



# SOLAR OUTDOOR AIR PURIFIER WITH AIR QUALITY MONITORING USING IOT

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**Abstract**--Air pollution has become a serious problem these modern days. Air pollution is present outside in the environment and has become difficult to provide safety inside the house. This polluted air can cause many serious health problems in cities. If someone is suffering from breathing problems like Asthma or Sinus or suffering from any lung problem then air-purifier acts as a surviving tool. Air purifier reduces the chances of health issues caused by indoor pollutants, which directly trigger neurological problems, respiratory infection or symptoms in asthma suffering. Hence, the fabrication of a low-cost solar-powered air-purifier made using a HEPA filter, Activated Carbon Filter, Solar Panel, and some miscellaneous components that can become a low-cost but efficient alternative for surviving in such difficult times. This air purifier uses various processes like filtering large dirt particles on the first pre-filter, then capturing dust particles and smoke molecules at the HEPA-filter, and uses Carbon-filter to capture microparticles produces clean purified air. The analysis and results conclude that the Air Purifier can produce 96 percent of clean air and can run up to 14 hours a day by a solar-powered system.

**Keywords**—Air pollution, HEPA filter, IOT, Carbon filter, Solar.

## I. INTRODUCTION

An air purifier is a device which removes all air pollutants from the air and it is used for improving air quality index. Air purifier made using HEPA filter, Activated Carbon Filter and some miscellaneous components that can become an efficient alternative for surviving in such difficult times. This air purifier uses various processes like filtering large dirt particles on the first pre-filter, then capturing dust particles and smoke molecules at the HEPA-filter, uses Carbon-filter for capturing micro-particles, and hence produces clean purified air. After the Industrial Revolution, air pollution has become a serious problem and has become a major concern in today's world. Many reports published by various organizations stated that 4.21 million individuals died prematurely in 2012 as a result of air pollution. So, we have to work upon this major crisis. In spite of the fact that there are many types of air purifiers that are available in the market, none of them is working on solar energy with good efficiency [4].

## II. PROBLEM STATEMENT

Air pollution has become a serious problem these modern days. Air pollution is present outside in the environment and has become difficult to provide safety inside the house. This polluted air can cause many serious health problems in cities. Due to this people are suffering from breathing problems like Asthma, Sinus, suffering from any lung problem.

## III. LITERATURE REVIEW

Subramanian Sundarrajana, et al evaluated in his research papers that, HEPA filters and activated carbon filters are effective in clearing dirt molecules from the air. HEPA filters do have an efficiency of up to 99.97% in filtering micro particles and disinfect micro-organisms present in the atmosphere [1].

Aditya Roy, et al evaluated that, the process of air purification using Ultra Violet (UV) light as a filtration medium is very simplistic in nature. A source of UV radiations is selected appropriately which emits UV radiations in the surrounding medium. Polluted air is made to pass through this medium as a result of which, the bacteria and pathogens present in air get filtered out. UV filters are responsible for removing only microbes and pathogens from air and do not contribute in PM filtration [3].

Ping Zhou, et al evaluated that, the electrostatic purifier is a kind of electrostatic air filter, which has better purification effect on the larger particulate pollutants. However, the electrostatic purifier is being phased out because it will produce secondary pollutants such as ozone while working [5].



IV. METHODOLOGY

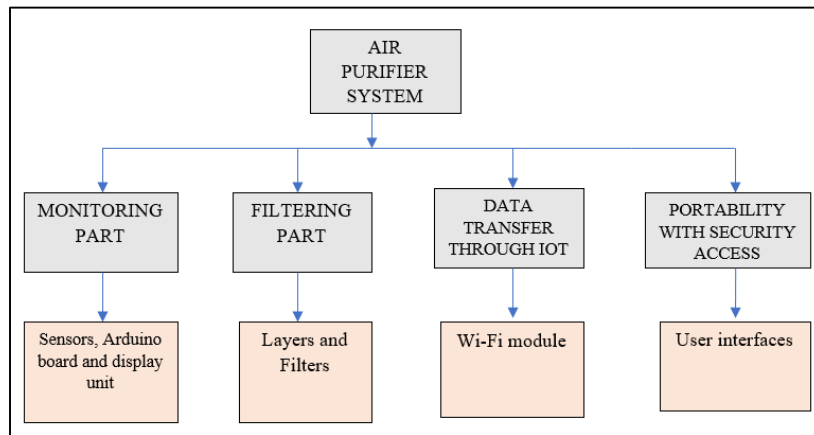


Figure 1: Block diagram of Air purifier system

The above figure 1.2 shows the block diagram of air purifier system which describes features and their requirements for the process.

A sensor system, Wi-fi module and display units are included in the monitoring part of the system to monitor the number of pollutants present in the air as it enters the system and the amount of air purification when the air leaves the system.

The filtration part of the system includes HEPA filters, activated carbon filters, UV layers, and silica layers. These filters play a vital role in cleaning polluted air before entering the system.

Data transfer is another key feature through which monitored data can be transferred to servers like pollution control boards. Portability with security access is another key feature that allows the system to be transferred from one place to another. If the system is portable, there is a chance of theft. So, to avoid this, a security access feature is included.

