GREEN UNIVERSITY OF BANGLADESH (GUB)

IOT BASED SMART WASTE MANAGEMENT SYSTEM

Submitted by:

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A project submitted to the Department of Computer Science & Engineering

for the partial fulfillment of the degree of

Bachelor of Science in Computer Science & Engineering

Supervised by

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Declaration

We here by declare that the work which is being presented in the project entitled **IOT BASED SMART WASTE MANAGEMENT SYSTEM** in partial fulfillment of requirements for the award of degree of Computer Science and Engineering (CSE), Green University of Bangladesh is an authentic record of our own work carried out during a period from September, 2021 to October, 2022 under the super-vision of MD. RIAD HASSAN , LECTURER (GUB). The matter presented in this project has not been submitted by us to any other University or Institute for the award of any Degree.

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Certificate

This is to certify that the project entitled **IOT BASED SMART WASTE MANAGEMENT SYSTEM** has been prepared and submitted by **SAZZAD KABIR SAGOR** and **HASID ISLAM** in partial fulfillment of the requirement for the degree of Bachelor of Science in Computer Science and Engineering on October, 2021.

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Abstract

The main goal of this project is to develop a smart trash can that helps keep our environment clean and green. Today, technology is getting smarter by the day, and to clean up the environment, we are designing smart trash cans with Arduino. This smart trash management system is based on a micro controller-based system with ultrasonic sensors in trash cans. Unmaintained trash cans can lead to unhealthy environments and pollution, which can affect your health. In this proposed method, we used ARDUINO UNO with ultrasonic sensors, servo motors and battery jumper cables to design a smart trash can. Once all hardware and software connections are complete, the smart dustbin program will run. The trash can lid waits for the user to put down the trash can and close it when someone approaches from a distance. does it work correctly? From a social point of view, it contributes to health and hygiene, and from a business point of view, we try to make it affordable for as many people as possible. Ultrasonic and proximity sensors warn the collection truck that the bin is full, assess the degree of separation, and allow the driver to decide whether to stop or continue. Weight sensors can also be used to track the level of large containers. This data can be used by fleet he operators to track and redirect their vehicles in real time. Combining this data with the planning engine allows the team to design highly optimized collection schedules and predict what to expect weeks in advance. Compactor-equipped bins can pick up more trash in the same space, making fewer stops for collection vehicles while picking up the same amount of trash, thus further improving efficiency.

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Chapter 1

Introduction

1.1 Overview

We live in a society where tasks and systems are merging with IoT for a more proper system to work and get tasks done quickly. With all the energy at your fingertips, it's what we've imagined. The Internet of Things (IoT) must be able to seamlessly and transparently integrate a large number of disparate systems while providing data that millions of people can use and exploit. Therefore, building a common architecture for IoT is a very complex task, mainly because there are so many devices, link layer technologies, and services that can participate in such a system. One of our main environmental concerns is solid waste management that has an impact on society's health and the environment. The detection, monitoring and management of waste is one of the major problems of the present era. The traditional way of manually monitoring trash in bins is a cumbersome and labor-intensive process, time and human cost that can be easily avoided with our current technologies.The trash can is just an ordinary trash can where people can throw their garbage but the integration of some hardware components is done for more efficient use. The smart trash can is integrated with several hardware parts such as ultrasonic sensor and Arduino, Servo Motor. These components help open

lids, detect human hands and trash cans, and send notifications in LEDs.

1.2 Objectives

Waste is an important issue that needs to be addressed wisely. We separate household waste for easier disposal and recycling. We have observed garbage trucks coming to homes irregularly and causing looting of homes. For this reason, many civilians are emptying trash bins that overflow the vacant lots. This increases contamination. Waste puts a huge strain on our health and the environment and has many horrific consequences. Garbage is a breeding ground for bacteria, insects and flies. These flies are the same ones that roam around the edible and drop offspring. They therefore increase the risk of insects causing food poisoning, typhoid fever, gastroenteritis, salmonella, malaria, dengue fever, etc. In addition to these flies and insects, other animals that thrive in litter are disease-spreading rats and stray dogs. Various respiratory diseases also cause health problems and toxic pollutants such as CO2 methane and nitrous oxide, affecting the environment and causing air and water pollution. Dumping hazardous waste such as electronics and plastics into water affects aquatic life and indirectly affects humans. Overflowing trash is also an open nuisance and an eyesore. Everyone wants to visit a fresh and clean city. A stinking city with garbage everywhere means no tourists, lost income and opportunities.

Dealing with it and finding a suitable remedy is a very important issue. Some of them are against people throwing trash, against industry using no biodegradable materials, against using more recycled products and using less non-degradable materials, against reusing items. It's like a government that should make strict laws based on To some extent. Concepts are proposed along with the use of this technology to properly dispose of waste and reduce its harmful effects.

1.3 Motivation

Today, there are tons of apartments and condos built in rapidly urbanizing areas. In everyday life, disposal includes opening the lid of the trash can and throwing the waste in it, then cleaning or emptying the trash when it is become full. The same is done in a residential area, the garbage becomes more tough to handle, and if the bin is full, people started to throw garbage around the trash, which creates other diseases. The official companies who has to empty the trash will not empty the bin as often, and the garbage will sit on this street for weeks, creating an unhealthy environment and leading to many diseases. The trash can also not be properly maintained when the lid is damaged resulting in the trash can overflowing from the dustbin. If the tank is not maintained properly, the tank will have a bad smell. If the trash is not emptied immediately after the bin is full, many flies, mosquitoes and other insects will be around the trash can, which will create a various type of diseases. The idea came to us when we observed garbage trucks going around town picking up solid waste.

