IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 3, March 2025

Design and Implementation of a Multistage Smart Air Purifier

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Abstract: *This project focuses on the design and implementation of a multistage household air purifier that integrates advanced filtration, real-time air quality monitoring, and humidity control to enhance indoor air quality efficiently and cost-effectively. The system incorporates a three-stage filtration process using an activated carbon filter for volatile organic compounds (VOCs) and odor removal, a HEPA filter for particulate matter filtration, and a silica gel filter for humidity regulation. Additionally, an ultrasonic humidifier ensures optimal indoor humidity levels, while high-sensitivity sensors continuously monitor air quality and display real-time data. The design process includes problem analysis, component selection, system modeling using CAD, prototype development, testing, and data analysis to optimize efficiency. Key design calculations consider airflow requirements, fan selection, filter efficiency, humidifier sizing, and overall power consumption to ensure an effective and sustainable solution. Expected outcomes demonstrate the air purifier's ability to remove 99.97% of airborne particles, significantly reduce VOC levels, and maintain relative humidity within the recommended range of 40-60%. By addressing air pollution concerns and maintaining a healthy indoor environment, this project presents a practical and innovative solution for modern households at an affordable cost*

Keywords: HEPA filters , Activated carbon filters , Silica gel, Cost-effectiveness

DOI: 10.48175/568