B. TECH. PROJECT REPORT

On

IoT Enabled Smart 'Garbage Management System'

BY

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DISCIPLINE OF ELECTRICAL ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY INDORE

November 2016

IoT Enabled Smart 'Garbage Management System'

A PROJECT REPORT

Submitted in partial fulfillment of the requirements for the award of the degrees

of
BACHELOR OF TECHNOLOGY
in

ELECTRICAL ENGINEERING

Submitted by:
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INDIAN INSTITUTE OF TECHNOLOGY INDORE
November 2016

CANDIDATE'S DECLARATION

We hereby declare that the project entitled **"IoT Enabled Smart 'Garbage Management System' "**submitted in partial fulfillment for the award of the degree of Bachelor of Technology in **'Electrical Engineering'** completed under the supervision of **Dr. Santosh Kumar Vishvakarma , Associate Professor, Department of Electrical Engineering,** IIT Indore is an authentic work.

Further, we declare that we have not submitted this work for the award of any other degree elsewhere.

Signature and name of the student(s) with date

CERTIFICATE by BTP Guide

It is certified that the above statement made by the students is correct to the best of my knowledge.

Signature of BTP Guide with dates and their designation

Preface

This report on “IoT Enabled Smart ‘Garbage Management System’ " is prepared under the guidance of Dr. Santosh Kumar Vishvakarma.

Through this report we have presented our work on our prototype of Smart ‘Garbage Management System’ and tried to cover the various mechanical, electrical and programming aspects of the project.

We have included the engineering drawings of the parts, electrical connection diagrams, code and necessary theory for the project. Also we have presented a criticism over some previous projects in the field of garbage management system. We have ended the report with results, conclusions and scope for future work in this project.

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Abstract

At the moment when world is progressing at such rapid pace, more of the resources are being used and more of the waste is being produced. At the moment when this waste is posing a great deal of risks and challenges to civil societies as well as the mother nature, this paper is an another attempt in direction of waste management at the very grass root level. The idea remains to effectively transport the waste generated at various places to the waste treatment plants but with a higher level of efficiency and wide coverage. The aim is to provide the people of various locations where there's no options for disposing waste and where empty land becomes a landfill in no matter of time and hence causing loss to economy, health and aesthetic qualities of the place a central dustbin-a smart bin where the waste can be dumped and regularly the waste can be removed from it when the dustbin gets filled.

Keywords—grass root, efficiency

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Introduction

When we talk of smart garbage management system, the idea of a smart dustbin is an implicit one. The dustbin we talk about in this report has a great loading capacity as it employs Automatic Trash compactor to compress the garbage achieving optimum use of space inside the bin; it shows the percentage of dustbin filled on a website and an app which can be installed on a smartphone and hence the user can access the dustbin nearest and suitable for its convenience to dump its waste. Also the status and usage history of the dustbins can be accessed by the authorities governing the whole system from a central server, which provide them with the whole control over the system. Also for making it much handy for the garbage collectors employed by the authorities as well as the authorities the system sends an email alert when the bin is more than 90% filled of its volume.

Concept Design

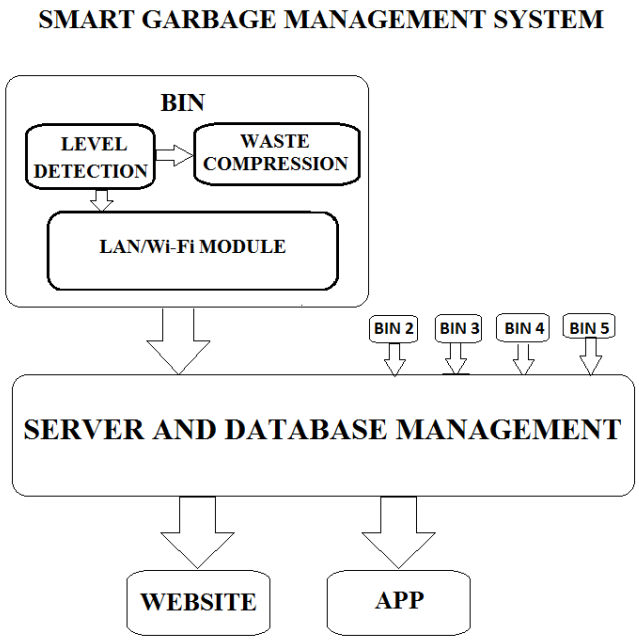

Fig. 1 Block Diagram of Management System

The dustbins are employed with sensors which detect the amount of garbage in the dustbin and get the percentage of dustbin volume filled. The generated value is transferred through internet to the database of the website. So internet connection is a necessary thing for the system which can be provided either through LAN connection or Wi-Fi. The current status of dustbin is presented over the website and the app which can also be used to access the status of all the dustbins employed in various locations.

Also the dustbin's mechanical compactor compresses the garbage inside it at regular intervals of time to remove any unused space and unevenness. Fig. 1 is the block diagram of IoT enabled Smart Garbage Management System.

Fig. 2 Bin

The components of the whole management system are given below:

Level detector:

For level detection, Ultrasonic sensor has been used. It gives an output value which is calibrated to the level of Waste Bin filled. The percentage of waste bin filled is given by the expression:

$$((H_0 - H_D)/H_0)*100 \quad (1)$$

In our case H_0 = 68 cms, so (1) becomes

$$100-1.47*distance \quad (2)$$

Where, H_0 is the height of the waste bin and H_D is the distance of garbage level from sensor.

Ultrasonic Sensor(HC-SR04):

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function. The modules includes ultrasonic transmitters, receiver and control circuit.

Working of Sensor:

(1) Using IO trigger, module sends at least 10us high level signal

(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

(3) If the signal is back having high level , time of high output IO duration is the time from transmitting ultrasonic wave to receiving.

Distance of object(in cms) = (high level time(in sec)×velocity of sound (340M/S) ×100 / 2

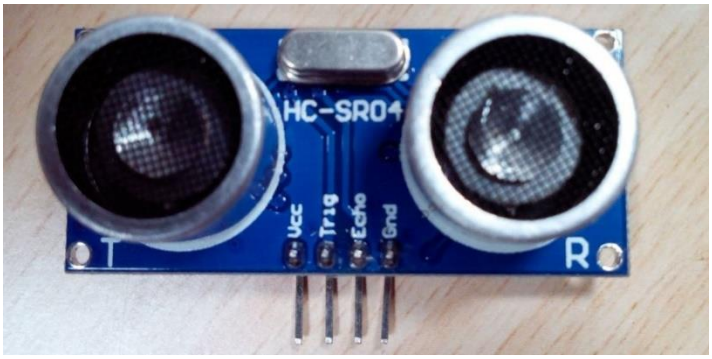

Fig. 3 Ultrasonic Sensor

Microcontroller : Arduino

The Arduino is the most important part of management system to which ultrasonic sensor, Ethernet shield Nodemcu, and motor driver are connected. It gives instructions to the mechanical compactor system when required. It processes the output values of the sensor and calibrates to the level of waste bin filled and sends it to the database maintained on the server.

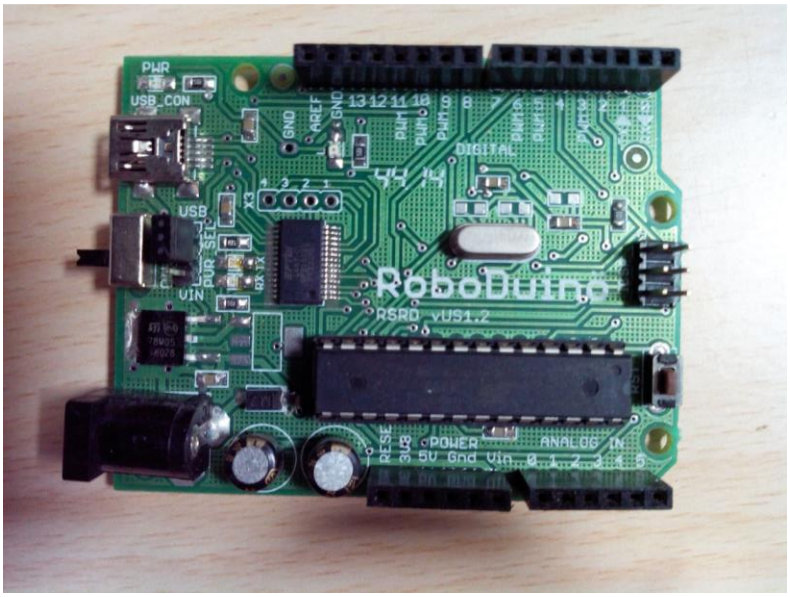

Fig. 4 Arduino board

Ethernet shield:

The Ethernet shield is used to connect the microcontroller to internet. So internet connection can be provided through LAN cable.

