



Improving the efficiency of solar panel using Automatic Cleaning System

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Abstract: *The large numbers of solar panels are used now days to generate the large amount of electrical energy. As the solar energy is available in large amount and free of cost the solar panels are used to generate the electrical energy from the solar energy. The big problem is that the efficiency of the solar panel is low as compared to the other method like hydro power plant, thermal power plant. The efficiency of solar panel is further decrease due to the effect of dust and dirt takes place on the panel. The dust and dirt reduces the amount of sun rays fall on the solar cells paced inside the glass panel of solar panel. The dust and dirt which are accommodated on the glass of solar panel creates the thin layer of no transparency. This reduces the overall efficiency of that solar panel output. The output power reduced as much as 30-50% if not cleaned for 1-2 month. To overcome this problem and improve the efficiency we have to make the cleaning system which removes the dust and dirt from the glass surface. This improves the transparency of glass and large amount of sun rays reach to the solar cells. Many methods are used to clean the solar panel like use of pressure water, manual cleaning by man power etc. There is risk to the person who clean the panels because of the panels have glass part and metal edges which are dangerous. The automatic cleaning system reduces the labor work and reduces the total cost require to the cleaning as compared to the manual. The automatic cleaning system consists of microcontroller, DC motors, LDR, Brushes. In this paper we discuss about the automatic cleaning system to get the better efficiency of PV panel.*

Keywords: MICROCONTROLLER, DC MOTOR, PV PANEL, RAINFALL SENSOR, LDR, BRUSH.

1. INTRODUCTION

Today there are lots of colleges, small business, offices uses the solar panels for generating the electricity from the solar energy which is free of cost. The electricity production companies like reliance power, adani power now days focus on the renewable energy sources to produce the electrical energy. They use large number of solar panel to generate the pollution free energy. The panels are mostly placed in industrial areas and desert areas where the dust and dirt particles are present in the environment. These particles make the thin layer on the glass panel of the solar panel. This reduces the efficiency of electricity generation of the solar panel which is big problem in now day. The automatic solar panel cleaner sense the dust and dirt layer on panel and remove it automatically. The efficiency of solar panel is limited due to natural conditions so we have to take care about the how we can improve the efficiency. The automatic solar panel cleaning system consist of microcontroller, sensors, the mechanical rollers, water supply system this whole system is implemented to clean the panel. The developed project includes the microcontroller based cleaning system. The dust and dirt reduces the efficiency of solar panel up to 30-50% depending on environmental condition. The cleaning panels by using the automatic cleaning system help us to reduce the labor work and also the expenses on them. The automatic cleaning system is more reliable and economical. The life span of the panel also increases as we clean it regularly. The comparison between the output of solar panel before cleaning and output of solar panel after cleaning clearly shows the improves efficiency. This whole process and results are discussed in this paper.

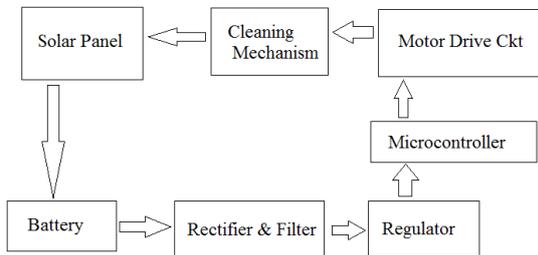


Fig.1 GENERAL BLOCK DIAGRAM

2. METHODOLOGY

1. Block Diagram

Block diagram consist of following components

- Solar Panel
- Battery
- Micro-controller
- Motor Drive Circuit
- Cleaning Mechanism
- Regulator

2. Block Diagram Description

a. Solar panel -

A solar panel is consisting of solar photovoltaic modules electrically connected and mounted on a supporting structure. The solar panel converts the solar radiation into the electricity. The solar panel made of the glass panel which is transparent, below that glass the photovoltaic module is placed.



FIG 2: A SOLAR PANEL

b. Battery –

The electrical energy required for the operation of the cleaning system is provided using a battery. The solar panel produces the electrical energy which is used for the operation of the electrical kit, the remaining power is stored in the battery which

is further used for the operation. Here we use the 12V DC battery for the operation.

