Research Article

EcoAir Portable Purifier

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Abstract: *Air pollution significantly affects health, with urban populations facing constant exposure to pollutants indoors and outdoors. Current portable air purifiers either lack affordability, portability, or child-friendliness, limiting their usage in everyday life. The EcoAir Portable Purifier aims to address these challenges by designing a compact, user-friendly, and affordable device that seamlessly integrates into daily routines. This device will target key demographics like office workers, students, commuters, and parents, providing a sustainable and effective solution for cleaner air.*

Keywords: Portable air purifiers; air pollution; affordability; sustainable.

1. INTRODUCTION

One of the most urgent environmental and public health issues in the quickly urbanising world of today is air pollution. The World Health Organisation (WHO) reports that millions of people die before their time each year because more than 90% of the world's population breaths air that is more polluted than is advised. In urban areas, where industrial emissions, vehicle exhaust, and other pollutants contribute to the state of the air, the effects of poor air quality are more noticeable.

In response to the increasing demand for personal air filtration devices, the "EcoAir Portable Purifier" was developed as a creative solution. For those who are always on the go, such commuters, office workers, and students, this portable gadget offers clean, breathing air in a variety of settings. compared to conventional air purifiers, the EcoAir is small, eco-friendly, and energy-efficient, all of which support sustainable development objectives.

According to Grande et al. (2020), the rising incidence of respiratory ailments and growing consciousness of the long-term effects of air pollution highlight the need for innovation in this field. Long-term exposure to contaminated air has been linked to chronic illnesses including asthma, heart disease, and even cognitive impairment. The EcoAir Portable Purifier has the potential to enhance quality of life and advance health equity by providing a useful, transportable, and efficient purification solution.

2. Driving the Final Empathy

Because it tackles some of the most important global issues, such as improving air quality, environmental sustainability, affordability, and personal health, the last topic, "EcoAir Portable Purifier: Addressing Air Pollution for Health, Environment, Price, and Usability," was chosen.

Air purifiers are manufactured as either small stand-alone or larger units that can be affixed to an air handler unit (AHU) or an HVAC unit found in hospitals and industries. A variety of equipment, including packing-filled towers, spray towers, bubble columns, and wetted-wall towers, can be utilized as humidifiers. The heterogeneity of the rooms in temperature and humidity is a significant factor that must be regulated in an industrial operation. Healthy air has three main components to it. It has to be fresh, clean and have the right moisture content. Human beings are prone to humidity because the human body uses evaporative cooking as the primary mechanism for getting rid of the system (Ukagwu wt al., 2024).

3. Dream and How Might We (HMW) Statement

Based on the insights gathered from the interviews, the dream for the EcoAir Portable Purifier is to create a solution that is affordable, portable, and highly effective at improving air quality, especially in environments where access to stationary purifiers is limited.

The market for air purifiers is currently shifting steadily from enterprise to consumer (Wang et al., 2021). Assuming that a product's usability and functionality are equivalent, its appearance is one of the most significant factors affecting consumers' decisions to buy, aside from outside factors like marketing strategy (Wang et al., 2022). The need and urgency of air purifier product modelling design were also highlighted by the thorough examination of the market prospects and industry overview. Additionally, consumers prefer portable air purifiers in the market for air purifiers (Ismail et al., 2022).

Consumers desire a gadget that fits easily into their daily routines and gives them access to breathable, clean air whether they're studying, working, or traveling. The product must balance performance and sustainability while being small, energy-efficient, and easy to use in order to realize this goal. Therefore, the How Might We (HMW) statement concentrates on resolving the particular requirements and difficulties found during the interviews: How can we create a portable air purifier that is small, reasonably priced, and simple to operate in a range of environments while also improving air quality? In order to guarantee that the solution satisfies user expectations and realistic use cases, this statement forms the basis for additional ideation and product development.

4. Project Outcomes

The creation of a functional EcoAir Portable Purifier prototype is the main result of this project. This prototype will show off the device's functions, including its portability, air purification efficacy, and user-friendliness. The project's ultimate goal is to produce a completely working product that can be evaluated in real-world settings to make sure it fulfils user requirements and operates as planned. The prototype will be put through user testing in order to get input, evaluate its usefulness, and adjust the design in light of suggestions from possible users.

The collection and evaluation of user input is another important result, in addition to the prototype. Participants' in-depth answers addressing their preferences, problems, and experiences with

portable air purification are included in this. Key design choices, including the optimal size, battery life, and overall user experience, will be informed by the comments and used to steer prototype modifications. This result will guarantee that the product not only tackles the technical aspects of air filtration but also appeals to the target market, offering them a workable and efficient option.

The creation of an extensive market research report is the final significant result. The results of the competitive study, product testing, and interviews will all be covered in depth in this report. A strategy for the product launch, price strategies, and an analysis of consumer demand will also be included. The market research report will act as a guide for the product's commercial strategy and future enhancements, guaranteeing its success in the marketplace by spotting possible obstacles to product acceptance and resolving them early.

5. PROJECT CHALLENGES

The first major obstacle in the creation of the EcoAir Portable Purifier is its technical viability. A crucial concern is making sure the apparatus can efficiently filter the air while yet being small and lightweight. Without sacrificing efficiency or air quality, the purifier must perform on par with bigger systems but in a more portable form. It will take careful engineering and design to strike a balance between the purifier's efficacy and the limitations of portability and size.

