NANDHA ENGINEERING COLLEGE

ERODE–638052 (Autonomous)

(Affiliated to Anna University, Chennai)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

22AIC14 – INTERNET OF THINGS AND ITS APPLICATIONS

MINI PROJECT REPORT ON

TOPIC – SMART DUSTBIN

Submitted by

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BONAFIDE CERTIFICATE

This is to certify that the project work entitled "SMART DUSTBIN" is the Bonafide work of CHRISTY ANN NAVEENA J J(22AI008), ILAKHIYAA S(22AI018), GOWRIHA B(22AI059) who carried out the work under my supervision.

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Submitted for End semester PBL review held on ______________

SMART DUSTBIN

AIM:

To design and implement a Smart Dustbin integrated with ultrasonic, weight, temperature, gas, and vibration sensors, along with a servo motor, for efficient waste management by automating lid control, monitoring environmental parameters, and providing real-time status updates

SCOPE:

This project automates monitoring of a smart dustbin, tracking waste level, weight, temperature, gas, and vibrations. Users can check its status through Telegram commands like **level**, **weight**, and **temperature**. It ensures efficient and hygienic waste management with no manual effort.

BRIEF HISTORY:

Smart dustbins were developed to improve waste management and hygiene. Initially, they used simple automation like touchless lid mechanisms. With advancements, sensors like ultrasonic, weight, temperature, gas, and vibration were added, allowing real-time monitoring and notifications via platforms like Telegram. These dustbins are now widely used in smart cities to promote cleanliness and efficiency.

PROPOSED METHODOLOGY:

1. **Sensor Integration:**
    - Use an **ultrasonic sensor** to monitor the garbage level inside the bin.
    - Integrate a **flame sensor** to detect fire hazards.
    - Employ a **gas sensor** to monitor harmful gases inside the bin.
    - Include a **weight sensor** to measure the weight of the garbage for additional monitoring.
2. **Microcontroller and Connectivity:**
    - Use an **ESP32 microcontroller** for its Wi-Fi and Bluetooth capabilities.
    - Transmit sensor data to a mobile application using **IoT protocols** for remote monitoring and control.

3. **Real-Time Monitoring and Alerts:**
    - Implement alerts for when the bin is full, when fire or dangerous gases are detected, and when the weight exceeds a certain threshold. Display sensor readings and alerts on the **Blynk app** in real-time for user convenience.
4. **Automation and Control:**
    - Use an **MG995 servo motor** to automatically open and close the bin lid based on the garbage level detected by the ultrasonic sensor.
5. **Data Logging:**
    - Store sensor data on cloud servers for long-term analysis and to optimize waste management processes over time.

COMPONENTS REQUIRED:

S.NO	COMPONENTS	NO'S
1	ESP32 microcontroller	1
2	Ultrasonic Sensor	2
3	Mg995 Motor	1
4	SW-420 Vibration Sensor	1
5	LM 393 flame detector	As required
6	Jumper Wires	As required
7	Mq2 Gas Sensor	1

DESCRIPTION:

The IoT-based smart dustbin system uses an ESP32 microcontroller to automate waste level monitoring and safety detection. An ultrasonic sensor continuously measures the waste level, determining if the bin is empty, half-full, or full. The system includes an LM393 flame detector and a gas sensor to detect potential fire hazards and harmful gases, ensuring enhanced safety. The MG995 servo motor is used to automatically open and close the bin lid based on waste detection. The ESP32 connects the system to the internet, allowing users to monitor the bin's status and receive alerts, such as when the bin is full or when hazardous conditions are detected, via a smartphone app or web interface.

