SMART WASTE MANAGEMENT SYSTEM FOR METROPOLITAN CITIES

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Introduction

- In general, solid waste is described as garbage from homes, hazardous solid waste from businesses, hospitals, and markets, as well as yard debris and street sweepings.
- In large cities, it is difficult for waste collectors to gather the junk waste. We displayed them on an LCD screen using a garbage can to avoid their difficulties.
- Waste collectors arrived and collected the waste after seeing the LCD allocation in the municipality, therefore we installed cameras in each trash can to measure the volume of waste.

Motivation

- One of the major issues the globe has faced in recent years is waste management.
- Frequently, we observe in our city or neighbourhood that the trash cans or dustbins located in public areas are overflowing.
- It brings out a negative side.
- There was a bad odour and an unhealthy situation for the locals.
- The proposed Smart Bin concept aids in resolving all waste management-related issues.

Description

The sensors will continuously monitor the smart trash cans spread out in different locations.

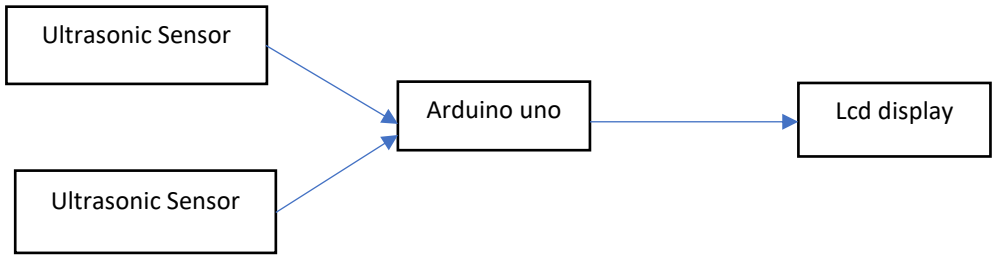
- From all of the surrounding trash cans , the collected data will be routed hierarchically to a gateway node(Arduino uno), which will upload the data into a cloud database.
- A trigger will be set off based on the bin updates (status) received from the lcd, alerting the responsible admin about the allocation of a driver to a specific bin.
- The concerned admin can keep track of the real-time updates for all the bins and driver information via a lcd.

Problem Overview

The following list summarises the primary issues with the current smart trash collecting procedure and management system:

- Lack of knowledge on the location and timing of the collection.
- Absence of an effective mechanism for tracking and monitoring trucks and trash cans in real time after collection.
- Productivity loss brought on by improper and wasteful use of cars.
- For serious situations like truck accidents, breakdowns, and prolonged idle times, there is no immediate solution.
- In response to complaints from customers regarding uncollected trash, there is no quick solution.

System Model



Hardware Requirement

- Arduino Uno
- Ultrasonic Sensor
- Lcd

Arduino Uno

- The DC Current per I/O Pin is 20 mA, and there are 6 analogue input pins.
- The 3.3V pin's direct current is 50 mA.
- The main component of the flash memory for this Arduino is 32 KB, of which 0.5 KB is used by the bootloader.
- It also has 2 KB of SRAM and 1 KB of EEPROM with a clock speed of 16 MHz.
- The Arduino is 68.6 A microcontroller board called the Arduino Uno is reliant on the ATmega328 (datasheet).
- The operating voltage of the Arduino microcontroller, a Microchip ATmega328P, is 5 volts.
- There are 14 digital I/O pins, 6 of which are used for PWM output, and the input voltage ranges from 7 to 20 volts. millimetres long having a width of 53.4 mm and weighing.

Ultrasonic Sensor

- The four pins on an ultrasonic (US) sensor are labelled Vcc, Trigger, Echo, and Ground, respectively.
- This detector might be a widely used of this detected.

- Numerous applications where measuring distance or sensing things is required could make use of this detector.

- The front of the module, which frames the ultra-supersonic transmitter and recipient, has two eyes that resemble those of a robot companion.

- The locator operates using a straightforward secondary school formula that

Distance Time = Distance x Speed

- The supersonic wave that the ultrasonic transmitter transmitted.

