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Design of Intelligent Agriculture Remote Monitoring System

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Abstract

With the development of Internet of things technology, remote monitoring technology has obtained great development space. Traditional agriculture is also gradually developing towards intelligent agriculture with automatic control, which can not only liberate a large number of labor, but also improve crop yield and labor productivity. Intelligent agriculture based on automatic control technology and Internet of things technology will be the main direction of China's agricultural industry development in the future, which can effectively improve the modern level of agriculture. This paper focuses on the framework design and key technologies of remote monitoring system for intelligent agriculture.

Keywords

Raspberry pi; OneNET; Remote Monitoring.

1. Introduction

With the development of new generation information technology such as Internet of things and artificial intelligence, traditional agriculture will enter a new stage of development. As a highly reliable technical means, Internet of things technology has accelerated the transformation and upgrading of traditional agriculture, provided a scientific basis for the standardization, mechanization, automation and intelligence of modern agricultural production, and laid a solid foundation for the development of intelligent agriculture. With information and knowledge as the core, smart agriculture deeply applies modern information technologies such as Internet of things, big data, cloud computing and artificial intelligence to all links in the agricultural field. The Agricultural Internet of things collects information on environmental factors such as soil and water content and crop growth in real time through a large number of sensors and other sensing devices, All kinds of data and information are transmitted to the application layer through the Internet. The application layer integrates and processes a large amount of agricultural information, effectively processes and makes decisions on relevant information, and realizes automatic production and optimal control.

2. Hardware design of the system

This design is an agricultural environment detection system based on raspberry pie 3B +, which uses raspberry pie 3B + as the main control because it fully meets the design requirements in terms of performance, and the performance of subsequent expansion also meets the requirements. In this design, the hardware circuit needs to have a certain foundation for analog-to-digital electricity, assembly test and layout, which is a test of hands-on ability. As shown in Figure 1, it is the hardware block diagram of intelligent agriculture system, which is mainly divided into main control part, bus part, digital to analog conversion part, control part and alarm part. The control part is mainly raspberry pie 3B +. The sensor part includes: DS18B20 circuit, DH11 circuit, bh1750 circuit and sgp30 circuit. The bus part includes: circuit connection board and IIC bus. The digital to analog conversion part includes mq-2 circuit, mh-rd module

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circuit and raindrop sensor circuit. The control part includes: water pump circuit, exhaust fan circuit and stepping motor drive circuit. The alarm part includes: detection alarm circuit.

