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## Outdoor Air Filtration System

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**Abstract:** Urbanization and industrialization increased population density in cities and consequently leads to severe indoor and outdoor air pollution. As a result of these trends, the issue of sustainable and healthy indoor and outdoor environment has received increasing attention. Various air filtration techniques have been adopted to optimize indoor and outdoor air quality. Air filtration technique can remove air pollutants and effectively alleviate the deterioration of indoor and outdoor air quality. A comprehensive review on the synergistic effect of different air purification technologies, air filtration theory, materials and standards. It evaluated different air filtration technologies by considering factors such as air quality improvement, filtering performance, energy and economic behavior, thermal comfort and acoustic impact. Current research development of air filtration technologies along with their advantages, limitations and challenges are discussed. Air pollution has become the world's single biggest environmental health risk, linked to around 7 million deaths in 2012 according to a recent World Health Organization (WHO) report. The new data further reveals a stronger link between indoor and outdoor air pollution exposure and cardiovascular diseases, such as strokes and ischemic heart disease, as well as between air pollution and cancer. This project aims to drive the future of air filtration technology research and development in achieving sustainable and healthy building ventilation.

### I. INTRODUCTION

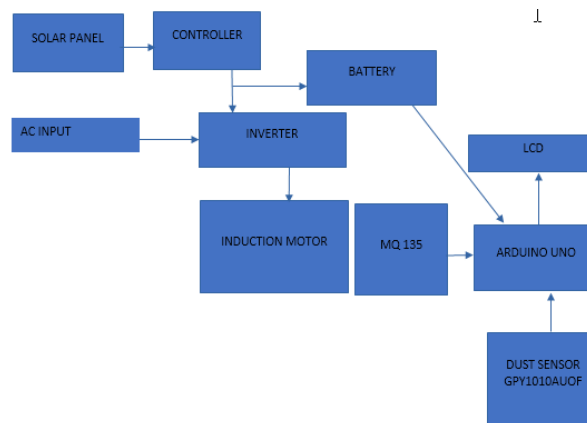
Pollution has rocked the world with skyrocketing pollution levels. Though the long-term solution to the pollution problem lies in finding and minimizing pollution sources, we need to bring the current pollution levels under control by the time. The best way of controlling pollution is by using air purifiers. But regular indoor air purifiers are small low power devices that don't possess enough purifying capability needed for outdoor spaces. Even though indoor air purifiers help. For controlling air pollution, we need reliable, low-cost device to tackle these problems. This Air filtration system can be used to clean the air up to hundred cubic meters of its surroundings. This device can also be used for very large spaces. By using solar energy, it can be used without any external power source. Can be used in very crowded areas and educational institute and so on. This device can help maintain safe environment for people. An air purifier or air cleaner is a device which removes contaminants from the air in a room to improve indoor air quality. These devices are commonly marketed as being beneficial to allergy sufferers and asthmatics, and at reducing or eliminating second-hand tobacco smoke. The commercially graded air purifiers are manufactured as either small stand-alone units or larger units that can be affixed to an air handler unit (AHU) or to an HVAC unit found in the medical, industrial, and commercial industries. Air purifiers may also be used in industry to remove impurities from air before processing. Pressure swing adsorbers or other adsorption techniques are typically used for this. Air filters, and primarily those intended for ventilation of living and working spaces, are classified by efficiency in the CEN/EUROVENT classification, much depends, in their selection, on the degree of protection required and the volume of air to be treated. Actual requirements can range from normal room protection to the supply of sterile air for critical processes and biomedical applications. For positive protection against sub-micrometre particles and small particles of up to 5–10  $\mu\text{m}$ , filters capable of an absolute cut-off are essential. This sets on specific limits.

