

Solar Operated Dust Collector

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Abstract—The renewable energy is very important for today's world as in near future the non-renewable sources that we are using are going to get exhausted. The solar operated dust collector is a step in saving these non-renewable sources of energy. Today more than ever we see and feel the consequences of the climate change. From melting ice caps, to the rising sea levels, weather changes and temperature rises, there are more and more natural disasters that we learn about from the news. People have come up with many different kinds of methods and solutions in order to fight these changes but not many of them are as effective as needed. Thus we need to step on more complex approaches and more general and interlinked solutions for solving the pressing problems. The technology that can help us to maintain our environmental climate, and also help in our daily lives. We offer Smart Solar dust collector as one possible solution that can slightly change our way of living for better. Solar dust collector can help us to reduce the pollution. to collect the sun rays, provide a better platform to collection of dust which is helps to environment.

I. INTRODUCTION

The Energy is one of the most vital needs for human survival on earth. We are dependent on one form of energy or the other for fulfilling our needs. One such form of energy is the energy from fossil fuels. We use energy for the sources for generating electricity, running automobiles etc. But the main disadvantages of these Fossil Fuels are that they are not environmental friendly and they are exhaustible. To deal with these problems of Fossil Fuels, we need to look at the renewable energy source of energy. With regard to this idea we have designed dust collector that runs on solar energy. In earlier days we used to the cleaning manually. In further days we use electrically operated vacuum cleaner, but this is restricted for residential & commercial applications only. For cleaning of bigger area the diesel operated dust collectors are used, but unfortunately this more costly and they create pollution due to (diesel, petrol etc). This helps to increase global warming. To reduce this drawback we use solar operated dust collector.

II. BASIC FUNCTIONAL DIAGRAM

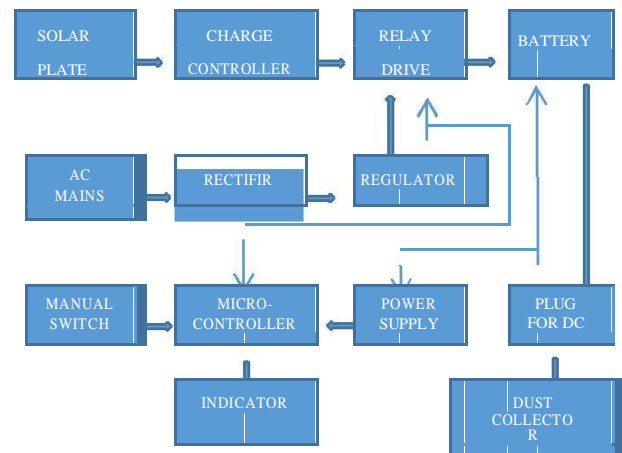


Fig. 1 Basic block Diagram Representation of Solar Operated Dust Collector

The above diagram gives an overview of the working of solar operated dust collector . Sun is the main source of energy for the dust collector. Energy from Sun is captured by the solar panels and is converted to electrical energy. The electrical energy thus formed is being fed to the batteries that get charged and is used to run 12 V DC dust collector. The batteries are initially fully charged and thereafter they are charged by panels. This helps in completing the charging-discharging cycle of the batteries, which is very important for proper working of batteries.

III. COMPONENTS USED

Various types of electrical components were used for making the solar operated dust collector. A list of these components used with their range and the specific quantities that were required for making the solar operated dust collector is given in the following table.

Components used	Ranges	Quantity
Solar plate	74 Watt	1
Battery	12V/26AH	1
Charge controller	-	1
Rectifier	230AC/12DC	1
Voltage regulator	LM7812	1
Micro-controller	PIC18F458	1
Dust collector	150 Watt	1

Table 1

A. SOLAR PLATE



Fig. 2 Solar plate

The solar panel used in the solar operated dust collector is of the rating of 74 WP. The main point that should be kept in mind while making a solar operated dust collector is the mounting of the solar panel. The panel should be mounted in such a way that it receives maximum sun rays so that it gives its maximum efficiency. For design, we have mounted the solar panel in SOUTH-EAST direction during the time 6 AM to 11.30 AM. After that the panel is changed to a SOUTH-WEST direction. We have used the conventional roof-top mounting technique for the solar panel A 3 feet by 2 feet plywood has been used and mounted on the top of dust collector. The solar cell used in the dust collector is multi-crystalline. The reason behind using the multi crystalline cell is that it is more efficient than the mono-crystalline cell and the rate of conversion of energy is faster in the former. 36 cells are used in the PV module of this vehicle. The upper frame of this solar module is covered with thick glass to avoid breakage of the solar panel.

