IoT- based Smart Dustbin Management System

- **Group - 4**

OUR TEAM

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INTRODUCTION

- Effective Waste Monitoring is crucial for maintaining a clean and healthy environment

- There are various factors involved such as,

    - Poor waste management can cause health hazards and environmental pollution

    - Traditional methods rely on fixed routes, lacking real-time adaptability which is inefficient and leads to increased operational costs

    - Lack of real-time monitoring leading to delayed waste disposal

OUR AIM....

To develop a smart system that provides real-time data on dustbin fill levels, which thereby optimizes the waste collection routes and reduces health risks

COMPONENTS

Hardware components :

- NodeMCU ESP8266
- 3-4 Dustbins
- NodeMCU jumper wires
- Connector
- BreadBoard
- Power Supply

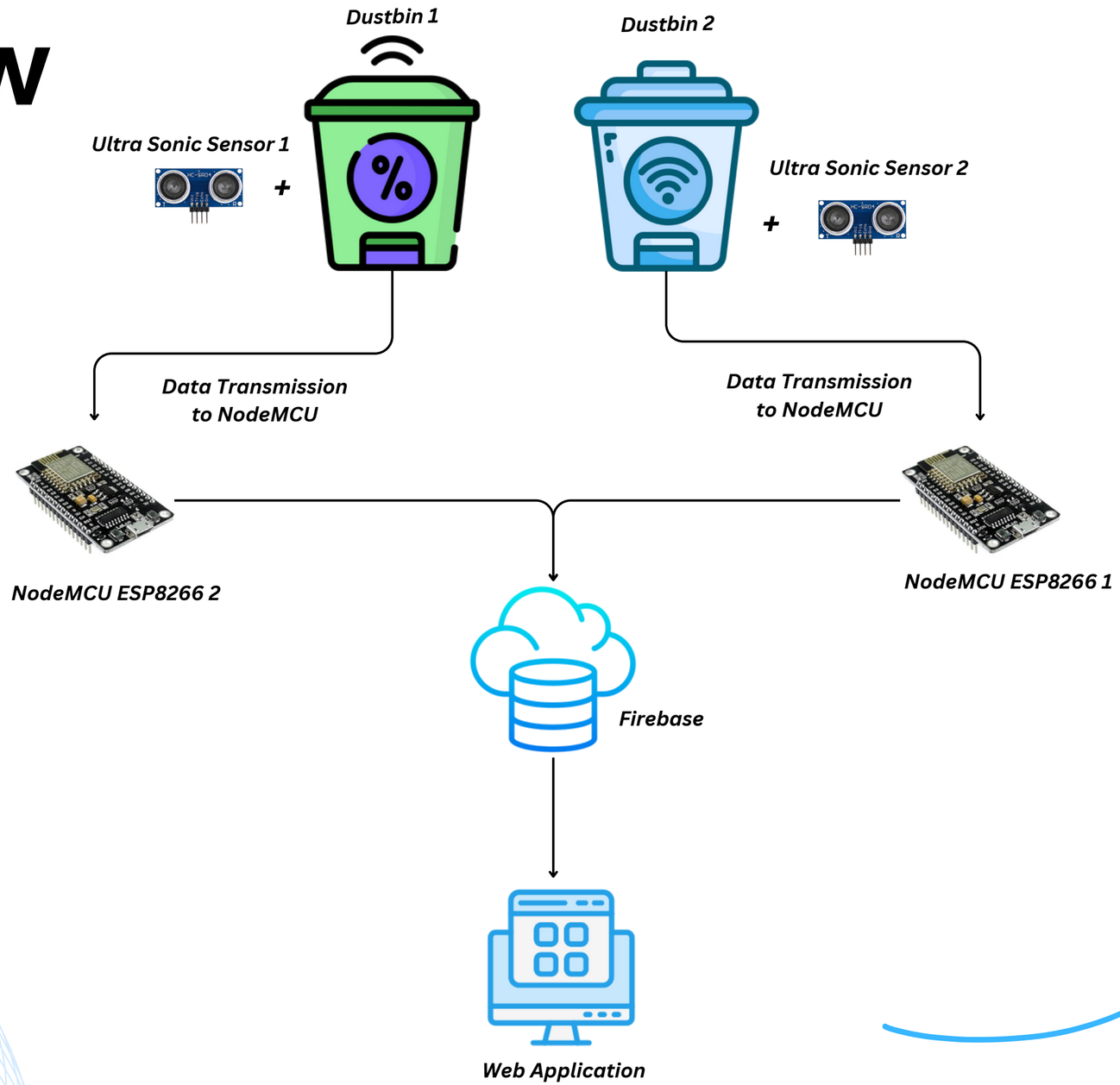
Software components :

