



MINISTRY OF EDUCATION AND TRAINING

FPT UNIVERSITY

Capstone Project Document

Car Rental Portal

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Definitions, Acronyms, and Abbreviations

Name	Definition
CRP	Car Rental Portal

Table 1: Definitions, Acronyms, and Abbreviations

A. Introduction

1. Project Information

- Project name: **Car Rental Portal**
- Project Code: **CRP**
- Product Type: **Website Application**
- Start Date: **September 1st, 2016**
- End Date: **December 1st, 2016**

2. Introduction

In this document, we introduce a car rental portal solution – a website application to help car rental service provider to bring their business online. The solution allows providers to define their own rental policy and price. It also simplifies the providers' rental management process. Our solution also allows customer to easily find and book the most suitable car for their trip.

3. Current Situation

Nowadays, there are many car rental providers in Vietnam. However, only a small percent of them have utilized internet to promote their business. Part of them (Large rental companies, taxi companies) have their own website or mobile application, while some choose to become driver for online rental portal solution like Uber and Grab.

Many small and middle-sized providers cannot afford their own website or mobile application, and also find contract with Uber and Grab too rigid because they are not allowed to define their own rental price and policy. Uber's and Grab's solutions also do not apply well for long-period rental.

A new solution that has just appeared recently is Aleka, which they themselves claimed to be inspired by Uber and Airbnb. Their approach take a lot after Airbnb. They allow providers to post their vehicles on their website, and then helps customer to find and book the most suitable vehicle in their system. Their solution however does not offer any way for customer to rate and comment about the service of provider, as well as to read other customers' ratings and reviews before deciding to book the vehicle.

4. Problem Definition

The current situation has several problems:

- **Cost barrier:** The cost to develop an online rental application is too high for small rental providers.
- **Ill-suited rental portal solutions:** There are great rental services like Uber, Grab, or Aleka on the market. However, their solutions have yet to completely satisfy the user. Their shortcomings include limiting provider's ability in deciding their own policies, cannot handle long-period rental very well, or lack of a mean for rating and reviewing provider's service.

5. Proposed Solution

Our proposed solution, named Car Rental Portal, is a car rental portal website application that takes after Airbnb. We provide a flexible mean for provider to promote their rental service online while still allows them to define their own rental policy. Our solution also allows customer to rate and comment about their past renting, as well as read others' review on vehicles. Our solution also offers a searcher integrated with recommender engine that can help customer to find the best matched vehicle quickly and easily.

5.1. Featured functions

- **Manage online rental service:** Provider can manage their vehicles' and bookings' information, as well as declare their own rental policies, including price constraint, time constraint, travel distance constraint...
- **Advanced vehicle searcher with recommender engine:** System can help customers to find the most suitable vehicle fast and easily based on their booking history.
- **Review vehicle and read vehicle's reviews:** Customer can comment and rate rental service after renting vehicle, as well as read reviews from other customer for a vehicle.
- **Book vehicle and cancel booking:** Customer can book and pay booking fee through NganLuong payment portal, as well as cancel their booking easily.

5.2. Advantages

- Offer a cheap and easy online rental management solution.
- Allow provider to define their own rental policies.
- Support both hourly and daily rental.
- Offer vehicle searching with recommender engine.
- Offer rental service rating/reviewing function.
- Allow paying through NganLuong payment portal.

5.3. Disadvantages:

- Since recommender works depending on customer's booking history, customer must have booked at least once in the past to utilize it.
- Depends on NganLuong and has no alternative payment method in case NganLuong goes down.

6. Functional Requirements

- Manage vehicles:
 - Provider can create, update, and delete vehicle.
- Manage vehicles' bookings:
 - Provider can keep track of their vehicle's booking schedule.
 - Provider can create self-booking to reserve their vehicle.
 - Provider can cancel self-booking.
- Manage garage:
 - Provider can create, update, and delete garage.

- Provider can specify their garage's rental policy.
- Provider can group vehicle into garage.
- Provider can close their garage temporary.
- Manage price group:
 - Provider can create, update, and delete price group.
 - Provider can group vehicle that he want to apply specific price options.
 - Provider can disable the group and every vehicle inside the group.
- Manage booking:
 - Customer can book vehicle.
 - Customer can cancel their booking.
 - Customer can keep track of their booking history.
 - Customer can rate and comment about their booking.
- Manage user account:
 - Administrator can lock and unlock user account.
- Search and view vehicle's information.
- View report:
 - Administrator can view system's business report in dashboard.
 - Provider can view personal business report in dashboard.
- Receive notification email:
 - Customer will receive notification email when he has booked a vehicle.
 - Provider will receive notification email when their vehicle has been booked.
 - Customer will receive notification email when he has canceled a booking.
 - Provider will receive notification email when their vehicle's booking has been canceled.

7. Roles and Responsibility

No	Full Name	Role	Position	Contact
1	Lâm Hữu Khánh Phương	Project Manager	Supervisor	phuonglhk@fpt.edu.vn
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5	Nguyễn Tường Tâm	Developer	Member	tamntse61384@fpt.edu.vn

Table 2: Roles and Responsibility

B. Software Project Management Plan

1. Problem Definition

1.1. Name of this Capstone Project

- **Official name:** Car Rental Portal
- **Vietnamese name:** Cổng thông tin cho thuê xe
- **Abbreviation:** CRP

1.2. Problem Abstract

Nowadays, there are many car rental providers in Vietnam. However, only a small percent of them have utilized internet to bring their business online. Aside from creating their own online rental applications, providers can also utilize rental solution services like Grab, Uber, or Aleka. These new services however still contain many flaws that keep a large number of providers away.

1.3. Project Overview

1.3.1. Current Situation

Our project has the following problems:

- **Recommender engine is dependent on customer's booking history:** The recommender engine cannot work on customer that has not placed any booking in the past.
- **Has no alternative payment method:** Our system depends completely on NganLuong for payment processing. There is currently no alternative payment method.

1.3.2. The Proposed System

The proposed system is a rental portal website application that can help car rental service provider to bring and manage their rental service online and allow customer to find and book vehicle easily. The system utilize NganLuongApi to process payment and has a recommender engine to improve vehicle searching.

Separated based on user's role, the system offers the following functions:

- For guests:
 - Search vehicle.
 - View vehicle's rental information.
- For customers:
 - Search vehicle.
 - View vehicle's rental information.
 - Book vehicle and cancel booking.
 - Track booking history.
 - Register providership.
 - Receive notification email upon booking or canceling booking.
- For providers:
 - Manage vehicles.
 - Manage vehicles' bookings.

- Manage garages.
- Manage price groups.
- View personal business report.
- Extend providership period.
- Receive notification email upon receiving booking or booking was canceled.
- Administrator:
 - Manage user accounts.
 - View system's business report.

1.3.3. Boundaries of the System

- The system targets mainly small and mid-sized car rental service providers, but can also handle the needs of large providers with large number of vehicles and multiple garages.
- The system supports both daily and hourly booking.
- The language of the system is Vietnamese.
- The completed product includes:
 - Booking system for customer.
 - Rental service managing system for provider.

1.3.4. Future Plans

- Offer pricing scheduler so that price group can change price during special events.
- Support self-driving rental.
- Support motorbike rental.
- Offer driver management functions.
- Support internationalization.
- Develop mobile version.

1.3.5. Development Environment

1.3.5.1. Hardware requirement

For web server:

Hardware	Minimum Requirements	Recommended
Network Bandwidth	4 Mbps	8 Mbps
Operating System	Window Server 2008	Window Server 2008
Computer Processor	Intel® Xeon Dual Core® 1.4GHz (4MB Cache)	Intel® Xeon® Quad Core (8M Cache, 2.40 GHz)
Computer Memory	2GB RAM	4GB or more
Hard disk	40GB	80GB

Table 3: Hardware requirement for Web Server

For web development:

Hardware	Minimum Requirements	Recommended
Internet Connection	512 Kbps	8 Mbps
Operating System	Window Vista, 7, 8	Window 7, 8
Computer Processor	1 GHz	Intel® Core™ i5 CPU 2.53 GHz
Computer Memory	2GB RAM	4GB or more

Table 4: Hardware requirement for Web Server

1.3.5.2. Software requirement

Software	Name / Version
Operating system	Windows 7 or above
Modeling tool	StarUML version 2.7.0 (UML2.0 standard ¹)
IDE	Microsoft Visual Studio 2015 Community
DBMS	SQL Server 2014
Source control	Git 2.9.0.windows.1
Web browser	Chrome (v.42 and above), Firefox (v.38 and above), and any equivalent web browser

Table 5 : Software requirement

2. Project organization

2.1. Software Process Model

Modified waterfall model (Sashimi ²) is applied in this project. This model was chosen because:

- The requirements of the project are well-defined and well-understood by all team members.
- The deliverables in each phase of the model can be corresponded with the reports that have to be submitted in each process of the capstone project.

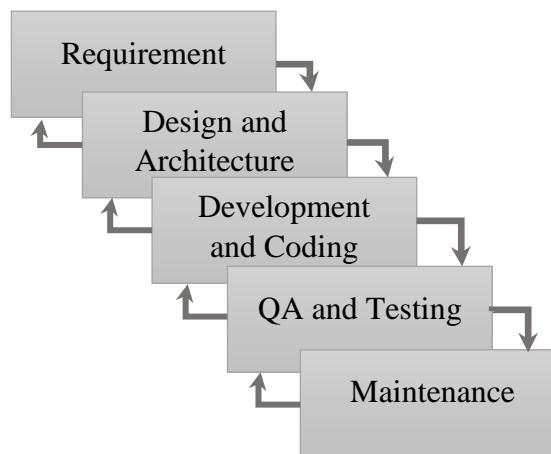


Figure 1: Modified Waterfall Development Model

2.2. Roles and responsibilities

No	Full name	Role in Group	Responsibilities
1	Lâm Hữu Khánh Phương	Supervisor / Project Manager	<ul style="list-style-type: none"> - Clarify user requirement - Give technical support and business analysis - Track development process - Review document and product
2	Trần Hữu Đức	Team leader, Business Analyst, Developer, Tester	<ul style="list-style-type: none"> - Manage development process - Analyze requirement - Design database - Prepare documents - Design GUI - Code - Test - Deploy product
3	Huỳnh Công Thành	Team member, Business Analyst, Developer, Tester	<ul style="list-style-type: none"> - Analyze requirement - Design database - Prepare documents - Design GUI - Code - Test
4	Lê Vũ Đăng Khoa	Team member, Business Analyst, Developer, Tester	<ul style="list-style-type: none"> - Analyze requirement - Design database - Prepare documents - Design GUI - Code - Test
5	Nguyễn Tường Tâm	Team member, Business Analyst, Developer, Tester	<ul style="list-style-type: none"> - Analyze requirement - Design database - Prepare documents - Design GUI - Code - Test

Table 6: Roles and responsibilities

2.3. Tools and Techniques

Tool / Technique	Name / version
Frontend	HTML5, CSS3, JavaScript, jQuery, Bootstrap
Backend	ASP.NET MVC 5, Entity Framework, NganLuong, Cloudinary
Web server	IIS 8
Development tool	Microsoft Visual Studio 2015 Community
DBMS	MSSQL Server 2014
Source control	Git 2.9.0.windows.1
Modeling tool	StarUML 2.7.0
Document tool	Microsoft Word 2013

Table 7: Tools and Techniques

3. Project Management Plan

3.1. Tasks

3.1.1. Initiating

Task name	Initiating
Description	<ul style="list-style-type: none"> - Clarify user requirements on the rental portal. - Research business logic of car rental service. - Research popular car rental solutions (Grab, Uber, Aleka) as well as other similar websites (Carmudi, Airbnb). - Offer team's solution, declare its pros and cons, introduce some core function of the new system.
Deliverables	Report No.1 – Introduction
Resource needed	20 man-days
Dependencies and constraints	No
Risk	<ul style="list-style-type: none"> - Missing requirement - Unclear project scope - Lacking teamwork in new formed team

3.1.2. Planning

Task name	Planning
Description	<ul style="list-style-type: none"> - Review team's solution - Verify project's scope - Build project management plan
Deliverables	Report No.2 – Software Project Management Plan
Resource needed	16 man-days
Dependencies and constraints	<ul style="list-style-type: none"> - Base on Report No.1 – Introduction. - Planned project must be completed in the following 12 weeks
Risk	Impractical plan

3.1.3. Specifying requirements

Task name	Specifying requirements
Description	Identify and clarify software requirements.
Deliverables	Report No. 3 – Software Requirement Specification
Resource needed	20 man-days
Dependencies and constraints	Base on Report No.2 – Software Project Management Plan.
Risk	Misunderstood or unclear system's requirement

3.1.4. Designing database

Task name	Designing database
Description	<ul style="list-style-type: none"> - Create conceptual, logical and physical database designs - Implement in SQL Server 2014
Deliverables	Physical database and SQL script.
Resource needed	12 man-days
Dependencies and constraints	Base on Report No. 3 Software Requirement Specification
Risk	Unreasonable database design

3.1.5. Create Software Design Description

Task name	Create Software Design Description
Description	Decide software architect and clarify software detail design.
Deliverables	Report No. 4 – Software Design Description
Resource needed	40 man-days
Dependencies and constraints	Base on Report No. 3 Software Requirement Specification and designed database
Risk	Unreasonable software design

3.1.6. Implementing

Task name	Implementing
Description	Implements all functions of system.
Deliverables	Software package.
Resource needed	80 man-days
Dependencies and constraints	<ul style="list-style-type: none"> - Base on Software Requirement Specification and Software Design Description. - Follow coding convention.
Risk	Incorrect implementation

3.1.7. Testing

Task name	Testing
Description	<ul style="list-style-type: none"> - Create test plan - Perform tests. - Fix bugs
Deliverables	Report No. 5 – System Implementation & Test
Resource needed	40 man-days
Dependencies and constraints	Implementation is finished
Risk	<ul style="list-style-type: none"> - Incompleted test plan - Lacking time for iterative test and bug fixing

3.1.8. Creating User's Manual

Task name	Creating User's Manual
Description	Create user's manuals
Deliverables	Report No.6 – Software User's Manual
Resource needed	12 man-days
Dependencies and constraints	Product has passed acceptance test.
Risk	Bad and unclear documenting

3.2. Task sheet

Please refer to “Tasksheet.xlsx” file in the attached CD.

3.3. All Meeting Minutes

Please refer to “Meeting minutes” folder in the attached CD.

4. Coding Convention

This project follows “C# coding conventions”.

- Naming Convention :
 - o For variable's name, use camel case (numOfVehicle, currentDate...)
 - o For function name, class name, use pascal case (SearchVehicle, VehicleInfoViewModel...)
- Layout Convention :
 - o Use the default Code Editor Settings (smart indenting, four-character indents, tabs saved as spaces).
 - o Write only one statement/declaration per line.
 - o Add at least one blank line between method definitions and property definitions.
 - o Use parentheses to make clauses in an expression apparent
- Commenting Convention :
 - o Place the comment on a separate line, not at the end of a line of code.
 - o Begin comment text with an uppercase letter.
 - o End comment text with a period.
 - o Insert one space between the comment delimiter (//) and the comment text.
- Language Guidelines :

<https://msdn.microsoft.com/en-us/library/vstudio/ff926074.aspx>

C. Software Requirement Specification

1. User Requirement Specification

1.1. Guest requirements:

A guest is a person who has not been authenticated by the system. A guest has access to a limited number of system's functions, which are:

- Log in
- Sign up
- Recover account's password
- Search vehicle
- View rental information of vehicle

1.2. Customer requirements:

A customer is an authenticated user that can utilize the system to find and book vehicle. A customer is able to:

- Log out
- Change personal information
- Change account's password
- Search vehicle
- View rental information of vehicle
- Book vehicle
- Cancel booking
- Track booking history
- Comment and rate the car provider's service after:
 - The booking has been canceled
 - The rental period has started
- Receive notification email when:
 - A booking has been placed successfully using this account
 - A booking has been canceled using this account

1.3. Provider requirements:

A provider is an authenticated user that can use the system to manage their car rental business. A provider can:

- Log out
- Change personal information
- Change account's password
- Search vehicle
- View rental information of vehicle
- Manage vehicles:
 - Register vehicle
 - Deregister vehicle

- Update vehicle's information
- Group vehicles into garage
- Group vehicles into vehicle group for price management
- Manage vehicles' bookings:
 - Review booking schedule
 - Create self-booking to reserve vehicle
 - Cancel self-booking
- Manage garages:
 - Register new garage
 - Deregister garage
 - Edit garages' information
 - Close garage
 - Reopen garage
 - Add vehicle to garage
 - Move vehicle to another garage
- Manage vehicle grouping for easier price management:
 - Register new group
 - Deregister group
 - Change group's information and pricing
 - Deactivate group
 - Reactivate group
 - Add vehicle to group
 - Remove vehicle from group
- Extend providership period
- Receive notification email when
 - A vehicle has been booked.
 - A customer has canceled a booking.
- View personal business report

1.4. Administrator requirements:

An administrator is an authenticated user that is tasked with managing the system and its users. Administrator is able to:

- Log out
- Change personal information
- Change account's password
- Search vehicle
- View rental information of vehicle
- Deactivate customer/provider account
- Reactivate customer/provider account
- View system's business report

2. System Requirement Specification

2.1. External Interface Requirement

2.1.1. User interface

- Graphics User Interface (GUI) should be simple, clear, intuitive, and reminiscent.
- GUI uses Vietnamese language.
- GUI uses consistent palette of colors between the text and the background.
- GUI displays best on screen with 1366x768 or higher resolution.

2.1.2. Hardware Interface

- N/A

2.1.3. Software Interface

The website works well on Chrome (v.42 and above), Firefox (v.38 and above), and any equivalent web browser.

2.1.4. Communication Protocol

Web server supports HTTP protocol v.1.1.

2.2. System Overview Use Case

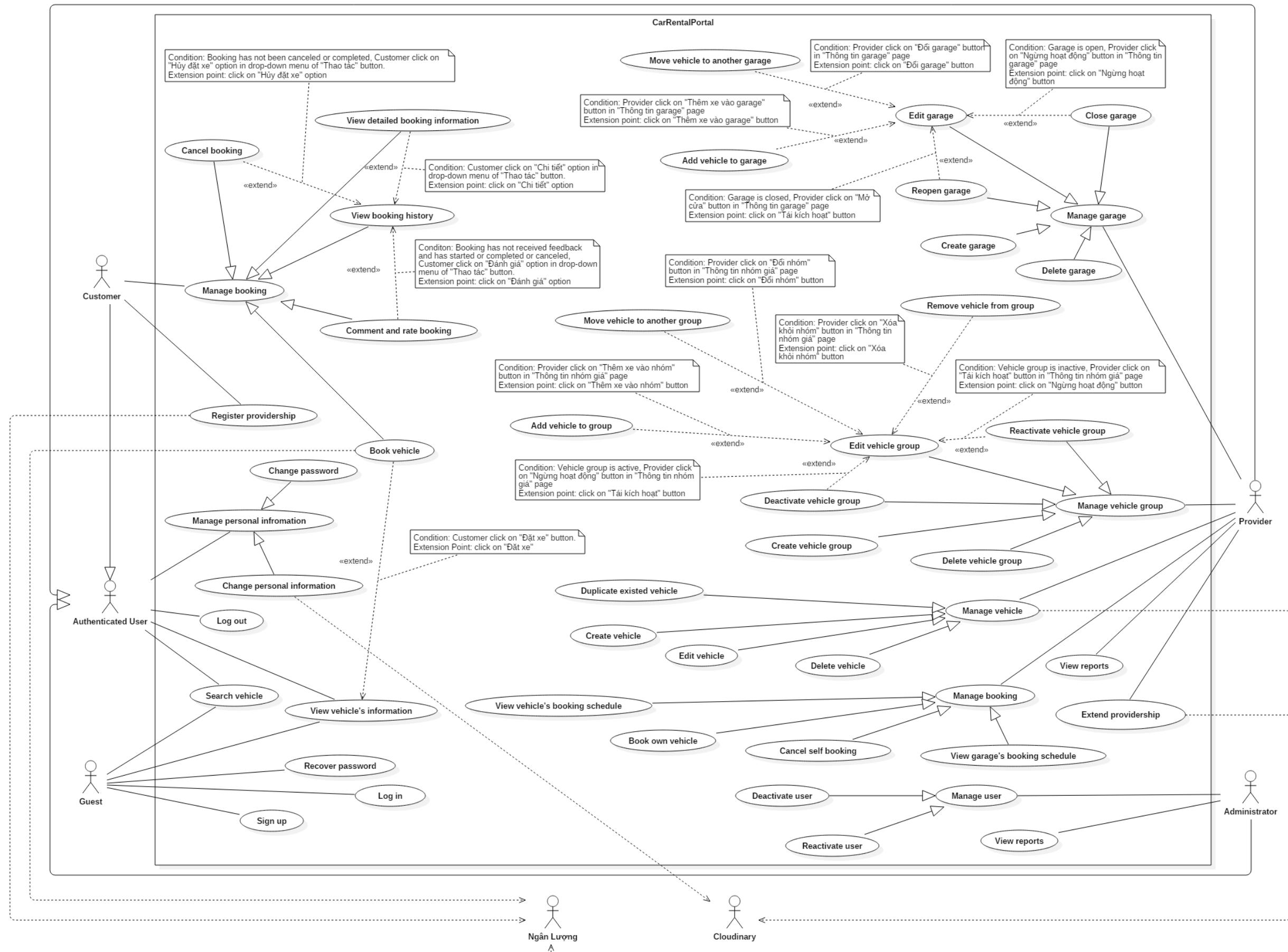


Figure 2: System Overview Use Case

2.3. Use Cases

2.3.1. <Guest> Use Cases Overview

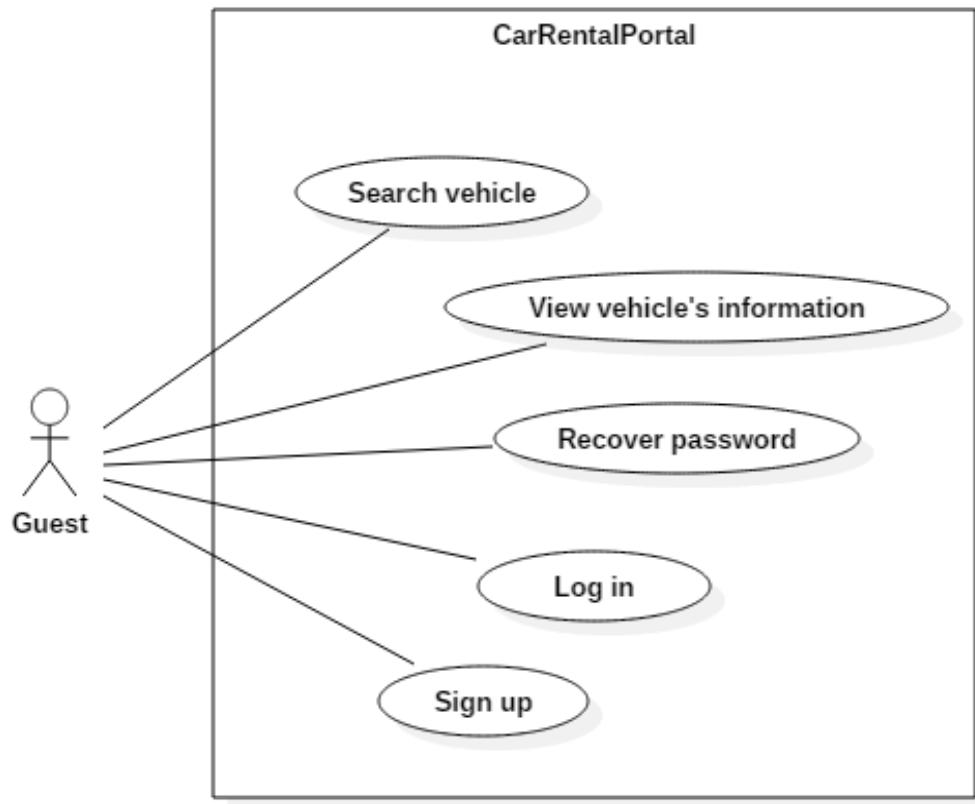


Figure 3: <Guest> Use Case Overview

2.3.1.1. <Guest> Log in (UC01) <Excluded>

2.3.1.2. <Guest> Sign up (UC02) <Excluded>

2.3.1.3. <Guest> Recover password (UC03) <Excluded>

2.3.1.4. <Guest> Search vehicle (UC04) <Excluded>

2.3.1.5. <Guest> View vehicle's information (UC05) <Excluded>

2.3.2. <Authenticated user> Use Case Overview

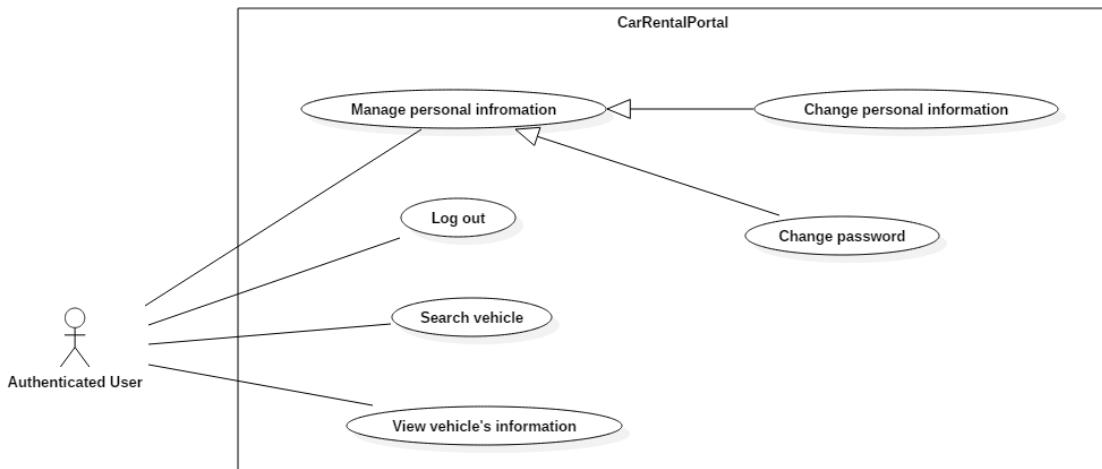


Figure 4: <Authenticated user> Use Case Overview

- 2.3.2.1. < Authenticated User > Log out (UC06) <Excluded>**
- 2.3.2.2. < Authenticated User > Change personal information (UC07) <Excluded>**
- 2.3.2.3. < Authenticated User > Change password (UC08) <Excluded>**
- 2.3.2.4. < Authenticated User > Search vehicle (UC09)**

