International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i03.023 ISSN: 2581-4621

DESIGN AND FABRICATION OF INDOOR AIR PURIFIER & HUMIDIFIER IN FOOD INDUSTRY

Gowtham M [1], Karthick V[2], Chandrupriyadharshaan C [3], Pradeep AR [4], Aravind M [5]
[1] *Assistant Professor, Mechanical Engineering, SNS College Technology, Coimbatore, TamilNadu*
[2,3,4,5] *UG - Mechanical Engineering, SNS College Technology, Coimbatore, TamilNadu*
Corresponding Author Orcid ID: 0009-0007-2359-5368

ABSTRACT
In 2021, air pollution has gone beyond all limits. According to the WHO, 7 million people die annually as a result of air pollution. A whopping 91 percent of the world's population is now exposed to air pollution due to its wide distribution. This also implies that the air within your home is contaminated. In order to address this problem, we have developed a small air purifier that employs water as an air filter rather than pricey filters. Additionally, it functions as an air humidifier. The design and development of the next-generation indoor air purifier is the subject of this thesis. The project was carried out using a human-cantered design process, and a patient was the end outcome. The system uses two high performance, low noise centrifugal fans to draw air through a safety mesh. At the bottom of the purifier, there is a water tank through which the air is pushed and subsequently passed. Water catches dust, fungi, germs, and other contaminants, which causes the air it passes through to be automatically cleansed. If you suffer from asthma or another breathing difficulty, you may find a HEPA (sometimes defined as "high-efficiency particulate air," sometimes as "high-energy particulate arresting") air purifier (or a vacuum with a HEPA filter) well worth the investment.
Keywords— Air purifier, Air Humidifier, Water filter, Air pollution, Air quality

1. INTRODUCTION
The most common problem during the summer season is pollution, dust, and allergies. With increase in the number of pollutants in the air, there is an increase in the demand for air purifiers. These air purifiers can be used in offices, homes, commercial places, and if their efficiency is high, then they can also be used outdoors. Air purifier is a device used to remove contaminants like dust particles, cloth fibres etc. present in the air.
These devices are claimed to be beneficial to people having allergies, and asthma.
A standard air purifier consists of various types of filters, and filter levels to remove the contaminants from the surrounding air.
However, the majority of air purifiers available today use so-called HEPA filters, which need to be changed out frequently and use a lot of energy. Since pricing is one of the most crucial considerations for clients when purchasing an air purifier, this solution is fairly expensive and not appropriate for everyone. The aesthetic design of an air purifier is crucial because it is a component of the aesthetic in a food industry.

2. OBJECTIVE
The main objective of making this machine is to do technical advancement in the air purification field. To carry out the following process. Research and analysis of room dust.
Uses of sensors can make the purifier cost high in market.
Disposable filters must be frequently replaced approximately every 90 days. Some of the filters should receive training in proper handling technique. All incoming filters needs to be visually inspected.

3. LITERATURE REVIEW
HEPA filters were originally classified as top-secret, developed by the US Atomic Energy Commission to protect soldiers from radioactive particles on the battlefield. During World War II,

DOI:10.46647/ijetms.2023.v07i03.023 ISSN: 2581-4621

scientists involved in the Manhattan Project used HEPA masks to guard against contaminants from the atomic bomb.

Although these early HEPA masks couldn't possibly protect people from atomic radiation, the research spawned the HEPA filter, which provided protection against chlorine gas, mustard gas, and flame throwers. It was not until the 1960s that specifications were standardized and the term HEPA or "High Efficiency Particulate Air" was officially coined by the Department of Energy (DOE).

As defined by the DOE, HEPA filters remove at least 99.97% of dust, pollen, mould, bacteria and any airborne particles with a size of 0.3 microns at 85 litres per minute. From the beginning, HEPA filters were employed to filter out highly hazardous aerosols, toxic carcinogens, radioactive particles, and biohazardous contaminates. In Germany, brothers Klaus and Manfred Hames purchased a patent for a simple air filtration system.

