SMART BIN

Report submitted to

Techno India University, West Bengal
for the partial fulfillment

Of

Bachelor of Technology (B. Tech.)
degree in
Computer Science & Engineering

By

SALONI KYAL

(ID NO. - 141001001172)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
TECHNO INDIA UNIVERSITY, WEST BENGAL, SALT LAKE,
KOLKATA – 700091, INDIA
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CERTIFICATE

This is to certify that the Dissertation Report entitled, "**Smart Bin**" submitted by **"Ms. Saloni Kyal**" to Techno India University, Kolkata, India, is a record of bonafide Project work carried out by her under my/our supervision and guidance and is worthy of consideration for the award of the degree of Bachelor of Technology (B.Tech) in Computer science & Engineering.

Approved By:

_____

 Supervisor(s)
 Date:

_____

 HOD, CSE, Techno India University

Date:

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I would also like to thank Dr. Jayanta Poray (Teacher-in-charge) and other faculties of CSE Department for the most required guidance of the technical details of the various latest technologies.

It has been a pleasure working with my team which includes students from ECE department who helped me to widen my ideas about the hardware field too. This project enhanced my technical knowledge and helped me to acquire the practical knowledge & advancements of various software technologies that was unfamiliar before.

Lastly, with all my heart, I express my deep gratitude to my parents for their support.

ABSTRACT

With the increasing population and industrialization of nations throughout the globe, waste has become a great concern for all of us. Over years, the traditional waste management system is not enough for its proper treatment and disposal techniques to preserve our environment and keeping it clean in this era of globalization. Garbage overflow and un-optimized garbage collection are the common problems as the waste from bins are collected by the garbage trucks using fixed schedules regardless they are full or not.

 By collecting and analyzing data from refuse containers, this project is able to create efficiencies and cut the cost of waste collection and incentivize recycling. It simplifies, de-risks and optimizes the waste management process, helping to make a sustainable waste-free environment a more achievable proposition.

Smart Bin combines IOT technology and real-time data and analytics, including trend data from fill-level sensors in waste containers, for optimized planning and routing of collection services. This project is divided into two parts, hardware and front-end implementation. In hardware implementation, the smart bin is fitted with Ultrasonic Sensors, GSM Module and Arduino which together helps to collect the waste level in the bin and this detail is displayed in the front-end using back-end technologies leading to an effective and optimized collection of waste.

CONTENTS

INTRODUCTION

1.1 Objectives

The main goal of this project is to eliminate old ways of garbage collection and replace them with a time and cost effective technological method. Moreover it will also solve pollution due to garbage and prevent people from hazardous diseases and stench. This project focuses on the design and prototype of a smart dustbin that can detect the level of the waste inside the dustbin and monitor waste management and collection according to that data. The data of the bin will be displayed in the mobile application and website and when the bin is almost full, a notification will be sent so that the drivers can go to collect the waste. This will save time and money which is lost in the form of fossil fuel, transportation cost etc. when the waste is collected from a bin which was not full and will prevent disease which is caused due to garbage overflow when the waste is not collected from a bin which was filled long back. Waste Management is all the activities and actions required to manage waste from inception to its final disposal. So this can be done by implementing IOT based waste management using smart dustbin.

1.2 Problem Specification

The greatest problem regarding waste management in developing countries begins at the very starting point of the process. Due to lack of proper systems for disposal and collections, wastes and garbage's end up in the roads and surrounding. According to a report published in 2002, the amount of waste generation in 2010 was around 20,000 tons per day, and it is estimated that by 2025 the amount will be no less than around 47000 tons per day. Moreover, there is a loss of economy because of the un-optimized waste collection. With the existing methods of collecting and disposal it is near impossible to manage such amount of waste in the future as around 30% of waste end up on the roads and public places due to ineffective disposing and collecting methods. The prime impediment of implementing smart waste management system using smart bin in a developing country is the social and economic infrastructure of the country.

1.3 Methodologies

In this project, model takes the fundamental process activities of Project Plan, Specification, Analysis, Design, Development, Validation and Evolution and represents them as separate process phases. This project uses a waterfall model as a development methodology. The system architecture and detailed design of the project, to implementation process uses Android Studio, Xampp and Aurdino tool for developing the modules in windows platform.

In the Smart Bin, ultrasonic sensors will continuously monitor the status of the bin. If the bin reaches more than certain level, the sensors will trigger the message to the concerned authority with the help of GSM module. The Arduino gives power to the sensor and GSM module and converts the hexadecimal value returned by the ultrasonic sensor to waste level percentage. The status of the bin will be continuously updated to the admin in the front-end technologies i.e. Mobile Application and Web Dashboard. The data from Arduino is sent to the server where the bin data is stored in the database. An API is generated from the database with the help of PHP code and the application extracts the bin data with the help of the API in Json format.

The schematic representation of the waterfall model used in this project is as follows:
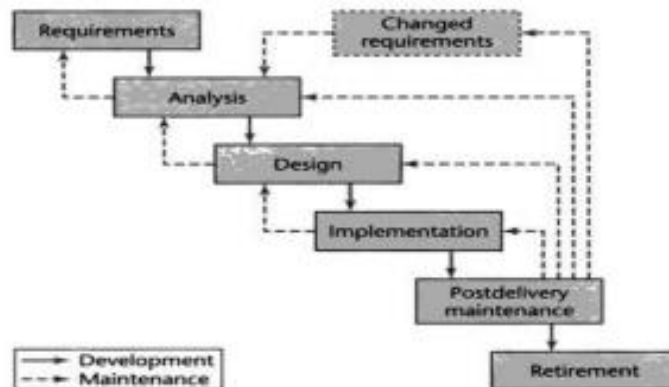

Fig : The Schematic Representation of Waterfall Model.

LITERATURE SURVEY

Literature review takes an overview on the relevant smart waste collection as well as monitoring literature. More recently, cities become more populate so with expanding the size of the cities, thus cities need to be smarter for living so smart services on city such as smart and intelligent traffic, smart and intelligent health care, and smart waste collection, smart education, smart living, smart energy etc. Amount of solid waste will increase so this impacts the environment and pollutant the air as well as create health issues. Therefore, it is very important to optimize the collection process and manage waste solid smarter and more efficient. Many studies were carried out on different ways for solid waste management, generate, collection, as well as monitoring, many researchers have given special guidance on different types of economical, technological and managerial challenges for the city solid waste management collection in the developing countries, researches have been achieved for the solid waste generated of different sectors.

2.1 HISTORY

Following the onset of industrialisation and the sustained urban growth of large population centres, the build-up of waste in the cities caused a rapid deterioration in levels of sanitation and the general quality of urban life. The streets became choked with filth due to the lack of waste clearance regulations. In the UK, London, The Metropolitan Board of Works was the first city-wide authority that centralized sanitation regulation for the rapidly expanding city and the Public Health Act 1875 made it compulsory for every household to deposit their weekly waste in "moveable receptacles: for disposal—the first concept for a dust-bin. Early garbage removal trucks were simply open bodied dump trucks pulled by a team of horses. They became motorized in the early part of the 20th century and the first close body trucks to eliminate odours with a dumping lever mechanism were introduced in the 1920s in Britain.

2.2 The studies of some researchers about waste management are discussed below:-

2.2.1 A Wireless Sensor Network Architecture for Solid Waste Management

In numerous application fields, for example, home, industry, environment and wellbeing, diverse Wireless Sensor Network (WSN) applications have been create to take care of administration issues with well-informed executions. In this challenge, the strong waste administration is a field where this methodology can be connected, in this paper another building design is proposed with intend to enhance the location where taking care of and move streamlining in the waste administration process. The framework structural planning depends on TelosB sensor hubs and makes utilization of Data Transfer Nodes (DTN) keeping in mind the end goal to give to a remote server the information recovered from the refuse canisters filling estimations. In addition, a remote checking arrangement has been actualize, giving client probability to associate with the framework by utilizing a web program. A few exercises have been produced to give a Decision Support System (DSS) to disentangle the finding of answers for assets association issues connected to strong waste management (Longhi et al., 2012)
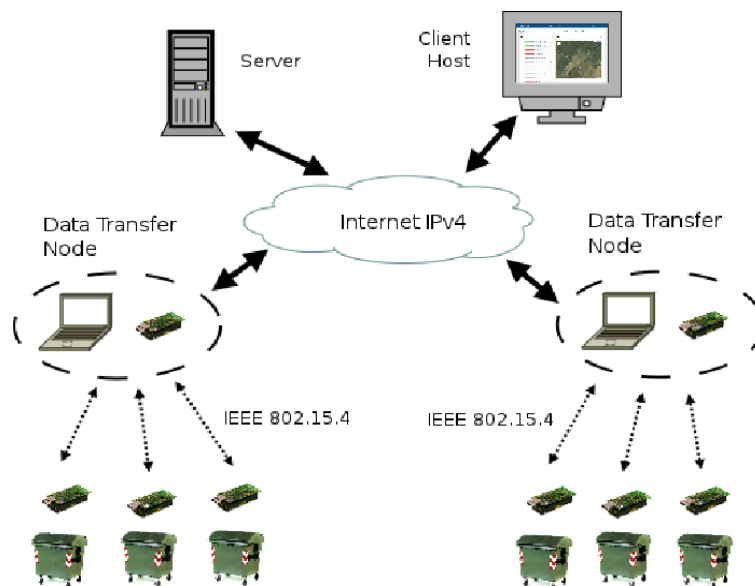

Fig: AWS Architechture

The architecture is composed of three parts:-

1)Long range communication module

Long-range correspondence sheets have been produced beginning from the Quected l M10 GSM/GPRS modules with a specific end goal to give adaptable and dependable ease DTNs. These modules incorporate an installed ARM processor and are programmable by utilizing implanted Open CPU.

2) Server layer

Server layer actualizes the part of middle person in the middle of clients and WSNs. The cooperation with the long-run correspondence modules must be deliberately composes. At this respect, in the building design, two arrangements have been actualize to permit information exchange in the middle of modem and server: one taking into account the TCP/IP attachment methodology and one on SMS. The first makes utilization of a daemon, which performs a pre-processing of the information guaranteeing the consistency of them. While the second one has been execute to give the information procurement when the GPRS association is absent. In the established arrangement, SMS is send to a passage hub, which advances a HTTP gets ask for the SMS information.

3) User interface

The entire framework gives two approaches to permit a client to connect with it: a custom programming customer and a Web application. The first comprises of a customer introduced on the client PC and has admittance to the focal DB. This arrangement is a touch antiquated and absences of adaptability. On the other side, the second one uses the cutting edge distributed computing and gives access through a Web application. Alluding to the sea venture, a standout amongst the most critical prerequisites is the remote filling observing of the trash containers. Beginning from this, the server gives the best way to the social affair (Longhi et al., 2012).

2.2.2 A Novel Prototype and Simulation Model for Real Time Solid Waste Bin Monitoring System

Solve to display the solid waste bin condition on real time. The system architecture is designed using wireless sensor networks chosen sensors are used to measure the status of the bins and ZigBee and GPRS are used as communication technologies. Wireless networking and defines the physical layer and ZigBee support large networks, but still have limitation for the smart bin uses. Physically the system is designed that consisting three main parts since the contains and bin to the control station namely.
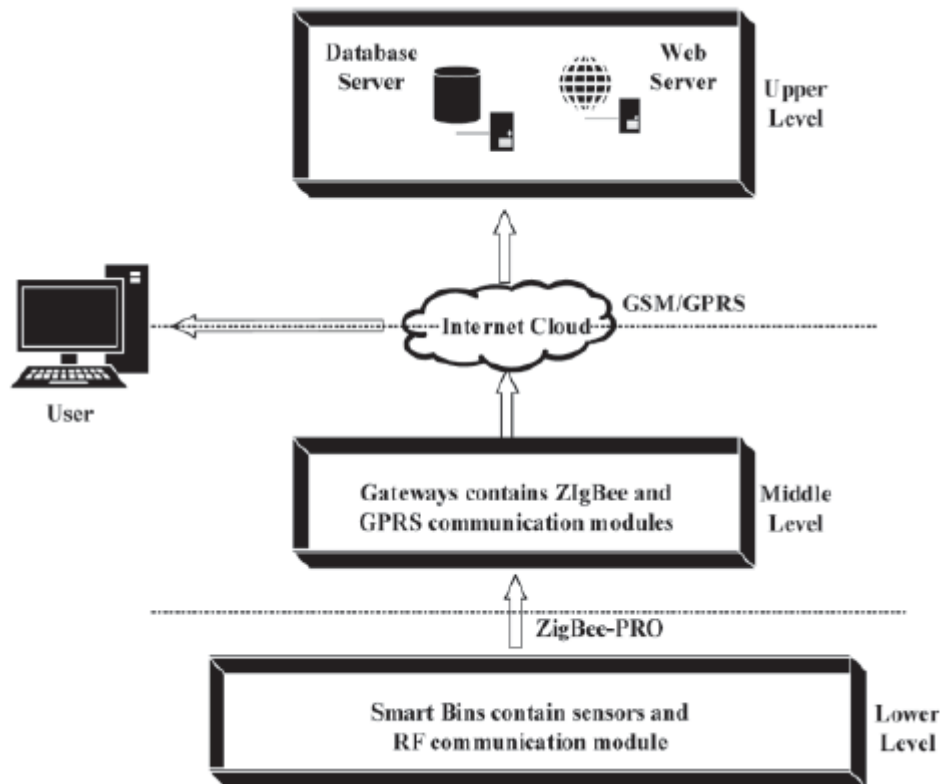
1. Smart bin
2. Gateway
3. Control station

Fig: Architecture of the Real Time Bin"s Monitoring System

The figure demonstrates that the System Architecture divides into three levels as lower, middle and upper levels, the lower level bins and contains smart which are collected of a set of sensory component. The selected sensors divided into two groups. The first group is mounted underneath the contain, and bin cover and the other is in the bottom of the contains and bin. The previous group consists of an accelerometer, a hall result, a temperature and an ultrasound, a humidity sensor and the latter group consists of the load cell sensor. The middle level, the data measured by the sensors are sends to the gateway through ZigBee and GPRS communication module, which is base of IEEE 802.15.4 and developed by ZigBee association. IEEE 802.15.4 standard is design for reliable. and wireless networking The ZigBee association optimized the feature set. The upper level consists of web server and data base server. The Getaway obtains the data sent by the lower level. It next parses the data and stores to its local database. If the GPRS connectivity is available, it sends connection request with the server to the control station through GPRS communication. After the establishment of connection, the control station exists in the upper level that contains servers. A daemon development in the server is responsible to make connection with the gateway when a connection request is arrived (Al Mamun, et al., 2014).

