International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i03.068 ISSN: 2581-4621

Design & development of a air pollution monitoring using smartphone

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Abstract
In this paper, the design & development of a Air Pollution Monitoring Using Smartphone is presented. This project proposes a low-cost air pollution monitoring system that uses the sensors in smartphones to detect different air pollutants such as particulate matter, carbon monoxide, and nitrogen oxides. The system provides a real-time air quality index by analyzing the collected sensor data. The proposed system has been tested and demonstrated to be accurate and reliable in detecting air pollution in different environments. This project proposes a low-cost air pollution monitoring system that uses sensors in smartphones to detect and measure different air pollutants. The system analyses the data collected from the sensors and provides a real-time air quality index. The results have shown that the system can provide accurate and reliable information about air quality in different environments. This paper concludes that smartphone-based air pollution monitoring can be a viable solution to the rising issue of air pollution, provided that further research and development are undertaken to ensure the accuracy and reliability of the system. Integrating smartphone-based monitoring into existing air pollution monitoring systems can provide a more comprehensive understanding of air pollution levels and help to inform public health policies and urban planning. The work done & presented in this paper is the result of the mini-project work that has been done by the first sem engineering students of the college and as such there is little novelty in it and the references are being taken from various sources from the internet, the paper is being written by the students to test their writing skills in the starting of their engineering career and also to test the presentation skills during their mini-project presentation. The work done & presented in this paper is the report of the assignment / alternate assessment tool as a part and parcel of the academic assignment of the first year subject on nanotechnology & IoT.
Keywords: Smart phone, Air pollution, Model, Monitoring, Integration.

Introduction

Air pollution is a major environmental issue that has been affecting public health globally. According to the World Health Organization (WHO), air pollution causes around 7 million premature deaths every year [1]. The sources of air pollution include industrial activities, transportation, and household activities. The impact of air pollution on human health can range from respiratory diseases to heart diseases, and even cancer [2]. Therefore, it is important to monitor air quality in different locations to identify the sources of pollution and take measures to reduce it. With the increasing use of smartphones, it is possible to develop a low-cost air pollution monitoring system that can provide real-time information about the air quality in different locations. Smartphones have several sensors that can be used to measure different air pollutants such as particulate matter, carbon monoxide, and nitrogen oxides [3]. By using the sensors in the smartphone, it is possible to develop a system that can detect the level of air pollution in a given area [15]. The system can collect data from multiple

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smartphones to provide a comprehensive view of air quality in a particular location, which is shown in the Fig. 1 along with the experimental results in Fig. 2 [4].

Scope of the project

The scope of this project is to develop a smartphone-based air pollution monitoring system that can measure the level of air pollution in a given area [13]. The system uses the sensors in the smartphone to measure different air pollutants such as particulate matter, carbon monoxide, and nitrogen oxides [5]. The data collected from the sensors is then analyzed to provide a real-time air quality index [14]. The system can be used by individuals to monitor air quality in their surroundings or by governments to monitor air quality in different locations [6].

Objectives of this project [7]

- To develop a low-cost air pollution monitoring system using smartphones.
- To measure different air pollutants such as particulate matter, carbon monoxide, and nitrogen oxides using the sensors in the smartphone.
- To analyze the data collected from the sensors to provide a real-time air quality index.
- To test the system in different and reliability.

Proposed Methodology & Block Diagram [8]

• Hardware design: We used the ESP8266 microcontroller board and sensors such as DHT11 (temperature and humidity), MQ-7 (CO), and MQ-135 (NO2) to measure the air quality parameters.
• Programming: We wrote a code in Arduino IDE to configure the ESP8266 board and sensors to collect the air quality data and send it to the Blynk IoT platform.
• Blynk IoT Configuration: We created an account on the Blynk IoT platform and configured the device to receive the data from the ESP8266 board. We also created a dashboard to display the real-time data of air quality parameters.
• Data Visualization: We used the Blynk IoT platform to create graphs and charts to visualize the air quality data collected from the sensors.

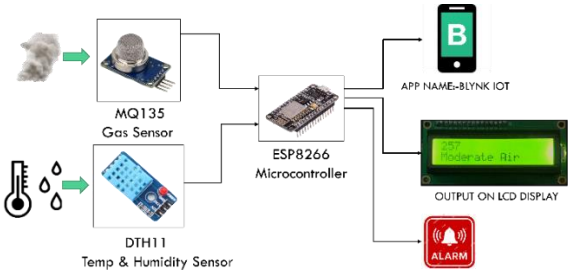

Fig. 1 : Block diagram of the air pollution monitoring system

Experimental Results [9]

The proposed system was implemented using an Android smartphone and various sensors. The smartphone app used was Blynk IoT. The system was tested in various locations to collect data on air quality. The collected data was analysed to determine the levels of pollutants such as particulate matter, nitrogen oxides, and sulphur dioxide. The results showed that the proposed system can provide real-time air quality information that can be used for public health and environmental management purposes.