- Aurdino IDE
- Web Application (Interface)
- Firebase (To store data)

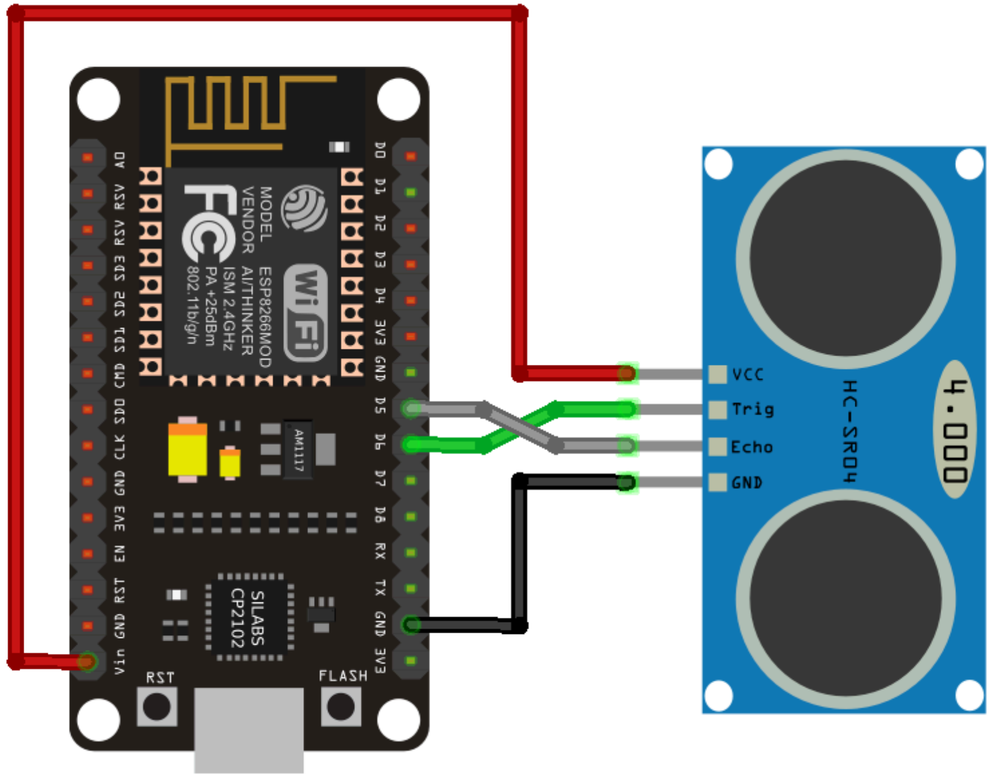
STEPS INVOLVED

- **Data Collection:**
    - Ultra-Sonic Sensors installed in dustbins measure the fill level and send data to the NodeMCU.
- **Data Transmission:**
    - NodeMCU transmits the data to a central server or cloud-based platform like Firebase etc
- **Data Processing:**
    - In this step, Analysis of the data is performed to be sent to Application
- **Real-time Application:**
    - The processed data is now utilized in the application to monitor the dustbins and take efficient and necessary actions accordingly

OVERALL WORK FLOW



SCHEMATIC



Ultrasonic Sensor	ESP8266
VCC	VIN
Trig	GPIO 12 (D6)
Echo	GPIO 14 (D5)
GND	GND

CONNECTIVITY AND FIREBASE SETUP

- **NodeMCU** Captures data from the ultrasonic sensor.
- It already has a built-in **WiFi module**. One need to connect to the WiFi network and configure it to communicate with Firebase by providing the HOST_URL and API_KEY
- Collection of Sensor Data : Measure the height of waste in the bin using the ultrasonic sensor (Consider 10 readings).
- The collected data will be sent to Real-Time Database in Firebase using the WiFi module.
- Firebase Stores average waste for remote monitoring as key-value pairs in the database

