Railway Transportation Dispatching System Based on Mobile Internet Technology

Junhui Di*

1School of Railway Institute, Hohhot Vocational College, Hohhot, Inner Mongolia, China

*Corresponding author e-mail: 328231235@qq.com

Abstract. With the continuous development of mobile communication and Internet technologies, the development and research of software applications based on mobile Internet have also entered the blowout development stage. At the same time, the shortcomings of traditional PC desktop applications, which lack portability, have been gradually enlarged. What has emerged are the rapid development of Web applications and mobile applications, and the emergence of new concepts such as mobile office. To this end, this article studies the design and implementation of a railway transportation dispatching system based on mobile Internet technology. On the basis of the existing office supervision method of the railway supervision company and the on-site supervision method of the supervision engineer, based on the MQTT protocol, it implements the active push of messages, develops basic supervision and to-do tasks modules. During the design and development of this system, the Web end will apply the current popular responsive web development technology to enhance the user's interactive experience on a variety of different platforms. This system uses an object-oriented analysis method to design the architecture of the railway transportation dispatching system. After a detailed design analysis, a complete set of railway transportation dispatching solutions is proposed.

Keywords: Mobile Internet, Railway Transportation Dispatch, Responsive Webpage, Interactive Experience

1. Introduction

With the development of science and technology and the improvement of engineering construction level, the existing on-site railway transportation dispatching work methods cannot meet the current requirements for transportation quality and safety supervision [1]. Rail transport dispatch projects have multiple locations, line lengths, and decentralization characteristics. On-site supervision engineers and supervision stations, supervision units, and other units are inconvenient in issuing documents, and there are a lot of contents in on-site transportation work. All actions and effects are ended [2]. To this end, the mobile rail transport dispatch module has been developed to meet the needs of daily work schedules.

Many data show that the traditional manual railway transportation dispatching and management methods are inefficient in actual work and difficult to meet daily business needs. Moreover, the maintenance and statistical work of the data generated by the railway behavior in the daily work is quite heavy, which may cause the accuracy of the data to be difficult to guarantee [3]. Therefore, with the development of the times, new information management technology based on mobile Internet gradually replaces traditional manual information
management technology, which plays a significant role in promoting the informatization process of railway transportation dispatching. Companies with mature rail transportation systems need to include the entire process from design to operation, which can generally be divided into three major parts: design, manufacturing, and operations. [4]. It covers the range of railway passenger transport systems, from traditional and high-speed intercity systems to suburban, regional and urban systems. In addition, it completely covers the freight railway system for transporting conventional, heavy and dangerous goods [5-6]. For each system, it provides a definition, a brief overview of its evolution, and examples of good practices, major design, structural and operational characteristics, prerequisites for selection, and steps required to check the feasibility of its implementation [7-8]. This book, developed for engineers, designers, and operators of railway systems, also provides a general overview of issues related to safety, interface to the environment, cutting-edge technology, and techniques for controlling the stability and guidance of rail vehicles on the track [9-10]. Contains information on the three main components of all railway systems: railway infrastructure, rolling stock, railway operations department provides a method to test the suitability of railway system implementation, outlines issues related to railway system safety, and generally describes The interface between the railway system and the environment, the cutting-edge technology already in place and the technology being studied, and the stability and guidance technology of railway vehicles in the rail transit system [11-12].

The railway transportation dispatching system designed in this paper establishes the database structure using the E/R model according to the demand analysis, then completes the system's business logic processing through the SSH framework, and finally uses the hybrid mobile application development technology and Web technology to display the operation interface. By investigating the current situation and main problems of official vehicles in detail, I am familiar with the work flow of railway transportation dispatch and combine this with the system. Therefore, we can judge that this system can be implemented. In the mobile monitoring module, users use the tree query mode to implement high-speed query specifications through the network. The basic form of supervision is applicable to mobile clients, and supervision engineers can communicate with other users instantaneously through the system. The online supervision will pass the railway inspection to timely and comprehensively record and report the situation of the railway dispatch site.

