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Real Time Monitoring System for Detecting Humidity in Palm Farms

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Abstract

This study aims (1) to develop a real-time monitoring system which can detect the humidity of palm oil plantation, as well as, (2) to store and process the collected data using information technology and networking system. The study area is located in oil palm plantation in Thasala district, Nakhon Si Thammarat province. We have installed weather/soil station and sensors from Davis company (<https://www.weatherlink.com/>) to collect weather and soil data from the palm plantation. These data are processed in the cloud and stored in the storage system. Farmers in the oil palm plantation are able to see all data and the graphs by using their smartphones or computers. Our system assists the palm farmers to monitor their farms, and take actions based on the requirements.

Keywords: Cloud storage, Davis instruments, monitoring system, palm plantation, sensors

Introduction

Thailand is an agricultural country, and the primary export commodities are industrial products. Whereas, Thai researchers have conducted a few researches on industry development and industrial products. On the other hand, scientists from developed countries are researching industry development and industrial products by using several modern technologies such as computers, electronics, IT, communications, and sensors [2]. They are researching how to turn a farm into a smart farm for getting more benefits from the agricultural farms. Usually, a farm can be modified into a smart farm by installing a sensor network with a small processor in the farm, and it can help the farm owner in many ways. For example, in the case of a palm farm, the sensors can notify the farm owner (1) about providing water into the palm garden when the humidity in the soil drops, and (2) about how much water should be provided. The host computer (farmer's computer) receives information from the computer where the sensors are installed [3] and can process the information initially. Sensors collect information about temperature and light intensity, and by using this information, the computer can calculate the evaporation level of water. This computer sends the daily water requirement information to the farmer's computer to control the water management system. This technology benefits the farmers by (1) reducing the excessive amount of water discharge, and (2) increasing the palm/palm oil production.

The aims of this study are: (1) to develop a real-time monitoring system for detecting palm oil humidity, and (2) to store the collected data by using information technology and networking system.

Methods

Study site

This research is applied research (Experimental Development) and was conducted in a palm plantation in Thasala district, Nakhon Si Thammarat province (longitude: 8.704693E and latitude: 99.93211N) (Fig.1).

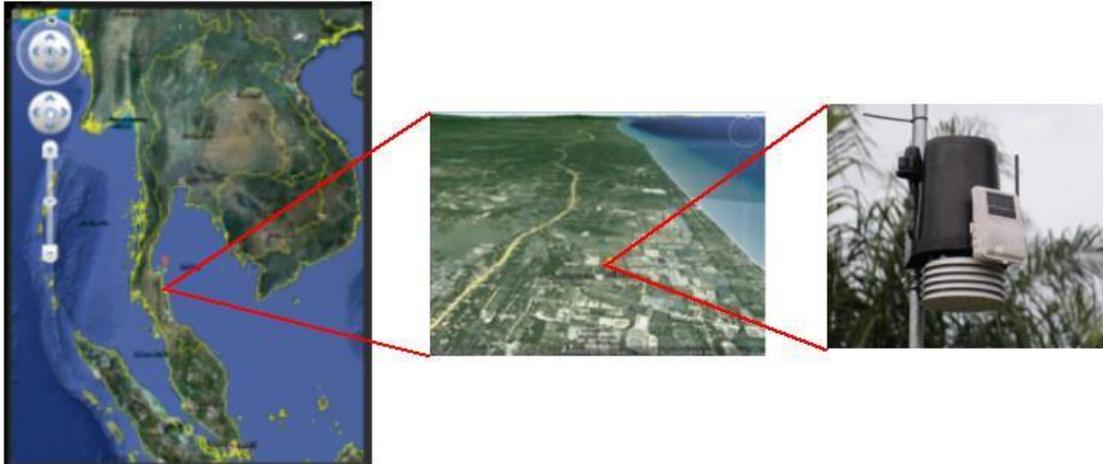


Figure 1. Study Site at Ban Tha Khuen palm oil plantation, Tha Sala District, Nakhon Si Thammarat Province.

Installing sensors and real-time monitoring system

In this study, we used the weather/soil station and sensors from Davis company (<https://www.weatherlink.com/>). We installed several types of sensors (temperature, humidity, rainfall, and soil) to collect data about weather and soil (Fig. 2a).

