

# *Design and Implementation of Green Travel Smart Environmental Protection System*

**Yifan Bai**

*Dalian University of Foreign Languages, Lushunkou District, Dalian, Liaoning, 116044, China*

**Keywords:** Spring Boot Vue; green travel; intelligent environmental protection

**Abstract:** The study proposes a point system for system accounts, in which users earn points by travelling green on public transport and participating in activities, and redeem points for vouchers, effectively reducing carbon emissions, mobilizing public participation in environmental protection activities, and fundamentally promoting the implementation of policies related to emission reduction and carbon reduction.

## **1. Introduction**

Environmental protection has always been a key concern for society. In the past, most people have used registration forms and notes to participate in environmental activities and record their travel history, which can easily lead to ambiguous information and data loss. As environmental issues have become more and more important, more and more people have become involved in environmental protection, dating back to the 1960s with the "green travel" movement, and in 2007 the United Nations Environment Programme introduced the "green travel" calling on governments and all sectors of society to take action to promote low-carbon travel and reduce the environmental impact of transport. In China, the 2008 Beijing Olympic Games promoted the concept of "green mobility". In order to cope with the traffic pressure and environmental pollution during the Olympic Games, the Beijing Municipal Government introduced a series of "green travel" measures, such as traffic restrictions, public transport priority, bicycle lanes, etc. The rise of new modes of travel, such as bicycle sharing and car sharing, has also provided more options for "green travel". The rise of new modes of travel such as bicycle sharing and car sharing has also provided more options for "green travel". But in today's technologically advanced world, little research has been done to develop green travel combined with systematic digital environmental protection organisations.

SpringBoot+ Vue combined as a web project is a common full-stack development approach, where SpringBoot acts as the back-end framework, providing data interfaces and business logic processing, and Vue acts as the front-end framework, responsible for user interface presentation and interaction. It has the following advantages: front-end and back-end are separated, the front-end and back-end are developed separately and communicate through API interfaces, which separates the front-end from the back-end and improves development efficiency and maintainability. The front-end technology stack: Vue as the front-end framework, you can use Vue-Router, Vuex and other plug-ins to achieve single-page applications and improve user experience; back-end technology stack: SpringBoot as the back-end framework, you can use Spring Security, MyBatis and other plug-ins to achieve security authentication and database operations; data interaction: the front-end through Ajax or Axios and

other tools, send requests to the back-end, the back-end returns data in JSON format, which the front-end parses and displays; deployment: the front-end and back-end can be deployed on separate servers, or packaged into a war package and deployed together on the same server. The model is an efficient, flexible and easy-to-maintain full-stack development model. Therefore, the development of green travel and environmental protection system has a broad development prospect, and is also the way to develop a green ecological civilization city[1-2].

## **2. Needs analysis**

### **2.1 Role requirements**

The system will be used by residents, drivers and administrators.

#### **2.1.1 Resident Requirements**

New resident users will be able to view the current environmental activities and system introduction as a visitor when they first log in to the system. After logging in, you can check the details of the environmental activities and the specific participation time, pre-register, follow the environmental activities, confirm the registration and check the residents' points ranking. Resident users can choose their appropriate practice for registration or other related operations.

#### **2.1.2 Driver requirements**

Driver Requirements: New driver users will be able to view the current environmental activities and system profile as a visitor when they first log in, and will need to register and log in if they need to perform operations such as green travel records (green footprints in the system), environmental activity registration, environmental activity check-in and voucher redemption. After logging in, you can check the details of environmental activities and the specific participation time, pre-register, follow environmental activities, confirm registration, sign in for environmental activities and check driver points ranking. Driver users can select their own appropriate practice for registration or other related operations.

#### **2.1.3 Administrator requirements**

The system administrator has the highest authority, including resident management, driver management, environmental protection activity management, voucher management, adjusting the ranking of residents, adjusting the ranking of drivers, checking the feedback and reporting information of residents and driver users in the mailbox, etc.

