"IOT Based Waste Bin"

Submitted in the partial fulfillment of the requirements of

the degree of

BACHELOR OF ENGINEERING IN INFORMATION TECHNOLOGY

By

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UNDER THE GUIDANCE OF

Prof. Kirti Mhamunkar

SARASWATI Education Society's

SARASWATI College of Engineering

Learn Live Achieve and Contribute

Department of Information Technology
Saraswati College of Engineering, Kharghar, Navi Mumbai
University of Mumbai
2022-23

VISION, MISSION AND PROGRAM EDUCATIONAL OBJECTIVES

Vision and Mission of the Institute

Vision of the institute
To be universally accepted as autonomous center of learning in engineering education and research.

Mission of the institute
M1.   To educate Students to become responsible & quality technocrats to fulfill society and industry needs.
M2.   To nurture student's creativity and skills for taking up challenges in all facets of life.

Vision and Mission of the Department

Vision of the department
To create technically qualified talent through research to take up challenges in industries.

Mission of the department
M1.   To strengthen theoretical and programming skills through teaching-learning and technical trainings to fulfill society and industry needs.
M2.   To nurture young minds to participate in research, innovation and entrepreneurship.
M3.   To encourage participation in co-curricular and extra-curricular activities to equip students with communication, team work and leadership skills.

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PEO 1: To embed a strong foundation of Information Technology Engineering fundamentals to identify, solve, analyze & design real time Engineering problem as a professional or an entrepreneur for the benefit of society

PEO 2: To motivate & prepare students for lifelong learning & research to manifest global competitiveness.

PEO 3: To equip students with communication, team work & leadership skills to accept challenges in all facets of life ethically.

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At the end of the program, a student will be able to:

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2. Identify, formulate and analyze Information Technology Engineering problems to derive conclusion using first principles of mathematics and Computer Science.

3. Investigate complex Information Technology engineering problems and find appropriate solution leading to valid conclusion.

4. Design IT systems, components or processes to meet specified needs with appropriate attention to health, safety, standards, environmental and societal consideration.

5. To create select & apply appropriate techniques, resources advance engineering & software tools necessary to analyze & design Information Technology Problems.

6. Understand the impact of IT Solutions on society and environment for sustainable development

7. Understand social, safety, culture and legal issues and responsibilities relevant to engineering profession.

8. Apply professional ethics, accountability and equity in engineering profession.

9. Work effectively as a member and leader in multidisciplinary team for a common goal.

10. Communicate effectively within a profession and with society at large.

11. Appropriately incorporate principles of Management & Finance to one's own work.

12. To identity educational needs & engage in lifelong learning in a changing world of technology.

CERTIFICATE

This is to certify that the requirements for the project report entitled " IOT BASED WASTE BIN "

Have been successfully completed by the following students:

Roll numbers   Name
1) 13.   Piyush Debnath
2) 33.   Diksha Meena
3) 36.   Pranav More
4) 45.   Sakshi Patil

In partial fulfillment of Sem –VIII, **Bachelor of Engineering of Mumbai University in Information Technology** of Saraswati college of Engineering, Kharghar during the academic year 2022-23.

Internal Guide   **External Examiner**

(Prof. Kirti Mhamunkar)

Project co-ordinator   **Head of Department**

(Prof. Ragini Sharma)   (Prof. Maahi Khemchandani)

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(Dr. Manjusha Deshmukh)

Project Report Approval for B. E.

This project report entitled (***IOT Based Waste Bin***) by (***Piyush Debnath, Diksha Meena, Pranav More, Sakshi Patil***) is approved for the degree of **Bachelor of Engineering**.

Examiners

1.---

2.---

Date:

Place:

DECLARATION

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

(Signature)

Piyush Debnath 13

Diksha Meena 33

Pranav More 36

Sakshi Patil 45

Date:

ABSTRACT

Waste management has become one of the crucial universal problems at present. The rapid growth in world population, their complex living styles and the rate of urbanization have increased the amount of solid waste produce. Therefore, having a proper monitoring mechanism is a must to manage the situation. This paper suggests a solution to enable the society to automate and optimize waste management process using Internet of Things (IOT) technologies. The proposed solution will notify the user and other authorities when the waste bins are getting filled or when there is an unusual condition inside the bins like having high temperature or high humidity. Users can take necessary action based on the details. Researchers have used the layered architecture to develop this model and the main objective of the project is to gather waste collecting data and inform householders and relevant authorities online. The proposed model provides dashboard, sound and light alerts in the system.

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CHAPTER 1

INTRODUCTION

Over the decades, human had their own ways of waste management mechanisms at household levels. They had simple life styles in which everything consumed was environmental friendly. The wastes produced at households were in small quantities and biodegradable. The houses had enough land space where the residents were able prepare garbage pits. Over the time, the waste turned into compost and was used in plantation as a fertilizer. The whole process was environmental friendly and sustainable. Eventually, with the increase in population people tend to move into cities looking for better living standards. Land areas used to build houses became limited to a few number of perches and the goods/products consumed are readymade wrapped in artificial materials like polythene or plastics. In such a situation, it is unable to manage waste as done in the past. Thus, people tend to dump garbage into surrounding natural environments or waste disposal sites maintained by government authorities, however, garbage is not separated in either case. Due to the large population within city areas, the amount of garbage dumped into these places is increasing daily. The municipal solid wastes are generated in large quantities creating many social and environmental issues in many countries.

1.1 BACKGROUND

The traditional approach to waste management is becoming increasingly unsustainable as cities and urban areas continue to grow. There is a need for a more efficient and sustainable solution to manage waste. With the advancement of technology, there has been a growing interest in developing smart waste management systems that can help optimize waste collection, reduce waste and promote sustainable waste management.

