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DEFILEMENT MONITOR: IOT SOLUTION TO THE SOURCE OF POLLUTION

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Abstract: **In the world of technology, everything is interlinked with the Internet. Whether it be business, socializing or education, the internet has taken over the life of an individual. Since the Internet is dominating the world, the appliances in day-to-day usage are also sinking into the evolution, by which the emergence of the concept of "Internet of Things" or "IoT" comes into the picture. The existence of IoT is so prominent that it has made nearly every device readable in terms of data generated through it. Hence making monitoring actions even easier than before. The ultimate Source of pollution that has made Indian cities to show up into the top 10 list of the most polluted cities[1] are the Vehicles driven by Indians. As the greater urge of purchasing a new vehicle is intensifying in the populated country like India, the nation continues becoming more vulnerable in getting its atmosphere polluted. The congestion on the roads with the increase in vehicles is also visible. Albeit there are several legal reforms in order to control such unfavorable circumstances, but a head-to-head solution is also needed for the people living around, breathing in the same toxic air as we do.**

Keywords: **Pollution, IoT, Vehicles, toxic, internet, cities.**

I. INTRODUCTION

The main reason for pollution in cities is because of vehicles. The mature use of vehicles in cities ends in an exceedingly very important increase within the emission load of various toxins into the air. As a consequence increase in environmental quandaries which can damage human health in urban places [2]. Air pollutants from taxies, cars, and buses follow in the damage of ground-level ozone and other respiratory intricacies like asthma attacks. Transportation is the root of generating carbon monoxide that adds 72% of the total pollution in metropolitan cities like Calcutta, Mumbai, and Delhi. Currently, the Indian pollution control board has made the compatibility certificate as mandatory for public and commercial vehicles once a year to monitor the pollution. Pollution Under Control (PUC) certificate for every three months is obligatory for all sort of vehicles from the date of registration [3]. In order to manage pollution, the measure of pollution should be monitored and vehicles in charge of polluting ought to be known. IoT is becoming effective in towns for observing pollution from vehicles and further, the data associated with the amount of emission for different types of vehicles in a particular city can be accumulated and examined. IoT is a potential technology that induces the eye of both, academe and enterprise. IoT is recognized as an arrangement of things, that can be labeled with a distinctive Identity and communicate supported by conventional communication protocols. IoT makes the objects to interact with one another, to accost data on the network, to stock and handle information, and to associate with the users, thereby formulating clever, omnipresent and invariably relevant surroundings. The researchers observed that it will be dormant to identify a recently built shape to IoT, collect with the splintering of ubiquitous devices in the future. Since IoT is for connecting and making use of the internet with the most common appliance around us, its large scale implementations have been performed in the field of ferriage, roadways in the metropolitan transportation system, wireless pill-shaped cameras for regulating the digestive records of healthcare applications, and for small scale machineries such as air conditioning systems and other home appliances.

IoT is perceived as an essential element of the future internet. The research goal's key issues are identification, privacy, and security. In order to set up fast progression in technologies similar to IoT, thus, the combination of big data, cloud technologies and future networks like 5G with loT must also be favored into recognition [4].

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The pollution standards for in-use vehicles have been prescribed under Rule 115(2) of Central Motor vehicles Rules, 1989 [5].

TABLE 1: Pollution Threshold for Petrol/CNG/LPG Vehicles

S NO.	Vehicle Type	CO%	HC in ppm
1	2&3-Wheelers (2/4-stroke)(Vehicles manufactured on and before 31/3/2000)	4.5	9000
2	2&3-Wheelers (2-stroke) (Vehicles manufactured after 31/3/2000)	3.5	6000
3	2&3-Wheelers (4-stroke) (Vehicles manufactured after 31/3/2000)	3.5	4500
4	4-wheelers manufactured as per pre-Bharat Stage II norms	3.0	1500
5	4-wheelers manufactured as per Bharat Stage- II, Bharat Stage III	0.5	750

This paper proposes an embedded system using a wireless gas sensor that provides a framework for collecting the sensor data for any vehicles using IoT in order to monitor vehicular pollution spread by that particular transport. This paper is divided into five segments, Introduction (In section I) followed by the Description of design and its workflow (In section II), the Physical setup (In section III), How it was implemented, its modules (In section IV), and finally the conclusion that we can deduce from the project implementation (In section V). The Acknowledgement is stated for remarkable sources (in section VI).

