Charge Management System of Water Companies

Luyao Li, Zhiyu Huang and Likun Lu*

School of information engineering Beijing Institute of Graphic Communication, Beijing, China

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Abstract: With the development of society and the advancement of urbanization, the domestic water consumption of residents in our country is increasing, and users have higher and higher requirements for the water supply guarantee of the water company. At present, it coincides with my country's promotion of "smart water affairs" and the introduction of "water price reform" requirements. It is imperative to realize automated water fee information management through scientific and advanced information technology. In line with this trend, this article has done an in-depth study of the current China's more advanced water company charging management system, and consulted some materials, and made a study and summary of my country's current water industry charging management system. Based on the current charging management system that has been designed in our country, this paper has made changes and summaries, and compiled a water company charging management system. This system mainly uses Visual Studio as a development tool, the programming language is C#, and the software support environment is Windows 7 and above.

1 INTRODUCTION

With the rapid development of my country's economy, the construction of public services is also speeding up and improving. The number of users of water supply companies is increasing. Many small towns still use the old set of charging management system for many years. This is far from satisfying the current number of users and the realization of management functions, such as meter reading, summary, charging and other services. The project only relying on manual or low-level automated charging can no longer quickly and conveniently realize the management and service of tap water users. At present, when water fee management is carried out in many areas in China, manual meter reading and recording are performed, and manual background operations are used to input water consumption and calculate fees. This form is firstly not conducive to error checking and correction, and secondly, it requires a lot of manpower support, and most importantly, it is not conducive to the management of the water company, and there may be artificial work records and other trends. Therefore, the most important thing at present is to improve work efficiency and office quality in order to continue to develop in the increasingly competitive tap water market and gain a long-term foothold (China Water Network 2021).

1.1 Current Status of Foreign Research

The informatization of tap water charging management in foreign countries has been around for many years. Many places have already had a complete set of fully informatized charging management system, and there are also technology companies that are developing various charging management systems one after another. There is no shortage of mature and excellent systems. Although the development is not at the top, there are many things that we can learn from.

1.2 Research State in China

China has also made a lot of efforts in the direction of smart water affairs, but there are still some backward areas that fail to realize the water charging system with all big data networks.

My country has implemented measures such as separation of government and enterprise, separation of government and capital, and business separation, and has achieved significant results. A large amount of non-state capital has entered the water supply industry, which has eased capital pressure to a certain extent and improved operating efficiency in the industry.

In order to adapt to the rapid development of

society and meet the increasingly large user groups and user needs of the tap water industry, the integration of management and informatization of the tap water industry in my country is also accelerating. The research and study on the charging management system is also to meet this goal. Efforts will be made to achieve a perfect fit between charge management and computer network operation as soon as possible.

1.3 The Main Work of this Paper

Focus on analyzing the audience and business needs of the water company's charging management system, and initially design all the business function modules of the system. The divided modules include: login module (sub-authorization), basic file operation module, expense business operation module, user management Module, query statistics module, etc. After the use case analysis of the divided modules, the design of each core function is completed by using the block-based idea and the modeling ideas such as collaboration diagrams, sequence diagrams, and operation diagrams.

After determining the basic requirements of the system to be designed and the modules to be

implemented in this graduation project, the basic methods and the entire framework to be used in this graduation project are determined. Use visual studio to realize the overall window function, and use SQLserver2008 as the backend support to design the database of relational data tables.

Debug the designed code and the entire system. Make sure that there are no loopholes in the code to ensure the smooth operation of the system. The system is then tested to determine the smooth operation of the login module, user addition and deletion modules, payment module, and query module of the system (Yusta 2020).