### I. SCOPE OF PROJECT

Past few decades the air pollution is getting worse and people are dying because of that. To solve this problem, we need clean air. So, by making air filtration system for large spaces and outdoor we can reduce the air pollution. This project aims to make air filtration system for large spaces and outdoor. It's the basic solution which can be done. We need to reduce the rate at which the pollution happens but immediately we need to reduce the pollution. By making use of this device, we are planning to control the pollution. It's slightly disgusting to think about, but many of the viruses that make us sick are found in the air we breathe. When someone who is sick sneezes or coughs, they expel infected droplets into the air. Those droplets remain in the air and may be inhaled by others later, causing illness. Diseases ranging from the common cold to COVID are spread via airborne transmission. Whether it's because of pet dander, seasonal pollen, or dust mites, allergies are commonly triggered by the air we breathe. Home air

purifiers effectively filter out a wide variety of airborne contaminants that lead to allergy symptoms like watery eyes, wheeziness, and overall discomfort. A 2018 study found that air purification systems provided significant relief for allergy sufferers over a four-week trial period. One of the long-term benefits of an air purifier is the support it provides to your air conditioning system. An air purifier can help extend the life of your AC by removing airborne contaminants that add an extra burden on your system. Researchers from the University of Denmark discovered that the quality of the air we breathe has a major impact on our sleep quality. It's as important as the temperature in the room and noise levels. With lower risks of heart disease and obesity directly correlated with proper sleep, it's clear that enough rest is a critical component for overall health. Consider air conditioning with air filtration or purification systems that can help improve your sleep quality. Air purifiers suck dust and other airborne pollutants right out of the air, trapping the particles within internal filters inside of the device. This means less dust finding its way into nooks and crannies throughout your home. But not all air purifiers rely on a passive filter-based approach to fight indoor air pollution. Ever traced your finger over a surface in your home, and found it caked in dust? Even if you frequently clean, getting rid of dust can feel like a Sisyphean task with no end in sight. Luckily, an air purifier system can actually help you in your struggle.

## II. BLOCK DIAGRAM & CIRCUIT DIAGRAM



### Block diagram specifications

**Solar panel:** solar panel is kept outside to collect solar radiations to generate required electricity. it has the output of 20W.

**Controller LM2596:** it controls the input power supply.

**AC input:** it is the main supply for the system to operate.

**Inverter:** it converts AC supply into DC supply. The output of 200KVA.

**Battery:** we are having lead acid battery for the back up purpose of output 7 Ah.

**Induction motor:** to suck the air from outside we fixed the two motors of output 28W and 38W.

**MQ 135 sensor:** it senses the carbo hydrate gas in the atmosphere.

**Dust sensor GPY1010AUOF:** it senses the dust in the air specifications are discussed after.

**LCD:** which displays the output data.

**Arduino UNO:** which controls the sensors and helps to display.

### CIRCUIT DIAGRAM

IN THE BELOW FIGURE WE HAVE SHOWN AIR MONITORING SYSTEM CIRCUIT DIAGRAM. IN WHICH THE SENSORS ARE CONNECTED TO ARDUINO AS SHOWN IN THE ABOVE FIGURE. THE SENSORS LIKE DUST SENSOR GPY1010AUOF IS CONNECTED TO ANALOG INPUT A0 AND

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A1 and MQ-135 sensor is connected to analog input A2 and A3. and MQ-7 is connected to analog input A5. two of output from dust sensor is connected power of the Arduino board which is again inter connected with LCD display. 16x2 Display is used here and the inputs the display are connected to board as shown..

