiplying device in radio frequency circuit, mixing devices application or can be used to make logic decision in digital circuit.

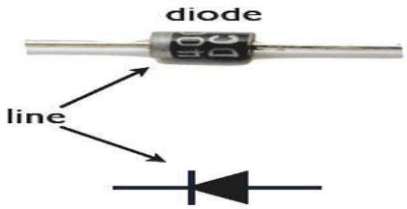


Fig : 2.2.10.1 Diode & Simble

Characteristics of diode:

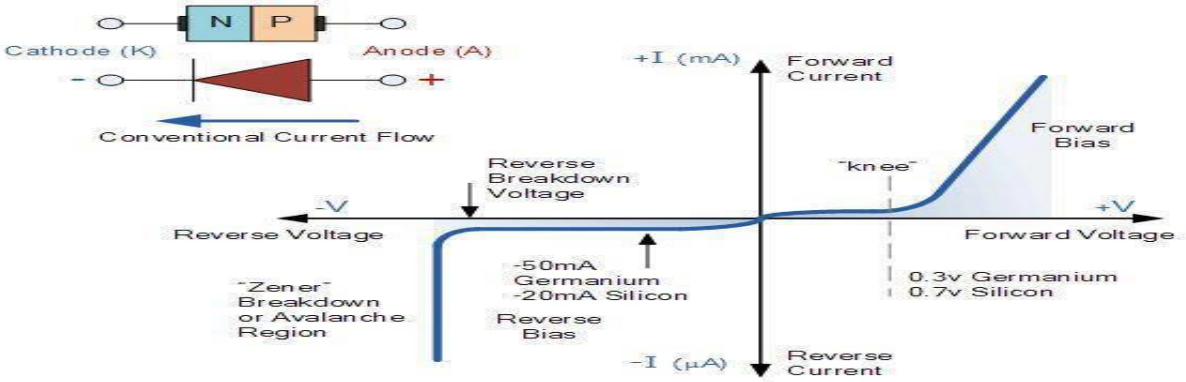


Fig : 2.2.10.2 IV-Characteristics of Diode.

There are two operating regions and three possible “biasing” conditions for the standard Junction Diode and these are:
1. Zero Bias – No external voltage potential is applied to the PN junction Diode
2. Reverse Bias – The voltage potential is connected negative, (-ve) to the P type material and positive, (+ve) to the N-type material across the diode which has the effect of Increasing the PN junction diode’s width.
3. Forward Bias – The voltage potential is connected positive, (+ve) to the P type material and negative, (-ve) to the N-type material across the diode which has the effect of Decreasing the PN junction diodes width.

2.2.11 LED :

The Light emitting diode(LED) is a two-lead semiconductor light source. The light emitting diode is a p-n junction diode. It is a specially doped diode and made up of a special type of semiconductors. When the light emits in the forward biased, then it is called as a light emitting diode. The light emitting diode simply, we know as a diode. When the diode is forward biased, then the electrons & holes are moving fast across the junction and they are combining constantly, removing one another out. Soon after the electrons are moving from the n-type to the p-type silicon, it combines with the holes, then it disappears. Hence it makes the complete atom & more stable and it gives the little burst of energy in the form of a tiny packet or photon of light. The working principle of the Light emitting diode is based on the quantum theory. The quantum theory says that when the electron comes down from the higher energy level to the lower energy level then, the energy emits from the photon. The photon energy is equal to the energy gap between these two energy levels. If the PN-junction diode is in the forward biased, then the current flows through the diode.

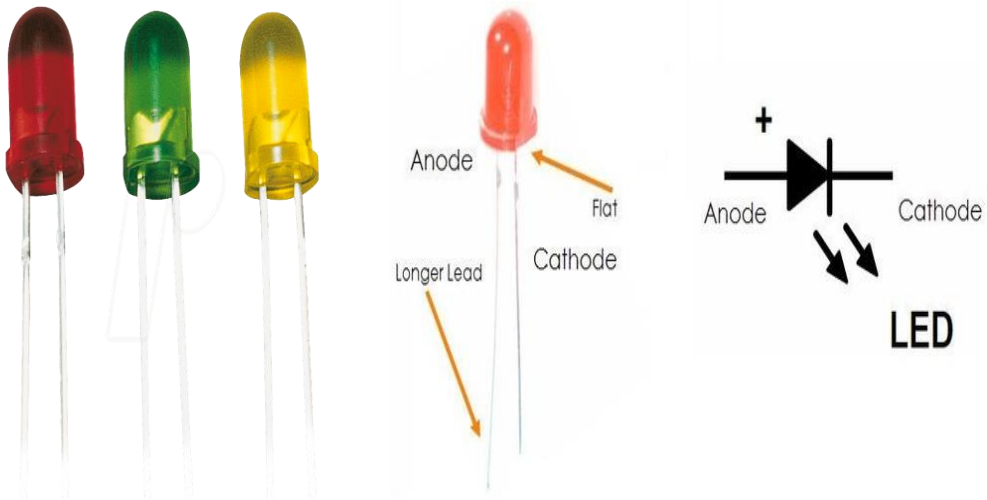


Fig : 2.2.11.1 LED & Simble of LED

2.2.12 7805 Voltage Regulator

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink .

7805 IC Rating :

Input voltage range 7V- 35V

Current rating Ic = 1A

Output voltage range VMax=5.2V ,VMin=4.8V

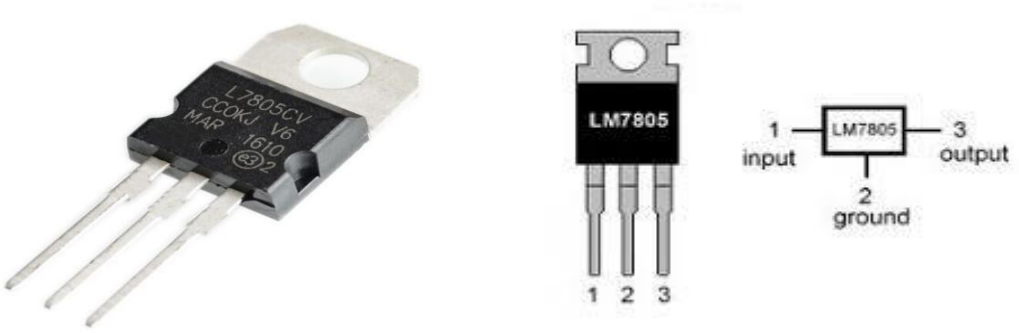


Fig : 2.2.12.1 L7805 voltage regulator & pin diagram.

