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SMART HOME SYSTEM DESIGN-MOBILE TERMINAL

Li Zhonglin, Deng Yun *
College of Information Science and Engineering, Guilin University of Technology, Jiangan Road 12, Guilin, China

Abstract For many traditional smart home systems, users have to use fixed terminals or mobile handheld terminals with touch screens and buttons to operate the device within a certain distance at home. Although these methods provide conveniences to the users, they cannot meet users' desire to control the various devices at home at anytime, anywhere from the remote end (office, outdoor). Smart home system- mobile terminal adopts Socket to correctly access to background server functional interface and data interface of the smart home device, thus achieving full-duplex communication between the browser and the server. The mobile terminal can achieve real-time monitoring of temperature, humidity, illuminance, human body infrared, combustible gas, flame sensor data collection; historical data query, data statistics, year-on-year, month-on-month analysis functions. It can set alarm thresholds for sensors, etc., and alarm based on thresholds. It is also possible to control sound and light alarms, adjustable lights, relays, fans.

Keywords: smart home system; Web App; cross-platform; socket; sensor; home equipment data analysis; good compatibility.

1. INTRODUCTION

Nowadays, the public has increasingly higher requirements for the comfort, efficiency and safety of home life, and wireless networking construction system has become the mainstream choice for smart homes. People are no longer satisfied with using terminal devices inconvenient for mobile use at home. It is hoped that there is an excellent application for observation and real-time control of the situation at home at anytime and anywhere.

For the above problems, web is used to solve the needs. The smart home system can be successfully connected by logging in to the home IP through the WEB browser of mobile devices like mobile phones and iPads. Real-time monitoring of environmental data is then possible, and the real-time change trend of data collected by each sensor can be expressed in a manner with good user experience. Interesting indexes can be derived from query, statistics, year-on-year, month-on-month analysis of the sensor collection data.

2. SYSTEM PHYSICAL ARCHITECTURE

Smart home system consists of perception layer, control layer, network layer and application layer, which includes sensors for STM32 intelligent nodes (fused with ZigBee, WIFI network, Lora WAN network), temperature and humidity, light, human body infrared, infrared correlation barrier,

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flammable gas, flame, omnidirectional infrared transmitting receiver; controlled equipment like roller shutter motors, sound and light alarms, adjustable lights, relays; CotexA53 gateway, camera, 4G module, PLC controller. The software resources include C#, JAVA Web, Android-end data acquisition, analysis and control development kits. The sensing layer and the control layer contain multiple intelligent nodes. Each intelligent node can freely select to drive different sensors or devices through the connection line. By terminal, it can select to be connected to the gateway and Lora base station through the Zigbee network, WIFI network, Lora network. Through the Lora base station and 4G module, data is uploaded to the Alibaba Cloud IoT platform or stored locally. The system architecture is shown in Figure 1.

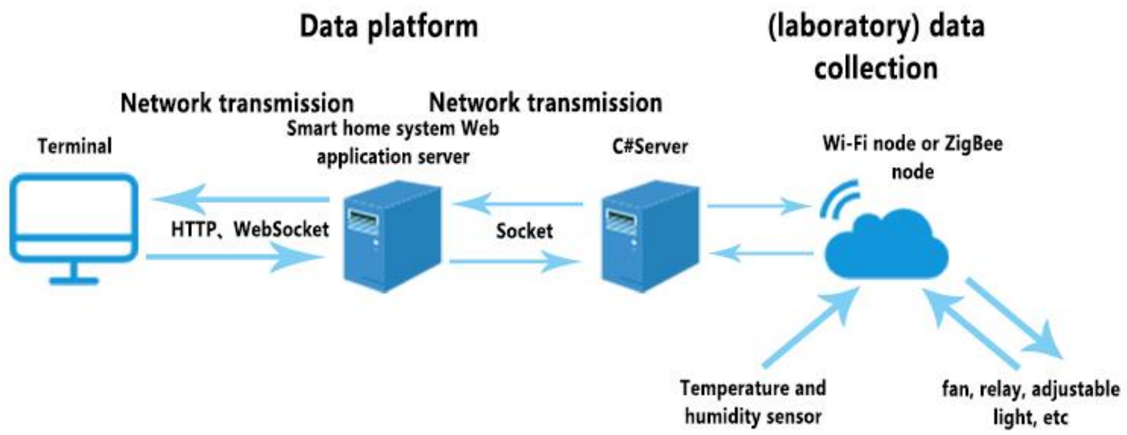

Figure 1. Smart Home System Architecture

3. Mobile Terminal Software System Design for Smart Home System

3.1. System Architecture Design

Smart home system-mobile terminal adopts B / S mode. The specific design idea is as follows: According to the business characteristics, the front and back ends are separated, React builds the user interface, Express uses middleware for WEB service and HTTP request processing. The application system architecture is a multi-layer architecture-based architecture WEB, as shown in Figure 2:

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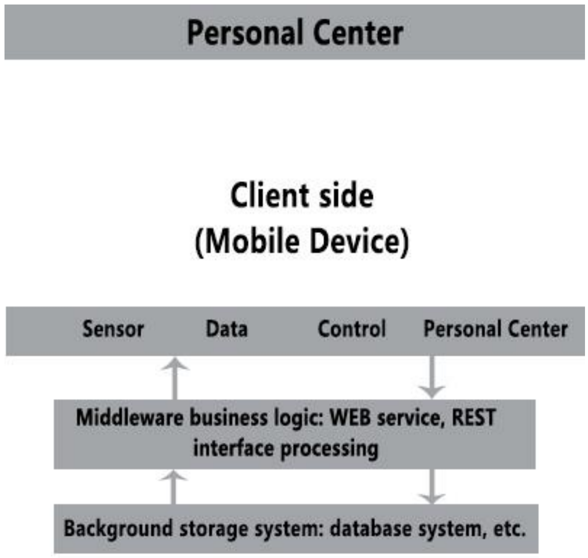

Figure 2. Multi-layer architecture of WEB

3.2. Hierarchical structure design of system function modules

Hierarchical structure chart of smart home system-mobile terminal is shown in Figure 3:

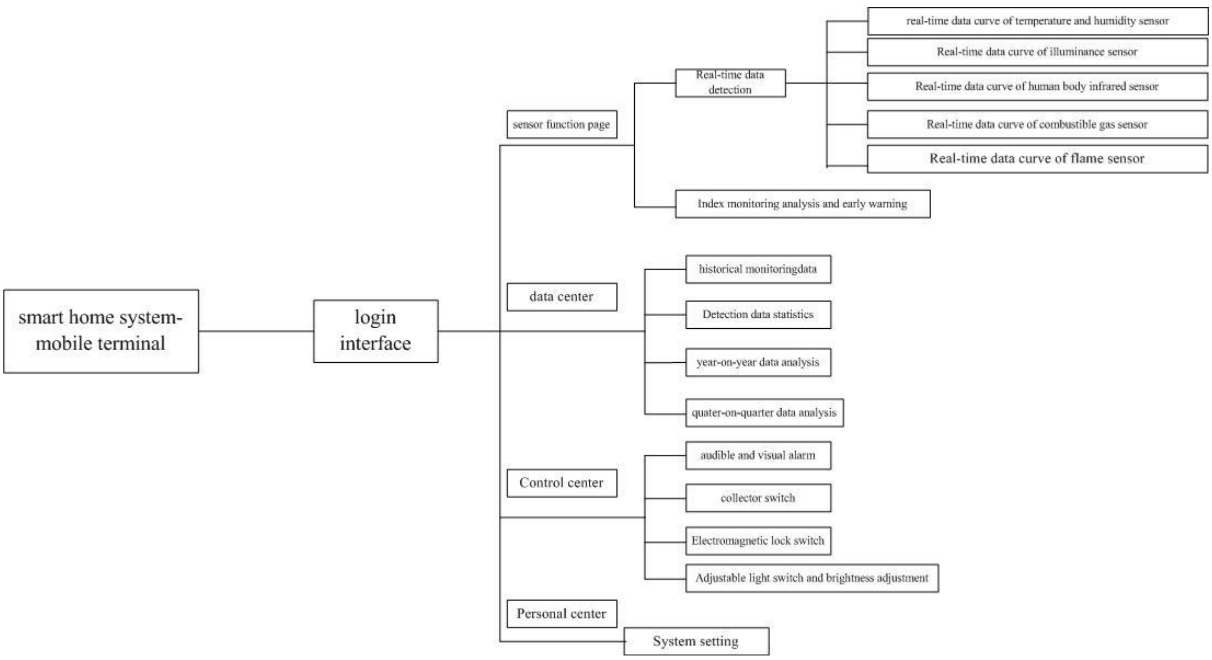

Figure 3. Hierarchical Structure of Smart Home System-Mobile Terminal

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4. System detailed design

4.1. System login interface and system interface design and implementation

Figure 4. Web system login interface

After the user logs in to the software (Figure 4), the current account permission is extracted from the database and the functions owned by the corresponding role are triggered. For example, a user with administrator role will have access to all the function pages, while a user with monitor role can only have access to function pages allowed for the monitor. Similarly, a user with analyst role can only have access to function pages allowed for the analyst.

