

Designing and Modeling Of Dustbin using IOT

Submitted in partial fulfillment of the requirements

for the award of

Bachelor of Engineering degree in Computer Science and Engineering

By

PAVITHRA B (40110928)



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Category-1 University by UGC

Accredited with Grade “A++” by NAAC | 12B Status by UGC | Approved by

AICTE JEPPIAAR NAGAR, RAJIV GANDHISALAI,

CHENNAI - 600119

APRIL - 2024



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited "A++" Grade by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **Pavithra B** who carried out the Project entitled "Designing and Modeling of Dustbin using IOT" under my supervision from November 2023 to April 2024.


16/4/24

Internal Guide

Dr.G. Kalaiarasi M.E., Ph. D.,

HEAD OF THE DEPARTMENT
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Head of the Department

Dr.L. Lakshmanan M.E.,Ph.D.,

Submitted for Viva Voce Examination held on 16-4-24


16/04/24

Internal Examiner


16/4/24

External Examiner

DECLARATION

I, PAVITHRA B (Reg.No - 40110928), hereby declare that the Project Report entitled "Designing and Modeling of Dustbin Using IOT" done by me under the guidance of Dr.G.Kalalarasi M.E., Ph.D., is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering

DATE: 16-4-24

Pavithra.B

PLACE: Chennai

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **The Board of Management of Sathyabama Institute of Science and Technology** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr.T. Sasikala M.E., Ph.D.**, Dean, School of Computing, **Dr.L.Lakshmanan M.E., Ph.D.**, Head of the Department of Computer Science and Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Dr.G.Kalaiarasi M.E., Ph.D.**, for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Computer Science and Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT

The rise of smart technologies has revolutionized various aspects of our daily lives, including waste management. An innovative IoT-based model of a movable smart dustbin designed for indoor environments has been designed. Traditional waste disposal methods often lack efficiency and real-time monitoring capabilities, leading to issues such as overflow, odor, and unhygienic surroundings. In response to these challenges, the proposed smart dustbin leverages Internet of Things (IoT) technology to enhance waste management practices indoors. The smart dustbin integrates sensors, microcontrollers, and connectivity modules to enable real-time monitoring and management of waste. As the human population increases waste generated by the human beings has also increased. The main reason for disease spreading is mainly due to improper disposal of waste. Previous researchers have focused to upgrade the features like sending the location of bins, sending alerts to concerned authorities when the bin is full, sending data regarding the presence of toxic gases. People who are elderly and differently abled people find difficult to move from their place and dispose the trash which may again lead to lack of cleanliness. To make bins accessible for people unable to move a smart bin has been developed but that model was a Bluetooth based model which can be controlled only upto a certain distance. So in order to cover a larger distance and also to send and receive data at a faster rate we need IOT based model. An IOT based model of a bin has been developed which has movement feature. The developed model of bin helps elderly people and physically challenged people to dispose the waste without moving from their place. For controlling IOT devices we use Blynk IOT application. In the Blynk app, buttons like Forward, Backward, Left, Right have been provided to control movements and when the bin reaches the user and when trash detected the lid is opened. The level of the trash can also be monitored using Blynk app interface.

Keywords: IOT, sensors, actuators, smart bin

TABLE OF CONTENT

CHAPTE R NO.	TITLE	PAGE NO.
	ABSTRACT	v
	LIST OF FIGURES	vi
1	INTRODUCTION	1
2	LITERATURE SURVEY	2
	2.1 INFERENCES FROM LITERATURE SURVEY	2
	2.2 DISADVANTAGES OF EXISTING SYSTEMS	5
3	SYSTEM REQUIREMENTS	6
	3.1 HARDWARE REQUIREMENTS	6
	3.2 SOFTWARE REQUIREMENTS	23
4	DESCRIPTION OF THE PROPOSED SYSTEM	25
	4.1 DESCRIPTION OF THE SYSTEM	25
	4.2 TECHNOLOGY USED	26
	4.3 BLOCK DIAGRAM	28
	4.4 SYSTEM ARCHITECHTURE DIAGRAM	30
	4.5 WORKING MECHANISM	31

5	RESULTS AND DISCUSSION	33
	5.1 RESULTS	33
	5.2 DISCUSSION	35
6	CONCLUSION AND FUTURE WORK	36
	6.1 CONCLUSION	36
	6.2 FUTURE WORK	36
	REFERENCES	37
	APPENDIX	38
	A SOURCE CODE	38
	B SCREENSHOTS	43
	C RESEARCH PAPER	45
	D CERTIFICATE OF PUBLICATION	51

LIST OF FIGURES

FIGURE NO	FIGURE NAME	PAGE NO
3.1.1.1	NODEMCU	6
3.1.1.2	PIN DETAILS OF NODEMCU	7
3.1.2.1	MOTOR DRIVER	9
3.1.3.1	ULTRASONIC SENSOR	11
3.1.4.1	INFRARED SENSOR	14
3.1.5.1	SERVO MOTOR	17
3.1.6.1	DC MOTOR AND WHEEL	19
3.1.7.1	BREADBOARD AND JUMPER WIRES	22
3.2.1.1	BLYNK IOT APP	23
3.2.2.2	ARDUINO IDE 2.2.1	24
4.2.1	IOT TECHNOLOGY	26
4.3.1	BLOCK DIAGRAM	28
4.4.1	SYSTEM ARCHITECHTURE DIAGRAM	30
4.5.1.1	FLOWCHART	31
5.1.1	MODEL OF SMART DUSTBIN	33
5.1.2	TRASH LEVEL OF BIN – 0%	33
5.1.3	TRASH LEVEL OF BIN – 50%	34
5.1.4	TRASH LEVEL OF BIN – 100%	34
B .1	PROTOTYPE OF SMART DUSTBIN	43
B.2	BIN EMPTY	43
B.3	BIN HALF FILLED	44
B.4	BIN FULLY FILLED	44

CHAPTER 1

INTRODUCTION

As per the Swachhata Sandesh Newsletter released by the Ministry of Housing and Urban Affairs in January 2020, 1,47,613 metric tonnes of solid waste is generated per day from 84,475 wards across India. The lack of dustbins at regular intervals is prompting the public to litter, making the cities unclean and unhygienic. To make it easy for the public to discard trash, many cities around the world provide dustbins at regular intervals in public places. For a long time, the waste that humans generate has been harmful to our environment. In 2017, the Environmental Protection Agency estimated that the total amount of municipal solid waste generated in the United States that year was 267.8 million tonnes. Due to physical contact between the bin and the user, and improper waste disposal various diseases like Tuberculosis, Pneumonia, Cholera spread among the humans. To avoid this well waste disposal system is much needed. Previously researchers have contributed their work for the proper wastage disposal system by developing smart dustbin systems that have features like segregation of wastes, alerting the trash collecting centres about the filled bins, calculating the effective way to collect the bins using machine learning algorithms, In places like hospitals, industries proper waste disposal is very important as improper waste disposal may lead to a great negative impact to the environment. Poor medical waste disposal can cause significant environmental risks. It is important to ensure environmentally-friendly biohazard waste disposal systems to prevent water contamination and incineration issues. But still those dustbins need more upgradation in future. Elderly people or people who are physically challenged may have an issue in disposing the waste in the Bin. So in order to help them disposing the waste without moving, an IOT based model has been developed, an IOT based smart bin which can move based on our button signal.

CHAPTER 2

LITERATURE

SURVEY

2.1 INFERENCES FROM LITERATURE SURVEY

[1] **Vijay Babu K , Vivek Gowda J:** A system has been developed which can notify the firms to empty the bin on time. In the system, a sensor has been placed on top of the trash bin which can detect the entire level of garbage inside it consistent with the entire size of the bin. When the rubbish reaches the utmost level, a notification is sent to the corporation's office, then the workers can take further actions to empty the bin. This system will help in cleaning the town during a better way. By using this technique people don't need to check all the systems manually but they're going to get a notification when the bin will get filled.

INFERENCE: The model is used for measuring the level of the trash in the Bin. Arduino board cannot be directly connected to the internet So an internet module ESP8266 is used in combination. Instead of this Node MCU can be used

[2] **Srinivasan ,Thiyaneswaran :** This model shows whether the dustbin is filled or not and the waste level of the trash bin is measured. The NodeMCU and the ultrasonic sensor is a hardware component for measuring the garbage bin. The software component is an IFTTT Webhook, and it is used to receiving a notification. When more than 70 percent of the garbage bin is filled, the IFTTT Webhook sends the notification and the email is sent to the concerned people

INFERENCE: If the dustbin is nearly 70 percent, a mail notification is sent immediately. It helps to keep the environment clean and without causing any kind of disease. The model helps to know only about the level of bin and cannot provide other information as well as move to the user location.

[3]Y.Appa Rao, A.Narayana Murthy: The real-time status of all bins is interpreted which is situated in various parts of the city by sending an alert signal to the municipal workers for immediate cleaning of a dustbin with proper verification based on the level of garbage filling, moisture, and temperature. Manual monitoring and verification process is reduced to a larger extent **INFERENCE:** IOT technology has been used .Sending alert signal when the bin is full and displaying the level of the bin using LCD display is mainly focussed. The prevention of overflow of trash which is a very important aspect in order to maintain proper hygiene and overall health can be largely avoided. Implementation of any short route finding algorithm would have been much beneficial to the trash collecting authorities to find the short route

[4] Dr. Sudha L K, Mohammed Tahir:A smart dustbin in which segregation is achieved using respective automated sensors and the wastage level both dry waste and wet waste of the dustbins are monitored and recorded simultaneously. It ultimately helps to keep cleanliness in the society and hence the expansion of diseases caused by waste material is reduced.

INFERENCE: Segregation of dry and wet waste is done effectively without the need of Human effort. This helps to reduce the spread of various diseases. The alert system used for sending the status of the bin helps to avoid the overflow of bins and thus helps to avoid spreading various diseases.

[5] **Diksha Pagare, Nikhil Nikam:** A reward bin has been developed which rewards the user based on the trash they disposed. This model has the lid open/close feature where the lid opens based on the presence of trash. When a particular person drops the waste that person needs to scan their unique barcodeID in the bar code scanner of the bin based on the trash discounts and coupons is sent to the particular person's account.

INFERENCE: This model will make people throw their trash in the bin as it gives discounts based on the dropped trash. As it gives people discounts and tokens people might develop the habit of disposing the trash only at the bin. By this we can inculcate the habit for people to dispose the trash at bin and also encourage people who have this habit by providing benefits.

[6] **Prof. Pooja V Pawar, Harshali Bodkhe:** To avoid overflow of trash the alert is sent to the authority when the bin is full. ATmega microcontroller board has been used. When bin is full then a SMS message along with the location is sent to the authority. The status of bin is also displayed using an LCD screen. So when a user uses the bin first the user need to check whether the bin is not full.

INFERENCE: The model is a much effective model since it sends message as well as displays the status of the bin Using LCD display. Overflow of trash can be avoided which will largely help to maintain clean environment and overall health.

[7] **Chinmay Kolhatar, Pratichowdari:** The status of the bin is shared wirelessly using IOT protocol. When the trash gets filled an email is sent to the concerned authorities. Ultrasonic sensor is used to measure the level of trash and proximity sensor used for obstacle detection. LCD display is used to display the level of the bin.

INFERENCE: The model is a much effective model since it sends message as well as displays the status of the bin Using LCD display. Overflow of trash can be avoided which will largely help to maintain clean environment.

2.2 DISADVANTAGES OF EXISTING SYSTEMS:

Initially Smart Bins were developed to sense the presence of trash. If present then the servo motor opens the lid. Later models for measuring the trash level were developed.

These models were not suitable for certain use cases .The disadvantages of the models are

The Bins that are developed

- Can only open and close based on the presence of trash
- Used Arduino Board which requires internet module ESP8266 to connect to Internet.
- Used GSM or GPRS for sending the bin status and bin location.
- Lacked movement in many models
- Many models focused only on alerting the status of the bin using various ways.