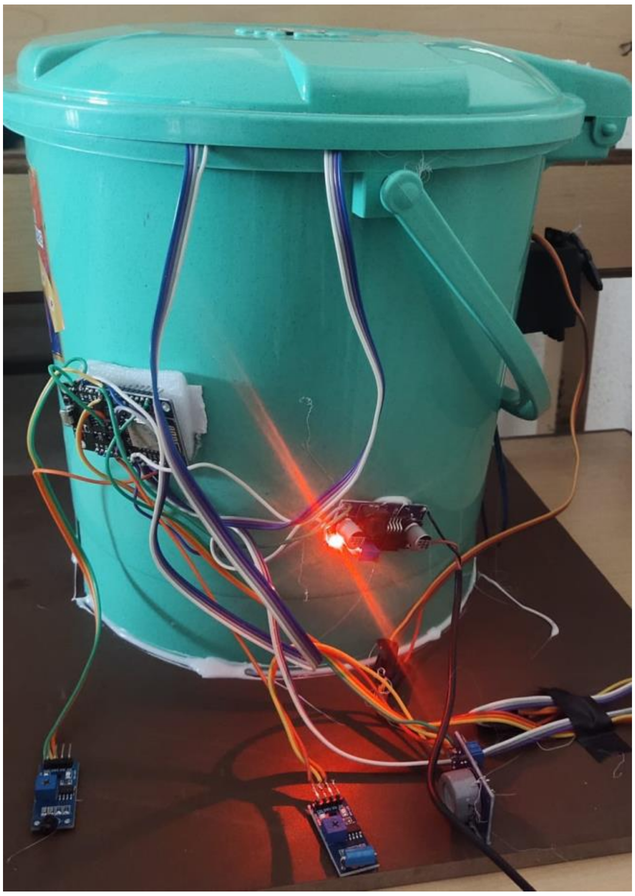
CODING:

```
#include "HX711.h"
#include <Servo.h>

Servo myservo;
#define BLYNK_TEMPLATE_ID "TMPL3wkIDWRE6"  #define
BLYNK_TEMPLATE_ID "TMPL3cqPEVGX5"
#define BLYNK_TEMPLATE_NAME "dustbin"
#define BLYNK_AUTH_TOKEN "pncKwBBXEi5eL3Ysk7GhbIxIt-fUeA6n"
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
  char auth[] = BLYNK_AUTH_TOKEN;
  char ssid[] = "project12345"; // Enter your WIFI name   char
pass[] = "project12345"; // Enter your WIFI password   int
data=0;    //variable to store data from virtaul pin

const int LOADCELL_DOUT_PIN = D1; const
int LOADCELL_SCK_PIN = D2;
HX711 scale;

int fire = D0;
int gas = A0;
int trigPin =
D6;  int
echoPin =
D7;
int vibration=D8;

void setup() {
  Serial.begin(9600);
 pinMode(fire, INPUT);
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  scale.begin(LOADCELL_DOUT_PIN, LOADCELL_SCK_PIN);

Serial.println("System Initialized. Monitoring sensors...");
myservo.attach(D5);
pinMode(vibration, INPUT);
pinMode(gas, INPUT);
```

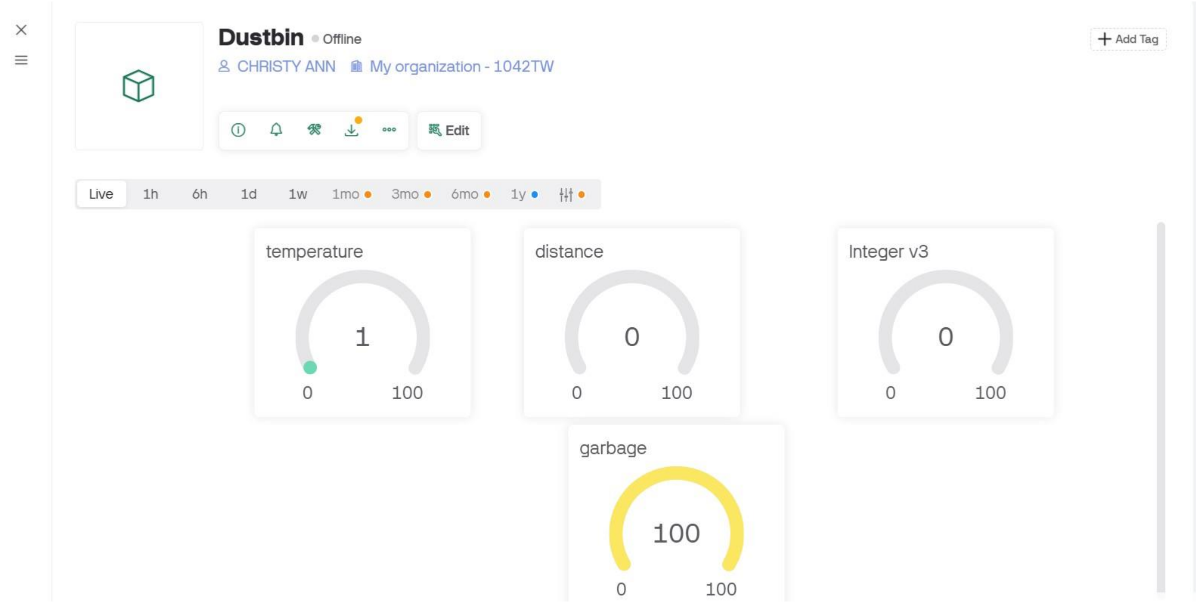
```
Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
}

void loop() {
long reading = scale.read()- 160135;
Serial.print("HX711 reading: ");
Serial.println(reading);     int
fireState = digitalRead(fire);
int gasState = digitalRead(gas);


long duration;
int distance;

digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = duration * 0.034 / 2;
distance= map(distance, 15,0,0,100);


if (fireState == HIGH) {
Serial.println("Fire detected!");
}


else {
Serial.println("No fire detected.");
}
if (gasState == HIGH) {
Serial.println(gasState);
} else {
Serial.println(gasState);
}

  if (distance <= 10) {
    Serial.print("Object detected at a distance of: ");
```

```
    Serial.print(distance);
    Serial.println(" cm. Too close!");
    // Add logic here (e.g., stop a motor or trigger an alert)
  }

 else {
    Serial.print("Distance measured: ");
    Serial.print(distance);
    Serial.println(" cm.");



  }

  delay(1000);
for(int
i=0;i<500;i++)
{
  if(digitalRead(vibration)==HIGH)
  {
    myservo.write(0);
    delay(3000);
    myservo.write(180);
    delay(1000);

  Blynk.virtualWrite(V0, fireState);
     delay(2000);
      Blynk.virtualWrite(V1, gasState );
       delay(2000);

   Blynk.virtualWrite(V2,distance);
delay(2000);
    Blynk.virtualWrite(V3,reading);
    }
delay
(10);
}
}
```