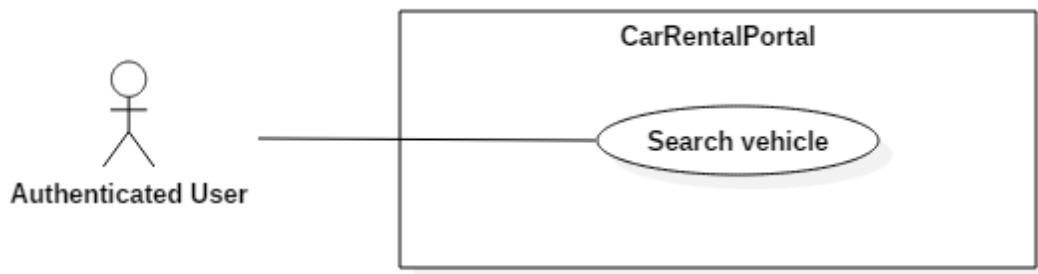


Figure 5: < Authenticated User > Search vehicle Use Case

USE CASE – UC09			
Use Case No.	09	Use Case Version	1.0
Use Case Name	Search vehicle		
Author	TamNT		
Date	30/09/2016	Priority	High
Actor:	<ul style="list-style-type: none"> - Authenticated User. 		
Summary:	<ul style="list-style-type: none"> - This use case allows authenticated user to search vehicle. 		
Goal:	<ul style="list-style-type: none"> - Authenticated user can search for the vehicle with their required. 		
Triggers:	<ul style="list-style-type: none"> - Authenticated user access search page. 		
Preconditions: N/A.			
Post Conditions:	<ul style="list-style-type: none"> - Success: Shows vehicles that fit filtering conditions. - Fail: Show error message. 		
Main Success Scenario:			
Step	Actor Action	System Response	
1	User access search page.	System shows search page with search result and various filters	
2	User changes a filter condition	System apply recommender's scores and refresh search result. [Alternative 1,2,3,4,5,6]	
Alternative Scenario:			
No	Actor Action	System Response	

1	User select start time / end time for their trip	System filters out vehicles that has been booked in this time span.
2	User select location where they want to rend vehicle	System shows only
3	User checks seats box at “Số chỗ ngồi”	<p>System shows vehicles which has seats corresponding with seats box user checked:</p> <ul style="list-style-type: none"> - 2 chỗ: 2 seats - 4 chỗ: 4 seats - 5 chỗ: 5 seats - 7 chỗ: 7 seats - 8 chỗ: 8 seats - 16 chỗ: 16 seats
4	User pulls the slider at “Mức giá”. User pulls the left slider to User pulls the right slider	System shows vehicles with price that fit with user's conditions. System changes min pride up to the value of left slider. System changes max pride up to the value of right slider.
5	User choose options of the list “Sắp xếp theo”	<p>System shows the result order by options user choose:</p> <ul style="list-style-type: none"> - Gói thời gian thuê xe phù hợp nhất: System will show vehicles in order of provided rental option that has rental time span closest to user's rental time span (deduced from start time and end time) - Xe có điểm đánh giá tốt nhất: System will show vehicles order from high rating to lower. - Garage có điểm đánh giá tốt nhất: System will show vehicles order by their garage from high rating to lower <p>Giá từ thấp đến cao: System will show vehicles order from low pride to high pride.</p>

		<ul style="list-style-type: none"> - Giá từ cao đến thấp: System will show vehicles order from high pride to low pride. - Xe từ mới đến cũ: System will show vehicles order from new to old which define by the year they made - Xe từ cũ đến mới: System will show vehicles order from old to new which define by the year they made
6	<p>User clicks on “Lọc chi tiết hơn về xe” tab:</p> <p>User choose an option in “Dòng xe” list</p> <p>User pulls the slider at “Năm sản xuất”</p> <p>User checks options at “Hộp số”</p> <p>User choose options of “Loại nhiên liệu” list</p> <p>User choose options of “Loại xe” list</p> <p>User checks colors at “Màu xe”</p>	<p>System shows more detail options for user to find suitable vehicles.</p> <p>System shows vehicles which has brand/model that fits with user's condition</p> <p>System shows vehicles fit with the year range user chose</p> <p>System shows vehicles which has transmission type that fits with user's choice:</p> <ul style="list-style-type: none"> - Số tự động: automatic - Số sàn: manual <p>System shows vehicles which has fuel type that fits with user's choice:</p> <ul style="list-style-type: none"> - Xăng: gasoline - Dầu diesel: diesel - Điện: electric - Điện hybrid: hybrid electric - Điện plug-in hybrid: plug-in hybrid electric <p>System shows vehicles belongs to user selected categories.</p>

		System will show vehicles which has the color user chose.
7	<p>User clicks on “Lọc theo đánh giá” tab</p> <p>User choose option of “Đánh giá xe” list.</p> <p>User choose option of “Đánh giá cửa hàng xe” list.</p>	<p>System will show options for user to find vehicles by rating.</p> <p>System will show vehicles which rated fit which option user choose:</p> <p>4.0 ★★★★★ trờ lên : above 4 star</p> <p>3.0 ★★★★☆ trờ lên : above 3 star</p> <p>2.0 ★★★☆☆ trờ lên : above 2 star</p> <p>System will show vehicles which their garage's rate fit which option user choose:</p> <p>4.0 ★★★★★ trờ lên : above 4 star</p> <p>3.0 ★★★★☆ trờ lên : above 3 star</p> <p>2.0 ★★★☆☆ trờ lên : above 2 star</p>
8	User clicks on “Xóa bỏ lọc” button.	System will reset all filtering conditions, except location, start time, and end time, back to default.

Exceptions: N/A

Relationships: N/A

Business Rules:

- Start time cannot be sooner than 6 hours from now.
- Start time cannot be later than 30 days from now.
- End time cannot be sooner than 1 hours from start time.

2.3.2.5. < Authenticated User > View vehicle's information (UC10)

<Excluded>

2.3.3. <Customer> Use Case Overview

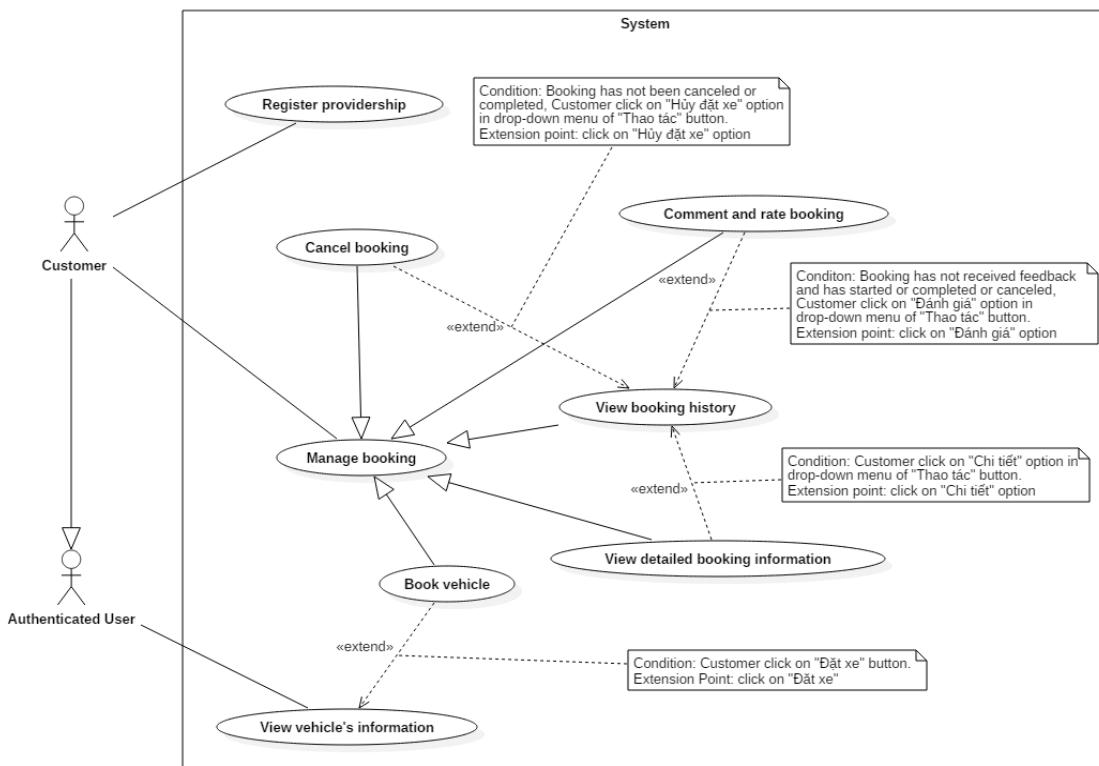


Figure 6 <Customer> Use Case Overview

2.3.3.1. < Customer > Book vehicle (UC11)

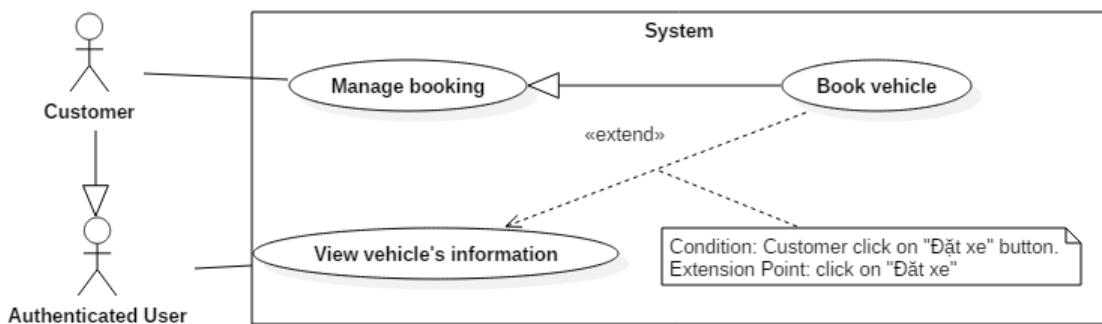


Figure 7: < Customer > Book vehicle Use Case

USE CASE – UC11			
Use Case No.	11	Use Case Version	1.0
Use Case Name	Book vehicle		
Author	DucTH		
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Customer 		
Summary:	<ul style="list-style-type: none"> - This use case allows customer to book vehicle. 		
Goal:	<ul style="list-style-type: none"> - Customer books vehicle successfully. 		

Triggers:

- Customer clicks on “Đặt xe” button in vehicle’s rental information page.

Preconditions:

- Log in successfully as customer.

Post Conditions:

- **Success:** Vehicle is booked successfully.
- **Fail:** Show error message.

Main Success Scenario:

Step	Actor Action	System Response
1	Customer accesses vehicle’s rental information page.	System shows webpage of corresponding vehicle with options for rental plan (Hourly and daily).
2	Customer select a rental plan, start time and end time, then clicks “Đặt xe” button.	<p>System creates a pending booking receipt, then redirects customer to booking confirmation page, where customer can review the booking and select a payment method from the following methods:</p> <ul style="list-style-type: none"> - Thanh toán online bằng thẻ ngân hàng nội địa: purchase using bank’s card. - Thanh toán bằng thẻ tín dụng / ghi nợ: purchase using credit card. - Thanh toán bằng Ví điện tử NgânLượng: purchase using NgânLượng account. <p>[Exception 1]</p>
3	Customer selects payment method and clicks “Đặt xe” button. [Alternative 1] [Alternative 3]	System redirects customer to purchase page.
4	Customer pays the booking. [Alternative 2] [Alternative 3]	System validates the booking receipt, sends alert email to related customer and

		provider, and then redirects customer to receipt page.
--	--	--------------------------------------------------------

Alternative Scenario:

No	Actor Action	System Response
1	Customer presses “Thay đổi” button or “Hủy” button	System removes the pending booking and redirects user to vehicle’s information page.
2	Customer clicks “Hủy” button.	System removes the pending booking and redirects user to vehicle’s information page.
3	Customer does not pay the booking within 10 minutes	System removes the pending booking and redirects user to vehicle’s information page.

Exceptions:

No	Actor Action	System Response
1	Customer books vehicle during unavailable time	System alerts the customer.

Relationships: Extend for “View vehicle’s information”

Business Rules:

- Booking’s start time must be after 6 hours from now.
- Booking’s start time must be before 30 days from now.
- Booking’s end time must be after 1 hours from start time.
- Booking’s start time and end time must be within working time of garage.
- Booking’s time must not conflict with any other booking of the booked vehicle.
- Customer has to pay deposit specified by provider and system’s service fee (1% of total rental price) to book a vehicle.

2.3.3.2. < Customer > View booking history (UC12) <Excluded>**2.3.3.3. < Customer > View detailed booking information (UC13) <Excluded>**

2.3.3.4. < Customer > Cancel booking (UC14)

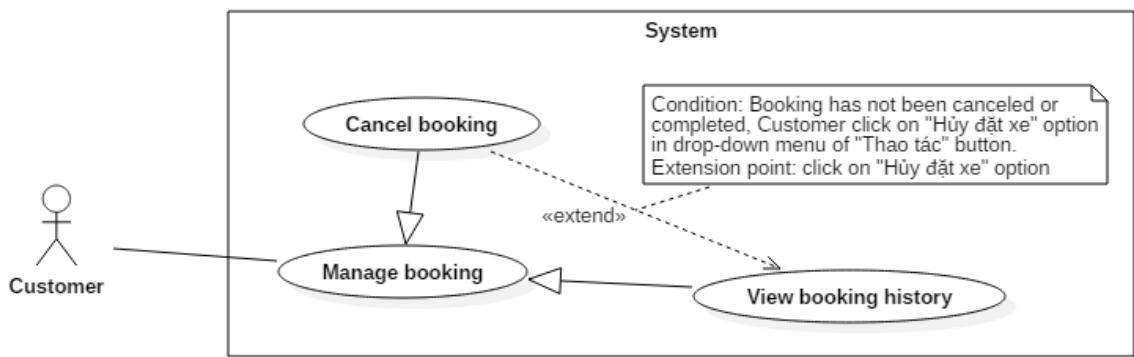


Figure 8: < Customer > Cancel booking Use Case

USE CASE – UC14												
Use Case No.	14	Use Case Version	1.0									
Use Case Name	Cancel booking											
Author	DucTH											
Date	30/09/2016	Priority	Normal									
Actor:	<ul style="list-style-type: none"> - Customer 											
Summary:	<ul style="list-style-type: none"> - This use case allows customer to cancel their booking. 											
Goal:	<ul style="list-style-type: none"> - Customer can cancel their unfinished booking. 											
Triggers:	<ul style="list-style-type: none"> - Customer selects “Hủy đặt xe” option in drop-down menu of “Thao tác” button of a booking record. 											
Preconditions:	<ul style="list-style-type: none"> - Log in successful as customer. - The target booking has not been completed or canceled. 											
Post Conditions:	<ul style="list-style-type: none"> - Success: Booked vehicle will appears in “Lịch sử đặt xe” page. - Fail: Show error message. 											
Main Success Scenario:	<table border="1"> <thead> <tr> <th>Step</th><th>Actor Action</th><th>System Response</th></tr> </thead> <tbody> <tr> <td>1</td><td>Customer selects “Hủy đặt xe” option in drop-down menu of “Thao tác” button of a booking record.</td><td>System cancels the target booking, send alert email to the related customer and provider, then close the popup.</td></tr> <tr> <td>2</td><td>Customer clicks on “Hủy” button [Alternative 1]</td><td></td></tr> </tbody> </table>			Step	Actor Action	System Response	1	Customer selects “Hủy đặt xe” option in drop-down menu of “Thao tác” button of a booking record.	System cancels the target booking, send alert email to the related customer and provider, then close the popup.	2	Customer clicks on “Hủy” button [Alternative 1]	
Step	Actor Action	System Response										
1	Customer selects “Hủy đặt xe” option in drop-down menu of “Thao tác” button of a booking record.	System cancels the target booking, send alert email to the related customer and provider, then close the popup.										
2	Customer clicks on “Hủy” button [Alternative 1]											

		System cancels the target booking, send alert email to the related customer and provider, then close the popup.
--	--	-----------------------------------------------------------------------------------------------------------------

Alternative Scenario:

Step	Actor Action	System Response
1	Customer clicks on “Đóng” button, “X” button, or outside the popup.	System close the confirmation popup.

Exceptions: N/A**Relationships:** extend from “View booking history”.**Business Rules:**

- The target booking has not been completed (End time has not passed) or canceled.

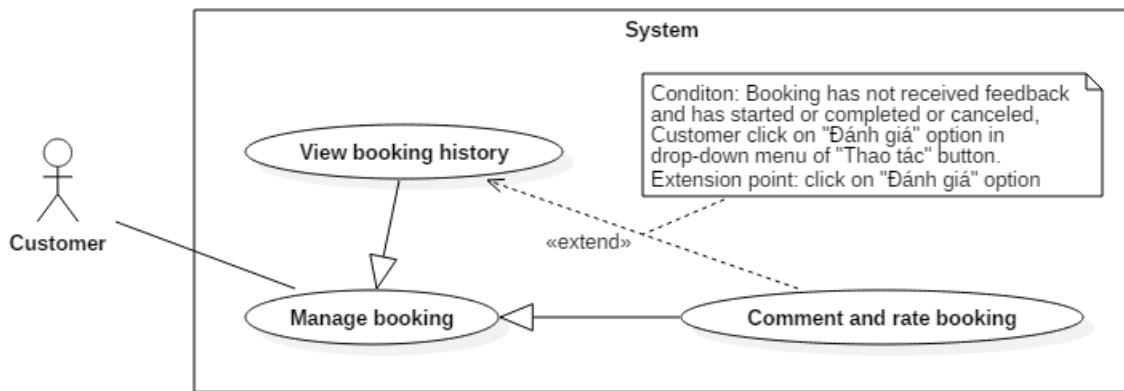
2.3.3.5. < Customer > Comment and rate booking (UC15)

Figure 9: < Customer > Comment and rate booking Use Case

USE CASE – US15			
Use Case No.	15	Use Case Version	1.0
Use Case Name	Comment and rate booking		
Author	DucTH	Priority	Normal
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Customer 		
Summary:	<ul style="list-style-type: none"> - This use case allows customer to feedback about their booked vehicle's service. 		
Goal:	<ul style="list-style-type: none"> - Customer submits successfully rating and comment for their booking. 		
Triggers:	<ul style="list-style-type: none"> - Customer chooses “Đánh giá” option in drop-down menu of “Thao tác” button of a booking record in “Lịch sử đặt xe” page. 		

Preconditions:

- Log in successfully as a customer.
- The target booking must not have received feedback and have either started (Start time of booking is before current time) or been canceled.

Post Conditions:

- **Success:** Comment and rating for booking is submitted successfully.
- **Fail:** Show error message.

Main Success Scenario:

Step	Actor Action	System Response
1	Customer chooses “Đánh giá” option in drop-down menu of “Thao tác” button of a booking record in “Lịch sử đặt xe” page.	System shows “Đánh giá xe” popup for customer to write comment and choose rating.
2	Customer fills the form in the popup and clicks “Gởi” button. [Alternative 1]	System will update booking's comment and rating, as well as related vehicle's and garage's ratings, then show “Đã gửi đánh giá thành công” alert to customer. [Exception 1] [Exception 2] [Exception 3] [Exception 4]

Alternative Scenario:

No	Actor Action	System Response
1	Customer clicks “Đóng” button, “X” button, or clicks outside the popup box.	System will close “Đánh giá xe” popup.

Exceptions:

No	Actor Action	System Response
1	Customer don't do anything and clicks “Gởi” button	System will display “Vui lòng nhập” alert above “Đánh giá” textbox.
2	Customer choose rating but does not type anything in “Đánh giá” textbox.	

		System will display “Vui lòng nhập” alert above “Đánh giá” textbox.
3	Customer type less than 20 words.	System will display “Vui lòng nhập ít nhất 20 chữ” alert above “Đánh giá” textbox.
4	Customer type more than 200 words	System will display “Vui lòng nhập ít hơn 200 chữ” alert above “Đánh giá” textbox.

Relationships: Extend from “View booking history”

Business Rules:

- The target booking must not have received feedback and have either started (Start time of booking is before current time) or been canceled.
- The related vehicle's and garage's ratings must be updated accordingly.

2.3.3.6. < Customer > Register providership (UC16)

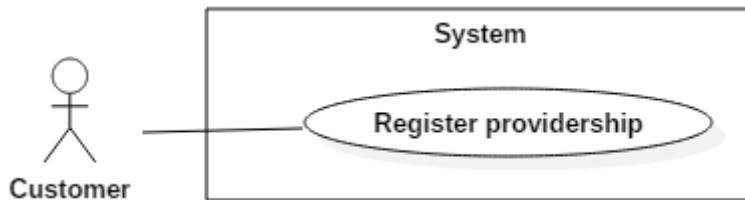


Figure 10: < Customer > Register providership Use Case

USE CASE – US16			
Use Case No.	16	Use Case Version	1.0
Use Case Name	Register providership		
Author	DucTH		
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Customer 		
Summary:	<ul style="list-style-type: none"> - This use case allows customer to become provider. 		
Goal:	<ul style="list-style-type: none"> - Customer attains Provider role. 		
Triggers:	<ul style="list-style-type: none"> - Customer clicks on “Trở thành nhà cung cấp” link on navigation sidebar. 		
Preconditions:	<ul style="list-style-type: none"> - Log in successfully and account only has role customer. 		
Post Conditions:	<ul style="list-style-type: none"> - Success: User attains Provider role. - Fail: Show error message. 		

Main Success Scenario:

Step	Actor Action	System Response
1	User clicks on “Trở thành nhà cung cấp” at navigation bar.	System shows providership registration page, which allows user to choose 1 in 3 subscription plans (1-month, 3-month, and 6-month).
2	User clicks on “Đăng ký” button of a subscription plan.	System shows “Phương thức thanh toán” panel where user can choose payment method: <ul style="list-style-type: none"> - Thanh toán online bằng thẻ ngân hàng nội địa: purchase using bank's card. - Thanh toán bằng thẻ tín dụng / ghi nợ: purchase using credit card. - Thanh toán bằng Ví điện tử NgânLượng: purchase using NgânLượng account.
3	User selects payment method and clicks on “Thanh toán” button. [Alternative 1]	System redirects user to payment page.
4	User pay for subscription. [Alternative 2]	System adds role Provider for user and sets expiration day, sends alert email, then redirects user to success page

Alternative Scenario:

No	Actor Action	System Response
1	User clicks on “Hủy đơn hàng” button at become provider page.	System will redirect user to homepage.
2	User clicks on “Hủy đơn hàng” button at purchase page.	System will redirect user to homepage.

Exceptions: N/A**Relationships:** N/A**Business Rules:**

- Only user with role Customer and only role Customer can register new providership.

