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Advanced Smoke Monitoring System for Automobiles Using IoT

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***Abstract*: Now-a-days, the main source of atmospheric pollution is caused by automobiles. Using theoretical examination, ritual mechanized air monitoring system for vehicle is very difficult, but uneconomical and single datum class make it unfeasible for large-scale furnishing. For the purpose of solving the issues in existing systems we have introduced Internet of Things (IoT) into the field of environmental barrier. This project aims to construct a vehicle emission monitoring system using Internet of Things (IoT) which is a most beneficial device for tracking down vehicle causing pollution on the city roads and measures various genres of toxic wastes, and its level in air. This project puts forward a kind of real-time air pollution monitoring system at any time anywhere using Gas Sensor. The measured data is shared to vehicle owner via text message. This system provides good results in monitoring the air pollution especially in the urban areas.**

***Keywords*: Arduino, Gas sensors, Smoke detection, Vehicle monitoring.**

1. Introduction

1) What is air pollution?

Air pollution is due to any physical, chemical or biological change in the atmosphere. It is the contamination of air by harmful gases, dust and smoke which affects the plants, animals, and humans dreadfully.

2) Need for IOT device in each vehicle

Usage of Vehicle by people can be responsible for more than 50 percentage of carbon monoxide in the air. This carbon monoxide can destroy the human health. And may also lead to chronic obstructive pulmonary disease (COPD) and increases the risk of cancer. Recent studies in sensing technology, particularly in the area of Sensor Networks (SNs), it is now authorizing environmental monitoring in real time at special and temporal scales. Many research papers are specially designed to operate the system using sensor network and gather the information about pollutant levels discharged by the vehicles using the wifi connection.

IoT is a booming technology which produces the consideration for both academia and industry. IoT is realized as a network of things, each of which can be label using a unique ID and convey based on standard communication protocols. IoT helps the objects to communicate with one other, to fetch information on the web, to store and collect data, and to collaborate with users, thereby creating smart, constantly encountered and a well-connected environment.

2. Objective

In the present situation, one of the major problems that the world is facing today is pollution, increasing every year and causing fatal and also irreversible damage to the Earth. In order to minimize these problems, smart emission monitoring system has been used. In this system, there are three various sensors such as co, hydrogen and gas sensors are connected to the input pins of arduino and the values are sensed continuously. If the sensed value is greater than the threshold value set in the program, then automatically an alert message will be sent to the vehicle owner by using ESP8266 Wi-Fi enabled module and the smoke level values are continuously stored in cloud database. By using this system, the owner can monitor the details about the emission level of his own vehicle up to date.

3. Methodology

In this System, When the vehicle's engine is ignited, the MQ-2 Hydrocarbon gas sensor, MQ-7 Carbon monoxide gas sensor, MQ-5 Nitrogen Oxide gas Sensor and Microcontroller system are activated. The Arduino microcontroller is designed to do three functions namely comparison, timer and triggering circuit. The various modules are:

A. Checking the input values from gas sensors

- In this module, Arduino Uno is a microcontroller board based on the ATmega328P will be used to process the input anolog signals from the gas sensors.
- It has 14 digital input/output pins (of which can be used as PWM outputs), analog inputs.
- The microcontroller takes in two inputs; one from the smoke sensor's output and another being the pre-defined threshold value specified for the demo project.

B. Displaying the gas value information

- In this module, there is a basic (16x2) 16 character by 2-line display. It indicates the value of gas detected from the exhaust of the vehicle.

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- The microcontroller compares the input value with the programmed Values, if the values are higher than the threshold value, then the digital signal is send to the LCD display with the message indicating the smoke values.

C. Storing the values in cloud database

- In this module, there is a ESP8266 which is a Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit) capability.
- It runs on 3.3V and gives our system access to Wi-Fi or internet connected to Arduino helps to fetch data and get stored in cloud database.

D. Developing a user interface Application

- In this module, a user-friendly application will be created with cloud platform for storing and retrieving the data of the emission System.
- It is used to give the online updates to the customer about their vehicular condition as the alert messages.

4. Proposed System

A. Block Diagram

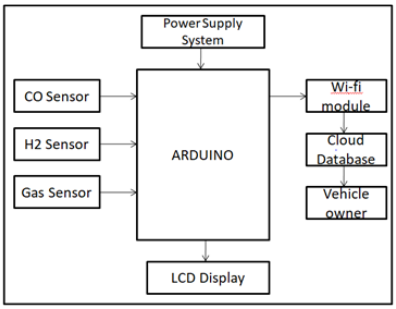

Fig. 1. Block diagram for emission system

B. Hardware Requirements

1) Arduino

Arduino is a micro controller board based on the mega328P (data sheet). The components in arduino board consist of 14 digital input/output pins, 6 analog inputs, a USB connection, a 16 MHz ceramic resonator, an ICSP header, a power jack, and a reset button. It provides the overall support to the micro controller for giving the best results. The operating voltage is 5V. DC current or I/O pins is 40mA. DC current for 3.3V Pin is 50mA. The name "Uno" means one in Italian which is chosen to mark the release of Arduino Software (IDE) 1.0, the Uno board and version of Arduino. The first in a series of USB Arduino boards is the Uno board, which is a reference model for the Arduino platform.

2) CO Sensor (carbon monoxide)

The Co sensor is otherwise known as MQ-7 gas sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. High sensitivity to carbon monoxide. Stable and long life. They are helpful as gas detecting equipment for carbon monoxide (CO) in family and industry or car.

