International Journal of Research in Engineering, Science and Management
Volume 4, Issue 11, November 2021
https://www.ijresm.com | ISSN (Online): 2581-5792

IoT Based Air Quality Monitoring with Multi-Model Analysis using Machine Learning Algorithms

Intekhabur Rahman Shaikh[1*], Surbhi Tankkar[2]
[1]*Student, Department of Electronics and Telecommunication Engineering, Alamuri Ratnamala Institute of Engineering and Technology, Thane, India*
[2]*Professor, Department of Electronics and Telecommunication Engineering, Alamuri Ratnamala Institute of Engineering and Technology, Thane, India*

***Abstract*: Using conventional methodological analysis, air automatic monitoring system has decent perfection and accuracy with high cost and bulky systems which makes the unsuitable for large-scale installation. Grounded on introducing embedded system into the field of environmental protection, this design puts forward a kind of real-time air pollution monitoring system. By using embedded, this system can reduce the tackle cost into 1/10 as ahead. The system can be laid out in a large number in monitoring area to form monitoring detector network mesh. Besides the functions of conventional air automatic monitoring system, it also exhibits the function of development trend of air pollution within a certain time range by analyzing the data attained by embedded system. Furthermore, the system logs the data collected to cloud server which can be used for analysis and prediction using multiple ML algorithms for better accuracy and consistent results.**

***Keywords*: Air pollution monitoring, embedded systems, Internet of Things, Machine Learning.**

1. Introduction

Air quality is a very important factor affecting health of humans as well as other living beings. However, there are situations where we are exposed to polluted air that has a high concentration of Volatile Organic compounds (VOC), both in outdoor as well as indoor environments. It is very important for a better health to breathe clean air that has low concentrations of VOC.

With the development of economy taking place rapidly, there is a frequent increase in chemical industries construction and production activity are increasing frequently, leading to increase in air pollution. Considering the meteorological and geographical conditions, air pollution will cause great harm or even extreme destruction to everyone. Conventional air quality monitoring systems are expensive, bulky and cannot be set everywhere. So, it is important to set up a real-time air pollution monitoring system with low cost and portable system.

The system developed should be able to collect data from sensors connected to it and log them to cloud server after processing. The cloud server in use must be able to export this data into format suitable for analysis using Machine Learning which would be used for analysis and prediction.

2. Literature Review

In paper [1] an IoT based pollution monitoring system is developed which will monitor the Air Quality over an internet server. Existing monitoring systems have low precision, sensitivity and need laboratory analysis. Therefore, improved monitoring systems are needed. To overcome the issues of existing systems, they have proposed a three-phase pollution monitoring system. The system will determine the air quality in PPM using MQ2 and MQ7 and display it on the LCD and also as on webpage so that it can be monitored very easily. Remote monitoring is possible in this system.

In paper [2] the project developed can detect the temperature and density of dust which will send an alert if the air quality is not safe for human health. It uses Arduino Mega as the microcontroller to determine the values related to dust which may lead to eye irritation or other health effects. The alert is provided to user so that it will be easier to plan the day and reduce outdoor activities. The device developed detects high temperature and air with dust particles. A buzzer is used to provide alert to the user.

In paper [3] the system developed is used to monitor the Air Quality over an internet web server. It triggers an alarm when the air quality goes down beyond a certain threshold set in the code. This means when the quantity of harmful gases available in the air like CO2, smoke, benzene, NH3 etc. crosses a predefined value. The air quality will be displayed using an I2C LCD in PPM while it is also displayed on a webpage which can be monitored very easily. Air quality is monitored using MQ135 and MQ6 sensor as it detects most harmful gases which can be accurately determined.

3. Existing System

There are various air quality monitoring systems which are

*Corresponding author: intekhabb.sir@gmail.com

used in different regions of India that collect sensor data for monitoring levels of PM10, PM2.5, SO2, NO2, CO, CO2, NH3 etc. The existing system network has a limited scope as the values are recorded at a very long interval. Due to this real time action is not possible. In the existing system analysis of recorded values is not done. Predictive analysis based on the past reported values is missing in the systems deployed.

