The Modeling and Implementation of the Intelligent Family Balcony Farm System Based on MCS-52

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Abstract: The system can realize the information management of family balcony farm, it Can use unused balcony space to undertake vegetable breeding reasonably. The use of UML can do object-oriented analysis and modeling, creates a system static model. MCS-52, WIFI module, temperature and humidity module and relay module are combined to monitor the environment through mobile APP and implement accurate control according to the environmental requirements of crops, so as to conduct scientific and efficient management.

1. Introduction

While developing the core and key technologies of the Internet of things, China also attaches great importance to the development of applied business models, strengthens the top-level design of the industrial chain of business models, and establishes the ecosystem of agricultural Internet of things. Although it started late in the balcony agricultural Internet of things in China, but the government is more and more attention to the development of agriculture in the Internet of things, some enterprises and academics have been actively studying of the balcony agricultural Internet of things, some successful case is worth learning and using for reference. The large-scale application of the Internet of things and other emerging technologies in agriculture is bound to become a new engine to boost the comprehensive leapfrog development of agriculture in China [1].

2. UML Modeling

System modeling is the core part of the software development process, the purpose of modeling is to integrate the structure and behavior of the system, which makes the system better development to meet the needs of users.

The process of UML modeling is divided into three stages: requirement modeling, domain modeling and design. The static modeling and dynamic modeling are two kinds of UML modeling mechanisms. The use case diagram, class diagram and object diagram are used to define the relationship between the object and the static system in the system object model; The component diagram and deployment diagram reflect the software architecture, hardware architecture and communication mechanism; The interaction and the relationship between the state of the object adopt sequence diagram, collaboration diagram, state diagram and activity diagram.

2.1. Static Modeling Mechanism

According to the functional requirements of the system in the process of analyzing and designing, we should firstly make the static modeling the software by UML, and the static modeling mechanism is the foundation of the software model. The static modeling uses the use case diagram, class diagram, object diagram, package diagram, component diagram and configuration diagram.

2.2. Dynamic Modeling Mechanism

Dynamic modeling can reflect dynamic modeling mechanism through sequence diagram, collaboration diagram, state diagram and activity diagram. The interaction between objects is accomplished through the transmission of messages between objects, and the state of the object will change with the change of the transmission results.

3. Needs Analysis

Requirement analysis is the most basic and important software development. It is the premise of all the development and design, if you do not understand the needs of users, enter on design programming, the consequences are no matter how the program is done in vain. What is the basic task of requirements analysis to tell us "what system must do?". Although we have a rough understanding of the analysis phase of the needs of users in the feasibility, but the feasibility study is to lower cost in a short period of time to determine what work must be completed, is presented to the requirements of the complete and accurate, clear and specific. The result of requirement analysis is the foundation of system development, which is related to the success or failure of the project and the quality of the software product.

4. System Modeling

The use case diagram is used to describe the operation of users or participants in the system, which plays an important role in the demand analysis stage. The whole development process of the system revolves around the problem and the model of the requirement [2].

4.1. Overall Business Modeling

The first step to create a system use case is to identify the participants of the system. After comprehensive analysis, there are two participants in the system, namely system administrators and ordinary users. System administrators have monitoring and control functions, ordinary users only have monitoring functions. The overall use case package diagram for establishing the system through the above analysis is shown in Figure 1.

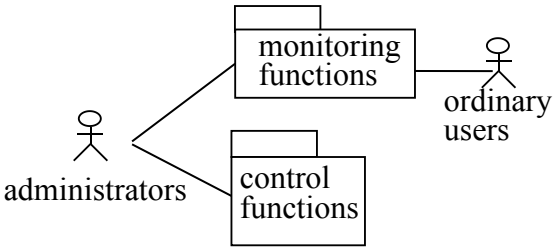

Figure 1: Overall use case package.

4.2. Static Modeling of Monitoring Module

Monitoring module is the core of the system [3], the main functions include display temperature, display humidity, automatic control. The use case diagram for the monitoring module is shown in Figure 2.

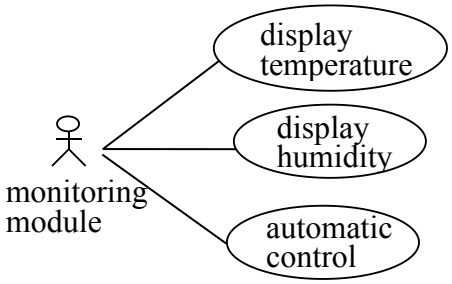

Figure 2: Static modeling of monitoring module.

