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Review on: IoT based Air pollution monitoring techniques

*[1]Monali S.Hase, [2] Umesh. J. Tupe, *[3]Vijay S. Kale

[1, 3]Department of Electronic Science and Research Center, Loknete Vyankatrao Hiray Arts, Science and Commerce College Panchavati, Nashik, Affiliated to SPPU, Pune, Maharashtra - 422003, India.

[2]Department of Electronic Science,VADP's Arts, Science & Commerce College, Shirsondi, Tal – Malegaon, Dist-Nashik, Affiliated to SPPU, Pune, Maharashtra – 423208,India.

Abstract:-

During the previous few decades, global warming and climate change have been major issues among scientists. Almost all atmospheric scientists agree that global warming is a serious environmental hazard caused by increased quantities of certain trace gases in the atmosphere. The pollution level has risen through time due to a variety of growing populations, increased vehicle use, industrialisation, and urbanisation, all of which have negative consequences on human wellbeing by directly impacting the health of those who are exposed to it. Monitoring of poisonous gases such as CO_2, Methane, NH_3, CFC, Dichlorofluoromethane, NOx, and others is a necessity in today's world. IoT provides a versatile platform for monitoring these types of gases. The Internet of Things (IoT) might be a global network of "smart gadgets" that perceive and communicate with their environment, as well as interact with humans and other systems. It will display the air elements in PPM on the Display and on the website so that we can easily monitor them. The current research paper discusses the various IoT-based air pollution monitoring techniques.

Keywords:*Global Warming, NOx, CFC, Internet of Things, Air Pollution*.

I. Introduction:

The rise of technology, as well as increased harmful pollutants from factories and automobiles, causes atmospheric conditions to deteriorate each year. Despite the fact that air is a life-giving resource, many people are unaware of the severity of air pollution or have only just become aware of the issue [1, 2]. Air pollution is the most hazardous and severe of the numerous types of pollutants, including water, soil, heat, and noise, and is responsible for climate change and daily life illnesses. Pollution has very serious health consequences, including strokes, emphysema, and cardiovascular disease. Moreover, as evidenced by recent global air pollution concerns like ozone depletion [3, 4], air pollutants have a

harmful influence on humans and the earth's ecology. As a result, monitoring and control of air quality are major concerns [1, 4].

In recent years, new technologies such as the Internet of Things (IoT) and cloud computing have unveiled new real-time monitoring possibilities in a variety of industries. The Internet of Things (IOT) is a system in which matter and people are given limited identities and the ability to move data over a network without the need for two-way human-to-human (source-to-destination) or human-to-computer (human-to-computer) communication. As a result, numerous researchers [5-8] have looked at integrating these technologies into indoor air quality monitoring systems. These investigations, on the other hand, were limited to incorporating an IoT platform architecture to monitor air quality in real time. Combining these new technologies, which include a wireless sensor network that automatically transmits, processes, analyses, and visualises data, can provide significant benefits in terms of improving indoor air quality [9, 10].

The properties of the Internet of Things, such as an ultra-large network of things, device and network level heterogeneity, and massive quantities of events generated spontaneously by these things, will make expansion of diverse applications and services extremely difficult. Middleware, in general, will make the development process easier by coordinating the actions of heterogeneous data and networking equipment and facilitating interoperability between different software and systems. A lot of suggestions for IoT middleware have surfaced in recent months. Wireless sensor networks (WSN), a critical component of IoT, were the focus of these concepts [10, 11].

To create an IoT-based pollution monitoring system that can be accessible through Wi-Fi and used to assess the level of pollution in a specific location or site. A variety of sensors are used to collect data from the atmosphere or its contents. Sensors that measure air pollution and noise pollution measure sound levels [9-12]. The distance between the Garbage Bin lids is measured using ultrasonic sensors. Ultrasonic sensors collected data. The IoT Platform integrates the fire alarm and monitoring systems. It can detect smoke, temperature changes, and flames, among other things. All of the data from these sensors is essentially analogue. These signals are digitally transformed. The system also includes a Wi-Fi module for transferring data to other locations or gaining access to data from afar [10-13].

The Air Pollution Monitoring System uses the Internet to monitor the air quality and will sound an alert if the air quality drops below a particular level, which indicates there are enough harmful gases. It will display the air quality in PPM (Parts Per Million) on the display unit and on the website page so that it can be readily monitored.

