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Design and Implementation of Intelligent Switch System Based on IoT

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Abstract: This system takes home equipment as an example, and improves its ease of use by adding sensors and smart modules to the equipment, and realizes a smart home IoT(Internet of Things) platform. Through the combination of software and hardware, functions such as lighting control, temperature and humidity detection, intelligent watering, and curtain opening and closing are realized.This system uses MQTT(Message Queuing Telemetry Transport) protocol for communication, uses Arduino and other hardware devices to realize the intelligence of existing devices, and uses MongoDB to store device data.

Keywords: *IoT; Smart Home; MQTT; Arduino; MongoDB*

I. INTRODUCTION

The concept of IoT was proposed in 1999, To put it simply, it is to obtain information from the devices around you through sensors, transmit information through various networks, connect the devices to the Internet, and then through the software system to provide users with display, Control and other functions. The smart home IoT system is mainly divided into two parts: hardware part and IoT platform. Emqx is used as MQTT (Message Queuing Telemetry Transport) server, MongoDB is used to store device data, MySQL is used to store business data, and Redis is used as high-speed cache. In terms of hardware, it is realized with the help of Arduino development board, ESP8266 module, NEMA42 stepper motor, infrared receiver module, etc., and the furniture in a room is controlled by a remote control. The platform part adopts the front and back separation mode development, the front end uses the VUE+Element-UI framework, and the back end uses the Spring Boot framework to visually present data to users in the form of web pages, which is convenient for users to monitor and control. The main functions of this system include lighting switch, humidity detection, intelligent watering, opening and closing of curtains and other functions.

II. RELATED DEVELOPMENT TECHNOLOGY

1.Spring Boot framework

Spring Boot is a brand new framework provided by the Pivotal team, and its design purpose is to simplify the initial setup and development process of new Spring applications . The framework uses a specific way to configure, so that developers no longer need to define boilerplate configurations.

2.Redis

It is an open source log-type, Key-Value database that is written in ANSI C language, complies with the BSD protocol, supports the network, can be based on memory and can be persisted, and provides APIs in multiple languages.

It is usually called a data structure server because the value can be of String, Hash, list, sets and sorted sets.

3.Vue

The development of front-end frameworks is changing with each passing day. As one of the three front-end frameworks in the Web, the Vue framework has high performance and can meet the needs of the front-end. Vue represents today's popular front-end technology, with rich grammar, rigorous and ingenious design thinking. The backend interacts with Vue, and only needs to provide JSON data, and Vue will automatically render the data after receiving it. Vue is convenient and flexible to use, you only need to configure some Package files by yourself.

4.Element-UI

Element-UI framework is a simple and easy-to-use front-end framework. Its interface is simple and intuitive, with diverse components, which can almost meet most of the front-end needs. By quoting the template and adding CSS styles, it can be used quickly, which is conducive to the rapid development of front-end newcomers. The framework contains many useful components such as buttons, forms, and questions. The rich components have a concise style.

5.EMQX

EMQX is an open source Internet of Things MQTT message server developed based on the Erlang/OTP platform. Communication and data exchange based on the Publish/Subscribe model is essentially different from the HTTP Request/Response model. The subscriber subscribes to a topic to the message server. After a successful subscription, the message server will forward the message under the topic to all subscribers.

III. SYSTEM IMPLEMENTATION

1. Smart watering

In order to achieve soil moisture detection, this system selects a soil moisture detection module, and adjusts the threshold of soil moisture through a potentiometer. According to the suitable humidity of each green plant, the adjusted threshold will be different. Because it is necessary to connect to Wifi and subscribe and publish MQTT messages at the same time, this module also chooses ESP8266 to receive the value sent by the soil moisture detection module. After detecting that the soil moisture reaches the condition, it needs to be watered. In terms of irrigation, the author chose a relay module and a miniature water pump. The relay is powered by ESP8266 at 3.3v, and the miniature water pump is powered by 4 AA batteries, and the 4 batteries are connected in series with a total voltage of 12v. The relay IN is connected to the ESP8266 pin, and the switch of the water pump is controlled by sending a signal to IN. When the soil moisture reaches the threshold, ESP8266 will make a judgment and send a signal to IN to let the pump work for a period of time. After a period of time, it will detect the soil moisture.

