# Research and Development of Precision Ecological Agriculture Management Platform Based on Internet of Things Technology (CPCI)

Hongbin Pan

*KunMing metallurgy College*
*No.388, Xuefu Road, Wuhua District, Kunming City, Yunnan Province*
*Email: bestphb@21cn.com*

**ABSTRACT**
This paper mainly introduces the significance, key technologies and application of the Internet of Things in the agricultural field of the application of the Internet of Things technology to the precision ecological agriculture management platform, so as to realize the intelligence and precision of agricultural production, so that farmers can obtain technical support from agricultural experts; promote agricultural products. The healthy development of the market; promote the research and development of the Internet of Things and automatic control systems, technologies and equipment with independent intellectual property rights.

***Keywords:*** *Internet of Things; precision ecological agriculture; management platform; research and development*

## 1. INTRODUCTION

The Internet of Things is an emerging information technology that has received widespread attention in my country in recent years, and its application value is comparable to the previous computer and Internet technologies. With the development of microelectronics technology, computer network technology and communication technology, IoT technology can be better applied to production practice, forming wide-area interconnection, realizing intelligent perception, management and control, changing traditional management, Production and other methods have become an inevitable trend. Based on this, this paper takes the wireless sensor network as the basis, applies the Internet of Things technology to agricultural production, promotes the precision of agricultural breeding methods, and lays the foundation for the improvement of the overall strength of my country's agriculture [1].

## 2. THE SIGNIFICANCE OF IOT TECHNOLOGY IN AGRICULTURAL PRODUCTION

In the process of continuous development of science and technology, agricultural production has gradually improved its degree of automation. As far as the degree of automation of agricultural production at this stage is concerned, it has even been directly connected to the management system. In terms of informatization data, etc., it is still limited to the equipment level, and there is no substantial breakthrough. Although some agricultural production enterprises are at the factory level and workshop level, or even at the group level, the actual relationship between agricultural production-related manufacturers, and there is a lack of communication. This also directly causes the operation of agricultural production to be usually isolated. The agricultural production enterprises have not been able to grasp the development of various agricultural production in a timely manner, and even more unable to give full play to the efficiency of agricultural production. Moreover, under this situation, agricultural production enterprises cannot effectively obtain relevant economic benefits, so they cannot effectively combine the actual operation of agricultural production to improve and optimize agricultural production, so that the efficiency of agricultural production cannot be quickly improved and improved. promote.

The effective application of Internet of Things technology to agricultural production can effectively solve the above-mentioned related problems. For example, agricultural production can be effectively evaluated. For the specific operation of agricultural production, agricultural production enterprises can also better and more timely. It is very important and meaningful for enterprises to judge the economic benefits of agricultural production by understanding and controlling them and clarifying the specific operation of agricultural production. For agricultural production enterprises, the effective implementation of various agricultural production activities usually results in very high cost input, and the effective application of Internet of Things technology to remotely control agricultural production can not only improve the speed of agricultural production, but also improve the efficiency of agricultural production. A good way to reduce the cost of agricultural production. In addition, the rational use of IoT technology can effectively strengthen the collaboration capabilities of relevant remote teams. Especially at the current stage of use, agricultural production enterprises are not only in the form of in-plant production teams, but also involve relevant staff of agricultural production enterprises, such as OTLY, the world's largest oat milk company. Therefore, the agricultural production of enterprises is It is necessary and important to integrate with a more unified and open IoT platform [2].

## 3. SPECIFIC APPLICATION CONTENT OF IOT TECHNOLOGY IN AGRICULTURAL PRODUCTION

IoT technology can be reflected in two aspects, namely sensor technology, RFID tag and embedded system technology.

Sensor technology. This technology is a key part of the Internet of Things technology, which converts various analog signals through sensors and converts them into digital signals.

RFID tags. It is a technical form in sensor technology, which integrates two technologies of radio frequency and embedded technology, and has a wider application prospect in the automatic identification and management of logistics.

After the description, the agricultural production information can be sent to the cloud with the help of Internet technology and IOT protocol, and shared with agricultural production enterprises. From the perspective of the Internet of Things architecture, the Internet of Things in agricultural production includes automatic control systems, Sensors, manual intervention and external devices are stored in the cloud, and a special docking communication system is configured, which is composed of APP, application program and browser as an interface. Through the effective use of Internet of Things technology, agricultural production can be remotely diagnosed and maintained. Manufacturers can check the running status of agricultural production in a timely manner through the monitoring program set up in the cloud, receive sensor prompt signals, and issue early warnings if there is an abnormality. , alarms and data and other information for diagnosis. Through the reasonable application of the Internet of Things technology, it provides great convenience for agricultural production in the storage and sharing of information, effectively solves the problem of remote monitoring and maintenance of equipment, thereby effectively reducing the production cost of agricultural production enterprises and promoting their healthy and sustainable development. [3].

## 4. WIRELESS SENSOR NETWORK NODE DESIGN

Wireless sensor network is a multi-hop self-organizing network system formed by wireless communication, which is composed of a large number of micro sensor nodes deployed in the monitoring area. information and send it to the observer. At present, many universities and research institutions in the world have used sensor network technology to support precision agriculture. WSN nodes will be divided into 3 main categories:

Multi-function closed-circuit detection and control integrated node (S-Node): Compared with eKo node, S-Node has more powerful functions and can connect various sensors. S-Node can also be connected with brakes and RFID readers to form a flexible closed-circuit monitoring and control integrated node.