2.3.4. <Provider> Use Case Overview

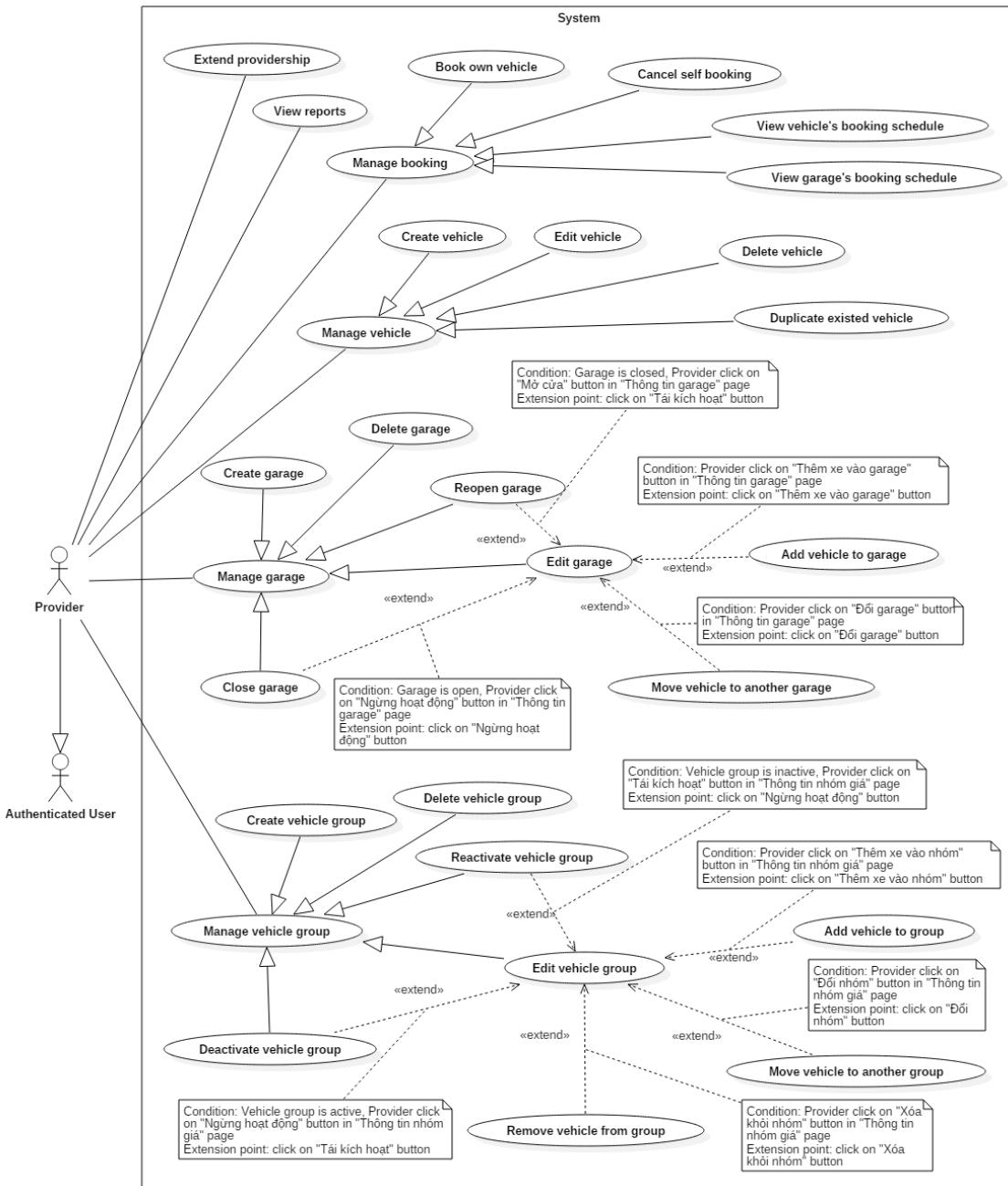


Figure 11 <Provider> Use Case Overview

2.3.4.1. < Provider > Create vehicle (UC17)

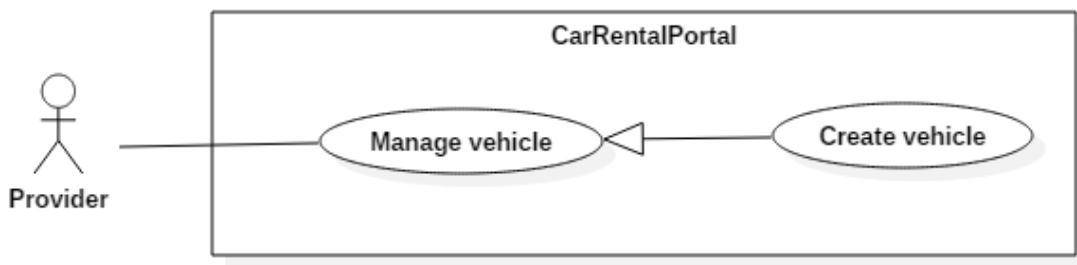


Figure 12: < Provider > Create vehicle Use Case

USE CASE – UC17			
Use Case No.	17	Use Case Version	1.0
Use Case Name	Create vehicle		
Author	KhoaLVD		
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Provider 		
Summary:	<ul style="list-style-type: none"> - This use case allows provider to create vehicle. 		
Goal:	<ul style="list-style-type: none"> - Provider can add vehicle for customer to book. 		
Triggers:	<ul style="list-style-type: none"> - Provider clicks “Thêm xe mới” button at “Quản lý xe” page. 		
Preconditions:	<ul style="list-style-type: none"> - User must login into the system with role “Provider”. 		
Post Conditions:	<ul style="list-style-type: none"> - Success: New vehicle appear at chosen garage. - Fail: Show error message. 		
Main Success Scenario:			
Step	Actor Action	System Response	
1	Provider clicks “Thêm xe mới” button at “Quản lý xe” page.	System shows “Tạo xe mới” popup display all information needed to fill.	
2	Provider inputs vehicle information.	System require information: <ul style="list-style-type: none"> - “Tên xe”: textbox, required, min length10, max length100. - “Biển số xe”: textbox, required, min length10, max length50. - “Dòng xe”: dropdownlist, required - “Năm sản xuất”: number, required, chosen from 1908 to current year. 	

		<ul style="list-style-type: none"> - “Garage”: dropdownlist, required - “Nhóm xe”: dropdownlist - “Loại hộp số”: radio button, required, choose between “Số tự động” or “Số sàn” - “Chi tiết về loại hộp số”: textbox, maxlenht50. - “Loại nhiên liệu”: dropdownlist - “Đặc tả về động cơ”: textbox, maxlenht50. - “Màu xe”: radio button, required - “Mô tả xe”: textarea, maxleght500. - “Hình ảnh”: dropzone, at least 4 images, max at 10 images.
3	<p>Provider send creation request. [Alternative 1]</p>	<p>Popup close and “Tạo xe thành công” alert appear on the top right side.</p> <p>[Exception 1] [Exception 2] [Exception 3] [Exception 4] [Exception 5] [Exception 6] [Exception 7] [Exception 8] [Exception 9] [Exception 10] [Exception 11] [Exception 12] [Exception 13] [Exception 14] [Exception 15] [Exception 16] [Exception 17]</p>

Alternative Scenario:

No	Actor Action	System Response
1	Provider clicks an exit button or clicks outside the popup box.	System will close “Tạo xe mới” popup and back to “Quản lý xe” page.

Exceptions:

No	Actor Action	System Response
1	Provider does not fill anything and send request.	

		Show a message to notify that “Tên xe phải từ 10 đến 100 chữ cái”
2	Provider missed to input “Tên xe” field.	Show error message “Tên xe phải từ 10 đến 100 chữ cái”.
3	Provider inputs too long string in “Tên khách hàng” textbox	Show error message “Tên xe phải từ 10 đến 100 chữ cái”.
4	Provider inputs too short string in “Tên khách hàng” textbox	Show error message “Tên xe phải từ 10 đến 100 chữ cái”.
5	Provider missed to input “Biển số xe” field.	Show error message “Biển số xe phải từ 10 đến 50 ký tự”.
6	Provider inputs too long string in “Biển số xe” textbox	Show error message “Biển số xe phải từ 10 đến 50 ký tự”.
7	Provider inputs too short string in “Biển số xe” textbox	Show error message “Biển số xe phải từ 10 đến 50 ký tự”.
8	Provider missed to choose “Dòng xe” list.	Show error message “Vui lòng chọn dòng xe”.
9	Provider missed to input “Năm sản xuất” field.	Show error message “Vui lòng khai báo năm sản xuất của xe”.
10	Provider input the year before 1908	System will automatic change back the year to 1908
11	Provider input the year after current year.	System will automatic change back the year to the current year
12	Provider missed to choose “Garage” list.	Show error message “Vui lòng chọn garage xe”.
13	Provider missed to choose “Loại hộp số”.	Show error message “Vui lòng chọn loại hộp số”.
14	Provider missed to choose “Màu xe”.	Show error message “Vui lòng chọn màu xe”.
15	Provider missed to upload picture.	Show error message “Bạn phải upload ít nhất 4 hình”.
16	Provider upload less than 4 pictures	Show error message “Bạn phải upload ít nhất 4 hình”.
17	Provider upload more than 10 pictures	

	Only the first 10 pictures are uploaded
--	-----------------------------------------

Relationships: N/A

Business Rules:

- “Tên xe”: textbox, required, min length 10, max length 100.
- “Biển số xe”: textbox, required, min length 10, max length 50.
- “Dòng xe”: dropdownlist, required
- “Năm sản xuất”: number, required, chosen from 1908 to current year.
- “Garage”: dropdownlist, required
- “Nhóm xe”: dropdownlist
- “Loại hộp số”: radio button, required, choose between “Số tự động” or “Số sàn”
- “Chi tiết về loại hộp số”: textbox, max length 50.
- “Loại nhiên liệu”: dropdownlist
- “Đặc tả về động cơ”: textbox, max length 50.
- “Màu xe”: radio button, required
- “Mô tả xe”: textarea, max length 500.
- “Hình ảnh”: dropzone, at least 4 images, max at 10 images.

2.3.4.2. < Provider > Duplicate existed vehicle (UC18)

<Excluded>

2.3.4.3. < Provider > Edit vehicle (UC19)

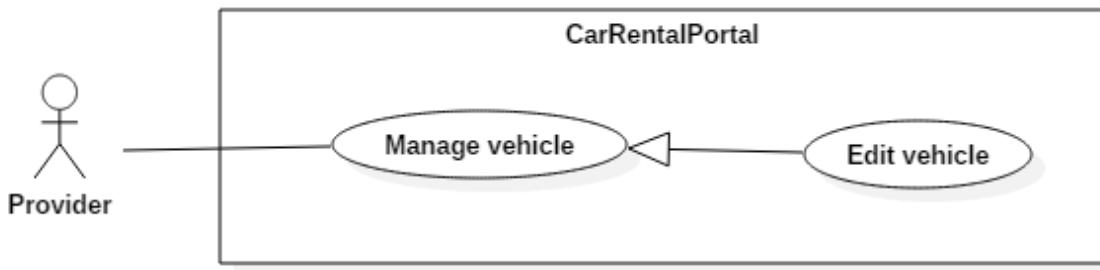


Figure 13: < Provider > Edit vehicle Use Case

USE CASE – UC19			
Use Case No.	19	Use Case Version	1.0
Use Case Name	Edit vehicle		
Author	KhoaLVD		
Date	30/09/2016	Priority	Normal
Actor:			
- Provider			
Summary:			
- This use case allows provider to edit information of existed vehicle.			
Goal:			
- Provider can edit information of existed vehicle for customer to book.			
Triggers:			
- Provider clicks vehicle's name at “Quản lý xe” page.			
Preconditions:			

- User must login into the system with role “Provider” still existed.

Post Conditions:

- **Success:** Save new information of the chosen vehicle.
- **Fail:** Show error message.

Main Success Scenario:

Step	Actor Action	System Response
1	Provider clicks vehicle's name at “Quản lý xe” page.	System open “Thông tin chi tiết của xe” page display all information of chosen vehicle.
2	Provider clicks “Chỉnh sửa thông tin” button	<p>System shows form to edit vehicle's information, which requires:</p> <ul style="list-style-type: none"> - “Tên xe”: textbox, required, min length 10, max length 100. - “Biển số xe”: textbox, required, min length 10, max length 50. - “Garage”: dropdownlist, required - “Nhóm xe”: dropdownlist - “Chi tiết về loại hộp số”: textbox, max length 50. - “Động cơ”: textbox, max length 50. - “Màu xe”: radio button, required - “Mô tả xe”: textarea, max length 500. - “Hình ảnh”: dropzone, at least 4 images, max at 10 images.
4	Provider changes vehicle's information and saves the changes. [Alternative 1, 2, 3]	System save edited information and reload the page.

Alternative Scenario:

No	Actor Action	System Response
1	Provider clicks on “Hủy bỏ” button.	System closes the edit form.
2	Provider uploads more pictures	

		System uploads new pictures sequentially.
3	Provider click on “Xoá” button under a picture.	System deletes the target picture.

Exceptions:

No	Actor Action	System Response
1	Provider deletes all information in “Tên xe” field.	Show error message “Tên xe phải từ 10 đến 100 chữ cái”.
2	Provider inputs too long string in “Tên xe” textbox	Show error message “Tên xe phải từ 10 đến 100 chữ cái”.
3	Provider inputs too short string in “Tên xe” textbox	Show error message “Tên xe phải từ 10 đến 100 chữ cái”.
4	Provider deletes all information in “Biển số xe” field.	Show error message “Biển số xe phải từ 10 đến 50 ký tự”.
5	Provider inputs too long string in “Biển số xe” textbox	Show error message “Biển số xe phải từ 10 đến 50 ký tự”.
6	Provider inputs too short string in “Biển số xe” textbox	Show error message “Biển số xe phải từ 10 đến 50 ký tự”.
7	Provider missed to upload picture.	Show error message “Bạn phải upload ít nhất 4 hình”.
8	Provider deleted pictures and make the total number of picture less than 4	Show error message “Bạn phải upload ít nhất 4 hình”.
9	Provider uploaded more pictures and make the total number of picture more than 10.	11 th and later pictures are not uploaded.

Relationships: N/A**Business Rules:**

- “Tên xe”: textbox, required, min length 10, max length 100.
- “Biển số xe”: textbox, required, min length 10, max length 50.
- “Garage”: dropdownlist, required
- “Nhóm xe”: dropdownlist
- “Chi tiết về loại hộp số”: textbox, max length 50.
- “Đặc tả về động cơ”: textbox, max length 50.
- “Màu xe”: radio button, required

- “Mô tả xe”: textarea, max length 500.
- “Hình ảnh”: dropzone, at least 4 images, max at 10 images.

- 2.3.4.4. < Provider > Delete vehicle (UC20) <Excluded>**
- 2.3.4.5. < Provider > View vehicle's booking schedule (UC21) <Excluded>**
- 2.3.4.6. < Provider > View garage's booking schedule (UC22) <Excluded>**
- 2.3.4.7. < Provider > Book own vehicle (UC23)**

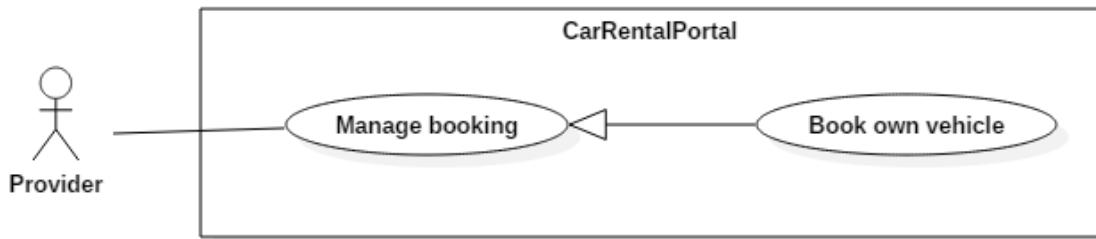


Figure 14: < Provider > Book own vehicle Use Case

USE CASE – UC23			
Use Case No.	23	Use Case Version	1.0
Use Case Name	Book own vehicle		
Author	KhoaLVD		
Date	30/09/2016	Priority	Normal
Actor:			
- Provider			
Summary:			
- This use case allows provider to book their own vehicle.			
Goal:			
- Provider can book their own vehicle in other to reserve it.			
Triggers:			
- Provider clicks on “Tạo đặt xe mới” button in “Thông tin chi tiết của xe” page of a vehicle.			
Preconditions:			
- User must login into the system with role “Provider”.			
Post Conditions:			
- Success: Provider successfully book the vehicle. - Fail: Show error message.			

Main Success Scenario:

Step	Actor Action	System Response
1	Provider clicks on “Tạo đặt xe mới” button in “Thông tin chi tiết của xe” page of a vehicle.	System shows popup to create new self-booking.
2	Providers provides start time and end time of the booking, then submit. [Alternative 1]	System create new self-booking for vehicle. [Exception 1]

Alternative Scenario:

No	Actor Action	System Response
1	Provider clicks “Thoát” button, “X” button, or outside the popup box.	System closes the popup.

Exceptions:

No	Actor Action	System Response
1	Provider submits new booking that time is conflicts with another existed booking.	System shows error alert.

Relationships: N/A**Business Rules:**

- Booking's start time must be after 6 hours from now.
- Booking's end time must be after 1 hours from start time.
- The booked vehicle must not has any other booking in this booked time span.

2.3.4.8. < Provider > Cancel self-booking (UC24) <Excluded>

2.3.4.9. < Provider > Create garage (UC25)

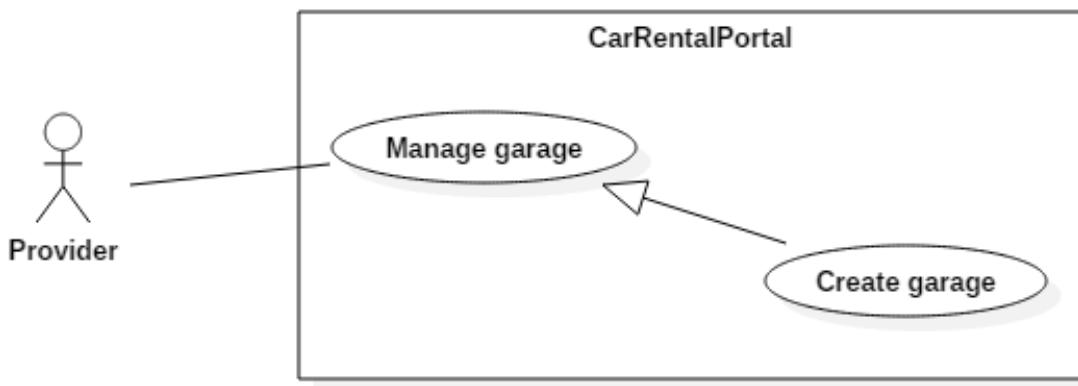


Figure 15: < Provider > Create garage Use Case

USE CASE – UC25			
Use Case No.	25	Use Case Version	1.0
Use Case Name	Create garage		
Author	ThanhHC		
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Provider 		
Summary:	<ul style="list-style-type: none"> - This use case allows provider to create a new garage. 		
Goal:	<ul style="list-style-type: none"> - Provider can create new garage. 		
Triggers:	<ul style="list-style-type: none"> - Provider send request in page “Quản lý garage” to create garage by click on “Tạo garage mới”. 		
Preconditions:	<ul style="list-style-type: none"> - Login as roles provider. 		
Post Conditions:	<ul style="list-style-type: none"> - Success: Provider has new garage. - Fail: Show error message. 		
Main Success Scenario:			
Step	Actor Action	System Response	
1	Provider click “Tạo garage mới” button.	System show popup requires information : <ul style="list-style-type: none"> - Tên garage: free text input, required, max length 100. - Địa điểm: dropdown list, required. - Địa chỉ: free text input, required, max length 200. - Email: free text input, required. 	

		<ul style="list-style-type: none"> - Số điện thoại (mặc định): numeric, required, min length 10, max length 20. - Số điện thoại (bổ sung): numeric, min length 10, max length 20. - Mô tả: free text input. - Điều khoản: free text input. - Thời gian mở cửa: text input with time format and checkbox “Nghi”. By default, from Monday to Friday open at 8:00, close at 17:00. Saturday and Sunday checkbox “Nghi” is checked.
2	Provider inputs information.	
3	Provider click to button “Tạo garage” that sends request to create to system. [Alternative 1]	<p>Provider creates a new garage successfully.</p> <p>[Exception 1] [Exception 2] [Exception 3] [Exception 4] [Exception 5] [Exception 6] [Exception 7] [Exception 8] [Exception 9]</p>

Alternative Scenario:

No	Actor Action	System Response
1	Provider clicks on “Đóng” button, “X” button, or outside the popup.	Current popup will be closed.

Exceptions:

No	Actor Action	System Response
1	Provider missed to input “Tên garage” field.	System show error message “Vui lòng nhập tên garage”.
2	Provider missed to input “Địa chỉ” field	System show error message “Vui lòng nhập địa chỉ”
3	Provider missed to input “Email” field	

		System shows error message “Vui lòng nhập email”
4	Provider missed to input “Số điện thoại (mặc định)” field	System shows error message “Vui lòng nhập số điện thoại”
5	Provider input “Tên garage” is over length allowed	System shows error message “Xin lỗi. Tên của garage vượt quá độ dài quy định”
6	Provider input “Địa chỉ” is over length allowed	System shows error message “Xin lỗi. Địa chỉ vượt quá độ dài quy định”
7	Provider input “Email” is wrong format	System shows error message “Email không hợp lệ”
	Provider input “Số điện thoại” is wrong format. Valid format: ^([0-9-+]+\$)	System shows error message “Số điện thoại không hợp lệ”
8	Provider input “Thời gian mở cửa” textfield “Từ” has higher value than textfield “Đến”.	System shows error message “Xin lỗi, thời gian đóng cửa không được sớm hơn thời gian mở cửa”
9	Provider input “Thời gian mở cửa” wrong time format	System shows error message “Xin lỗi, giá trị thời gian không hợp lệ”
Relationships: N/A		
Business Rules: N/A		

2.3.4.10. < Provider > Delete garage (UC26) <Excluded>

2.3.4.11. < Provider > Edit garage (UC27)

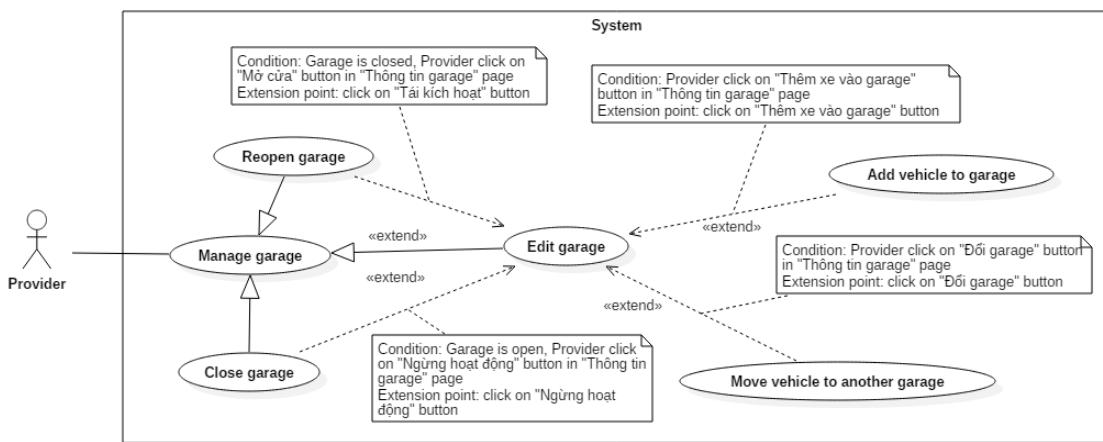


Figure 16: < Provider > Edit garage Use Case

USE CASE – UC27			
Use Case No.	27	Use Case Version	1.0
Use Case Name	Edit garage		
Author	ThanhHC		
Date	30/09/2016	Priority	Normal
Actor:			
- Provider			
Summary:			
- This use case allows provider to edit garage's information.			
Goal:			
- Garage's information will be updated.			
Triggers:			
- Provider clicks “Chỉnh sửa thông tin” button in garage's details page.			
Preconditions:			
- Login as roles provider.			
Post Conditions:			
- Success: Garage's information will be updated in system.			
- Fail: Show error message.			
Main Success Scenario:			
Step	Actor Action	System Response	
1	Provider clicks “Chỉnh sửa thông tin” button in garage's details page.	System shows a form to edit garage, which requires: - Tên garage: free text input, required, max length 100. - Địa điểm: dropdown list, required - Địa chỉ: free text input, required, max length 200 - Email: free text input, required	

		<ul style="list-style-type: none"> - Số điện thoại (mặc định): free text input, required, min length 10, max length 20 - Số điện thoại (bổ sung): free text input, min length 10, max length 20 - Mô tả: free text input - Điều khoản: free text input - Thời gian mở cửa: text input with time format and checkbox “Nghi”. By default, from Monday to Friday open at 8:00, close at 17:00. Saturday and Sunday checkbox “Nghi” is checked.
2	Provider updates garage's information and saves the updates [Alternative 1]	System updates garage. [Exception 1] [Exception 2] [Exception 3] [Exception 4] [Exception 5] [Exception 6] [Exception 7] [Exception 8] [Exception 9]

Alternative Scenario:

No	Actor Action	System Response
1	Provider click to “Hủy bỏ” button.	All display controls will be closed.