CHAPTER 3

SYSTEM REQUIREMENTS

3.1 HARDWARE REQUIREMENTS:

3.1.1 NODEMCU:

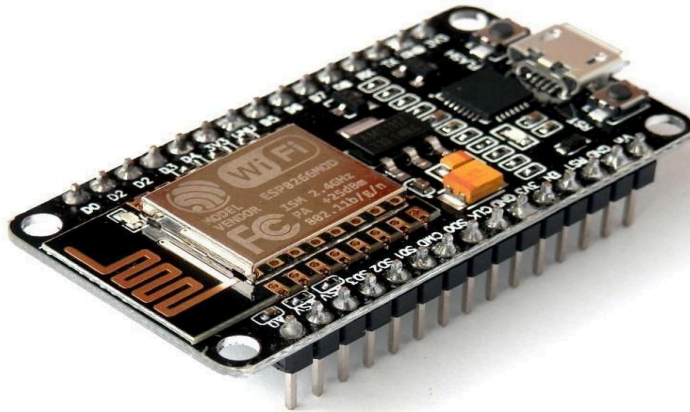


Fig. No. :3.1.1.1 NodeMCU

- **NODE MCU ESP8266** is a microcontroller used in IOT based systems .
- The NodeMCU (*Node MicroController Unit*) is an open-source software and hardware development environment built around an inexpensive System-on-a- Chip (SoC) called the ESP8266.
- However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the “computer”
- We also need to program it in low-level machine instructions that can be interpreted by the chip hardware.

- The most common models of the NodeMCU are the Amica (based on the standard narrow pin-spacing) and the LoLin which has the wider pin spacing and larger board. The open-source design of the base ESP8266 enables the market to design new variants of the NodeMCU continually
- The NodeMCU is available in various package styles. Common to all the designs is the base ESP8266 core. Designs based on the architecture have maintained the standard 30-pin layout. Some designs use the more common narrow (0.9") footprint, while others use a wide (1.1") footprint – an important consideration to be aware of.

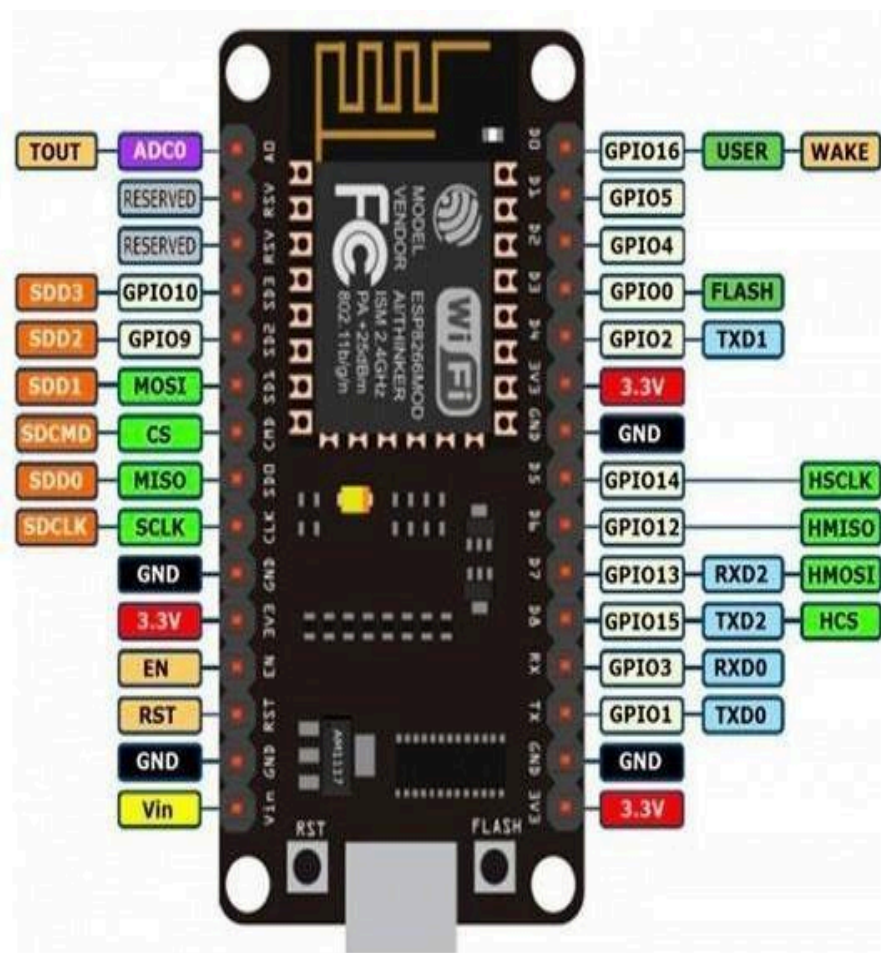


Fig. No:3.1.1.2 PIN DETAILS OF NODEMCU

- **POWER PIN** :There are four power pins. **VIN** pin and three **3.3V** pins.
- **VIN(Voltage IN)** can be used to directly supply the NodeMCU/ESP8266 and its peripherals.**3.3V** pins are the output of the onboard voltage regulator and can be used to supply power to external components.
- **GND (Ground)**are the ground pins of NodeMCU/ESP8266
- **I2C pins** are used to connect I2C sensors and peripherals.
- **GPIO (General Purpose Input/Output)PINS**:NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically.
- **ADC (Analog to Digital) CHANNEL** :The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC.
- **UART (Universal Asynchronous Receiver/Transmitter) PINS**:
- NodeMCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485), and communicate at up to 4.5 Mbps.
- **SPI (Serial Peripheral Interface) PINS**: NodeMCU/ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support general features.
- **PWM (Pulse With Modulation) PIN**:The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000 μ s to 10000 μ s (100 Hz and 1 kHz).
- **CONTROL PINS** :are used to control the NodeMCU/ESP8266. These pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin.
- **EN(ENable)**: The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum power.
- **RST(ReSeT)**: RST pin is used to reset the ESP8266 chip.

3.1.2 MOTOR DRIVER :

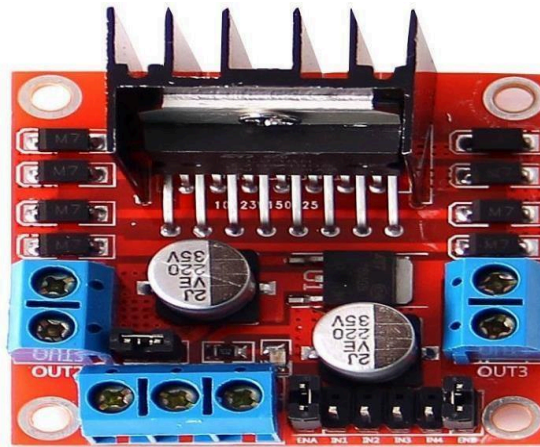


Fig NO : 3.1.2.1 MOTOR DRIVER

- **L298 DRIVER MODULE** is a high power motor driver module for driving DC and Stepper motors.
- This module consists of an L298 motor driver IC and a 78M05 5V regulator.
- **L298N Module** can control up to 4 DC motors, or 2 DC motors.
- In the developed system 4 DC motors are connected to the motor driver.

L298N Module Pinout Configuration:

- IN 1 & IN 2 - Motor A pins, Used to control the spinning direction of Motor A.
- IN 3 & IN 4 – Motor B pins, Used to control the spinning direction of Motor B
- ENA –enables PWM pins for Motor A.
- EN B –enables PWM pins for Motor B.
- OUT 1 & OUT 2-Output pins for Motor A

- OUT 3 & OUT 4 – Output pins for Motor B
- 12V – 12V input from DC power source.
- 5V – Supplies Power for the switching logic circuitry inside L298N Inc.
- GND – Ground pin.

FEATURES & SPECIFICATIONS:

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current: 2A
- Logical Current: 0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance
- Power-On LED indicator.

APPLICATIONS OF MOTOR DRIVER L298N:

- L298N motor driver IC is used in different fields like robotics, embedded, etc. We know that microcontrollers work with very little voltage and current but motors use high voltage and current. So, for this reason, motor driver ICs are used to provide high voltage and current.
- L298 motor driver is applicable where H- BRIDGE is used.
- This motor driver is used in high power-based applications.
- This IC is used where current control & PWM operable IC is required.
- This IC is used where the control unit provides only TTL output.

3.1.3 ULTRASONIC SENSOR:



Fig. NO:3.1.3.1 ULTRASONIC SENSOR

- **Ultrasonic sensor** is a sensor that uses Ultrasonic waves to measure distance
- It has Four pins such as **Vcc**, **Trig**, **Echo**, **Gnd** pins
- In the developed system we use ultrasonic sensor to measure the *level of trash of the bin.*

ULTRASONIC SENSOR PIN CONFIGURATION:

- Pin1 (Vcc): This pin provides a +5V power supply to the sensor.
- Pin2 (Trigger): This is an input pin, used to initialize measurement by transmitting ultrasonic waves by keeping this pin high for 10us.
- Pin3 (Echo): This is an output pin, which goes high for a specific time period and it will be equivalent to the duration of the time for the wave to return back to the sensor.
- Pin4 (Ground): This is a GND pin used to connect to the GND of the system.

FEATURES:

The features of the HC-SR04 sensor include the following

- The power supply used for this sensor is +5V DC
- Dimension is 45mm x 20mm x 15mm
- Quiescent current used for this sensor is <2mA
- The input pulse width of trigger is 10µs
- Operating current is 15mA
- Measuring angle is 30 degrees
- The distance range is 2cm to 800 cm
- Resolution is 0.3 cm
- Effectual Angle is <15°
- Operating frequency range is 40Hz
- Accuracy is 3mm

APPLICATIONS OF ULTRASONIC SENSOR:

- Ultrasonic sensors have utilized in the healthcare industry in ultrasonography wherein doctors do an ultrasound of pregnant women or people suffering from stomach related diseases.
- The ultrasonic sensor has widely utilized in chemical, oil, milk, or water tanks for measuring the level of the liquid present in the tank.
- These sensors have implemented through-beam detection for higher speed counting.
- The sensors mostly implemented in the robotic industry for embedding them in robots and helps in robot sensing.
- These sensors found their usage in the car parking system at the place where car entry allowed through the barrier system. The barrier should not

come down when a vehicle passes through it. All this process is possible only by using ultrasonic sensors.

- The sensors help in the bottle cutting and drink filling machines, in which the bottle is detecting at various points and follows a continuous recording by the ultrasonic sensor.
- The sensors also implemented in transporting printed circuit boards (PCBs) industry, which designs, develops, and prints smartphones, computer motherboards, and home appliances circuit boards.
- These sensors are implementing in the car manufacturing sector that manufactures or assembles the car automatically.
- The ultrasonic sensor also embedded in the car washing system for identifying and washing the car automatically.

3.1.4 INFRARED SENSOR:

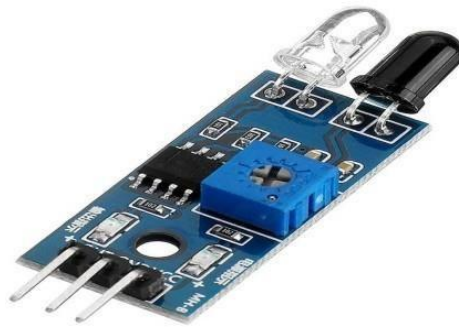


Fig.No : 3.1.4.1 Infrared Sensor

- An **IR sensor** is a sensor that can measure the heat of an object as well detects motion
- It has 3 pins such as **Vcc,OUT,Gnd**.
- In the developed system infrared sensor is used to detect the *presence of trash*.