3) H2 sensor (hydrocarbon)

H2 sensors are useful for gas leakage detection (In home and industry). It is helpful for The Grove-Gas Sensor (MQ2) module is detecting LPG, CH4, CO, Alcohol, smoke or Propane. The measurements can be taken as soon as possible due to its high sensitivity and fast response time. The sensor's sensitivity can be adjusted by using the potentiometer.

4) NOx sensor (NitrousOxide)

Nitrous Oxide sensor Which is known as MQ-135 Gas sensors. They are useful for air quality control equipments and also are apt for detecting or measuring of NH3, NOx, Alcohol, Benzene, Smoke, CO2. The MQ-135 sensor module has its additional advantage with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas

5) ESP 8266 WI-FI MODULE

The ESP8266 is a really useful, cheap Wi-Fi module for controlling devices over the Internet. It can function together with a micro-controller like the Arduino or it can be programmed to work on its own. The Internet of Things (iot) has been made useful for its cheaper and easier characteristics. It is a self-contained SOC which contains the integrated TCP/IP protocol stack that can give any micro controller access to your Wi-Fi network. These wifi module is capable of hosting an application. They can even be offloading all Wi-Fi networking functions from another application processor.

6) LCD

Liquid -crystal display which is otherwise known as LCD is a flat-panel display which is used for the light modulating properties of liquid crystals. The liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are suitable for displaying the arbitrary or fixed images with low information content, which can be displayed or hidden, such as preset words.

7) Transformer

One of the most important and commonly used Transformer is Power transformer. At the electrical power generating station and distribution station, it is very widely used for stepping up and stepping down the voltage respectively. We use the Step-down transformer in our Power supply circuits, as we need to lessen the AC power to DC. The result of this Step-down transformer will be less in power and this will be given as the input to the next section, called rectifier

C. Working

In this System, When the vehicle's engine is ignited, the MQ-2 Hydrocarbon gas sensor, MQ-7 Carbon monoxide gas sensor, MQ-135 Nitrogen Oxide Gas Sensor and Microcontroller system are activated. The microcontroller is designed to do three major functions namely comparison, timer and triggering circuit. The microcontroller takes in two inputs; one from the smoke sensor's output and another being the pre-defined threshold value specified for the demo project. When the smoke sensor output is more than the threshold value, the microcontroller triggers the timer circuit, IoT and Wifi modules and an alarm is set off to inform the driver that his vehicle has

some pollution related issues. It also indicates that the vehicle will come to a halt as soon as the IoT detects a safe zone.

For the above working to be done, the Arduino board should have the power supply system which includes the following components. Those are power guard, Transformer, bridge rectifier, capacitor, regulator and a Light emitting diode as the parts of the power supply section. In this the transformer give the power supply of 1 amps and 12 amps which are the AC supply. To convert the AC to DC supply we have used bridge rectifier and then to get the pure DC output, capacitor is used. For getting the 12 volt and 5 volt supply to the Arduino board, we have used regulators of 7805 and 7812 is used. Then the Light emitting Diode is used to indicate the power supply states in this system. When the Power supply is in ON state, the three sensor sense the gases which are emitted from the Vehicle exhaust, then sends as the analog inputs at A0 to the Arduino board. Then the microcontroller compares the input value with the programmed Values, if the values are higher than threshold value, then the digital signal is send to the LCD display with the message "Smoke Monitoring". At the same time the emitted level will be monitored by the vehicle owner by uploading the data in the user application. By using the "Things View" Application, the owner can monitor the details about emission level of his own vehicle using IoT.

D. Flow diagram

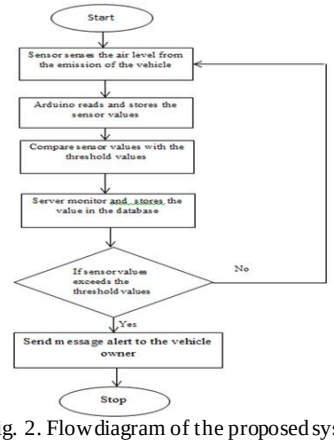

Fig. 2. Flow diagram of the proposed system

5. Output

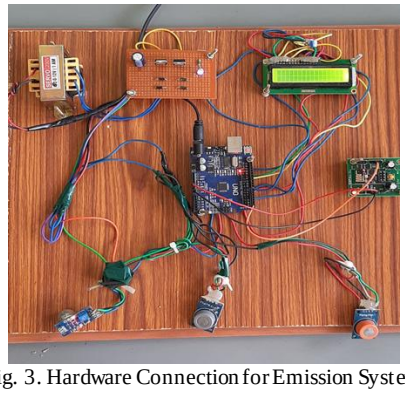

Fig. 3. Hardware Connection for Emission System

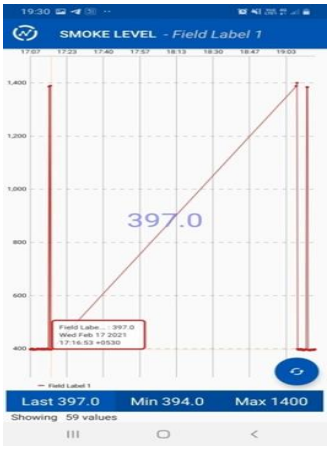

Fig. 4. Before Detecting the Smoke in UI

Fig. 5. After Detecting the Smoke in UI

6. Conclusion

The main objective of smart emission monitoring system is to make it more innovative, user friendly, time saving and also more efficient than the existing system. Using smart systems not only efficiently takes an advance in environmental quality, but it also helps vehicle owner to save a lot of unnecessary troubles compared to the traditional emission test. Hence, it is possible to get the vehicle's emission level in the user's application using this system.

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