IoT based smart waste bin systems are a modern approach to waste management that use various technologies such as sensors, cloud-based servers, and mobile apps to monitor and manage waste in a more efficient and sustainable way. The systems aim to improve the efficiency of waste collection services by enabling real-time monitoring of waste levels, optimizing waste collection routes, and reducing unnecessary waste collection.

Overall, IoT based smart waste bin systems have the potential to revolutionize the waste management industry by providing an efficient and effective solution for waste collection and disposal.

1.2 RELEVANCE

The IoT based smart waste bin system is highly relevant in the context of the growing concern over the unsustainable and inefficient waste management practices in cities and urban areas. With the increasing urbanization and population growth, there is an urgent need for an efficient and sustainable waste management system. The traditional waste management system is becoming increasingly unsustainable, leading to issues such as overflowing waste bins, inefficient waste collection routes, and unnecessary waste disposal.

The IoT-based smart waste bin system provides a modern and innovative approach to waste management. It utilizes various technologies such as sensors, cloud-based servers, and mobile apps to monitor and manage waste in a more efficient and sustainable way. By enabling real-time monitoring of waste levels and optimizing waste collection routes, this system can help reduce unnecessary waste collection, saving time and resources.

Furthermore, the system's integration with other technologies such as autonomous waste collection vehicles and blockchain can further enhance its efficiency and promote sustainable waste management practices. Overall, the IoT-based smart waste bin system is highly relevant and has the potential to revolutionize the waste management industry by providing an efficient and sustainable solution for waste collection and disposal.

CHAPTER 2

LITERATURE SURVEY

2.1 INTRODUCTION

2.1.1 Paper 1 - IOT Based Garbage Monitoring System Indo-Iranian Journal of Scientific Research (IIJSR), March 2019

This paper Eventually, with the increase in population people tend to move into cities looking for better living standards. Land areas used to build houses became limited to a few perches and the goods/products consumed are readymade wrapped in artificial materials like polythene or plastics. In such a situation, it is unable to manage waste as it did in the past.

2.1.2 Paper 2 - IOT Based Smart Dustbin Annals of the Romanian Society for Cell Biology. March 2021

Conventional garbage collection is not efficient since the authorities are not notified until the waste bin is full, and this leads to overflow of waste material. Efficient way of waste disposal and collection of disposed garbage is essential for a sustainable and clean India.

2.1.3 Paper 3 - lot Based Smart Dustbin International Journal of Scientific & Technology Research February 2020

According to the Ministry of Urban Wellbeing, Housing and Local Government shows that these waste are resulting in tremendous land and air pollution for the environment, health problems for communities and bottlenecks to economic growth.

2.1.4 Paper 4 - Smart Waste Management Using IOT Powered Dustbin UIRT-December 2019

The identification of Smart cities have been done by promising potential application domains for the Internet Of Things, with the wide range of possible services that can benefit City administration and citizens alike. Smart waste management in a smart city is one service that can be provided.

2.1.5 Paper 5 -Design and Fabrication of IOT based Smart Dustbin July 2022

We frequently observe garbage bins being filled over and additional waste materials being disposed of and accumulated around the bin in different cities of Ethiopia. Because of this, severe and contagious disease is stimulated and also a bad smell comes out of it and may cause illness to human beings. The municipality of most cities in Ethiopia has strived its best to alleviate this problem by providing several garbage bins throughout the town.

2.2 EXISTING METHODOLOGIES

SR. NO.	YEAR	AUTHOR	NAME OF THE PAPER	METHODOLOGY
1.	2019	Banumathi. A, Ashmithawathi. K, Bhavani. P, Azhagu Avudai Nayaki. G, Niranjana. R	IOT Based Garbage Monitoring System Indo-Iranian Journal of Scientific Research (IIJSR)	This Garbage monitoring system when filled with a particular level ultrasonic sensor will indicate that the "Garbage is full". Once the dustbin gets filled with more than 40 KG weight, the sensor indicates that the "Dustbin is overloaded". These information are collectively updated in the website through IOT in the corporation office so that workers could dispose of it as soon as possible.
2.	2021	Srinivasan, Thiyaneswran B, Jaya Priya Dharani, Kiruthigaa V	IOT Based Smart Dustbin Annals of the Romanian Society for Cell Biology	In this project, Ultrasonic sensor is used to measure the distance and level of

				the dustbin and the NodeMCU is used to upload the code and connecting with Wi-Fi. IFTTT webhook is a server to send the notification.
3.	2020	Telugu Maddileti , Harish Kurakula	lot Based Smart Dustbin International Journal of Scientific & Technology Research	.Smart Dustbin is integrated with some hardware components such as Arduino, NODEMCU, Servo Motor, Ultrasonic sensors. These components help in opening the lid, on detection of human hand and waste and also sending the notification in the form of LED.
4.	2019	Prof. N.D Sonawane, Mandhare Gulab M, Dixit Shweta P, Londhe Sonali P, Todkar Priyanka D	Smart Waste Management Using IOT Powered Dustbin UIRT	The smart dustbin uses a NodeMCU as the microcontroller. An ultrasonic sensor is used in order to detect the level of garbage filled in the dustbin. An

				RTC module is used for registering time stamp. All this data is sent to an Android app which has an in built QR Scanner for ensuring Garbage Collection and Disposal.
5.	2022	Arindam Ghosh , Debajyoti Sarkar , Aditya Kumar Jha , Saikat Banerjee , Sujay Barui , Biswanil Ghosh , Tapas Kumar Nandi	Design and Fabrication of IOT based Smart Dustbin	Smart Dustbin using Arduino is an IOT based project. Here we are using Arduino for code execution, for sensing we used ultrasonic sensor which will open the lid and wait for a few moments. It will bring drastic changes in term of cleanliness with with the help of technology.