II. Literature Survey:

The wireless standard was used to design, build, and observe an Air Pollution Monitoring System for monitoring the combination of key air pollutant gases. Using semiconductor sensors, this device measures a mixture of hazardous gases. A single-chip microprocessor, an array of air pollution sensors, a GSM-Module, and a GPS-Module are all included in the hardware unit. The Central-Server is an internet-connected high-end personal computer application server. The hardware collects air pollution levels and stores them in a frame that includes the GPS physical location, time, and date. Finally, the

frame is uploaded to the GSM-Modem and communicated through WSN to the Central-Server. Environmental air pollution has a substantial impact on the mixture of elements in the atmosphere, resulting in global warming and acid rain. It is critical to have an air pollution monitoring system in place to avoid such detrimental natural imbalances. The typical air quality monitoring method, which is overseen by the Pollution Control Department, is too expensive. Wireless Sensor Networks are a novel and difficult study subject for embedded system design automation because their design must adhere to strict power and cost constraints [12, 13].

Saiye, Y.D. et al. (2020) [14] designed air quality detection and monitoring system employs a wireless sensor network to monitor air quality in various places while also producing near real-time information and data that can be retrieved via smartphones, tablets and internet compatible device. Designed system that can track the amount of contaminants in the air developed by using Arduino Uno, a WIFI module, and a MQ135 gas sensor.

Chourey, Pet al. (2022) [15]Designed IoT baised air pollution monitoring system using MQ135, MQ7, and DHT11 gas sensors. These sensors will respond to the esp32 module, which will show the information on the ThinkSpeak web server, and configure a buzzer to notify us if the air quality drops below the set value.

Sunil Mahesh Pattar et al. (2018) [12] reported survey on IoT-based air pollution monitoring system and purposed the level of pollution has risen through time due to a variety of factors such as population growth, increased vehicle use, industrialisation, and urbanisation, all of which have negative consequences on human wellbeing by directly impacting the health of those who are exposed to it. an IOT-based Air Pollution Monitoring System in which we will monitor the air quality over the internet using a web server and will activate an alarm when the air quality drops below a certain level, which means when there is a sufficient amount of harmful gases such as CO_2, smoke, alcohol, benzene, and NH_3 gas in the atmosphere. It will display the air components in PPM on the LCD and on the website so that we can easily monitor them. One can use your computer or smartphone to monitor the air pollutants in this IoT project.

Harsh Gupta and colleagues (2019) [16] developed an IoT based air pollution monitoring system for smart cities. Smart cities are under pressure to stay livable as the world's population becomes more urbanised. The air quality of urban centers has become a prominent source of worry around the world in recent years. As a result, in order to make a city smart and livable, it is vital to regularly evaluate its air quality index. We propose and construct an IoT-based Air Quality Monitoring System for Smart Cities in this research. Air quality data is retrieved in real time via smart devices and analysed to determine the influence on city people. Temperature, Humidity, Carbon Monoxide, LPG, Smoke, and other harmful particulate matters like PM2.5 and PM10 levels in the atmosphere can all be measured using smart devices. An Android application makes the obtained data available to everyone in the world.

Harsh N. Shah and colleagues et al. (2018) [17] developed IOT based air pollution monitoring system using ATmega328P, Wi-Fi module ESP8266, MQ135 Gas sensor, MQ 6 LPG gas sensor, LM35 temperature sensor and humidity sensor SY-H5220. The Internet of Things-based Air Pollution Monitoring System is used to monitor the air quality via a web server. It will sound an alert if the air quality falls below a particular threshold, which signifies there are enough dangerous gases in the air, such as CO_2, smoking, alcohol, benzene, NH_3, and NOx. It will display the air quality in PPM on the LCD as well as on the webpage, allowing for easy monitoring of air pollution.

Patil, P., et al. (2017) [18] developed smart IoT based system for vehicle noise and pollution monitoring. The hardware architecture as well as the software implementation are thoroughly detailed. IoT technology is also used to verify the system's performance. The clever intelligent environmental system that was built monitors the pollutants produced by automobiles and alerts vehicle owners to take action to reduce pollution. The data on pollution levels is also sent to a server for further study. Air pollution authorities can examine data and identify car registration numbers that contribute to increased pollution in the atmosphere. The designed system is low-cost, easy-to-use, and may be placed in any location. The created system outperforms the old system in terms of accuracy and cost.

Saha, A.K., et al. (2018) [19] developed raspberry Pi controlled cloud based air and sound pollution monitoring system with temperature and humidity sensing using Raspberry Pi, Wi-Fi module. Authors reported controlling and carefully monitoring the situation has become necessary in order to take the necessary steps to alleviate the situation. An IOT-based technique for monitoring the Air Quality Index and Noise Intensity of a region has been proposed in this research. The Air Quality Index Monitoring Module, the Sound Intensity Detection Module, the Cloud-based Monitoring Module, and the Anomaly Notification Module are the four modules that make up the recommended technology. To begin, the Air Quality Index is calculated based on the presence of five specific air contaminants. The sound intensity is then detected using the appropriate sensor. After that, the Cloud-based Monitoring Module ensures the data collection process with the support of the Raspberry Pi's Wi-Fi module, achieving the goal of data analysis on a regular basis. Finally, the Anomaly Notification Module notifies the user if there is a problem.

