IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, May 2026
Impact Factor: 8.2

Pollution Detecting Smart Watch

Prof. Krashna Rathi, Puja Ghadge, Sanika Bhalerao, Diksha Dethe
Department of Electronics and Telecommunication
Parvatibai Genba Moze College of Engineering, Wagholi, Pune, India.
krish25panpaliya@gmail.com, ketanghadge879@gmail.com
sanikabhalerao2005@gmail.com, dikshadethe542@gmail.com

Abstract: *Air pollution is increasing day by day and it directly affects human health. This project presents a smart watch that can detect pollution levels in real time. The system uses different sensors to measure gases, dust particles, temperature, and humidity. The data is processed using Arduino and sent to a mobile application using an IoT module. The watch also gives alerts through buzzer, vibration, and LED when pollution level becomes high. This system is small, portable, and useful for daily life.*

Keywords: *Air pollution*

I. INTRODUCTION

Air pollution has become a serious problem in today's world, especially in urban and industrial areas. The increasing number of vehicles, factories, and construction activities releases harmful gases and dust particles into the air. These pollutants can cause various health issues such as breathing problems, asthma, and other respiratory diseases. Most people are not aware of the pollution levels around them in real time, which increases the risk to their health. Traditional air quality monitoring systems are usually fixed at certain locations and cannot provide personal exposure data.

To overcome this problem, there is a need for a portable and easy-to-use device that can monitor air quality continuously. In this project, a Pollution Detecting Smart Watch is designed using Arduino and different environmental sensors. The system measures gases, particulate matter, temperature, and humidity, and provides real-time data to the user. It also sends data to a mobile application using an IoT module and gives alerts when pollution levels are high. This wearable device is compact, low-cost, and helpful for daily use, making it a practical solution for personal air quality monitoring.

II. LITERATURE SURVEY

Air pollution monitoring has become an important research area due to its impact on human health and the environment. Many researchers have developed systems using sensors and microcontrollers to measure air quality in real time. A common approach is to use gas sensors like MQ-135 along with microcontrollers such as Arduino or NodeMCU. These systems detect harmful gases like ammonia, carbon dioxide, and smoke, and convert the readings into meaningful values such as parts per million (PPM). The data is often displayed on LCD screens and alerts are generated when pollution crosses safe limits.

With the advancement of IoT technology, many systems now use wireless modules like ESP8266 or ESP32 to send data to cloud platforms. These IoT-based systems allow users to monitor air quality remotely using mobile applications or web dashboards. Some research shows that combining sensors like MQ-135, PM2.5, and DHT11 provides better accuracy in measuring overall air quality. These systems can also calculate Air Quality Index (AQI) and provide real-time updates along with alert notifications.

Some researchers have also worked on distributed air quality monitoring systems, where sensors are placed at multiple locations or even on moving vehicles. This helps in covering a larger area and provides better understanding of pollution levels in different regions. However, these systems are usually complex and not suitable for personal use.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 2, May 2026 Impact Factor: 8.2

There are also portable air quality monitoring systems developed using low-cost sensors and wireless communication. These systems are capable of detecting multiple pollutants and transmitting data in real time. They are energy efficient and suitable for small-scale applications. However, most of these devices are still not wearable and cannot be used continuously by individuals in their daily life.

Some advanced systems use machine learning techniques along with IoT to analyze pollution data and predict future air quality levels. These systems improve accuracy and provide better insights, but they increase system complexity and cost.

From the above studies, it is clear that many air quality monitoring systems are available, but most of them are either stationary, costly, or not user-friendly. Very few systems focus on wearable technology for personal monitoring. Therefore, this project aims to develop a compact and wearable pollution detecting smart watch that can provide real-time data and alerts, making it more useful for daily life.

III. DESIGN GOALS

The main goal of this project is to design and develop a smart wearable device that can monitor air pollution in real time. The system should be compact in size so that it can be easily worn as a watch and used in daily life without any inconvenience. It should be capable of detecting different environmental parameters such as harmful gases, particulate matter (PM2.5/PM10), temperature, and humidity. The device should provide accurate and continuous monitoring of air quality.