II. DESIGN OF THE PROPOSED SYSTEM

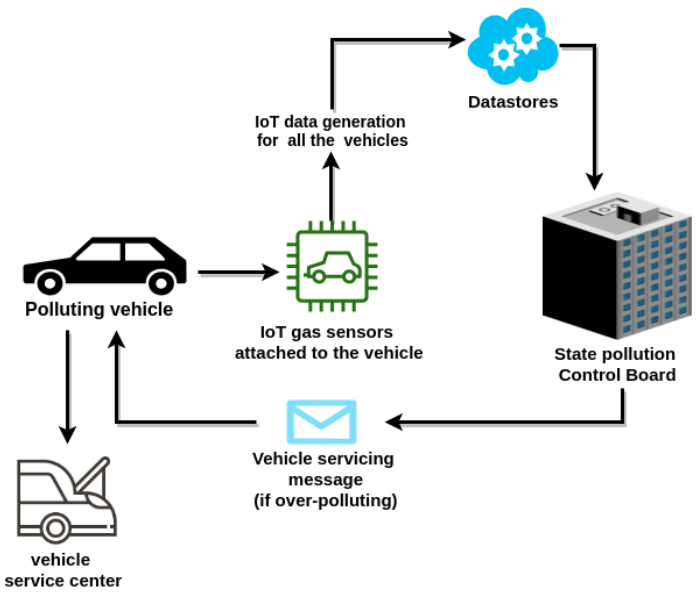

Fig 1: WorkFlow of Defilement Monitor

The framework of the proposed system is connected to the vehicles and uses IoT to monitor the pollution level of that particular transport in real-time. Gas sensor MQ-2, MQ-9, and MQ-135 are used to monitor the pollutants (such as CO) continuously to observe the number of pollutants released by the vehicle into the air.

The data that is collected by the sensors is sent to the datastores, here MySQL, containing the vehicle details and the pollution levels for that particular transport. Since the data can be flexible hence a SQL database is used here. After the data is sent to the authority the value is checked with the threshold value. If the value exceeds the given one, then a NOT

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SAFE FOR DRIVING is prompted on the dashboard and a message is then sent that requests the owner of the vehicle to get it services as soon as possible. If still, the vehicle shows the same pollution level, the owner can be fined for the same or any action could be taken as per the state pollution control board. Provided this mechanism would work more efficiently if the system is installed at the time of manufacturing.

III. EXPERIMENTAL SET-UP

The setup that has been done is shown in the figure below.

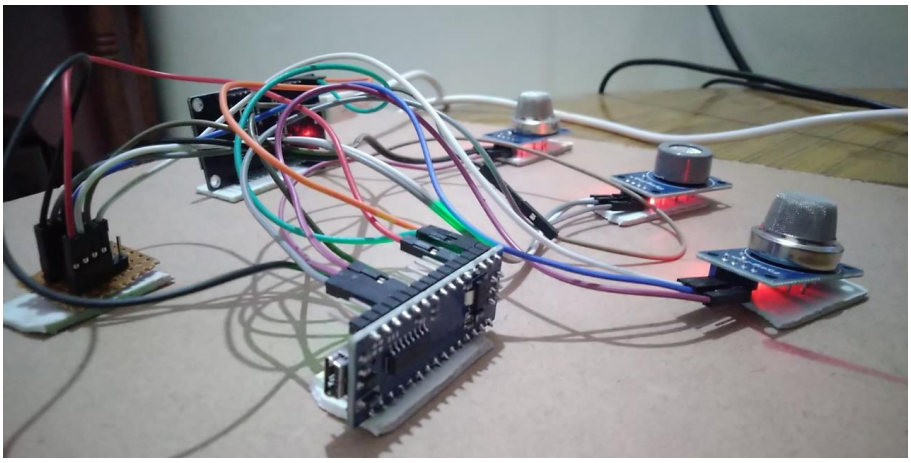

Fig 2: Working Model of PRASUK: Defilement Monitor

In the following setup, the gas sensors will be attached to the exhaust mechanism of the vehicle and will send real-time data to the database, which is later going to be fetched to display on the UI. The state control board will be provided with a dashboard to monitor the pollution level of the vehicle. If they found out someone violating the rules they would first be sending an alert message to get the vehicle services if still, the levels stay the same then they can take any measures they desire that can be either imposing a fine or seizing the vehicle.