PROJECT PLANNING

3.1 STEPS

The planning steps involve:-

- Gather all the required hardware tools for the project.
- Start with the block diagrams and circuit diagrams for hardware setup.
- Implement the circuit.
- Check whether the hardware is working as required.
- Buy a server for collecting and storing all the data of the project.
- Once the data is sent to the server from the hardware tools successfully, store it in a database.
- Create the design of an interactive website and application where all the details can be displayed.
- Extract the data from the database in the application and website.
- Test the whole project.

3.2 RESOURCES

The next step is deciding what resources you need to accomplish the tasks in the time you have allotted for each. This can include everything from project planning tools and team members to equipment and office space. We have to manage these resources, so we need to know what they are and plan accordingly. This project includes hardware as well as software tools.

Hardware Tools

- Arduino
- GSM Module
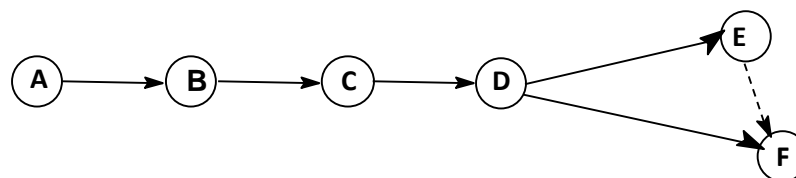- Ultrasonic Sensor
- Wires
- Bred Board

Software Tools

- Arduino Software tool
- Android Studio
- Xampp

3.3 TIME TAKEN

The following activities were included in project planning:-

Activity	Activity Name	Duration (Hour)	Predecessor Activity
A	Planning	30	-
B	Designing	90	A
C	Hardware & Coding	163	B
D	Testing Hardware	33	C
E	Testing	25	D
F	Implementation	17	D,E

Critical Path = 30+90+163+33+25+17 = 358 Hours

Hence the critical path for the project is 358 hours.

PROJECT DESCRIPTION

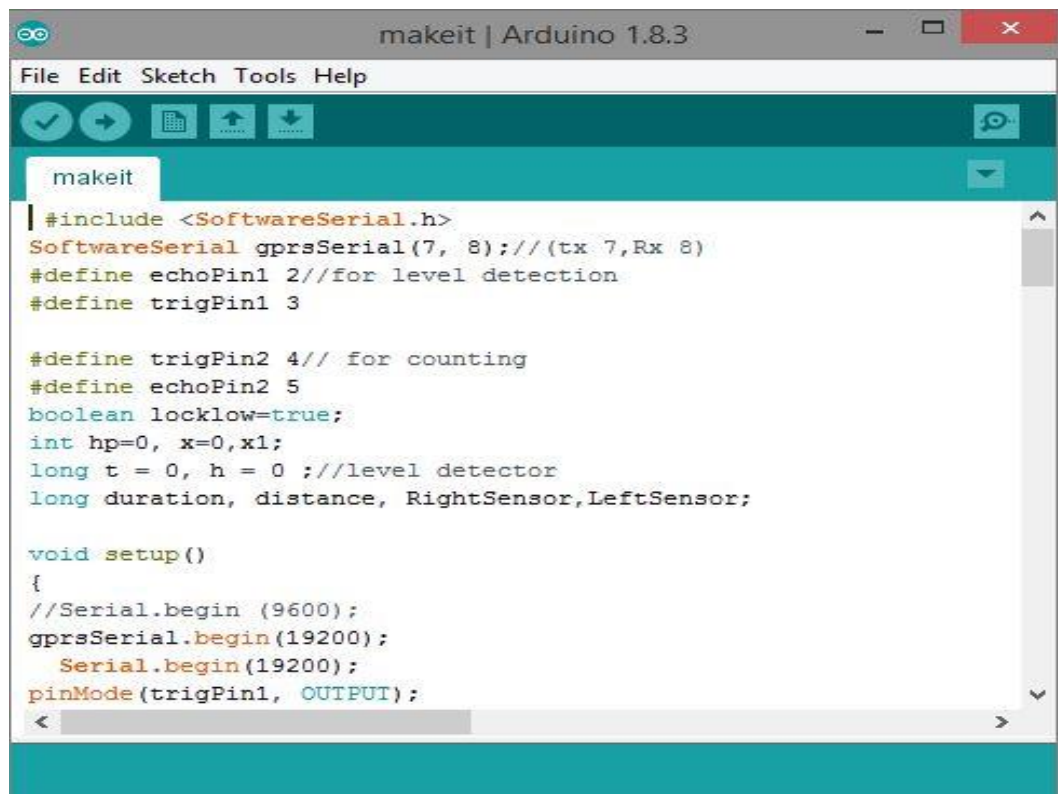## 4.1 Hardware Specifications:

4.1.1 ARDUINO

Arduino is a software company, project, and user community that designs and manufactures computer open-source hardware, open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices [3]. The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog I/O pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages, C and C++. The first Arduino was introduced in 2005, aiming to provide a low cost, easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.
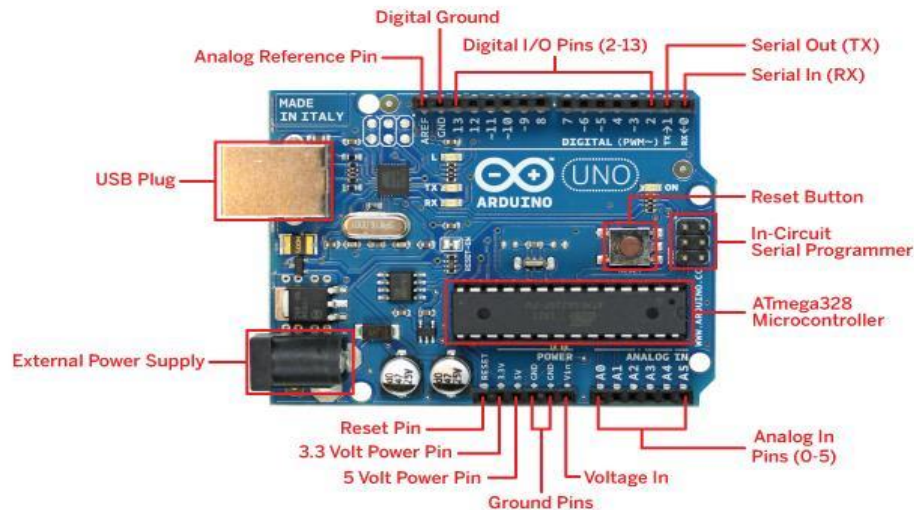
4.1.2 Software of ARDUINO:

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and provides simple one-click mechanism to compile and load programs to an Arduino board. A program written with the IDE for Arduino is called a "sketch" [4]. The Arduino IDE supports the languages C and C++ using special rules to organize code.


```
makeit | Arduino 1.8.3
File  Edit  Sketch  Tools  Help

  makeit

#include <SoftwareSerial.h>
SoftwareSerial gprsSerial(7, 8);//(tx 7,Rx 8)
#define echoPin1 2//for level detection
#define trigPin1 3

#define trigPin2 4// for counting
#define echoPin2 5
boolean locklow=true;
int hp=0, x=0,x1;
long t = 0, h = 0 ;//level detector
long duration, distance, RightSensor,LeftSensor;

void setup()
{
//Serial.begin (9600);
gprsSerial.begin(19200);
  Serial.begin(19200);
pinMode(trigPin1, OUTPUT);
```

Software Application

4.1.3 ULTRASONIC SENSOR

A special sonic transducer is used for the ultrasonic proximity sensors, which allows for alternate transmission and reception of sound waves. The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.
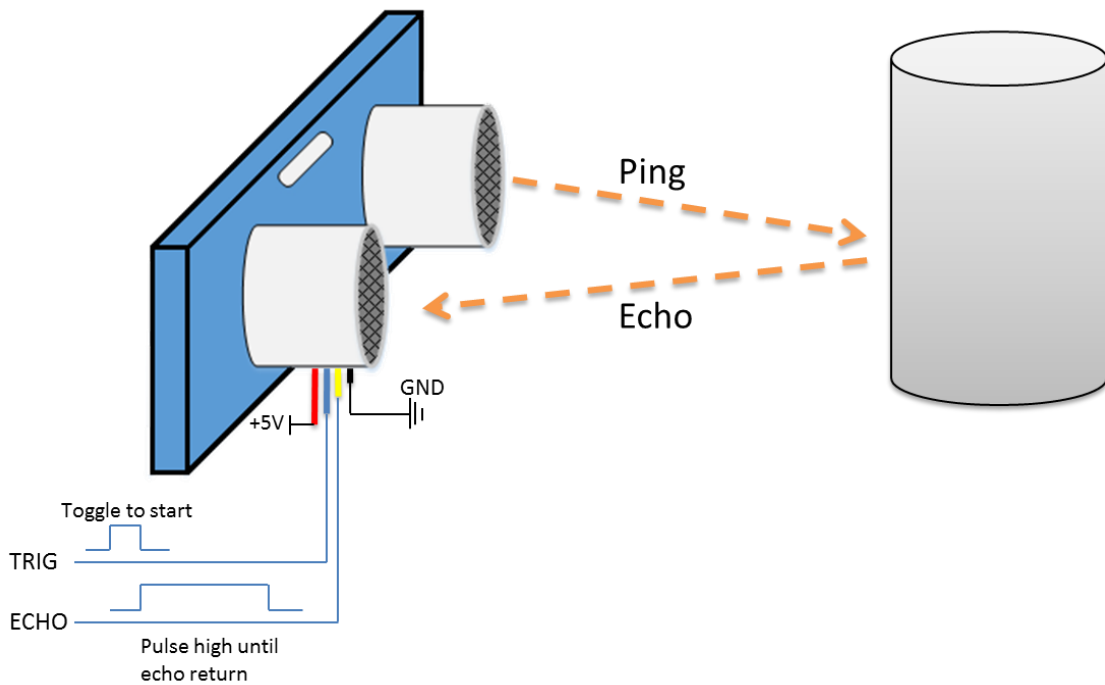
Ultrasonic sensors generate high-frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object.
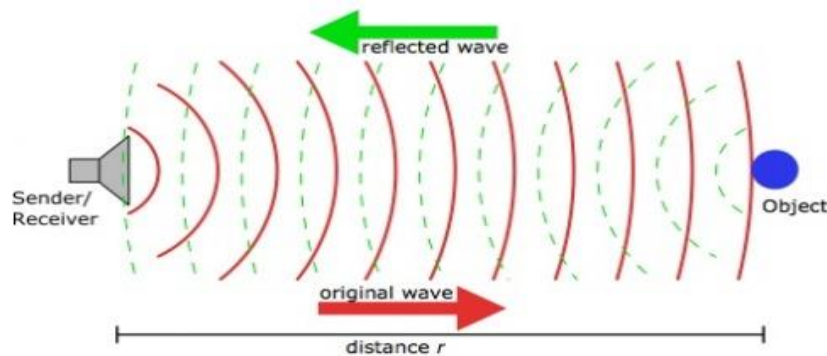
4.1.4 GSM MODULE

GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used bymobile phones, first deployed in Finland in July 1991 [5]. As of 2014 it has become the default global standard for mobile communications - with over 90% market share, operating in over 219 countries and territories [6].
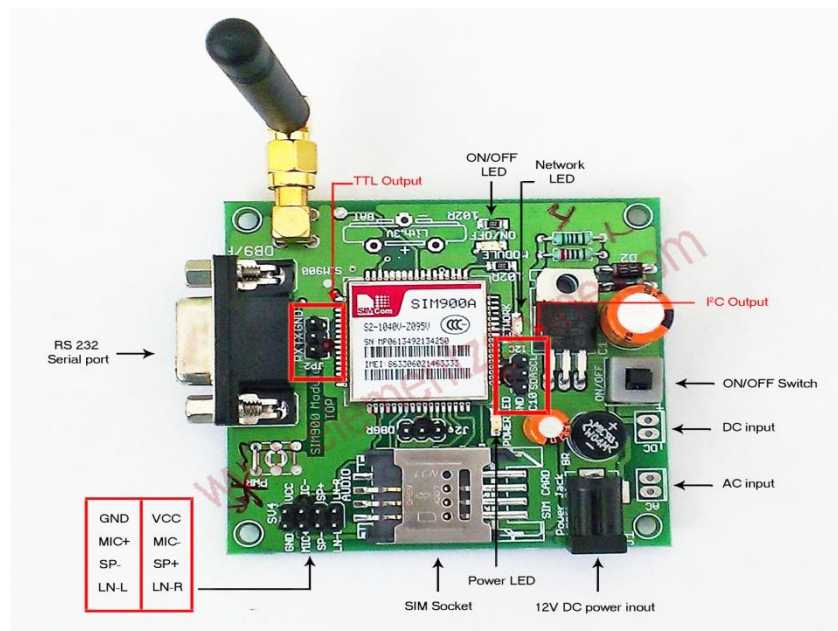
GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and the United States). In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first generation systems.