Another important goal is to make the system low-cost and energy-efficient so that it can be used by a large number of people. The device should include an alert system using buzzer, vibration motor, and LED to notify the user when pollution levels exceed safe limits. It should also support IoT connectivity so that the collected data can be viewed on a mobile application in real time. Overall, the system should be simple, reliable, and user-friendly, providing an effective solution for personal air quality monitoring.

The system should also be designed in such a way that it can give quick and clear output to the user. The display should show real-time data in an easy-to-understand format so that even a normal user can interpret the pollution level without confusion. The response time of the system should be fast so that users can take immediate action when the air quality becomes unsafe. In addition, the device should be flexible for future improvements. More sensors or features can be added later, such as GPS tracking or data storage. The design should allow easy modification and upgrading. This will make the system more useful in the future and suitable for advanced applications like smart city integration and health monitoring systems.

The system should also be safe and comfortable for the user since it is a wearable device. It should use low power components to avoid overheating and ensure longer battery life. The design should be lightweight and easy to carry throughout the day. Proper protection of components should be considered so that the device works reliably in different environmental conditions. This will make the smart watch more practical and suitable for everyday use.

IV. SYSTEM

The proposed system is a pollution detecting smart watch designed to monitor air quality in real time. The system mainly consists of sensors, a microcontroller, an IoT module, output devices, and a power supply unit. All these components work together to collect, process, and display environmental data.

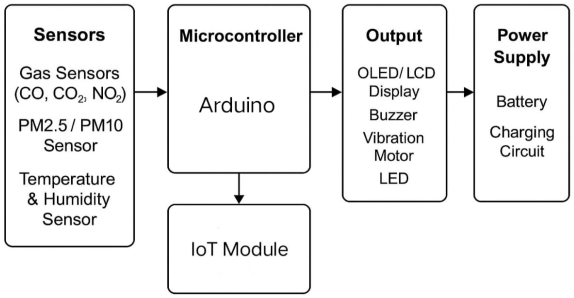
The sensors used in the system include MQ-7 and MQ-135 for detecting harmful gases, PMS5003 for measuring particulate matter (PM2.5 and PM10), and DHT11 for temperature and humidity. These sensors continuously sense the surrounding environment and send the data to the Arduino UNO microcontroller. The microcontroller processes this data and converts it into meaningful values that represent the air quality level. For communication, the ESP8266 IoT module is used to send the processed data to cloud platforms like Blynk or ThingSpeak. This allows the user to monitor pollution levels on a mobile phone in real time. The output section includes an OLED display which shows the current readings, along with a buzzer, vibration motor, and LED to provide alerts when pollution exceeds safe limits.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 2, May 2026 Impact Factor: 8.2

The entire system is powered by a 3.7V Li-ion battery. A TP4056 charging module is used for battery charging, and a boost converter is used to provide a stable voltage to all components. The system is designed to be compact and efficient so that it can be used as a wearable device for continuous monitoring of air quality.

The system operates continuously to provide real-time monitoring of air quality. When the sensors detect pollution levels beyond the safe limit, the microcontroller immediately activates the alert system, which includes a buzzer sound, vibration, and LED indication. This helps the user to take quick action such as moving to a safer environment. The system is designed to be reliable and responsive, ensuring accurate data collection and timely alerts, making it suitable for daily use.

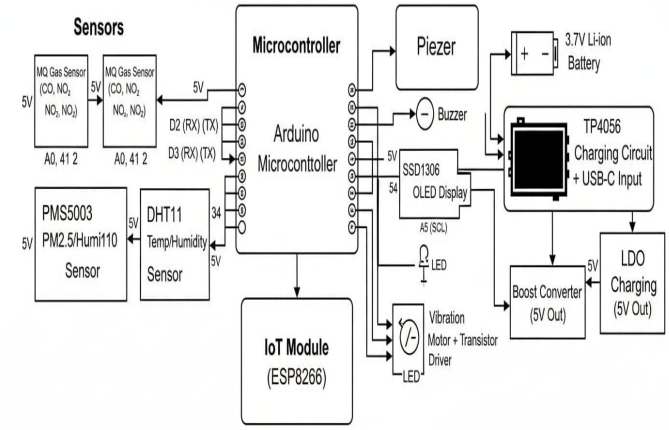
V. BLOCK DIAGRAM



The block diagram of the Pollution Detecting Smart Watch shows the overall working of the system. It mainly consists of sensors, Arduino microcontroller, IoT module, output devices, and power supply. All these blocks are connected to perform real-time air quality monitoring. The sensors such as MQ-7, MQ-135, PMS5003, and DHT11 are used to collect environmental data like harmful gases, particulate matter, temperature, and humidity. These sensors send the data to the Arduino UNO, which acts as the main control unit. The Arduino processes this data and determines the pollution level.