IV. IMPLEMENTATION

In the following model of the Defilement Monitor, there are four major components:

1.Hardware(Sensor and microcontroller)

2.Backend (Nodejs)

3.Webpage (HTML and CSS)

4.Database (MySQL)

Hardware:

The hardware part of the project is using the amalgamation of the sensor and the microcontroller which when combined gets the value measures of gas component (in percent) that are used to calculate the impact and contribution of the vehicle towards the pollution in the environment. If it is found out to be greater than the recommended (threshold) value than a suitable message is also triggered along with the percentage of the gas produced, to the back end.In this, MQ-2, MQ-9, and MQ-135 sensors are used to get the percentage of the gas composition produced by a vehicle. The fetched value is passed into the microcontroller which is already being programmed with the code to get the values and use those to find out the different components of gases in it. These compositions are then compared to the predefined values and the result along with the value are passed on the backend using a wifi module(ESP8266).

Software:

The backend is programmed using NodeJS server which redirects the values sent by the microcontroller towards the database. The database stores the data of the user and the device, each entry with a unique ID. Other than sending data to the database, the webpage designed for the higher authorities will get its table values with the help of the server that

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would again fetch the data and display over the web portal. Since it all happens real time hence NodeJS server is being used.

Web Page:

With the WebPage for the project, all the data related to the vehicle is going to be provided to the authorities. The authorities will continuously be monitoring the pollution rate of the vehicles in which the proposed system is installed. The data that is displayed over the page would consist of the vehicle details such as vehicle_id, owner name, license No. as well as the emission details. This is done to allow the officials to easily track down the level of pollution emitted by the vehicle and the owner of the vehicle can be easily contacted as well.

Database:

The database used here is MySQL since it stores easily operatable data. The data stored here are the owner details, the vehicle details as well as the emission details of a particular vehicle in which the system proposed is being installed. The Database is used to keep the data for any further reference and usage, for example, contacting the owner when pollution level extend to a dangerous level.

V. CONCLUSION

The conclusion for the following can be stated with the amount of pollution lowered into the atmosphere. The particular model and the web portal are being proposed for implementation for the beneficiaries that it may provide in the future. The resulting outputs of the following project are as follows:

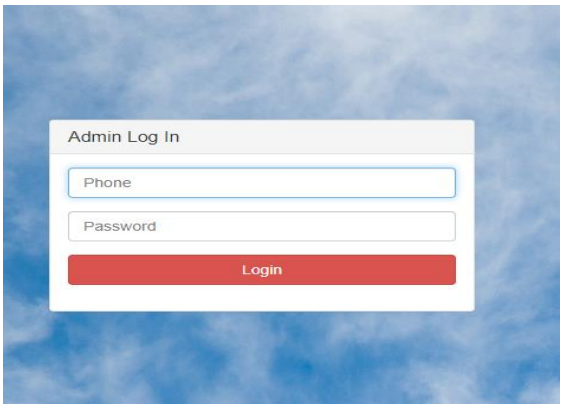

Fig 3: Login Page of PRASUK: Defilement Monitor

The Web portal that is going to be provided to the State pollution board.

For handling the data the authorized person must log into the system to access it and hence redirecting to the home page once verified.

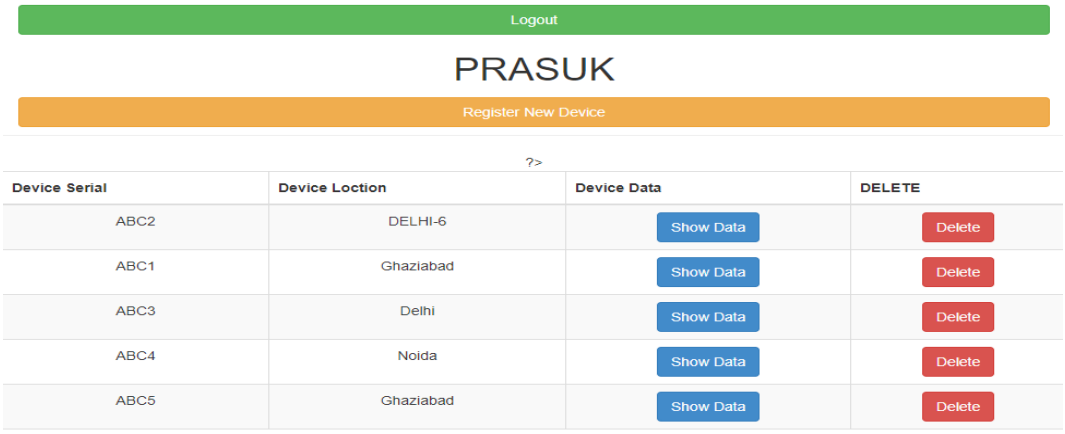

Fig 4: Home Page of PRASUK: Defilement Monitor

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The Home page, that represents the data.

