

Vehicle Pollution Monitoring using IoT

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Abstract — Pollution is one of the major cause affecting the environment in today's world, especially Air Pollution. According to the data the contribution of air pollution itself is upto 70% is that of the total pollution causing damage to the environment. Also it is one of the major factor that has caused uncertainty in global warming. And due to global warming, we came across with the uncertainty in the weather or climatic conditions of the planet Earth. As noticed and recorded we saw a huge discrepancy in the climate and seasons too. The climate became more of humid in most of the regions of the earth. The Glacier has started melting at a tremendous decreasing rate of 25 meters annually. All is due to the Global warming, and major factor contributing to this is pollution.

Keywords: Node MCU, Internet of Things (IOT), MQ-135, MQ-7, Sensors

I. INTRODUCTION

As of now we all know air pollution is one of the major factor affecting the nature and also causing global warming at the same time, but precisely one thing is constantly increasing this rate is pollution that gets emitted on a day to day regular basis is vehicle pollution. Knowingly or unknowingly, we see the gas that gets emitted out of the exhaust pipes of the vehicles you see on the roads are playing a lead role here in air pollution. Majorly, the gases that get emitted from these engines are carbon monoxide (CO) and some minor proportion of carbon dioxide (CO₂). The process goes like this, the very first thing is when one turns on the ignition the engine starts, these engines are combustion engines which mainly run on the gasoline (Diesel, petrol) causing spark in the engine, this leads to power production and thus the vehicle is able to move forth. The process does have a byproduct of this combustion that is gas emission through the exhaust pipe. Therefore for tackling this event we are building an IoT based Software Application to limit the emissions by imposing restrictions as well as keeping an eye on each and every vehicle using our monitoring device on gas exhaustion of vehicles.

II. LITERATURE SURVEY

To your conformity we have a paper proposed in January 2023 in the journal published by the "International Research Journal of Modernisation in Engineering Technology and Science" which comes across the same problem. In our environment of the pollution is mostly because of the emission of harmful gases from the automobiles. This can be reduced only by strictly monitoring the concentrations of harmful pollutants like CO, NOX, smoke etc. It is difficult to check that manually. At that time this system is very useful to calculate the concentrations of harmful gases and to inform the vehicle owner and the transport department which helps in proper maintenance of the vehicles. G Hauber-Davidson discussed the role of smart water meters and their real-time monitoring capabilities for water consumption. The paper

proposed taking action in response to the increasing cost of water [1].

In addition to this, we also got a paper proposed in the year April 2022, covering the same obstacle published in the "International Journal of Advanced Research in Science, Communication and Technology", this paper RFID technology, as one of the enabling technologies of IoT (Internet of Things), is employed to develop the information system. RFID reading can be interrogated along with the corresponding tag ID through a wireless connection among traffic lights and vehicles. This will maintain the database and graph for the data by monitoring the emissions data, the engine health can be easily inspected and examined. Tracy C. Britton shared insights into improving water distribution systems for water utilities. The paper emphasized the reduction of water loss in the network, estimating customer post-meter leakage to be up to 10% of total water consumption. The conclusion highlighted the importance of identifying and addressing post-meter leakage [2].

Also we have got a paper from the year 2022 month January from the conference of "International Journal of Engineering Research & Technology", decoding on the solution of the obstacle which goes like every 15 days, a pollution check is required, and just a few people follow through. This project setup has been Technology (LERT) calibrated, and the system's performance has been validated. The designed system monitors the pollution level released by automobiles, and if it exceeds a certain threshold value, a warning message is delivered to the vehicle owner via the GSM module [3].

III. PROJECT CONCEPT

A. Overview

As per the recent data, the vehicular emission is a major cause of air pollution in urban areas. Typically, the vehicular emission contributes in an unbelievable ratio of 20-30% of the overall damage to the environment, which makes breathing nearly harmful for the human mankind. If the percentage rises in upcoming years this would be a big trouble maker for the mankind. So to restrict and overcome this we are proposing a concept of monitoring and controlling the vehicular emissions to somewhat extent. We are going to design two models based on IoT to keep eyes on the "ppm" values of the gases emitted by the vehicles. Basically, we figured out that the vehicles that aren't serviced frequently comparatively and majorly violated the ppm value which exceeded over '150' which is in the red zone. For a safer side the ppm value should be around 80 maximum, if it exceeds over 100 the air quality gets in trouble.