4.1.5 BREADBOARD

A breadboard is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. In the 1970s the solder-less breadboard (AKA plug board, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. "Breadboard" is also a synonym for "prototype". Because the solder-less breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solder-less breadboards are also extremely popular with students and in technological education. Older breadboard types did not have this property. A strip-board (veroboard) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing   units   (CP
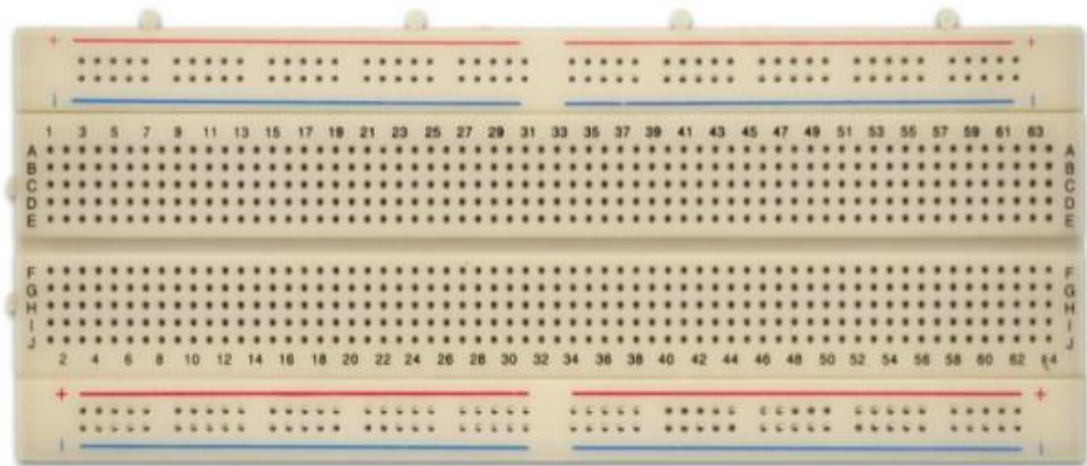
A modern solder-less breadboard consists of a perforated block of plastic with numerous tin plated phosphor bronze or nickel silver alloy spring clips under the perforations. The clips are often called tie points or contact points. The number of tie points is often given in the specification of the breadboard. The spacing between the clips (lead pitch) is typically 0.1 in (2.54 mm). Integrated circuits (ICs) in dual in-line

packages (DIPs) can be inserted to straddle the centerline of the block. Interconnecting wires and the leads of discrete components (such as capacitors, resistors, and inductors) can be inserted into the remaining free holes to complete the circuit. Where ICs are not used, discrete components and connecting wires may use any of the holes.

4.1.6 JUMPER WIRES:

Jump wires (also called jumper wires) for solder-less bread-boarding can be obtained in ready-to-use jump wire sets or can be manually manufactured. The latter can become tedious work for larger circuits. Ready-to-use jump wires come in different qualities, some even with tiny plugs attached to the wire ends. Jump wire material for ready-made or homemade wires should usually be 22 AWG (0.33 mm2) solid copper, tin-plated wire - assuming no tiny plugs are to be attached to the wire ends. The wire ends should be stripped 3 ⁄16 to 5 ⁄16 in (4.8 to 7.9 mm). Shorter stripped wires might result in bad contact with the board's spring clips (insulation being caught in the springs). Longer stripped wires increase the likelihood of short-circuits on the board. Needle-nose pliers and tweezers are helpful when inserting or removing wires, particularly on crowded boards.

 Differently colored wires and color-coding discipline are often adhered to for consistency. However, the number of available colors is typically far fewer than the number of signal types or paths. Typically, a few wire colors are reserved for the supply voltages and ground (e.g., red, blue, black), some are reserved for main signals, and the rest are simply used where convenient.
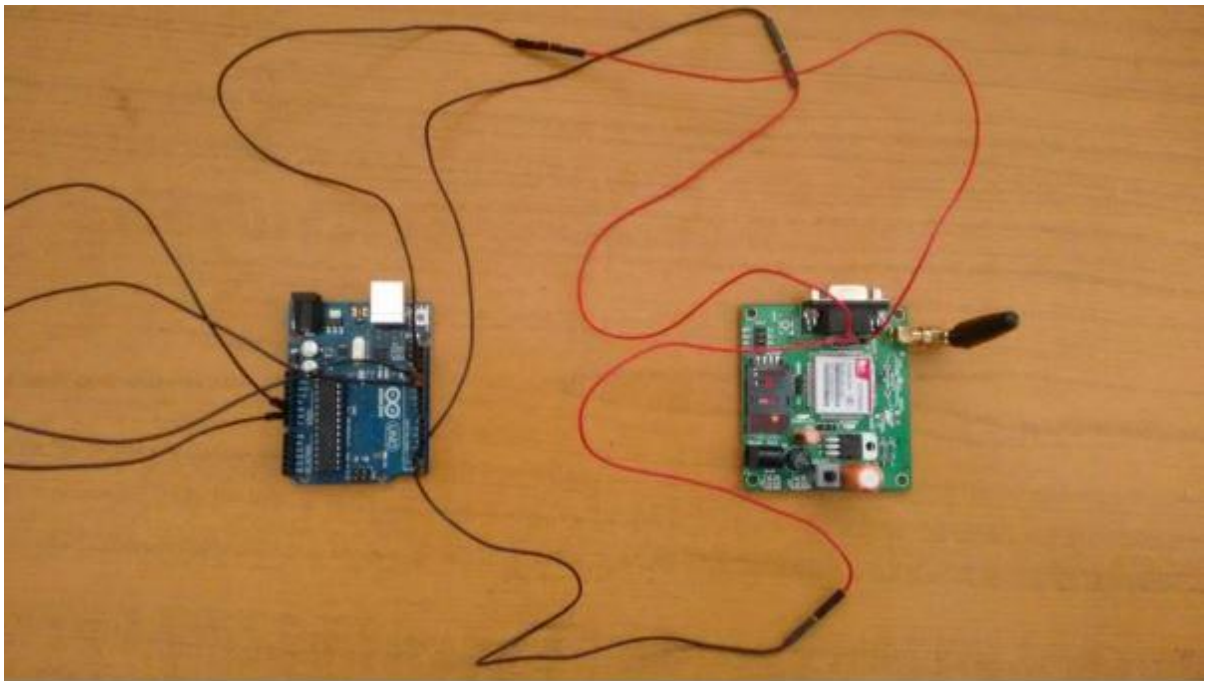
4.2 HARDWARE CONNECTION:

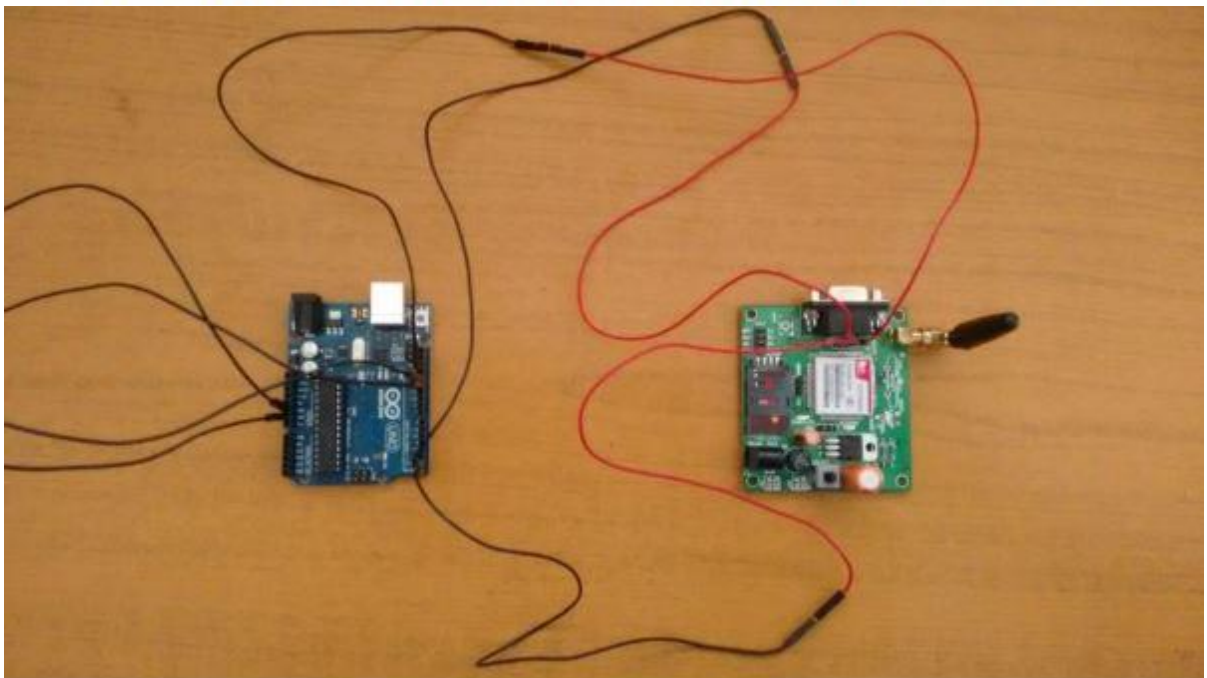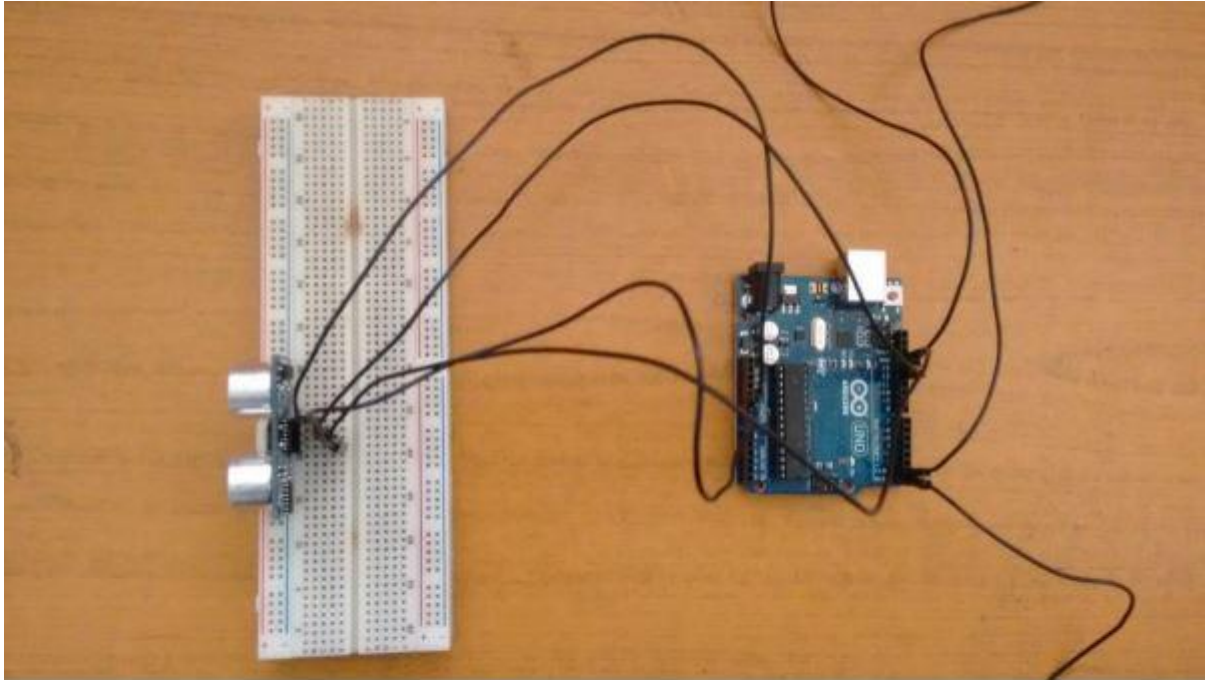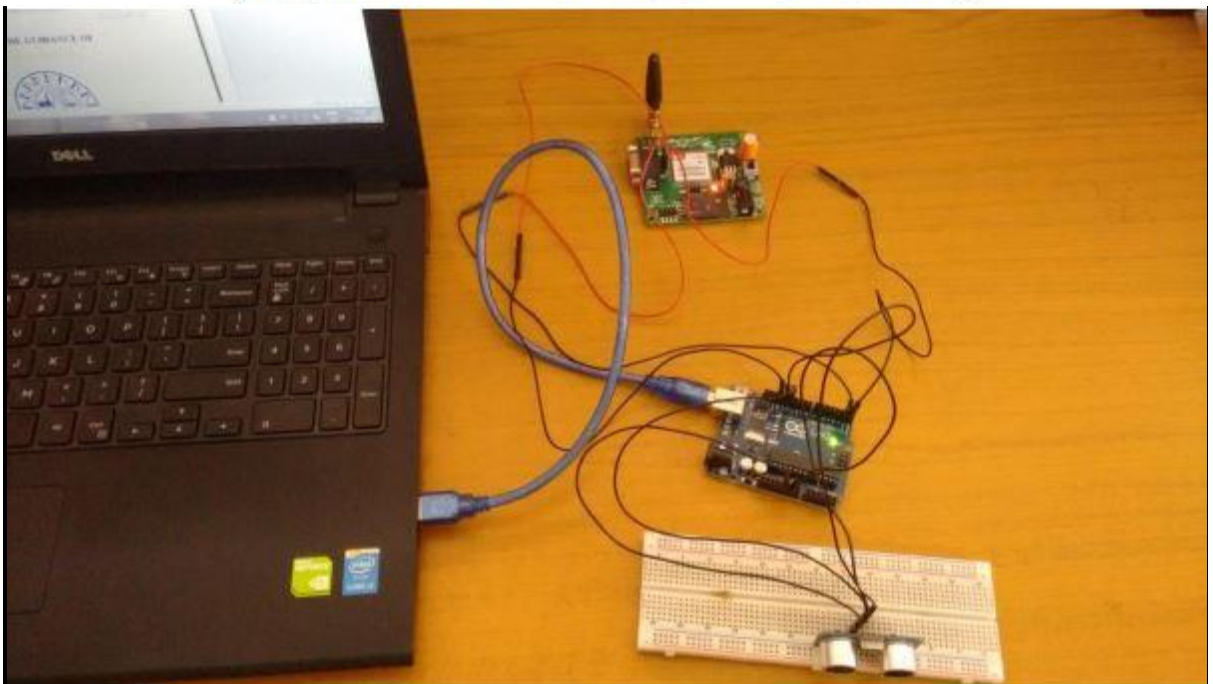FIG 5.8 : GSM MODULE IS CONNECTED WITH ARDUINO BOARD THROUGH JUMP WIRES

