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Automated Pollution Control System in Vehicles: A Review

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I. Introduction

In developed and developing nations, a large fraction of people travel daily for work, shopping and social reasons. In modern world, we cannot imagine a life without cars. In some ways, our life is depended on cars. Like, a coin has two sides vehicles also have negative effects. One of the main negative effect of vehicles is air pollution Every vehicle has its own emission of gases due to combustion of fuel. To a certain standard value this emission doesn't cause pollution. But the problem occurs when the emission is beyond the standardized values. The 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. Avoiding this emission completely is not possible, but in a way we can control it.

- **Emissions from Petrol Vehicles**: Emissions from petrol cars have been dramatically reduced by the introduction of catalytic converters, which oxidise pollutants such as CO to less harmful gases such as CO_2. When compared to petrol cars without catalysts, catalyst cars have much lower CO, HC and NOx emissions, at the expense of CO_2 emissions, which increase due to the oxidation of carbon monoxide to CO_2. As a consequence of this, a catalyst car will also use slightly more fuel and become less efficient. However, despite these improvements, petrol cars with catalysts still produce more CO and HC than diesel cars, although exhaust emissions of NOx and particulates are much lower than diesel cars. Infact particulate emissions from petrol cars are so low that they are not routinely measured.
- **Emissions from Diesel Vehicles**: Diesel fuel contains more energy per litre than petrol and coupled with the fact that diesel engines are more efficient than petrol engines, diesel cars are more efficient to run. Diesel fuel contains no lead and emissions of the regulated pollutants (carbon monoxide, hydrocarbons and nitrogen oxides) are lower than those from petrol cars without a catalyst. However, when compared to petrol cars with a catalyst, diesels have higher emissions of NOx and much higher emissions of particulate matter.

Smoke

The darker the smoke is the more serious the problems grows. A graycolour is a red warning light of possible transmission fluid burning. Thick, black smoke suggests that the engine is being flooded with gasoline. The white smoke is serious if there appears to be a cracked cylinder head or an engine block that is showing fissures. The black smoke may show there is a return fuel line which is obstructed. Fuel injectors and sensors might also be damaged. A final problem which can be diagnosed from black smoke is problem with the air filter.The smoke also gives you a good idea of the kind of repair work that is going to be necessary. Blue smoke will suggest piston rings have become faulty and has allowed oil to move from lubricating engine parts. A turbocharged car will also send out blue smoke whenever the blower has to be replaced.

Particle pollution, also called particulate matter or PM, is a mixture of solids and liquid droplets floating in the air. Some particles are released directly from a specific source, while others form in complicated chemical reactions in the atmosphere.

EPAcategorises particle pollutants into categories:

- Coarse dust particles (PM10) are 2.5 to 10 micrometres in diameter. Sources include crushing or grinding operations and dust stirred up by vehicles on roads. Pleasant particles (or pm2.5) together with those found in smoke and haze have diameters less than 2.5 microns.
- Fine particles (PM2.5) are 2.5 micrometres in diameter or smaller, and can only be seen with an electron microscope. Fine particles are produced from all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes

The primary pollutants emitted from the motors are hydrocarbons, lead/benzene, carbon monoxide, sulphur dioxide, nitrogen dioxide and particulate remember. The main motive of vehicular pollutants is the unexpectedly

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growing quantity of cars. The opposite factors of vehicular pollution inside the urban areas are 2-stroke engines, poor fuel best, vintage automobiles, insufficient protection, congested traffic, poor avenue circumstance and antique automotive technologies and site visitor's management gadget. In India, the range of vehicles expanded from 0.3 million in 1951 to 58.three million in 2001-02.

The vehicle owner has to check the emission from the vehicle in authorized centers. Computerized facilities for checking of pollution levels and issue of PUC (Pollution Under Control) Certificates (to vehicles meeting emission standards) are available at many petrol pumps/workshops. These authorized Pollution Checking Centers are spread all over India. In case the vehicle is found polluting beyond prescribed norms, necessary repairs/ tuning in the vehicle would be required.

When vehicles emit excess levels of smoke, chances are that it is not properly tuned or maintained since long time. In case a vehicle is poorly tuned or maintained, the other parts on the vehicle may also not work properly. The Smoke emitted from petrol engine vehicles (most cars) is mainly due to excessive wear, form diesel vehicles (most trucks) it may from poor injector maintenance, excessive fuel delivery rates or poor driving technique (for example, lugging which is labouring the engine in too high a gear). Emission of smoke means that the vehicle is wasting fuel and engine damage is getting damaged. Servicing according to company norms will eliminate many problems that cause smoke emissions and save the environment and your vehicle from getting damaged early.

