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Eco-Friendly Vehicle Pollution Detection and Controlling System using IoT

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***Abstract*: Air and sound pollution is a growing threat now-a-days. It is mandatory to monitor air quality and keep it under control for a better future and healthy living for all. Here we propose an air quality as well as sound pollution monitoring system to monitor and check smoke emission and noise produced in a particular vehicle through IOT. When we start the system, the latitude and longitude of the user is read by GPS. After that using gas sensor MQ135 the pollution ranges of the system are sensed. This pollution ranges are compared with standard reference level. If pollution level is higher than standard level, then mail is sent to RTO control station. If the pollution level does not exceed the reference level, then the smoke emission and noise is continuously compared with standard reference level. If the owner is not responding the alert mail from RTO, the control station will make relay on and stop the vehicle**

***Keywords*: Internet of Things, ESP Microcontroller, Air Pollution, Sound sensor, GPS.**

1. Introduction

The environmental pollutions are rapidly increasing now days. Air pollutions from cars, buses and trucks can worsen respiratory diseases and trigger asthma attacks. Pollution from vehicle is responsible for more than 50 percent of CO in the air. This carbon monoxide can play havoc on human health as in Fig. 1. Hemoglobin carries oxygen and carbon dioxide.

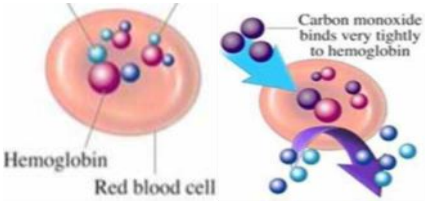

Fig. l. Effect of carbon monoxide on human health

The air pollution may lead to chronic obstructive pulmonary disease (COPD) and escalates risk of cancer. One of the major reasons of air pollution is emission of polluting gases from vehicles which is responsible for almost 70% of the total air pollution. [1], [4]. To control the air pollution, the percentage of air pollutants to be monitored and vehicles causing the air pollution should be identified. Latest technology Internet of Things (IoT) can be helpful in cities for monitoring air pollution from vehicles and also to collect pollution related data for different location of a city and it can be analyzed. Due to flexibility and low cost, Internet of things (IOT) is getting popular day by day. Air pollution and sound pollution are major constituents for adverse and harmful effects on environment as well on human beings [2], [4]. To monitor these pollutions are very difficult task. Traditionally, authorities like data loggers are used to collect the data of different pollutions and analyzed. This is lengthy, time consuming and expensive task Due to the use of sensors accompanied with internet can make pollution monitoring a less complex, less time consuming and flexible [3]. By analyzing these authorities data can access data at any time. The system an d ESP microcontroller is connected to the internet and it helps to system to mail the GPS location to RTO. If pollution has been detected then RTO will warn to user /owner to maintain the vehicle. If user do not maintain the vehicle, then RTO can block his vehicle using IoT [4].

2. Related work

A novel solution is presented in [1], to monitor and control the pollution at the traffic signaling lights. A simple wireless embedded chip is inserted in the personal vehicles to control the ignition on and off remotely. Depends upon the pollution level measured from sensors at the traffic signaling, the operator will send command to the wireless traffic pollution control system. Also a simple radio frequency based embedded chip is inserted in the personal vehicles to control the ignition on the of remotely via control system at the traffic lights is the best way to reduce the air pollution. IOT based pollution control system will allow the operator to monitor and control the pollution from anywhere and anytime. In [2], according to recent technology development in this miniaturization of electronics and wireless communication technology have led to the emergence of environmental pollution sensor network wireless air pollution monitoring system provides real-time information about the level of air pollution. In this regions, as well as provides alerts in case of drastic change in quality of air. The system also uses the AQI to evaluate the level of health concern for a specific area. In [3], Wireless sensors are used in most of the in real time applications for collecting physical information. The impossible measurements in typical ways have Currently become attainable using the wireless technology. In this technology, the measurement of air quality is one of the difficult

areas for the researchers. The main source of atmosphere pollution happens due to vehicles. The high inflow of vehicles in urban area causing more air pollution and decreasing air quality l that leads to severe health diseases. The performance of the system is also verified using IOT technology.

