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Design and Implementation of Vehicle Emission Testing System using MQ-5 and MQ-7 Sensors

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ABSTRACT: One of the major reasons of air pollution is emission of polluting gases from vehicles which is responsible for 70% of the total air pollution. The traditional air quality checking framework, controlled by the Pollution Control Department, is very costly and monotonous. Systematic measuring equipment is expensive, time consuming and power expending. As opposed to traditional air pollution checking stations an idea is planned, execution, and assessment of low power, minimal effort Wireless-sensor Air Pollution Monitoring System which gives continuous observing of pollutants materials discharged from the petrol vehicles. The real target of the proposed framework is to powerfully and persistently screen the discharge from a two wheeler petrol vehicles. The MQ-5 and MQ-7 sensors are used to sense Hydro-Carbon (HC) and Carbon Monoxide (CO) respectively from the emission of the vehicles. These sensors are given a maximum threshold values that is the range is specified for individual vehicle type. When the emission exceeds the maximum threshold value the sensor communicates with the mobile phone through HC-05 Bluetooth module which sends the data to the monitoring system that is mobile phones.

KEYWORDS: Arduino UNO, MQ-5 & MQ-7 sensors, Threshold value, HC-05 Bluetooth module.

I. INTRODUCTION

Air contamination observing is critical as air contamination directly affects human wellbeing and condition. The major pollutants from vehicle emission are Carbon monoxide and Hydro-Carbon. Carbon monoxide when released from vehicles responds with different contaminations noticeable all around to shape possibly un-safe ground level ozone. This happens near the site of emission. The human being impacts of CO rely on upon the level of CO and length of presentation and additionally every individual's well being condition. The Carbon monoxide concentration is measured in percentage. The level of CO from 0.00001% - 0.0007% are uncertain, however a great many people won't encounter any side effects. Some heart patients may encounter an expansion in trunk torment. When CO level increase from 0.0007% symptoms will be noticeable like head ache, nausea and so on. If the CO level is in the range of 0.0015%-0.002% or above then disorientation, unconsciousness and death are possible. Incomplete combustion of fuels in the vehicles form $1/6^{th}$ of the pollution in the air. Hydro-Carbon concentration is measured in parts per million (ppm). Only Hydrocarbons in air don't cause any harmful impacts. Be that as it may, they experience synthetic responses within the sight of daylight and nitrogen oxides. They frame photo-chemical oxidants prompting photo-chemical smog. This causes disturbance in the eyes and lungs prompting respiratory sicknesses. In this paper we present a sensor framework for air contamination observing. The customary air quality observing framework, controlled by the Pollution Control Department, is greatly costly as far as testing procedure and types of gear and it is tedious. Logical measuring hardware is expensive, time and power expending. As opposed to customary air contamination checking stations, we display the plan, execution, and assessment of low power, minimal effort, versatile Wireless-sensor Air Pollution Monitoring System which gives ongoing observing of dirtying materials discharged from the bike oil vehicles. The reason for the proposed framework is to powerfully and consistently screen the emanation from a vehicle. The sensors are put or settled to the vehicles close to the fumes and these sensors are given a greatest edge values. At the point when the outflow surpasses the most extreme limit esteem the sensor speaks with the HC-05 Bluetooth module which sends the information to the observing framework. The primary reason for contamination checking is not exclusively to give the

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gathered information to the end client it might likewise help the organizers, approach producers and researcher to take the choice on contamination level and attempt to enhance the vehicle emanations control [1].

II. EXISTING SYSTEM

At present we have Emission Testing Centers to look at the Quality of Emission from an Automobile. This emanation test focuses will be subsidiary to the vehicle Department of the nearby/focal government. They test the Vehicles/Automobiles in the Test result: Idling. This outflow testing focuses would check just for the CO (carbon monoxide) and HC (hydro carbon) content from the discharge of the vehicle. In like manner the testament given by the test focuses would be legitimate for Six months from the date of test. This validation would moreover fuse Photo of the vehicle in which the Number plate purposes of intrigue would be accessible. It would likewise contain some more subtle elements of the vehicle like Vehicle Number, Month and Type of the Fuel and so on. According [3] these centers mainly work according to the Vehicle Meets Emission Standards Prescribed by rule 115(2) of central Motor vehicle Rules 1989.

