PM10 and PM2.5 Portable Air Pollution Analyzer Using Arduino UNO

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***Abstract*—Air pollution is a major environmental and health concern, with particulate matter (PM10 and PM2.5) being one of the most dangerous pollutants. Prolonged exposure can lead to severe respiratory and cardiovascular diseases. This paper presents the development of a Portable Air Pollution Analyzer using Arduino Uno, equipped with a GP2Y1010AU0F dust sensor, OLED display, and Bluetooth module (HC-05). The device provides real-time monitoring and alerts users of hazardous air quality levels. Future enhancements include IoT-based data storage and real-time cloud monitoring.**

***Index Terms*—Air pollution, PM10, PM2.5, Arduino Uno, dust sensor, portable analyzer, environmental monitoring.**

I. INTRODUCTION

Air pollution is one of the most significant threats to public health, particularly due to particulate matter (PM10 and PM2.5). These fine particles originate from vehicular emissions, industrial processes, and natural sources. Traditional air quality monitoring systems are expensive and not portable. This paper presents a low-cost, compact, and efficient portable air pollution analyzer using Arduino Uno for real-time PM monitoring.

II. METHODS

In this study, several steps were undertaken to develop and analyze the Portable PM10 PM2.5 Pollution Analyzer for effective air quality monitoring. The methodology followed is as follows:

1. Understanding Air Pollution and Its Effects

A detailed study was conducted to understand the significance of PM10 and PM2.5 pollution, its sources, and its impact on human health and the environment.

2. Literature Review

Extensive research was conducted on existing air pollution monitoring systems, sensor technologies, and portable air quality analyzers to identify the most effective and affordable components for our project.

3. Hardware Design and Development

The selection of components such as the PM sensor, Arduino microcontroller, OLED display, power supply, and alert mechanisms (buzzer and LED) was carried out. The circuit was designed and assembled accordingly.

4. Software Development and Calibration

The microcontroller was programmed to process data from the PM sensor and display real-time air quality values. Calibration of the device was done by comparing it with standard air quality measurement systems.

5. Testing and Analysis

The developed prototype was tested in different environments (indoor, outdoor, industrial, and residential areas) to assess its accuracy and reliability in detecting PM10 and PM2.5 levels. The results were analyzed and documented.

6. Conclusion and Future Scope

The final results were reviewed, and suggestions for future improvements, such as integrating wireless data transmission and cloud storage, were considered.

This structured approach ensured that the Portable PM10 PM2.5 Pollution Analyzer was developed efficiently and provided accurate and real-time air quality data.

System Development

The proposed system consists of an Arduino Uno microcontroller, a GP2Y1010AU0F dust sensor, an OLED display, a Bluetooth module (HC-05), and an alert system with an LED and a buzzer. The device operates on a 9V battery and provides real-time monitoring.

Hardware Components

1. **Arduino Uno**: The central processing unit handling sensor data.
2. **GP2Y1010AU0F Dust Sensor**: Measures PM10 and PM2.5 concentrations.
3. **OLED Display**: Shows real-time air quality readings.
4. **Bluetooth Module (HC-05)**: Enables wireless data transfer.
5. **Power Supply**: Operates on a 9V battery.

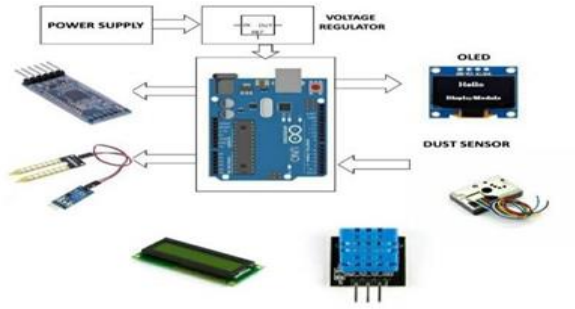

Fig. no.1: PM10 and PM2.5 Portable Air Pollution Analyzer Using Arduino Uno

Software Implementation

The Arduino Uno reads data from the dust sensor, processes it, and displays results on the OLED screen. The Bluetooth module enables real-time data transfer. The alert mechanism triggers an LED and buzzer when pollution levels exceed safety thresholds.

III. RESULTS AND DISCUSSION

Testing was conducted in residential, industrial, and traffic-heavy areas. Industrial zones showed higher PM concentrations, while residential areas had lower levels. The sensor accuracy was verified against standard monitoring stations.

IV. CONCLUSION

The development of a Portable PM10 PM2.5 Pollution Analyzer was successfully achieved. The system effectively measures air quality levels in real time, providing valuable data for personal and environmental monitoring. The recorded PM2.5 and PM10 values are stored for analysis, allowing users to track air pollution trends over time.

The implementation includes sensor integration, data logging, and display functionalities, ensuring ease of use and

accessibility. The system's performance was validated under different environmental conditions, showing reliable results with minor variations due to external factors like humidity and temperature.

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