WWW.IJRPR.COM

**International Journal of Research Publication and Reviews**

Journal homepage: www.ijrpr.com ISSN 2582-7421

# Air Purification Using Water Filtration and HEPA Filter

***Aastha Raulkar[1], Laxmi Meshram[2], Achal Kalambe[3], Kamini Bagde[4], Dr. Sushma Telrandhe[5]***

[1234]B.Tech,ETC, Guru Nanak Institute Of Engg And Technology, RTM Nagpur University
[5]HOD,ETC, Guru Nanak Institute Of Engg And Technology,RTM Nagpur University

ABSTRACT :

The "AIR PURIFICATION SYSTEM USING WATER FILTERATION AND HEPA FILTER" is a system that presents the design and implementation of a smart air purification and alert system. It integrates a HEPA filter, water-based filtration, and real-time air quality monitoring using an air quality index sensor, CO2 sensor, and oxygen sensor. If elevated CO2 levels are detected, the system automatically disconnects devices like heaters or ACs using a relay, activates a ventilation system, and alerts users via an alarm. This system aims to maintain healthy indoor air quality while minimizing the risk of CO2 buildup, making it ideal for enclosed spaces such as homes and offices.

This paper investigates the efficacy of hybrid air purification systems that combine water filtration and HEPA filters for enhanced air quality. The study explores the mechanisms through which each filtration method operates, their respective strengths and weaknesses, and how their integration offers a more comprehensive solution for the removal of airborne particles, allergens, and pollutants. Laboratory experiments and case studies are reviewed to assess the performance, cost-effectiveness, and practical applications of this hybrid approach in residential, commercial, and industrial settings

Air pollution is a pressing concern that requires innovative solutions to ensure a healthy living environment. This study proposes a novel air purification system combining water filtration and a HEPA filter, integrated with a smart control mechanism using Arduino Uno. The system employs a blower fan, suction pump, water pump, air nozzles, MQ15 gas sensor, relay board, and motor driver to achieve efficient air filtration. Results demonstrate significant reductions in particulate matter and harmful gases, showcasing the system's potential for residential and industrial applications

**Keywords**: Air Purification, Water Filtration, HEPA Filter, Arduino Uno, MQ15 Sensor, Air Quality, Automation

## INTRODUCTION :

Air pollution has emerged as one of the most pressing environmental and health concerns worldwide. The presence of harmful pollutants such as particulate matter (PM), volatile organic compounds (VOCs), and other airborne contaminants poses significant risks to human health, ecosystems, and overall environmental quality. Indoor air quality, in particular, has garnered increased attention as people spend a substantial portion of their time indoors. The demand for efficient and sustainable air purification systems has driven innovation in this field. Among the various methods, combining water filtration and HEPA (High-Efficiency Particulate Air) filtration has proven to be an effective approach for air purification.

This paper presents a novel design and implementation of an air purification system that integrates water filtration and HEPA filtration, supported by essential components such as a blower fan, suction pump, water pump, air nozzle, MQ-15 gas sensor, Arduino Uno, relay board, and motor driver. The system is designed to capture and remove a wide range of airborne pollutants, including fine particulate matter and harmful gases, ensuring cleaner and healthier indoor air.

The water filtration mechanism acts as the first stage of purification by trapping larger particles, dust, and soluble contaminants. When polluted air passes through water, it undergoes a scrubbing process, which effectively reduces particulate matter and humidifies the air. Following this, the HEPA filter captures ultrafine particles, such as allergens, pollen, and microbial contaminants, achieving a high level of air purity.

The system’s functionality is enhanced by the use of a blower fan and suction pump, which work synergistically to draw polluted air into the purification chamber and maintain a consistent airflow. The water pump ensures continuous circulation of water in the filtration unit, while the air nozzle facilitates the dispersion of water droplets to maximize air-water interaction. The inclusion of an MQ-15 gas sensor enables real-time monitoring of air quality, particularly the detection of harmful gases such as carbon monoxide, methane, and other VOCs. Data from the sensor is processed by an Arduino Uno microcontroller, which serves as the control unit of the system. A relay board and motor driver are incorporated to manage the operation of various motors and pumps efficiently, ensuring synchronized performance

## 2. SYSTEM DESIGN AND DEVLOPMERNT :

### *2.1 System Overview:*

The system integrates mechanical and electronic components for air filtration and quality monitoring. The design consists of the following components:

1. Blower Fan: Facilitates airflow into the purification system.
2. Suction Pump: Draws air from the environment into the water filtration unit.
3. Water Pump: Circulates water in the filtration unit to trap particulates.
4. Water Filtration Unit: Removes large particulates and water-soluble pollutants.
5. HEPA Filter: Traps fine particulate matter (PM2.5 and PM10).
6. Air Nozzles: Distribute purified air back into the environment.
7. MQ-15 Gas Sensor. Detects air quality by measuring gas concentrations.
8. Arduino Uno: Microcontroller for automation and data processing.
9. Relay Board: Controls power to the blower fan, suction pump, and water pump.
10. Motor Driver: Regulates the operation of motors.