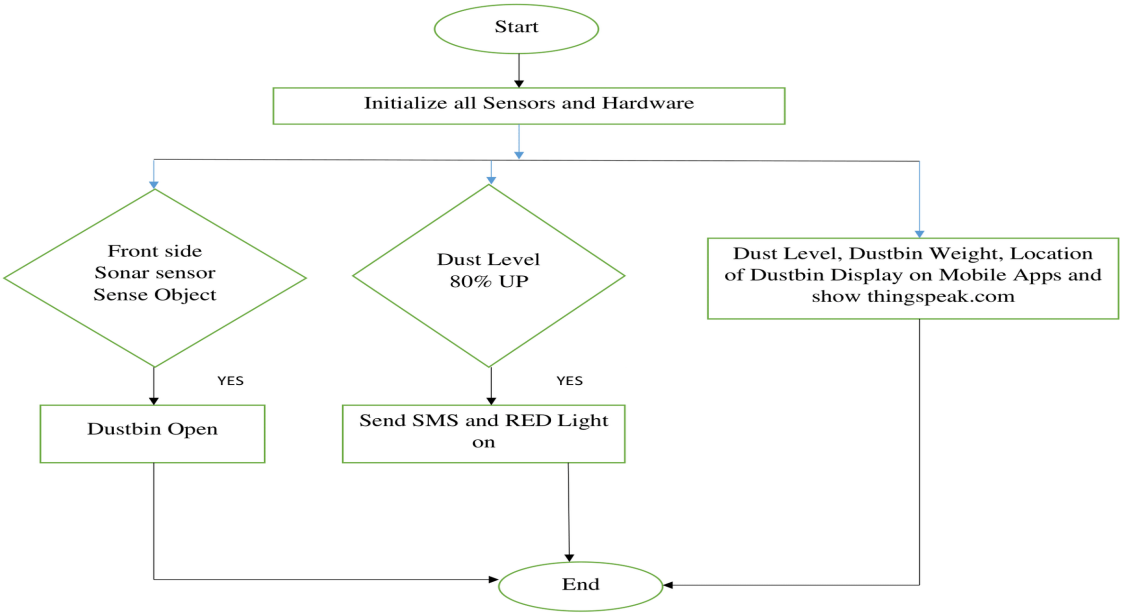

Figure 1.1: Flow chart

What our machine does is it offers a real-time indicator of the rubbish stage in a garbage can at any given time. Using that information we will then optimize waste series routes and in the long run lessen gasoline consumption. It lets in trash creditors to plot their daily/weekly pick-up schedule. An Ultrasonic Sensor is used for detecting whether or not the trash can is packed with rubbish or not. Here Ultrasonic Sensor is hooked up on the pinnacle of the Trash Can and could degree the gap of rubbish from the pinnacle of the Trash are we able to can set a threshold price in step with the scale of the trash can. If the gap might be much less than this threshold price, method that the Trash can is complete of rubbish and we can print the message “Basket is Full” at the message if the gap might be greater than this threshold price, then we can print the gap closing for the rubbish vat to be complete.

1.4 Conclusion

In our modern life, smart dustbin is a very important discovery for environment. This section is discuss about the problem which is created for the regular dustbin.In this part we discuss about smart dustbin and give a short details by flow chart that how will smart dustbin can be made. The next chapter will discuss about hardware that will needed to create a smart dustbin.

Chapter 2

Background Study

The quantity of waste produced regular via way of means of industries and families is growing at an appalling rate, and the primary motive for that is the hovering use of packaged items, textiles, paper, food, plastics, metals, glass, etc, therefore control of this refuse will become a vital element in our regular life.in maximum of the advanced international locations, there are numerous green strategies which might be used for the right control of this waste, however in a few international locations particularly the growing ones the careless mind-set of human beings closer to keeping easy surroundings, in conjunction with this many troubles consisting of no stringent legal guidelines for the use of the biodegradable materials, no right environ policies, no legal guidelines for sustainable improvement are the seed for the deadly consequences of waste control. Due to the growing waste, the general public boxes which might be used for gathering this waste are overflowing, the locality is jumbled with trash, inflicting now no longer simplest malodorous streets however additionally a bad effect at the fitness and environment.

As prosperity grows, 62 million heaps of rubbish is generated each day via way of means of the 377 million human beings dwelling in city India, now the world's 1/3 biggest rubbish generator. However, it is now no longer the quantity of waste gen-

erated that is as a good deal of an difficulty because the truth that greater than forty five million heaps, or three million vans worth, of rubbish is untreated and disposed of via way of means of municipal government each day in an unhygienic manner.

Several authors have presented systems in which bin sensors check whether the bin is full to the brim. If filled, an automated message will be sent to the system's end server, via the Arduino SIM module, which already uses the Arduino board application. After the server receives the message, it will forward the message to the responsible employee, if the employee is present, he will announce his presence by accepting the job and going to the requested destination. bridge. If the worker is not present, the work will be transferred to another worker.

Some authors have also implemented real-time waste management systems using smart bins to check how full the bins are and whether they are full. By implementing this proposed system, cost reduction, resource optimization and efficient use of smart buckets have been achieved. This system has indirectly reduced traffic volume in the city. In large cities, garbage trucks will come to the area two or three times per day depending on the population of the particular area. The system notifies the status of each trash can in real time so that the authorities can only send garbage trucks when the bins are full. Several smart waste management systems are proposed using infrared sensors, microcontrollers and Wi-Fi modules. This system ensures that the bins are cleaned as soon as the trash level reaches the maximum level. If the bin is not emptied within a certain time, the record will be sent to the higher authority and appropriate action will be taken against the contractor concerned.

The system also helps to monitor false reports and thus helps to reduce corruption in the overall management system. This ultimately helped maintain cleanliness in the society. Gradually, trash cans with Wi-Fi routers were born. The trash can has a passive infrared sensor. Wi-Fi routers have been programmed to display temporary login codes. When the user throws trash in the trash, the PIR sensor detects the garbage and sends a signal to the microcontroller. The microcontroller detected the signals and

forwarded them to the router. The router checked the signals and generated random codes, then passed them back to the microcontroller. The microcontroller scans the signals and transfers them to the LCD display. The LCD screen showed that. The user enters a random code generated by the router on the PHP interface hosted on the server. The server then responded to the request and showed the master Wi-Fi password to the user. The user then used the master Wi-Fi password to connect to the Internet. User has been on the internet for 10 minutes and automatically logged out.

Chapter 3

HARDWARE REQUIREMENT

We will need the those hardware to accomplish our project.

- **A**rduino mega
- **L**CD Display
- **B**in
- **X**HM711
- **L**oad sensor
- **N**odemcu
- **G**PS
- **G**SM
- **S**ervo motor
- **T**wo Sonar
- **L**ED Bulb

- **S**MPS 12v 2A
- **B**uck converter **2** pin plug wire

3.1 ARDUINO UNO

Arduino is an open-source stage utilized to construct electronic ventures. Arduino comprises both a physical programming board (commonly known as a microcontroller) and a program, or IDE (coordinates advancement environment) running on your computer, utilized to type in and transfer machine code charged on the physical board.

- The Arduino platform has become very famous with novices electronically and for good reason. Unlike most previous programming boards, Arduino does not need a separate piece of hardware (called a programmer) to load the new code into the board - you can simply use a USB cable. More, The Arduino IDE uses a simplified version of C++, making it easier to learn to program.

