IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 11, Issue 12, December 2024

DOI: 10.17148/IARJSET.2024.111256

# VOICE CONTROLLED AIR PURIFIER

**Abhishek H C[1], Aadhya B N[2], Bindushree S[3] , Likitha L[4] , Rekha N[5]**

Dept. Of Electronics and Communication Engg, K S Institute of Technology,

Affiliated to VTU, Belagavi, Bangalore, India[1-4]

Professor, Dept. of Electronics and Communication Engg.

K S Institute of Technology, Affiliated to VTU, Belagavi, Bangalore, India[5]

**Abstract**: This project presents the design and implementation of a voice-controlled air purifier. The system utilizes HEPA filtration and UV technology to effectively remove pollutants and allergens from the air, ensuring a healthier indoor environment. The air purifier is equipped with voice-activated controls for power, fan speed, and real-time air quality notifications, providing a user-friendly and contactless operation. Additionally, the device features a voice-activated music player. The project aims to address common issues with existing air purifiers, such as inadequate pollutant removal, noise disturbances, and user control challenges. The proposed solution offers an innovative approach to improving air, making it a valuable addition to modern smart home environments.

**Keywords**: Voice Control, Air Purifier, HEPA Filtration, UV Technology, Indoor Air Quality (IAQ), Real-Time Monitoring, Machine Learning, IoT (Internet of Things), Sustainable Energy, Smart Home.

## I. INTRODUCTION

In today's world, maintaining indoor air quality has become increasingly important due to rising pollution levels and the prevalence of airborne diseases. The "Voice Controlled Air Purifier " project aims to address these concerns by integrating advanced air purification technology with user-friendly voice control features. This innovative device not only ensures a healthier living environment but also enhances the user's overall well-being.

The air purifier utilizes HEPA filtration and UV technology to effectively remove pollutants, allergens, and harmful microorganisms from the air. HEPA filters are known for their ability to capture particles as small as 0.3 microns, including dust, pollen, and pet dander, while the UV light helps in neutralizing bacteria and viruses. By combining these technologies, the air purifier provides a comprehensive solution for improving indoor air quality.

One of the standout features of this air purifier is its voice control capability. Users can easily operate the device using voice commands, allowing for a hands-free and convenient experience. The voice control system enables users to adjust fan speed, turn the purifier on or off, and receive real-time air quality notifications. Additionally, the device includes a voice-activated music player that plays soothing music to aid in relaxation and sleep, further enhancing the user's comfort..

Overall, the "Voice Controlled Air Purifier" project represents a significant advancement in smart home technology. By addressing common issues such as poor air quality and sleep disturbances, this device offers a practical and innovative solution for modern households. Its user-friendly design and multifunctional features make it a valuable addition to any home, promoting a healthier and more comfortable living environment.

## II. LITERATURE SURVEY

Jared Gamutin et al. explore the development of an air purifier that integrates thermoelectric cooling and advanced air monitoring sensors. The system enhances indoor air quality and comfort while allowing remote operation. The thermoelectric cooling helps in maintaining a comfortable temperature, and the advanced sensors provide real-time data on air quality. However, the system faces challenges related to initial costs, complexity of operation, and maintenance requirements.[1]

Annmaria Poulose et al. present a real-time indoor air quality monitoring and purification system that utilizes sensor data and machine learning techniques. The system offers predictive analysis and automated responses to improve air

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 11, Issue 12, December 2024

DOI: 10.17148/IARJSET.2024.111256

quality. By analyzing sensor data, the machine learning model can predict air quality trends and adjust the purification process accordingly. Challenges include sensor accuracy issues, data integration, and machine learning model optimization.[2]

Zhipeng Deng et al. have researched on assesses the impact of indoor air quality (IAQ) and noise on productivity using portable air cleaners and physiological signals. The study highlights the importance of enhancing indoor environment quality, as poor IAQ and noise levels negatively affect productivity and overall health. The use of physiological signals provides insights into how environmental factors influence human performance and well-being.[3]

Aparna Jose et al. discuss an IoT-based solar-powered air purifier with an integrated air quality monitoring system. The device improves indoor air quality and utilizes sustainable energy. The IoT connectivity allows for remote monitoring and control, while the solar power ensures energy efficiency. However, it faces limitations such as initial cost, dependence on sunlight, and maintenance requirements.[4]

Hao Xie, Hengmin Jia et al. study analyzes the performance of a novel air filtration and sterilization system using a PV-Trombe wall. The system leverages solar energy for power generation, air heating, and purification. The PV-Trombe wall design enhances the efficiency of air filtration and sterilization processes. Challenges include reduced airflow and decreased PV efficiency.[5]

