Solar Powered Portable Air Purifier

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Abstract- - This research paper is about designing an air purifier system which is powered by solar energy and testing the effectiveness of the system to curb the air pollution. The focus is on extracting the suspended particulate matter from the air which are the major contributors in the pollution of air in many urban cities. It works on a non-conventional method and intents to achieve best possible air purification results using eco-friendly and economical method. The principles of all four filters that we will be using are different. Principle of HEPA filter is it works by forcing air through a fine mesh that traps harmful particles such as pollen, pet dander, dust mites, and tobacco smoke, Principle of Carbon filter is that they remove pollutants from the air with a process known as adsorption, UV filter, principally work by reflecting and scattering the UV radiation, while the organic UV filters, or also called chemical UV filters, absorb the light and Cotton filter working is the cloth will swell in alkali solutions to create a better gasket effect during filtration. The fan, arduino, MQ135, LCD in system is operated with the help of solar energy, produced by solar panels, which converts the solar radiations into electricity.

Keywords—Pollutants, Filters, gasket effect

I. INTRODUCTION

As we know that air pollution level in cities is very high. Most of pollution comes as by-product from vehicle and construction of buildings, these are in form of particulate matter which are like methane, carbon dioxide, dust particulate etc. These create a lot of health problems like respiratory illness, decreased lung functions, development of diseases like asthma etc. Larger dust particles are major particulate among these and if its air quality value is down too minimum then air has very improved quality in which all type of living things can breathe easily.

Although there are many types of air purifier that are available in market but none of them are sufficient enough to deliver its working efficiency in public places like bus stand, near hospitals, traffic signals etc. Many institutes are also not able to afford these because of high cost and installation cost. Government organizations have very low budget for air purifier like extra expenditure. So, it is advisable to develop such air purifier which can cost less and are highly efficient. So, we are making solar powered air purifier, which runs on solar energy with use of filters and also works for longer duration than others

. Our system has multiple stages which simultaneously throws clean air out after filtering polluted air. So basically, there are air purifier already installed in various places like railway stations, bus stations, etc but these systems consume large amount of electricity and cost around 79,000Rs. Whereas our system uses solar power to purify the air and hence there is no large consumption of electricity due to which the price of our system reduces as compared to the already installed systems. It uses component like solar panel, fan, HEPA filter, Carbon Filter, Uv filter, Cotton filter, Arduino, MQ135, DC charge controller, DC choke. The objective for this project is to develop and design concepts for the next generation Air Purifier.

II. PROBLEM STATEMENT

The World Health Organization measures indoor and outdoor air pollution. They report more than 4 million people die each year from indoor air pollution. This number is more than from outdoor pollution. An avalanche-like pollution of the natural environment, including air, has a negative effect on living organisms. This is especially true for residents of large urban agglomerations. The exposures are subjected to residents staying both in the open area and in enclosed spaces. Commonly used room ventilation systems in most cases do not have an appropriate mechanism for monitoring and cleaning the air entering the building. The idea motivating to engage in this problem is the contrivance of providing users, of said above building objects, the access to air devoid of mechanical and chemical pollution, negatively affecting human health.

Air purifier, why do we need it??

- Due to millions of microscopic particles around you, what actually happens is we are not aware to the diseases that may have inserted in your body without you being completely unknown about it which may lead to many affects.
- COPD (Chronic obstructive pulmonary disease), asthma and lung cancer.
- This will result to causing more spread in elder people who are above the age of 60.
- More diseases may spread in dependent demographic of the sub-continent.

- The effective use of the purifier will help to reduce the risk of one's safety in public place. Consequently, maintaining air quality below the satisfactory category (less than 100ppm).
- The use of air purifier will forward the goal of the improving public health and reducing risk towards one's life.
- The long-term use of air purifier along with improving science and technology in the medical field will decrease mortality rates and improve life expectancy.
- Making use of air purifiers will also help us to worry less about the industrial fumes.
- People with weak immune system will also have a very secure environment.
- Making use of air purifier will also help us stay aware about the particles and chemical mycotoxins into the air.

III. LITERATURE SURVEY

1] National Air Quality Index

Awareness of daily levels of air pollution is important to the citizens, especially for those who suffer from illnesses caused by exposure to air pollution. Further, success of a nation to improve air quality depends on the support of its citizens who are well-informed about local and national air pollution problems and about the progress of mitigation efforts. Thus, a simple yet effective communication of air quality is important. The concept of an ai quality index (AQI) that transforms weighted values of individual air pollution related parameters (e.g. SO2, CO, visibility, etc.) into a single number or set of numbers is widely used for air quality communication and decision making in many countries.

2] Identification and Characterization of Particulate Matter Concentrations at Construction Job-sites

The identification and characterization of particulate matter (PM) concentrations from construction site activities pose major challenges due to the diverse characteristics related to different aspects, such as concentration, particle size and particle composition. Moreover, the characterization of particulate matter is influenced by meteorological conditions, including temperature, humidity, rainfall and wind speed. This paper is part of a broader investigation that aims to develop a methodology for assessing the environmental impacts caused by the PM emissions that arise from construction activities. The objective of this paper is to identify and characterize the PM emissions on a construction site with different aerodynamic diameters (PM2.5, PM10, total suspended particulates (TSP)), based on an exploratory study. Initially, a protocol was developed to standardize the construction site selection criteria, laboratory procedures,
field sample collection and laboratory analysis.

