CPT202 2023/2024 Semester 2

Final Report for Software Engineering Group Project

< Online Booking Service for a Sport Centre >
<2024.5.24>

URLs:
We provide you the URL for each sub-pages of our system, but each URls will jump to the login page because you need to login first. We prefer you to use the Google Chrome browser to visit our website because it is more stable.
http://121.43.129.89:9012/login/html/logtest.html
http://121.43.129.89:9012/home/html/homePage.html
http://121.43.129.89:9012/piao/html/football_booking.html_
http://121.43.129.89:9012/community/html/community.html
http://121.43.129.89:9012/user/html/personal_information_display.html

We also give you two default account and please feel free to add more by signing up.

Default account	*Username*	*Password*
Normal user	Usertest	User123456
Administrator	Admintest	Admin123456

Group number: <07>
Student Name: Bowen Fang
Student ID: 2144218

Contents

Introduction

The purpose of our project is to create a university sports booking website that meets the various needs of teachers, students, and administrators. For school teachers and students, it is mainly necessary to implement functions such as login, ticket booking, and personal center management. For administrators, it is mainly necessary to implement functions such as managing users, managing sports activities, maintaining main files, and querying ticketing information.

Our ultimate solution is to divide user needs into six key parts to complete (Use case diagram is shown in Appendix A1 Use case diagram):

1. **Registration & Login:** Register, log in, and retrieve passwords.
2. **Home page & Sport:** View basic information and booking overview of the sports arena, as well as provide ticketing tutorials and venue service guides.
3. **Sports activity booking:** Purchase tickets for the selected sports.
4. **Personal center:** edit personal information, view and manage ticket orders.
5. **Community:** Sports experience rating, upload posts to share insights.
6. **Admin:** Manage sports and users. View statistical reports and maintain system master files.

Through the implementation of the above functions, we provide users with a beautiful browsing interface, user-friendly booking and personal information management functions. We provide administrators with a clear management interface, simplifying their daily operational operations. At the same time, as an innovative part of our community function, it provides a space for sports enthusiasts to communicate, allows users to upload posts to share experiences, and scores feedback for others to learn from, enhancing user engagement.

In the team work that completed the above projects, each member undertook specific tasks, including front-end design and development, back-end logic implementation, and database management. I was mainly responsible for the first half of the ticket booking function, including selecting the type of sports, time, and number of tickets, as well as visualizing the booking situation. There is also an introduction to sport center services on the homepage. In the above section, I provided an overview of the project. The following content will be elaborated in detail from the following aspects: **1. Software Development Process 2. Software Design 3. Change Management 4. Legal, social, ethical, and professional issues 5. Conclusion.**

Through in-depth analysis of six parts, this report aims to showcase the implementation process and results of our project around the Scrum framework.

Software Development Process

Agile development originated in 2001, when 17 software developers signed the Agile Manifesto [1], marking the birth of new methods in software development. Agile development has the advantages of high flexibility, short iteration cycles, and emphasis on communication. Scrum, one of the methods of agile development is one of the vangards of the new way to manage software development [2]. Scrum is also the framework we used in this software development.

Scrum provides a framework and principles. We allocate projects reasonably to each sprint, helping our team efficiently deliver work in an iterative and incremental manner. Collaboration is crucial [3], so Scrum also promotes close collaboration among team members. We conducted three sprints during the scrum development process, each lasting two weeks. Next, I will discuss how our team can promote software development and effective communication through Scrum.

Our 8 team members consisting of:

- Product Owner: Each member, as we are also users.
- Scrum Master: Our team leader, he usually initiates meetings.
- Developer: Each member.

In the project development process using the scrum framework, at the beginning stage, we identified the product backlogs to be completed. There are a total of forty, corresponding to the needs of ordinary users and administrators. Afterwards, we entered the sprint. Sprint is divided into the following four parts (detailed meeting minutes will be included in the Appendix A2 sprint meeting):

1. Sprint Planning:

At the beginning of each sprint, we held a meeting to ensure the product backlogs to be completed in this sprint. We confirmed the tasks for each of the three meetings:

Sprint1: We focus on the Login & Registry Module, Personal Center Module.

Sprint2: We focus on the Sports activity booking, Admin, Home page & sport modules.

Sprint3: We focus on the advanced PBIs, Community model and other PBIs in the previous modules.

2. Sprint execution:

This is the longest process in the sprint, during which each team member strives to complete the functions they need to develop. During this process, communication within our group was very frequent, and we synchronized our progress in real-time because the functions responsible for by different team members intersected. For example, the pie chart part that I designed needs to be displayed on Jiayu Shen's sports page. I discussed with him where to place this feature appropriately on the page, and we integrated the code to make them a whole. In daily meetings, we also communicate progress, promptly identify and resolve issues.

3. Sprint Review:

As each of us is both a developer and a target user, we provide feedback on the completed PBI during each sprint review. For example, during the first sprint, I did not participate in the development of the login and register, so I provided feedback from a stakeholder perspective. I suggested that there should be a password rule in the password setting section, and that there should be error feedback to remind users of password input errors. In addition, in the third sprint review, regarding the PBI of the select booking date that I completed, Jingjie Qiu provided feedback on my PBI-Select booking date, pointing out that there is no time limit for date selection and suggesting adding a limit. I subsequently optimized this.

4. Sprint Retrospective:

In each Sprint Retrospective meeting, we will review from two aspects: Team collaboration and Technical improvement. In terms of the team, in the 1st sprint, as we were both using the Scrum framework for the first time, there were still information gaps in communication, such as inconsistent webpage fonts used by me and other classmates. Later on, we adapted to working under the Scrum framework and avoided such problems. In terms of technology, we will discuss our respective technical issues in meetings and try our best to solve them.

The Scrum framework has had a profound impact on our software development and team communication. Through high-frequency communication and information transparency, our team members can maintain synchronization, strengthen team collaboration, and improve development efficiency. In the problem-solving and decision-making process, due to the support of the Scrum framework for rapid iteration and decision-making, our team is also able to quickly respond to challenges and find solutions.