Table 2.1 - Existing Methodologies

CHAPTER 3

PROBLEM STATEMENT

Nowadays, there are tons of flats and apartments which have been built in the rapid urbanization area. This is due to high housing demands which have been drastically risen as a result of migration from villages to cities to find work. In order to accommodate the growing population in the urban area, the government has also constructed more apartment complexes. There are several issues faced by the residents of the flats. One of them is disposal of solid waste. Unlike private houses, the residents of all the apartments use a common dustbin, which tends to fill up very quickly. This overflowing of garbage is a sanitary issue which might cause diseases like cholera and dengue. Moreover it is a waste of fuel to travel around a complex or an area to find that some of the garbage are filled and some are not. Also, on rare days, problems might arise that there is so much garbage that the truck doesn't have enough capacity. The idea struck us when we observed that the garbage truck use to go around the town to collect solid waste twice a day. Although this system was thorough it was very inefficient. For example let's say street A is a busy street and we see that the garbage fills up really fast whereas maybe street.

What our system does is it gives a real time indicator of the garbage level in a trashcan at any given time. Using that data we can then optimize waste collection routes and ultimately reduce fuel consumption. It allows trash collectors to plan their daily/weekly pick up schedule. An Ultrasonic Sensor is used for detecting whether the trash can is filled with garbage or not. Here Ultrasonic Sensor is installed at the top of Trash Can and will measure the distance of garbage from the top of Trash can and we can set a threshold value according to the size of trash can. If the distance will be less than this threshold value, means that the Trash can is full of garbage.also we used gps module for location.which wastebin is full or not.

Why we choose IOT

- It is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data.
- Creating opportunities for more direct integration between the physical world and computer-based systems.

CHAPTER 4

SYSTEM ANALYSIS

4.1 METHODOLOGY

This smart IoT-based waste bin has various sensors to track various parameters. This waste bin consists of a GPS module, which is also fitted in the waste bin, which acquires the GPS coordinates and transmits them Node MCU - a WI-FI module is provided which transmits the data to the concerned authority through a mobile phone over WI-FI.

The Node MCU Wi-fi module is a major part of our system. Node MCU Wi-fi works as a controller and for wifi connectivity. In our system, we used an ultrasonic sensor and a GPS module. All these modules & sensors interface with the node MCU Wi-Fi.

We have uploaded and compiled the programme with the help of the Arduino IDE software. After the programme was uploaded to the node MCU Wi-fi, We used the Blynk app for monitoring data. Depending upon sensor value, node MCU takes a reading and sends it to the Blynk app with the help of the internet and a cloud server. The Blynk App allows us to continuously monitor our data and receive notifications in the event of an emergency.

4.2 WORKING

The working plan is to connect all the device into the waste bin.The System works in such a manner that whenever the garbage bin is full an alert message is semt over the blynk app, any authorized person who is having hs credentials registered on the blynk app gets the notification. The monitoring of the waste bin is done using ultrasonic sensors and Whenever the level of threshold is reached the ultrasonic senor sends the indication using the Node NPU wifi model over the internet on the blynk app with this the municipal officer gets to know whether the dustbin is full or not. The collector will collect the garbage and the verification message is send. There is a GPS module present in the system which is used to locate the waste bin by the municipal garbage collectors. The Garbage bin is tracked with the help of GPS tracking system, so that fuel is consumed less as the garbage collectors know where the exact fully filled bin is present using the google maps. There are different types of sensors and technologies that can be embedded and involved in this approach to make the process much easier, using Internet of Things makes an interaction with any object and internet, we shall see some of the sensors equipments and modules that can be used in this approach.
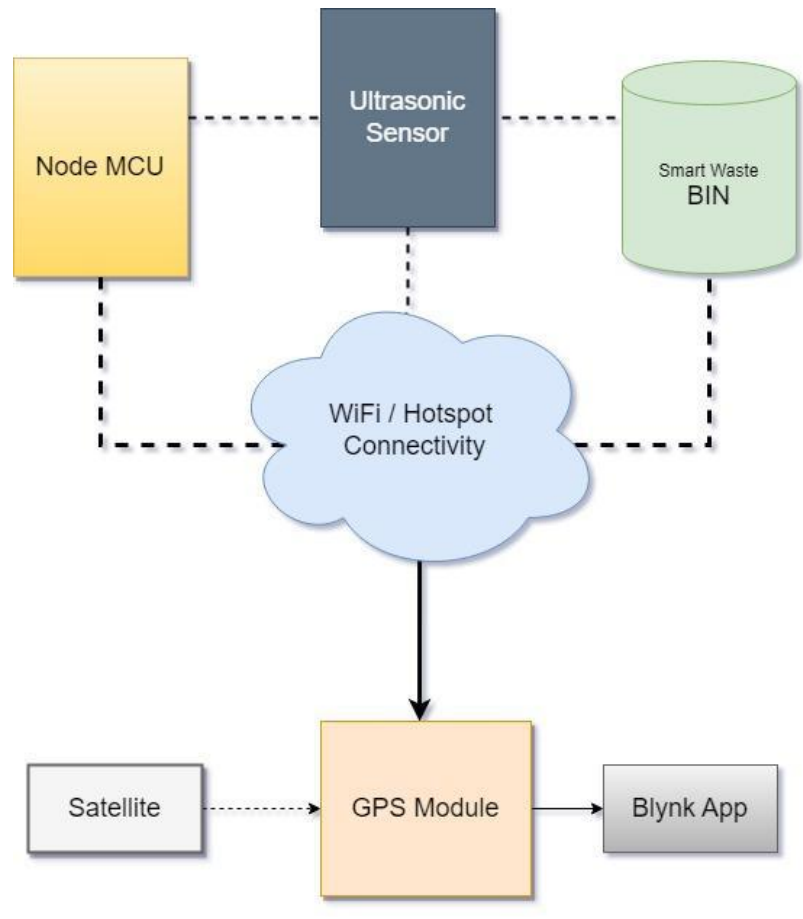
4.3 BLOCK DIAGRAM
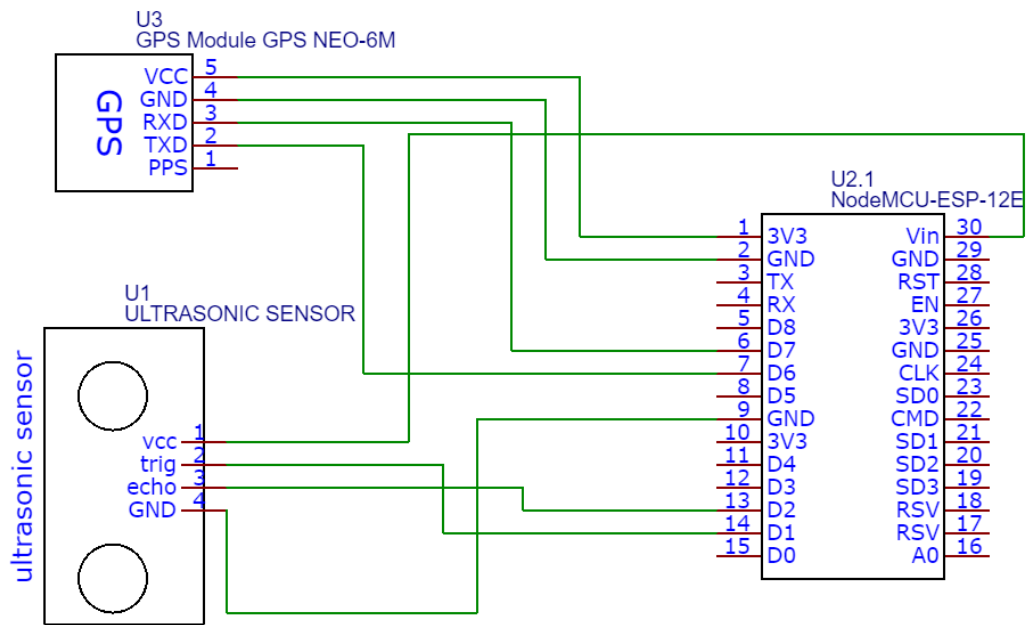

