

# **DESIGN AND HARDWARE DEVELOPMENT OF IOT BASED GARBAGE MANAGEMENT SYSTEM**

**A Project and Thesis submitted in partial fulfillment of the requirements for  
the Award of Degree of  
Bachelor of Science in Electrical and Electronic Engineering**

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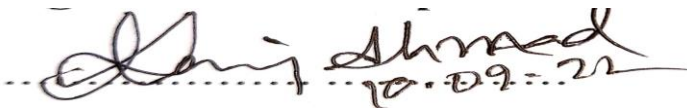
**DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING  
FACULTY OF ENGINEERING  
DAFFODIL INTERNATIONAL UNIVERSITY**

**August 2022**

# CERTIFICATION

This is to certify that this project entitled “**Design and Hardware Development of IOT Based Garbage Management System**” is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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**Dedicated to**

**Our Parents**

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# ACKNOWLEDGEMENT

First we are thankful to Allah subhanahu wa ta'ala for providing us with the patience and strength to go on and complete this thesis.

We are really grateful to our supervisor "KANIJ AHMAD" lecturer, Department of Electrical and Electronics Engineering, Daffodil International University for her friendly guidance and encouragement in many ways throughout her project work. We also appreciate her vision, experience, interest and support for her project which came to us with greater help writing this report paper.

We would like to express our heartiest gratitude to Dr. Md. Rezwanul Ahsan, Professor and Head of the Department of EEE for his kind help to finish our project and also to other faculty members and the staff of EEE department of Daffodil International University.

We offer our regards and gratitude towards all of those who supported me in any aspect during the completion of this thesis. Finally, we convey our heartily gratitude to our parents and family members for their moral support.

## ABSTRACT

Everyone in the world throws garbage in the form of plastic, waste water, dry waste and more. The dustbin is a plastic bag where anyone can dispose of their garbage. Dustbin is used as a waste disposal area, but we cannot specify how much open waste is being disposed of, it can take up more space than disposal there. We must declare garbage and garbage disposal and based on that we can have close relationships with people or they will not use it. In this smart dustbin project, we have created a kind of waste disposal site and when a person's hand is detected in the waste, the level of waste in the waste is sent to the display. ESP32, as well as other components, were utilized in this display, IR sensor, servo motor and ultrasonic sensors. The software component is an application called Blink, which is used to get the status quo. Dirt disposal could be the beginnings of a smart waste management system where government officials can clean or dispose of dust depending on the level they receive without an unexpected call from the person telling them to dump the truck.



# CHAPTER 1 INTRODUCTION

## 1.1 Introduction

Dustbin is a safe place that everyone in the world uses for garbage disposal. The main thing they look for in their environment to dispose of waste is powder. The beautiful dustbin is an easy place where everyone can throw away the garbage but the installation of some hardware components is done for efficient operation. The smart cable is connected to some hardware components such as ESP32, IR sensor, 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. The code required to perform the above-mentioned operation is dumped in ESP32 [1].

## 1.2 IoT

The Internet of Things, or IoT, is a combination of computer, digital, machine, animal, or human devices that have unique identifiers (UIDs) and the ability to transmit data over a network without the need for human social interaction or computer.

A pet with a heart monitor, biochip transponder on the Internet, a car with a sensor to alert the driver when the tire pressure is low, or it could be natural or man-made. Internet Protocol (IP) can assign an address and transfer data to a network.

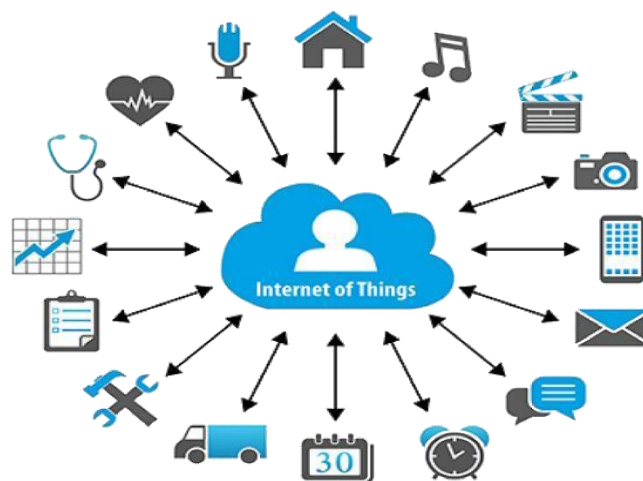


Figure 1.1: IoT

## 1.3 Smart Dustbin

The smart dustbin is a carefully designed solution that solves the social issue of waste disposal, the smart dustbin identifies the condition of inside it and notify to the cleaner through mobile

app. The cleaner can see the level of waste of all bins. Then he/she can decide which bin have to clean first. Also the bins gates are automated no need to use hand to open and close the gates of bins [2].

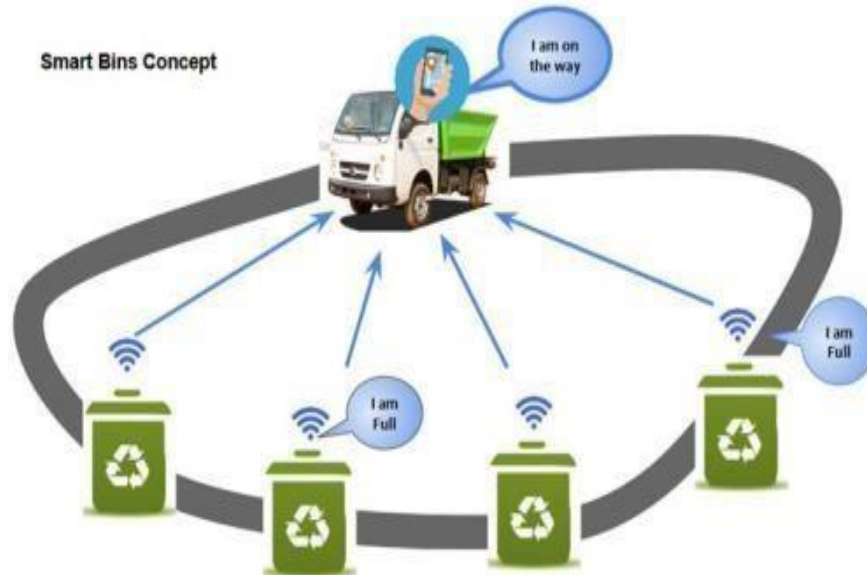


Figure 1.2: Smart Dustbins

## 1.4 Motivation

The Government of Bangladesh has adopted digital technology and is working to create a digital Bangladesh by 2021. Another goal is to become a middle-income and peaceful, prosperous and respectable nation with the help of technology during this period. As a result, the Government of Bangladesh has launched a number of projects related to smart and digital technologies such as internet business and payment technology, promotion of trade and commerce, advanced technology centers, human resource development, construction of elearning infrastructure. , ICT-based education, e-administration infrastructure, e-citizen services, i-governance services, health care services, agriculture, effective and efficient public relations, environmental work. Some are planned and some are on the line

(Hasanuzzaman Zaman and Rokonuzzaman, nd) (Rehman, 2015). As part of sustainable environmental development and greening of the city of Dhaka, DCC has developed improved waste collection technologies such as garbage bags, cars, trucks, bulldozers etc. As much as possible. The plant replaces coal with coal and uses 2000 tons of household waste from the city's daily waste collection (SM Alauddin 31 October, 2015).

For this reason, we propose measures to improve the current waste management situation in Bangladesh to assist in such development planning. The model we propose is viable, sustainable and can be improved from waste disposal to solve current problems [3].

## **1.5 Objective of this Project**

As the Internet of Things (IoT) allows access to large amounts of data selected for the development of many digital services, different numbers can be integrated into different systems in a transparent and hassle-free manner. Building infrastructure for IoT is a complex task, mainly due to the large number of devices, connectivity technologies and services that can participate in such a system. One of the biggest impacts on our environment is strong waste management, which not only disrupts the ecological balance but also has a negative impact on public health. Diagnosis, monitoring and waste management is one of the major issues today. The traditional way of manually inspecting waste and bins for free is a complex, complicated and expensive process that consumes human effort, time and expense. It is an advanced system of automatic waste management. Project IoT Garbage Management System is a new system that helps keep the community clean. This system scans the garbage disposal and reports the level of garbage collection from the blogs through the Android app. This application also sends all the information to the garbage truck.

## **1.6 Organization of the Project Book**

This book consists of four chapters.

**Chapter 1:** Gives a brief discussion of the project introduction, project objectives, project motivation and history.

**Chapter2:** Focuses on hardware we used, their theoretical background and applications.

**Chapter 3:** Complete discussion of system designing of proposed “IoT Based Garbage Management System” project.

**Chapter 4:** Concludes overall discussion of the proposed project and future recommendation are also presented in this chapter.