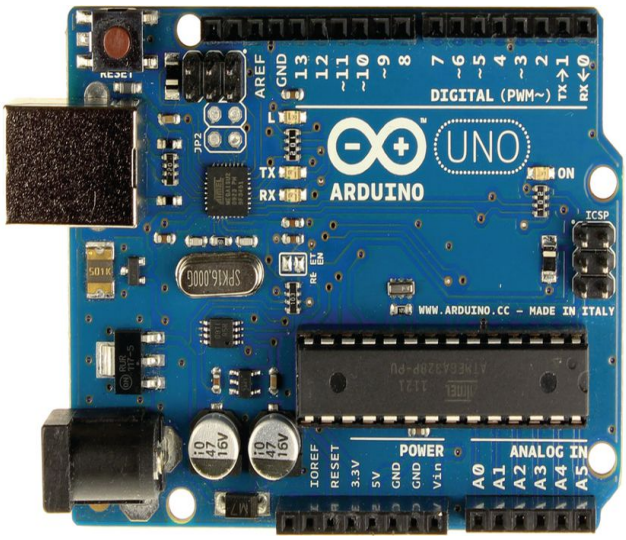

Figure 3.1: ARDUINO UNO BOARD

Finally, the Arduino gives a proper form that breaks down functions of micro-

controller in a more flexible files. Arduino is a microcontroller board based on ATmega8. It contains everything needed to support Microcontrollers. The map includes the new features:

- More powerful reset circuit
- At mega 16U2 replace 8U2.

3.2 NodeMCU

NodeMCU is an IoT-based platform. This is used to make things work using Wi-Fi. This board includes firmware running on the ESP8266 Wi-Fi SoC Express system and hardware based on the ESP-12 module. A second ultrasonic sensor is connected to this card and a second coin code is loaded into this card. Before rendering the code, in the Arduino IDE, the correct board must be selected. This uses many open-source projects like Luacjson and SPIFFS.

Figure 3.2: NodeMCU

3.3 Ultrasonic sensor

The ultrasonic sensor is hardware that finds out the litter distance by ultrasonic sound waves. This sensor has a transducer that sends and receives ultrasonic pulses based on the proximity of the object. The ultrasonic sensor catches objects and wastes. The integrated circuit in the module calculates the time it takes for the US wave to return and activates the high echo pin at this same time, this way we can also know how long it takes.

Figure 3.3: Ultrasonic sensor

3.4 Servo motor

Servo motor helps to open the trash can lid.The Arduino is programmed in such a way that after the ultrasonic sensor detects the trash, the lid opens automatically and this is done by this servo motor.

Figure 3.4: Servo motor

3.5 GSM module”

The GSM module is used to establish communication between the computer and the GPRS GSM system. The Global System for Mobility (GSM) is an architecture used for mobile communications in most countries. Global Packet Radio Service (GPRS) is an extension of GSM that allows higher data rates. The GSM/GPRS module consists of a GSM/GPRS modem assembled with a power circuit and communication interfaces (such as RS-232, USB, etc.) to the computer. GSM/GPRS MODEM is a type of wireless MODEM device designed for computer communication with GSM and GPRS networks.

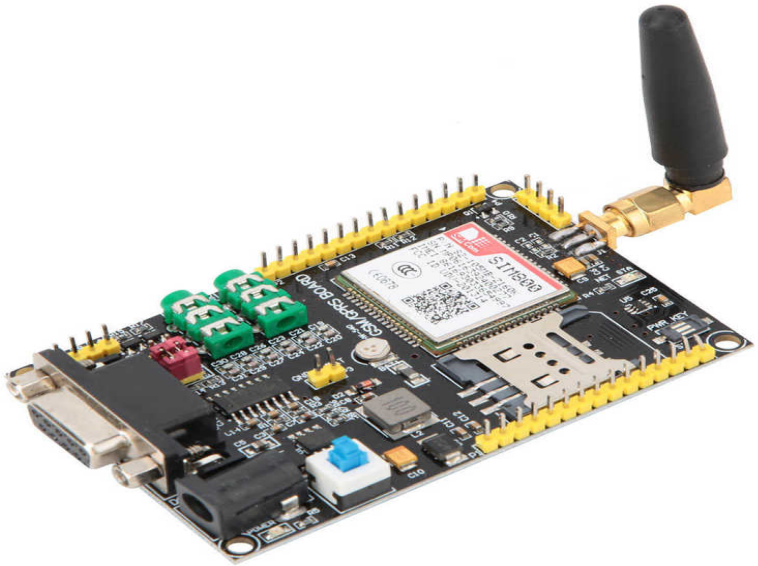

Figure 3.5: GSM/GPRS module

It requires a SIM (Subscriber Identity Module) card like a mobile phone to be able to communicate with the network. In addition, they have the same IMEI (International Mobile Equipment Identity) number as a mobile phone for identification.A GSM modem is a wireless modem that works with GSM wireless networks. One wireless modem works like a dial-up modem. The main difference between them is that dial-up modems send and receive data through landline phone lines while wireless modems send and receive data through radio waves. The GSM modem can be an external device or a PC. Like GSM cell phones, GSM modems require a SIM card from a wireless service provider to function.

3.6 Blynk App”

Blynk is a platform with IOS and Android applications to control Arduino, Raspberry Pi and other applications over the Internet. It’s a digital dashboard where you can create a GUI for your project by simply dragging and dropping widgets