Pin Details of 7805 IC

Pin no:	Pin	Function	Description
1	Input	Input voltage (7V-35V)	In this pin of the IC positive unregulated voltage is given in regulation.
2	Ground	Ground (0V)	In this pin where the ground is given. This pin is neutral for equally the input and output.
3	Output	Regulated output:5V (4.8V-5.2V)	The output of the regulated 5V volt is taken out at this pin of the IC regulator.

Table : 2.2 Pin Details of 7805 IC

2.2.13 Power Switch:

A power switch controls the flow of power to an electric device. The switch has an on and off position, usually represented by a 1 (on) and a 0 (off). Ship type switch used in Electronic circuit, water dispenser, treadmill, computer speakers, battery car, motorcycle, ion television, coffee pot, platooninsert, massage machine, etc., mainly household appliances such as the use of more.

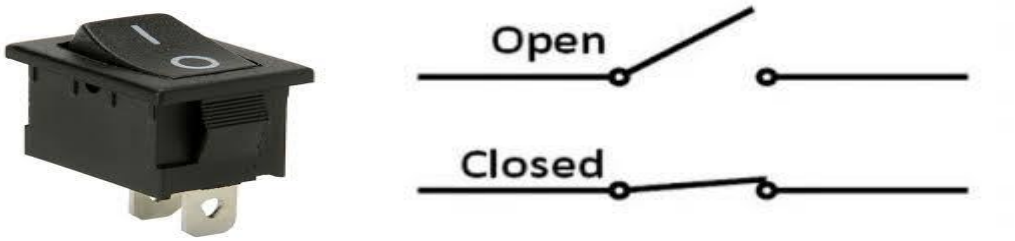


Fig : 2.2.13.1 Ship type power Switch. And Symbol of Open & Close.

2.2.14 LED Street Light:

An LED street light is an integrated light that uses light emitting diodes (LED) as its light source. These are considered integrated lights because, in most cases, the luminaire and the fixture are not separate parts. In manufacturing, the LED light cluster is sealed on a panel and then assembled to the LED panel with a heat sink to become an integrated lighting fixture.Different designs have been created that incorporate various types of LEDs into a light fixture. Either few high-power LEDs or many low-power LEDs may be used. The shape of the LED street light depends on several factors, including LED configuration, the heat sink used with the LEDs and aesthetic design preference.



Fig : 2.2.14.1 LED Street Light.

2.2.15 Light Dependent Resistor(LDR):

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. The most common type of LDR has a resistance that falls with an increase in the light intensity falling upon the device (as shown in the image above). The resistance of an LDR may typically have the following resistances: Daylight = 5000Ω , Dark = 20000000Ω.



Fig : 2.2.15.1 Light dependent resistor (LDR).

Variation in resistance with changing light intensity:

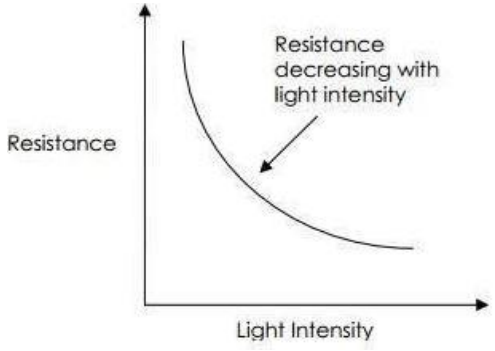


Fig:2.2.15.2 Typical LDR resistance vs light intensity graph

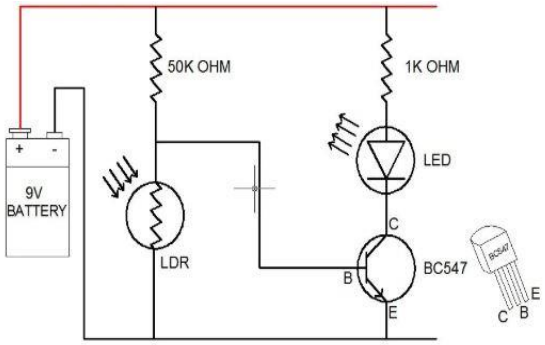


Fig:2.2.15.3 LDR controlled Transistor circuit.

The circuit shown above shows a simple way of constructing a circuit that turns on when it goes dark. In this circuit the LDR and the other Resistor form a simple 'Potential Divider' circuit, where the centre point of the Potential Divider is fed to the Base of the NPN Transistor.When the light level decreases, the resistance of the LDR increases. As this resistance increases in relation to the other Resistor, which has a fixed resistance, it causes the voltage dropped across the LDR to also increase. When this voltage is large enough (0.7V for a typical NPN Transistor), it will cause the Transistor to turn on.The value of the fixed resistor will depend on the LDR used, the transistor used and the supply voltage.

Applications of LDRs:

(1) Lighting switch : The most obvious application for an LDR is to automatically turn on a light at a certain light level. An example of this could be a street light or a garden light.
(2) Camera shutter control : LDRs can be used to control the shutter speed on a camera. The LDR would be used to measure the light intensity which then adjusts the camera shutter speed to the appropriate level.

2.2.16 Battery:

A battery is a device that produces electrons through electrochemical reactions, and contains positive (+) and negative (-) terminals. A battery consists of one or more electrochemical cells, which transform stored chemical energy directly into electrical energy. When an external load connects to a battery, electrons cross from the negative to the positive terminal, creating an electrical current. This current may power a motor, a light bulb, a clock, a computer, a cellphone, and other electronic devices or equipment. Battery flow speed is determined by the battery's internal resistance and outside load.



Fig : 2.2.16.1 Lithium Ion Battery

Lithium ion Battery:

A lithium-ion battery is a family of rechargeable battery types in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging.

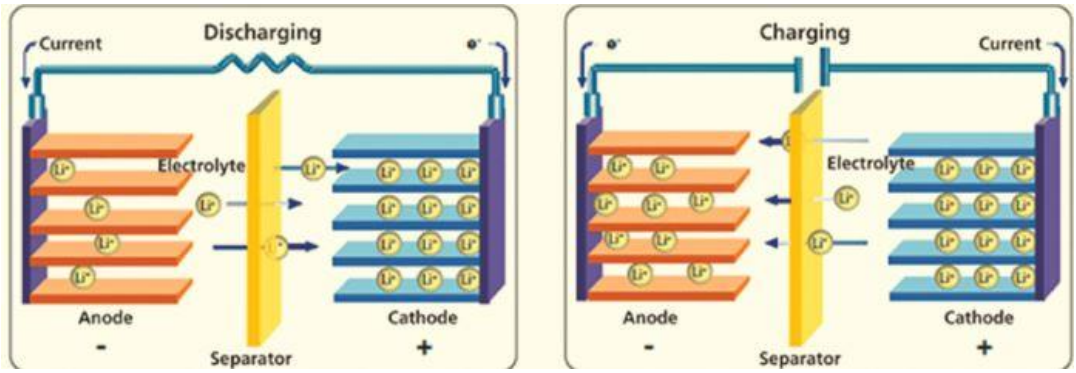


Fig : 2.2.16.2 Lithium ion battery Charging & Discharging time.