Fig: Air monitoring circuit diagram

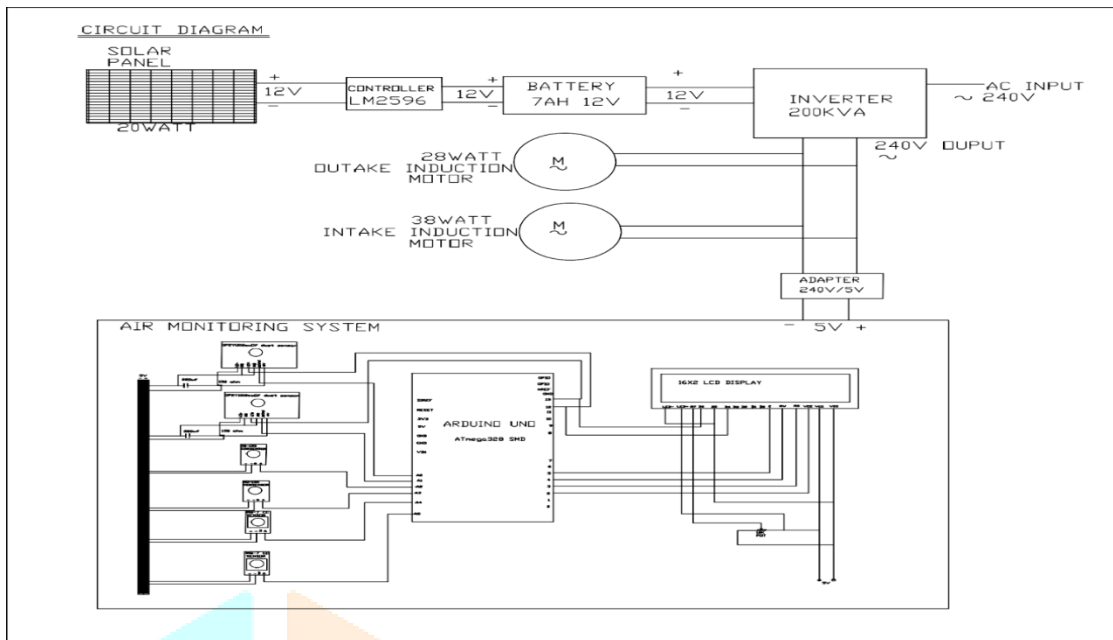


Fig:overall system diagram

As mentioned in the earlier circuit diagram of the monitoring system the system is connected to the external supply of 5V. At first the solar panel output is connected to controller LM2596 of 12V output supply. Again, it is connected to battery of 7Ah capacity for backup. Inverter is which converts supply from AC to DC. Two induction motors are connected to supply air to purify of output 28W and 38W.

