Frontiers in Computing and Intelligent Systems
ISSN: 2832-6024 | Vol. 3, No. 2, 2023

Design of application layer software platform of remote monitoring system

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Abstract: Application layer software is an important component of IoT projects. A software platform of remote monitoring system is designed based on MySQL, Vue and C#. Through the software platform, data and data trends can be viewed intuitively through front-end software which is developed based on Vue. All the information data from hardware devices and the software platform are stored in the MySQL database. Back-end software is developed by C# to connect hardware devices and users. After debugging, the system can achieve remote monitoring and control combining with the IoT devices.

Keywords: MySQL database; C#; Vue framework; Remote monitoring.

1. Introduction

With the maturity of IoTs technology, IoT applications in various fields are becoming increasingly widespread. Convenient IoT applications cannot be achieved without application layer software systems [1-2]. The information collected by the device layer needs to be displayed through the application layer software. The devices can also be controlled through it. A reliable software platform is necessary for remote monitoring system. The software platform typically consists of three parts. Front-end software is mainly used to present content to users by web or app pages. Developers can develop various front-end frameworks through different code languages. The most commonly used technologies are HTML/css/js, Vue, iOS development, and Android development [3-5]. Back-end software is mainly used for server-related development, including interface development, database operations and etc. The most commonly used technologies include c #, vb.net and etc. The data generated during the entire process needs to be stored and managed through a database, like Oracle, SQL and MySQL [2].

In this study, MySQL database is used to store data because of the following reasons. Firstly, MySQL is a powerful relational database system, which can store data in groups. It can greatly improve the efficiency and flexibility of data processing. Secondly, the SQL language used by MySQL can realize the fast access to data and provide a unified standard for the operation and maintenance of the database. MySQL software is open source, which makes it the first choice for many small, medium and large Web sites [2]. A lightweight framework Vue is used for front-end framework. Compared with traditional frameworks, route hopping is used instead of page refreshing, which can greatly speed up access and improve user experience. Componentized development is carried out using Vue. Data is separated from structure. It can reduce the amount of code and improve development efficiency significantly [3]. A popular language C# is used to write back-end code. It is an object-oriented programming language with high security, robustness, usability and aesthetics. It not only retains the powerful functions of C and C++, but also abandons some unnecessary elements, such as macros, which does not allow multiple inheritance. Since it combines visual operation with efficient operation, it has excellent execution speed, delicate syntax structure and advanced programming ideas. Through debugging, the remote information monitoring system is realized based on these tools. In this system, information from device can be displayed and managed. The devices can also be controlled remotely.

2. Application layer software platform design

The design of this software platform is mainly divided into three parts, include MySQL database, front-end software and back-end software. After the requirements analysis, the software platform is designed to connect to the hardware devices and the users. Through the software platform, users can check all the data uploaded by the hardware devices at any time. Instructions can also be sent to the hardware device through the software platform.

2.1. Overall design

The specific design is provided in Figure 1.

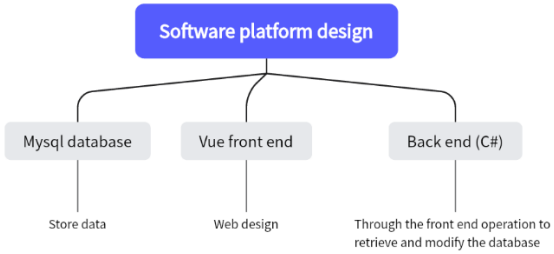


Figure 1. Schematic diagram of software platform design

As shown in Figure 1, the front and back ends are separated in the design. The front-end of the software platform is written through the Vue front-end framework. The main function of the front-end is to design the interface of the software platform system. The back-end program is written by C# programming language, which is mainly used to design the interface and modify the content of the MySQL database. MySQL database is used to store data. For smart home system, the database stores the environment information data, like temperature, humidity, combustible gas value and light value

uploaded by hardware devices and some data generated by software platform.

2.2. Database design

Figure 2. gives the diagram of the Database.