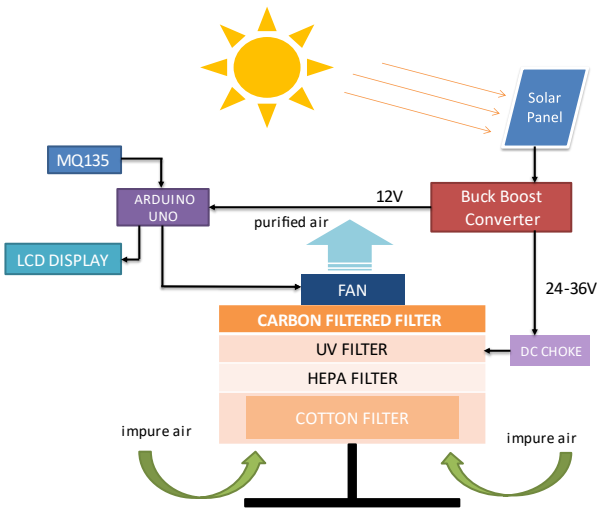
Carbon filtering is a method of filtering that uses a bed of activated carbon to remove contaminants and impurities, using chemical adsorption. Each particle/granule of carbon provides a large surface area/pore structure, allowing contaminants the maximum possible exposure to the active sites within the filter media. One pound (450 g) of activated carbon contains a surface area of approximately 100 acres (40 Hectares). Typical particle sizes that can be removed by carbon filters range from 0.5 to 50 micro-meters. The particle size will be used as part of the filter description. The efficacy of a carbon filter is also based upon the flow rate regulation.

UV air purifiers are designed to use short-wave ultraviolet light (UV-C light) to inactivate airborne pathogens and microorganisms like mild, bacteria and viruses. They have the same ultimate goal of all air purifiers: to reduce indoor air pollutants. The technology is also referred to as UV germicidal irradiation, or UVGI air purifiers. This is different from other air purifier technologies that contain UV light technology but do not use it directly against air pollutants.

On the market, UV-C air purifiers are currently sold as stand-alone, freestanding devices or as systems installed into pre-existing residential or commercial HVAC units. As air is forced through the device, it passes UV lamps, which directly attempt to disinfect the air by means of germicidal irradiation. Rarely a stand-alone product, UV-C light air purifiers often require additional systems for full effectiveness and are most often included in larger High-efficiency Particulate Arrestance (HEPA) air filtration systems. In fact, the EPA says that a UV-C air purifier does not seem effective as a stand-alone unit because it cannot trap or remove particles.

IV. METHODOLOGY

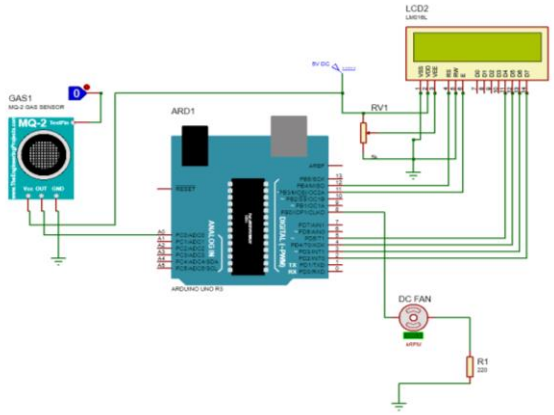
A] BLOCK DIAGRAM



Our Proposed system has blocks shown in above diagram, the solar panel converts the solar energy into electrical energy i.e. dc voltage. To provide a dc stable voltage to the output devices like Arduino and dc choke we have to first filter and regulate the voltage using a Buck Boost converter. This converter provides stable dc voltage at the output which is given to the Arduino which controls the Fan speed depending upon the result of our air quality sensor MQ135. This sensor detects the quality of the air depending upon the pollutants and bacteria present in the air and gives an index number to the Arduino which then depending upon this index value controls the speed of the fan. A similar Arduino circuit is connected at the output of filters to determine by how much factor the quality of the air differs from the input of the filters. The circuit diagram for this Arduino circuit is

given below.

B] CIRCUIT DIAGRAM



We are using Arduino uno for controlling input- Sensor MQ135 and output devices-LCD, fan at the input side and as well as at the output side of our system. Starting with the sensor MQ135, the pin VDS is connected to the 5V DC supply. OUT pin is connected to the A0 of arduino. Next the output device LCD, the VSS pin is connected to the gnd. VDD is connected to the 5V dc supply. VEE and RW are connected to potentiometer. The RS pin is connected to the pin no.12 of arduino. E pin of the LCD is connected to pin no. 11 of arduino. The data pins of LCD – D4, D5, D6, D7 are connected to the pins – 5,4,3,2 of the arduino respectively. And finally, the DC fan is connected to the pin no. 9 of the arduino uno. The index value obtained at A0 pin of arduino from the sensor is displayed on the LCD. If the air is highly polluted then the index value if high and is air is less polluted then the index value is low. The speed of the depends on this index value. Higher the value, higher the speed of rotation of the fan. Lower the value of index, lower the speed of the fan.

V. CONCLUSION

For sustainable development, applying Solar Energy technology which is simple and renewable and that provides us constant supply of electricity; to our air purifier which is used to achieve a better air quality index. In this project, our Solar powered air purifier which can cost less and is highly efficient, which promotes the use of sustainable development and is economical. Also in future, modifications can be made to improve working efficiency without effecting setup.

VI. REFERENCES

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