**IOE LAB MINI PROJECT REPORT**

on

**“SMART DUSTBIN”**

Submitted in partial fulfillment of the requirements of the degree

**BACHELORS OF INFORMATION TECHNOLOGY**

**BY**

Vaibhav parikh 07

Siddhant vishwakarma 15

Harshikesh yadav 16

### UNDER THE GUIDANCE OF

Mr. Sandeep Dubey



### DEPARTMENT OF INFORMATION TECHNOLOGY UNIVERSAL COLLEGE OF ENGINEERING, KAMAN.

**UNDER UNIVERSITY OF MUMBAI**

**2023-24**

i

**CERTIFICATE**

This is to certify that the B.E. a IOE lab mini-project entitled “**SMART DUSTBIN USING ESP 8266** " is a Bonafede work of “Vaibhav parikh” (07) ,“Siddhant Vishwakarma” (15) and “Harshikesh Yadav"(16) submitted to University of Mumbai in partial fulfillment of the requirement for the award of the degree of “Information Technology Engineering” during the academic year 2023-2024.

Mr. Sandeep Dubey

[PROJECT GUIDE]

Dr. Yogita Mane Dr. J.B. Patil

Head of Department Principal

ii

**APPROVAL**

B.E. Mini-Project Report Approval This mini-project synopsis entitled smart dustbin using esp 8366 by Vaibhav parikh, Siddhant Vishwakarma and Harshikesh Yadav is approved for the degree of Information Technology Engineering from University of Mumbai.

***Examiners***

1.----------------------------

2.----------------------------

Date: \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_

Time: \_ \_ \_ \_ \_ \_ \_ \_ \_ \_

iii

**ACKNOWLEDGEMENT**

This is great pleasure and immense satisfaction to express our deepest sense of gratitude and thanks to everyone who has helped us in completing our work successfully. We are presenting this Project report on **“SMART DUSTBIN USING ESP 8266”** as part of the curriculum of B.E. Information Technology. Inspiration and guidance are invaluable in every aspect of life especially in the field of academics, which we have received from our respected **Project Guide: Sandeep Dubey** and **Head of Information Technology:** Dr. Yogita D. Mane. Besides, we take this opportunity to express our sincere gratitude to the **Principal:** Dr. J. B. Patil, UCoE for providing a good environment and facilities to complete this project. We would also like to thank all our staff and friends who have directly or indirectly guided and helped us in the preparation of this report and also for giving us an unending support right from the stage this idea was conceived.

Vaibhav parikh

Siddhant Vishwakarma

Harshikesh Yadav

iv

**Abstract**

The "Smart Dustbin" project presents an innovative and efficient waste management solution that leverages IoT technology and cloud connectivity. This system is designed to monitor the garbage level within a dustbin and provide real-time data visualization while ensuring effective waste collection. The core components of this project include a dustbin equipped with a garbage level sensor, a microcontroller for data processing, a Wi-Fi module for internet connectivity, and LED indicators to signal the dustbin's status. The dustbin sensor continuously measures the garbage level, while the microcontroller processes this data and communicates it to the ThingSpeak cloud platform via Wi-Fi.

ThingSpeak serves as the central hub for data storage and visualization, offering a user-friendly dashboard. The garbage level data is transmitted to ThingSpeak, where it is displayed on a gauge, providing an intuitive representation of the dustbin's fill status, ranging from 1 (empty) to 15 (full). Additionally, the system employs two LEDs to provide a visual indication of whether the dustbin is full or not, enhancing user convenience.

This Smart Dustbin system offers numerous benefits, including efficient waste management, reduced operational costs, and improved environmental sustainability. Waste collection services can optimize their routes and schedules based on real-time data, ensuring that dustbins are emptied only when necessary. This minimizes fuel consumption and reduces the environmental footprint associated with waste collection operations.

