



Development of a Restricted Access and Energy-Efficient IoT-Based Greenhouse System for Tropical Climates

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Abstract. Agriculture as a cornerstone of global food production, faces sustainability and environmental impact issues. Conventional greenhouses while aiding crop production, often contribute to high energy consumption and substantial greenhouse gas (GHG) emissions. They are also vulnerable to the introduction of diseases due to uncontrolled access. Theoretical frameworks highlight the greenhouse effect and the impact of climate change on traditional agricultural methods, emphasizing the urgency of alternative sustainable practices. This paper introduces and implements a Radio Frequency Identification (RFID) and Internet of Things (IoT)-based energy-efficient greenhouse system for tropical climates applications. The system employs a solar energy source, an Arduino microcontroller, and various units for soil moisture, temperature monitoring, and RFID-based access control. The Arduino system enhances security by managing a list of approved RFID card (UIDs), granting access only to authorized users, and activating a buzzer for unauthorized access attempts. Performance tests of the prototype demonstrated superior results in temperature and soil resistance management compared to open-field farming, thus highlighting its potential for increased yield, resource efficiency, and enhanced farm security. This eco-friendly system is particularly suitable for deployment in energy-deprived tropical regions, offering improved farm yield and robust protection for greenhouse operations.

Keywords: energy · agriculture · greenhouse · IoT · radio frequency identifier

1 Introduction

One of the most pressing issues confronting the world today is the provision of adequate nourishment to a population exceeding eight billion individuals worldwide [1]. Despite its favorable agro-ecological endowments of a total landmass of 92.4 million hectares