2022 International Conference on Computers, Information Processing and Advanced Education (CIPAE) | 978-1-6654-6812-1/22/$31.00 ©2022 IEEE | DOI: 10.1109/CIPAE55637.2022.00035

Design and implementation of campus bike rental system from the perspective of sharing economy

Yanjun Lin, Jifan Xu, Junhao He, Xinlu Meng, Yifan Wang, Songchun Wang*
Zhuhai College, Beijing Institute of Technology, Zhuhai, Guangdong, 519088, China
*Corresponding author: 79365190@qq.com

***Abstract*—In college campus life under the perspective of sharing economy, private bikes bought by teachers and students are easy to become idle resources, resulting in resource waste, traffic congestion and other problems. In view of these problems, this paper proposes and develops a university campus bike rental system on the basis of sharing economy. Through comprehensive use of Vue technology, MySQL, UNI-app, SpringBoot and other tools, the overall framework of the bike rental system based on the perspective of sharing economy is designed, developed and implemented. The practical results prove that the system can fully realize all the functions, not only to meet the needs of users, but also improve the utilization rate of campus bike resources, improve the bike sharing market in fewer types, rental time and trouble to investigate the responsibility and other shortcomings.**

Keywords—campus bikes, Sharing economy, rental system

I. INTRODUCTION

With the wide application of "Internet plus", people's consumption concept has changed and their consumption ability has improved, and the sharing economy model has emerged at the historic moment. In the era of pursuing privatization of resources, a large number of people will also choose the lifestyle of resource sharing. The Report on China's Sharing Economy Development (2021) released by the State Information Center shows that the transaction scale of China's sharing economy will expand to about 3 trillion yuan in 2020. With the stimulation of market demand and the guidance of national policies, the sharing economy market will be in a long-term stage of rapid development, and is expected to reach 16.9 trillion yuan by 2021, fully driving the national economic growth[1]. Scientific and technological progress drives the development and popularity of sharing economy, especially in university campuses.

In today's university campus, many teachers and students for the convenience of travel and purchased private bikes, but in fact, in addition to adding and dropping classes daily use, most of the time private bikes are parked in a dorm or staff dormitory building, become the idle resources, and there are some bikes in the use of a few times was placed for a long time and then aging until discarded, It wastes resources and occupies space. Moreover, due to the large number of people on campus, the shared bikes, which are also part of the sharing economy, are often in short supply, the rental time is limited, and they are vandalized and cannot be held responsible. Therefore, linking the idle private bicycle resources of teachers and students with the sharing economy will greatly improve the utilization rate of resources and improve the selection and accountability of bicycles in the sharing market.

The design of this paper is a bike rental system based on the sharing economy. Its core is to provide users with a trading and communication platform for renting or renting idle bikes. This design focuses on the realization of users online commodity release, mutual communication, order submission and view related information and other functions. Through computer technology, the information management of the bike rental system is constructed to realize the efficient, electronic and intelligent bike rental management. At the same time, the problem of disorderly parking and traffic jams caused by school bikes will be solved, and the defects of short rental types, quantities and rental periods of shared bikes will be remedied, so as to improve energy saving emissions and resource reuse. It is hoped that the bike rental system can not only help teachers and students to solve the problem of idle bikes, but also provide more, better and more convenient options for people who need to rent bikes.

II. SYSTEM FEASIBILITY ANALYSIS

A. Objective Feasibility

In order to facilitate daily travel, college students usually choose to buy bicycles, but the use of bicycles is relatively special, some bikes are not used frequently or will be eliminated after a period of time or after graduation, some students will directly ignore or simply throw away, no longer use, resulting in a certain waste. Although some students thought about selling them, they were hard to find the seller, so they had to leave them under the dormitory building, which caused that the goods could not be used to their full potential.

In the campus, bicycles are used items with high reuse rate, high recycling rate and high value.Moreover, bicycle is required for daily travel of college students, which is irreplaceable to a certain extent. Therefore, it is important to create a professional and standardized shared bike rental platform, and the campus shared bike rental system came into being. The campus shared bike rental system fundamentally solves the problem that there are many useless bikes on traditional campuses, and effectively integrates all kinds of bike information on campus to facilitate students' renting and using.

