

## 1. Project Background

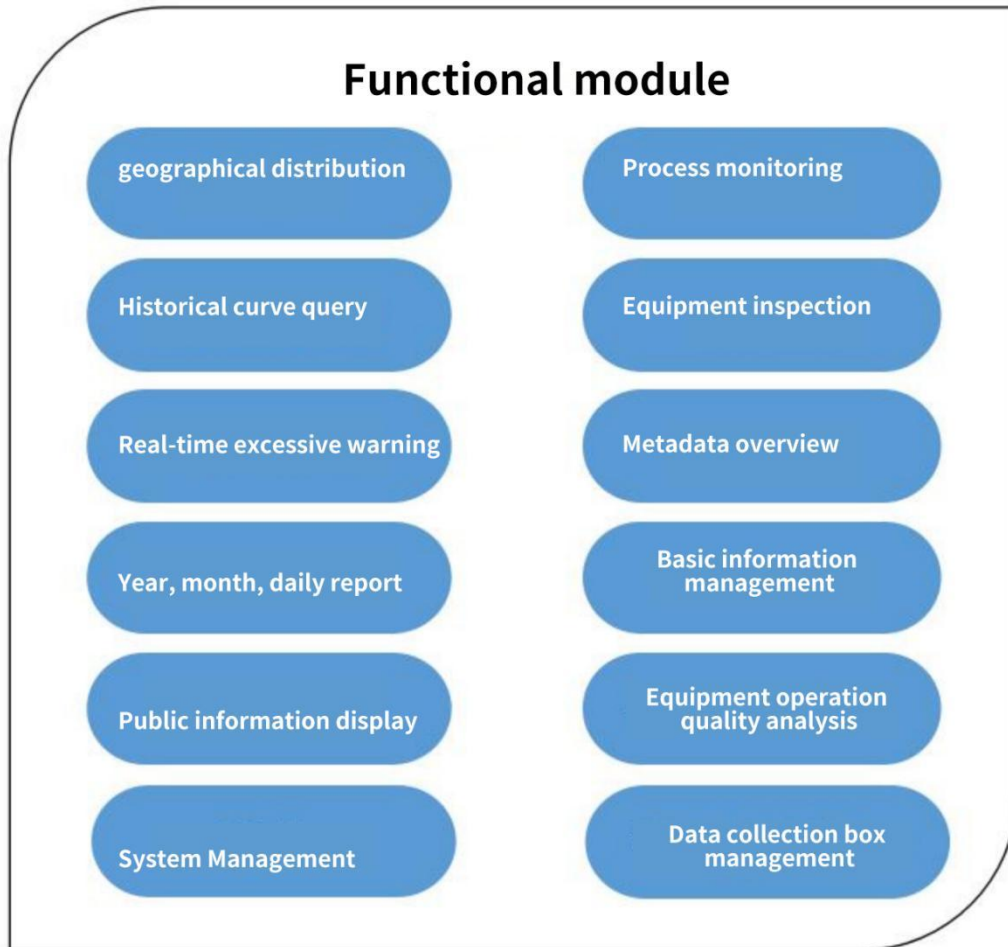
With the increasing marketization of my country's water and environmental protection industry, the business scope of equipment manufacturers has also spread all over the country. These water plants/sewage plants are widely distributed, and the operation and management levels of each plant are different, and the information level is uneven. Therefore, equipment manufacturers have a lagging understanding of the operation status and operation parameters of their own equipment, and the utilization rate is low, resulting in a lack of timely maintenance of equipment, which slightly weakens the stickiness between equipment manufacturers and users. Therefore, equipment manufacturers are in urgent need of building an information platform to create a standardized, scientific, digital, and easily expandable equipment management model, strengthen the company's control over equipment, and improve the company's scientific decision-making ability and operation management level.

Soft Neighbor---Smart Water Service Cloud Platform is based on a deep understanding of environmental protection equipment management, combined with the advanced management experience of environmental protection enterprises across the country, based on the overall operation and assets of equipment, tracking and managing the entire life cycle of equipment, and using information technology management methods. It is a tailor-made equipment management system for equipment manufacturers and water management companies.