PIN CONFIGURATION OF INFRARED SENSOR:

- The IR sensor module includes five essential parts like IR Tx, Rx, Operational amplifier, trimmer pot (variable resistor) & output LED. The pin configuration of the IR sensor module is discussed below.
- **VCC (Voltage Common Collector)** Pin is power supply input
- **GND** Pin is power supply ground
- **OUT** is an active-high o/p

FEATURES AND SPECIFICATIONS:

The main specifications and features of the IR sensor module include the following.

- The operating voltage is 5VDC
- I/O pins – 3.3V & 5V
- Mounting hole
- The range is up to 20 centimeters
- The supply current is 20mA
- The range of sensing is adjustable

TYPES OF IR SENSORS:

The classification of IR sensors can be done based on the application which includes the following.

Active IR Sensor

- This type of sensor includes both the emitter & the receiver which are also known as transmitter & receiver. In most situations, a laser diode or LED is used as a source. For non-imaging infrared sensors, LED is used whereas laser diode is used for imaging infrared sensors.
- The best examples of active infrared sensors are reflectance & break beam sensors.

PASSIVE INFRARED SENSOR

- Passive Infrared Sensor (PIR) includes detectors only and this kind of sensor uses targets like infrared transmitters or sources. Here, the object will radiate the energy & detects it through infrared receivers. After that, a signal processor is used to understand the signal to obtain the required data.
- The best examples of PIR sensors are bolometer, Pyro-Electric Detector, Thermocouple-Thermopile, etc.

APPLICATIONS OF IR SENSOR:

The applications of the infrared sensor include the following.

- Rail Safety
- IR Imaging Devices
- Infrared Astronomy
- Optical Power Meters
- Night Vision Devices
- Sorting Devices
- Moisture Analyzers
- Missile Guidance
- Flame Monitors
- Remote Sensing
- Climatology
- Gas Analyzers
- Meteorology
- Rail safety
- Photobiomodulation
- Exploration of Petroleum
- Flame Monitors
- Testing of Anesthesiology
- Gas detectors
- Moisture Analyzers
- Water analysis

3.1.5 SERVO MOTOR:



Fig.No:3.1.5.1 Servo Motor

- A **servo motor** is a type of motor that can rotate with great precision.
- Servo motor has 3 pins such as Vcc,Gnd,Control pin.
- In the developed system servo motor is used to open the lid

PIN CONFIGURATION OF SERVO MOTOR:

- Pin 1: **Brown** – Ground wire connected to the ground of system
- Pin 2: **Red** - Powers the motor typically +5V is used
- Pin 3 : **Orange** – PWM signal is given through this wire to drive the motor.

FEATURES AND SPECIFICATIONS:

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Gear Type: Plastic
- Rotation : 0°-180°
- Weight of motor : 9gm

APPLICATIONS OF SERVO MOTOR :

- **Cameras:** Cameras focus images with a tiny, very precise servo motor that corrects the lens as necessary to sharpen images until they're in focus.
- **Metalworking:** When most people think of metalworking, they may think of diecasts, lathes and other cutting, shaping and melting machines. However, servo motors can be an extremely important element in many of these machines, providing the precise control necessary to fabricate certain items, such as those used in the aerospace or automotive industries.
- **Woodworking:** By the same token, mass production of specific wood shapes, like various furniture items, can be greatly accelerated without losing precision through the application of machines using servo motors.
- **Solar array and antenna positioning:** Servo motors are the perfect mechanism for moving solar panels into place and allowing them to keep following the sun or rotating antennae to make sure they're getting the best signal reception possible.
- **Rocket ships:** Any number of processes in aerospace may owe their functioning to the precise positioning and rotation enabled by servo motors.
- **Robot pets:** It's true. Roboticists have made great strides in building robotic dogs and cats that use servo motors to get around extremely effectively without falling over (and with the ability to get back up when they do). You wouldn't mistake one for your own beloved Fido or Puss 'n' Boots, but it's pretty incredible what these pets can do with a few servo motors helping them along.
- **Textiles:** Just as with metal and woodworking, servo motors are not the first thing that comes to mind when people think of textile production. But of course, like most of today's major industries, the textile industry has moved far beyond a bunch of workers sitting in rows weaving. The textile industry uses complex weaving, knitting and spinning machines to make today's fabrics and the blankets, drapes and articles of clothing that come from them, and servo motors are a crucial element in making those machines run properly.

- **Automatic doors:** You didn't think those doors that open as soon as you approach them at the grocery store or the airport do it by magic, did you? The action of pulling the doors open and closed can be attributed to servo motors inside the door. They're connected to sensors that let them know when to jump into action.
- **Remote control toys:** Certain modern toys are another great application for servo motors. Many of today's motorized toy cars, planes and even tiny robots have servo motors in them that allow children to control them.
- **Printing presses:** When someone is printing a newspaper, magazine or other mass-printed item, it's essential for them to be able to move the printing head to precise locations on the page to make sure the print appears in the layout precisely as planned. Servo motors allow printers to make sure this process goes smoothly and everything ends up in its proper place.

3.1.6DC MOTOR AND WHEEL:



Fig.No: 3.1.6.1 Dc Motor and Wheel

DC Gear motors are connected to the wheels and motor driver
We use **4 DC MOTORS** and **4 WHEELS** to the system

PIN CONFIGURATIONS OF DC MOTOR:

- PIN 1- Positive
- PIN 2 - Negative

FEATURES AND SPECIFICATIONS:

- Frame sizes from 8 to 35 mm
- Speeds from 5,000 to 14,000 rpm
- Continuous motor torque - 0.36 to 160 mNm
- Coreless rotor design
- Low rotor inertia
- REE coil
- High power to weight ratio
- Neodymium magnet available in some brush DC motor models
- Sleeve and ball bearing versions

- High motion efficiency, that allows you to build a more compact, precise and energy-efficient solution

Types of DC motors :

- Permanent Magnet DC Motor (PMDC Motor)
- Separately Excited DC Motor
- Self Excited DC Motor
- Shunt Wound DC Motor
- Series Wound DC Motor
- Compound Wound DC Motor
- Short shunt DC Motor
- Long shunt DC Motor
- Differential Compound DC Motor

Applications of DC MOTOR:

- DC series motor is suitable for both high and low power drives, for fixed and variable speed electric drives. This type of motor has simple construction. Also, it is easy for design and maintenance.
- Because of its high starting torque, this motor uses in the cheap toys and automotive applications such as,
 - Cranes
 - Air compressor
 - Lifts
 - Elevators
 - Winching system
 - Electric traction
 - Hair drier
 - Vacuum cleaner and in speed regulation application
 - power tools

3.1.7BREADBOARD AND JUMPER WIRES:

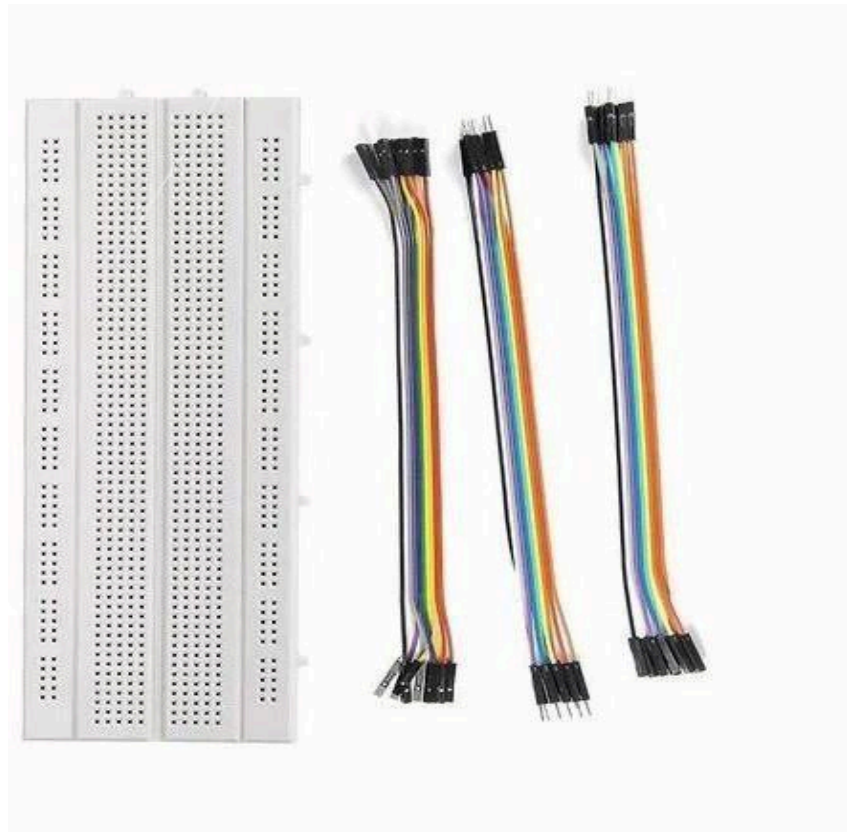


Fig.No :3.1.7.1 Breadboard and Jumper Wires

- Breadboard and jumper wires are used to connect components
- The arrangement of different components on a breadboard can be done by inserting their terminals into the breadboard, so it is frequently known as a plugboard.
- Breadboard definition is a plastic board in rectangular shape that includes a lot of small holes in it to allow components to build an electronic circuit is known as a breadboard.
- The connection on the breadboard is not permanent but they can be connected without soldering the components.

3.2 SOFTWARE REQUIREMENTS:

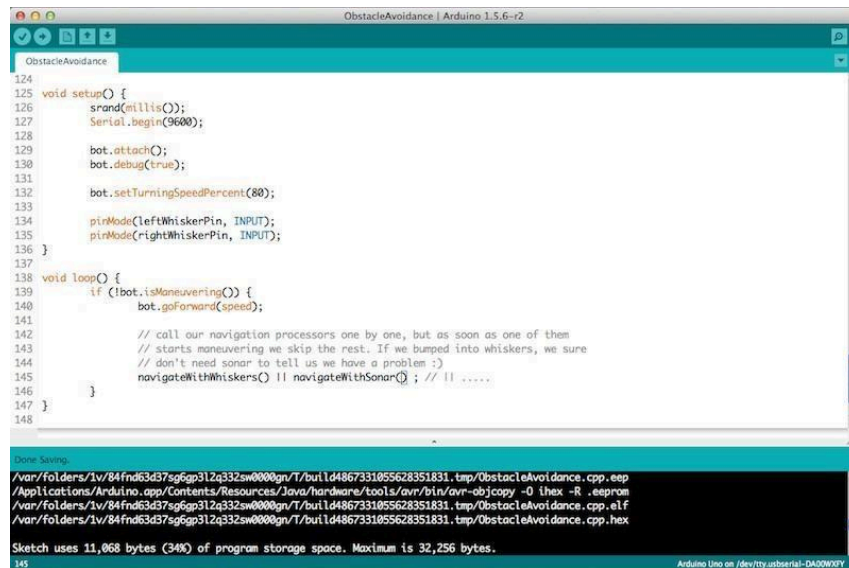
3.2.1 BLYNK IOT APP :



Fig.No 3.2.1.1 Blynk IOT app

- Blynk app is an app that is used to develop an interface connect with devices and control them.
- We can connect our devices to the Blynk app by using the Blynk Auth token
- In order to connect our smart device to Blynk through internet we need to give the Auth Token in the Arduino code .
- In the code we have to specify the details about the virtual number Through which we create buttons ,Gauge widgets to access and monitor our system using Internet

3.2.2 ARDUINO IDE 2.2.1:



```
124
125 void setup() {
126     srand(millis());
127     Serial.begin(9600);
128
129     bot.attach();
130     bot.debug(true);
131
132     bot.setTurningSpeedPercent(80);
133
134     pinMode(leftWhiskerPin, INPUT);
135     pinMode(rightWhiskerPin, INPUT);
136 }
137
138 void loop() {
139     if (!bot.isManeuvering()) {
140         bot.goForward(speed);
141
142         // call our navigation processors one by one, but as soon as one of them
143         // starts maneuvering we skip the rest. If we bumped into whiskers, we sure
144         // don't need sonar to tell us we have a problem :)
145         navigateWithWhiskers() || navigateWithSonar(); // !! .....
146     }
147 }
148
```

Done Saving.