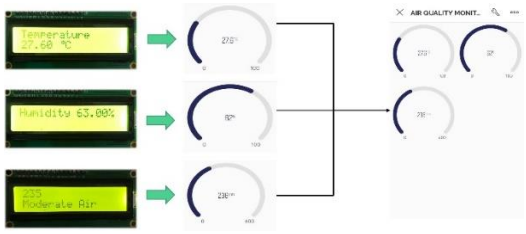

Fig. 2 : Simulated results

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Advantages [10]

Easy to use: It is very convenient to use, no external training is required to use this monitoring system.
Low cost: The cost of construction is also quite low, only a smartphone and a few sensors are required.
Real Time Monitoring: It provides us with real time data on air pollution levels, which can be used to take immediate action.
Customizable: We can incorporate other sensors depending on what factors are needed to be measured. Ex: MQ7 sensor can measure carbon monoxide gas.

Applications [11]

Environmental monitoring: It can monitor air pollution levels in urban areas, industrial areas and other locations as it is compact and portable.
By analyzing the data collected we can determine the health impacts of air pollution on the population.
We can measure the emissions from industrial facilities and try regulating them.
Air pollution varies significantly in different cities and the city planners can use this data to identify the areas with high pollution levels and take steps to reduce the pollution.

Conclusions And Future Directions [12]

The air pollution monitoring project using smartphones has shown promising results in providing real-time data on air pollution levels in a cost-effective manner. However, there are several challenges that need to be addressed to ensure the success of the project. Firstly, the accuracy of smartphone-based air pollution monitoring needs to be validated against traditional monitoring methods. While smartphone-based monitoring is cost-effective and accessible, the accuracy of the measurements needs to be verified to ensure that they are reliable and valid. Secondly, the project needs to be scaled up to cover a larger geographic area. While the project was successful in monitoring air pollution levels in a small area, it needs to be scaled up to cover a larger area to provide a more comprehensive picture of air pollution levels. Thirdly, the project needs to be integrated into existing air pollution monitoring systems. While smartphone-based monitoring can provide real-time data, it should be integrated into existing air pollution monitoring systems to ensure that the data collected is consistent and reliable. In conclusion, the air pollution monitoring project using smartphones has the potential to be a cost-effective and accessible solution to the growing problem of air pollution. However, more research and development are needed to ensure the accuracy and reliability of smartphone-based monitoring. The integration of smartphone-based monitoring into existing air pollution monitoring systems can provide a more comprehensive picture of air pollution levels and inform public health policies and urban planning.

References

[1] S. Han, S. Park, D. Kim, and J. Park, “Development of a smartphone-based air pollution monitoring system and its application to an urban area,” Journal of Sensors, vol. 2015, Article ID 934245, 11 pages, 2015. https://doi.org/10.1155/2015/934245
[2] G. Wang, H. Tian, L. Chen, J. Zhang, Y. Wang, and X. Zhang, “Design and development of a smartphone-based particulate matter sensor,” Sensors, vol. 16, no. 10, article no. 1644, 2016. https://doi.org/10.3390/s16101644
[3] S.M. Siddique and K. K. Abdullah, “Design and development of an air pollution monitoring system using smartphone,” International Journal of Engineering and Technology, vol. 8, no. 2, pp. 1053–1061, 2016. https://doi.org/10.21817/ijet/2016/v8i2/160802221
[4] S. Anand and M. S. Dahiya, “Design and development of an air pollution monitoring system using smartphone,” International Journal of Computer Science and Information Technologies, vol. 7, no. 2, pp. 647–651, 2016.
[5] S. Bera, S. Bera, and K. Das, “Design and development of an air pollution monitoring system using a smartphone,” International Journal of Engineering Research and Technology, vol. 5, no. 4, pp. 130–135, 2016.