Figure 4.1 - Block Diagram

4.4 CIRCUIT DIAGRAM

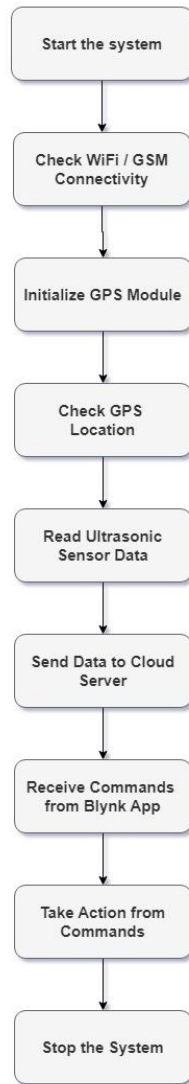
Figure 4.2 Circuit Diagram

4.5 ACTIVITY DIAGRAM

Figure 4.3 - Activity Diagram

Sr. No.	Name	Symbol
1.	Action State	
2.	Control Flow	→

Figure 4.4 Notation for Activity Diagram

CHAPTER 5

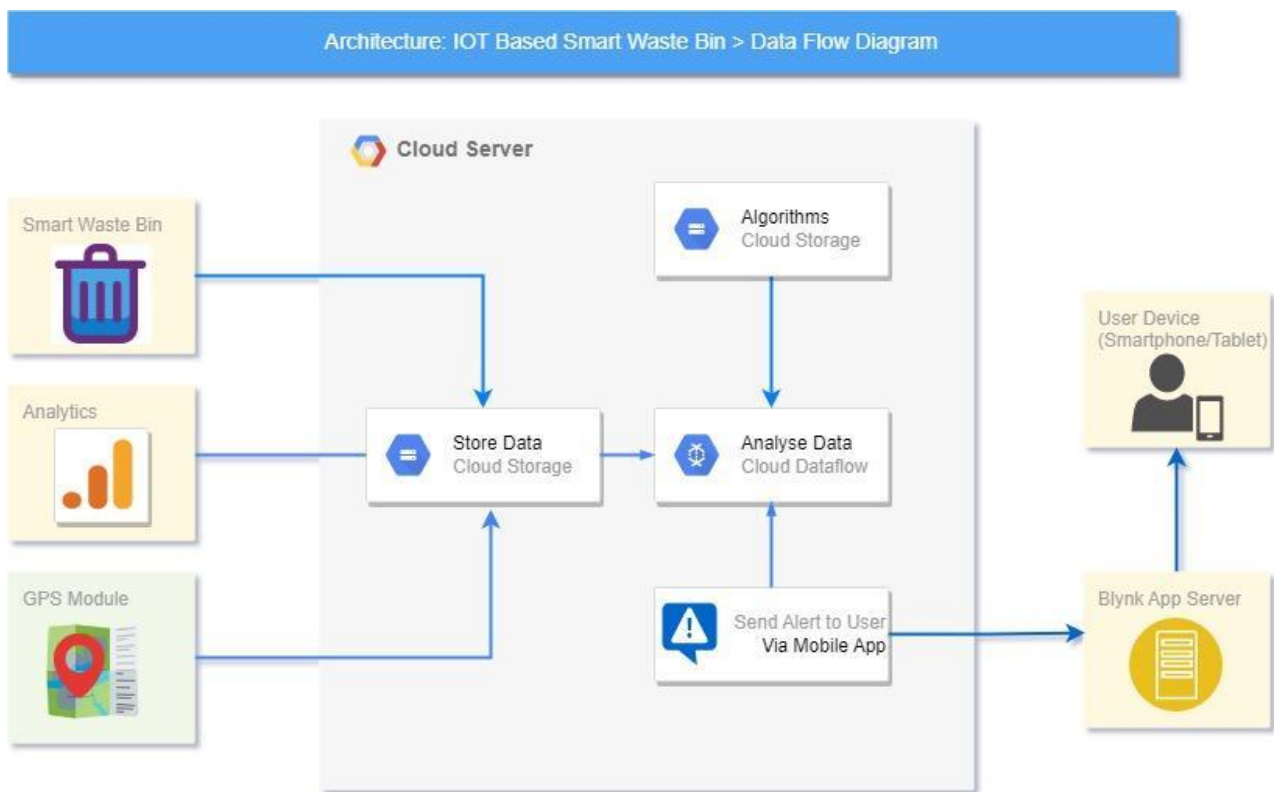# SYSTEM DESIGN

5.1 DESIGN MODEL

5.1.1 DATA FLOW DIAGRAM

Figure 5.1 - Data Flow Diagram

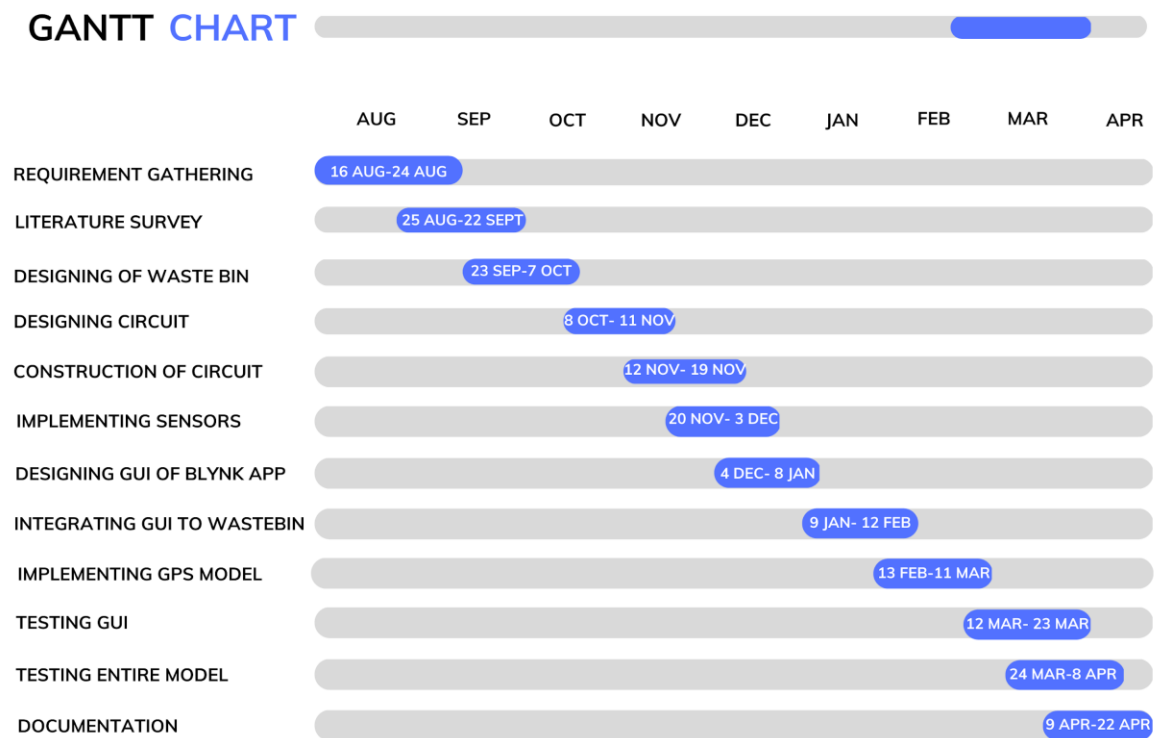# CHAPTER 6

PROJECT TIMELINE

6.1 GANTT CHART

Figure.6.1 Gantt Chart

CHAPTER 7

IMPLEMENTATION, RESULT AND TESTING

7.1 DETAILS OF HARDWARE AND SOFTWARE

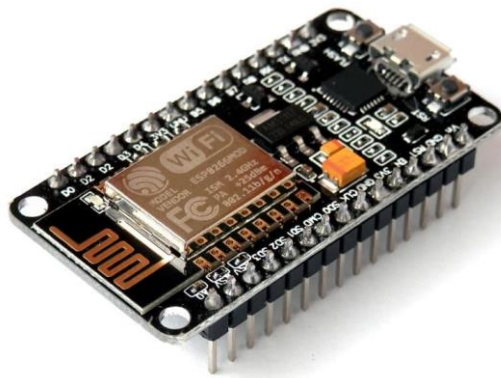## 7.1.1 HARDWARE REQUIREMENTS
7.1.1.1 NODE MCU WIFI MODULE

Figure 7.1 - Node MCU Wifi Module

The ESP8266-12E Wi-fi module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-fi network. The ESP826612E is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each Wi-Fi module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your arduino device and get about as much Wi-Fi ability as a Wi-fi Shield offers.

