



Design and Development of Solar Air Purifier Using High Voltage Generator

¹Ali Raza, ²Anas Ibrar, ³Muhammad Zeeshan Gillani, ⁴Mubashir Bakhshesh, ⁵ Muhammad Awais, ⁶Muhammad Usama

Department of Electrical Engineering
Wah Engineering College,
University of Wah

uw-18-ee-bsc-025@wecuw.edu.pk, anas.ibrar@wecuw.edu.pk, uw-18-ee-bsc-016@wecuw.edu.pk, uw-18-ee-bsc-018@wecuw.edu.pk, uw-18-ee-bsc-023@wecuw.edu.pk, uw-18-ee-bsc-010@wecuw.edu.pk,

ABSTRACT

According to a recent World Health Organization (WHO) report, air pollution has become the world's single biggest environmental health risk, causing around 7 million deaths in 2012. The new research also reveals a stronger link between indoor and outdoor air pollution exposure and cardiovascular diseases like strokes and ischemic heart disease, as well as cancer. Some pollutants in the air are poisonous. Inhaling them can result in serious health issues. These days, air pollution is a major issue. If someone has breathing problems such as Asthma or Sinus, or if they have any lung problems, an air purifier can be a lifesaver. Indoor pollutants directly cause neurological problems, respiratory infections, and asthma symptoms, so an air purifier reduces the risk of health problems. A low-cost solar-powered air-purifier made with a HEPA filter, Activated Carbon Filter, Solar Panel, and a few other miscellaneous components that can become a low-cost but effective alternative for surviving in such difficult times. This air purifier uses a number of processes to produce clean, purified air, including filtering large dirt particles on the first pre-filter, capturing dust particles and smoke molecules on the HEPA-filter, and using a carbon-filter to capture micro-particles. Indoor air cleaning systems are widely used. As a result, research into air purification systems for factories and highways is required. Air pollution is becoming more prevalent as the demand for fossil fuels, vehicles, and factories grows. One of the most serious issues is the increase in fine dust. Fine dust is made up of very small particles that are less than 10um in diameter and is difficult to remove because it cannot be seen with the naked eye.

Key words: Fly-back, HEPA, AVR Atmega 2560, Fine dust.

1. INTRODUCTION:

One of the world's major concerns today is providing clean and sustainable energy to future generations. The usage of fossil fuels and the demand for personal automobiles has increased as industry has grown, resulting in an increase in fine dust levels. Sulphate and nitrate make up the majority of fine dust, which generate pollution and affect human health. Fine dust, in

particular, is difficult to remove because it can be seen with the naked eye. Fine dust is an extremely small particle with a diameter of less than 10 m that is difficult to see. As a result, thorough clearance necessitates the use of a fine dust cleaning device. Even on a clear day without smog, significant concentrations of these small particles can penetrate the respiratory system. If this happens, it

may be ejected through the respiratory tract depending on its size, but it will injure the lungs, blood vessels, and stomach. Carbon monoxide (CO), different nitrogen oxides (NO+NO₂=NO_x), Sulphur dioxide (SO₂), ozone (O₃), volatile organic compounds (VOCs), and other atmospheric particles are some of the short-lived species that have the greatest impact on air quality (also called aerosols). Some pollutants, like as NO_x and VOCs, play a vital role in the development of ozone, a key component of city pollution, whereas SO₂, NO_x, and other gases can create Particles, which can cause acerbic rain and other environmental issues.

2. BLOCK DIAGRAM:

A solar panel converts solar energy into electrical energy, which is one of the project's components. The charge controller received this electrical energy and charged the battery. When solar energy is sufficient to meet the load and the battery is fully charged, the charge controller sends power directly to the Marx generator, which is a high-voltage generator. To generate high voltage pulses, the Marx generator uses a low voltage supply. When solar energy isn't available, the battery powers the Marx Generator, which produces high voltage at the electrode. At both ends of the high voltage Electrodes, there are two gas sensors in the circuit. The initial gas sensor detects the pollutants in the air and displays them on the LCD display. Ionization occurs when gas passes through the electrodes, and pollutants are absorbed in the electrode. Another gas sensor detects the filtered gas, and any

pollutants present are displayed on the LCD display.