- Operating voltage 5V (supplied from the Arduino Board)
- Connection speed: 10/100Mb/s
- Connection with Arduino on SPI port

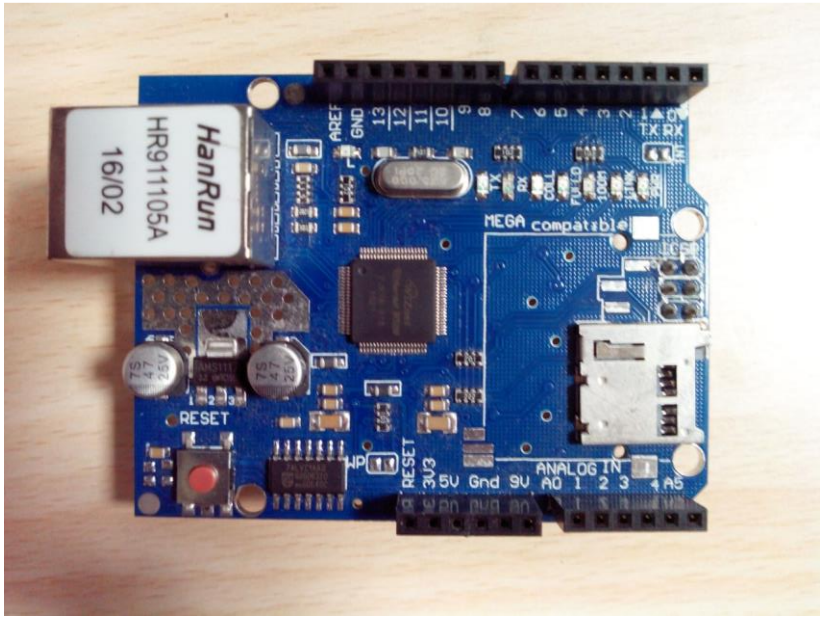

Fig. 5 Ethernet Shield

NodeMCU:

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC, and hardware. Using it, we can connect to internet using WiFi. It uses 5V DC supply.

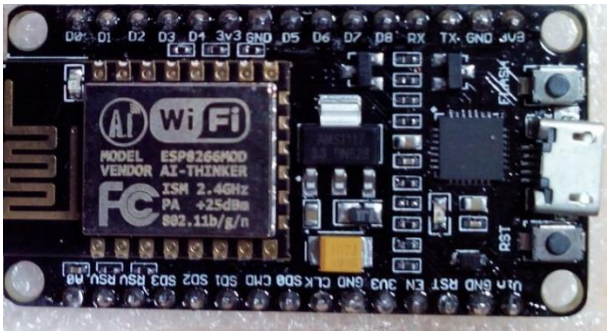

Fig. 6 NodeMCU

Mechanical Compactor:

The mechanical compactor consists of a DC motor (electrical component), lead screws and compressing plate which together compress the garbage when it gets filled to a certain level.

Fig. 7 Mechanical Compactor

Server and Website:

The function of the server is to receive the values given by various bins and save those values on a database maintained on the server. Also, a website runs on the server which can be accessed anywhere in the world. The website retrieves the values from the database and shows the status of various bins.

Mail Functionality:

An email functionality has been added to the system. When a bin is filled by amount more than 90%, then a system generated mail is sent to the garbage collectors to take the garbage out of that bin and empty it. The email functionality can have as many recipients as needed.

App:

The Android App can be downloaded and installed on any Android smartphone. The App like the website shows the status of all the bins and retrieves those values from the database. Hence the app makes it much easier for the users to be a part of this whole system.

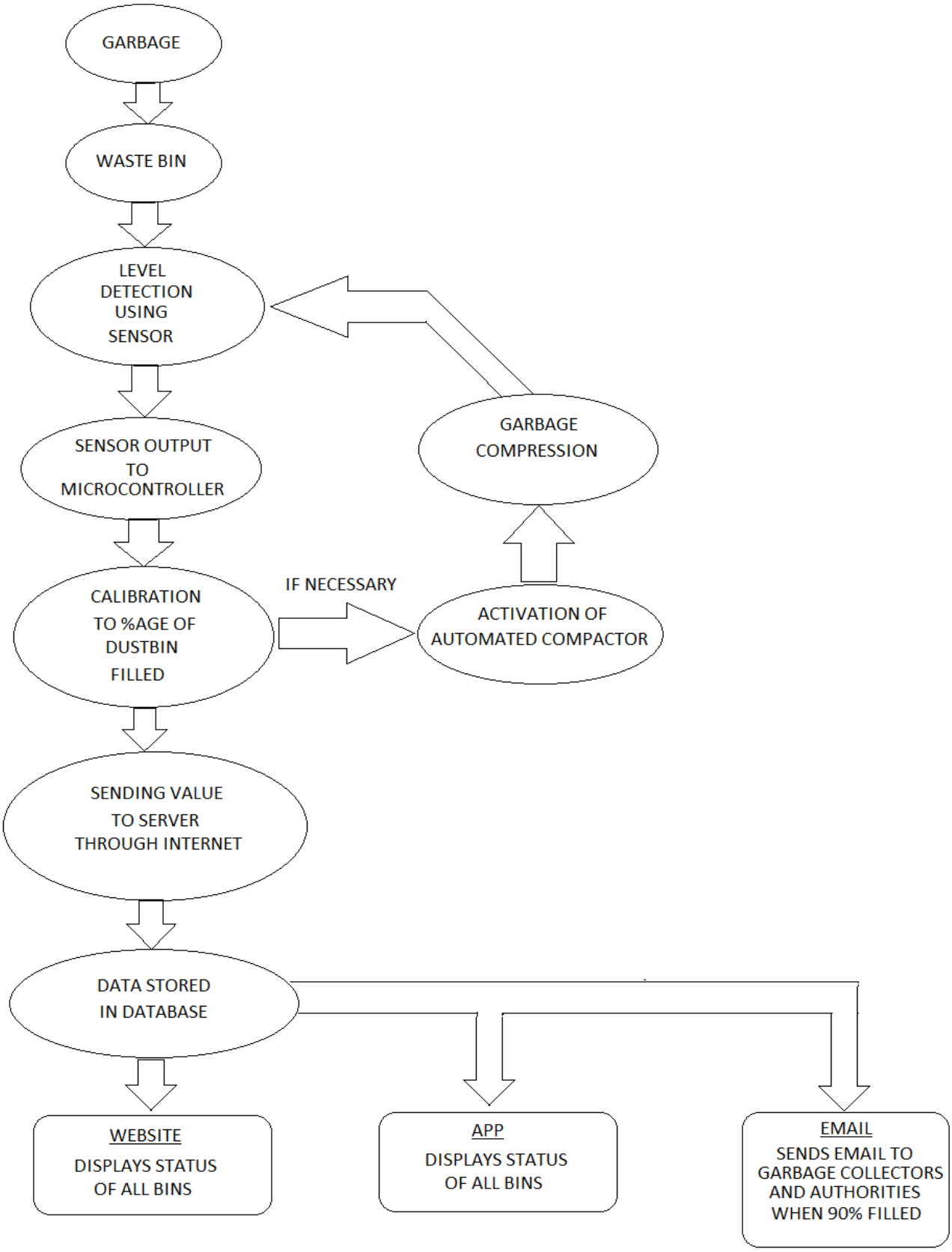

Fig. 8 Functioning of whole System

LITERATURE REVIEW

Internet of Things for Smart Cities by Andrea Zanella, et.al. This Paper provided fundamental framework for designing IoT based technologies for smart cities. The IoT based developed devices are playing a very important role to connect the user and multiple on a common platform. Author has described many IoT Based Services in the paper. The system is a well-developed form of a service conceptualized as waste management.