III. PROPOSED SYSTEM

Each vehicle has its own discharge of gasses, yet the issue happens when the emission is past the institutionalized qualities. The essential explanation behind this break of outflow level being the inadequate ignition of fuel provided to the motor which is because of the disgraceful upkeep of vehicles. This emission from vehicles can't be totally maintained a strategic distance from, yet it unquestionably can be controlled. To lighten the air contamination issue created by vehicle emissions, distinctive vehicle review programs have been presented, in which vehicles are inspected by experiencing various discharge tests. Be that as it may, these outflow tests are typically taken a toll insufficient and tedious. It is in like manner difficult to actualize the vehicle proprietors on watching the soundness of their engines consistently and making snappy move to settle their vehicle surge issues. Along these lines, here we propose another vehicle emission examination and warning framework to help day by day checking of motor wellbeing.

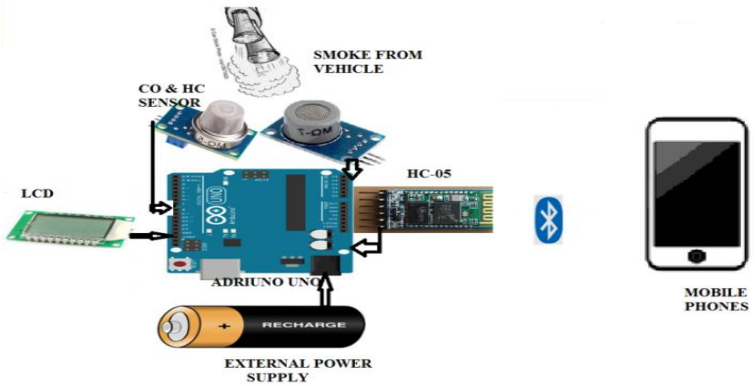

Figure. 1. System Architecture of the proposed ssystem

We exhibit a framework where the framework gets the outflow values from the sensor hub. Figure 1 shows the overall system architecture of the project and is as shown above. The sensor hub involves MQ-5[4] and MQ-7[4] sensors for Hydro-Carbon and Carbon-Monoxide detecting. Later the emission values are passed to Arduino-UNO microcontroller. It compares the emission values with the local emission standards set by the emission department. For Carbon Monoxide the threshold value is 3% and for Hydro Carbon it is 100ppm.The Arduino-UNO compares the emission values. If it exceeds the threshold value it is transmitted through wireless mode and stored in the server. If the received vehicle emission exceeds the allowed figure, the emission test certificate will not be issued to the vehicle owner and made a request to repair the vehicle as quickly as time permits and to rehash the emission test once. On the off chance that the vehicle owner does not repeat the emission test inside the given time frame, a notice is sent to the vehicle

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owner's address to repair their vehicles as quickly as time permits and get affirmed. The project details like step by step process and actions are figured in the flow chart. Figure 2 show the flow steps of the proposed system.

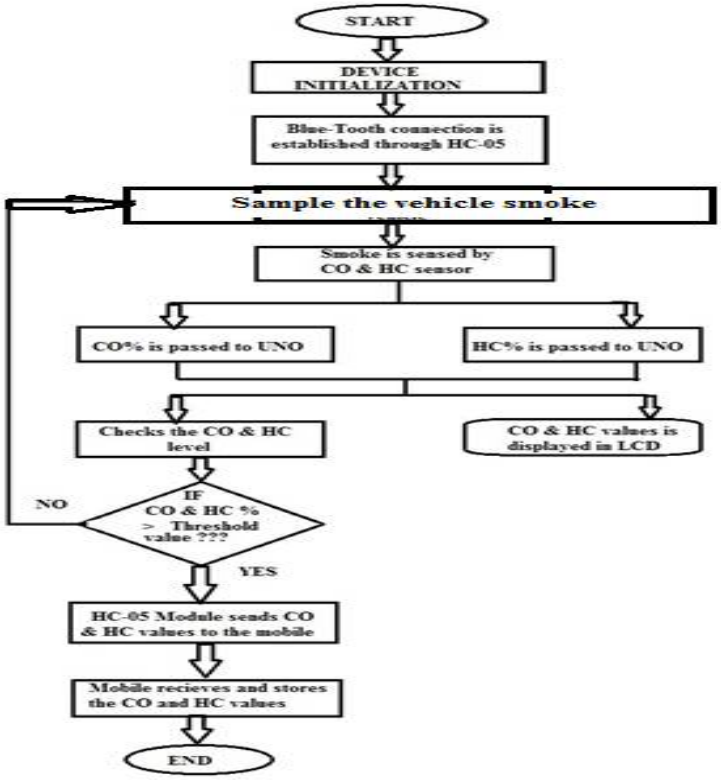

Figure. 2. Flow steps of the proposed system

SYSTEM MODULES:

There are 3 modules

1. Sensing module.
2. Processing module.
3. Communication module.

Sensing module: It comprises MQ-5 and MQ-7 sensor. These two sensors are used to sense Hydro-Carbon and Carbon Monoxide particles respectively. Simultaneously emission from the vehicle is passed to both sensors. The sensing process is done by the sensor and the values are passed to the Arduino-UNO AT 328P micro-controller for the comparison process.