# **CHAPTER 2 LITERATURE REVIEWS**

## **2.1 Introduction**

The inevitable result for the development and prosperity of the manufacturing industry is the production of waste. Therefore, efficient waste management is a global and national waste management system with a strong waste management strategy for reorganizing development goals and environmental sustainability. In this chapter, we have discussed all aspects of our model as well as the background studies and related services.

## **2.2 Literature Survey**

There are three traditional ways to manage waste. The first is the use of the traditional method or the usual dustbin in our daily lives. Everyone in the world throws garbage and rubbish and when the space is full, he throws the garbage in the pot and uses another dustbin. This is the main use of the powder where nothing is used, no code is made and everything is done manually, everything happens manually. No battery, no accessories like Arduino, NodeMCU. The only way to dispose of it is to open the lid of the dustbin and then throw away the waste and clean or empty it after filling. When the same is applied to a neighbor or area, the waste is further disposed of if crowded people start dumping garbage around the sand. A government official who empties his residences when garbage is dumped is in a bad mood, the garbage stays on the road for weeks and leads to an unhygienic environment and causes various diseases. The care of the bin is also poor, where the cover can break, which can lead to the accumulation of waste from the bin. Using this disposal system the waste is disposed of in a jar and the container is easy to open as there are no electronic devices to use. In this method, plastic bag storage is available for waste disposal but this process has various disadvantages rather than advantages. The disadvantages are that if the can is not maintained properly, the area will stink. If the waste is not disposed of immediately after feeding, flies, mosquitoes and other insects can get around it and cause various diseases. If the bin is not covered, the waste will be filled with environmental damage [4].

The second method is to use different types of trash cans, such as those mixed with emerald and blue waste or garbage that can only be disposed of. This system also has the above mentioned advantages and disadvantages as this system also does not use hardware or software like the method mentioned above. Only the boxes showing the toxins to be disposed of in a bag are segregated into different types.

The third method is the smart dustbin, which uses electronic components such as Arduino, servo motor, ultrasonic sensor, NodeMCU and GSM modules. Inside this code, open the dust cover and send a message to the phone using Node MCU. GSM modules are installed on Arduino and NodeMCU. Compared to the stainless steel sink above, this beautiful stainless steel sink is elegant and comfortable. This powder mixer works as follows: The ultrasonic sensor is on a dry surface and the sensor is attached to the coating of the powder and to the ultrasonic sensor in the arduino. The ultrasonic sensor detects when a person's hand and its waste is applied for disposal in front of the sensor, and then opens the powder lid and injects it. The trash can has an additional ultrasonic sensor that measures the height of the waste as a powder and sends it to a mobile phone using a GSM module. Dust or appeared. The advantages of this method are as follows: Garbage is stored in the landfill. Electronics are used in this process and the debris is called a smart dustbin. This dust cleaner automatically opens the soap lid when the human hand touches the clean dirty cleaner. This machine also sends a message to the mobile phone, which tells us whether the filter is full or not. Considering the advantages and potential of the two methods mentioned above, these wastes also have some disadvantages. The advantages of this method are as follows: The mobile phone must have a good carrier line to receive instant message, if the phone is not reached or there is no proper signal, sent messages will not be received unless whitened. Clean or empty. Most users share the same bandwidth; with a full service staff, delivery can be interfering. Radiation is considered more dangerous than Wi-Fi radiation [5].

## **2.3 Summary**

We discussed whole over the smart garbage management system from beginner to twenty first century in this chapter-2. We mentioned history of smart garbage management system, deference between old and present smart garbage with the new features and adventure of IoT. We think this smart garbage management system is very important for our country.

# **CHAPTER 3 ANALYSIS OF THE COMPONENT SYSTEMS**

## **3.1 Introduction**

In this chapter, we have discussed various components that will be needed to make this design and hardware development of smart garbage management.

## 3.2 Required Components

The required components to complete our project are following:

- i. ESP32
- ii. IR Sensor
- iii. Ultrasonic Sensor
- iv. 16\*2 LCD Display
- v. Jumper Wire
- vi. Servo Motor
- vii. Bread Board
- viii. LM2596 Buck converter
- ix. Lithium Ion Battery
- x. ON OFF switch
- xi. Battery Holder
- xii. PVC Board

### 3.2.1 ESP32

A new development board is introduced as ESP32. ESP32-WROOM-32D and ESP32WROOM-32U are Wi-Fi, Bluetooth and BLE MCU modules. Many applications can be extended, from low-impact networks to demanding services such as voice encryption, MP3 streaming conversion, Bluetooth LE, and Wi-Fi connection. This module can be used in a variety of ways: Wi-Fi allows users to connect to the Internet via physical connection from a Wi-Fi router, while Bluetooth allows users to connect to their phone. The ESP32 explorer has a sleep time of less than 5 seconds, making it ideal for batteries and wearable applications. To ensure maximum bandwidth, the module supports data rates up to 150 Mbps with an antenna







Fig. 3.9 IR Sensor Module

### 3.2.3 Ultrasonic Sensor

Ultrasonic Sensor is a device that uses wavelengths to measure distance and displacement. There are transducers that help send and receive ultrasonic waves depending on the object. It found things and trash.

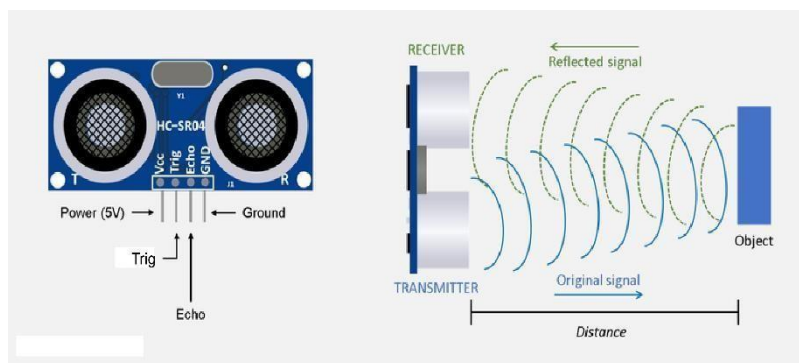


Fig 2.7: Ultrasonic Sensor

#### 3.2.3.a Working Procedure of Ultrasonic Sensor

The HC-SR04 Ultrasonic Sensor-Working Sensor, shown above, HC-SR04 Ultrasonic (USA), is a 4-pin module with pin names Vcc, Trigger, Echo, and Ground, respectively. Many applications that require measurement or identification this module is for the development of ultrasonic transmitters and receivers. seen as a front-end function. The sensor works in a typical high voltage system,  $\text{distance} = \text{speed} \times \text{time}$  the ultrasonic transmitter travels the wave, when the wave flies and something reacts. The sensor will revert to the visible sensor. The ultrasonic extraction module is shown in the figure below.



Fig 2.8: Object detecting by Ultrasonic Sensor

The Ultrasonic Sensor is working on calculating the length using the above method. We need to know speed and time. Because we use ultrasonic waves so we know the velocity of the US wave in indoor conditions at 330 m/s. The circuit built into the module corresponds to the time that the US wave returns, and then the shutter command is activated simultaneously. In this way, we can know the time. Available now only microcontroller or microprocessor is used to calculate the length. How to use HC-SR04 Sensor Ultrasonic Sensor HC-SR04 Optical sensors are commonly used by both microcontroller and microprocessor platforms such as Arduino, ARM, PIC, Raspberry Pie, etc. They are used. Computer the sensor is activated using the +5V configured by the sensor Vcc sensor. The charging sensor is currently rated at less than 15mA or supported by the 5V pin board (if applicable). The trigger of the resonance is the I pin. /O to be able to connect to the microcontroller's I/O pins to start measurement the trigger point should be raised for 10uS and then turned off. The process emits an ultrasonic wave up to 40Hz from the transmitter and the receiver waits for the wave to return. As soon as the wave reverses when something appears, the Echo pin will rise for a moment, corresponding to the time the wave returns to the sensor. The MCU/MPU uses the Echo pin to raise it as it provides information about the time the wave returned to the sensor. When using this information This is expected as described in the above section.

### 3.2.3.b Ultrasonic Sensor Pin Configuration

Table 3: Pins of Ultrasonic Sensor

Pin Number	Pin Name	Description
1	VCC	The VCC pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

### 3.2.4 16\*2 LCD Display

The LCD screen is an electronic screen and has a wide range of applications. The 16x2 LCD screen is a very important part and is often used for devices in various circuits. A 16x2 LCD means that 16 characters can be displayed per line as well as two similar characters. Each character in this LCD is displayed in a 5x7 pixel matrix. The 16x2 smart digital matrixes can display 224 characters.

