

Original Article

# A Noval Approach for Revolutionizing Clean Living with Advanced Air Purification Technology

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**Abstract:** Air quality has become a major concern for citizens all over the world. It is well documented that Fine Particulate Matter (FPM) is a health hazard which can affect the cardiovascular system, respiratory system, etc. and lead to high mortality rates. This paper aims to provide insights into the technological, economic, and environmental implications of this novel approach, fostering a comprehensive understanding of its potential impact on clean living in one of the world's most densely populated and polluted urban landscape. The purifier is controlled by a microcontroller of the Arduino UNO series. The model is equipped with a set of sensors which are used to determine the air quality. After exceeding the adopted threshold in the software, the system automatically starts the process of air filtering. The air purification system depends on the optical dust sensor readings as it senses the quality of air in the room and turns the air purifier On and Off accordingly. The body of air purifier is made by metal and filters. The filter used are Active filter, HEPA filter, Carbon filter. The purifier absorbs pollutants and reduce Volatile Organic Compounds (VOC) pollutants. The system has been equipped with an LCD Screen informing the user about the parameters and the quality of air being purified. The major focus of this work is to design and develop a "Air Purifier" in areas with poor air quality with a focus on aspects like functionality, user experience and sustainability.

**Keywords:** AP-Air Purifier.

## I. INTRODUCTION

In a world increasingly beset by environmental challenges and health concerns, the quality of the air we breath has emerged as a critical issue. Clean air is not just a luxury but a fundamental necessity for healthy living. However, in our modern world, where pollution levels continue to rise and indoor environments are often filled with unseen contaminants, ensuring pristine air quality has become a daunting challenge. To solve this problem, a working air purification system will address this issue. I would like to leverage the advantages of sensors and to make the air purifier smarter. Instead of the conventional way that turning on the air purifier whole day, but with the use of "microcontroller" and "sensor" to operate only if the presence of dust reach certain level of awareness, this could save a lot of electricity and also keep the room, apartment, not only clean the air pollutants in the room but also monitors the quality of air been purified at the particular instant of time. Air pollution is an increasing problem in the 21<sup>st</sup> century. It is one of the main causes for climate change and it can cause a lot more problems in the future. Hence, our group decided to design an Air purifier that can be installed in any room of your house, in the ICU of a Hospital or in our college for that matter. By using some basic sensors with our air purifier, the power consumption becomes less hence it is very important element. Next, we are building an air quality monitoring system using some basic sensors.

## II. METHODOLOGY

### A. Find out the scope of future research.

The global air purifier market is projected to experience significant growth, with a forecasted Compound Annual Growth Rate (CAGR) of 12.17% from 2021 to 2031. This growth can be attributed to several factors, including the rise in urbanization, increasing health problems associated with air pollution, and the demand for energy-efficient air purifiers. Air pollution has become a pressing global concern, with detrimental effects on human health and the environment. As a result, the demand for air purifiers has been steadily increasing in recent years. These devices are designed to filter and purify the air, removing harmful pollutants, allergens, and odors, thereby improving indoor air quality and promoting a healthier living environment.

### B. According to the scope preparing problem statement.

The various causes of air pollution are:



- I. Combustion processes in industries release pollutants like sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM), and volatile organic compounds (VOCs).
- II. Exhaust from automobiles, trucks, buses and other vehicles emits pollutants such as carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), hydrocarbons (HC), and particulate matter (PM).
- III. Burning fossil fuels (coal, oil, natural gas) in power plants emits pollutants like sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), and particulate matter (PM).
- IV. Use of fertilizers and pesticides can release ammonia (NH<sub>3</sub>) into the air. Livestock farming can also release methane (CH<sub>4</sub>) and ammonia.
- V. Dust and particulate matter are generated during construction and demolition activities, contributing to air pollution.
- VI. Open burning of waste materials and landfills produce methane (CH<sub>4</sub>) and other pollutants.
- VII. Industrial processes and household products that contain volatile organic compounds (VOCs) contribute to air pollution.