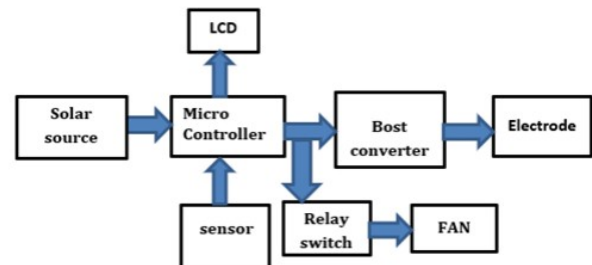


Figure 6.1 :Block Diagram

3. HARDWARE REQUIREMENT:

Design and Development of Solar Air Purifier Using High Voltage Generator is based on the following most important & main equipment's:

1. Electrode
2. Buck converter
3. AVR Atmega 2560
4. MQ-2 Gase Sensors
5. Power Supply
6. Somke Sensors
7. Dust sensors
8. Relay Switch
9. Fan
10. LCD 16x4
11. High Voltage Generator Transformer (Fly-back)

When the power is supply to the generator the primary side of generator which work as inductor store the current in it and when the power is turned off a quick reversal of the generator terminal release the energy stored in the inductor in the form of magnetics field. The diode

which is placed in generator is power diode and it is 17 also called fly-back diode. Because the diode is used to completed the circuit when the power is turned off. Because inductor is needed only one winding so that's why this generator is also called fly-back transformer. When the primary switch is off this system connection has the unique property of transferring energy to the secondary side of the power supply. There are only a few components which are used to create a simple fly-back converter. The energy in the primary side is transmitted to the secondary side through the switching transformer after a switching device off the input DC voltage. This secondary voltage is rectified by a diode and the rectified voltage is stored by the capacitor. A feedback circuit is used to monitor the output voltage in a practical circuit, while a control circuit is used to switches the device. The fly-back transformer is used to store the energy while the ordinary transformer does not store the energy. This transformer is used to operate at high frequency while ordinary one is operating at low frequency. Its core is usually made of ferrite and includes a nonmagnetic air gap across which the energy is stored. While the ordinary transformer is made of an iron core.

4.RESULTS AND DISCUSSIONS:

We will discuss about the simulation and result of this project. We will briefly explain the result of this project in order to show that the output of our project is same as we expected and also what we observed in the software simulation. So, in this chapter we will discuss about both

results software and hardware of the subject system.

4.1. Software Simulation Results:

4.1.1.Input result CASE:

In this case we observed that the air in our environment is not purified, so in this project we came up with a solution. First, we display the dust value in ppm of air coming from the environment and displayed it on LCD. It shows the quality of air, that how much dust particles are present in it and displayed it on LCD shown in below Figure:

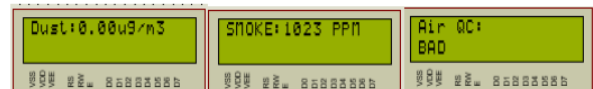


Figure 6.2 :Input results

4.1.2.Output result CASE:

In this second case we observed that the air quality that comes out from the chamber is purified significantly. It displayed the quality of air that how much air is purified and displayed the status of the air that the air is good or excellent. It also displayed that how much dust particle is removed from the air and how much air is purified as shown in below Figure:

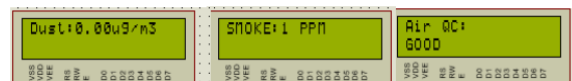


Figure 6.3 :Output result

4.2. Hardware Implementation Results:

4.2.1. Input results CASE:

In this case we observed that the air in our environment is not purified, so in this project we came up with an air purifying solution. We displayed not only the dust contents of input air but the dust contents of air at purified end are also being displayed on LCD. It identifies the quality of air, that how much dust particles are present in it and displayed it on LCD as shown in below Figure:

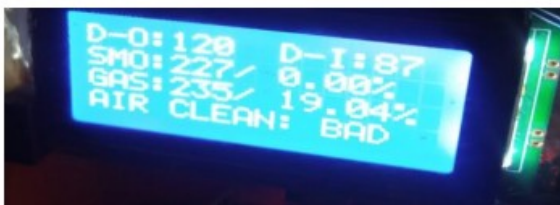


Figure 6.4 :Input result

4.2.2. Output result CASE:

In this case we observed the quality of air that comes out of the chamber. It displayed the quality of air that how much air is purified and displayed at the L.C.D that the air is good or excellent. It also displayed that how much dust particle is removed from the air and how much air is purified as shown in below Figure:

Figure 6.5 :Output result



4.3. Discussion

- To get the high voltage at the electrode side we must use a high voltage generator.
- We cannot supply the voltage directly from solar panel to generator because at night time solar panel does not give the power so that's why we used the batteries to store the energy.
- We use the charge controller because when the batteries charge we supply the solar voltage directly to the generator.

5. CONCLUSION:

Now we can conclude that how the power solar Air purifier filter is efficiency than the other purifier filters. Moreover, it is economical due to use of the solar panel as input and its components are not damage very quickly. And the most important it purifies the air particle more than the other filters. And it has no harmful effects on the environment. We conclude that in this filter we used a HEPA filter which efficiency is very high so that overall the system efficiency is also is high. And we conclude that this system can easily places at any place.

6. FUTURE SCOPE:

As in this project we used HEPA filter which range is lie between 3m to 10m, so in future we can use a filter which range is lie below form the 3 so that it can purify the air more efficiently and system efficiency is increase.

Moreover, in this project we work with high voltage generator which is very risky and costly, so by using the electrode which has low heating point

can easily ionized at low voltage.

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