Mikul Saravanan et al. research introduces a multipurpose air purification and distribution robot equipped with AI-based anomaly detection. The robot can purify, humidify, dehumidify, and disinfect the air. The AI-based anomaly detection system ensures optimal performance by identifying and addressing any issues. However, it faces issues related to low-quality air causing health problems and low humidity leading to dehydration and dryness.[6]

Sehyeong Oh et al. study investigates the effects of air purifiers and mechanical ventilation units on particulate matter concentration in a semi-outdoor space using CFD simulations. The research highlights the challenges of accurate predictions and computational costs. The findings provide insights into the effectiveness of different air purification and ventilation strategies in reducing particulate matter levels.[7]

Daniela Obitkova et al. paper examines the effectiveness of HEPA filters and nanotextiles in removing viruses from the air. The study indicates that viruses can be trapped by the nanotextile, enhancing the filtration capacity of HEPA filters. However, challenges include compatibility issues, replacement costs, and limited virus capture.[8]

Chenhua Wang et al. research explores the mitigation of airborne transmission of the COVID virus in a confined room using an air purifier. The study uses computational fluid dynamics to analyze the dispersion of the virus. The findings suggest that air purifiers can reduce the risk of airborne transmission, but challenges include the risk of infection in confined spaces.[9]

Jonathan Lagrimino et al. paper presents the implementation of an inclusive robotic air purifier designed for a smart, healthy, and age-friendly environment. The system offers autonomous air purification and an inclusive interface, minimizing user burden. The design focuses on creating a user-friendly experience for all age groups, particularly the elderly.[10]

Bangjie Sun et al. study introduces FilterOp, a novel method for testing masks and air filters using smartphones. The system estimates filtration efficiency by analyzing the airflow and particle capture. However, it faces challenges related to reliability and diverse filter standards.[11]

Yuxi Zhang et al. research evaluates the efficiency of portable air purifiers in removing particulate matter from public buses. The study finds that portable air purifiers are more effective than traditional ventilation methods in reducing PM2.5 levels. However, the effectiveness is influenced by factors such as relative humidity and bus occupancy.[12]

Zhe Liu et al. investigates the cardiovascular benefits of air purifiers for patients with stable coronary artery disease. The study highlights the control of drug use and multiple indicators of inflammation, coagulation, and plaque stability. Challenges include variability in air purifier effectiveness and interference from medication.[13]

C. Gnana Kousalya et al. study discusses the design of an IoT-based indoor air purifier that offers real-time air quality monitoring, remote access, and data storage. The system aims to provide effective air purification by leveraging IoT technology for enhanced control and monitoring.[14]

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 11, Issue 12, December 2024

DOI: 10.17148/IARJSET.2024.111256

J curtius et al. research tests the effectiveness of mobile air purifiers in reducing airborne transmission risk for SARS-CoV-2 in school classrooms. The study includes aerosol measurements and air purifier performance, highlighting the importance of maintaining air quality in educational settings. Challenges include limited duration and assumptions on virus-containing aerosols.[15]

## III. CONCLUSION

The reviewed literature underscores the critical importance of maintaining high indoor air quality (IAQ) for health, productivity, and overall well-being. Various innovative approaches have been explored to enhance air purification systems, including the integration of advanced sensors, IoT technology, machine learning, and sustainable energy sources.

1. **Technological Integration:** Many studies emphasize the integration of IoT and advanced sensors for real-time monitoring and control of air quality. These technologies enable automated responses to changing air quality conditions, improving the efficiency and effectiveness of air purifiers.
2. **Health Benefits:** Several studies highlight the health benefits of using air purifiers, particularly for individuals with respiratory conditions and cardiovascular diseases. The ability of air purifiers to remove particulate matter, allergens, and pathogens from the air contributes to better health outcomes.
3. **Energy Efficiency:** The use of sustainable energy sources, such as solar power, in air purification systems is a recurring theme. These approaches not only reduce the environmental impact but also enhance the feasibility of deploying air purifiers in various settings.
4. **Challenges and Limitations:** Despite the advancements, challenges such as sensor accuracy, initial costs, maintenance requirements, and compatibility issues persist. Addressing these challenges is crucial for the widespread adoption and effectiveness of air purification systems.
5. **Future Directions:** The literature suggests that future research should focus on improving sensor accuracy, optimizing machine learning models, and exploring new materials and technologies for air filtration. Additionally, the integration of user-friendly interfaces and inclusive designs can enhance the accessibility and usability of air purifiers.

Overall, the literature surveys provide valuable insights into the current state of air purification technology and highlight the potential for further innovation and improvement. By addressing the identified challenges and leveraging emerging technologies, air purification systems can play a vital role in promoting healthier and more comfortable indoor environments.