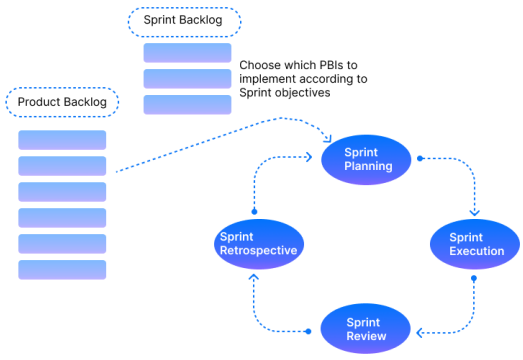


Figure 1 Sprint

Software Design

In the software design section of this report, I will delve into the design and implementation of the 6 PBIs that I have

completed. I am mainly responsible for the first half of the ticket purchasing process, from selecting sports types to selecting ticket quantities, as shown in Figure 2. In addition, there is also a visualization of ticket booking status and an introduction to venue services. I have drawn an activity diagram for the ticket purchasing process, which is attached in Appendix A3.

Figure 2 Booking process

PBI #1 Choose sports activity

Design:

Function Overview: Each user can choose the type of exercise they want to purchase before purchasing tickets. There are eight sports to choose from.

Design Concept: In UI/UX design, each sport has a separate page with<li>links to other sports, making it easy to navigate.

Implementation： Final effect can be found in the Appendix A5

Front-end Implementation: This feature is mainly implemented by combining HTML and CSS. The following are key code snippets with various motion connections.

```
<nav class="menu">
    <ul>
        <li            class="active"><a
    href="badminton_booking.html">Badmi
    nton</a></li>
        <li><a
    href="football_booking.html">Footba
    ll</a></li>
        ……
    </ul>
</nav>
```

Justify： Successful effect shown in Figure 3

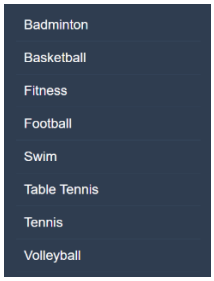


Figure 3 Choose sports

PBI #2 Choose sports date：

Design:

Function Overview: Users can book tickets for the next seven days, including the current day.

Design Concept: UI/UX design is to allow users to intuitively and conveniently select dates. I have chosen to place a calendar in the upper left corner of the page. Users can click to see the date and make a selection.

Implementation:

Front-end Implementation: This feature is only implemented by the front end, and its main feature is that the selectable date range is limited to seven days, through `maxDate.setUTCDate(today.getUTCDate()+6);`The complete JavaScript code is in Appendix A6.

Justify： Successful effect shown in Figure 4

Figure 4 Choose date

PBI #3 Choose specific time slot

Design:

Function Overview: Users can click on the time area with votes to jump to the vote page.

Design concept: In the front-end design, I hope to allow users to make intuitive choices. Considering that each sport has one or more venues, I have designed a two-dimensional table representation of time venue. When tickets are sold out during a certain time period, the color of the time period will change from blue to red. Here, the backend retrieves the remaining tickets from the database and provides feedback to the frontend.

Implementation：

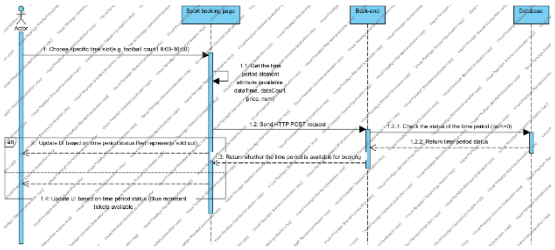


Figure 5 sequence diagram

This function sends an AJAX request through JavaScript to call the '/groupTick' path. After receiving the request, the backend triggers this method to interact with the MyBatis database. OrderEntity is used in the backend to represent order data, which is encapsulated in "responseVO" and passed to the frontend in the form of JSON. Change the displayed color according to the settings in JavaScript.

Justify： Successful effect shown in Figure 6

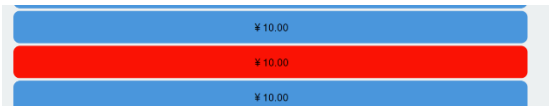


Figure 6 Choose time slot

PBI #4 Choose ticket number

Design：

Function Overview: The front-end page here displays detailed ticket purchase information, and users can click the plus or minus sign or enter a number to change the number of tickets, with a maximum value not exceeding the inventory.

Design philosophy: In the front-end design, I hope that users can confirm their chosen sports type, time, and venue again, so the corresponding front-end choices are reflected on this page.

Implementation ：

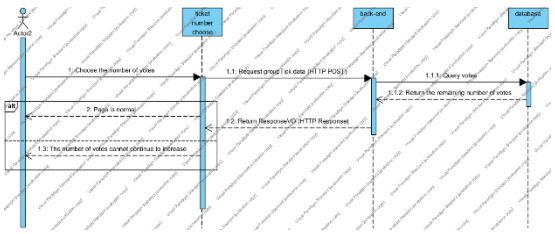


Figure 7 sequence diagram

This feature also obtains votes, so the backend and database logic is the same as PBI # 3, but the updateTicketAlert() function in the JavaScript section of the frontend handles situations with different votes. As shown in Figure 8.

Justify： Successful effect shown in Figure 8

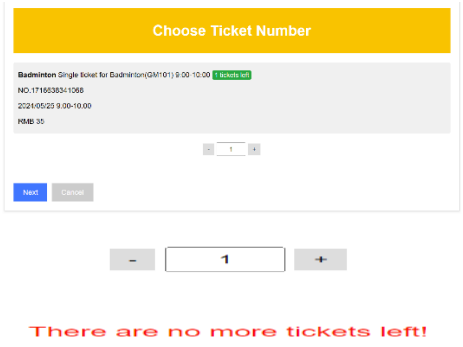


Figure 8 No more tickets

PBI #5 View pie chart for timeslot booking

Design：

Function Overview: On each sports homepage, the difference in radius of the pie chart reflects the ticket purchasing situation at different times.