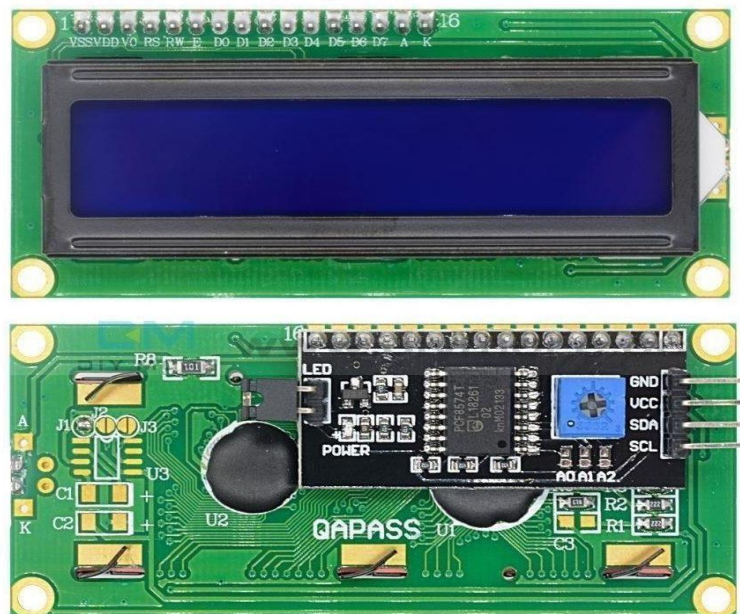


Fig 2.9: 16\*2 LCD Display with I2C Module

### 3.2.5 Jumper Wire

Telephone jumpers (jumpers, jumper wires, jumper wires, DuPont wires, or DuPont wires - specified by the manufacturer) are electrical wires or ropes that have tiles or pins at each end.

(Sometimes with or without - "dyed" only), which is often combined with bread slices or other samples or test circuit using other apps or apps inside or without clothes install the wires one at a time by plugging them in. "End connector" into the socket provided in the bread. Connectors made of circuit boards or test kits There are different types of jumper wires. Some have the same electrical connection at both ends. while some have different connections.

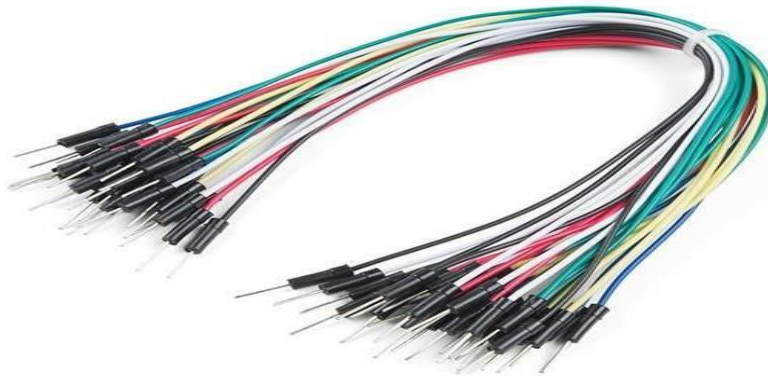


Fig 2.11: Connecting Wires

### 3.2.6 Servo Motor

Servo motor which is high force engines which are usually utilized in mechanical technology and a few different applications because of the way that it's anything but difficult to control their turn. Servo engines have an equipped yield shaft which can be electrically controlled to turn each degree in turn. For control, not at all like ordinary DC engines, servo engines for the most part have an extra pin aside the two force pins (Vcc and GND) which is the sign pin.

The sign pin is utilized to control the servo engine, turning its shaft to any ideal point.



Figure 2.12: Servo Motor

### 3.2.6.a Wire Configuration

Table 4: Pins of Servo Motor

Wire Number	Wire Color	Description
1	Brown	Ground wire connected to the ground of system
2	Red	Powers the motor typically +5V is used
3	Orange	PWM signal is given in through this wire to drive the motor

### 3.2.6.b Selecting Servo Motor

There are many servo motors on the market and each has its own characteristics. The next two paragraphs will help identify the types of servo motors for IoT services based on waste disposal. Most servo motors have an ambient voltage ranging from 4.8V to 6.5V, which can provide high pressure high torque. But they are usually rated at +5V. Almost all servo motors spin from 0 C to 180 C due to application configuration. and make sure the work can be in a semicircle Motor can be selected from 0 to 360 or motor rotation. An application is installed on the engine to view and tear. So this app needs a powerful and working engine. This can be powered by a mechanical device or attached to a simple plastic application. The next most important parameter is the operating torque of the motor. There are several options here. But the most

common is the 2.5kg/cm torque that comes with the TowerPro SG90 motor. This 2.5kg/cm torque means the motor can lift 2.5kg when suspended at 1cm. Suspension suspended at 0.5 cm, the engine can pull 5 kg the same way. And if the suspension stops at 2cm, it only pulls 1.25kg. The engine can be selected with the appropriate torque according to the load used in this project. The picture below shows the same thing.

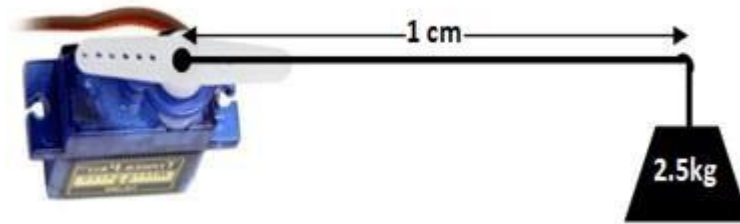


Fig. 2.13: Lifting weight by Servo Motor

### 3.2.6.c Utilization of Servo Motor

The question is how to use it when choosing the right servo motor for the job. As we all know, three wires are coming out of this motor. Details are at the top of this page. Use the + 5V power supply to power the motor to turn on the motor and send the PWM signal to the orange wire. So this engine can generate a PWM signal to work when some need arises. It could be a 555 timer or any microcontroller platform like Arduino, PIC, ARM or a microprocessor on a raspberry. Let's look at the photos provided in the datasheet.

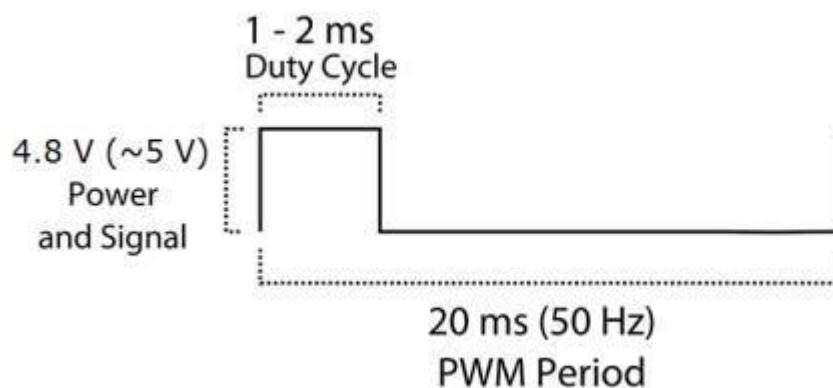


Fig. 2.14: PWM

From the figure we can understand that the PWM signal should have a frequency of 50Hz, which means that the PWM time should be 20ms. These times can vary from 1ms to 2ms, so the motor time is 0 when equal to 1ms and the motor is 90. When it's 1.5 milliseconds and 180 when it's 2 milliseconds. The motor is controlled from 0 180 to 180 with a time shift from 1ms to 2ms.

### 3.2.6.d Applications

- Used as an actor in many robots such as Biped Robot, Hexapod, Mechanical Arm, etc.
- RC is often used for navigation systems and RC children's toys.
- Robots that require unresponsive positional control.
- Therefore, DOF robots are not used as heavy objects like humanoid robots.

### 3.2.6.e SG90 Servo Motor Dimensions

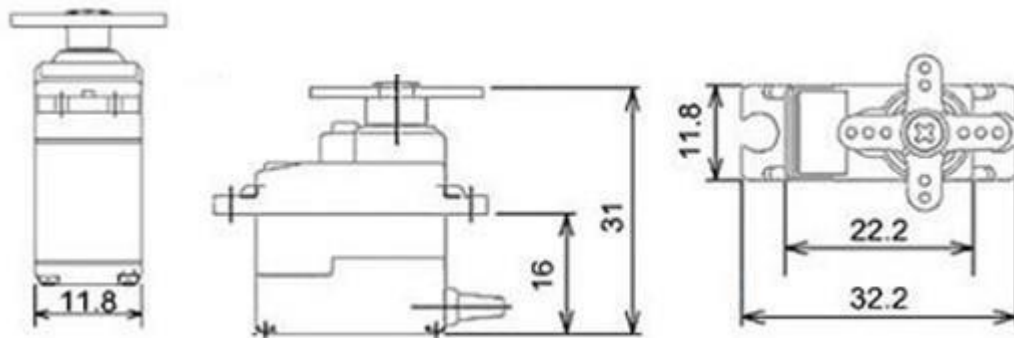


Fig. 2.15: Dimensions of Servo

### 3.2.7 Bread Board

Breadboard is a rectangular plastic board with small slots inside. These slots allow for simple installation of tools. Electrical circuits (first type creation and testing) such as circuits with batteries, switches, resistors and LEDs.