The owner of the vehicle shall get his vehicle checked for emission in authorized centers that have computerized facilities for checking the pollution levels and issue of PUC (Pollution Under Control) Certificates (to vehicles meeting emission standards) are available at many petrol pumps/workshops. The pollution centers are spread all over India. In case the vehicle is found emitting pollution beyond defined standard values, the vehicle should get checked and serviced.

II.   Literature Survey

The previously proposed ideas for tackling this problem are:

- **Automated System for Air Pollution Detection and Control of Speed in Vehicles:** Various automobiles comes with various scales for gas emission, however it becomes the matter of concern when it crosses the threshold scale level. This paper focuses on pursuing monitoring and controlling the unwanted polluting waste in the automobile by incorporating pollution control circuit. This particular control circuit consists of sensor circuit containing sensors like gas sensor and temperature sensor, and the wide concept of GSM and pulse width modulation (PWM), altogether attached to the controller. The idea suggests the control system in accordance with the level increase pollution level, i.e. the system slowdowns on vehicle touching certain predefined pollution level, and a fan automatically gets-on when it crosses the threshold. PWM is used for controlling the speed of DC motor. By means of MATLAB with the help of PID and PWM, it's verified.

- **A Novel Approach to Implement Self-Controlled Air Pollution Detection in Vehicles using Smoke Sensor:** This paper is mainly concentrated on controlling the air pollution caused by the vehicles. It can be done by using semi-conductor gas sensor, which is used to detecting emission level from vehicles. In vehicles, emission-level of pollution becomes higher than the standard emission level because vehicles do not get service regularly. To detect the level of gases they have used gas sensor. If the level of the pollution is more than the standard value given by the government than it will give an alarm through LCD by using microcontroller. By using GSM module, it will send the signal of pollution level to the service station through a text message. Timer will be activated which tell after how much time the vehicle will stop. Within that time interval GPS will find the location of the vehicle and display it on LCD. The service station gets the GPS value which is send by GSM through a text message. The fuel supply to the engine will be cut off as soon as the time in the timer gets over and vehicle will stop this process is done by microcontroller with the help of relay. The service station tracks the GSM value of the vehicle and services it. The vehicle should be registered with service station by sending text message.

- **Metal Oxide Semi-Conductor Gas Sensors in Environmental Monitoring**: The gas sensor, which is used in variety of different role and in different industry, is metal oxide semiconductor gas sensors. It is relatively cheaper than the other sensing technologies. The response time is also faster than the other. The gases that can sense by this gas sensor are carbon monoxide, LPG, i-butane, propane, methane, alcohol, Hydrogen, smoke and nitrogen dioxide. In this project, nature of gas and the basic structure is being explored. It also tells about the effect of gases on the surface structure. An outlook has been done for the imperative aids and some researches on advancement are done for the utilization of metal oxide semiconductor sensors for the recognising of various gases, such as, CO, NO_x, NH_3 and mainly typical case of CO_2.

- **Automated Control System for Air Pollution Detection in Vehicles**: Inadequate fuel combustion supply for engine, which is the result of inappropriate automobile maintenance leads to the defilement of emission standard. Fully ignoring the unwanted emission cannot surely be the matter to escape from; rather the measures could be done to control it. Semiconductor

sensors evolution for spotting different gases. This model's objective is incorporating those semi-conductors at the outlets of automobile, which spots the level of unwanted gases, by indicating it with meter. On the reaching the level above the predefined threshold, an alert will generate in the car and it will stop after some decided time, which has been decided by taking flexible time to park the car safely and then the supply of fuel to the engine cuts off. The model uses micro controller for monitoring and controlling.

- **Automated System for Air Pollution Detection and Control in Vehicles**: In this paper the aim is to made an automated system for air pollution detection and control in vehicle. Pollution occurs due to improper maintenance and check-up of vehicle. Therefore they proposed a system which controls the air pollution with the help of detection from the motor vehicle. In this system there is a smoke sensor which continuously checks the pollution. Smoke sensor is used to measure the percentage of carbon pollutants present in the smoke which is the cause of the air pollution. The output is in the analog form then it will be converted in the digital form using the Atmega 8 microcontroller. As the pollution reaches to threshold value the system will be trigged and engine goes on to the off state.