Smart Bin Implementation for Smart Cities by Narayan Sharma, et.al. In this paper, smart bins have been developed with the help of sensor and GSM module and these smart bins have been deployed at different locations in the city and a single monitoring system has been developed to monitor the smart bin and in this way overflow can be minimized. In our system we have gone beyond that, incorporating user interaction with dustbin with the help of handy platforms such as website and an Android app .

Smart Garbage management system by Vikrant Bhor, et.al. It provided information regarding design flow of the garbage bin and interface to communicate with the concerned contractors of that location. In our system we included System generated E-mail facility with the help of which direct instructions can be given to garbage collectors avoiding any kind of delay.

CONNECTION DIAGRAM

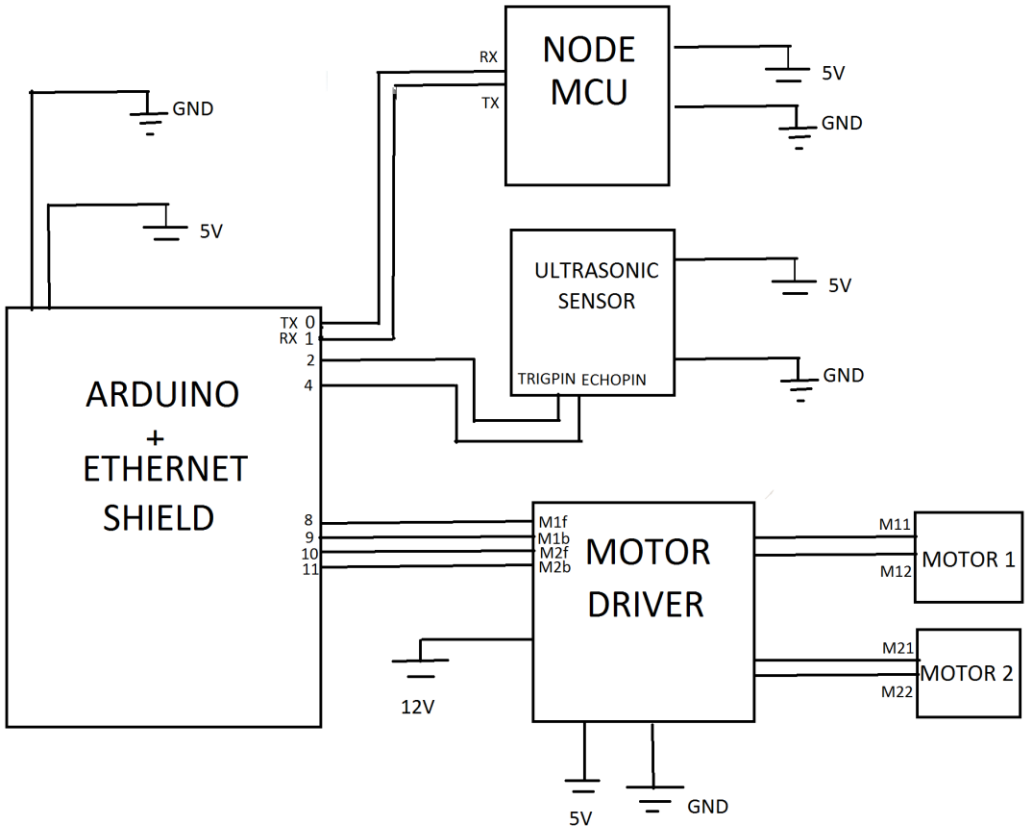

Fig. 9 Connection Diagram

CODE

Arduino Code:

```
#include <SPI.h>
#include <Ethernet.h>
byte mac[] = {
  0xDE, 0xAD, 0xBE, 0xEF, 0xFE, 0xED };
IPAddress ip(192,168,1,18);
const int trigPin = 2;
const int echoPin = 4;
const int motor1f=8;
const int motor1b=9;
const int motor2f=10;
const int motor2b=11;
long duration;
int distance;
int binStatus=0;
char server[] = "www.smartgarbagemanagement.dx.am";
EthernetClient client;
void setup() {
pinMode(echoPin, INPUT);
pinMode(trigPin, OUTPUT);
pinMode(motor1f, OUTPUT);
pinMode(motor1b, OUTPUT);
pinMode(motor2f, OUTPUT);
pinMode(motor2b, OUTPUT);
Serial.begin(9600);
while (!Serial) {
```

```
  ;}}
void loop() {
  digitalWrite(motor1f, HIGH);
  digitalWrite(motor1b, HIGH);
  digitalWrite(motor2f, HIGH);
  digitalWrite(motor2b, HIGH);
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = duration*0.034/2;
  binStatus=(int)(100-1.47*distance);
  if(binStatus>70){
    digitalWrite(motor1f, HIGH);
    digitalWrite(motor1b, LOW);
    digitalWrite(motor2f, HIGH);
    digitalWrite(motor2b, LOW);
    delay(30000);
    digitalWrite(motor1f, HIGH);
    digitalWrite(motor1b, HIGH);
    digitalWrite(motor2f, HIGH);
    digitalWrite(motor2b, HIGH);
    delay(5000);
    digitalWrite(motor1f, LOW);
    digitalWrite(motor1b, HIGH);
```

```
    digitalWrite(motor2f, LOW);
    digitalWrite(motor2b, HIGH);
    delay(30000);
    digitalWrite(motor1f, HIGH);
    digitalWrite(motor1b, HIGH);
    digitalWrite(motor2f, HIGH);
    digitalWrite(motor2b, HIGH);
}
  Serial.println(distance);
  Serial.println(binStatus);
 if (client.connect(server, 80)) {
    client.print("GET /write_data.php?"); // This
    client.print("value="); // This
    client.print(binStatus);
    client.println(" HTTP/1.1");
    client.println("Host: www.smartgarbagemanagement.dx.am ");
    client.println("Connection: close");
    client.println();
    client.stop();
    Serial.println(distance);
    Serial.println(binStatus);
    }
  else {
   Serial.println("--> connection failed\n");
  }
  delay(5000);
}
```

SignInActivity.java

```
package rg.smartbin;
import java.io.BufferedReader;
import java.io.InputStreamReader;
import java.io.OutputStreamWriter;
import java.net.URI;
import java.net.URL;
import java.net.URLConnection;
import java.net.URLEncoder;
import org.apache.http.HttpResponse;
import org.apache.http.client.HttpClient;
import org.apache.http.client.methods.HttpGet;
import org.apache.http.impl.client.DefaultHttpClient;
import android.content.Context;
import android.os.AsyncTask;
import android.widget.TextView;
import android.view.View;
import android.widget.ImageView;

public class SigninActivity  extends AsyncTask<String,Void,String>{
   private TextView roleField;
   private Context context;
   private ImageView ima1;

   public SigninActivity(Context context,TextView roleField, ImageView ima1 ) {
      this.context = context;
      this.roleField = roleField;
      this.ima1=ima1;
   }

   protected void onPreExecute(){

   }

   @Override
   protected String doInBackground(String... arg0) {
      try{
         String link = "http://smartgarbagemanagement.dx.am/perdetailsapp.php";
         //String link="http://smartgarbagemanagement.dx.am/perdetails.php?block=A+Block";
         HttpClient client = new DefaultHttpClient(); // error 2
         HttpGet request = new HttpGet();
         request.setURI(new URI(link));
         HttpResponse response = client.execute(request);
         BufferedReader in = new BufferedReader(new
InputStreamReader(response.getEntity().getContent()));
         StringBuilder sb = new StringBuilder(""); // error 3
         String line="";
         while ((line = in.readLine()) != null) {
            sb.append(line);
         }
```

```
      /* if ((line = in.readLine()) != null) {
          sb.append(line);
       }*/
       in.close();
       return sb.toString();
    }

    catch(Exception e){
       return new String("Exception: " + e.getMessage());
    }

}

//@Override//error
//protected String doInBackground(String arg0) {



// }

@Override
protected void onPostExecute(String result){
    String result1="%age of Dustbin filled:"+result;
    this.roleField.setText(result1);
    int id = Integer.valueOf(result);
  // int id = 32;

    if(id==0)
       this.ima1.setImageResource(R.drawable.b0);

     if(id>0&&id<=5)
       this.ima1.setImageResource(R.drawable.b1);
     if(id>5&&id<=10)
       this.ima1.setImageResource(R.drawable.b2);
     if(id>10&&id<=15)
       this.ima1.setImageResource(R.drawable.b3);
     if(id>15&&id<=20)
       this.ima1.setImageResource(R.drawable.b4);
     if(id>20&&id<=30)
       this.ima1.setImageResource(R.drawable.b5);
     if(id>30&&id<=36)
       this.ima1.setImageResource(R.drawable.b6);
     if(id>36&&id<=45)
       this.ima1.setImageResource(R.drawable.b7);
     if(id>45&&id<=52)
       this.ima1.setImageResource(R.drawable.b8);
     if(id>52&&id<=60)
       this.ima1.setImageResource(R.drawable.b9);
     if(id>60&&id<=70)
       this.ima1.setImageResource(R.drawable.b10);
```

```
        if(id>70&&id<=80)
           this.ima1.setImageResource(R.drawable.b11);
        if(id>80&&id<=85)
           this.ima1.setImageResource(R.drawable.b12);
        if(id>85&&id<=90)
           this.ima1.setImageResource(R.drawable.b13);
        if(id>90&&id<=95)
          this.ima1.setImageResource(R.drawable.b14);
        if(id>95&&id<100)
           this.ima1.setImageResource(R.drawable.b15);
       if(id==100)
           this.ima1.setImageResource(R.drawable.b16);
       if(id<0&&id>100)
           this.ima1.setImageResource(R.drawable.b17);
    }

}
```