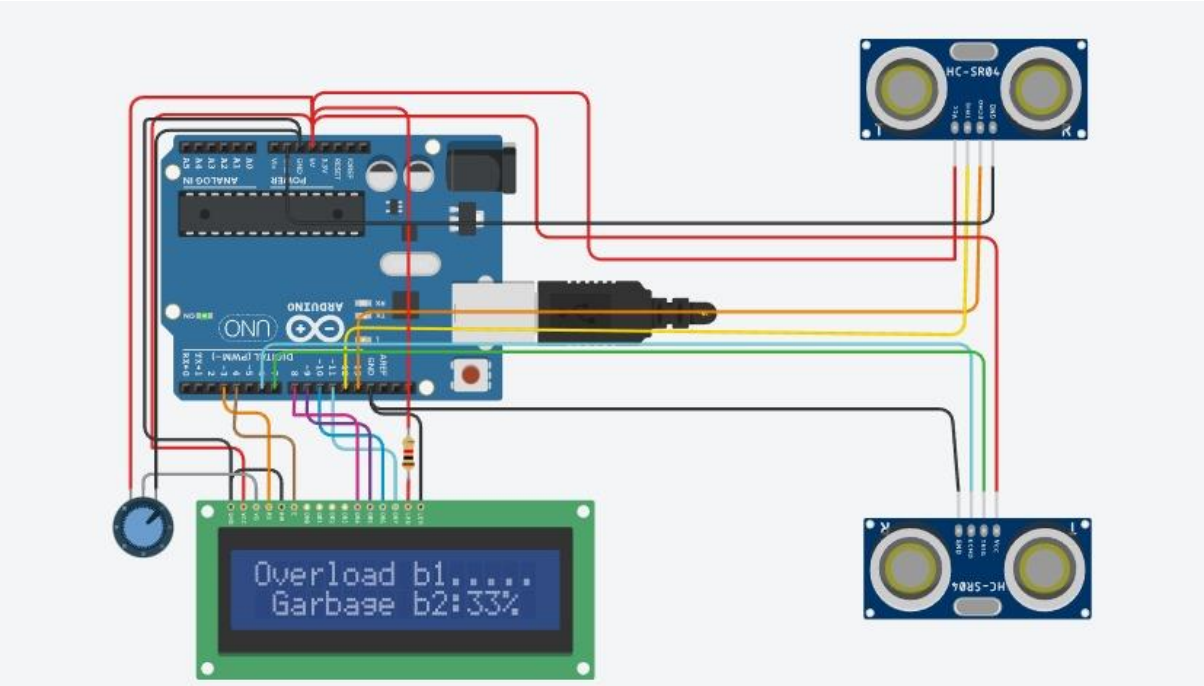
Program coding

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(3,4,8,9,10,11);
const int triggerPin1 = 12;
const int echoPin1 = 13;
const int triggerPin2 =7;
const int echoPin2 = 6;
long duration;
int distanceCm;
int percentage;
void setup()
{
lcd.begin(16,2);
pinMode(triggerPin1, OUTPUT);
pinMode(echoPin1, INPUT);
pinMode(triggerPin2, OUTPUT);
pinMode(echoPin2, INPUT);
}
void loop()
```

```
{
digitalWrite(triggerPin1, LOW);
delayMicroseconds(10);
digitalWrite(triggerPin1, HIGH);
delayMicroseconds(10);
digitalWrite(triggerPin1, LOW);
duration = pulseIn(echoPin1, HIGH);
distanceCm= duration*0.034/2;
percentage= (((-10*distanceCm)+100)/9)+100;
lcd.setCursor(0,0);
  if (distanceCm >=100)
  {
    lcd.print("Empty b1........");
  }
  else if (distanceCm<=10)
  {
    lcd.print("Overload b1.....");
   }
  else if(distanceCm>10 && distanceCm<100 )
  {
   lcd.print("Garbage b1:");
   lcd.print(percentage);
   lcd.print("%")
delay(10);
  }
digitalWrite(triggerPin2, LOW);
delayMicroseconds(10);
digitalWrite(triggerPin2, HIGH);
delayMicroseconds(10);
digitalWrite(triggerPin2, LOW);
duration = pulseIn(echoPin2, HIGH);
distanceCm= duration*0.034/2;
percentage= (((-10*distanceCm)+100)/9)+100;
lcd.setCursor(1,1);
  if (distanceCm >=100)
  {
    lcd.print("Empty b2........");
```

