

SOLAR PANEL AUTOMATIC CLEANING SYSTEM

Vivek Marathe, Atishkumar Gadhav, Rohit Kangane

UG Student, Department of Electrical Engineering, Sandip Institute of Engineering & Management, Nashik

Abstract-- The photovoltaic cell works under the impact of solar energy. The higher the insolation received perpendicular to the cell surface, higher is the energy generation. Due to the upwards angle of solar panels, they are more liable to a build up the dust and bird dropping which is reducing the amount of light incident on the panel and reducing panel output. So it becomes quite essential to clean the solar panel so as to keep the effectiveness of generation at finest level. The contents included in this paper aims at increasing the efficiency of photo-voltaic cell by resolving the delinquent of accumulation of dust on the external surface of panel. It recommends to undertake the development of a Photovoltaic Panel Cleaning System that can effectively remove the hoarded dust on its surface on a systematic basis. The system is a robotic system which could move autonomously on the surface of solar panels by using pneumatic suction cups and use dry methods for cleaning such as revolving tubular brush and vacuum scrubbing system, in guardianship to the point that the availability of water is limited in areas where such plants are mainly located.

Keywords - Locomotion Unit, Pneumatic system, DC Motor, Vacuum Pump

I. INTRODUCTION

The resolution of the arrangement is to improve a structure for spontaneous and automatic solar panels washing, for the escalation in the efficiency of panel and energy output from these panels. It is publicized that PV-panel efficiency may be bargained by up to 5% to 10% from the build-up dust particles alone. Accumulation to this point, is the other factors that contribute to the problem such as tumbling leaves, bird dropping and water zipping, the efficiency of these panels can be supplementary reduced to as much as 10 –30%. As in the case of housing use, the significance on cleaning is not that much and mainly depends on contractual cleaning services which incurs cost. Also, solar panels are usually placed on the roof or terrace to receive the maximum amount of sunlight. Additional influence taken into contemplation was that solar panels be likely to be positioned in areas where there is a lot of daylight and very little rain. Also there is a requirement to govern at what time to sanitize the solar panel since having it cleaned all the time would be equally a waste of power or energy. Additionally, we could not depend on there being a reduction of power from the panels as a method of determining when it should be cleaned since a whole cloudy day would also result in a reduction in absorption of solar rays. [1] The accumulation of dirt on solar

panels ("soiling") can have a substantial impression on the enactment of photovoltaic systems in regions where rainfall is imperfect for a dry season of a number of months. The adverse impact of soiling on solar collectors, and the mitigation of the related energy yield losses, are the main scopes of this paper. While soiling related losses have been studied more extensively for flat-plate photovoltaic (PV) panels, this revision concentrates chiefly on the influence of dust amassing on concentrated photovoltaic (CPV) and concentrated solar power (CSP) systems. We report on different methods used for cleaning solar collectors:

- (i) Natural cleaning by rain and snowfall
- (ii) Manual cleaning by water and detergent
- (iii) Electro-dynamic screens (EDS)

Majority of the large scale solar sites are built in desert environments, benefiting the high radiation. At the similar hit, these locations grieve from recurrent dust storms and fabrication losses related with dirtying. Existing physical scrubbing resolutions are neither operative nor ascendable, and necessitates thousands of liters of water which are scarce resources in these geographies. A successful design should operate without the use of water. This will help solar panel arrays achieve a production output closer to their maximum potential and save companies on costs associated energy generation. The current apparatus utilizes a brush cleaning system that operates on pre-programmed cycles.

II. EFFECT OF DUST ON SOLAR PANEL

The accumulation of dust on the surface of a photovoltaic unit diminutions the radiation realizing at the solar cell and produces losses in the spawned voltage and power. Dust not only diminishes the radiation on the solar cell, but also vicissitudes the requirement on the angle of incidence of such active radiation. Conferring to the present examinations, the diurnal energy loss along the year instigated by dust deposited on the superficial layer of the PV module is around 4.4%. In long periods without rain, daily energy losses can be higher than 20%. Moreover, the irradiance losses are not relentless during the course of the day and are sturdily hooked on on the sunlight incident angle and the relation amongst diffuse and direct radiations.

III. COMPONENTS OF SYSTEM

The solar panel cleaning system consists of two basic system unit depending on their functioning, namely Locomotion Unit and Cleaning Unit.

a) *Locomotion Unit*- It is accountable for the association of robot on the external layer of the solar panel. Meanwhile, solar panels are straddled at an angle to ground level so as to capture maximum solar irradiance, the robot cannot rely entirely on the conventional wheel based system for its movement. The inclined surface of the solar panel demands for a locomotion appliance that can twig to the external layer of the panel and avert the robot from slithering on the surface. So the pneumatic suction arrangement that was used together with a double rack and pinion apparatus.

The strategy comprises of two legs existing at the top and bottom of the robot. Each leg has two poignant platform which move comparable to each other with the help of a double rack and pinion machinery. On the base of every single moving podium a Pair of Suction Cups are attached which are connected to a vacuum pump. The functioning of the legs is validated in figure 1. The suction cups get activated alternatively on each of the moving podium level in discrete legs. A rack is attached to each moving platform. When the suction cup in Platform 1 is actuated, it becomes motionless.

