Smart Farm Management System Using Humidity Meter

Yuseung Shin[1] and Jaeyun Jeong[2](✉)

[1] Kyunghee High School, Seoul 02447, Korea
[2] Hankuk University of Foreign Studies, Seoul 02450, Korea
3500jjy@gmail.com

Abstract. With the recent development of IoT technology, farmers can enjoy convenient and practical lives with smart farms created by combining agriculture and IoT technology. In this paper, we introduce the characteristics of plants and explain the direction of Beacon devices and smart devices through AAP. When managing smart farm moisture using a hygrometer, it is useful for promoting plant growth as well as saving water.

Keywords: Smart Farm · IoT · ICT

1 Introduction

The development of the Internet of Things (IoT) has made people enjoy a more comfortable life. Since then, the combination of agriculture and the Internet of Things has allowed farmers to enjoy a convenient and practical life with smart farms.

Although cultivation kits are being released as personal smart farms, there is a limit that plants are not compatible with various pots, and the types of plants are limited to vegetables, and temperature and humidity light should be correlated in the actual environment. To solve this problem, moisture can be measured with existing moisture sensors and weight sensors, but measurement errors and weight sensors are unstable due to plant growth, so an automated humidity control algorithm is needed with development of humidity sensors and beacons. In this paper, we propose a method to provide the appropriate humidity of plants using a humidity sensor.

2 Related

This section introduces existing smart farm and beacon technologies and explains the characteristics of plants and the plants introduced by Korea.

J. C. Hung et al. (Eds.): IC 2023, LNEE 1045, pp. 767–773, 2023.
https://doi.org/10.1007/978-981-99-2287-1_104

2.1 Definition of Beacon

Beacon is a Bluetooth protocol-based NFC device. Beacon's wireless communication has recently been in the spotlight as a near-field communication technology due to many advances such as low power, miniaturization, life extension, and increased reception distance, without the pairing process that had to be done to connect between the two devices using Bluetooth. In addition, the maximum communication distance is relatively long at about 50m, and sophisticated location can be identified indoors. Beacons classify certain objects with beacons as UUID values and transmit signals to users without a separate pairing procedure for each close-range section using RSSI (Received Signal Strength Indicator) to individuals with smartphones at low cost. The beacon transmitter periodically signals its UUID and RSSI values, and when a person with a smartphone comes within the reach of this signal, the smartphone recognizes it and sends signal information to the server [3].

2.2 Implementing Beacons

There are Starbucks siren orders, hospital appointments, and mobile payments for medical expenses using APP, but the service is not working well in some places in the hospital due to battery consumption problems, but the problem is expected to be solved in the future. There is also a disadvantage of weak security.

2.3 Smart Farm

It is a system created by the fusion of precision agriculture and ICT technology that emerged in the 1980s, and a system that collects data on plant growth and environment and helps decision-making is called a smart farm. It uses crop data collected through satellites, weather information, and environmental information collected using various sensors [1].

2.4 Smart Farm Trends

According to the Korea Institute for Science and Technology Jobs, industrial trends by smart farm country are spreading to areas such as distribution and consumption of smart farms in Korea, but so far, agricultural production has been the core. It is believed that it is concentrated in the monitoring and control stages, and developing optimized algorithms using big data and automation technologies related to robots are currently in the R&D stage Currently, the smart farm system applied to our farms remains at the level of opening and closing of cultivation facilities (insulation cover, ceiling, curtain, ventilator, sprinkler, fluid, hot air, etc.) through smart media based on environmental information (temperature, humidity, CO2, illumination, etc.). In the future, it is required to develop a growth optimal environment setting model for precise crop management by growth stage based on cultivation growth information and to develop a specialized model for diagnosis of crop physiological disorders and pests.

The Netherlands is a representative smart farm-using country, and although its land area is only 1/2 of that of Korea, it has become the world's second-largest exporter of agricultural products through the introduction of ICT. The Netherlands is a representative horticultural country, and 99% of all greenhouses are glass greenhouses, and various sensors and control solutions have been developed based on decades of accumulated big data and experience optimized for the cultivation environment. Through these agricultural ICT technologies, production and quality optimization will be planned, and Priva, a leading Dutch company, is producing the world's best greenhouse environment control system and exporting it to countries around the world.

The U.S. is attempting to use not only IoT but also nanotechnology and robot technology for agriculture in earnest. In the case of Google, it is trying to develop an artificial intelligence decision support system technology that helps spread seeds, fertilizers, and pesticides by collecting big data on soil, moisture, and crop health.

In Japan, companies such as IBM, NEC, Fujitsu, and NTT provide various services by incorporating ICT technology into the agricultural field.

Examples of Japan are IBM's agricultural product history tracking service, NEC's M2M-based growth environment monitoring and logistics service, and Fujitsu's agricultural management cloud service system.

