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An Overview of Solar Panel Cleaning Robot and Enhancing Efficiency of Solar Panel

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ABSTRACT

Solar energy is that the most abundant source of energy for all the sorts of life on the earth Earth. It is also the essential source for all the sources of energy except atomic energy. But the solar technology has not matured to the extent of the traditional sources of energy. It faces many challenges like high cost, erratic and unpredictable in nature, need for storage and low efficiency. This project aims at increasing the efficiency of solar energy plants by solving the matter of accumulation of dust on the surface of solar array which results in reduction in plant output and overall plant efficiency. It proposes to develop a solar array Cleaning System which could remove the accumulated dust on its surface on a daily basis and maintain the solar energy plant output. The system may be a robotic system which could move autonomously on the surface of solar panels by using pneumatic suction cups and use dry methods for cleaning like rotating cylindrical brush and vacuum cleaning system keeping in mind the limited availability of water in areas where such plants are mainly located. This project also aims to scale back the human involvement within the process of solar array cleaning because it may be a very hazardous environment for them in scorching sun.

1. INTRODUCTION

A robot is a machine equipped with the ability to carry out various operations by giving it the input and functions is carried out.

1.1 Autonomous Robot

An autonomous robot has the ability to carry out tasks and commands with high degree of accuracy autonomously according to the following rules. Has the power to realize tangible inputs from the environment. Has the power to perform task for long intervals without human interferences. Has the power to maneuver in its workspace without human help. Has the ability to avoid situations that are harmful to itself or humans unless it is programmed to do so

1.2 Cleaning Robot

Cleaning is one of the necessary activities in the daily life of human beings, but in the same time regarded as one of the least preferred jobs. In Some places cleaning also becomes hazardous for humans. So time and again machines have been invented to assist us in this necessary evil of cleaning. Robotic cleaning is the most recent trend which is being seen in the recent years. Robotic cleaner is an autonomous device that can move around and clean the surface using different techniques such as mopping, vacuum cleaning, or simply scrubbing the surface with a rotating brush. The proposed solar panel cleaning system falls in the category of cleaning robots, but for industrial cleaning application in large scale solar power plants. It is an autonomous robot that moves on the slanted surface of the solar panels with the help of vacuum suction .

2. CLEANING TECHNIQUE

There are different types of cleaning with different challenges and benefits. This all technique are used to reduce the bond between the dust and the panel. This strategy is aimed at incorporating materials or system designs that use non-contact, continuous Techniques which require little or no labor for cleaning.

2.1 Autonomous Cleaning Techniques

There are a couple of techniques accessible in industrial grade that would be utilized in real time through robots for cleaning, where the prevailing solutions are subject to geographical terrain, application area, cost of device, sophistication and performance ratio. On the idea of cost, simple utilization, performance rate, water consumption, etc., robotic solutions have emerged as a beautiful option for SPV surface cleaning. Solar panel cleaning robot may be a two-body structure for SPV module cleaning. It comprises a mobile robot which carries the cleaning payload and cleaning head, which actually does the cleaning work. The cleaning head undergoes horizontal motion with the help of motorized trolleys at the edges of panels, while the belt-driven system attached directly with the cleaning head undergoes vertical motion. Cleaning head comprises rotating ant scratch cylindrical brushes to wash the SPV surface.

3. WASHING

Washing of SPV panels is traditionally known for effective cleaning using centralized cleaning facilities. For optimizing the performance, it is better to clean the panels early in the morning and using pressure-induced dematerialized water. As the SPV surface is wet thanks to dew, it are often rinsed easily. Meanwhile, when SPV panel temperature becomes high (mid-noon), it requires more water and human effort to urge the specified result.

4. AUTOMATIC SOLAR PANEL CLEANING SYSTEM

Heliotex's automatic solar panel cleaning system automatically washes and rinses the SPV panels50. It attaches nozzles to SPV panel along with a reservoir for concentrated cleanser. There is a silt channel containing water softner media. This system has an additional anti-siphon valve to prevent backwashing step, which comprises a controller for automatic wash and rinse cycles. The controller programming can be changed to suit seasonal needs. Such systems are beneficial for areas with limited manpower. Literature survey and laboratory Tests show that high-pressure water sprays in the range 500–10,000 psi can recover 95% of the original reflectance.

5. CONCLUSION & FUTURE PERSPECTIVE

Cleaning and prevention are two main options to counter the deposition problem in SPV panels. Cleaning are often achieved by various manual processes, but they appear to be energy-intensive and time-consuming efforts. Automatic robotic system has been successfully employed, but the extra maintenance and energy consumption always remain some extent of debate for commercial applications. In terms of prevention, coating seems to be an honest approach, because it is effective in protecting the surface from harmful deposition. However, transparency of coating material is usually a challenge for this approach. Additionally, impact of environment on the steadiness of coating is area of concern. Also, limited research on measurement and quantification of SPV coating limits the event of a successful system with long-term applications. Furthermore, coating-based research is currently at an experimental level and more studies are required for its effective commercialization. This is often a challenging task and demands more precise structural engineering. Undoubtedly, there need for a replacement, self-healing coating material with high flexibility, transparency for construction of stable and versatile SPV devices.

The coating should even be impervious to oxygen and moisture. Dust deposition on SPV panels limits their efficiency and remains a challenging parameter to enhance the performance of the general system. Generally, it's going to be concluded that dust are going to endless challenge for SPV panels, particularly in desert areas. Lack of natural cleaning like rainfall and lack of water resources increase the severity of the matter. Additionally, dew/moisture results in of dust. Stowing, inverting and vibration techniques might be considered as simple and robust approaches to stop the build-up of dust. Adequately transparent, durable coating is to be required for effective performance, preservation and enhancement of SPV panels. Sensors to detect the juncture for cleaning of surfaces also are required in order that simultaneously hot point, partial shading, etc. also can be solved

6. REFERENCES

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