The real-time monitoring system for monitoring the humidity in palm oil plantation is equipped with a sensor that stores data every 1 minute. The sensor sends data to the data loggers (WeatherLink IP) inside the Davis console using Davis WiFi. Due to the short storage system of the data loggers, they send data to the computers which is fixed in the palm oil farm. We have installed a Davis software in this computer which can produce images and graphs in every 5 minutes. These data and graphs are sent to the public cloud storage system through file service Protocol (for doing this, the computer needs to be connected with the internet). The data storage capacity of this computer is 1 GB which can store data for a long time. If the internet does not work/internet connection gets lost, and the computer cannot send data to the cloud service, we can collect data directly from the computer in the oil palm farm. We have another host computer at Nakhon Si Thammarat Rajabhat University that receives the data and graphs from the public cloud. Moreover, we have made a website (<http://hvd.nstru.ac.th/weather/>) by using PHP language and Codeigniter Web (open source). This website imports data and graphs from the host computer and show directly (Fig. 3).



Figure 2. (a) Automatic Davis Weather Station (consists of temperature, humidity, rainfall sensors), and (b) soil sensor (consists of 4 sets of soil temperature and 4 sets of soil moisture sensors).

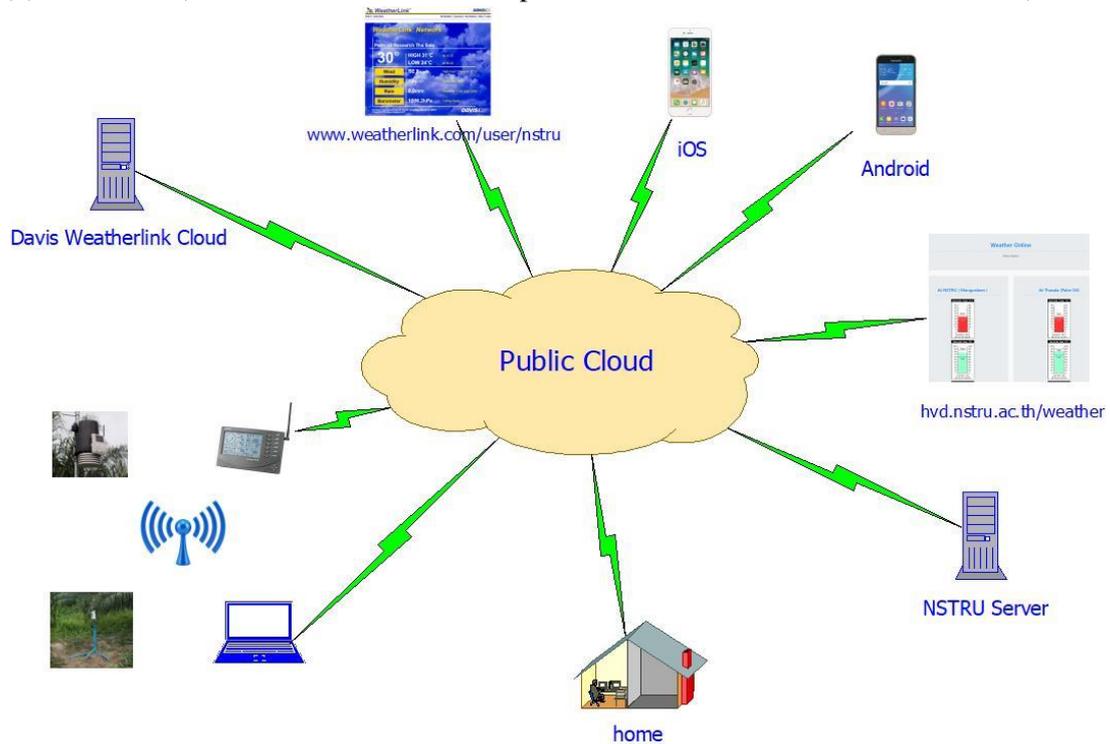


Figure 3. The architecture of real-time system design

Results and discussion

This research proposes a real-time surveillance system for monitoring the humidity in the palm oil plantations. The results are presented as follows.

1. Results obtained from the website. <http://www.weatherlink.com/user/nstru> (Figure 4).

1.1 Online results show data analyses and graphs. Provided information consists of Air Link Information System, Weather Link Network, and Map Data System (Figure 4).