2 SYSTEM REQUIREMENTS ANALYSIS

2.1 Functional Requirements

For a billing system to do all the work, it should contain at least the following modules and content.
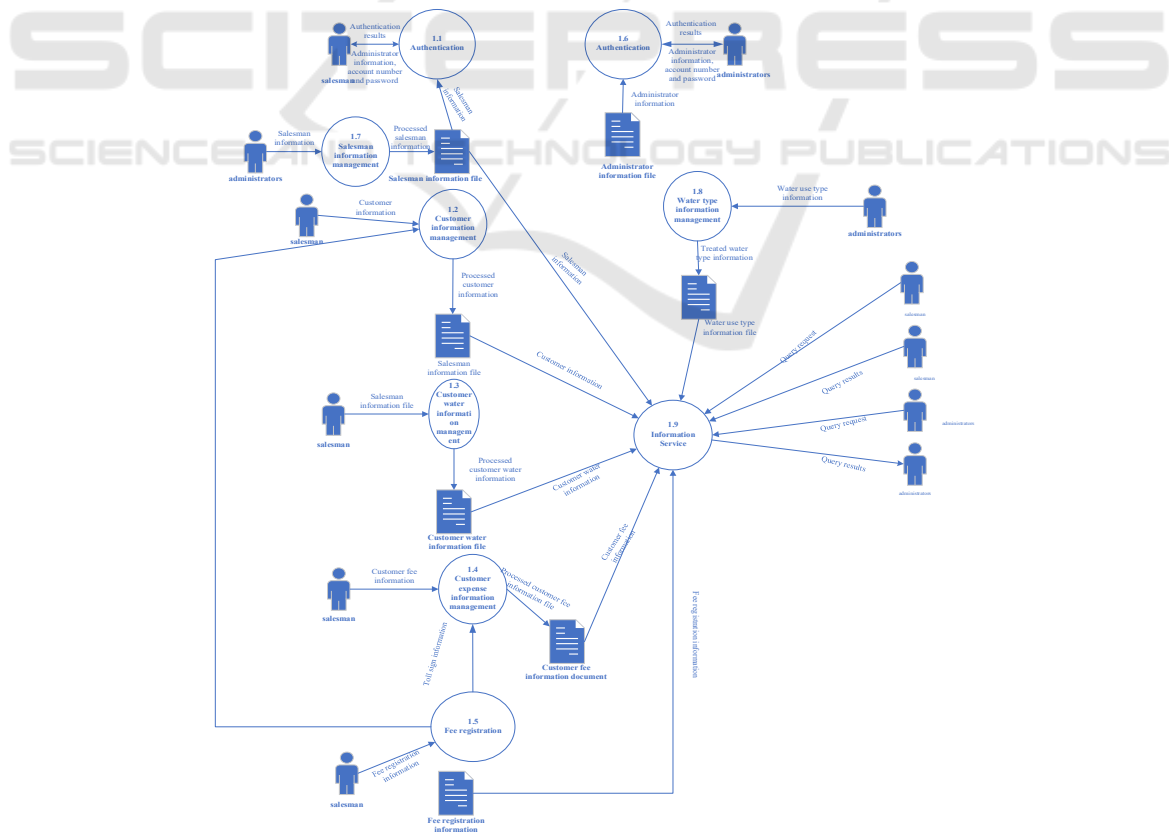

Figure 1: Network diagram of charging management system.

2.2 Non-functional Requirements

1) Safety. Security can guarantee the realization of other non-functional requirements of the charging management system. Ensure that the data in the system has the greatest privacy, not everyone can see it, and it also prevents hackers from attacking (Compagnucci, Spigarelli 2018).

2) Reliability. Reliability is the cornerstone of a software system. With reliability as a guarantee, the functional system that the system should implement can be successfully completed under the specified conditions and within the specified time.

3) Reusability. Reusability is an important factor that reflects the practical value of a system. The charge management system in this article should take into account factors such as different companies facing different objects, so good reusability is a must. It can improve system quality, reduce costs and risks,

and improve production efficiency (Attaallah, Algarni, Khan 2021).

3 INTERFACE DISPLAY

The client interface of this billing system is shown below.

4 SYSTEM TEST

Software testing is an indispensable and important part of completing a software design. System testing includes black box testing and white box testing. Both forms of software testing are carried out from the aspects of the functions that the software should complete.
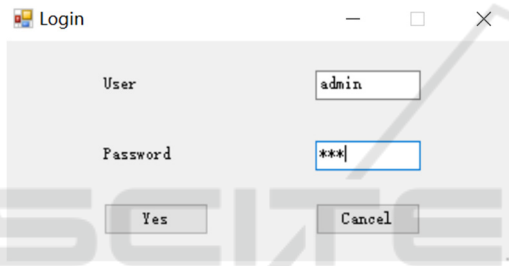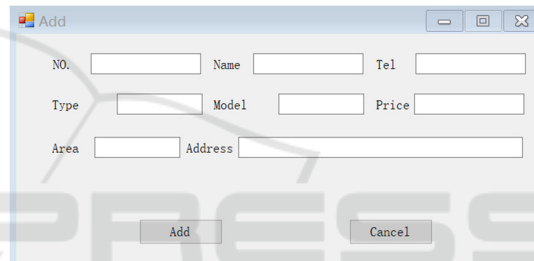