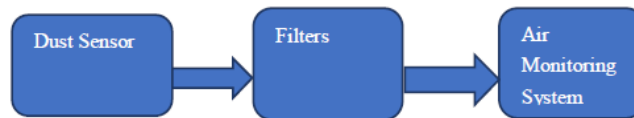
**Figure 1: Show that the burning of agriculture waste, that reduce road visibility**

### C. Material selection of Air Purifier

The architecture of the proposed Air Purifier is presented in two main sections are:

- Mechanical Design
- Filter Unit

The architecture of the Air Purifier in Fig.2



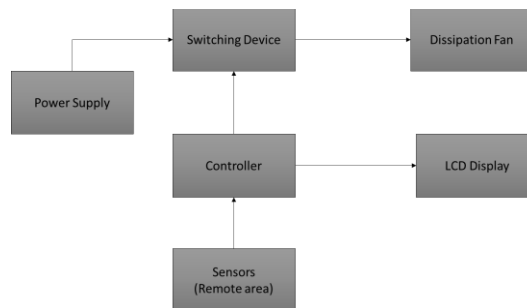
**Figure 2: Architecture of the Air Purifier**

#### a) Mechanical Design:

We need a fan with similar diameter as the filter and enough power to be able to suck air in and pass it through the filter. We are using AC single phase fan and the rated voltage of 220V-240V, 50Hz with the power consumption of 24W. The main advantage of using this fan Full of plastic body, lighter, easy to install and clean, Unique blade design for higher air flow, low noise, Durable motor, super silent and smooth running, etc.

The Arduino is a microcontroller development board that acts as the “brain of the device”. It takes the information from the sensor, process it and then sends it to the display. The small screen has just enough space to display the required information. We are using two quantity of MQ-6 and one quantity of MQ-135 sensors to detect the smoke and send the digital signals to the Arduino UNO with the help of male to female mod wire to make the connections.

The Mechanical Design of the Air Purifier in block diagram is shown in the Fig.3.



**Figure 3: Design of Air Purifier**

*b) Filter Unit:*

An air purifier mainly consists of following parts.

- **ANTIBACTERIAL FILTER**-Efficiently remove bacteria and viruses in the air.
- **ACTIVATED CARBON FILTER**-Absorbs and collects dust, smoke, fumes and harmful gases.
- **HEPA FILTER**-Capture 99.97% of airborne contaminants like dust, bacteria, fungi, viruses and allergens.

The filter used in the project is shown in the Fig.4



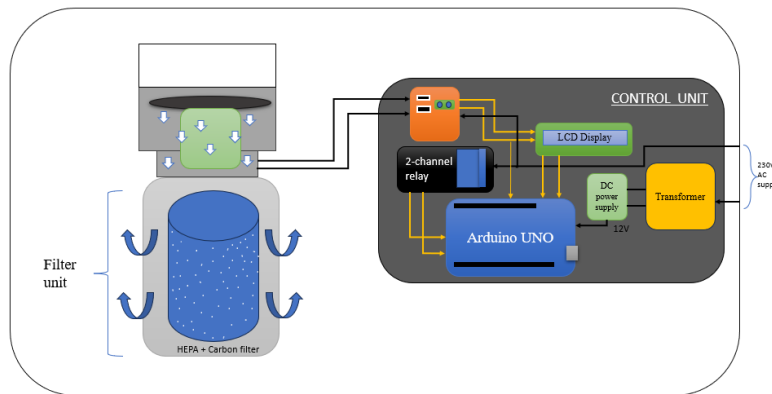
**Figure 4: Filter of the Air Purifier**

**D. Existing Method**

- Adoption and enforcement of stricter emission standards for vehicles, promoting the use of cleaner fuels, and periodic vehicle emission testing.
- Improvement and expansion of public transportation systems to encourage people to use buses and metro instead of personal vehicles.
- Initiate to plant more trees across the city to absorb pollutants.

**E. Proposed Method**

The air purification system depends on the optical dust sensor readings as it senses the quality of air in the atmosphere and turns the air purifier On and Off accordingly. The body of air purifier is made by metal and filters. The filter used are Active filter, HEPA filter, Carbon filter. The purifiers absorb pollutants and reduce Volatile Organic Compounds (VOC) pollutants. The system has been equipped with an LCD Screen informing the user about the parameters and the quality of air being purified. The major focus of this work is to design and develop a “Air Purifier” in areas with poor air quality with a focus on aspects like functionality, user experience and sustainability. The block diagram of the Air Purifier is shown in Fig.5.



**Figure 5: Block Diagram of the Air Purifier**

**IV. CONCLUSION**

Air pollution in large urban areas has a drastic effect on humans and the environment. Ecological issues in India are growing quickly. Air contamination is mainly caused by vehicles and industries which cause various respiratory disease such as asthma and sinusitis. The quality of air is inferior in metropolitan cities like Delhi, Kolkata and Mumbai due to a large amount of carbon dioxide and other harmful gases emitted from vehicles and industries.

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