Israel is a leader in monitoring the growing environment and automatically measures crop growth information such as crop size, stem change, and leaf temperature, and predicts accurate yields by automatically adjusting water supply cycles and water supply, especially, the development of crop stress sensors has increased production by more than 40% [2].

2.5 Plants

The current status of inflow-oriented plants in Korea and their generative characteristics the distribution of origin of 114 species of inflow-oriented plants is shown in Fig. 1. There were 17 species of plants native to North and South America, accounting for 14.9% of the total. Next, 15 species of plants native to Africa and Asia each accounted for 13.3%. In addition, there were 14 species of plants native to North America and 11 species in South America, 42 species native to North and South America, accounting for 36.8% of the total. Therefore, thorough quarantine should be carried out because seeds of imported plants are most likely to be mixed or adhered to agricultural products imported from North and South America, Africa, and Asia. And there were nine species of plants native to the Mediterranean coast. Therefore, the nine species were distributed on three continents: Europe, Africa, and Asia. It was included in the top 100 malignant weeds designated by IUCN and was designated as an introductory plant in Korea, but some of them are native to tropical regions, so they cannot survive even if they enter Korea. Although it is judged that plants of this inflow should be excluded, even if some tropical regions are native, Jeju Island has a tropical climate due to global warming, suggesting the possibility of survival.

3 Smart Farm Management System Using Humidity Meter

This section presents prior research and the direction in which Beacon devices and smart devices configure smart farm systems through (APP) apps.

3.1 System Configuration Diagram

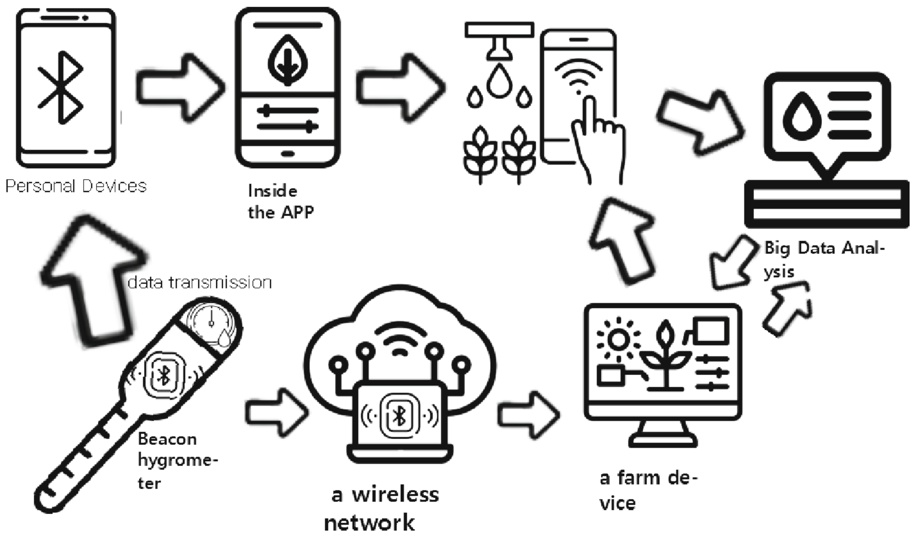

Fig. 1. System Configuration Diagram

After connecting the Beacon device built into the hygrometer and the smart device (smartphone) through the (APP) app, farm use is presented at startup. Users can choose plant types by presenting a list of plants, register photos and names, and finish setting up Wi-Fi after connecting the mobile device and the humidity sensor using a beacon in the process of adding them. For farms, help connect the farm device to the sensor.

The hygrometer settings are as follows (Figs. 2 and 3).