FIG 5.8 : GSM MODULE IS CONNECTED WITH ARDUINO BOARD THROUGH JUMP WIRES

FIG 5.7 : ULTRASONIC SENSOR IS CONNECTED WITH ARDUINO BOARD THROUGH JUMP WIRES (THIS SETUP WILL HELP IN SENSING OF THE GARBAGE LEVEL)

FIG 5.10 : ARDUINO BOARD IS CONNECTED WITH LAPTOP THROUGH DATA CABLE FOR DUMPING OF PROGRAM

4.3 CODES FOR HARDWARE INTERFACE:

```
#include <SoftwareSerial.h>
SoftwareSerial gprsSerial(7, 8);//(tx 7,Rx 8)
#define echoPin1 2//for level detection
#define trigPin1 3
#define trigPin2 4// for counting
#define echoPin2 5
boolean locklow=true;
int hp=0, x=0,x1;
long t = 0, h = 0 ;//level detector
long duration, distance, RightSensor,LeftSensor;
void setup()
{
        //Serial.begin (9600);
        gprsSerial.begin(19200);
        Serial.begin(19200);
        pinMode(trigPin1, OUTPUT);
        pinMode(echoPin1, INPUT);
        pinMode(trigPin2, OUTPUT);
        pinMode(echoPin2, INPUT);
        Serial.println("Config SIM900...");
         delay(2000);
         Serial.println("Done!...");
         gprsSerial.flush();
         Serial.flush();
        // attach or detach from GPRS service
         gprsSerial.println("AT+CGATT?");
         delay(100);
         toSerial();
```

```
        // bearer settings
        gprsSerial.println("AT+SAPBR=3,1,\"CONTYPE\",\"GPRS\"");
        delay(2000);
        toSerial();
        // bearer settings
        gprsSerial.println("AT+SAPBR=3,1,\"APN\",\"airtelgprs.com\"");
        delay(2000);
        toSerial();
        // bearer settings
        gprsSerial.println("AT+SAPBR=1,1");
        delay(2000);
        toSerial();
}


void loop() {
        x1=x;
        locklow=true;
        gprsSerial.println("AT+HTTPINIT");
        delay(2000);
        toSerial();
        SonarSensor(trigPin1, echoPin1);
        if((hp>1)&&(hp<103))
        {
                RightSensor = hp;
        } //ok
        SonarSensor(trigPin2, echoPin2);
        if((hp>=10)&&(hp<=90))
        {
                if(locklow)
                {
                        x++;
```

```
                     LeftSensor = x;
                     locklow=false;
           }
       }
        else
       {
               if(!locklow)
               {
                       locklow=true;
               }
       }
        Serial.print(LeftSensor);
        Serial.print(" - ");
       Serial.print(RightSensor);
       Serial.println(" %");
        if(x>x1)
               gsmcall();
}


void SonarSensor(int trigPin,int echoPin)
{
       digitalWrite(trigPin, LOW);
       delayMicroseconds(2);
       digitalWrite(trigPin, HIGH);
       delayMicroseconds(10);
       digitalWrite(trigPin, LOW);
       duration = pulseIn(echoPin, HIGH);
       distance = duration / 58;
       // distance = distance - 6;  // offset correction
       distance = 76 - distance;  // height, 0 - 50 cm
       hp= 2 * distance;  // distance in %, 0-100 %
```

```
   }

 void toSerial()
{
 while(gprsSerial.available()!=0)
 {
  Serial.write(gprsSerial.read());
 }
}

void gsmcall() {
        String m = String(RightSensor);
        String s = String(LeftSensor);
         // set http param value hfgf
        //Serial.println("AT+HTTPPARA=\"URL\",\"http://www.admybin.com/intern_test/1.
        php?sensorval1=" + s + "&sensorval2=22\"");
        Serial.println("AT+HTTPPARA=\"URL\",\"http://www.admybin.com/intern_test/1.p
        hp?bin_code=xxxxxxx&sensorval1=" + s + "&sensorval2=" + m + "\"");
        gprsSerial.println("AT+HTTPPARA=\"URL\",\"http://www.admybin.com/intern_test
        /1.php?sensorval1=" + s + "&sensorval2=22\"");
        gprsSerial.println("AT+HTTPPARA=\"URL\",\"http://www.admybin.com/intern_test
        /1.php?bin_code=INF-1&sensorval1=" + s + "&sensorval2=" + m + "\"");
        delay(2000);
        toSerial();
         // set http action type 0 = GET, 1 = POST, 2 = HEAD
          gprsSerial.println("AT+HTTPACTION=0");
        delay(6000);
        toSerial();
        // read server response
         gprsSerial.println("AT+HTTPREAD");
        delay(1000);
```
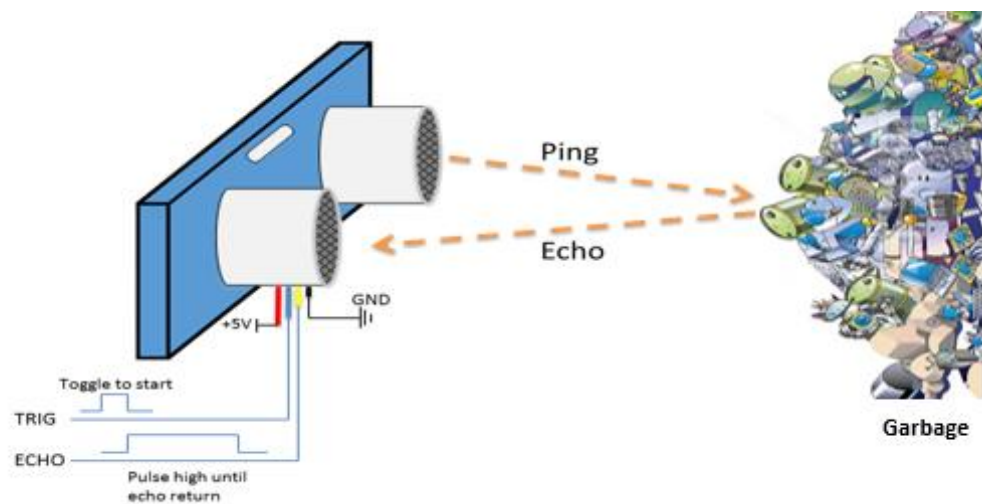
```
        toSerial();
         gprsSerial.println("");
        gprsSerial.println("AT+HTTPTERM");
         toSerial();
        delay(300);
        gprsSerial.println("");
        delay(2000);
}
```

## 4.4 Hardware Uses

4.4.1 Ultrasonic Sensor

- Ultrasonic Sensor sends out a high-frequency sound pulse, and then times how long it takes for the echo of the sound to reflect back.
- The length of the returning pulse is proportional to the distance of the garbage from the sensor.
- The travel time and, the speed of sound is taken into account to calculate the distance.

4.4.2 Arduino
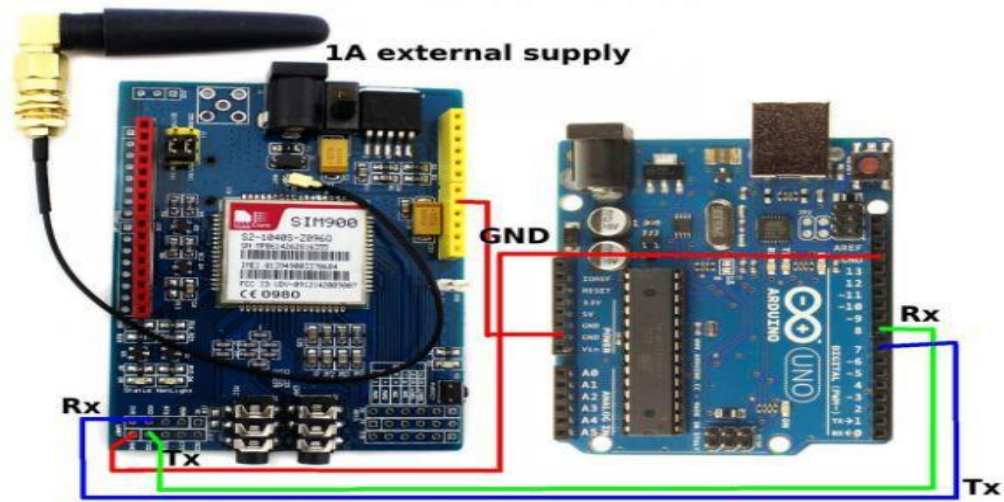
- Arduino Uno is the key component of this project. It is a micro-controller board that provides both Hardware and Software platform.
- Both, Ultrasonic Sensor and GSM module, is interfaced with the Arduino.
- The code is written in Arduino IDE software, where the data is analysed, calculated, and transferred successfully to the server.

4.4.3 GSM Module
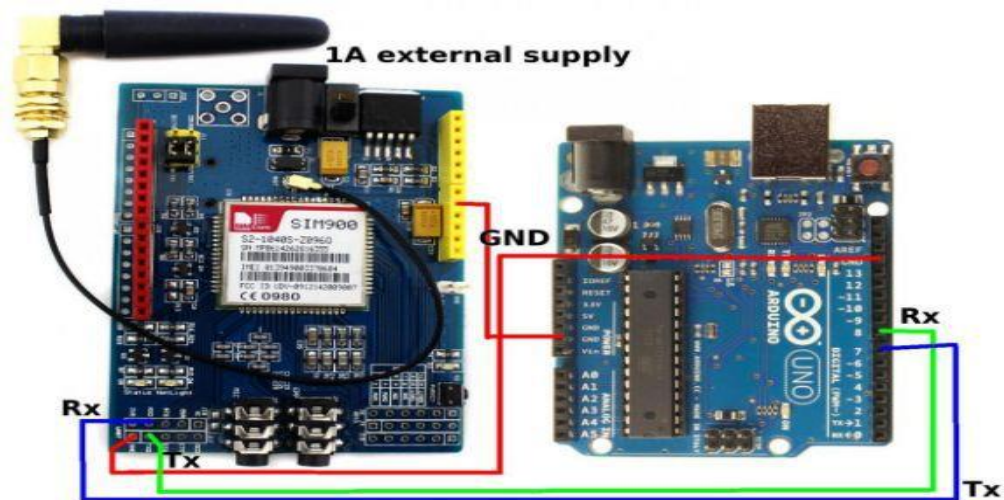
- GSM Sim 900 module is an ultra-compact, and reliable Quad-band modem.

- It provides an internet connection, and transfers the data to the server.
- The unique IMEI no. of the Sim is used to distinguish each bin from the other bins.

4.5 Back-end Specification

In the back-end the data from the hardware is stored. The data is extracted and displayed in the mobile application using PHP technologies. The data is sent to the server where it is stored in the database using PHP code. AN API is generated in JSON format in order to extract information from the database in the mobile application.

4.5.1 PHP
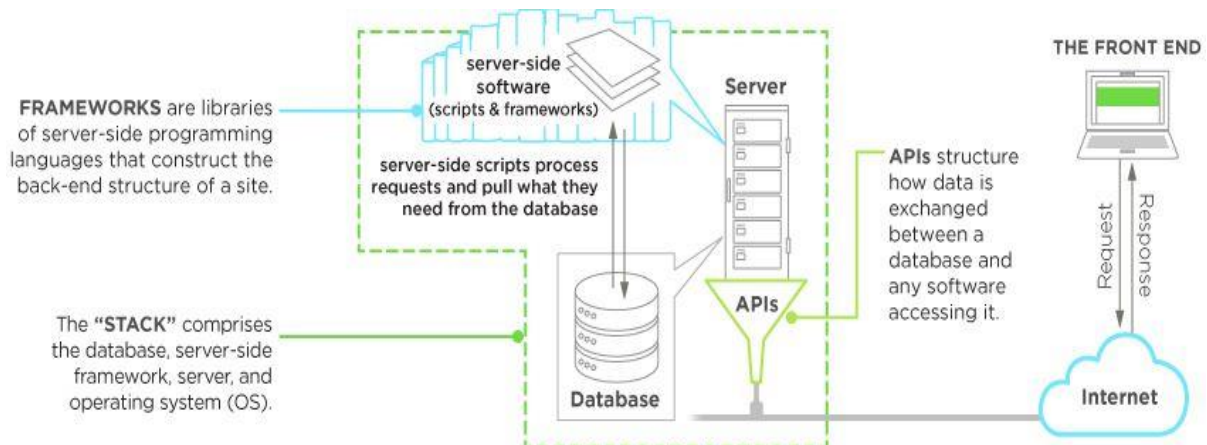
- PHP (Hypertext Pre-processor) is a server-side back-end programming language.
- It facilitates the transfer of data from Arduino to the Database server.
- It is designed to interact with the database, and process information from the server to access the database.
- It is use to build Application Programming Interfaces (APIs), which controls what data and software a site shares with other apps.