## 2. System Requirements Analysis

### 2.1 Functional Requirements

The functions involved in the system cover multiple aspects of operation and management. The construction of the system adopts the steps of overall planning, step-by-step implementation, and continuous in-depth improvement and expansion.



**Figure 1 Functional composition of the smart water service cloud platform**

## 2.2 Performance Requirements

Soft Neighbor---Smart Water Management Platform is aimed at all operators of Yipai Fude Environmental Protection, Yipai Fude Environmental Protection customers, etc., so that these users can view production data in real time and understand the production process through browsers or mobile phones. There are many departments involved and the amount of real-time information is large. Although there are few management users, the amount of data calls is large. Therefore, the system supports large amounts of data and concurrent access. Through this project construction, this system will achieve the following goals:

(1) Operational requirements: All kinds of human-computer interaction operations, information queries, graphic operations, etc. of the software system should respond

in real time, and be displayed on the computer in the form of graphics, text and tables. It has report printing function and is simple and easy to operate.

(2) Interface and view requirements: Reasonably classify the various functions required by the system, optimize the layout, and ensure that the interface layout is simple and clear.

(3) Support 500 people and 20 concurrent users.

### 3.2 System Advantages

#### High-quality services

The system function design will combine the successful experience of the remote data collection box of Minmian Intelligent to provide stable data collection and transmission services, rich data display modes and analysis modes. The Softneighbor cloud platform is free to test, and provides users with data reports and other analysis services regularly in the form of operating service fees every year, aiming to provide users with the best quality services.

#### High cost performance and easy maintenance

With the help of the cloud platform, users do not need to build their own servers or have dedicated personnel for maintenance, which saves enterprises from investing in servers, databases, IP addresses, etc., and the overall cost is lower. Data is permanently stored and permanently online. Cloud security policies, user-based storage, data confidentiality and other security mechanisms ensure data security. Ready-to-use, no dedicated maintenance is required. All maintenance work is the responsibility of Minmian Intelligent, and the sewage treatment station only needs MM Box to ensure the normal collection and transmission of on-site data.

#### Cross-platform

The system does not rely on the computer operating system or the hardware environment. It can be run, developed and maintained on multiple operating systems such as Linux operating system and Windows operating system. The data acquisition software of each plant area can realize production data acquisition and management without changing the existing automatic control system and configuration software. It ensures the stability and continuity of the enterprise's production operation.

#### Configuration flexibility

The cloud platform is based on functional modules. The sewage treatment plant can customize its business functions at any time according to its own needs and development strategies. It has high flexibility and scalability.

#### Support mobile applications

The existing system is made mobile, including mobile real-time monitoring, query, and out-of-office work. It solves the problem that users work in fixed places and cannot monitor remotely and in real time. Improve the timeliness and accuracy of data.

#### Online upgrade

Software and hardware can be upgraded online, eliminating the complex process of on-site deployment, installation, and debugging.

### 4 System Detailed Design Plan

#### 4.1 Equipment Distribution

Display the geographic information of the business scope of the equipment manufacturer. The homepage will initially display the geographic location information of all equipment in the form of dots or icons. Clicking the icon will pop up the sewage plant or buyer name, equipment name, equipment model, commissioning time, actual operation time, etc. This module can intuitively view the location information

of the company's projects and the operation information of the company's equipment.

