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Vehicle Pollution Monitoring System using IoT

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Abstract: ***The environmental concerns are on the rise these days. Car, bus, and truck air pollutants can worsen respiratory diseases and cause asthma attacks. Transportation is responsible for airborne carbon monoxide at more than 50 per cent. At present, the emissions of the vehicle is checked with the aid of pollution control stations built in some cities only when the fitness certificate (FC) is obtained from the RTO office. In case of private cars, the health certificates are valid for 15 years and every 5 years thereafter. In case of Transport Vehicles, the fitness certificate is given for a new vehicle for 2 years and then extended each year. Under this process, we cannot detect emissions caused if the vehicle has been repaired until FC. Using IoT Technology, this project aims to monitor and alert air pollution on roads and to track vehicles that cause emissions above a given threshold by connecting the Global System of Mobile Communications Network to the cloud. This also concentrates on avoiding the accidents caused by vehicle-generated carbon monoxide gas using MQ7 Gas sensor.***

Keywords: CO, GSM, MQ7 Gas Sensor, Threshold Level

I. INTRODUCTION

The content of this paper is based on the problem that the society is facing nowadays. Pollution continues to be a significant issue for our environment. The pollutants from vehicles can impact the atmosphere in a variety of ways. This project suggests a valuable route for sensing engine emissions, particularly CO gas emissions. This involves Gas sensor to identify Motor Vehicle Pollution. This helps to track the data in real time and with low costs. The vehicle owner can identify the emission level easily in advance. We used Thinkspeak cloud to store the data and to read the data at any time. The aim of this system is to create a compact vehicle pollutant detection tool that could be mounted on the vehicle itself and to reduce the CO emission in the atmosphere. The smoke ratio emitted from the vehicle is monitored by sensors, and the data can be displayed on the vehicle owner's phone, which can be displayed to officials when asked about the vehicle's emissions report, for example, when they visit the hill station.
Hardware processes implemented are:

- Arduino Board - Acts as a board for integrating the sensor and GSM.
- Global System for Mobile Communications - It gets the data from Thinkspeak Cloud and sent the alert message to the specific user if the CO emission level from the vehicle crosses the required threshold level. It also shows the data in user's phone's Android application.
- MQ7 Gas Sensor - To detect the emission of Carbon monoxide from vehicles.

We used IoT technology that is rapidly increasing in today's scenario. IoT is used in all sectors nowadays. With the help of this technology, human intervention can be used.

II. LITERATURE SURVEY

A. Minimization of CO & CO2 from Two Wheeler Motorcycle Exhaust Gases

This paper includes a method to eliminate CO & CO2 from Two Wheeler Motorcycle Exhaust Gases by adsorption technology. The emphasis of this paper was focused on developing an environment-friendly and value-effective adsorption model that can actively reduce the amount of pollution from vehicle exhaust gases [1]. Here, adsorption is done in an adsorber-like structure that includes a charcoal pad, through which the exhaust gases pass. Charcoal powder is used as an adsorbent which can significantly reduce the total cost. The adsorption-based model can be easily adapted to a two-wheeler emission portion. In this system, there is a considerable amount of CO2 reduction following adsorption from exhaust gases with great output. Here, the CO2 adsorption performance of charcoal is predicted to be 20 %.It is beneficial to the society by reducing the release of pollutants into the atmosphere from vehicles.

B. Air Pollution monitoring system based on Geosensor Network

This paper involves geosensor-based air quality monitoring system which uses the contextual model to understand environmental pollution status in the present and near future pollution region [2]. This offers the guidance for alert and protection according to remote place location. It also uses the versatile adjustment in the sampling period depending on the nature of the condition being recognized. In contextual model, it is helpful for tradeoff between battery life and representation of emissions. It can save geosensor batteries, as it limits the amount of data transfer. The output of the power is improved depending on the versatility of the exchange between sampling rates and battery life.

