

# Development of Automatic Control System for Emission Detection in Vehicles using IoT

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**Abstract**— The impact of pollution is one of the important issues with respect to scientific, social and economic aspects all over the world. The main source for this pollution is due to emissions from vehicles, power plants and industries. Moreover, increase in the use of vehicle in cities which contributes to 72% of the total pollution and results in increased greenhouse gases(GHG). In addition, these pollutants have direct and indirect effects on the health of human beings, environmental issues like acid rain, ozone layer depletion, global warming(GW) and loss of biodiversity. In addition, these issues leads to major issues towards the world like, rising sea levels, melting of snow, altered rainfall pattern etc. To address these problems, the objective of this project is to design and develop an automatic control system for emission detection in vehicles using IoT has been done. The proposed automated control system uses CO sensor which is fixed at the end of exhaust of vehicles from where the smoke is released into the environment. The CO sensor is connected to the raspberry pi through ADC. The sensor detects the level of CO and is compared to the threshold value, which is already programmed in the raspberry pi. If the obtained value exceeds the threshold value, the raspberry pi alerts the user by LED. If the emission is detected again then the buzzer alarms and further it will stop the vehicle. In addition the alert SMS will be sent to the pollution control centre and owner by using IoT.

**Key words:** Emission Detection, Vehicles, IoT

## I. INTRODUCTION

Air pollution occurs when harmful substances are introduced into Earth's atmosphere. It Affects humans, animals and food crops. It is mainly caused by pollutants emitted from motor vehicles which lead to greenhouse effect. Survey states that motorcycles and scooters emit highest amount of gas in rural and highway and second highest in urban areas. Also the concentration of CO is higher in gases emitted from the vehicles. Hence we are in urge to reduce the pollution by greenhouse gases which leads to global warming. The paper states that the level of gas emitted from a vehicle is measured and when it reaches beyond the threshold value a sensor senses it and alert the user and also sends sms to RTO and pollution control centre through Raspberry pi using IoT (Internet of Things). The main aim of this paper is to bring awareness about the polluted environment and make each individual to take steps towards creating a pollution less atmosphere.

## II. LITERATURE SURVEY

Piyush R. Tapar, Prof. A. K. Pathrikar stated that ,sensors in the system detect the level of pollution gases. If the pollution level goes beyond the threshold level the

microcontroller alert's the buzzer and displays pollution level on LCD. The GSM sends the alert SMS at registered mobile number with vehicle current location using GPS [1]

Ranga Reddy and Sarath Chandra have done their project using semi-conductor sensors at the emission outlets of vehicles which detects the level of pollutants. When emission level shoots beyond the already set threshold level, there will be a buzz in the vehicle [9].

Marco Santonico et al described a calibrated device for oxygen and carbon dioxide measurements. The sensors are lodged in a vial containing a physical solution. The device composed of three electrodes . The output signals are obtained applying an input[7].

Chaitanya H P, H. Prasanna Kumar have done their project to monitor and control the pollutants in the vehicle by using the pollution control circuit. This pollution control circuit consists of various sensors, GSM, Pulse width modulator (PWM) and all of them are integrated and connected to a Controller.The DC motor speed control of the system is done using PWM [2].

Marina Sruthi.M, Dr. L. Josephine Mary was able to detect presence of carbon monoxide remotely, from wherever you are. This paper is mainly interested in reducing pollution mainly from the vehicles using IOT.Using this ,the system pollution is tracked and then AWS cloud takes necessary measures by sending SMS to the mobile phones[11].

Aleena Mary Anson, Dr. Karamjit stated that incomplete combustion of fuel supplied to the engine is the primary reason for this breach of emission level, which is due to the improper maintenance of vehicles. The vehicle owner has to check the emission from the vehicle in authorized centres. [5].

Prof.D. D Mondal et al described that this paper consists of various sensors like MQ7 and Alcohol sensor which detects the concentration of CO gas and Alcohol. If this concentration is beyond the threshold value, the microcontroller sends the trigger pulse to motor to stop the ignition of fuel. [10].

Shu-Chiung Hu et al stated that Carbon dioxide (CO<sub>2</sub>) gas has been proven to be one of the most significant gases that will cause global warming. This paper proposes the architecture of a vehicular sensing system for CO<sub>2</sub> monitoring applications. Our system relies on GSM short messages and geographic locations of vehicles.

Mohammad A. Al-Khedher These systems are implemented using several hybrid techniques like wireless communication, geographical positioning and embedded applications. A Fleet management system can minimize the cost and effort of employees to finish road assignments within a minimal time [14].