In summary, the Smart Dustbin project demonstrates an intelligent waste management solution that combines sensor technology, cloud connectivity, and data visualization to enhance waste collection efficiency. By providing actionable insights into garbage levels, this system contributes to smarter and more sustainable waste management practices.Top of Form

v

**CONTENTS**

**Title Page ……………………………………………………………………….. i**

[**Certificate ………………………………………………………………………. ii**](#_heading=h.2s8eyo1)

**Acknowledgements …………………………………………………………….. iv**

[**Abstract …………………………………………………………………………**](#_heading=h.30j0zll) **v**

[**List of Figures ………………………………………………………………….. vi**](#_heading=h.1fob9te)**i**

**List of Abbreviations and Symbols ………………………………………...…. viii**

1. **Introduction …………………………………………………………….**

1.1 Smart dustbin for waste segregation……………………………… 1

1. **Aims and Objective …………………………………………………….**

2.1 Objective ……….…………………………………………… **2**

2.2 Aim ……………………………………………………………. **2**

1. **Literature Survey… …………………………………………………….**

3.1 Literature survey ……………………………………………… **3**

1. **Existing system ………………………………………………………… 4**
2. **Problem Statement …………………………………………………… 5**
3. **Scope …………………………………………………………………… 6**
4. **Proposed System….. …………………………………………………… 7**  7.1 System Architecture………………………………………….….. 7
5. **Methodology…………………………………………………………..... 8**

8.1 List of component …………………………………………………. . 8

8.2 Circuit diagram …………………………………………………. . 11

8.3 Working …………………………………………………….…. . 12

1. **Design Details …… …………………………………………………… 14**
   1. Coding …….. ……………………..…………………………..… 14
   2. Flowchart ………………………..……………………………. 17

**10. Analytics …………………………………………………………… 18**

1. **Details of Hardware and Software …………………………………… 19**
2. **Advantages …………………………………………………………… 20**
3. **Conclusion ………..……………………………………………………. 21**

**References …………….…………………………………………………………..** **22**

**LIST OF FIGURES**

|  |  |  |
| --- | --- | --- |
| **Fig no.** | **Figures** | **Page No.** |
| 7.1 | Block diagram | 7 |
| 7.2 | Model image | 7 |
| 8.1.1 | Ultrasonic sensor | 8 |
| 8.1.2 | IR sensor | 8 |
| 8.1.3 | ESP 8266 | 8 |
| 8.1.4 | Servo motor | 9 |
| 8.1.5 | LED | 9 |
| 8.1.6 | Breadboard | 9 |
| 8.2.1 | Circuit Diagram | 10 |
| 8.3.1 | Green LED on | 12 |
| 8.3.2 | Dustbin lid in open state | 12 |
| 8.3.3 | Dustbin full | 13 |
| 8.3.4 | UI of App | 13 |
| 9.4.1 | Flowchart | 17 |
| 10.1 | Pareto chart | 18 |

vii

##### LIST OF ABBREVIATIONS

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **Short form** | **Abbreviation** |
| 1 | UNO | Universal Networking Object |
| 2 | LED | Light Emitting Diode |
| 3 | USB | universal serial bus |
|  |  |  |

viii

## INTRODUCTION

### In an era marked by rapid urbanization and expanding populations, effective waste management has emerged as a pressing global concern. Overflowing dumpsters, inefficient waste collection routes, and unnecessary resource consumption have become all too common in many urban areas. To address these challenges and usher in a more sustainable and efficient waste management paradigm, we introduce the "Smart Dustbin" project. The Smart Dustbin is a pioneering solution that combines the power of Internet of Things (IoT) technology, real-time data analytics, and cloud connectivity to transform the way we manage and monitor waste. Traditional waste management systems rely on predetermined collection schedules or manual inspections, often resulting in either overflowing bins or unnecessary pickups of half-empty containers. This project reimagines the process by creating an intelligent and data-driven approach to waste collection.

### At its core, the Smart Dustbin comprises a standard waste receptacle equipped with advanced sensors that continuously monitor the garbage level within. These sensors feed data to a microcontroller that processes and transmits it to the cloud via a Wi-Fi module. This cloud connection is established through ThingSpeak, a powerful IoT platform that provides real-time data visualization and analytics tools. One of the standout features of the Smart Dustbin is its ability to provide instant feedback on the garbage level. Users and waste collection services no longer need to rely on guesswork or fixed schedules to determine when a dustbin needs emptying. A visual gauge on a digital dashboard, powered by ThingSpeak, offers a clear and intuitive representation of the garbage level, ranging from 1 (fill) to 15 (empty). Additionally, two LED indicators mounted on the dustbin itself provide a quick and easily recognizable signal of whether the bin is full or not.

### 2. Aim & Objectives

**2.1 Objective:**

The "Smart Dustbin" project is all about using smart technology to make taking out the trash much easier and efficient. They put special sensors in trash cans that can tell us when the cans are getting full. This information is sent to a big computer in the cloud, and when a trash can is about to be full, it sends a message to the garbage truck so they can come and empty it. This means trash cans don't overflow, and garbage trucks don't drive around when they don't need to.