4.5.2 Database

- The database is responsible for accepting the query, fetching the data, and returning it to the website and the application.
- It accepts new, and edited data when Arduino interacts with then using PHP.

- The relevant details of each Bin is stored in the bin_info table.

- The details are imported in MYSQL Database from the Excel Sheet using PHP.

- The level of the bin is stored in the bin_level_data table.
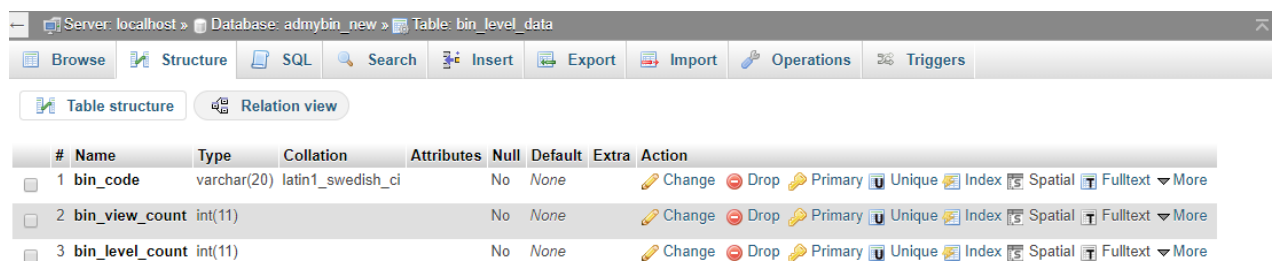
4.5.2.1   Tables
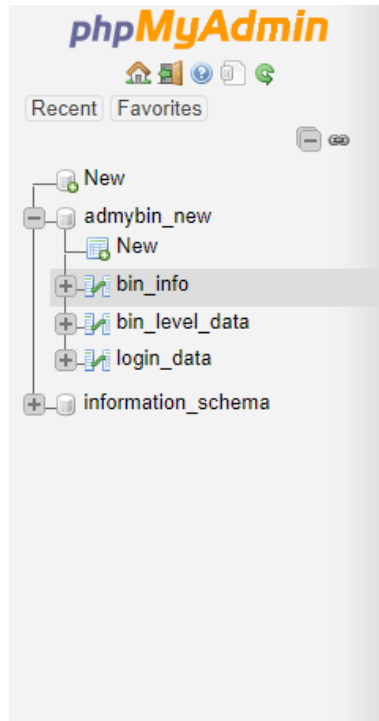
4.5.2.2   Table Structure and Code

#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	bin_id	int(20)			No	None	AUTO_INCREMENT	Change Drop Primary Unique Index Spatial More
2	bin_code	varchar(20)	latin1_swedish_ci		No	None		Change Drop Primary Unique Index Spatial More
3	bin_name	varchar(20)	latin1_swedish_ci		No	None		Change Drop Primary Unique Index Spatial More
4	imei_no	varchar(20)	latin1_swedish_ci		Yes	NULL		Change Drop Primary Unique Index Spatial More
5	type	varchar(10)	latin1_swedish_ci		No	None		Change Drop Primary Unique Index Spatial More
6	latitude	decimal(12,9)			No	None		Change Drop Primary Unique Index Spatial More
7	longitude	decimal(12,9)			No	None		Change Drop Primary Unique Index Spatial More
8	location	varchar(500)	latin1_swedish_ci		No	None		Change Drop Primary Unique Index Spatial More
9	address	varchar(5000)	latin1_swedish_ci		No	None		Change Drop Primary Unique Index Spatial More

Fig: Table structure for bin-info

The bin information details can be stored in the database using a web page by the admin where the admin can either store enter the bin details manually which will be stored in the database or the user an upload an excel file with all the details. The code for adding data is:-

```php
<?php
session_start();
include('connection.php');
$b_id=$_POST['b_id'];
$b_name=$_POST['b_name'];
$b_imei=$_POST['b_imei'];
$b_type=$_POST['b_type'];
$b_lat=$_POST['b_lat'];
$b_lng=$_POST['b_lng'];
$b_landmark=$_POST['b_landmark'];
$b_add=$_POST['b_address'];
$sql="insert into bin_info (bin_id,bin_name,imei_no,type,latitude,longitude,location,address)
values ('$b_id','$b_name','$b_imei','$b_type','$b_lat','$b_lng','$b_landmark','$b_add')";
$res=mysqli_query($con,$sql);
if(!$res)
{
        echo mysqli_error($con);
}
else
{
        $data="Yes Inserted into table";
        echo $data;
        $_SESSION['upload']=1;
        header('location:add_bin.php');

}
?>
```


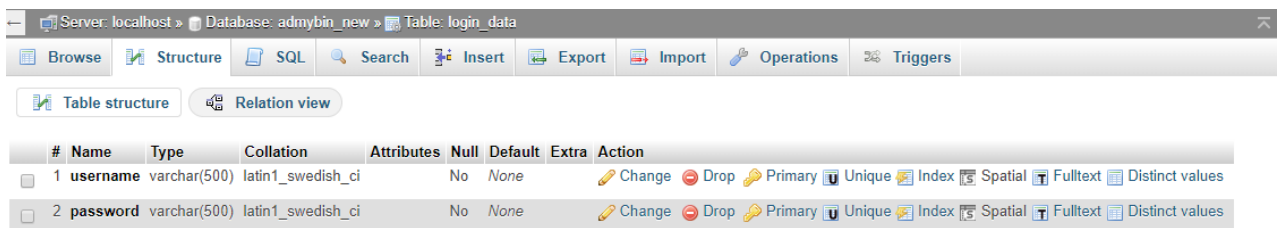| #	Name	Type	Collation	Attributes	Null	Default	Extra	Action
1	bin_code	varchar(20)	latin1_swedish_ci		No	None		Change Drop Primary Unique Index Spatial Fulltext More
2	bin_view_count	int(11)			No	None		Change Drop Primary Unique Index Spatial Fulltext More
3	bin_level_count	int(11)			No	None		Change Drop Primary Unique Index Spatial Fulltext More

Fig: Table structure for bin-level-data

The bin level and count data is stored in the database by the values sent by the hardware modules to the server. The values are added to the database by the help of PHP code.

The code to add the bin level data the database is as follows:-

```php
<?php
include('connection.php');
$x=$_GET['x'];
$sql="select * from bin_info where bin_id='".$x."'";
$res=mysqli_query($con,$sql);
if(!$res)
{
$data=mysqli_error($con);
echo json_encode($data);
}
else
{
$row=mysqli_fetch_assoc($res);
$r_array=$row['bin_id']."*".$row['imei_no'].'*'.$row['location'].'*'.$row['address'].'*'.$row['latitude'].'*'.$row['longitude'];
$sql1="select * from bin_level_data where imei_no='".$row['imei_no']."'";
$res1=mysqli_query($con,$sql1);
if(!$res1)
{
        $data=mysqli_error($con);
        echo json_encode($data);
}
else{
        $row1=mysqli_fetch_assoc($res1);
        $r_array=$r_array."*".$row1['bin_view_count']."*".$row1['bin_level_count'];
}
echo json_encode($r_array);
}
?>
```

Fig: Table structure for login_data

The admin saves the login information and can change the details whenever required. The

code for handling login is:-

```php
<?php
include('connection.php');
//$data="admybin_admin*admybin_admin";
$X=$_GET['x'];
```

```
//echo json_encode($X);
$X=explode("*",$X);
$usr=$X[0];
$pwd=$X[1];
$sql="select * from login_data where username='$usr' and password='$pwd'";
$res=mysqli_query($con,$sql);
if(!$res)
die(mysqli_error($con));
else
{
if(mysqli_num_rows($res)==0)
$data=0;
else
$data=1;
}
echo json_encode($data);
?>
```

4.5.2.3   Table Data

			bin_id	bin_code	bin_name	imei_no	type	latitude	longitude	location	address
☐	Edit	Copy	Delete	1	NIT-201	NIT 1	123456	W	22.676934290	88.379202780	NIT	near the entrance
☐	Edit	Copy	Delete	2	NIT-202	NIT 2	897282	W	22.676687110	88.378914780	NIT	inside campus in garden lobby
☐	Edit	Copy	Delete	3	NIT-203	NIT 3	799843	W	22.676687110	88.378914780	NIT	inside campus in garden lobby
☐	Edit	Copy	Delete	4	NIT-204	NIT 4	891471	W	22.676571720	88.379050900	NIT	outside building exam cell in garden
☐	Edit	Copy	Delete	5	NIT-205	NIT 5	8976	W	22.676411790	88.379145120	NIT	outside mechanical department
☐	Edit	Copy	Delete	6	NIT-206	NIT 6	78354	W	22.676310930	88.379418700	NIT	outside exit gate
☐	Edit	Copy	Delete	7	NIT-207	NIT 7	NULL	W	22.675983320	88.378766250	NIT	outside university building front side
☐	Edit	Copy	Delete	8	NIT-208	NIT 8	NULL	W	22.675874120	88.378689810	NIT	outside university building near stairs
☐	Edit	Copy	Delete	9	NIT-209	NIT 9	NULL	W	22.675951460	88.378710600	NIT	inside building OPP room 101
☐	Edit	Copy	Delete	10	NIT-210	NIT 10	NULL	W	22.675639930	88.378698860	NIT	outside canteen building
☐	Edit	Copy	Delete	11	HER-1	heritage 1	1234	Two sided	22.499202446	88.416726217	heritage	near college and hostel
☐	Edit	Copy	Delete	12	HER-2	heritage 5	NULL	Two sided	22.518358631	88.418013006	heritage	outside cafeteria
☐	Edit	Copy	Delete	13	HER-3	heritage 6	3	Two sided	22.517717523	88.417101726	heritage	senior building school
☐	Edit	Copy	Delete	14	HER-4	heritage 3	4	Two sided	22.517094375	88.418367729	heritage	come building
☐	Edit	Copy	Delete	15	HER-5	hertiage 4	NULL	Two sided	22.518089490	88.418771401	heritage	CAC building
☐	Edit	Copy	Delete	16	HER-6	hertiage 7	NULL	Two	22.518306909	88.416347019	heritage	main building school 2 sets in current

Fig: Bin info table data
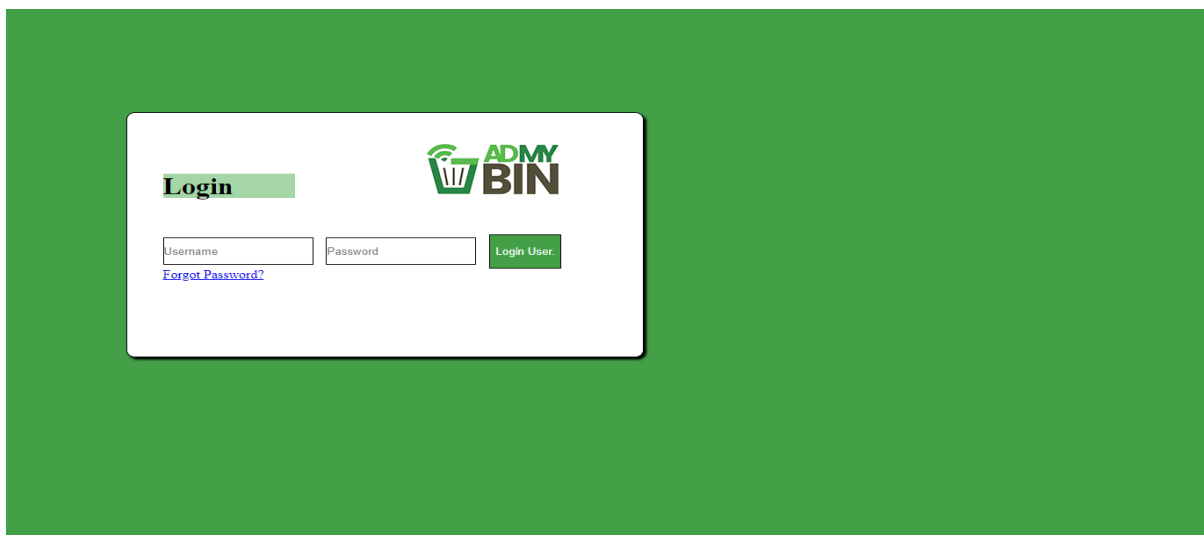
Fig: Bin level and count data received from the hardware