B. Technical feasibility

This design is based on WeChat applet and B/S architecture for system development, and IDEA and MySQL are used in the development process, compared with other development tools, the developer has sufficient practical experience with these two development tools. And the core part of WeChat applet is based on WeChat developer tools, so there is no need to consider the inapplicability caused by the difference of the mobile system itself. In summary, the technical feasibility is reasonable.

978-1-6654-6812-1/22/$31.00 ©2022 IEEE
DOI 10.1109/CIPAE55637.2022.00035

C. Economic feasibility

In terms of economic investment, the programming tools and database tools used to develop the system can be downloaded from the Internet and used for free, so there are basically no additional costs other than the Internet access fees that must be paid every cycle. In addition, we spend less money on electronic equipment, and the system is developed by ourselves, so the human resource cost and maintenance cost can be ignored. In summary, the economic feasibility is reasonable.

D. Personnel feasibility

The tools and methods used in the development of the system are essential knowledge for this major, among which IDEA and MySQL are the main development tools used in the system. And the team members have the ability to develop the system, so they can do their own work and discuss with each other to complete the task together. In summary, the feasibility of personnel is reasonable.

III. System Business Process Analysis

The main business process of the university campus bicycle rental system: the renter logs in with WeChat authorization, selects the bicycle that meets his or her needs in the information browsing interface, checks the type of bicycle, parking location, usage requirements and other information, and then confirms that there is no error before placing an order. After the platform receives the order information, it will automatically send the bicycle lock code left by the publisher to the renter in advance. The publisher and the manager can process the order. The related business process is shown in Figure 1.

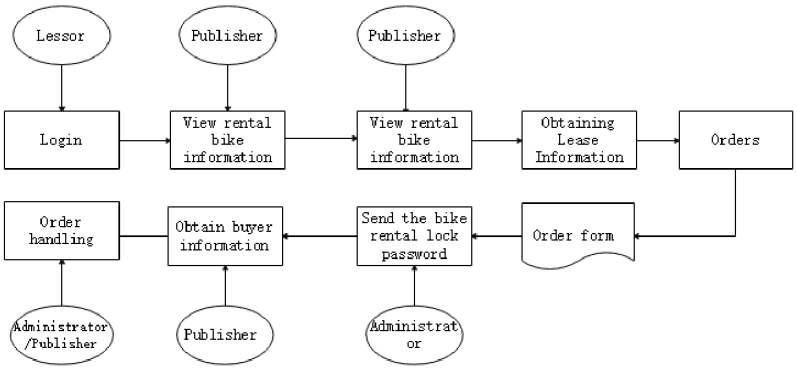

Figure 1.Business flow chart.

IV. System Requirement Functional Analysis

According to the system business analysis, this bicycle rental system is mainly divided into two sections for users and administrators, and the main functions are shown in Figure 2.

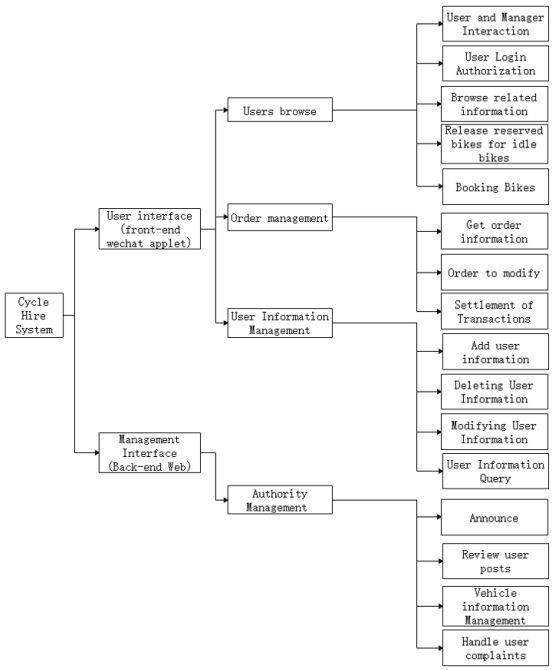

Figure 2. System function diagram.

Users logging into the system and entering the user interface can browse relevant information, publish or book bicycles and communicate with other users, and the order data is monitored by the backstage manager management; after logging into the system and entering the management interface, the manager can manage user information and management rights. The credit system is enabled, when the user does not complete the order process such as the renter does not return the vehicle, illegal operation and other behaviors, the administrator can restrict the corresponding user's rights in the background, and can also impose fines on them in serious cases. The system can achieve specific functional sections are user browsing, order management, user information management and permission management.

