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High Polluting Vehicles Detection System

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Abstract: **- Pollution has been one of the major concerns of a lot of countries across the globe. With the rapib urbanization and decreasing green cover, it has become very important to continously monitor the air quality and keep pollution below the prescribed limits. Though the goverments have set norms at for every vehicle pollution level, it becomes very difficult to keep a check on the vechile emissions in develping countries like India where the vehicle density is very high and not all owners are aware or take the effort to keep a check on the pollution caused by their vehicles. The paper presents a solution which can be implemented on strategic locations on the road to identify the vehicle which are emitting pollutants above the prescribed limits and allow the authorities to imitate necessary actions against such vehicles.**

I. INTRODUCTION

According to [1] pollution is seen as one of the growing problems by 74% of indians. According to [2] there has been a 30% rise in respiratory disases due to toxic air.Air pollution is stated as the cause for more than 5.5 million premature deaths across the globe, with more than half of them in India and China [3]

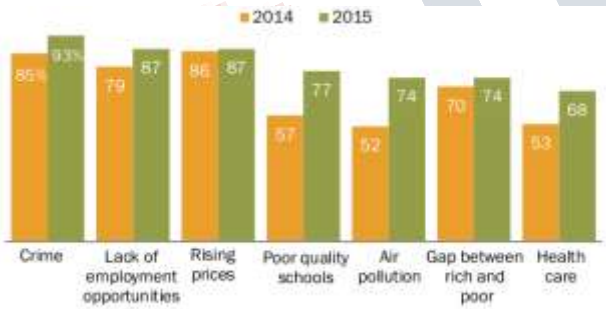

Fig. 1. Air pollution seen as a huge problem

To reduce the pollution government has set norms for vehicle emissions [4], which is updated periodically to ensure that the overall air quality reomains well with in the presribed limits for healthy breathing

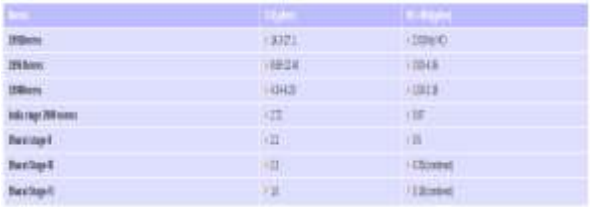

Fig. 2. Pollution norms in india [4]

Currently the vehicles manufactured need to follow the barath IV norms with bhrath stage VI proposed for year 2020.

II. LITREATURE SURVEY

A lot of work has been carried out to keep a check on the pollution and monitor the air quality. In [5] Souhir Bedoui et al discuss the implementation of a labview based system to monitor hydrogen sulfide gas in real time. The implemetation concentrated on detecting and transmitting the gas levels in realtime using wireless transmission.

A wireless sensor network was implemented by Kavi K. Khedo , Rajiv Perseedoss and Avinash Mungur [6] in mauritius to monitor the air pollution of the city. They derived an Air quality index indicating the health risks associated with various levels of air quality index.

A. R. Al-Ali,Imran Zualkernan, and Fadi Aloul, [7], demon- strate the use of a mobile GPRS sensor array for air pollution monitoring. The high polluting areas are detected by their GPS location and allows the analysis of the pollutants over a period of time.

To get the general public involved in tracking the pollution levles David Hasenfratz et al [8] use smartphones to measure and track the pollution levels in city. Based on the concen- tration levels obtained in the readings obtained the city was divided into different zones.

Carlos T. Calafate and Bertrand Ducourthial in [9] mounted the sensors on buses to get a detailed map of ozone levels of the city. A combination of static and mobile sensors provided a map of the ozone distribution in the city.

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Other than only monitoring the control over pollution has also been attempted. Like, in [10] Siva Shankar Chan- drasekaran, Sudharshan Muthukumar and Sabeshkumar Rajen- dran have described a control system for detection of pollution in vehicles by installing sensors at the emission outlets. This puts the onus on the vhicle owner to install these devices in their vechiles and monitor the emission continously to keep it in check.