It also helps people know when to take out their trash, making life more convenient. With this technology, garbage collection becomes smarter, saving time, money, and being kinder to the environment.

**2.2 AIM:**

The Smart Dustbin project is dedicated to creating a cutting-edge waste management system that not only boosts the efficiency of waste collection but also champions eco-friendliness. It achieves this by implementing several key features: Real-time Garbage Monitoring, which employs advanced sensors to continuously track the fill levels of trash bins; Cloud Connectivity, which allows for the seamless transmission of this data to a central cloud-based platform; Data Visualization, enabling comprehensive and easy-to-understand representations of the waste collection process; and Automatic Alerts, ensuring timely notifications to waste management teams when bins are nearing capacity. Collectively, these elements create a system that optimizes waste collection, reduces environmental impact, and streamlines the overall waste management process.

**3. Literature review**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No:** | **Author** | **Project title** | **Publication** | **Difference** |
| 1. | Vaibhav Parikh  Siddhant vishvkarma  Harshikesh yadav | Smart Dustbin using ESP 8366 | 2023 | Opens the lid and closes lid And gives indications while being empty |
| 2. | Aksan Wijaya Zahirzainzudd  Muhammad nissar | Design smart waste bin for smart waste mangement | 2017 | A smart waste Consist of smart sensor |
| 3. | Vinoth Kumar  Krishna Kumar  Mahantesh | Smart Garbage Monitoring and Clearance system | 2017 | Checks the waste level over the dustbins |

***Table no. 3.1 literature survey***

**4. Existing system**

The existing waste management system relies on traditional methods that lack the advanced technological features of the proposed "Smart Dustbin" project. In this conventional system, waste collection and disposal are primarily managed through manual processes. Waste collection personnel typically follow predetermined schedules or engage in manual inspections of dustbins to assess their fill levels. These manual methods are often prone to inaccuracies, leading to inefficiencies in waste collection.

Fixed collection schedules are a common practice in the existing system, which often results in unnecessary pickups of partially filled dustbins. This rigid approach fails to adapt to changing fill levels, leading to increased fuel consumption, wear and tear on collection vehicles, and additional labor costs. Furthermore, residents and businesses using the existing system lack real-time visibility into the fill status of nearby dustbins, which can result in uncertainty and inconvenience regarding waste disposal.

**5. PROBLEM STATEMENT**

The Smart Dustbin project aims to make garbage collection in cities and suburbs much better. Right now, we often see overflowing trash cans and trucks driving around to collect trash even when it's not full. This is bad for the environment and costs a lot of money.

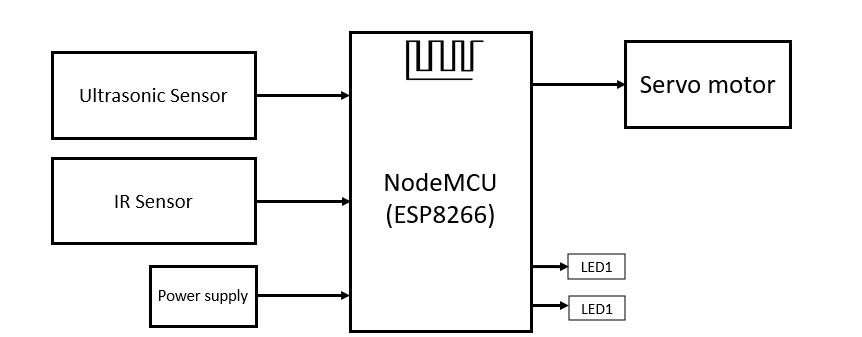
To fix this, the Smart Dustbin uses special sensors in each trash can to see how full it is. This information is sent to a computer in the cloud that can think and learn. It uses this data to predict when a trash can will be full. Then, instead of having a fixed schedule, the garbage trucks come to pick up the trash when it's actually needed. This saves money, reduces pollution, and makes our neighborhoods cleaner and nicer to live in.

**6. SCOPE**

The "Smart Dustbin" project is a multifaceted initiative that aims to revolutionize waste management by integrating cutting-edge technologies into its design and development. At the core of this project is the hardware component, which involves careful selection and integration of sensors for accurate garbage level measurement. Two primary sensor types, ultrasonic and infrared sensors, are commonly used in such applications. Ultrasonic sensors emit high-frequency sound waves and measure the time it takes for the sound waves to bounce back from the trash's surface, providing precise fill-level data. In contrast, infrared sensors use beams of light to detect the level of trash within the bin. These sensors are instrumental in ensuring real-time data on garbage levels, a critical component of efficient waste collection.