5. System Implementation

5.1. Overall Design

In addition to displaying temperature and humidity, the mobile phone APP also sends instructions to the WiFi module, which sends instructions to the SCM through the serial port to realize the control function.

5.2. Implementaion

5.2.1. MCS-52 Program

The main tasks of programming include IO port definition area, variable definition, delay function, the correlation function of LCD1602 screen processing, the reading function of temperature and humidity sensor, the correlation function of serial port processing and the WIFI module ESP826.

IO port of MCS-52 is determined as follows:

```
Sbit P2_0 = P2 ^ 1;//P2.1 connects with the temperature and humidity sensor
Sbit rs = P1 ^ 0;// P1.0 connects with the RS of LCD1602
P1 sbit rw = ^ 1;// P1.1 connects with the RW of LCD 602
Sbit en = p ^ 2;// P1.2 connects with the EN of LCD1602
Sbit led = P2 ^ 0;/ / P2.0 connects with the leds
Sbit jidianqi = P2 ^ 2;// P2.2 connects with the electrical
```

The TXD interface of the WIFI module is connected to the P3.0 of the MCU, and the TXD interface is connected to the P3.1 of the MCU.ESP826 initialization program code snippet is as follows:

```
Void esp8266_init ()
{
Uart1Sends (" AT + CIPMUX = 1 \ r \ n ");
Delayesp (50000);
Uart1Sends (" AT + CIPSERVER = 1808 0 \ r \ n ");
}
Void main ()
```

```
{
Uchar dcom [3].
Delay_nms (300);
LCD_Init ();
LCD_Clear ();
Usart_init ();
Esp8266_init ();
While (1)
{
RH();// call the temperature and humidity reading subroutine
Uart1Sends (" AT + CIPSEND = 0, 2, \ r \ n ");
// serial port display program
Delay (10000);
Dcom [0] = U8RH_data_H;// humidity data
Dcom [1] = U8T_data_H;// temperature data
SendByte (dcom [0]);
SendByte (dcom) [1];
……
}}
```

5.2.2. Android Program

It mainly includes login module, main interface module and hardware operation module programming.

The code snippet for updating the temperature and humidity is as follows:

```
private void updateView(byte[] buffer)
{
humidity =(buffer[0]&0xff);
temperature= (buffer[1]&0xff);
guang=(buffer[2]&0xff);
            wendu.setText(temperature+"℃");
shidu.setText(humidity +"%");
}
```

The code snippet of APP and WIFI connection is as follows:

```
try
{
mSocketClient = new Socket(sIP, port);
mBufferedReaderClient = mSocketClient.getInputStream();
mPrintWriterClient = new PrintWriter(mSocketClient.getOutputStream(), true);
recvMessageClient = "connected to server!\n";
Message msg = new Message();
 msg.what = 1;
mHandler.sendMessage(msg);
}
catch (Exception e)
{
recvMessageClient = "connecting IP is error:" + e.toString() + e.getMessage() + "\n";
Message msg = new Message();
msg.what = 1;
```

```
mHandler.sendMessage(msg);
return;
}
byte[] buffer = new byte[1024];
int count = 0;
while (isConnecting)
{try
{
mBufferedReaderClient.read(buffer);
Message message = new Message();
message.what = 2;
message.obj = buffer;
mHandler.sendMessage(message);
}}
```

5.2.3. Interface Implementation

When you enter the system, the login interface pops up firstly, as shown in Figure 3. Enter the password and enter the main interface of the system [4]. The main interface of the system is shown in Figure 4[5]. It has 5 modules, namely data administration, system setup, note pad, help and exit. Click data administration to display the interface of temperature and humidity, as well as the display and control interface. It is shown in Figure 5.

Figure 3: Login Interface

Figure 4: System Main Interface

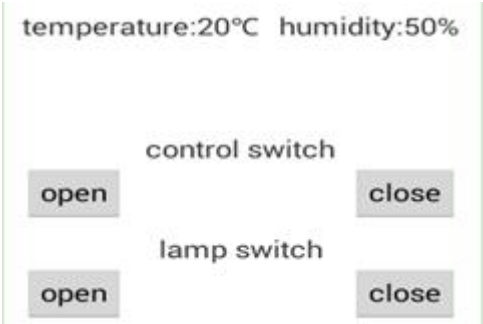

Figure 5: Temperature and Humidity Display and Control Interface

6. Conclusions

System modeling is the core of the software development process, the purpose of modeling is to combine the structure and the designed system behavior so that the system can better meet the needs of users. This paper analyzes firstly the requirements of system function, the system uses the UML static model. The system uses Java and C for program development [6], combined with MCS-52, WIFI, temperature and humidity module, control module, to achieve intelligent management of family balcony farm.

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