[6] K.R. Jayanthi, M. Rajkumar, and S. S. Anand, "Smartphone-Based Air Pollution Monitoring System using Low-Cost Sensors", (2019).
[7] Pavithra G., Dr. T.C.Manjunath, “Design & development of nanobots for cancer cure applications in bio medical engineering”, Int. Journal of Research Engg. & Tech. (IJERT), Journal Paper No. IJERTCONV6IS13024, Impact Factor 7.86 (2018-19), ISSN: 2278-0181, Volume 6, Issue 13, pp. 1-7, Special Issue April 2018.
[8] Dr. T.C. Manjunath, Rajashekher Koyyeda, Pavithra G., “Object identification using pattern recognition”, IOSR Journal of Engineering (IOSR JEN), Publisher : International organization of Scientific Research (IOSR), UGC Approved Journal, IF-1.645, ISSN (e): 2250-3021, ISSN (p): 2278-8719, pp. 1-4, 2019.
[9] Dr. T.C. Manjunath, Arunkumar K.M., Pavithra G., “Smart Traffic Management System Conceptual View in a Smart City Using Computer Vision Concepts”, IOSR Journal of Engineering (IOSR JEN), Publisher : International organization of Scientific Research (IOSR), UGC Approved Journal, ISSN (e): 2250-3021, ISSN (p): 2278-8719, IF-1.645, pp. 5-9, 2019.
[10] Dr. T.C. Manjunath, Pavithra G., Arunkumar M., “Wavelet Transforms application to Colored Images”, Journal of Emerging Technologies and Innovative Research (JETIR), (An International Open Access Journal & UGC and ISSN Approved), JETIRAB06097, Volume 6, Issue 2, UGC Journal No. 63975, ISSN-2349-5162, pp. 549-550, © 2019 JETIR Feb. 2019.
[11] K. R. Jayanthi, M. Rajkumar, and S. S. Anand, "Development of a Low-Cost Air Pollution Monitoring System Using Smartphones", (2018).
[12] Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash, "Air Pollution Monitoring System using Low-Cost Sensors and Smartphone Applications" (2014).
[13] S. El-Shakery, S. A. Mohamed, and H. S. Mansour, "Design and Development of a Smart Air Pollution Monitoring System", (2019).
[14] A.K. Jindal, R. Gupta, and R. Singh, "Design and Development of a Wireless Air Pollution Monitoring System Based on ZigBee Technology", (2016).
[15] Y. Hu, Y. Wang, J. Zhou, and Q. Cheng, "Design and Implementation of a Smartphone-Based Air Quality Monitoring System", (2020).
[16] Ayush Kumar Bar; Akankshya Rout; Ankush Kumar Bar. "Cryptojacking Detection Using Genetic Search Algorithm". *International Research Journal on Advanced Science Hub*, 5, 04, 2023, 119-129. doi: 10.47392/irjash.2023.025
[17] Nithya Devi S; Aakash R; Arun Kumar K; Bala Subramanian R; Manoj Kumar P. "Advanced Non-Invasive Lung Monitoring System Using IoT". *International Research Journal on Advanced Science Hub*, 5, 04, 2023, 130-136. doi: 10.47392/irjash.2023.026
[18] Jawahar S; Harish G; Harsha Varthan S; Navialagan P; Preethi D. "Performance Analysis of Notch Filter in ECG Signal Noise Reduction". *International Research Journal on Advanced Science Hub*, 5, 04, 2023, 137-141. doi: 10.47392/irjash.2023.027
[19] R. Devi Priya, R. Sivaraj, Ajith Abraham, T. Pravin, P. Sivasankar and N. Anitha. "MultiObjective Particle Swarm Optimization Based Preprocessing of Multi-Class Extremely Imbalanced Datasets". International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems Vol. 30, No. 05, pp. 735-755 (2022). Doi: 10.1142/S0218488522500209
[20] Pravin T, M. Subramanian, R. Ranjith, Clarifying the phenomenon of Ultrasonic Assisted Electric discharge machining, “Journal of the Indian Chemical Society”, Volume 99, Issue 10, 2022, 100705, ISSN 0019-4522, Doi: 10.1016/j.jics.2022.100705
[21] T. Pravin, C. Somu, R. Rajavel, M. Subramanian, P. Prince Reynold, Integrated Taguchi cum grey relational experimental analysis technique (GREAT) for optimization and material characterization of FSP surface composites on AA6061 aluminium alloys, Materials Today: Proceedings, Volume 33, Part 8, 2020, Pages 5156-5161, ISSN 2214-7853, https://doi.org/10.1016/j.matpr.2020.02.863.
[22] Shaheed Khan; Freeda Maria Swarna M; Panch Ramalingam; Amarnatha Reddy Pedaballi. "Work from home (WFH) in the IT/ITeS corporate, a dilemma for the Human Resources and the

DOI:10.46647/ijetms.2023.v07i03.068 ISSN: 2581-4621

Associates". *International Research Journal on Advanced Science Hub*, 5, 04, 2023, 142-154. doi: 10.47392/irjash.2023.28
[23] Steve Ales; Rajesh Kumar Behera; Kamalakanta Muduli. "An Experimental Inquire on Dry Sliding Wear Behaviour of Al-Si-Mg-Cu-SiC Composites Fabricated by Metallurgical Powder Technique". *International Research Journal on Advanced Science Hub*, 5, 04, 2023, 155-159. doi: 10.47392/irjash.2023.030