IoT Based Vehicle Emission Monitoring System

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Abstract: An increase in automobile vehicle leads to an increase in air pollution since automobiles are the main source of environmental pollution. The smoke emitted from the vehicle consists of gases like nitrogen oxides (NO_x), carbon monoxide (CO), and hydrocarbon (HC). approximately one-half of the nitrogen oxide gases, carbon monoxide and one-fourth of hydrocarbon gases in our environment are emitted from automobile vehicles, which leads to global warming. Due to poor vehicle maintenance and ignition defect. the gases emitted from the exhaust may increase. In order to reduce environmental pollution and to increase vehicles life, we can use this system. when the rate of gases emitted from the vehicle exceeds the threshold limit set by the government, our system will alert to the user through LCD. Using IOT, the emission level is also displayed and stored in the database of a vehicle owner. When the vehicle owner ignores it, the report will send to the transport office with entire details. The entire system is controlled by Node MCU microcontroller.

Keywords: smoke, IoT, gas sensor, LCD, Node MCU.

I. INTRODUCTION

Environmental pollution in India turns out to be a serious issue in the 21st century. The main source of pollution in India is due to automobile vehicles. Government of India made many regulations to control environmental pollution caused due to vehicle emission, but most of them turn to be unsuccessful. Government of India instituted a standard called Bharat stage emission standard (BSES) to regulate the air pollution from motor vehicles. BS- 4 standard is following in India since April 2010. To speed up the green initiative, government made order to move from BS-4 to BS-6 in 2020. The Indian pollution control board has made FC (Fitness certificate) and PUC (Pollution under control certificate) is compulsory for commercial and public vehicles to control air pollution. Carbon monoxide, hydrocarbon and nitrogen oxides are the gases emitted from the exhaust.

The CO in the atmosphere reduces the capability of blood in carrying oxygen, hydrocarbon in the atmosphere affects heart, brain, kidney and bone marrow. NO_x affects the lung and causes a respiratory problem. In the era of urbanisation due to the rapid increase in an automobile vehicle, it is difficult to inspect all the vehicles. It requires a lot of man force to inspect all those vehicles.

In order to monitor all the vehicles easily, we develop a system called IoT based emission monitoring system, through which we can able monitor all the vehicles easily. The IOT plays a vital role in this project, the sensors placed at the exhaust monitors the level of different gases, with help of IOT the value is updated to the cloud. Which makes both the vehicle owner and transport office to monitor the vehicle easily.

II. PROPOSED METHODOLOGY

In this system mq2, mq7, mq135 sensors placed at the vehicle exhaust, monitor the hydrocarbon, carbon monoxide and nitrogen oxide value emitted from the exhaust. The analog value received from the sensors is processed by the controller with wifi connection to the internet. The value obtained from the sensors is continuously updated to LCD and cloud. When the value obtained from the sensor reaches the threshold limit, the controller will alert to the user through LCD and database of the vehicle owner. Io T helps the system to update the value to the cloud. The Node MCU connected to the sensors helps to update the value obtained from the sensors to cloud when wifi is connected to the internet. The value is continuously updated to vehicle owners cloud storage. when the value reaches the threshold limit set by the government, it will indicate it to the vehicle owner. When the vehicle owner ignores the alert, the entire details will be shared with the transport office.
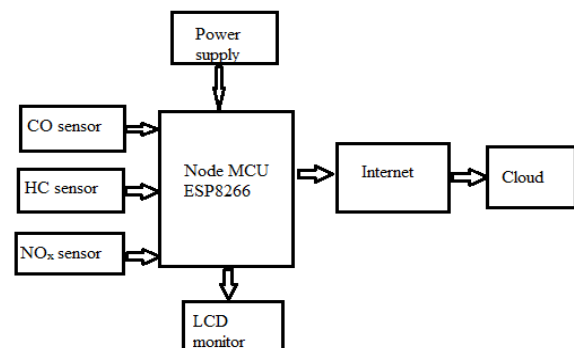

Fig. 1 Block Diagram

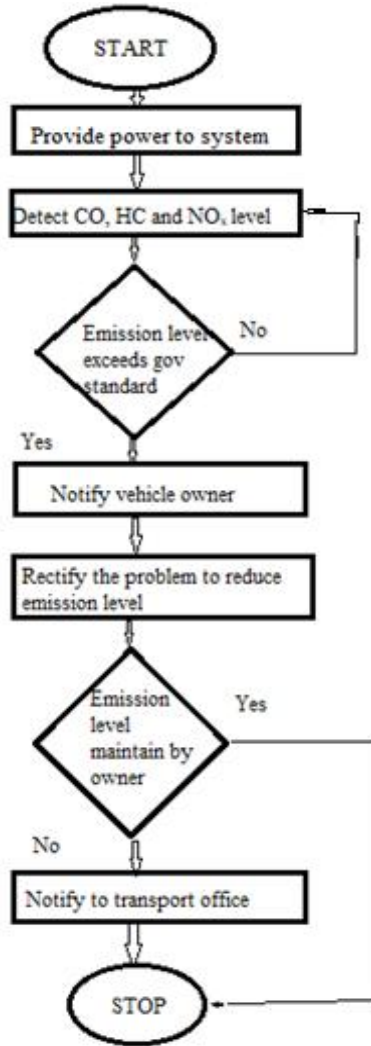# Iot Based Vehicle Emission Monitoring System

Flow Chart

Fig. 2 Flow chart

Node MCU

The Node MCU- ESP8266 is a microcontroller with wifi capability. It is an open source Io T platform. This small board allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. Node MCU refers default to the firmware. Lua is a scripting language used by this firmware. The operating system and processor used in it is XTOS and ESP8266. It has a memory of 128KB and storage of 4MB. The power for the controller is provided through USB.

