RESEARCH ARTICLE OPEN ACCESS

"Economical Automatic Solar Panel Cleaning System using arduino."

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ABSTRACT –Solar energy is the biggest renewable energy option nowadays and thus people are moving forward towards it but when there are different kind of debris are there on the solar panel the efficiency will not be get as it is designed for and there will be around 40% power loss due to it so there is a need to develop a system which will improve the efficiency of the solar panel so the Automatic Solar Panel Cleaning System is a system which uses the sensors such as water drop sensor, temperature and humidity sensor, light sensor, all the sensors are used to measure the impact of the different environmental effect on the solar panel for electricity generation. Guide-ways are use to glide the cleaning wiper all over the solar panel surface. Cleaning wiper is used to clean the surface of the solar panel. Arduino Microcontroller is use to operate the whole system automatically. Motors are used to operate the guide-ways in different direction like left-right and up-down.
Keywords – Automatic, solar, cleaning ,system ,arduino

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I. INTRODUCTION

Solar panel absorbs the sunlight as the source of energy and then it is converted into the electricity or heating purpose. A photovoltaic module of the solar panel contains the about 6*10 photovoltaic cell. This photovoltaic module represents the electrical phenomenon array of electrical phenomenon system that generates the electricity for various purpose of use. The Automatic Solar Panel Cleaning System is an advanced system used to clean the solar panels automatically in industrial area as well as it is used for the residential purpose too. The sensor embedded in the system is used to measure the various input from the environment and the work according to it. Thus system is useful for cleaning the solar panels which are beyond the reach for humans for cleaning purpose as well as where there is a threat for a human being then this system can be used.

The main and prime agenda for developing this system is there are lots of people who cannot buy the automatic cleaning system just because they are pretty costly and thus they tends to go out for reaching to the solar panels and clean them. This act might prove to be life taking and thus they can be safe via using this product.

Figure 1: Solar panel cleaning system

II. LITERATURE SURVEY

Manju B. et. al. July 2018 – "Automatic Solar Panel Cleaning System". They observed that the energy requirement is increasing day by day and the sources to get the fuel for generation of the electricity are getting less and less. The solar energy is the free and widely available in the surroundings. The 70% of the needs for electricity is fulfilled by the non-renewable energy sources. There are multiple automatic solar panel cleaning systems are available in market but they are so costly that the middle class people who are having the solar panel for electricity generation cannot have that system so

the goal is to build the system which is affordable for the middle class families too.[1]

Nasib khadka et. al. April 2018 - "Solar Panel Cleaner Technology: A Review". They observed that there are so many factors which affect the efficiency of the solar panel. The first and foremost one is dust. Dust accumulation on the PV module surface is the prime factor which affects the efficiency of the solar panel. The main problem of the dust accumulation on the solar panel is in the Asia region and mainly in the area where there is more dust than the average dusty area just like UAE, Kuwait, Saudi Arabia and the countries where there are gigantic desert are situated.

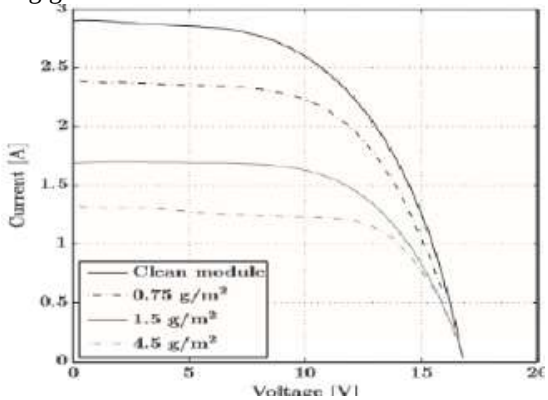

Figure 2: Effect of dust accumulation on panel in Kuwait.

The second factor which affects the efficiency of the solar panel is the temperature and the humidity in the environment. As the temperature increases the incident light has enough energy to raise the charge carries from the valence band to the conduction band and it will create the less generation than the panel which is colder. Same way the humidity will stop the direct contact of incident light of the sun on the solar panel and thus it will fail to produce the designed amount of electricity. The following figure shows the temperature effect on the panel.[2]

