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Design and realisation of residential property management information system based on browser/server mode

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Abstract

The data filling, mathematical calculations and statistical operations for property management are realised by a system development tool that adopts the browser/server (B/S) architecture, Java, as the development language and a framework that adopts Spring MVC mode; additionally, the MySQL database is used, the source code and database interaction process use the Mybatis framework and the front-end display uses the VUE.js framework.. Functional modules include the following elements: owner information, real estate information, engineering equipment, personnel management and lease management. The system has passed the functional test, if it has been in trial operation for 1 year in multiple residential communities and has the characteristics of simple operation, stable operation and strong scalability, among others.

Keywords: information system, management, browser/server, Spring MVC, MySQL database

1 Introduction

China's property management informatisation construction began in the 1990s, and after 30 years of development, some achievements have been made. In system design and development, Zeng xiyin combined ASP.NET technology and browser/server (B/S) and C/S architecture to design and implement an Internet-based property management system [1]. Under the framework of B/S mode, Liu ruoyu analysed the charge management, equipment and expense management in property management, and designed the property management system under B/S mode [2]. In the system development, Wei zhongyi and others designed and implemented the community property management system based on .NET from the aspects of financial charging, complaint management, parking space management and other aspects. [3]. Sun zhonghua studied the B/S mode of intelligent community property management system from the aspects of community parking lot monitoring, metre reading and charging [4]. Based on the J2EE platform, An sibo uses Spring and B/S framework to design and implement a WEB-based residential property management system in the system design and development process [5].

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Liu chunli and Xu chenglin design an ASP.NET-based intelligent community property management system [6]. Yang jun, Zhang huaqiang and others, after studying the combined needs of property management, analysed and studied several modules, such as property charges, and designed and used SSH to build a residential property management system [7]. Zhong luo and others analysed the design plan of the property management system, and designed and implemented the property management system based on Struts and JDO [8]. Chen hui uses Visual Basic and ACCESS tools to research the residential property management system based on VB development [9]. Based on the SSH architecture, Hu fengjuan uses B/S to design and implement a property management system based on the SSH architecture [10]. Yao fen analyses the current status and development trend of property management, and designs the ASP.NET architecture of the property management system [11]. Wu linglin uses the B/S architecture and LINQ to SQL technology to research the residential property management system based on LINQ technology [12]. At the same time, some foreign experts and scholars in property management have also contributed to the research; for instance, the research undertaken by Alice christudason suggests the two were selected on the basis that, although they share certain similar characteristics including age, tenure and locational attributes, each employs different systems of property management; data were gathered mainly through interviews with the Property Managers and Chairs of the Management Council [13]. The B. klingenberg and R.J. brown analysis suggests optimisation of residential property management. Their concept expands the existing literature of the agency problem in real estate by providing an optimisation model for management of investment properties [14].

As an important part of informatisation, the property management information system has developed rapidly under the impetus of information technology and computer technology. Especially in recent years, the development and application of intelligent property management has become the key to improving the market competitiveness of property companies. However, compared with developed countries, China's property management information system still has some problems. Specifically, they are mainly reflected in the following aspects:

- (1) The information system has a single function and cannot realise the comprehensive service management of the community property;
- (2) Part of the information system does not meet the actual needs, the operating efficiency of the system is low, the role is not fully utilised, the data security and data accuracy are not high, and the time for querying, creating and updating pages is too long;
- (3) The information system is plagued by the problem of poor compatibility;
- (4) The intelligence of the information system is low, and the property management is still point-to-point manual management;
- (5) The accumulation of basic data for residential property management is limited, and many business data are still mainly recorded manually. The movement of personnel or the relocation of office locations may cause the loss of historical data, and paper materials are difficult to store for a long time.

Therefore, in the future development, the means to develop a realistic, low-threshold and systematic property management information system has become one of the urgent problems to be solved.