ESP8266-12E is high integration wireless SOC, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front end module, which is designed to occupy minimal PCB area. The ESP8266 supports APSD (Automatic Power Save Delivery) for VoIP (Voice Over Internet Protocol) applications and Bluetooth coexistence interfaces, it contains a self- calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

7.1.1.2 ULTRASONIC SENSOR

Figure 7.2 - Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).
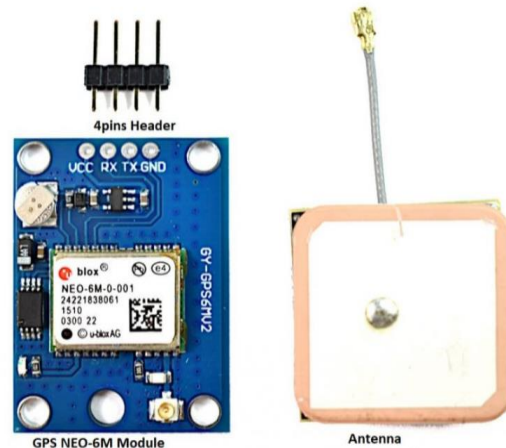
7.1.1.3 GPS MODULE

Figure 7.3 - GPS Module

This is a complete GPS module that is based on the NEO-6M. This unit uses the latest technology to give the best possible positioning information and includes a larger built-in 25 x 25mm active GPS antenna with a UART TTL socket. A battery is also included so that you can obtain a GPS lock faster. This is an updated GPS module that can be used with ardupilot mega v2. This GPS module gives the best possible position information, allowing for better performance with your Ardupilot or other Multirotor control platform.

The NEO-6M GPS engine on this board is a quite good one, with the high precision binary output. It has also high sensitivity for indoor applications. NEO-6M GPS Module has a battery for power backup and EEPROM for storing configuration settings. The antenna is connected to the module through a uf1 cable which allows for flexibility in mounting the GPS such that the antenna will always see the sky for best performance. This makes it powerful to use with cars and other mobile applications.

The GPS module has serial TTL output, it has four pins: TX, RX, VCC, and GND. You can download the u-center software for configuring the GPS and changing the settings and much more.

7.1.2 SOFTWARE REQUIREMENTS

7.1.2.1 ARDUINO IDE

Figure 7.4 - Arduino IDE

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.

The Arduino integrated development environment (IDE) is a cross-platform application written in Java, and derives from the IDE for the Processing programming language and the Wiring projects. 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 is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a "sketch".

Most Arduino boards contain an LED and a load resistor connected between the pin 13 and ground, which is a convenient feature for many simple tests. The previous code would not be seen by a standard C++ compiler as a valid program, so when the user clicks the "Upload to I/O board" button in the IDE, a copy of the code is written to a temporary file with an extra include header at the top and a very simple main function at the bottom, to make it a valid C++ program.

7.1.2.2 BLYNK APP

Figure 7.5 - Blynk Application

Blynk platform powers low-batch manufacturers of smart home products, complex HVAC systems, agricultural equipment, and everyone in between. These companies build branded apps with no code and get the full back-end IoT infrastructure through one subscription.

Everything you need to build and manage connected hardware: device provisioning, sensor data visualization, remote control with mobile and web applications, Over-The- Air firmware updates, secure cloud, data analytics, user and access management, alerts, automations and much more.
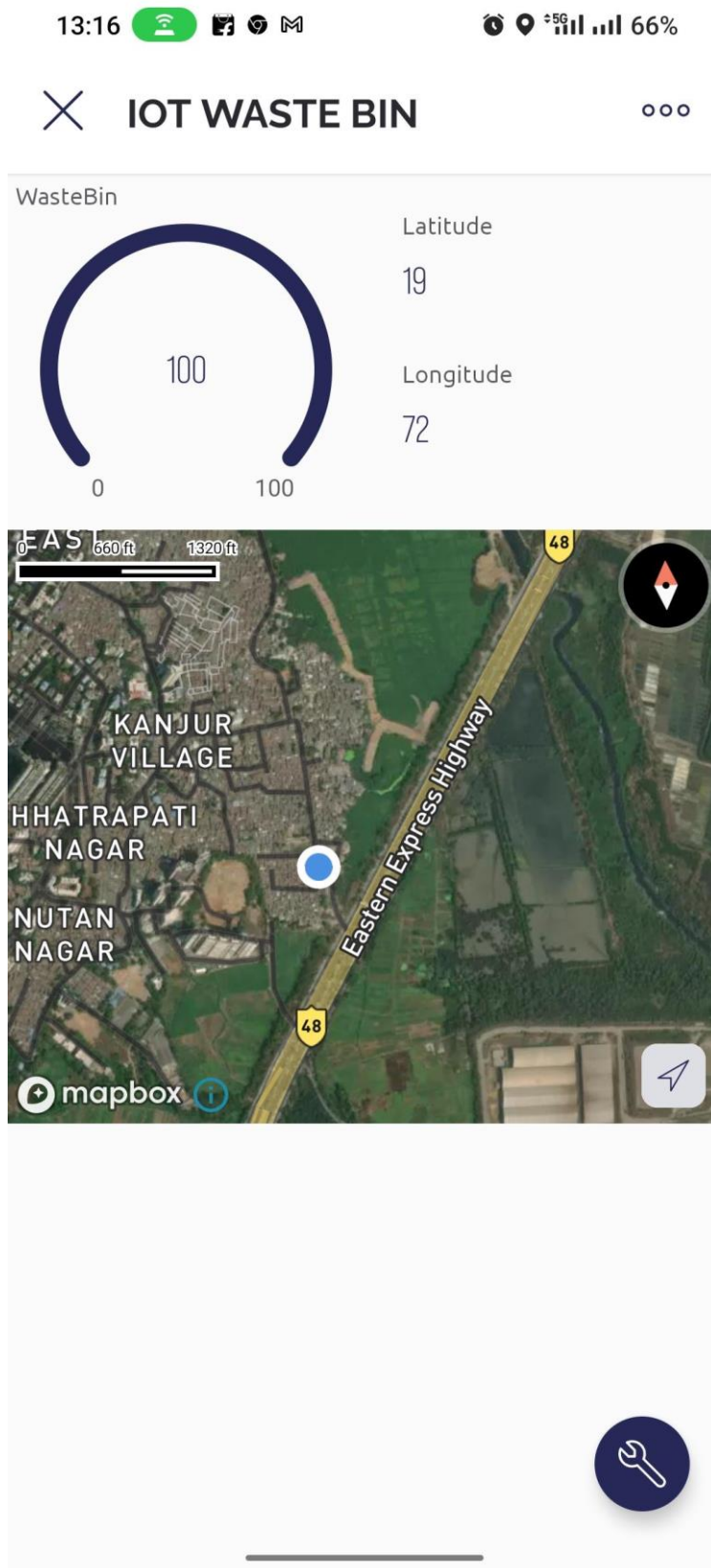
7.2 RESULTS