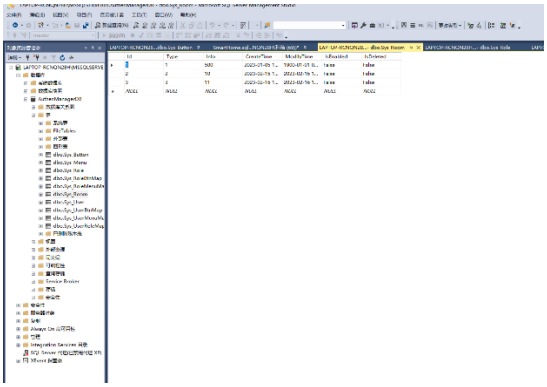


Figure 2. Database diagram

As shown in Figure 2, the project includes multiple tables to store the data which is divided into different groups. It can make the project more accurately and greatly improve the efficiency and flexibility of data processing. In this project, MySQL stores the information from devices, as well as the data in the software platform, such as account passwords, permissions, etc.

2.3. Front-end design

The schematic diagram of front-end design is shown in Figure 3.

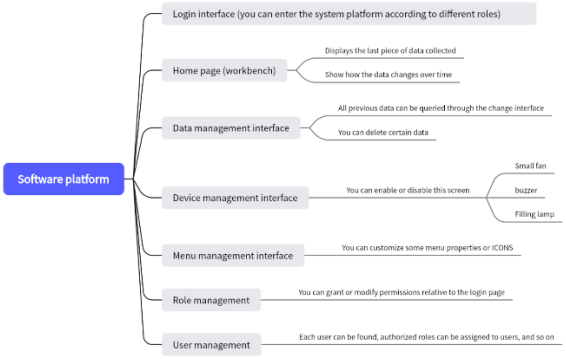


Figure 3. Front-end design diagram

As shown in Figure 3, the front-end software is divided into seven pages, which are login interface, home page (workbench), data management interface, device management interface, menu management interface, role management interface and user management interface. On the login page, users can select different roles to log in to the software platform. Different roles have different permissions. On the home page, users can view real-time device information and data trends. Users can query all data of previous devices by category and delete specified data with high permission on the data management interface. Commands can be sent from the software platform to the hardware device on the device management interface, such as starting or closing the fan, filling light, and buzzer.

Menu management interface is for private customization to generate a favorite interface. Users can modify the information of each page, such as ICONS, names and so on. On the role management page, users can create or modify the rights of each role. The user management interface can browse the basic information of each user. Some personalized rights can be granted to individual users by administrator according to special requirements. User's account can also be frozen or unfrozen on this page.

2.4. Back-end design

The back-end is designed by C# to read the information from hardware devices, operate databases, and provide data to front-end. The schematic diagram of back-end design is shown in Figure 4.

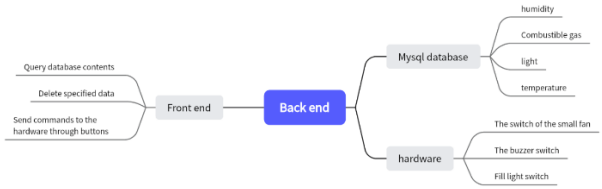
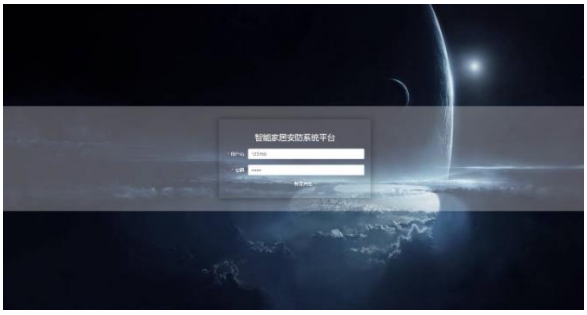


Figure 4. Back-end diagram

As can be seen from Figure 4, the design of back-end software is mainly used to control and retrieve database data based on the operation of front-end web page. Temperature, humidity, combustible gas values and light values can be retrieved and display on the front-end software. Operation of the hardware devices is allowed, such as turning on and off the small fan, turning on and off the fill light, turning on and off the buzzer, etc.