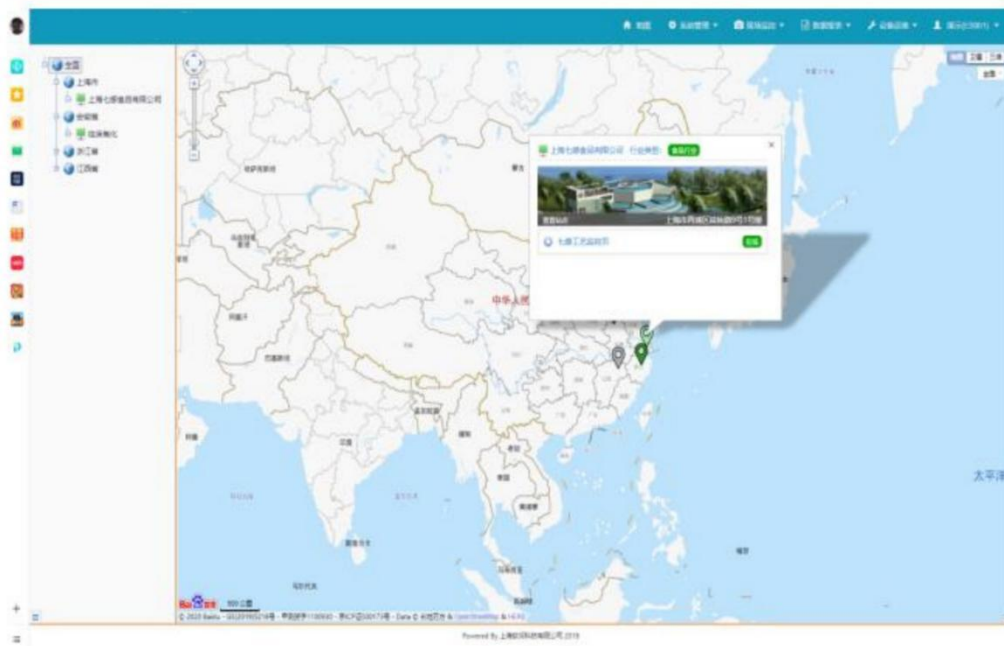


Figure 4 Example of equipment distribution

### 3.3 Remote process monitoring

Process monitoring mainly realizes remote monitoring functions, simulates on-site process layout, equipment layout and real-time equipment status, and can alarm and display real-time data exceeding the standard and equipment failure. The functional use case design of the process monitoring system is shown in the figure below.

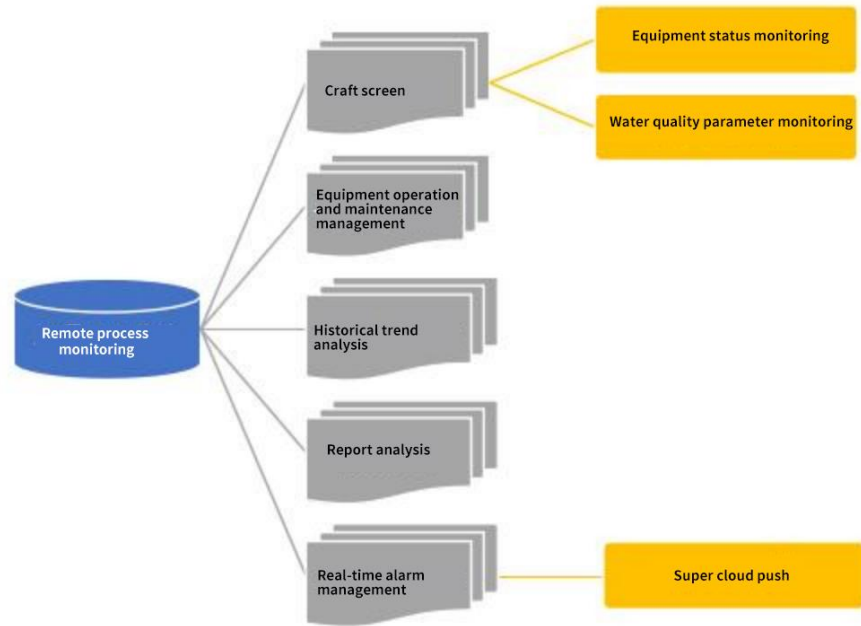


Figure 5 Functional logic diagram of process monitoring system

### 3.3.1 Real-time screen display

Through process monitoring, the process production sites of each factory are simulated, and process parameters such as inlet and outlet water quality (COD/ammonia nitrogen), pump room liquid level, and equipment status information of the booster pump are displayed in real time. This solution adopts real-time monitoring based on the web network. The biggest advantage of this monitoring method is convenience and openness, allowing users to realize process monitoring in places with network.



Figure 6 Functional use case design of process monitoring system

### 3.3.2 Curve trend display

Generate historical curves for collected data. Users can select process parameter curves according to process analysis needs and compare and analyze parameter changes in real time.