1.2 Smartphone (IOS, Android) (Figure 5).

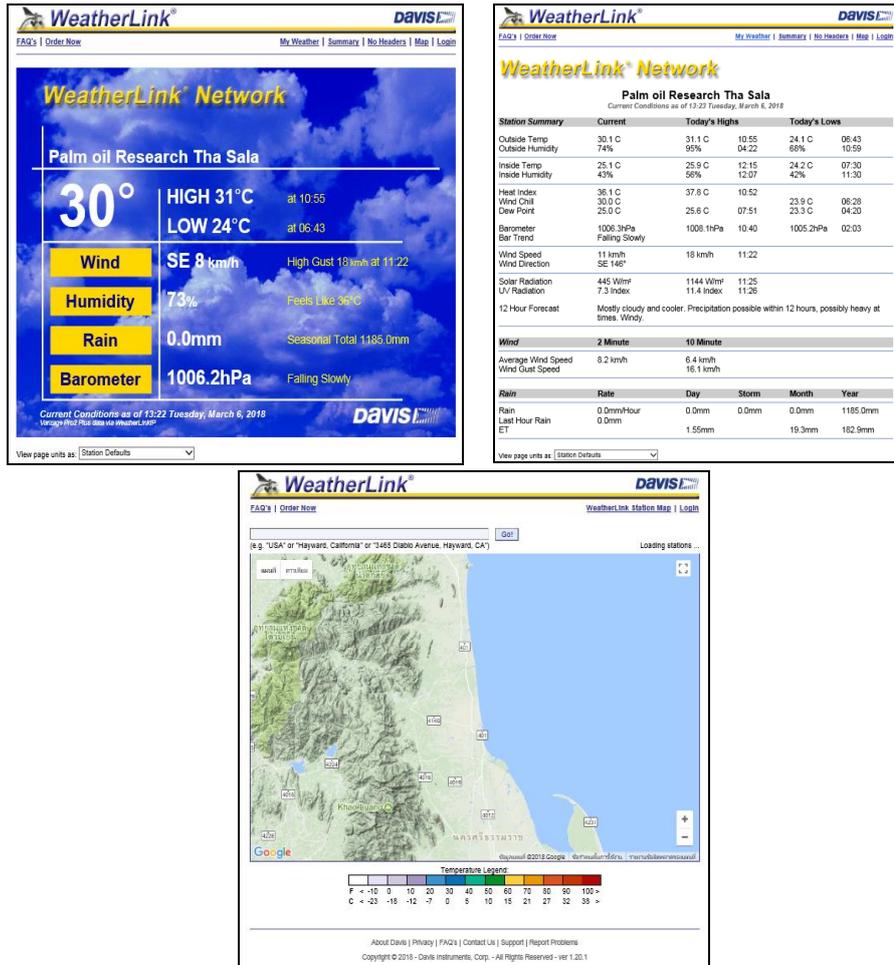


Figure 4. Weather Information System, Weather Online System, and Map information system

1.2 Smartphone (IOS, Android) (Figure 5).

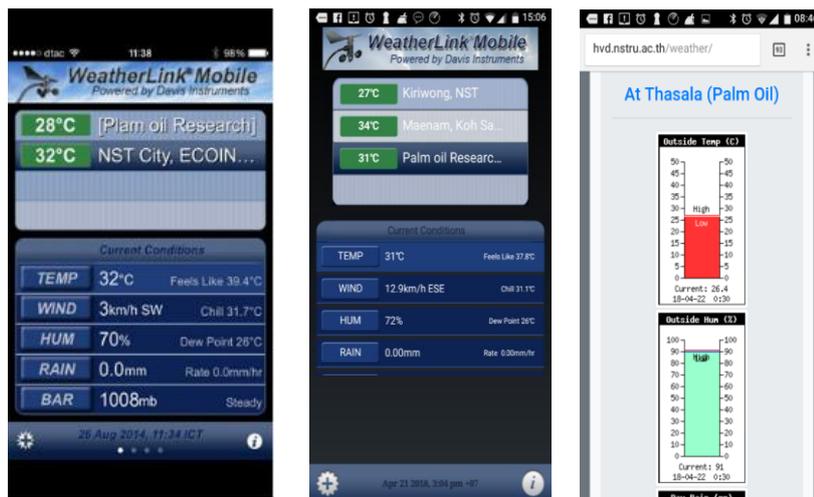


Figure 5. Smartphone (IOS, Android)

2. Results obtained from the website <http://hvd.nstru.ac.th/weather/> Online Information (Figure 6). Results are shown in numerical and graph forms (Figure 6). Information includes weather data, rainfall data, light intensity data, temperature data, humidity data, wind direction data, and wind speed data.