Working principle of lithium ion battery :

How a lithium-ion battery charges and discharges:

(1) During charging, lithium ions (yellow circles) flow from the positive electrode (Sky) to the negative electrode (Orange) through the electrolyte (white). Electrons also flow from the positive electrode to the negative electrode, but take the longer path around the outer circuit. The electrons and ions combine at the negative electrode and deposit lithium there.

(2) When no more ions will flow, the battery is fully charged and ready to use.

(3) During discharging, the ions flow back through the electrolyte from the negative electrode to the positive electrode. Electrons flow from the negative electrode to the positive electrode through the outer circuit, powering your laptop. When the ions and electrons combine at the positive electrode, lithium is deposited there.

2.2.17 Connecting Wire:

A wire is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate. Wire gauges come in various standard sizes, as expressed in terms of a gauge number.
The term 'wire' is also used more loosely to refer to a bundle of such strands, as in "multistranded wire", which is more correctly termed a wire rope in mechanics, or a cable in electricity.

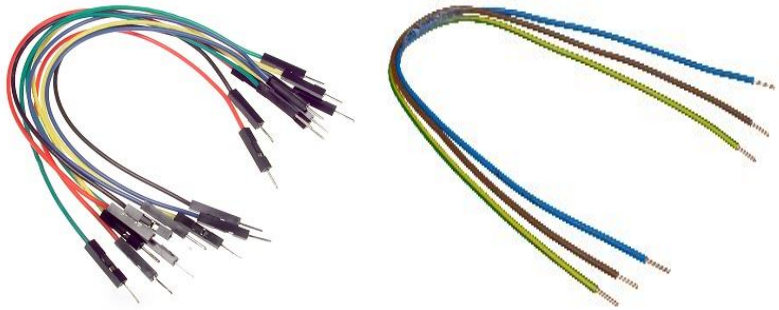


Fig : 2.2.17.1 Connecting Wire.

2.2.18 Strip Board or Vero Board:

Stripboard is the generic name for a widely used type of electronics prototyping board characterized by a 0.1 inches (2.54 mm) regular (rectangular) grid of holes, with wide parallel strips of copper cladding running in one direction all the way across one side of the board.
It is commonly also known by the name of the original product Veroboard, which is a trademark, in the UK, of British company Vero Technologies Ltd and Canadian company Pixel Print Ltd. In using the board, breaks are made in the tracks, usually around holes, to divide the strips into multiple electrical nodes. With care, it is possible to break between holes to allow for components that have two pin rows only one position apart such as twin row headers for IDCs.

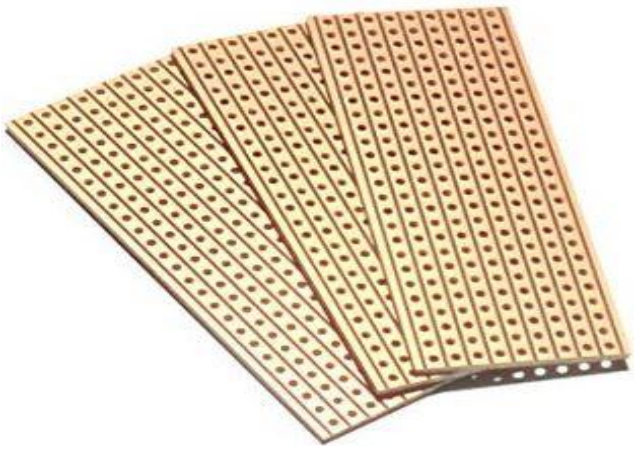


Fig : 2.2.18.1 Strip board (Vero board).

CHAPTER III

DESING OF PROJECT

3.1 Introduction

In this chapter fully cover with discuss design and fabrication of this project. Here we will discuss about developed block diagram and briefly describe about the circuit description and also learn about working principle. Total project flow chart is also available in this chapter.