Exceptions:

No	Actor Action	System Response
1	Provider missed to input “Tên garage” field	System show error message “Vui lòng nhập tên garage”
2	Provider missed to input “Địa chỉ” field	System show error message “Vui lòng nhập địa chỉ”
3	Provider missed to input “Email” field	System shows error message “Vui lòng nhập email”
4	Provider missed to input “Số điện thoại (mặc định)” field	

		System shows error message “Vui lòng nhập số điện thoại”
5	Provider input “Tên garage” is over length allowed	System shows error message “Xin lỗi. Tên của garage vượt quá độ dài quy định”
6	Provider input “Địa chỉ” is over length allowed	System shows error message “Xin lỗi. Địa chỉ vượt quá độ dài quy định”
7	Provider input “Email” is wrong format	System shows error message “Email không hợp lệ”
	Provider input “Số điện thoại” is wrong format. Valid format: ^-[0-9-+]+\$	System shows error message “Số điện thoại không hợp lệ”
8	Provider input “Thời gian mở cửa”textfield “Từ” has higher value than textfield “Đến”.	System shows error message “Xin lỗi, thời gian đóng cửa không được sớm hơn thời gian mở cửa”
9	Provider input “Thời gian mở cửa” wrong time format	System shows error message “Xin lỗi, giá trị thời gian không hợp lệ”
<p>Relationships: extended by “Close garage”, “Reopen garage”, “Add vehicle to garage” and “Move vehicle to another garage”</p> <p>Business Rules: N/A</p>		

- 2.3.4.12. < Provider > Close garage (UC28) <Excluded>
- 2.3.4.13. < Provider > Reopen garage (UC29) <Excluded>
- 2.3.4.14. < Provider > Add vehicle to garage (UC30)

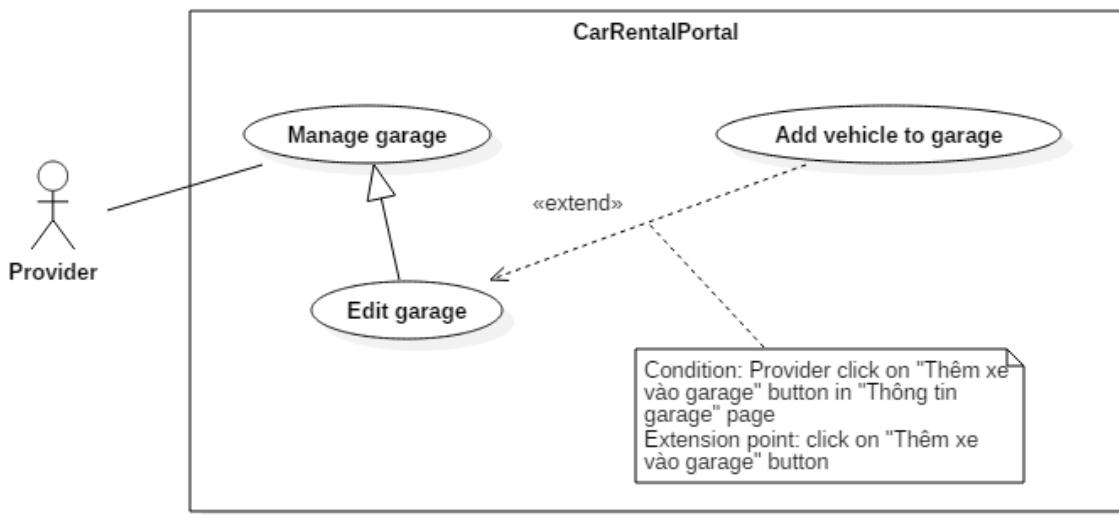


Figure 17: < Provider > Add vehicle to garage Use Case

USE CASE – UC30			
Use Case No.	30	Use Case Version	1.0
Use Case Name	Add vehicle to garage		
Author	ThanhHC		
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Provider 		
Summary:	<ul style="list-style-type: none"> - This use case allows provider to add vehicle to current garage. 		
Goal:	<ul style="list-style-type: none"> - The selected vehicle will be moved into the target garage. 		
Triggers:	<ul style="list-style-type: none"> - Provider click on “Thêm xe vào garage” at “Thông tin garage” page. 		
Preconditions:	<ul style="list-style-type: none"> - Login as roles provider. 		
Post Conditions:	<ul style="list-style-type: none"> - Success: Vehicle added to garage successfully. - Fail: Show error message. 		
Main Success Scenario:			
Step	Actor Action	System Response	
1	Provider clicks “Thêm xe vào Garage” button.	System shows popup for choosing vehicle to add to garage.	
2	Provider select vehicle to add to garage and click “Thêm” button		

	[Alternative 1]	System add vehicle to garage.
Alternative Scenario:		
No	Actor Action	System Response
1	Provider clicks on exist buttons from click outside the popup.	Current popup will be closed.
Exceptions: N/A		
Relationships: Extend from “Edit garage”.		
Business Rules: N/A		

2.3.4.15. < Provider > Move vehicle to another garage (UC31) <Excluded>

2.3.4.16. < Provider > Create vehicle group (UC32)

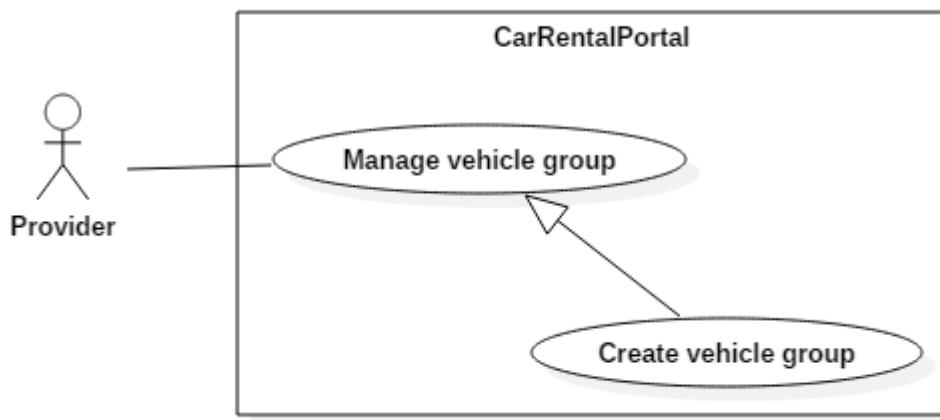


Figure 18: < Provider > Create vehicle group Use Case

USE CASE – UC32			
Use Case No.	32	Use Case Version	2.0
Use Case Name	Create vehicle group		
Author	ThanhHC		
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Provider 		
Summary:	<ul style="list-style-type: none"> - This use case allows provider to create a new vehicle group. 		
Goal:	<ul style="list-style-type: none"> - Provider has a group to manage price, info and vehicles belong to this group. 		
Triggers:	<ul style="list-style-type: none"> - Provider click button “Thêm nhóm mới” in page “Quản lý nhóm giá”. 		
Preconditions:			

- Login as roles provider.

Post Conditions:

- **Success:** Provider has new vehicle group to manage price. In default, this vehicle group has 0 vehicles. Provider can add vehicle to this group at later.
- **Fail:** Show error message.

Main Success Scenario:

Step	Actor Action	System Response
1	<p>Provider click “Thêm nhóm mới” button.</p> <p>[Alternative 1] [Alternative 2]</p>	<p>System show popup requires information :</p> <ul style="list-style-type: none"> - Tên nhóm: free text input, required, max length 50. - Đặt cọc: number input, required, value must in range [0..100] - Giá theo ngày: number input, required, not allow negative number. - Không giới hạn: checkbox. Default checked box, when uncheck, provider can input at “Kỳ hạn thuê tối đa”, “Số km tối đa một ngày” and “Số tiền trả thêm” text box. - Kỳ hạn thuê tối đa: number input, not allow negative number, can't input when “Không giới hạn” is checked. - Số Km tối đa một ngày: number input, not allow negative number, can't input when “Không giới hạn” is checked. - Số tiền trả thêm: number input, not allow negative number. Display with hint text “Được áp dụng khi vượt số Km quy định”, can't input when “Không giới hạn” is checked and “Số km tối đa một ngày” not yet input. - Bảng giá theo giờ: In default, table is hided, and only button “Thêm hàng mới” is displayed.
2	<p>Provider click “Thêm hàng mới” button.</p> <p>[Alternative 3] [Alternative 4]</p>	<p>On current popup show a table with columns:</p> <ul style="list-style-type: none"> - Thời gian (giờ): number input, value must in range [1..23] - Giá tiền (VNĐ): number input, not allow negative number - Số Km tối đa (Km): number input, not allow negative number.
3	Provider inputs information.	

4	<p>Provider click to button “Tạo nhóm” that sends request to create to system. [Alternative 5]</p>	<p>Provider create a new garage successfully.</p> <p>[Exception 1] [Exception 2] [Exception 3] [Exception 4] [Exception 5] [Exception 6] [Exception 7] [Exception 8] [Exception 9] [Exception 10] [Exception 11] [Exception 12] [Exception 13] [Exception 14] [Exception 15] [Exception 16]</p>
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Alternative Scenario:

No	Actor Action	System Response
1	Provider uncheck “Không giới hạn” at “Kỳ hạn thuê tối đa”	System allows provider to input “Kỳ hạn thuê tối đa” textbox.
2	Provider uncheck “Không giới hạn” at “Số km tối đa một ngày”	System allows provider to input “Số km tối đa một ngày” textbox.
3	Provider uncheck “Không giới hạn số km tối đa”	System allows provider to input “Số km tối đa” textbox.
4	Provider click to minus icon button.	A row in “Bảng giá theo giờ” table will be deleted.
5	Provider click to “Đóng” button.	Current popup will be closed.

Exceptions:

No	Actor Action	System Response
----	--------------	-----------------

1	Provider missed to input “Tên nhóm” field	System show error message “Vui lòng nhập tên nhóm”
2	Provider missed to input “Đặt cọc” field	System show error message “Vui lòng nhập giá trị đặt cọc”
3	Provider missed to input “Giá theo ngày” field	System shows error message “Xin vui lòng nhập giá thuê theo ngày”
4	Provider input “Tên nhóm” is over length allowed	System shows error message “Xin lỗi. Tên nhóm vượt quá độ dài quy định”
5	Provider input “Đặt cọc” is out of range	System shows error message “Xin lỗi. giá trị đặt cọc phải từ 0% đến 100%”
6	Provider input “Giá theo ngày” is a negative number.	System shows error message “Xin lỗi. Số tiền không được âm”
7	Provider input “Kì hạn thuê tối đa” is a negative number	System shows error message “Xin lỗi. Kì hạn thuê tối đa không được âm”
8	Provider input “Số Km tối đa một ngày” is a negative number.	System shows error message “Xin lỗi số km tối đa không được âm”
9	Provider input “Số tiền trả thêm” is a negative number	System shows error message “Xin lỗi. Số tiền không được âm”
10	Provider input “Thời gian (giờ)” but not input “Giá tiền (VNĐ)”	System shows error message “Vui lòng nhập giá tiền”
11	Provider input “Giá tiền (VNĐ)” but not input “Thời gian (giờ)”	System shows error message “Vui lòng nhập giờ”
12	Provider input “Số Km tối đa (Km)” but not input “Thời gian (giờ)” and “Giá tiền (VNĐ)”	System shows error message “Vui lòng nhập giờ và giá tiền”

13	Provider input “Thời gian (giờ)” is out of range.	System shows error message “Xin lỗi. Số giờ bị sai”
14	Provider input “Thời gian (giờ)” is duplicated.	System shows error message “Xin lỗi. Không được cấu hình giá một khung giờ nhiều lần”
15	Provider input “Giá tiền (VNĐ)” is a negative number.	System shows error message “Xin lỗi. Số tiền không được âm”
16	Provider input “Số Km tối đa (Km)” is a negative number.	System shows error message “Xin lỗi. Số tiền Km tối đa theo giờ không được âm”

Relationships: N/A

Business Rules:

- After vehicle group is created, group has no vehicle inside and status “Đang hoạt động”.

2.3.4.17. < Provider > Delete vehicle group (UC33) <Excluded>

2.3.4.18. < Provider > Edit vehicle group (UC34)

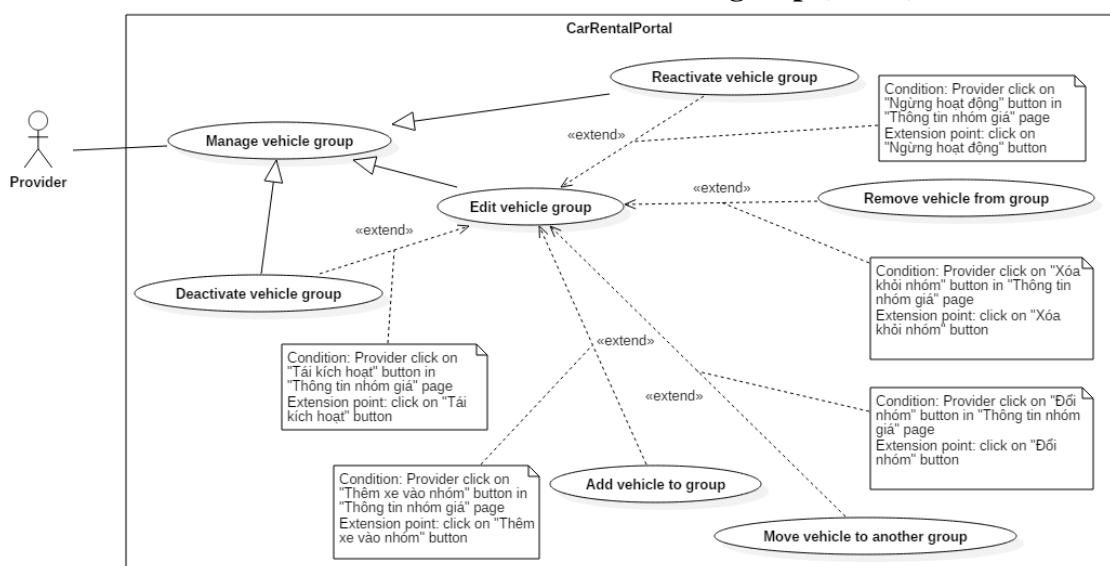


Figure 19: < Provider > Edit vehicle group Use Case

USE CASE – UC34	
Use Case No.	34
Use Case Name	Edit vehicle group
Use Case Version	1.0

Author	ThanhHC		
Date	30/09/2016	Priority	Normal
Actor:			
- Provider			
Summary:			
- This use case allows provider to update vehicle group's information.			
Goal:			
- New information of group will be updated.			
Triggers:			
- Provider click button “Chỉnh sửa thông tin” in page “Thông tin nhóm giá”.			
Preconditions:			
- Login as roles provider.			
Post Conditions:			
- Success: Provider has a vehicle group with new information.			
- Fail: Show error message.			
Main Success Scenario:			
Step	Actor Action	System Response	
1	Provider click “Chỉnh sửa thông tin” button. [Alternative 1] [Alternative 2]	System show popup requires information : - Tên nhóm: free text input, required, max length 50. - Đặt cọc: number input, required, value must in range [0..100] - Giá theo ngày: number input, required, not allow negative number. - Không giới hạn: checkbox. Default checked box, when uncheck, provider can input at “Kỳ hạn thuê tối đa”, “Số km tối đa một ngày” and “Số tiền trả thêm” text box. - Kỳ hạn thuê tối đa: number input, not allow negative number, can't input when “Không giới hạn” is checked. - Số Km tối đa một ngày: number input, not allow negative number, can't input when “Không giới hạn” is checked. - Số tiền trả thêm: number input, not allow negative number. Display with hint text “Được áp dụng khi vượt số Km quy định”, can't input when “Không giới hạn” is checked and “Số km tối đa một ngày” not yet input.	

		- Bảng giá theo giờ: In default, table is hided, and only button “Thêm hàng mới” is displayed.
2	Provider click “Thêm hàng mới” button. [Alternative 3] [Alternative 4]	Add a row on current table “Bảng giá theo giờ” with columns: <ul style="list-style-type: none"> - Thời gian (giờ): number input, value must in range [1..23] - Giá tiền (VND): number input, not allow negative number - Số Km tối đa (Km): number input, not allow negative number.
3	Provider inputs information.	
4	Provider click to button “Lưu lại” that sends request to create to system. [Alternative 5]	Provider create a new garage successfully. [Exception 1] [Exception 2] [Exception 3] [Exception 4] [Exception 5] [Exception 6] [Exception 7] [Exception 8] [Exception 9] [Exception 10] [Exception 11] [Exception 12] [Exception 13] [Exception 14] [Exception 15] [Exception 16]

Alternative Scenario:

No	Actor Action	System Response
1	Provider missed to input “Tên nhóm” field	System show error message “Vui lòng nhập tên nhóm”
2	Provider missed to input “Đặt cọc” field	System show error message “Vui lòng nhập giá trị đặt cọc”
3	Provider missed to input “Giá theo ngày” field	

		System shows error message “Xin vui lòng nhập giá thuê theo ngày”
4	Provider input “Tên nhóm” is over length allowed	System shows error message “Xin lỗi. Tên nhóm vượt quá độ dài quy định”
5	Provider input “Đặt cọc” is out of range	System shows error message “Xin lỗi. giá trị đặt cọc phải từ 0% đến 100%”

Exceptions:

No	Actor Action	System Response
1	Provider missed to input “Tên nhóm” field	System show error message “Vui lòng nhập tên nhóm”
2	Provider missed to input “Đặt cọc” field	System show error message “Vui lòng nhập giá trị đặt cọc”
3	Provider missed to input “Giá theo ngày” field	System shows error message “Xin vui lòng nhập giá thuê theo ngày”
4	Provider input “Tên nhóm” is over length allowed	System shows error message “Xin lỗi. Tên nhóm vượt quá độ dài quy định”
5	Provider input “Đặt cọc” is out of range	System shows error message “Xin lỗi. giá trị đặt cọc phải từ 0% đến 100%”
6	Provider input “Giá theo ngày” is a negative number.	System shows error message “Xin lỗi. Số tiền không được âm”
7	Provider input “Kì hạn thuê tối đa” is a negative number	System shows error message “Xin lỗi. Kì hạn thuê tối đa không được âm”
8	Provider input “Số Km tối đa một ngày” is a negative number.	System shows error message “Xin lỗi số km tối đa không được âm”
9	Provider input “Số tiền trả thêm” is a negative number	System shows error message “Xin lỗi. Số tiền không được âm”

10	Provider input “Thời gian (giờ)” but not input “Giá tiền (VNĐ)”	System shows error message “Vui lòng nhập giá tiền”
11	Provider input “Giá tiền (VNĐ)” but not input “Thời gian (giờ)”	System shows error message “Vui lòng nhập giờ”
12	Provider input “Số Km tối đa (Km)” but not input “Thời gian (giờ)” and “Giá tiền (VNĐ)”	System shows error message “Vui lòng nhập giờ và giá tiền”
13	Provider input “Thời gian (giờ)” is out of range.	System shows error message “Xin lỗi. Số giờ bị sai”
14	Provider input “Thời gian (giờ)” is duplicated.	System shows error message “Xin lỗi. Không được cấu hình giá một khung giờ nhiều lần”
15	Provider input “Giá tiền (VNĐ)” is a negative number.	System shows error message “Xin lỗi. Số tiền không được âm”
16	Provider input “Số Km tối đa (Km)” is a negative number.	System shows error message “Xin lỗi. Số tiền Km tối đa theo giờ không được âm”
Relationships: Extended by “Deactivate vehicle group”, “Reactivate vehicle group”, “Add vehicle to group”, “Move vehicle to another group”, “Remove vehicle from group”		
Business Rules: N/A		

- 2.3.4.19.** < Provider > Deactivate vehicle group (UC35)
<Excluded>
- 2.3.4.20.** < Provider > Reactivate vehicle group (UC36)
<Excluded>
- 2.3.4.21.** < Provider > Add vehicle to group (UC37)

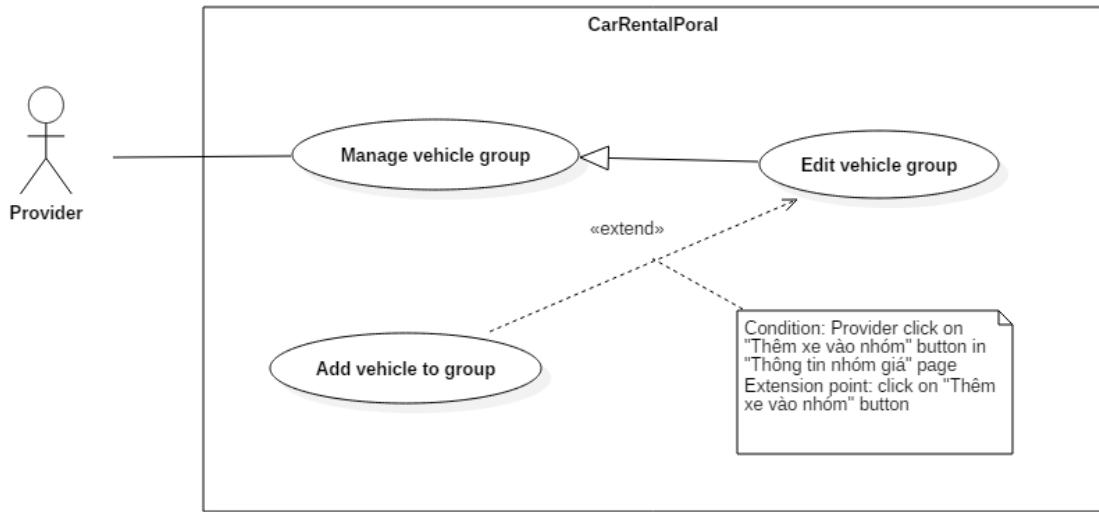


Figure 20: < Provider > Add vehicle to group Use Case

USE CASE – UC37			
Use Case No.	37	Use Case Version	1.0
Use Case Name	Add vehicle to group		
Author	TamNT		
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Provider. 		
Summary:	<ul style="list-style-type: none"> - This use case allows provider to add vehicle to group. 		
Goal:	<ul style="list-style-type: none"> - Provider can add vehicle to group. 		
Triggers:	<ul style="list-style-type: none"> - Provider clicks on “Thêm xe vào nhóm” button in “Thông tin nhóm giá” page. 		
Preconditions:	<ul style="list-style-type: none"> - Login to system as role “Provider”. 		
Post Conditions:	<ul style="list-style-type: none"> - Success: Add vehicle to group successfully. - Fail: Show error message. 		
Main Success Scenario:			
Step	Actor Action	System Response	
1	Provider clicks on “Thêm xe vào nhóm” button in “Thông tin nhóm giá” page.		

		System shows popup for provider to select vehicle to add into the target vehicle group.
2	Provider selects vehicle and send adding request. [Alternative 1]	System adds selected vehicle into target vehicle group.

Alternative Scenario:

Step	Actor Action	System Response
1	Provider click “Đóng” button	System will cancel operation.

Exceptions: N/A**Relationships:** Extend from “edit vehicle group”.**Business Rules:** N/A

2.3.4.22. < Provider > Remove vehicle from group (UC38)
<Excluded>

2.3.4.23. < Provider > Move vehicle to another group (UC39)
<Excluded>

2.3.4.24. < Provider > View reports (UC40) <Excluded>

2.3.4.25. < Provider > Extend providership (UC41)

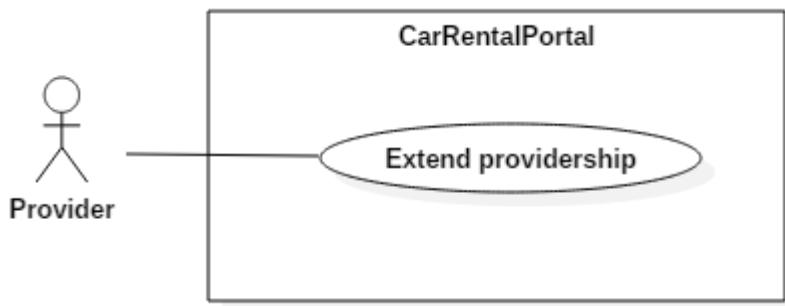


Figure 21: < Provider > Extend providership Use Case

USE CASE – UC41			
Use Case No.	41	Use Case Version	1.0
Use Case Name	Extend providership		
Author	KhoaLVD		
Date	30/09/2016	Priority	Normal
Actor:	<ul style="list-style-type: none"> - Provider 		
Summary:	<ul style="list-style-type: none"> - This use case allows provider to extend their providership. 		
Goal:			

- Provider successfully extends their providership.

Triggers:

- Provider clicks on “Trở thành nhà cung cấp” at navigation bar.

Preconditions:

- Log in successful as role provider.

Post Conditions:

- **Success:** Provider successfully extends their providership.
- **Fail:** Show error message.

Main Success Scenario:

Step	Actor Action	System Response
1	User clicks on “Gia hạn quyền cung cấp” at navigation bar.	System shows providership prolongation page, which allows user to choose 1 in 3 subscription plans (1-month, 3-month, and 6-month).
2	User clicks on “Gia hạn” button of a subscription plan.	System shows “Phương thức thanh toán” panel where user can choose payment method: <ul style="list-style-type: none"> - Thanh toán online bằng thẻ ngân hàng nội địa: purchase using bank's card. - Thanh toán bằng thẻ tín dụng / ghi nợ: purchase using credit card. - Thanh toán bằng Ví điện tử NgânLượng: purchase using NgânLượng account.
3	User selects payment method and clicks on “Thanh toán” button. [Alternative 1]	System redirect user to payment page.
4	User pay for subscription. [Alternative 2]	System sets new expiration day for user's providership, send alert email, then redirect him to success page

Alternative Scenario:

No	Actor Action	System Response
----	--------------	-----------------

1	User clicks on “Hủy đơn hàng” button at become provider page.	System will redirect user to homepage.
2	User clicks on “Hủy đơn hàng” button at purchase page.	System will redirect user to homepage.

Exceptions: N/A

Relationships: N/A

Business Rules: N/A

2.3.5. <Admin> Use Case Overview

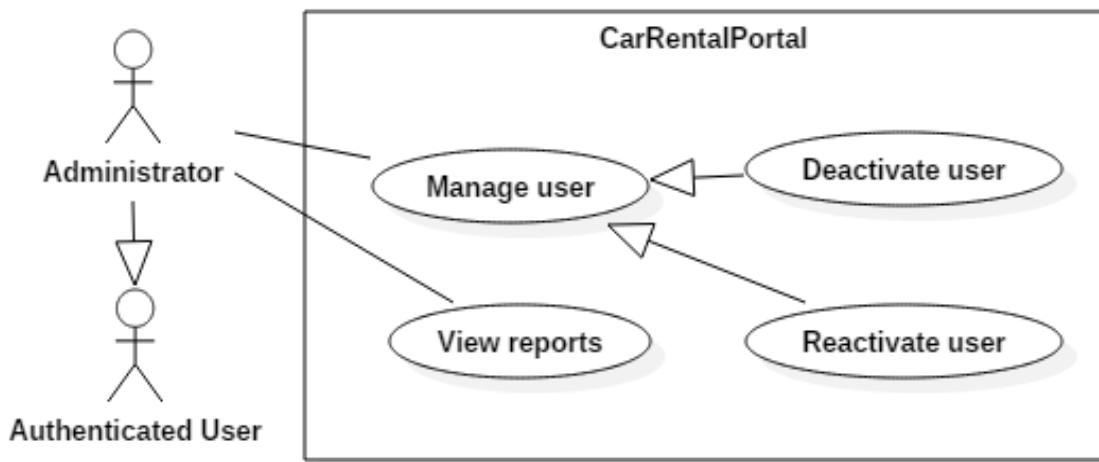


Figure 22: <Admin> Use Case Overview

2.3.5.1. < Admin > View reports (UC42) <Excluded>

2.3.5.2. < Admin > Deactivate user (UC43) <Excluded>

2.3.5.3. < Admin > Reactivate user (UC44) <Excluded>

3. Software System Attribute

3.1. Usability

3.1.1. Graphic User Interface

GUI must use Vietnamese as main language and should be simple, clear, intuitive, and, reminiscent.