Combined with the characteristics of property management, there are not many reports on the community property management information system covering all aspects of property management. This article aims to change the current property management methods and improve the efficiency of property management. By summarising the informatisation needs of the property management process of each community, and aiming at the large and medium-sized communities of the 'residential + community' model, a set of property management information systems has been designed and developed using Java technology, which is simple, object-oriented, distributed, robust and safe, organically combines traditional property management with the Internet, manages and displays the elements of community owners, real estate, equipment and facilities, personnel and leases on the Internet, and realises the accurate recording, management, query and analysis of the entire process of community property management and the associated statistical information, as well as ensures the uploading and issuing of various notices between residential area and communities and enables property management staff to view and report anytime and anywhere, freeing property management staff from tedious data filling, math-

ematical calculation, compilation of statistics, summarisation, uploading and distributing, so that the property management staff, among others, conduct residential property management scientifically, conveniently and efficiently, serve the residential area well, enhance the experience of residential area owners and improve the satisfaction of residential area owners.

2 Residential property management information system design

2.1 Demand analysis and data collection

Through the investigation of multiple residential communities, it was found that almost all of the communities under investigation did not use the property management system, and still used manual 'work' methods to manage the communities. At the same time, a large number of texts, tables and graphics were collected during the survey. Analysing the received data, it is found that the data is diversified, the format is random and the filling is random, which involve all aspects of property management. Subsequently, we organise and analyse the collected data, extract data structure and functional requirements and determine the system development technical framework.

2.2 Database design

The property management mode determines the multi-level characteristics of the data in each link of the property management of the community, and the database is designed as an attribute database. The attribute database covers basic information of the community, data related to property management etc. According to some community data collected in the survey, the attribute data is classified according to the system function settings, and is specifically divided into data about interest groups such as owners, real estate, engineering equipment, personnel management and lease management.

2.3 System development technology architecture

The B/S mode is the most widely used structure in the development of property management information systems. The property management information system developed by the B/S mode is simple, convenient, safe and stable. When developing the property management information system, the functions associated with it are reflected on the server. In actual applications, as long as the relevant hardware and software facilities, such as databases, are installed on the server side, users can access and operate the property management information system through a browser. After logging in to the property management information system through the browser, the user clicks on the corresponding module. The module can call the database to realise the functional operation of the property management information system. The B/S mode is not restricted by time and location, and users can access and operate the system wherever Internet connectivity is available. The property management information system developed by the B/S model has relatively low cost, a short development cycle and high development efficiency. The system has strong scalability, understandability, testability, modifiability, portability, reusability, easy maintenance and good system compatibility; also, users do not need to install special applications on the computer when accessing applications.

The system development adopts the B/S with a three-tier architecture for system construction. The first layer is constituted by customer service, system administrators, property management managers and property management staff; and residential owners can access and operate the residential property management information system through the Internet within the authorised scope; the VUE.js framework is used for customer service, and it is the bridge between the user and the system; it has the functions of displaying data and receiving user input, and it mainly realises the coordinated operation of the user and the system. The second layer is business services, which are undertaken by the web server of the property information centre, responsible for the operation of data services, and provide interactive interfaces for customer services, which have the effect of connecting

the previous and the next. The development of business services adopts the Spring MVC framework pattern. Spring MVC separates the roles of controllers, model objects, filters and handler objects. Through the definition of interfaces and configuration files, the dependencies between classes are completely decoupled [15]. The third layer is data services, and the database server located in the property information centre stores all information and data related to property management and provides data or data services for business services. Application deployment supports Windows/Linux server operating systems and source code. The database interaction process uses the Mybatis framework, and the Database uses the MySQL database management system. The technical framework of system development is shown in Figure 1.

Fig. 1 System development technology architecture diagram.

3 System implementation

3.1 Functional module division

According to demand analysis and business logic, the system is divided into five functional modules. The functional structure of the system is shown in Figure 2. In addition to basic data management operations such as data addition, deletion, modification and inspection, each functional module provides comprehensive functions such as mathematical calculation and summary.