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C. Air Pollution and Insurance Based Vehicle Locking System:

Abu Jayyab et. al have proposed Air Pollution and Insurance Based Vehicle Locking System which is designed with Atmega processor that controls the engine of vehicle based on the values of the sensors and preset date on the controller [3]. Every vehicle which crosses the pollution threshold level in an area, the vehicle's engine will be automatically turned off by the engineered circuit.

D. Wireless Sensor Network for Real-time Air Pollution Monitoring

This paper describes a framework for tracking the ambient air quality in real time. The network consists of many distributed monitoring stations, which use machine-to-machine connectivity to communicate wirelessly with a backend server [4]. The backend server gathers data from the stations in real time and translates it via web portals and mobile apps into data transmitted to users. Every facility is fitted with gaseous and meteorological sensors.

It also provides the ability for data logging and wireless communication. The system is deployed in the pilot phase and four solar energy stations which are built over a 1 km 2 field. Here, the information is gathered over a span of four months and then performance analyzes and tests are carried out.

III. EXISTING SYSTEM

The emissions of vehicles are checked using emission control stations built in some cities only when the fitness certificate (FC) is obtained from the RTO office. For private vehicles, fitness certificates are valid for fifteen years and renewed every five years. For transport vehicles, a fitness certificate for a new vehicle shall be issued for 2 years and subsequently renewed annually.

A. Demerits of Existing System

- It cannot detect emissions caused when the vehicle was repaired until FC was received.
- In the years between, the vehicle can generate more pollution. The release of emissions cannot be tracked in real time.

IV. PROPOSED SYSTEM

A. Block Diagram

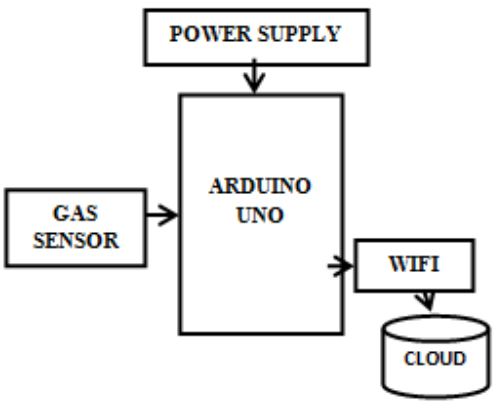

Fig. 1. System Architecture

Table 1. Sensor Used for Gas

Parameter to be Tested	Sensor Used
Carbon monoxide (CO)	MQ7 Gas Sensor

B. Working Principle

Step 1: MQ7 Gas Sensor is mounted in the smoke outlet of the vehicle, and its output is supplied as input to the Arduino. MQ7 Gas sensor will find the Carbon Monoxide's emission level in the unit of Parts per million.

Step 2: Thinkspeak binds the sensor data and stores it inside. The CO Value is stored by date and can be accessed by date at any time.

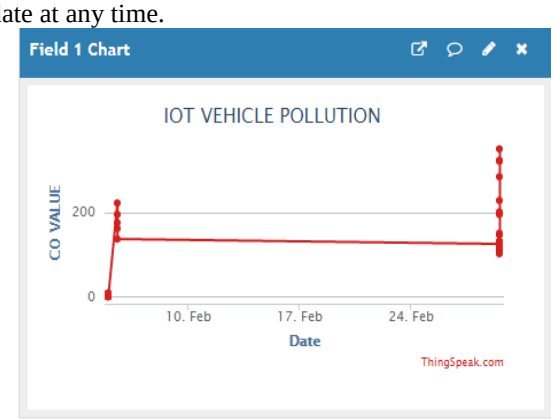

Fig. 2. Thingspeak Cloud Data.

This graph depicts the emission of Carbon monoxide from the vehicle datewise.

X – Axis: Date

Y – Axis: CO Value

Step 3: GSM receives the data and sends a warning message to the individual user if the vehicle's CO emission level crosses the required threshold.