Fig. 3 Node MCU

Liquid Crystal Display

LCD is a combination of two states of matter, the solid and the liquid. It is an electronic display module with a 16x2 LCD screen which says that it has 16 characters with respect to 2 rows. LCD uses a crystal liquid to produce a visible image. This technology used for displaying the image in the notebook or some other electronic devices. It works on the principle of blocking light rather than an emitting light and consists of 16 pins from that 8 pins are input and also it contains the external input voltage pin of 5v. It has a unique advantage of having low power consumption than the LED or cathode ray tube.
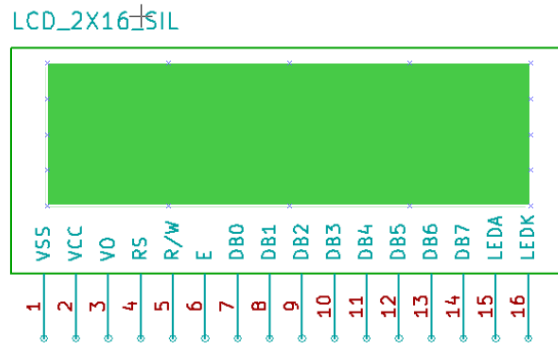

Fig. 4 Pin Diagram of LCD

Hydrocarbon sensor

MQ-2 sensor detects the presence of hydrocarbon gases (HC) (methane, propane and n-butane) at concentrations from 3000 to 10,000 ppm. measuring hydrocarbon gases is important for pollution monitoring. It has 4 pins (power, ground, digital and analog output). the sensitivity of the sensor can be varied by the onboard trimmer. The sensor can operate at temperatures from -20 to 50-degree Celsius.

Fig. 5 Mq-2 Gas Sensor (Hydrocarbon Sensor)

Carbon Monoxide Sensor

MQ-7 sensor is used to detect Carbon Monoxide(CO) from 20 to 2000ppm. the sensitivity of the sensor can be adjusted by using a potentiometer. It has 4 pins (power, ground, digital and analog output). The output is directly proportional to the density of Carbon monoxide gas. The data from the sensor is in terms of analog output.

Fig. 6 Mq-7 Gas Sensor (Carbon Monoxide Sensor) No$_x$ Sensor

SnO_2 is a sensitive material used in MQ135 gas sensor. Which has lower conductivity in clear air, when the concentration of gas gets increase it's conductivity also get's increase. It has high sensitivity to Sulphide, Ammonia, Benzene steam and also sensitive to smoke. It is used to detect gases from a concentration of 10 to 10,000 ppm.

Fig. 7 MQ-135 gas sensor (NO$_x$ sensor)

Internet of Things

The network of physical devices embed with electronics, sensors, software, actuator and internet, connect together to share data is called as Internet of Things (IoT). IoT helps object to sense data and control it remotely.
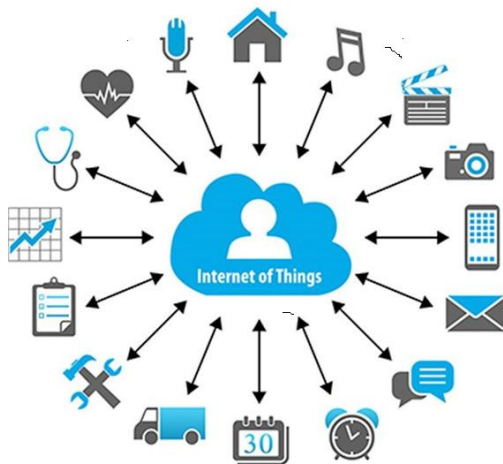

Fig. 8 Internet of Things

III. CONCLUSION AND FUTURE SCOPE

The environmental pollution caused due to the emission of gases like carbon monoxide, hydrocarbon and nitrogen oxide emitted from vehicle exhaust need to be reduced in order to save our environment. The proposed system provides the best solution to monitor the gases emitted from the vehicle exhaust to increase the life of the vehicle and to reduce environmental pollution. The proposed system is low cost and easy to maintain. In future GPS can be added to send the details to the regional transport office and to calculate the amount of gases emitted from vehicles in a particular region.

REFERENCE

1. S.P. Bangal1, Gite Pravin E2 IoT Based Vehicle Emissions Monitoring and Inspection System 2017 IJIREEICE
2. Chandra Mohan Reddy S 2015 Development of IoT based Vehicular Pollution Monitoring System
3. Ashita Jagasia1, Sanjana Advani2 IoT based Vehicle Monitoring System using Bluetooth Technology 2017 IJIRSET
4. 1.Priyadarshini.J.Patil, 2Revathi.M A Survey on Intelligent System for Vehicle Emission Monitoring 2018 IJETT
5. D.Arunkumar, K.Ajaykanth, M.Ajithkannan, Sivasubramanian Smart Air Pollution Detection and Monitoring Using IOT International Journal of Pure and Applied Mathematics
6. Jagadish Nayak Round the Clock Vehicle Emission Monitoring using Io T for Smart Cities 2018 IJACSA