/var/folders/1v/84fnd63d37sg6gp3l2q332sw0000gn/T/build4867331055628351831.tmp/ObstacleAvoidance.cpp.eep
/Applications/Arduino.app/Contents/Resources/Java/hardware/tools/avr/bin/avr-objcopy -O ihex -R .eeprom
/var/folders/1v/84fnd63d37sg6gp3l2q332sw0000gn/T/build4867331055628351831.tmp/ObstacleAvoidance.cpp.elf
/var/folders/1v/84fnd63d37sg6gp3l2q332sw0000gn/T/build4867331055628351831.tmp/ObstacleAvoidance.cpp.hex

Sketch uses 11,068 bytes (34%) of program storage space. Maximum is 32,256 bytes.

145

Arduino Uno on /dev/tty.usbserial-D40W0F0Y

FIG NO:3.2.2 Arduino IDE 2.2.1

- The **ARDUINO IDE** (Integrated Development Environment) is used to write the code and upload this code to the physical board.
- For programming our system we used **ARDUINO IDE 2.2.1**
- In the beginning of the code first we have to define the pins of microcontroller to which we are connecting various devices.
- After defining next we have to include libraries like Blynk SimpleESP8266.h
ESP8266Wifi.h
- In Arduino IDE programming we use two functions void loop () and void setup()
- In void setup we use pinMode () which says which pin is used for input and which pin is used for output.
- void loop() function is used to give statements that we need to continuously use it as a loop .
- In this function we use two functions digitalWrite () and digitalRead()

CHAPTER 4

DESCRIPTION OF THE PROPOSED SYSTEM

4.1 DESCRIPTION OF THE SYSTEM:

From the literature survey of the recent papers we can conclude that smart bins were developed to check the status and alert the user when it is full, receiving voice commands through Bluetooth and moving accordingly. These systems may not be much effective as it have less features and uses technologies that covers less distance. Considering the necessity of waste disposal of elderly and physically challenged people movable dustbin is developed in this project which is a IOT based smart dustbin. The movements of the bin can be controlled through buttons displayed in the Blynk app .The Interface of Blynk app developed as a part of this project have Forward, Backward, Right, Left buttons and also the level of the trash filled is displayed in percentage. The user can click the Button the command signal then goes from Blynk app to NodeMCU. The NodeMCU then sends the signal to motor driver and then the motor driver in turn sends the signal to motor and the smart bin moves based on the command. When the bin comes near to the user the lid opens based on the presence of trash. The level of the trash filled is also displayed using the Blynk app interface

4.2 TECHNOLOGY USED:

In this system we used a technology:

IOT [Internet Of Things]:



Fig.No:4.2.1 IOT Technology

- IOT is a technology that is used to connect various devices using Internet in order to develop smart systems.
- The term IOT, or Internet of Things, refers to the collective network connected devices and the technology that facilitates communication between devices and the cloud as well as between the devices themselves.
- An IoT ecosystem consists of web-enabled smart devices that use embedded systems such as processors, sensors and communication hardware to collect, send and act on data they acquire from their environments
- IOT is used along with many other technologies like Machine Learning, Deep Learning, Cloud Computing and Big Data Analytics.

- In the field of Agriculture ,Fleet Management ,Health care , Transport IOT technology is extensively used .
- Some Examples of IOT based systems are IOT based fire extinguisher, IOT based theft alert system.

IOT USED IN VARIOUS FIELDS:

IOT technology is used in various fields. Due to the implementation of IOT in various devices It has reduced a lot of human effort and time.

APPLICATIONS OF IOT TECHNOLOGY:

1. FIRE SAFETY DEPARTMENT :

- In fire safety department IOT technology is used to send robots to the fireplace and extinguish the fire without the involvement of humans
- This reduces the human loss and avoid humans getting intoxicated to toxic gases

2. TRANSPORT DEPARTMENT :

- In highways IOT technology is used to automatically detect the car's number and bill the toll fee in the user's account.
- By this we can avoid human errors and save a lot of human effort .

3. CORPORATE COMPANIES:

- In Corporate companies IOT technology is used for recording the attendance of the employee with their ID card.
- By this we can avoid a lot of human error and also can reduce a lot of human time.

4. HEALTHCARE INDUSTRY:

- In healthcare IOT technology is used in health monitoring devices in order to identify the diseases beforehand and also to monitor the health status of the patients .
- By this we can monitor the health status of elderly people .

4.3 BLOCK DIAGRAM

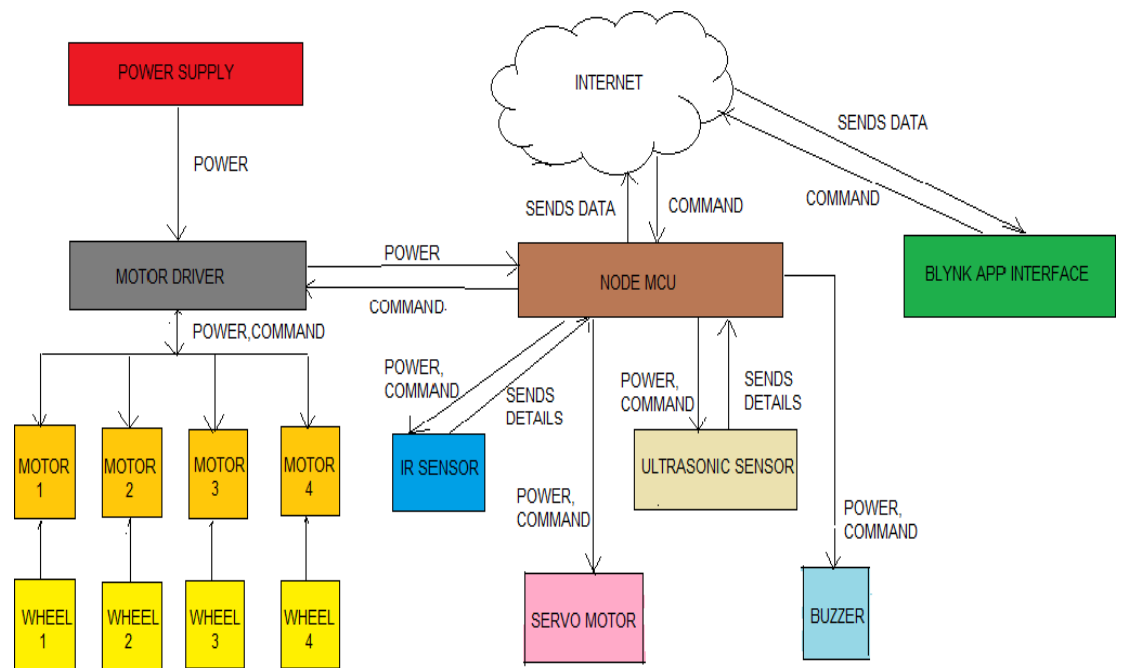


Fig.No :4.3.1 Block Diagram

- The microcontroller NODEMCU ESP8266 and the BLYNK IOT application is connected using internet .Power supply is provided to the dustbin using 12V battery which is formed by 3.7V batteries connected in series.
- The NODEMCU ESP8266 microcontroller is programmed in such a way that the movements can be controlled using the buttons of user developed GUI and the lid opens based on the detection of trash , displays the percentage of filled trash in the user developed GUI. Using the commands (Forward , Backward, Left, Right) movements of the dustbin can be controlled using user developed GUI at Blynk IOT application.
- When the dustbin is in no movement IR sensor checks for the presence of any obstacle (trash).If there is any trash detected then the signal goes to the servo motor via microcontroller .

- If trash detected then the servo motor knob takes a swing of 90 degrees by which the lid attached to the knob also opens for 3 seconds and then closes.
- The Ultrasonic sensor constantly measures the level of the trash inside the bin and the percentage of the filled trash is calculated using the distance.
- After which the percentage is displayed in the user developed GUI of Blynk IOT application