A. User Browse

The functions of the user browsing section include user login authorization, browsing related information, posting unused bikes, booking bikes, user-administrator communication interface and user-user communication interface.

(1)User login authorization. Users are authorized to bind a micro-signal to log in to the system to achieve real-name leasing, and at the same time to achieve the password "*" number, fully protect user privacy and ensure user rights.

(2)Browse related information. The user page will be divided into home page, category, posting, order list and user personal information page for users to browse bike type, price, style, order information and user personal information such as reputation score, etc.

(3)Post unused bikes. Users can post the rental information of unused bicycles by uploading information about bicycles through the "Post" button on the main page.

(4)Book a bike. Users can browse or search for the desired bicycle through the home page, and click to browse and reserve the bicycle.

(5)User-administrator communication interface. Users can communicate directly with administrators and customer service.

(6)User-to-user communication interface. Renters can communicate directly with publishers.

B. Order Management

The functions of the order management section are to obtain order information, order modification and transaction settlement[2].

(1)Get order information. The user can get the relevant order information in the order list.

(2)Order modification. Users can modify the order information, but cannot modify the rental price again after submitting the order.

(3)Transaction Settlement. Transaction settlement through WeChat payment.

C. User Information Management

The functions of the user information management section include adding user information, deleting user information, modifying user information and querying user information, that is, the administrator has the right to add, delete and check user information.

D. Authority Management

The functions of the authority management section include publishing announcements, reviewing user information, vehicle information management and handling user appeals.

(1) Release announcements. The administrator edits the bulletin and displays the information in the front - end small program information bar by way of round - cast graph.

(2) Review the information posted by users. After the user uploads the bike rental information, the administrator will review it in the back end. If it passes the review, the release will be successful; otherwise, the release will fail and relevant reply will be given.

(3) Vehicle information management. Administrators can manage the information of all published bikes[3].

(4) Handle user complaints. After the user appeals the order, the administrator will review and deal with it in the back end. If the appeal passes, the credit value of relevant users will be reduced; otherwise, the appeal fails and relevant reply will be given.

V. THE SYSTEM DESIGN

A. Development methods and tools

The university campus bike rental system is divided into two parts: the front desk and the back desk. The front desk is used by renters and publishers through wechat mini program and developed by uni-App framework. Background through B/S structure of the Web system interface for the administrator to use, using VUE + Springboot technology for development.

(1) the uni - app

Uni-app is a framework for developing front-end applications using vue. js. Developers can write a set of code and publish it to ios, Android, Web and various small applications for multiple platforms. Uni-app benefits from a high number of developer cases, improved cross-side performance, faster loading of new pages, and low learning and development costs. When cross-ended, uni-App uses conditional compilation plus platform-specific API calls to invoke proprietary capabilities while completing the writing of personalized code for one platform without affecting other platforms. Realize the front desk function module (wechat mini program) through UNI-App: Publishers release bikes, renters query, browse, rent bikes, query orders, contact customer service, bike bulletin board, search bikes by type, search bikes by name.

(2) Java language

Java as the current mainstream development language has many advantages, JS framework to programmers can provide a solid foundation to build programs, it includes defined classes and functions for hardware devices and system software interaction and processing input, so that developers more easily. There is also the Srping MVC-Java WEB Framework, which provides software engineers with a complete toolkit for WEB application configuration, application development, and security projects[4]. Fast development, simple security policy integration, support for relational and non-relational databases and other advantages[5]. Through Java framework, Spring mainly realize the background function module (Web) : User

management (query user related information), bike management (shelf goods, edit goods, delete goods, query goods), rental records (user rental bike information, query order information), announcement management (query announcement, edit announcement, delete announcement, add announcement), appeal management[6].

B. Database Design

(1) Conceptual structure design

The conceptual structure design of the campus bike rental system is. The entity user attributes are ID, name, gender, telephone number, etc. ID is the primary key. The entity order attributes have the order number and rent-return record primary key is the order number. Entity vehicle attributes include vehicle number, owner ID, location of receiving car, location of returning car, etc., of which the vehicle number is the primary key. The connection between entities is that a user can pay for multiple orders, each car can only have one order, and a user can only rent one car, where the connection attribute is the rental time. The details are shown in Figure 3.