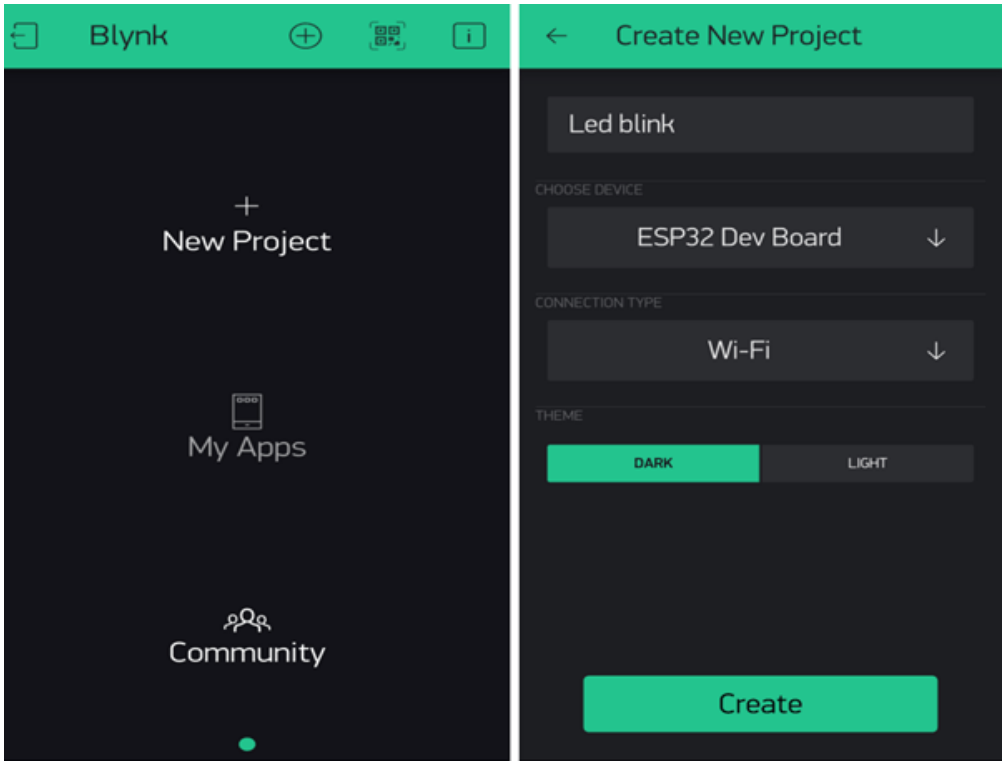

Figure 3.6: Blynk App

3.7 ThingSpeak Website

ThingSpeak is open source software written in Ruby that allows users to communicate with Internet-enabled devices. It facilitates data access, retrieval, and logging by providing APIs for both devices and social networking sites. ThingSpeak allows you to publish your sensor readings to a website and view them in graphs with time stamps. You can then access your measurements from anywhere in the world. ThingSpeak is an IoT analytics service that allows the aggregate, visualization, and analysis of live data streams in the cloud. ThingSpeak instantly visualizes data sent from your device to ThingSpeak. You can run MATLAB code in ThingSpeak, so you can perform online analysis and process incoming data. ThingSpeak is commonly used for prototyping and proof-of-concept IoT systems that require analytics. You can send data directly

to ThingSpeak from any internet-connected device via Rest API or MQTT. Additionally, cloud-to-cloud integrations with The Things Network, Senet, Libelium Meshlium Gateway, and particle. ThingSpeak lets you store and analyze data in the cloud without configuring a web server. You can also create advanced event-based email alerts that are triggered based on incoming data from connected devices.

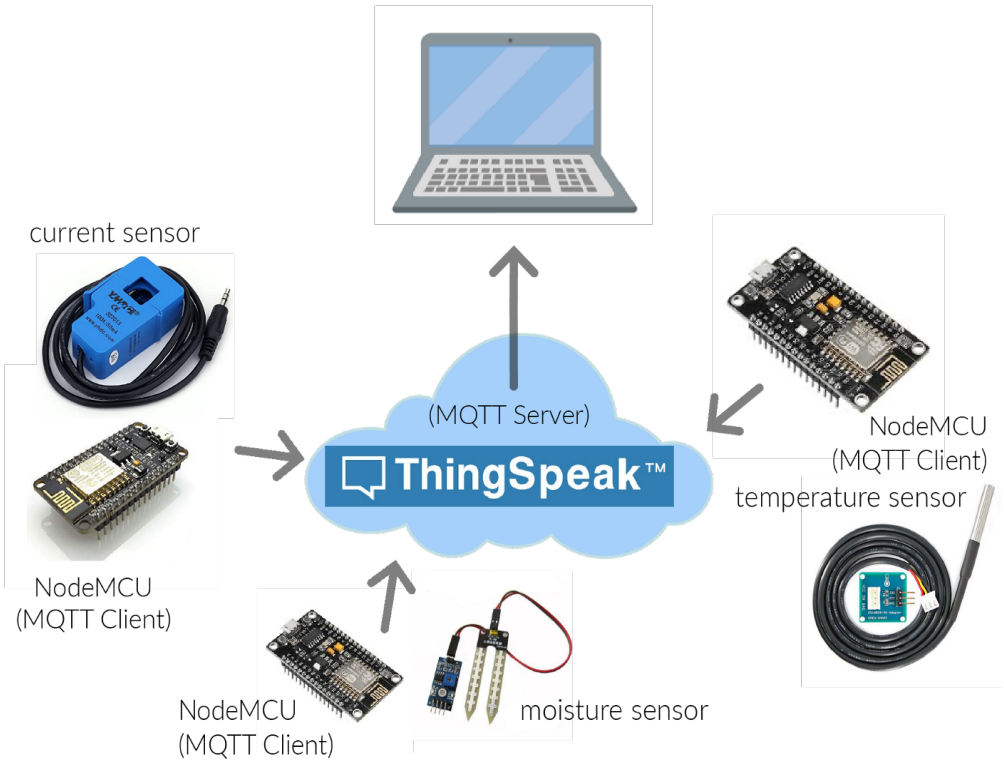

Figure 3.7: ThingSpeak Website

3.8 Conclusion

The chapter is discuss about hardware that will needed to create a smart dustbin. The part's images and details are briefly showed in this hardware requirements part. Arduino uno and ultrasonic sensor are take a great role in creating smart dustbin project.

Chapter 4

DESIGN AND MODELLING

4.1 Introduction

In this section, we design the structure of the system before implementing the circuit. It uses an advanced microcontroller called Arduino (ATmega8). It incorporates many components such as analog-to-digital converters, 16MHz clocks and shift registers. For this project, I attached an ultrasonic sensor to the trash. The final result of the ultrasonic sensor is created by the hardware named Arduino, and the result is sent to the GSM, which will send an update details to the infected person.In other words, if the distance from the top of the trash to the sensor is less than 5 cm, the bin is full message is output.

4.2 PROPOSED SYSTEM

The prototype is built as follows: Take a plastic trash can or trash can and place an ultrasonic sensor in the front part of the trash can. The lid of the dustbin is made of cardboard and a servo motor is placed on the lid. Another ultrasonic sensor is placed inside the barrel. The code for this project is divided into two parts. The header code

indicates the operation of the recycle bin, i.e. mainly the operation of opening the lid of the trash can. The second part code indicates the portion of the message received on the mobile device using the Blynk app.

