Vehicle Pollution Monitoring System using IoT

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***Abstract* - Pollution has a significant part in the degradation of our planet. Quick industrialization, rapid urbanisation, rapid population expansion, a dramatic increase in automobiles on the road, and other human activities have disrupted the natural environment's balance. It alters the climate's quality, and season change is caused by build-up of the greenhouse gases in the aerosphere. Global warming, which is produced by the release of greenhouse gases, is one of the most serious environmental issues confronting the globe today. CO2, which is a main component of the circumstances, is causing the globe's surface to warm. Observing and regulating these seasonal changes is a major problem in saving our ecosystem. The transportation sector is a main source of air pollution in urban cities, particularly in growing countries such as India. This project uses multiple sensors, including a gas sensor located at the vehicle's exhaust, to measure pollution limits in real time. The information collected checks the standard limits and is sent to the vehicle operator via the Global System for Mobile Communication module (GSM) and the cloud using Internet of Things (IoT).**

Keywords—Nodemcu, MQ2, CO_2, GSM, IOT.

I. INTRODUCTION

The huge amount of air pollution in metropolitan cities, which is largely driven by vehicle traffic, necessitates the adoption of constant and precise observing techniques if vehicle emissions are to be reduced. Road transport is the single main driver of hazardous gas emissions in India, accounting for one fifth of total Carbon monoxide, COx, and Nitrous oxide emissions in the airspace. To reduce pollution in cities, it is necessary to track emissions of vehicles and develop short term and long-term reducing strategies. Critical and long-term health implications of vehicle air pollution include asthma, eye irritation, lung problems, and reproductive repercussions. The population of people living in rapidly expanding cities is at an elevated risk of poor health.

The Air (Precaution and Reduction of Air Pollution) Act of India was passed in 1981 and updated in 1987 to issue for the Precaution, Reduction, and decreasing of air pollution. Currently, the administration has established the latest emission standards for observing air pollution, and the information obtained allows for the reduction of the harmful impacts on the environment. In metro cities, taxis, buses, and lorries are in charge for 72 percent of Carbon monoxide and Nitrous oxide emissions. Due to these concerning circumstances, the CPCB made FC renewal required for Huge Transport Vehicles every year and for Light weight Motor Vehicles every five years. Every three months, every vehicle must be assessed to receive a Pollution Under Control (PUC) certificate, according to the legislation. Vehicle pollution may be controlled by observing the Air Quality Index using the appropriate sensors. The transmission and communication of data from the sensors are carried out utilising innovative approaches such as the Internet of Things and Wireless Sensor Networks, which have opened the way for real-time and huge trustworthy data.

The high concerning situations arise when the vehicle emissions surpass the certain limitations, which may be determined by devising a method of measuring each vehicle output. The metro company will use accurate mobile and fixed sensing equipment to make emission rules more rigorous in order to cut emissions as part of the process of monitoring the AQI. For now, the usage of electric vehicles in many European nations, particularly Austria and Norway, analyses and comprehends the elements impacting electronic vehicles competitiveness and socio-economic aspects. In addition, they are making emission regulation as a harsh state and running public acknowledgement campaigns.

Even while the long-term income consequences of electric vehicles are minor, the expense of bringing a new innovation to market is considerable. Developing countries such as India, and South Africa, on the other hand, rely heavily on petrol, diesel for vehicle and home use. When a new car is acquired in these nations, emission certifications are supplied, although most residents do not renew them. This initiative pivots on the creation of field devices as a means of increasing individual attention. A microcontroller and a sensor are used in this project's prototype to analyse car emissions, communicate through GSM, and warn the vehicle user when it's time to service the vehicle.

II. LITERATURE SURVEY

We started our literature survey with the “IOT Based Smart System for Controlling Co2 Emission” paper. They are monitoring the vehicle, forest fire and industrial pollution

level. They are using raspberry pi for better efficiency. We are using Microcontroller in order to reduce the cost.

In this paper "IOT Enabled Carbon Dioxide and Carbon Monoxide Monitoring and Control for Vehicles to Reduce Air Pollution" they are monitoring both carbon dioxide and carbon monoxide for every 15-day using an arduino. In our project we are monitoring carbon dioxide only in the vehicle. It is enough to reduce the pollution level by repairing the vehicle.