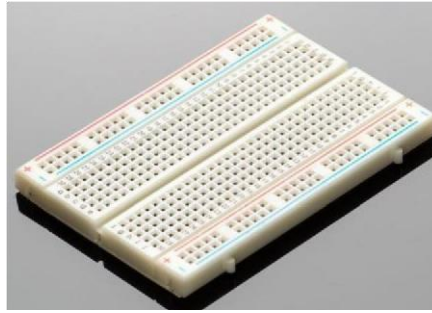


Fig. 2.16: Bread Board

### 3.2.8 LM2596 Buck Converter

The LM2596 is a well-known IC deer adaptor. This converter can accept input voltages ranging from 4.5 to 40 volts and convert them to an alternating voltage with a current flow of up to 3 amps. It's often utilized in power modules and heavy load management because of its high current capacity. The present high level of 3A is known for LM2596. It comes in a variety of output voltages, including 3.3V, 5V, and 12V. The LM2596-ADJ, which features a variable output voltage, is the most well-known. The main converter, which operates at a frequency of 150 kHz, consumes the input voltage and adjusts the needed output voltage using an internal switching circuit. It has a high level of performance, as well as thermal and current maximum performance closure. So, if you're seeking for a low-cost, simple-to-use IC converter, go no further.



Fig.3.17. LM2596 Converter

### 3.2.9 Lithium Ion Battery

For all electrical appliances that require electricity, we used this 3.7 volt lithium ion battery. The lithium battery represents a step forward in sustainable energy storage, for both PE and mobile devices. In any case, some important questions remain unanswered in the car industry. Despite significant advances in recent cell systems, modern lithium batteries do not have the power or life required for use in a car to make changes in the movement of an internal combustion motor.



Fig.3.18. Lithium Ion Battery

### 3.2.10 ON OFF switch

This is done to activate and turn on the project's power supply. It provides additional protection to our project. Actually this gives our devices extra protection. The switch where we can press is called a "positive on off switch". The most regular utilization of this kind of switch is to turn lights or other electrical hardware on or off.



Fig.3.19: On/Off Switch

### 3.2.11 Battery Holder

The battery holder is picked to hold the battery. A battery holder, sometimes known as a battery mount, is a hole that holds cells in a coordinated or separate way. It's usually attached to a cell-powered device if it's a different compartment. It's used to keep the cells secure while also providing power to the device to which it's attached. A battery holder's primary function is to support the power supply to the device to which it is connected. A battery holder, sometimes known as a battery mount, is a hole that holds cells in a coordinated or separate way. It's usually attached to a cell-powered device if it's a different compartment.

It's used to keep the cells secure while also providing power to the connected device.



Figure 3.20: Battery Holder.

### 3.2.12 PVC Board

PVC foam board is a feather light, extended unbending PVC froth sheet that is utilized for an assortment of uses including signs and shows, display corners, photograph mounting, inside plan, thermoforming, models, model making and substantially more. It very well may be effectively sawed, stepped, punched, cut, sanded, bored, screwed, nailed, or bolted. It tends to be fortified utilizing PVC cement. It properties incorporate brilliant effect opposition, exceptionally low water ingestion and high erosion obstruction.

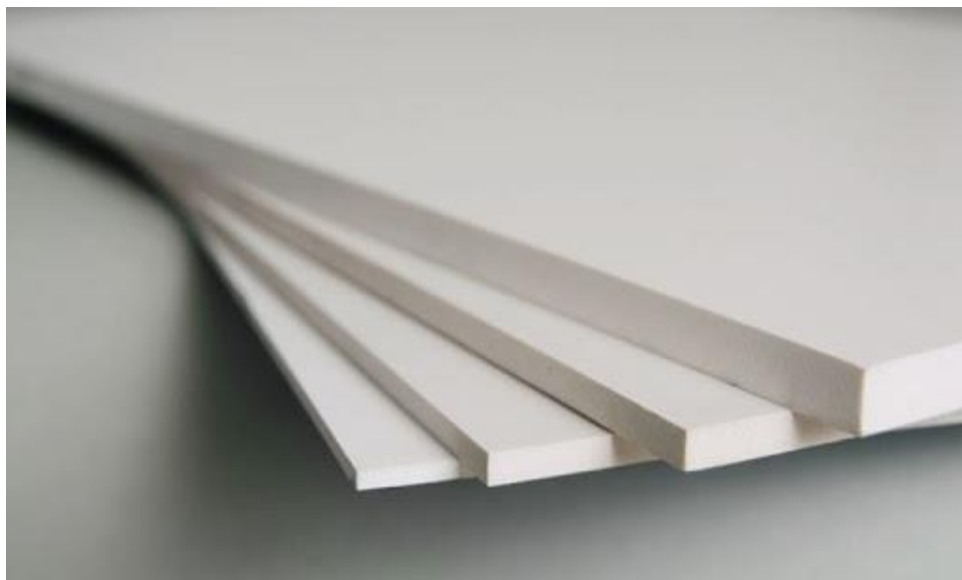


Fig.3.21. PVC Foam Board

# CHAPTER 4 SOFTWARE REQUIRMENT AND HARDWARE DEVELOPMENT

## 4.1 Introduction

The development and design systems were described in this chapter. The block diagram, proposed system, methodology, system description, and working system will all be covered.

## 4.2 Required Software

To complete our project, we need many types of software, most important of them are following

1. Arduino IDE-1.8.9
2. Blynk Android App

### 4.2.1 Arduino IDE

The software used to program microcontroller is advanced software. But can be downloaded for free at [www.arduino.cc](http://www.arduino.cc) Using "Arduino Software" we can use microcontroller to write small programs. This program is called "Sketch".

Finally, the image will be transferred from the USB cable to the microcontroller. More that's off on the topic of "Programs"

#### 4.2.1.a Arduino IDE Installation

The Arduino software and the board's USB driver must now be installed one after the other.

#### 4.2.1.b Installation and Setup of The Arduino Software

1. We have downloaded the Arduino software at [www.arduino.cc](http://www.arduino.cc). and install it on the computer (Not connected to PC) After that, we open the software file and install a program called `arduino.exe`.

Two settings in the program are important and should be considered.

- a) The board we want to connect to the Arduino software is selected "Arduino Uno" called "Arduino/Genuino Uno in NodeMCU".

b) We must carefully select the "Serial Port". To let the computer know the port to which it is connected. This is only possible if the USB drivers are properly installed. It can be viewed as follows.

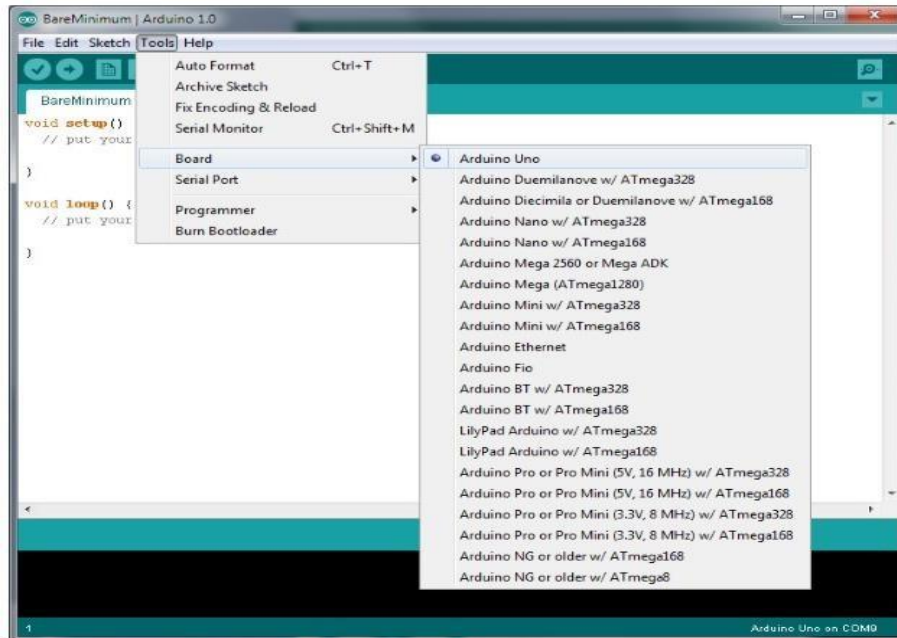


Fig. 4.1: Program installation process -1

At that moment the Arduino is not connected to the PC. If you select "Ports" in the "Devices" section, we now need to see at least one port here (COM1/COM2/COM3...). Number of USB ports on the computer when the board is connected to the computer We will also see other ports.