3.1.2. Usability

- Rental service provider should be able to operate the system properly in the matter of hours.
- The system must be simple and intuitive so that customer can start using without any taking any tutorial or training.

3.1.3. Installation

The system should be easy and fast to deploy following installation guide.

3.2. Reliability

The system must not have any inconsistency in booking processing.

3.3. Availability

The system should not have any downtime beside 6 hours of monthly maintenance.

3.4. Security

- System must implement strict authorization and authentication.
- Passwords have to be encrypted before saving into database.

3.5. Maintainability

- The system must be divided into separated, high-cohesive, and low-coupling modules.
- Code should be clear, DRY, and have helpful commands.

3.6. Portability

- The web server can be deployed in any server machine that supports IIS8.
- Website should be able to run on Chrome (v.42 and above), Firefox (v.38 and above), and any equivalent web browser.

3.7. Performance

Server must respond to user's request from machine with minimum 4 Mbps connection and 1GHz CPU in less than 5 seconds.

4. Conceptual Diagram

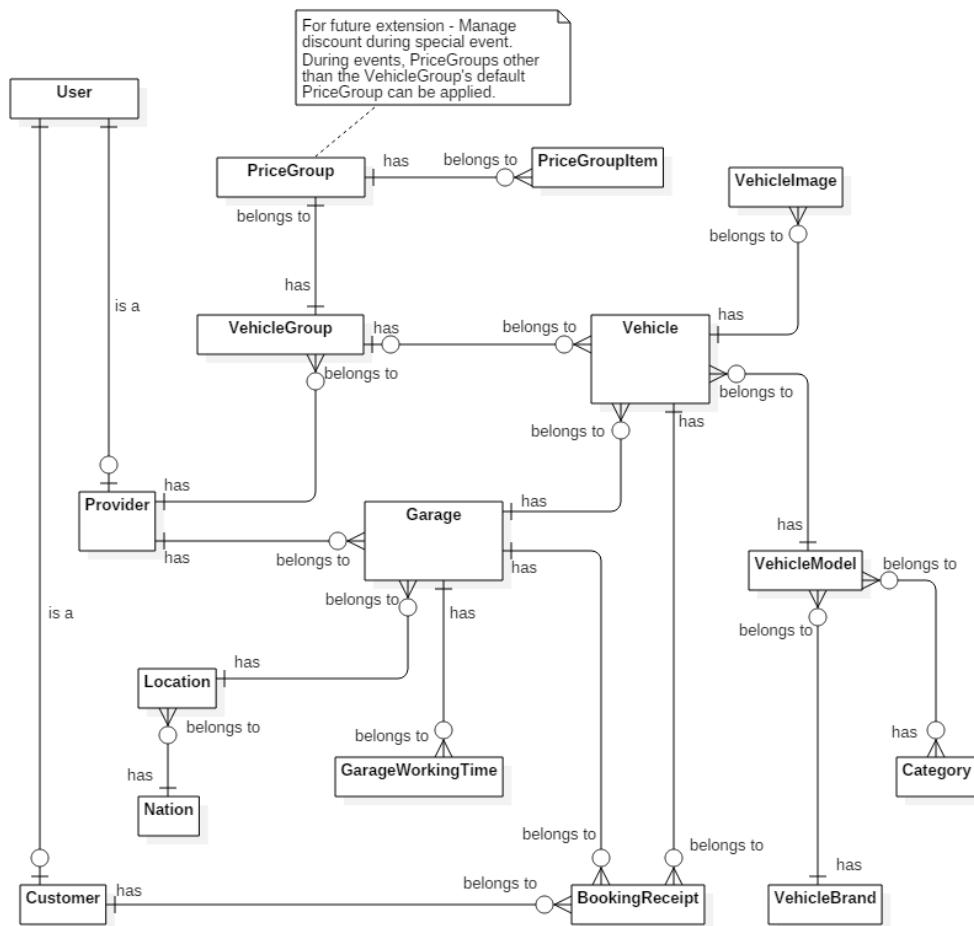


Figure 23: Conceptual Diagram

Entity Data dictionary	
Entity Name	Description
User	Abstract entity, represent user in system
Provider	User with provider role
Customer	User with customer role
Vehicle	Represent vehicle in system
VehicleImage	Represent image of vehicle
VehicleModel	Represent vehicle model
VehicleBrand	Represent vehicle brand
Category	Represent vehicle category
Garage	Represent garage
GarageWorkingTime	Describe working time constraints of garage each day of week
Location	Represent location inside a country
Nation	Represent nation
VehicleGroup	Represent group of vehicles with the same rental constraints
PriceGroup	Describe rental constraints of a vehicle group
PriceGroupItem	Describe rental constraints of each daily rental option of price group
BookingReceipt	Represent booking receipt in system

Table 8: Data dictionary

D. Software Design Description

1. Design Overview

This document describes the technical and user interface design of CRP System. The document includes architectural design, detailed design of core functions and business functions, and database design.

The architectural design describes the overall architecture of the system and relations between components and sub-systems inside.

The detailed design describes static and dynamic structure of each component and function. The design includes class diagram, class explanations, and sequence diagrams of each of the important use case.

The database design describes the relationships between system entities and details about attributes of each entity.

Document overview:

- Section 2: System architectural design.
- Section 3: Component diagrams describes the connections and integration of components inside the system.
- Section 4: Detailed design description including class diagram, class explanations, and sequence diagrams.
- Section 5: User interface design.
- Section 6: Database design.
- Section 7: Algorithms.

2. System Architecture Design

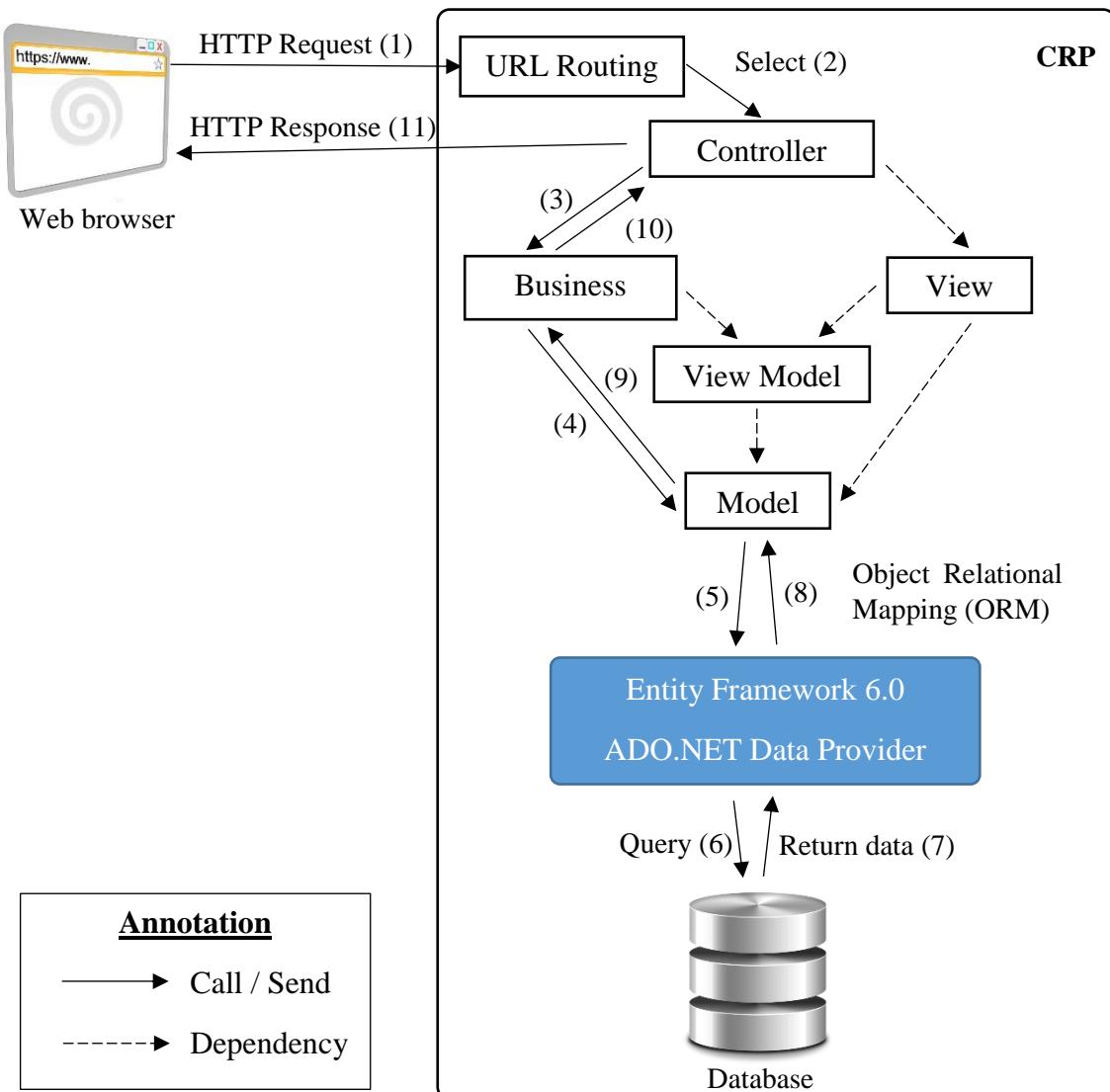


Figure 24: System architecture design

2.1. Web Application architecture description

The system is developed using ASP.NET MVC5 and Entity Framework 6.0 (EF6). The system has 5 important parts:

- **Model** is the part that acts as a data transfer object between the system and database. Models are generated using Object relational mapping (ORM) offered by EF6.
- **View** is the part that handles the display of data. A view renders the display using data from the model or view model that is passed down by controller.
- **Controller** is the part that acts as event handler to handle the user interaction. Typically, a controller reads data from the request, calls the appropriate Business's method, then selects view to render display and then send response back to user.
- **Business** is the part that contains all business handling methods.

- **View Model** is the part that acts like value object. Typically controller passes view model to view and view uses view model as data source for display rendering.

NganLuong's web-service is utilized for payment processing while Cloudinary's web-service is used for image management.

3. Component Diagram

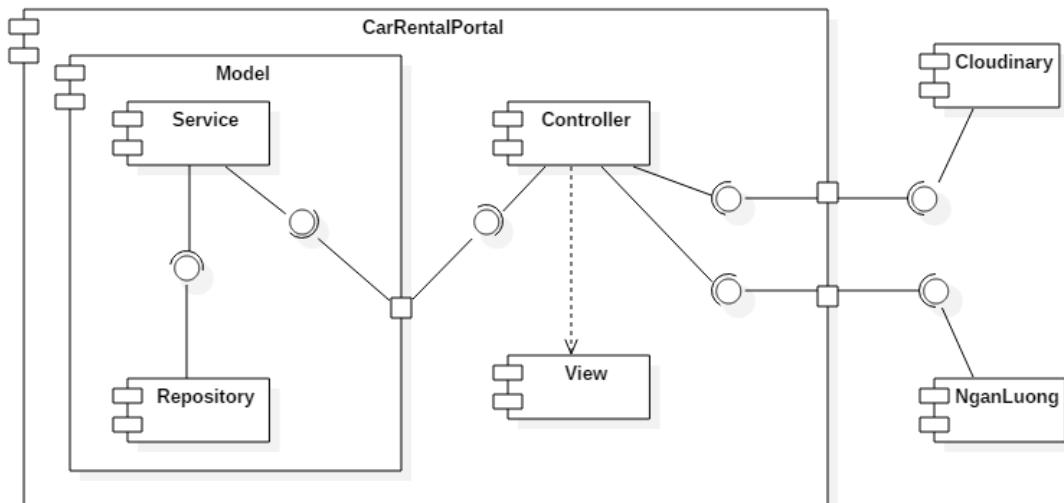


Figure 25 : Component diagram

Component	Description
Controller	Represent all controllers in the system.
View	Represent all views in the system.
Model	Represent all models mapped by Entity Framework.
Repository	Are components that provide simple CRUD operations to interact with database.
Service	Are components that provide more complex, business-related operations, implemented using repository's simple functionality.
Cloudinary	Online file management solution
NganLuong	Online payment gateway

Table 9: Component dictionary

4. Detailed Description

4.1. Class Diagram

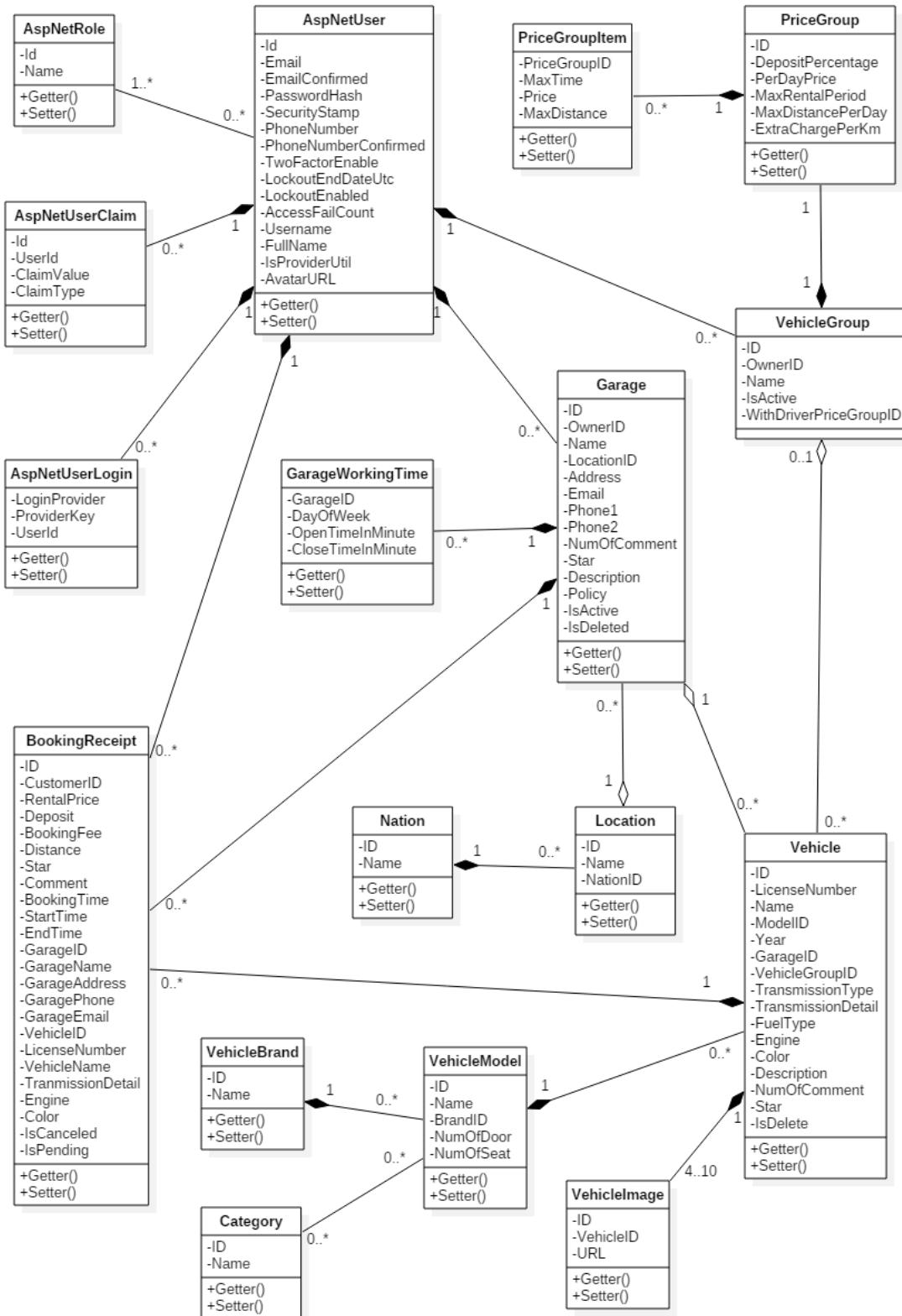


Figure 26: Class Diagram

Class dictionary		
Class Name	Mapping column with Conceptual diagram	Description
AspNetUser	User	Generated by ASP.NET MVC5. Describe all user in system
AspNetRole	N/A	Generated by ASP.NET MVC5. Describe existing user's roles in system.
AspNetUserClaim	N/A	Generated by ASP.NET MVC5. Describe all stored claims (Special attributes) of AspNetUsers.
AspNetUserLogin	N/A	Generated by ASP.NET MVC5. Describe information about 3 rd party/external logins allowed for each AspNetUsers.
Vehicle	Vehicle	Describe all vehicles in system.
VehicleImage	VehicleImage	Describe all images of each vehicle.
VehicleModel	VehicleModel	Describe all vehicle models in system.
VehicleBrand	VehicleBrand	Describe all vehicle brands in system.
Category	Category	Describe all vehicle categories in system.
VehicleGroup	VehicleGroup	Describe all vehicle groups in system
PriceGroup	PriceGroup	Describe rental constraints (Pricing, travel distance...) of each VehicleGroup.
PriceGroupItem	PriceGroupItem	Describe detailed constraints for hourly rental options of each PriceGroup in system.
Garage	Garage	Describe all garages in system
GarageWorkingTime	GarageWorkingTime	Describe working time constraints of each Garage in system.
Location	Location	Describe all locations in system.
Nation	Nation	Describe all nations in system.
BookingReceipt	BookingReceipt	Describe all booking receipts in system.

Table 10: Class dictionary

4.2. Class Diagram Explanation

4.2.1. AspNetUser

Attribute	Type	Visibility	Description
<code>Id</code>	<code>String</code>	Private	Unique identifier of <code>AspNetUser</code> .
<code>Email</code>	<code>String</code>	Private	Email of user.
<code>EmailConfirmed</code>	<code>Boolean</code>	Private	Status indicating whether email has been confirmed.
<code>PasswordHash</code>	<code>String</code>	Private	Encoded password of user.
<code>SecurityStamp</code>	<code>String</code>	Private	Stamp used to authenticate user's cookies and session.
<code>PhoneNumber</code>	<code>String</code>	Private	Phone number of user.
<code>PhoneNumberConfirmed</code>	<code>Boolean</code>	Private	Status indicating whether phone number has been confirmed.
<code>TwoFactorEnabled</code>	<code>Boolean</code>	Private	Status indicating whether two-factor sign-in is enabled.
<code>LockoutEndDateUtc</code>	<code>Nullable<DateTime></code>	Private	Date until which this user is locked out if <code>lockoutEnable</code> is true.
<code>LockoutEnable</code>	<code>Boolean</code>	Private	Status indicating whether lockout is enabled.
<code>AccessFailedCount</code>	<code>Integer</code>	Private	Number of failed access for this account.
<code>UserName</code>	<code>String</code>	Private	Username
<code>FullName</code>	<code>String</code>	Private	Full name of user
<code>IsProviderUntil</code>	<code>Nullable<DateTime></code>	Private	Date until which this user has provider role.
<code>AvatarURL</code>	<code>String</code>	Private	URL of user's avatar

Table 11: `AspNetUser` class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 12: AspNetUser class – Methods

4.2.2. AspNetRole

Attribute	Type	Visibility	Description
Id	String	Private	Unique identifier of AspNetRole
Name	String	Private	Name of role

Table 13: AspNetRole class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 14: AspNetRole class - Methods

4.2.3. AspNetUserClaim

Attribute	Type	Visibility	Description
Id	Integer	Private	Unique identifier of claim
UserId	String	Private	ID of AspNetUser whom this claim belongs to
ClaimType	String	Private	Type of claim
ClaimValue	String	Private	Value of claim

Table 15: AspNetUserClaim class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 16: AspNetUserClaim class - Methods

4.2.4. AspNetUserLogin

Attribute	Type	Visibility	Description
LoginProvider	String	Private	Name of third-party login provider
ProviderKey	String	Private	Login key of user provided by third-party service
UserId	String	Private	ID of AspNetUser who can log in using this login

Table 17: AspNetUserLogin class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 18: AspNetUserLogin class - Methods

4.2.5. Vehicle

Attribute	Type	Visibility	Description
ID	String	Private	Unique identifier of vehicle
LicenseNumber	String	Private	License number of vehicle
Name	String	Private	Name of vehicle
ModelID	Integer	Private	Model of vehicle
Year	Integer	Private	Year in which this vehicle was produced
GarageID	Integer	Private	ID of Garage containing this vehicle
VehicleGroupID	Nullable<Integer>	Private	ID of VehicleGroup containing this vehicle
TransmissionType	Integer	Private	Transmission type of vehicle
TransmissionDetail	String	Private	Detailed description about transmission of vehicle
FuelType	Nullable<Integer>	Private	Fuel type of vehicle
Engine	String	Private	Description about engine of vehicle
Color	Integer	Private	Color of vehicle
Description	String	Private	Description about vehicle
NumOfComment	Integer	Private	Number of customer's feedback this vehicle has received
Star	Decimal	Private	Rating of vehicle
IsDeleted	Boolean	Private	Status indicating whether this vehicle was deleted

Table 19: Vehicle class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 20: Vehicle class - Methods

4.2.6. VehicleImage

Attribute	Type	Visibility	Description
ID	String	Private	Unique identifier of image returned by clouddinary
VehicleID	Integer	Private	ID of Vehicle which this image belongs to
URL	String	Private	URL of image

Table 21: VehicleImage class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 22: VehicleImage class - Methods

4.2.7. VehicleModel

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of vehicle model
Name	String	Private	Name of role
BrandID	Integer	Private	ID of Brand of this model
NumOfDoor	Integer	Private	Number of door on this vehicle
NumOfSeat	Integer	Private	Number of seat in this vehicle

Table 23: VehicleModel class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 24: VehicleModel class - Methods

4.2.8. VehicleBrand

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of vehicle brand
Name	String	Private	Name of brand

Table 25: VehicleBrand class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 26: VehicleBrand class - Methods

4.2.9. Category

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of category
Name	String	Private	Name of category

Table 27: VehicleBrand class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

*Table 28: VehicleBrand class - Methods***4.2.10. Garage**

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of garage
OwnerID	String	Private	ID of AspNetUser owing this garage
Name	String	Private	Name of garage
LocationID	Integer	Private	ID of Location of garage
Address	String	Private	Address of garage
Email	String	Private	Email of garage
Phone1	String	Private	Primary phone number of garage
Phone2	String	Private	Secondary phone number of garage
NumOfComment	Integer	Private	Number of customer's feedback this garage has received
Star	Decimal	Private	Rating of garage
Description	String	Private	Description of garage
Policy	String	Private	Policy of garage
IsActive	Boolean	Private	Status indicating whether this garage is active.
IsDeleted	Boolean	Private	Status indicating whether this garage was deleted.

Table 29: Garage class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 30: Garage class - Methods

4.2.11. GarageWorkingTime

Attribute	Type	Visibility	Description
GarageID	Integer	Private	ID of Garage which this working time constraint is applied to.
DayOfWeek	Integer	Private	Day of week which this working time constraint represents.
OpenTimeInMinute	Integer	Private	Opening time of this garage in this day of week.
CloseTimeInMinute	Integer	Private	Closing time of this garage in this day of week.

Table 31: GarageWorkingTime class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

*Table 32: GarageWorkingTime class - Methods***4.2.12. Location**

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of location.
Name	String	Private	Name of location.
NationID	Integer	Private	ID of Nation to which this location belongs.

Table 33: Location class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

*Table 34: Location class - Methods***4.2.13. Nation**

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of nation
Name	String	Private	Name of nation

Table 35: Nation class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 36: Nation class - Methods

4.2.14. VehicleGroup

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of vehicle group
OwnerID	String	Private	ID of AspNetUser whom this group belongs to
Name	String	Private	Name of group
IsActive	Boolean	Private	Status indicating whether this group is active
WithDriverPriceGroupID	Integer	Private	ID of default PriceGroup which is applied for driver-included rent.

Table 37: VehicleGroup class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 38: VehicleGroup class - Methods

4.2.15. PriceGroup

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of price group.
DepositPercentage	Decimal	Private	Percentage of total rental price which customer has to pay to provider when booking.
PerDayPrice	Double	Private	Pricing of daily rental.
MaxRentalPeriod	Nullable<Integer>	Private	Maximum days a rental can last.
MaxDistancePerDay	Nullable<Integer>	Private	Maximum km that customer can travel in 1 days without being charged extra fee with the rented vehicle.
ExtraChargePerKm	Nullable<Double>	Private	Extra fee for every 1 km outside allowed travel distance.

