CARBONIC OXIDE MONITORING AND CONTROL IN VEHICLE USING RASPBERRY PI-3

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Abstract

The incomplete ignition of a carbon fuels results in the poisonous gas known as Carbonic oxide (CO). It can produce headache, vomiting and sickness for human beings and also produce global warming. So, carbonic oxide emission level of vehicle is calculated and examined in the paper. The proposed technique employs a MQ-7 gas sensor to monitor the concentration of carbon monoxide, a contaminant in the environment. MQ-7 sensor is employed to determine the level of carbonic oxide and then it is indicated to the vehicle. If the CO level is above the threshold value, then this information will be informed to the pollution control board and intimate this over pollution from the vehicle. Based on IOT monitoring, Raspberry pi-3 will send the information to PHB. Hence the proposed system can be employed for pollution monitoring worldwide.

Keywords: Raspberry PI-3, MQ-7 Sensor, Internet of Things (IOT), LCD display, Relay

1. Introduction

Recent advancement in technology mainly focuses on controlling and monitoring of different environmental activities in order to reach the human needs. Efficient monitoring system is required to monitor and assess the pollution levels in case of exceeding the prescribed level of parameters (e.g., noise, CO and radiation levels). Air pollution means the introduction of solid dust particles, liquid droplets, or gases into earth's atmosphere which causes diseases, allergies and death to the living beings in ecosystem [3]. The atmosphere is a gaseous system essential to support life on planet earth. Blacksmith institute announced world's worst polluted places; it lists various indoor and air quality problems [7]. Pollutants are produced naturally or artificially with the human being's involvement. Air pollutants are major released from motor vehicle exhaust and factories produced large amount of ash, carbonic oxide and sulfur dioxide respectively. If any emission in smart surroundings, a notification will be provided to the consumer and also atmosphere contamination related department is alerted immediately. The impacts of the vehicle's burning of fuel can be tracked and regulated using an air pollution tracking mechanism. Application of smart environment targets using of embedded intelligence into the environment which makes the environment interactive with objectives. To monitor particular signals, there is a need of sensor devices with good data gathering capability. Smart environment is of two type such as event detection based and spatial process estimation. Sensor devices are placed in the vehicle to collect the data in order to predict the behavior of pollutants [5]. Aim behind this analysis is to design and implement an efficient monitoring system which monitors remotely using internet.

The information collected by the sensor is recorded in a remote location and analyzed through a web-based application [2]. If the estimated value crosses the threshold limit then we conclude the presence of the pollution in the particular environment.

2. Literature Survey

Hakim Baha and Zohir Dibi Laboratoire proposed a novel neural network-based technique for smart gas sensors operating in a dynamic environment used to their high sensitivity and low-cost, metal oxide gas sensor. In this paper, a neural network centered technique is used to overcome these difficulties. The idea is to create intelligent models; the first one, called corrector, can automatically liberalize a sensor's response characteristics and eliminate its dependency on the environmental parameters. To eliminate the detected gas, the proposed model is employed. The design phase and optimization uses MATLAB. For realization and examination, the PSPICE tool is utilized. The nonlinear nature of the output and the dependency on temperature and humidity are defined using sensor models. This method distinguishes between various gases. The benefit of the technique is that it utilizes a lesser illustrative database.

Grzegorz Lehmann, Andreas Rieger explores 3-Layer architecture for Smart Environment Models.

Kavi K.Khedo, Rajiv Perseedoss and Avinash Mungur premeditated the result of a wireless sensor network air pollution monitoring system for sensor networks are currently an active research area mainly due to the potential of their applications.

P.Vijnatha Raju, R.V.R.S.Aravind and B.Sangeeth Kumar developed the sensor based pollution monitoring system in Visakhapatnam. As the technology increase, the degree of automation also increases.

James J.Q.Yu, Victor O.K.Li, Fellow Albert Y.S.Lam explored the air pollution monitoring system based on sensor deployment through public transport system to monitor the level of air pollution. It is a very popular research topic and many monitoring systems have been developed.

Anjaiah Guthi developed an effective noise and air pollution monitoring system using Internet of Things (IoT) to detect the level of air pollution.

