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/*
Smart Waste Management System
Author: Amala Sojin Aldo S
College: Jayamatha Engineering College
Date: 13/10/2025
Description:
This IoT project monitors the fill level of a dustbin using an Ultrasonic Sensor (HC-SR04)
and sends the data to Firebase via NodeMCU (ESP8266).
*/

#include <ESP8266WiFi.h>
#include <FirebaseESP8266.h>

// ---------- CONFIGURATION ----------
#define WIFI_SSID "Your_WiFi_Name"
#define WIFI_PASSWORD "Your_WiFi_Password"

// Firebase configuration
#define FIREBASE_HOST "your-project-id.firebaseio.com" // Replace with your Firebase Realtime DB link
#define FIREBASE_AUTH "your-firebase-secret" // Replace with your Firebase database secret key

// Ultrasonic sensor pins
#define TRIG_PIN D5
#define ECHO_PIN D6

// Bin information
String BIN_ID = "B01";
int MAX_BIN_HEIGHT = 30; // Height in cm (distance from sensor to bottom of bin)

// Firebase object
FirebaseData firebaseData;

// ----------------------------------------------------

void setup() {
Serial.begin(9600);
pinMode(TRIG_PIN, OUTPUT);
pinMode(ECHO_PIN, INPUT);

// Connect to Wi-Fi
Serial.println();
Serial.print("Connecting to WiFi");
WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
}
Serial.println();
Serial.println("WiFi Connected!");
Serial.print("IP Address: ");
Serial.println(WiFi.localIP());
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// Connect to Firebase
Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
Firebase.reconnectWiFi(true);
}

// ---------------------------------------------------------

void loop() {
long duration;
int distance;

// Trigger ultrasonic pulse
digitalWrite(TRIG_PIN, LOW);
delayMicroseconds(2);
digitalWrite(TRIG_PIN, HIGH);
delayMicroseconds(10);
digitalWrite(TRIG_PIN, LOW);

duration = pulseIn(ECHO_PIN, HIGH);
distance = duration * 0.034 / 2; // Convert to cm

// Calculate fill level (in %)
int fillLevel = 100 - map(distance, 0, MAX_BIN_HEIGHT, 0, 100);
if (fillLevel < 0) fillLevel = 0;
if (fillLevel > 100) fillLevel = 100;

Serial.print("Bin ID: ");
Serial.print(BIN_ID);
Serial.print(" | Fill Level: ");
Serial.print(fillLevel);
Serial.println("%");

// Send data to Firebase
String path = "/SmartWaste/Bins/" + BIN_ID;
Firebase.setInt(firebaseData, path + "/FillLevel", fillLevel);
Firebase.setString(firebaseData, path + "/Timestamp", getFormattedTime());

// Alert if bin is full
if (fillLevel >= 90) {
Firebase.setString(firebaseData, path + "/Status", "FULL");
} else {
Firebase.setString(firebaseData, path + "/Status", "OK");
}

delay(10000); // Upload data every 10 seconds
}

// ---------------------------------------------------------

String getFormattedTime() {
// Simple timestamp using millis (placeholder)
unsigned long seconds = millis() / 1000;
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return String("Uptime: ") + seconds + "s";
}
```