3. Flow chart

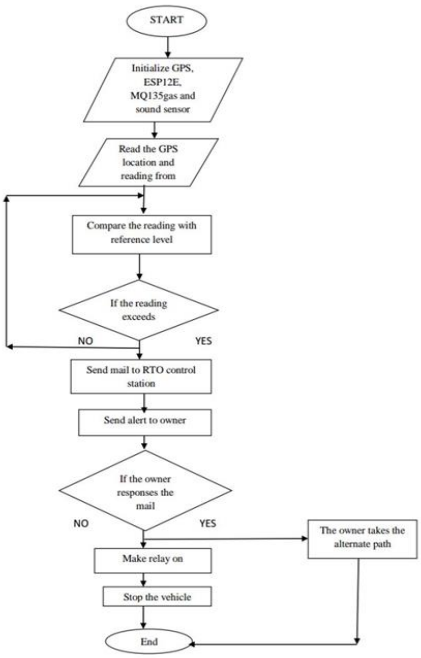

Fig. 2. Flow chart

A. *Flow chart description*

When we started the system, first we read the GPS location in the form of latitude and longitude. After that using gas sensor MQ135 sense the pollution ranges of the system. This pollution ranges compared with standard reference level. If pollution level is higher than standard value then send mail to RTO control station else pollution level is normal then continuously compare pollution with standard reference level until our pollution ranges changes. After that send warning to owner if the owner will not response the mail then RTO or the control station will make relay on and stop the machine.

4. Proposed framework

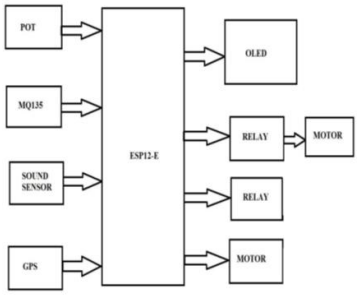

Fig. 3. Vehicle Pollution Detection and Controlling System using IOT

In this section, we would like to present effective use of Internet of Things to address the issue of vehicle pollution. In a present world monitoring system used to monitor the concentration of gas and noise pollution in the vehicle. For this purpose, the hardware system is designed to find the carbon monoxide, carbon dioxide and smoke concentration. The relays control the ignition system and fuel pump system. Normally their lays are in ON state. The system's output obtained from the sensor and processor collaboration is in the form of digital output. A network using the Wi-Fi technology can transmit the information of sensor modules to any location. The proposed system is supposed to measure the pollution levels of various places or websites so that the authorities will be able to control the pollution by taking necessary precaution and measures. The IOT used OFF the relays.

A. *Implementation of the framework*

In this section, implementation of the framework is discussed. Before that it will be prudent to brief about technologies involved and used in this work. Despite the fact that IOT is a relatively new idea, there are already a few open thesaurus available which are able to perform remote and seamless management and experimentation with sensor data. These technologies are analyzed in the subsequent subsection

B. *Esp12-e Micro controller*

ESP8266 is an open hardware thesaurus which is able to work with various sensing and communication technologies. The ESP8266 Wi-Fi Module is a self-contained SOC with combine TCP/IP protocol stack that can give any microcontroller retrieve to your Wi-Fi network. The ESP8266 is able to either hosting an application or offloading all Wi-Fi networking functions from another application processor. we are using ESP8266 microcontroller with the support of detecting the gas and sound modules. First connect the ESP8266 with the bread board then connect the MQ135 gas sensor as per the pin connection. This connection gives the output for the range of gases. Then same as the gas sensor, sound sensor is using to detect the sound.

C. *MQ135 Gas sensor*

The MQ series of Gas Sensors used in this research work are simple and cost efficient sensors useful for sensing gases in the air. Air quality sensor for identifying a vast range of gases, including NH3, NOx, alcohol, benzene, smoke and CO_2. Ideal for use in office or factory. MQ135 gas sensor is highly sensitive to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful gases. we are using mq135 to detecting the range of gases. In the case of working with MQ135 pin connections are given below

VCC ↔ 2.5V ~ 5.0V
GND ↔ power supply ground
AOUT ↔ MCU.IO (analog output)
DOUT ↔ MCU.IO (digital output)

D. Sound sensor

The Sound Sensor can identify the noise strength of the environment. The main component of the module is a simple microphone and LM393 level convertor chip. The sensor can provide both digital as well as analog output. Specifications: Operating voltage 3.3V-5V. Sound sensor pin connection are given below.

A0 ↔Analog pins
D0 ↔ Digital pins
GND↔GND
VCC↔ 5V

E. GPS

GPS systems are extremely versatile and can be found in any industry sector. This system is used in military applications and by emergency crews to locate people in need of assistance. This system consists of three segments: the space segment, the control segment, and the user segment. We are using the GPS to track the vehicle exact location. This module has following features Inbuilt antenna Receiver and Transmitter connection.

F. LED display

An LED display is a flat panel display that uses light emitting diodes as the video display. An LED display panel can be either a small display or larger display. LED diodes are used in order to make an LED display. LED displays are also used in billboards. Also it is store the display the speed of the vehicle.