MainActivity.java

```
package rg.smartbin;
import java.util.ArrayList;
import java.util.List;
import android.app.Activity;
import android.os.Bundle;
import android.view.Menu;
import android.view.View;
import android.view.View.OnClickListener;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.ImageView;
import android.widget.Spinner;
import android.widget.Toast;
import android.widget.EditText;
import android.widget.TextView;
import android.widget.AdapterView;
import android.widget.AdapterView.OnItemSelectedListener;
import java.io.BufferedReader;
import java.io.InputStreamReader;
import java.io.OutputStreamWriter;
import java.net.URI;
import java.net.URL;
import java.net.URLConnection;
import java.net.URLEncoder;
import org.apache.http.HttpResponse;
import org.apache.http.client.HttpClient;
import org.apache.http.client.methods.HttpGet;
import org.apache.http.impl.client.DefaultHttpClient;
import android.content.Context;
import android.os.AsyncTask;

public class MainActivity extends Activity implements OnItemSelectedListener{

    private Spinner spinner1;
    private Button btnSubmit;
    private TextView role;
    private ImageView bini;
    String inputBlock1="";

    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        Spinner spinner1 = (Spinner) findViewById(R.id.spinner1);
        spinner1.setOnItemSelectedListener(this);
        // Create an ArrayAdapter using the string array and a default spinner layout
        ArrayAdapter<CharSequence> adapter = ArrayAdapter.createFromResource(this,
                R.array.blocks, android.R.layout.simple_spinner_item);
```

```
        // Specify the layout to use when the list of choices appears
        adapter.setDropDownViewResource(android.R.layout.simple_spinner_dropdown_item);
        // Apply the adapter to the spinner
        spinner1.setAdapter(adapter);

        role = (TextView)findViewById(R.id.textView2);
        bini= (ImageView)findViewById(R.id.i1);

        btnSubmit = (Button) findViewById(R.id.btnSubmit);

        btnSubmit.setOnClickListener(new OnClickListener() {

            @Override
            public void onClick(View v) {
                submission(v);
            }
        });}



    public void onItemSelected(AdapterView<?> parent, View view,  int pos, long id) {
        // An item was selected. You can retrieve the selected item using
        // parent.getItemAtPosition(pos)
       // inputBlock1 = spinner1.getSelectedItem().toString();
        inputBlock1= parent.getItemAtPosition(pos).toString();
    }

    public void onNothingSelected(AdapterView<?> parent) {
        // Another interface callback
    }

    public void submission(View view){
        new SigninActivity(this,role,bini).execute(inputBlock1);
    }
}
```

AndroidManifest.xml

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
   package="rg.smartbin"
   >

<uses-permission android:name="android.permission.INTERNET"/>
<uses-permission android:name="android.permission.ACCESS_NETWORK_STATE" />

<application
android:allowBackup="true"
android:icon="@drawable/ic_launcher"
android:label="@string/app_name"
android:theme="@style/AppTheme" >

<activity
   android:name="rg.smartbin.MainActivity"
   android:label="@string/app_name" >

   <intent-filter>
      <action android:name="android.intent.action.MAIN" />
      <category android:name="android.intent.category.LAUNCHER" />
   </intent-filter>

</activity>
   <!-- Deep Links -->

</application>
   </manifest>
```

Strings.xml

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string name="app_name">SmartBin</string>
    <string name="block_prompt">Choose a suitable place for disposal</string>

    <string-array name="blocks">
        <item>School Building</item>
        <item>Central Workshop</item>
        <item>Cafetaria</item>
    </string-array>
    <string name="block_prompt2">Select your area</string>
    <string name="Result"></string>


</resources>
```

activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:orientation="vertical" >

    <TextView
        android:id="@+id/textView1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/block_prompt"
        android:textAppearance="?android:attr/textAppearanceLarge" />

    <Spinner
        android:id="@+id/spinner1"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:entries="@array/blocks"
        android:prompt="@string/block_prompt2" />


    <Button
        android:id="@+id/btnSubmit"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:onClick="submission"
        android:text="Submit" />

    <TextView
        android:id="@+id/textView2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="@string/Result"
        android:textAppearance="?android:attr/textAppearanceMedium"
        android:textSize="12sp" />

    <ImageView
        android:id="@+id/i1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:src="@drawable/b0"/>