4. Proposed System

The project uses ESP32 as a microcontroller. It uses multiple sensors for monitoring air quality. MQ5 and MQ135 gas sensors are used along with Sound Sensor and DHT sensor. MQ5 sensor provides smoke sensing while MQ135 is used for overall Air Quality Index Monitoring. The sound sensor used here detects levels of sound while DHT sensor provides values of temperature and humidity. All the sensors will log their values to ThingSpeak Server. The data from ThingSpeak server can is then converted to CSV file. This CSV file is used as a dataset for Machine Learning. Machine Learning algorithms such as Random Forest and Logistic Regression is used in this system for analysis and prediction purpose.

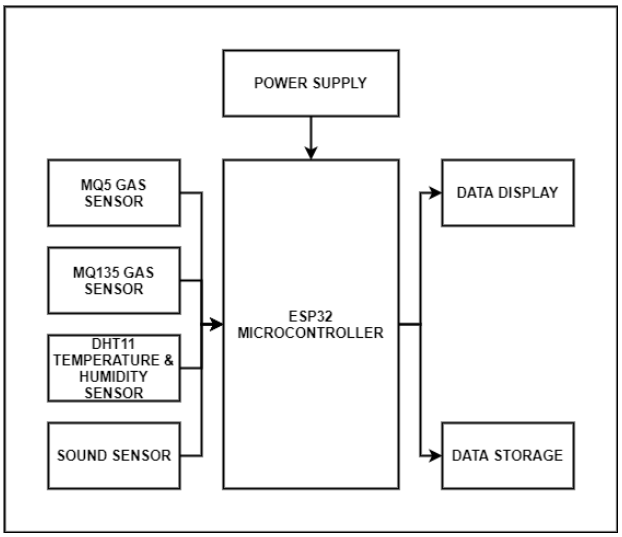

Fig. 1. Data collection embedded system board

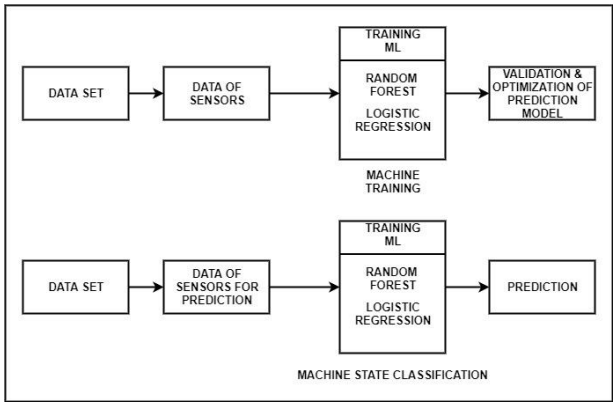

Fig. 2. Analysis using machine learning process flow

5. Conclusion and Future Work

Air pollution is one of the vital factors that affects the quality of people's life in the urban environment. Existing monitoring systems play an important role in many smart city developments in urban areas for monitoring and governing air quality and the main pollutant concentrations. Using such information, we could revisit the concepts like when, where the emission decreases and why the dangerous exposures of atmospheric pollution have been over-estimated from urban areas. The system proposed here works as expected. It collects data after a regular interval of time which is the used for analysis purpose. Future work may include addition of more gas sensors to get additional parameters. Size of the dataset can be increased which means more data can be collected for more accurate predictions. Other models apart from Random Forest and Logistic Regression can be used to validate the system.

References

[1] Anand Jayakumar A, Praviss Yesyand T. K, Venkstesh Prashanth K. K, Ramkumar K, "IoT Based Air Pollution Monitoring System," *International Research Journal of Engineering and Technology*, vol. 8, no. 3, pp. 2458-2462, March, 2021.

[2] M. K. Fadzly, Yiling, M. F. Rosli, T. Amarul and M S M Effendi, "Smart Air Quality Monitoring System Using Arduino Mega," *2nd Joint Conference on Green Engineering Technology & Applied Computing*, 2020.

[3] Harsh N. Shah, Zishan Khan, Abbas Ali Merchant, Moin Moghal, Aamir Shaikh, Priti Rane, "IoT Based Air Pollution Monitoring System," *International Journal of Scientific & Engineering Research*, vol. 9, no. 2, pp. 62-65, February, 2018.