4.4 SYSTEM ARCHITECHTURE DIAGRAM:

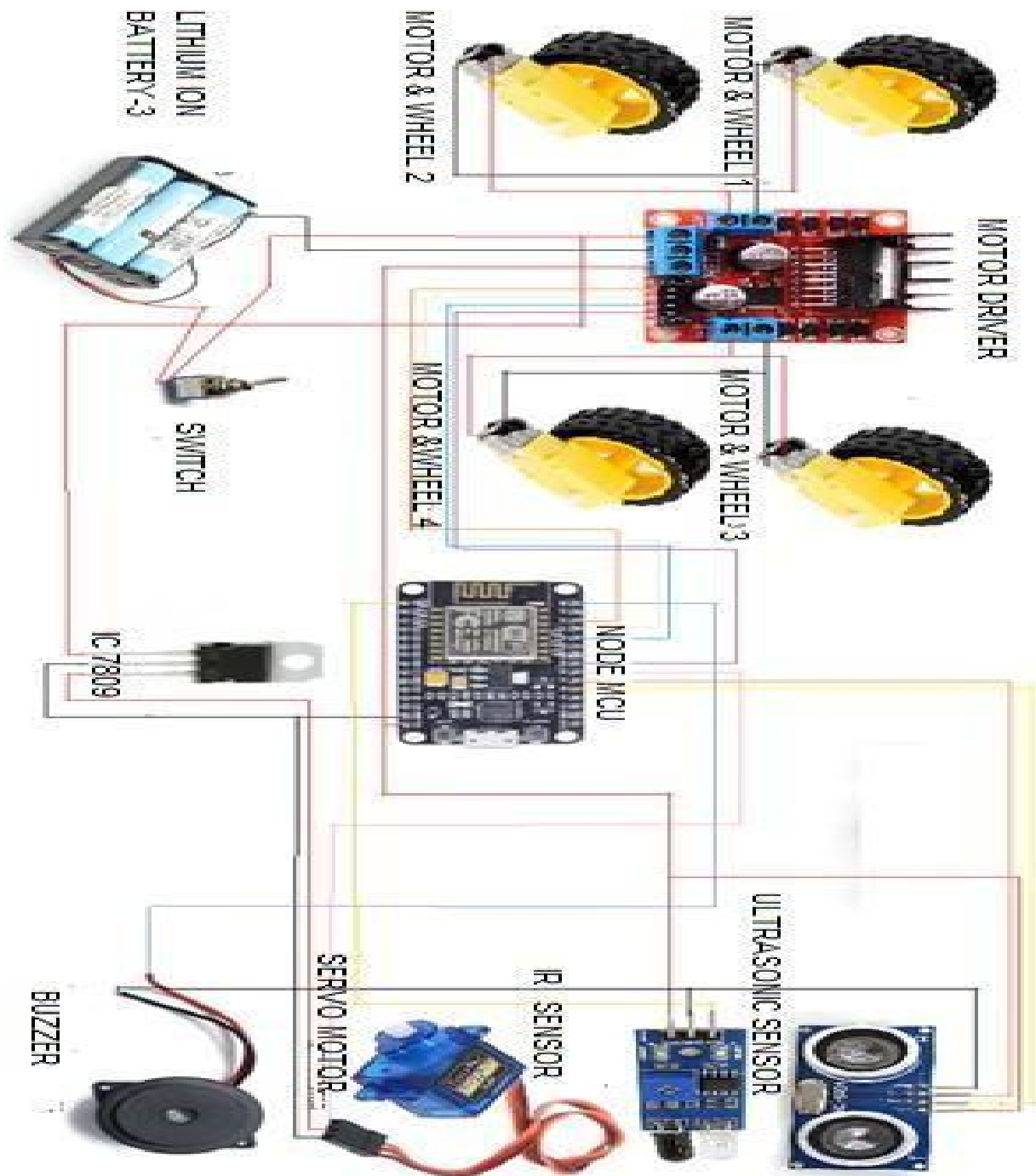


Fig. No :4.4.1 System Architechture Diagram

4.5 WORKING MECHANISM :

4.5.1 FLOWCHART:

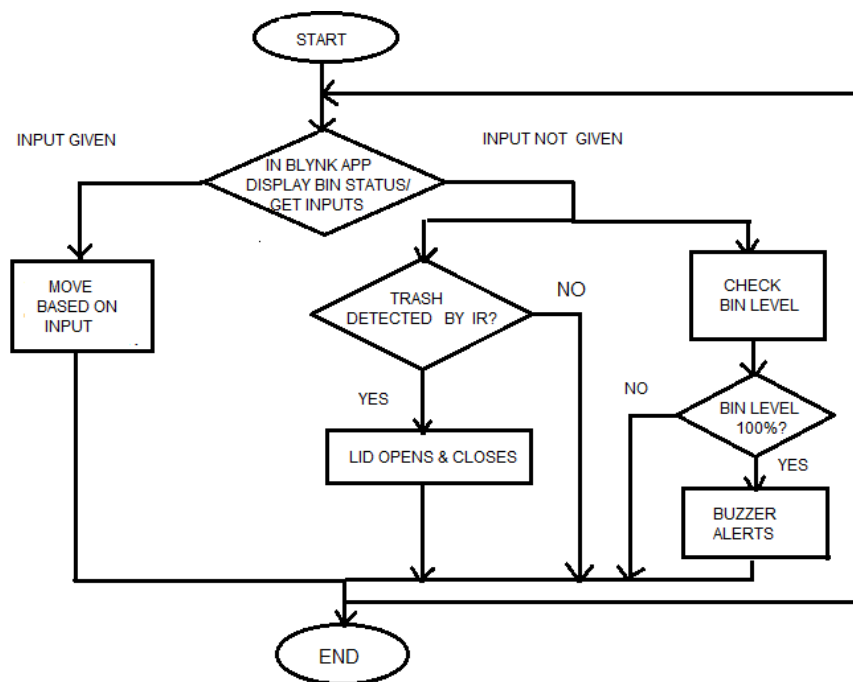


Fig. No :4.5.1 FLOWCHART

WORKING:

The proposed system has three features :

- Automatic lid open/close
- Movement through Button[Blynk app]
- Display of trash filled.

AUTOMATIC LID OPEN /CLOSE:

- We have developed a smart dustbin which opens and closes based on the presence of trash.
- The presence of trash is detected by the infrared sensor after which it sends signal by which the (servo motor) open the lid
- By using the ultrasonic sensor we get the distance between the trash and the sensor and with that the level of the bin is calculated.
- The level of the bin is also displayed in the Blynk app's interface

MOVEMENT THROUGH BUTTON CLICK:

- We use Blynk app in order to receive the button commands from the user
- First we develop an interface and develop buttons using widgets
- The user clicks a button.
- When the user clicks the button the command signal then goes on to the NodeMCU
- The NodeMCU sends the command to Motor, after which the motor gets activated and the smart dustbin moves based on the command.

DISPLAY OF TRASH FILLED:

- The ultrasonic sensor is placed near the lid of the bin
- The distance between the trash and the ultrasonic sensor is measured using the sensor
- The distance measured is then converted to percentage and displayed to the user by the blynk app interface.

CHAPTER 5

RESULTS, DISCUSSION

4.4 RESULTS:

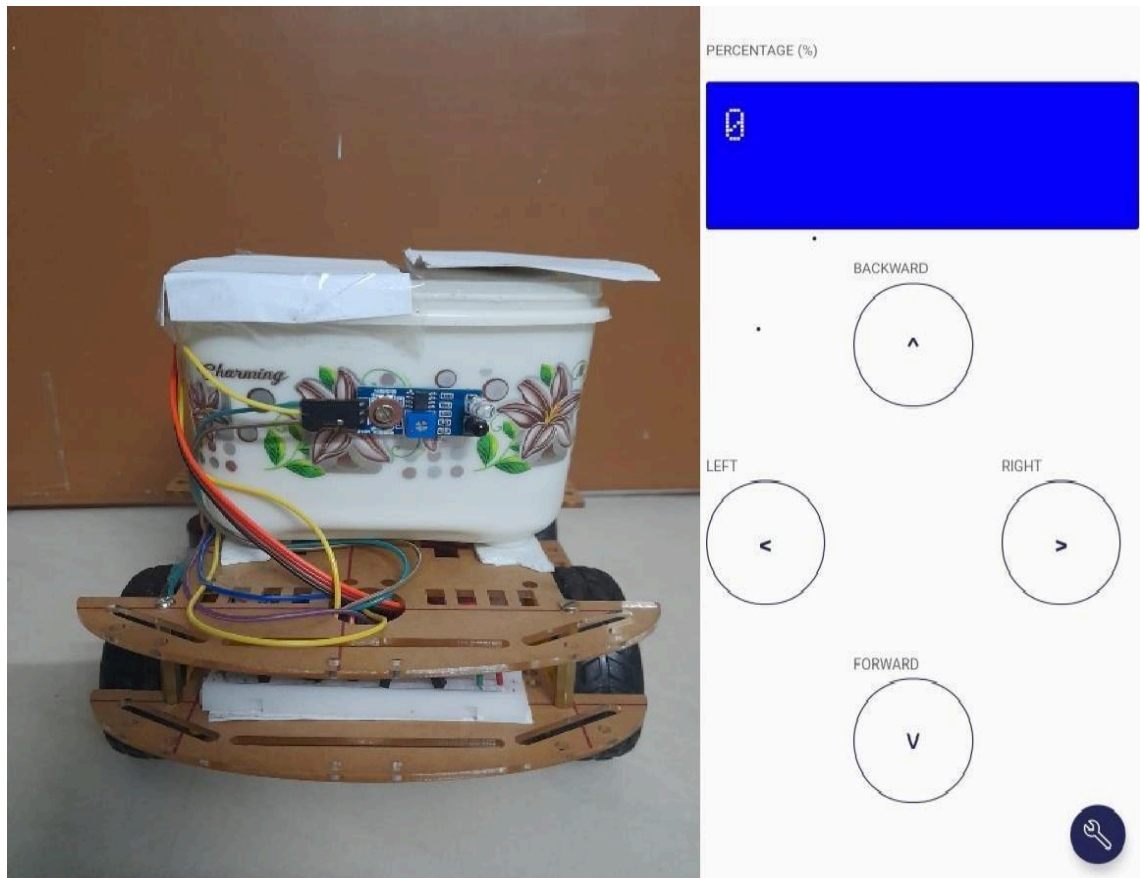


Fig No :5.1.1 Model Of Smart Dustbin

- The commands to the dustbin can be given by using the buttons available at the user developed Blynk IOT interface .
- In this model the buttons such as Forward, Backward, Left, Right are customized in such a way that we can operate when the dustbin is towards us.
- The IR sensor detects trash and opens the lid only when the model is in no movement of dustbin

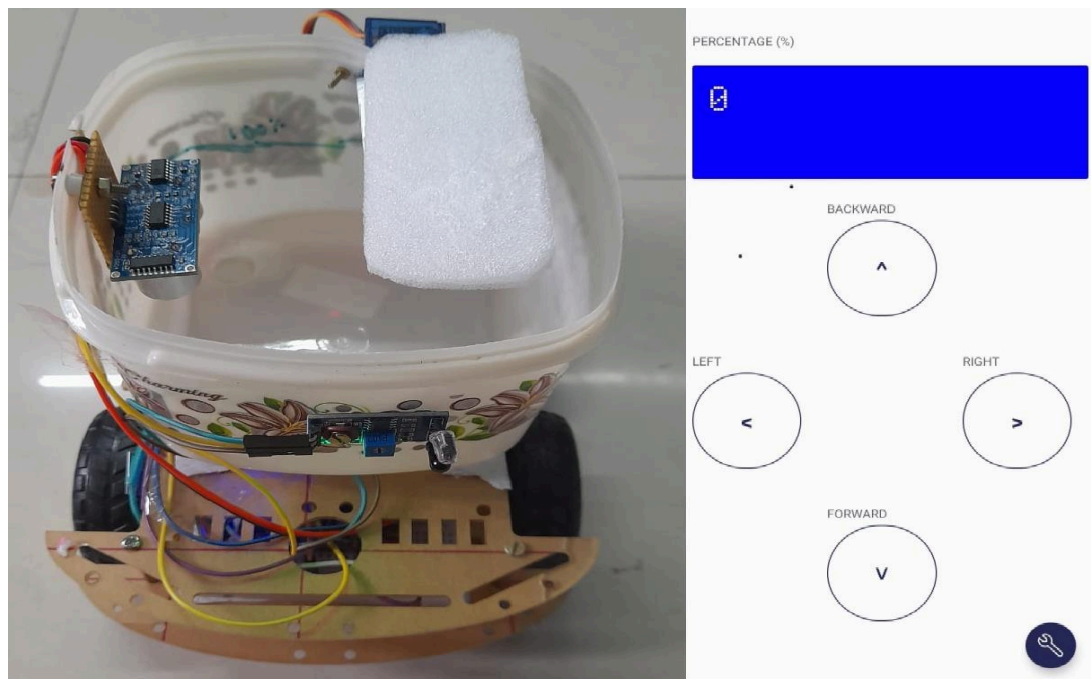


Fig .No.5.1.2 Trash level-0%



Fig No.5.1.3 Trash level - 50%

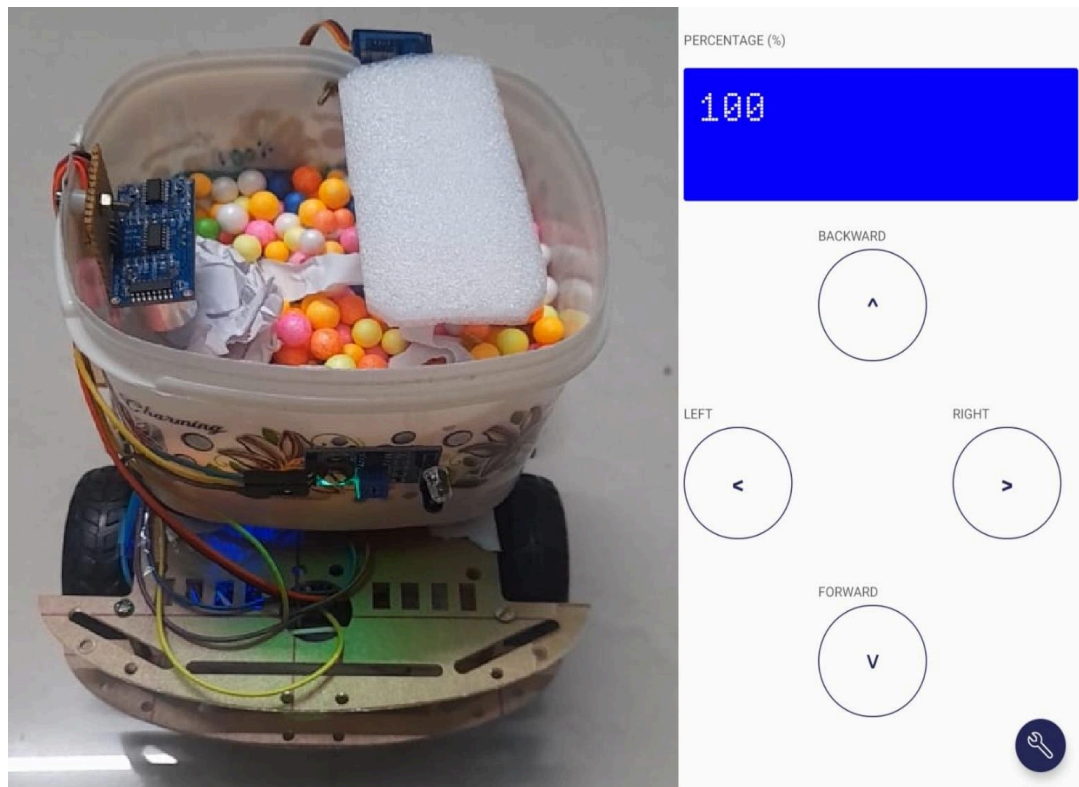


Fig No.5.1.4 Trash Level-100%

5.2 DISCUSSION

- The entire depth of the dustbin was around 6 centimeters(cm).
- When there is no trash the developed GUI displays zero percentage, when the trash reaches half-filled level 50 percentage is displayed .
- When the trash level reaches the full filled level 100 percentage is displayed along with the buzzer played for 3 seconds with a 2 second interval .

CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 CONCLUSION:

- The aforementioned Dustbin model is an important step towards Indian government's Swachh Bharat Abhiyan.
- It focuses on making a dustbin movable.
- The Smart Dustbin aims to help physically challenged people and elderly people to dispose waste and also constantly displays the percentage of trash filled and alerts using buzzer when the dustbin is full
- When compared to old techniques, the features such as automated lid opening, trash level detection, and dynamic mobility of the Dustbin will lessen the amount of labor needed from humans to dispose of waste.
- There are still certain problems, such the unpleasant smell and the manual control that may limit the dustbin's mobility, that may hopefully be resolved in later dustbin models.

6.2 FUTURE WORK:

- In the future, route finding algorithms can be used to cover all users and choose the shortest route in order to satisfy the need for an autonomous dustbin.
- The robot's motor can be improved for faster and more durable performance, and it can be updated to link more people in public areas.
- For recharging the battery after it runs out, a charging port can also be included

REFERENCES:-

- [1] Vijay Babu K , Vivek Gowda J , Mrs Yeshwini (2021) , Smart Garbage Monitoring System,International Advanced Research Journal in Science, Engineering and Technology
- [2] Srinivasan, P., Thiyaneswaran, B., Jaya Priya, P., Dharani, B., & Kiruthigaa, V. (2021). IOT based smart dustbin. Annals of the Romanian Society for Cell Biology, 7834-7840
- [3] Y.Appa Rao, A.Narayana Murthy, D.Subhakar, P.Veera Babu(2023),IOT Based Smart Waste Monitoring System, International Research Journal of Engineering and Technology (IRJET)
- [4] Dr. Sudha L K, Mohammed Tahir, Ruchitha E, Varshini R, Syed Saif Ali(2023) "Smart Dustbin Monitoring System using Arduino UNO ,International Journal of Engineering Research & Technology (IJERT)
- [5] Diksha Pagare, Nikhil Nikam, Pratik Chinchore, Prof.Y.S.Rathod ,(2023),Smart Dustbin Reverse Vending Reward Machine,International Journal Of Multidisciplinary Research In Science, Engineering and Technology (*IJMRSET*).
- [6] Prof. Pooja V Pawar, Harshali Bodkhe, Ajaykumar Motikar, Shivani Tonape, Vishal Lonkar(2023),Smart Dustbin With IOT ,International Research Journal of Modernization in Engineering Technology and Science
- [7] Chinmay Kolhatar, Prachichowdari,Bhaves Josh, Dhruvin Bhuva (2018),Smart E-Dustbin, IEEE Xplore

APPENDIX

A SOURCE CODE:

```
#define BLYNK_TEMPLATE_ID "TMPL3R_RZ6-VY"
#define BLYNK_TEMPLATE_NAME "binbot"
#define BLYNK_AUTH_TOKEN
"yv_SdkYn7ssouLjRFLVVRsu4Vkf91UDw" #define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include<BlynkSimpleEsp8266
. h> #include <Servo.h>
#define buzzerPin
D0 #define IN1 D2
#define IN2 D3
#define IN3 D4
#define IN4 D5
#define trigPin D8
#define echoPin
D7 #define
servoPin D6
#define irPin A0
bool forward =
0; bool
backward = 0;
bool left = 0;
bool right
=0; int
Speed;
int
trashCapacity;
int duration,
distance=0;
int
percentag
e;
char auth[] = BLYNK_AUTH_TOKEN; // Blynk application auth token char
ssid[] = "Hotspot"; //WIFI name
char pass[] = "12345679"; // WIFI
password Servo myservo;
const int infraredSensorPin = 14;
WidgetLCD lcd(V4);
void setup() {
pinMode(infraredSensorPin, INPUT);
Serial.begin(9600);
pinMode(IN1,OUTPUT);
pinMode(IN2,OUTPUT);
pinMode(IN3,OUTPUT);
pinMode(IN4,OUTPUT);
pinMode(trigPin, OUTPUT);
pinMode(buzzerPin,
OUTPUT);
pinMode(echoPin, INPUT);
```

```
pinMode(servoPin,
OUTPUT);
myservo.attach(servoPin);
myservo.write(0);
Blynk.begin(auth, ssid,
pass);
}
```

```
BLYNK_WRITE(V0) {
    forward = param.asInt();
}
```

```
BLYNK_WRITE(V1) {
    backward = param.asInt();
}
```

```
BLYNK_WRITE(V2) {
    left = param.asInt();
}
```

```
BLYNK_WRITE(V3) {
    right = param.asInt();
}
```

```
}
```

```
BLYNK_WRITE(V5) {
trashCapacity =
distance;
}
```

```
void smartcar() {
    if (forward == 1)
    {carforward();
        Serial.println("carforward");
    }else if(backward
        == 1)
        {carbackward();
```

```
Serial.println("carback
ward ");
```

```
    } else if (left == 1) {
        carturnleft();
```

```
Serial.println("carfleft");
```

```
    } else if (right
        == 1) {
        carturnright();
        Serial.println("
car right");
```

```
    } else if (forward == 0 && backward == 0 && left == 0 && right == 0) {
```

```

carStop();
Serial.println("car stop "); irFn();
    Serial.println("ir execution on car stop");
    }else{
        irFn();
        Serial.println("ir execution");
    }
}
void loop() {
Blynk.run();
Blynk.virtualWrite(V4,percentage); smartcar();

}

void irFn(){
    if(analogRead(irPin)<=500)
    { myservo.write(180);
      delay(500);
      ultrasonicFn();
    }else{
        myservo.write(0);
        delay(1000);
        ultrasonicFn();
    }
}

void servoAction(){
    myservo.write(180);
    delay(1000);
    myservo.write(0);
    delay(1000);
}

void ultrasonicFn1(){
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);
    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    ; digitalWrite(trigPin, LOW);
    duration = pulseIn(echoPin, HIGH);
    distance = (duration / 2) / 29.1;
}

```

```

    lcd.print(7,1,distance);

}

void ultrasonicFn(){
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);
    digitalWrite(trigPin,
    HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
    duration =
    pulseIn(echoPin, HIGH);
    distance = (duration / 2) / 29.1;
    Serial.println(distance);
    if (distance > 6 || distance <= 0)
    {
        Serial.println("Object out of
        range"); delay(500);
    }
    else
    {
        Serial.print(distance);
        Serial.println(" cm");
        percentage=100-((distance*100)/
        4); percentage=percentage*2;
        Serial.println("percentage====");
        Serial.println(percentage);
        delay(100);
    }
    delay(500);
    if(percentage>=70){
        digitalWrite(buzzerPin,HIG
        H); delay(2000);
        digitalWrite(buzzerPin,LO
        W); delay(1000);
    }else
    {
        digitalWrite(buzz
        e rPin,LOW);
        delay(1000);
    }
}

void carforward() {

```

```

digitalWrite(IN1,
LOW);
digitalWrite(IN2,
HIGH);
digitalWrite(IN3,
HIGH);
digitalWrite(IN4,
LOW);
    }
void carbackward()
{
    digitalWrite(IN1,
HIGH);
    digitalWrite(IN2,
LOW);
    digitalWrite(IN3,
LOW);
    digitalWrite(IN4,
HIGH);
}
void carturnleft() {
digitalWrite(IN1,
HIGH);
digitalWrite(IN2,
LOW);
digitalWrite(IN3,
HIGH);
digitalWrite(IN4,
LOW);
}
void carturnright() {
digitalWrite(IN1,
LOW);
digitalWrite(IN2,
HIGH);
digitalWrite(IN3,
LOW);
digitalWrite(IN4,
HIGH);
}
void carStop() {
digitalWrite(IN1,
LOW);
digitalWrite(IN2,
LOW);
digitalWrite(IN3,
LOW);
digitalWrite(IN4,LOW
W);
    }

```

B SCREENSHOTS:



Fig.No.B.1 Prototype of Smart Dustbin

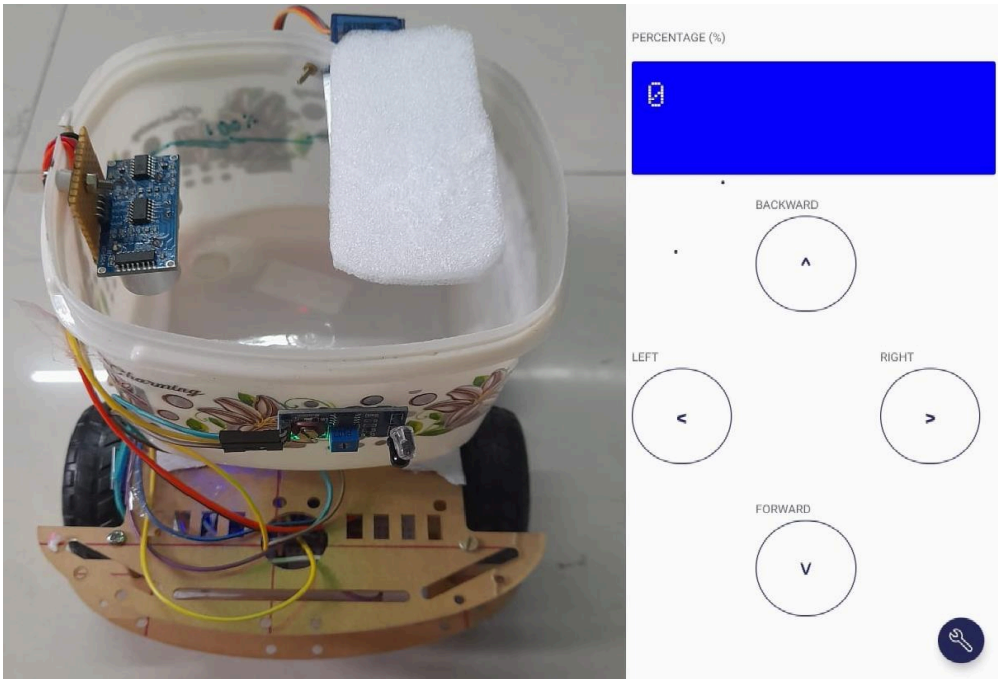


Fig.No.B2.BIN EMPTY



Fig.no.B2.Bin Half filled

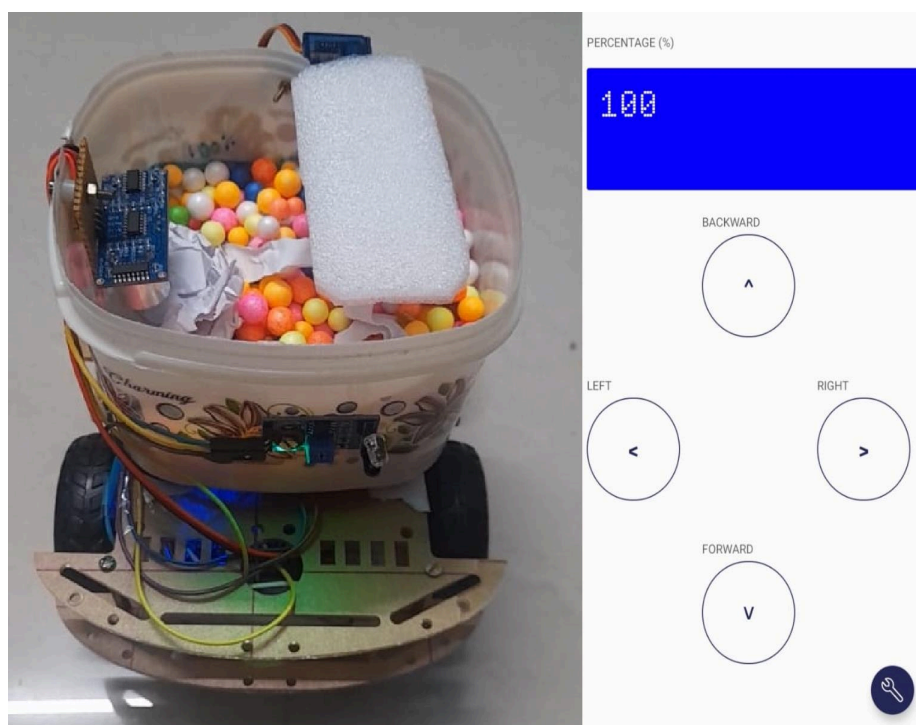


Fig.No.B3.Bin Fully filled

IOT BASED MOVABLE SMART DUSTBIN USING BLYNK IOT APPLICATION

Pavithra .B
Department of Computer Science
and Engineering Sathyabama Institute of
Science and
Technology,
Chennai, India-600119
pavithrabalrajsat@gmail.com