SCREENSHOTS:



OUTPUTS:



PROTOCOL:

In the smart dustbin system, we have used the MQTT protocol over Wi-Fi for communication. MQTT (Message Queuing Telemetry Transport) enables efficient, low-bandwidth data exchange between the dustbin and the cloud server or mobile app, ensuring real-time status updates and remote control.

LIMITATIONS:

1. **Sensor Accuracy**: The **ultrasonic sensor** might face challenges in accurately detecting waste levels if objects are irregularly shaped or if there is debris blocking the sensor's path. Similarly, **gas** and **flame sensors** may have limitations in their detection range or sensitivity.
2. **Power Consumption**: The **ESP32** and multiple sensors like the **flame sensor**, **gas sensor**, and **MG995 servo motor** require continuous power to function, which may result in higher energy consumption, especially if not designed for low-power operation or powered by batteries.
3. **Environmental Factors**: External environmental factors like dust, moisture, or extreme temperatures could affect sensor performance. For instance, **ultrasonic sensor** may be affected by dirt build-up, and the **flame sensor** might give false positives due to extreme heat.

FUTURE ENHANCEMENTS:

1. **Solar Power Integration**: Adding solar panels to power the system could make the dustbin more energy-efficient and sustainable, reducing reliance on external power sources.
2. **AI-based Waste Sorting**: Incorporating AI and computer vision could allow the dustbin to automatically sort waste into recyclable and non-recyclable categories, improving waste management efficiency.
3. **Smart Notification System**: Enhance the notification system by providing users with detailed alerts based on patterns, such as waste accumulation trends, or predictive maintenance for sensors and motor components.
4. **Automatic Waste Compression**: Introducing a mechanism to compress waste inside the bin could increase the capacity and reduce the frequency of waste collection, especially in urban areas.
5. **Advanced Health and Safety Monitoring**: Adding more advanced sensors like CO2 or air quality sensors could provide additional insights into environmental conditions around the bin, especially in industrial or highly polluted areas.
6. **Integration with Smart City Infrastructure**: The smart dustbin could be integrated with smart city platforms, enabling municipal authorities to track and optimize waste collection routes, leading to more efficient and timely waste disposal.
7. **Touchless Operation with Voice Control**: Voice recognition could be added for more intuitive control, allowing users to open or close the bin by giving simple voice commands.

CONCLUSION:

The IoT-based Smart Dustbin system showcases an innovative application of IoT and sensor technologies to improve waste management and safety. Its capability to automatically monitor waste levels, detect hazardous conditions, and operate autonomously makes it an efficient solution for modern waste disposal. Future enhancements could include integrating advanced sensors for more detailed environmental monitoring, smart notifications for optimized waste collection, and solar-powered operation for sustainability