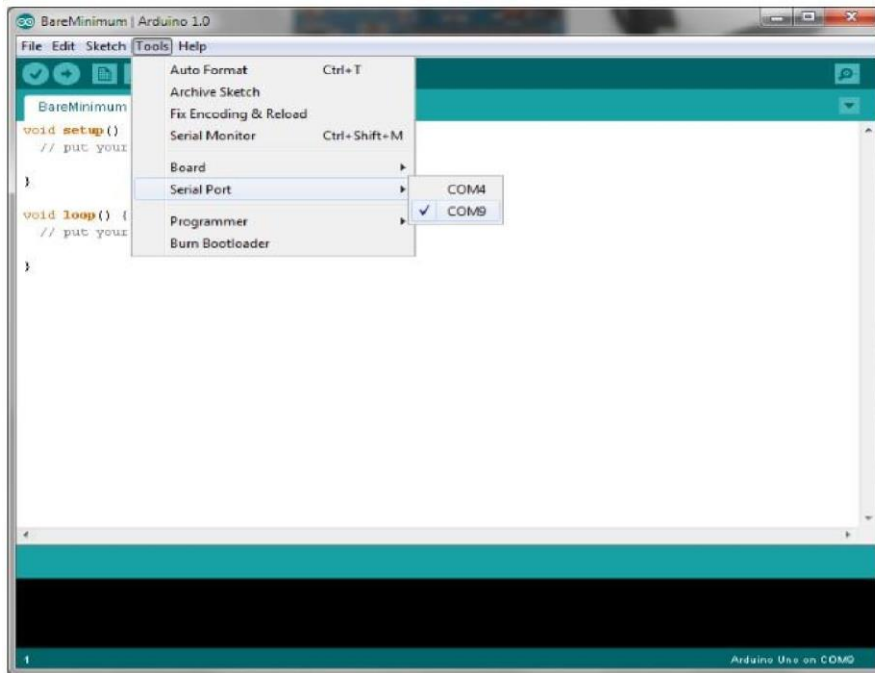


Fig. 4.2: Program installation process -2

### 4.2.2 Blynk Android App

Blynk is a new platform that provides quick access to manage and monitor hardware services from iOS and Android devices. After downloading the Blink app, you need to create a task dashboard. And customize buttons, sliders, diagrams and other widgets on the screen.

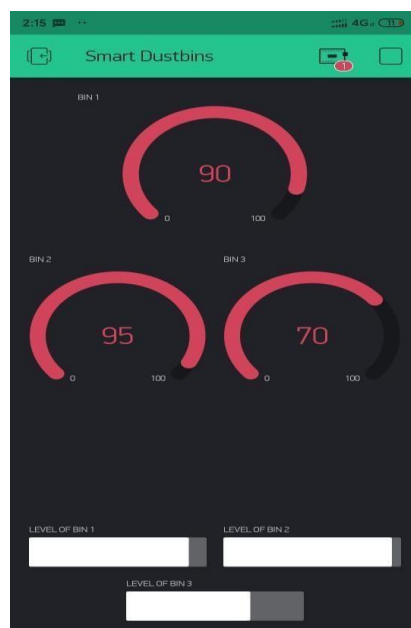


Fig. 4.3: Blynk App

### 4.2.3 Programming

The development cycle is divided into 4 phases:

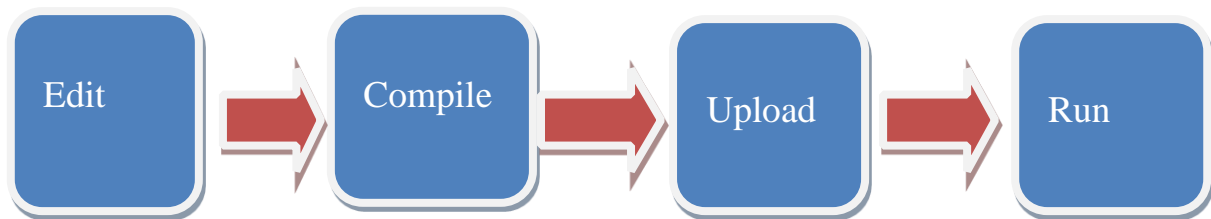


Fig. 4.4: Flowchart of the compiling process

**Compile:** The term "compile" refers to the process of converting a sketch into machine language, also known as object.

**Run:** The Arduino sketch is run as soon as the uploading phase on the board is completed.

#### 4.2.3.a Arduino Program Development

- Based on C++ without 80% of the instructions.
- A handful of new commands.
- Programs are called 'sketches'.
- Sketches need two functions:
  - void setup ( )
  - Void loop ( )
- Setup ( ) runs first and once.
- loop ( ) runs over and over, until power is lost or a new sketch is loaded.

### 4.3 Hardware Implementation

This section is where we implement our hardware by following diagram.

### 4.3.1 The Connection of Block Diagram

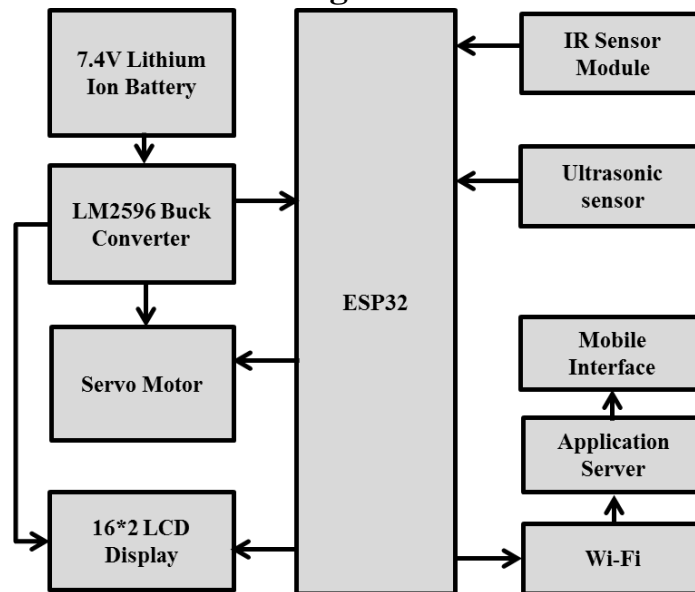


Figure 5.6: Diagram for controlling the bin Gate

To begin, the whole ultrasonic sensor receives a signal based on the distance between the waste can and the dustbin. Subsequently it transmits the three data to ESP32 for transmission to an internet server, which then displays the data on a mobile device through an app.

Each one produces an ultrasonic signal for servo conversion when the dust reaches the corner. The reason why the numbered gate is connected to the servo motor is that the door opens or closes when the motor is moving.