3.2 Block Diagram

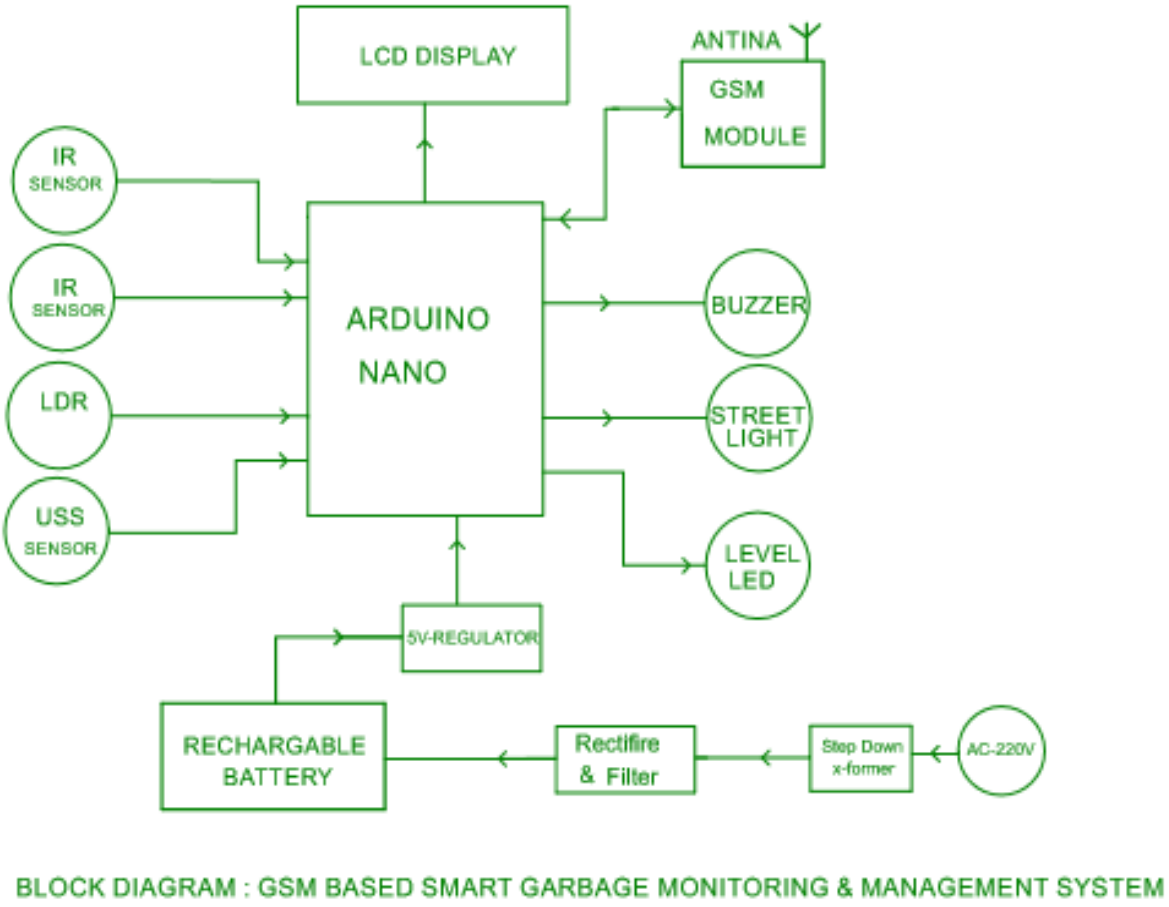
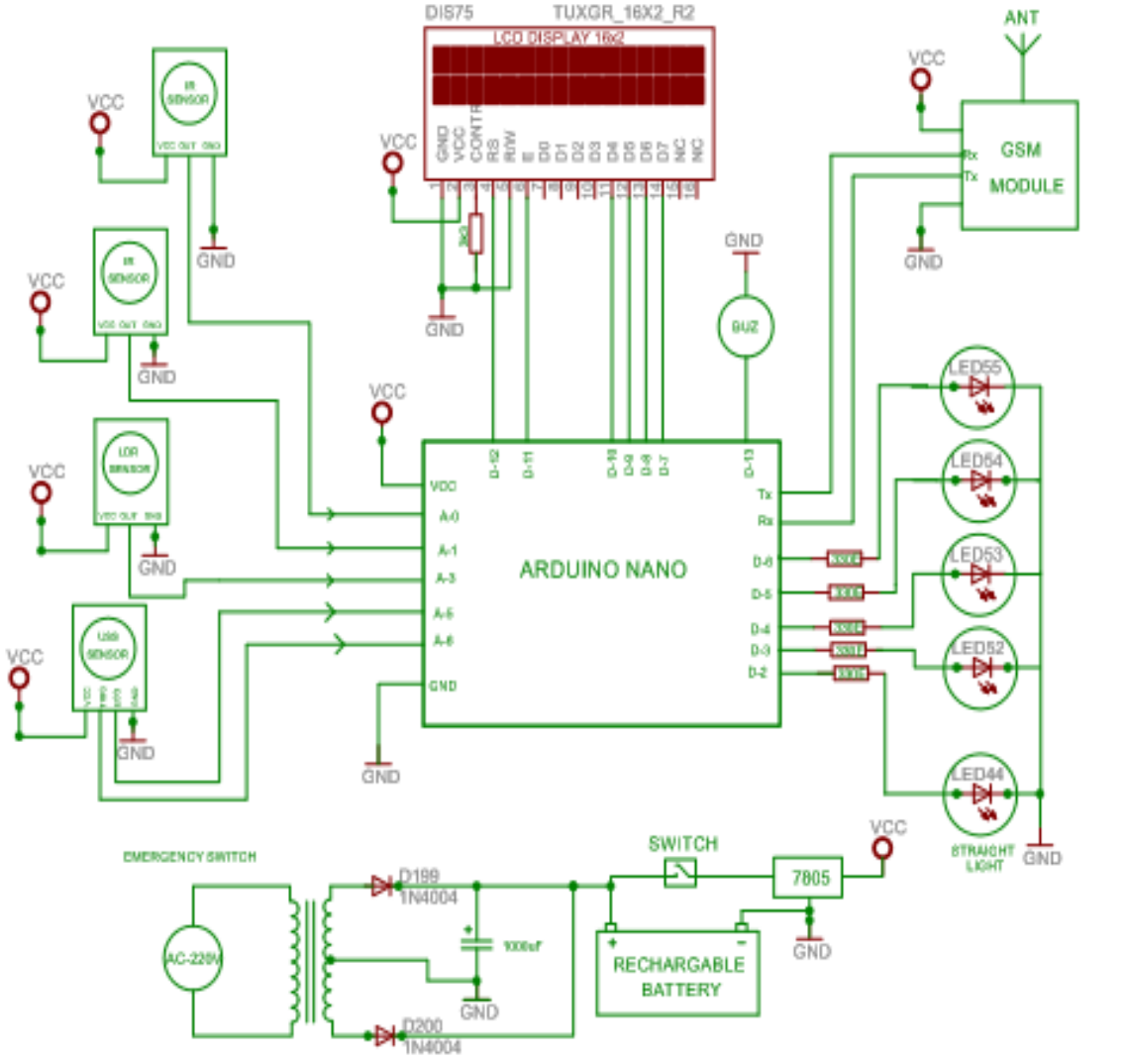


Fig : 3.2.1 Block Diagram of GSM based Smart Garbage Monitoring system.

Here's the block diagram of our GSM Based Smart Garbage Monitoring system. We can clearly describe the working process through this block diagram. Firstly we have two energy sources to supply electricity. One is the Rechargable battery and the other is the electrical power. Generally Electric power is the first priority of supplying the electricity. Our control system continuously monitors the garbage box by sensor . If any box is full, our system immediately contact the authority by short message service(SMS) and signal the buzzer and send the notification is shown in a LCD display.

3.3 Circuit Diagram



CIRCUIT DIAGRAM : GSM BASED SMART GARBAGE MONITORING & MANAGEMENT SYSTEM

Fig : 3.3.1 Circuit Diagram of GSM based Smart Garbage Monitoring system.

In our circuit, we've used an Arduino nano as the controller, 3 sensors to measure the sence from object. A current sensor is used to measure the load current. A voltage stabilizer is also used to provide a stable voltage to the loads. We made the voltage sensors using opto-cupler and 2 voltage dividing resistors.

3.4 Overview of GSM Based Smart Garbage monitoring System

This is Smart garbage Monitoring System, In this Project, we are monitoring garbage of the dustbin, Once the garbage bin is filled we can see the status indication of the LED. There is an ultrasonic sensor in the garbage bin. In the same way, we also get the alert message is Beep that the garbage bin is filled.

