



# DESIGN AND FABRICATION OF AIR PURIFIER USING WATER AS FILTER

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## ABSTRACT:

Population density increased by the social development in cities, contributing to extreme air contamination in the inside. As a result of these developments, greater attention has been paid to the problem of safe and balanced indoor environments. To enhance the indoor air quality, various air purifying techniques were adopted. Air filtration technique can eliminate air contaminants and effectively reduce worsening air quality indoors the system makes use of blower which sucks the air. When air is passed through a water tank situated at the bottom of the purifier. The air passed through water gets purified as water traps dust, fungi, bacteria etc... In the water. The resulting air rising through the water is a purified air. Also added essential oils to the system allow for humidifying the area/room with essential oils which helps humans to relax. This project finds its application in various places like in IT industries, colleges and schools, clinics and medicals, Bakery factory, high population cities Where air is polluted due to large number of vehicle travels and industries The people living in metro cities may get effects on their skin, age and their organs. By using our waterbased air purifier the affects may get decrease to some extent.

## INTRODUCTION:

Air pollution has crossed all bounds in 2021. WHO estimates that around 7 million people die every year from exposure to polluted air. The spread of air pollution is so high that about 91% of the world population is exposed to air pollution. Poor indoor air quality is commonly found in homes in larger cities, and it's result of a growing industrialization that pollutes air we breathe with contaminants like industrial dust, smoke and other particles from traffic. Well this also means that the air you breathe in your house is polluted. To counter this issue we here develop a mini air purifier with that does not use expensive filters but rather uses water as an air filter. Also it acts as an air humidifier and can be used as oil diffuser too which helps you relax and also kills certain bacteria and viruses present in the air. The solution from user perspective, is to use an air purifier that clean the air from these particles inside the users home. An air purifier can also be used to ease annoyance for people suffer from allergies. This matter thesis concerns the design and development of the next generation of the air purifier for indoor use. The project has been conducted with human centred design process and co-design approach. The development of this project contains several methods commonly used in order to achieve a result that is trustworthy and in line with user needs. The project also resulted in a patient application for new type of filters that the user can clean without the need of continuous buy of new filters. This leads to less material use which results in less negative environmental impact [1-5]

## AIR PURIFIER

An air purifier is a device that absorbs and removes harmful particles from its surrounding environment to prevent respiratory diseases on humans. The most widespread use for an air purifier is to clean the air from harmful airborne particles in homes, hospitals and office environments. Some of the airborne particles that an air purifier removes includes air pollutants, allergens, cigarette smoke and dust. Many are emitted by human activities where some of the common sources is construction work, traffic and industry.[6-11]

The purpose of this project is to design and create an air purifier and humidifier that uses water to filter and purify the air in a room. The air purifier and humidifier will be designed to help improve indoor air quality by removing impurities and adding moisture to the air.

### COMPONENTS:

- Air Blower Pumps
- Water Tank
- Pipe
- Pipe Fittings
- Nozzle
- Pipe Connector
- Transformer/Adapter
- Protective Mesh
- Monitoring Glass
- Mounts and Joints
- Base Frame
- Supporting Frame
- Screws and Fittings

### WORKING:

An air purifier is usually equipped with a fan that absorbs air and lets the air pass through a filter media where particles get stuck. Usually there is a pre-filter that captures larger particles. Behind the pre-filter, some air cleaning technology, usually use a finer filter, captures smaller sized particles.

### DESIGN:

The air purifier and humidifier will consist of a water reservoir, a fan, a filter, and a humidifying element. The fan will pull air into the unit and through the filter, which will remove dust, pollen, and other particles from the air. The humidifying element will add moisture to the air by evaporating water from the reservoir.[12-16]

The filter will be made of a combination of activated carbon and HEPA material, which will capture a wide range of air pollutants. The water reservoir will be located at the bottom of the unit, and will have a capacity of at least 2 liters[17]. The fan will be located above the filter and will pull air through the filter and into the unit. The humidifying element will be located at the top of the unit and will release water vapor into the air.[18-23]

### GENERAL DESIGN PROCEDURE :

The size and thickness of the sheet metal used will depend on the project's size, complexity, and required durability. Common sheet metal thicknesses for small projects range from 22 to 16 gauge, with 16 gauge being the thickest. Thicker gauges provide more strength and durability but can be more challenging to work with and more expensive.

Sheet metal can be cut, bent, and formed into various shapes and sizes. Tools such as shears, brake presses, and rollers can be used to shape sheet metal into desired dimensions.

It is important to consider the tolerances and clearances required for the project to ensure that the components fit and function properly. Accurate measurements and precise cutting and forming are critical to achieving the desired result.

Surface finishing techniques such as painting, powder coating, and anodizing can be used to improve the appearance and durability of the sheet metal components.