Using a fiberglass pad attached with small magnets to the air outlet of a residential oil oven, the Hammes brothers were able to filter soot from the air. In 1963, the 31 Hammes brothers simple but effective filter became the first air cleaner to be utilized in homes across Germany. In the same year, through fuel emissions standards. Although it was not Congress first attempt at reducing air pollution, the Clean Air Act of 1963 alerted scientist's materials, chemicals, pesticides, and allergens.

4.AIR PURIFIER

An air purifier is a device which removes contaminants from the air in a room. These devices are extremely beneficial for allergy sufferers, asthmatics and at reducing or eliminating second-hand tobacco smoke, they are also extremely useful for reducing pollutants from a room if you live in a highly polluted environment, for instance New Delhi, Patna or Gwalior, which are among the most air polluted cities in the world. They also help eliminate virus and bacteria from a room which prevents the spread of disease.

5. HEPA TECHNOLOGY

HEPA is an acronym for High Efficiency Particulate Air and is a technology that has been used for many years to filter particles. HEPA filters must meet a standard of trapping at least 99.97% of all particles larger than 0.3 microns.

The human eye can only see particles larger than 10 microns; so, particles caught in a HEPA filter such as chemicals, bacteria and viruses cannot be seen.

Because HEPA filters can trap mold and bacteria, they create a more sanitary environment. Additionally, this does not generate ozone or any other harmful by products.

Figure No 1: Hepa Filter

6. PROTOTYPE OF AIR PURIFIER

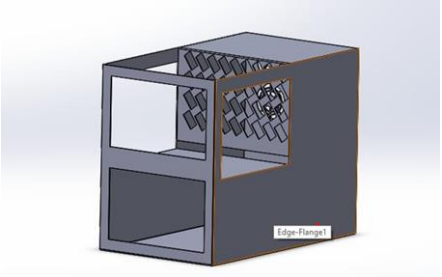

Figure No 2: 3D Prototype

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i03.023 ISSN: 2581-4621

Prototype of Air purifier is shown in the above figure.
The prototype is Designed using the software Solid works 2016.
The tools used to design the protype are described below,

- Weldments.
- Extrude.
- Endcap.
- Structural Member.
- Trim.
- Extend.
- Sketch.
- Base Flange.
- Edge Flange.
- Extrude.
- Cut.

These are some of the tools used in designing the Prototype.

7. FILTERING PROCESS

The air circulating through the room that passes through the filter, the filter it passes through first is the carbon filter, where large contaminants get captured in the pores of active carbon. Then the air passes through cold catalyst filter there by removing any harmful gases like formaldehyde, benzene gases and deodorizes the air. The third filter it passes through is antimicrobial filter where the microorganisms are stopped from spreading and growing. And finally the air passes through HEPA filters, where the minute contaminants, micro bacteria and fungus gets stopped, thereby effectively purifying the air. By adding a UV light to the 49 filtering process, these microorganisms can be killed and prevent from spreading any diseases

8. COMPONENTS

- Aluminum frame
- ACB sheet (aluminum composite board)
- Acrylic sheet
- Nylon net
- Blower
- Exhaust fan
- Switch
- Speed controller
- Lithium battery 12v

8.1.Blower

An exhaust fan is a fan which is used to control the interior environment by venting out unwanted odors, particulates, smoke, moisture, and other contaminants which may be present in the air. Exhaust fans can also be integrated into a heating and cooling system.

8.2.Aluminum frame

The aluminium frame is the base to fix pantograph frames. It supports the fixed part of the frame and is mounted on supporting insulator. Base frames are usually made of profile steel, plates through extrusion, or steel tubes through splicing or castings and profile steel through splicing.

8.3.Exhaust fan

Blowers are installation equipment that provides the transfer of air in the emitted environment at high or low pressure and rotates the fan with the force received from the motor Blower is a plumbing equipment that rotates the fan with the force it receives from the engine, which transfers the air in the

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 3 Volume No.7 May - June – 2023
DOI:10.46647/ijetms.2023.v07i03.023 ISSN: 2581-4621

emitted environment at high flow or low pressure. The fan in the blowers rotates and vacuum the air in the suction section The trapped air is then pushed into the outlet side. Blowers are often used to move air.