4.6 Front-end Specification

4.6.1 Web pages

LOGIN PAGE

Admin login by entering username and password. The HTML code for design is:-

```html
<html>
<head>
<style>
html, body, div, span, applet, object, iframe, h2, h3, h4, h5, h6, p, blockquote, pre,
a, abbr, acronym, address, big, cite, code,
del, dfn, em, img, ins, kbd, q, s, samp,
small, strike, strong, sub, sup, tt, var,
b, u, i, center,
dl, dt, dd, ol, ul, li,
fieldset, form, label, legend,
table, caption, tbody, tfoot, thead, tr, th, td,
article, aside, canvas, details, embed,
figure, figcaption, footer, header, hgroup,
menu, nav, output, ruby, section, summary,
time, mark, audio, video {
        margin: 0;
        padding: 0;
        border: 0;
        font-size: 100%;
        font: inherit;
        vertical-align: baseline;
}
/* HTML5 display-role reset for older browsers */
article, aside, details, figcaption, figure,
footer, header, hgroup, menu, nav, section {
        display: block;
}
body {
        line-height: 1;
}
ol, ul {
        list-style: none;
}
blockquote, q {
        quotes: none;
}
blockquote:before, blockquote:after,
q:before, q:after {
        content: '';
        content: none;
}
table {
        border-collapse: collapse;
        border-spacing: 0;
}
</style>
```

```
</head>
<body id='body' style='display:hidden;background-color:#43A047'>
 <div      class="login"      style='border:1px      solid      black;padding-top:3%;padding-
left:3%;width:40%;margin:10%;height:40%;border-radius:0.6em;background-
color:white;box-shadow:3px 3px 3px'>
 <div>
 <table>
 <tr>
 <td style='width:50%'>
        <h1 style='background-color:#A5D6A7;width:100%;'>Login</h1>
        </td>
        <td><img style='margin-left:100%' src='admybin-logo.gif'></td>
        </tr>
        </table>

   <form method="post">
        <input      type="text"      name="u"      id='usname'            style='margin-
top:3%;height:13%;border:1px solid black ;' placeholder="Username" required="required" />
     <input      type="password"      name="p"      id='pwd'      style='margin-top:3%;margin-
left:2%;height:13%;border:1px solid black ;' placeholder="Password" required="required" />
        <button type="button" id='click' style='color:white;margin-top:5%;margin-left:2%;box-
shadow:3px      3px      3px;      border:1px      solid      black;      background-
color:#43A047;height:16%;'class="btn      btn-primary      btn-block      btn-large">Login
User.</button>
   </form>
        </div>
        <a href= "forgot_pass.php">Forgot Password?</a>
</div>
        <script src = "http://ajax.aspnetcdn.com/ajax/jQuery/jquery-2.2.3.js"></script>
        <script>
  $(function(){
   $('#click').click(function(){
     var z=$('#usname').val();
              var y=$('#pwd').val();
              var x=z+"*"+y;
     $.ajax({
        url: "login_backend.php",
        dataType: "json",
        data: { x : x },
        success: function(result){
                              //alert(result);
                              if(result==1)
                                    window.location.assign("index.php");
                              else
                                    alert("Username Or Password incorrect");
        },
```

```
        error: function(e) {
          // Handle error here
            console.log(e);
        }
     });
    });
    })
        </script>
</body>
</html>
```

Check Data

Data can be checked using three parameters

- Area Wise Search
- Bin code Search
- Imei no. Search

The admin can use this web page to check the bin data and information to know the details about a particular bin.

Add Bin

The admin can add a bin by entering each detail in a for, one at a time or can add many bins together belonging to the same are by uploading an Excel file in the format given and all the bin details will be added to the database from the excel file.

The code for adding bin is:

```
<!DOCTYPE html>
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
    <meta charset="utf-8" />
  <meta name="viewport" content="width=device-width, initial-scale=1.0" />
```

```html
    <title>Simple Responsive Admin</title>
        <!-- BOOTSTRAP STYLES-->
    <link href="assets/css/bootstrap.css" rel="stylesheet" />
     <!-- FONTAWESOME STYLES-->
    <link href="assets/css/font-awesome.css" rel="stylesheet" />
      <!-- CUSTOM STYLES-->
    <link href="assets/css/custom.css" rel="stylesheet" />
        <link rel="stylesheet" href="examples/css/normalize.css">
  <link rel="stylesheet" href="dist/css/asPieProgress.css">

    <!-- GOOGLE FONTS-->
  <link        href='http://fonts.googleapis.com/css?family=Open+Sans'        rel='stylesheet'
type='text/css' />
  <style>
  .pie_progress {
   width: 160px;
   margin: 10px auto;


  }
  @media all and (max-width: 768px) {
   .pie_progress {
    width: 80%;
    max-width: 300px;
   }
  }
        div.vertical-line{
   width: 1px; /* Line width */
   background-color: grey; /* Line color */
   height: 100%; /* Override in-line if you want specific height. */
   float: left; /* Causes the line to float to left of content.
    You can instead use position:absolute or display:inline-block
    if this fits better with your design */
  }
  </style>
</head>
<body>
   <div id="wrapper">
     <div class="navbar navbar-inverse navbar-fixed-top">
       <div class="adjust-nav">
         <div class="navbar-header">
           <button   type="button"   class="navbar-toggle"   data-toggle="collapse"   data-
target=".sidebar-collapse">
               <span class="icon-bar"></span>
               <span class="icon-bar"></span>
               <span class="icon-bar"></span>
           </button>
```

```html
        </div>
         <span class="logout-spn" >
          <i    class="fa    fa-sign-out"    aria-hidden="true"></i><a    href="logout.php"
style="color:#fff;">LOGOUT</a>
          </span>
        </div>
      </div>
     <!-- /. NAV TOP  -->
     <nav class="navbar-default navbar-side" role="navigation">
        <div class="sidebar-collapse">
          <ul class="nav" id="main-menu">
            <li >
              <a  href="index.php"  ><i  class="fa  fa-desktop  "></i>Dashboard  <span
class="badge">Home</span></a>
            </li>
            <li>
              <a href="blank.php"><i class="fa fa-circle-o-notch "></i>Check Data </a>
            </li>
            <li class="active-link">
              <a href="add_bin.php"><i class="fa fa-trash-o "></i>Add Bin </a>
            </li>
                                    <li>
              <a href="blank.php"><i class="fa fa-users "></i>Add Users  </a>
            </li>
          </ul>
                </div>


     </nav>
     <div id="page-wrapper" >
        <div id="page-inner">
          <div class="row">
            <div class="col-md-12">
             <h2>Add Bin </h2>

            </div>
          </div>
           <!-- /. ROW  -->
            <hr />

<div class="form">
         <div class="container" >Select bin view method :
         <ul class="nav nav-tabs">
  <li class="active"><a data-toggle="tab" href="#home">Add Bulk Bin</a></li>
  <li ><a data-toggle="tab" href="#menu1">Enter bin Manually</a></li>

 </ul>
```

```
<div class="tab-content col-sm-6">
  <div id="home" class="tab-pane fade in active">
        <br/>
    <label for="sel1">Enter bin details in this excel file :</label><br/>
        <a       href="download/shubham.xlsx"       download>CLICK       HERE       TO
DOWNLOAD!</a><br/>
        <form action="upload.php" method="post" enctype="multipart/form-data">
        Upload file:
              <input type="file" name="fileToUpload" id="fileToUpload">
              <br/>
        <input    type="submit"    id='submit1'    class="btn-success"    name="submit1"
value="Submit">
              </form>
  </div>
  <div id="menu1" class="tab-pane fade ">
        <br/>
        <label>Enter Bin Details :</label>
        <form class="form-inline"method="POST" action="add_bin_backend.php">
        <div class="form-group">
  <label>Bin ID</label>
  <input type="text" class="form-control" name="b_id" id="b_id">
</div><br/><br/>
<div class="form-group">
  <label>Bin Name</label>
  <input type="text" class="form-control" name="b_name" id="b_name">
</div><br/><br/>
<div class="form-group">
  <label for="pwd">IMEI NO</label>
  <input type="text" class="form-control" name="b_imei" id="b_imei">
</div><br/><br/>
<div class="form-group">
  <label>Type :</label>
  <input type="text" class="form-control" name="b_type" id="b_type">
</div><br/><br/>
<div class="form-group">
  <label for="pwd">Latitude</label>
  <input type="text" class="form-control" name="b_lat" id="b_lat">
</div><br/><br/>
<div class="form-group">
  <label for="pwd">Longitude</label>
  <input type="text" class="form-control" name="b_lng" id="b_lng">
</div><br/><br/>
<div class="form-group">
  <label for="pwd">Landmark</label>
  <input type="text" class="form-control" name="b_landmark" id="b_landmark">
</div><br/><br/>
```

```html
  <div class="form-group">
   <label for="pwd">Address</label>
   <input type="text" class="form-control" name="b_address" id="b_address">
  </div>
  <br/><br/>
  <button type="submit" class="btn btn-default">Submit</button>
</form>
   </div>
   <div id="menu2" class="tab-pane fade">
        <br/>
    <label>Input IMEI number :</label>
        <input     type="text"     class="form-control"     id='imei_no'     name="bin_id"
style="width:30em;"><br/>
   <input type="button" id='submit3' class="btn-success" value="Submit">
        <div class="container" id="result3"></div>
        </div>
  </div>
        </div>
   </div>
            <!-- /. ROW  -->

        </div>
         <!-- /. PAGE INNER  -->
        </div>
      <!-- /. PAGE WRAPPER  -->
       </div>

   <div class="footer">

         <div class="row">
          <div class="col-lg-12" >
             &copy;  2014 yourdomain.com | Design by: <a href="http://binarytheme.com"
style="color:#fff;"  target="_blank">www.binarytheme.com</a>
          </div>
     </div>
     </div>

   <!-- /. WRAPPER  -->
   <!-- SCRIPTS -AT THE BOTOM TO REDUCE THE LOAD TIME-->
   <!-- JQUERY SCRIPTS -->
   <script src="assets/js/jquery-1.10.2.js"></script>
    <!-- BOOTSTRAP SCRIPTS -->
   <script src="assets/js/bootstrap.min.js"></script>
    <!-- CUSTOM SCRIPTS -->
```

```
 <script src="assets/js/custom.js"></script>
      <script type="text/javascript" src="dist/jquery-asPieProgress.js"></script>

 <script>
 $(function(){
      <?php
      session_start();
           if(isset($_SESSION['upload']))
           {
                 echo "alert('bin added successfully');";
           }
      ?>
 });
 </script>

</body>
</html>
```

UPDATE BIN

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The bin information can be updated for a particular bin using this web page by the admin.
The code for this is:-

```
<!DOCTYPE html>
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
    <meta charset="utf-8" />
  <meta name="viewport" content="width=device-width, initial-scale=1.0" />
  <title>AdMyBin</title>
        <!-- BOOTSTRAP STYLES-->
        <link rel='icon' href='admybin-logo.gif'/>
  <link href="assets/css/bootstrap.css" rel="stylesheet" />
   <!-- FONTAWESOME STYLES-->
  <link href="assets/css/font-awesome.css" rel="stylesheet" />
     <!-- CUSTOM STYLES-->
  <link href="assets/css/custom.css" rel="stylesheet" />
        <link rel="stylesheet" href="examples/css/normalize.css">
 <link rel="stylesheet" href="dist/css/asPieProgress.css">

  <!-- GOOGLE FONTS-->
  <link        href='http://fonts.googleapis.com/css?family=Open+Sans'        rel='stylesheet'
type='text/css' />
  <style>
  .pie_progress {
   width: 160px;
   margin: 10px auto;

  }
  @media all and (max-width: 768px) {
   .pie_progress {
    width: 80%;
```

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```
      max-width: 300px;
    }
  }
          div.vertical-line{
    width: 1px; /* Line width */
    background-color: grey; /* Line color */
    height: 100%; /* Override in-line if you want specific height. */
    float: left; /* Causes the line to float to left of content.
      You can instead use position:absolute or display:inline-block
      if this fits better with your design */
  }
  </style>
</head>
<body>
  <div id="wrapper">
      <div class="navbar navbar-inverse navbar-fixed-top">
        <div class="adjust-nav">
          <div class="navbar-header">
            <button type="button" class="navbar-toggle" data-toggle="collapse" data-
target=".sidebar-collapse">
              <span class="icon-bar"></span>
              <span class="icon-bar"></span>
              <span class="icon-bar"></span>
            </button>
          </div>

          <span class="logout-spn" >
          <i   class="fa   fa-sign-out"   aria-hidden="true"></i><a   href="logout.php"
style="color:#fff;">LOGOUT</a>

          </span>
        </div>
      </div>
      <!-- /. NAV TOP  -->
      <nav class="navbar-default navbar-side" role="navigation">
        <div class="sidebar-collapse">
          <ul class="nav" id="main-menu">
            <li >
              <a  href="index.php"  ><i  class="fa  fa-desktop  "></i>Dashboard  <span
class="badge">Home</span></a>
            </li>
            <li>
              <a href="blank.php"><i class="fa fa-circle-o-notch "></i>Check Data </a>
            </li>
            <li >
              <a href="add_bin.php"><i class="fa fa-trash-o "></i>Add Bin </a>
```

```html
                    </li>
                        <li  class="active-link">
                        <a href="blank.php"><i class="fa fa-users "></i>Update Bin Info </a>
                        </li>
                    </ul>
                            </div>
        </nav>
        <div id="page-wrapper" >
            <div id="page-inner">
                <div class="row">
                    <div class="col-md-12">
                    <h2>Update Bin Info </h2>

                    </div>
                </div>
                <!-- /. ROW  -->
                <hr />
<div class="form">

        <div class="container" >
        <div class="container">
        <br/><span style="margin-left:56px;" ><h4>Insert Bin Id: </h4></span>
        <input    type="text"    class="form-control"    style="width:15em;"name="b_id"
id="b_id">
        <br/>
        <button type="button" id="submit" class="btn btn-default">Submit</button>
        </div>
        <div id="results">

        </div>
        <div id="results2"></div>
        </div>

    </div>
            <!-- /. ROW  -->

        </div>
        <!-- /. PAGE INNER  -->
        </div>
        <!-- /. PAGE WRAPPER  -->
    </div>