As the vehciles age their ability to keep the emission of pollutants with in the prescribed limits keeps deteriorating. It is the onus of the owner of the vehicle owner to keep emission levels of the vehicle in check by periodic maintainence. But practially it is observed that a number of vehicles on road seem to be spewing smoke which is visibly above the prescribed limits. Vechiles which are used for transport and goods movment seem to be on the top list of polluting vehicles. It becomes very important that the vechiles which fail to keep their emission below the prescribed levels be identified and made to reduce their emission levls to provide clean air for every body. The paper proposes a solution which can help in identifying such vechiles on the road in real time.

III. PROPOSED SYSTEM

Figure 1 provides the block diagram description of the system being proposed

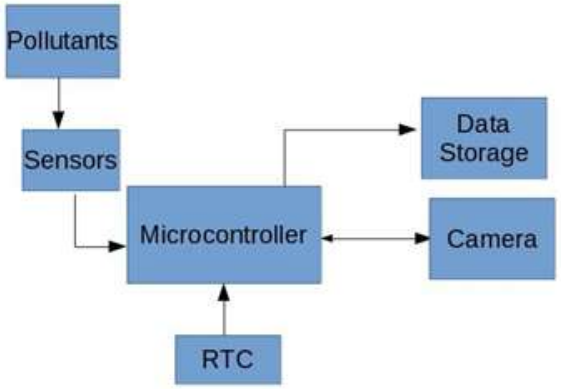

Fig. 3. Block Diagram

A. Sensors

The common pollutants that need to be sensed in air are benzene(C_6H_6),carbon monoxide(CO), lead, nitrogen dioxide(NO_2), Ozone(O_3), particulate matter(PM 10 and PM 2.5) and sulphur dioxide(SO_2).

One of the most commonly used sensors available are the MQ series of sensors. MQ135 is capable of detecting NH3,NOx, alcohol, Benzene, smoke,CO_2, similarly MQ7 is capable of sensing carbon monoxide(CO). The MQ series of gas sensors use a small heater inside with an electro-chemical sensor.The output of the MQ series sensors is an analog signal which can be read with an analog input of the microcontroller. The connection of MQ135 along with its connection to the driver circuit is shown in the figure 4

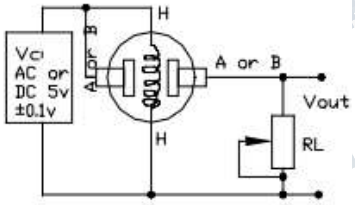

Fig. 4. MQ135 with Driver

The sensitivity characteristics of the MQ135,figure 5 has to be used to calibrate the sensor to measure the gas required

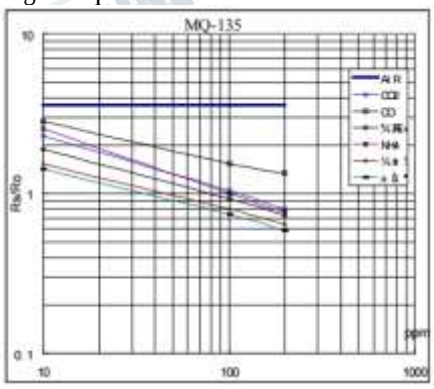

Fig. 5. MQ135 sensitivity

B. Microcontroller

The microcontroller adds the inteligence required for the system. The pollutatnts detected by the sensors have to be converted to the corresponding PPM values and compared with the standards set for the maintaing the air quiatlity. The micrcontroler will have to log the pollutants detected continously when the detected value crosses a threshold, the microcontroller will have to command the camera to take the picture as required.