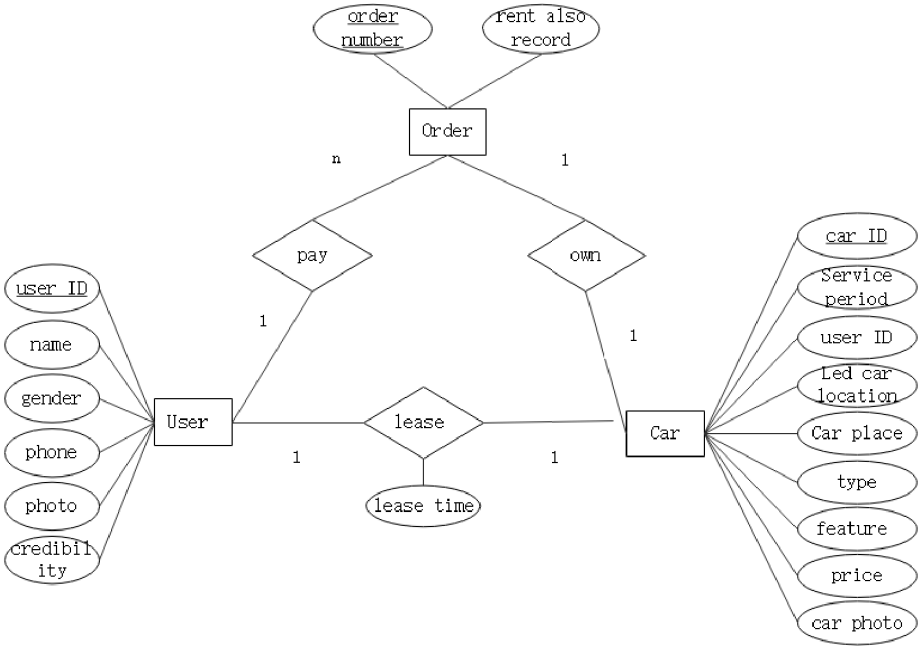

Figure 3. Rental ER diagram.

(2) Logical Structure Design, as shown in table I and table II.

TABLE I ER DIAGRAM TRANSFORMATION MODEL.

User	User ID, phone number, gender, credit, name, profile picture
Vehicle	Vehicle number, use period, place of receiving and returning, type, price, photo, description, owner ID, release time, rental time, review time, user ID
Order	Order number, rental record, completion date, user ID, vehicle number
Administrator	Administrator ID, name, gender, phone number
Complaints Suggestions	Event Number, Complaint Type, Complaint content[7], picture, Processing status, Processing time, Complaint time, User ID, Administrator ID
Bulletin	Bulletin number, title, content, and administrator ID

TABLE II DATA MODEL OPTIMIZATION.

Vehicle	Vehicle number, Use time period, Pick up location, Drop off location, Type, Price, Photo, Feature description, Vehicle owner ID
Goods	Product Number, Release time, Vehicle number, User ID
Rental Goods	Rental number, Rental time, Vehicle number, User ID
Review Goods	Audit number, Review time, Admin ID, Vehicle number

VI. SYSTEM FUNCTION REALIZATION

According to the design idea of the bicycle rental system on university campuses from the perspective of sharing economy, the Zhuhai College of Beijing Institute of Technology will be taken as an example to implement the specific functions of the rental bicycle management system. The front-end functions include users publishing, inquiring, browsing and renting bicycle information, inquiring about orders, contacting customer service, displaying bicycle bulletin boards, and searching for bicycles by type or name. The specific functional structure diagram is shown in Figure 4.

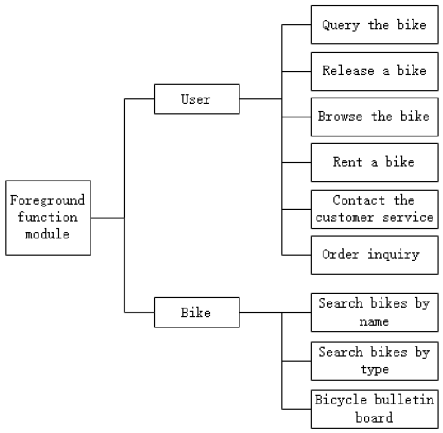

Figure 4. Front desk function structure diagram.