2. Method

2.1. Responsive Web Design Technology and Hybrid Mobile Application Development Technology
Among the front-end technologies of the mobile Internet, HTML5 has gradually attracted widespread attention due to its developed applications that can well adapt to the characteristics of hardware platforms of various sizes. Responsive web design technology is a very important web design technology in mobile Internet-based website development. The concept of responsive web design is to enable the website pages to be adaptively adjusted according to different user behaviors and hardware device environments (screen size, operating system platform, etc.). Regardless of whether the user is using a computer browser or a mobile phone or iPad, the website page can automatically switch to the corresponding resolution, adjust the size of the picture and the layout of the content, etc. to adapt to different devices. In other words, the page has the ability to automatically respond to different device environments, and maintains a relatively uniform interface and good interactivity. Responsive web design technology makes it unnecessary for us to do a development work for each platform or screen of each resolution during the development process, which can greatly reduce the development cost.

This technology makes APP developers not need to master too many development languages of a specific platform, but can directly use a Web development technology such as HTML, CSS, JavaScript to build a highly interactive mobile application. This cross-platform feature has relatively low technical threshold requirements for application developers. As a result, developers' learning costs can be reduced, and the cost of cross-platform development of applications can be reduced. Based on this advantage, this system is developed using this technology.

2.2. MVC
MVC is a design pattern. MVC applications are divided into three core components: models, views, and controllers.

2.2.1. M-model Model MVC is an enterprise data and business rule set. Of the three components in this set, the most tasks are to process and respond to various tasks. For example, EJB-type components deal with database-related business, and the returned data type is neutral. Which is data independent of the data format.
2.2.2 V-view In the case of old-fashioned web applications, views are interfaces made up of HTML elements. For new-style Web applications, HTML plays an important role in the field of vision. However, several new technologies appear indefinitely. Some markup languages and web services, such as XHTML, XML / XSL, WML.

2.2.3 C-controller The controller is used to receive user input and call the corresponding data model and view according to the user input data. Therefore, if the user needs to click the hyperlink of the web page, the controller will not output any content and do nothing.

3. Experiment Analysis

3.1. Experimental Steps

Step1: The presentation layer contains the view part and the controller part. The controller part is responsible for the implementation of the system control logic. This part is based on the Struts Interceptor mechanism and Action. When a user's request comes, the Struts framework maps the user's request to a specific Action object according to the mapping rules, and then the processing function in the Action calls the service interface provided by the business logic layer for business processing, and finally performs a page jump or Returns the corresponding result data to the view section.

Step2: The business logic layer is mainly responsible for the realization of business logic. The control part of the presentation layer passes the necessary data into the model and calls the service interface provided by the business logic layer. After performing certain data operations, the data is directly returned to the presentation layer or the data is persisted through the interface of the DAO layer. Each Service Object is a service class that implements some business logic interfaces. Service Manager is similar to the simple factory method, and provides an interface to get a specific Service Object, which relies on Spring's reverse control feature.

Step3: The data interface access layer (DAO layer) encapsulates commonly used database operations, such as adding, deleting, modifying, and checking database tables. After using the Hibernate framework, each database table corresponds to a Java Bean entity class, and each entity class has a mapping file to configure the mapping relationship between the attributes in the entity class and the attributes in the database table. Finally, the important data information is persisted to a physical storage device such as a hard disk for storage.

3.2. Analysis of Experimental Results

This system uses a JavaScript server, which can complete functions such as accessing the database, querying logistics data, and responding to client requests.

Table 1. Rail transport dispatch system page summary

| Page operation summary                  |        |
|----------------------------------------|--------|
| [Running] Total page element hits       | 20     |
| [Running] Page element average response time | 110    |
| [Running] Page element minimum response time | 186:237 |
| [Running] Page element maximum response time | 361:712 |
| [Running] Total page element hits       | 10     |
3.3. Performance Analysis of Railway Transportation Dispatching System Based on Mobile Internet Technology

The railway transportation dispatch management system is a comprehensive application system suitable for managing railway operations of various railway units. The system uses the latest computer network technology to strengthen enterprise railway transportation management, improve railway transportation efficiency, improve work processes, save costs, and improve the maintenance and management automation of railway employees. The systematic management method can improve the boring workflow of manual operation and maintenance management in the past. In this way, the scientific automatic decision of dispatching railway transportation and management is realized, operating conditions are improved, and production efficiency and profit are improved.

