Real Time Vehicle Emission Monitoring and Warning System Using GSM Module

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ABSTRACT

In the quest for a cleaner and healthier environment, vehicle emission monitoring and warning system takes the center stage. The main purpose of this proposed work is to create a sophisticated system for monitoring and warning against vehicle emissions with a focus on mitigating air pollution and promoting sustainable transportation practices. The proposed method employs processor and sensor units along with global system for mobile communication to continuously monitor emissions from various vehicle types and operating conditions. This real-time data is then processed through an intelligent warning system, capable of detecting high emission levels and notifying both vehicle operators and relevant authorities promptly. The significance of this work lies in its potential to transform the way of addressing vehicular emissions. By providing real-time feedback to vehicle owners and operators, this system not only raises awareness but also encourages emission reduction efforts. Moreover, it equips city planners and policy makers with valuable data to formulate evidence-based methods for lowering greenhouse gas emission and enhancing air quality.

Keywords : Pollution , Sensors , Monitoring , Warning System, Gases.

1. INTRODUCTION

Vehicle emissions pose a significant challenge in today's world, with detrimental effects on air quality, public health, and environment. The introduction of the Vehicle Emission Monitoring and Warning System will represent a timely and innovative response to this pressing issue. With the global surge in urbanization and automobile usage, emissions of greenhouse gases and other pollutants have reached alarming levels, necessitating proactive solutions. [1] discusses the environmental pollution its causes and its effects in detail. The system's primary objective is to continuously monitor emissions from vehicles on the road, collect and analyze emission data, and provide real-time warnings to both vehicle operators and relevant authorities when emissions exceed permissible limits. By addressing the compliance aspect of emission standards, this system aligns with international efforts to reduce pollution, combat climate change, and enhance urban living conditions. [2] explains the standards of the vehicle emission according to the pollution control board standards. Its potential to integrate seamlessly with existing transportation and environmental management systems underscores its relevance and scalability. Furthermore, the report will develop into the methodology behind the system's development, focusing on sensor technologies, data analytics, and communication protocols. The Vehicle Emission Monitoring and Warning System is a positive step toward a society where technology is essential to protecting the environment and promotes health and cleanliness.

2.RELATED WORKS

[1] examines the fluctuations in dangerous pollutants such as carbon monoxide (CO) and carbon oxides (COx). For additional analysis, the gathered data is sent via the Internet of Things (IoT) and the Global System for Mobile Communication (GSM). The PIC Micro- controller was utilized to code the control technique for determining the limits of gases released. Technology [2] of notifying the user via LCD when the rate of gases emitted from the vehicle surpasses the government-set threshold level is discussed where, the emission level is additionally shown and saved in the car owner's database via IOT. The Node MCU microcontroller is in charge of the entire system. System [3] uses IoT-MQ135 and Arduino tools to gather primary data from automobiles that release gases. The instruments are then utilized to display the air quality and air pollution. [4] measures pollution limitations in real time using a variety of sensors, one of which is a gas sensor at the vehicle's exhaust. The vehicle owner receives information via Global System for Mobile Communication module (GSM) and cloud via Internet of Things when it has been verified to meet standard limitations. By linking the Global System of Mobile Communications Network to the cloud, [5] uses IOT technology to track vehicles that produce emissions beyond a predetermined level and to monitor and inform users about air pollution on roads. This also focuses on utilizing MQ7 Gas to prevent mishaps brought on by carbon monoxide gas produced by vehicles.

3.EXISTING SYSTEM

This system consists of Node MCU , sensors , LCD display and cloud used for storing data. The overview of this System is mentioned below.

