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Solar Panel cleaning Robot

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<p>Keyword:</p> <p>Solar panel cleaning robot.</p>	<p>ABSTRACT</p> <p>Photovoltaic power generation system (PV system) is a device which changes the solar power into the electricity by solar cells and the principle of the solar cells is the use of semiconductor materials electronics characteristics of P-V conversion. PV system and its application is a profound research project, facing the 21st century, which gathers the utilization of green renewable energy, improve the ecological environment, ameliorate people's living conditions as integral whole will be of great benefits to economy, politics, coupled with society, and also contains rich academic studies value and the basic theory issues. One of the biggest difficulties confronting the globe today is energy availability, which has been a huge concern for both urban and rural populations in India. Approximately 60–70% of the nation's energy needs are satisfied by fuel, wood, and agricultural leftovers. The sun radiates solar energy, which is a renewable energy source with enormous potential. It is crucial to switch from using petroleum-based electric energy to renewable energy. Solar energy applications should be expanded since solar power has emerged as a renewable energy source. The solar photovoltaic modules are generally employed in dusty environments e.g. tropical countries like India. The dust gets accumulated on the surface of the module and blocks the incident light from the sun. So it reduces the power generation capacity of the module. The power output is reduces by 50% if the module is not cleaned for a month. The cleaning mechanism uses an Arduino programming control to clean the module. The primary goal is to increase the solar power production system's power generating efficiency by clearing the dust from the photovoltaic modules. In order to increase the effectiveness and lifespan of photovoltaic systems, this study describes the design and execution of an autonomous robot for cleaning solar panels.</p>
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INTRODUCTION

Clean solar panels operate more efficiently, as dirt and debris accumulation can significantly reduce their output. Cleaning robots offer a proactive approach to maintaining optimal performance, ensuring maximum energy generation from solar installations. The development of cleaning robots involves integrating advanced technologies such as robotics, artificial intelligence, sensors, and data analytics. This intersection of disciplines fosters innovation and drives advancements in both the renewable energy and robotics industries.

For all life forms on Earth, solar energy is the most plentiful source of energy. Photovoltaic (PV) technology is constantly evolving for a variety of purposes, meaning that it produces electricity without negatively impacting the environment. Numerous energy sources, including coal, gas, hydro, nuclear, and diesel, will run out of fuel in a few years. In general, solar panel cleaning robots are a state-of-the-art technology that optimizes energy production while also extending the lifespan and sustainability of solar installations.

PROPOSED METHODOLOGY

In order to help the solar panel absorb the most energy possible, the proposed solar panel cleaning robot is utilized to clear dust and debris that has accumulated on the panel. The cleaning robot and the carrying robot are the two primary components of the suggested system. By shifting from one panel to another, the carrier robot performs the role of a carrier for a cleaning robot. The cleaning robot travels the full length of the panel in tandem with the carrier robot. Dust and debris are removed from the panel by the cleaning robot's brush attachment. 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. In practice, cleaning of solar panels should be frequently done which makes the process more laborious and expensive. In this paper, the effects of accumulated dust on the performance of the solar panels are investigated by referring



the results obtained by experimentation in dusty atmosphere of different levels. An auto cleaning robot to work as the auto cleaner which is equipped on the solar panel is also proposed.

EXPERIMENTAL RESULT

A solar panel cleaning robot is an automated device designed to efficiently clean solar panels, ensuring optimal performance and longevity. Equipped with brushes or wipers, it navigates across the panels, removing dust, dirt, and debris without damaging the surface. Some models utilize water jets or microfiber pads for thorough cleaning. Advanced versions may incorporate sensors to detect dirty areas and adjust cleaning patterns accordingly. These robots improve energy production by maintaining panels at peak efficiency, reducing the need for manual cleaning and minimizing labor costs. Overall, they contribute to the sustainability and effectiveness of solar energy systems.

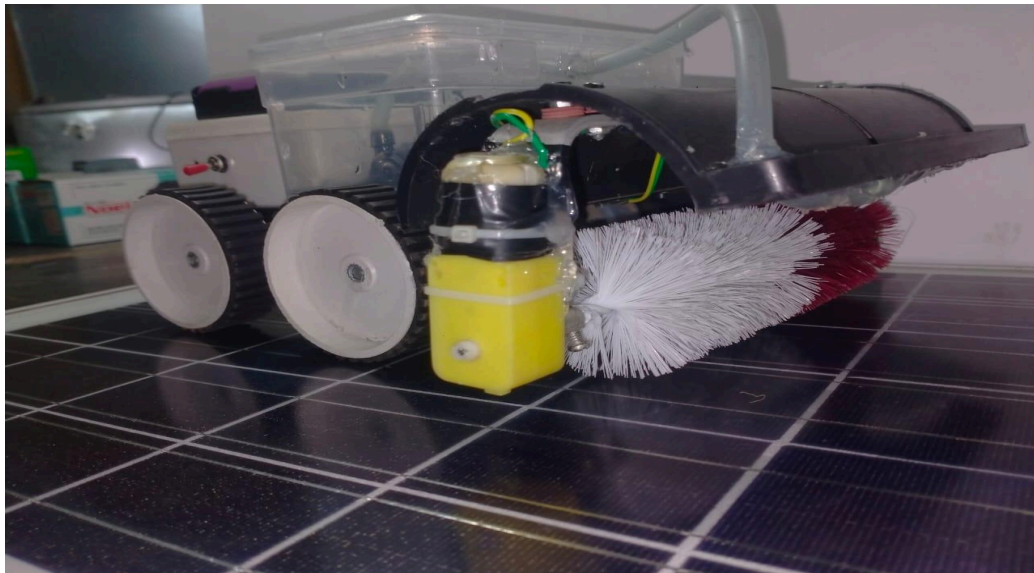


Figure 1





Figure 2

CONCLUSION

A conclusion for a solar panel cleaning robot project could highlight the benefits of such technology, including increased efficiency and energy production of solar panels, reduced maintenance costs, and environmental benefits from using renewable energy sources more effectively. It could also emphasize the potential for further research and development to optimize the design and performance of solar panel cleaning.

Robots that clean solar panels have made a substantial contribution to the upkeep of renewable energy sources by providing practical, economical, and eco-friendly ways to increase solar energy output. By combining cutting-edge technology, creative design, and self-governing functionality, these robots meet the vital requirement of routine cleaning to preserve peak efficiency and optimize energy production. The capacity of solar panel cleaning robots to autonomously travel and clean massive arrays of solar panels without human assistance is one of their main advantages. These robots are outfitted with sensors, cameras, and sophisticated algorithms that enable them to identify dirt, dust, and debris on the panel surfaces and ascertain the most effective cleaning procedure.



This autonomous operation reduces the need for manual labour, minimizes downtime, and ensures thorough cleaning coverage across the entire array. Moreover, solar panel cleaning robots utilize various cleaning mechanisms, such as brushes, wipers, or water jets, to effectively remove contaminants from the panels' surfaces. These mechanisms are designed to be gentle yet thorough, ensuring the removal of stubborn debris without causing damage to the panels. Additionally, some robots incorporate environmentally friendly cleaning solutions or utilize recycled water, further minimizing their ecological footprint. In terms of maintenance, solar panel cleaning robots are typically designed for durability and reliability, with weather-resistant materials and components that can withstand harsh environmental conditions. They may also feature self-diagnostic capabilities to detect and address any technical issues promptly, ensuring continuous operation with minimal downtime. Furthermore, the implementation of solar panel cleaning robots offers economic benefits by increasing energy production and extending the lifespan of solar installations. By maintaining clean panels, these robots optimize energy output, leading.

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