- **Automated System for Air Pollution Detection and** Control: Vehicle and industry are the major sources of pollution. However, due to improper emission of fuel the problem is increasing and we have to control this. To resolve this problem in this paper they build an automated control system for emission level detection in vehicles and industries. When the pollution level increases and pass the threshold level a alarm will buzz and to industry to indicate that the limit has been reached after the system send information to environmental control room .the information include vehicle number and owner detail after that a challan will be generated and send directly to the owner. Before challan a message will be send to the owner that your pollution level crosses limit take necessary steps and control this. This paper help society and country from pollution.

- **Automated Control System for Air Pollution Detection in Vehicles**:Vehicles play very important role to travel from one place to another. Nowadays almost all trucks and cars operate using internal combustion engines that burn gasoline and other fossil fuels. Pollutants are released into the atmosphere that causes air pollution due to the process of burning gasoline that powers trucks and cars. Primary source of vehicular pollution is the release of pollutants directly from the tailpipes of trucks and cars into the atmosphere. When the level of pollution exceeds beyond a set threshold value, an indication is given to the driver that the maximum limit is reached and the vehicle will come to an halt after certain specified time i.e. safety time given to the driver to park his/her vehicle. The GPS starts locating the position of the nearest service station within that specified period. In case the time elapses, supply of fuel to the engine is cut off and is required to be towed to the nearest service station. This whole process is controlled using microcontroller.

- **Automated System for Air Pollution Detection and Control:**Nowadays air pollution has become a threat to human life. Vehicles and industries have become the main source of air pollution. Emissions from vehicles and industries cannot be stopped, but the problem arises when these emission becomes harmful due to improper maintenance of machineries. The solution to above problem is to build an automated system that controls and detects the air pollution. When the pollution level shoots beyond the set threshold value then there will be alarm in the vehicles or industry that indicates them that the limit has reached and this information will sent to environmental control room along with the vehicle number and the details of the owner. If this information is received more than 3 times to the government, a challan will be generated and will be sent to the owner directly. This will put a pressure on the owner to get his vehicle serviced on time.

- **Smart Pollution Detection and Tracking System Embedded with AWS IOT Cloud:**Our air system is depleting day by day and main cause of this is pollution from vehicles which is very harmful to our harmful to us. With the existing infrastructure The Internet of Things (IOT) is the most uniquely identifiable interconnection. The IOT mainly deals with the connection of physical devices (smart phones, cars, home lighting, smart meters, and tide sensors) to the Internet.The main aim of this paper is to incorporate IOT for measuring pollution emitted from vehicles using MQ7 Arduino which may be sensitive for Carbon Monoxide. The location of the vehicle is found out by GPS. The emission of Carbon Monoxide is checked once in (like 20 km) and also the location of vehicle is used to find the area which is most polluted by the vehicle. These parameters are combined to the Amazon Cloud IOT which is much secure and along with this many services of AWS can be used. This will send a message to the mobile phone incase if vehicle is emitting higher level of pollution.

- **Development of an Active Vehicle Air Pollution-Control System (activAPS):**Major source of air pollution these days is CO, HC, and NOx. In order to curb the problem of air pollution an Active Vehicle Air Pollution-control System (ActivAPS) can be used to minimize the negative aspects of pollution from vehicles.

The device installed calculates the percentage of pollution emitted from the vehicle and informs the owner of the vehicle and the appropriate authorities via mobile network about the higher pollution level that has crossed the threshold value. The concerned authorities then take the required action to curb the problem by analyzing the real time data of the vehicular pollution and stores it in a systematic manner in individual's profile on one online source.

III. Future Scope

Future work includes adding a GPS and GSM module along with the tachometer. This not only indicates the owner when there is slight change in pollution content but also helps the owner to find a service station nearby. Owner will receive a message followed my change of smoke level and change of LED light. All measures are taken so that the owner never miss any notification.When the car comes to halt state the location of nearest service station and location of car is send to nearest service station informing them that the car is in halt state. So the owner wont be stuck for a long time.

References

[1] Chaitanya H P, H. Prasanna Kumar, Automated system for air pollution detection and control of speed in vehicles, International Journal of Advances in Engineering & Technology, 2016.