The motor committed to the pinion travels in the clockwise track and the pinion moves on platform 1. As a result the rack committed to platform 2 also travels in the forward direction. Once the pinion reaches to the end of the first rack the motor stops and the suction cups on platform 2 actuates making it stationary. In the same time the suction cups attached to platform 1 gets disengaged making it in motion. Now the pinion moves in anticlockwise direction on the rack attached to the platform 2. So the platform 1 now moves in the forward direction. This process sequence repeats themselves for stirring the robot in the forward direction.

b) *Cleaning Unit*- It is accountable for captivating clean and care of the cleaning achievement of the robot. It is positioned perpendicular to both the legs. Both the legs are existent in at the contradictory end of the scrubbing unit. Cleaning unit consists of two main parts, namely, Linear Actuator and the Rotating Brush.

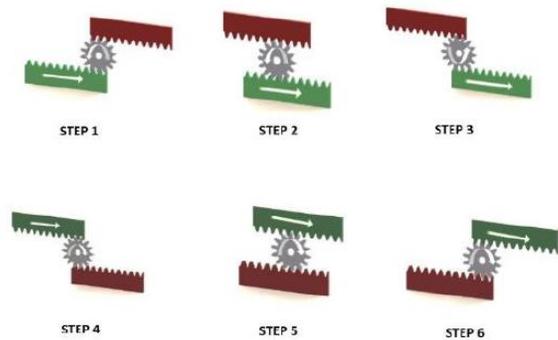


Figure 1- Illustration of Motion

c) *Linear Actuator*- It creates motion in a straight line, in contrast to the circular motion of a conventional electric motor. Linear actuator is used in machine tools and industrial machinery, in computer peripherals, in valve and dam and dampers. There are 12 various categories of linear actuators provisioned upon the apparatus used and power source, namely, power-driven actuators, hydraulic actuators, pneumatic actuators, piezo-electric actuators, electro-mechanical actuators, linear motor and telescopic linear actuators.

d) *Brush*- It is responsible for scrubbing and dusting away of the dust accumulated on the surface of the solar panel. It is attached to the v-slot gantry plate platform which moves in the linear actuator. The brush is mounted on radial bearing which is rotated with the help of a 12 volt DC motor.

IV. WORKING AND BLOCK DIAGRAM

In the automatic cleaning system, when the dust accumulates on the solar panel, microprocessor sends a signal to actuate the system. One DC motor accompanying with the battery start revolving the brush and the other one start rotating the threaded rod. This vertical movement of brush cleans the panels. Solar panel cleaner system contains wheels, brush, motors to run on the surface of panel motors are used for driving the wheels of robot, brushes are used for cleaning the surface of solar panel, jet spray are used for spray of water on panel while running.

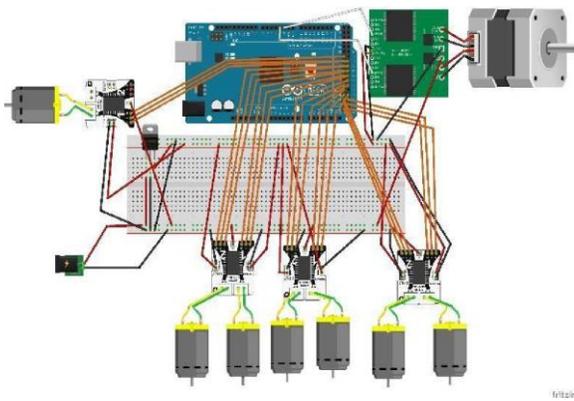


Figure 2- Basic Connections

We are using microcontroller in that timer is used for sending the signal to the motors, when the timer sends signal to the motors that are driving the wheels of robot are start rolling at the same time pumping motors also start, so water is sprayed on the panel by jet spray and by brush it is cleans the surface of panel robot rolls in the upward direction and stops when reaches to the other end of panel and again return backward direction and when reaches to the initial position it stops. Stopper is provided on the both side solar panel so the robot did not falls down. Again according to time set in the timer, it stars rolling automatically for cleaning as per above steps.

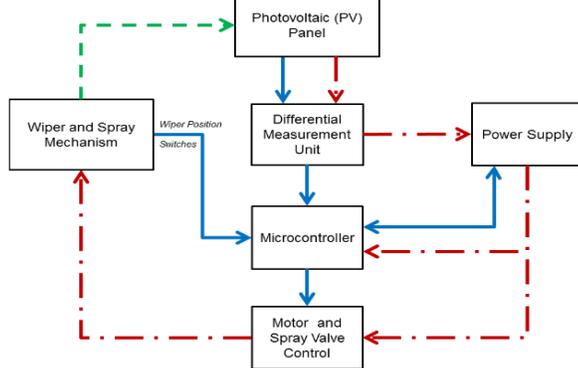


Figure 3- Block Diagram of System

VI. REFERENCES

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V. CONCLUSION

Designed solar panel cleaning system clean the surface of panel automatically by robot by rolling on the surface of panel according to the time set in the timer so no need of manual cleaning, it saves the time and money for manual cleaning. And every day automatic cleaning of panel can be achieved and the efficiency of solar panel regain means efficiency is maintained of particular solar panel.