Anita kulkarni, T. Ravi Teja stated that vehicles are one of the major contributors to air pollution apart from

industries. The paper gives the background information and a brief note about the various research activities, on gas sensors and monitoring systems, discusses about the various blocks of the proposed system [13].

Abid khan, Ravi Mishra Proposed a design which is cost-effective, reliable and has the function of accurate tracking. The system has an “On-board Module” which consists of GPS receiver, a GSM modem and ARM processor. It can provide tele-monitoring and management system for inter-cities transportation vehicles. [15].

Ulhas Patil, Pranali More, Rahul Pandey, Prof. Uday Patkar The data is analysed and all the information can be observed by remote location. Tracking of the vehicle can be done in all-weather condition. GPS and GSM technologies are used in this system [8].

In the forthcoming sections, II section explains about block diagram and III,IV,V,VI,VII by proposed framework, components descriptions, conclusion, result and discussion, future scope.

### III. BLOCK DIAGRAM

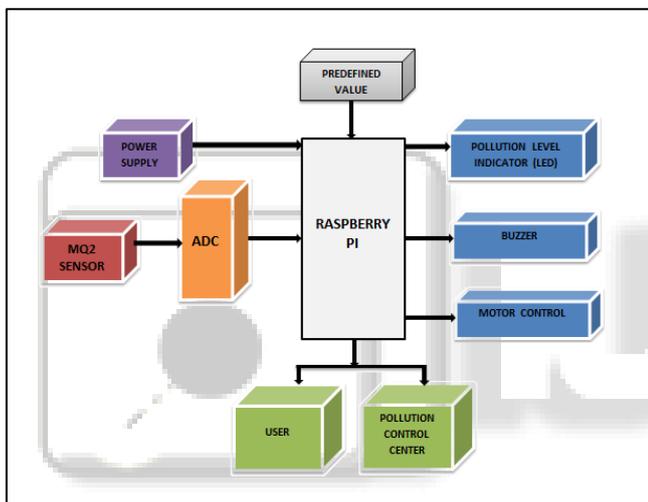


Fig. 1: pollution control system block diagram.

### IV. PROPOSED FRAME WORK:

In this section we have proposed the design falls in the IoT framework. The frame work of IoT serves as a transparent bridge between physical word like objects, a social world together with itself to form an intelligent pollution control system. The process of our system where emission from the vehicle is monitored and controlled, explained in fig1.

### V. COMPONENTS DESCRIPTIONS:

#### A. MQ2 sensor:

The MQ-2 is a sensor which detects flammable gas and smoke concentrations of combustibile gas in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of flammable gas of 300 to 10,000 ppm. The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. They are used in gas leakage detecting equipment in family and industry and in portable gas detector.

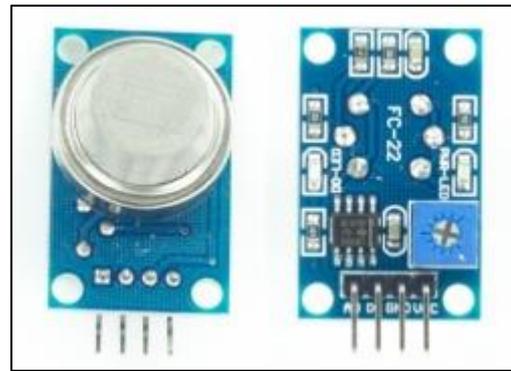


Fig. 2: MQ2 Sensor

#### B. Analog to digital convertor:

The ADC gets input from the sensor which converts the analog input into digital output which is given to the raspberry pi for further process.

#### C. Raspberry pi zero:

This is the most important unit and the core of the system to function.it handles all the processing and controlling needed for the system to function.it receives the sensing information, processes It, returns the corresponding values, and generates the necessary controls to guide the data to the desired destination.

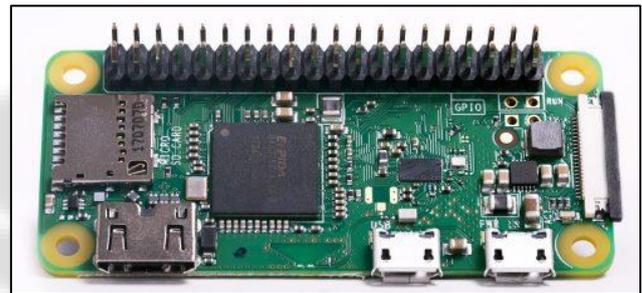


Fig. 3: Raspberry pi zero

#### D. Light emitting diode:

A light emitting diode is a two-lead semiconductor light source .it is a P-N junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photon. This effect is called electroluminescence.