    <div class="footer">
        <div class="row">
            <div class="col-lg-12" >
```

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         </div>
     </div>
     </div>
  <!-- /. WRAPPER -->
  <!-- SCRIPTS -AT THE BOTOM TO REDUCE THE LOAD TIME-->
  <!-- JQUERY SCRIPTS -->
  <script src="assets/js/jquery-1.10.2.js"></script>
   <!-- BOOTSTRAP SCRIPTS -->
  <script src="assets/js/bootstrap.min.js"></script>
   <!-- CUSTOM SCRIPTS -->
  <script src="assets/js/custom.js"></script>
        <script type="text/javascript" src="dist/jquery-asPieProgress.js"></script>

  <script>
  $(function(){
        $('#submit').click(function(){
                var x=$('#b_id').val();
                //alert(x);
          $.ajax({
      url: "update1.php",
      dataType: "json",
      data: { x : x },
      success: function(result){
                            //alert(result);
                            var z=result.split('_');
                             $('#results').html(" <div class='row'><form method='POST' action='update2.php'><table><tr><td>Latitude :</td> <td><input type='text' name='lat' value='"+z[0]+"'>/td></tr><tr><td>Longitude :</td> <td><input type='text' name='lng' value='"+z[1]+"'>/td></tr><tr><td>Address :</td> <td><input type='text' name='add' value='"+z[2]+"'>/td></tr><tr><td>Imei No :</td> <td><input type='text' name='imei_no' value='"+z[3]+"'>/td></tr><tr><td><button type='submit' id='submit' class='btn btn-default'>Submit</button>/td></tr></table></form></div>");
                            //$('#button_start').trigger('click');

      },
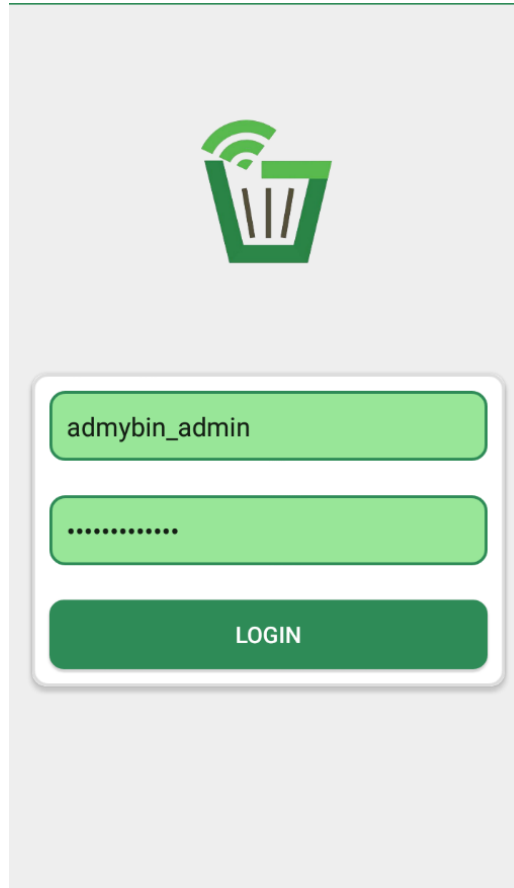   error: function(e) {
       // Handle error here
        console.log(e);
      }
   });
        });
  });
  </script>
</body></html>

4.6.2 Mobile Application

- Mobile application displays the location of the bin.

- It also shows the level of waste and count of people using the bin.
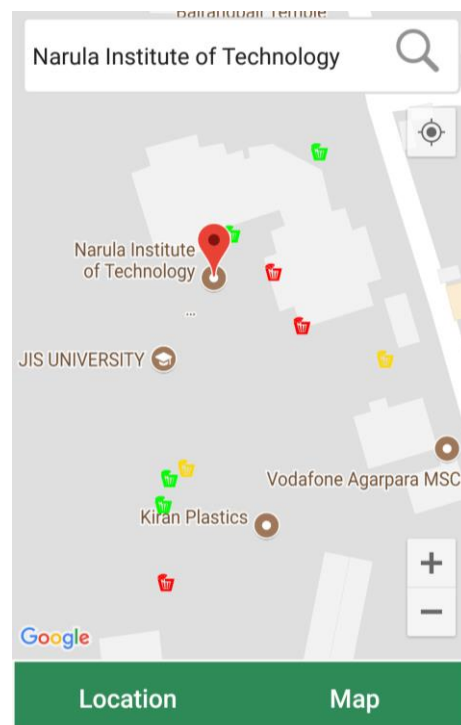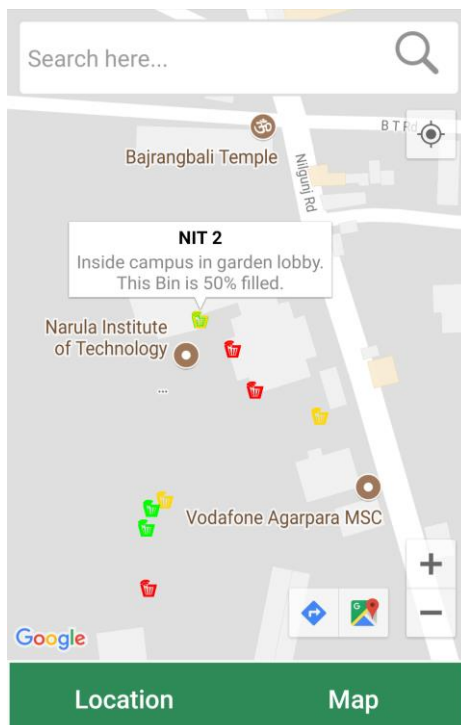
- The location of the bin is also displayed in a map.

LOGIN ACTIVITY

LOCATION and BIN DETAILS

MAP ACTIVITY

The application displays the are/location where the bins are installed in the first page.
 On clicking on a particular location, the list of bins present in the location will be displayed in the recycler view. The bin id along with the level of waste in the bin in percentage and the count of the people using the bin will be shown. The colour of the background of the bin box shows the level of waste filled. When the bin is almost filled, a notification is sent to the admin so that they can monitor waste collection and collect waste in an optimized manner. This is done to optimize the collection of waste and prevent problems. In the MapView, all the bins are pinned in the location. As we open the map, the current location is shown with all the bins present nearby. We can also enter a location and the marker will be shifted to that location and all the bins nearby will be visible. The colour of the bin changes according to the waste level as:

➢ On searching a location in the map, it's nearby bins will be displayed.

➢ The bin colour distinguishes the level of waste in the bin.

0-30%

31-70%

71-100%

On clicking on the icon of the bin, a detail is displayed which mentions the location, address and count and level of waste in percentage. On clicking on the bin in the list view even a dialog box appears with the details of the bin in a descriptive manner.

The code of the application is huge and hence cannot be attached with the report. The application is made using Android Studio tool in which the design of the app is done using XML and the coding part to make the application interactive is done using the language Advanced JAVA. The structure of the code is given.
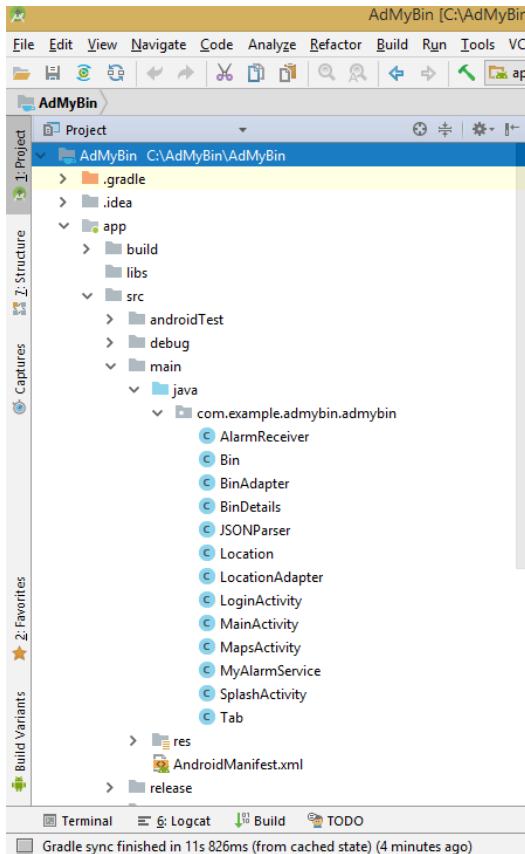
Fig: Java files
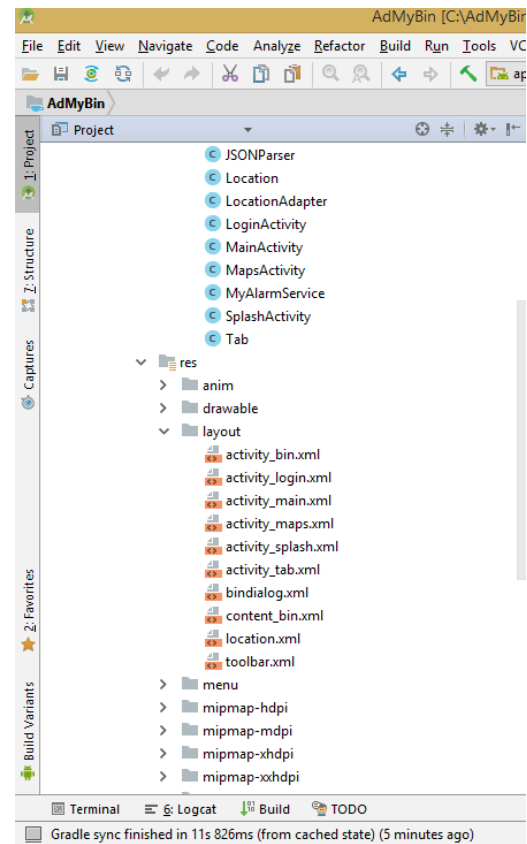
Fig: Layout files

The count of number of people is recorded to make the project economical to the admin. There will be and advertisement installed above each bin and the number of people using the bin will be the number of people looking at the advertisement according to which the company whom we are promoting by displaying their advertisement will pay us. The diagram of this real life implementation is given below:

Fig: Real Life Implementation

DESIGN SPECIFICATION

5.1 System Architechture
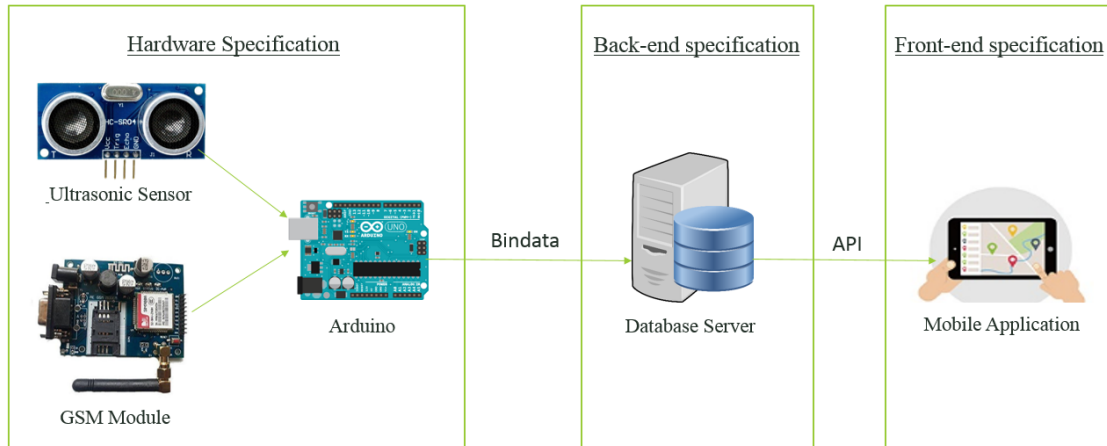
The hardware tools are fixed on the cap of the bin. Arduino is used to give power to ultrasonic sensor and GSM module and converts the data by sensor to percentage and send it to the server with the help of GSM module which provides internet connect and has a sim-card with IMEI number which helps to differentiate the value from different bins. This data on being sent to the server is stored in the database and is displayed in the application which can be used by the admin to monitor smart waste collection system and eliminate all the problems cause by the traditional and old ways of waste collection.

5.2 Flowchart

Figure 3.6: Flow Chart of Application Simple Module

5.3 Optimized and Un-optimized Route

The traditional way of garbage collection, regardless they are full or not, leads to:

- Un-optimized route
- Higher transportation cost
- Loss of fossil fuel(petrol/diesel)
- Loss of time

Overflowing garbage bin is a common sight for us. The sluggish clearance of   garbage is leading to potentially hazardo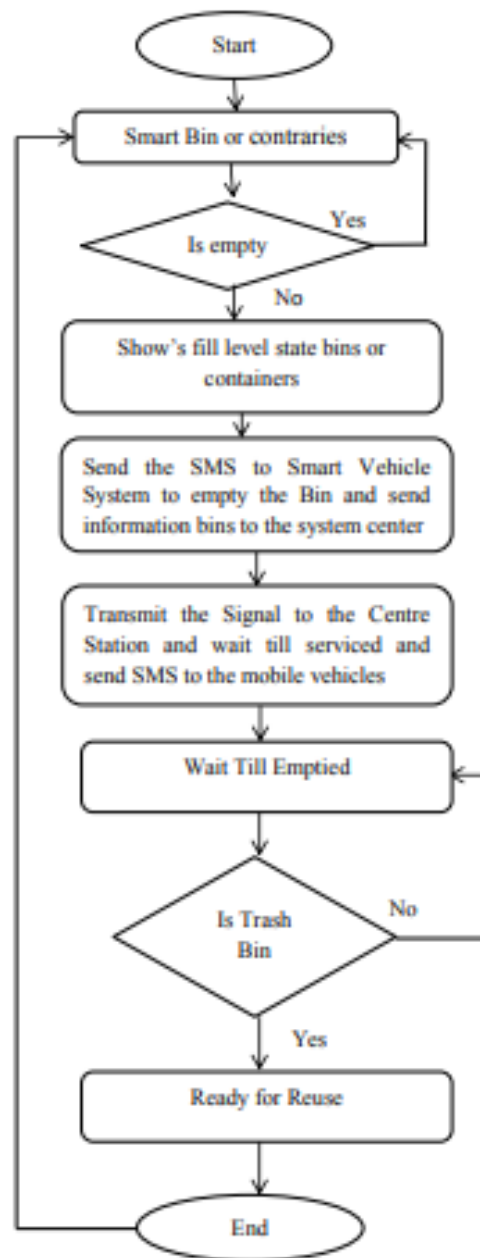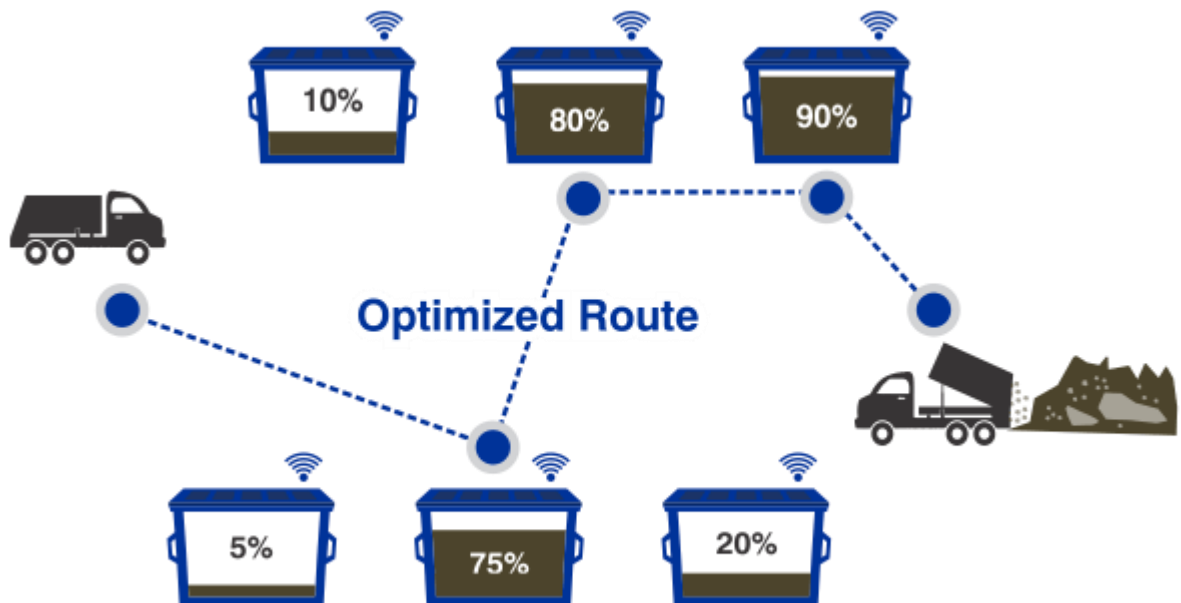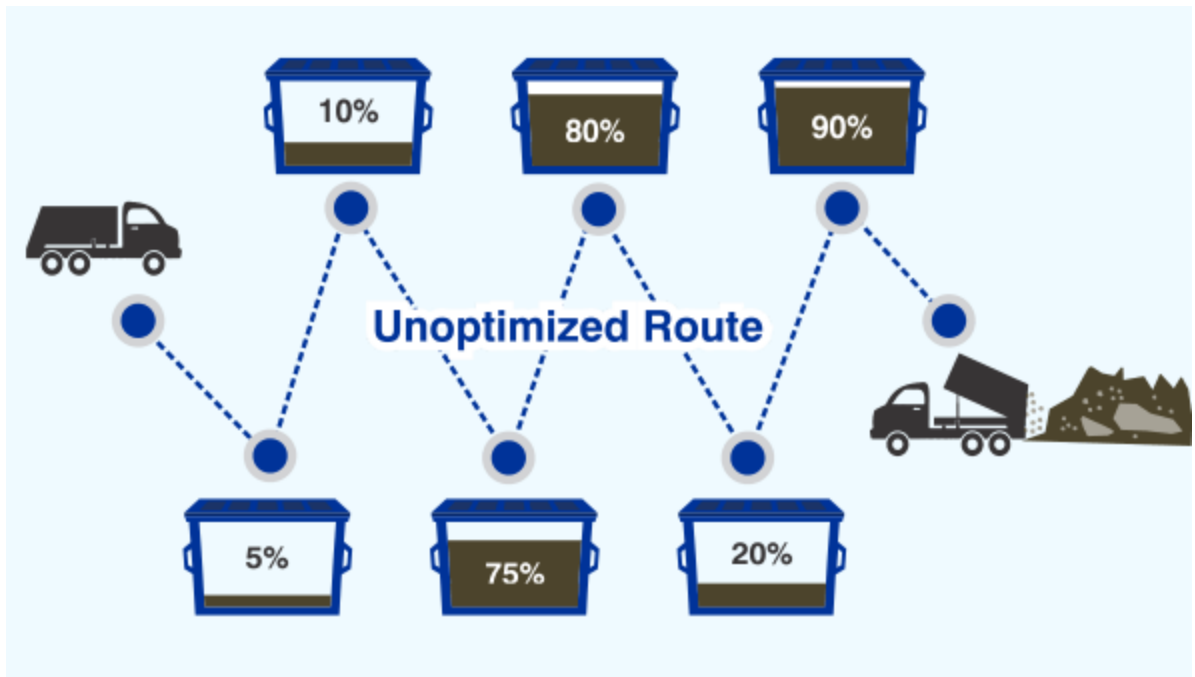us health situations. Garbage trucks collect waste using fixed schedules every week and people are forced to bear with the stench.

All the above problems are solved by using optimized route which is done by collecting garbage from Smartbins based on the level of waste and not time schedules.

5.4 Software Requirement Specification

- **Android Studio**

  It is used to make the mobile application which will display all the bin data to the admin and will also sent a notification when the bin is almost full. The map shows the location of the bin which can be sent to the drivers to track the bin and collect waste from the bins which is almost full.

- **Xampp Tool**

  It is used to make web pages to add bin details and also view them. It also provides phpmyadmin which has the database where all the data is stored.

- **Server/ Domain**

  A domain has to be purchased were the data will be sent by the hardware tools.

- **Arduino Software Tool**

  The hexadecimal value which is returned from the sensor is converted to a percentage and the count of no. of people is calculated and stores in the variable by the coding in Arduino tool.

Languages used:-

- C# language for Arduino tool
- JSON for sending the data from database via API to application
- PHP for making database and website interactive
- HTML for the design of the website
- CSS for the template of the website
- Java for making the application interactive
- XML for the design of the application

5.5 Hardware Tools and Cost

SERIAL NO.	ITEM	QUANTITY	COST
1	ARDUINO BOARD	1	595
2	ULTRASONIC SENSOR	1	150
3	GSM MODULE	1	1050
4	GSM CABLE	1	320
5	BREAD BOARD	1	340
6	JUMP WIRES	10	60
7	DUSTBIN	1	1500
8	STATIONARY ITEMS	5	500
9	TOTAL		4515

SUMMARY