In addition to sensors, the project incorporates a microcontroller, often an ESP8266, to manage the overall system operations. The microcontroller serves as the brain of the Smart Dustbin, processing data from the sensors, making decisions based on pre-set parameters, and initiating actions such as sending alerts or triggering data transmission. Furthermore, the project employs Wi-Fi modules like ESP8266 to establish wireless internet connectivity. This connection is pivotal for transmitting data to the cloud, where the information can be further analyzed, and waste management decisions can be made. The combination of sensors, microcontrollers, and Wi-Fi modules in the project's hardware development is what allows it to provide real-time data on garbage levels and contribute to the optimization of waste collection processes, ultimately enhancing the efficiency and sustainability of waste management practices.

**7. Proposed System**



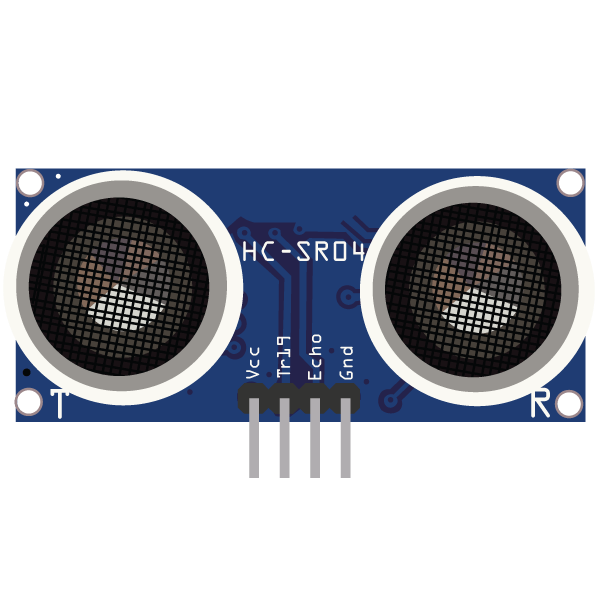
***Fig no. 7.1 Block Diagram***

Ultrasonic Sensor measures the dustbin's fill level. IR Sensor detects the presence of a person near the dustbin and triggers lid opening. ESP8266 Microcontroller: Manages data acquisition from both the ultrasonic sensor and IR sensor. Determines whether the dustbin is full based on the ultrasonic sensor data. Drives LED indicators to show the dustbin's status. Controls the opening and closing of the lid based on IR sensor input. Establishes IoT connectivity via Wi-Fi. Red and Green LEDs. Indicate the dustbin's status: Red LED ON: Dustbin is full. Green LED ON: Dustbin is not full. Lid Actuator (e.g., a servo motor or a solenoid). Mechanism for opening and closing the dustbin lid. Facilitates communication with external systems. Sends data (dustbin status) to a cloud platform or local server.

**8. Methodology**

**8.1 List of components**

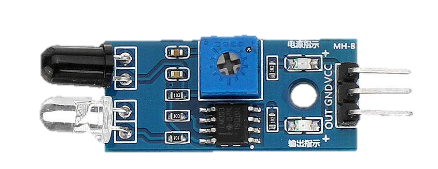
1. Ultrasonic sensor



***Fig no 8.1.1 ultrasonic sensor***

An ultrasonic sensor is a type of sensor that uses high frequency sound waves to detect the distance to an object. In the context of a smart stick for blind people, an ultrasonic sensor can be used to detect obstacles and provide haptic or audio feedback to the user to help them navigate their environment safely

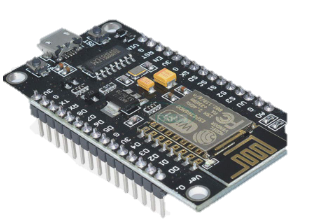
1. IR sensor

****

***Fig no 8.1.2 IR sensor***

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest

1. ESP 8366



***Fig no 8.1.3 ESP 8266***

NodeMCU is an open-source LUA based firmware developed for the ESP8266 wifi chip. By exploring functionality with the ESP8266 chip, NodeMCU firmware comes with the ESP8266 Development board/kit i.e. NodeMCU Development board.

1. Servo motor

****

***Fig no 8.1.4 servo motor***

A servo motor is defined as an electric motor that allows for precise control of angular or linear position, speed, and torque. It consists of a suitable motor coupled to a sensor for position feedback and a controller that regulates the motor’s movement according to a desired setpoint.