M.Selvi Department of
Computer Science and Engineering,
Sathyabama Institute of Science and
Technology,
Chennai, India-600119
selvi.cse@sathyabama.ac.in

G.
Ka
lai
ara
si
De
pa
rt
me
nt
of
Computer Science and
Engineering,
Sathyabama Institute of
Science and Technology,
Chennai,
India-600119
kalaiaarasi.cse@sathy
abama.ac.in

R
.Y
og
ith
a
De
pa
rt
m
en
t
of
Computer Science and
Engineering.
Sathyabama Institute of
Science and Technology,
Chennai, India -600119
yogitha.cse@sathyabama.ac.in

Abstract— Iot is a technology that uses internet medium for communicating within electronic devices. It also uses sensors, actuators in order to enhance the usage . The movable dustbin developed in this paper is an Iot based model. The existing systems of movable dustbins majorly focusses on movement of dustbin based on user commands which may not be suitable for deaf-mute people. The proposed system focusses on moving the dustbin based on the user's button commands and displaying level of trash filled in user developed interface of BLYNK IOT app. The lid opens when trash detected and closes after a specified time. In this paper, Nodemcu microcontroller has been used which is better than Arduino board. This model will be useful for elderly and physically challenged people

Keywords- Nodemcu, Arduino, BLYNK IOT, Sensor

I.INTRODUCTION

IOT is a technology that uses internet to connect, control, manage electronic devices. By using IOT technology in our daily used products timely updates can be received and also be used based on our convenience. For a developing country like India, waste disposal plays a major role for the development. In our country , disposal and management of waste is becoming a challenging issue. The earlier Dustbin

versions were designed with the intention of addressing certain waste management issues.

The next generation's fundamental demand is hygiene, and hygiene starts with our immediate environment. Due to improper disposal of waste many deadly diseases spread which can affect both animals and humans. The major reason for the improper disposal of trash is the lack of facility in bins

. Along the roadside the overflow of bins has also affected the animals such as dogs and cows which consume the trash. The overflow of bin has also affected the water management systems by contaminating the water bodies nearby. In India total waste generated per year is 60 million tonnes of which 10 million tonnes of waste are produced alone in India's major cities. This is an enormous amount of rubbish, which the authorities take extremely seriously and work hard to control. Most nations agree that the "waste management hierarchy" is the first stage in creating a policy for the control of Municipal Solid Waste (MSW). Many times, Garbage is tossed outside of regular dustbins because people are generally observed to be the least responsible when using them. Because of the smart Dustbin's immobility, dustbin location is also a significant problem.

The waste produced on a daily basis is referred to as household waste. Similar to any industrial setting handling potentially hazardous products, homes also utilize and discard dangerous materials. Because of the chemicals in the waste, our home becomes dangerous if waste is not disposed

of properly. It could corrode, explode, or ignite. The waste can be disposed of improperly by being thrown on the ground, into storm sewers, or down the drain. Certain HHW kinds have the potential to endanger small children and pets if left out in the open within the home, even though it may not be immediately apparent that these materials once disposed of can be hazardous. As the harmful microorganisms are growing quickly, exposure to the hazardous waste would be extremely dangerous for both humans and animals. Segregation system of hazardous waste from nonhazardous waste is rare. An estimated 540 million tonnes of Municipal Solid Waste (MSW) are produced annually in countries that are members of the Organization for Economic Cooperation and Development (OECD), with household trash making up 67% of the total amount of trash. The estimated quantity of HHW fluctuates greatly because it's not always obvious what exactly qualifies as home waste as opposed to MSW. When HHW is disposed of improperly, it releases toxic substances into the environment that are unable to be eliminated by treatment facilities and end up in the tissues of people, animals, and plants. Inadequate disposal can take several forms, such as emptying the contents into the trash, down the drain, or even onto the ground outside. So in order to maintain clean environment household waste maintenance plays a major role.

The previous researchers have majorly focused on adding certain features like constantly displaying the status of the bin through LCD display , mobile application , sending alert messages to GSM , figuring out the quickest way to gather Dustbins, rewarding the user based on the trash disposed. The models developed previously mainly focuses on finding short routes to reach bins , getting bin fullness status alert through GSM . In One domestically used bin model , the model can move based on voice commands given through Bluetooth which is less efficient than Internet . It's a high time that we focus on adding features to bin to make the bin user-friendly to physically challenged and elderly people.

The purpose of this paper is to design an efficient smart dustbin that can be adjusted to the user's needs and have its level continuously monitored. The main requirement of a clean lifestyle is having a proper waste disposal system. Smart Dustbins can be efficient only when it is accessible for all people. The model developed in this paper is suitable even for physically challenged and elderly people.

II. LITERATURE REVIEW

Sending alert message [1] when the trash level meets the threshold is a very important aspect. In this model when the trash reaches the threshold level alert email is sent using IFTT and webhooks.

In this model [2] the level of the bin is displayed through LCD and sends alert message along with location using GSM when the trash reaches the threshold level.

To avoid overflowing [3] alert signals are needed when bin is full. This model has been developed to avoid

overflow of dustbins. Municipal employees receive a warning message by GPRS module and Internet media that includes temperature, moisture content, and trash level when the bin's contents exceed a certain level.

In this model [4] the level of the trash is constantly checked . If level of the bin reaches a particular level the bin gets locked and then the alert message through GSM is sent to the officials. If cleaning process not done within stipulated time then the message is sent to higher officials.

This model [5] detects the presence of trash using PIR sensor ,monitors the level of bin using Ultrasonic Sensor and displays the level at LCD display ,has automatic lighting system at night and detects presence of any harmful gases.

In this model [6] Arduino board is used as the microcontroller. PIR sensors is used to detect trash/human motion and based on the signal from the sensor the servo motor opens the lid. Ultrasonic sensor is used to measure the level of trash. It sends messages regarding the status of the bin using GSM at regular intervals

This model [7] has been developed in order to reward the user who drops the waste in the bin. The model encourages people to dispose waste properly.

Many type of waste are collected inside a bin In order to make a effective disposal system we need effective segregation process. In this model [8] the trash received by the bin is segregated as wet waste and dry waste .

This model[9] uses LORAWAN and Blockchain technologies to send details such as volume and location of the bin to the authorized user.

LORAWAN technology is used for less-power consumption [10]. In this model the information of filling of trash in the public bins are collected, analyzed after which optimized trash collecting routes are generated. Information about the waste container's weight, filling volume, and temperature is sent to the authorities, who receive an alert in the event of an incidence.

In this model[11] there is a server where details of the public bins are saved .An individual bin user must update the bin status to the server using an android application which in turn will be viewed by authorities.

In this model[12] we have a monitoring system for public bins and home bins, the data is collected and sent to the central monitoring station for storing and analyzing data. To see and assess each garbage can's unfilled status, a graphical user interface is utilized.

This model [13] uses NodeMCU as microcontroller. There are two monitoring systems for public bin and home bin. This model also constantly checks the level of the trash and sends alert message using GSM and GPRS to the authorities. If action not taken then the message is sent to higher authorities

This model [14] helps us to measure level of trash and detect the presence of any harmful level of gases. If gas level exceeds a threshold value then buzzer plays and a notification to the user is sent through Blynk server . If the level of the trash exceeds the threshold value then a notification to the user is sent through Blynk server.

This model [15] is a voice controlled model of a dustbin that can move based on voice commands from the user. The microphone receives the voice command and sends it to microcontroller . The microcontroller then sends the signal to the motors for movements . Based on the detection of trash the servo motor can open the lid and close after certain time.

This model [16] travels along a predetermined route to gather trash and dispose of it in a collection spot. Ultrasonic sensor is used to detect the presence of trash based on by which servo motor opens the lid. Infrared sensor is used to measure the level of trash which is then stored in cloud and used for future analysis. This is best suitable for public bins.

In this model [17] the level of the public bins is communicated to center planning entity which then proposes a novel route based on the filling of bins. This saves a lot of human effort, time to maintain the public bins.

In this model [18] the data is collected from all dustbins and is analyzed and also. There is also an Android app available that allows users to locate the closest Dustbin and helps drivers to find the shortest route when picking up trash..

In this model [19] NodeMCU is used as microcontroller. Ultrasonic sensor is used to measure the level of trash which is displayed to the user by LCD display. When the level of trash is full then an alert email is sent to the concerned person.

This model [20] is an RFID based smart dustbin. To avoid explosives by terrorist this model allows to dispose the trash in the bin only by authorized users. When the user wants to use the bin then the tag must be taken near the reader, if authorization is verified then the bin opens. Solar power is used in order to provide power to the smart bin.

III. PROPOSED SYSTEM

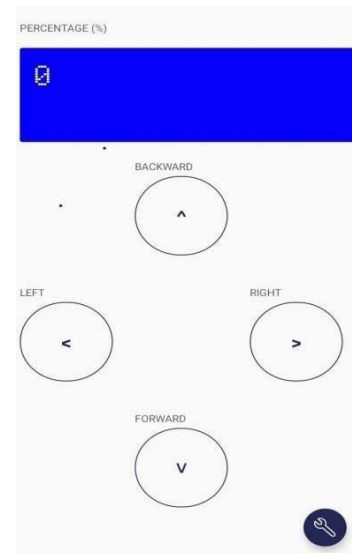


Fig. no.1: The proposed model

This paper is a model of IOT based model of a movable dustbin. Physically challenged people and elderly people who find difficult to walk can use this dustbin model in order to dispose their waste without moving from their place .In order to use the bin first the bin must be brought closer using the buttons displayed in user-developed GUI after which when the IR sensor detects the trash the lid opens and we can dispose the trash without contacting the dustbin. Constantly the level of the bin is also monitored which is measured using the Ultrasonic sensor and sent to the Blynk IOT application which then displays the percentage of trash using the user developed GUI .

ARCHITECHTURE DIAGRAM:

Fig. no.2: The architecture diagram of the proposed model

The microcontroller NODEMCU ESP8266 and the BLYNK IOT application is connected using internet. Power supply is

provided to the dustbin using 12V battery which is formed by 3.7V batteries connected in series. The NODEMCU ESP8266 microcontroller is programmed in such a way that the movements can be controlled using the buttons of user developed GUI and the lid opens based on the detection of trash, displays the percentage of filled trash in the user developed GUI. Using the commands (Forward, Backward, Left, Right) movements of the dustbin can be controlled using user developed GUI at Blynk IOT application. When the dustbin is in no movement IR sensor checks for the presence of any obstacle (trash). If there is any trash detected then the signal goes to the servo motor via microcontroller. If trash detected then the servo motor knob takes a swing of 90 degrees by which the lid attached to the knob also opens for 3 seconds and then closes. The Ultrasonic sensor constantly measures the level of the trash inside the bin and the percentage of the filled trash is calculated using the distance. After which the percentage is displayed in the user developed GUI of Blynk IOT application.