Processing module: Microcontroller plays a main role in processing the emission values. Based on the data received from the MQ-5 and MQ-7 sensor, the Arduino-UNO AT 328P processes ie it compares the CO and HC values with the threshold values. The threshold value for CO is 3% and for HC the threshold value is 100 parts per million (ppm). If the emission is above the threshold value, then the data is passed to the mobile phones via HC-05 Bluetooth module.
The 16*2 LCD display is used to display the CO and HC emission values. The system initialization will be displayed and along with it if the emission is above the threshold value the “HIGH EMISSION” message will be displayed with the CO and HC values.

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Communication module: If the emission is above the threshold values then the CO% and HC in parts per million (ppm) is sent to the mobile phones through HC-05 Bluetooth module from the Arduino UNO AT 328P microcontroller after the comparison process.HC-05 Bluetooth module is used for converting a serial port to Bluetooth. The module contains Bluetooth serial interface and Bluetooth adapter. The mobile phone is installed with the readily available Bluetooth compatible app. The app used is Bluetooth Terminal. The app permits to imitate a Bluetooth terminal, from which we can interface with any Bluetooth-serial connector system/gadget. The version of the app used is 1.2. The received data is saved in system.

IV. EXPERIMENTAL RESULTS

With a particular true objective to ensure the adequacy of the information structure, numerous trials were directed out. For the trails we have considered one vehicle for the comparison analysis of the vehicle with the constraint of "before service" and "after service". The vehicle considered is Honda Dio model. Readings are taken out from the vehicle in 2 cases and are plotted in a graph as shown in the figure 3 and figure 4 below. First case is "Before Service" and second one is "After Service". In the both the graphs, x-axis is marked with the number of trails conducted for both the CO and HC particles. In the Carbon Monoxide graph of the vehicle, the y-axis is marked with the CO%. Likewise in the Hydro-Carbon graph of the vehicle, the y-axis is marked with the HC in parts per million (ppm).

The vehicle was last serviced approximately around 40,000kms and was supposed to be serviced approximately around 44,000kms. Purposefully the vehicle was not serviced on time and the vehicle was used for more duration and was approximately around 46,000kms. Around 46,000kms the CO and HC was measured from the vehicle emission using the proposed system. 5 trails were conducted and the 5 different values were tabularized for each CO and HC. After collecting the data from emission test the vehicle was given to the service station for Engine Tune Up Procedure. This procedure includes cleaning the air filters, carburetor, air vent screws, fuel jet etc. along with adjusting spark plug gap, spark timing etc according to the manufacturer's design. After servicing the vehicle that is Engine Tune Up Procedure again the CO and HC emission was measured from the vehicle emission using the proposed system.5 trails were conducted and the 5 different values were tabularized for each CO and HC. Later 2 different graphs were plotted for CO and HC, in which the 5 values noted are plotted with respect to before servicing and after servicing the vehicle.

