Humidity-Driven Smart Solar Panel Cleaning System

Al-Sumaiti , Hamad (School: Qatar Science and Technology Secondary School for Boys)
Al-Kuwari, Rashid (School: Qatar Science and Technology Secondary School for Boys)

In the coming decade, renewable energies are set to replace conventional fuels, driven by their environmental benefits and long-term cost advantages. Solar energy, particularly prominent for its reliability in powering buildings, emerges as a key player in global sustainability efforts. Qatar, in alignment with its National Vision 2030, exemplifies this shift with the ambitious "Kharsaa solar farm" in its desert expanse. This large-scale initiative seeks to provide ample green energy of 800 MW at peak for Qatar, leveraging abundant sunshine in the desert landscape. However, a significant challenge faced by the solar industry, even with such advancements, is the frequent obstruction of solar panels by dust particles and moisture namely muddy stains, compromising their efficiency. To address this, a novel automated cleaning system harnessing water from humid air has been developed. This system collects water in a storage tank from the atmosphere through stacked Aluminum mesh using Coalescence phenomenon and sprays it onto the panels as needed. The system is integrated with comprehensive weather station and other assistive sensors to sense the surrounding conditions and take subjective decisions, the system ensures a dust-free surface using a sliding wiper mechanism while guarantees relatively warm water for spraying to preserve the efficiency of the PV process. Initial results are promising, with efficiency improvements of up to 90%, achieved with minimal water usage of around 250 ml covering nearly 90% of affected panels. This innovation holds great potential for sustaining optimal solar panel performance in challenging environmental conditions, contributing actively to UN SDGs.

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