



Ministry of Higher Education and Scientific Research

Tikrit University

Engineering College - AL Shirqat

Department of Mechanical Engineering



"Design and Implementation of a Solar Panel Cleaning System"

A project

As part of the requirements for obtaining a bachelor's degree in mechanical engineering

Tikrit University – AL Shirqat College of Engineering

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Abstract

In conclusion, this research on the Design and Implementation of a Solar Panel Cleaning System highlights its significance, which directly relates to improving the efficiency of energy extraction from solar cells, which is significantly affected by the accumulation of dust and dirt. Studies and field experiments have shown that the build-up of dust on the surface of solar panels can lead to a noticeable decrease in electricity production, thus negatively impacting the overall performance of solar systems and their economic viability, especially in desert and dry environments where dust is abundant.

The design and implementation of this system came in response to the real need for effective and practical solutions that ensure the cleanliness of solar panels in a periodic and regular manner, without the need for repeated human intervention or reliance on traditional methods that might be costly, inefficient, or even harmful to the panels over time. The system was designed to be simple, reliable, energy-efficient, and adaptable to various types of solar installations, whether fixed or mobile.

The implementation of the system involved the use of techniques tailored to the nature of solar panels, such as soft-brush systems, compressed water spraying, or a combination of dry and wet methods for effective cleaning without causing scratches or damage to the sensitive surface of the solar cell. Moreover, automated control elements were incorporated, allowing the system to operate at specific times (e.g., early morning or evening to avoid rapid water evaporation) or based on dust levels detected by sensors on the panels.

From the experimental results obtained, it was found that the proposed system led to a noticeable improvement in the electrical performance of the solar cells, as

the energy output increased significantly compared to the non-cleaned panels. Additionally, the system helped reduce the need for costly manual maintenance and minimized the risks associated with manual cleaning, especially in elevated or remote locations.

However, it is important to note that this system is not without its challenges. Issues such as water consumption (in wet systems), the impact of wind, and varying weather conditions require further research and development to improve cleaning efficiency and reduce waste. Furthermore, there may be a need to develop cleaning systems based on innovative technologies such as electrostatic cleaning, fine vibrations, or autonomous robotic systems that could be more suitable for specific environments.

In light of the above, it is crucial to continue developing these systems in the future, in line with the rapid technological advancements in solar energy and smart systems. It is also recommended to conduct comparative studies between various cleaning techniques in terms of efficiency, cost, and environmental impact to determine the most suitable solution for each type of solar installation. Investing in such solutions will undoubtedly contribute to enhancing the efficiency of renewable energy sources in general and improving the sustainability of solar energy projects, aligning with global trends toward building a clean and sustainable energy future.

In conclusion, this project emphasizes the importance of integrating practical engineering design with a deep understanding of environmental variables to ensure the highest possible benefit from solar energy, thus opening new horizons for innovation and creativity in this vital and sensitive field.