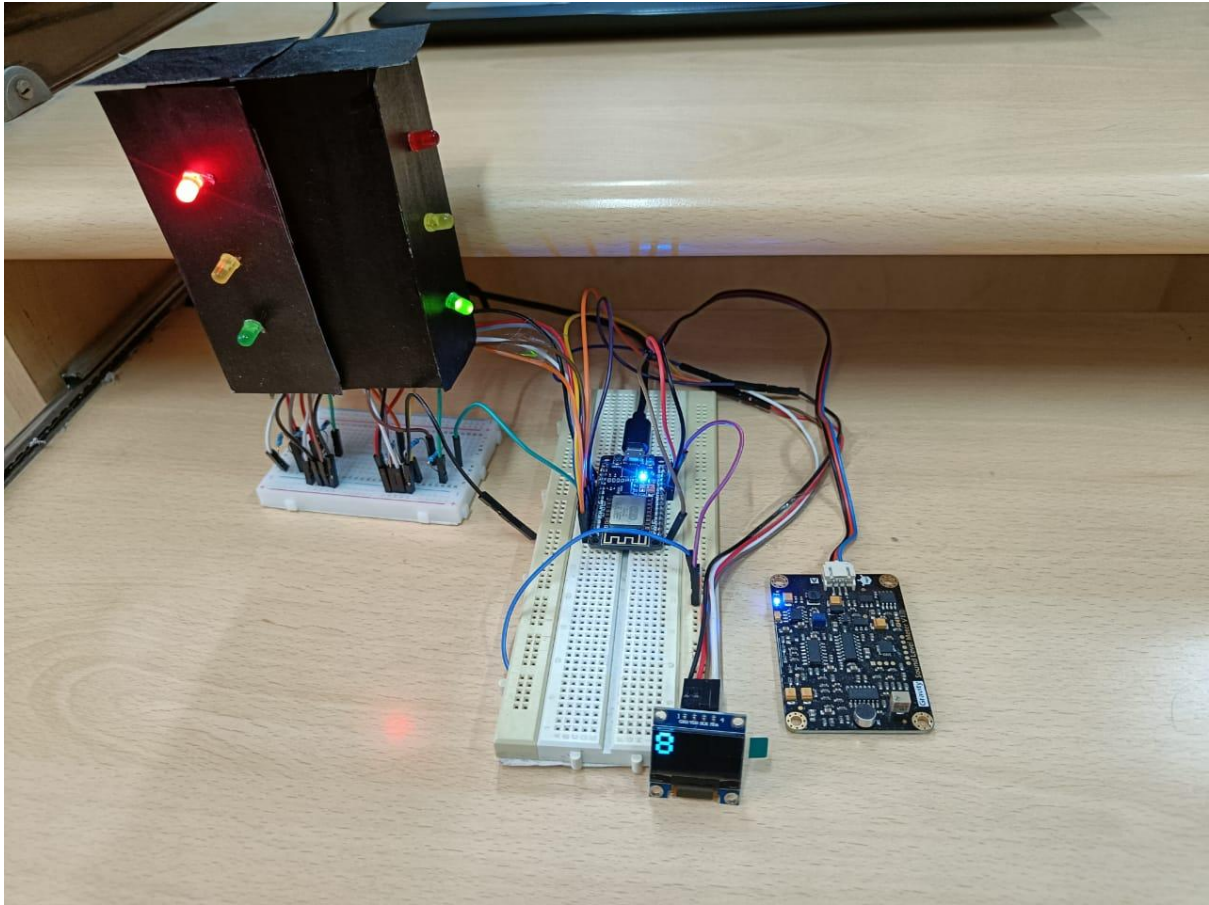


## Phase 2: Innovation

To bring awareness on noise pollution levels in places with heavy traffic inflow and introduce measures to discourage people from honking.



## Things used in this project

### Hardware components

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NodeMCU ESP8266 Breakout Board

DFRobot Gravity Analog Sound Level Meter

ElectroPeak 0.96" OLED 64x128 Display Module

5mm LED \*10

USB-A to Micro-USB Cable

Resistor 220 ohm \*6

## Software apps and online services

Arduino IDE

Postman

Eclipse OM2M

Grafana

Postgresql

Django

## Problem Statement

Noise pollution to a huge extent is neglected despite its short and long-term ramifications on human health. The various permissible noise limits in residential, commercial, and industrial areas should be strictly followed in accordance with the governing law and WHO guidelines to reduce the effects of noise pollution on human health. Honking by commuters near traffic junctions is one of the main sources of noise and the effect of increased automobile use in recent years especially in various metropolitan cities has resulted in increased noise levels in urban areas.