**DESIGN OF BODY AND CONSTRUCTION**

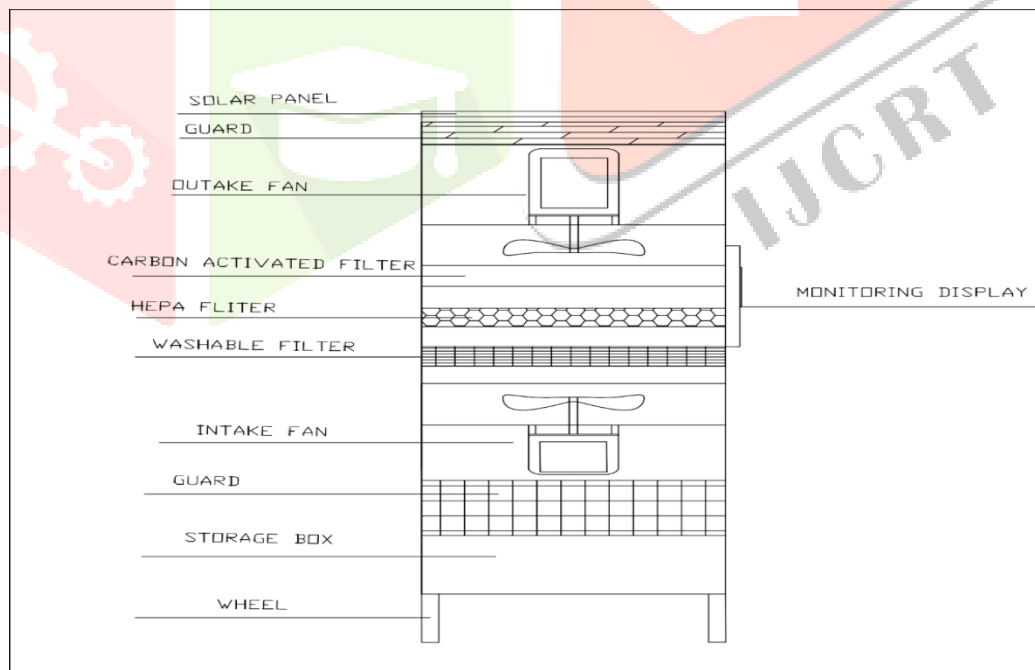


Fig:Body design

The outdoor air filtration system is consisting of BLDC motors, air filters and air quality monitoring unit. This system has multiple layers of filters and we are using renewable solar as a source. Where solar panel is connected to chopper and then to battery. And for fan rotation we are using BLDC motor. For measurement of quality of air and working consumption and capacity of system is monitored through monitoring unit or display unit. It can be fitted in area of 2 square meter. Here we are using five filters they are UV light filter, HEPA filter, carbon activated filter, ozone filter and washable filter. In air quality monitoring unit consist of MH-Z19 carbon dioxide sensor, PM503 VOC sensor, MQ-131 ozone sensor, PMS5003 particle concentration sensor, LCD display this all are connected to Arduino pro mega.

### Construction

- As we can see from the above figures, we first built the outer body part with welding within required dimensions.
- As we can see from the above figures, we first built the outer body part with welding within required dimensions. And then we fitted solar panel at angle of maximum solar radiations absorbing points.
- One blower exhaust fan is fixed inside the top of the body so it can suck the air with pressure.
- The first layer of filter is fixed properly. the first one is washable filter.
- Then HEPA filter is fixed above the washable filter.
- activated carbon filter is fixed above the carbon filter because air is sucked from the bottom part of the system.
- And HEPA is the filter which absorb maximum air and filters more so we are planned purify the air maximum at first case.
- And one blower fan is fixed again bottom at the system.
- Supporting stands are given for balancing and moving purpose.
- At last, we fixed the air monitoring system for getting data's as we expecting after purifying process.
- Inside of the chamber is filled with thermocol and cardboard so excess impurified air cannot pass through.
- Sensors are fixed in section of filters.so it senses the content of air and gives the data in monitoring system.
- Display is there to show the outcome data of ait quality.

### III. WORKING METHODOLOGY

Most outdoor air purification technologies come from industrial waste gas and related gas treatment technologies. The technology is divided into three main categories: dust removal technology, gas purification and sterilization technology. The main outdoor air purification technologies include filtration purification, activated carbon adsorption purification, water washing purification, electrostatic purification, plasma purification, photocatalytic purification and other purification technologies. Here outdoor air dust removal technology is derived from atmospheric dust removal technology. The most common methods are fibre filtration and electrostatic dust removal. Activated carbon filtration is still the most common method for gas purification, and ozone and ultraviolet radiation are the most commonly used sterilization techniques. We are now using carbon, washable and HEPA purifying methods.

#### Overall method of work

- At first air is sucked through air blower fan from four sides.
- Then air passes through the washable filter and HEPA filter purifies it.
- Again, it passes through activated carbon filter and purifies.
- At last, all purified air passes out and monitoring.
- During passing out process the sensors are used to read or sense the air quality and gives information to the main controller.
- One exhaust fan is fixed so by putting pressure on air it can suck the air.
- All the air is out through filters with better quality of air and through display we can get the data.

### IV. CONCLUSION

The main focus of this project is to get better quality of air in different methods by using multi filters. And we are hoping in getting that.

This project includes the fact of purification of air where air can be treated well enough to breath from polluted air. This method of purifying air is natural where we are using renewable energy so it is outdoor air filtration system. Can be kept outside and can use without electricity supply.

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