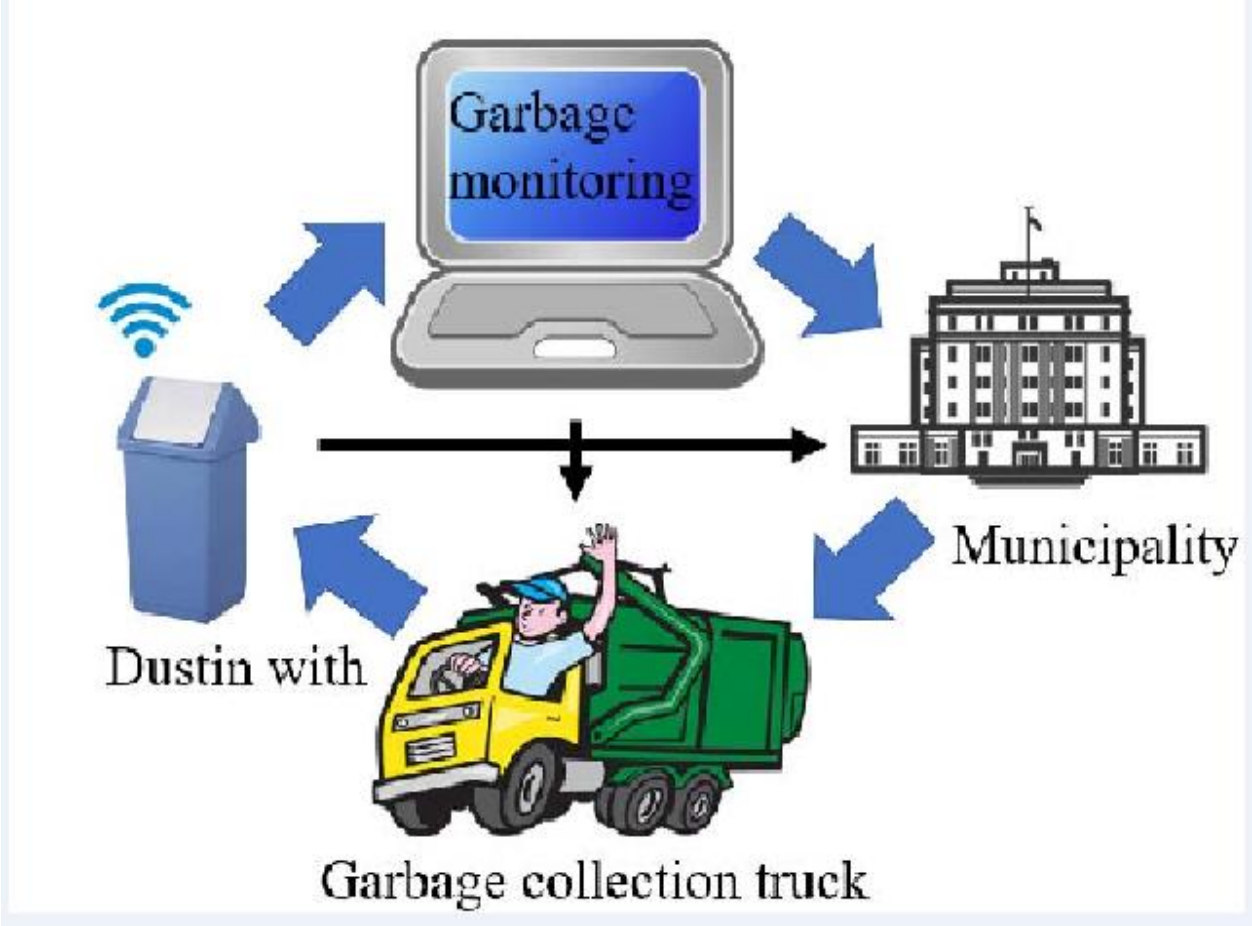


Fig : 3.4.1 Overview of Smart Garbage Monitoring Technology

3.5 Working Principle

The project can be divided into two modules, one is detection of garbage level and then the second module is send the information to the corresponding officials through GSM.

Description of project: Garbage level detection is the done by ultrasonic sensors (HC-SR04).The ultrasonic sensors is placed on top of the dustbin facing the bottom. The sensors continuously emits the sonic waves, when the sonic waves hit the object and reflect back, the echo in the sensors senses the waves and calculates the distance of the object. Arduino nano is used for controlling whole the process detecting garbage in different places and depending on the program first display in LCD to reminding the garbage level in the bin even though the garbage is not take out from the bin then the particular bin information is sent to higher officials through GSM.