Fig. 3. Message sent to the owner of the vehicle

Step 4: Vehicle Owner can use the Android application to know the Carbon monoxide emission Rate in units of parts per million.

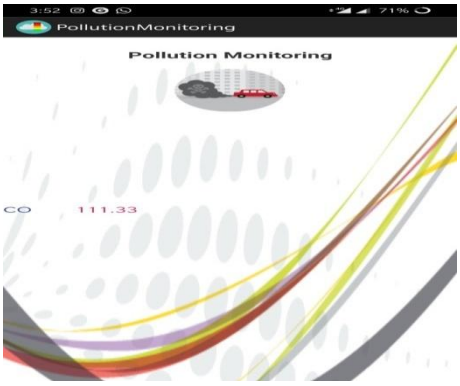

Fig. 4. Readings on the Pollution Monitoring Android application installed in the user's mobile phones

Step 5: In the event of avoidance by the vehicle owner, the emission rates are sent to the Pollution Control Board via Global System of Mobile Communications and the board may take the appropriate steps.

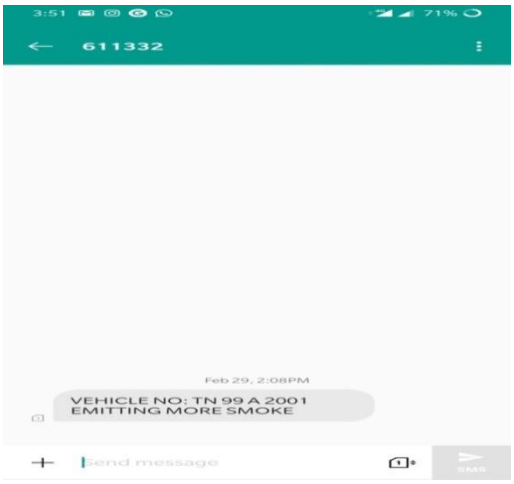

Fig. 5. Message to the Pollution Control Board

C. Merits of Proposed System

It helps to track data in real-time.

- It is a system with low costs.
- Unacceptable vehicle emissions can be reduced to 98%
- The emission of the vehicles can be easily tested in advance by the vehicle owner without a visit to RTO office.
- Also, the user can service the vehicle ahead of time on getting the alert message regarding pollution level.

D. Final Setup of the Device

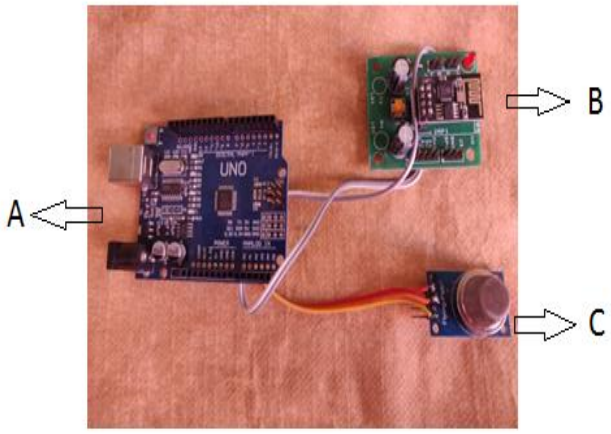

Fig. 6. Working setup of the Device

A – Arduino
B – Global System for Mobile Communications
C – MQ7 Gas Sensor

V. RESULTS

Table 2. Sensor Requirements

Sensor	Parameter	Threshold Level/Value
MQ7 Gas Sensor	Mass of Carbon monoxide (CO), max .ppm	<110 ppm

VI. CONCLUSION

This particular system contains a sensor, which detects the parameter (Carbon monoxide) that causes vehicle pollution. The sensor used is sensor detecting carbon monoxide (MQ7). Whenever Carbon monoxide level increases, the sensor senses the situation and the vehicle owner is given an alert or sign. The emission levels are transmitted to Pollution Control Board via GSM module.

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