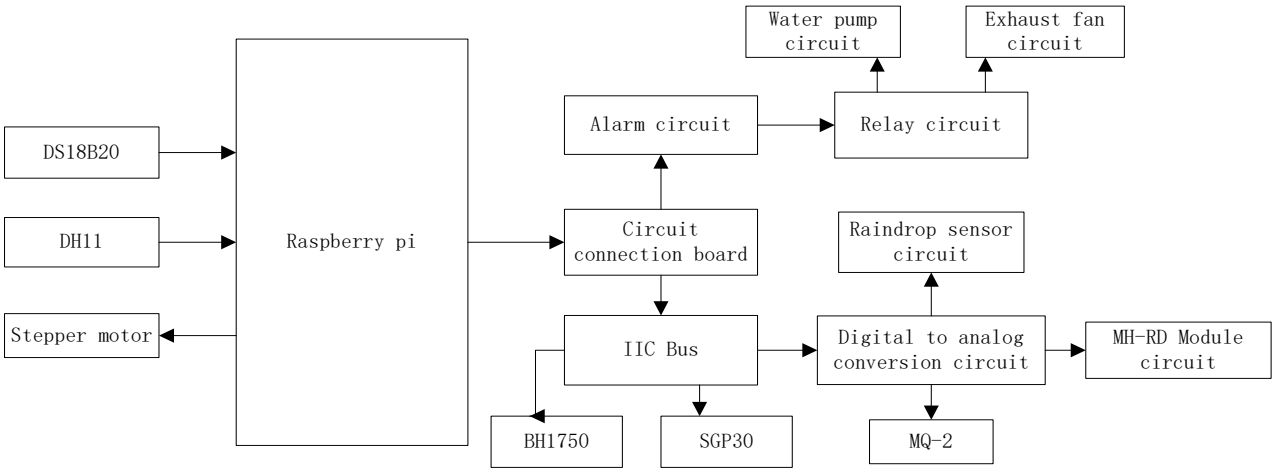

Figure 1. System block diagram

Smart agriculture promotes the refinement of agricultural production. By building an agricultural production automation system and platform integrating environmental monitoring, crop model analysis and precise regulation, smart agriculture implements precise operations on different agricultural production objects with the help of the Internet of things, detects the physical parameters of the environment through sensing equipment, and carries out real-time dynamic monitoring of the production environment conditions such as soil, air and light, Make it meet the environmental standards for agricultural production; For each link of the production process, according to the requirements of certain technical standards and specifications, the quality of agricultural products has been greatly improved through the influence and control of intelligent equipment; Through intelligent equipment, the quality of agricultural products can be accurately detected in real time, so as to ensure that agricultural products meet the needs of consumers and realize the effective connection between supply and demand.

3. System software design

The smart agriculture software design uses raspberry pie as the central master. This design enables the development of visual studio code and native idle, and uses pahon mqtt, JSON struct and other standard libraries for design and programming. Upload and download programs through SFTP and use VNC to operate raspberry pie. The system uses python programming language. Because this project needs follow-up maintenance and processing in the later stage, C language is difficult to find the source program in the later stage because it needs to be compiled, while Python is an explanatory language and runs the source program, which is superior to C language in debugging and later maintenance. Python's data processing and analysis is very convenient in use because it has a large number of open source libraries, In the future, python language will be used more and more in programming. To sum up, the project is developed in Python language, which greatly reduces the development difficulty and development cycle. The software design process is shown in Figure 2, which is divided into network protocol initialization part, detection part and control part. The network protocol is initialized to automatic configuration. Therefore, after power on, the system will automatically use the mqtt protocol of TCP protocol for cloud connection. In the detection part, the acquisition operation of data initialization will be carried out for multiple data. At the same time, the dual

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thread operation is used to initialize the control part. First, the cloud instruction is used. If there is no instruction, it will always wait for the instruction to arrive. If there is an instruction, it will judge the instruction option. There are operation of exhaust fan, water pump and skylight respectively. When there is operation, carry out corresponding operation. If there is no operation, use heartbeat connection to hold cloud connection for waiting.