8.4.Acrylic sheet

Acrylic is a transparent plastic material with outstanding strength, stiffness, and optical clarity. Acrylic sheet is easy to fabricate, bonds well with adhesives and solvents, and is easy to thermoform. It has superior weathering properties compared to many other transparent plastics.

8.5.Lithium battery 12v

A battery pack is a set of any number of (preferably) identical batteries or individual battery cells. They may be configured in a series, parallel or a mixture of both to deliver the desired voltage, capacity, or power density. The term battery pack is often used in reference to cordless tools, radio-controlled hobby toys, and battery electric vehicles.

8.6.Speed controller

The list of speed control comprises a wide range of appliances, beginning with household electrical appliances used in the garden and garage, and ending with large industrial plants with conveyor belts, pumps and machine tools. We will quickly see how essential and important this type of speed control is for various machines. A sophisticated society can no longer do without an effective way to control speed.

9.RESULT AND DISCUSSION

HEPA filter remove 99.97% of particle that have a size of less than 0.02 micron. Composite filter consisting Cold Catalyst Filter and Activated carbon require frequent replacement after 6-8 month. Area Cover: About 275Sq. ft. Clean Area Delivery Rate: 175m3/hr Air Change per Hour: 2.56 Time required to purify air to a safer lever: 10-15 min


Figure No 3: Air Purifier and Humidifier

10. CONCLUSION

A conclusion Some purifiers also contain more than one technology for advanced functioning and better results. Thus, choose the best one matching your requirement and budget. The main function of HEPA Filter is to remove contaminated viruses from the air and provide clean and pure air.

11. REFERENCE

1. Vo Ngoc Mai Anh; Hoang Kim Ngoc Anh; Vo Nhat Huy; Huynh Gia Huy; Minh Ly. "Improve Productivity and Quality Using Lean Six Sigma: A Case Study". *International Research Journal on Advanced Science Hub*, 5, 03, 2023, 71-83. doi: 10.47392/irjash.2023.016

2. R. Devi Priya, R. Sivaraj, Ajith Abraham, T. Pravin, P. Sivasankar and N. Anitha. "MultiObjective Particle Swarm Optimization Based Preprocessing of Multi-Class Extremely Imbalanced Datasets".

