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Control and supervision for agricultural stations using combined communication between lora and internet

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ABSTRACT: Currently, high-tech agriculture is an inevitable trend to bring the high efficiency and productivity in the process of agricultural production. The application of IoT solutions has shown advantages in many fields in general and the agricultural industry in particular. This paper proposes a solution to control and monitor agricultural stations through the combination of sensors with the use of data communication via LoRa and the Internet. By proposing a control and monitoring structure combined with running experiments on the model, the accuracy of the proposed solution has been verified.
camless engine.
KEYWORDS: Intenet of thing, LoRa technology, Iot Farm, agricultural technology, Smart Farm

I. INTRODUCTION

Agriculture is a basic production industry, playing an important role in economic development in most countries, especially in developing countries. However, attention to productivity and quality of agricultural products has only been focused on recent years. In rural areas, most people live by farming, but the proportion of young people working in this field is still limited. One of the reasons for this is the work nature of the agricultural sector, which requires farmers to spend a lot of time and effort. Besides, the agricultural sector is greatly affected by environment conditions such as wind, storms, etc. Especially in the field of growing vegetables and fruits, weather factors such as temperature, humidity, light, etc. are very important for plants.

Currently, most agricultural areas are often located away from people's houses from a few hundred meters to a few kilometers, even to tens of kilometers. Therefore, it is very difficult to manage and take care of, and it takes a lot of time to move from home to the farming area. Moreover, the control of parameters such as temperature, humidity, light, etc. inappropriately will adversely affect product quality.

Therefore, the technology is applied for caring and harvesting in agriculture in order to improve product quality, harvest productivity, overcome natural disasters and environmental problems, save human resources, simplifying management. One of the outstanding technology applications introduced into agriculture in recent years is the Internet of Things (IoT), which has been bringing many encouraging results, gradually being applied and popularized in a certain number of agricultural areas. Recently, there have been many studies on this field such as: In [1], [2] the authors focus on analyzing applications of IoT technology in the field of agricultural production. Research [3] focuses on providing an overview of protocols used in IoT and exploring the relationship between IoT and other emerging technologies including big data analytics and cloud computing. In [4], [8], [10], the author studied wireless sensors for agricultural applications.

The authors in [5] propose a control solution via the Arduino Uno board combined with the signal collected from the wired sensor. In [6], the research focuses on IoT applications for the protection of space security around the farm using infrared sensors. Research [7] applies IoT for the analysis of crop parameters through sensors to give a solution to provide accurate nutrients to plants in each stage. In [9], the authors propose a structure to process data collected from sensors and process data through layers to ensure high efficiency in production applications. Thus, it can be said that researching IoT application control solutions for agricultural production is an area that needs attention. The article focuses on researching and proposing to build an IoT system in agriculture that has capable of monitoring temperature, humidity,

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light (through sensors), stabilizing environmental conditions through devices. Equipment such as: water pump system, lighting system, convection fan system, ... controlled via app and website using Wifi and LoRa waves.

II. PROPOSING IOT MONITORING AND CONTROL STRUCTURE FOR AGRICULTURAL STATIONS

The structure of control and monitoring of agricultural station applying IoT technology is proposed as Fig.1. Including the coordination between LoRa and Internet communication waves.