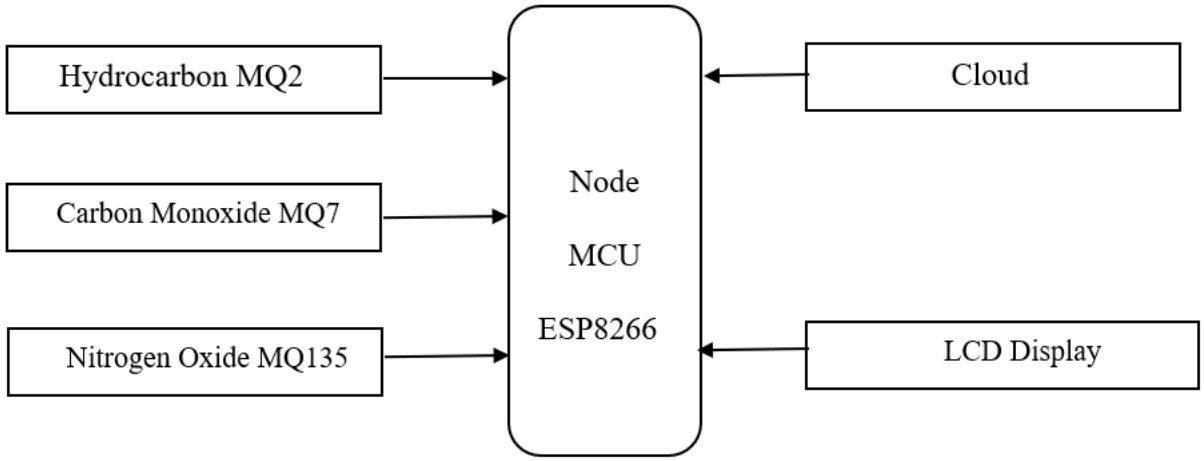

Figure 1 Existing System

4.PROPOSED WORK

The Emission Monitoring and Warning System aims to give drivers and the local pollution control organization a more dependable, accurate, straightforward, and efficient means of tracking the real-time emissions of various gases, such as CO and NOx, from their vehicles. It does this by using a modem such as GSM to notify both the vehicle's owner/driver and the local pollution control body.

The proposed system consists of two primary components: a sensor module and a communication module. The sensor module incorporates the MQ2 gas sensor to detect carbon monoxide emissions The sensor is interfaced with an controller unit ,which acts as the central processing unit to gather data and execute control functions.

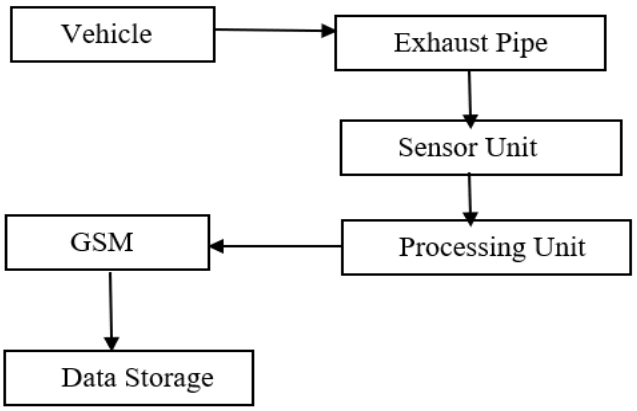

Figure 2 Block diagram of Proposed Work

The data collected from the sensors are processed by the Node MCU, which calculates the emission levels categorizes the emissions based on predefined thresholds. When an excessive emission level is detected, the Node MCU triggers the communication module to send real-time alerts through the Global System for Mobile Communications (GSM) network to a designated monitoring center or relevant authorities . GSM module is generated then the If the emitted gas exceeds the limit then GSM module sends the message to the user. The communication here is done through UART interface. The data is sent to the module or received from the module through UART interface.

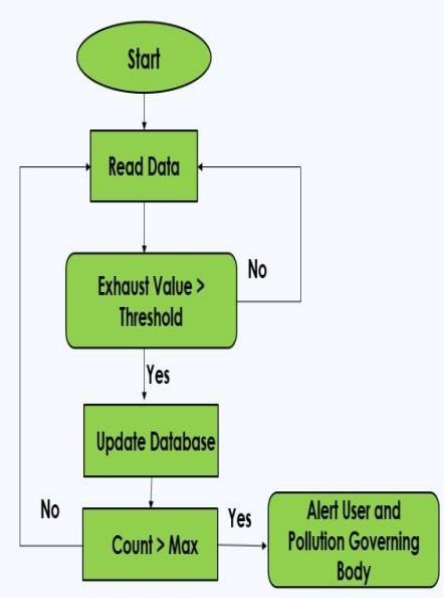

Figure 3 Flow Diagram of Proposed System

Software Specifications:

Arduino IDE :

A user-friendly software platform for programming and creating applications for microcontroller boards is the Arduino Integrated Development Environment (IDE). It provides a straightforward, user-friendly interface for creating, uploading, and debugging hardware-based programs.

The IDE is open-source and supports multiple programming languages, including C and C++. It includes a wide range of pre-written libraries and examples, simplifying the process of creating electronic projects and prototypes. Arduino IDE is a popular choice for makers, hobbyists, and professionals working on various electronics projects, from simple LED blinkers to complex robotics. The system provides real time monitoring of vehicle emission and provide users to enhancing their driving experience. The system is cost effective for consumers as it really monitors the excess emission of gases in a vehicle. It uses the advanced technologies in order to ensure the security of a driver.

It provides a user friendly interface and enhances the overall driving experience. The instruments have to be small, light weight, withstand difficult environment, and must not pose a safety hazard.

Hardware specifications

MQ2 Sensor:

The MQ2 sensor, part of the MQ sensor series , is a metal -oxide-semiconductor(MOS) sensor known for its versatility. It runson5V DC and consumes approximately 800mW of power. This sensor is based on the resistance of the material when exposed to gases, making it a valuable tool for gas detection. The MQ2 change in resistance of the material when exposed to gases, making it a valuable tool for gas detection. The MQ2 sensor can detect concentrations of various gases, including liquefied petroleum gas, smoke, alcohol, propane, hydrogen, methane and carbon monoxide, ranging from 200 to 10,000 ppm. It offers two different outputs that provide both a binary display of the presence of flammable gases and an analog representation of their concentration in the air.