```
  }
  else if (distanceCm<=10)
  {
    lcd.print("Overload b2.....");
    }
  else if(distanceCm<100 && distanceCm >10)
  {
lcd.print("Garbage b2:");
lcd.print(percentage);
lcd.print("%");}
delay(10);
 }
```

Connection Output



Wokwi code

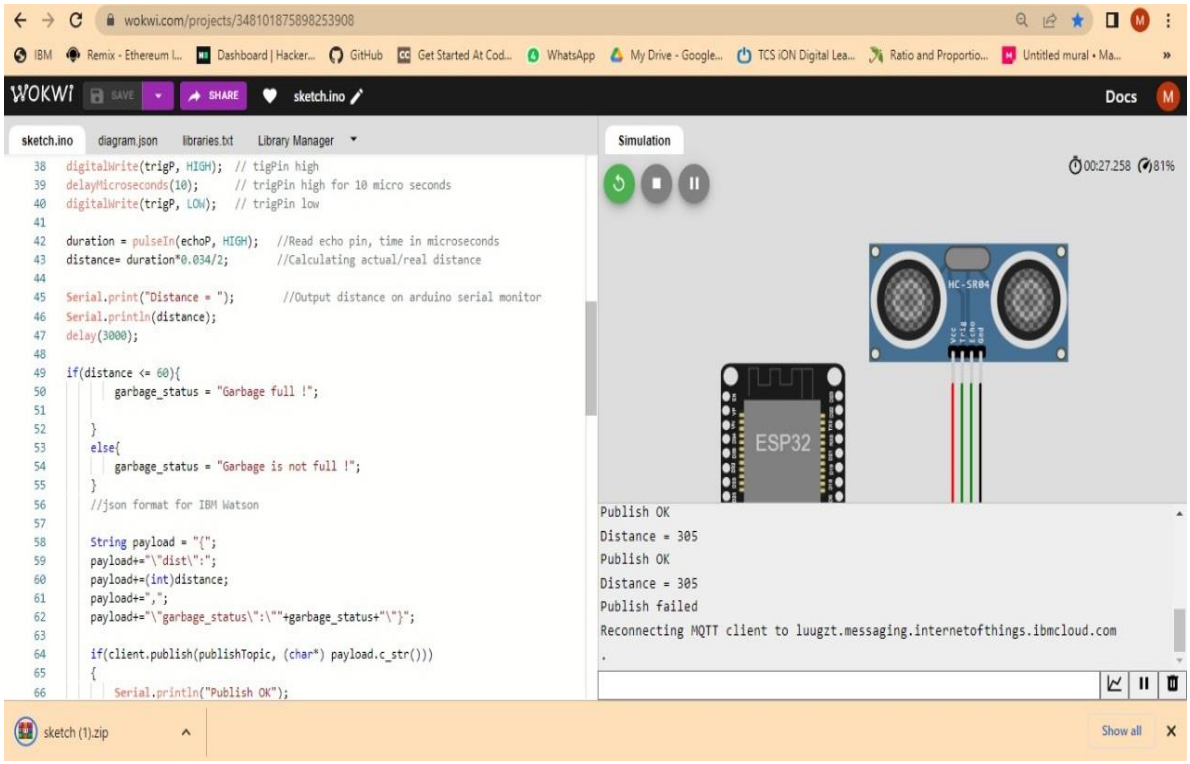
```
#include <time.h>
#include <WiFi.h>
#include <PubSubClient.h>

#define ORG "luugzt"
```

```
#define DEVICE_TYPE "nodemcu"
#define DEVICE_ID "12345"
#define TOKEN "@StVt)+)?pZUwEPT@Q"

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/data/fmt/json";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;