### 4.3.2 Flow chart for Level displaying

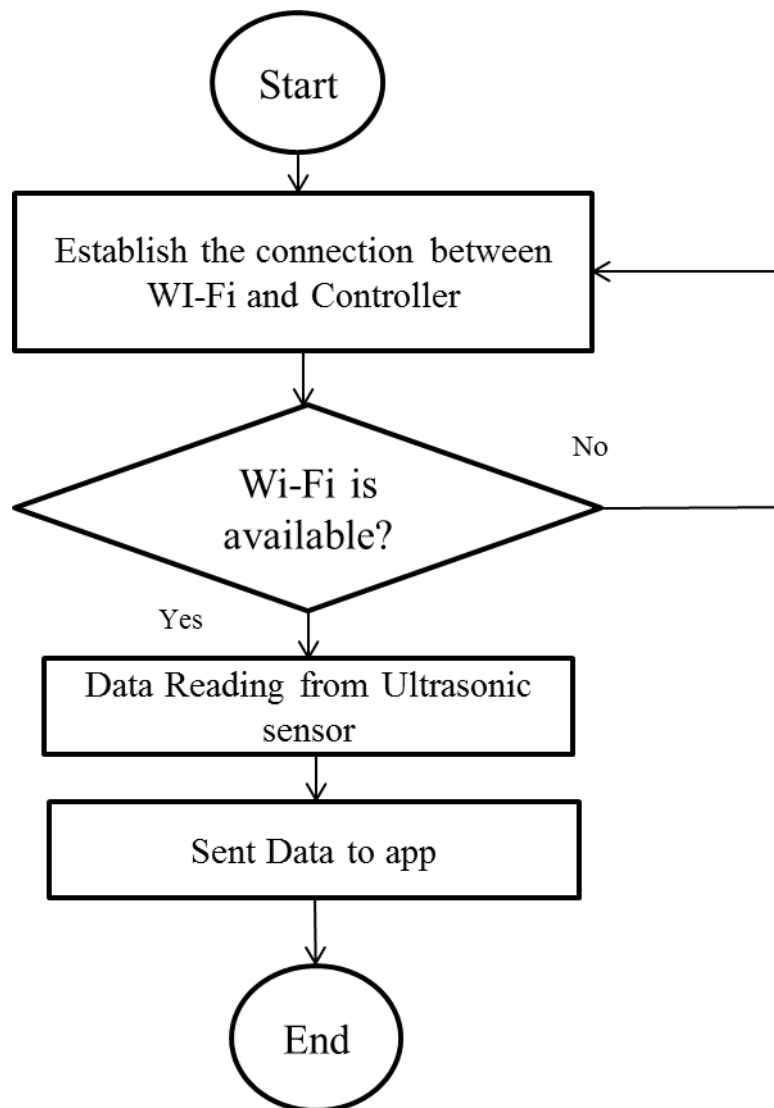


Figure 4.7: Diagram for controlling the bin Gate

### 4.3.2 Flow chart for Bins Gate Controlling

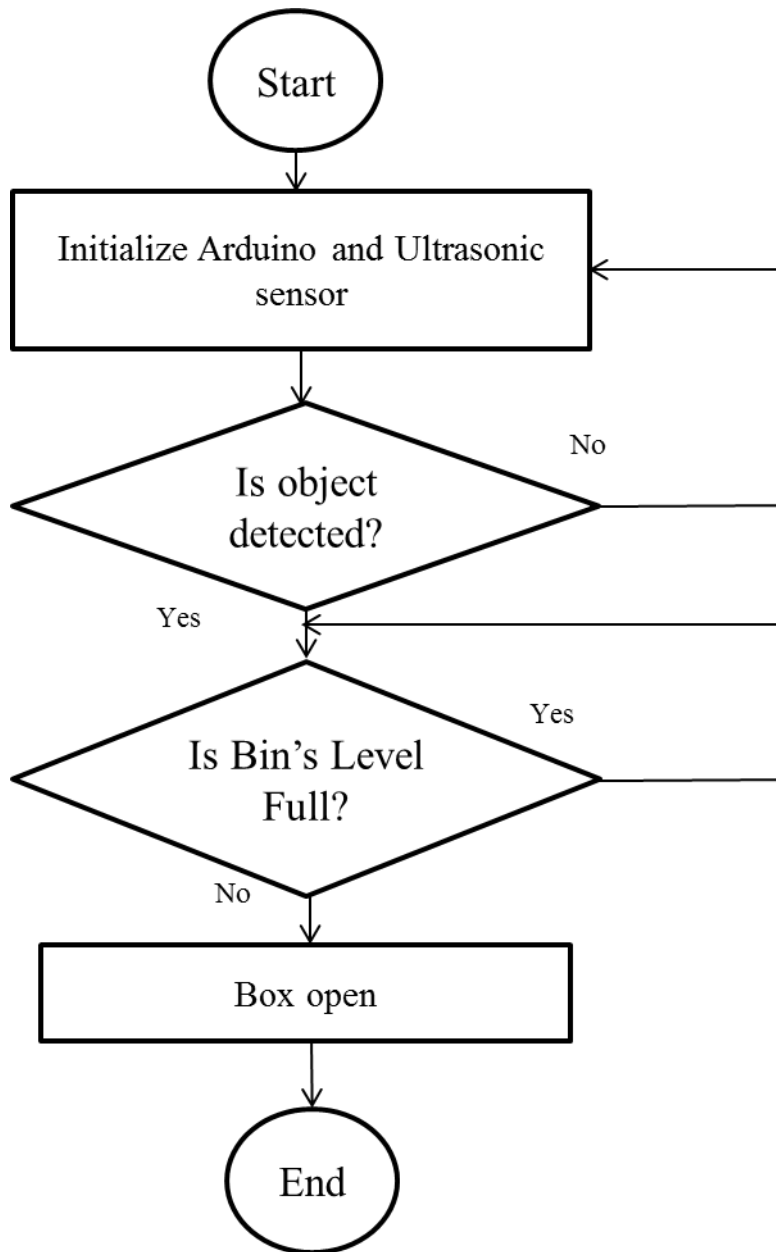


Figure 4.8: Diagram for controlling the bin Gate

### 4.3.3 Hardware Connection

The hardware connection circuit is shown in Figure 1. We configure the terminal and connect the 5V power supply to the terminal. Then we connect 2 ultrasonic sensors to ESP32, 1st ultrasonic trigger and Echo pin to 33 and 32. Second ultrasonic trigger with Echo pin and 23 with 22 with ESP32 and GND and VCC all connected. In conjunction with the GND and VCC batteries, we finally connected the 16 \* 2 i2c LCD display, connected to the D1 and D2 converters of the SDA and SCL slots.

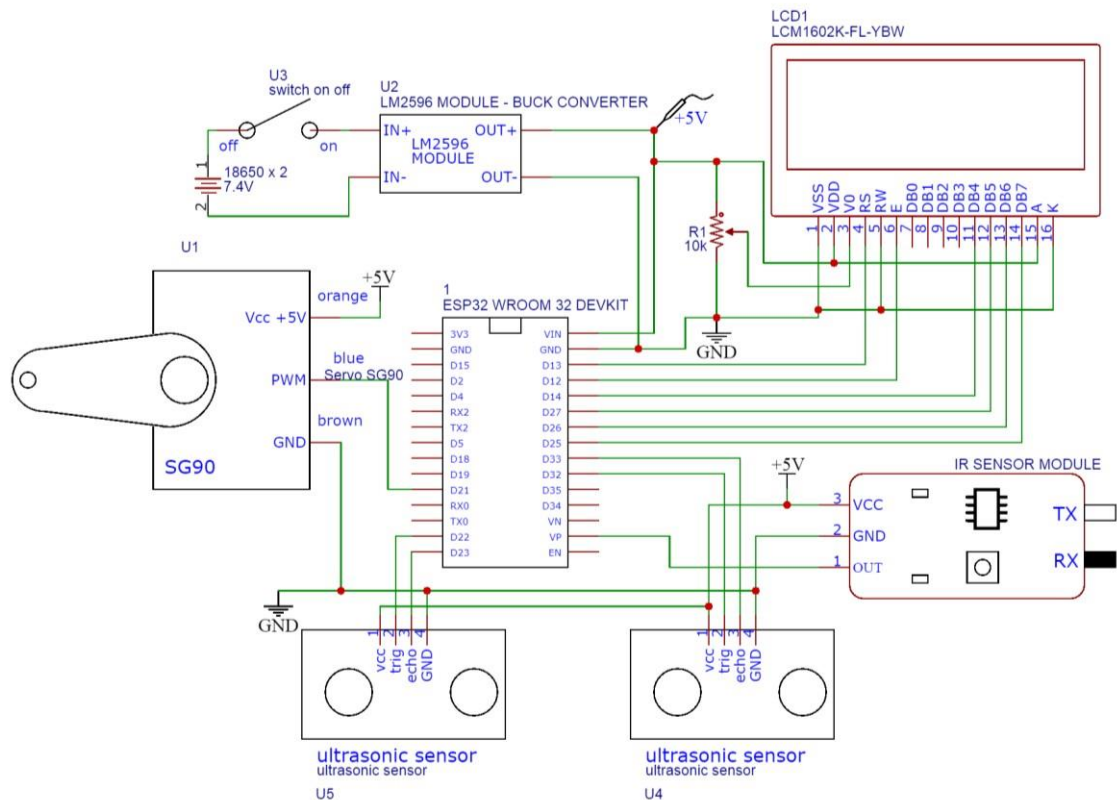


Fig. 4.9: Circuit Diagram of Controlling bin's level and bin's gate

First we build the ESP32 and then repair the ultrasonic connector on the reflection pins on the ESP32 Pins 23 and 22. Then connect the servo seal to the A0 ESP32 pin. Both VCC and GND are connected to VCC and GND batteries of the same size.

## **4.4 Chapter summary**

The main drawback of any project is the cost. This paper is studied and reviewed on the basis of IoT based smart garbage management. Practically to carry out that we can cope with problems such as strong Wi-Fi connection requirements, large LCD unit and we need to prepare cost effective circuits.

# CHAPTER 5 RESULTS

## 5.1 Introduction

The results of this chapter will be summarized as well as all conversations and discussions. After finished the project we run experiment on smart management system. During the successfully experiment period we become a conclusion on smart management system.

## 5.2 Final Result

The Final result is now we can monitor and observe all dustbins from our mobile and take immediate action as per the garbage's condition.

