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(57) Abstract :
Intelligent solar drying for eco-smart agriculture integrates adaptive climate sensing and power flexibility to optimize the drying conditions of agricultural and food products. A significant drawback of conventional drying methods, such as sun drying, is their dependence on weather, susceptibility to contamination, and inefficiency in moisture removal. To address these challenges, we designed a solar drying system incorporating a charge controller for power distribution uniformly and a DHT11 sensor to monitor temperature and humidity in real-time, ensuring effective functioning even at night. A relay module automatically adjusts the Peltier system, which contains a fan for drying operations. An Arduino Uno microcontroller controls the operations of the DHT11 sensor and the relay module. Additionally, a Wi-Fi module provides instant updates about system conditions and power flexibility mechanisms such as battery and biomass backup, maintaining continuous operation during cloudy days and night-time. These enhancements increase drying efficiency, reduce post-harvest losses, and promote sustainable food storage, particularly in remote regions. This paper presents a framework for eco-smart solar dryers with climate adaptive control and energy management for optimal performance.

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