Node MCU (ESP8266MCU):

Based on Espress if Systems ESP8266 system-on-chip (SoC) , Node MCU is a cost- effective and versatile platform. It includes core components such as processor, RAM, Wi-Fi capabilities and a modern operating system as well as a software development kit (SDK). Node MCU operates at 5V and is equipped with a 20kΩ load resistoranda33Ω heater with a heat consumption of±5%. This makes it an ideal choice for Internet of Things (IoT) projects. GSM module.

GSM-SIM800L:

The SIM800L GSM/GPRS module is a compact GSM module suitable for a variety of IoT applications. This module offers similar functionality to a standard mobile phone, including ending SMS messages, voice calls and GPRS internet connection. Its main element is the GSM cellular system Sim com SIM800L, which operates in voltage range 3.4v to 4.4v .The module features connectors for easy integration, containing the pins required for UART communication with the microcontroller. It supports baud rates from 1200 bps to 115200 bps and has automatic baud rate detection.

RESULT AND DISCUSSION:

The prototype was constructed using the components proposed like ESP8266 Node MCU , GSM SIM 800L Module and MQ2 gas sensor. Fig.4 shows the prototype model build during the test phase. Node MCU is powered through the USB cable connected with the laptop, MQ2 sensor and GSM SIM 800L Module is connected to the Controller via cables The supply for the GSM module is given through a 3.7 volt Li-Po battery. Once the setup is turned on, the gas levels were monitored in the Serial Monitor of the Arduino IDE software. Fig.4 shows the final output of the project. Future these gas levels are communicated to the GSM module. The GSM module then forwards the information to the end user.

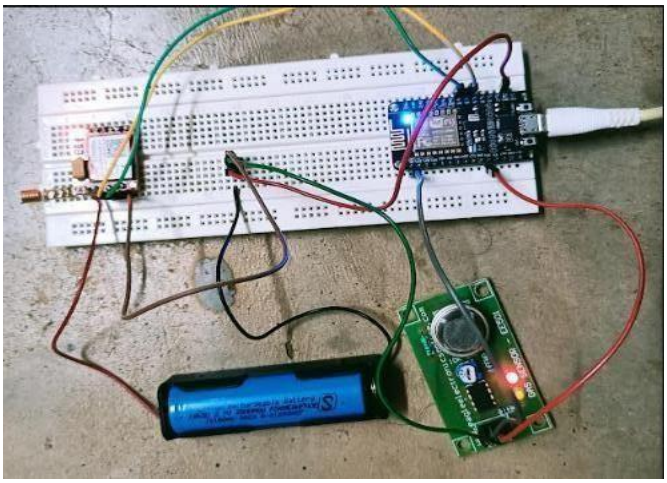

Figure 4 Proposed Model Setup

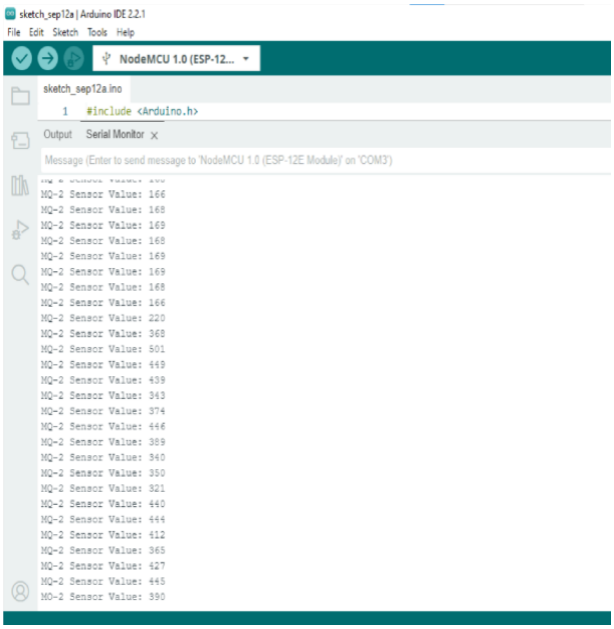

Figure 5 Output taken from serial monitor

CONCLUSION:

The proposed prototype can be proved as cost-effective. The system follows the Government standards along with customer notification when the gas level reaches its maximum threshold. "Vehicle Emission Monitoring and warning System" was created with a sole goal to measures and forward the real-time data about vehicle emissions. This system helps us understand and address air pollution better. It also encourages people to think about reducing emissions for a cleaner environment. It is proven that technology can play a big role in fighting pollution and promoting eco- friendly transportation. This system can be further improved by collaboration with government transport corporation and other private transport corporations. Goal is to make a positive impact in the fight against air pollution and climate change, making the world cleaner and healthier, this can be achieved with the help of vehicle emission monitoring and warning system.

Statements and Declarations

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Conflict of Interest

No potential interest of conflict was reported by the authors.

Competing Interest

The authors have no relevant financial or non-financial interests to disclose.

Author Contribution

All the authors contributed to the work. Material preparation, data collection, programming, execution was performed by Yogesh.P, Arunkumar G , Aravindh.S, and Arishenbagam.P.

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