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C. Camera

The camera will be used in the system to capture the image or video of the hugh polluting vehicle on the road. The camera will be connected to the microcontroller and recieve input from the microcontroller to decide when to capture an image or a video. The image captured will be stored in an flash memory or a storage system which the authorities can access to acquire the data of the high pollution causing vechiles

IV. RTC

The DS1307 Serial Real-Time Clock having 8 Pin DIP is a low-power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. Address and data are transferred serially via a 2-wire, bi-directional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including correc- tions for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator. The DS1307 has a built-in power sense circuit that detects power failures and automatically switches to the battery supply. [11] The DS1307 operates as a slave device on the serial bus. Access is obtained by implementing a START condition and providing a device identification code followed by a register address. Subsequent registers can be accessed sequentially until a STOP condition is executed

V. WORKING

Figure 6 is the flowchart of working the whole system

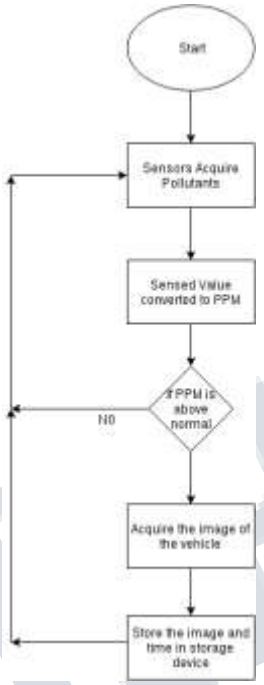
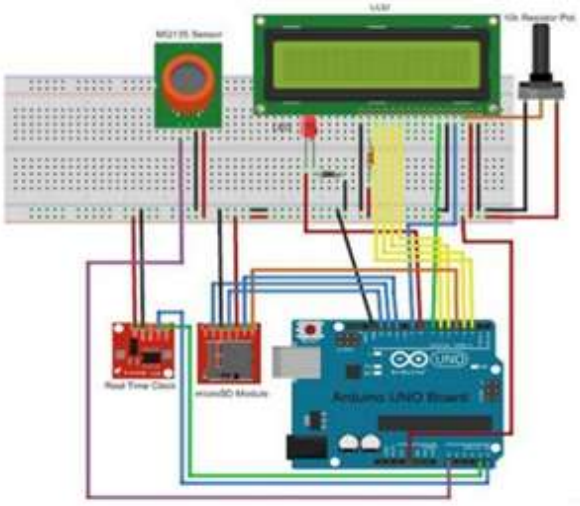


Fig. 6. Flow Chart

The MQ sensors used can be configure for various pol- lutatns, making the system veratile and applicable to many scenarios as needed. The prototype was built using Arduino uno and an MQ 135 sensor. The circuit configuration is shown in figure 7



VI. RESULTS

The prototype was built and tested in the lab. and the readings were recorded over a period of time with no extra pollutants and then exposed to high level of CO_2 and

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readings were continued, providing a real time reading of what the sensors recoded as they were exposed to the pollutants.

The following figure shows the prototype implementation of the system described.It was implemeted with a single sensor

Fig. 8. Prototype

MQ7 for carbon monoxide. The graph in the figure **??** shows how the readings in the system spiked suddenly when exposed to a high level of pollutant. The points A and B are the times when a high pollutant was detected, indicating a vechile causing high pollution passed near the sensor.

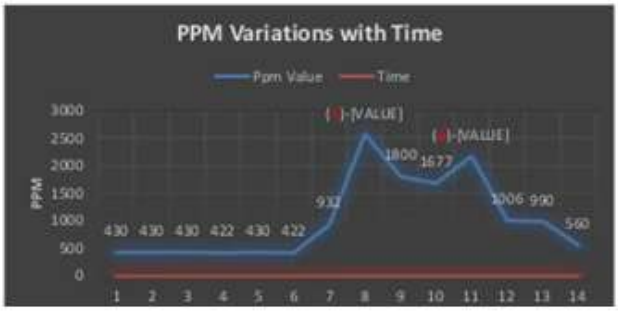

Fig. 9. Pollutant vs Time

The microcontroller will be able to detect this sudden rise and send a signal to the camera to capture the image.

VII. CONCLUSION

The system was succesfully implemented for CO_2 and is easily extendable to any other polllutants. Proper implemetna- tion of the system in real time will ensure that the vechiles which cause high levels of pollution can be identified and monitored, ensuring that we are a step closer to creating clean breathable air for the generations to come.

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