Ultra-miniature sensor node (T-Node): This node expands the monitoring range of S-Node. The size of the T-Node is very small (usually 1.5cm), and its small size and low price allow it to be deployed in most environments.

SMD passive RFID tags: The hardware of the RFID node is very simple and only has the ability to transmit the tag code. And the price is very low, which is conducive to ultra-large-scale deployment [4].

### *4.1 S-Node*

In terms of software, there are already operating systems (such as TinyOS) specially developed for sensor networks. However, this kind of operating system still has the problem that the expansion ability is not strong enough. In general, the operating system is optimized for a single sensor interface. For example, TinyOS abstracts the interface for reading sensors into a simple general function. This approach is simple, but not flexible and not easy to extend. Moreover, sensor network-specific OSs such as TinyOS do not directly support common interfaces such as industrial serial ports. Therefore, in the design of this subject, a more advanced OS, such as embedded Linux, WindowsCE or VxWorks, will be used. Such operating systems can often provide enough system software support to develop interface programs, support complete thread and process support, and provide inter-process communication. It is easiest to use direct S-Node native IPC for a single machine, such as the Master process and Worker process in EggJS. Communication.

### *4.2 T-Node*

Low power consumption and miniaturization are distinguishing features of ultra-miniature sensor nodes. The idea of low power consumption can basically be summarized as the idea of "barrel short board". That is, for a well-designed low-power system, each component of the system must be similar in terms of energy consumption. All design effort becomes moot once the energy consumption of one component exceeds that of the other components by a large amount. For a wireless sensor node, the most energy-consuming part is the wireless transmission module (ie, the Radio chip). Therefore, the solution will use ultra-low power consumption, single-channel wireless transmission chip. At the same time, the solution will use technologies such as dutycycling to greatly reduce the real working time of the Radio chip [5].

**Figure 1** Ultra-small T-NODE node

## 5. SIMULATION RESULTS AND ANALYSIS

### *5.1 Simulation parameter settings*

Taking an agricultural production enterprise as the most basic simulation network scenario, the radius of the coverage area of the base station is set to about 1km, the data of each time slot is generated by the location of the receiving equipment terminal as a random location, and the receiving priority of each receiving equipment terminal is Make random assignments. Each time slot data starts to be transmitted, the network controller starts loading devices to connect to the entire virtual scene, the channel end machine and the server end to collect data information, and finally, the decision based on the ABDE-TO algorithm is finally made in the order of loading. The device will select the appropriate resource block according to the download instruction and execute the download task. After uninstalling, performance data such as latency and power consumption data will be randomly returned.

**Table 1** Simulation parameters

| Parameter | Numerical value | Parameter | Numerical value |
|---|---|---|---|
| M | 20 | γm | 200 |
| N | 20 | α | 2 |
| K | 20 | Ptm | 1.2W |
| T | 500 | NG | 25*10-13W |
| AM（t） | 20-30Mbits | Em，max | 320J |
| fk（t） | 5-15GHz | V | 0.2 |
| Bm | 8-12MHz | Δlm | 0.05 |
| ηm | 0.4，0.6.08，1 | | |

Compared with the original heuristic algorithm, the superiority of the algorithm in terms of delay performance and power consumption performance is illustrated. The specific settings of the comparison algorithm are shown in Table 2.

**Table 2** Specific comparison algorithm settings

| | |
|---|---|
| EO-TO(Energy-Optimal Task Offloading) | In the algorithm, only the transmission energy consumption (reducing transmission delay) in the offload task is randomly defined as the computer unit that allocates the optimization target resources. Gradient price based auction algorithms still use optimization methods. |
| DO-TO(Delay-Optimal Task Offloading) | The algorithm is only based on the assumption of the overall target loading delay in the optimization process, and does not consider the constraints of long-term energy consumption. Therefore, the optimization method still uses an auction algorithm based on gradient prices. |

| | |
|---|---|
| R-TO(Random Task Offloading) | In the algorithm, different terminal channels and computer resource blocks are randomly allocated |

### *5.2 Simulation results*

In the DO-TO algorithm, the delay performance is optimal, but the transmission interruption will occur in the 440 time slots. Combined with Figure 2 above, we found that the cumulative standby power consumption of the terminal has reached the upper limit of the power budget, which indicates that the algorithm only uses the standard optimization algorithm, uses time delay, and does not save system power significantly, so despite the delay, in the short term not effectively. However, the remaining power stored in the terminal will be automatically exhausted in advance, and functional data transmission cannot be implemented. For the EO-TO algorithm, although its power consumption is relatively low, its delay optimization performance is poor, because the current algorithm is usually only optimized for power consumption, and the power consumption design is too simple and conservative to effectively improve its delay optimization. performance. For the R-TO algorithm, the energy budget is consumed faster due to completely random performance, poor latency and power consumption for its power consumption. For the algorithm in this paper, when the initial energy is sufficient, the algorithm tends to optimize the delay. In the case of reduced power consumption, the algorithm calculates the interaction between transmission delay and transmission delay, and appropriately sacrifices delay to ensure system power consumption performance. Thus, a trade-off between latency and energy consumption can be achieved.

## 6. CONCLUSION

To sum up, the precision ecological agriculture management platform designed by using wireless sensor network has high application value and promotes the precision of agricultural breeding methods.

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