



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

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Automatic Solar Panel Cleaning Mechanism to Improve Efficiency Solar Panel

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ABSTRACT: This project aims at increasing the efficiency of solar power plants by solving the problem of accumulation of dust on the surface of solar panel which leads to reduction in plant output and overall plant efficiency. The Proposed system is a robotic system which could move autonomously on the surface of solar panels dry as well as wet methods for cleaning such as rotating cylindrical brush. The limited availability of water in areas where such plants are mainly located. The proposed work is to improve the performance of solar grids by using cleaning methodology that includes simultaneous cleaning.

KEYWORDS: Solar power plants, accumulation of dust, solar panel, plant efficiency, proposed system, solar grids, simultaneous cleaning.

I. INTRODUCTION

Solar panel is panels designed to absorb sun's rays as a source of energy. Solar photovoltaic (PV) panels system subsists of solar cells for energy conversion from sun radiations into electricity sunlight is a combination of ultraviolet light, visible light, and infrared light. Only high frequency radiations due to ultraviolet and visible light are converted into electricity, whereas infrared whose emission is less, is converted into thermal radiation. It is positioned in an open environment under the sun and connected to an inverter, to convert the DC energy received from sun into AC energy the life span of solar parks is up to 20 to 25 years, such panels require magnifying the power by producing potential in daily service.

The performance of solar PV Panels will affect negatively due to accretion of dust particles on the surface, similarly as a cloudy day also affects their efficiency. A photovoltaic (PV) module is a packaged connects assembly of typically 6×10 photo voltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 watts. The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 watt modules will have twice the area of a 16% efficient 230V module.

In [1] As stated by the MNRE on their official website, about 5,000 trillion kWh per year energy is incident over India's land area with most parts receiving 4-7 kWh per sq. m per day. There are a few commercially available solar modules that exceed 22% efficiency and reportedly also exceeding 24%. A single solar module can produce only a limited amount of power and most installations contain multiple modules. Robotic cleaning solution is required to serve huge solar panels arrays regular cleaning of the solar panels increases the efficiency., Surface acoustic wave is utilized in [2] to remove the spoiling particles from the surface of solar panel. Cleaning effects of surface acoustic wave are also analyzed in this study where spoiled solar panels are used. Several methods are used to clean the panels, many studies have been taken to develop anti-soiling coating and also manual cleaning techniques are generally used, which requires labour to clean manually by using of bucket, sponge, mop, non-scratching brush and wiper etc.

II. RELATED WORK

One of the major issues that people face with the installation and the use of solar panels is the cost that is involved in it. But the cost can be drastically reduced by increasing the efficiency of each solar panel and hence reducing the number of solar panels that needs to be installed. Using less number of solar panels in order to get the required electricity will not only be cost-efficient but will also help in having a positive impact on the environment. In order to improve the efficiency of the solar panels, there are two main aspects that need to be considered; the first aspect is the amount of light that falls directly on the solar, and the second aspect is how much of this light energy is capable of using effectively in order to generate power. The issue that is faced with the use of solar panels is the dust that forms

over it. Dust on the cells of the solar panels reduces the efficiency of the solar panels to a large extent especially in Saudi Arabia where dust and sand storms are very common. Hence, there will be an automated system that will periodically clean the solar panels in order to make sure that they perform at peak performance level. The use of right fabrication and controllers will help in making this project possible.

In [3] A low cost and simple robotic cleaner system. The system included a tube carrying air to blow the dust and a rolling brush moving smoothly over the panel and cleaning the glass surface with .The parts used for metal connections are wire and the Designs are produced with a 3D printer. Reduced weight and cost of a program designed for SPCR (solar panel cleaning robot), cheap, lightweight, Automatic and low maintenance cleaning. In [4] There machine completes the cleaning with limit and distance sensors and has a changeable battery bank it uses pulley pallet system for pvpanel ,Aluminium sigma profiles used as frame and rail system provide the advantage of lightness to the device. The parts used in connections of materials are filament and the designs are produced with 3D printer. By reduced weight and cost of the designed SPCR (solar panel cleaning robot) system, cheap, lightweight, automatic and low maintenance cleaning will be obtained. In [5],Constructed a 2 wheel drive to clean solar panel consisting of microcontroller unit, battery, ultrasonic sensor, two-wheel-drive (WD) car chassis with DC motor, water pump, water tank, and brushes. There was a 50% improvement at the output current as well as the maximum power before and after cleaning. In[6],Fabricated two-step cleaning techniques. An exhaust fan removes dust from the surface of the panel as much as possible as a wiper made of soft clothes are used to swipe. Therefore, no water used for cleaning.

