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| **Title:** | IoT-Based Automated Solar Panel Cleaning and Monitoring Technique | | |
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| **Abstract:** |  |
| Aims: The objective of this research work is to design and develop an IoT-based automated solar panel cleaning and real-time monitoring system using a microcontroller to improve the output and efficiency of a solar module at a low cost.  Study Design: Most of the time, dust over solar panels creates a barrier that obstructs the sun’s radiation and reduces their performance. As such, it is necessary to keep the solar panel clean to improve output power levels. We integrated the IoT technology along with a range of components, including a microcontroller, a NodeMCU, a servo motor, a DC motor-driven submersible pump, a Light Dependent Resistor (LDR), an LCD with driver IC, etc. to design the system. We developed the assembly language program for the microcontroller.  Place and Duration of Study: The work was conducted individually under the supervisor of a faculty member as a part of the final project work of the Master of Engineering degree in Electrical and Electronic Engineering at American International University Bangladesh (AIUB), Dhaka, Bangladesh. The student conducted his research work at AIUB for two consecutive semesters from September 2022 to May 2023.  Methodology: An LDR sensor detects the solar panel’s dirtiness and triggers the cleaning process through the microcontroller. The system monitors this continuously and real-time vital data is accessible to have some performance metrics, empowering timely maintenance actions to be triggered by the system and hence ensuring the maximum power output. The automated cleaning mechanism, driven by servo motors and mini submersible DC motor pumps, effectively removes dust and dirt from solar panels. An application was used to get real-time data through the internet to the user’s smartphone.  Results: The server data is accessed to observe the system performance. The cost analysis shows that this system offers a cost-effective and sustainable solution for maintaining clean solar panels and optimizing power output.  Conclusion: Such an automation system can contribute meaningfully to the progression of renewable power generation by significantly improving the efficiency and longevity of solar panels. Thus, we can have sustainable and efficient energy systems in the country by integrating IoT-based automation systems. | |