

Application of Internet of Things Wireless Sensor Technology in Agriculture

Yiyang Fang*

University of China Jiliang University, Hangzhou 310016, Zhejiang, China. E-mail: 2425883197@qq.com

Abstract: With the development and progress of science and technology, the technology of Internet of Things has been applied to various fields. The development of this technology is making agricultural production tend to be more intelligent. This paper analyzes the application of Internet of Things in farmland cultivation, aquaculture, and agricultural product logistics. It also discusses the encountered challenges and solutions during the development of the Internet of Things in agriculture.

Keywords: Internet of Things; Agriculture

1. Concept of Internet of Things

There isn't a authoritative definition for Internet of Thing. Generally from the technical level, it is a combination of sensing technology, embedded technology, electronic label technology and so on. From the technical architecture perspective, it can be roughly divided into three levels of perception layer, network layer and application layer. The sensing layer consists of temperature and humidity sensor, QR code label, RFID label and reader, camera, infrared, GPS and other sensing terminals. The perceptual layer is equivalent to the skin and features of the Internet of Things technology, which is used to perceive things to obtain information. The perceptual layer is the core of the Internet of Things and the key part of information collection. sensing layer consists of sensors, RFID, embedded systems and other key technologies. Sensor technology, mainly used to convert other forms of data signals into electrical signals, through electronic lines to carry out transmission. RFID technology is mainly composed of tag and reader, which

can identify the tag by electromagnetic coupling principle, and get the required information without direct contact. Embedded system is mainly used to analyze and process data. The network layer is more like the neural center of the Internet of things technology. The network layer is composed of the Internet, private network and wireless communication network, so that different devices can connect to the network such as the Internet, and the data transmission as well as processing are the key bridge to connect the perceptual layer and the application layer. The application layer is equivalent to the brain of the Internet of things technology, which is mainly responsible for the processing of the collected data, and then the management of various devices, generally according to the different requirements of the implementation of different functions are also different^[1].

2. Application of Internet of Things technology in agriculture

2.1 Farmland cultivation

Copyright © 2019 Yiyang Fang

doi: 10.18686/esta.v6i1.120

This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Farmland cultivation requires real-time attention to environmental conditions, which can be achieved by wireless sensors. A wireless sensor can monitor ambient temperature and humidity, soil PH, ambient carbon dioxide concentration and light in the area for 24 hours. By collecting the corresponding data it can provide useful information for improving agricultural planting yield, facilitate making reasonable judgments, and can also detect the growth status of crops in fact. After obtaining the dynamic change of crop growth environment information by sensor, a series of automatic control can be carried out, such as automatic irrigation, automatic fertilization, automatic spraying and automatic cooling according to the feedback of the above data to achieve highly intelligent agriculture.

2.2 Aquaculture

In aquaculture, wireless water quality sensors are mainly used to obtain various indicators in the environment, and the environment is maintained within the range suitable for aquatic survival by controlling the corresponding facilities. Changes in the environment are recorded in real time and sent to the mobile phone of the manager by means of short message. The manager can observe the breeding environment by monitoring or controlling the instrument work artificially. For example, the amount of oxygen in water is the key data of fish and shrimp, and long-term lower than the amount of oxygen required for biological survival will lead to the death of nitrifying bacteria, which will lead to the death of harmful substances in water, resulting in the death of fish and shrimp. Too low oxygen content in water will directly lead to reduced food intake, reduced resistance, and so on, while too high oxygen content in water will also lead to fish oxygen poisoning, and more serious, fish death.

2.3 Agricultural food regulation

In recent years, food poisoning and other situations occur frequently. Because of the lack of specific food production information, people are often attracted by those who reduce the price of substandard food and can not make a correct judgment. Internet of Things wireless sensing technology can effectively solve this problem. First of all, in food processing, each box of food will have a corresponding RFID electronic label. Information

will be entered into the data center when each box is loaded into the transport vehicle. Then all the information will be written into the label before the start of the transport vehicle. The use of food classification labels and electronic labels will also make customs easier. Labels can be read faster and multiple at the same time, which can achieve rapid customs clearance. Each transport vehicle will be equipped with a reader and electronic label, which can monitor the transport route in real time and plan the shortest time route to facilitate transportation, greatly improving the efficiency of transport. The sensors in the car can access the environment, which is important for some foods. Consumers increase their trust in food by learning about transportation and processing so that they are no longer blinded by substandard food.