B. Hardware Requirements

For this model we are using a few components as our hardware for the model and some sensors to majorly focus on the monitoring of the CO gas emitted by vehicles. The first one is the Node MCU, then we have used MQ135 for the

sensor part of the hardware LM35 as our temperature sensor and A/D converter for conversion of analog signals to digital signals.

1) *Node MCU (Microcontroller):*

The main working of the node MCU that is the microcontroller has the major role in this project covering all the connections and integrations part on a motherboard. Mainly this is the connecting block of the software part and the hardware part of the project.



Fig. 1: Node MCU (MicroController)

2) *MQ135 (Gas Sensor):*

This sensor is widely used for sensing gases from the atmosphere. It can detect Ammonia (NH₃), sulfur (S), Benzene (C₅H₆), Carbon dioxide (Co₂) as well as the Carbon Monoxide (CO). So we decided to select this particular sensor for the job.



Fig. 2: MQ135 (Gas sensor)

3) *LM35 (Temperature Sensor):*

This is a temperature sensor which is again important while monitoring the emissions of the vehicle. The LM35 outputs the analog signal which is proportional to the instantaneous temperature, meaning as the temperature increases or decreases the analog signal value increases and decreases simultaneously.



Fig. 3: LM35 (Temperature Sensor)

4) *A/D converter:*

The A/D converter is an analog signal converter to digital signal converter. Basically it is a translator between the

analog signals like sound, light, temperature) to digital signals like the computers. This process allows one from real-world to get the analog data in the human understandable language.

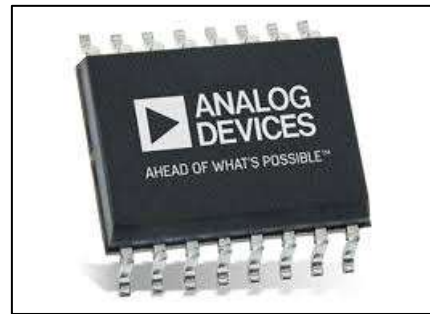


Fig. 4: A/D Converter

C. *Working Modules*

We have 2 modules ready for the action. The first one can be placed at each and every vehicle at the time of manufacturing itself, and the other one will be placed in heavy crowded areas like congestion areas of the region, the traffic signals and some of the heavily traffic areas. The vehicle module has a job of monitoring the gas emission levels from the exhaust pipe. The area module has a job of taking a note of air quality of that particular area where it has been placed so that the RTO nearby can take actions particularly.

1) *Vehicle Module:*

For this module we have also developed an application for 2 people one is for the user and one is for the administrator. To be precise the user app consists of the basic information such as the vehicle details and if the device is installed or not. Also in addition to it the user also has the acknowledgment of the challans he has to pay in accordance with the violation of the rules and regulations of his vehicle. He also can register new vehicles through the application, also he gets a payment gateway in built in the app so he doesn't have to check any other website or application to pay-off his challans. Lastly he has a history of the challans and a pay-check of the past payments. If the device is not installed he too gets a mail directly from the admin to immediately install the device or further actions could be taken. All the information would be in real-time and date.



Fig. 5: User App

2) Area Module:

For this module we have not made any complexed structure of the application just the thing is that this would be only accessible to the administrator or the person who is in authority of the application. Here in this we have check marked all the left out points of the user app like the total information of the vehicles with the installed devices and their current activity status. In addition, the admin will also be able to check out the area where we have installed the area device, also he could see the air quality of the area in real-time in a pre-defined radius coverage of 1km within a particular area where the device is installed.



Fig. 6: Admin App for Area

IV. CONCLUSION

This Project represents the design and development of vehicular pollution monitoring system. The developed system checks the pollution level emitted by the vehicles and if it is above the threshold, a warning message will be sent to the vehicular owner using the GSM module. These data are finally stored in a cloud for future analysis. This idea differs from the existing system that the vehicle owner gets an awareness about the emission level without going for a checking process. The main objective is we will be aware of the pollution level from the vehicles. Hence a solution for global warming.

A. Future scope:

In future as the number of vehicles will increase the pollution will also increase. The air quality will become worse in future so it is necessary to control the pollution as it can adversely affect human health and can cause severe diseases like lung cancer, astama, respiratory problems and many more. So through our project the pollution will be in control and the vehicles causing pollution will be detected.

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