In this paper "A System detecting Air Pollution and tracking using GPS & GSM" they are monitoring and alerting the user by buzzer. The buzzer sound will disturb the vehicle user. So that we try to send SMS to vehicle users by using GSM. In our project we are using NodeMcu mainly because there is no need for an extra Wi-Fi module. We can easily transfer the data to IOT.

In this paper "IoT Based Vehicle Emission Monitoring and Alerting System" they are using Pic microcontroller for detecting the pollution level. If we are using Pic, we have to use pickit for connecting to pc. It will increase the components and cost so that we are using NodeMCU for our project.

In this paper "IoT Based Vehicle Emission Monitoring System" they are using NodeMCU for controlling the entire circuit and displaying the real time values in the LCD. Displaying the real time value of gas is very easy to know the values. So that we are implementing the ideas in our project.

III. BLOCK DIAGRAM

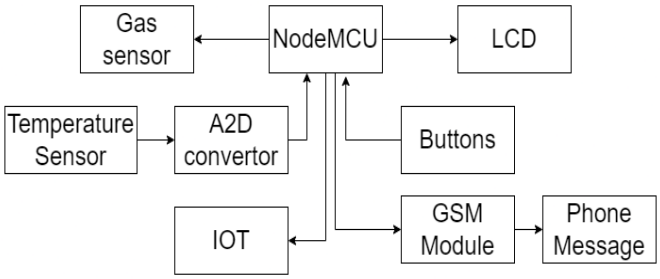

Fig. 1 Overall Block diagram of the system

NodeMCU

The NodeMCU (Node Micro Controller Unit) is an open-source programming and equipment improvement domain based on the ESP8266, a minimal expense System-on-a-Chip. It's a great decision for a wide range of Internet of Things (IoT) projects. We'll have to program it in low-level machine guidelines that the chip equipment can comprehend. Using the ESP8266 as an inserted regulator chip in an efficiently manufactured device considers this degree of joining.

The NodeMCU arrives in an assortment of packaging styles. The ESP8266 core is used in all of the designs. The conventional 30-pin configuration has been kept in plans dependent on the design. The Amica (which utilises the ordinary thin pin dispersing) and the LoLin (which has a more extensive pin separating and a bigger board) are the two most popular NodeMCU models. The open-source nature of the base ESP8266 allows the market to create new NodeMCU variations on a regular basis.

Sensors

The MQ2 gas sensor is one of the MQ sensor family's most extensively used models. It's a MetalOxide Semiconductor type Gas Sensor, otherwise called Chemiresistors, since the location is reliant upon an adjustment of the detecting material's obstruction when the gas comes into contact with it Gas focuses might be detected utilising a straightforward voltage divider organisation. The MQ2 Gas Sensor runs on 5V DC and burns-through around 800mW. It has a location scope of 200 to 10000ppm for LPG, Smoke, Alcohol, Propane, Hydrogen, Methane, and Carbon Dioxide.

A temperature sensor is a device used to decide the level of hotness or chilliness in a given thing. The voltage across the diode decides how well a temperature metre functions. The diode's obstruction changes in direct proportion to the temperature change. The opposition diminishes when the temperature drops, as well as the other way around. The opposition across the diode is estimated and converted into clear temperature units (Fahrenheit, Celsius, Centigrade, etc) prior to being shown in numeric structure over the understanding units. These temperature sensors are used in the geotechnical observing industry to recognize the interior temperature of constructions, for example, spans, dams, structures, power plants, etc.

Global System for Mobile Communications (GSM)

GSM is the globe's highly recommended and utilised cell phone communication system. GSM is an open and electronic cellular system that uses the different types of bands such as 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands to provide cell phone voice and information services. For communication reasons, GSM technology was designed as an electronic system employing the time division multiple access (TDMA) approach. The data is digitised and reduced before being sent across a channel with a pair of distinct streams of client information, everyone in its own schedule. The electronic system can handle information speeds ranging from 64 kbps to 120 Mbps.