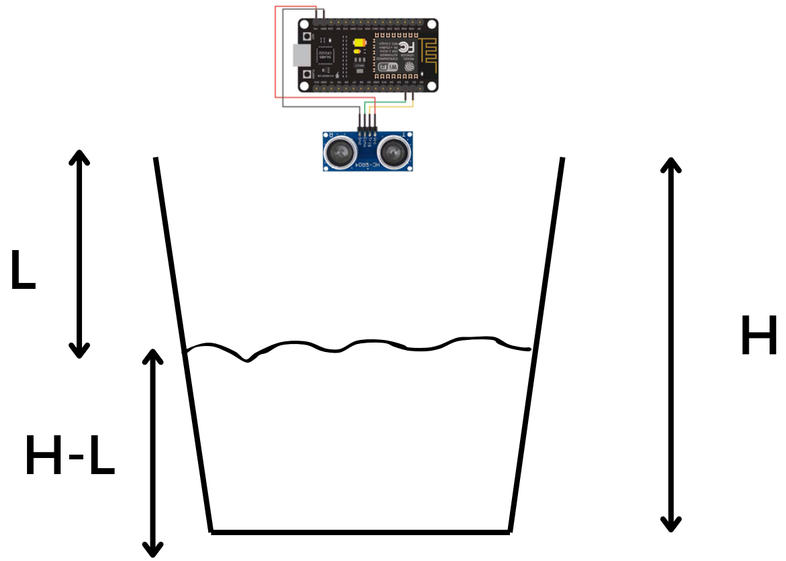
WORKING PRINCIPLE

Ultrasonic Sensor Functionality :

- The ultrasonic sensor measures the distance between itself and the waste in the dustbin. It has a 120° beam, which means some readings might come from the walls or bottom of the dustbin.

- Distance Calculation: The value of waste height is calculated using the formula:

Percentage of Waste Level= ((H-L) / H)*100



Contd..

Where:

- **H** : Total height of the dustbin
- **L** : Average Distance detected by the sensor

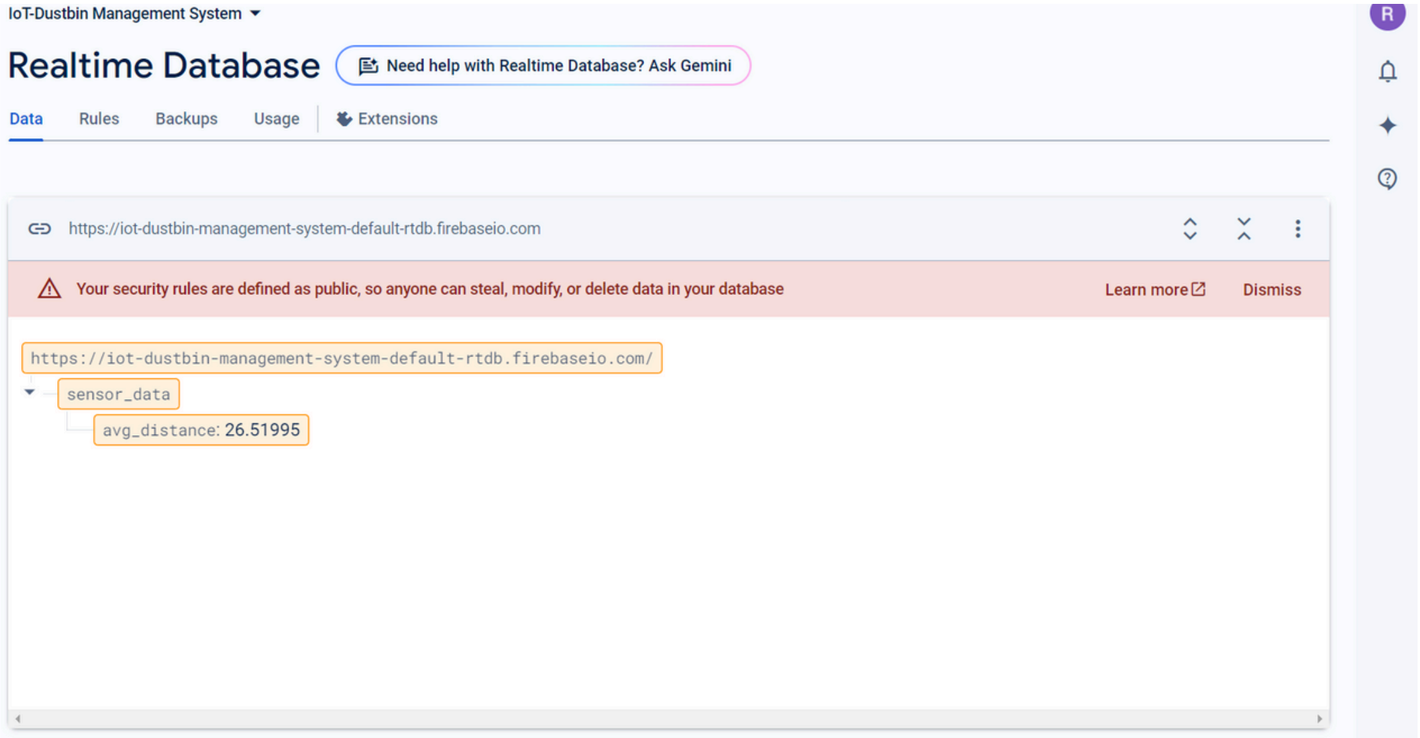
Why Average ‘L’ Value ?