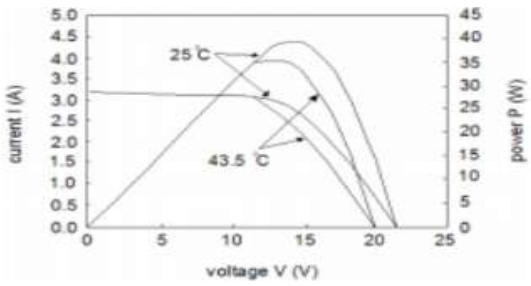

Figure 3: Effect of two different temperatures on P-V and I-V module

Akhil Mishra et. al. September 2017 – "Study of solar panel cleaning system to enhance the performance of solar system". They observed that there are various factors which affect the performance of the solar panel system and it has to be clean to get the maximum output. Also there are different techniques are there which can be use to clean the solar panel. First one is natural removal of the solid contaminants like solid dust with the help of the natural wind or the gravitational force or with the help of the rainy water. The method to clean the solar panel is with the help of mechanical instruments like manually operated robot or a robotic arm which is remote controlled. Also the brushes or wiper are used which not that much effective against the small dust particle because it cannot reach to the dust particle which are trapped in the abrasive surface of the solar panel. The most effective method to clean the solar panel is electrostatic dust removal in which if the solar panel has high electric potential, the charged and uncharged dust particle will attract because they have the electrostatic force. Then, the particles will have be charged by the panel and they will have the same charge as the panel and as the scientific rule there will be a repulsion between the same electric charge and finally the dust particle can float away from the solar panel. But the main problem in this method is that it is almost not useful in rainy season due to the accumulation of so many dust particle in a small area when there will be a drizzling rain only.[3]

Nagesh Naik et. al. April 2019 – "Automatic Solar Panel Cleaning System". They observed that dust is not the only problem which causes the decrease in the efficiency of the solar panel, improper utilization of the incident solar radiation on the earth is also the cause in the decreasing in the efficiency of the solar panel. Thus cleaning with different methods is not only the way to increase the efficiency of the solar panel. One can increase the efficiency with help of acquiring the maximum amount of the solar radiation and get the maximum output from it. This can be achieved with help of systems called sun tracking or maximum power point tracking. This solar ray's tracker will help the solar panel to be at the optimum position perpendicular to the solar rays in daylight time. This will increase about 40% of output than the one without tracker. Also at the end of the day the solar panel should be in it is original position that it can start collecting the solar energy from the beginning of the day itself.[4]

Swanand S. Wable et. al. July 2017 – "Design & Manufacturing of Solar Panels Cleaning System". They observed that in the conventional cleaning of the solar panel there was lot of waste of water and particularly in the tropical region where there are lot of dusts accumulation will be there on the solar panels then the use of the water will be high when it is cleaned via conventional technique. Thus there is a need for a method which

uses the brush or wiper to clean the system and save the water or eliminate the water use completely. Also in the region where the water plays the crucial role like in dessert area say UAE, the constant need of water is satisfied with the help of cleaning the ocean water and also that region has the potential to produce the large amount of electricity from the solar radiation so when this both is important then there must be a elimination of the water. Also in the conventional method there is need of human power too while on the other hand in this method the human force are totally eliminated and hence there is no harm or threat to the human being. The robot is used to clean the panels as the cleaning material like bush or wiper is placed and it will clean the panel automatically at the designed interval. Also the robot is a self charged so it will take the power from the generated electricity itself so there is no need for the extra power source to charge the robot too.[5]

III. FUTURE WORK

There is a wide scope of using the mobile and other application based system which can be useful for the cleaning the solar panel automatically. The owner can also keep an eye for the dust accumulation on the panel and the energy generation from the panels using the different sensors mounted on it. According to it one can also press the button on the electrical device and clean the solar panel before it reaches t the pre set value at which the system should run for the better efficiency. The outer panel on which the cleaning system is mounted should have the telescopic length so it can be mounting on different sizes of panels up to limited tolerance. The metal used in the making should be light weighted so it can handle very easily at the time of service. Also the system can be made portable so it can mount and un-mount on the different panels at different places with the same sizes. There will be a wide range of a applications development in this area.

IV. MERITS AND DEMERITS

4.1 Merits

I. The first and foremost merit of using this product is there will be no need of human being for reaching to the panels and risking their own lives for the sake of cleaning only.
II. The prime benefits via using this system are a person is going to get it in a cheap price.
III. The maintenance cost of the product is going to be very less compare to the other available products in the market.
IV. It will be affordable by the middle class families who own a solar energy generation system.
V. It can be controlled with the help of using the application on the mobile phone as well as your laptop or tablet too.
VI. It can be controlled from anywhere in the world if where the internet connection will be available.
VII. The owner can keep the track of the energy generation throughout the day from the mobile application itself.

4.2 Demerits

I. The entire system will be dependent on the arduino chip and the sensors only if one of them will fail the entire system will fail.
II. The cleaning wiper or flappers needs to be changed at the regular interval.
III. The cost of a high end sensor will be more for the better and accurate result and it will be costly for some of the user.

V. CONCLUSION

In spite of the cost, the human life factor is highly concentrated in this project because the prime motive of the production of this product is to help the household solar energy generation plants which are on smaller scales. Automation will lead to the cost cutting of this kind of the product as well as the people who wants to implement the solar energy generation plant on the roof top but as without the cleaning system there will be a continuous decrease in the efficiency is the demerit of the normal solar plant without the cleaning system will be eliminated and the people will be more lean towards the renewable energy rather than depending upon the sources which are getting extinct at the much higher rate than it was expected.

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