## **2.2 Functional requirements**

### **2.2.1 Registration and Login**

Take the resident user as an example, after entering the system, the resident user can browse the basic information, such as: the theme of environmental protection activities, the maximum number of environmental protection activities registration, environmental protection activities contact person, etc. If you want to view more information, you need to register and log in. Resident users fill in their own name, password, age, contact information, address, select gender and ethnicity as personal information when registering. After registration, the system defaults to setting 0 points for users and blank travel records, and resident users carry out relevant operations according to their own needs after successful login[3-4].

### 2.2.2 Selecting the mode of travel

The system will add points to the user's score when the user selects the shared single, bus, underground or walking travel mode displayed on the homepage, and the user can subsequently exchange the points for vouchers, which can be used when riding again.

### 2.2.3 Display environmental activities

This function displays all the environmental activities that can be registered, including the corresponding points, registration time, activity location, contact person, maximum number of registrants, etc.

### 2.2.4 Pre-registration

When a user chooses to register for an event, the user will not be immediately redirected to the registration success page, but a pre-registration list will be generated, i.e. the user can register for multiple events at the same time, and the number of registrants can be modified in the pre-registration list. The system automatically calculates the total number of points for each activity. The user will not be redirected to the next page until he/she clicks to confirm the registration.

### 2.2.5 Event check-in

Only when the user has signed up for the event will the points be added to the user's points according to the calculated amount, otherwise they will not be valid.

### 2.2.6 Voucher redemption

The administrator sets the amount of vouchers and the number of points corresponding to the number of vouchers. When the user chooses to redeem points for vouchers, the system automatically detects whether the user's points balance meets the number of points to be spent and saves it to the user's voucher after successful redemption[5-6].

### 2.2.7 Database Concept Design

In the green travel smart environmental protection system, the entity classes include resident user entity, driver user entity, administrator user entity, activity entity, pre-registration entity, confirmation registration entity, green travel record entity, activity contact entity, system internal mailbox entity, and voucher entity. An E-R diagram of the response is drawn based on the relationships between the data entities designed for this system. (Figure 1)

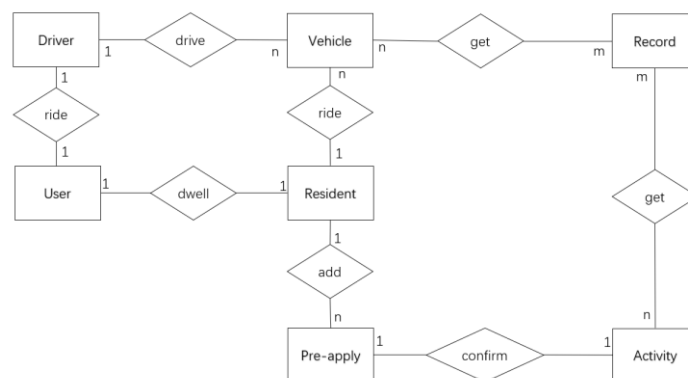


Figure 1: Database Design

### 3. The design of system functions and flow chart display

The system is mainly divided into seven modules: personal centre, environmental activities registration, voucher redemption, in-system mailbox, points ranking, green travel record, current affairs information, where each section contains a number of functions, the function of each module is divided. (Figure 2 - administrators transaction process diagram, Figure 3 - Residents transaction process diagram, Figure 4 - Drivers transaction process diagram)