### *2.2 Working Principle:*

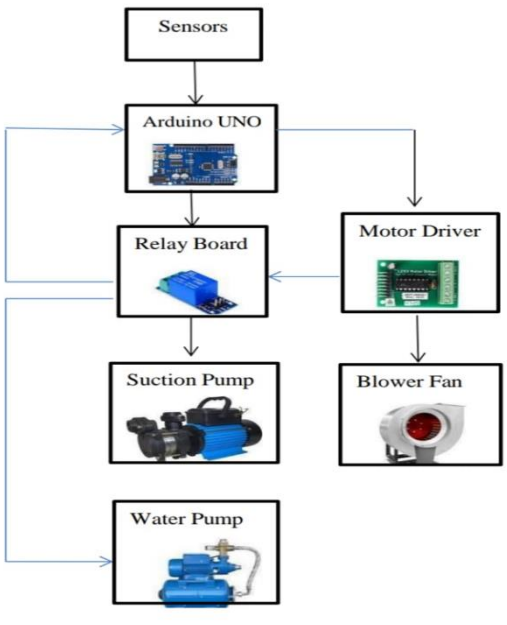
1. 1.Air Intake: The suction pump pulls polluted air into the system.
2. 2.Water Filtration: Air passes through a water curtain created by the water pump. The water traps larger particulates, dust, and some water-soluble gases.
3. 3.HEPA Filtration: The pre-cleaned air then moves to the HEPA filter to remove fine particles and allergens.
4. 4.Air Quality Monitoring: The MQ-15 sensor continuously monitors the air quality and sends data to the Arduino Uno.
5. 5.Automation and Control: The Arduino Uno processes sensor data to control the relay board and motor driver, optimizing the system's performance.

## 3. PROPOSED METHODOLOGY :

- Filtration Process: Air passes through a HEPA filter and water-based filtration unit.
  - HEPA Filter: HEPA filter captures airborne particles. A HEPA (High- Efficiency Particulate Air) filter is type of air filter designed to remove at least 99.97% of airborne particles as small as 0.3 microns in diameter
  - Water Filtration: Water filtration process to further cleanse the air. The water filtration process in an air filtration system is often part of a broader air purification mechanism that removes airborne contaminants and controls humidity.

- Sensor Monitoring: Real-time AQL, CO2, and oxygen levels are monitored using corresponding sensors. A sensor monitoring process in an air filtration system involves the use of various sensors to track and manage the performance and conditions of the air filtration system in real-time.
- Control System: A microcontroller continuously processes sensor data. If CO2 levels exceed the defined threshold, the controller signals the relay to disconnect power-hungry devices (e.g., heater, AC)
- Ventilation. Upon detecting poor air quality, the ventilation fan is activated. and the alarm alerts the users. The ventilation process in an air filtration system ensures the circulation and purification of air within a space.
- Automation: The system works autonomously and ensures safe air quality, Automation in air filtration systems involves the integration of advanced technologies to improve the efficiency, reliability, and functionality of the filtration process.

## 4.BASIC BLOCK DIAGRAM :



## 5.RESULT AND DISCUSSION :

### *5.1 Advantages:*

- Cost-effective design using readily available components.
- Reduced maintenance due to pre-filtration by water.
- Enhanced filtration efficiency for a wide range of pollutants.

### *5.2 Challenges:*

- Regular maintenance of the water filtration unit is required to prevent clogging.
- Fine-tuning of the MQ-15 sensor is essential for accurate readings.

## 6. CONCLUSION AND FUTURE WORK :

The hybrid air purification system combining water filtration and HEPA filtration demonstrates a promising approach to air quality improvement. The incorporation of Arduino Uno enables automation, making it user-friendly and efficient. Future work will focus on optimizing energy consumption and integrating IoT capabilities for remote monitoring.

REFERENCES :

1. ES Mousavi, J Godri (2015) Performance analysis of portable HEPA filter.
2. Krystal Indoor Air Quality: A summary of available information Residential Air Cleaners 2009 EPA 402-F-09-002.
3. Apte, K. and Salvi, S. (2016). Household air pollution and its effects on health. F1000 Research: F1000 Faculty Rev-2593, 5.
4. Shrimandilkar, P.P. (2013). Indoor air quality monitoring for human health. International Journal of Modern Engineering Research
5. Gautam, S.K., R., Suresh, Sharma, V.P., & Sehgal, M. (2013). Indoor air quality in the rural India.
6. Vijayan, V.K., Paramesh H., Salvi, S.S., & Dalal, A.A.K. (2015). Enhancing indoor air quality.