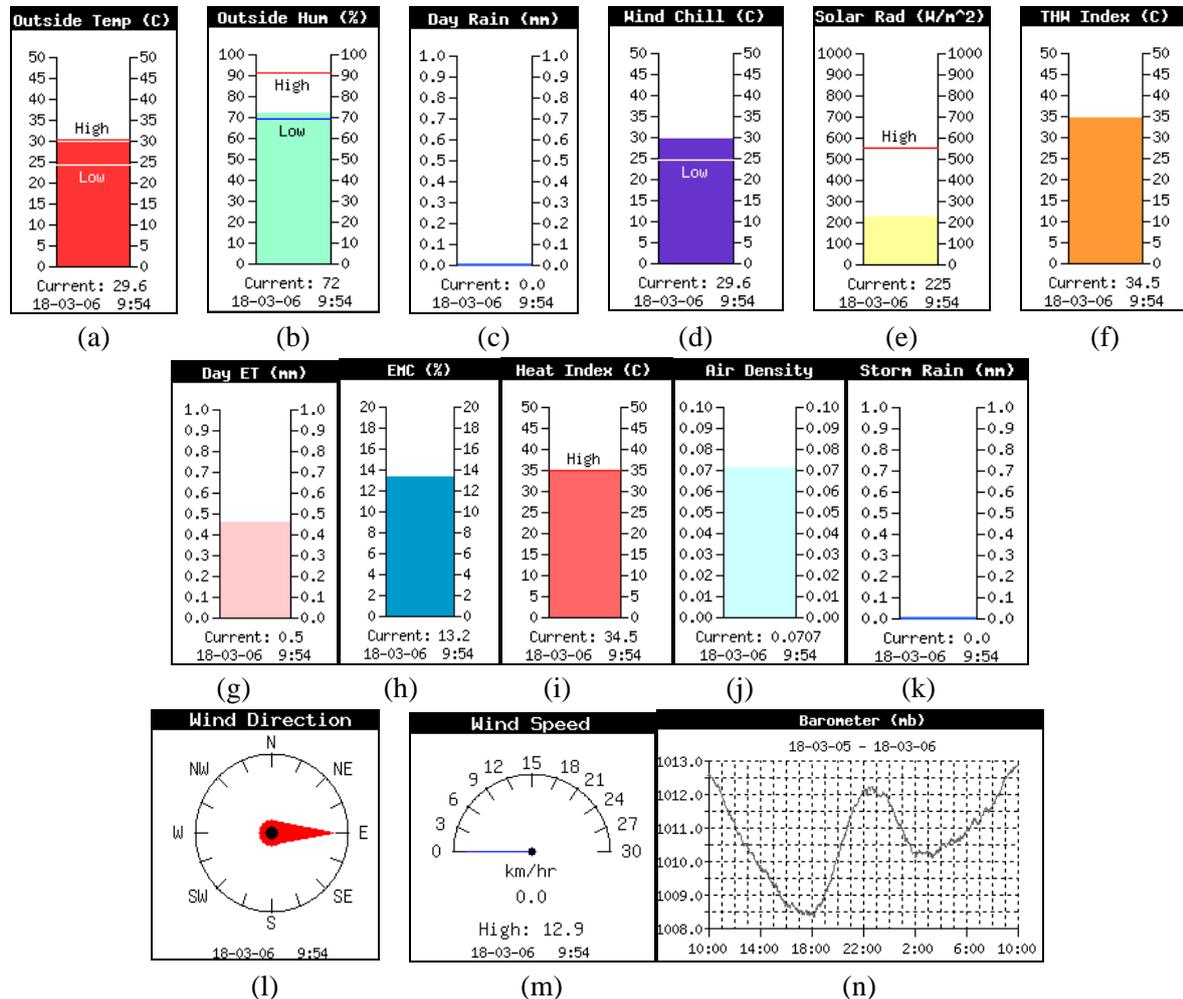


Figure 6: Online data: (a) temperature, (b) humidity, (c), day rain, (d) wind chill, (e) solar radiation, (f) THW index, (g) day ET, (h) EMC, (i) heat index, (j) air density, (k) storm rain, (l) wind direction, (m) wind speed, (n) barometer

The real-time surveillance system has collected data on relative humidity, air temperature, and soil temperature. Graphs are made based on these data and are shown below (Figure. 7 a - h). The graphs, 7a-d, show moisture content in the soil. Moisture content was different in the months. When the moisture content is low at different depths, it indicates the water requirement in the palm farm. Though rainfall was observed from May to June, still moisture content was low in the soil. Thus, water should be provided in the palm farm. Figure7 (e) shows the trends of air temperature each day. Figure 7 (h) shows the soil temperature; usually, soil temperature is related to temperature and relative humidity in the air which influences the soil temperature.