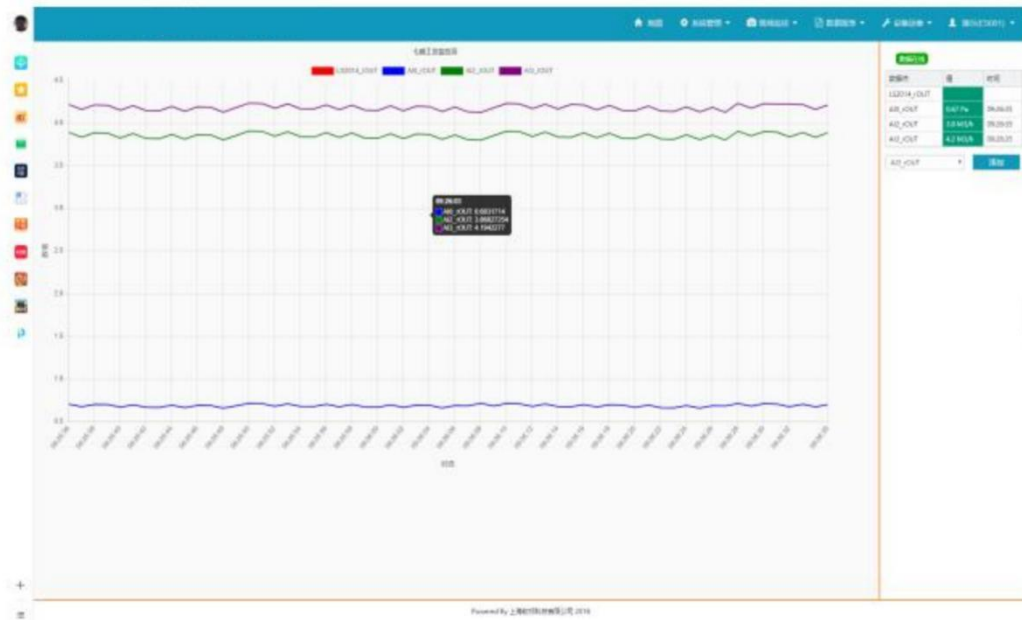


Figure 7.1 Real-time curve trend chart

Query the parameter change trend over a period of time, conduct comparative analysis, and assist in analyzing process problems in the production process.



Figure 7.2 Example of historical curve display

### 3.3.3 Equipment status display

The process monitoring system interface can intuitively display the status information of the equipment through colors, green for normal operation and red for stopped operation.

### 3.3.4 Real-time over-limit alarm

This module realizes the alarm prompt function for abnormal conditions of various real-time monitoring data. Including data over-limit warnings at each process stage, effluent COD warnings and other data, the alarm limits of various parameters can be set, and real-time reminders can be given on the GIS interface and remote monitoring interface.







Figure 9 Example of remote control interface

### 3.4 Real-time equipment operation data report

The real-time equipment operation data adopts the MM box-4G box to collect the on-site equipment operation condition data. After the data is uploaded, it is displayed in real time on the system software. The data includes the equipment switch status, equipment current, temperature, process parameters, etc. The equipment operation status is analyzed through the recording and display of the data uploaded by the box, and the equipment operation status can be viewed at any time through the platform.

The system can query the equipment operation status according to administrative divisions and factory areas, and realize the statistics of the operation status. Provide the front-line production and operation personnel with the data recording and query function of the equipment operation status, so that the operation management personnel can accurately record the equipment operation status and report the equipment failure in time. Friendly operation interface, company personnel can easily enter the equipment operation data .

时间	进水量	进液浓度	出液浓度	累计流量
2020-09-25 00:00	111	0.08	4.2	3462
2020-09-25 01:00	110	0.71	4.2	3525
2020-09-25 02:00	98	0.67	4.2	3522
2020-09-25 03:00	101	0.67	4.2	3518
2020-09-25 04:00	107	0.66	4.1	3525
2020-09-25 05:00	114	0.70	4.2	3517
2020-09-25 06:00	110	0.70	4.2	3520
2020-09-25 07:00	98	0.67	4.2	3523
2020-09-25 08:00	101	0.66	4.2	3520
2020-09-25 09:00	100	0.68	4.1	3525
2020-09-25 10:00	112	0.70	4.2	3519
2020-09-25 11:00	117	0.71	4.2	3524
2020-09-25 12:00	97	0.71	4.2	3521
2020-09-25 13:00	100	0.68	4.1	3524
2020-09-25 14:00	100	0.71	4.1	3523
2020-09-25 15:00	111	0.69	4.2	3523
2020-09-25 16:00	110	0.70	4.2	3518
2020-09-25 17:00	98	0.66	4.1	3521
2020-09-25 18:00	100	0.68	4.1	3523
2020-09-25 19:00	104	0.67	4.2	3525
2020-09-25 20:00	111	0.67	4.2	3523
2020-09-25 21:00	117	0.69	4.2	3499
2020-09-25 22:00	98	0.70	4.2	3517
2020-09-25 23:00	101	0.68	4.1	3519
总计	2572			