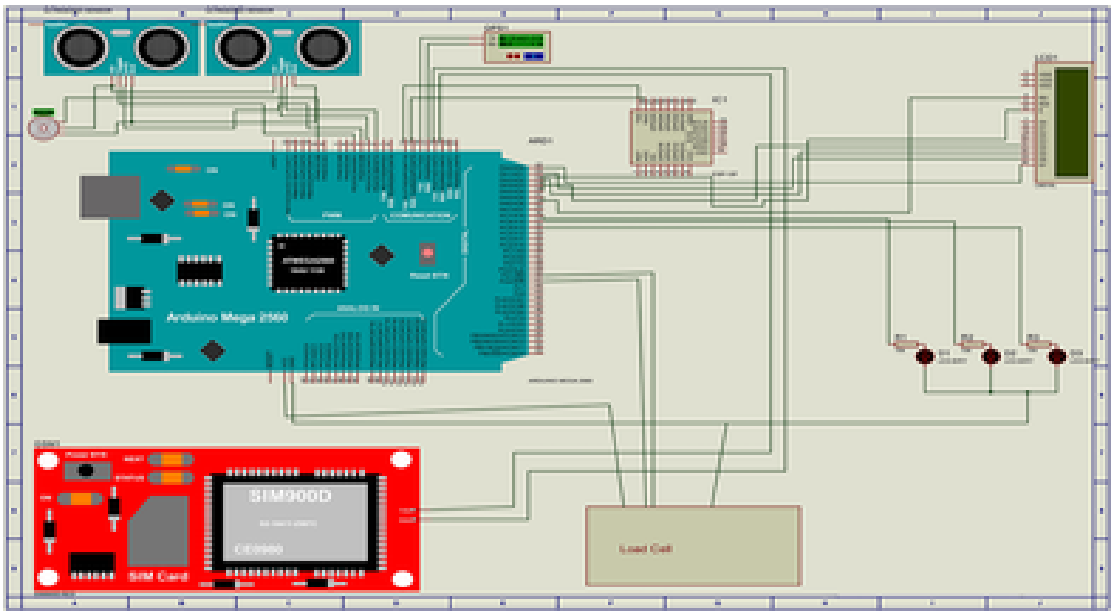

Figure 4.1: Circuit Diagram

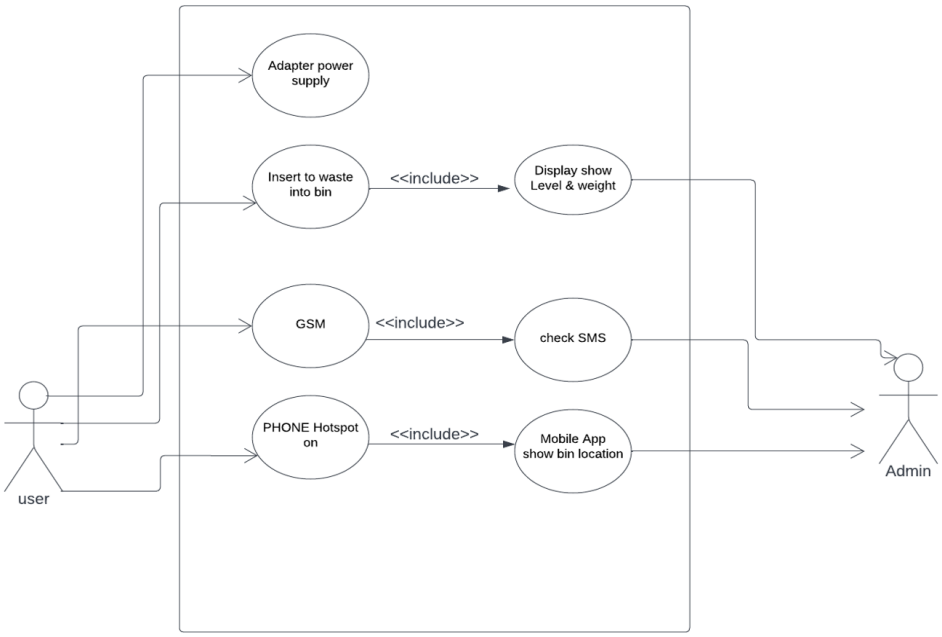

Figure 4.2: Use case diagram

4.3 Conclusion

In this design and modelling part we discussed about the proposed system with data flow diagram, circuit diagram for connection with arduino and other sensors and the last part is use case diagram by where user and admin can find their role on this iot based project perfectly.

Chapter 5

Implementation

5.1 Introduction

Implementation and Outcome Result chapter is containing all essential information for the user to make full use of the **IOT BASED SMART WASTE SYSTEM**.This chapter describes system features and functions, contingencies and alternate modes of operation, and step-by-step instructions for accessing and using the system. We discuss the design and implementation process, requirement collection and analysis, and main module functions, which review our total system

5.2 Hardware implementation

The ultrasonic sensor is located on the front panel which has four pins labeled Vcc, GND, ECHO, and trig. The TRIG and ECHO pins are connected to digital pins two and three on the Arduino board. The servo motor has three pins named Vcc, GND, and the servo pin. The servo pin of the servo motor is connected to pin number nine on the Arduino board. Once the connections are made, the Arduino is plugged into the

system, and using the Arduino IDE, the code is injected inside the Arduino. This ends the connection and returns the code for the first part. The second part is structured as follows:

The ultrasonic sensor placed inside the tank also has the same four pins named Vcc, GND, ECHO, and TRIG. In Arduino IDE, the board should be changed from Arduino UNO to NodeMCU, if the board is not on the list, we need to install the board from the board manager. In this section, the TRIG and ECHO pins of the ultrasonic sensor are connected to the digital pins D5 and D6 of the NodeMCU. Vcc is connected to the Vin of NodeMCU and GND to the ground of NodeMCU. This requires login and now the code needs to be injected into the NodeMCU. Connect the Arduino's RX pin to the GSM module's TX pin and the Arduino's TX pin to the GSM module's RX pin. Connect the Arduino's GND to the module's ground. In addition, the GSM module needs an external 12v power supply.