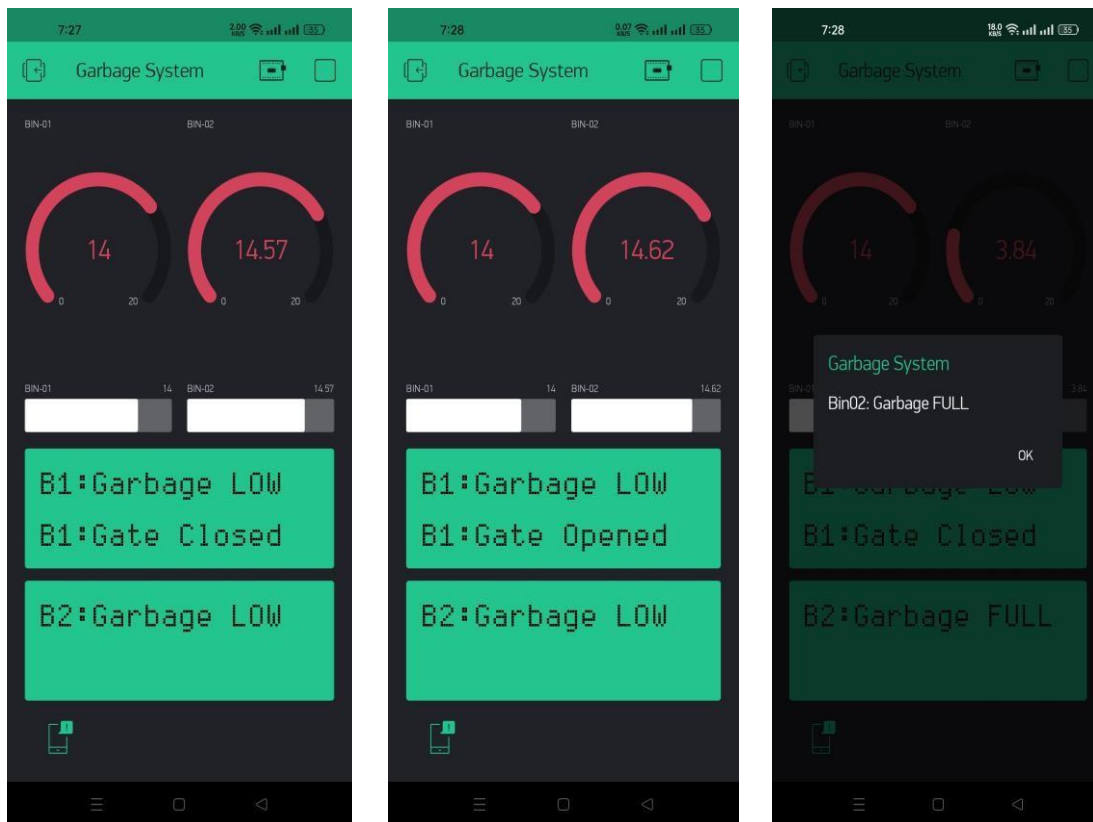


Fig 5.1: Blynk app interface

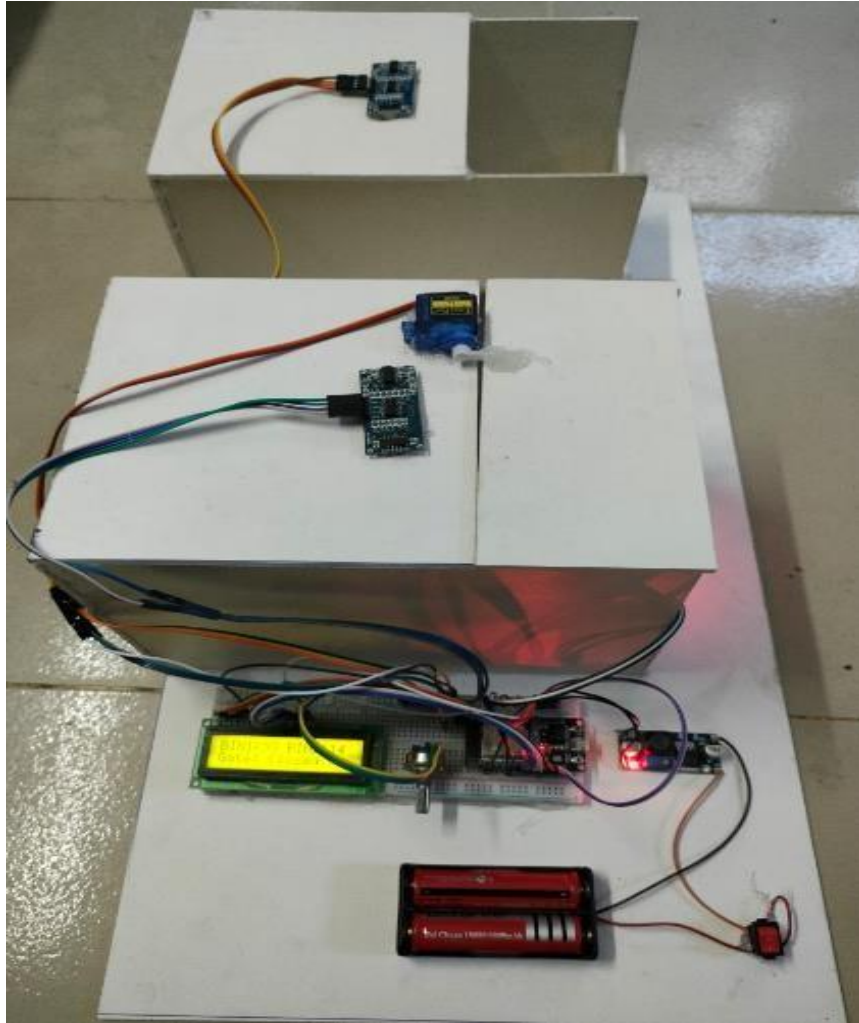


Fig 5.2: Front view of garbage management system

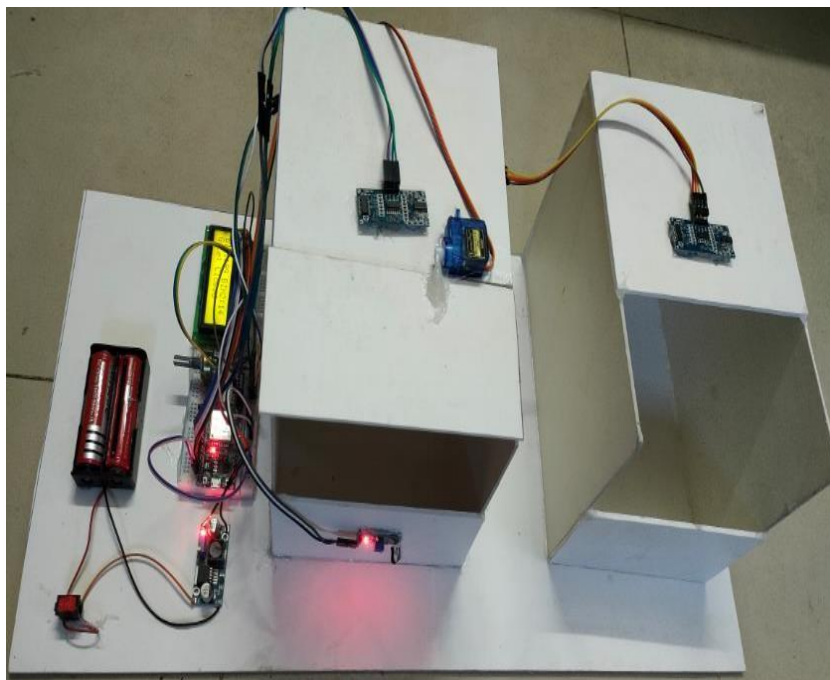


Fig 5.3: Gate closed of garbage management system

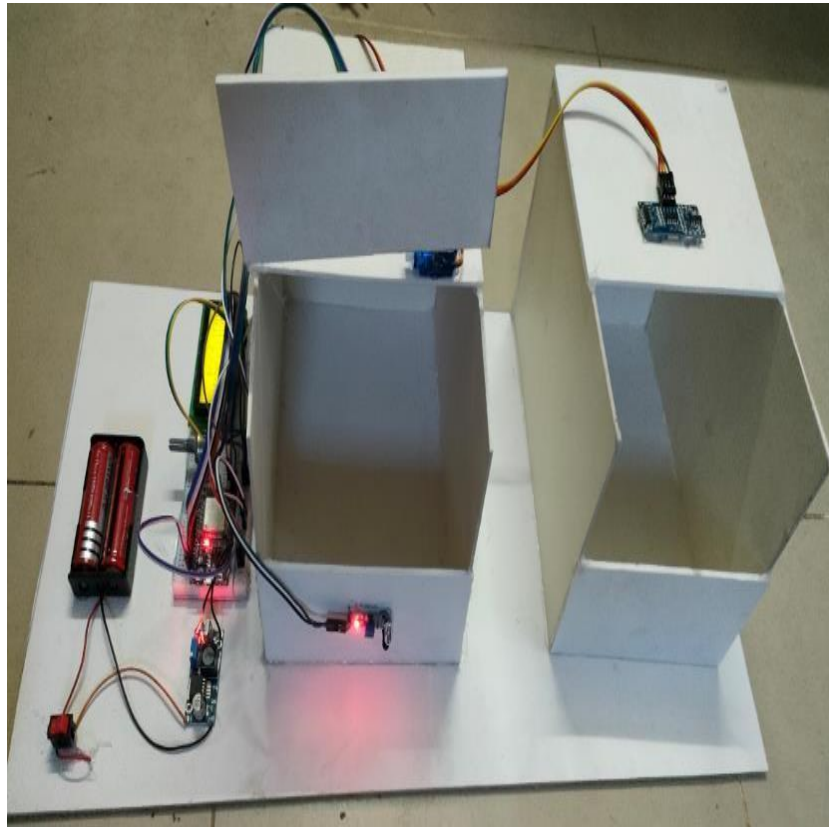


Fig 5.4: Gate Opened of garbage management system

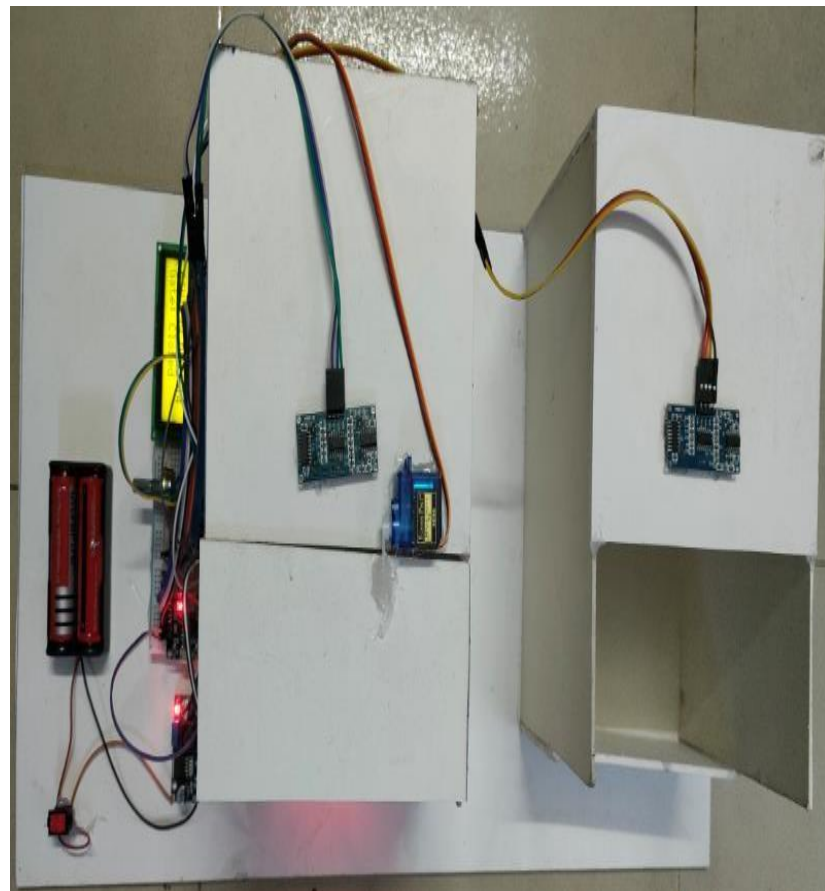


Fig 5.6: Top view of garbage management system

### 5.3 Cost Analysis

This project is not very costly. The costing of our project is following:

Table 5: Cost of This Project

SI No	Equipment	Price
1	ESP32	900
2	IR Sensor	400
3	Ultrasonic Sensor	480
4	Power Supply	400
5	Servo Motor	120
6	16*2 LCD I2C	300
7	Bread Board	100
8	Jumper Wire	100
9	Others	500

### 5.4 Summary of the chapter

After all that is done as a result of this, the IoT-based smart management system is ready to display. The main problem in this chapter is to build a hardware connection about the performance of this function. Therefore, the main purpose of these words is to understand the block diagram and the connection diagram.

## CHAPTER 6 CONCLUSION AND RECOMMENDATION

### 6.1 Future Work

The above procedure is only one step in IoT configuration. This model will have many improvements. This will change the way we keep our environment clean and healthy. Some possible fixes: The more bins are added, the better. where the type and waste can be identified automatically in the area by the appropriate color scheme given to the model. These bins can



be placed on a GPS tracker, which can place bins in the specified area and discard it. This leads to an intelligent waste management system.

## **6.2 Limitations**

1. It has the potential to be stolen.
2. Because it is electrical equipment, it might be damaged by water. (Unless we make it water and dust resistant.)
3. An issue with the internet connection and data speed.
4. The precision of the sensor.

## **6.3 Advantages**

1. Deep conversion system promotes waste collection methods and waste management systems based on real-time and historical data. Provide predictive analytics to make decisions ahead of time and advice on waste disposal sizes. The cost reduction of smart waste equipment greatly reduces the collection time. This saves fuel, labor and ship maintenance costs.
2. Better hygiene in crowded areas Rapid waste disposal often results in congested areas and poor road conditions. Our solution allows waste disposal staff to immediately read the full notice. and receive alerts about peak densities. CO2 reduction is a highly polluting strategy. Our solution allows light trucks to be on the road for a short period of time. which means less smoke noise pollution and less clothes
3. Inspect the landfill and report the level of waste collected in the landfill. To keep our environment clean and green the mouth and nails are small in this system.