Design concept: Initially, my idea was to use a bar chart for visualization, but I thought the sector chart was not aesthetically pleasing. Therefore, I came up with the idea of dividing the circle into twelve parts corresponding to twelve time periods, reflecting data differences based on different radii.

Implementation:

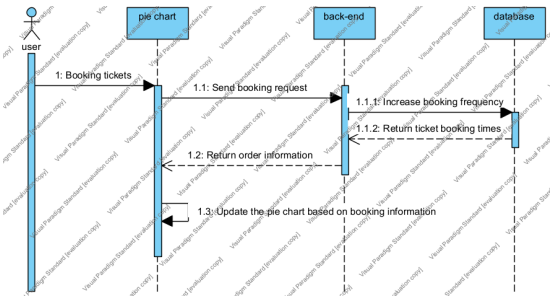


Figure 9 sequence diagram

This feature also obtains votes, so the backend and database logic is the same as PBI # 3, but in the front-end JavaScript, `createCanvas (data)` will handle the

length and color of the sector based on the booking situation.

Justify： Successful effect shown in Figure 10

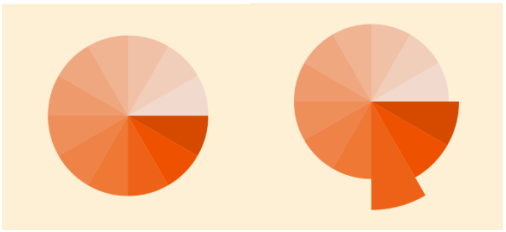


Figure 10 Visualization of ticket purchase situation

PBI # 3, PBI # 4, and PBI # 5 all use the same database table 'tb_order'. It records the various attributes of the ticket.

Table: tb_order

Columns:

id	bigint AI PK
discount_id	bigint
pay_type	varchar(255)
create_time	datetime
use_date	datetime
available	int
court	varchar(255)
time	varchar(255)
price	varchar(255)
type	varchar(255)
user_name	varchar(255)
num	int

Figure 11 tb_order table

PBI #6 View venue service

Design：

Function Overview: This section realizes the display of shower, locker and equipment rental services.

Website design: In order to make our website content more rich and comprehensive, I have chosen this dynamic rotating format to introduce venue services. The main design is to place the service rules in the center of the screen, with the service number and name on the left and a switching indicator on the right. For example, when it is service 1's turn to take a shower, all related parts will have the same color. In addition, each page is displayed for five seconds before being replaced. In order to provide users with better progress feedback, I have added a progress bar to indicate the time.

Implementation:

Front end implementation: This PBI only involves the HTML of the front end, CSS and JavaScript. The key is to switch between text, circles, and icons in JavaScript. The implementation logic of this effect in JavaScript is shown in the figure, and the actual implementation effect is shown in Appendix A5, and code in A6.

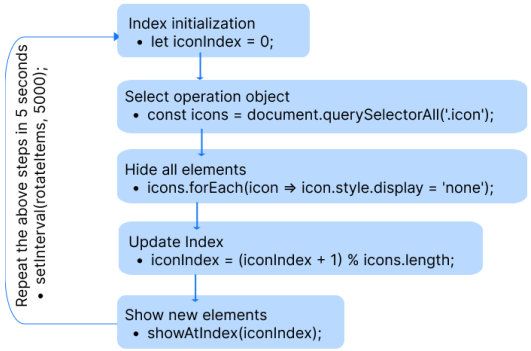


Figure 12 flow chart

Change Management

Among the six PBIs I completed, PBI #3 and PBI #5 encountered a change in requirements.

PBI #3 Choose specific time slot: In the initial requirements, users can choose exercise time in 12 time slots. But then I realized that there may be special circumstances in real life (such as holidays and organizing events) that prohibit ticket purchases at certain times. Therefore, during the daily meeting, I communicated with the student in charge of the administrator, hoping that he could add functionality to control the booking permissions for specific times.

PBI # 5 View pie chart for timeslot booking: In the initial demand, it is stipulated that the radius increases by 20px for each additional purchase of the sector length. However, after completing this requirement, I found that due to the different number of votes in each sports venue, the sector radius in venues with more votes would be very long, which would obscure other content, while the radius change in venues with fewer votes was not significant. Therefore, after discussing in the daily meeting, we decided to limit the minimum radius to `const minradius=150;` And the maximum radius `const maxradius=250;`, At the same

time, each increase is no longer a fixed value of 20px, but rather a targeted calculation of the increment based on the number of votes for each movement. In this way, each motion's pie chart can be displayed in a staggered manner, increasing its aesthetic appeal. Here is a key code snippet,

```
for (let i = 0; i < 12; i++) {
    var c = sum * (data[i] || 0)
    const radius = minRadius + c;
}
```

In agile development, requirement changes are a common phenomenon. My team members and I flexibly responded to these changes and quickly adjusted the design to meet new requirements. Through these experiences, I realized the importance of maintaining communication with stakeholders and updating PBI details in a timely manner.

Legal, social, ethical, and professional issues

In the development process of this project, our team believes that Legal, Social, ethical, and professional issues are also highly valued as they are closely related to developers and stakeholders. I will explain my thoughts on these four parts separately.

1. **Legal Issues:**

- **Question/Consideration:** Copyright is one of the important legal issues. In front-end page, I used a lot of icons, such as the community service icons in PBI#6.
- **Solution:** When using icons, I paid special attention to the usability and copyright issues of these icons. As they did not require commercial use, I ultimately chose the materials provided by the *iconfont* website.

2. **Social Issues:**

- **Question/Consideration:** Considering digital payment trends and our online ticketing services, we've support to diverse societal payment preferences.
- **Solution:** We provide four payment methods on the payment page to ensure that the payment methods can reach a wider audience.

3. **Ethical Issues:**

- **Question/Consideration:** We considered public interest: personal data privacy.
- **Solution:** During the design process, we ensure that all personal information, except for the username, is not visible to other users and administrators, and can only be viewed by the user themselves.

4. **Professional Issues:**

- **Question/Consideration:** We considered quality assurance and efficiency.
- **Solution:** As we are using the Scrum framework, communication within the team is very timely, and any issues will be promptly resolved.