Fig. 7.6 IOT based waste bin

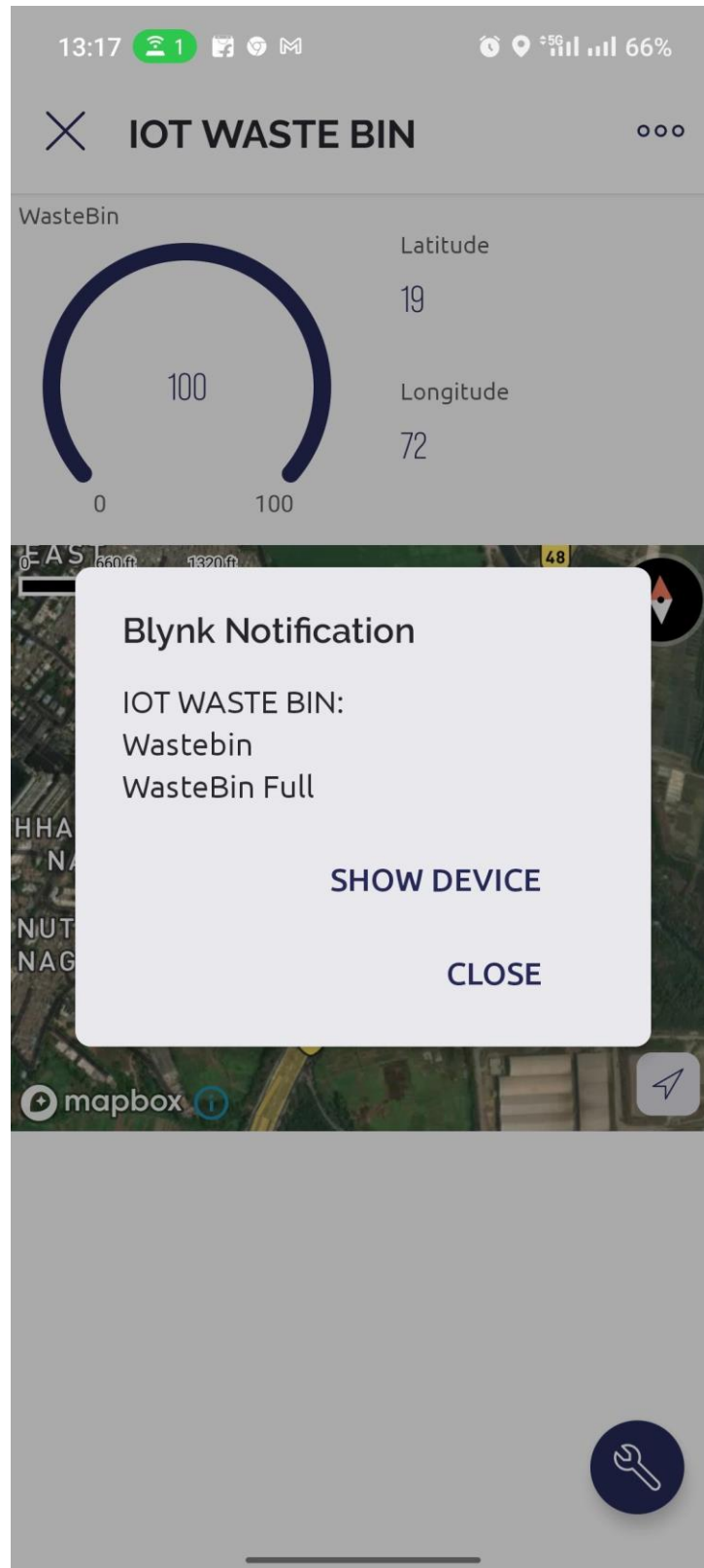Fig 7.7 Location generation with Blynk app
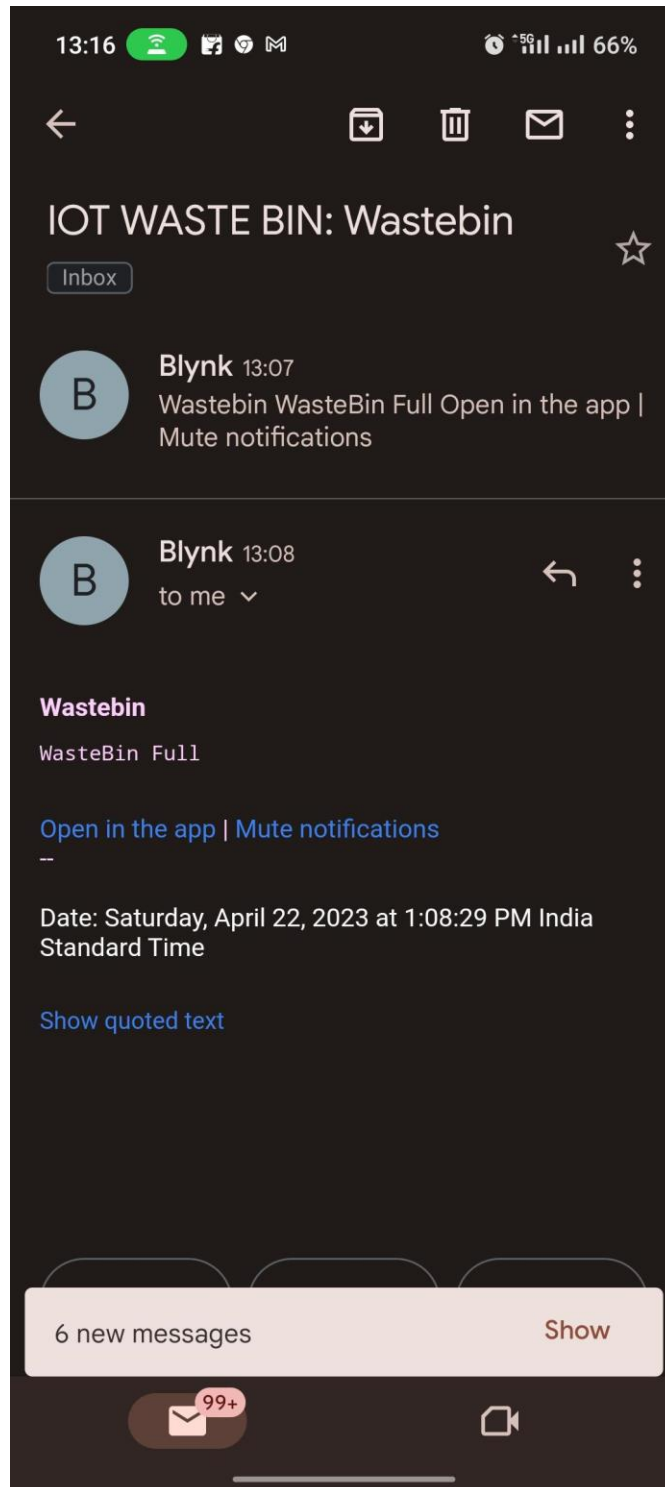
Fig.7.8 Alert Box via Blynk App