Depending on the project's requirements, fasteners such as rivets, screws, or welds may be necessary to connect sheet metal components together.

In summary, the size, thickness, and details of sheet metal used for a small mini project will depend on the specific project's needs and requirements. The precise dimensions and specifications should be determined based on the project's design, purpose, and desired outcome.

For an air purifier, a general rule of thumb is to choose a unit that can effectively purify the room's air at least twice an hour. To calculate the necessary air flow rate, multiply the room's volume (length x width x height) by 2.

**For example, for a 10ft x 10ft x 8ft room, the volume would be 800 cubic feet. Multiplying by 2 gives a necessary air flow rate of 1600 cubic feet per hour (approx.=30CFM).**

Also the air delivered is humidified as the air is pumped into the water for purification and thus it also paves way for an added advantage by humidifying the air at zero power consumption. For humidification the design calculations can also be made.

For a humidifier, the necessary output will depend on the desired level of humidity in the room. A comfortable humidity level for most people is around 40-60%. To calculate the necessary output, determine the amount of moisture needed to raise the humidity level to the desired amount.[24-25]

### OUR DESIGN ASPECT:

The system makes use of 2 x high power low noise centrifugal fans that are used to suck in air through a protection mesh. The pulled air is then passed through a water tank situated at the bottom of the purifier. The air passed through water gets auto purified as water traps dust, fungi, bacteria etc in the water. The resulting air rising through the water is a high humidity cool air.

The mini Air Purifier brings up the following key aspects

- A Low Cost Purifier
- No Expensive Filters Just Water
- Quiet Operation
- Easy Maintenance
- Also acts as a Humidifier
- Low Power Consumption

- Easy To Use
- Can be used as an Oil Diffuser

Table.1 Technical Specifications Of The Project - Air Purifier

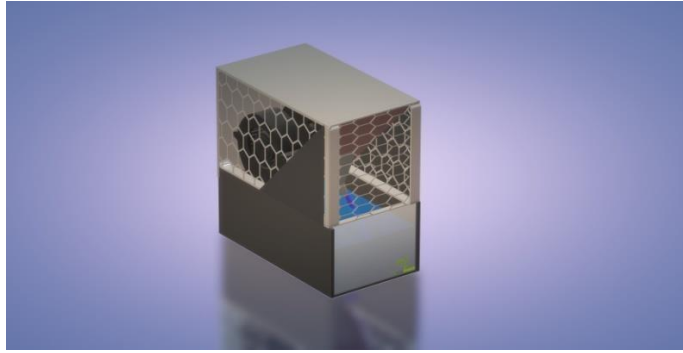
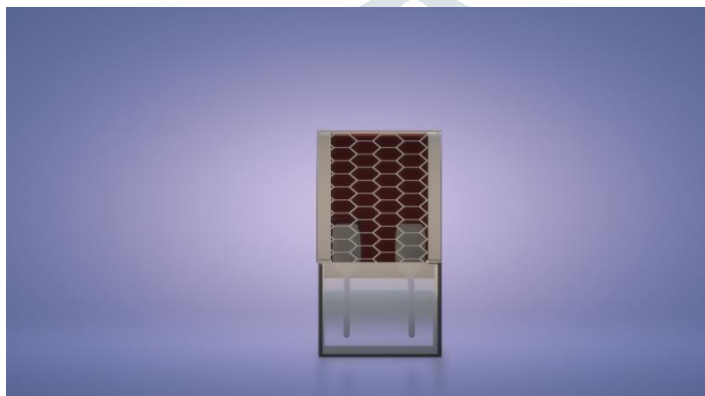
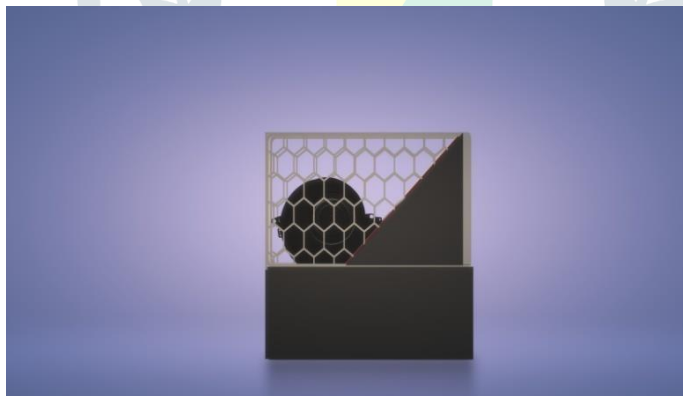
Air distribution(Maximum) :	150 CFM
Length:	14 inches
Width:	8 inches
Height:	16 inches

These dimensions are for a compact and portable air purifier with a humidifier that is designed for a room up to 140-160 sq. ft. The device can process a maximum airflow rate of 150 CFM, which is sufficient for improving the air quality in a small room.