## Solution

The solution focuses on traffic junctions throughout the city and plans to deploy a noise monitoring node at every junction. As a part of the solution to this project, we have implemented a "**Punishing Signal**" to create awareness about noise pollution among commuters. The implementation includes a noise pollution monitoring node that reads the noise levels at a given traffic junction and also the prototype of a traffic light controller which controls the flow of traffic at a junction. The idea is to discourage commuters from honking unnecessarily at a traffic light.

## Proposed System - How it works

We aim to propose a low-cost, reliable, compact, and real-time **OM2M** and **IoT** noise pollution monitoring system at high-density traffic junctions and develop a mechanism to **discourage people from honking**.

We use the **ESP8266** microcontroller interfaced with the **DF Robot Analog Sound Level Meter** sensor whose output is in Decibels with 'A' weighting (dB(A)) with the same weighting closest to how humans perceive sound. The Traffic Signal Controller code to implement the Punishing Signal runs on Arduino IDE.

The traffic signal prototype is programmed to stay RED for 20 seconds, YELLOW for 3 seconds, and GREEN for 30 seconds. The countdown timer for each state is shown on an OLED screen. When the noise level above a specified threshold is sensed more than 3 times when the traffic signal is in RED state then 10 seconds is added to the red signal countdown timer.

The noise data, signal status, and countdown timer are all sent to the **OM2M Eclipse server**, and using OM2M functionality the data is subscribed to a **Django** server. The data from the Django server is created into a database in **PostgreSQL**. The database is then used to create a **Grafana** dashboard for analytics.

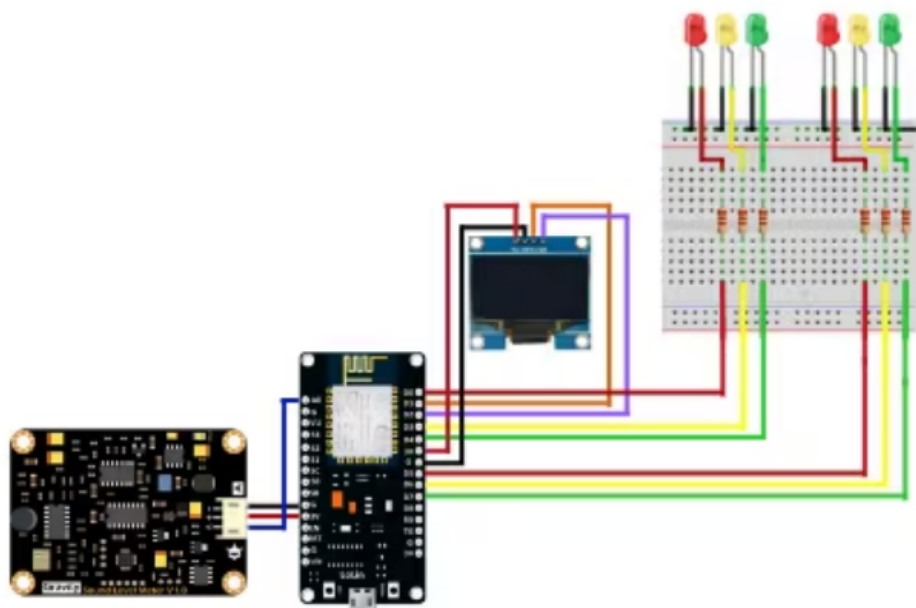
## Implementation of the Punishing Signal