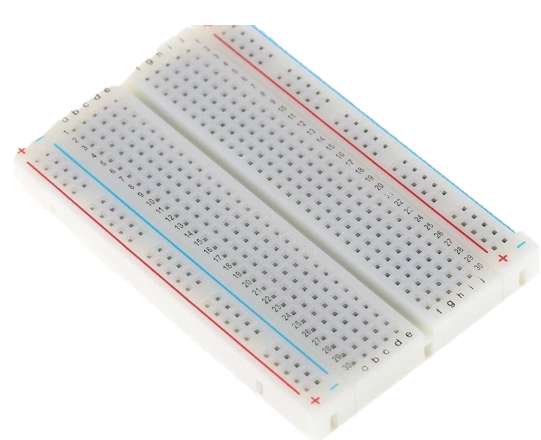
1. LED

****

***Fig no 8.1.5 LED***

An LED (Light Emitting Diode) is a semiconductor device that emits light when an electric current is passed through it. In the context of a smart stick for blind people, LEDs can be used as visual feedback mechanisms to indicate the presence of an obstacle or other important information to the user.

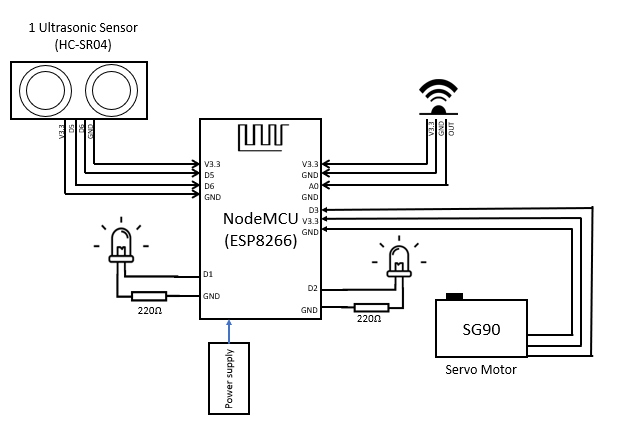
1. Breadboard



***Fig no 8.1.6 Breadboard***

The breadboard contains spring clip contacts typically arranged in matrices with certain blocks of clips already wired together. The components and jump wires (assorted wire lengths with pins at both ends) are plugged into the clips to create the circuit patterns. The boards also typically include metal strips along the side that are used for common power rails and signal buses.

**8.2 Circuit diagram**



***Fig no. 8.2.1 Circuit Diagram***

The circuit incorporates a Wi-Fi module, like the ESP8266 or ESP32, for wireless internet connectivity, enabling data transmission to the cloud. LED indicators are integrated into the circuit to visually communicate the fill status of the dustbin. The MCU orchestrates data acquisition from the sensors, processes the information, and sends it to the ThingSpeak cloud platform via the Wi-Fi module.2 pin, the +ve pin is connected to pin no 9 of Arduino via a slide switch to ON/OFF the vibrator when required.

**8.3 Working**

1. Empty Dustbin 2. Dustbin in open state

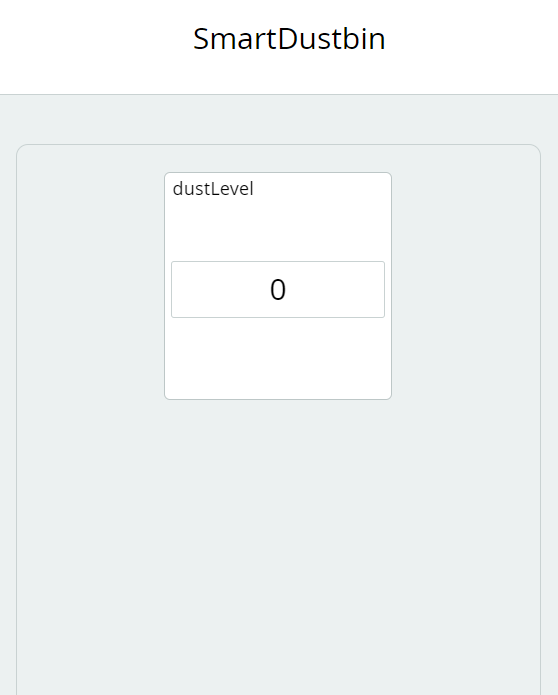
 

***Fig no. 8.3.1 Green LED on Fig no. 8.3.2 Dustbin lid in open state***

In the figure 8.3.1 you will the the model or smart dustbin project, there gree led is in on state which means it is indication you can use the dubtbin and there is a IR sensor above the lid whci help to automate the lid opening which is veru usefull for make hygienic in today time.