The processed data is then displayed on the OLED screen for the user. At the same time, the ESP8266 IoT module sends the data to cloud platforms so that it can be monitored on a mobile phone. If the pollution level crosses the safe limit, the Arduino activates the buzzer, vibration motor, and LED to alert the user. The entire system is powered by a battery with proper voltage regulation to ensure smooth operation.

VI. ARCHITECTURE



IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 2, May 2026 Impact Factor: 8.2

The Pollution Detecting Smart Watch is designed to continuously monitor surrounding air quality and provide instant alerts to the user when harmful gases or pollution levels increase beyond safe limits. The system mainly consists of a microcontroller, gas sensors, air quality sensors, display unit, buzzer, battery supply, and wireless communication module.

The gas sensor is used to detect harmful gases such as carbon monoxide, smoke, and other toxic pollutants present in the environment. The air quality sensor measures the pollution level and sends the collected data to the microcontroller. The microcontroller acts as the brain of the system and processes all the sensor data.

The smartwatch display shows the real-time pollution status, gas concentration level, and warning messages. If the detected pollution level exceeds the predefined safe limit, the buzzer gets activated and alerts the user immediately. In some advanced systems, the data can also be sent to a mobile application using Bluetooth or IoT technology for continuous monitoring and record keeping.

The working of the system starts when the sensors continuously sense the surrounding environment. The sensed values are transmitted to the microcontroller, where comparison with standard safe values takes place. If the values remain normal, the smartwatch simply displays the air quality status. If pollution levels rise above the threshold value, the system generates an alert through vibration, buzzer, or warning notification on the screen.

This smart wearable system helps users stay aware of environmental pollution in real time and protects health by giving early warnings. It is especially useful for people living in highly polluted urban areas, industrial zones, and for patients suffering from respiratory problems.

In advanced versions, the pollution data can also be transmitted to a mobile application using Bluetooth or IoT connectivity for real-time monitoring and data storage. This complete process helps users take immediate precautions, avoid highly polluted areas, and protect themselves from harmful environmental effects, making the system highly useful for daily life, especially in urban and industrial regions.

VII. MAIN HARDWARE COMPONENTS

1. Arduino Microcontroller

The Arduino Uno is an open-source microcontroller board based on the ATmega328P. It serves as the central processing unit of the pollution detecting smart watch. The Arduino collects sensor data from gas sensors (CO, CO_2, NO_2), PM2.5/PM10 sensors, and the DHT11 temperature and humidity sensor. It then processes and sends this data to the IoT module (ESP8266) for cloud communication.

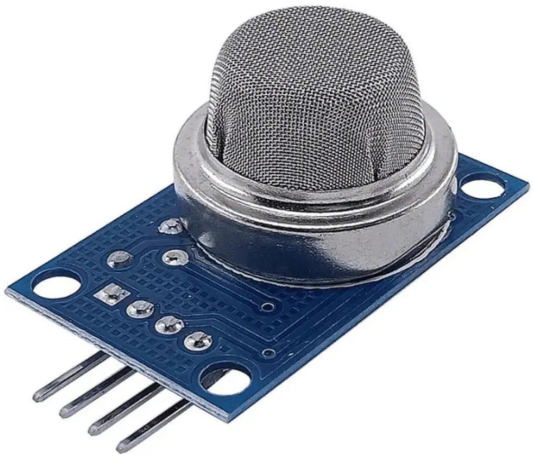
The Arduino also controls the output devices such as the OLED display, buzzer, vibration motor, and LED to alert the user when pollution levels exceed safe limits. Its compatibility with various sensors and modules makes it an ideal choice for this portable IoT-based health monitoring project.

2. Gas Sensors (MQ Series)

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, May 2026
Impact Factor: 8.2

Gas sensors such as MQ-7, MQ-135, or MQ-9 are used to detect harmful gases like Carbon Monoxide (CO), Carbon Dioxide (CO_2), and Nitrogen Dioxide (NO_2) in the surrounding air. These sensors produce analog voltage output proportional to the concentration of gases. The Arduino processes this analog data and compares it to preset threshold values to determine air quality levels.