Conclusion

My development of six PBIs successfully met all specified user requirements in the project description, while also responding well to requirement changes. My innovative idea of visualizing the popularity of sports venues at different time periods using a sector chart has received support and praise from the team. Through this project development, I have gained a deeper understanding of the operational process of Scrum and its advantages in communication and efficiency. Technically, my programming and design abilities have been improved. In terms of team collaboration, I gradually learned how to communicate effectively and how to collaborate with members.

Regarding my six PBIs, I think there are a few areas where they can be improved in the future. Firstly, the UI/UX of the booking section can be more aesthetically pleasing. Secondly, optimize the backend and database of the booking system to improve code quality. Finally, continue to collect user feedback to iterate the product. Through these improvement measures, I believe that our project can better meet the needs of users.

References (if needed, not count into the limit of 6 pages)

[1] Kuhrmann, M. et al. (2021) What Makes Agile Software Development Agile, IEEE Transactions on Software Engineering, pp.TBC. doi: 10.1109/TSE.2021.3099532.

[2] Schwaber, K., & Beedle, M. (2002). Agile Software Development with Scrum. IEEE Software, 15(1), 37-41.

[3] K. Beck, M. Beedle, A. Van Bennekum, A. Cockburn, W. Cunning- ham, M. Fowler, J. Grenning, J. Highsmith, A. Hunt, R. Jeffries et al., “Manifesto for agile software development,” 2001.

Appendix (not count into the limit of 6 pages)

A1 Use case diagram

A2 sprint meeting

Sprint1

Sprint planning notes

3.25 CB714 20:00-22:00 2hours

1. Overview

This Sprint we will focus on the Login & Registry Module, Personal Center Module

2. Work division

Peizheng Zhao: Check sports center agreement, User login, password recovery

Gaoping Zhou: User registration, Password reset, Set security questions

Jiayu Shen: User logout, View booking history, Sort booking history
Jingjie Qiu: Display user personal information, Modify user personal information, Display user body information, Modify user body information, View user login history, Delete booking

Sprint review notes
4.5 CB547 10:00-13:00 3houes
1. Overview
Bangxu Tian, Kuo Guo, and Bowen Fang acted as the stakeholder to judge on the increment and give feedback

2. Feedback
For personal center, Bowen Fang mentioned that the sorted ticket history can add more buttons like "Past" and "Future" to sort more specificly. Kuo Guo mentioned that the body and personal information can add an "Add more" button that allow the users to put more body information for some personal reasons. That is a more flexible modify way not just amend the current information. Bangxu Tian mentioned about the usage of the security questions, he thought that there will be no usage for this feature.

For login, Kuo Guo mentioned that if the security quesiton is used here for forgot password or just the usage of the email validation. Bowen Fang mentioned that the passwords rule need work actually, that means when user sign up with the password not follow the passwords rules, the system should show up a error messsage to let the user to retry.

Spint retrospective notes
4.7 CB714 16:00-18:00 2hours
The developer analysis the feedback and taked about how to improve them in the next sprint.
Sprint2
Sprint planning notes
4.8 CB714 20:00-22:00 2hours
1. Overview
This sprint we will focus on the Sports activity booking , Admin, Home page & sport moduel

2. Work division
Peizheng Zhao: View interactive booking guidance
Gaoping Zhou: View rolling image and introduction
Jiayu Shen: View a single sport page
Bowen Fang: Choose sports activity, Choose sports date, Choose specific time slot, Choose ticket number, View venue service
Kuo Guo: Check fee caculation, Choose payment form, Confirm payment
Ming Wang: Add new sports activity, Manage court number of sports activity, Set up time slot for sports activity, Manage limit of participants, Add new users
Bangxu Tian: Generate daily report, modfy user information, View user's booking, View user informatopn, Choose coupon

Sprint review notes
4.19 CB814 19:00-22:00 3hours
1. Overview
Jingjie Qiu acted as the stakeholder to judge on the increment and give feedback.

2. Feedback
For sports activity booking, he mentioned that the logic have some bugs. Why one timeslot can only be booked for one time even if there are much more tickets available for this timeslot. He also mentioned about the fee caculation cannot below 0RMB due to the coupon usage. He also mentioned that the date cannot be the past and maybe restricted within 7 days will be a good choice.
For Admin, he mentioned that the admin can be available to control the status of the sports activity booking. For instance, add a column as "Available", when the admin changed it to the unavailable, the specific sports cannot be booked anymore.
For homepage and single page, he mentioned that the real-time ticket counting maybe wrong, it is the order number not the ticktes number because the system allowed the user to book more than one tickets in a order. And the venue rate and reviews need to be dynamic which means connected to the community to show it in real-time.

Spint retrospective notes
4.21 CB547 10:00-12:00 2hours
The developer analysis the feedback and taked about how to improve them in the next sprint.

