SMART BIN

Engineering Design Course

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Problem Statement:

- *Inefficient waste management practices in the handling of dustbins have led to frequent overflow and littering in public areas, contributing to environmental pollution and health hazards.*
- *Inadequate maintenance and oversight of dustbins contribute to foul odors and pest infestations, creating unsanitary conditions that compromise public health and community well-being.*

Causes:

- *Carelessness of people regarding public hygiene leads to improper waste management.*
- *Dustbins gets filled quickly in crowded areas like marketplaces, thus leading to lack of space to accumulate more waste.*
- *Improper waste management and emptying of dustbin by Municipal Corporation.*
- *Open lid dustbins also leads to littering and scattered debris in the surroundings.*

Features of Smart Bin

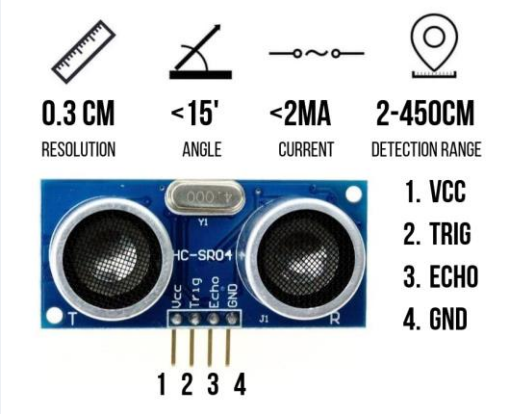
- ***Automatic Opening and Closing of Lid:*** *When someone comes near to throw garbage in the dustbin it opens and closes the lid automatically.*
- ***Dustbin Fill percentage control:*** *It detects the height up to which the dustbin is filled and calculates the percentage of dustbin full.*
- ***Real Time Data Management:***
  - *The dustbin keeps updating the data about the percentage of dustbin filled on the ThingSpeak cloud.*
  - *ThingSpeak cloud sends alert mails to the concerned authorities if the bin percentage filled is greater than some threshold value.*

Future Advancements

- ***Plastic and Paper Compression:*** *The bin would be able to compress the soft waste like papers, plastics etc. achieving some extra space.*
- ***AI-based Recognition of Nearby Garbage:***
  - *The bin could be fitted with camera which would detect the presence of garbage lying in the proximity of the dustbin.*
  - *It could raise alarms if it detects a person not throwing garbage directly into the bin.*

Fill percentage Control:

The dustbin is equipped with an Ultrasonic Sensor on the bottom of lid. It measures the distance of the garbage level from the lid and hence percentage of dustbin filled.



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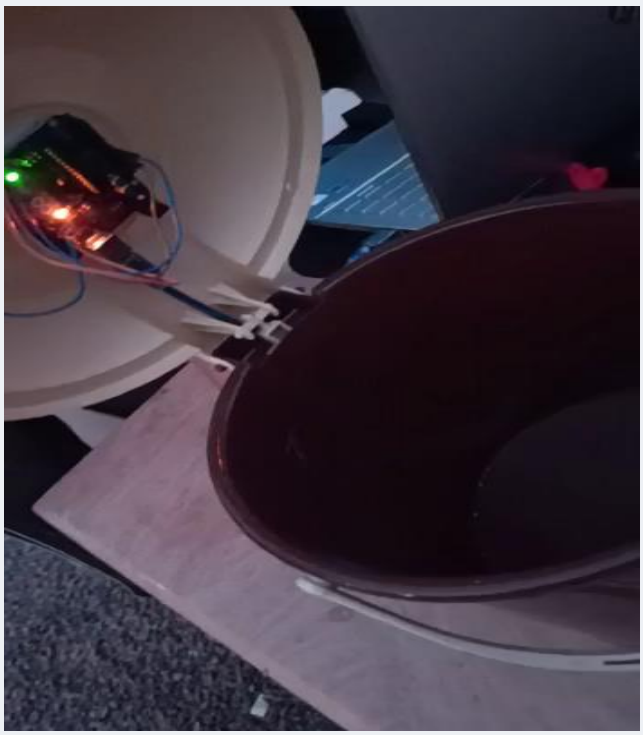
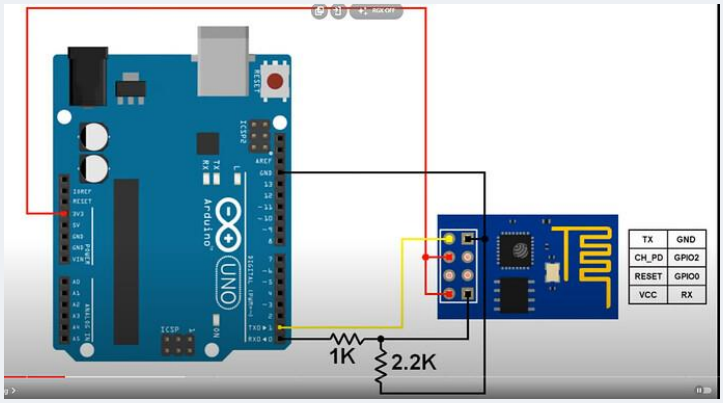