3.6 Image of the Project

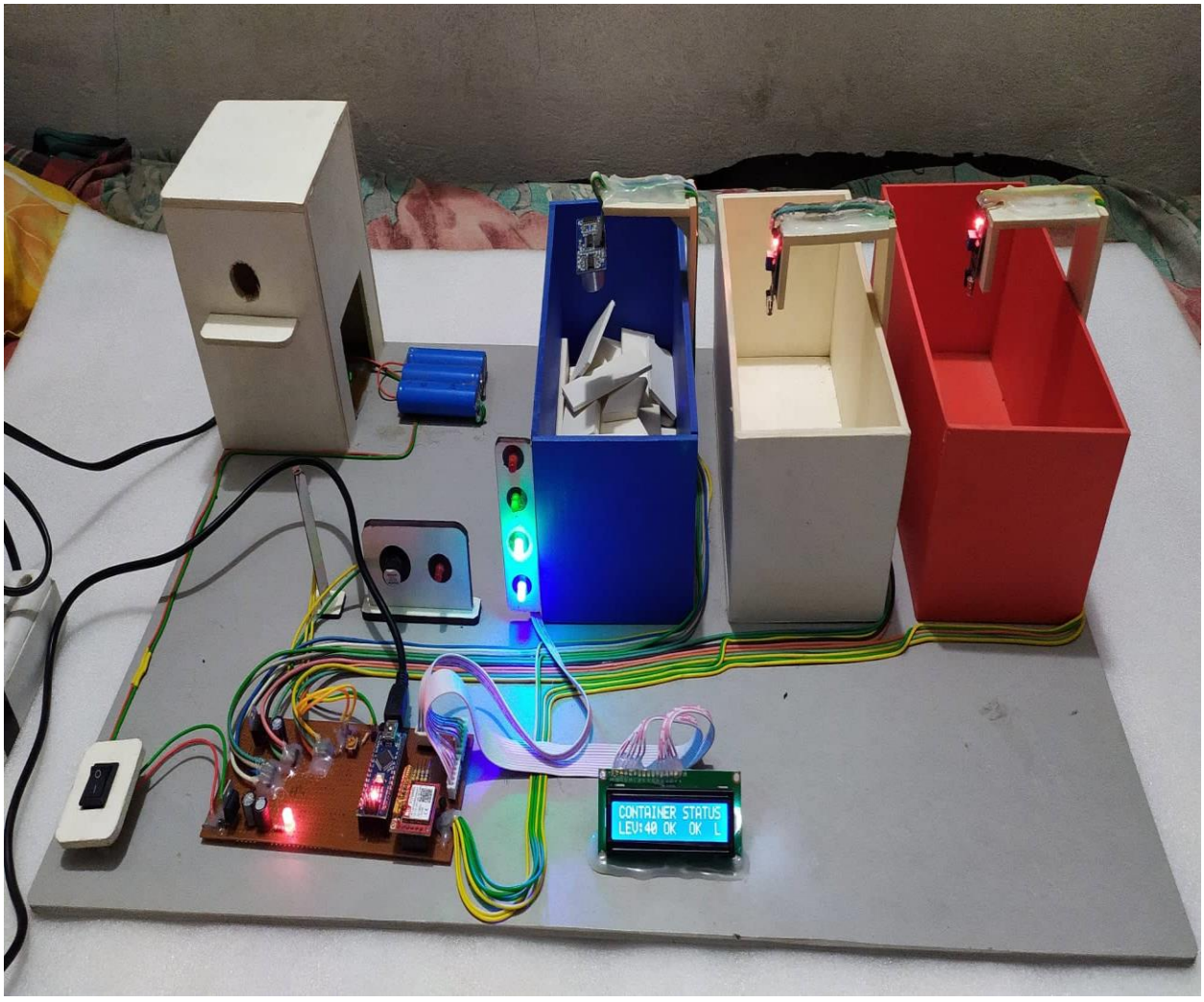


Fig: 3.6.1 Real image of the project

3.7 Flow Chart

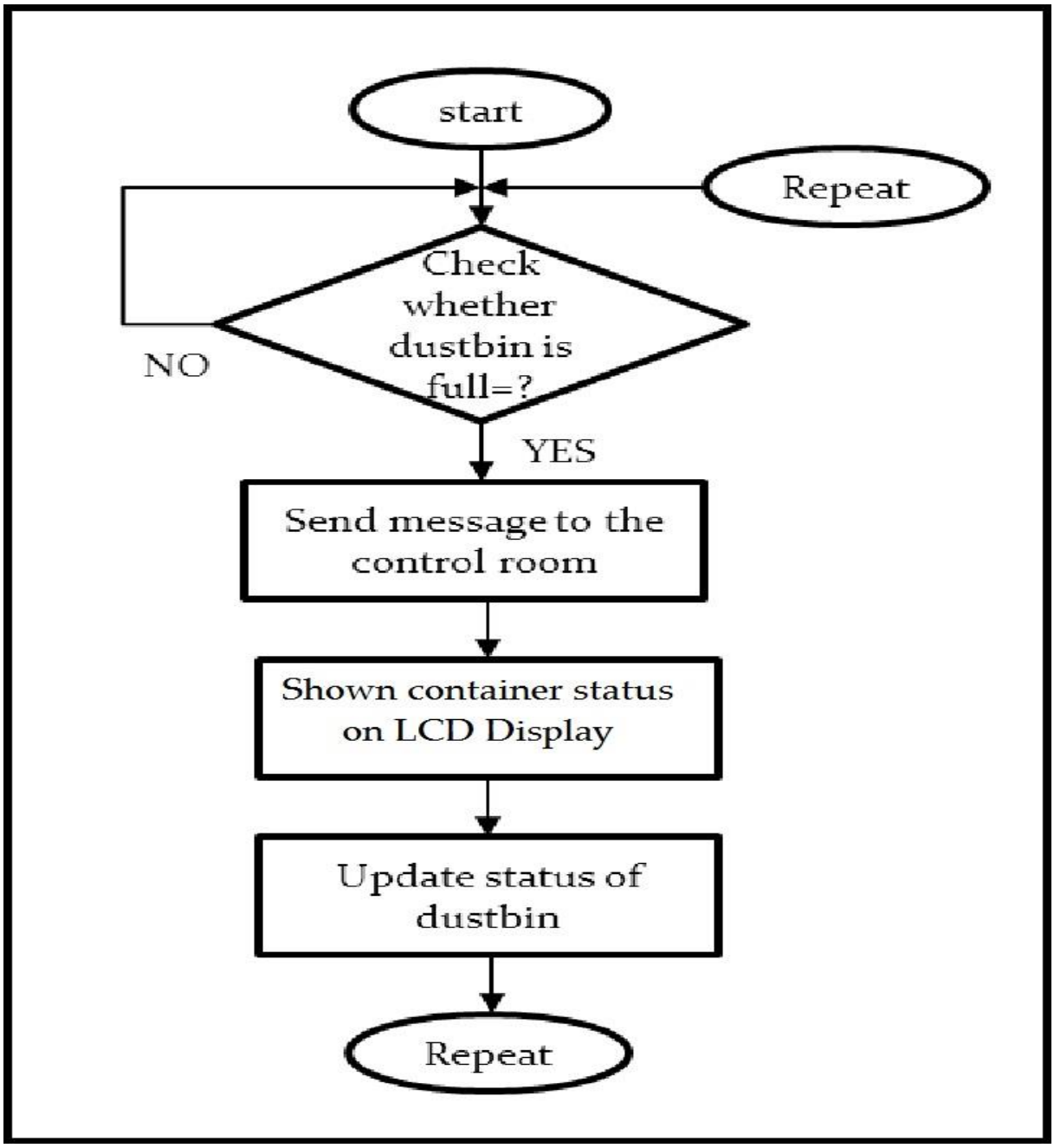


Fig : 3.7.1 Flow chart of the project

In this flowchart we can easily determine the working process of our system. Starting with some control initializations our control system reads/measures the all module is ready. The container status is shown & updated every second in a LCD display. The control system continuously checks the dustbin is full or empty. If the dust bin is full so our system is done the send messege to control room & Shown the status on Lcd Display .