IV. METHODOLOGY

This suggested technique is concentrated on monitoring and detecting separate vehicle emission levels, and informing the vehicle user if the vehicle pollution level is higher than the regulatory limit. By storing the CO2 rate in the car, the suggested technology attempted to make the CO2 detector intelligent. This approach comprises a gas sensor having the ability to identify the presence of CO2 and a temperature sensor having the ability to identify the presence of the temperature value. We have to place the sensors near the exhaust of the vehicle**.** The gas sensor is connected to the analog pin of Nodemcu. The temperature sensor is connected to PIC IC for analog to digital conversation and input goes to the Nodemcu. Now a LCD is connected to the NodeMcu for

displaying the Output values. A GSM module is connected from the NodeMCU for messaging purposes. The GSM module is working with the AT commands. We have to give necessary commands for operating the module. Input consisting of real time Carbon dioxide value and temperature value from the sensors and are displayed in the LCD. The NodeMCU will get the input from both the sensors.

The assembling of components and completing the code in the Arduino software is to be done. In the coding process, we have to include necessary library files and build coding for creating necessary variables with data types, void setup and void loop. After typing the coding, we should run and check the program for errors. After checking and correcting the errors in the program, a cable is connected from the PC to NodeMCU and selects the port in the Arduino software. Now upload the program to the NodeMCU board. The NodeMCU which collects the data from the sensor compares the Carbon dioxide value with the pollution limit value if the values from the sensor is normal there is no problem in the vehicle if the data is higher than the normal limit, the NodeMCU controls the GSM module and send message to the respective user by which button is clicked. If the button is not pressed it will send a message to the default user.

After uploading the program to the NodeMCU microcontroller, the gas sensor and temperature sensor read the value and display it in the LCD. The GSM module will send an alert message to the vehicle user if the value is exceeding the standard limit. After knowing the result the vehicle user can service the vehicle according to the Co2 values. In the serial monitor page it displays the AT command used in the program. In the message, the GSM sends the data of user name, Co2 value, Temperature value and a text of Kindly service your vehicle in 10 days. So that the vehicle user can easily know the data and repair their vehicle.

V. RESULT AND DISCUSSION

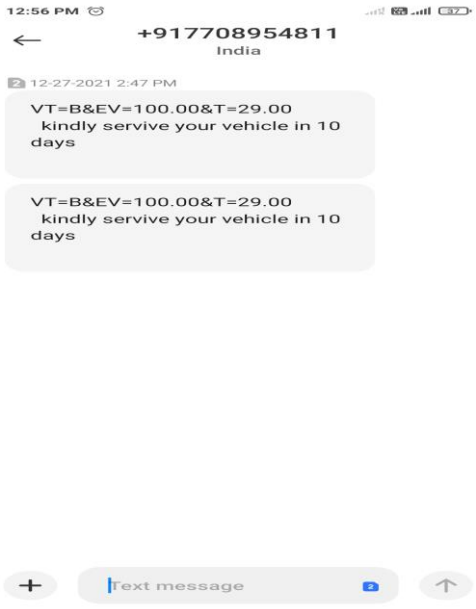

Fig. 2 Message from the proposed system

Every 15 days, a pollution check is required, and just a few people follow through. This project setup has been 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. In the future, if the vehicle companies set up the project inbuilt in the vehicle it will be very useful for the vehicle buyers. When compared to the existing arrangement of contamination control, the model also adheres to continual CO2 monitoring, which may reduce the ozone-harming chemical in the atmosphere. This product may considerably reduce and regulate the discharge. When carried out on a global basis, it will continue to reduce Global Warming.

FUTURE SCOPE

The suggested model accounts for carbon dioxide outflow. In any event, dangerous gases such as carbon monoxide, CO2, methane, NO, and the others pollute the atmosphere. The model will be used to monitor the gases that are causing harm to our precious climate. This MQ2 sensor is now being used to detect CO2 outflow. This sensor can resist temperatures of up to 70 degrees Fahrenheit. The total structure may be inserted into the vehicle's exhaust. The model may be utilised not only in automobiles, but also in a variety of industries to assess hazardous chemicals and reduce air pollution produced by these gases.

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