- To minimize network strain while maintaining real-time insights, we average sensor readings over time and transmit the data to Firebase at defined intervals (every n seconds)

- Averaging 10 recordings helps filter out in-accuracies caused by the ultrasonic sensor's 120° beam detecting signals from the dustbin walls or bottom, ensuring accurate waste-level measurements.

CURRENT WORK

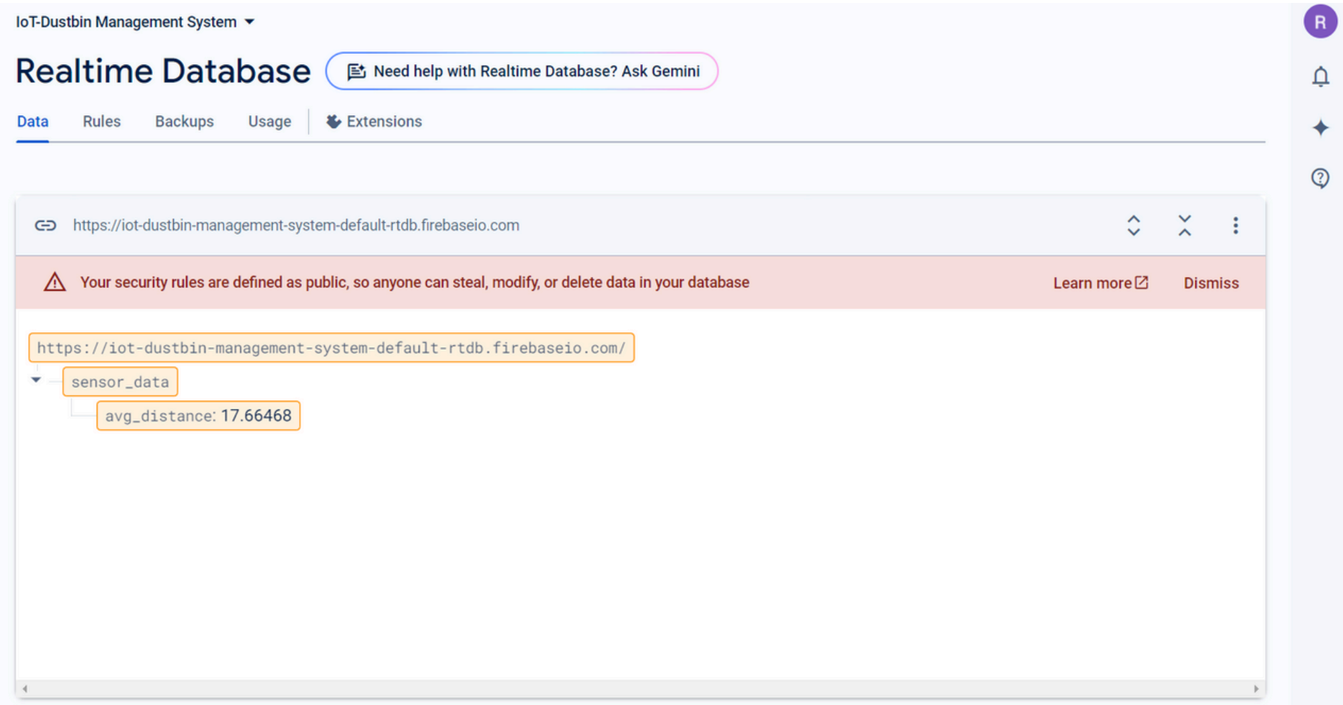
Empty dustbin



Firebase Visuals

CONTD...

Partially filled dustbin



Firebase Visuals

THANK YOU

- Group 4