Table 39: PriceGroup class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 40: PriceGroup class - Methods

4.2.16. PriceGroupItem

Attribute	Type	Visibility	Description
PriceGroupID	Integer	Private	ID of PriceGroup to which this hourly rental option belongs.
MaxTime	Integer	Private	Rental duration of this rental option.
Price	Double	Private	Rental price of this rental option.
MaxDistance	Integer	Private	Maximum km that customer can travel without being charged extra fee with the rented vehicle using this rental option.

Table 41: PriceGroupItem class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 42: PriceGroupItem class - Methods

4.2.17. BookingReceipt

Attribute	Type	Visibility	Description
ID	Integer	Private	Unique identifier of receipt.
CustomerID	String	Private	ID of AspNetUser who is the customer of this receipt.
RentalPrice	Double	Private	Total rental price.
Deposit	Double	Private	Deposit paid by customer to provider when booking.
BookingFee	Double	Private	Fee paid by customer to system when booking.
Distance	Nullable<Integer>	Private	Maximum distance customer can travel without being charged extra fee with the rented vehicle.
Star	Nullable<Integer>	Private	Rating from customer for this rental period.
Comment	String	Private	Feedback from customer about this rental period.
BookingTime	DateTime	Private	Time when this booking is made.
StartTime	DateTime	Private	Time when rental period starts.
EndTime	DateTime	Private	Time when rental period ends.
GarageID	Integer	Private	ID of Garage to which this booking belongs.

GarageName	String	Private	Name of Garage at booking moment.
GarageAddress	String	Private	Address of Garage at booking moment.
GaragePhone	String	Private	Phone1 of Garage at booking moment.
GarageEmail	String	Private	Email of Garage at booking moment.
VehicleID	Integer	Private	ID of booked Vehicle.
LicenseNumber	String	Private	License number of Vehicle at booking moment.
VehicleName	String	Private	Name of Vehicle at booking moment.
TransmissionDetail	String	Private	TransmissionDetail of Vehicle at booking moment.
Engine	String	Private	Engine of Vehicle at booking moment.
Color	Integer	Private	Color of Vehicle at booking moment.
IsCanceled	Boolean	Private	Status indicating whether this booking has been canceled.
IsPending	Boolean	Private	Status indicating whether this booking has not been paid.

Table 43: BookingReceipt class - Attributes

Method	Return type	Visibility	Description
Getter	Attribute type	Public	Get value of attribute
Setter	Void	Public	Set value of attribute

Table 44: BookingReceipt class - Methods

4.3. Interactive Diagram

4.3.1. Common

4.3.1.1. Search vehicle

Summary: This diagram illustrates the process of searching vehicle

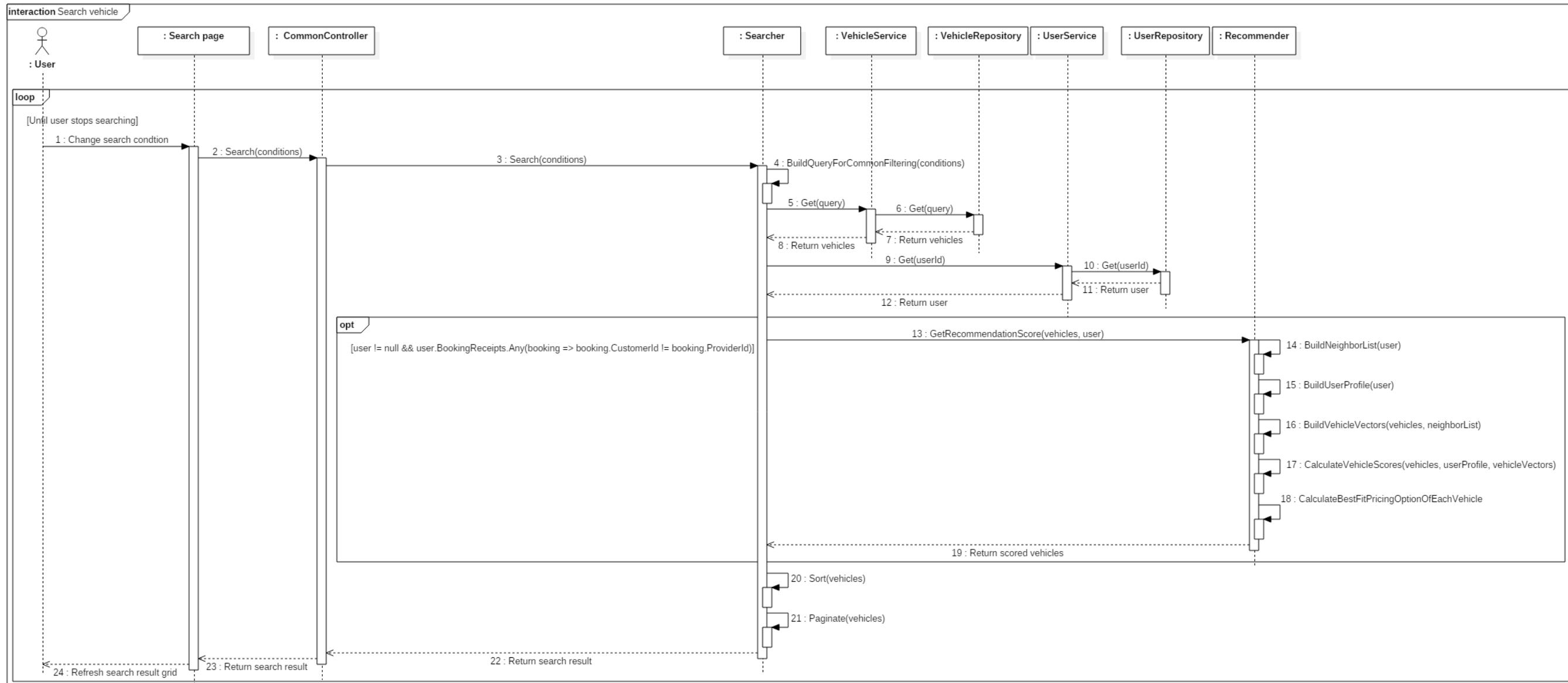


Figure 27: Search vehicle sequence

4.3.1.2. Register/extend providership

Summary: This diagram illustrates the process of registering providership of customer or extending providership of provider.

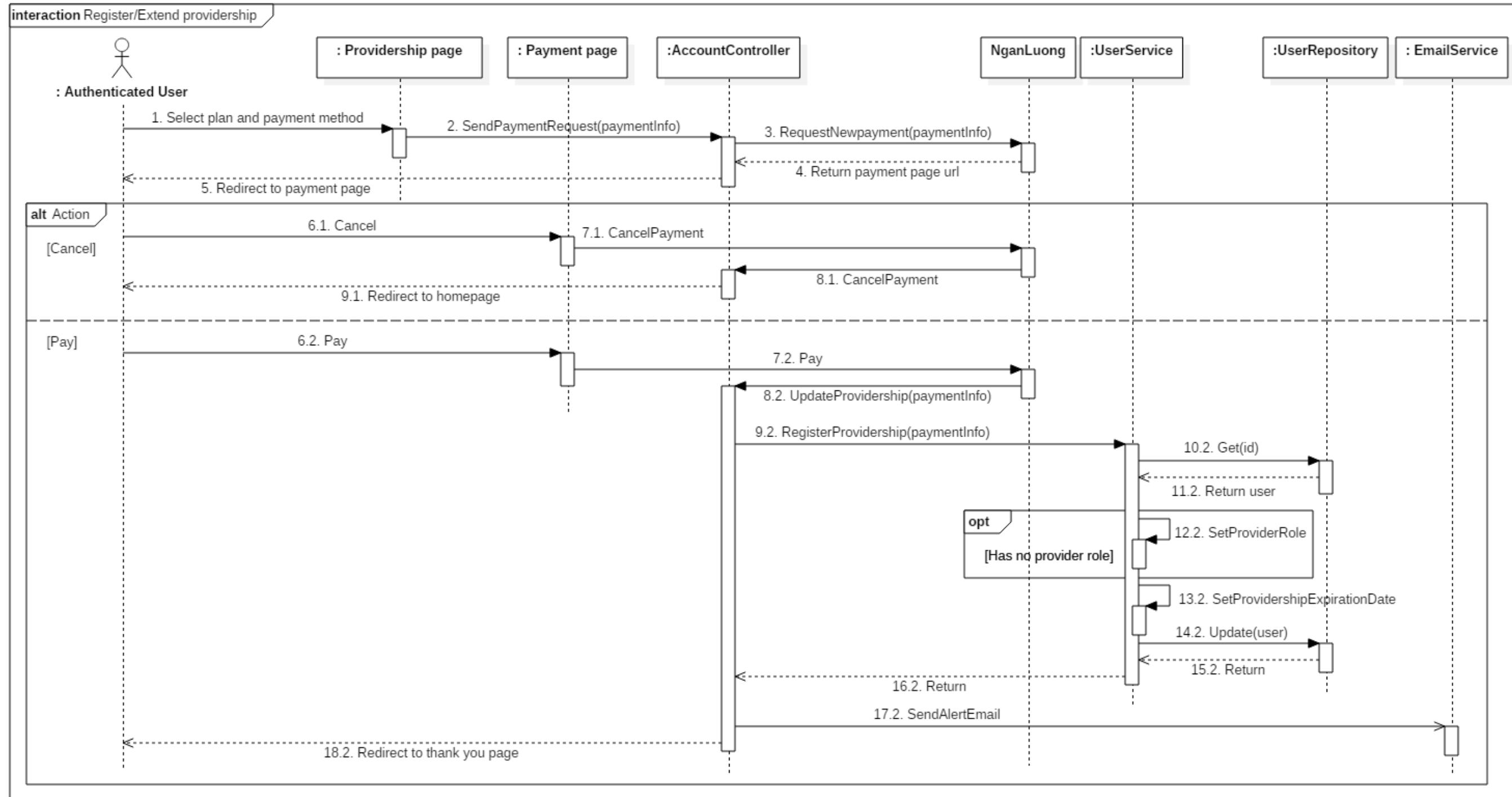


Figure 28: Register/extend providership sequence

4.3.2. Customer

4.3.2.1. Book vehicle

Summary: This diagram illustrates the process allowing customer to book a vehicle.

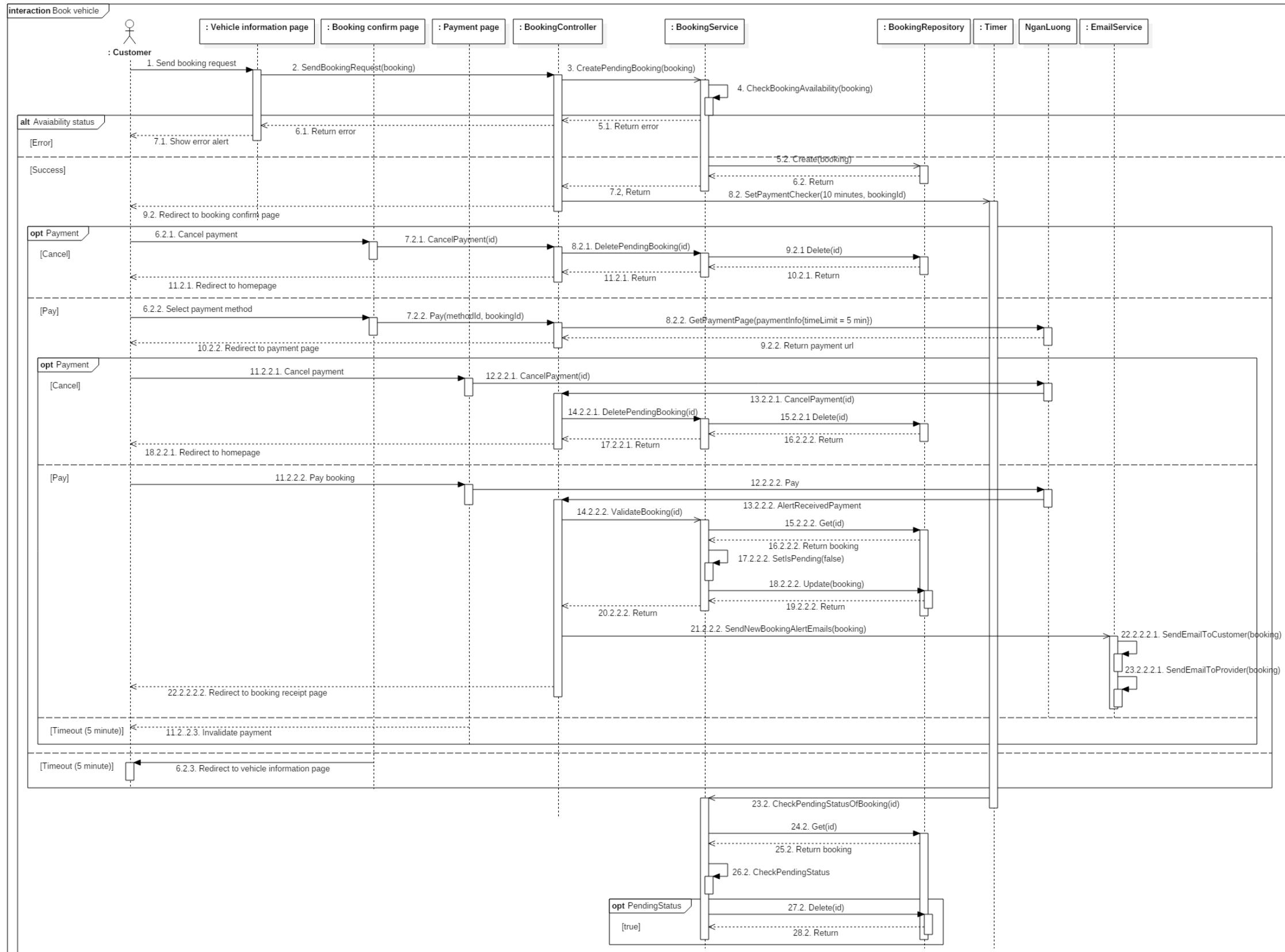


Figure 29: Book vehicle sequence

4.3.2.2. Comment and rate booking

Summary: This diagram illustrates the process allowing customer to comment and rate about their rental experience.

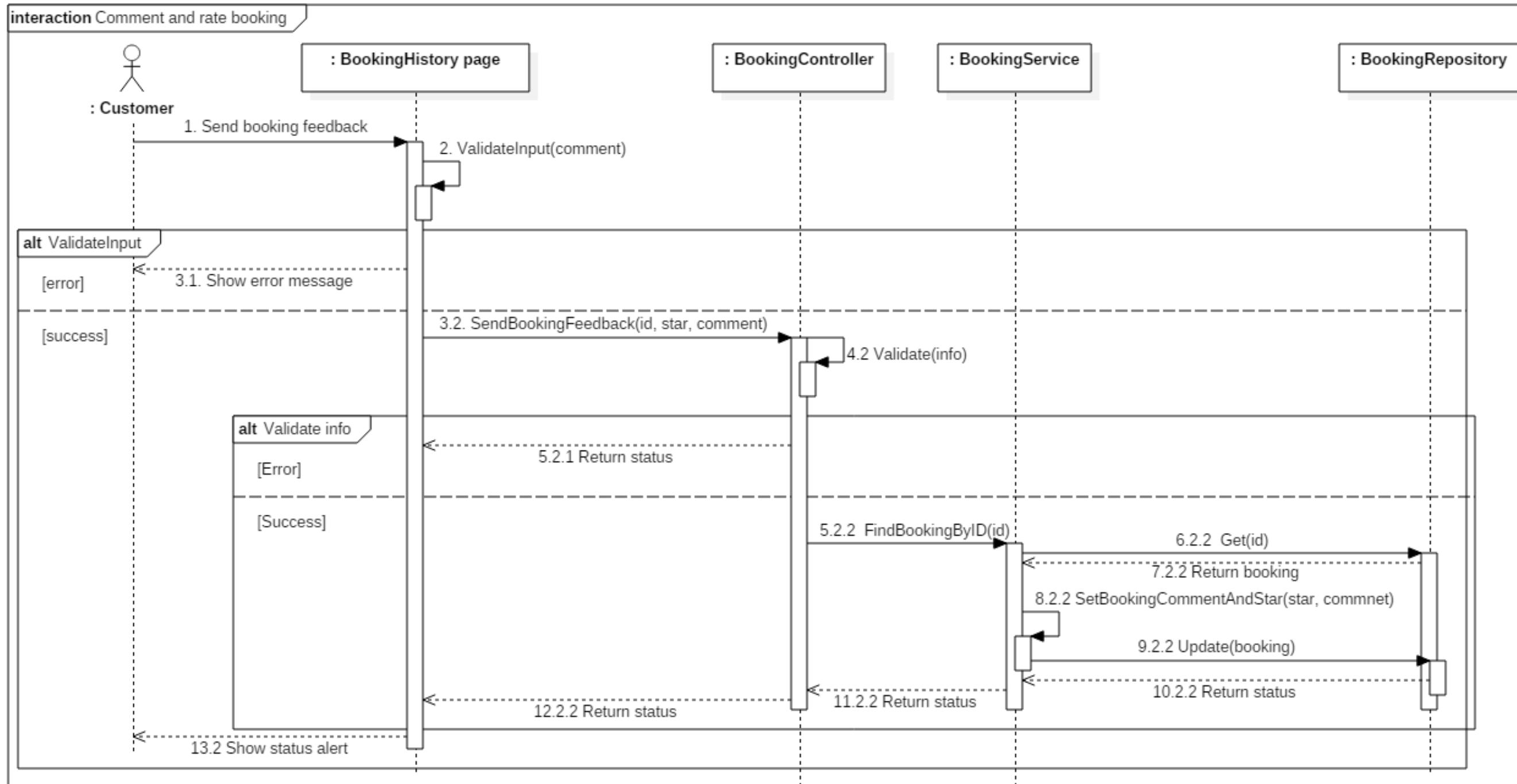


Figure 30: Comment and rate booking sequence

4.3.2.3. Cancel booking

Summary: This diagram illustrates the process allowing customer to cancel a booking.

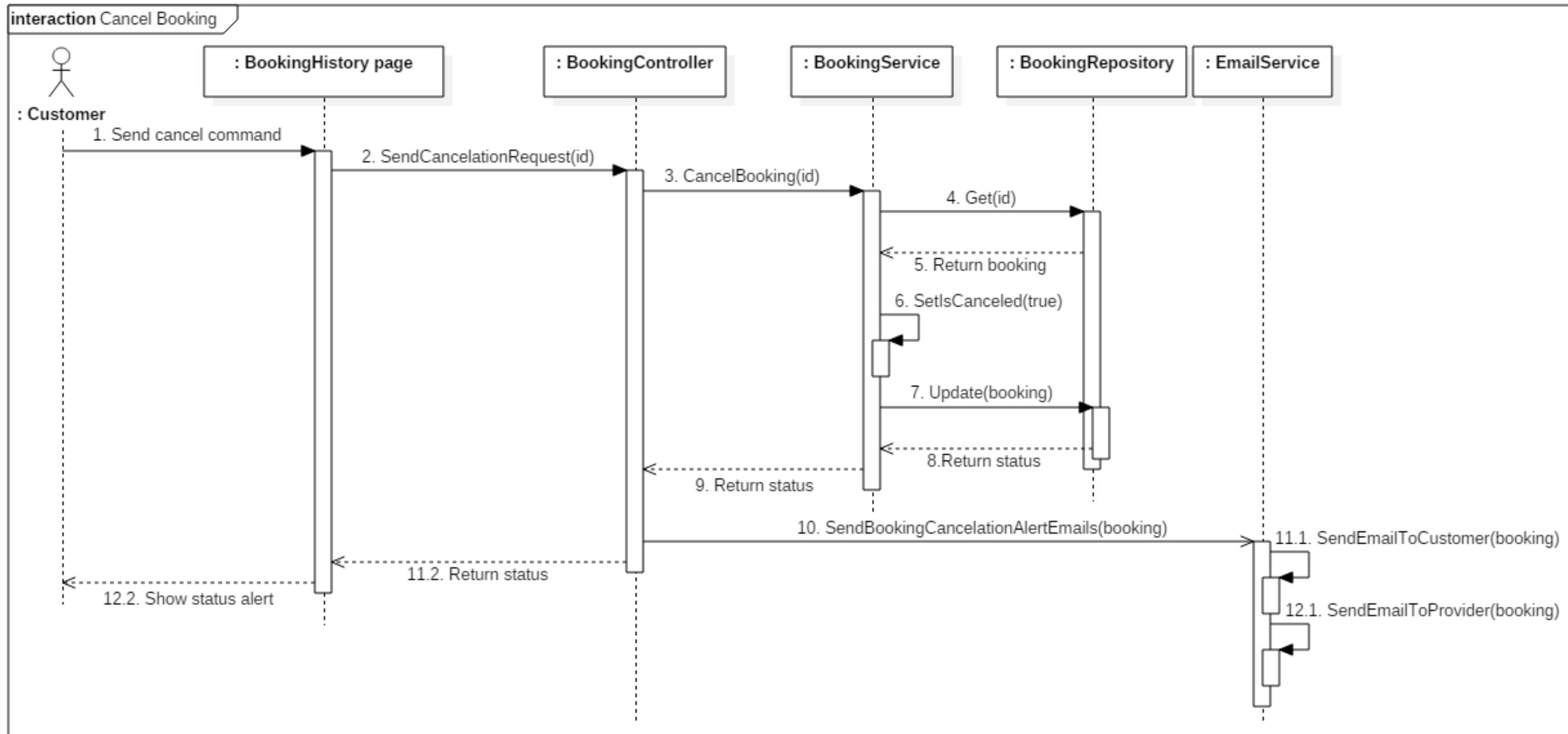


Figure 31: Cancel booking sequence

4.3.3. Provider

4.3.3.1. Create vehicle

Summary: This diagram illustrates the process allowing provider to create a new vehicle.

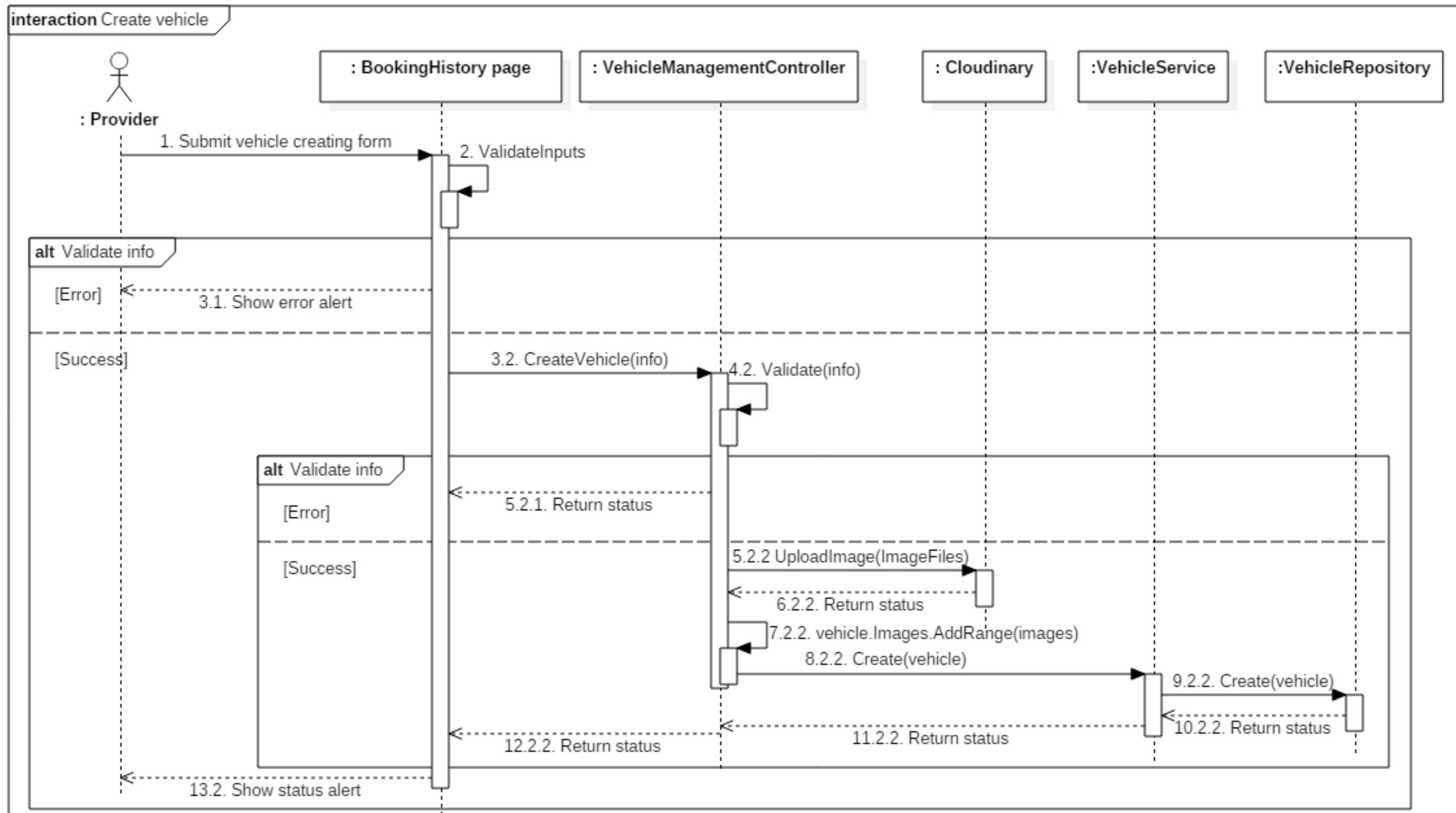


Figure 32: Create vehicle sequence

4.3.3.2. Edit vehicle

Summary: This diagram illustrates the process allowing provider to edit a vehicle.