Automatic Opening and Closing of Lid:

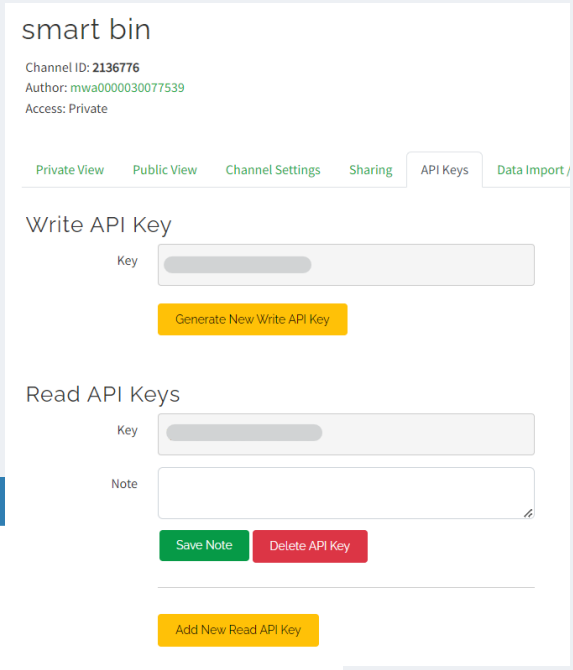
The Servo motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism.

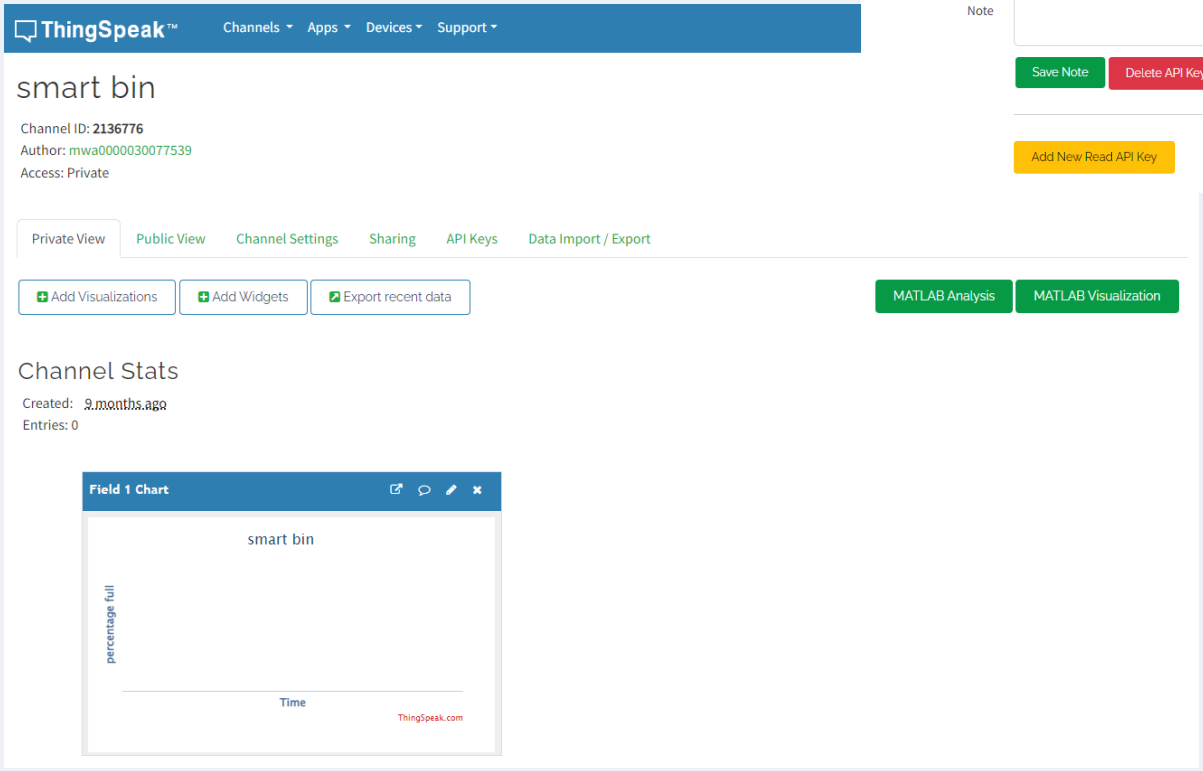
Real Time Data Management:



- **ESP8266 WiFi Module -** *The ESP8266 WiFi module facilitates wireless connectivity for microcontroller-based projects, enabling devices to connect to local networks or the internet. Its affordability and ease of use make it a popular choice for IoT applications, hobbyist projects, and rapid prototyping.*

- **ThingSpeak API -** *ThingSpeak is an IoT analytics service that allows you to aggregate, visualize, and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak by creating a ThingSpeak Channel.*





Arduino Programming:

```
#include <ThingSpeak.h>
#include <ESP8266WiFi.h>
#include <Servo.h> // including library for servo motor
Servo servo;

char ssid[] = "Vishesh mobile"; //SSID here
char pass[] = "vishesh12"; // Passowrd here
unsigned long Channel_ID = 2136776; // Your Channel ID
const char * myWriteAPIKey = "AANGE1EZJFSY3FFY"; //Your write API key

// Ultrasonic Sensor present at top of the dustbin.
const int trigPin1 = 9;
const int echoPin1 = 10;
// Ultrasonic sensor present on outer part of bin to open the lid
int trigPin2 = 5;
int echoPin2 = 6;
int servoPin = 7;
const int buzzer = 11;
const int ledPin = 13;

const float totalheight = 23;//(in cm)
long duration1,duration2, distance2;
float distance1,percentfull,safetydistance = 10;
int flag = 0;
const int Field_Number_1 = 1;
WiFiClient  client;

void setup() {
  Serial.begin(115200);
  delay(10);
  //WiFi.mode(WIFI_STA);
  internet();
  ThingSpeak.begin(client);

  pinMode(trigPin1, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin1, INPUT); // Sets the echoPin as an Input
  pinMode(buzzer, OUTPUT); // Sets the echoPin as an Input
  pinMode(ledPin, OUTPUT); // Sets the echoPin as an Input

  servo.attach(servoPin);
  pinMode(trigPin2, OUTPUT);
  pinMode(echoPin2, INPUT);
  servo.write(0); //close cap on power on
  delay(100);
  servo.detach();
}
```

```
void loop() {
  // Clears the trigPin
  internet();
  digitalWrite(trigPin1, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin1, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin1, LOW);
  // Reads the echoPin, returns the sound wave travel time in microseconds
  duration1 = pulseIn(echoPin1, HIGH);
  distance1= duration1*0.034/2;
  percentfull = ((totalheight-distance1)/totalheight) *100;

  digitalWrite(trigPin2, LOW);
  delayMicroseconds(5);
  digitalWrite(trigPin2, HIGH);
  delayMicroseconds(15);
  digitalWrite(trigPin2, LOW);

  pinMode(echoPin2, INPUT);
  duration2 = pulseIn(echoPin2, HIGH);
  distance2 = duration2*0.034/2;

  if (percentfull>=70){
    // Giving tone signal to the piezobuzzer (RC)
    tone(buzzer, 330);
    digitalWrite(ledPin, HIGH);
    }
  else{
    digitalWrite(ledPin, LOW);
    noTone(buzzer);
  }
  Serial.print("Percentatge of Dustbin full: ");
  Serial.println(percentfull);
  if (distance2<10) {
  //Change distance as per your need
    if (!flag){
      flag = 1;
      servo.attach(servoPin);
      delay(1);
      servo.write(0);
      delay(500);
      servo.write(120);
      delay(500);
      servo.detach();
    }
  }
  else{
```

```
    if (flag){
      flag = 0;
      delay(3000);
      servo.attach(servoPin);
      servo.write(0);
      delay(500);
      servo.detach();
    }
  }
  upload();

  delay(1000);
}

void internet()
{
  if (WiFi.status() != WL_CONNECTED)
  {
    while (WiFi.status() != WL_CONNECTED)
    {
      WiFi.begin(ssid, pass);
      delay(5000);
    }
  }
}

void upload()
{
  ThingSpeak.writeField(Channel_ID, Field_Number_1, distance1, myWriteAPIKey);
  delay(15000);
}
```

Alert Mails using ThingSpeak:

Make a MATLAB Analysis to send alert mail. ThingSpeak has added an alerts API to let you send emails from your ThingSpeak account.

```
channelID = 2136776;
alertAPIKey = 'AAN**********';
alert_body = 'Dustbin is full at location – "";
alert_subject = 'Dustbin Full';
alertUrl = "https://api.thingspeak.com/alerts/send";
options = weboptions("HeaderFields",["ThingSpeak-Alerts-API-Key",alertAPIKey]);
alertSubject = sprint("Dustbin Full");
percentfull = thingSpeakRead(channelID, 'percentage full', 1, "Fields",1);
if (percentfull>70);
        try
                webwrite(alertUrl, "body", alert_body, "subject", alertSubject, options);
        catch someException
        end
end
```

Thank You