## REFERENCES

[1]. Jared Gamutin, Jonathan Tungal & Arnel Valdueza , “Air Purifier with Thermoelectric Cooling and Advanced Air Monitoring Sensors”, Advances in NanoTechnology , Material Science and Engineering Innovations, Vol.20,S2[2024], Available: nano-ntp.com/index.php/nano/article/view/470, Accesed: May 5 ,2024.

[2]. Annmaria Poulose, Aswathy Manoj, V A Fathima Muhsina, E Gaea Titus, & M Neema, “Real-Time Indoor Air Quality Monitoring and Purification System Using Sensor Data and Machine Learning Technique”,2nd International Conference on Sustainable computing and Smart Systems, Available: ieeexplore.ieee.org/abstract/document/10624835, Accessed: 20 August, 2024.

[3]. Zhipeng Deng, Bing Dong, Xin Guo, Xuezheng Wang, Jianshun Zhang , “Assessing multi-domain impact of IAQ and noise on productivity with portable air cleaners through physiological signals “, Building and environment , Vol.254, 15 April 2024, Available: Sciencedirect.com, Accessed:15 April 2024.

[4]. Aparna Jose* ,C.Abraham, Akhil K Soman,Ajumal T J,Anandakrishna ,Abison Shibu, “IoT based solar powered air purifier with air quality monitoring system”, International Conference on Sustainable Goals in Materials, Energy and Environment (ICSMEE’24), Volume 529, 2024, Available: https://doi.org/10.1051/e3sconf/202452904016, Accessed: 29 May 2024.

[5]. Hao Xie, Hengmin Jia, Yu Qian, Hongju Meng, Yan Mu, “Performance analysis of a novel air filtration and sterilization PV-Trombe wall”,Building and Environment , Vol.264 , 1 November 2024, Available: Sciencedirect.com, Accessed: 1 November 2024.

[6]. Mikul Saravanan, “ Novel Multipurpose Air Purification and Distribution Robot with AI-Based Anomaly Detection”, International Journal of Health Sciences and Research, Available: amazonaws.com, Accessed: 2023.

 

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 11, Issue 12, December 2024

DOI: 10.17148/IARJSET.2024.111256

[7]. Sehyeong Oh, Jaehee Chang, Dong Jin Ham, Rob Vervoort, "Effects of air purifiers and ventilation on particulate matter concentration at semi-outdoor space", Journal of Cleaner Production, Vol 434,1 January 2024 , Available: sciencedirect.com, Accessed: 1 January 2024.

[8]. Daniela Obitkova, Milan Mraz, Emil Pavlik , "Virus removal by high-efficiency air (HEPA) filters and filtration capacity enhancement by nanotextiles", Folia Microbiologica , Springer, Volume 69, pages 459–464, (2024), Available : link.springer.com , Accesssed: 14 February 2024.

[9]. Chenhua Wang, Chengjun Li, Hanqing Wang, Chuck W Yu , "Mitigation of airborne transmission of COVID virus between occupants in a confined room with an air purifier", Indoor and Built Environment, Volume 32 , Issue 10, Available: journals.sagepub.com, Accessed: July 20, 2023.

[10]. Jonathan Lagrimino, Sara Viviani, Alessandra Rinaldi, "Implementation of Smart, Healthy, Age-Friendly Environment Through an Inclusive Robotic Air Purifier ", AHFE International , Available: flore.unifi.it, Accessed: 2023.

[11]. Bangjie Sun, Kanav Sabharwal, Gyuyeon Kim, Jun Han, Mun Choon Chan , "Testing Masks and Air Filters with Your Smartphones", Proceedings of the 21st ACM Conference on Embedded Networked Sensor Systems, 2023,Available : dl.acm.org , Accessed: 26 April 2024.

[12]. Yuxi Zhang, Amir Ebrahimifakhar, Christian Ramos,Shanshan Si, Rongbin Xu, "Efficiency of portable air purification on public buses", Environmental Pollution, Volume 329, Available: sciencedirect.com, Accessed: 15 July 2023.

[13]. Zhe Liu, Qin Wang, Yang Mo, Yunpu Li, Feng Han, "Cardiovascular benefits of air purifier in patients with stable coronary artery disease", Frontiers in Public Health, Available : frontiersin.org, Accessed : 9 January 2023.

[14]. C. Gnana Kousalya,Udaya Mouni Boppana,Raja Kondapalli, " Design of IoT Based Indoor Air Purifier ", IEEE, Available:https://ieeexplore.ieee.org/abstract/document/9917953,Accessed: 2022.

[15]. J curtius, M granzin ,J schrod , "Testing mobile air purifiers in a school classroom: Reducing the airborne transmission risk for SARS-CoV-2", Aerosol Science and Technology, Available: tandfonline.com, Accessed: 1 march, 2021.

 