Fig.7.9 Alert Box via Email account

Figure 7.10 Snapshot of Arduino IDE code

CHAPTER 8

CONCLUSION AND FUTURE SCOPE

8.1 CONCLUSION

Currently, one of the most important global issues is waste management. Because of their complex lifestyles, rising urbanization, and rapid population expansion, people produce more solid garbage than ever before.

So, the IOT-based Smart bin was successfully developed with the environment in mind. The suggested method aims to develop a model that provides data on the amount of waste in the bin. Using an ultrasonic sensor and the Internet of Things, the level of garbage is determined and notified when disposal is required. By doing this, the risk of the garbage can overflowing is decreased, and the effectiveness of the collector's pick-up schedule is increased. . It has been known that by using the Internet of things (IOT) for proper waste management, we can have a proper and pollution free city and thereby making the nation neat and clean. Using smart sensors like Ultrasonic sensors, embedding them into the smart bin we can have an efficient way of waste management.

8.2 FUTURE SCOPE

The IoT based smart waste bin system has significant potential for future development and expansion. Some possible future scopes of this system are:

Integration with Autonomous Waste Collection Vehicles: With the advancement of technology, it is possible to integrate IoT-based smart waste bins with autonomous waste collection vehicles. This integration can help optimize waste collection routes and reduce the need for human intervention in waste collection.

Waste Sorting: The IoT-based smart waste bins can also be used for sorting waste into different categories such as recyclable and non-recyclable waste. This can help promote sustainable waste management by facilitating effective waste segregation and recycling.

Integration with Blockchain Technology: Integration with blockchain technology can provide a secure and transparent platform for waste management. The blockchain can help track the movement of waste and ensure that waste is disposed of in an ethical and sustainable manner.

Smart City Integration: The IoT-based smart waste bin system can be integrated into a larger smart city infrastructure, where the data from the system can be used to optimize the overall city operations. For instance, waste collection data can be used to optimize traffic management and reduce congestion.

Overall, the future scope of the IoT-based smart waste bin system is vast, and there is enormous potential for further development and integration with other technologies to promote sustainable waste management.

CHAPTER 9

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CHAPTER 10

PUBLICATION AND CERTIFICATE

10.1 CERTIFICATES

SARASWATI Education Society's

SARASWATI College of Engineering

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Kharghar, Navi Mumbai 410210

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OF PARTICIPATION

This Certificate is presented to

Piyush Debnath

for participating in the **"SCOE AVISHKAR - 2023"**
Project Competition held on 3rd April, 2023.

Dr. Saumya Singh
Convener, SCOE AVISHKAR - 2023

Dr. Manjusha Deshmukh
Principal, SCOE

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This Certificate is presented to

Sakshi Patil

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Dr. Saumya Singh
Convener, SCOE AVISHKAR - 2023

Dr. Manjusha Deshmukh
Principal, SCOE

SCOE's Department of Information Technology

CHAPTER 11

ACKNOWLEDGEMENT

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