

DESIGN, FABRICATION AND EVALUATION OF IOT-BASED SOLAR DRYER FOR AGRICULTURAL PRODUCTS

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In pursuit of transitioning the food sector of Sri Lanka towards sustainability, this study advocates for the adoption of an Internet of Things (IoT)-based solar drying system, incorporating both direct and concentrated solar technologies. Subsequently, the objective of this study was to design, and fabricate, an IoT-based direct solar cum concentrated solar dryer for agricultural products to reduce the cost of energy for drying and explore the possibility of using free renewable energy for food processing. The dryer was composed of a parabolic solar reflector, a unit for water heating and circulation, a modified direct solar dryer, and an IoT controlling unit. Notably, the entire system is operated solely on solar panel-generated power. Concentrated solar radiation from the parabolic solar reflector was directed to the focal point, where the water heating system was positioned. Heated water circulated through the direct solar drying unit over a circulation unit made up of copper tubing and a pump. The IoT unit-controlled temperature, humidity, and the circulating pump to increase drying rates, providing operators with real-time monitoring and control over drying conditions. In the performance evaluation, the newly designed dryer was compared with the direct solar dryer. The mean maximum temperature of the newly designed dryer was recorded as 89°C, while that for the direct solar dryer was 70°C. Additionally, fresh mushroom samples with an initial moisture content of 90% (wb) were dried to assess the dryer performance. The time required to reach optimal storable conditions MC 8% (wb) was 256±5.77 min for the newly designed dryer, a significant improvement compared to the 347±11.54 min for the direct solar dryer ($p \leq 0.05$). In summary, it is suggested that the newly designed direct cum concentrated solar dryer offers an effective method for food drying. Nevertheless, further studies are required to fully optimize the dryer's operation with different food items.

Keywords: Concentrated solar, Direct solar, IoT-based solar dryer