A Smart (save money, decrease trash, progresses public health and impact, decrease environmental pollution, reduce traffic jam, increasing space and grown green space). Residential waste decrease program means incentivizing populaces to decrease and recycle by charging per unit for trash disposal. The Smart strategy empowers government to take control of the quantity they spend on garbage. Usually talking, Smart communities treat waste like a utility. Approximately cities and towns along with many more worldwide, have implemented to collection solid waste. When people pay by the unit, they become more aware of the waste they produced, which activates a lasting sustainable behavioral modification. SMART communities create proportional unit based valuing structures that contain all costs related with waste and recycling. Residents pay as they go for waste, while unlimited recycling is available to all households with no extra cost. It is the impartial of a Smart waste organization collection to make a successful, possibly cost actual inhabited reprocessing program while working within the current collection infrastructure. Possibly as a throw away level that continues on its own without a great deal of re-education effort easy-to-use as easy to understand and involved, and cost actual in that complete costs are less than different programs.by using smart stuffing. The ultrasonic sensor put on the top of the bins with Arduino and ultrasonic sensor send signal to the center with the help of GSM module and informs the admin about the level of rubbish in the bins or containers. So, the admin use GLCD to show bins with level of the bins full half full and empty information about bins or container with Arduino and GPS/GRPS, here the message will be send to the trucks and advise them the bins or containers are full of trash and need to be emptied, the admin also give information about road it also backup all information in the database.

IMPLEMENTATION ISSUES

- Availability of resources: The setup of the project requires an Arduino chip set, GSM module, ultrasonic sensors and other hardware are needed.

- Trial and testing of the project requires specific environment and labs equipped with proper facilities.

- Implementation of the project requires prescriptive regulations to be legally and operationally enforceable.
  - Whether the project if comprehensive or not.
  - Whether the project is supported by the scientific data provided in the prescription to allow the development of specific standards which are protective of human health and environment.

- Scope of the project: The project can be implemented only in the metropolitan cities and some tier II cities. Small towns and tier III cities are out of the bound as technical feasibility is not possible.

Effective management of human resources: Skilled and trained people are required to operate the whole mechanism.

FUTURE SCOPE

As a feature of continuation for this task, loads of future work is ahead for the full usage and full organization of this undertaking in urban communities. Future proposals and work could be concentrating on the accompanying:

- Separate type of waste collection put in difference bins by using other sensor.

- Install LCD screen in front of bins which displays the level of the bin to public.

- Generate a voice message whenever people throw the waste outside the bin.

- Application of improvement in other city administration this would likewise decide the part of the structure that should be disconnected from city administrations. Deliberation of structure capacities would make it less demanding to apply structure to different city administrations without requiring numerous program

CONCLUSION

By using Smart Bin the collection of waste in the city becomes easier. It helps in reducing air pollution, traffic flow, man power, time and money. With the help of proper technology we can guide the trucks in selecting the shortest path for garbage collection. This project can add an edge to the cities aiming to get smart and people-friendly. A Smart City is an efficient and sustainable place with intelligent public services. There is not just a single style of Smart City; each one can become more effective and sustainable with different solutions that can be tailored to its specific needs. The cities of the future must be more sustainable, safer, effective, relaxed, and communicating. They will be an urban environment that is always connecting with the residents and capable of managing public services in real time to progress their quality of life, waste collection, through traffic management, irrigation systems, alerting the local authority when an event occurs and allowing the government to stay in touch with the people. Technologies allow us to make more reasonable decisions. Technology driven initiatives to encourage people and children to throw rubbish in the bin, this will keep them up on good conduct, keep on health, save the environment, make more space for Malls, Restaurants, Parks, Schools, Universities and Homes. So, the smart waste management system is a step forward to make the manual collection and detection of wastes smart in nature and monitoring waste collection. The developed system by using five subsystems Smart Waste System, Local Station, Smart Monitoring and controlling, Smart Truck System and Smart Monitoring and controlling Interface the Smart waste to monitor the bins filling, include the Centre system get data from Wireless ultrasonic Sensor Networks have been working to specific sensors with RF transmitter use with arduion and, use GSM/GPRS. Solid waste collection management processes and monitoring. This offer the organization of wastes is effective and time saving process than the presently start technique in which worried urban worker has to see for the filled waste bins manually through different spots in a region/street for testing regularly whether The waste bin is filled or not and show 60 waste levels bins, which is difficult and time consuming development. This smart of waste too decreases the human effort and as a result the cost of the whole process. This system might be implemented at any residence with simplicity and within reasonable quantity of time. The implementation costs for the smart is also affordable. The general method for the discovery and management of waste becomes

efficient and intelligent. This planned system would not only purpose for collecting and updating data automatically and timely, but similarly it might analyses and use data intelligently. The planned system would solve a lot of problems connected to solid waste collection, minimizing cost, monitoring and accelerate the management. The system has many advantages than the other system was done before because:

• The hardware used more developer and using Arduino is open foundation can use free to Get the schematics and programming software and advance them with free code libraries. And used to GSM/GPRS One advantage of using SMS is that it will preserve the shield having to begin a GPRS connection which will usually take longer and may use more power.

• Offer a higher quality service to the citizen

• Can be easily implemented in the city and Easy-to-use Service

• Can be used everywhere when the place have network and signal of mobile phone with SIM card

• Economical design.

REFERENCES

1. Glossary of Environment Statistics: Series F, No. 67 / Department for Economic and Social Information and Policy Analysis.

2. United Nations Environmental Programme (2013). "Guidelines for National Waste Management Strategies Moving from Challenges to Opportunities."

3. "Arduino - Introduction". arduino.cc.

4. "Programming Arduino Getting Started with Sketches". McGraw-Hill. Nov 8, 2011. Retrieved 2013-03-28.

5. Anton A. Huurdeman, The Worldwide History of Telecommunications, John Wiley & Sons, 31 juli 2003, page 529

6. "GSM Global system for Mobile Communications". 4G Americas. Retrieved 2014-03- 22.

7. The national environment policy, 2006 available at http://www.tnpcb.gov.in/pdf/nep2006e.pdf

8. National Waste & Recycling Association. "History of Solid Waste Management". Washington, DC. Retrieved 2013-12-09.

9. AdMyBin- Green Clean Media Works   https://www.admybin.com

10. Enovo One Technology available at https://www.enovo.com