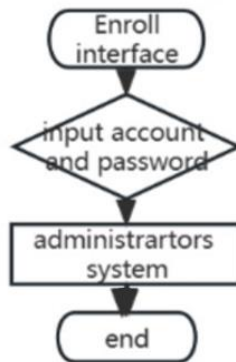


Figure 2: Administrators transaction process diagram

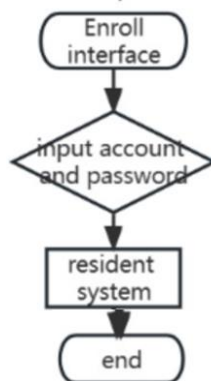


Figure 3: Residents transaction process diagram

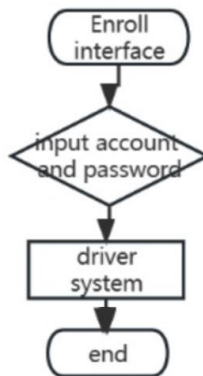


Figure 4: Drivers transaction process diagram

### **3.1 Personal Centre**

The main function of this module is to present user information, which includes not only basic personal information, such as name, gender, age, contact details, address, etc., entered by the user when registering, but also includes functions such as the feedback sent by the resident or driver user to the administrator user, and the administrator's reply to the feedback received. Residents and drivers can only view basic information about the event if they are not registered, and when they click on an action, the system will display "Not logged in yet, please log in". When registering, personal information is filled in and subsequently displayed in the Personal Centre interface. The system generates an image verification code and caches the code information for verification to protect system security.

### **3.2 Environmental Activities Registration**

The main function of this module is for residents or drivers to select an activity to register for. It can be divided into two steps: the first step is for the user to view the event on the display page and sign up immediately, the second step will subsequently enter the sign-in page; it can also be divided into three steps: when the user clicks on the event to join the pre-registration list, the second step in the pre-registration list to modify the number of participants and the event to be registered, the third step subsequently enter the event sign-in page[7-8].

### **3.3 Voucher redemption**

The main function of this module is for residents or drivers to redeem vouchers based on the points in their account. The system will check if the user has enough points to redeem the vouchers, and will remind the user that the redemption has failed if the points are insufficient. The points are accumulated by users travelling on public transport and participating in environmental protection activities. The system is used to raise public awareness of environmental protection and to implement and promote the goal of building an ecological civilisation.

### **3.4 Mailboxes within the system**

This module is divided into two main parts: the first part is for residents or drivers to give feedback to the administrator through the mailbox about problems in the process of activity registration and voucher redemption, and the administrator receives the feedback and makes changes and adjustments through resident management, driver management, voucher management and activity management. The second part is to send the corrected information to the email address of the resident or driver after the administrator has processed the feedback.

### **3.5 Point Ranking**

The main function of this module is to count the accumulated points of all users and drivers and to rank them. Similarly, when a driver logs in to view the leaderboard, he or she can only see the driver's points ranking.

### **3.6 Green Travel Record**

The main function of this module is to record the registration records and public transport rides of residents and administrators. It not only records the basic information of the activities and the means of transport, but also records the time and the corresponding number of points, so that users can easily

calculate their own points and respond to the administrators.

### 3.7 Current Events

This function mainly uses a rotating map to display current affairs information, click on the rotating map to switch between left and right, click on the content in the rotating map to jump to the page. If the rotating image is a recommended activity, it will enter the registration interface of that activity; if the rotating image is the latest research results in the field of environmental protection or the current environmental protection policies implemented by the state.

## 4. System development and implementation

### 4.1 Personal Centre

The functions of the personal centre are relatively simple and consist mainly of registration and login. The administrator does not need to register and is pre-defined by the database. The system sets up a database "auto-increment" function, which adds users and increments the user id (resident id/driver id) when they register, and the password length must be between 6 and 20 for user registration. Message: 'Please enter a password', trigger: 'blur' },{ min: 6, max: 20, message: 'Password length 6 to 20', trigger: 'blur' } The system compares the user's content in the input box with the data in the database when logging in. Mainly through the back-end return verification code to indicate the part of the login process occurred exception. For example, if the back-end passes "A000" type error, the front-end will display "verification code error", if the back-end passes "A001" type error, the front-end will display " The mailbox is not registered", the back end passes "A002" type error, the front end displays "password error", while the catch statement is used to catch other exceptions, when the content of the input box does not meet the set rules, it displays "Form validation Failure"[9-10].