International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems Vol. 30, No. 05, pp. 735-755 (2022). Doi: 10.1142/S0218488522500209
3. Swathi Buragadda; Siva Kalyani Pendum V P; Dulla Krishna Kavya; Shaik Shaheda Khanam. "Multi Disease Classification System Based on Symptoms using The Blended Approach". *International Research Journal on Advanced Science Hub*, 5, 03, 2023, 84-90. doi: 10.47392/irjash.2023.017
4. Susanta Saha; Sohini Mondal. "An in-depth analysis of the Entertainment Preferences before and after Covid-19 among Engineering Students of West Bengal". *International Research Journal on Advanced Science Hub*, 5, 03, 2023, 91-102. doi: 10.47392/irjash.2023.018
5. Ayush Kumar Bar; Avijit Kumar Chaudhuri. "Emotica.AI - A Customer feedback system using AI". *International Research Journal on Advanced Science Hub*, 5, 03, 2023, 103-110. doi: 10.47392/irjash.2023.019
6. Rajarshi Samaddar; Aikyam Ghosh; Sounak Dey Sarkar; Mainak Das; Avijit Chakrabarty. "IoT & Cloud-based Smart Attendance Management System using RFID". *International Research Journal on Advanced Science Hub*, 5, 03, 2023, 111-118. doi: 10.47392/irjash.2023.020
7. Minh Ly Duc; Que Nguyen Kieu Viet. "Analysis Affect Factors of Smart Meter A PLS-SEM Neural Network". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 288-301. doi: 10.47392/irjash.2022.071
8. Lely Novia; Muhammad Basri Wello. "Analysis of Interpersonal Skill Learning Outcomes in Business English Students Class". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 302-305. doi: 10.47392/irjash.2022.072
9. Ms. Nikita; Sandeep Kumar; Prabhakar Agarwal; Manisha Bharti. "Comparison of multi-class motor imagery classification methods for EEG signals". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 306-311. doi: 10.47392/irjash.2022.073
10. Aniket Manash; Ratan Kumar; Rakesh Kumar; Pandey S C; Saurabh Kumar. "Elastic properties of ferrite nanomaterials: A compilation and a review". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 312-317. doi: 10.47392/irjash.2022.074
11. Prabin Kumar; Rahul Kumar; Ragul Kumar; Vivek Rai; Aniket Manash. "A Review on coating of steel with nanocomposite for industrial applications". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 318-323. doi: 10.47392/irjash.2022.075
12. Twinkle Beniwal; Vidhu K. Mathur. "Cloud Kitchens and its impact on the restaurant industry". *International Research Journal on Advanced Science Hub*, 4, 12, 2022, 324-335. doi: 10.47392/irjash.2022.076
13. V.S. Rajashekhar; T. Pravin; K. Thiruppathi , “Control of a snake robot with 3R joint mechanism”, International Journal of Mechanisms and Robotic Systems (IJMRS), Vol. 4, No. 3, 2018. Doi: 10.1504/IJMRS.2018.10017186
14. T. Pravin, C. Somu, R. Rajavel, M. Subramanian, P. Prince Reynold, Integrated Taguchi cum grey relational experimental analysis technique (GREAT) for optimization and material characterization of FSP surface composites on AA6061 aluminium alloys, Materials Today: Proceedings, Volume 33, Part 8, 2020, Pages 5156-5161, ISSN 2214-7853, https://doi.org/10.1016/j.matpr.2020.02.863.
15. Pravin T, M. Subramanian, R. Ranjith,Clarifying the phenomenon of Ultrasonic Assisted Electric discharge machining, “Journal of the Indian Chemical Society”, Volume 99, Issue 10, 2022, 100705, ISSN 0019-4522, Doi: 10.1016/j.jics.2022.100705
16. M. S. N. K. Nijamudeen, G. Muthuarasu, G. Gokulkumar, A. Nagarjunan, and T. Pravin, “Investigation on mechanical properties of aluminium with copper and silicon carbide using powder metallurgy technique,” Advances in Natural and Applied Sciences, vol. 11, no. 4, pp. 277–280, 2017.
17. T. Pravin, M. Sadhasivam, and S. Raghuraman, “Optimization of process parameters of Al10% Cu compacts through powder metallurgy,” Applied Mechanics and Materials, vol. 813-814, pp. 603–607, 2010.

