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# THE OPTIMAL IRRIGATION SCHEDULING FOR SMART FARM VIA REAL-TIME SENSOR

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# Abstract

Although Thailand is one of the prominent exporters of agricultural production, Thailand faces many challenges in many aspects such as declining average farm size, labor shortage in the sector, and water shortage under recent drought years. Since the farmers are used to traditional farming based on the experience without considering plants and soil status, the watering somehow was operated overrated and wasted labor and water resources.

The project study aims to develop smart IoT irrigation scheduling via the real-time sensor data of the green park area's soil moisture, water storage, and irrigating patterns. The soil moisture was monitored and analyzed to understand the actual water demand of plants. Then, IoT machine learning was applied to train the proper irrigation scheduling, which guides the farmers to utilize water more efficiently.

The results show that the innovative irrigation system saves water for the planting 20% to 30% from the traditional irrigation schedule without any adverse impact to plants.

**Keywords:** sensor, Information system, communication

# Introduction

Hence, "Sustainable irrigation management" is essential for farmers to ensure food security in Thailand and the region. Therefore, the Agricultural irrigation system is required to improve the efficiency of the production process, especially the lack of water sources during the drought. Therefore, adopting modern technologies were expected to promote production processes and reduce water and labor in the agriculture sector.

# Objectives and approach

The project study aims to develop an innovative irrigation system via the real-time sensor data of the green park area's soil moisture, water storage, and watering patterns. The modified water irrigation pattern is expected to reduce the water and labor in irrigation activities.

# Methods used

First, the study monitored the changed soil moisture, volume water use, climate data at the green park (Al Nahian, Biswas et al. 2021). The data was collected and sent to the server through IoT technology via the 3G mobile network. The IoT system was assisted in avoiding missing data under unstable signals. Second, the study team estimated the allowable water in soil via Hydrus 1D to avoid water deficit for plants.

Third, the data were used to create a general curve that reveals the optimum moisture content for plant growth in each soil type (Simunek, Van Genuchten et al. 2005). Final, the optimal water irrigation was determined to maintain soil moisture retention range for the plant as a whole.

# Results

According to the soil moisture, the soil status was divided into four levels, namely 1) saturated soil, 2) wet soil, 3) dry soil, and 4) very dry soil. Under current evapotranspiration, the soil will change the drier soil status after five days without water. Hence the team has developed a smart irrigation scheduling notification system through the Line system based on the monitored soil moisture, climate.

The notification will send the guideline to the responsible person every day at 8:00 am for the decision-maker to adjust the water supply to meet the soil moisture conditions. As a result, the optimal irrigation scheduling by IoT system was saved 20%-30% compared with the traditional irrigation plan.

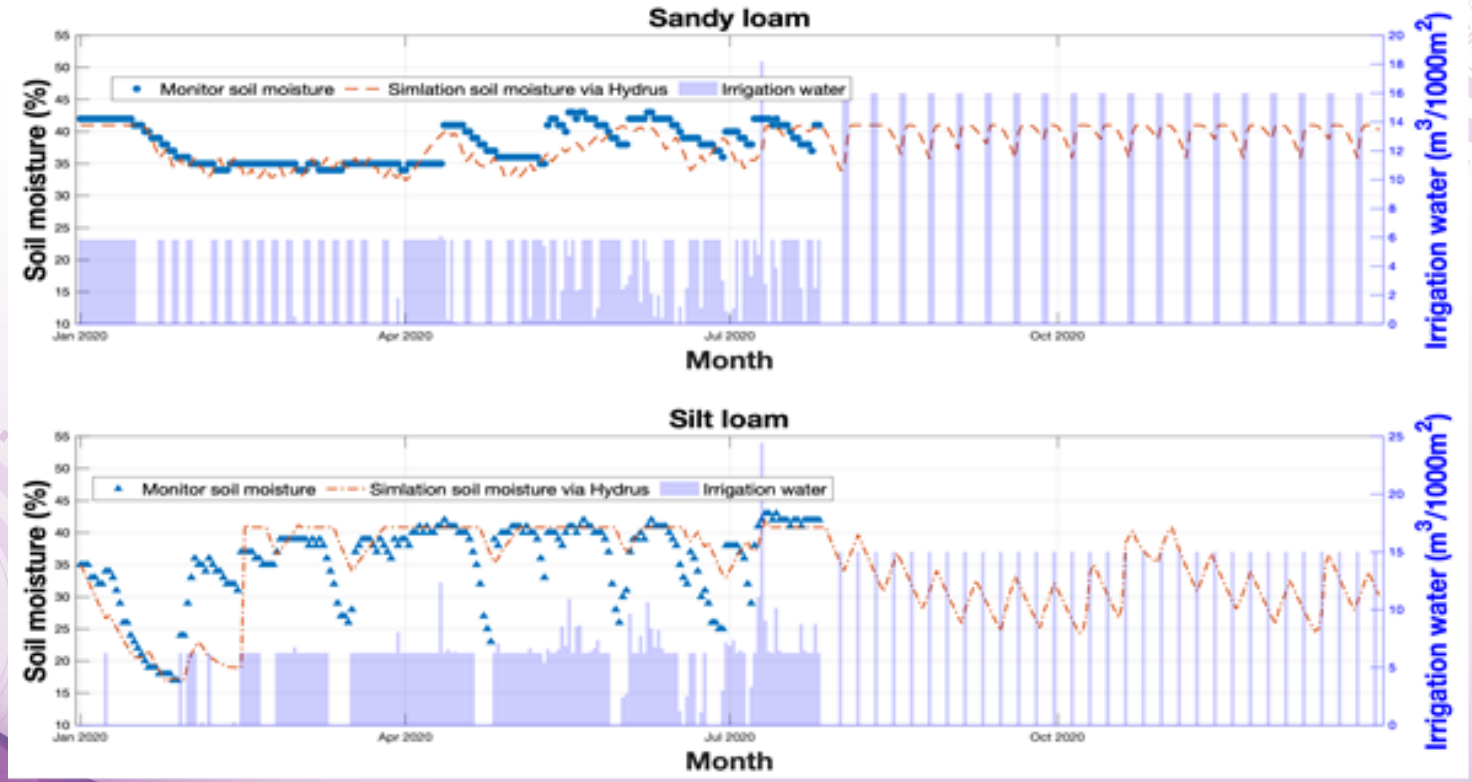


**Figure 1.** Comparison of soil moisture from past irrigation with an alternative irrigation model.

# Discussion

The study successfully developed an intelligent irrigation management system from soil moisture sensors and weather-connected wireless networks. The study provides adequate management tools for water irrigation in the field at the plant farm level at a reasonable price, efficient and valuable. The device can be adapted to optimize the water resources for the agriculture sector in developing countries. This tool ingress minimizes the burden of agricultural water, which is the cost of the country.

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