WiFiClient wifiClient;
PubSubClient client(server, 1883, wifiClient);

const int trigP = 4;  //D4 Or GPIO-2 of nodemcu
const int echoP = 2;  //D3 Or GPIO-0 of nodemcu

long duration;
int distance;
String garbage_status="";

void setup() {
  pinMode(trigP, OUTPUT);  // Sets the trigPin as an Output
pinMode(echoP, INPUT);   // Sets the echoPin as an Input
  Serial.begin(99900);
   wifiConnect();
   mqttConnect();
}

void loop() {
digitalWrite(trigP, LOW);   // Makes trigPin low
delayMicroseconds(2);       // 2 micro second delay

digitalWrite(trigP, HIGH);  // tigPin high
delayMicroseconds(10);      // trigPin high for 10 micro seconds
digitalWrite(trigP, LOW);   // trigPin low
```

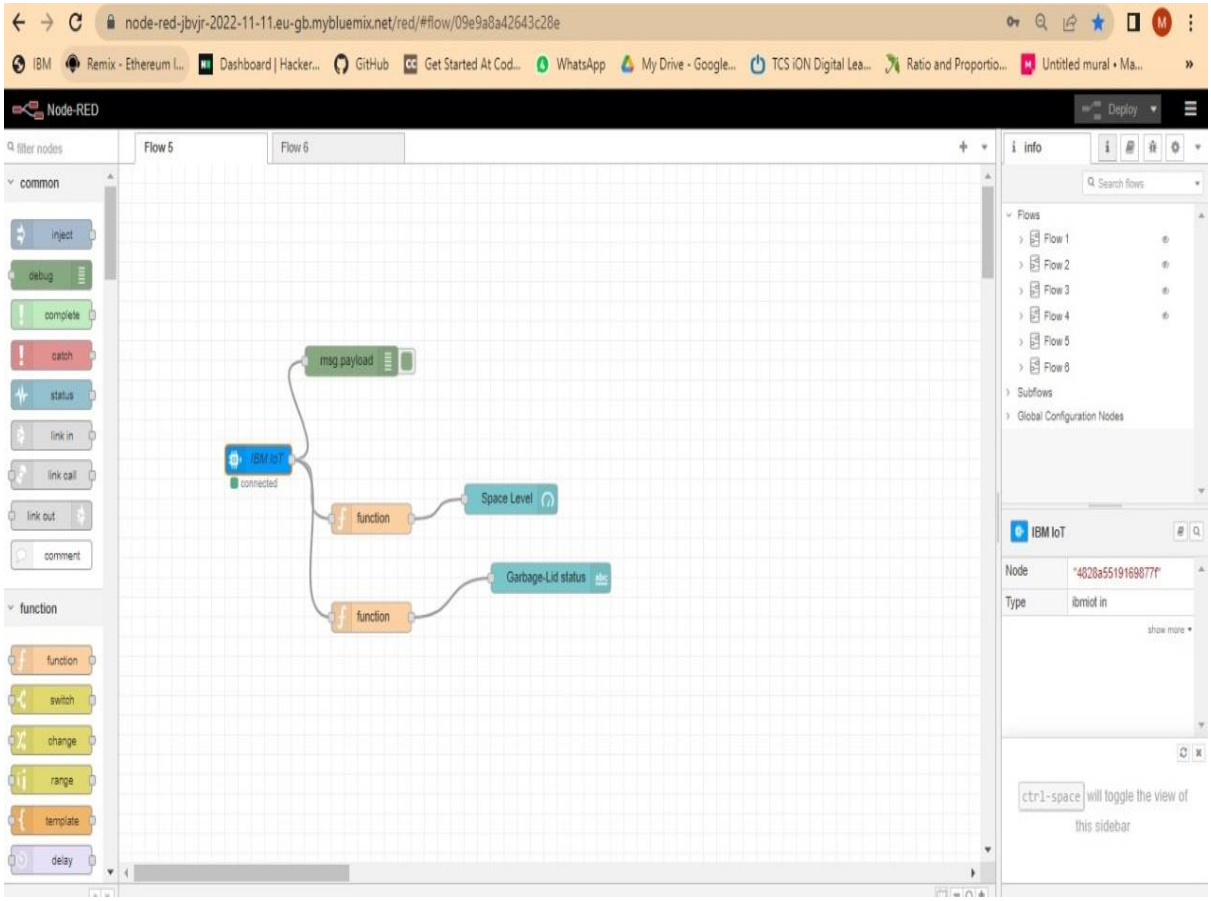
```
duration = pulseIn(echoP, HIGH);   //Read echo pin, time in microseconds
distance= duration*0.034/2;        //Calculating actual/real distance

Serial.print("Distance = ");        //Output distance on arduino serial monitor
Serial.println(distance);
delay(3000);

if(distance <= 60){
        garbage_status = "Garbage full !";