Figure 5.1: Construction of top part of dustbin

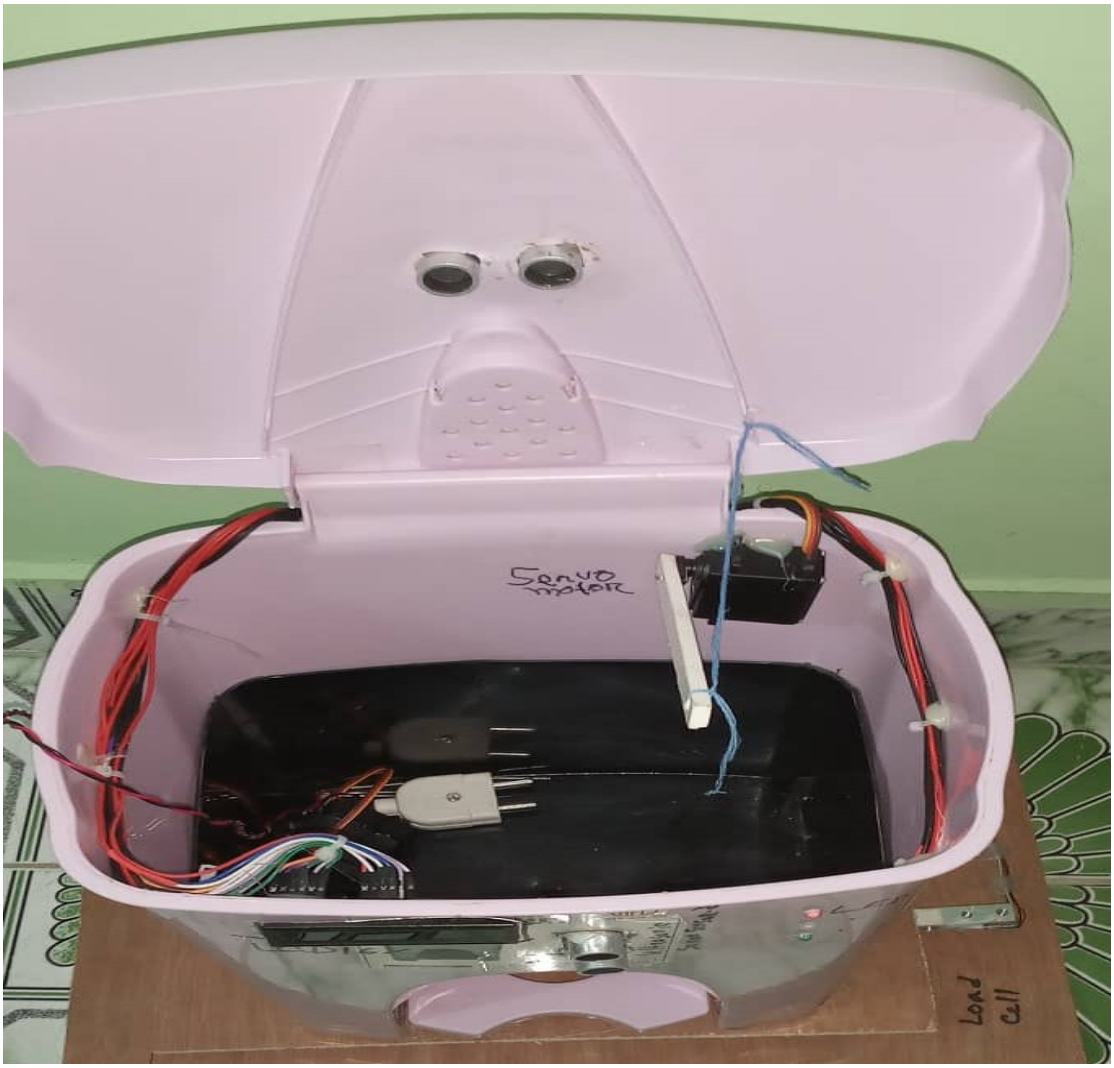

Figure 5.2: Construction of inside part of dustbin

Figure 5.3: Construction of left part of dustbin

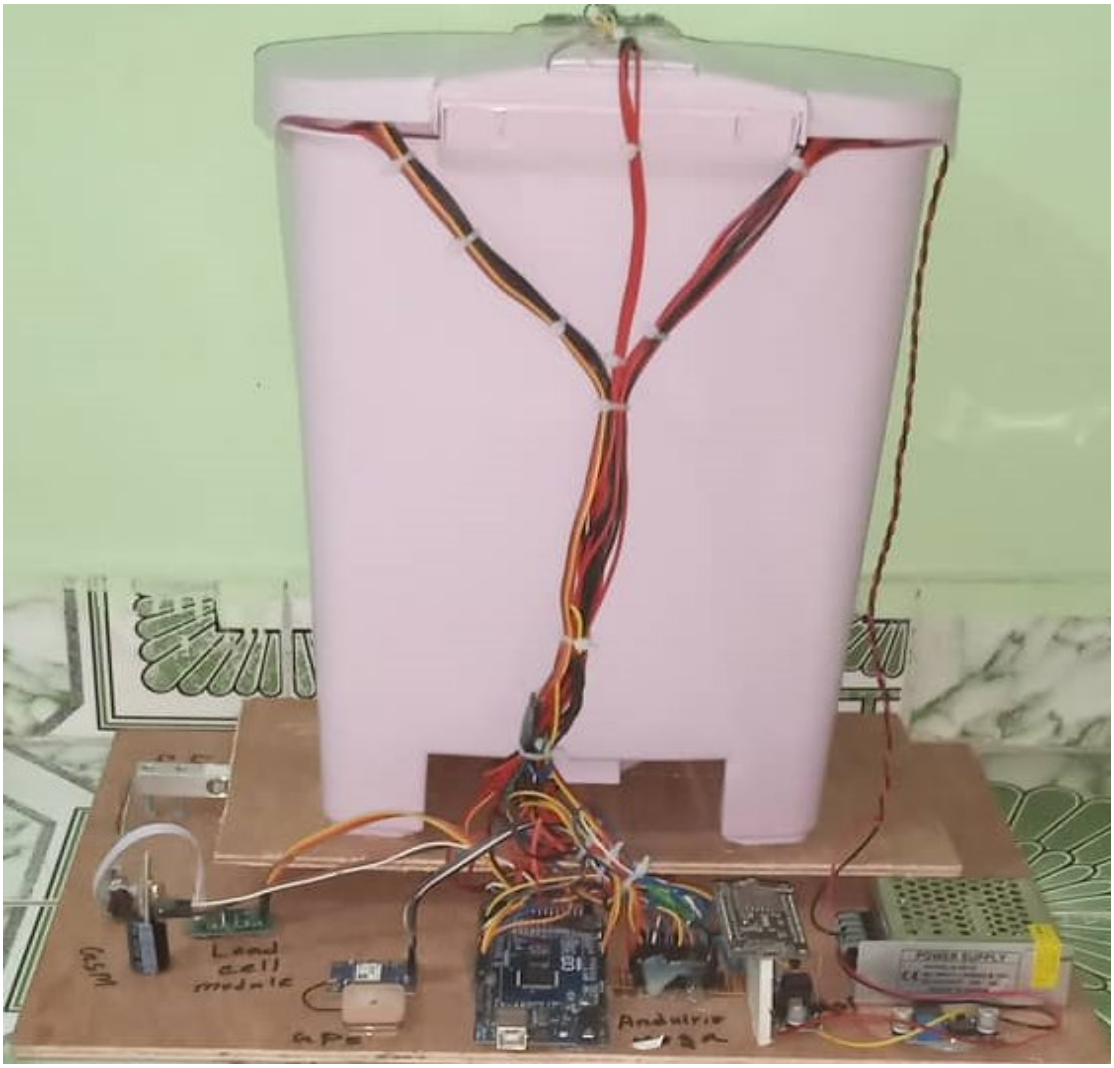

Figure 5.4: Construction of back part of dustbin

Figure 5.5: Construction of front part of dustbin

5.3 Source Code

include ¡Servo.h¿

include ¡LiquidCrystal.h¿

include ¡HX711$_A$*DC.h* >

include < *TinyGPS* + +.*h* >

const int $HX711_dout = 10; //mcu > HX711 dout pin$

$const int HX711_sck = 11; //mcu > HX711 sck pin$

$HX711_ADC LoadCell(HX711_dout, HX711_sck);$

const int rs = 22, en = 23, d4 = 24, d5 = 25, d6 = 26, d7 = 27;

LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

Servo myservo;

