Smart Waste Bin Monitoring System Using Ultrasonic Sensors

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# Abstract

Unattended or overflowing garbage bins in urban areas lead to sanitation issues and inefficiencies in waste collection. This project proposes a smart solution using ultrasonic level sensors to monitor the fill status of garbage bins. An Arduino microcontroller processes the sensor data and alerts municipal authorities through a connected dashboard. This real-time monitoring system optimizes collection routes and ensures timely waste management.

# Problem Identification

Municipal waste bins often overflow due to irregular or inefficient collection schedules. This leads to foul smells, unhygienic surroundings, and public dissatisfaction.

# Objective

To develop a smart garbage monitoring system using ultrasonic sensors and Arduino that notifies authorities about bin status through a mobile dashboard.

# Tools Used

- Arduino Uno  
- Ultrasonic Sensor (HC-SR04)  
- Buzzer  
- Tinkercad for simulation  
- Arduino IDE

# Simulation Setup

The system is simulated using Tinkercad, where an ultrasonic sensor is used to detect the bin level. A buzzer indicates when the bin is full. The code runs on Arduino Uno.

# Arduino Code

#define trigPin 9  
#define echoPin 10  
#define buzzer 7  
  
long duration;  
int distance;  
  
void setup() {  
 pinMode(trigPin, OUTPUT);  
 pinMode(echoPin, INPUT);  
 pinMode(buzzer, OUTPUT);  
 Serial.begin(9600);  
}  
  
void loop() {  
 digitalWrite(trigPin, LOW);  
 delayMicroseconds(2);  
 digitalWrite(trigPin, HIGH);  
 delayMicroseconds(10);  
 digitalWrite(trigPin, LOW);  
  
 duration = pulseIn(echoPin, HIGH);  
 distance = duration \* 0.034 / 2;  
  
 if (distance < 10) {  
 digitalWrite(buzzer, HIGH);  
 } else {  
 digitalWrite(buzzer, LOW);  
 }  
 delay(1000);  
}

# Future Scope

In future, the system can be integrated with IoT modules to push data to the cloud and display it on a mobile app. Route optimization algorithms can be applied for efficient waste collection.

# Project Photos