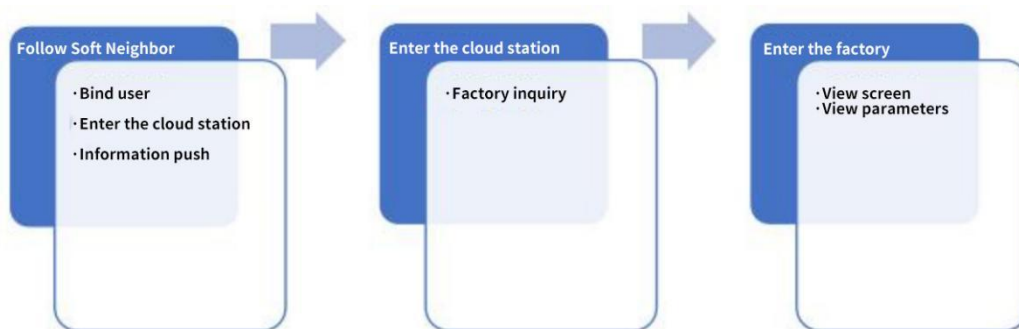
图10设备运行状况统计示例图

### 3.5 Public Information Display

### 3.6 Mobile Client

The system provides mobile applications, which enable sewage treatment plants to view process data and report data on the mobile Internet. The functions include equipment viewing, report query, and historical data.

The specific screen flow is as follows:

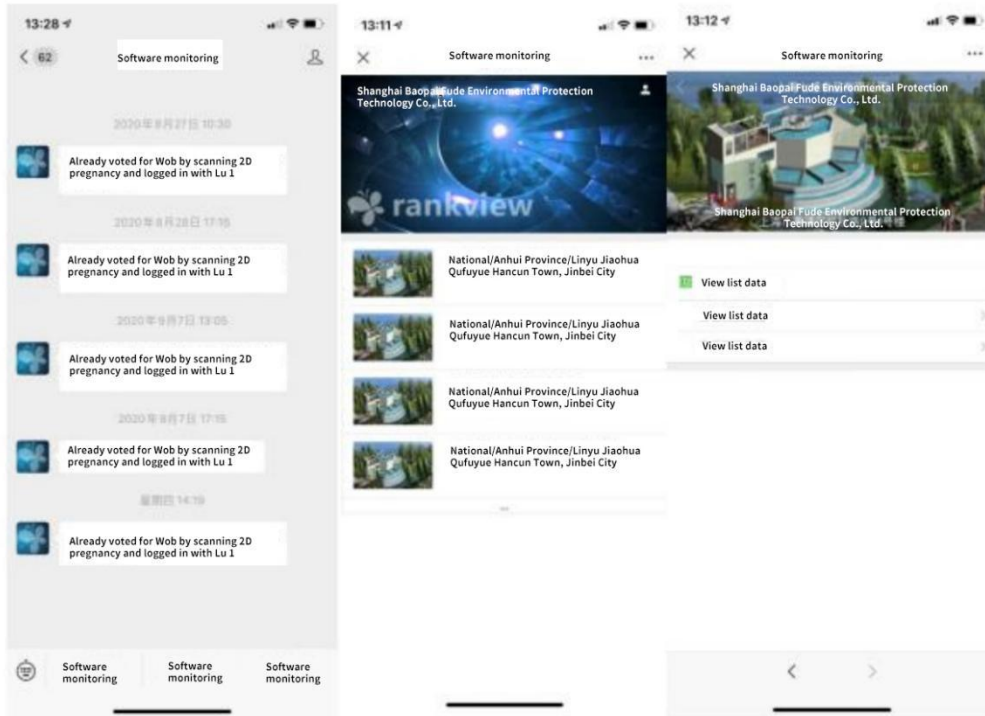


#### Bind user

After binding, users can directly log in to the cloud platform using WeChat on their mobile phones.