TinyGPSPlus gps;

define trigPinA1

define echoPinA1

define trigPinA2

define echoPinA2

define servo

define LEDR

define LEDB

define LEDG

unsigned long previousMillis = 0;

const long interval = 2000;

int FF = 0, S = 0;

float latitude;

float longitude;

float speed;

float satellites;

String direction;

float waight = 0;

void setup()

```
lcd.begin(16, 2);
Serial.begin(9600);
Serial1.begin(9600);
Serial2.begin(9600);


Serial3.begin(9600);
myservo.attach(servo);
myservo.write(0);
pinMode(trigPinA1, OUTPUT);
pinMode(echoPinA1, INPUT);
pinMode(trigPinA2, OUTPUT);
pinMode(echoPinA2, INPUT);
pinMode(LEDR, OUTPUT);
pinMode(LEDB, OUTPUT);
pinMode(LEDG, OUTPUT);
digitalWrite(LEDR, LOW);
digitalWrite(LEDB, LOW);
digitalWrite(LEDG, HIGH);
LoadCell.begin(); LoadCell.start(1000); LoadCell.setCalFactor(52);
void loop()
while (Serial2.available() ¿ 0)

if (gps.encode(Serial2.read()))
displayInfo();

int F = sennorA2();
if (F ¡ 45)
myservo.write(90);
```

```
else
LoadCell.update(); float i = LoadCell.getData();
waight = (i / 1000);
if (waight ¡= 0)
waight = 0;

myservo.write(0);
FF = sennorA1();
Serial.print(FF);
FF = map(FF, 5, 28, 100, 0);
if (FF ¡= 0)
FF = 0;

if (FF ¿= 100)
FF = 100;

Serial.print(””);
Serial.println(FF);
lcd.setCursor(0, 0);
lcd.print(”D. W : ”);
lcd.print(waight);
lcd.print(” KG ”);
lcd.setCursor(0, 1);
lcd.print(”D. L : ”);
lcd.print(FF);
lcd.print(” if (FF ¡ 30)
digitWrite(LEDR, LOW);
digitWrite(LEDB, LOW);
digitWrite(LEDG, HIGH);
S = 0;
```

```
else if (FF ¿= 50  FF ¡ 80)
digitWrite(LEDR, LOW);
digitWrite(LEDB, HIGH);

digitWrite(LEDG, LOW);
S = 0;

else if (FF ¿= 80)
digitWrite(LEDR, HIGH);
digitWrite(LEDB, LOW);

digitWrite(LEDG, LOW);
if (S == 0)
S = 1;
String asd = ”Dustbin Full.....Take Action.....: ” + String(latitude, 6)
+ ”: ” + String(longitude, 67+ ”Level : ” + String(FF) + ”
sendSMS(asd);



unsigned long currM = millis();
if (currM - prevsM ¿= interval)
prevsM = currM;
String sms = ”” + String(latitude, 6) + ”@” + String(longitude, 6) + ”@” + String(FF)
+ ”@” +
String(waight) + ”*”; Serial.println(sms);
Serial3.println(sms);

delay(300);
```

```
long sennorA1()
digitWrite(trigPinA1, LOW);
delayMs(2);
digitWrite(trigPinA1, HIGH);
delayMs(10);
digitWrite(trigPinA1, LOW);
long duration = pulseIn(echoPinA1, HIGH);


        int distance = duration * 0.034 / 2;
return distance;

long sennorA2()
digitWrite(trigPinA2, LOW);
delayMs(2);
digitWrite(trigPinA2, HIGH);
delayMs(10);
digitWrite(trigPinA2, LOW);
long duration = pulseIn(echoPinA2, HIGH);
int distance = duration * 0.034 / 2;
return distance;

void sendSMS(String msg)
Serial1.println(”AT”); updateSerial();


        Serial1.println(”AT+CMGF=1”); updateSerial();
Serial1.println(”AT+CMGS=ǂ8801324181158¨);
updateSerial();
Serial1.print(msg); updateSerial();
```

```
Serial1.write(26);
delay(3000);

void updateSerial()

delay(500);
while (Serial1.available())

Serial.write(Serial1.read());//Forward what Software Serial received to Serial Port


void displayInfo()

if (gps.location.isValid() )

latitude = (gps.location.lat()); longitude = (gps.location.lng());
Serial.print(”LAT: ”);
Serial.println(latitude, 6); Serial.print(”LONG: ”);
Serial.println(longitude, 6);
speed = gps.speed.kmph(); direction = TinyGPSPlus::cardinal(gps.course.value()); satell
= gps.satell.value();
```

5.4 Conclusion

For creating a smart dustbin we need software and coding with hardware .In this chapter we implement hardware and added their images also given source code which is build in C language. In next chapter we will do testing on this hardware.

Chapter 6

System Test

6.1 Introduction

We test the project in two phases: software and hardware. The hardware part should be physically tested, while the software part is meant to be tested via the Arduino IDE. I need to verify if the system is working properly. Check the distance indicated by the sensor to make sure the reading is correct.Put the trash in front of the ultrasonic sensor first, or the sensor will detect the trash and close the lid of the trash can Open and throw the trash in the trash can. this The process repeats and continues like a cycle

6.2 Testing tools

To test the project, we need a tool called the Arduino IDE to test the necessary Arduino program software. This way you can check if the program is working properly. Hardware testing requires a power supply and a suitable range measurement and tape measure. A landfill can only contain solid waste. The Nodemcu should connect to the Blynk app and the app should display the output. To do this, the node MCU first needs

to connect to a WiFi hotspot.

6.3 Testing strategy:

To test, first use your computer to connect the circuit to the Arduino's power supply. This can be done using batteries. This is how the entire test circuit is constructed. Let's change the level of solid waste and input it to HC-SR04. Garbage level changes should be reported via the GSM module. Summary of test procedures:

- According to the diagram, connect the circuit.
- Turn the system on.
- Change the loss level so that the ultrasonic sensor provides the output.
- After getting output it will send a message via the GSM module.

6.4 Thinkspeak View

In Thinkspeak website we can determine the cureent situation of smart dustbin. We can see the percent and weight of a garbage with date.