2.4 Livestock farming

A series of data, such as environment condition of farm and growth condition of animals, can be obtained by wireless sensor, and the measures of automatic food supply, automatic management and automatic alarm can be achieved by analyzing the data. The sensor can monitor the health status of animals in real time. If there is a flu situation, it can be timely control so that influenza transmission is reduced. Animal behavior can also be studied by detecting data such as animal intake, body weight, methane emissions, etc.

2.5 Food storage

Grain storage is the key to grain sales, and infinite temperature sensors can play a critical role in grain storage. Automatic temperature adjustment based on the real-time parameters from the temperature sensors in the cold storage, through which we can also learn the concentration of carbon dioxide, oxygen concentration and relative humidity in the cold storage. And therefore we can adjust the relative ratio of different temperature and humidity and oxygen carbon dioxide according to the different types of grain stored to achieve the best storage conditions to make sure the food sold is in its best condition, so as not to deceive consumers with substandard.

3. Difficulties and solutions in

developing internet of things agriculture

3.1 Problems

3.1.1 Sensors

The scarcity of kinds of agricultural sensors is a huge defect in China's Internet of Things technology. The types of agricultural sensors used in China are less than 10% of the world, and the performance of agricultural sensors in applicability and coverage is not good. So there is still a lot of room for progress. China's sensors pay more attention to the detection of temperature and humidity, for the rest of the indicators such as soil PH value, carbon dioxide concentration, oxygen concentration and perception of the body of organisms are relatively small.

3.1.2 Low performance of equipment

The reliability, stability and accuracy of the sensor are relatively low, which still not satisfied with the use requirements. Such a situation will seriously affect the growth and marketing of crops, and the overall practicability and durability of the sensor also has a great room for improvement. Carbon dioxide sensors and sensors for soil PH conditions, for example, these sensors need to be exposed to outdoor at all times, with 24 hours uninterrupted, subject to different external environment interference such as weather and other factors. The durability or low precision of the equipment will not be able to read the data accurately and even be destroyed directly by the environment, which will greatly affect the production efficiency of agriculture and increase production costs. The same sensors need to be repaired once every three months in China and only once every three years in foreign countries, which is the deficiency of domestic sensors.

3.1.3 Challenging operation

Agricultural workers have become accustomed to traditional greenhouse farming methods. The introduction of new methods and the operation challenges will make agriculture worker feel difficult to adapt. Moreover, the agricultural workers are generally older and it's not easy for them to accept new things, so it is disguised that the use of Internet of Things in agriculture is not very common currently.

3.2 Solutions

3.2.1 Enhancing independent innovation

China needs to insist on independent research and development and introduction and strengthen the innovation ability of agricultural Internet of Things, the development of products needs to be paid attention to, the development of scientific research needs to be strengthened, the goal is to take advanced foreign sensors as the goal, to adapt to the market, to strengthen independent research and development, to take a path of independent development suitable for domestic conditions, not to blindly imitate and learn from, nor to build behind closed doors. actively research the cutting-edge sensor technology and strive to make the sensor technology into the world's top^[2].

3.2.2 Optimizing product performance

For poor sensor accuracy, high cost stability and other problems, it is best through the real-time communication between manufacturers and users when using any problems even if the reaction. Let manufacturers make corrections, so that the future sensor performance can be more excellent. For the country, it is necessary to study different sensor performance for different scene applications, so that sensor technology can be better applied to agricultural production and transportation.

3.2.3 Simplification

It is very important to simplify the operation of Internet of Things technology. If the operation is too complex, it is necessary for practitioners to master this knowledge, which is more difficult for most people, The simplification of operation can greatly accelerate the popularization of Internet of Things technology in agricultural production.

4. Conclusion

The popularization of Internet of Things wireless sensing technology in agriculture can effectively improve the agricultural ecological environment, significantly improve the efficiency of agricultural production and operation, solve the problem of increasing shortage of agricultural labor force, and completely change the concept of agricultural producers, consumers and organizational structure. Internet of Things wireless sensing technology has brought a new way to the development of agriculture, and the new automatic agriculture makes people's lives more relaxed. However,

if the Internet of Things technology want to have a better development in agriculture in the future, or can not do without government policies and support, it needs government publicity, and actively solve the problem to promote the Internet of Things technology in agriculture for a better application prospects.

References

1. Wen Ou. Internet of things technology and its application in agricultural production (in Chinese). Kunming University of Technology 2015.
2. Liu PJ. Analysis on the technology of internet of things to benefit the development of modern agriculture (in Chinese). *Agricultural Resources and Zoning in China* 2016; 37(2): 66-71.