18. Rajashekhar, V., Pravin, T., Thiruppathi, K.: A review on droplet deposition manufacturing a rapid prototyping technique. Int. J. Manuf. Technol. Manage. 33(5), 362–383 (2019) https://doi.org/10.1504/IJMTM.2019.103277
19. Rajashekhar V S, Pravin T, Thirupathi K, Raghuraman S.Modeling and Simulation of Gravity based Zig-zag Material Handling System for Transferring Materials in Multi Floor Industries. Indian Journal of Science and Technology.2015 Sep, 8(22), pp.1-6.
20. Shoeb Ahmed Syed; Steve Ales; Rajesh Kumar Behera; Kamalakanta Muduli. "Challenges, Opportunities and Analysis of the Machining Characteristics in hybrid Aluminium Composites (Al6061-SiC-Al2O3) Produced by Stir Casting Method". International Research Journal on Advanced Science Hub, 4, 08, 2022, 205-216. doi: 10.47392/irjash.2022.051
21. Nirsandh Ganesan; Nithya Sri Chandrasekar; Ms. Gokila; Ms. Varsha. "Decision Model Based Reliability Prediction Framework". International Research Journal on Advanced Science Hub, 4, 10, 2022, 236-242. doi: 10.47392/irjash.2022.061
22. Vishnupriya S; Nithya Sri Chandrasekar; Nirsandh Ganesan; Ms. Mithilaa; Ms. Jeyashree. "Comprehensive Analysis of Power and Handloom Market Failures and Potential Regrowth Options". International Research Journal on Advanced Science Hub, 4, 10, 2022, 243-250. doi: 10.47392/irjash.2022.062
23. Ashima Saxena; Preeti Chawla. "A Study on the Role of Demographic Variables on Online Payment in Delhi NCR". International Research Journal on Advanced Science Hub, 4, 08, 2022, 217-221. doi: 10.47392/irjash.2022.052
24. Vishnupriya S; Nirsandh Ganesan; Ms. Piriyanga; Kiruthiga Devi. "Introducing Fuzzy Logic for Software Reliability Admeasurement". International Research Journal on Advanced Science Hub, 4, 09, 2022, 222-226. doi: 10.47392/irjash.2022.056
25. GANESAN M; Mahesh G; Baskar N. "An user friendly Scheme of Numerical Representation for Music Chords". *International Research Journal on Advanced Science Hub*, 4, 09, 2022, 227-236. doi: 10.47392/irjash.2022.057
26. Kakali Sarkar; Abhishek Kumar; Sharad Chandra Pandey; Saurabh Kumar; Vivek Kumar. "Tailoring the structural, optical, and dielectric properties of nanocrystalline niobate ceramics for possible electronic application". International Research Journal on Advanced Science Hub, 5, 01, 2023, 1-7. doi: 10.47392/irjash.2023.001
27. Pavan A C; Somashekara M T. "An Overview on Research Trends, Challenges, Applications and Future Direction in Digital Image Watermarking". *International Research Journal on Advanced Science Hub*, 5, 01, 2023, 8-14. doi: 10.47392/irjash.2023.002
28. Pavan A C; Lakshmi S; M.T. Somashekara. "An Improved Method for Reconstruction and Enhancing Dark Images based on CLAHE". *International Research Journal on Advanced Science Hub*, 5, 02, 2023, 40-46. doi: 10.47392/irjash.2023.011
29. Subha S; Sathiaseelan J G R. "The Enhanced Anomaly Deduction Techniques for Detecting Redundant Data in IoT". *International Research Journal on Advanced Science Hub*, 5, 02, 2023, 47-54. doi: 10.47392/irjash.2023.012
30. Nguyen Kieu Viet Que; Nguyen Thi Mai Huong; Huynh Tam Hai; Vo Dang Nhat Huy; Le Dang Quynh Nhu; Minh Duc Ly. "Implement Industrial 4.0 into process improvement: A Case Study in Zero Defect Manufacturing". *International Research Journal on Advanced Science Hub*, 5, 02, 2023, 55-70. doi: 10.47392/irjash.2023.013
31. Gyanendra Kumar Pal; Sanjeev Gangwar. "Discovery of Approaches by Various Machine learning Ensemble Model and Features Selection Method in Critical Heart Disease Diagnosis". *International Research Journal on Advanced Science Hub*, 5, 01, 2022, 15-21. doi: 10.47392/irjash.2023.003
32. Nirsandh Ganesan; Nithya Sri Chandrasekar; Ms. Piriyanga; Keerthana P; Mithilaa S; Ms. Jeyashree. "Effect of Nano Reinforcements Tio2 And Y2O3 on Aluminium Metal Matrix Nanocomposite". *International Research Journal on Advanced Science Hub*, 5, 01, 2023, 22-32. doi: 10.47392/irjash.2023.004

DOI:10.46647/ijetms.2023.v07i03.023 ISSN: 2581-4621

33. Nur Aeni; Lely Novia; Mr. Muhalim; Nur Fitri. "Incorporating Secret Door in Teaching Vocabulary for EFL Vocational Secondary School Students in Indonesia". *International Research Journal on Advanced Science Hub*, 5, 01, 2023, 33-39. doi: 10.47392/irjash.2023.005