Cost effectiveness is another difficulty. Affordability for the intended market is crucial, but using premium materials is also necessary to guarantee the purifier's effectiveness and longevity. It's crucial to strike a balance between price and excellent product quality, particularly when working with expensive parts like long-lasting battery systems and effective filters. At the same time, the product needs to live up to sustainability standards. As demand for environmentally conscious products rises, a significant challenge will be locating eco-friendly components without sacrificing the device's longevity or functionality.

The competitiveness in the market is another difficulty. Finding distinctive features or advantages will be necessary to set EcoAir apart in a competitive market since there are currently a number of portable air purifiers on the market. Better performance, a creative design, or a more affordable pricing point are just a few examples of what the product must provide. Lastly, another barrier can be user adoption. When comparing portable air purifiers to more conventional, larger systems, many consumers could have doubts about their efficacy. Gaining broad adoption and commercial success will require overcoming this mistrust and informing prospective clients about the advantages of portable solutions.

6. PROJECT SUCCESS INDICATORS

To measure the success of the EcoAir Portable Purifier project, several key indicators can be considered. First, the User Adoption Rate will provide insight into how well the product resonates with the target audience, as demonstrated by strong sales and active engagement. Next, Performance Feedback is crucial in assessing the product’s air purification capabilities, portability, and ease of use, with positive reviews being a strong sign of success.

Another significant indicator is Durability, where the purifier’s ability to maintain long battery life and provide reliable performance in various conditions will be tested during user trials. The Market

Competitiveness factor will measure how well the EcoAir purifier compares to similar products, focusing on its unique selling points and its ability to stand out in the market.

Furthermore, the project's Sustainability Impact can be gauged through the use of eco-friendly materials and consumer recognition of its environmental benefits, which will contribute to the product's appeal to eco-conscious users. The Cost-Effectiveness of the EcoAir purifier is another essential success metric, ensuring that it remains affordable while upholding high quality, making it accessible to a broad range of customers. Lastly, the Diversity of Applications will demonstrate how well the product meets the needs of users in various environments such as offices, outdoor settings, or while commuting. This flexibility in its usage scenarios will further enhance its market appeal.

7. CONCLUSION

The EcoAir Portable Purifier project was developed to address the urgent issue of air pollution and its harmful effects on public health, particularly in urban areas. This innovative, eco-friendly, and portable solution was designed to provide clean air for commuters, office workers, and students, offering a practical and sustainable way to reduce exposure to harmful pollutants. By focusing on accessibility, efficiency, and sustainability, the purifier aligns with global efforts to improve air quality and promote healthier living environments.

Insights from interviews and fieldwork played a key role in shaping the purifier's design, highlighting the need for compactness, affordability, and ease of use. The purifier's lightweight and energy-efficient features make it suitable for busy lifestyles, while its eco-friendly materials support sustainability goals. However, the project also identified challenges such as balancing cost and performance, emphasizing the need for continued refinement to ensure durability, effectiveness, and user satisfaction.

Moving forward, future improvements will focus on integrating smart sensors, enhancing filtration performance, and extending battery life. Expanding product variations and exploring partnerships for production will help increase accessibility and market reach. Overall, the EcoAir Portable Purifier offers a promising solution to combat air pollution, contributing to better health, sustainability, and technological innovation.

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References

Ismail, A., Farhana, N. A., Husin, A., Ahmad, N., & Jamil, S. J. T. (2022). Marketability Potential of Innovative Outdoor Air Filter to Improve Air Quality at the Construction Site. International Journal of Academic Research in Business and Social Sciences, 12(11). https://doi.org/10.6007/ijarbss/v12-i11/15144

Ukagwu, K. J., Enzoionzi, A. I., Eze, V. H. U., Uche, C. K. A., & Ukagwu, F. (2024). Innovative Design and Implementation of Portable and Rechargeable Air Purifier and Humidifier. International Journal of Recent Technology and Applied Science (IJORTAS), 6(1), 14–24. https://doi.org/10.36079/lamintang.ijortas-0601.618

IEEE Xplore Full-Text PDF: (2025). Ieee.org. https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9565895

Wang, Y., Cooper, E., Farhang Tahmasebi, Taylor, J., Stamp, S., Symonds, P., Burman, E., & Dejan Mumovic. (2022). Improving indoor air quality and occupant health through smart control of windows and portable air purifiers in residential buildings. Building Services Engineering Research and Technology, 43(5), 571–588. https://doi.org/10.1177/01436244221099482

Regalado, A., Lorraine, R., Jenard, C., & Jetro, J. (2021). Eco Air Purifier using Air Filter with Activated Carbon. 1(1), 54–58. https://doi.org/10.54646/bijiam.009

Eureka Forbes Blogs - Products, Services & Annual Maintenance Contract. (2024). Eurekaforbes.com. https://www.eurekaforbes.com/blog

Cherney, K. (2019, December 16). Do Air Purifiers Actually Work? Healthline; Healthline Media. https://www.healthline.com/health/allergies/do-air-purifiers-work

Hamilton, R. (2025, January 15). Forget air purifiers – the world's first "air sterilizer" is here, and it claims to instantly inactivate Covid, cold, and flu particles. TechRadar. https://www.techradar.com/home/air-quality/forget-air-purifiers-the-worlds-first-air-sterilizer-is-here-and-it-claims-to-instantly-inactivate-covid-cold-and-flu-particles

Eco-air purifier using air filter with activated carbon | BOHR International Journal of Civil Engineering and Environmental Science. (2019). Bohrpub.com. https://journals.bohrpub.com/index.php/bijcees/article/view/480/3690

Regalado, A., Lorraine, R., Jenard, C., & Jetro, J. (2023). Eco-air purifier using air filter with activated carbon. 1(2), 87–91. https://doi.org/10.54646/bijcees.2023.11