[2] V V R Kishore Ch, Suman M, A Novel Approach to Implement Self-Controlled Air Pollution Detection in Vehicles using Smoke Sensor, International Journal of Engineering Trends and Technology (IJETT) Volume 16 Number 6, 2014.

[3] Mohammad Akthar Ali, M.VenkataSireesha, Automated Control System for Air Pollution Detection in Vehicles, International journal of scientific engineering and technology research vol.03, issue.32, 2014.

[4] George F. Fine, Leon M. Cavanagh, Ayo Afonja, Russell Binions, Metal Oxide Semi-Conductor Gas Sensors in Environmental Monitoring, MDPI volume 10, issue 6, 2010.

[5] NishigandhaAthare, Prof.P.R.Badadapure, Human safety and air pollution detection in vehicles, International Journal of Technical Research and Applications e-ISSN: 2320-8163, www.ijtra.com Volume 3, Issue 6, 2015.

[6] https://en.wikipedia.org/wiki/Bharat_Stage_emission

[7] Anita Kulkarni, Ravi Teja Automated System for Air Pollution Detection and Control in Vehicles", IJAREEIE, vol 3, issue 9, September 2014.

[8] S. Arun ,Dr. J.L Mazher Iqbal, "Embedded System Based Air Pollution Detection in Vehicles V. Siva Krishna1"

[9] K.Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi, "Investigation of gas sensors for vehicle cabin air quality monitoring," vol. 42, pp. 167-175, 2002.

[10] P.Vijnatha Raju, R.V.R.S.Aravind, B.Sangeeth Kumar, "Pollution Monitoring System Using Wireless Sensor Network In Visakhapatnam", IJETT, Volume4, Issue4, April-2013

[11] Amarakanth, N.V.Uma Reddy, "Engine Self-Test With Air Pollution Detection and Remote

[12] http://en.wikipedia.org/wiki/Emission_standard

[13] http://www.cpcb.nic.in/Introduction.php

[14] Embedded Technology for vehicle cabin safety Monitoring and Alerting system by V. Ramya, B.Palaniappan.

[15] "Car Cabin air Quality sensors and Systems" by Kosmas Galatsis, WojtekWlodarsk.

[16] S. D. T. Kelly, N. K. Suryadevara, and S. C. Mukhopadhyay,"Towards the implementation of IoT for environmental condition monitoring in homes," IEEE Sensors Journal, vol. 13, no. 10,pp. 3846–3853, 2013.

[17] C. A. Trasviña-Moreno, R. Blasco, R.Casas, and A. Marcus.AutonomousWiFi Sensor for Heating Systems in the Internet of Things

[18] Tsow, F.; Forzani, E.; Rai, A.; Rui Wang; Tsui, R.; Mastroianni, S.; Knobbe, C.; Gandolfi, A.J.; Tao, N.J., "A Wearable and Wireless Sensor System for Real-Time Monitoring of Toxic Environmental Volatile Organic Compounds," Sensors Journal, IEEE , vol.9, no.12, pp.1734,1740, Dec. 2009. DOI= 10.1109/JSEN.2009.2030747.

[19] International Conference on Pollution Control & Sustainable Environment, April 25-26, 2016 Dubai, UAE. http://www.omicsonline.org/conferences-list/effects-of-pollution.

[20] Pooja Pathe,Prof.R.H.Talwekar ―GPRS BASED ROUTING & TRACKING OF MOBILE VEHICLES USING ARM International Journal of Engineering Research and Applications , Vol. 2, issue no.4, Pp: 1088-1090 ,2012.

[21] Dr. Kamal Jain and Rahul Goel―GPS Based Low Cost Intelligent Vehicle Tracking System (IVTS) International Conference on Traffic and Transportation Engineering, Vol. 26, issue no.36, Pp: 93-102 , 2012.

[22] S.P. Bhumkar, V.V. Deotare, R.V.Babar ―Intelligent Car System for Pollution Prevention Using ARM-7‖, International Journal of Emerging Technology and Advanced Engineering, Volume 2, Issue 4, Pp: 56-78,2012.

[23] Abid Khan, Ravi Mishra ―GPS – GSM Based Tracking System‖, International Journal of Engineering Trends and Technology ,Volume3,Issue2, Pp: 161-169,2012.

[24] RogierNoldus, Intelligent Networks for the GSM, GPRS and UMTS Network.