The background functions include user management for querying user information, bicycle management for listing bicycles, editing bicycle information, deleting bicycles and querying bicycle information, rental records for querying rental information and order information, and announcement management for adding, deleting, and modifying announcements. Another appeal module can communicate with users to solve problems. The specific functional structure diagram is shown in Figure 5.

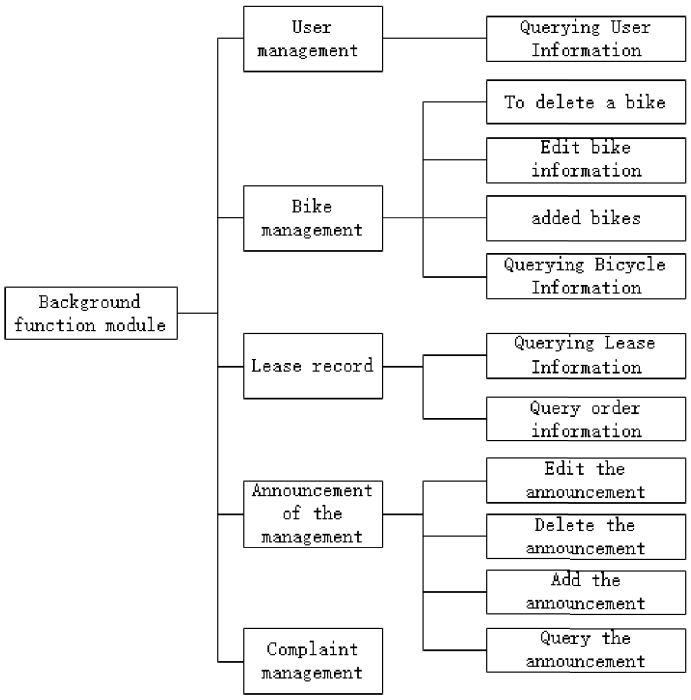

Figure 5.Background function structure diagram.

It can be seen from the above that the system is divided into a foreground function module and a background function module. The front desk is based on the WeChat applet. The functions that users can perform on the applet mainly include publishing bicycles, inquiring bicycles, browsing bicycles, renting bicycles, inquiring about orders, and contacting customer service. Additionally, the applet will display a simple bicycle bulletin board for posting important messages, and users can search for bicycles by type or by name.

VII. Conclusion

With the increasing updating of science and technology, people's way of life has also undergone significant changes[8]. Through the comprehensive application of Vue technology and MySQL, uni-app, SpringBoot tools, etc., the system realizes functions such as user login, browsing, order transaction, administrator authority management, etc., and achieves the expected effect in the interface display design. The realization of the system provides users with a good bicycle rental platform, and also enables managers to have an effective way to manage the bicycle rental platform system, fully realizes the advantages of sharing economy, improves resource utilization, and brings great convenience.

Acknowledgments

Special innovation projects of key platforms and scientific research projects of colleges and universities in Guangdong Province; Subject number: 2021wtscx141.

References

[1] "Insights 2019" Report Released: Investment Weather Vane of the Top 30 Emerging Industries [N]. Sina.com, 2019

[2] Pan Qin. Research on Network Publishing and Applied Technology [J]. "Master Thesis of Capital University of Economics and Business", 2002

[3] Gong Wen. Design and implementation of vehicle rental mobile application platform [J]. "Hunan University Master Thesis", 2017

[4] Comparison of the advantages and disadvantages of the five JAVA Web frameworks, Spring MVC leads [N]. Cloud + Community, 2019-7-21

[5] Wu Xiaobo. Why do Java programmers have to master Spring Boot? [N] .Blog Garden, 2019-11-7

[6] Liu Yiling. Design of property management system based on J2EE platform [J]. "Master Thesis of Guizhou University", 2017

[7] Lv Bo. Design and Implementation of Liaoning Netcom Broadband Business Platform [J]. "Master Thesis of Dalian University of Technology", 2013

[8] Guan Jiantai. On Promoting the Development of Prison Enterprises with Market Laws [J]. Journal of the Party School of the Shanxi Provincial Committee of the Communist Party of China, 2005