#### Factory area query

Easily and quickly find the operation and maintenance factory area and enter to view new messages.



**Figure 23.1 Main interface of mobile phone**

#### View the screen

Through the process monitoring screen, you can view the equipment operating parameters anytime and anywhere, and display dynamic data in real time on the mobile phone, including the equipment switch status, equipment current, and temperature data.

#### View parameters

Realize year-on-year and month-on-month comparative analysis of production data, operation data, process parameters, etc., and realize comparative analysis of the same period and the same data between factories. Users can configure it according to their needs.



Figure 23.2 Main interface of mobile phone

### 3.7 System Management

The system management function includes three parts: user information management, authority management, and system log.

#### 3.7.1 User Information Management

User management mainly involves adding, deleting, modifying, and querying all operating users who can use the system. After logging in, the user enters the system and accesses related operations according to the authority granted by the system administrator.

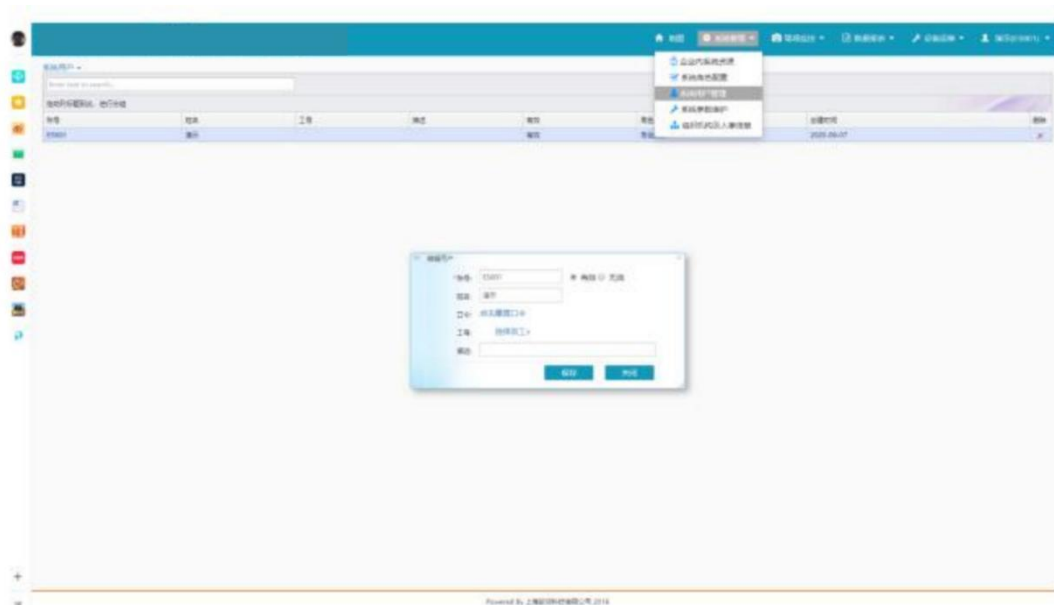


Figure 24 Example of user management interface

### 3.7.2 User Rights Management

The rights management module is both the user entrance of the entire system and the guarantee of system data security. The system adopts a single role authorization mode management to control the user's authorization to access the specified data or menu. The rights include personnel viewing the interface, adding, deleting, modifying, and querying data, which are divided into different viewing rights according to the member's responsibilities.

