

GSM and IoT for Monitoring Air Pollution caused Due to Vehicles

^[1] Madhumathy P ^[2] Adarsh.A ^[3] Kishor.N ^[4] Rakshith B.K
^{[1][2][3][4]} Dayananda Sagar Academy of Technology and Management, Bangalore

Abstract:— Vehicles are the major sources for air pollution. The increasing number of vehicles on road causes more air pollution and thereby decreases the quality of air which leads to severe health diseases. This paper proposes an IoT based pollution monitoring system for vehicles which can be used to measure several pollutants and its level in air. Hence the vehicles which cause pollution are identified. The measurements of pollutants which are released by the vehicles are carried out using wireless sensors. The measured data is compared with the threshold value which is stored in the microcontroller. If this value exceeds the threshold level, then the data will be shared with traffic department, environmental agencies using Internet of Things (IoT). This data is also shared with the user using GSM.

Keywords: GSM, Internet of Things, Pollution monitoring system, wireless sensors

I. INTRODUCTION

The significant problem especially in metropolitan cities is the air pollution from vehicles due to rapid growth of urbanization. Air pollution causes various health issues in human beings such as Asthma, Lung Cancer, and various Bronchial diseases. Carbon monoxide (CO), Carbon dioxide (CO₂), and Sulphur dioxide (SO₂) are the major pollutants from the automobiles. The percentage of pollutants in air from the emission of vehicles as increased numerously when compared to other sources of pollution [1].

To control the air pollution, the amount of air pollution needs to be monitored and vehicles responsible for pollution must be recognized. One of the emerging trends in technology is the IoT that can be used to monitor air pollution from automobiles. The database of the various pollutants emitted from the vehicles can be monitored using IoT. It is used in industries as well as academics and is a platform that interconnects several devices and controls them.

IoT and wireless sensor networks which are used together to allow objects to be sensed and controlled remotely across existing network and providing opportunities for more direct integration of the physical world into computer-based systems, and increasing the efficiency, accuracy and economic benefit [2].

The wireless sensor networks are the useful sources of sensor entities that provide solutions for different applications under various demanding situations. These networks play a vital role in applications where sensing of some physical quantity is the primary aspect. In addition to sensing applications, they are also used for assisting in evaluating different situations along with higher level applications [3].

This paper is specially designed to operate the system using sensors and collect the details about pollutant levels discharged by the vehicles using IoT. This paper proposed an embedded system using wireless sensor network that collects the sensor data at any place. Wireless sensor along with the GSM technology is used in the proposed wireless system to monitor the vehicular pollution based on IoT [4-6].

II. PROPOSED SYSTEM

The proposed system uses both GSM and IoT to monitor air pollution. In this regard, each vehicle has gas sensors and GSM which are interfaced with the microcontroller. The gas sensors measure the amount of pollutants released by the vehicle. The data from the sensors are sent to the microcontroller which is released by the vehicles. The permissible level of the pollutants that are released by the vehicle will be stored in microcontroller as the Threshold level. The measured value is compared with the threshold value by the microcontroller. If this measured value exceeds the threshold level then the vehicle details

will be sent to the cloud. Vehicle details include information about vehicle number, unique GSM number, amount of pollutants released by that vehicle, date and time. In this system a GSM module is used to identify the vehicle. Each vehicle is fitted with a GSM module which uses a SIM card using which the vehicle is identified uniquely. When the measured value of pollutant is more than the threshold value a message is sent to the user regarding status of the pollutants that released by his vehicle and also this value is displayed on the LCD. This creates awareness in the user regarding the pollution caused by his vehicle.

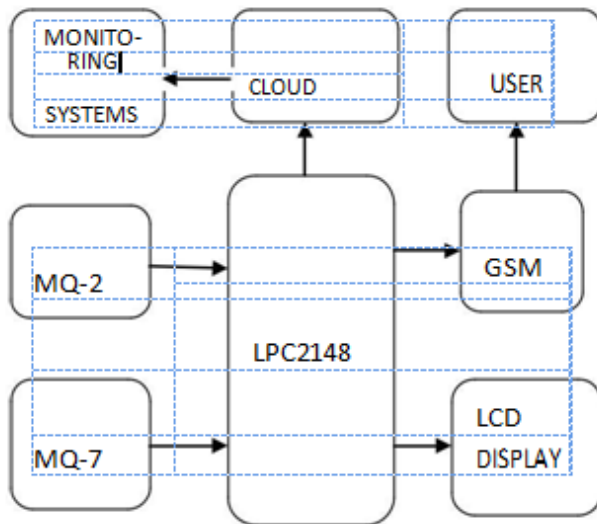


Fig 1: Block diagram of Proposed System

Figure 1 shows the block diagram of the proposed system. The components used to develop the proposed system are LPC2148, MQ-2, MQ-7, GSM Module, LCD Display. LPC2148: It is ARM 7 family, 32 bit microcontroller with low power consumption and high computational speed. This microcontroller is used to read the data from the sensors and the processed data is sent to the server and LCD display. A message is sent to the user by interfacing GSM module with the microcontroller.