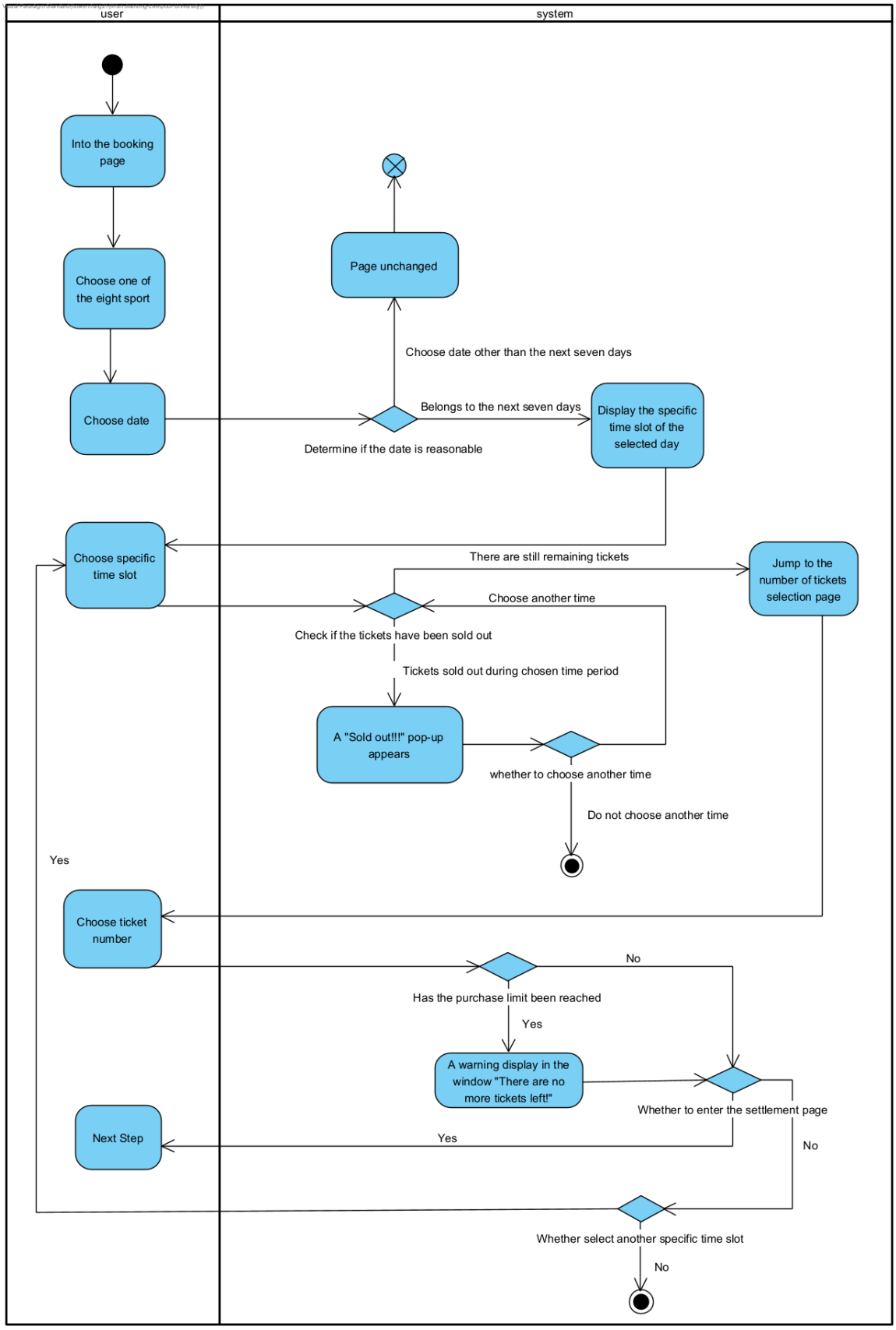
Sprint3

Sprint planning notes
4.22 CB714 10:00-12:00 2hours
1. Overview
This sprint will focus on the advanced PBIs, Community model and other PBIs in the previous modules
2. Work division
Peizheng Zhao: View heatmap for real-time booking
Bowen Fang: View pie chart for timeslot booking
Kuo Guo: Score for sports activity, Add new post, Upvoting for post

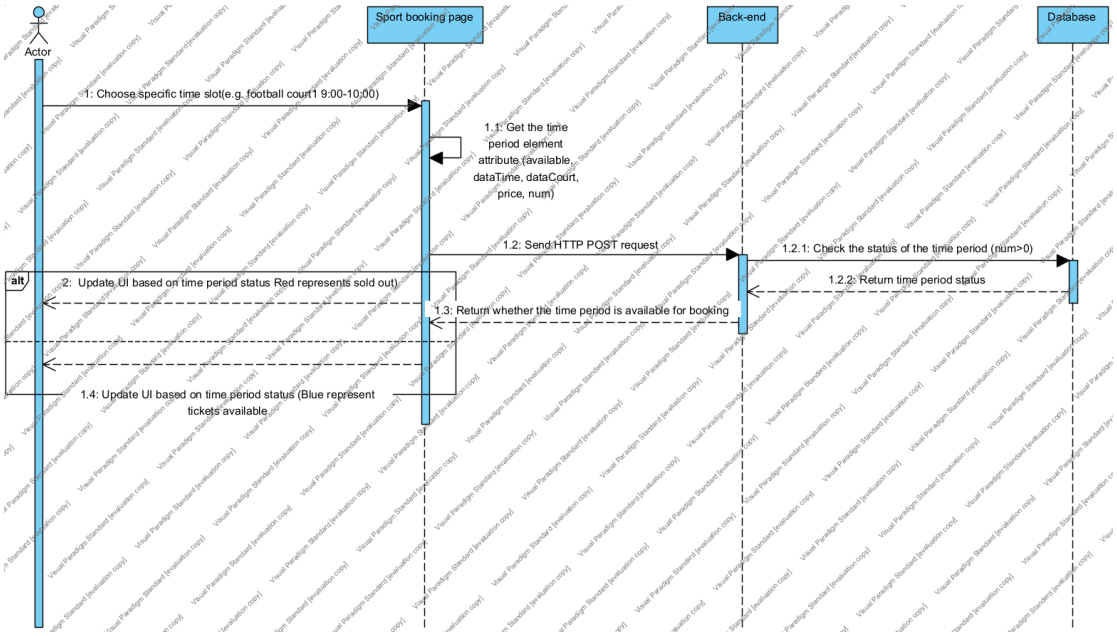
Sprint review notes
5.3 CB814 14:00-17:00 3hours
1. Overview
Gaoping Zhou acted as the skateholder to judge on the increment and give feedback
2. Feedback
For the pie chart, he mentioned that the color can be changed to be more consist to the whole interface. Using different shade of the orange color will be a good choice. For the community, he mentioned that the calculaiton of the score can be just the integer or two decimal places.

