



# Effective Monitoring of Vehicular Pollution

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## Abstract

*Pollution is a continuously growing problem of today's world. The major contributor of air pollution is pollutants emitted from various vehicles. The rapidly growing number of vehicles is a matter of concern for developing countries as monitoring of pollution level emitted from these vehicles is a constant challenge. Developed countries have established various systems for monitoring and controlling of vehicular pollution but due to technological and economical differences of developed and developing countries, these projects cannot be implemented in developing countries. In India, it is mandatory to get pollution under control (PUC) certificate to run a vehicle on road but its constant monitoring is a challenge. This paper discusses the various pollutants emitted by these vehicles (using different fuels), and proposes an online system for monitoring the already existing PUC requisite for vehicles on road for a strong hold on controlling of vehicular pollution.*

**Keywords:** Pollution, pollutants, monitoring system.

## 1. Introduction

Air pollution is a global issue. The major sources of air pollution, on one hand, are flue gases, emissions from refineries and factories etc. On the other hand, exhaust and emissions from vehicles are responsible for 2/3<sup>rd</sup> of the air pollution in urban areas. Measures for controlling vehicular pollution has attracted attention of major authorities as increasing number of vehicles is continuously resulting in higher levels of air pollution. The internal combustion engines need a mixture of air and fuel to burn and produce energy. These burnt gases which come out of the exhaust are responsible for vehicular pollution. If these gases are in excess quantities, vehicular pollution is caused. The common pollutants emitted are by motor vehicles are carbon mono oxide CO, oxides of nitrogen NO<sub>x</sub>, sulphur oxides SO<sub>x</sub>, hydrocarbons HC, lead and suspended particulate matter SPM. Carbon monoxide, ozone, particulate matter, and the other forms of pollution can cause smog and other air quality concerns, but there are vehicular emissions that contribute to a completely different pollution issue: global warming. Global warming is the biggest challenge for the world. The gases that contribute to global warming are related to the chemical composition of the Earth's atmosphere. Some of the gases in the atmosphere function like the paves of a greenhouse. They let some radiation (heat) in from the sun but do not let it all back out. The past century has seen a dramatic increase in the atmospheric concentration of heat-trapping gases, due to human activity. If this trend continues, scientists project that the earth's average surface temperature will increase between 2.5°F and 10.4°F by the year 2100.

The problem is largely occurring in metro cities like Mumbai, Delhi, Pune etc. To control this problem, an effective monitoring system needs to be developed. The system has to be cost efficient, easy to implement and should monitor vehicular emission without wasting time of vehicle owner.

Presently we are practicing issue and checking of PUC certificates to monitor vehicular pollution but the credibility of PUC centres is not very high at present. Many of them are prone to various levels of malpractices. A major problem with PUC certificates is its constant monitoring. An online system is discussed in this paper for periodic monitoring of PUC certificates so that vehicular pollution can be controlled effectively.