(1) Owner information. In the property management, all owner information and resident information need to be registered in detail, and updated and maintained in time, and therefore, the owner information management function needs to be established, which directly determines whether the residential property management information system can provide high-quality property management services; owner information mainly includes name, identity card, sex, telephone, address, community, building, unit, floor, room number, creation time, update time, status and version number among other elements.

(2) Real estate information. Real estate information is the basic content of real estate management. Real estate management personnel need to manage and maintain real estate information in a timely manner. Real estate information management is also one of the most basic functions in residential property management; real estate information mainly includes owner information, address, community, area, house type, orientation, structure, type, building, unit, floor, room number, room status, creation time, update time, status, version number and picture path among other elements.

(3) Engineering equipment. In property management, it is necessary to register the information of engineering equipment in detail, and to update and maintain it in time, and therefore, it is necessary to establish the function of engineering equipment management, which directly determines the improvement of the maintenance service quality in the residential property management. The equipment mainly includes primary key, name, number, type, model, brand, size, power, weight, date of production, service life, status, remarks, creation

time, last modification time, data status and version number among other elements.

(4) Personnel management. Personnel management is mainly for residential property managers. Property managers are the core of property services, and therefore, it is necessary to manage the basic information and basic data of property managers to ensure the accuracy and change of information timeliness. Personnel management mainly includes primary key, name, sex, position, telephone, identity card, occupation, resume, age, date of birth, remarks, creation time, modification time, status and version number among other elements.

(5) Lease management. In order to grasp the situation of item leasing (including housing leasing) and ensure the safety of property, it is required to register and manage the situation of item leasing (including housing leasing) in residential property management. If the situation involves item leasing (including housing leasing) changes, it will be updated in a timely manner; the lease management mainly includes primary key, name of contract, contract number, type of contract, date of signatures, state, first party, party B, appendices, remarks, creation time, update time, version number and status among other elements.

Fig. 2 System function structure diagram.

3.2 Implementation points

(1) Selection of development integration framework

Frameworks such as Spring MVC and Mybatis are integrated and applied in the development environment, and these frameworks are optimised and combined according to the layered concept to promote project development, thereby supporting the continuous change of system requirements and continuous expansion of functions, and the low coupling between layers is enhanced improve the scalability of the system and improve the quality of system development.

(2) System performance design

The system uses MySQL database technology to strictly process the security and data accuracy of related data when developing the system, and fully meets user needs in terms of performance and security; the response time of the system query page is <1 s, and the response time of new and updated pages <0.3 s; the system uses the JAVA development language to carry out the necessary tasks within the Windows operating system; as long as a Windows-compatible browser or operating system is used, the system can be in normal operation, it has better adaptability and compatibility, and for those users with special needs, an interface can be initiated and maintained with other systems in the maintenance phase after completion, and this interface is capable of meeting user requirements at any time.

(3) Data input and output design

The system needs to check the validity of data input, which can be printed in such a way as to ensure that the output is in a suitable file format, which is compatible with the user's selection of the corresponding function menu and flexible according to the user's operation. The data is added, deleted, modified, checked and subject to other processes, and the corresponding information is returned to the system interface.

(4) Data management capability design

In terms of functional design, the database can be tuned, reorganised and rendered compatible with security management, analysis and summary of error reporting, related data processing, special management of data flow and independent data management.

(5) User type and authority setting

According to the size of the residential area and the division of property management functions, the system has set up user types with different functional rights for system administrators, property management managers, property management staff and owners.

4 System test results

After a comprehensive test, the residential property management information system can meet the basic functions; at the same time, it has a good user interface, which is very convenient for users to perform various operations, and it can also verify the information entered by the user and provide prompt information to the user when the entered information is incorrect. System functional test results are shown in Table 1.

Table 1 System functional test results.