G. Motor

A DC motor is a rotary electrical machine that converts direct current electrical energy into mechanical energy. All types of DC motors have same internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in the motor.

H. Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid state relays. Relays are used where it is necessary to control a circuit by a separate low power signal, or where several circuits must be controlled by one signal. The first relay were used in long distance telegraph circuits as amplifiers: the relay repeat the signal coming in from one circuit and re-transmit it to another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. In this project, the relay is used to switch ON and OFF the ignition system and fuel pump system.

I. Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat. In this project, the pot is used to control the speed of the DC motor.

J. ADC

Analog to digital convertor is abbreviated as ADC. Real world parameters are mostly analog signals but microcontrollers' process digital signal. Thus ADC is used to convert analog signals to digital signal. There are several ADC architectures. ESP8266 has a single 10bit ADC channel. ESP8266 is near 0V it value is 0 and when it reaches 3.3V it value should 1024. The Esp12-E has only one ADC but in this project it needs two ADC so IC MCP3008 is used for 10bit ADC. The ESP8266 only converts voltage between 0 and 3.3Volts. If apply any voltage to ADC channel, use a voltage divider.

Vout = Vin * R2/R1+R2

This IC has following features

- ± 1 LSB max DNLs
- ± 1 LSB max INL
- On-chip sample and hold
- SPI serial interface (modes 0,0 and 1,1)
- Single supply operation: 2.7V - 5.5V

5. Software descriptions

Software is a collection of instructions that enable the user to interact with a computer, its hardware, or perform tasks. Without software, most computers would be useless. For example, without your Internet browser software, you could not surf the Internet or read this page and without an operating system, the browser could not run on your computer.

Most required software is:

- Arduino IDE 1.8.5
- Proteus design suite 8.0
- Cayenne

A. Arduino IDE 1.8.5

Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board while Arduino makes hardware projects simple.

B. Proteus design suite 8.0

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. It is a software suite containing schematic, simulation as well as PCB designing. ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation. we are using the PCB board instead of bread board. breadboards were in fact as they sound to be a board in which bread was cut on. These PCB boards were easy-to-access, and inexpensive way to mount your

electrical projects ON.

C. Cayenne

Cayenne is an online IOT dashboard that takes most of the complication out of creating hardware-oriented programming. Originally it worked with just the ESP8266 Microcontroller. Now it is available for the Arduino as well. Cayenne is a drag-and-drop programming system for the IoT that really does make it much easier.

6. Controlling

Pollution control is the process of reducing or eliminating the release of pollutants (contaminants, usually human-made) into the environment. It is regulated by various environmental agencies that establish limits for the discharge of pollutants into the air and sound. This system gives availability of viewing the sensor outputs through internet. It can be made to control the emission of pollutant gases by alerting from owner.

Fig. 4. controlling

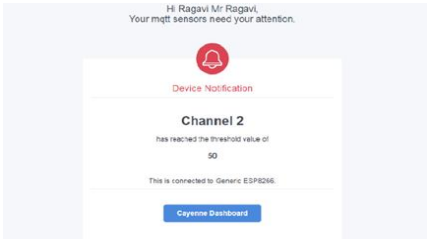

Fig. 5. Notification

7. Advantages and applications

A. Application

- Automobiles industries
- RTO office
- National pollution control organization
- Central Pollution Control Board
- Municipal Corporation

B. Advantages

- Flexible system to solve noise and pollution problems
- Low cost.
- Coupled data generators and consumers.
- Local or personal air pollution information is available.
- The sensor nodes are densely distributed at locations of dense population area. Data with higher spatial resolution and accuracy can be achieved mobility of sensor nodes.
- The mobility of the cell phones or users enlarges the geographic coverage area of sensor nodes.

8. Conclusion

The proposed monitoring and controlling of pollution will reduce the air pollutions. A simple inserted in the personal vehicle to control the ignition on and off remotely via control system it is the best solution to reduce the air and sound pollution. IoT based control system will allow the operator to monitor and control the pollution from anywhere and anytime. We have used our system in vehicles. When a pollution gets detected system warns to Regional transport office(RTO). By using mailing technique with vehicle's owner details and location send to given mail address which is unique for every vehicle and senders mail address is based on vehicle number plate.

9. Future scope

In this project can add more sensors for accident detection also inbuilt this system to upcoming vehicle. IoT connected smart cars are already in the market. Driverless cars and other automobiles are going to rule the future. Already many large companies are interested in IOT connected smart cars and developed them. Soon this project might be implemented in real time applications. A study by BI expects that there will be around 94 million connected cars by 2021.

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