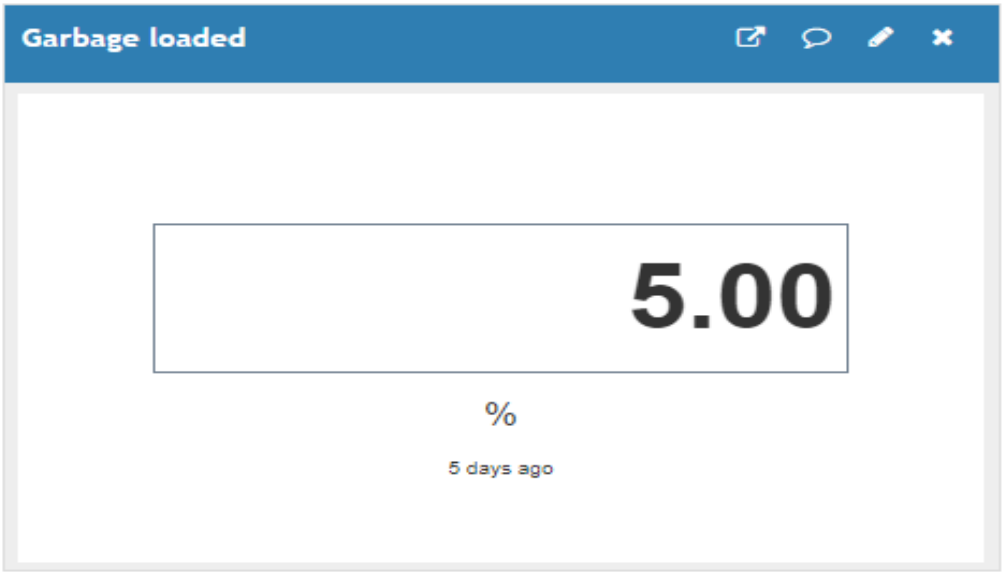

Figure 6.1: Garbage loaded percentage

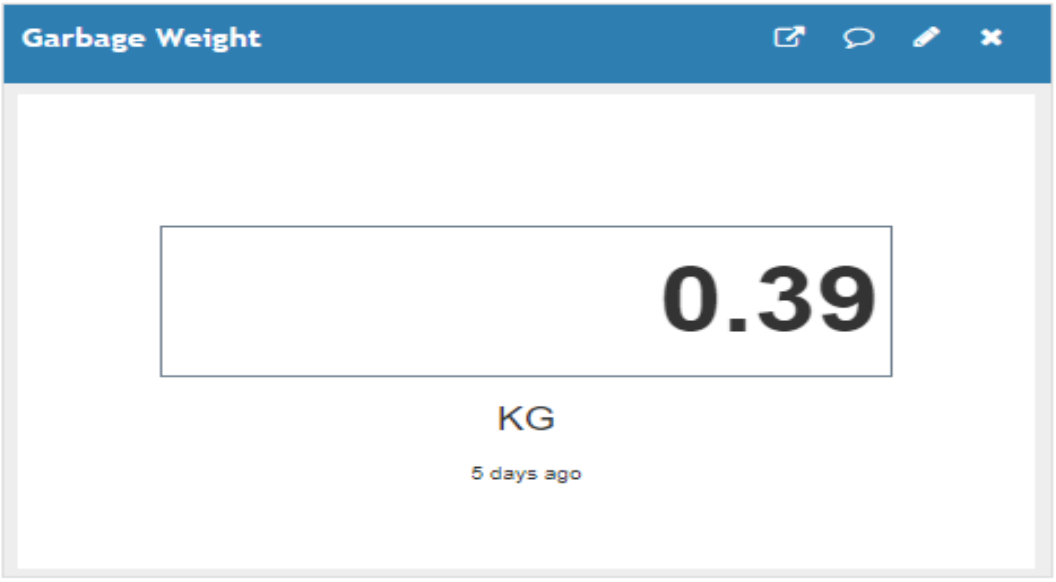

Figure 6.2: Garbage loaded weight

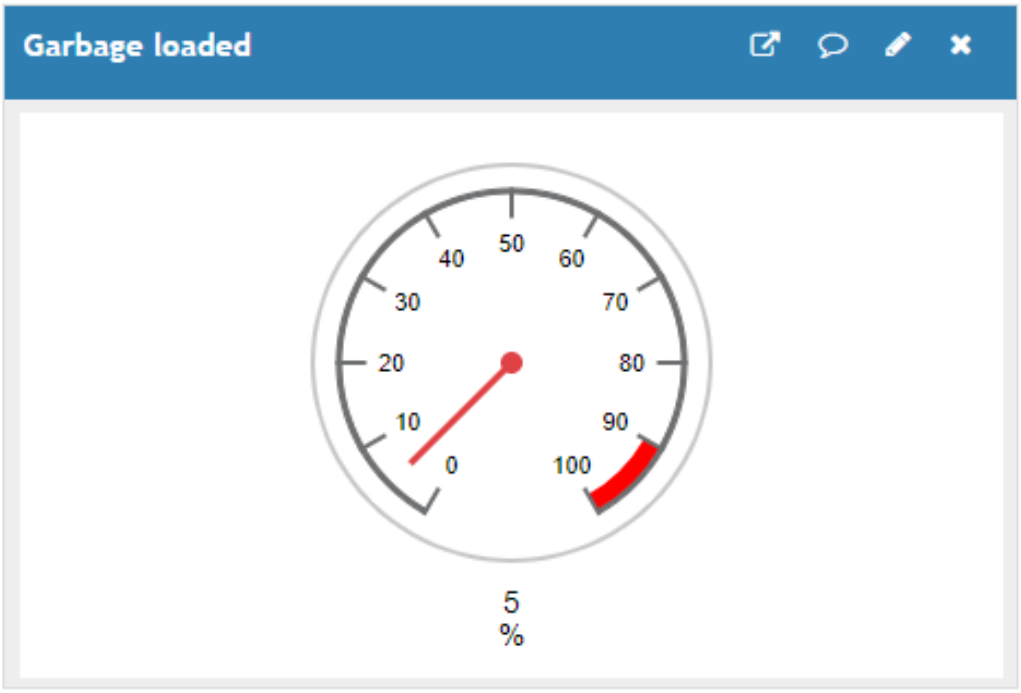

Figure 6.3: Garbage loaded percentage

6.5 Conclusion

In this chapter we do testing on hardware and software. After that we added test results by how the smart dustbin react with those garbage. The testing procedure also added for remember the steps of how it works. Lastly the thinkspeak speak give us the real situation of a smart dustbin that we build.

Chapter 7

Conclusion and Future Development

7.1 Conclusion

IoT-based trash cans help people dispose of their waste It's easy and helps reduce phone calls and waiting work Designated area cleaners and A healthier environment to live in, you are nothing. Diseases and people become healthier and less vulnerable Diseases caused by these waste products. This system Ensure trash cans are cleaned as soon as they reach trash level reach the maximum. It takes over power with the help of battery. If you don't clean the trash can within a certain amount of time, For appropriate action to be taken, recordings might be transmitted to a sweeper or higher authority for affected contractors. this Finally, keep the environment clean and Waste management becomes much easier

7.2 Future activity plan

The above approach is only a stepping stone for the implantation of IOT. There may be many improvements accomplished to this the prototype which may be a progressive

extrade in maintaining our surroundings is smooth and healthy. A few improvements may be accomplished are: The implementation of extra collective bins located aspect via way of means of aspect in which it automatically recognizes the waste kind and places it in the corresponding bin color that is designated for that type.

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