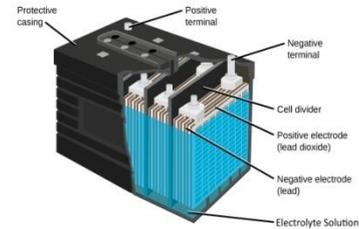


FIG 7: BATTERY

c. Regulator –

The regulator circuit is used to regulate the power supply coming to the controller circuit. The supply coming from the battery and rectifier and filter circuit is 12V DC which we have to reduce to 5V DC for this we use the 7805 regulator. The output we get from regulator is 5V DC which is provided to the Controller Circuit

d. PIC16F877A-

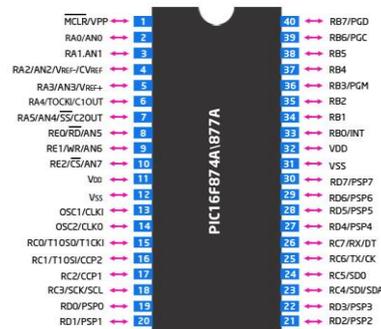


FIG 8: PIC16F877A

The microcontroller used in this system is PIC 16F877A. This controller operates on the 5V DC which is supply from the regulator. The PIC 18F877A is more efficient and uses the less power so we use this type of controller in our system. The controller is like heart of the whole system so it is the most important part of the system. The all operations which we have to carried out is controlled by this controller. The input to controller is all sensors and the output is operation of motor.



e. Motor Drive Circuit–

The motor drive circuit consists of the relay circuit. We use the two relays for the operation of the motor. The relay gets operated from the signal coming from the limit switches. The two switches are connected to the two relays. The relays are used to change the operation direction of the motor i.e. forward or reverse. This control the whole operation of the motor used for the cleaning mechanism.

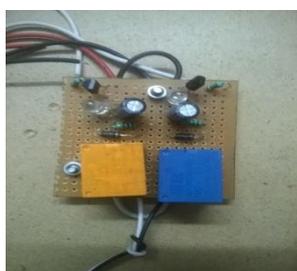


FIG 9: MOTOR DRIVE CIRCUIT

f. Cleaning Mechanism-

The cleaning mechanism consists of the roller cleaner and the water mechanism. The roller used for the cleaner is made of the soft material and the water spray is used for the proper cleaning of the panel. The roller starts rolling down and up using the chain wheel mechanism. The cleaner roller placed in such manner to make contact with glass surface of the panel to as to clean it properly. The wiper motor is used for the movement of the roller and another motor used for the supply of the water.

3. RESULT

By using the automatic solar cleaning we remove the dirt and dust which get deposited on the solar panel front glass. This reduced the efficiency of the solar panel. The observation is takes place on the solar panel with dust and the solar panel without dust. The result output is impressive the difference between the dusty solar panel output and the clean solar panel output simply show the effect cleaning system.

We take reading on solar panel and we observe the improved efficiency up to the 15-20% compare to dusty panel. So we can use this or apply the system to improve the efficiency.

4. CONCLUSION

Our project mechanism is more suitable in dusty areas where the solar panels are installed in large amount. The mechanism is more easy to use and install, this helps to improve efficiency and reduce the labor work and money spending on them. The system is more flexible and can be installed on solar panels available in large amount.

5. REFERENCE

- 1) Design and automated cleaning system to improve efficiency of photo voltaic cells Indian J.Sci.Res.14 (2):376 378,2017
- 2) Automatic solar panel cleaning system, IJARSE Volume No.07,Special Issue No.07,2018 www.ijarse.com
- 3) Microcontroller Based Automatic Cleaning Of Solar Panel ,International Journal OF Latest Trends in Engineering and Technology (IJLTET)
- 4) Design and implementation of microcontroller based automatic dust cleaning system for solar panel. (IJERAT) ISSN 2454-6135 special volume. 02 Issue 01, May-2016
- 5) Solar panel dust cleaning system. (IJIACS) ISSN 2347-8616 Volume 7, Issue 3 March 2018.