III. METHODOLOGY

The proposed solar panel cleaning robot is used to remove the dirt and dust deposited on the solar panel thus helping the solar panel to absorb the maximum quantity of energy. The proposed system consists of two main parts, the first is the cleaning robot and the second is the carrier robot. The carrier robot acts as a carrier that carries a cleaning robot by moving from one panel to another. The cleaning robot travels along with the carrier robot, covering the entire length of the panel. The brush which is attached to the cleaning robot takes away the dirt and dust from the panel. The robot is programmed with a microcontroller which controls its operations and its movement from one panel to the other panel. The main criterion of the cleaning system design is its ability to clean multiple panels in a solar farm using a single robot. Such a system is considerably much simpler than having multiple robots in the same farm working simultaneously.

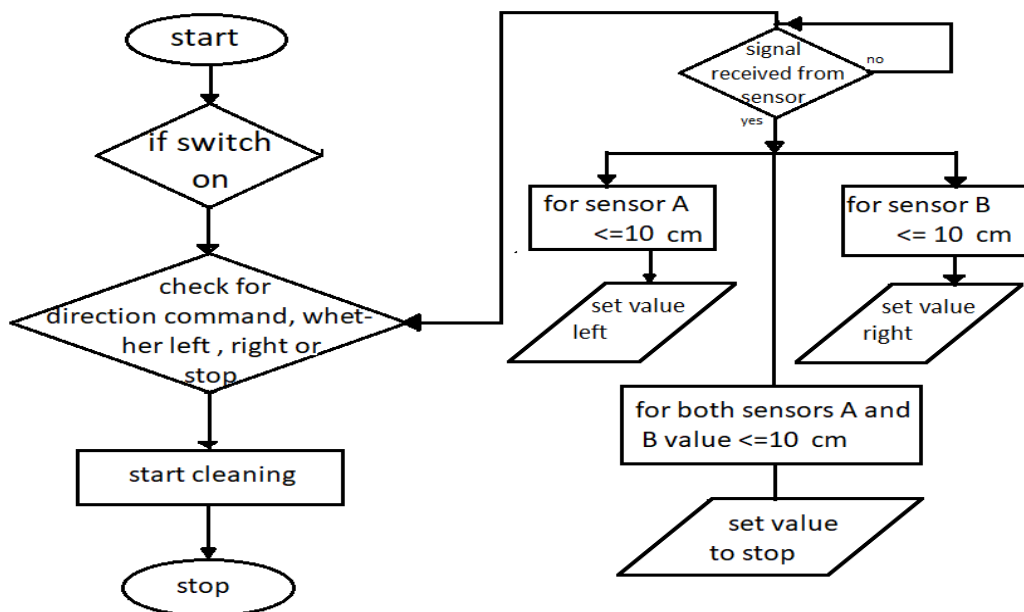


FIG.1 Shows Flow Chart of the program used for solar panel cleaner

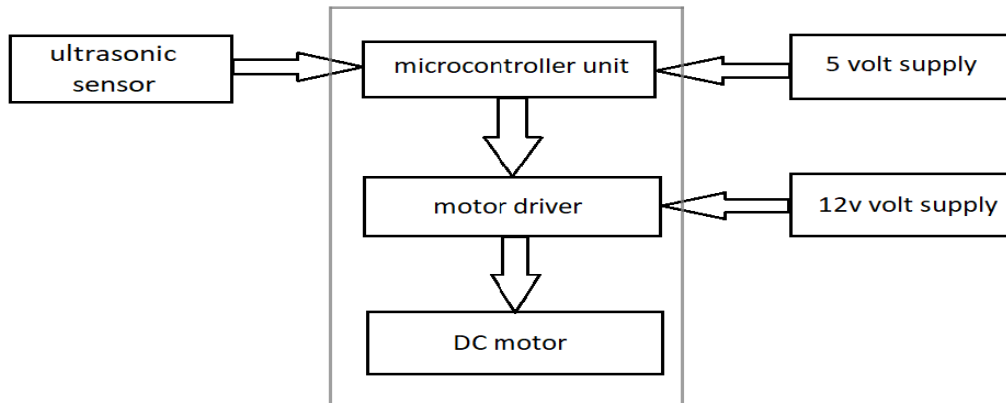


FIG. 2 Block Diagram of Circuit

IV. EXPERIMENTAL RESULTS



FIG. 3 Show Before and After Condition Of Solar Panel after Cleaning

Cleaning of solar panel validate that the proposed solar panel cleaning machine work efficiently . As it can be seen in fig .3 Dust on the panel is Cleaned which will result in increase in efficiency of solar panel output which is the Objective of this project.

V. CONCLUSION

In this paper, an automatic solar panel cleaning system is proposed and built with easily available components and the control algorithm and cleaning sequence are established with the Arduino platform to reduce the operation and maintenance (O&M) cost of large-scale solar and thermal energy harvesting plants and The proposed system reduces the effect of dusting on the output power of the PV panels, it is necessary to utilize a low-cost, durable, automated, and self-cleaning system developed.

As future aspects, the proposed system shall be connected to Internet of Things (IoT) for its operation from the control room/anywhere. The whole objective is to make sure that, at any point of given time window, the system should make sure no dust is present.

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Impact Factor: 8.118



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