Based on the mobile Internet application development technology and SSH framework, from the perspective of combining theory and practice, the design and implementation process of the mobile Internet-based vehicle dispatching system is discussed. The detailed explanation of how to use the SSH framework in combination with the MVC design pattern to reduce the coupling between the various levels of the system makes the system highly efficient and easier to develop and maintain. Developed using responsive web design technology and hybrid mobile application development technology. Complex business process processing is mainly on the server side, which is also in line with the increasingly popular cloud platform design ideas. The system runs with minimal resource consumption. Now that the performance of mobile devices is uneven, mobile applications of the system can run smoothly on most mobile devices, ensuring the ease of use and stability of the system.

From the perspective of user roles, this paper analyzes the requirements of six main functional modules. Detailed analysis of the database design of the system. The database environment and related tools used in the design are introduced, and the system ER model design diagram and analysis instructions are given. The database design is completed according to the system ER diagram. While improving the rationality of the database design and the efficiency of data access, in order to promote the reading and understanding of the database structure and improve the quality and efficiency of data sharing, the database design is specifically explained.

4. Conclusion

In the mobile monitoring module, users use the tree query mode to implement high-speed query specifications through the network. By applying the basic form of railway supervision to mobile customers, railway supervision engineers can communicate with other users through the system in real time. The online supervision will timely and comprehensively record and report the conditions of railway transportation stations through railway inspections. In the mobile OA module, the MQTT protocol is used to effectively promote messages. In this way, users with various permissions can get tasks immediately. According to the organizational structure of the railway or project, divide the railway transportation contacts and make a personal address book. Based on GPS and base station location decisions, mobile presence is achieved.
References

[1] Y.-R. Zhao, Z.-Z. Yang, N. Theo. Roles of China Railway Express in Sino-Euro trade transportation system[J]. Dalian Haishi Daxue Xuebao/Journal of Dalian Maritime University, 2018, 44(3):33-40.

[2] M.P. Linares, J. Barceló, C. Carmona,. Analysis and Operational Challenges of Dynamic Ride Sharing Demand Responsive Transportation Models[J]. Transportation Research Procedia, 2017, 21:110-129.

[3] Christo Ananth, K Nagarajan, Vinod Kumar.V. A smart approach for secure control of railway transportation systems[J]. Social Science Electronic Publishing, 2017, 117(15):1215-1221.

[4] Yong Li, Bonan An, Fang Liu,. An Asymmetrical Connection Balance Transformer-Based Hybrid Railway Power Conditioning System With Cost-Function Optimization[J]. IEEE Transactions on Transportation Electrification, 2018, 4(2):577-590.

[5] Moreno Ambrosin, Paolo Braca, Mauro Conti,. ODIN: O bfuscation-Based Privacy-Preserving Consensus Algorithm for D ecentralized I nformation Fusion in Smart Device N etworks[J]. ACM Transactions on Internet Technology, 2017, 18(1):1-22.

[6] J. Chen. The Scheme Research on the Introducing Zhengzhou-Wanzhou Railway to Zhengzhou[J]. Journal of Railway Engineering Society, 2017, 35(2):1-5 and 23.

[7] W. Wang, J.-J. Zhao, L. Peng,. Research on the Energy Saving Strategy for Long Distance Communication of Mobile Internet of Things Based on UAVs[J]. Tien Tzu Hsueh Pao/Acta Electronica Sinica, 2018, 46(12):2914-2922.

[8] Fotis Lazarinis, Kyriaki Alexandri, Chris Panagiotakopoulos,. Sensitizing young children on internet addiction and online safety risks through storytelling in a mobile application[J]. Education and Information Technologies, 2019(1):1-12.