The home page is for the details of gas emission for any particular vehicle. Here the Device's unique serial no. its location can also be viewed.

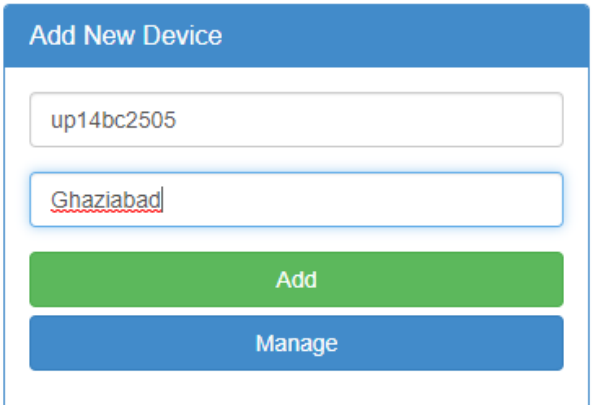
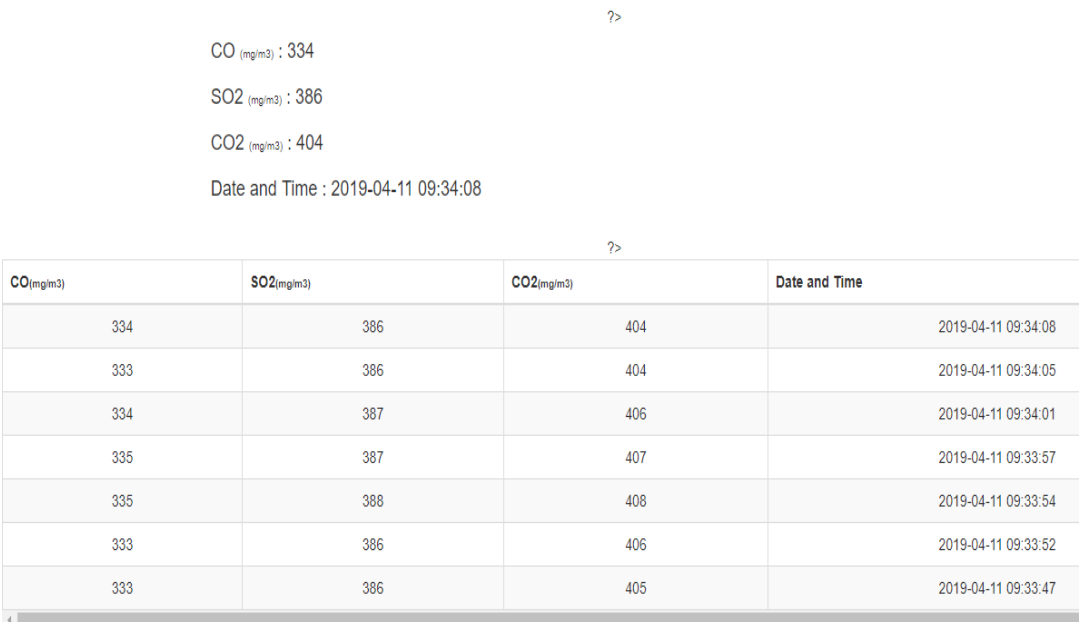


Fig 5: Add New Device Page of PRASUK: Defilement Monitor

The Add Device page, this is for establishing the linkage between the hardware device and the vehicle.

Add device is the functionality provided in the website that allows the addition of newly installed devices in the vehicle onto the website. In this, an id is provided by the user at the website that is the same as the id used at the hardware end. This allows the communication between hardware and website.


?>

CO (mg/m3) : 334

SO2 (mg/m3) : 386

CO2 (mg/m3) : 404

Date and Time : 2019-04-11 09:34:08

?>

CO(mg/m3)	SO2(mg/m3)	CO2(mg/m3)	Date and Time
334	386	404	2019-04-11 09:34:08
333	386	404	2019-04-11 09:34:05
334	387	406	2019-04-11 09:34:01
335	387	407	2019-04-11 09:33:57
335	388	408	2019-04-11 09:33:54
333	386	406	2019-04-11 09:33:52
333	386	405	2019-04-11 09:33:47

Fig 6: Show Data Page of PRASUK: Defilement Monitor

And lastly, the show data page where the emission of the gases is locked.

This page shows the real-time emission details of the vehicle having the device connected to it.

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