</LinearLayout>
```

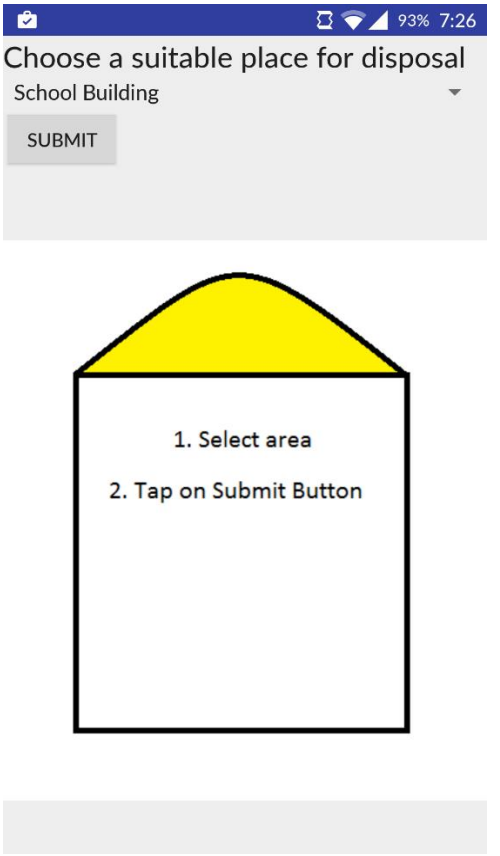

Fig. 10 Screenshots of App

Code for Website has 5 files:

1. index.html 2. location.php 3. writedata.php 4. perdetails.php 5. perdetailsapp.php

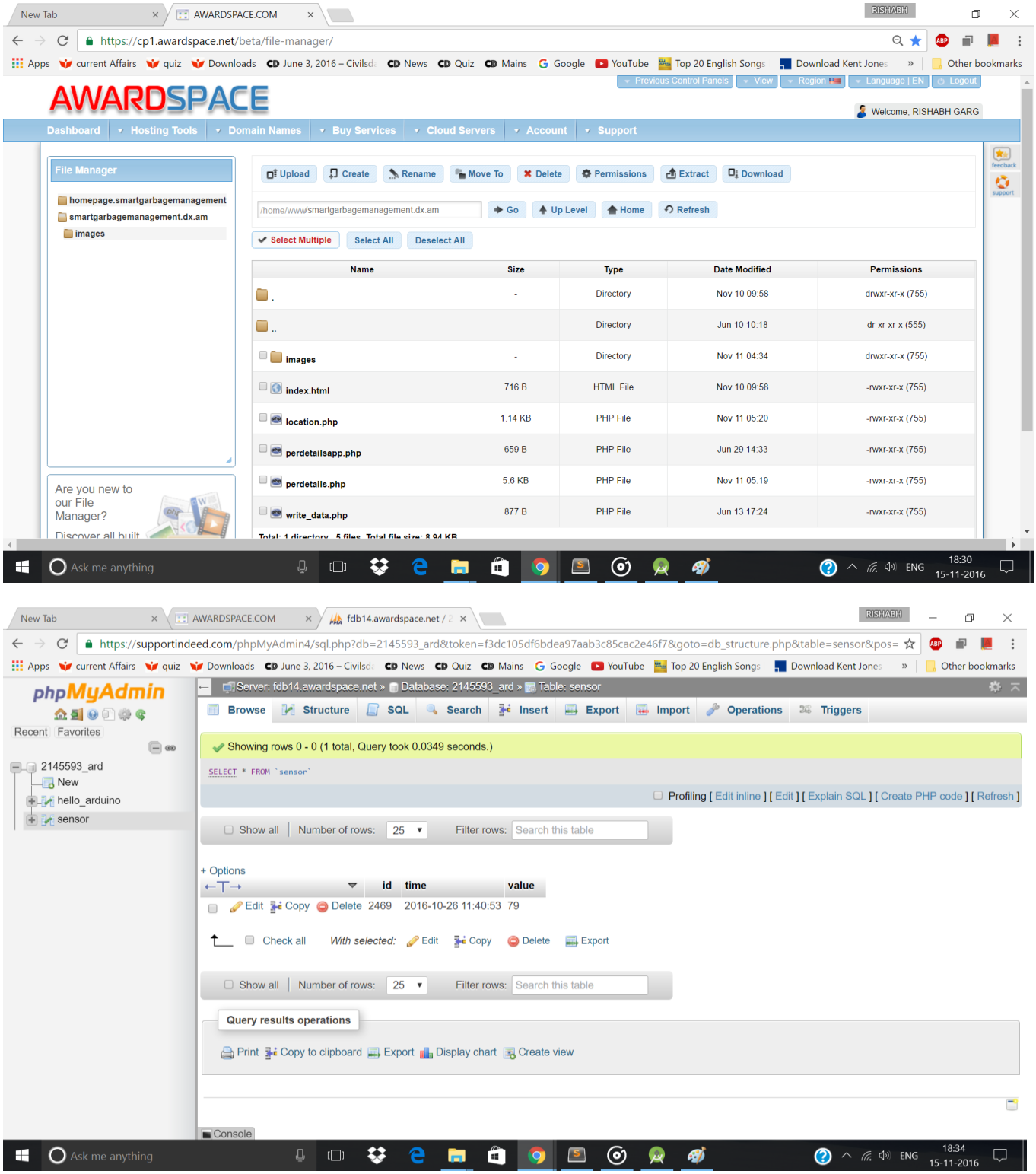

Fig. 11 Screenshots of Hosting platform

The website has 3 pages. The homepage of the website(index.html) has been embedded with a YouTube window and has a video link of Swachh Bharat Abhiyan.

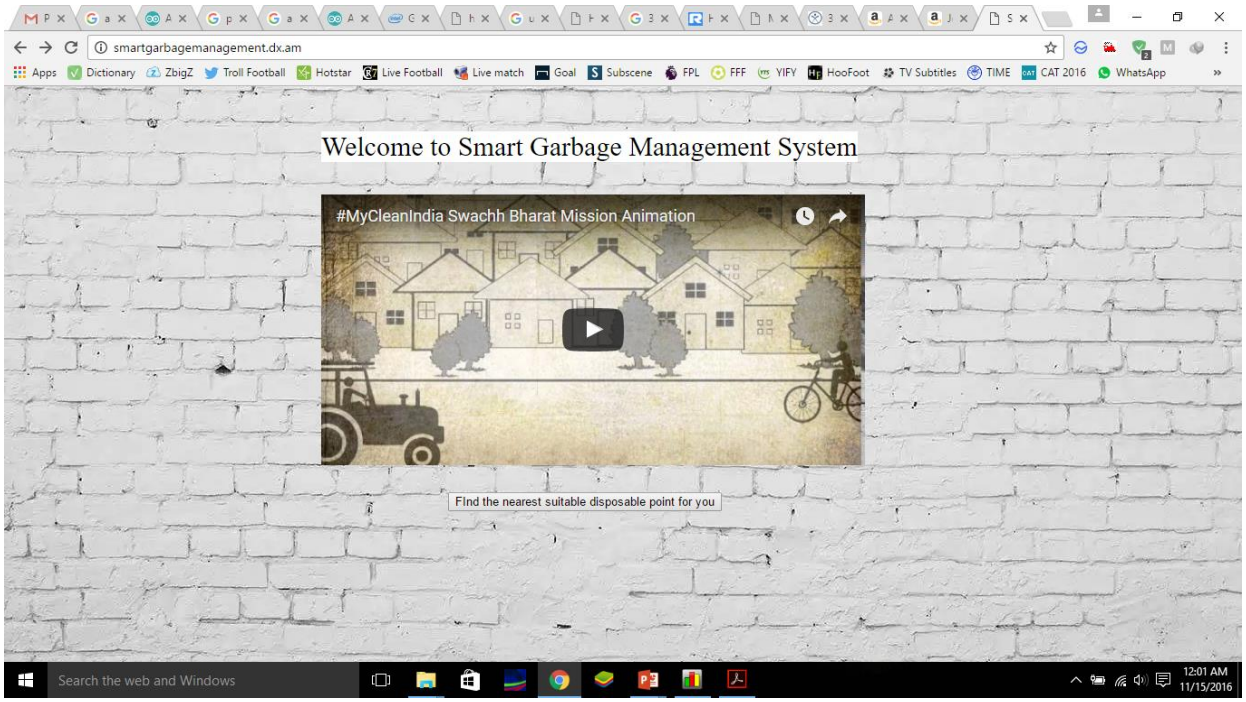

Fig. 12 Homepage of website

After clicking on the button 'Find the suitable disposable point for you', user gets the next page(location.php), on which the locations are listed, out of which one can be selected.

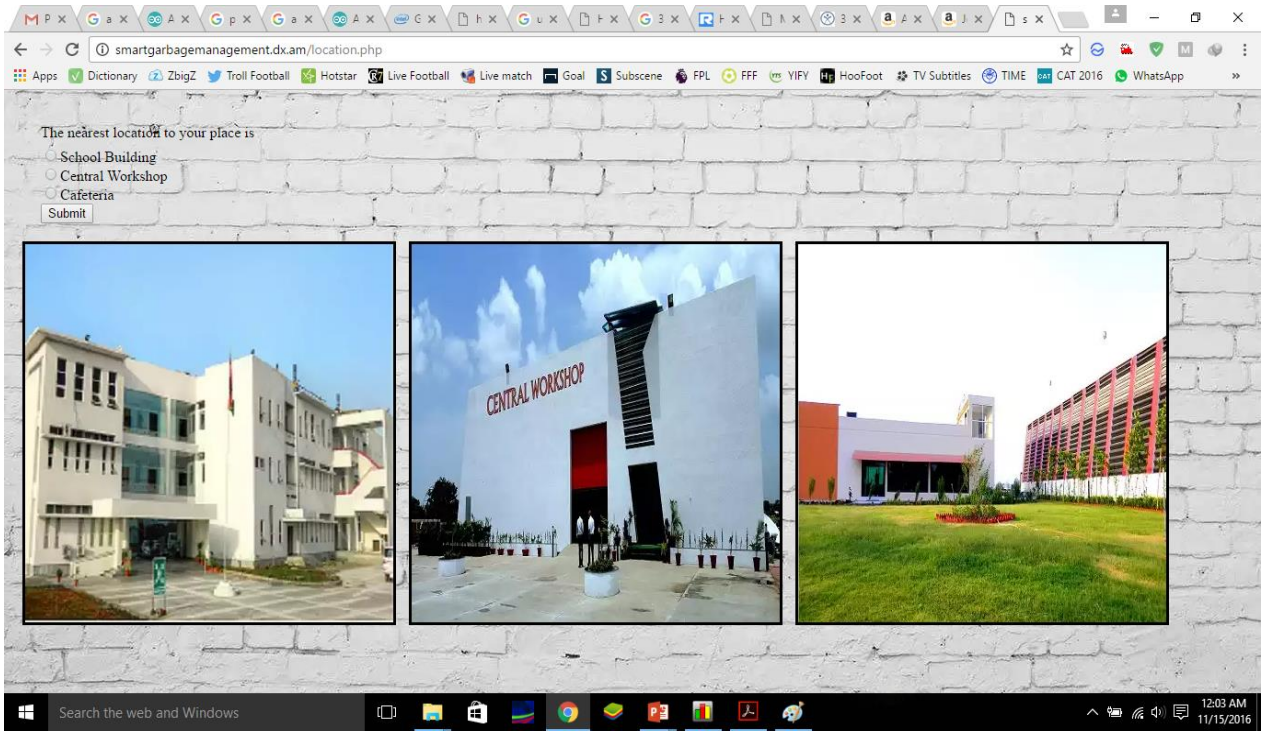

Fig. 13 Location page of website

After clicking the ‘Submit’ button, the next page opens up(perdetails.php). the third and final page shows the percentage of Dustbin filled and also indicated the percentage status of the bin using an image.

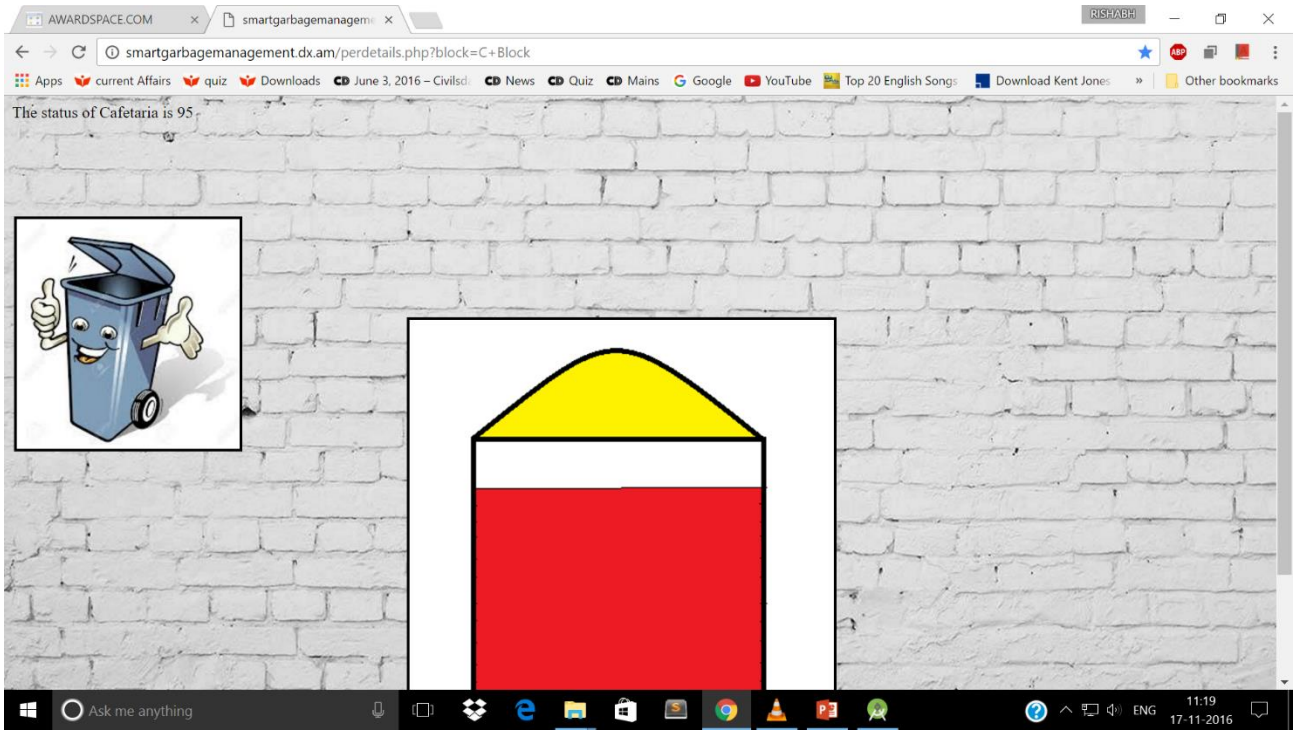

Fig. 14 Result page of website

index.html