3. Existing System Model

The prevailing embedded device for monitoring CO levels in the vehicle emission to make the environment intelligent or interactive with the objects through wireless communication. The proposed model is shown in fig. 2 which is more flexible to check the environmental parameters. The proposed model is shown in fig.2 which is more adaptable and distributive in nature to monitor the environmental parameters. The suggested architecture was discussed in a 4- tier model to detect the level of pollution with various modules [1]. Let the environment be tier 1, sensor devices be in tier 2, sensor data attainment be in tier 3 and intelligent environment be in tier 4. The existing architecture is shown in fig.1. The tier 1 offers the data about region which is required to be checked for air pollution control and noise level monitoring. Tier 2 deals with the sensor devices with suitable characteristics, features and each of these sensor devices is operated and controlled based on its sensitivity as well as the range of sensing. Tracking and handling factors according to different environmental factors to set a threshold values and intervals for tracking and specific alerts across tier 2 along with tier 3 scenarios. From the statistical analysis of data observed from tier 2 and tier 3 and also from previous experiences, the required parameters with threshold values were checked and determined. The Tier The existing embedded device [10] is for monitoring noise and CO levels in the atmosphere to make the environment intelligent or interactive with the objects through wireless communication [13]. 3 describes about the data acquisition from sensor devices and also includes the decision making, which specify the condition the data is representing on which parameter. In the proposed model, tier 4 deals IoT based intelligent system to find some variations in sensor data and threshold level based on identified CO value.

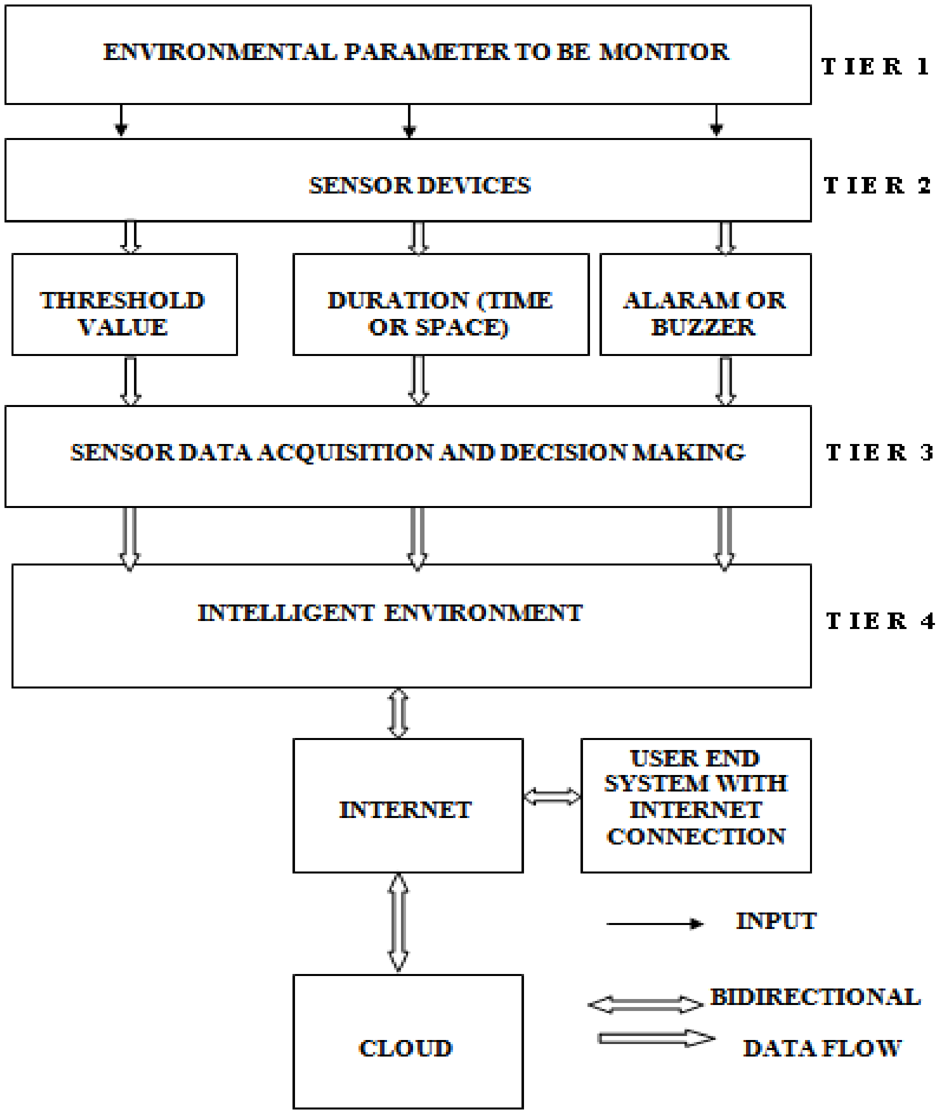

Fig. 1. Existing model

4. Previous Work

The existing method uses the intelligent environment which identifies the variations in the sensor data and fixes the threshold value depending on the identified level of CO. The tier sensed data which was combined with Google spread sheets and show a trend of the sensed parameters with respect to the specified values.