Test items	Test content	Test results
User login	The user enters the correct and incorrect login name and password to verify the login result; the login test includes entering the wrong information, not entering the information and entering the correct information for testing	Login is successful, the login function is correct
Owner information query and editing	The user inquires about the submitted owner information, and realises the testing of various operations such as editing, modifying and deleting owner information	Correct
Real estate information query and editing	The user queries the submitted real estate information, and realises the testing of various operations such as editing, modifying and deleting the real estate information	Correct
Engineering equipment query and editing	The user queries the submitted engineering equipment, and realises the testing of various operations such as editing, modifying and deleting the engineering equipment	Correct
Personnel management query and editing	The user queries the submitted property management personnel, and realises the testing of various operations such as editing, modification and deletion of the property management personnel	Correct
Lease management query and editing	The user inquires about the submitted item leasing (including housing leasing), and realises the testing of various operations such as editing, modification and deletion of the item leasing (including housing leasing)	Correct

In addition, the residential property management information system was tested for strength, safety, accuracy, response time for querying new and updated pages, flexibility, etc. The test results were all qualified.

5 System application and analysis

At present, the system has been in trial operation in eight different types of residential area for 1 year, and has assisted these eight residential areas to enter or import some years of historical data. Data for 2021 is continuously being added, the current system is operating stably and there is no data loss or communication packet loss, and in addition, the response time for query, new and update pages has not exceeded the specified time, because the system has comprehensive functions such as mathematical calculations and summary, and the labour intensity of property management staff is greatly reduced, effectively improving work efficiency by >70%.

5.1 System login

The system application takes a residential area as an example, the user enters the residential property management information system general interface as shown in Figure 3, clicks 'Manage login entry' in the upper right corner of the residential property management information system interface and the residential property management information system interface diagram appears as shown in Figure 4. Then, the user enters the correct user name and password in the user name box and password box to log in.

Fig. 3 General diagram of the residential property management information system.

Fig. 4 Residential property management information system interface.

5.2 Data reporting

In the function menu, the owner information, real estate information, engineering equipment, personnel management, lease management and other data are managed in the form of a list, which is edited by the property management managers and property management staff through the add, delete, modify and check buttons on the page.

After the property management managers and property management staff log in according to different functional rights, they edit the owner's information, including name, identity card, sex, telephone, address and community among other elements; subsequently, they edit the property information, including owner's information, address, community, area, house type, orientation and structure among other elements; further, they edit engineering equipment, including primary key, name, number, type, model, brand and size among other elements; further, they edit personnel management, including primary key, name, sex, position, telephone, identity card and occupation among other elements; further, they edit lease management, including primary key, name of contract, contract number, type of contract and date of signatures among other elements; the owner user can edit part of the information related to the owner information, real estate management and lease management function modules according to their authority; the above information is maintained by the system administrator.

System administrators, property management managers, property management staff and owner users fill in the reports according to different functional rights. For example, the interface of owner information, real estate information, engineering equipment, personnel management and lease management in a residential area in September 2020 is shown in Figure 5.

5.3 System application effect

(1) As the system business design is based on a large amount of demand analysis and data collection, the system can be applied to most residential areas;

(2) The standardised expression and unified storage of property management data solves the problems of random filling of property management data in the past, long-term difficulty in accumulation, difficulty in system preservation and difficulty in searching;

(3) The system has comprehensive functions such as data filtering, mathematical calculation and summary, which greatly reduces the labour intensity of property management staff and effectively improves work efficiency.

5.4 System comparability analysis

This system is designed with a B/S model with a three-tier architecture of customer service, business service, and data service; compared with the existing property management system, the system has multiple levels, highlighting the safety, stability and convenience of the system; practice has proved that this system has good compatibility, universal strength, is easy to maintain and is characterised by scalability, understandability, testability, modifiability, portability and reusability; when compared with the existing property management system, it is better, in particular, in the aspect that the system also has the capabilities of data filtering, mathematical calculations, summary and other comprehensive functions; since this system adopts the property management mode of 'owner + residential area' in the design, it is more practical in Chinese residential areas.