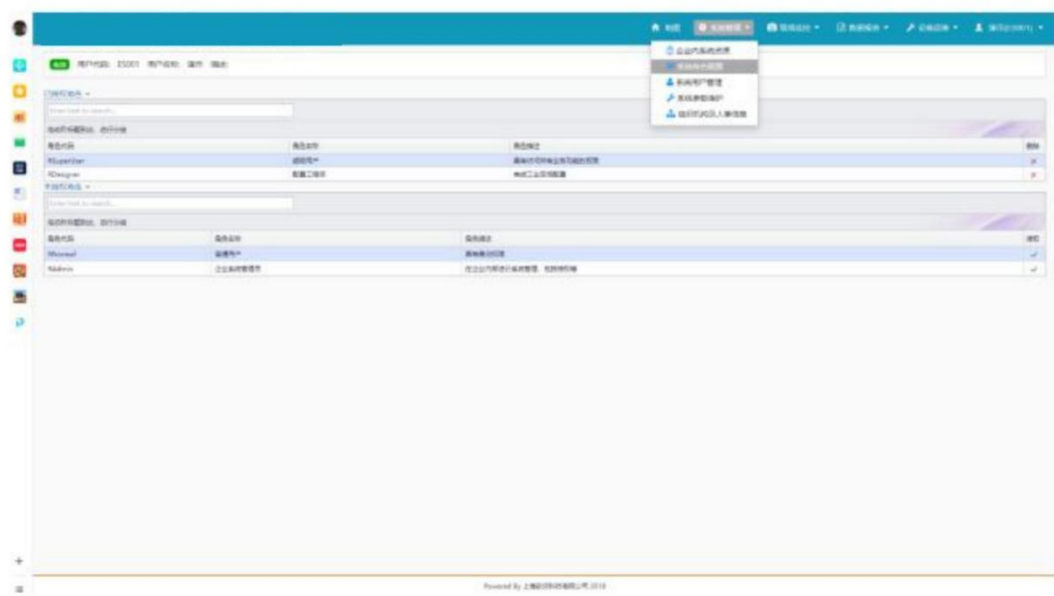


Figure 25 Example of permission management interface

#### **4. Features of the Solution**

##### **Powerful management function**

A fundamental purpose of this design is to effectively manage the operation of each system equipment and center belonging to the center through real-time monitoring of each subsystem in the system. The intelligent equipment service cloud platform unifies the equipment information on a computer application platform, enabling them to achieve the goal of information sharing. It gives full play to the management function of the system and optimizes its combination to meet the higher requirements of modern management.

##### **System scalability**

In the design of the intelligent equipment service cloud platform, we not only consider the perfection, advancement and economy of the function, but also its vitality and sustainable development: In terms of data collection, the scalability of the equipment is fully considered, and data collection can be expanded at unlimited points.

##### **Advanced design**

###### **1) Advanced technology**

Fully considered the future data network access to the Internet, and adopted a WEB browser interface. As the core technology of the real-time monitoring and management system, the various subsystems are integrated, which can not only monitor the working status of each subsystem, but also increase the control function.

###### **2) Product advancement**

When designing this system, we fully considered that the project should be built into a leading professional, modern real-time monitoring and management system. The

system equipment should be world-leading mature products. At the same time, based on the actual situation and our rich experience, we optimized the configuration of each system product. In terms of system basic network construction, we objectively selected more mature products at home and abroad.

### 3) Advanced management

The real-time monitoring and management system is the core of this system and is at the highest monitoring and management level in the entire system. It integrates various subsystems into a unified computer support platform through a distributed network, and establishes a central monitoring and management interface for each subsystem of the entire center. And through a visual, unified graphical window interface, system administrators can flexibly and quickly realize the monitoring, control and management functions of the integrated functional subsystems and the corresponding lower-level functional systems.

### 4. Flexibility and compatibility of design

Since our system has an open system structure, it communicates with other subsystems through standard interfaces, which makes the equipment selection and design of other subsystems very flexible and has good compatibility.

### 5. Reliability of system operation

Our company has been committed to providing comprehensive solutions and services for the informationization of the water industry. It is good at the design and development of application systems in the water industry and has completed the construction of dozens of information systems. The accumulation of these project experiences has laid a solid foundation for our construction of this project.

### 6. The interface of the business application system is intuitive and easy to operate



The interface of the business application system is intuitive, easy to operate and convenient, and the equipment status is clear at a glance. The system has powerful query functions and concise and clear reports, which reduce the workload of department management, improve management efficiency, and meet the requirements of daily management. At the same time, the system is conducive to data sharing, enhances the security, reliability and consistency of data, and enables data to be communicated and updated in a timely manner.