The customers can surf the data by means of mobile phones and computers [15]. In the Existing model tier 4 deals with the intelligent environment. Based on the identified CO level, it will resolve the threshold level. In this tier, sensed data will be processed, stored in the cloud. The conventional method [10] is for observing noise along with CO levels in the surroundings to achieve the smart environment by wireless transmission [13]. The existing model is shown in fig.1 which is more adaptable and distributive in nature to monitor the environmental parameters. The existing 4-tier architecture is developed for monitoring air pollution. The extant model consists of 4-tiers for the environment monitoring [11].

5. Proposed Model

The intention of this work is to offer human safety and also manage the air pollution by using IOT. The system reduces the CO level produced by the vehicle, so impacts on the human beings can be avoided. Table 1 shows the different effects of CO poisoning on humans. The proposed method continuously monitors the CO generated by partial fuel combustion. CO sensor should be installed at near (10 cm) the pipe of exhauster. The device has three main possible scenarios. These are whether the CO concentration around the area is in safe condition, warning, or danger state. The LCD will print those values every time and are evaluated of what is to be done next. The catalytic converter found in vehicles combines Carbonic oxide and oxygen to form less poisonous carbon dioxide (CO_2). Catalytic converter reduces the high concentration in the exhaust manifold (typically 30,000 ppm in open air and 300 ppm in inside the vehicle) to low concentration (typically below 900 ppm in open air and 90 ppm in inside the vehicle). If the concentration is less than 1000 ppm, the LCD will print the “SAFE” status. The LCD will display "SAFE" status if the value is below 1000 ppm. If the level is between 10,000 ppm in the atmosphere and 200 ppm into the car, the LCD will indicate "WARNING" and illuminate the alert LED. If the level is in excess of 30,000 ppm, the LCD will indicate the "DANGER" status, and the emergency LED will illuminate. If vehicle driver does not care about the CO level, the message will be sent automatically to pollution control board and display the producing of the CO level against the vehicle to produce the evidence of over pollution.

Table1. Physiological effects of CO in closed area.

Parts per million	Time of exposure	Response
50	-	Threshold limit non-toxic
100	Several hour	No symptoms
200	2-3 hour	Headache
400	1-2 hour	Headache and nausea
800	45 minutes	Headache, dizziness and nausea
800	2 hour	Unconsciousness
1600	20 minutes	Headache, dizziness and nausea
1600	2 hour	possible death
3200	5-10minutes	Headache and dizziness
3200	10-15minutes	Unconsciousness and possible death
6400	1-2minutes	Headache and dizziness
6400	0 minutes	Unconsciousness and possible death
12800	Immediate	Unconsciousness
12800	1-3 minutes	Danger of death

The table 1 shows that the physiological effects of Carbonic oxide present inside the vehicle. Here we consider the 3 ranges such as 100 ppm, 200 ppm and 400 ppm for CO detection. If the CO level exceeds the 400 ppm means the humans suffered by danger diseases, so we set the maximum detection level as 400 ppm.

Table 2. Physiological effects of vehicle CO emission in open air

Parts per million	**Time of exposure**	**Response**
Below 1000	-	Threshold limit no symptoms
10000	9-12 hour	Possible headache
30000	1-3 hour	Unconsciousness and possible death
Above 45000	1-3 minutes	Danger of death