The second figure 8.3.2 showing the distbin is open state which means someone opened the dustbin with the help of IR sensor. This dustbin is smart because it can show you wheather it is usable or not throught the red and green LED

3. Dustbin is full 3. Smart dustbin mobile phone UI

***Fig no. 8.3.3 Dustbin in full state Fig no. 8.3.4 User inter face of app***

In the figure 8.3.3. red LED is on which means the dustbin is full and as the red Led get on it will send a email to register emai id to this dustbin, so the person get the notification that the dustbin is in full state thet have to empty it.

In the figure 8.3.4. there is the screenshort of App interface the person can monitor the dustleve in percentages. You can also wodnload the cloud data from the online webite of archuino cloud.

### 9. Design detail

**9.1 Code**

#include <Servo.h>

#include <ESP8266WiFi.h>

String apiKey = "HGP3M3HKZC0USIMU"; // Enter your Write API key from ThingSpeak

const char \*ssid = "vishwakarma"; // replace with your wifi ssid and wpa2 key

const char \*pass = "8551806885";

const char \*server = "api.thingspeak.com";

#define IR D4 //pin where the dht11 is connected

#define RED\_LED D2 // RED Led pin

#define GREEN\_LED D1 // RED Led pin

Servo s1;

const int trigPin = D5;

const int echoPin = D6;

// defines variables

long duration;

int distance;

WiFiClient client;

void setup()

{

Serial.begin(115200);

pinMode(IR, INPUT);

pinMode(RED\_LED, OUTPUT);

pinMode(GREEN\_LED, OUTPUT);

pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output

pinMode(echoPin, INPUT); // Sets the echoPin as an Input

s1.attach(D3);

Serial.println("Connecting to ");

Serial.println(ssid);

WiFi.begin(ssid, pass);

while (WiFi.status() != WL\_CONNECTED)

{

delay(500);

Serial.print(".");

}

Serial.println("");

Serial.println("WiFi connected");

}

void loop()

{

float ir = digitalRead(IR);

Serial.print("IR Value: ");

Serial.print(ir);

if (ir == 0){

s1.write(180);

delay(5000);

s1.write(0);

delay(1000);

}

// Clears the trigPin

digitalWrite(trigPin, LOW);

delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds

digitalWrite(trigPin, HIGH);

delayMicroseconds(10);

digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds

duration = pulseIn(echoPin, HIGH);

// Calculating the distance

distance = duration \* 0.034 / 2;

// Prints the distance on the Serial Monitor

digitalWrite(GREEN\_LED, HIGH);

digitalWrite(RED\_LED, LOW);

if (distance < 4 )

{

digitalWrite(GREEN\_LED, LOW);

delay(1);

digitalWrite(RED\_LED, HIGH);

}

if (isnan(distance))

{

Serial.println("Failed to read from DHT sensor!");

return;

}

if (client.connect(server,80)) // "184.106.153.149" or api.thingspeak.com

{

String postStr = apiKey;

postStr +="&field1=";

postStr += String(distance);

postStr += "\r\n\r\n";

client.print("POST /update HTTP/1.1\n");

client.print("Host: api.thingspeak.com\n");

client.print("Connection: close\n");

client.print("X-THINGSPEAKAPIKEY: "+apiKey+"\n");

client.print("Content-Type: application/x-www-form-urlencoded\n");

client.print("Content-Length: ");

client.print(postStr.length());

client.print("\n\n");

client.print(postStr);

Serial.print("Distance: ");

Serial.println(distance);

}

client.stop();

Serial.println("Waiting...");

// thingspeak needs minimum 15 sec delay between updates

delay(1000);

}

int distance;

WiFiClient client;

void setup()

{

Serial.begin(115200);

pinMode(IR, INPUT);