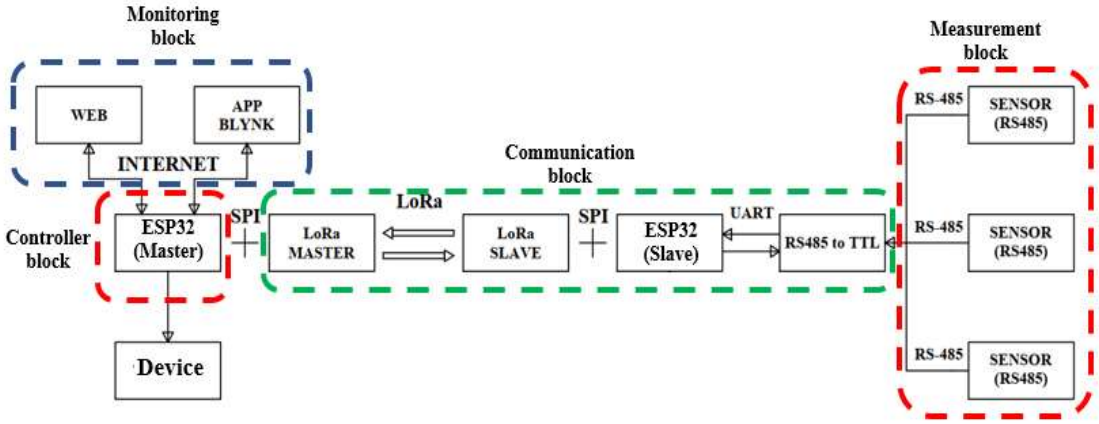

Figure1. Structure diagram for control and monitoring of agricultural station

In the Fig.1, the sensors with RS485 standard in the Measurement block will collect data from agricultural stations, including humidity temperature sensor, light sensor, soil moisture sensor, then transmit data to ESP32 microcontroller (Slave) through Modbus RS485 communication method. Next, thanks to the LoRa Slave module (LoRa SX1278 433MHz Ra-02 RF transmitter module) which is hard-wired to the ESP32 (Slave) via the SPI port, the data from the sensors will be sent as data packets to the central controller. Esp32 (Master) via LoRa wave is received via LoRa SX1278 433MHz Ra-02 RF receiver module. At the central controller, the data from the sensors will be compared with the conditions of the database, then the most appropriate control rules will be given to control devices such as pumps, convection fans, lights... to stabilize the environmental parameters. In addition, the data is pushed to the server of App Blynk, allowing control and monitor equipment as well as environmental parameters at the agricultural station through the App Blynk on Smartphone or the Web. The layout of the actual equipment on the farm is described in Fig.2.

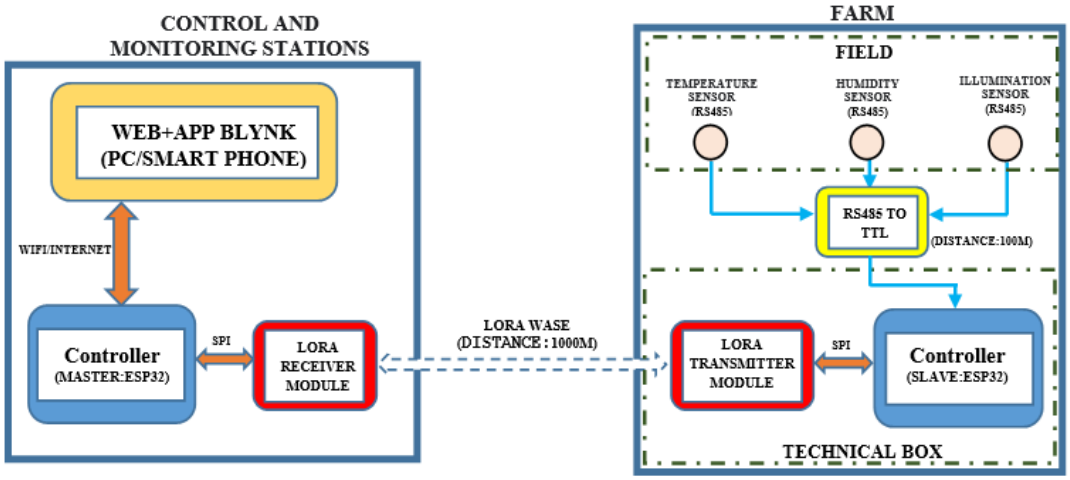

Figure2. Layout diagram of actual equipment on the farm

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III. BUILDING IOT CONTROL MONITORING INTERFACE FOR AGRICULTURAL STATIONS

The farm monitoring interface is set up via Web and App Blynk as shown in Fig.3, allowing the farm operator to manipulate and control the device at any location on the basis of a combination of LoRa and the Internet transmission lines to ensure reliable signal and control quality.

The data from the sensor measured at the farm is displayed on the App Blynk monitoring interface on the Smart phone, including temperature, air humidity, soil moisture, light intensity... Besides, direct control of actuators such as pumps, roofs, heaters, convection fans, etc. is allowed from the interface to ensure stable environmental conditions necessary for plant growth.