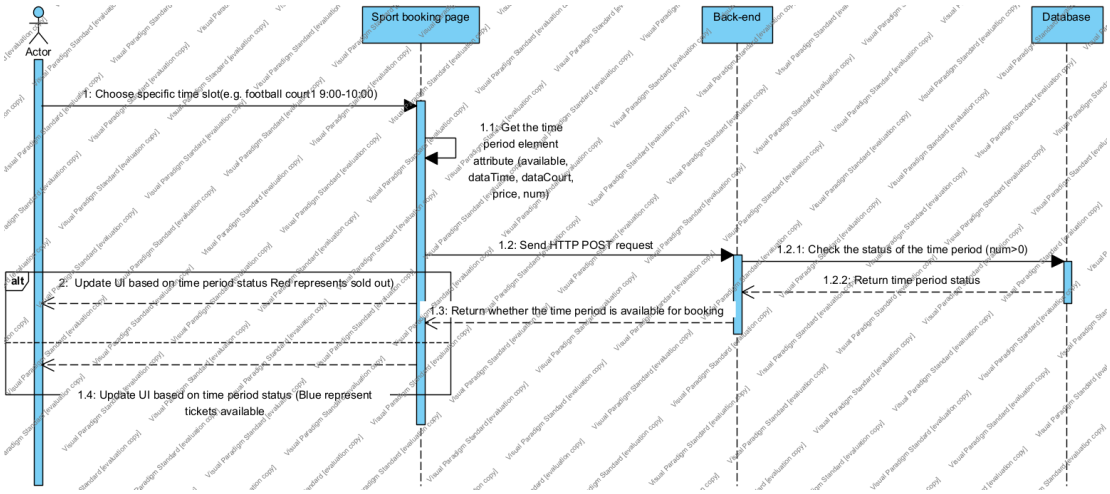
Spint retrospective notes
4.5 CB547 10:00-12:00 2hours
The developer analysis the feedback and taked about how to improve them in the next sprint.