### 4.2 Registration for environmental activities

The resident or driver user clicks on an event displayed on the home page. The home page activity display is built through the SpringBoot framework with a back-end connection to the database, combined with the front-end Vue component v-for, element-plus component tag, display data, here the number of points and the number of limit activities as an example {{item.acscore}}, {{item.limit}}, the display page only shows the basic information of the activity. When the user clicks on it, the details will be displayed and the user can select "Add to Pre-Registration List" or "Register Now". The corresponding implementation is to create a new object in the "Pre-registration" entity class, get the user id of the current login status, and the id of the pre-registration activity, as the property of the newly created "Pre-registration" entity class object `Long n = query().eq("resident_id",confirmEntity.getResidentId()).eq("activity_id",confirmEntity.getActivityId()).count();`. Similarly, if the user clicks Register Now, the page will jump to the Confirm Registration page, and the backend will create the Confirm Registration entity class to instantiate a new object in which the current user id, the id of the registered activity, the points of the activity, the sign-in status and the registration time are stored.

### 4.3 Voucher redemption

The resident or admin user redeems the voucher on the homepage, the front-end gets the user id and compares the corresponding points property with the number of points the user has chosen to

spend on the voucherconst moneyIndex = (money) => {axios.post('/ api/money/ getMoneyIndex', {money. moneyIndex}, if(moneyIndex < consume) show "insufficient points" when the account points balance is less than the number of consume points, show "successful redemption" when the account points balance is greater than or equal to the number of consume points ", a new voucher object is created in the database and the current user id is stored to indicate that it belongs to the user, who can view their vouchers in their personal centre. In order to prevent malicious selling and reselling of vouchers, the system adds an end date attribute (date data type endtime) to the voucher entity class, stipulating that the user must use up the voucher before the end date.

#### 4.4 Mailboxes in the system

The system sets a "mailbox" button in the personal centre for resident users, driver users and administrator users, after the user clicks the button, the backend creates a new email entity class object (new emailEntity), which automatically gets the current user type and id, the user edits the mailbox and clicks send. The content click to send, the content to string data type stored in the database, displayed in the administrator user's mailbox, the administrator again login to view the mailbox that is the feedback information. Implementation code: const emailIndex = (email) => {axios.post('/api/email/getEmailIndex',{email:emailIndex} The front-end renders the content stored in the email data table in the database by calling the back-end interface. Similarly, after verifying the feedback, the administrator solves the problem using functions such as activity management, voucher management, resident management and driver management, and then uses the same operational process to notify the sending user that the problem has been solved.

#### 4.5 Green Travel Record

Green travel record mainly includes two aspects, on the one hand, users travel by public transport to reduce exhaust emissions. Users click on green travel in the home page, select the mode of travel, such as underground, bus, shared bicycle, walking, each way corresponds to different points, the front-end access to the user's choice of travel mode will pass the data to the back-end for the use of points to increase, through the reference comparison analysis of different modes of travel plus points are different, walking 10 points, shared bicycle 8 points, take the underground 5 points, bus ride 3. database users Changes to the table of points are also updated on the front end. On the other hand, user participation in environmental activities is recorded, only those activities for which the user has confirmed registration are recorded, not pre-registered activities.

#### 4.6 Current affairs

There are two kinds of jumps in the current affairs information module. The first one is to access the official website of national policies and import the content of environmental policies and related news into the rotating module of the system, so that when users click on it, they will jump to the connected official website to understand the detailed content of national policies. When the user clicks on the event in the rotating image, the event details pop up and the user can further choose to add to the pre-registration list or register now. The administrator can modify the event image in the backend and the rotating image will be changed accordingly. The rotating image uses `<el-link: underline="false" @click="goToGoodsDetail(item) "></el-link>` implemented.



## 5. Conclusion

In order to meet the travel needs of residents and drivers, this paper has designed and implemented a green travel smart environmental system based on the SpringBoot framework, combined with front-end Vue components, connected to a MySQL database, and also using redis caching database technology.

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