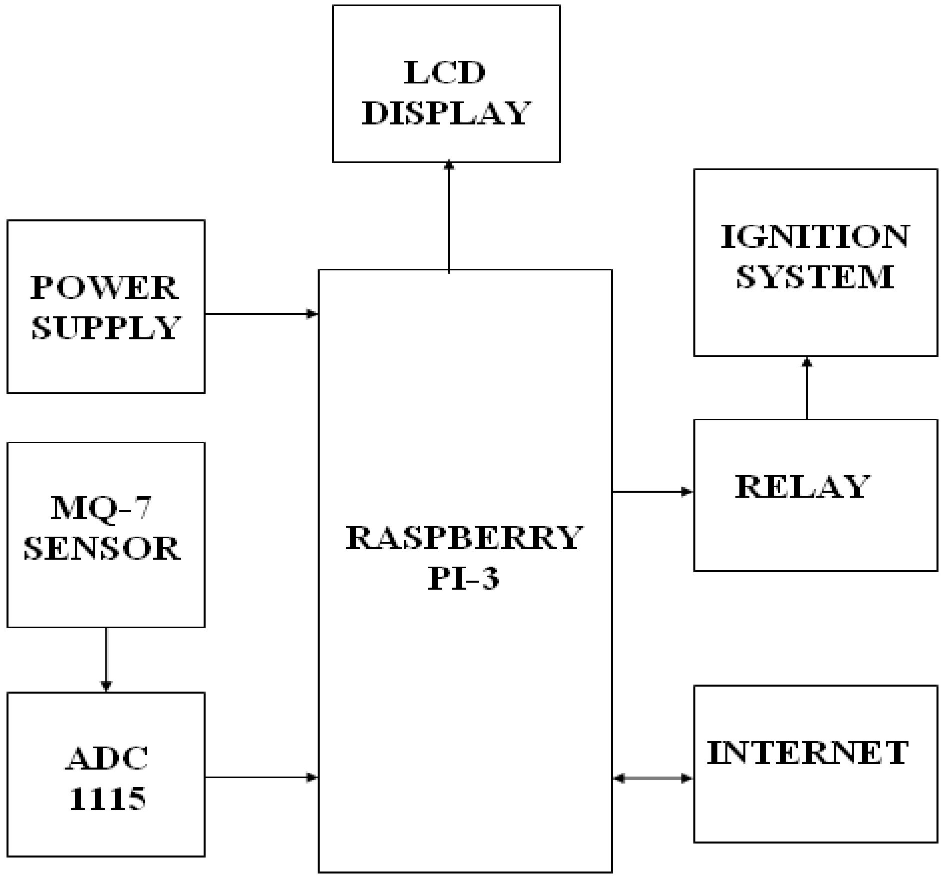

Fig. 2. Proposed model

After fine clearance, the OTP will send to the relay. Thus relay begins its functioning and starts vehicle. The proposed model is shown in fig 2: this model consists of CO sensor, Raspberry pi-3, LCD display relay. It is the latest version of Raspberry Pi 3 Model B with 40-pin GPIO and power charger.

Fig. 3. Raspberry pi-3 (model B)

Raspberry pi have an inbuilt internet connecting port. It acts as the small computer. Model B is the advanced version in fig 3, having the in built WI-FI module. This model b is more advanced in all application. Here the raspberry pi3 acts as processor.

5.1 CO Sensor

The CO sensor measures the amount of CO generated by the engine.. MQ-7 is one of the CO sensor types.

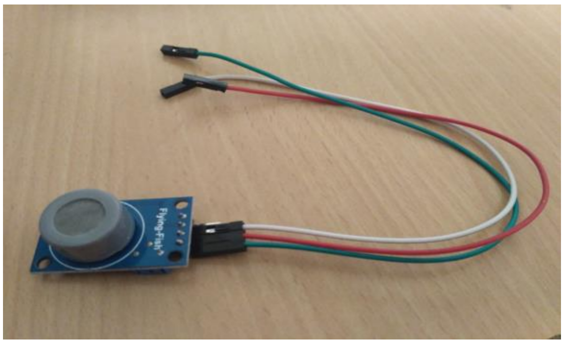

Fig. 4. MQ- 7 Sensor

Suppose the measured CO level is exceed the threshold value it will automatically displayed on the LCD display. Incase after two or three times the driver does not care about the CO level means the message will automatically to Pollution authorities and displayed the producing of the CO level.

5.2 Relay

A relay is an electrically operated switch. Relays connected together are used as an electromagnet to mechanically operate the switch and provide electrical isolation between two circuits. The optical and magnetic separation protects the inputs from electrical faults. In this case the office will file case against the vehicle to produce the evidence of over pollution. Relay is then unlocked, and thus car is then locked. After fine clearance, the OTP will send to the relay. Thus relay begins its functioning and starts vehicle.

5.3 Internet Of Things (IoT)

Internet of things (IoT) is used to monitor this system and the values are updated whenever the parameters cross the constraints. These updated values can be viewed anywhere and anytime by opening the link given through internet. The sensor inputs are linked with IOT and thus parameter conditions can be accessible online using the link. For data access, an IP address is generated. A web page arrives when the link is searched.