V. BLOCK DIAGRAM

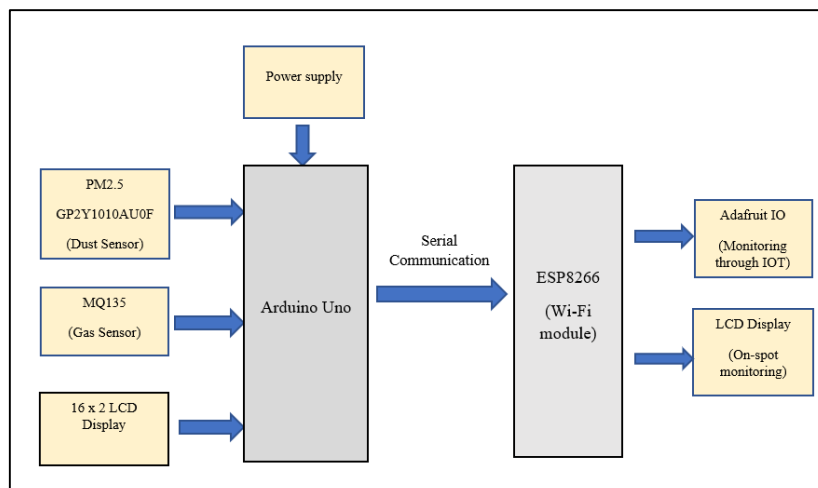


Figure 2: Block diagram of monitoring part

The Sensors used in monitoring part involves Dust sensor (PM2.5 GP2Y1010AU0F), gas sensor (MQ135) in order to measure the concentration level of pollutants present in the environment and to measure the purified air which was blown by the system by performing filtering operation. The main functional Unit of monitoring part is ESP8266 which is a wi-fi module used in because to publish the monitored data in the IOT web platforms.



In this case we are trying to interface four sensors to perform monitoring operation, but ESP8266 consists of only one Analog pin (A0). So, this is not sufficient to interface four sensors at a time so we need to perform Serial Communication to achieve this part. Serial communication refers to the process of sending and receiving data one bit at a time, sequentially, over a single communication channel. It is a common method used for transferring information between two devices, such as a computer and a microcontroller or two microcontrollers.

To achieve Serial Communication, we have used Arduino UNO which consist of six analog pins (A0 – A5), that is sufficient to interface four sensors at a time. The output of the monitoring part can be seen in two ways one is from Adafruit IO and from Spot monitoring.

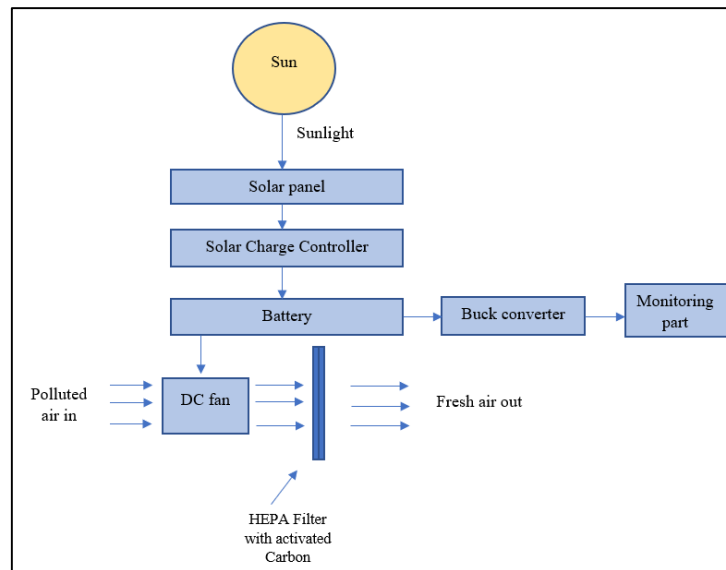


Figure 3: Block diagram of filtering part

The Solar Panel captures sunlight and converts solar-energy into electrical-energy, then sends it to Solar Charge Controller to handle the unstable current. The Solar Charge Controller supplies stabilized current with 12 Volts to the battery. The battery stores the current according to its respective capacity.

From Battery power is divided to DC fan and for Monitoring part through Buck Converter.

DC fan requires 12V and 1.5A for filtering operation. A buck converter or step-down converter is a DC-to-DC converter which steps down voltage (while stepping up current) from its input (supply) to its output (load). The Connected DC Fan Sucks the polluted air from the environment and releases the fresh air which was filtered using HEPA filter with Activated Carbon.

## VI. ADVANTAGES

- Eliminates harmful chemicals from outdoor environments
- Reduces the Chances of Airborne Diseases
- Removes Harmful Radon
- Neutralizes Unpleasant Odours
- Can Increase Life Expectancy
- Low cost and portability

## VII. APPLICATIONS

- Industrial areas
- Bus stands and railway stations
- Streets and metropolitan areas
- Mining areas



## VIII. RESULTS AND CONCLUSION

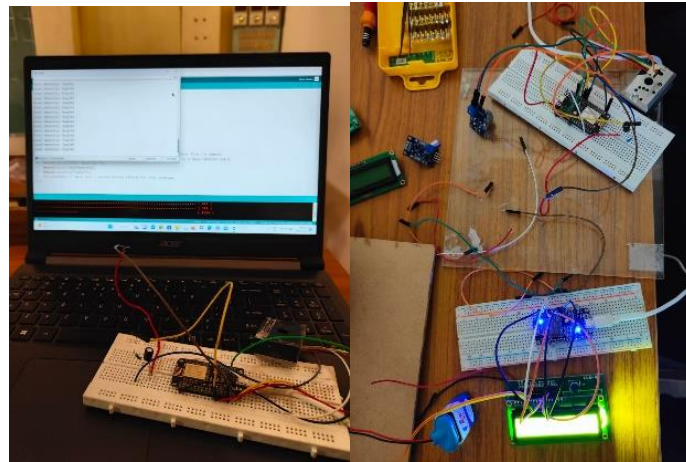


Figure 5: Monitoring part



The purpose of this project is to develop a portable solar outdoor air purifier and monitoring system. The idea is to reduce air pollution in outdoor environments as much as possible by using a set of filters. The air purifying system is specially designed for industrial areas, bus stands and railway stations, mining areas and busy streets.

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