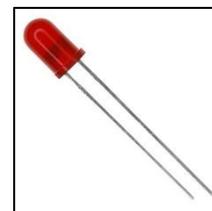


Fig. 4: LED

#### E. Buzzer:

The buzzer module is used for audible alerts when the emission level shoots beyond the set threshold level. The buzzer or beeper is an audio based signaling device.it is mainly designed as mechanical, electromechanical, or piezoelectric.



Fig. 5: Buzzer alarm

#### F. Motor control:

The main function of the fuel injector is to cut the supply of fuel to the engine, when sensors values are more than threshold values. A relay circuit is used to control the ON/OFF position of the fuel pump. Here raspberry pi is programmed in such a way that when the pi sends a trigger pulse after the timer runs out relay should get back to its original position. Which cutoffs fuel supply to engine.

### VI. CONCLUSION

This paper presented the design and development of IoT based vehicular pollution monitoring system for greenhouse gas reduction. The smart intelligent environmental system monitor the pollutants produced by the vehicles and also warn the vehicle owners to control the pollution. This system also sends the pollutants level data to the server for future analysis. The air pollution agencies can able to analysis the data and also detect the vehicle that cause more pollution in the atmosphere. The developed system is a low cost, simple to operate and provides better accuracy.

### VII. RESULTS & DISCUSSION

The developed system is mainly used for controlling the air pollution from vehicles when the values of sensors reach its maximum threshold value. The hardware module of the system developed is shown in Fig 29. The concept of detecting the level of pollution and indicating it to the owner/driver is implemented. Since there is an increase in the level of pollution over the last couple of decades, leading to several environmental problems. There will be a huge population, who do not take care of the pollution from their vehicles seriously, which has already resulted in several environmental problems such as Ozone layer depletion and so on. Hence this system will be highly beneficial in solving this problem.



Fig. 6: Hardware module of the system developed

The sensor used in this project can be directly placed near the exhaust of a two wheeler so that the smoke obtained as an input can be from the vehicle itself. The given input value will be compared with the already programmed threshold value, if it doesn't exceed the threshold value then the vehicle is said to be safe, pollution emitted are within safe limits and it will continue to run.

Hence the system displays "NORMAL AIR CONDITION". Once when it exceeds the threshold value the pi gives alerts to the user in three ways,

During the first process pollution gets detected, the pi activates the led, after a certain time period LED tends to OFF state. The system displays "GAS DETECTED 1".

During the second process, if again the pollution gets detected the pi activators the buzzer alarms and system displays "GAS DETECTED 2".

During the third process, the motor connected to the pi tends to OFF state. Hence the vehicle will be stopped and correspondingly "HIGH GAS DETECTED" will be displayed on the system.

So that we can reduce the pollution created due to vehicular emissions. This may also reduce the Greenhouse gases emission.



Fig. 7: Hardware model placed in vehicle

Also during the first stage when gas is detected the pi sends a message to the driver/owner. The message is sent through Way2SMS, which a web portal is used to free SMS to mobile phones. The results obtained through SMS are shown in Fig 30.

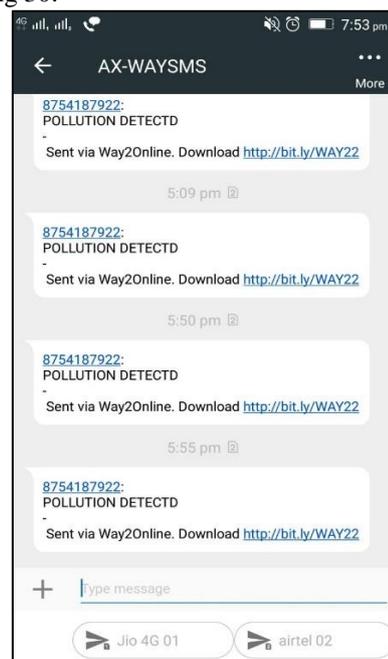


Fig. 8: Message received

When the smoke detected is high i.e. when the level of smoke exceeds the threshold value which was predefined in raspberry pi, then the message is sent to the user.

#### VIII. FUTURE SCOPE

In future, we are going to charge a lead-acid battery through a solar panel placed on the two wheeler. In addition, to couple the mechanism of both electric vehicle and petrol vehicle. We can run the vehicle through the battery, when battery runs out of charge we can switch over to petrol/diesel operated engine system. Such a hybrid vehicle reduces the pollutants emitted from automobiles and paves a way for better pollution-less environment.

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