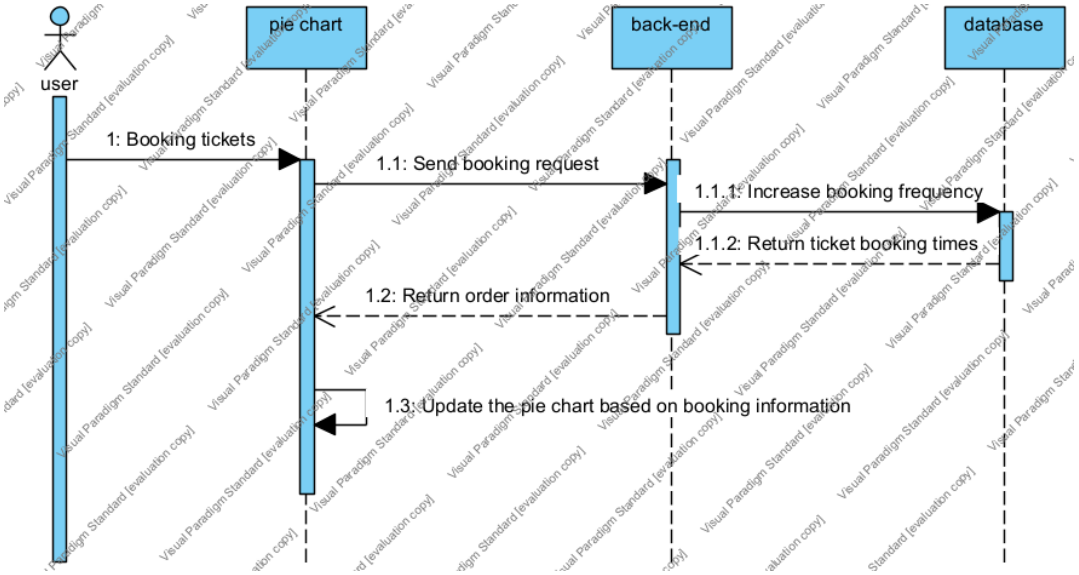
A3 activity diagram



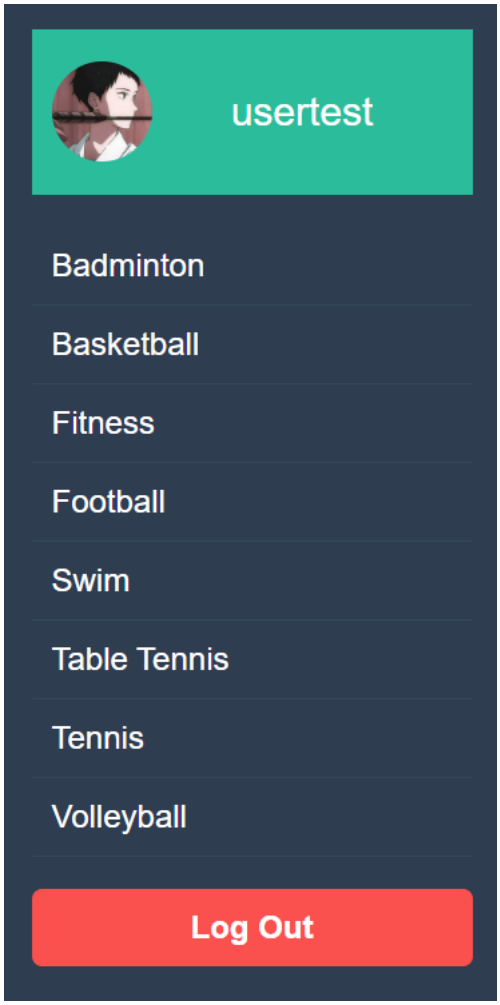
A4 sequence diagram







A5 Project screenshot




usertest
Badminton
Basketball
Fitness
Football
Swim
Table Tennis
Tennis
Volleyball
Log Out
Booking / Badminton
Select Ticket (Badminton)
2024/05/25
Court 1
Court 2
Court 3
Court 4
Court 5
Court 6
9:00-10:00
10:00-11:00
11:00-12:00
12:00-13:00
13:00-14:00
14:00-15:00
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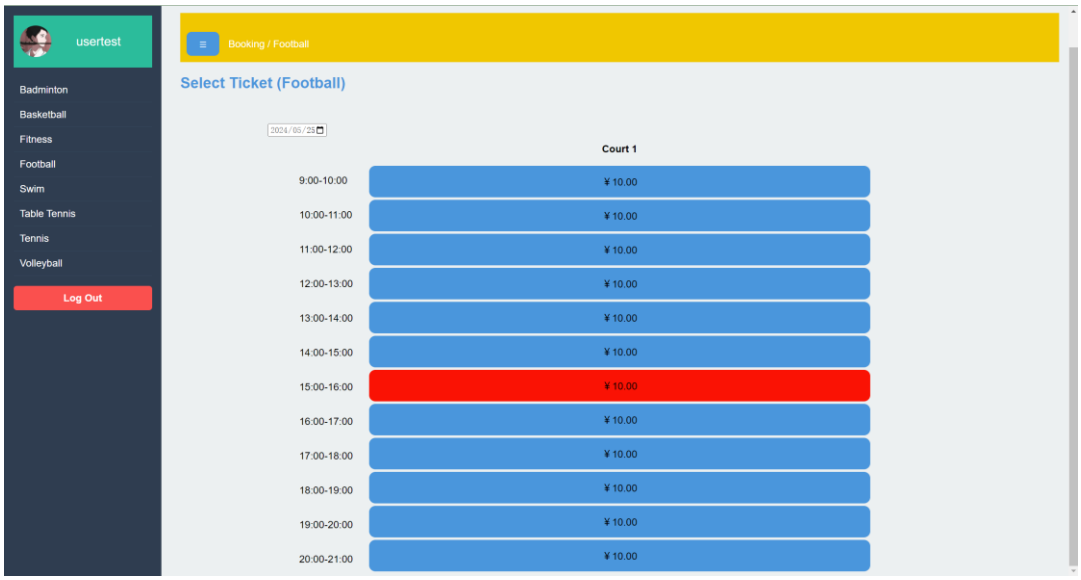
usertest
Badminton
Basketball
Fitness
Football
Swim
Table Tennis
Tennis
Volleyball
Log Out
Booking / Football
Select Ticket (Football)
2024/05/25
Court 1
9:00-10:00
10:00-11:00
11:00-12:00
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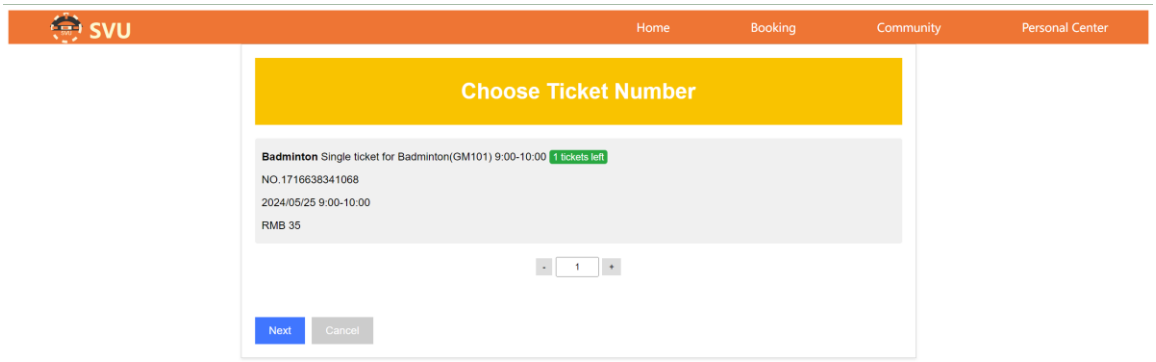
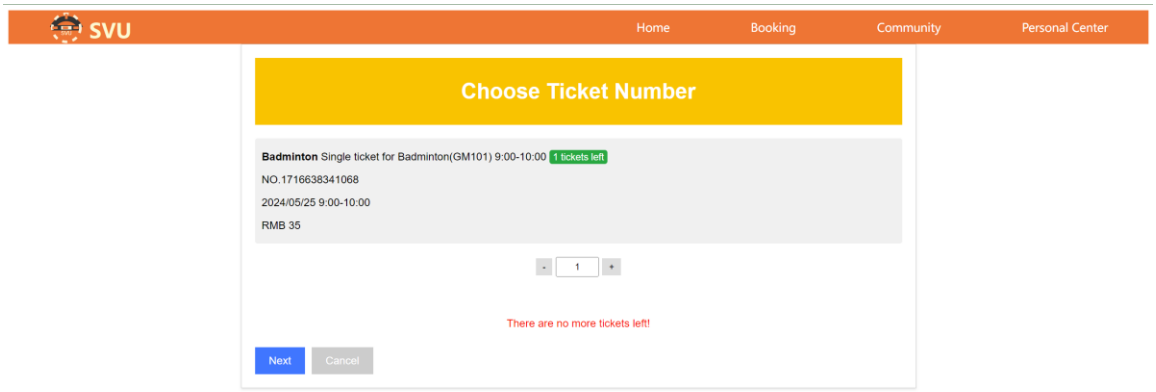
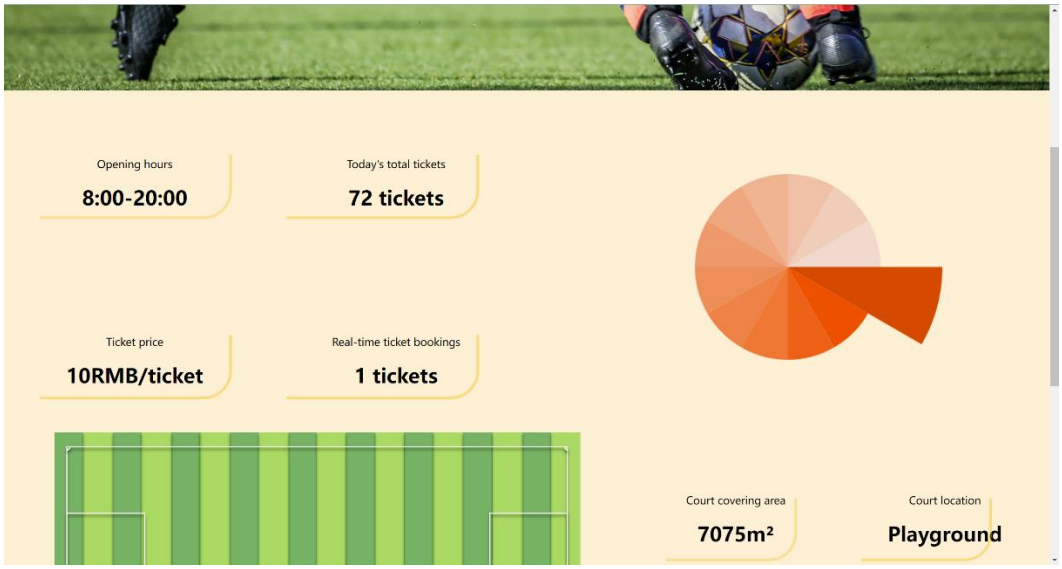
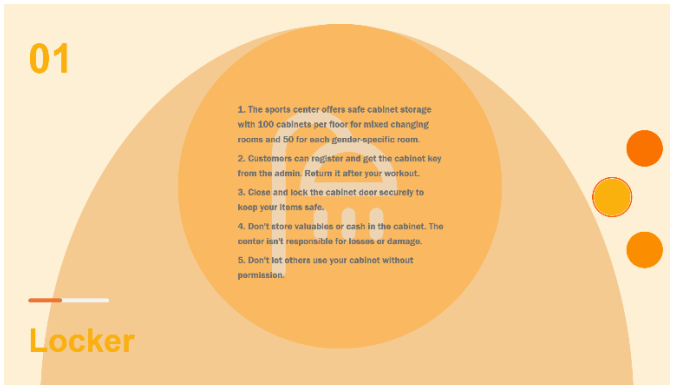
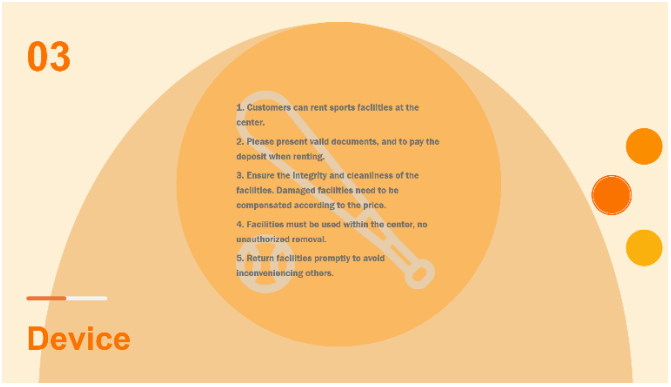
20:00-21:00
¥ 10.00