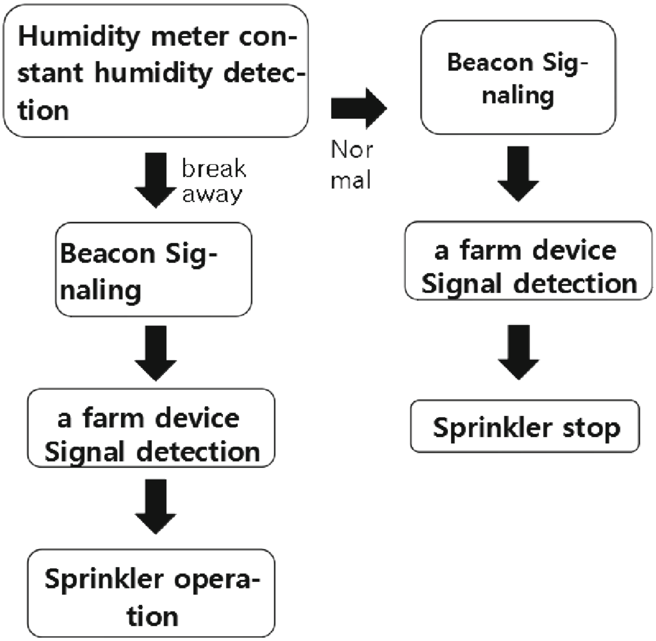

Fig. 2. The hygrometer settings

3.2 APP Internal

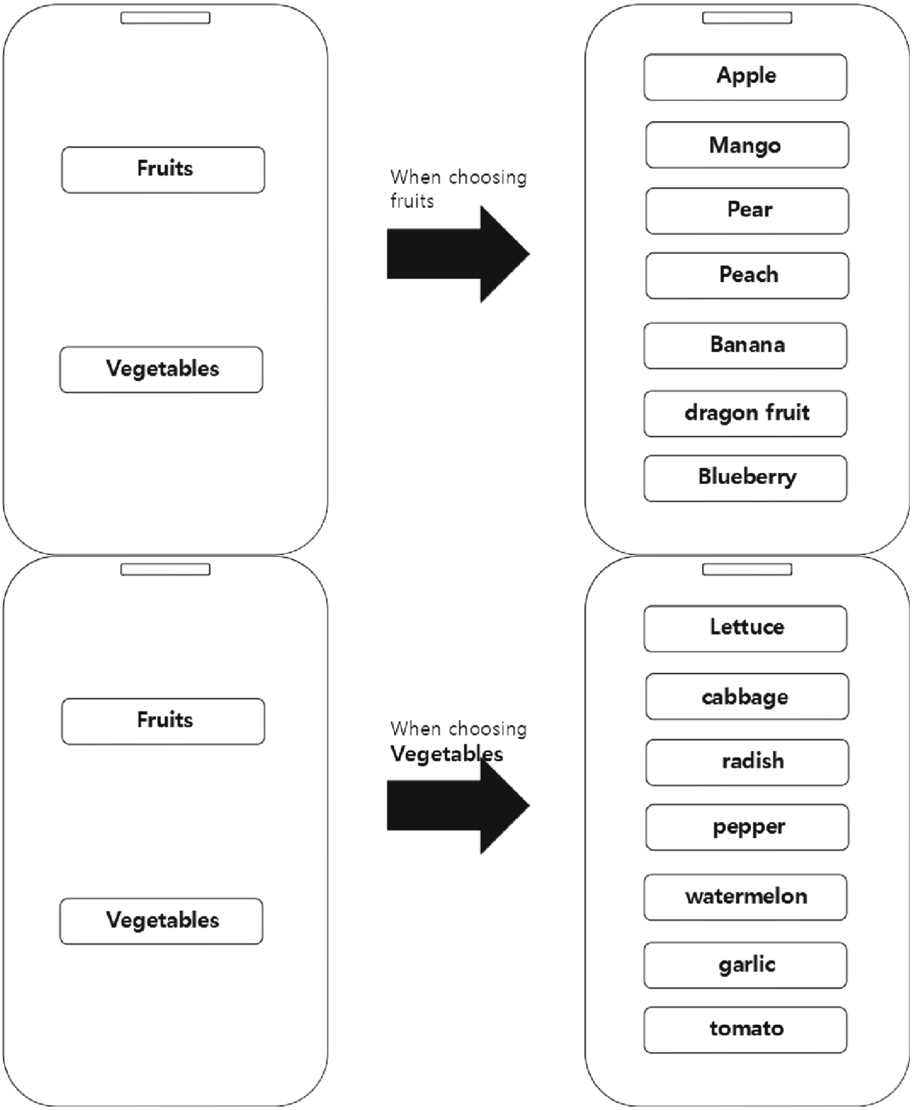

Fig. 3. Device Screen

After connecting the personal device and the hygrometer through APP, fruits, vegetables, and fruits are presented, and when the user selects fruits, the fruit type is presented, and even if the vegetables are selected, the vegetable type is presented. When the user selects the type of fruit or vegetable, set the appropriate humidity on the hygrometer.

There is a 'farm type' installation method so that the humidity controller can be applied in various places.

4 Conclusion

In this paper, we limited the humidity measurement system using soil humidity sensors that secure the limitations of plant types applied to existing smart farms and increase utilization and efficiency in smart farms. The system may expand the scope of application of existing smart farms such as various types of flower pots, vinyl houses, and open fields using various materials. Also, due to global warming, fruit production in Korea is changing little by little by little. It can also be applied to tropical fruits and plants such as mangoes and apple mangoes, which are tropical fruits grown on Jeju Island, suggesting higher viability. By implementing a humidity meter using Beacon and implementing an (APP) app, it presents a direction to grow various types of plants and fruits beyond smart farms, where the types of plants are currently limited to vegetables.

References

1. Park, S., Cho, J., Eom, S.H.: Smart Farm water management system using weight sensors. In: Proceedings of the Korean Information Science Society Conference, pp. 1731–1733 (2022)
2. https://www.bioin.or.kr/InnoDS/data/upload/tech/CF87C038-7017-11A5-6A54-5581930C2D2F.pdf
3. Park, J., Jungminwoo, S.L., Dae-Young, K.: Fire evacuation system using beacon for hard-of-hearning people. In: JKICS, pp. 319–330 (2022)