## **6.4 Conclusion**

IoT waste management system helps people manage waste easily. And it reduces the work of calling or waiting for an assigned person to clean the area and improve living conditions. They won't get any disease and people will get better and won't get sick with the waste produced by these wastes. A pure BD program can be easily implemented. This system promises to clean the mess as soon as the waste level reaches its maximum level. It will be powered with the help of batteries. If the waste is not cleaned in time Records will be sent to the sweeper or a higher authority that can take appropriate action on the affected contractor.

This will ultimately help to make the environment cleaner as well as easier to manage waste.

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- [3] Md. Shafiqul Islam, M.A. Hannan, Maher Arebey , Hasan Basri , “An Overview For Solid Waste Bin Monitoring System”, Journal of Applied Sciences Research, ISSN 181-544X, vol.5,Issue4, February 2012.
- [4] Twinkle sinha, k.mugesh Kumar, p.saisharan, “SMART DUSTBIN”, International Journal of Industrial Electronics and Electrical Engineering, ISSN: 2347-6982 Volume-3, Issue-5, May2015.
- [5] Telugu Maddileti, Harish, “IoT Based Smart Dustbin”, International Journal of Scientific & Technology Research, ISSN 2277-8616, volume 9, Issue 02, February 2020

## APPENDIX

### Programming Code for level controlling:

```
#define
BLYNK_PRIN
T Serial
#include
<WiFi.h>
```

```

#include
<WiFiClient.h>
#include
<BlynkSimpleE
sp32.h>

// Servo motor
#include
<Servo_ESP32.
h>

static const int
servoPin = 21;
//printed G14 on
the board static
const int IRpin
= A0; //printed
G14 on the
board

Servo_ESP32 servo1;

int angle = 0;
int angleStep = 5;

int angleMin =
0; int
angleMax =
90;

#include
<LiquidCrystal.
h>

```

```
const int rs = 13,  
en = 12, d4 =  
14, d5 = 27, d6  
= 26, d7 = 25;  
LiquidCrystal  
lcd(rs, en, d4,  
d5, d6, d7);
```

```
char auth[] =  
"e1Es8fTKRHg  
AShMAJQJ6zN  
WtsLftdoZY";
```

```
// Your WiFi  
credentials. //  
Set password  
to "" for open  
networks. char  
ssid[] =  
"Robotics";  
char pass[] =  
"iamrobot";  
BlynkTimer  
timer;
```

```
//int  
Water_Sensor1  
= A0;  
//int  
Sensor_Value1  
= 0;  
//int
```

```
Water_Sensor2
= A3;
//int
Sensor_Value2
= 0;

String condition
= "Md Shamiul
Islam"; String
condition2 =
"Md Rayhan
Mondol"; String
condition7 = " ";
String
condition8 = " ";
String
Ultrasonic1 =
"0";
String
Ultrasonic2 =
"0";
String
Ultrasonic3 =
"0";
String
Ultrasonic4 =
"0"; String
condition10 = "
"; String
condition11 = "
";

//int
```

```
motorPositive =  
33;  
//int  
motorNegative =  
32;  
  
int sensorMode  
= 0; int  
motorMode =  
0; unsigned long  
previousMillis =  
0; long interval  
=  
5000;  
}
```