Calculations are made based on the general applications and assumptions are made from relevant room dimension with effective purification rate.[28-29]

### IMPLEMENTATION:

The air purifier and humidifier will be made using a combination of plastic and metal materials. The water reservoir will be made of plastic and will be removable for easy filling and cleaning. The fan and housing will be made of metal to ensure durability and long-term use. The filter will be designed to be replaceable, with replacement filters easily available for purchase. The humidifying element will use ultrasonic technology to convert water into vapor and release it into the air. The unit will be powered by electricity and will have adjustable fan and humidifying settings to allow for customization of the air purification and humidity levels.

**MODAL VIEWS OF THE PROJECT WORK:****Fig1(a):3D View****Fig1(b):Front View****Fig1(c): Side View**

## COMPONENTS AND THEIR SPECIFICATIONS :

### 1. BLOWER FANS



**Fig2:Blower**

### BLOWER DETAILS

Type of blower used is centrifugal blower .these blowers draw air into center of the blowerand air leaves in another direction

Table.2 Blower Specifications

SPECIFICATION	LIMIT
SPEED	3000 rpm
VOLTAGE	12-40 V
RADIUS	3 cm



**Fig3:Cut Out View Showing The Working Of The Internal Parts**





**Fig4 : Fabricated Modal**

### **CALCULATION:**

Blower: Revolutions per minute =  $N = 3000$  R.P.  $MR_{radius} = 0.03$  m

Velocity =  $v = 9.425$  ms<sup>-1</sup>

Area =  $A = 0.00283$  m<sup>2</sup>

Volumetric Flow Rate =  $\dot{v} = 1.6$  m<sup>3</sup> /min Dimensions of Room:

Width = 3 m Length = 4.5 m Height = 3.6 m

Volume =  $V = 48.6$  m<sup>3</sup>

Time required passing all air of room through blower =  $t = v / \dot{v} = 30.39$  min

### **TESTING:**

The air purifier and humidifier will be tested for its effectiveness in purifying air and adding humidity to a room. The unit will be tested in a variety of room sizes and under different conditions to ensure its effectiveness in a range of environments. Air quality testing will be conducted before and after using the unit to determine the improvement in air quality.

### **FUTURE SCOPES & ADVANCEMENTS:**

In terms of future scopes and advancements in mini project reports on water-based air purifiers, there are several possibilities to consider:

**Further research and experimentation:** There is always room for further research and experimentation to refine the design and effectiveness of mini water-based air purifiers. This could involve testing different types of containers, fans, water pumps, filters, and other components to determine the most effective configuration.

**Implementation of advanced features:** Mini water-based air purifiers could be enhanced with advanced features, such as UV-C lights, to kill bacteria and other microorganisms in the water, or sensors that detect and monitor air quality levels.

**Integration with IoT technology:** Mini water-based air purifiers could be integrated with the Internet of Things (IoT) technology to enable remote control and monitoring of the device. This could involve the use of sensors to detect when the water needs to be changed or when the filter needs to be cleaned.

**Use of sustainable materials:** In an effort to reduce the environmental impact of mini water-based air purifiers, future designs could focus on the use of sustainable materials, such as biodegradable plastics or natural fibers, for the components and construction of the device.

Overall, the future scopes and advancements in mini project reports on water-based air purifiers will likely focus on improving the efficiency, effectiveness, and sustainability of these devices, while also integrating them with advanced technology to make them more user-friendly and convenient.

## CONCLUSION:

The air purifier and humidifier with water is an effective way to improve indoor air quality by removing impurities and adding moisture to the air. This unit will be designed to be durable, easy to use, and effective in a range of room sizes and environments. It will be a valuable addition to any home or office looking to improve indoor air quality and create a more comfortable living or working environment. In conclusion, the use of a water-based air purifier in a mini project can provide an effective solution for improving indoor air quality. The water in the purifier helps to capture and remove airborne particles and contaminants, while also adding moisture to the air. This can be particularly beneficial for individuals who suffer from allergies or respiratory issues. The mini project can be designed using readily available materials such as a plastic container, a fan, and a water pump. The purifier can be set up easily and can be used in different indoor environments, such as bedrooms, living rooms, or office spaces. However, it is important to note that a water-based air purifier may not be suitable for all types of pollutants, and it may require frequent cleaning and maintenance to prevent the growth of bacteria and mold in the water. Additionally, the purifier may not be as effective as other types of air purifiers such as HEPA filters in removing smaller particles or pathogens. Overall, the water-based air purifier mini project can be a cost-effective and environmentally friendly solution for improving indoor air quality in certain situations, but it is important to consider the limitations and potential drawbacks before using it as a primary air purifying solution.

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