    }
    else{
        garbage_status = "Garbage is not full !";
    }
    //json format for IBM Watson

    String payload = "{";
    payload+="\"dist\":";
    payload+=(int)distance;
    payload+=",";
    payload+="\"garbage_status\":\""+garbage_status+"\"}";

    if(client.publish(publishTopic, (char*) payload.c_str()))
    {
        Serial.println("Publish OK");
    }
    else{
        Serial.println("Publish failed");
    }
delay(100);

    if (!client.loop())
    {
      mqttConnect();
```

```
    }
}


void wifiConnect()
{
  Serial.print("Connecting to ");
  Serial.print("Wifi");
  WiFi.begin("Wokwi-GUEST", "", 6);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.print("WiFi connected, IP address: ");
  Serial.println(WiFi.localIP());

}


void mqttConnect()
{
  if (!client.connected())
  {
    Serial.print("Reconnecting MQTT client to ");
    Serial.println(server);
    while (!client.connect(clientId, authMethod, token))
    {
      Serial.print(".");
      delay(500);
    }

    Serial.println();
  }
}
```

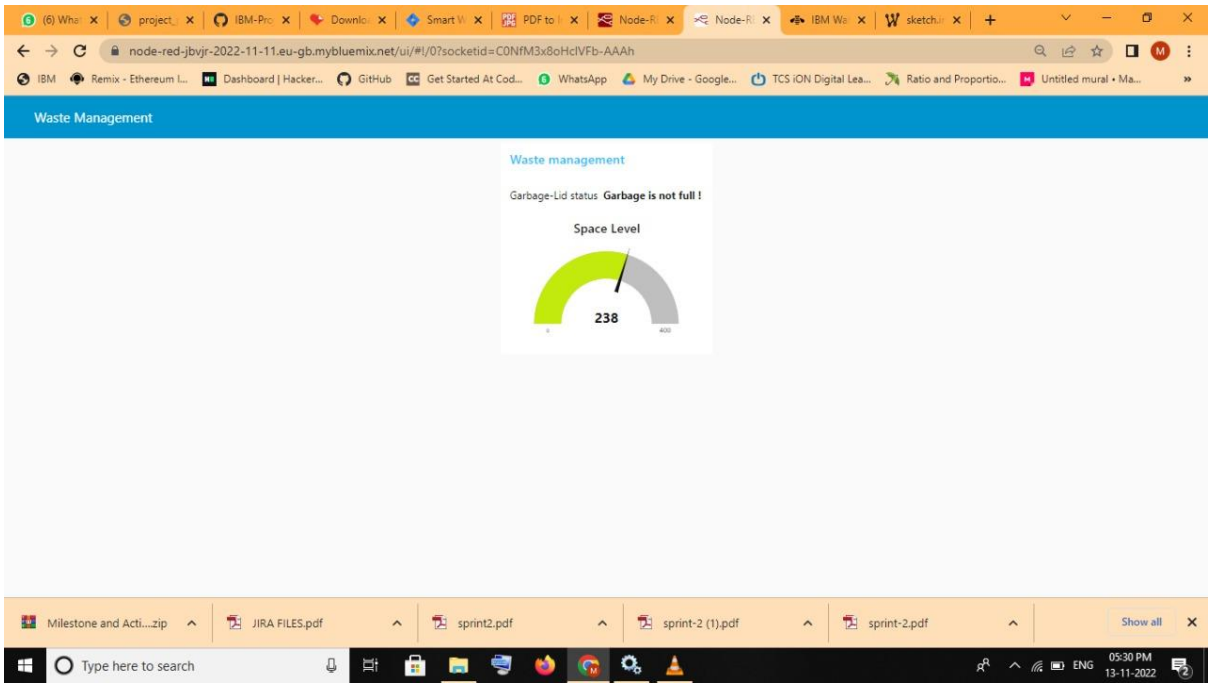
Wokwi Simulation



Node red simulation



Project Output



Future Implementation

In the future, when the trashbin overflow. We are planning to set GPS location of trashbin so that the cleaning staff knows and takes away the rubbish

Conclusion

We can keep ourselves and our surroundings neat and clean. Cleanliness is utterly essential to lead a healthy and peaceful lifestyle. We should not neglect it. Instead ,we should encourage other people as well to stay clean and lead a health life.