## 2. Related Work

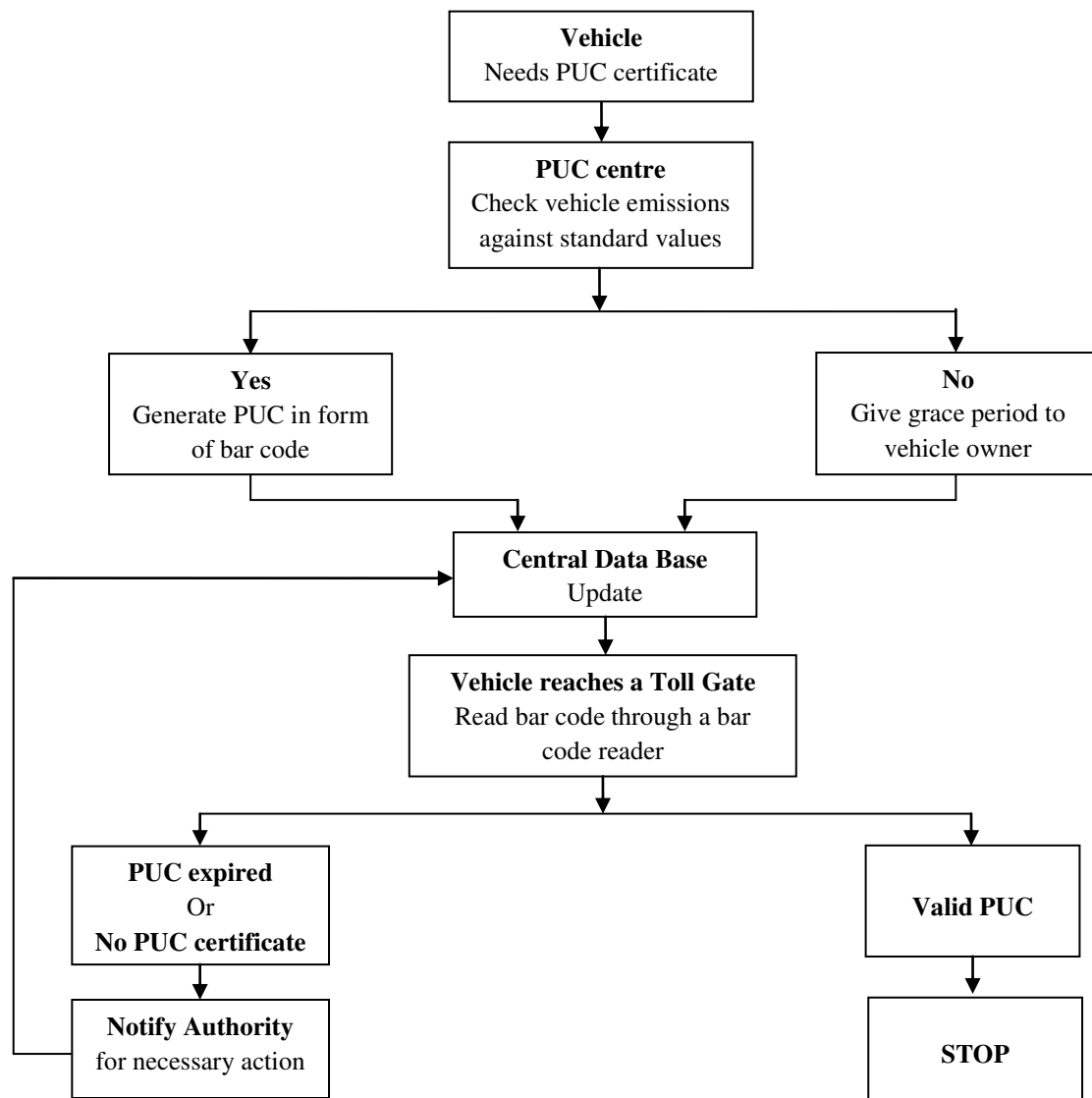
Various pollution control systems has been discussed in literature. In 2014 “Application of RFID technology and the maximum spanning tree algorithm for solving vehicle emissions in cities on internet of things” was presented by Chi-man Vong (Vong, 2014). This paper discusses a system consisting of RFID tag to which the lambda sensor is connected through analog to digital converter. The sensor measure air ratio in exhaust pipe this value is read by RFID reader. This data is then transferred to another RFID unit which is connected to 3G card for sending this data to database server where all data is maintained. Another paper “Automated system for air pollution detection and control in vehicles” presented by Anita Kulkarni (Kulkarni & Ravi, 2014), discuss on board pollution control system. If pollution exceeds the predefined standards then the vehicle is stopped by this system and a message is sent to specific number which is stored in GSM module. A. Rajalakshmi (Rajalakshmi et al., 2015); proposed another system which includes Arduino Board with ATmega 328 and GSM modem. This system also works using RFID technology for tracking vehicles responsible for creating pollution. J. N. Mohite (Mohite & Barote, 2015); in 2015 discussed another “Low cost vehicle pollution monitoring system” which proposes installation of onboard unit and send it to road side unit installed on traffic signal point. Sensors like MQ7, MQ5 are used to collect vehicle exhaust data which is part of on board unit and transfer it to road side unit. J.N. Mohite (Mohite & Barote, 2015); discussed another system which uses ZIGBEE tag to collect information regarding emission. ZIGBEE used for wireless communication between on board unit and road side unit overcomes range problem. D. Praveen (Kumar & Vijay, 2015); in 2015 pproposed another concept of IoT for mandatory vehicle emissions inspection and RFID is employed to develop the information system.

## 3. Proposed system

At present we have a system to monitor vehicular pollution manually. PUC certificate is mandatory for every vehicle owner. A vehicle owner not carrying a valid PUC certificate is liable to be prosecuted under section 190(2) of the motor vehicles act. Computerized facilities for checking of pollution levels and issue of PUC certificates to vehicles meeting emission standards are available at many petrol pumps/ workshops. But the periodic monitoring of PUC certificates manually is a constant challenge. Although many projects have been proposed in the literature but implementation of a thoroughly new system again presents a challenge. To overcome this difficulty, this paper proposes a system for periodic monitoring of PUC certificates. In the proposed system, PUC centres issue the certificate in the form of a barcode. The bar code issued has information of expiry date of PUC certificate and vehicle number. When a four wheeler goes to a toll plaza, the bar code is scanned and with the help of computer program, the data is sorted according to validity of PUC and maintains a central data base for future reference. If the vehicle’s PUC certificate has expired or it does not meet the set standards, then a grace period is given to vehicle owner to meet the requirements and is stored in the central data base against vehicle number. If the vehicle is found to violate the criteria even after grace period, then the separate database is maintained for the information of the concerned authority for necessary action. Authorised person can access this information by going through this data. If a vehicle is not having PUC certificate, its vehicle number can directly be fed in data base. In this way effective monitoring of PUC certificates can be initiated.

## 4. Functioning

For implementation of proposed system, the PUC centres have to be equipped with bar code generators. The bar codes generated have the information about the expiry date of certificate and vehicle number. Toll plazas have to be equipped with bar code readers. Computers, already available, on various toll plazas can be programmed to sort the information received by bar code reader according to their date of expiry. The following flow chart explains the working of proposed system.



## 5. Advantages

The system has following advantages in the present scenario:

- Extension of Present system
- Easy to implement
- Low chances of ill handling
- No on board unit required

## 7. Conclusion and Future Work

The system proposed in this paper suggests a methodology which strengthens the existing system. It is cost efficient and it also can be implemented with minimal effort. Monitor vehicular pollution on toll gates make it effective. This system can also be extended to petrol pumps in future for more regular monitoring of PUC.



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