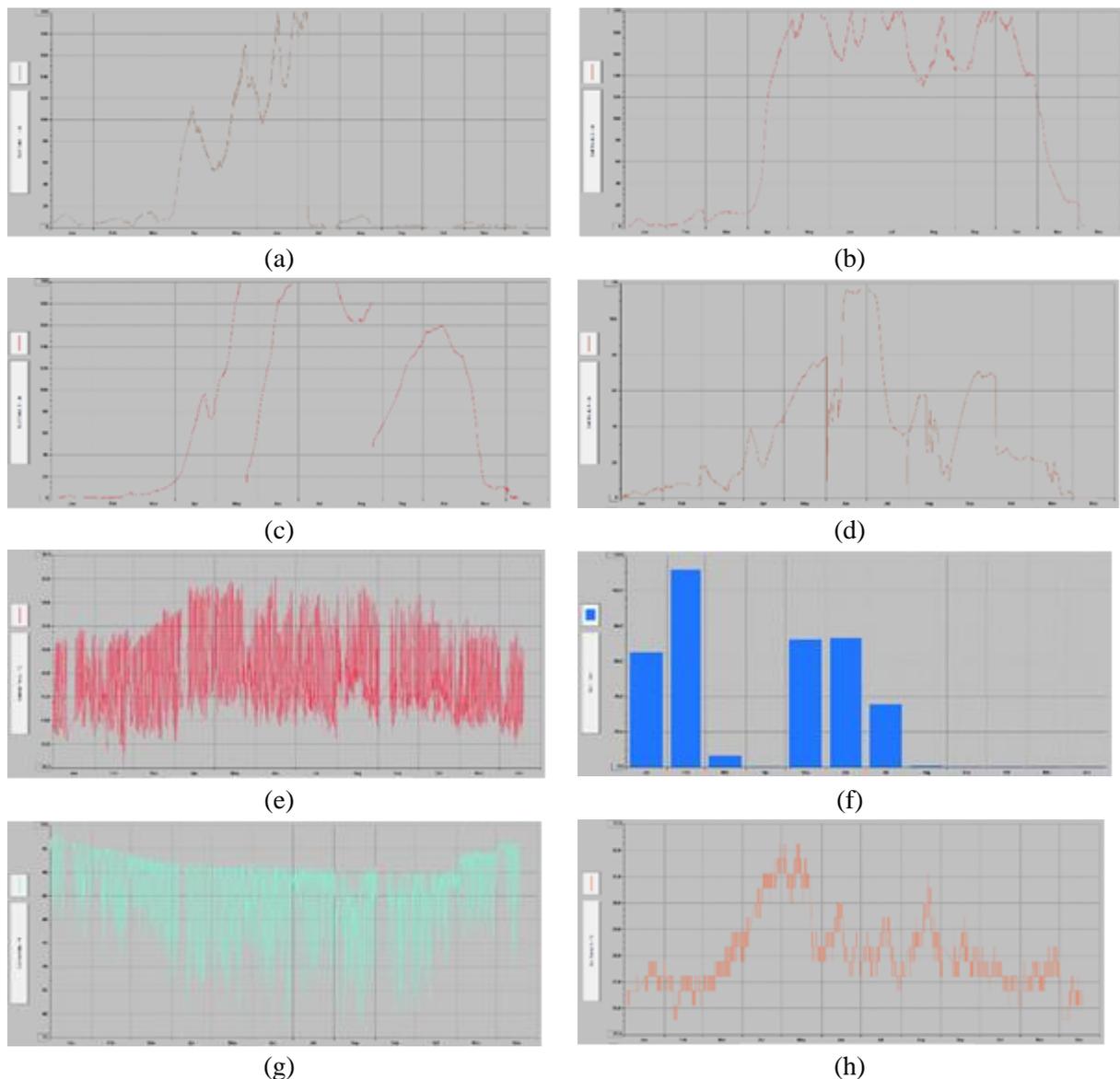


Figure 7. Graphs showing the relative humidity, air temperature, and soil temperature of Ban Tha Khuen oil palm plantation in Tha Sala district, Nakhon Si Thammarat province from January to December 2017; a-d, soil moisture at a depth of 25 cm, 50 cm, 75 cm, and 100 cm; e, air temperature (°C); f, rainfall (mm); f, relative humidity (%); and h, soil temperature

This system analyses data and display graphs online (<http://hvd.nstru.ac.th/weather>) based on the stored data. Graphs are very helpful for the farmers as they can easily understand the graphs. Therefore, farmers in oil palm plantations will be able to manage their water discharge system based on the humidity level in the soil, as well as, can increase their production. Thus, oil palm plantations can be managed effectively by using this smart sensing system.

Furthermore, when data will be stored for 1 year or more than 1 year, it will be possible to use this information for developing a Business Intelligence (BI) in future, as BI requires a long-term continuous data set.

Acknowledgments

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