IV. RESULTS

The Ultrasonic sensor is connected to NodeMCU microcontroller. The Ultrasonic sensor is used to measure the level of trash disposed in the dustbin. The percentage of the trash filled (i.e. empty, half-filled and full filled) was calculated by measuring the distance between the Ultrasonic sensor and trash of the dustbin. The entire depth of the dustbin was around 6 centimeters(cm). When there is no trash the developed GUI displays zero percentage, when the trash reaches half-filled level 50 percentage is displayed .When the trash level reaches the full filled level 100 percentage is displayed along with the buzzer played for 3 seconds with a 2 second interval .

The commands to the dustbin can be given by using the buttons available at the user developed Blynk IOT interface .In this model the buttons such as Forward, Backward, Left, Right are customized in such a way that we can operate when the dustbin is towards us. The IR sensor detects trash and opens the lid only when the model is in no movement. This feature avoids the useless process of opening and closing of lid during the movement of the dustbin.

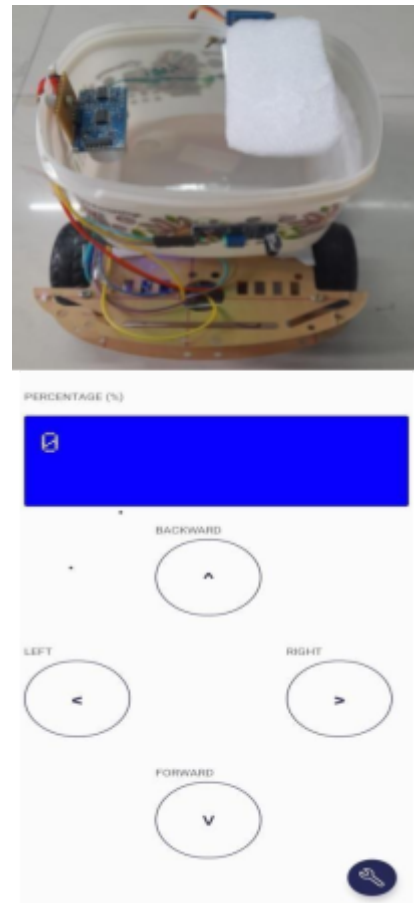


Fig. no.3: When the level of the bin is 0% (Empty)

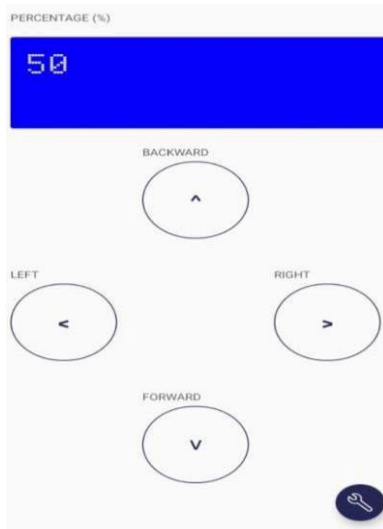


Fig. no.4: When the level of the trash is 50% (half-filled)

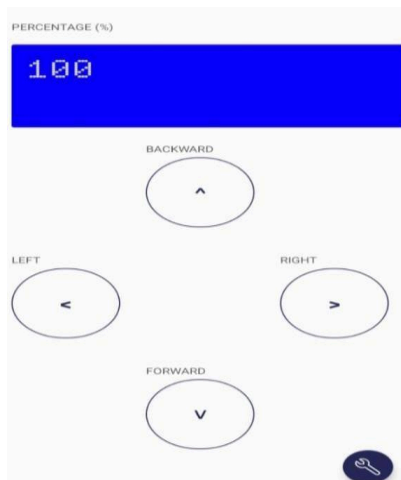
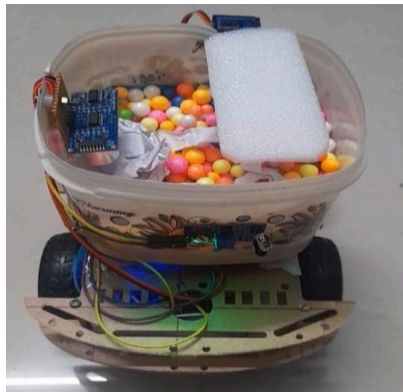


Fig. no. 5: When the level of the bin is 100% (fully-filled)

V. CONCLUSION:

The aforementioned Dustbin model is an important step towards Indian government's Swachh Bharat Abhiyan. It focuses on making a dustbin movable. The Smart Dustbin aims to help physically challenged people

and elderly people to dispose waste and also constantly displays the percentage of trash filled and alerts using buzzer when the dustbin is full. When compared to old techniques, the features such as automated lid opening, trash level detection, and dynamic mobility of the Dustbin will lessen the amount of labor needed from humans to dispose of waste. There are still certain problems, such as the unpleasant smell and the manual control that may limit the dustbin's mobility, that may hopefully be resolved in later dustbin models. In the future, route finding algorithms can be used to cover all users and choose the shortest route in order to satisfy the need for an autonomous dustbin. The robot's motor can be improved for faster and more durable performance, and it can be updated to link more people in public areas. For recharging the battery after it runs out, a charging port can also be included.

REFERENCES:

- [1] Srinivasan, P., Thiyaneswaran, B., Jaya Priya, P., Dharani, B., & Kiruthigaa, V. (2021). "IoT based smart dustbin". Annals of the Romanian Society for Cell Biology, 7834-7840
- [2] Prof. Pooja V Pawar, Harshali Bodkhe, Ajaykumar Motikar, Shivani Tonape, Vishal Lonkar (2023) "Smart Dustbin with IOT" International Research Journal of Modernization in Engineering Technology and Science(IRJMETS)
- [3] Y.Appa Rao, A.Narayana Murthy, D.Subhakar, P.Veera Babu.(2023)."IOT Based Smart Waste Monitoring System" International Research Journal of Engineering and Technology(IRJET).
- [4] Lincy, F. A., & Sasikala, T. (2021)" Smart dustbin management using IOT and Blynk application" In 2021 5th International Conference on Trends in Electronics and Informatics (ICOEI) (pp. 429-434).
- [5] Kolachalama Venkata Naga Sreya, Rengarajan Amirtharajan and Padmapriya Praveenkumar (2022) "Smart BIN for a Smarter city", IEEE
- [6] Chand, R. P., Sri, V. B., Lakshmi, P. M., Chakravathi, S. S., Veerendra, O. D. M., & Rao, C. V. (2021, December). "Arduino based smart dustbin for waste management during Covid-19". In 5th International Conference on Electronics, Communication and Aerospace Technology (ICECA) (pp. 492-496).
- [7] Pagare, D., Nikam, N., Chinchore, P., & Rathod, Y. S. (2023). " Smart Dustbin Reverse Vending Reward Machine". International Journal of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)
- [8] Dr. Sudha L K, Mohammed Tahir, Ruchitha E, Varshini R, Syed Saif Al.(2023) "Smart Dustbin Monitoring System using Arduino UNO". International Journal of Engineering Research & Technology (IJERT)
- [9] Filho, R. H., de Sousa, D. C. B., de Brito, W. A., Chaves, J. L. M. D. S., Sá, E. L., & Ribeiro, V. P. D. A. (2023). "Increasing Data Availability for Solid Waste Collection Using an IoT Platform based on LoRaWAN and Blockchain.", ScienceDirect.
- [10] Lozano, Á., Caridad, J., De Paz, J. F., Villarrubia Gonzalez, G., & Bajo, J. (2018). "Smart waste collection system with low consumption LoRaWAN nodes and route optimization. Sensors", 18(5), 1465, MDPI.
- [11] Kalpana, M., & Jayachitra, J. (2017). "Intelligent bin management system for smart city using mobile application". Asian Journal of Applied Science and Technology (AJAST), 1(5), 172-175.
- [12] Vishnu, S., Ramson, S. J., Senith, S., Anagnostopoulos, T., Abu-Mahfouz, A. M., Fan, X., & Kirubaraj, A. A. (2021). "IoT- Enabled solid waste management in smart cities". Smart Cities, 4(3), 1004-1017. MDPI

- [13] Rupesh, G. V. V. S. L., Advytha, M. S., Prakash, N. B., Sahu, V., Gupta, A., & Dargar, S. K. (2022). "A Smart-Dustbin and Integration of Waste Management System using IoT". In 4th International Conference on Inventive Research in Computing Applications (ICIRCA) (pp. 393-397). IEEE.
- [14] Ahmed Mohamed, Yara ElSayed, Hassan Mahasneh, Wesam M. Rohouma, Awni Al Ootom (2023) "Intelligent Trash Bin for Smart Cities", IEEE
- [15] Ayush, A., Kumar, A., Jha, A., Sarkar, N., Moharana, S. C., & Das, H. (2019, May). "Voice controlled automatic dustbin with garbage level sensing" In International Conference on Intelligent Computing and Control Systems (ICCS) (pp. 450- 453), IEEE.
- [16] Elam Cheren. S, Sampriiti. G, Subasree. T, Sumetha. M, Swetha. V (2022) "IoT based Smart Dustbin for Waste Management", IEEE
- [17] Gupta, A., Kremer, P., Park, S., & Göhlich, D. (2022, May). "Intelligent route planning for autonomous service robots using communicating smart dustbins." In ICC 2022-IEEE International Conference on Communications (pp. 1202-1207)
- [18] Ms. Akhila Joseph, Ms. Anjali, Ms. Suhaila B, Mr. Mahesh B.(2020) "Smart Garbage Management System", International Research Journal of Engineering and Technology(IRJET)
- [19] Kolhatkar, C., Joshi, B., Choudhari, P., & Bhuva, D. (2018, January). "Smart E-dustbin". In 2018 international conference on smart city and emerging technology (ICSCET) (pp. 1-3). IEEE.
- [20] Tripathi, A., Pandey, C., Narwal, A., & Negi, D. (2018, February). "Cloud based smart dustbin system for metro station". In 2018 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU) (pp. 1-4). IEEE

D.CERTIFICATE OF PUBLICATION

 AMITY UNIVERSITY UTTAR PRADESH	IEEE 11 th ICRI TO / _____  IEEE UP SECTION (INDIA)		
AMITY INSTITUTE OF INFORMATION TECHNOLOGY			
IEEE 11th INTERNATIONAL CONFERENCE			
ON			
RELIABILITY, INFOCOM TECHNOLOGIES AND OPTIMIZATION (ICRITO 2024) (TRENDS AND FUTURE DIRECTIONS)			
CERTIFICATE OF PARTICIPATION			
This is to certify that <u>Prof./Dr./Ms./Mr. Pavithra B</u> of <u>Sathyabama Institute of Science and Technology, Chennai , India</u> has participated and presented paper titled <u>IOT BASED MOVABLE SMART DUSTBIN USING BLYNK IOT APPLICATION</u> during the IEEE 11th International Conference on Reliability, Infocom Technologies and Optimization (ICRITO 2024) organised by Amity Institute of Information Technology from March 14-15, 2024 at Amity University Uttar Pradesh, India.			
 Prof. (Dr.) Rekha Agarwal General Chair, ICRITO 2024	 Prof. (Dr.) Sunil Kumar Khatri General Chair, ICRITO 2024	 Prof. (Dr.) K.M. Soni General Chair, ICRITO 2024	 Prof. (Dr.) Balvinder Shukla Co-Patron, ICRITO 2024 Vice Chancellor, AUUP
15th March 2024			