3.8 Used Materials

1. Microcontroller (Arduino) - 1 pcs
2. Ultrasonic Sensor - 1 pcs
3. IR Sensor - 2 pcs
4. GSM Module - 1 pcs
5. LCD -1 pcs
6. LDR -1 pcs
7. Buzzer -1 pcs
8. Battery 4V - 3 pcs
9. Transformer (12V) - 1 pcs
10. Power Switch - 1 pcs
11. LED light - 7 pcs
12. Connector - 3 pcs
13. Wires - As needed

3.9 Conclusion

In this chapter we have discussed the block diagram,circuit diagram, working principle, flow chart also show the real image of the project and others. In the later part of this paper we discussed the result & discussion of the project to make the concept clear to anyone.

Chapter IV

RESULT & DISCUSSION

4.1 Introduction

This chapter contains the results obtained and discussion about the project. We have also covered discussions about advantages, disadvantages and limitation of current version of the system.

4.2 Result

- Waste level detection inside the dustbin.
- Transmit the information wirelessly to concern.
- The data can be accessed any time and from anywhere.
- The real time data transmission and access.
- Avoids the overflow of the dustbin.

4.3 Advantags of Smart Garbage Monitoring System

➡It saves time and money by using smart waste collection bins and systems equipped with fill level sensors. As smart transport vehicles go only to the filled containers or bins. It reduces infrastructure, operating and maintenance costs by upto 30%.

➡It decreases traffic flow and consecutively noise due to less air pollution as result of less waste collection vehicles on the roads. This has become possible due to two way communication between smart dustbins and service operators.

➡It keeps our surroundings clean and green and free from bad odour of wastes, emphasizes on healthy environment and keep cities more beautiful.

➡It further reduces manpower requirements to handle the garbage collection process.

➡Applying smart waste management process to the city optimizes management, resources and costs which makes it a "smart city".

4.4 Disadvantages of Smart Garbage Monitoring System

➡System requires more number of waste bins for separate waste collection as per population in the city. This results into high initial cost due to expensive smart dustbins compare to other methods.

➡Sensor nodes used in the dustbins have limited memory size.

➡It reduces man power requirements which results into increase in unemployments for unskilled people.

➡The trainining has to be provided to the people involved in the smart waste management system.

4.5 Discussion

The system was checked repeatedly by increasing and decreasing the level of garbage in the bin. Notification was sent each time the level got changed. The user checked the notification was checked by the user on the blynk app, so it can be said that the system has worked in the way we planned. Proper security was also given to the hardware components so that the output which comes is accurate because further actions have to be taken based on the output.

4.6 Cost Estimation

SI	Particulars	Specification	Qty.	Unit Price	Total Price
1	Arduino Nano	ATMEGA328P	1	350	350
2	LCD Display	16x2	1	150	150
3	GSM Module		1	550	550
4	Step Down Transformer	230V/12V	1	300	300
5	IR module	TX and RX	2	70	140
6	Ultrasonic Sensor		1	96	96
7	7805 Regulator		2	10	20
8	Capacitor	122MF, 35v	8	7	56
9	LED		8	4	32
10	Power Switch	Ship type	1	20	20
11	Resistor	Various			50
12	wire	As per need	10ft	20	200
13	Battery		3	70	210
14	Buzzer		1	20	20
15	Vero Board		1	40	40
16	IC Bess		2	25	50
17	Diode	IN4007	6	5	30
18	Project Board		1	500	500
19	Soldering cost				30
20	Others				100
				Total	**2,944**

Table : 4.1: Cost Estimation

4.7 Applications

Following are the most common applications of smart garbage monitoring system.

- Domestic
- Hotels
- Homes
- Malls
- Railway Station
- Bus Stop
- Gardens
- Colleges

4.8 Conclusion

This GSM Based waste management is very useful for smart cities in diverse aspects. We have seen that, in cities there are dissimilar dustbins located in different areas and dustbins become over flown many times and the concerned people do not get info about this. Our system is designed to crack this issue and will offer complete details of the dustbins located in different areas throughout the city. The allocated authority can access the information from anywhere and anytime to get the details.

Chapter V

CONCLUSION

5.1 Conclusion

Garbage monitoring systems are the needs of Smart buildings. Smart waste monitoring and management is the keen idea of smart city planners. Garbage monitoring systems is a new idea of implementation which makes a normal dustbin smart using sensors for garbage level detection and sending message to the user updating the status of the bin. As soon as the dustbin is full it gives the information in LCD and sent the message to corresponding officials.
The IOT-Garbage monitoring system pays a lot towards clean and disinfected pollution less environment in building a smart city. As these technology is new in India there should be appropriate consciousness and alertness among the public before the operation of this technology. Otherwise, sensitive devices like sensors might be spoiled due to rough action of the users. It is an automatic dust bin monitoring system in order to sense the full condition of the garbage bins. This providesthe authorized users appropriate updates of the location of the garbage bins and thus eliminates the need of intermittent manual checks and overflowing garbage bins. This method finally helps in keeping the environment clean. Thus, the garbage collection is made more efficient, effective and operative.

5.2 Future Work

There is a great scope for the modifications of the Garbage monitoring system in future. The system can be improved by adding new functionalities like line follower robot to it, when the bin is full directly it is dumping on tipper.The system can be used as a benchmark by the people who are willing to take one step further for increasing the cleanliness in their respected areas. This system to check the level of garbage in the dustbins but in future various other types of sensors can be used with the ultrasonic sensor to get more precise output and to take this system to another level. Now this system can be used in certain areas but as soon as it proves its credibility it can be used in all the big areas. As this system also reduces manual work certain changes can be done in the system to take it to another level and make it more useful for the employees and people who are using it. In future, a team can be made which will be in charge for handling and maintaining this system and also to take care of its maintenances.

References

REFERENCES:

1. Marian Look, “Trash Plant: India”, earth 911B.National Conference on Product Design(NCPD 2016), July 2016.
2. Basic Feature, “Solid waste Management Project by MCGM”.
3. Microtronics Technologies, “GSM based garbage and waste collection bins overflow indicator”, September 2013.
4. “Smart garbage management system”International Journal of Engineering Research &Technology (IJERT) ISSN:2278-0181.
5. “Smart Dustbin” National Conference on Product Design (NCPD 2016), July 2016.
6. Prof.R.M.Sahu, AkshayGodase, PramodShinde, ReshmaShinde, “Garbage and Street Light Monitoring System Using Internet of Things” INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING, ISSN (Online) 2321 – 2004, Vol. 4, Issue 4, April 2016.
7. Kanchan Mahajan, Prof.J.S.Chitode, “Waste Bin Monitoring System Using Integrated Technologies”, International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 7, July 2014.
8. Twinkle sinha, k.mugesh Kumar, p.saisharan, “SMART DUSTBIN”, International Journal of Industrial Electronics and Electrical Engineering, ISSN: 2347-6982 Volume-3, Issue-5, May 2015.