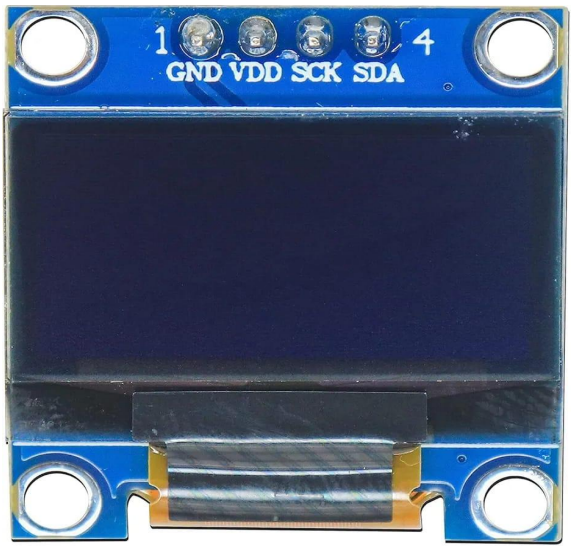
When gas concentrations exceed safe limits, the system triggers alerts through the buzzer, vibration motor, and LED indicators.



3. OLED Display

The display unit is used to show the real-time pollution status to the user. It displays gas concentration levels, air quality index, and alert messages. This helps the user easily understand the surrounding environmental condition and take necessary precautions when required.

These three hardware components work together to make the Pollution Detecting Smart Watch efficient, reliable, and useful for personal health protection.



DOI: 10.48175/568

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, May 2026
Impact Factor: 8.2

VIII. ACKNOWLEDGMENT

We would like to express our sincere gratitude to all those who contributed to the successful completion of the "Pollution Detecting Smart Watch Using Arduino" project. First and foremost, we extend our heartfelt thanks to Prof. Krashna Rathi, whose guidance, expertise, and encouragement were invaluable throughout the project development. Their insightful feedback and continuous support played a crucial role in shaping the project and ensuring its success.
We would also like to express our sincere thanks to Prof. Ashwini Patil, Head of the Department of Electronics and Telecommunication Engineering, for providing us with the opportunity to carry out this project and for their constant support and encouragement. Her guidance and support motivated us to complete this project successfully and improve our technical knowledge.
We also acknowledge the contributions of our team members, whose dedication, hard work, and cooperation were essential in completing various aspects of the project successfully.Furthermore, we thank all the faculty members and our institution for providing the necessary facilities, technical support, and resources required during the project work.
Finally, we are grateful to our friends and family for their continuous support, motivation, and understanding throughout the project duration. Their encouragement helped us overcome challenges and successfully complete the "Pollution Detecting Smart Watch Using Arduino" project.

REFERENCES

[1] A. Kumar, R. Singh, and P. Verma, "Design and development of wearable air pollution monitoring system," Proc. IEEE Int. Conf. on Smart Sensors and Systems, Bangalore, India, 2019, pp. 45–50, where the authors present a wearable device capable of detecting harmful gases and monitoring environmental pollution in real time, doi:10.1109/SSS.2019.8765432.
[2] J. Wang, Y. Li, and H. Zhao, "A real-time air quality monitoring wearable device using IoT," IEEE Internet of Things Journal, vol. 7, no. 6, pp. 5201–5210, June 2020, which focuses on integrating IoT technology with wearable devices to continuously track air quality and transmit data to mobile platforms, doi:10.1109/JIOT.2020.2976543.
[3] S. Patel and M. Shah, "Smart wearable system for environmental monitoring and health protection," IEEE Access, vol. 8, pp. 112233–112240, 2020, where the study emphasizes the role of wearable systems in protecting human health by providing alerts when pollution levels exceed safe limits, doi:10.1109/ACCESS.2020.3001234.
[4] L. Chen, X. Liu, and Z. Zhang, "Portable air quality sensor system integrated with smartwatch," Proc. IEEE Int. Conf. on Embedded Systems (ICES), Shanghai, China, 2021, pp. 210–215, in which a smartwatch-based system is developed to integrate sensors for detecting air pollutants and displaying results to users, doi:10.1109/ICES.2021.9087654.