GAS SENSORS: MQ-2 and MQ-7 are the two gas sensors used in our setup. MQ-2 is used to sense smoke and MQ-7 is used to sense the carbon monoxide content released from the vehicles. The sensing range of MQ-7 sensor is between 20 and 2000 ppm. These two sensors have high sensitivity and fast response time.

GSM MODULE: SIM900A is the GSM modem that is used in our experimental setup. It is a dual band modem being able to operate only in 900MHz and 1800MHz. This module is interfaced with the microcontroller using serial communication UART port. The modem is operated using AT commands.

LCD DISPLAY: The LCD Display used in our prototype model is 16x2 alphanumeric display. The results from the microcontroller will be displayed on the LCD screen.

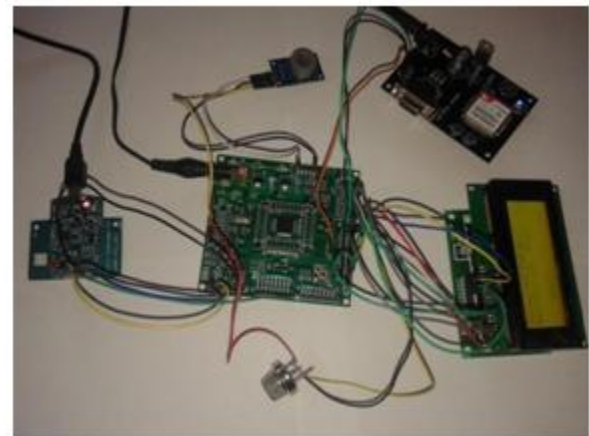


Fig 2 : Experimental Setup of our Proposed System

Figure 2 shows the integration of the gas sensors, GSM module with the microcontroller. A code was developed for integrating all the modules and the code is tested. The information to the cloud is sent using the AT commands and HTTP protocol with the help of GSM/GPRS module. The same AT commands are used to send the message to the user. The sensors continuously sense the pollutants and send the data to the microcontroller. This information will be shared with the user and the pollution monitoring agencies like RTO's, Environmental Agencies, Traffic Department.

III. EXPERIMENTAL RESULTS

The proposed system is successfully implemented for monitoring air pollution. The module is tested for different vehicles. The vehicle number is associated with the each GSM module present in the vehicle and the vehicle number along with pollutant information is displayed on the LCD Display. The same information is sent to the user through GSM. The controller sends the information regarding the vehicle number, GSM SIM number and pollutants level to

International Journal of Science, Engineering and Management (IJSEM)
Vol 1, Issue 7, November 2016

the Cloud. The server displays the server IP, vehicle number and pollutant levels.

IV. CONCLUSION

This paper presented the implementation of the system that monitors the vehicular air pollution using IoT and GSM. The experimental setup of the system is discussed in detail. The components that are used are also studied. This proposed system helps to create an awareness in the vehicle owners regarding their vehicular pollution and helps to monitor the environment. The environmental agencies can also take an action for monitoring vehicular pollution by using the proposed system. This system is simple to operate, low cost and user friendly.

REFERENCES

- [1] Ramagiri Rushikesh, Chandra Mohan Reddy Sivappagari, "Development of IoT based Vehicular Pollution Monitoring System" in "2015 International Conference on Green Computing and Internet of Things (ICGCIoT)", 2015, On page(s) 779 - 783
- [2] Moon, Soo-Hoon; Han, Seung-Jae "Lifetime optimization for large-scale sink-centric Wireless sensor networks", Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt), 2015 13th International Symposium on, On page(s): 213 - 220
- [3] R. Al-Ali, Member, IEEE, Imran Zualkernan, and FadiAloul, Senior Member, IEEE, "A Mobile GPRS-sensors array for Air Pollution Monitoring" vol.6, pp.410-422, Oct.2010.
- [4] NihalKularatna, Senior Member, IEEE, and B. H. Sudantha, Member, IEEE "An Environment Air Pollution Monitoring System Based on the IEEE1451 Standard for Low Cost Requirements" IEEE Sensors J., Vol. 8, pp.415-422, Apr. 2008.
- [5] M. Abu Jayyab, S. Al Ahdab, M. Taji, Z. Al Hamdani, F. Aloul, "Pollumap: Air Pollution mapper for cities", in Proc. IEEE Innovations in Information Technology Conf., Dubai, UAE, Nov.2006, pp.1-5.
- [6] Y. J. Jung, Y. K. Lee, D. G. Lee, K. H. Ryu, and S. Nittel, "Air pollution monitoring system based on geosensor network", in Proc. IEEE Int. Geoscience Remote Sensing Symp., 2008, vol. 3, pp. 1370-1373