Richu Sam Alex, R NarcissStarbell, “Energy Efficient Intelligent Street Lighting System Using ZIGBEE and Sensors”, International

Appendix

Program

```
 #include<LiquidCrystal.h>
LiquidCrystal lcd(12,11,10,9,8,7);

#define IR1P A0
#define IR2P A1
#define LDRPIN A3
#define STRL 2  //street light
#define LED1 3
#define LED2 4
#define LED3 5
#define LED4 6
#define TRIGP A6
#define ECOP  A5
#define BUZ 13

int i=0,cnt,cnt1;
int LDR,IR1=1,IR2=1,almstp=0;
int duration,distance,LEV;

void setup()
{
  pinMode(BUZ, OUTPUT);
  pinMode(STRL, OUTPUT);
  pinMode(TRIGP, OUTPUT);
  pinMode(LED1, OUTPUT);
  pinMode(LED2, OUTPUT);
  pinMode(LED3, OUTPUT);
  pinMode(LED4, OUTPUT);
```

```
  pinMode(ECOP, INPUT);
  pinMode(IR1P, INPUT);
  pinMode(IR2P, INPUT);
  pinMode(LDRPIN, INPUT);

  lcd.setCursor(0,0);                  // 1st row 1st coloum
  lcd.print("   WELCOME TO   ");
  lcd.setCursor(0,1);                  // 2st row 1st coloum
  lcd.print("      SU        ");
  delay(1500);                         //1500 mili second

  lcd.setCursor(0,0);
  lcd.print("SUBMITTED BY:   ");
  lcd.setCursor(0,1);
  lcd.print("   OAZID        ");
  delay(1500);
  lcd.setCursor(0,1);
  lcd.print("   PARTHO       ");
  delay(1500);
  lcd.setCursor(0,1);
  lcd.print("   NAZIR        ");
  delay(1500);
  lcd.setCursor(0,1);
  lcd.print("   NITISH       ");
  delay(1500);
lcd.setCursor(0,1);
  lcd.print("   MOKSEDUL       ");
  delay(1500);

  lcd.setCursor(0,1);
  lcd.print("Circuit Digest");
  delay(1000);
```

```
  lcd.setCursor(0,1);
  lcd.print("System Ready");

  SendMessage();
}
////////////////////////////////////////////////////////////////////////////
////////////////////////////////////////////////////////////////////////////
void loop()
{
  SENSOR();
  DISPLAY1();
  CONTROL();
}
////////////////////////////////////////////////////////////////////////////
////////////////////////////////////////////////////////////////////////////
void DISPLAY1()
{
    lcd.setCursor(0,0);
    lcd.print("CONTAINER STATUS");
    lcd.setCursor(0,1);
    lcd.print("LEV:");
    lcd.print(LEV);
    lcd.print(" OK  OK  ");
}
////////////////////////////////////////////////////////////////////////////
void SENSOR()
{
  LDR = analogRead(LDRPIN);
  IR1 = digitalRead(IR1P);
  IR2 = digitalRead(IR2P);
```

```
  digitalWrite(TRIGP, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIGP, LOW);
  duration = pulseIn(ECOP, HIGH);
  distance= duration*0.034/2;
  LEV=(10-distance);
  Serial.print("  Distance: ");=(LEV*10);       //delete

  Serial.print("  LEV: ");
  Serial.print("  LEV   ");

}
////////////////////////////////////////////////////////////////////////////
void CONTROL()
{
  if(LEV < 10)
  {
    digitalWrite(LED1,              LOW);digitalWrite(LED2,              LOW);digitalWrite(LED3,
LOW);digitalWrite(LED4, LOW);
  }
  if( LEV < 31 )
  {
    digitalWrite(LED1,              HIGH);digitalWrite(LED2,             LOW);digitalWrite(LED3,
LOW);digitalWrite(LED4, LOW);
  }
  if( LEV < 51 )
  {
    digitalWrite(LED1,              HIGH);digitalWrite(LED2,             HIGH);digitalWrite(LED3,
LOW);digitalWrite(LED4, LOW);
  }
  if( LEV < 71 )
  {
```

```
  digitalWrite(LED1, HIGH);digitalWrite(LED2, HIGH);digitalWrite(LED3,
HIGH);digitalWrite(LED4, LOW);
 }
 if(LEV ==100)
 {
  digitalWrite(LED1, HIGH);digitalWrite(LED2, HIGH);digitalWrite(LED3,
HIGH);digitalWrite(LED4, HIGH);
  almstp =3;              //DISPLAY SHOW
  SendMessage3();         //SMS
  alarm();          //BUZZER
 }
 if(IR1 ==0)
 {
  almstp =1;
  SendMessage1();
  alarm();
 }
 else if(IR2 ==0)
 {
  almstp =2;
  SendMessage2();
  alarm();
 }

 else
 {
  digitalWrite(BUZ, LOW);
  almstp =0;
 }
 if(LDR > 420)              //5V= 1023
 digitalWrite(STRL, HIGH);
 if(LDR < 400)
```

```
  digitalWrite(STRL, LOW);
}
//////////////////////////////////////////////////////////
void alarm()
{

    lcd.setCursor(0,0);
    lcd.print("    WARNING     ");
    digitalWrite(BUZ, HIGH);
    lcd.setCursor(0,1);
    lcd.print("                ");
    delay(300);
    digitalWrite(BUZ, LOW);

    if(almstp==1)
    {
     lcd.setCursor(0,1);
     lcd.print("CONTAINER-1 FULL ");
    }
    if(almstp==2)
    {
     lcd.setCursor(0,1);
     lcd.print("CONTAINER-2 FULL ");
    }
    if(almstp==3)
    {
     lcd.setCursor(0,1);
     lcd.print("CONTAINER-3 FULL ");
    }
    delay(300);

}
```

```
//////////////////////////////////////////////////////////
void SendMessage()
{
 Serial.println("AT+CMGS=\"+8801825404584\"\r");
 Serial.println("system ready...");
}
void SendMessage1()
{
 Serial.println("AT+CMGS=\"+8801825404584\"\r");
 Serial.println(" DUST CONTAINER-1 FULL ! ");
}
void SendMessage2()
{
 Serial.println("AT+CMGS=\"+8801825404584\"\r");
 Serial.println(" DUST CONTAINER-2 FULL ! ");
}
void SendMessage3()
{
 Serial.println("AT+CMGS=\"+8801825404584\"\r");
 Serial.println(" DUST CONTAINER-3 FULL ! ");
```