6 Conclusion

The residential property management information system based on the B/S model is designed and its realisation in this paper combines the needs of property management businesses to manage various data hierarchically, which better solves the problems existing in the current residential property management informatisation. The current system has the following characteristics:

(1) The system adopts the B/S mode, which is simple, convenient, safe and stable to operate. It is not restricted by time and place, users can access and operate the system wherever there is Internet connectivity and they do not need to install special applications on the computer. The system cost is relatively low, the development cycle is short and the development efficiency is high; at the same time, a responsive design is adopted to support users to access and operate the system through mobile terminals (such as mobile phones and tablets) anytime and anywhere.

Property management / Owner information

Owner information

	Name	Identity card	Sex	Telephone	Address	Community	Buildings	Unit	Floor	Room number	Operation
☐	Liao yun chuan	513901199509080015	Man	13739436438	Gui yang	Han ting	18	12	11	1103	
☐	He shan	51390119987681281	Woman	13765371688	Gui yang	Han ting	10	2	30	301	
☐	Xie guo jun	5139016631831838	Man	13131313131	Gui yang	Han ting	1	8	100	1001	
☐	Chou yang xin	52321838128312	Man	13765371680	Gui yang	Han ting	20	2	8	801	
☐	Zhang pei	2131231231	Woman	15153717371	Gui yang	Han ting	1	2	5	501	

Common 6 strip
5 strip/page
1 2
Go to 1 page

property management / Real estate information

Real estate information

Housing : Self-occupied ☐ Lease ☐ To be rented ☐ For sale ☐ Vacant ☐

Hanting buildings7 unit2 floor11
State:Self-occupied

Hanting buildings8 unit6 floor2
State:To be rented

Property management / Engineering equipment

Engineering equipment information

	Name	Number	Type	Model	Brand	Size	Power	Weight	Date of production	Service life	State	Remarks	Operation
☐	Excavator	001	For personal use	1-101	Test brand	2000*1000	1000kw	1 ton	2020-09-23	2	Normal	Test	
☐	Bulldozer	001	Public	2-201	Xugong	2000	100kw	10 ton	2020-09-23	10	Damage	Test	

Common 2 strip
5 strip/page
1
Go to 1 page

property management / Personnel management

Personnel information

	Name	Sex	Position	Telephone	Address	Identity card	Occupation	Resume	Age	Date of birth	Remarks	Operation
☐	He shan	Man	Manager	13739436438	Guiyang	519083913928183	Doctor	No	26	19950908	Physical health	

Common 1 strip
5 strip/page
1
Go to 1 page

Lease management / Contract information

Contract information

	Name of contract	Contract number	Type of contract	Date of signature	State	First party	Party B	Appendices	Remarks	Operation
☐	Sales contract	001	On sale	2020-09-23 00:00:00	Signed	Wangli	Zhangpei	Contract text	Contract completed	

Common 1 strip
5 strip/page
1
Go to 1 page

Fig. 5 Data management interface of a residential area.

(2) The system business design is based on a sufficient demand analysis, taking into account the characteristics of various types of residential area, and constructing a system based on the common characteristics of different types of residential area through a large amount of collected data; it is not restricted by the type of residential area and the mode of property management.

(3) The system development integrates three mature frameworks: Spring MVC, Mybatis and VUE.js, plus the use of layered development concepts; and so, the system has strong scalability, understandability, testability, capacity for modification, portability, reusability, easy maintenance and good system compatibility.

(4) The system builds a property management model of 'owner + residential area'; the management and service objects closely surround the owner and the residential area, the system has strong comprehensive functions, the labour intensity of the property management staff is greatly reduced, and the work efficiency is improved by more than 70%; thus, the owners experience strong, high satisfaction.

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