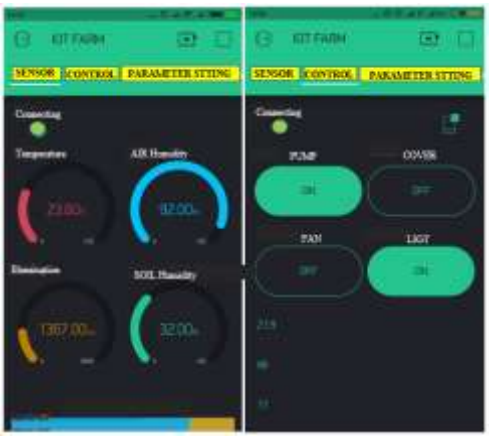

Figure 3. Monitoring interface on the App Blynk

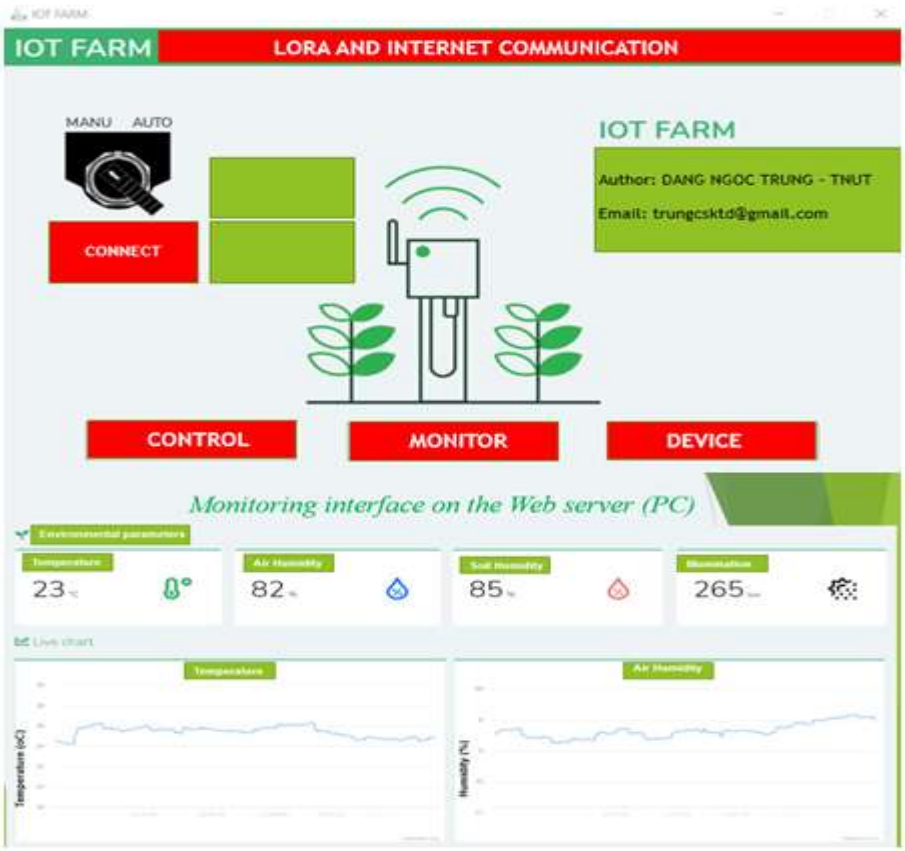

Figure 4. Monitoring interface on the Web server (PC)

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In addition, the system proposed in this paper also allows the operator to control and monitor via Web server (on PC) as Fig.4. The Web-based interface can set automatic and manual operating modes and output data can be obtained in the form of tables and graphs in real time.

Figure 5. IoT Farm Controller on the Farm

IV. CONCLUSION

By conducting experiments on real devices, we have verified the superiority of the structured monitoring and control solution proposed in this paper. By combining two types of LoRa waves and the Internet, it has brought a useful application of IoT technology to the agricultural industry. With the proposed communication structure, it provides accurate and reliable operation with unlimited control distance anywhere. Therefore, it can be applied to medium and large-scale farms.

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