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Figure 5. Main System Interface of Smart Home System-Mobile Terminal

The front-end interface is uniformly built using React and antd-mobile, and the data is acquired via Ajax asynchronous request to complete the page rendering. The page is automatically modified through React in combination with Redux's data response mode. Smart Home System- mobile terminal is a Web App and a SPA (Single Page Application), which is different from traditional multi-page websites (Figure 5).

4.2. Design and implementation of user management and automatic control strategy interface

4.2.1. User Management Function Implementation

Only users with administrator role can use this function page invisible to other users. The administrator can perform full management on each account by addition, deletion, modification and query operations. It mainly manages roles (including system management), and the data of all operations will be stored in the database (Figure 6).

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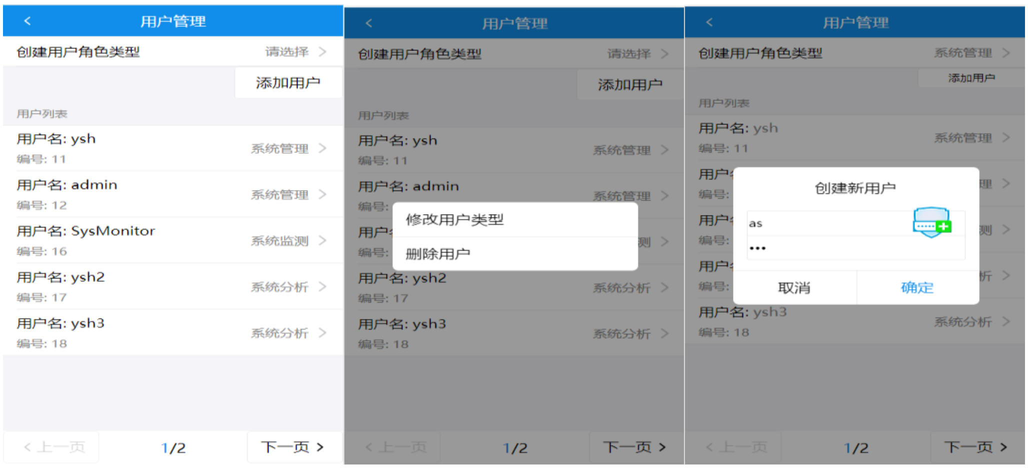

Figure 6. User Management

4.3. Implementation of environmental index monitoring analysis and early warning function

By analyzing the types of data collected in real time, it can implement alarm, analysis and evaluation of various collected data. By using rich perceptual data and existing models, life analysis index suggestive for users can be obtained (Figure 7).

Figure 7. real-time environmental index monitoring analysis and early warning

4.4. Implementation of real-time environmental data monitoring function

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The real-time environmental data monitoring function is to obtain the current dynamic data changes, indicate the real-time change trend of the sensor collection data in the form of a line chart, and monitor the health status of the collection nodes in real time. The data will be queried once every 5 seconds to obtain the most updated inserted database information. Its functional modules are shown in the Figure 8:

Figure 8. Line chart of real-time sensor data

4.5. Implementation of Historical Data Monitoring Function

Historical environmental monitoring data query function is to query and display the historical sensor data by classification based on the sensor type and query start time (Figure 9).

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Figure 9. historical sensor data query

4.6. Implementation of environmental monitoring data statistics function

Environmental monitoring data statistics is to select the sensor type, select the statistical start time, and select the statistical modes of year, month, day and hour (Figure 10).

Figure 10. Line chart of sensor monitoring data statistics

4.7. Implementation of year-on-year and month-on-month analysis of environmental data

4.7.1. Year-on-year Analysis of Environmental Data

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Year-on-year analysis function is available. The data is obtained by the year-on-year analysis between the same month of the current year and the same month of another year in the same period. Line chart is used to display the current period data, same period data and year-on-year growth rate of the specified sensor. The function modules are shown as follows:

Take air humidity as an example to display year-on-year analysis chart as shown in Figure 11:

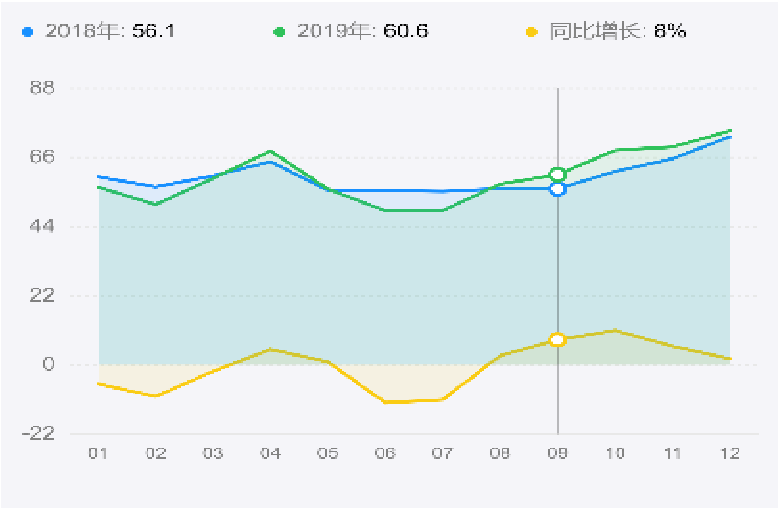

Figure 11. Year-on-year analysis of air humidity

4.7.2. Month-on-month analysis of environmental data

Month-on-month analysis of the specified sensor data means analysis between each month and the previous month in a year. Line chart is used to display the current period data, previous period data, month-on-month growth rate, and month-on-month development rate. It has basically the same functional modules as year-on-year analysis, but the comparison objects differ.

Take temperature as an example to display month-on-month temperature growth line chart as shown in Figure 12:

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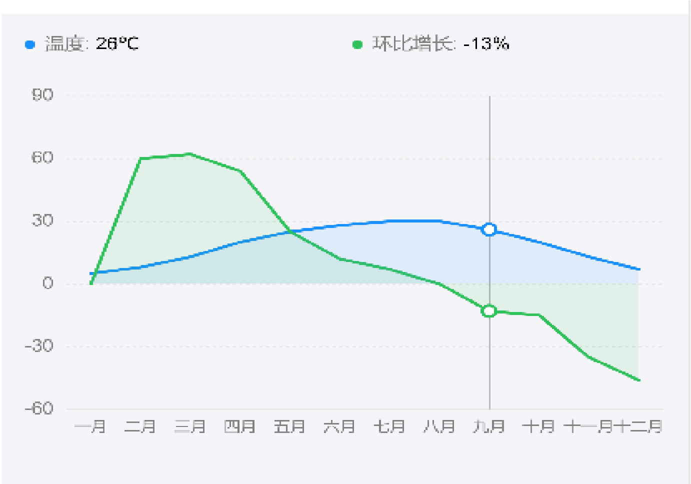

Figure 12. Month-on-month analysis chart of air temperature

4.8. Control Center Interface Design and Implementation

The control center interface design is shown in Figure 13:

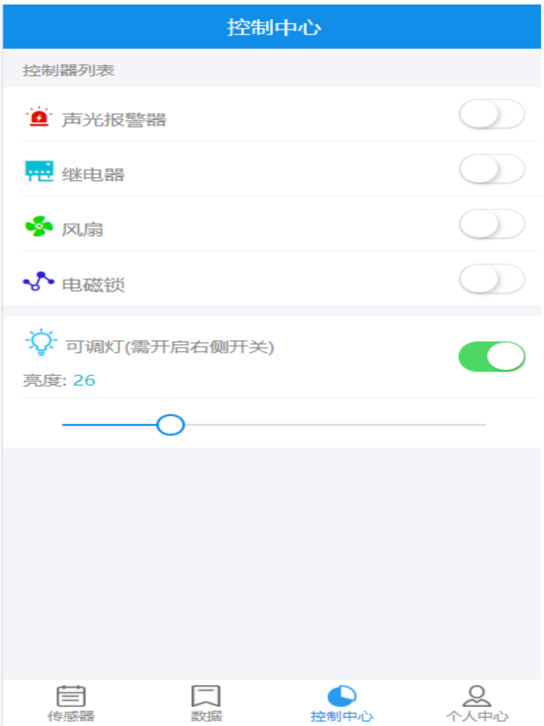

Figure 13. Control Center Interface

5. CONCLUSION

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In order to meet the needs of users in the remote, office (outdoor, outdoor) to control various devices anytime, anywhere. Smart home system-The mobile terminal correctly accesses the background server function interface and data interface of the smart home device through Socket, thereby realizing full-duplex communication between the browser and the server. The mobile terminal can realize real-time monitoring of temperature, humidity, illumination, human infrared, flammable gas, and flame sensor data, historical data query, data statistics, annual and monthly analysis functions. It can set alarm thresholds for sensors, etc. and alert based on the thresholds. You can also control sound and light alarms, dimmable, relays, fans. This model is verified to be feasible and effective.

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