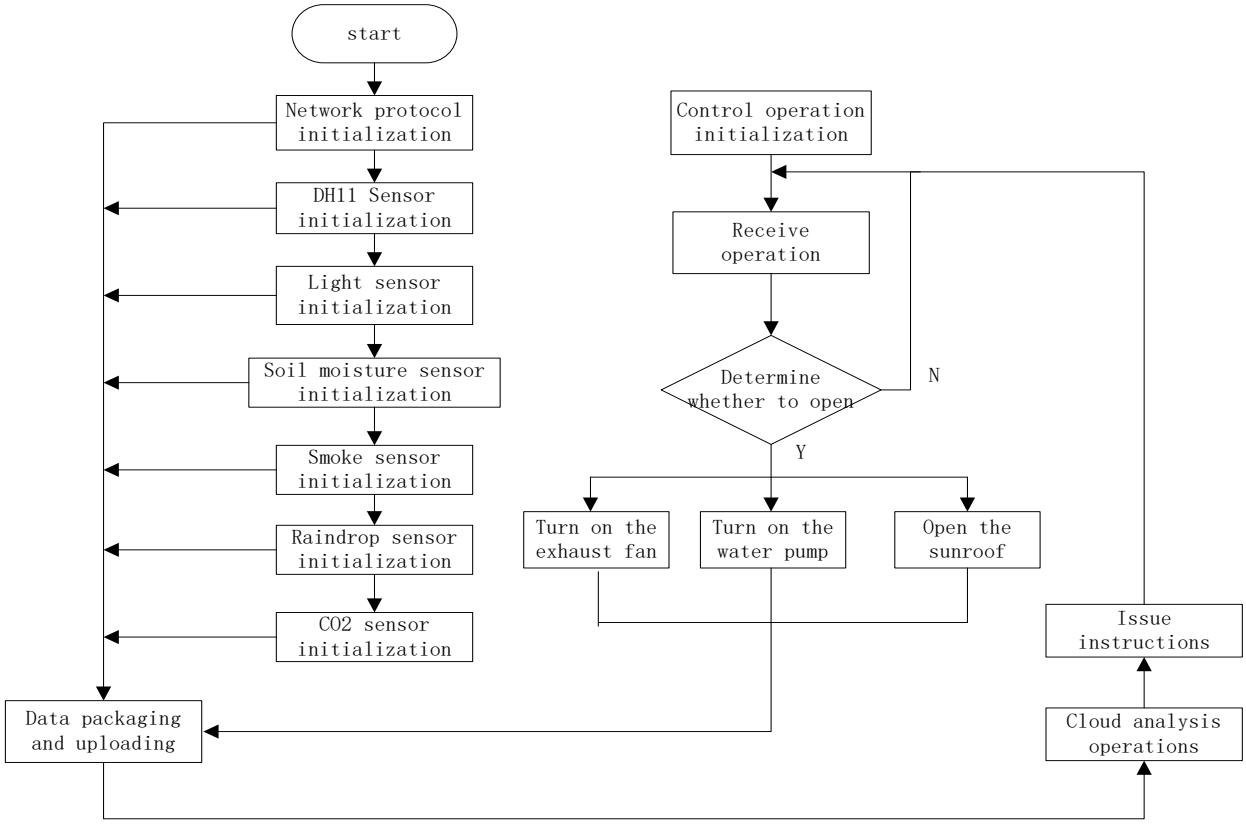

Figure 2. Flow chart

4. OneNET platform

Onenet is an efficient, stable and secure Internet of things open platform created by China Mobile. Onenet supports PAAS access capability, which can realize rapid access of various sensors and intelligent hardware, and complete product development and deployment.

4.1. OneNET Platform data upload

he mqtt protocol of onenet platform uses JSON to send the corresponding data content. According to the fixed format requirements of onenet, it uses UTF-8 coding format to convert ASII code and send it to the platform in hexadecimal form. The format is as follows, where type indicates the identification data type, and the current version range is [1,5] and dev_ ID is the corresponding device ID and DS_ ID is the data flow ID in the disclosure protocol, at is the corresponding platform timestamp, and the unit MS and value are the corresponding data values.

Data point message (type=1)

```
{
    "msg": {
            "type": 1,
             "dev_id": 593963650,
             "ds_id": "wendu",
```

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```
                "at": 1466133706841,
                "value": 42
            },
        "msg_signature": "message signature",
        "nonce": "abcdefgh"
    }
```


4.2. OneNET Platform debugging

Open the onenet official website, find the console in the upper right corner of the homepage official website, click enter, find multi protocol access, and then find the creation product. Follow the prompts to create the device to be created, and get the master apikey and access at the same time_ Key, used for encryption. Then find the device list in the left panel and add the device and authentication information like creating a device. After creating a data stream, click it to view all data information of the device, including pictures and text. It can also refresh and record the total data of the whole day in real time. Next, use the debugging tool to query the equipment.

http message:

GET http://api.heclouds.com/devices/654869941

api-key: syRaBbJTXnb7DyF=4c=3nq=RNGQ=

At this time, you can see the output error: 0, indicating that the device information has been received.

API Debugging assistant:

Then report the data and select the debugging assistant according to the settings

POST http://api.heclouds.com/devices/593963650/datapoints HTTP1.1

api-key: syRaBbJTXnb7DyF=4c=3nq=RNGQ=


```
{
   "datastreams": [{
        "id": "wendu",
        "datapoints": [{
            "at": "2021-03-01T00:35:43",
            "value": "20"
          }
                              }]
}
```


OneNET Platform data flow:

After receiving the data prompt succ, it indicates success. You can see the corresponding received data in the data flow of onenet control panel. Through continuous exploration of the above operations, the data upload is successfully completed.

In the list on the left of the product development interface, click application management to view the component library on the right. There are basic elements and control elements. Most of the other components are similar. Click the line chart component in the basic element and drag it to the page. Select this component. You can see the attributes and styles on the right. We can set them. Next, select the data flow, Then set the data flow for the corresponding legend, and the data will be displayed in the icon, which can be changed according to your own needs. Next, you can see several groups of data flows. Set the legend in the attribute, and we can see that the name of the component line on the left has changed. Finally, click save in the upper right corner, and then refresh our application interface, You can see the appearance of tables in the application.

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5. Conclusion

China is a large agricultural country, and smart agriculture will be the future development trend of modern agriculture. Through the integration and application of Internet of things technology, computer and network technology and big data cloud platform, the traditional crop management mode is broken, the information management is realized and the agricultural production efficiency is improved. Developing smart agriculture is an urgent need to implement China's national strategy of "synchronization of four modernizations", accelerate the transformation of agricultural development mode and promote agricultural modernization. It helps to promote the deep integration of informatization and agricultural modernization, promote the transformation and upgrading of the whole agricultural industrial chain, and plays an important role in building a digital China.

Acknowledgments

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