B. BATTERY

Battery is a device containing an electric cell or a series of electric cells storing energy that can converted into electrical power. Battery produces electrical power from chemical reaction. Generally battery consist of two or more cells connected in series or parallel. There are two types of battery, primary battery and secondary battery. Primary battery called as disposable battery and the secondary battery is called as

rechargeable battery. According to our application we use rechargeable battery (lead acid battery).



Fig. 3 Battery

The lead acid battery is most economical for larger power applications and having more reliable than other batteries.

C. CHARGE CONTROLLER

Solar charge controller play an important role in todays solar systems. The main function of charge controller is to control the overcharging of the battery. The charge controller is located between the solar plate and battery. When battery is fully charged then the charge controller plays role of disconnecting the battery from the solar. The design is limited to lead acid batteries, as they are currently the most used type in the isolated photovoltaic applications due to their high capacity and very good price per capacity compared with other battery types. Why would anyone want to use such controller when you can easily connect more batteries in parallel when needed? As one may know, lead-acid batteries can only be connected in parallel to increase the overall battery pack capacity when the individual batteries are of the same batch and age.

D. RECTIFIER

The rectifier is electronic device that is used for converts alternating current into direct current. (AC to DC Converter). This conversion process is known as rectification. There are different types of rectifiers are available in market but we use bridge rectifier for rectification process in our dust collector system.

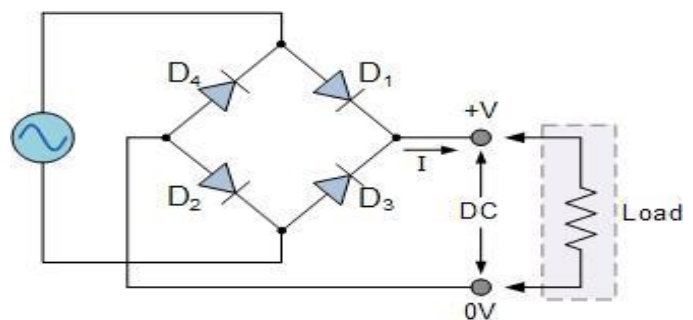


Fig. 4 Bridge rectifier circuit

The input to the rectifier is AC and output is in the form of DC as shown in above figure 3.

E. VOLTAGE REGULATOR

The voltage regulator is electronic device which is used to regulate the output voltage of rectifier and provide stable or constant dc voltage.



Fig. 5 Voltage regulator

There are two series of voltage regulator one is 78xx and 79xx. The 78xx represents the positive series of Voltage regulators and 79xx represents the negative series of the voltage regulator. According to our application we require positive series of regulator (7805 and 7812). 7805 is used for provide the constant 5v dc supply to the PIC microcontroller and the 7812 is used for provide constant 12v dc supply for charging of the battery.

F. MICRO-CONTROLLER

The main function of micro-controller is to indicate charging/discharging of battery by using programming. Peripheral Interface Controller (PIC) is microcontroller developed by Microchip, PIC microcontroller is fast and easy to implement program when we compare other microcontrollers like 8051. The ease of programming and easy to interfacing with other peripherals PIC became successful microcontroller. We know that microcontroller is an integrated chip which consists of RAM, ROM, CPU, TIMERS, and COUNTERS etc. PIC microcontroller is more advanced than the 8051 microcontroller.

G. DUST COLLECTOR

Dust collector is a device which is used for cleaning purpose. Now a days for cleaning more bigger area diesel operated dust collector are available in market , but this collector uses fuels which produces pollution. To overcome this problem we use solar energy, which is totally pollution free and free of cost. In dust collector turbo copper core high speed dc motor is used (100watt, 12v, 8.33amp). when supply given to the dust collector it produce high suction power, this suction power is used for collection of dust.

IV. WORKING

energy. This electrical energy is given to the battery through the charge controller and battery is charged. The function of charge controller is to control the overcharging of the battery. Output of the battery is directly given to the dust collector for its operation. In rainy season sun rays are not available for charging of battery so another method is provided for charging of battery, which is taken from grid. But grid supply is available in the ac form, so by rectification process this ac supply is converted into dc and given to the battery for charging, and further operation.

The picture of the solar operated dust collector is shown below.

Firstly the solar plate collect the sun rays from the sun which is freely available in nature and convert it into electrical.



V. CONCLUSION

The solar dust collector solves many problems related to the environment and is the best pollution free method. We need to make use of them so that we can reduce our dependence on fossil fuels. Solar dust collector do have some disadvantages like, initial cost is high. But these disadvantages can be easily overcome by conducting further research in this area; like the problem of solar cells can be solved by using the ultra efficient solar cells that give about 30-35% efficiency.

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