

Research and design of a smart greenhouse system under Lao climate conditions

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Abstract: This study presents the design and development of a smart greenhouse system tailored to the climatic conditions of Laos. Given the country's tropical monsoon climate, characterized by high temperatures, humidity, and distinct wet and dry seasons, conventional farming faces significant challenges. The proposed system integrates Internet of Things (IoT) technology with automated control mechanisms to optimize the growing environment. Key sensors monitor temperature, humidity, soil moisture, and light intensity, while actuators regulate irrigation, ventilation, and shading. A microcontroller processes data and executes control algorithms to maintain optimal conditions for crop growth. The system is designed for low cost, energy efficiency, and ease of local maintenance, utilizing locally available materials. Preliminary simulations and prototype testing demonstrate the system's ability to stabilize internal climate conditions, reduce water consumption, and improve crop yield compared to traditional open-field methods. This research provides a practical, scalable solution for sustainable agriculture in Laos, addressing food security and adapting to climate variability.

Keywords: Smart farming, greenhouse design, climate control, Laos