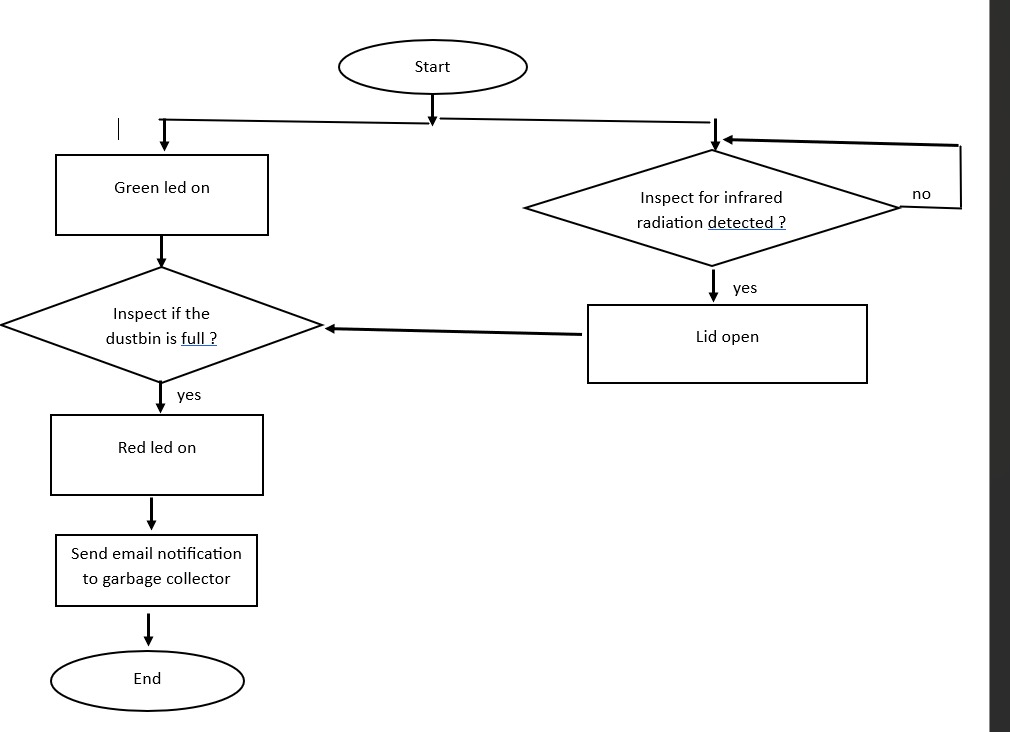
pinMode(RED\_LED, OUTPUT);

pinMode(GREEN\_LED, OUTPUT);

pinMode(trigPin, OUTPUT); // Sets the

* 1. **Flowchart**

The below figure shows the flow of program,



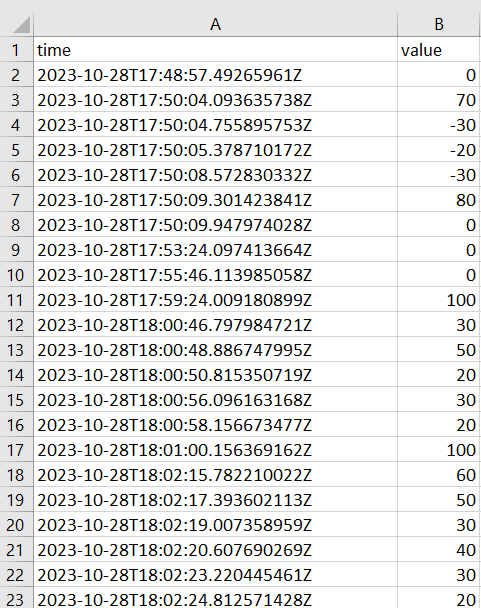
***Fig no. 9.4.1 Flowchart***

The above figure is the flowchart that is it showing that when the project starts the green led get on and the IR sensor get on to detect any object near it like human hand which will open the dustbin lid similarly it works continuously until the dustbin get full.

After the dustbin get full the red LED get on which means you can’t put anymore dust in it. After the red LED get on the dustbin send a email to headquarter to clean the dustbin.