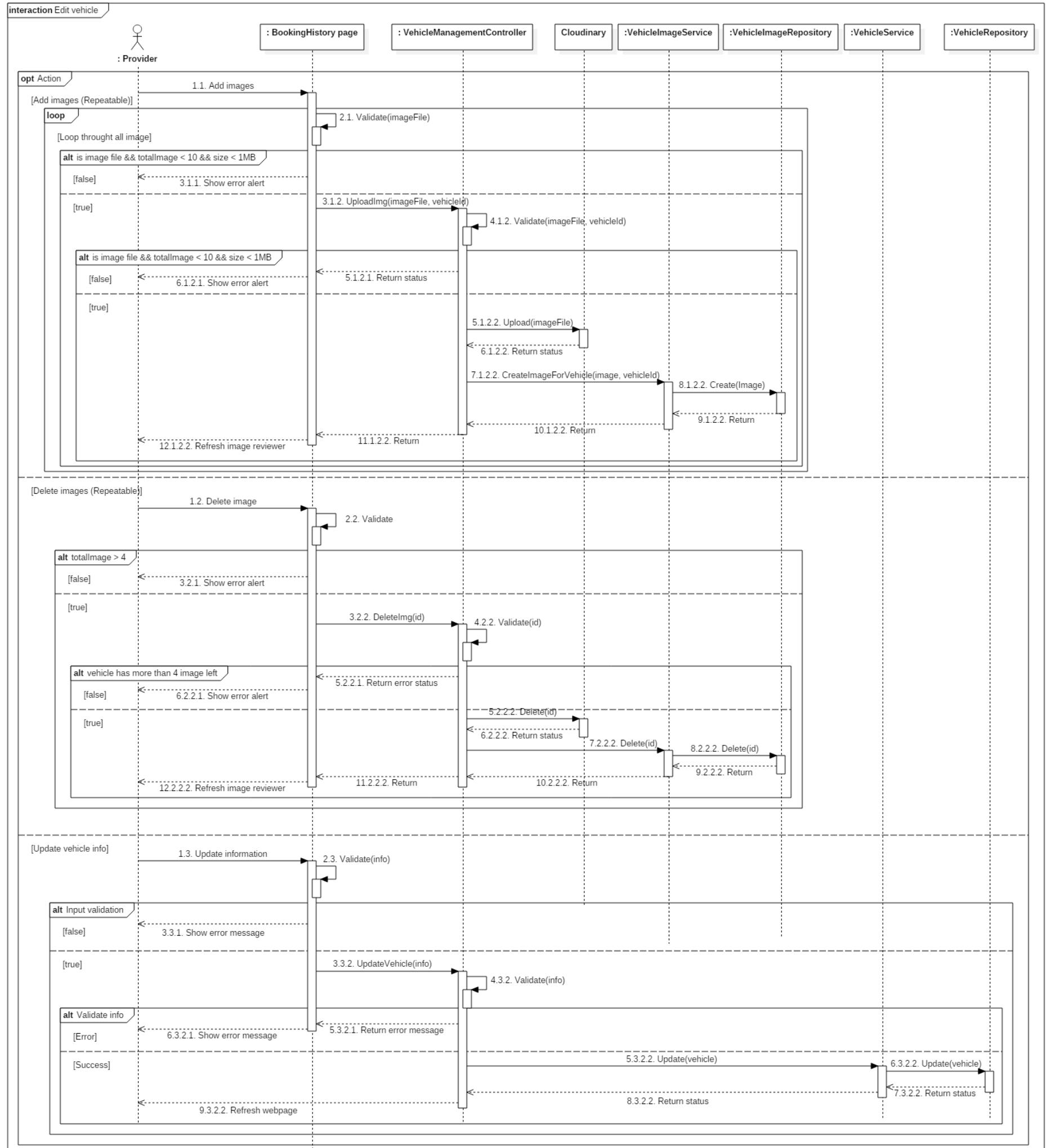


Figure 33: Edit vehicle sequence

4.3.3.3. Create garage

Summary: This diagram illustrates the process allowing provider to create a new garage.

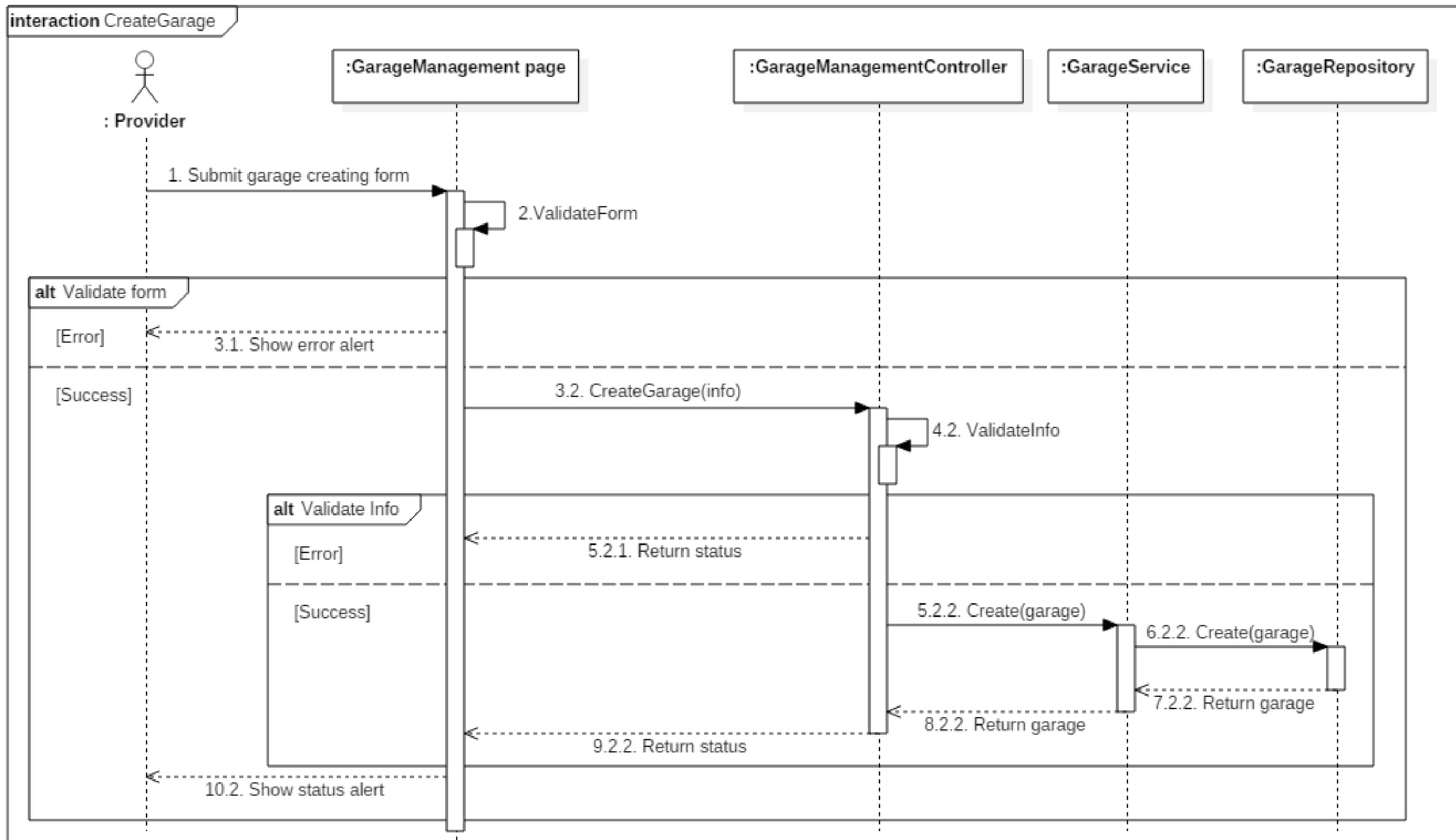


Figure 34: Create garage sequence

4.3.3.4. Edit garage

Summary: This diagram illustrates the process allowing customer to edit a garage.

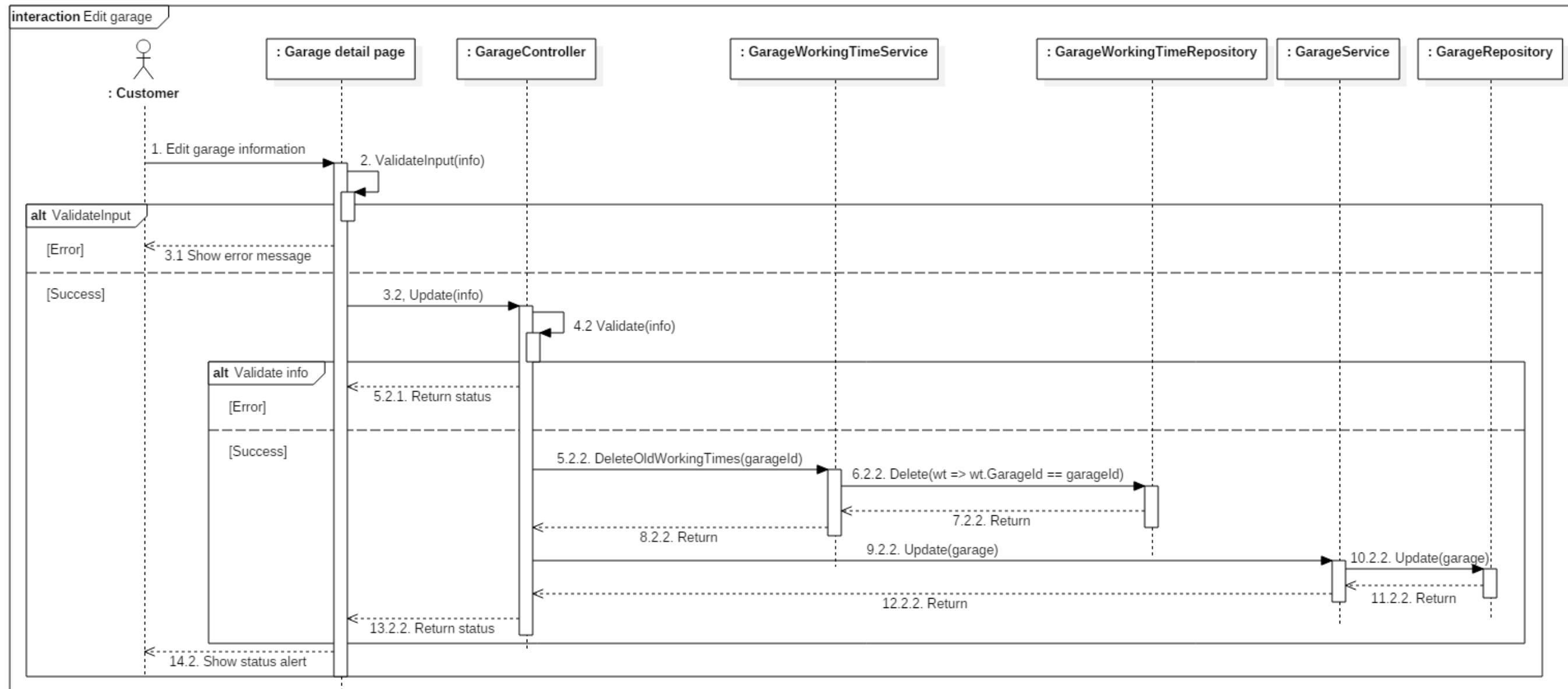


Figure 35: Edit garage

4.3.3.5. Create vehicle group

Summary: This diagram illustrates the process allowing provider to create a new vehicle group.

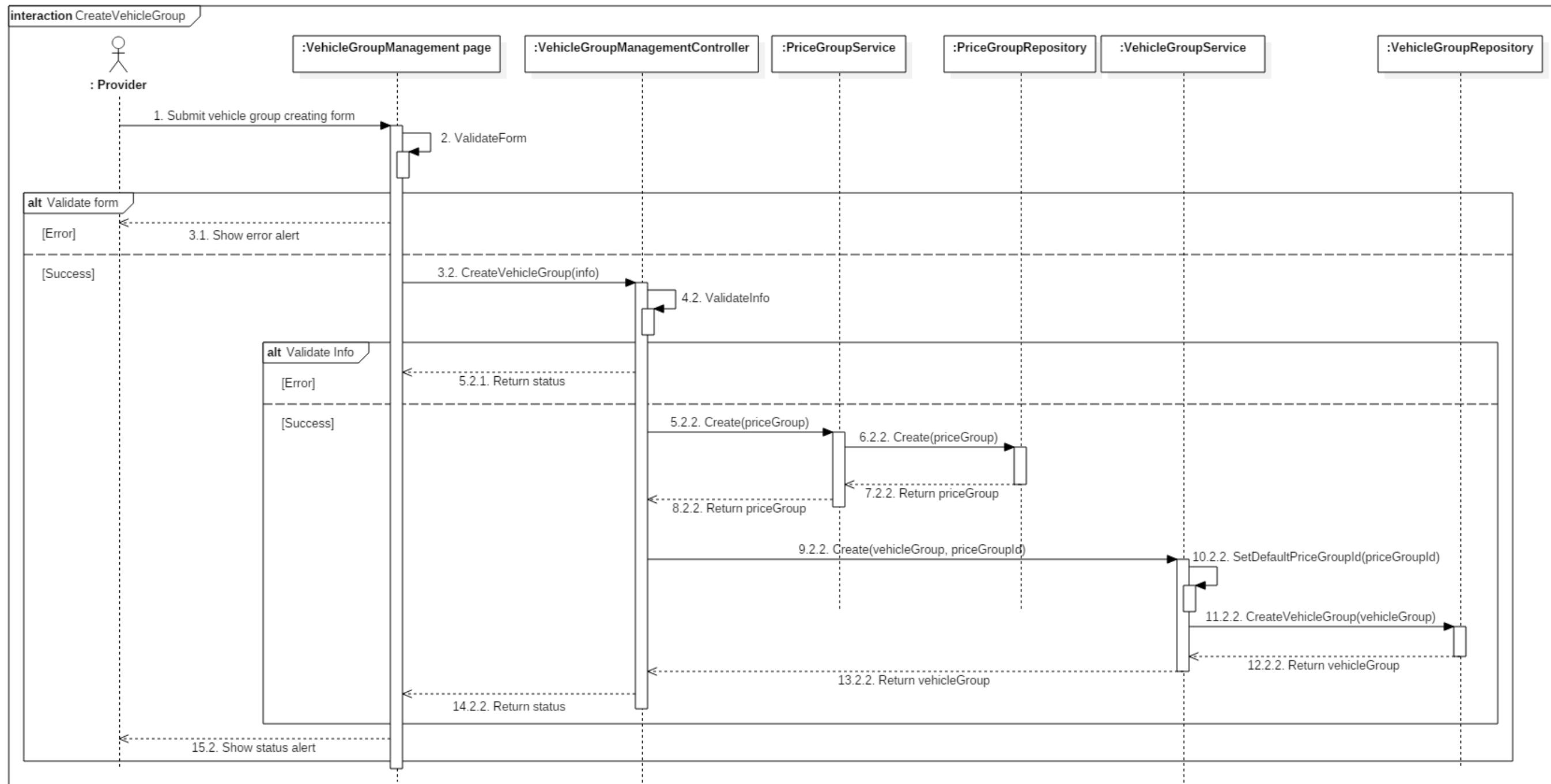


Figure 36: Create vehicle group sequence

4.3.3.6. Edit vehicle group

Summary: This diagram illustrates the process allowing provider to edit a vehicle group.

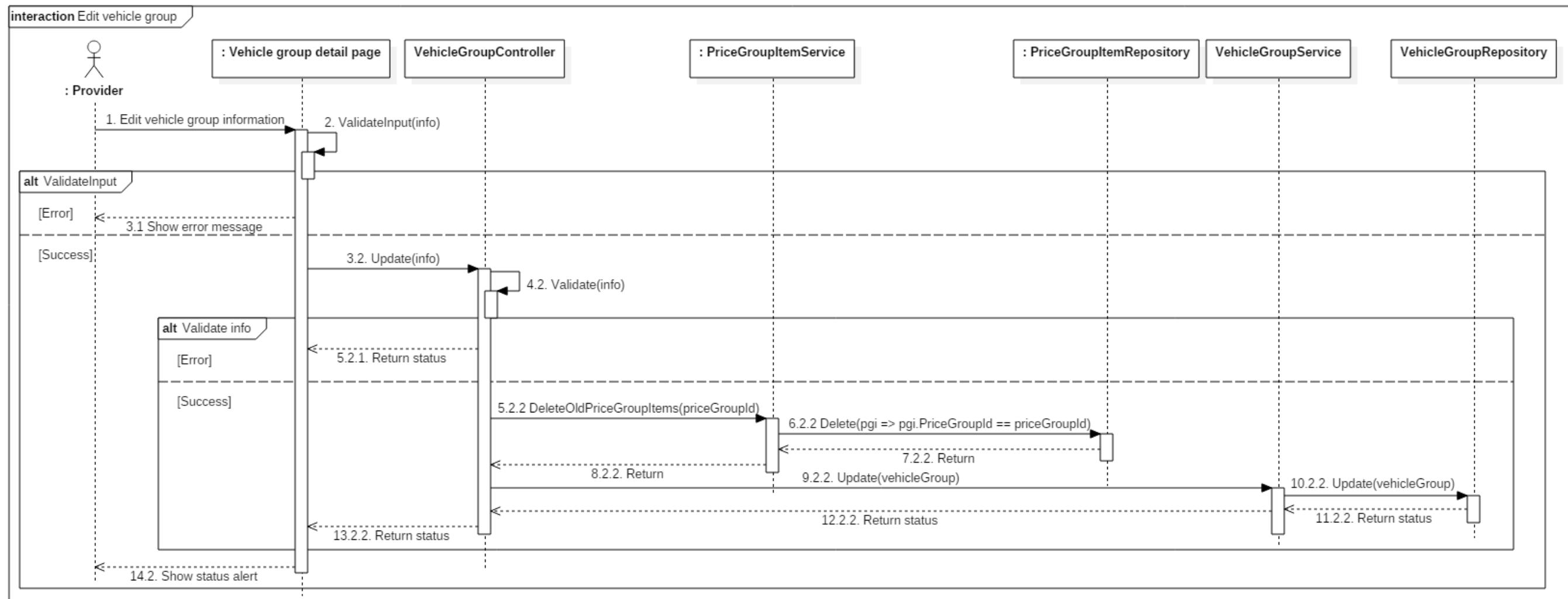


Figure 37: Edit vehicle group

4.3.4. System

4.3.4.1. Check providership expiration

Summary: This diagram illustrates the process allowing the system to warn provider about their almost expired providership and to expire their providership.

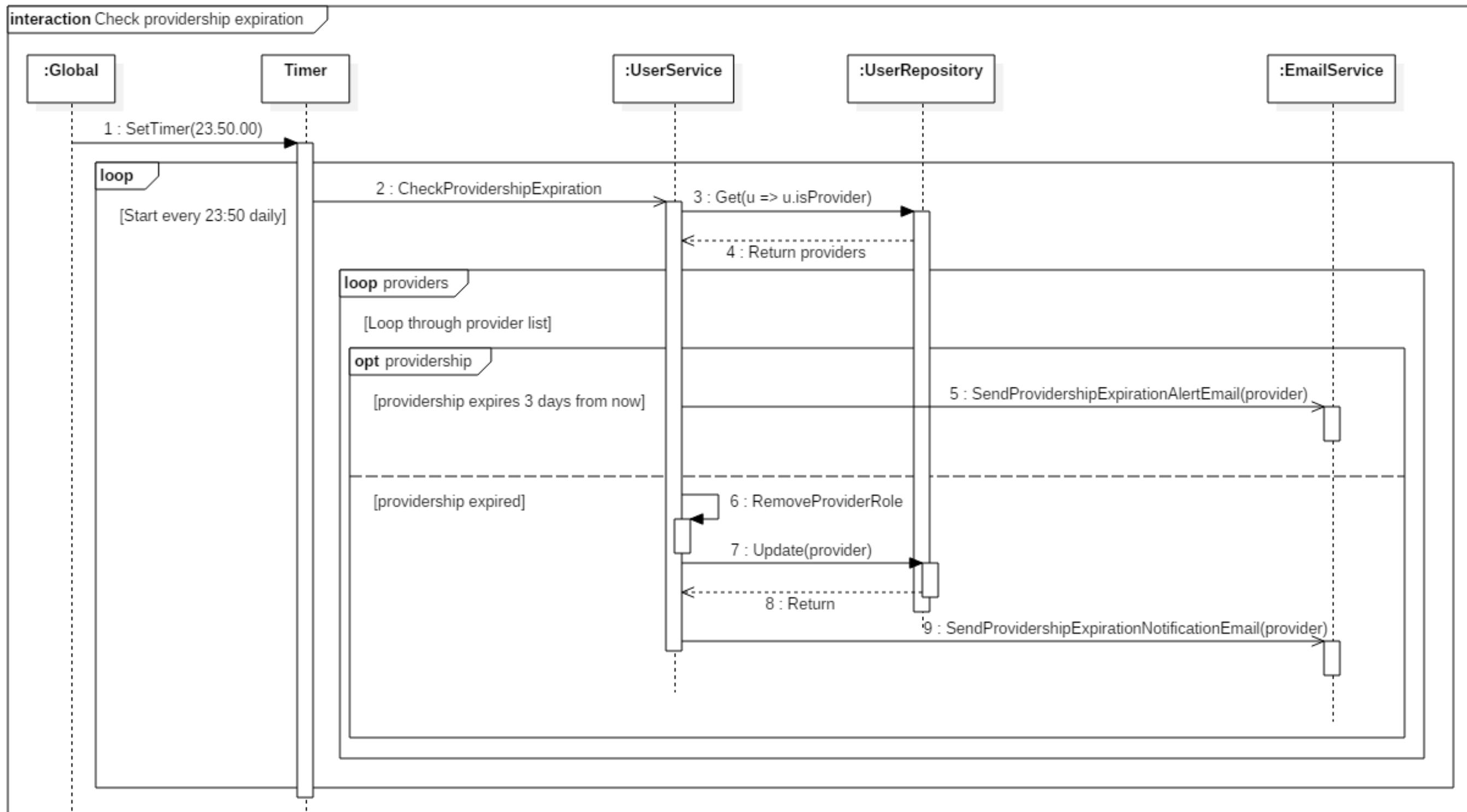


Figure 38: Check providership expiration sequence

5. User Interface Design

5.1. Login page <Excluded>

5.2. Home page <Excluded>

5.3. Advanced search page

The screenshot shows the 'Advanced search page' UI design. At the top, there are three buttons: 'Đăng ký' (2) and 'Đăng nhập' (3) on the right, and a placeholder 'CRP 1' on the left. Below these are three input fields: 'Địa điểm' (4) with a dropdown menu, 'Thời gian đi' (5) with a date/time picker showing '2016/11/17 13:41', and 'Thời gian về' (6) with a date/time picker showing '2016/11/18 13:41'. The main search area has a green header 'Xóa bộ lọc' (7). It contains a checkbox group for 'số chỗ ngồi' (8) with options 2, 5, and 8 checked, and 4, 6, and 7 uncheckable. Below is a price range selector for 'Mức giá' (9, 10) from 1,000,000đ/4 giờ to 9,000,000đ/12 giờ, with a midpoint of 4,000,000đ/ngày. A sorting dropdown 'Sắp xếp theo' (11) is followed by a dropdown for 'Gói thời gian thuê xe phù hợp nhất'. At the bottom are two green buttons: 'Lọc chỉ hiển thị xe vắng' (12) and 'Lọc theo đánh giá' (13). To the right, a vehicle listing for a 'Toyota Innova Crysta 2.4 Z (2015)' (14) is shown with a license plate 'Lê Biên Hà Nội' (15), a price of '4,000,000đ/ngày' (16), and a 4-star rating with 1 review.

Figure 39 : Advanced search page UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
4	location	Choose rent location	Yes	No	Dropdownlist	String
5	startTime	Choose start rent time	Yes	No	DateTimePicker	String
6	endTime	Choose end rent time	Yes	No	DateTimePicker	String
8	Seats	Choose how many seats for wanted vehicle	Yes	No	Combobox	String
9	leftSlider	Pull to higher the min price for search	Yes	No	Slider	String
10	rightSlider	Pull to lower the max price for search	Yes	No	Slider	String

11	Sort	Choose ways to show result	Yes	No	Dropdownlist	String
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Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
1	logoButton	Clicks to go to homepage	N/A	Homepage
2	signUp	Clicks to sign up	N/A	Register page
3	logIn	Clicks to login	N/A	Login page
7	resetFilters	Clicks to reset filters	N/A	Clear all input user did
12	additionFilter	Clicks to show more addition search	N/A	Show search by brand, year, transaction type, fuel type, vehicle type, color
13	ratingFilter	Clicks to show search by rating of vehicle and garage	N/A	Show search by rating of vehicle and garage
14	leftArrow	Clicks to show image on the left side	N/A	Show image on the left side
15	rightArrow	Clicks to show image on the right side	N/A	Show image on the right side
16	vehicleName	Clicks to show vehicle information and booking	N/A	Show vehicle info page

5.4. Vehicle Information page

The screenshot displays the 'Vehicle Information' page of a car rental portal. At the top, there are tabs: 'Thông tin xe' (selected), 'Đánh giá' (Reviews), 'Cửa hàng' (Branches), and 'Lịch đặt xe' (Booking History). Below the tabs, a large image of a dark blue Audi A6 Avant hybrid (2015) is shown, with a red box highlighting the side profile of the car.