```
<!DOCTYPE html>

<html>

<head>

<title>Smart Garbage Management System</title>

</head>

<body background="/images/green3.jpg" style="-moz-opacity:0.1;filter:alpha(opacity=10)">

<p style="position:absolute; left:350px; top:20px; background-color:white;font-size:30px">Welcome to Smart Garbage Management System</p

<br />

<FORM METHOD="POST" ACTION="location.php">

<INPUT style="position:absolute; left:490px; top:450px;"TYPE="submit" VALUE="FInd the nearest suitable disposable point for you">

</FORM>

<iframe style="position:absolute; left:350px; top:120px;" width=600px height=300px src="https://www.youtube.com/embed/friXH0vfo1E" frameborder="0" allowfullscreen></iframe>

</body>

</html>
```

location.php

```
<!DOCTYPE html>

<html>

<body background="/images/green3.jpg" style="-moz-opacity:0.1;filter:alpha(opacity=10)">

<p style="position:absolute; left:40px; top:20px;">The nearest location to your place is </p>

<form  action="perdetails.php" method="get" style="position:absolute; left:40px; top:60px;">

<INPUT  TYPE="radio" NAME="block" VALUE="A Block" >School Building<br>

<INPUT TYPE="radio" NAME="block" VALUE="B Block">Central Workshop<br>

<INPUT TYPE="radio" NAME="block" VALUE="C Block">Cafeteria<br>

<input type="submit" value="Submit">

</form>

<img style="position:absolute; left:20px; top:160px; background-color:white;"    "border:1px solid red;
height:70px; width:40px;" src="/images/school.jpg" alt="Test Image" border="3" align="center"/>

<img style="position:absolute; left:440px; top:160px; background-color:white;"    "border:1px solid red;
height:70px; width:40px;" src="/images/workshop.jpg" alt="Test Image" border="3" align="center"/>

<img style="position:absolute; left:860px; top:160px; background-color:white;"    "border:1px solid red;
height:70px; width:40px;" src="/images/garden.jpg" alt="Test Image" border="3" align="center"/>

</body>

</html>
```

perdetails.php

```
<!DOCTYPE html>
<html>
<body background="/images/green3.jpg" style="-moz-opacity:0.1;filter:alpha(opacity=10)">
The status of <?php
$answer = $_GET["block"];
if ($answer == "A Block") {
    echo 'School Building';
}
if ($answer == "B Block") {
    echo 'Central Workshop';
}
if ($answer == "C Block") {
    echo 'Cafetaria';
}
?> is
<?php
    // Connect to database
   // IMPORTANT: If you are using XAMPP you will have to enter your computer IP address here, if you are using webpage enter webpage address (ie. "www.yourwebpage.com")
    $con=mysqli_connect("fdb14.awardspace.net","2145593_ard","*rg599183#","2145593_ard");
    // Retrieve all records and display them
    $result = mysqli_query($con,'SELECT * FROM sensor'); // 'SELECT TOP 1 id FROM sensor'
    // Process every record
$row = mysqli_fetch_array($result);
        echo $row['value'];
        if($row['value'] ==0){
```