Advances in wireless communication and sensor technologies have resulted in a kaleidoscope of changes in the air pollution monitoring paradigm in recent years. The Internet of Things has made it possible to produce smart environments in which items communicate and collaborate. In order to avoid tragic mishaps, the researchers used Raspberry Pi and IoT to monitor dangerous gas leakage and air quality.

III. Conclusion:

This review article provides details of IoT based system used in recants years. The review provided technological details as well as recent communication standards and embedded system platforms used in air pollution monitoring systems.

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References:

1. Jo, J., Jo, B., Kim, J., Kim, S. and Han, W., 2020. Development of an IoT-based indoor air quality monitoring platform. *Journal of Sensors, 2020*.
2. Parmar, G., Lakhani, S. and Chattopadhyay, M.K., 2017, October. An IoT based low cost air pollution monitoring system. In *2017 International Conference on Recent Innovations in Signal processing and Embedded Systems (RISE)* (pp. 524-528). IEEE.
3. Okokpujie, K.O., Noma-Osaghae, E., Odusami, M., John, S.N. and Oluga, O., 2018. A smart air pollution monitoring system. *International Journal of Civil Engineering and Technology (IJCIET)*, *9*(9), pp.799-809.
4. Kulkarni, K.A. and Zambare, M.S., 2018. The impact study of houseplants in purification of environment using wireless sensor network. *Wireless Sensor Network*, *10*(3), pp.59-69.
5. Marques, G., Ferreira, C.R. and Pitarma, R., 2019. Indoor air quality assessment using a CO2 monitoring system based on internet of things. *Journal of medical systems*, *43*(3), pp.1-10.
6. Taştan, M. and Gökozan, H., 2019. Real-time monitoring of indoor air quality with internet of things-based E-nose. *Applied Sciences*, *9*(16), p.3435.
7. Rackes, A., Ben-David, T. and Waring, M.S., 2018. Sensor networks for routine indoor air quality monitoring in buildings: Impacts of placement, accuracy, and number of sensors. *Science and Technology for the Built Environment*, *24*(2), pp.188-197.
8. Benammar, M., Abdaoui, A., Ahmad, S.H., Touati, F. and Kadri, A., 2018. A modular IoT platform for real-time indoor air quality monitoring. *Sensors*, *18*(2), p.581.
9. Ghayvat, H., Mukhopadhyay, S., Gui, X. and Suryadevara, N., 2015. WSN-and IOT-based smart homes and their extension to smart buildings. *Sensors*, *15*(5), pp.10350-10379.
10. Gupta, K. and Rakesh, N., 2018, January. IoT based automobile air pollution monitoring system. In *2018 8th international conference on cloud computing, data science & engineering (Confluence)* (pp. 14-15). IEEE.
11. Pradhan, M.A., Patankar, S., Shinde, A., Shivarkar, V. and Phadatare, P., 2017, August. IoT for smart city: Improvising smart environment. In *2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS)* (pp. 2003-2006). IEEE.
12. Mohesh, P.S. and Rajendra, P.B., A survey Paper on Air Pollution Monitoring using IOT. *IJARIIE-ISSN (O)*, *4*.
13. Shaikh, I.R. and Tankkar, S., IoT Based Air Quality Monitoring With Multi-Model Analysis Using Ml Algorithms.
14. Saiye, Y.D. and Ajose-Ismail, B.M., 2020. IoT Based Air Quality Detection and Monitoring System. *International Journal of Research and Innovation in Applied Science*, *5*(7), pp.66-68.

15. Chourey, P., Soni, K., Singh, N.J. and Agarwal, R., 2022. IoT-Sodar Network for Airshed Management Planning. *IETE Journal of Research*, pp.1-15.
16. Gupta, H., Bhardwaj, D., Agrawal, H., Tikkiwal, V.A. and Kumar, A., 2019, February. An IoT based air pollution monitoring system for smart cities. In *2019 IEEE International Conference on Sustainable Energy Technologies and Systems (ICSETS)* (pp. 173-177). IEEE.
17. Shah, H.N., Khan, Z., Merchant, A.A., Moghal, M., Shaikh, A. and Rane, P., 2018. IOT based air pollution monitoring system. *International Journal of Scientific & Engineering Research*, *9*(2), pp.62-66.
18. Patil, P., 2017, May. Smart IoT based system for vehicle noise and pollution monitoring. In *2017 International Conference on Trends in Electronics and Informatics (ICEI)* (pp. 322-326). IEEE.
19. Saha, A.K., Sircar, S., Chatterjee, P., Dutta, S., Mitra, A., Chatterjee, A., Chattopadhyay, S.P. and Saha, H.N., 2018, January. A raspberry Pi controlled cloud based air and sound pollution monitoring system with temperature and humidity sensing. In *2018 IEEE 8th Annual Computing and Communication Workshop and Conference (CCWC)* (pp. 607-611). IEEE.