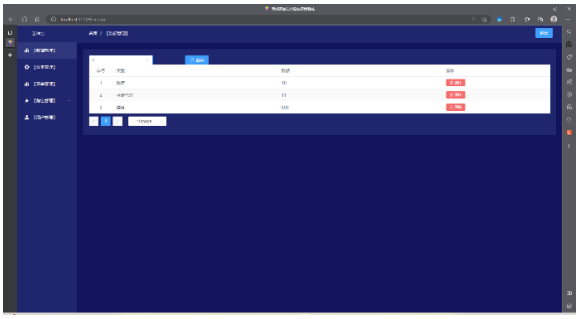
3. Results

After debugging, the results are shown in Figure 5.

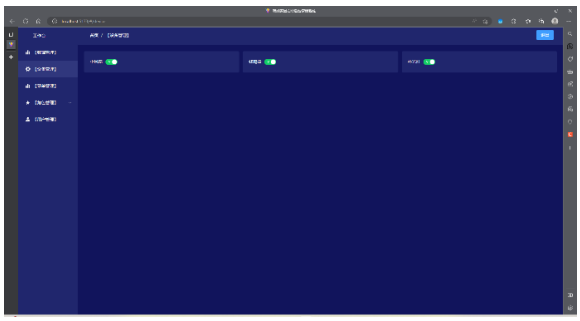


(a) login interface

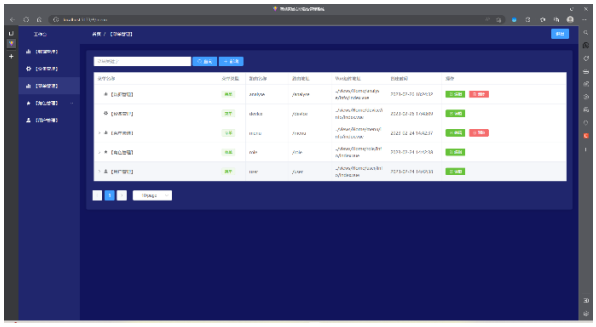
(b)home page



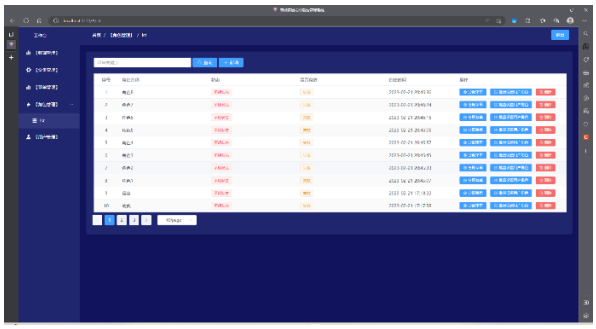
(c)data management interface



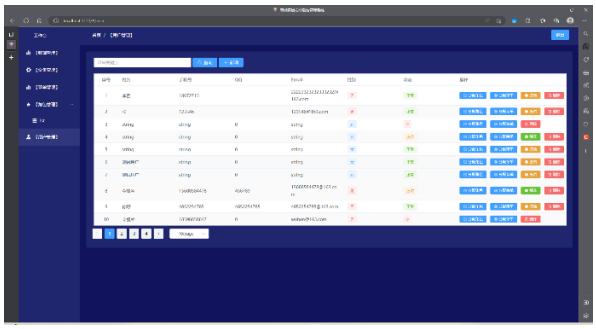
(d)device management interface



(e)menu management interface



(f)role management interface



(g)user management interface

Figure 5. Software interface

Login interface, homepage, data management interface, device management interface, menu management interface, role management and user management can work successfully. Through the software platform, data and data trends can be viewed intuitively. Meanwhile, commands can be sent to hardware devices more conveniently.

4. Conclusions

A software platform of remote monitoring system is designed for IoT application layer. MySQL database is used to store the information data from hardware devices. The front-end software is developed to display the information and send the control commands to the hardware devices based on Vue. The back-end software is developed based on C# to connect to hardware devices and users. Using this software platform, remote monitoring and control can be achieved conveniently combining with the IoT devices. This software platform is significant to realize the digitization.

Acknowledgements

This study was supported by Key Supported Project for Graduation Design of Suzhou Institute of Industry and Technology.

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