```
echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/0.png" alt="Test Image" border="3" align="center">'; }

if($row['value'] >0 && $row['value'] <= 5){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/1.png" alt="Test Image" border="3" align="center">'; }

if($row['value'] >5 && $row['value'] <=10){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/2.png" alt="Test Image" border="3" align="center">'; }

if($row['value'] >10 && $row['value'] <=15){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/3.png" alt="Test Image" border="3" align="center">'; }

if($row['value'] >15 && $row['value'] <=20){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/4.png" alt="Test Image" border="3" align="center">'; }

if($row['value'] >20 && $row['value'] <=30){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/5.png" alt="Test Image" border="3" align="center">';}

if($row['value'] >30 && $row['value'] <=36){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/6.png" alt="Test Image" border="3" align="center">'; }

if($row['value'] >36 && $row['value'] <=45){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/7.png" alt="Test Image" border="3" align="center">';}

if($row['value'] >45 && $row['value'] <=52){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/8.png" alt="Test Image" border="3" align="center">'; }

if($row['value'] >52 && $row['value'] <=60){

echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"   "border:1px solid red; height:300px; width:300px;" src="/images/9.png" alt="Test Image" border="3" align="center">';}

if($row['value'] >60 && $row['value'] <=70){
```

```
        echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"    "border:1px solid red; height:300px; width:300px;" src="/images/10.png" alt="Test Image" border="3" align="center">';}

        if($row['value'] >70 && $row['value'] <=80){

        echo '<img style="position:absolute; left:400px; top:120px; background-color:white;"    "border:1px solid red; height:300px; width:300px;" src="/images/11.png" alt="Test Image" border="3" align="center">';}

        if($row['value'] >80 && $row['value'] <=85){

        echo '<img style="position:absolute; left:400px; top:60px; background-color:white;"    "border:1px solid red; height:300px; width:300px;" src="/images/12.png" alt="Test Image" border="3" align="center">';}

        if($row['value'] >85 && $row['value'] <=90){

        echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"    "border:1px solid red; height:300px; width:300px;" src="/images/13.png" alt="Test Image" border="3" align="center">';}

        if($row['value'] >90 && $row['value'] <=95){

        echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"    "border:1px solid red; height:300px; width:300px;" src="/images/14.png" alt="Test Image" border="3" align="center">';}

        if($row['value'] >=95 && $row['value'] < 100){

        echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"    "border:1px solid red; height:300px; width:300px;" src="/images/15.png" alt="Test Image" border="3" align="center">';}

        if($row['value']==100){

        echo '<img style="position:absolute; left:400px; top:220px; background-color:white;"    "border:1px solid red; height:300px; width:300px;" src="/images/16.png" alt="Test Image" border="3" align="center">';}

    // Close the connection

     mysqli_close($con);

?>

<img style="position:absolute; left:10px; top:120px; background-color:white;"    "border:1px solid red; height:300px; width:300px;" src="/images/dustbin.jpg" alt="Test Image" border="3" align="center"/>

</body>

</html>
```

perdetailsapp.php

```
<?php

$answer = $_GET["block"];

    // Connect to database

   // IMPORTANT: If you are using XAMPP you will have to enter your computer IP address here, if you are using webpage enter webpage address (ie. "www.yourwebpage.com")

    $con=mysqli_connect("fdb14.awardspace.net","2145593_ard","*rg599183#","2145593_ard");

    // Retrieve all records and display them

    $result = mysqli_query($con,'SELECT * FROM sensor'); // 'SELECT TOP 1 id FROM sensor'

    // Process every record

$row = mysqli_fetch_array($result);

        echo $row['value'];

    // Close the connection

    mysqli_close($con);

?>
```

write_data.php

```
<?php

    // Prepare variables for database connection

    $dbusername = "2145593_ard";  // enter database username, I used "arduino" in step 2.2

    $dbpassword = "*rg599183#";  // enter database password, I used "arduinotest" in step 2.2

    $server = "fdb14.awardspace.net"; // IMPORTANT: if you are using XAMPP enter "localhost", but if you have an online website enter its address, ie."www.yourwebsite.com"

    // Connect to your database

    $dbconnect = mysql_pconnect($server, $dbusername, $dbpassword);

    $dbselect = mysql_select_db("2145593_ard",$dbconnect);

    // Prepare the SQL statement

    $sql = "INSERT INTO 2145593_ard.sensor (value) VALUES ('".$_GET["value"]."')";

    // Execute SQL statement

    mysql_query($sql);

    // Send a mail

    if($_GET["value"] >= 90){

        mail('rishabhgarg001iiti@gmail.com' , 'Full', "Take the trash out");