SVU
Home
Booking
Community
Personal Center
Choose Ticket Number
Badminton Single ticket for Badminton(GM101) 9:00-10:00 1 tickets left
NO.1716638341068
2024/05/25 9:00-10:00
RMB 35
1
Next
Cancel


SVU
Home
Booking
Community
Personal Center
Choose Ticket Number
Badminton Single ticket for Badminton(GM101) 9:00-10:00 1 tickets left
NO.1716638341068
2024/05/25 9:00-10:00
RMB 35
1
There are no more tickets left!
Next
Cancel


Opening hours
8:00-20:00
Today's total tickets
72 tickets
Ticket price
10RMB/ticket
Real-time ticket bookings
1 tickets
Court covering area
7075m²
Court location
Playground


01
1. The sports center offers safe cabinet storage with 100 cabinets per floor for mixed changing rooms and 50 for each gender-specific room.
2. Customers can register and get the cabinet key from the admin. Return it after your workout.
3. Close and lock the cabinet door securely to keep your items safe.
4. Don't store valuables or cash in the cabinet. The center isn't responsible for losses or damage.
5. Don't let others use your cabinet without permission.
Locker



A6 Code

PBI#2

```
document.addEventListener('DOMContentLoaded', function() {
    const dateInput = document.getElementById('date');
    const today = new Date();
    const maxDate = new Date();

    // 修正为当日日期，忽略时区
    today.setUTCHours(0, 0, 0, 0); // 设置为 UTC 时间的午夜，防止时区影响
    maxDate.setUTCHours(0, 0, 0, 0);
    maxDate.setUTCDate(today.getUTCDate() + 6); // 设置为七天后

    dateInput.min = today.toJSON().split('T')[0];
    dateInput.max = maxDate.toJSON().split('T')[0];
});
```

PBI#6

```
// 图标、数字、服务和规则的索引
let iconIndex = 0;
let numberIndex = 0;
let serviceIndex = 0;
let ruleIndex = 0;

// 图标、数字、服务和规则的元素数组
```

```
const icons = document.querySelectorAll('.icon');
const numbers = document.querySelectorAll('.number-item');
const services = document.querySelectorAll('.service-item');
const rules = document.querySelectorAll('.rule-item');

// 隐藏所有图标、数字、服务和规则的初始函数
function hideAll() {
    icons.forEach(icon => icon.style.display = 'none');
    numbers.forEach(number => number.style.display = 'none');
    services.forEach(service => service.style.display = 'none');
    rules.forEach(rule => rule.style.display = 'none');
}

// 显示指定索引的图标、数字、服务和规则
function showAtIndex(index) {
    icons[index].style.display = 'block';
    numbers[index].style.display = 'block';
    services[index].style.display = 'block';
    rules[index].style.display = 'block';
}

// 每 5 秒执行一次的函数，用于轮换图标、数字、服务和规则
function rotateItems() {
    hideAll(); // 隐藏所有元素

    // 更新索引，如果超过最大索引则回到 0
    iconIndex = (iconIndex + 1) % icons.length;
    numberIndex = (numberIndex + 1) % numbers.length;
    serviceIndex = (serviceIndex + 1) % services.length;
    ruleIndex = (ruleIndex + 1) % rules.length;

    // 显示新索引对应的元素
    showAtIndex(iconIndex);
    showAtIndex(numberIndex);
    showAtIndex(serviceIndex);
    showAtIndex(ruleIndex);
}

// 设置定时器，每 5 秒执行一次 rotateItems 函数
setInterval(rotateItems, 5000);

// 初始调用 rotateItems 函数以显示第一个图标、数字、服务和规则
rotateItems();
```