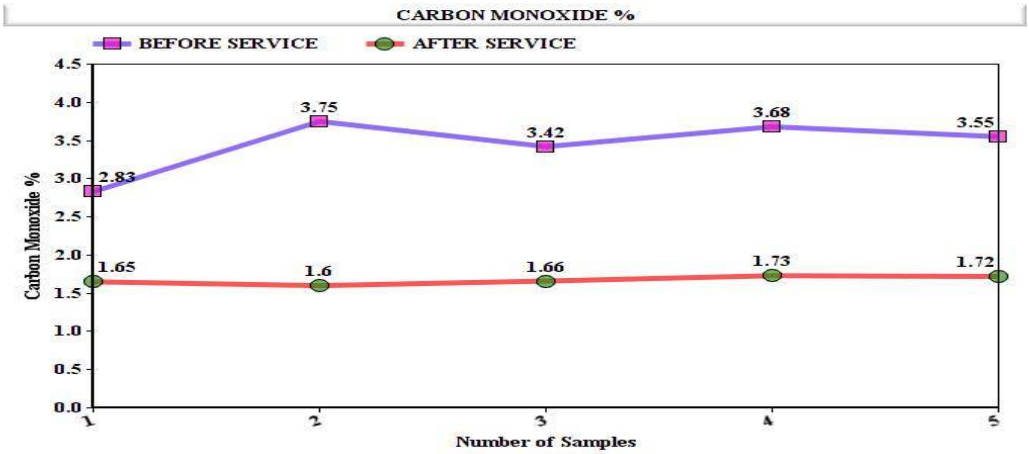

Figure 3.Carbon Monoxide graph of 5 samples from the Honda Dio vehicle.

Figure 3 shows the graph of the Honda DIO model for carbon monoxide percentage. From the graph plotted we can see the clear result of the CO emission from the vehicle in both the cases. In the graph we can see that the collected values before servicing the vehicle indicate that the concentration of CO% is more than the threshold value of 3%. Hence, the vehicle engine is not in a good condition resulting in high emission of pollutants to the environment. The CO% values

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collected after servicing the vehicle indicates the vehicle engine is in a good condition as the values collected are within the threshold value of 3%.

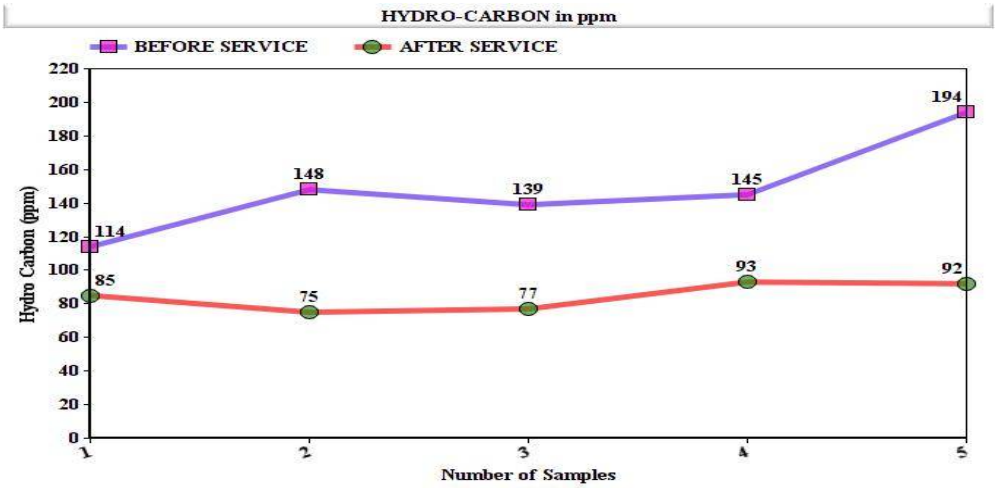

Figure 4 : Hydro-Carbon Graph of 5 samples from the Honda Dio vehicle.

Figure 4 shows the graph of the Honda DIO model for hydro-carbon in ppm. From the graph we can see the clear result of the HC emission from the vehicle in both cases. Like CO graph, HC graph also indicates that HC emission is more than the threshold value of 100ppm before servicing the vehicle and within the range of threshold value after serving the vehicle.

From these two graphs we can say that the vehicles which are not maintained properly with periodic servicing the engine and without taking care will produce more emission of the pollutants like CO and HC to the environment which leads to the air pollution. This can be controlled and monitored using the proposed system by frequent checking of the emissions from the vehicle randomly and dynamically. Later by notifying the vehicle owners regarding the pollution caused from their vehicle.

V. CONCLUSION AND FUTURE WORK

As India or any piece of the world is inclined to high activity and contamination of air this vehicle emission monitoring system has all the ability to overcome as it has more preferences on the road, traffic signals and so on. No strain to deal with, no practice required to utilize it, so it is smart and reasonable for this generation. This framework is financially smart answer for vehicle discharge issue what's more, can be utilized for other application once it mounted on vehicle. The sensors give the CO and HC levels. From investigation talk we can conclude that frequent checking the emission from the vehicles helps in minimizing the pollutants emission from the vehicles. This can help the traffic police to track and control vehicles with high emissions.

In future, this can applied to test for other types of fuels. Later it built on every traffic signal junctions to avoid human interactions with system.

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BIOGRAPHY

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