      }

?>
```

Mechanical Design

The mechanical design comprises of a box with upper and lower portion separated by plate. The lower portion is fitted with two lead screws. The motors which drive the lead screws and rest of the electronic equipment such as sensors, motor driver , arduino board and power supply are placed in the upper section. The plate is placed on the lead screws and moves up or down when the motor moves in one direction and then opposite direction. The engineering diagrams of box, ultrasonic sensor and lead screw are as below:

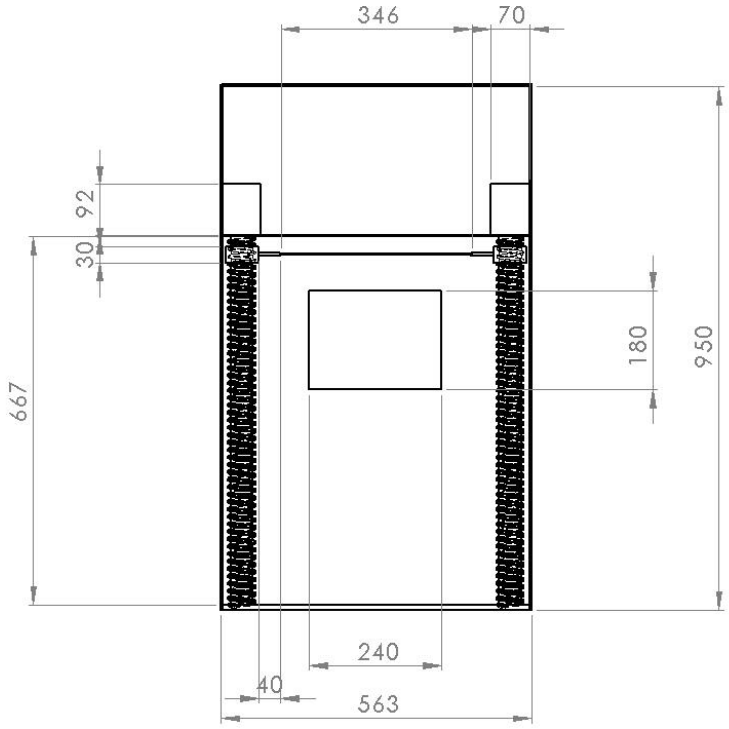

Fig. 15 Front View

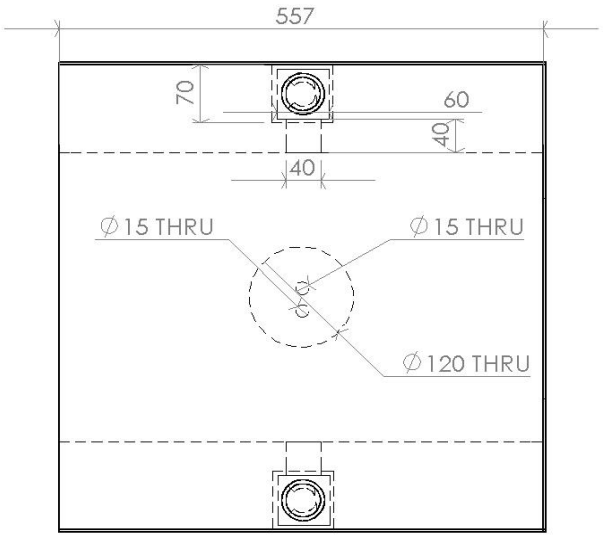

Fig. 16 Top View

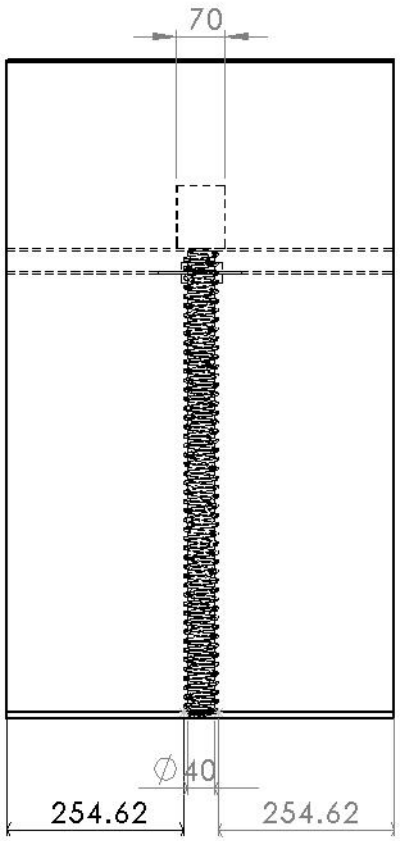

Fig. 17 Left View

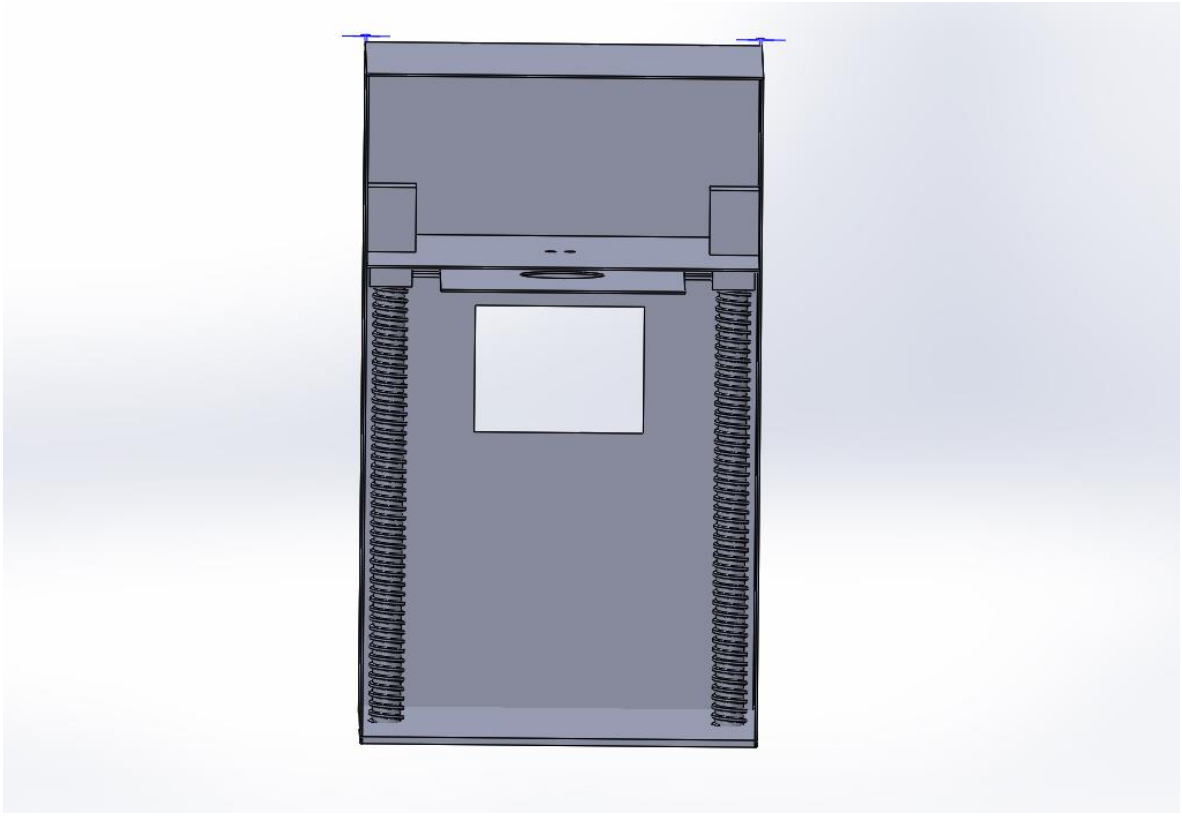

Fig. 18 Front Model

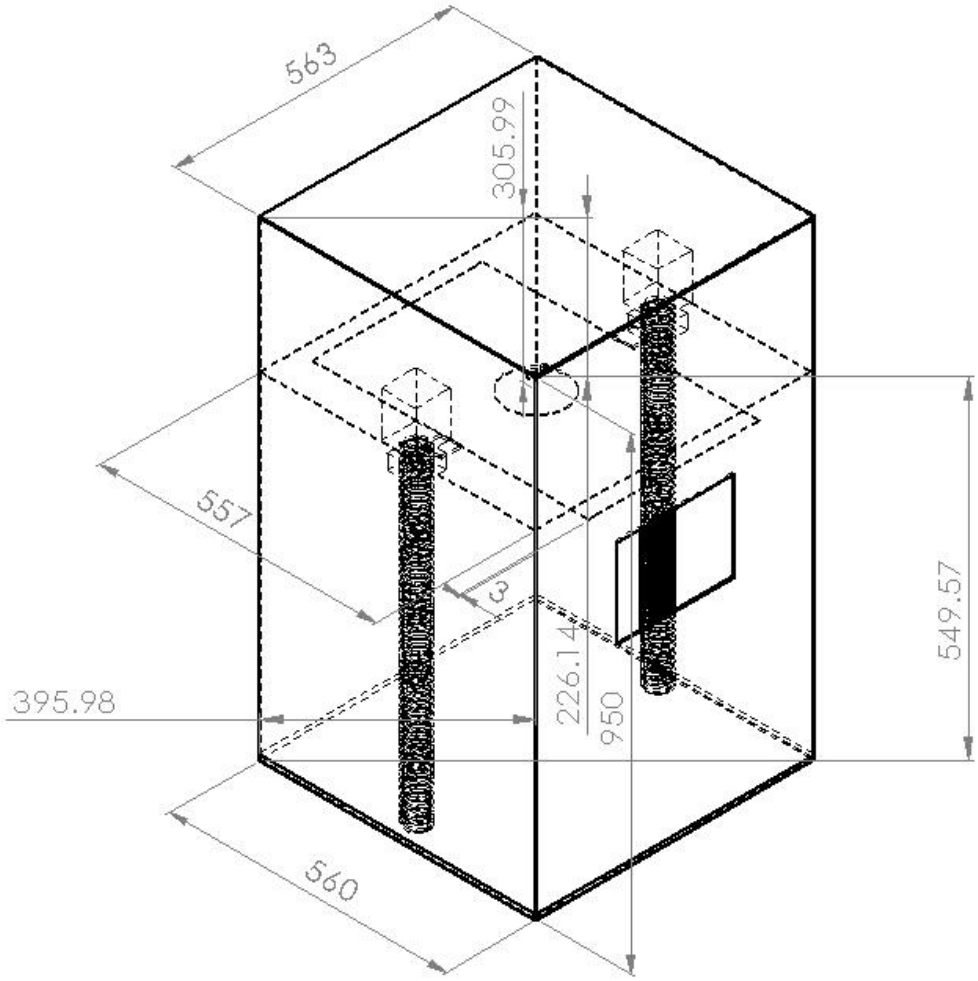

Fig. 19 Isometric View

Results

1. App is functioning correctly and showing the status of bin.
2. Website is functioning properly and showing the status of bin.
3. Mechanical compactor starts when the bin is more than 70% filled.
4. The email recipients get email when the bin is more than 90% filled.

Conclusions and Scope for Future Work

As the video of prototype was demonstrated in the presentation, hence the proposed idea of Smart garbage management can be a reality.

IC Design

In this project arduino board has been used but many of its pins and features have not been used so instead of using arduino board a complete IC specific for our purpose can be designed and manufactured so that power efficiency and cost efficiency can be achieved.

Mechanical Systems

Hydraulic Systems can be used instead of lead screws which will result in much smoother, fast and effective functioning of the compactor.

Solar panels:

The top of the Smartbin can be fitted with solar panels so that Smartbin is powered through solar panels instead of conventional power, hence making it eco-friendly.

References

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[3] A. Zanella, N. Bui, A. Castellani, L. Vangelista, M. Zorzi, “Internet of Things for smart cities,” IEEE, Internet of things Journal, vol. 1, no. 1, February 2014.

[4] N. Sharma, N. Singha, T. Dutta, “Smart Bin implementation for Smart Cities” in International Journal of Scientific & Engineering Research, vol. 6, no. 9, September-2015 ISSN: 2229-5518.

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[9] http://www.tutorialspoint.com/htm;/

[10] http://www.tutorialspoint.com/mysql/

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