### Schematics

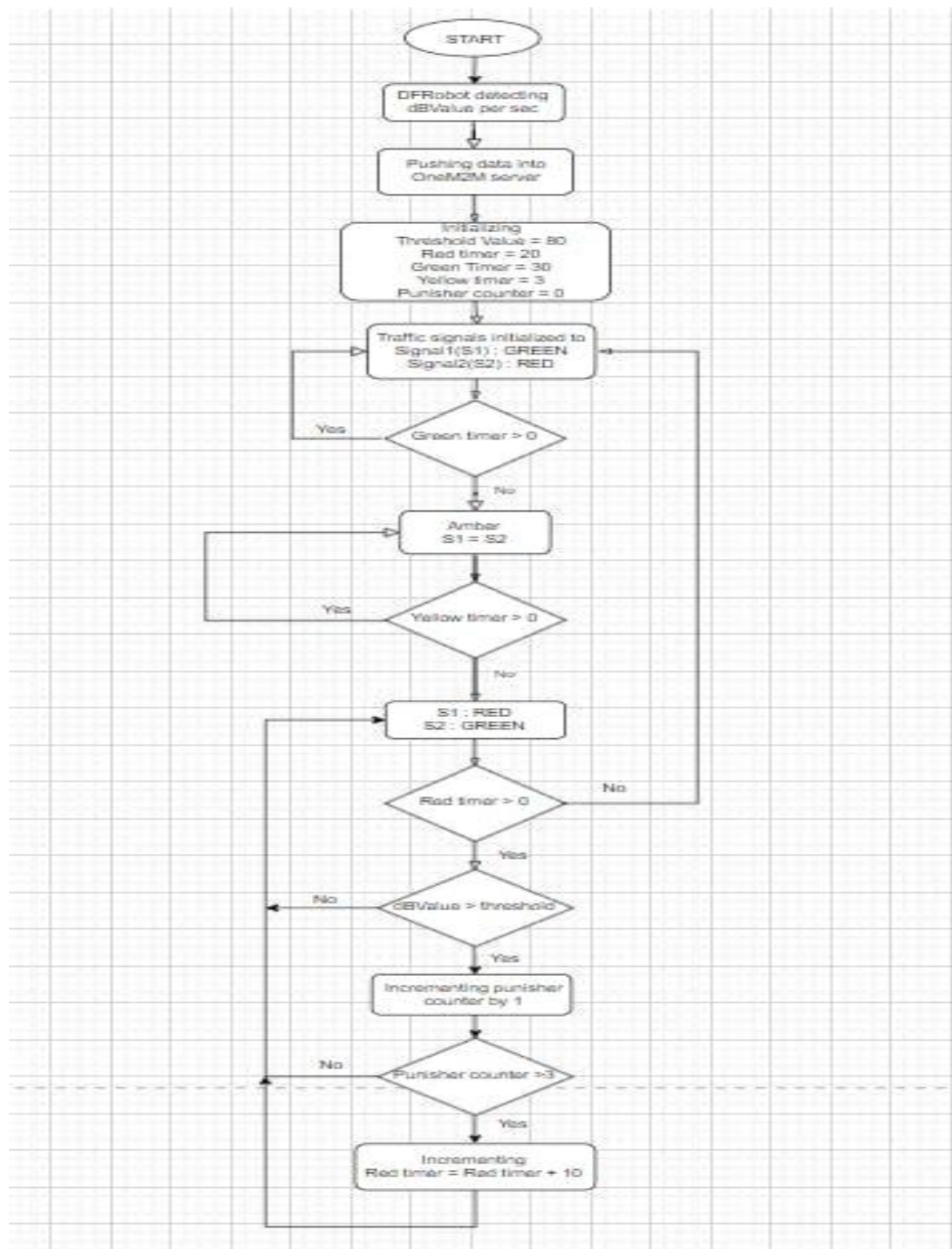
Connect the DFRobot Analog Sound sensor, OLED, and the respective LEDs to the NodeMCU board using the following components:

- Breadboard
- NodeMCU board

- DFRobot Analog Sound Level Meter
- OLED
- Red, Green, and Yellow LEDs.
- 220 ohmic resistors per LED.



# Flowchart



## Working

Imposing the RED signal is done when the noise levels exceed the threshold more than 3 times. This is done by initiating a counter and is based on the frequency of noise levels in dB(A) above the threshold. If it exceeds the threshold count again during the imposition of the RED signal, an additional 10 seconds are added to the wait time.

The Traffic Signal is demonstrated by using 3 LEDs which glow corresponding to their interval. Considering an intersection with the main road and a side road crossing the main road the time interval taken for the signal is 20 seconds and the GREEN signal is 30 seconds for the main road and 30 seconds for RED and 20 seconds for GREEN for the side road. Yellow LED will glow on each transition between GREEN to RED for 3 seconds. The countdown timer for each state is shown on an OLED screen. When the noise level above a specified threshold is sensed more than 3 times when the traffic signal is in RED state then 10 seconds is added to the red signal countdown timer as a punishment for excessive and unnecessary honking. If the commuters still honk even after 10 second punishment has been added and the noise levels cross the threshold more than 3 times again another 10 seconds is added to count down the timer as a punishment the second time. We have limited the number of punishments to 3 times. After the maximum number of punishments, the traffic light will go back to green and it will work as the regular traffic light controller.

## Actuators - Display Message

A message is generated to be flashed and displayed at the junction during the imposed AMBER signal time. The counter of the Signal states is also displayed clearly to the passengers. We are using an OLED connected to ESP8266 during the same interval. This puts into perspective the overall noise pollution and awareness to the general public of all the signals at the respective junction.