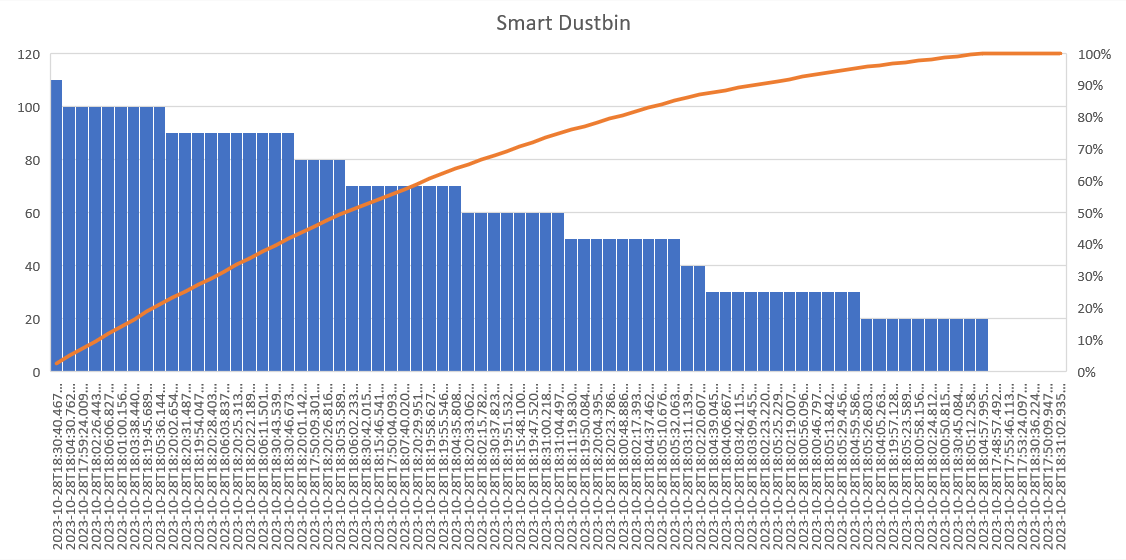
**10. Analytics**

**Data Example:**

****

The above data is the data of smart dustbin usages

**Pareto chart:**



***Fig no. 10.1 Pareto chart***

In above pareto chart there is red line showing that the dust level is increased up to 100% as the dustbin get full

**11. Hardware and software**

1. Hardware:

System : Intel Core i3 2.00 GHz.

Disk : 1 TB.

Monitor : 14’ Color Monitor.

Mouse : Mouse.

Ram : 2 GB.

Keyboard : Keyboard.

1. Software:

Operating system : Windows 10.

Coding Language : CPP.

Software’s used : Arduino IDE.

### 12. Advantages

1. Green LED Indicator: The green LED can indicate that the dustbin is not yet full. This helps users know that there is still space available for disposal, reducing the chances of overflows and littering.
2. Red LED Indicator: The red LED can signal when the dustbin is full. This feature helps prevent overflow and ensures timely waste collection and disposal.
3. The IR sensor for lid opening allows for a hands-free and hygienic experience. Users don't need to touch the dustbin, reducing the risk of contamination and improving overall hygiene.
4. The ability to indicate when the dustbin is full helps waste management authorities or homeowners plan waste collection schedules more efficiently. This can reduce operational costs and environmental impact.
5. Users can easily identify whether the dustbin needs to be emptied or not, which simplifies waste disposal routines.
6. Reducing overflow and ensuring that the bin is emptied at the right time can prevent littering and promote cleaner surroundings, contributing to a cleaner environment.

### 13. Conclusions

The "Smart Dustbin" project represents a pioneering and technologically advanced solution to the longstanding challenges in waste management. By combining IoT technology, cloud connectivity, and data-driven insights, this project has the potential to revolutionize the way we handle waste in urban and suburban environments. Through continuous monitoring of garbage levels within dustbins and real-time data transmission to the cloud, the project introduces a level of efficiency and responsiveness that was previously unattainable with traditional waste collection methods. It offers numerous advantages, including optimized waste collection routes, reduced operational costs, and a significant reduction in the environmental impact associated with waste management.

The user-centric approach of the project provides residents and businesses with a user-friendly interface to monitor dustbin fill levels, enabling them to make informed decisions about waste disposal. This not only enhances user convenience but also contributes to a cleaner and more pleasant living environment.

### 14. References

1. Zahir Zainuddin; Aksan S. Wijaya, Muhammad Niswar (2017) Design a smart waste bin for smart waste management.
2. [S. Vinoth Kumar](https://ieeexplore.ieee.org/author/37085900343); [T. Senthil Kumaran](https://ieeexplore.ieee.org/author/37688159900); [A. Krishna Kumar](https://ieeexplore.ieee.org/author/37085823487); [Mahantesh Mathapati](https://ieeexplore.ieee.org/author/37086235091) (2017) Smart garbage monitoring and clearance system using iot.
3. Pandey, Mamta & Gowala, Anamika & Goswami, Mrinal & Saikia, Chinmoy & Bora, Dibya. (2020). SMART DUSTBIN USING ARDUINO.
4. Vishali, R. & Sarmila, R.V. & Priyadharshini, K.M. & Rajkumar, R. & Thiyagarajan, D. & Menagadevi, M. (2022). Wireless Waste Management Monitoring System for Residential Society with Automatic Self-Navigated and Self- Sanitizing Trash Can.