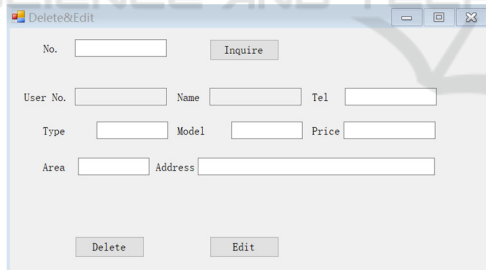Figure 2: Login module.

Figure 3: User Management.

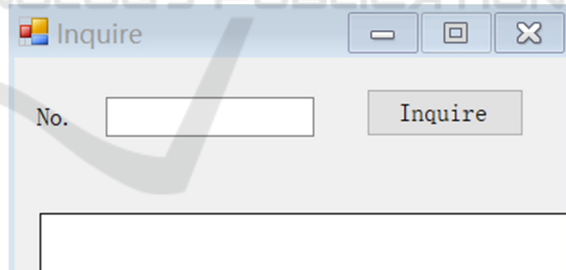Figure 4: User deletion and modification.
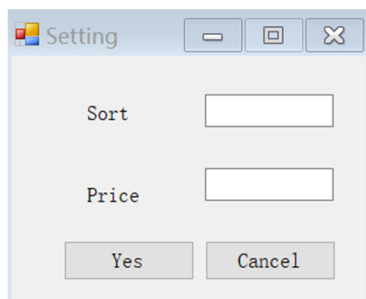

Figure 5: User query.

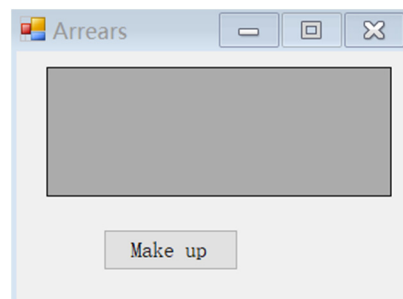

Figure 6: Water fee setting module.

Figure 7: Arrears inquiry.

4.1 White Box Testing

Use static white box testing and dynamic white box testing to complete. Static white box testing is mainly to conduct code review, including desktop inspection, code review, teacher walkthrough, etc.

Use dynamic white box testing to complete statement logic coverage and condition coverage, run statement by statement, and check the possibility of code execution results.

4.2 Black Box Testing

According to the step water price setting in the sample area, enter the maximum and minimum water fee settings to complete the water fee setting test;

Use the import and export function of the user table to import the information of 10,000 users at a time to test whether the system can import and export smoothly;

Use other similar operation functions to complete the black box test of the system.

5 SUMMARY AND OUTLOOK

5.1 Summary

This article is designed and implemented after summarizing various existing charging management systems in our country. This paper realizes the original intention of helping the water company to efficiently manage and work efficiently, and realizes the perfect combination of charge management and modern computer technology. Research and explain the current development status of the tap water industry, the specific functions of the charging management system are divided into modules, and the specific functions of each module are shown in detail.

Functional and non-functional tests were conducted on the completed charging management system, and the degree of completion and completeness of the design was determined.

5.2 Outlook

The existing charging management system in our country can only be used by the managers of the water company. This greatly guarantees the security of the residents' data. Although the charging management system is very convenient at present, users can use mobile devices to pay for water bills. Inquiry and management, but when residents want to

handle more difficult business, they still have to go to the water company for review and processing.

Therefore, I propose some ideas and further research directions for the future development of the water company:

Water companies can launch more intelligent services, such as smart reminder services, which can intimately remind users of their tap water usage. Some busy water companies can also use self-service check-in machines.

In addition, the water company can gradually build its own smart water system, adding big data and the concept of the Internet of Things, to realize the coverage of water information in the whole city and the whole region, and complete the construction of water information integration, so that the water company and branch companies can be integrated. Information exchange and interconnection to realize unmanned tap water charging management, saving human resources, and facilitating residents to complete online water fee payment without leaving home (Albahari 2012, Stellman 2016).

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