2. Electric curtain

Considering that the curtain has a relatively large requirement for the rotating force of the motor, a relatively large NEMA42 stepper motor is selected, and a4988 stepper motor drive module is used to drive it. The main control selects ESP8266, which is powered by a 12v power supply with a pressure reducing module. Since stepping requires high voltage, I chose a 12v, 1.5a power supply to supply power to the stepper motor and ESP8266 at the same time. The opening and closing of the series is completed by the rotation of the motor, which drives the transmission belt, and then the curtain is driven by the transmission belt. The a4988 module is powered by the ESP8266, and the stepping pin and the direction pin are connected to and controlled by the ESP8266. The stepping motor is connected to a4988. Through the different buttons of the infrared remote control, you can control the rotation of the motor in different directions. Taking into account the limit of rotation, for example, if the curtain has been pulled to the extreme edge and then pulled out, it will damage the curtain or the motor, so a limiter is added to the module. Place two potentiometers at the left end of the Roman rod to control the clockwise rotation limit and the counterclockwise rotation limit respectively. When the motor rotates clockwise, only the clockwise limit is used as the judgment condition and does not care about the counterclockwise limit. If it is restricted, it cannot continue to rotate. In this way, it can ensure that the curtain is not damaged.

3. Device Management.

After the user logs in to the system, the platform will request the database to display the relevant parameters of the platform to the foreground interface.After entering the switch management module, the user can view the status of various switches and manipulate them. Click Add in the upper left corner, a page box will pop up, fill in the device name, select the sensor type, device classification, and you can add a new device. After selecting a device, you can modify the device. After selecting a device, click the delete button to delete it from the database. Click the export button to export the names of the sensors in the current database into an Excel table. If there are too many indoor switches, you can search through the search bar.

3. System Start

```
@SpringBootApplication(exclude                    =
{ DataSourceAutoConfiguration.class })
   public class  IotApplication{
      @PostConstruct
         void started() {
            TimeZone.setDefault(
           TimeZone.getTimeZone("Asia/Shanghai"));
         }
         public static void main(String[] args){
            SpringApplication.run(IotApplication.class, args);
         }
      }
```

4.Set Switch Status

```
    @RequestMapping(value = "/setStatus",
          method = RequestMethod.POST)
   @ApiOperation("switch status，1-on 0-off")
   public AjaxResult SetSwitch(@RequestParam
   long deviceId, @RequestParam String
   switchA, @RequestParam String switchB) {
      System.out.println("0。");
      if (deviceId != 0) {
         KwSwitch kwSwitch =
           kwSwitchService
           .selectKwSwitchById(deviceId);
         if (kwSwitch.getState().equals("1")) {
            String topic = kwSwitch.getApiKey();
            String payload=switchA + switchB;
            String msg = switchA + switchB;
            System.out.println(topic);
            System.out.println(payload);
            gatewayConfig.sendToMqtt(msg,topic);
         }
      }
      return toAjax(1);
   }
```

CONCLUSION

The rapid development of the Internet of Things will inevitably give people new lifestyles and new experiences. The Internet of Things has now become an important breakthrough for smart homes in the market competition. Smart cameras, rain sensors, smart access control, smart watering, smart curtains, Smart voice, etc. are all indispensable smart application devices in the home. This system uses the current mainstream technology to realize the core functions of the smart home at a lower cost.

References

[1] Ali AlSabri Akram and Bao Xianan. Design and Research of Infrared Remote Control Based on ESP8266. Open Access Library Journal, 2021,08

[2] Cameron. Electronics Projects with the ESP8266 and ESP32. Apress, Berkeley, CA, 2021

[3] Yan Zhiping. Design and Implementation of the Proposal System of Teachers Congress Based on SpringBoot and Vue Framework. Science and Technology Innovation and Application. 2020(03)