Combining IoT and AI Technologies in Agricultural Irrigation Control

[1] Ching-Lung Chang and Chun-Chen Liu

Abstract— This paper combines Internet of Things (IoT) sensors with an LSTM AI model to investigate the permeability and diffusion of water in different soils. Based on the soil surface moisture values, it predicts the moisture values of plant root depths, determining the timing of irrigation and the duration of irrigation based on these predicted values. Additionally, irrigation duration is adjusted according to the water permeability and diffusion characteristics of the soil, aiming to achieve precise irrigation and water conservation.

I. Introduction

The main aim of this paper is to develop a soil moisture prediction method that combines Internet of Things (IoT) technology, multiple regression analysis, and Long Short-Term Memory (LSTM) networks. We aim to analyze and predict the variations in soil moisture at different depths by collecting real-time environmental parameters. Based on this, we formulate precise irrigation strategies. Our goal is to provide a more effective tool that can enhance the efficiency of water resource use and maximize crop yield and quality

II. Agricultural Irrigation System

Figure 1 illustrates the schematic diagram of the irrigation system, which consists of two main components: IoT data collection and AI model establishment.

IoT Data Collection: As depicted in Fig. 1, this system integrates various sensors to capture light intensity, temperature, humidity at different times, and soil moisture at various locations. Sensor data is collected every 15 seconds and transmitted to the server via the LoRa interface

AI Model Establishment: By utilizing the sensor data collected on the server, a combination of multiple linear regression and LSTM neural network models is employed. This enables the prediction of moisture values for different types of soil, various depths, and radii at drip irrigation positions. Based on these predicted moisture values, the irrigation timing is determined, along with the required duration for the irrigation process。

III. Experiment Results

Next, we compared the water usage and planting results of strawberry seedlings over a 7-day period between our irrigation system and two farmers with over twenty years of strawberry cultivation experience。

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Ching-Lung Chang is with the National Yunlin University of Science and Technology, Taiwan. e-mail: chang@ yuntech.edu.tw.

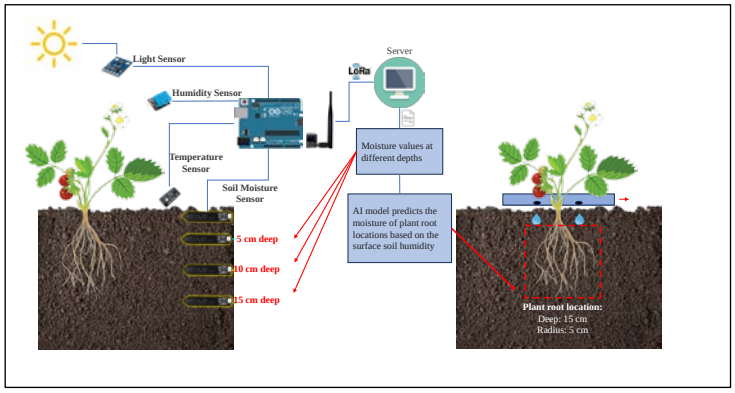
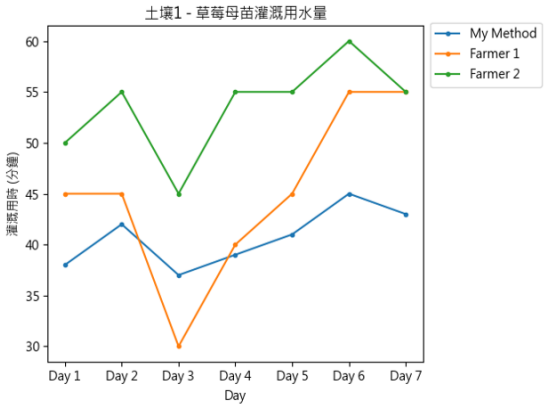


Figure 2 illustrates the water usage comparison. The results indicate that our research approach saved 10% of irrigation time compared to farmer 1 and 24% compared to farmer 2.



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