The output of sensors is IoT interfaced. The observations of sensors are collected in a web page. The data generated by each sensor are updated constantly and indicated on the pollution office's website. The output of sensors is accessed through the website link.

5.4 Implementation

In this implementation model we used Raspberry pi-3 model B with inbuilt internet connection port. Raspberry pi-3 consists of 40 GPIO (General Purpose Input Output) pins. The implementation model is shown in fig.5. The sensor data can be transferred to pollution authorities by using internet connection. This model shows embedded system with its components used for reading and storing sensed data. MQ-7 sensor are connected to Raspberry pi-3 for monitoring the CO level. MQ-7 sensor has 4 pins namely AO (Analog Output), DO (Digital Output), GND and VCC. The DO pin is connected to the input of Raspberry pi-3 in 13 pin and the output is obtained at pin 20. The pollution authority can get data from sensors through a website. Similarly, the Relay is connected to the Raspberry Pi 3 for (ON / OFF) control the vehicle.

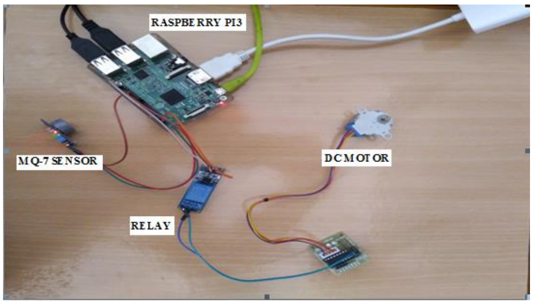

Fig. 5. CO Monitoring and control in vehicle by using Raspberry pi-3 System.

When the CO level exceeds the maximum range, the relay will disconnect the connection between ignition system and engine. Hence, as soon as user turns OFF key, the vehicle stopped. The relay will create a link after the emission authority's authentication code (OTP) has been issued via Internet of Things. So the vehicle is started.

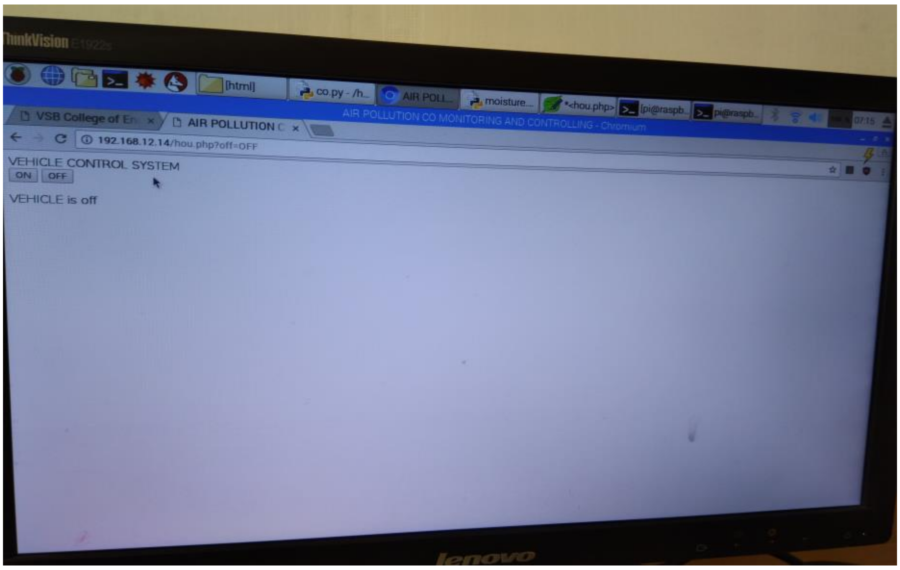

Fig. 6. Web Page Result

After the completion of data sensing it will be processed through IOT. The final result is shown in fig.6. The advantages of this project is to avoid the generation of CO due to the vehicles are not serviced. So this project makes humans service their vehicle properly.

6. Conclusion

The proposed system which is designed shows the output of sensing the Carbonic oxide gas and then displayed through LCD. Certain actions are taken by Pollution Control Board when the user does not take any steps to control the emissions of CO in vehicle even after the two warning messages is displayed on LCD. On third occasion, the sensor response is sent to cloud thus the Emission Control Board might observe online and lock the car through IOT. This is a robust system which is very useful for humans because of the increasing pollution due to increase in vehicles. The proposed system is simple at reasonable price. The results of the project are accurate. Hence, this model demonstrates effective vehicular pollution reduction.

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