Vehicle Details:

- Audi A6 Avant hybrid (2015)**
- ★★★★☆ - 1 đánh giá
- Cửa hàng Lê Biên Hồ Chí Minh
- ⋮ Hồ Chí Minh

Rental Rates:

4,000,000đ/ngày

Booking Options:

Gói thời gian thuê	Thuê theo ngày	6
Số ngày thuê	7	1
Thời gian nhận xe	2016/11/18 14:51	8
Phi thuê xe	4,000,000đ	
Đặt cọc	800,000đ	
Phi dịch vụ	40,000đ	
Tổng phí phải trả trước	840,000đ	
Quãng đường	300 km	

Buttons:

- Đặt xe (Book Now) - highlighted in green
- 9 (likely a placeholder for a date or step number)

Le Biên Hồ Chí Minh Branch Information:

Thông tin liên lạc: Địa chỉ: 23 CMT8, quán 10, Hồ Chí Minh
Liên lạc: Nhấn vào để lấy thông tin liên lạc. 10

Working Hours:

Thứ	Thứ 2	Thứ 3	Thứ 4	Thứ 5	Thứ 6	Thứ 7	Chủ nhật
	00:00 đến 24:00						

Booking History:

Lịch đặt xe

Có thẻ đặt: Có đặt trước:
Không thẻ đặt: Không làm việc:

Tháng 11 2016

11	Tháng	Tuần	12	Hôm nay	<	>
T2	T3	T4	T5	T6	T7	CN
31	1	2	3	4	5	
7	8	9	10	11	12	1
14	15	16	17	18	19	2
21	22	23	24	25	26	2
28	29	30	1	2	3	
5	6	7	8	9	10	1

Figure 40 : Vehicle information page UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
6	Type rent vehicle	Choose type rent vehicle, such as day or hour	Yes	Yes	Drop down list	String
7	Number day/hour for rent	Input time will rent vehicle	No	Yes	Text box	Number
8	Date will pick up vehicle	Input date and time will pick up vehicle	No	Yes	Text Box	Date time

Buttons/Hyperlinks:

No	Function	Description	Validation	Outcome
1	Moving main screen view to information of vehicle area	Main screen view switch to information of vehicle area.	N/A	Main screen view switch to information of vehicle area.
2	Moving main screen view to comment area	Main screen view to comment area.	N/A	Main screen view to comment area.
3	Moving main screen view to garage area	Main screen view to garage area.	N/A	Main screen view to garage area.
4	Moving main screen view to booking history area	Main screen view to booking history area.	N/A	Main screen view to booking history area.
5	View images of vehicle	View all images of vehicle	N/A	Show all images of vehicle
9	Booking request command	Send booking information to controller	N/A	Redirect to booking confirm page.
10	Show information of garage in detail	Show information of garage	N/A	Show pop up information of garage
11	Filter calendar view with month	Calendar of booking will represented by month	N/A	Calendar of booking will represented by month
12	Filter calendar view with week	Calendar of booking will represented by week	N/A	Calendar of booking will represented by week
9	Show Previous data of Calendar	Show previous data of calendar	N/A	Show previous data of calendar
11	Show Next data of Calendar	Show next data of calendar record of table	N/A	Show next data of calendar

5.5. Booking confirmation page

The screenshot displays the booking confirmation page with several key sections:

- Header:** CRP 2 (2) and Xin chào, customer! (3) with a Logout button (4).
- Vehicle Information:** Toyota Tundra CrewMax (Thông tin xe và cửa hàng 1). Includes a photo of the truck, model year (2014), engine type (Dầu Diesel), seats (4), and doors (4).
- Rental Information:** Thông tin đặt xe (Thống tin đặt xe 2). Shows rental period (From: 20/11/2016 14:14, To: 27/11/2016 11:11), distance (Quãng đường: 300 km), and costs (Phi thuê xe: 4,000,000đ, Phi dịch vụ: 40,000đ, Phi phải thanh toán: 840,000đ).
- Contact Information:** Thông tin cửa hàng: Lê Biên Hà Nội (Thống tin cửa hàng 3). Includes phone (0913337777), email (lebienservicehn@gmail.com), and address (112 Pasteur, quận Cầu Giấy, Hà Nội).
- Payment Methods:** Phương thức thanh toán (Phương thức thanh toán 4). Options include online banking (Thanh toán online bằng thẻ ngân hàng nội địa 5), ATM withdrawal (Thanh toán bằng thẻ tín dụng / ghi nợ 6), and mobile banking (Thanh toán bằng Ví điện tử NgânLượng 7). A note (Lưu ý) states that users can register for Internet Banking or make payments directly at the bank branch before the scheduled time.
- Bank Logos:** A large red-bordered area displays logos of various Vietnamese banks: Vietcombank, DongA Bank, Techcombank, MB, SHB, VIB, VietinBank, Eximbank, ACB, HDBank, Maritime Bank, NCB, Ngân hàng Việt Á, VPBank, Sacombank, OceanBank, PG Bank, GPBank, Agribank, SaigonBank, Nam A Bank, and BAC A Bank (8).
- Buttons:** Thanh toán (9) and Hủy đơn hàng (10).

Figure 41 : Booking confirmation page UI design

Fields

No.	Field name	Description	Read only	Mandatory	Control type	Data type	Length
8	Name of Bank	Allow user choose bank which want to payment.	No	Yes	Radio button group	String	N/A

Buttons/Hyperlinks

No.	Function	Description	Validation	Outcome
1	Change booking's information	Click “Thay đổi” button to back vehicle's information.	N/A	Redirect to view vehicle's information page.
2	Redirect to homepage	Click “CRP” icon to redirect to homepage.	N/A	Redirect to homepage.
3	Redirect to manager personal information	Click “Xin chào” to come manage personal information	N/A	Redirect to manage personal information page.

4	Log out	Click “Đăng xuất” button to delete session and redirect to homepage.	N/A	Delete session then redirect to homepage.
5	Online payment type	Choose radio button belong to online payment.	N/A	Show banks for online payment.
6	Credit card payment type	Choose radio button belong to credit card payment.	N/A	Show banks for credit card payment.
7	Digital wallet payment type	Choose radio button belong to digital wallet payment.	N/A	Show banks for credit digital wallet payment.
9	Pay	Click “Pay” to redirect “Ngân lượng” page.	N/A	Redirect to “Ngân lượng” website.
10	Cancel payment	Click “Hủy đơn hàng” to cancel payment.	N/A	Redirect to “Homepage”.

5.6. Booking history page

Lịch sử đặt xe

Lịch sử đặt xe						
Tên xe	Cửa hàng	Bắt đầu	Kết thúc	Tình trạng	Thao tác	
Toyota Camry SE	Lê Biển Hà Nội	T4, 09/11/2016, 21:22	T5, 10/11/2016, 21:22	Đã hủy	Thao tác	3
Toyota Camry SE	Lê Biển Hà Nội	T3, 08/11/2016, 21:22	T4, 09/11/2016, 21:22	Đã hủy	Thao tác	4
Toyota Camry SE	Lê Biển Hà Nội	T2, 07/11/2016, 21:22	T3, 08/11/2016, 21:22	Đã kết thúc	Thao tác	5
Toyota Camry SE	Lê Biển Hà Nội	CN, 09/11/2016, 21:22	T2, 07/11/2016, 21:22	Đã kết thúc	Thao tác	6
Toyota Camry SE	Lê Biển Hà Nội	T7, 09/11/2016, 21:22	CN, 09/11/2016, 21:22	Đã kết thúc	Thao tác	
Toyota Camry SE	Lê Biển Hà Nội	T6, 04/11/2016, 21:22	T7, 05/11/2016, 21:22	Đã kết thúc	Thao tác	
Toyota Camry SE	Lê Biển Hà Nội	T5, 03/11/2016, 21:22	T6, 04/11/2016, 21:22	Đã kết thúc	Thao tác	
Toyota Camry SE	Lê Biển Hà Nội	T4, 02/11/2016, 21:52	T5, 03/11/2016, 21:52	Đã kết thúc	Thao tác	
Toyota Camry SE	Lê Biển Hà Nội	T4, 02/11/2016, 21:22	T5, 03/11/2016, 21:22	Đã kết thúc	Thao tác	
Toyota Camry SE	Lê Biển Hà Nội	T3, 01/11/2016, 21:22	T4, 02/11/2016, 21:22	Đã kết thúc	Thao tác	

Figure 42 : Booking history page UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	numberOfDataShow	List of how many result user want to see in table	No	No	Dropdownlist	Integer

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome

2	linkToVehicleDetail	Go to vehicle detail page	N/A	Go to vehicle detail page
3	showOptionUserCanDoToVehicle	Show option user can choose: detail information, rating, cancel booking	User can't rate rated vehicle or cancel book ended booking	Show option user can choose: detail information, rating, cancel booking
4	previousButton	Show previous data page	N/A	Show previous data page
5	numberPage	Clicks to show data in choose page	N/A	Show data in choose page
6	nextButton	Show next page	N/A	Show next data page

5.6.1. Booking receipt's details popup <Excluded>

5.6.2. Feedback popup <Excluded>

5.7. Become provider page

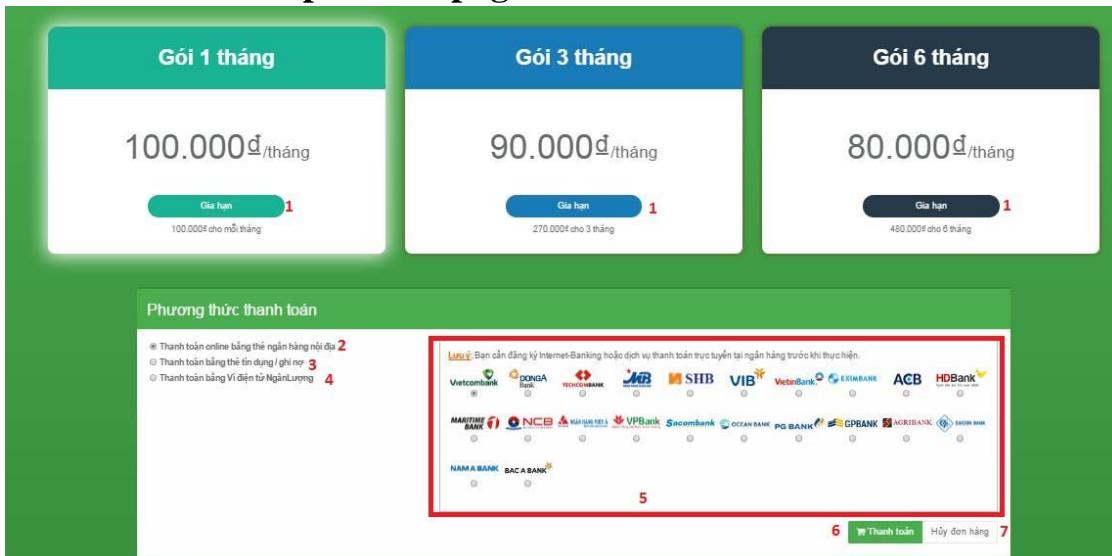


Figure 43 : Become provider page UI design

Fields

No.	Field name	Description	Read only	Mandatory	Control type	Data type	Length
5	Name of Bank	Allow user choose bank which want to payment.	No	Yes	Area radio button	String	N/A

Buttons/Hyperlinks

No.	Function	Description	Validation	Outcome
1	Choose type price which want to payment	Show payment methods pop up if click any “Gia hạn” button.	N/A	Show payment methods pop up.
2	Online payment type	Choose radio button belong to online payment.	N/A	Show banks for online payment.
3	Credit card payment type	Choose radio button belong to credit card payment.	N/A	Show banks for credit card payment.
4	Digital wallet payment type	Choose radio button belong to digital wallet payment.	N/A	Show banks for credit digital wallet payment.
6	Pay	Click “Pay” to redirect “Ngân lượng” page.	N/A	Redirect to “Ngân lượng” website.
7	Cancel payment	Click “Hủy đơn hàng” to cancel payment.	N/A	Redirect to “Homepage”.

5.8. Manage vehicle page

Quản lý xe

Tên	Biển số	Nhóm	Năm	Số chỗ	Đánh giá	Thao tác
BMW X1 6	FWR-52214	High-range	2016	7	★★★★★ (4.1)	<button>Thêm xe tương tự</button> <button>Xóa</button>
BMW X3 xDrive 35d	FWR-67214	High-range	2014	5	★★★★☆ (3.2)	<button>Thêm xe tương tự</button> <button>Xóa</button>
BMW X6	FWR-22110	High-range	2016	5	★★★★★ (4.5)	<button>Thêm xe tương tự</button> <button>Xóa</button>
Porsche Cayenne S	PPP-219391	Mid-range	2014	7	★★★★★ (4.1)	<button>Thêm xe tương tự</button> <button>Xóa</button>

Đang hiển thị 1 đến 4 trên tổng cộng 4 dòng

Trang trước **1** Trang sau
9 10 11

Figure 44 : Manage vehicle page UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	Garage name	Filter vehicle belong to garage	Yes	No	Dropdown	String
2	Number record in data table	Filter number record be showed in data table	Yes	No	Dropdown	Number

5	Key search	Filter vehicle belong to key word	No	No	Text Box	String
6	Specific Record Content	Contain all fields of specific record	Yes	No	Text Box	String
10	Current Page Of Table	Current page of table	Yes	No	Text Box	String

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
2	Move vehicles to another group or garage.	Show pop up for move vehicles to another.	N/A	Show pop up with 2 action is move to another group or garage.
3	Create new vehicle	Show pop up for require fields to create a new vehicle	N/A	Show require input field to create a new vehicle.
6	View detail vehicle's information	Redirect vehicle detail page	N/A	Show information of vehicle.
7	Duplicate vehicle	Create new vehicle with same information.	N/A	Create new vehicle faster
8	Delete vehicle	Delete vehicle	N/A	Show pop up confirm then delete vehicle
9	Show Previous Record Of Table	Show previous record of table	N/A	Show previous record of table
11	Show Next Record Of Table	Show next record of table	N/A	Show next record of table

5.8.1. Create new vehicle popup

The screenshot shows a 'Create new vehicle' (Tạo xe mới) form. The fields and their corresponding numbers are:

- Tên xe* (1)
- Dòng xe* (2)
- Garage* (3)
- Biển số xe* (4)
- Năm sản xuất* (5)
- Nhóm xe (6)
- Loại hộp số* (7)
- Loại nhiên liệu (10)
- Đặc tả động cơ (8)
- Màu xe* (11)
- Mô tả xe (12)
- Hình ảnh* (13)
- Buttons: Thoát (14), OK (15)

Figure 45 : Create new vehicle popup UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	Vehicle name	Allow user input name of vehicle	No	Yes	Tex box	String
2	Model of vehicle	Allow user choose model of car.	No	Yes	Dropdown	String
3	Garage of vehicle	Allow user choose garage of vehicle	No	Yes	Dropdown	String

4	License number of vehicle	Input license number of vehicle	No	Yes	Text Box	String
5	Year produced of vehicle	Input year of vehicle	No	Yes	Text Box	Number
6	Vehicle group	Choose vehicle group	Yes	No	Drop down	String
7	Transition type detail	Input transition type detail	No	No	Text box	String
8	Engine detail	Input engine detail	No	No	Text box	String
9	Transition type	Choose transition type	Yes	Yes	Radio button	String
10	Fuel type	Choose fuel type	Yes	Yes	Drop down	String
11	Color	Choose color of vehicle	Yes	Yes	Radio button	String
12	Description	Input description for vehicle	No	No	Text area	String
13	Images	Input images of vehicle	Yes	Yes	Dropzone	File

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
14	Cancel create new vehicle	Close pop up and cancel command	N/A	Pop up will be hided.
15	OK	Send command create new vehicle to controller	N/A	Create a new vehicle

5.9. Vehicle detail page

Thông tin xe

Toyota Fortuner

Biển số xe	FFF-95214
Dòng xe	Toyota Fortuner
Năm sản xuất	2016
Garage	Lê Biên Hà Nội
Nhóm xe	High-range
Loại hộp số	Số tự động
Loại nhiên liệu	Dầu Diesel
Màu xe	●



Mô tả Chưa có mô tả

3 Xóa xe 4 Chỉnh sửa thông tin

Figure 46 : Vehicle detail page UI design

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
1	leftArrow	Clicks to show image on the left side	N/A	Show image on the left side
2	rightArrow	Clicks to show image on the right side	N/A	Show image on the right side
3	deleteVehicle	Clicks to delete vehicle	N/A	Show delete vehicle confirm popup
4	editVehicleInfo	Clicks to edit vehicle information	N/A	Show edit field top edit.

5.9.1. Edit vehicle information

The screenshot displays the 'Edit vehicle information' interface. At the top, there's a header with a logo and the text 'Toyota Fortuner'. Below the header, there are several input fields and a preview area:

- Biển số xe:** FFF-95214 (labeled 1)
- Garage:** Lê Biên Hà Nội (labeled 2)
- Nhóm xe:** High-range (labeled 3)
- Chi tiết về hộp số:** (labeled 4)
- Động cơ:** (labeled 5)
- Màu xe:** A color selection grid with a checked black square (labeled 6). A red box highlights this grid, labeled 7.
- Preview Area:** Shows three exterior images of a Toyota Fortuner and one interior image of the dashboard and seats. Each image has a 'Xóa' (Delete) button below it (labeled 8).
- Mô tả:** A large text area for vehicle description (labeled 9).
- Buttons at the bottom:**
 - A red 'Xóa xe' (Delete car) button (labeled 10).
 - 'Hủy bỏ' (Cancel) and 'Lưu lại' (Save) buttons (labeled 11, 12, 13).

Figure 47 : Edit vehicle information UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	vehicleName Field	Input vehicle name	No	No	Textbox	String
2	licenseNumber	Input license number	No	No	Textbox	String
3	garageList	Choose garage that vehicle belong	Yes	No	Dropdownlist	String
4	vehicleGroup List	Choose vehicle group that vehicle belong	Yes	No	Dropdownlist	String
5	transitionTypeDetail	Input more information of the vehicle transition type detail	No	No	Richtextbox	String
6	Engine	Input engine of the vehicle	No	No	Textbox	String
7	Color	Choose vehicle's color	Yes	No	Radio button	String
10	Description	Input description of the vehicle	Yes	No	Richtextbox	String

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
8	deleteImage	Delete vehicle's image	Can't delete when current pictures less than 4	Show the remain image
9	uploadImage	Choose new images to upload	Can't upload more than 10 pictures	Show explorer where user can choose image from their computer
11	deleteVehicle	Clicks to delete this vehicle	N/A	Show delete vehicle confirm popup
12	cancelButton	Clicks to cancel edit view	N/A	Show back vehicle information

13	saveButton	Clicks to save the change user make to the vehicle	Validate all require field	Refresh current page to show new information
----	------------	----------------------------------------------------	----------------------------	----------------------------------------------

5.10. Manage booking page

The screenshot displays the 'Manage booking page' interface. At the top left is a dropdown filter for 'Garage' (1), currently set to 'Garage Lê Biên' (2). On the right, there's a section for 'Time range' (3) with options 'Tất cả' (All), 'Đã qua' (Overdue), and 'Sắp đến' (Coming soon). Below these are checkboxes for 'Hiển hóa đơn đã hủy' (4) and 'Hiển hóa đơn tự dat' (5). A search bar (6) is located at the top right. The main area contains a table with columns: Tên khách hàng, Tên xe, Biển số, Giá thuê, Đặt cọc, Thuê từ, Thuê đến, Dánh giá, Tình trạng, and Thao tác. A specific row is highlighted with a red box (8), showing details for 'Phạm Cường' (Customer), 'Toyota Camry SE' (Vehicle), license plate 'FFF-65266', rent price '500000', deposit '500000', start date 'T4, 26/10/2016, 21:22', end date 'T5, 27/10/2016, 21:22', rating '8', status 'Đã qua' (Overdue), and actions 'Chi tiết' (Detail) and 'Thành công' (Success). At the bottom, it says 'Đang hiển thị 1 đến 1 trên tổng cộng 1 dòng' (Showing 1 to 1 of 1 total rows). Pagination controls 'Trang trước' (1) and 'Trang sau' are at the bottom right (10, 11, 12).

Figure 48: Manage booking page UI design

Fields:

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	Disable/enable filter record belong to garage	Filter vehicle belong to garage be disabled/enable d	Yes	No	Checkbox	String
2	Garage name	Filter vehicle belong to garage	Yes	No	Dropdown	String
3	Status of booking sorted by time	Filter record of booking be showed in data table belong to status of booking	Yes	No	Radiobox	String
4	Status of booking sorted by action	Filter record of booking be showed in data table belong to status of sorted by action	Yes	No	Checkbox	String
6	Key search	Filter record belong to key word	No	No	Textbox	String

7	Number record in data table	Filter number record be showed in data table	Yes	No	Dropdown	Number
11	Current Page Of Table	Current page of table	Yes	No	Text Box	String

Buttons/Hyperlinks:

No	Function	Description	Validation	Outcome
8	Redirect to vehicle detail page	Show information of vehicle	N/A	Vehicle detail page.
9	Show booking in detail	Show pop up to show booking information	N/A	Show pop up to show booking information
10	Show Previous Record Of Table	Show previous record of table	N/A	Show previous record of table
12	Show Next Record Of Table	Show next record of table	N/A	Show next record of table

5.10.1. Create self-booking popup <Excluded>**5.11. Manage garage page**

Quản lý Garage

1 + Tạo Garage mới

2

3

4

5

6

7

Đang hiển thị 1 đến 2 trên tổng cộng 2 dòng

Trang trước 1 Trang sau

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Figure 49 : Manage garage page UI design

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
1	showCreateNewGarage	Show create new garage	N/A	Show create new garage popup

7	showOptionUser CanDoToGarage	Show options for user choose: detail information, open/close garage, delete	N/A	Show options for user choose: detail information, open/close garage, delete
3	showPreviousRec ordOfTable	Show previous record of table	N/A	Show previous record of table
5	showNextRecord OfTable	Show next record of table	N/A	Show next record of table

5.11.1. Create new garage popup

The image shows the UI design for the 'Create new garage' popup. It includes the following components:

- Input Fields:**
 - Tên garage (1)
 - Địa điểm * (2) - dropdown menu showing 'An Giang'
 - Địa chỉ * (3)
 - Email * (4)
 - Số điện thoại (mặc định) * (5)
 - Số điện thoại (bổ sung) (6)
 - Mô tả (7)
- Time Schedule Table:**

Thời gian mở cửa		8	9	10	
Thứ hai	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Thứ ba	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Thứ tư	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Thứ năm	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Thứ sáu	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Thứ bảy	Từ		Đến		<input checked="" type="checkbox"/> Nghỉ
Chủ nhật	Từ		Đến		<input checked="" type="checkbox"/> Nghỉ
- Buttons:**
 - Đóng (12) - Close button
 - Tạo garage (13) - Create garage button

Figure 50 : Create new garage popup UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	garageName	Field for input garage name	No	No	Textbox	String
2	location	Search data from table	Yes	No	Dropdownlist	String

3	address	Field for input garage address	No	No	Textbox	String
4	email	Field for input garage email	No	No	Textbox	String
5	phoneNumbrMain	Field for input main phone number	No	No	Textbox	String
6	phoneNumbrSub	Field for input sub phone number	No	No	Textbox	String
7	detailInformation	Filed for input detail information	No	No	Textbox	String
8	openTime	Field for input open time	No	No	Textbox	Integer
9	closeTime	Field for input close time	No	No	Textbox	Integer
11	policy	Field for input policy of garage	No	No	Textbox	String

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
10	indicateDayOff	Indicate day off	N/A	
12	cancel	Cancel	N/A	Garage management page
3	createGarage	Save information to database	Validate all require field	Create success

5.12. Garage detail page

The screenshot displays the 'Garage detail page' with the following sections and numbered UI elements:

- Header:** 'Trần Bảo Hồ Chí Minh' (Active) ★★★★★ 4.5, 1, Chỉnh sửa thông tin
- Contact Information:**
 - Địa điểm: Hồ Chí Minh
 - Địa chỉ: 666 Quang Trung, quận 12
 - Email: tranbao@gmail.com
 - Số điện thoại (mặc định): 016666661111
 - Số điện thoại (bổ sung): 026666666111
- Working Hours Table:**

Thời gian mở cửa	
Thứ hai	Nghỉ
Thứ ba	Nghỉ
Thứ tư	Từ 06:00 Đến 22:00
Thứ năm	Từ 06:00 Đến 22:00
Thứ sáu	Từ 06:00 Đến 22:00
Thứ bảy	Từ 06:00 Đến 22:00
Chủ nhật	Nghỉ
- Description:** Mô tả: Chào bạn
- Notes:** Điều khoản: Vào ngày nhận xe, chúng tôi sẽ đến tận nơi để rước bạn, vì vậy xin vui lòng liên hệ bằng điện thoại hoặc email và để lại địa chỉ để chúng tôi có thể phục vụ bạn tốt nhất.
- Buttons:** 2 (Ngừng hoạt động), 3 (Xóa garage)
- Vehicle Information:**
 - Thông tin xe: 4
 - Thông tin đặt xe: 5
 - + Thêm xe vào Garage: 6
 - Hiển thị: 10 dòng
 - Tim kiếm

Tên	Biển số	Nhóm	Năm	Số chỗ	Đánh giá	Thao tác
Porsche Cayenne S 8	PPP-219391	Mid-range	2014	7	★★★★★ 4.1	Đổi garage
BMW X6	FWR-22110	High-range	2016	5	★★★★★ 4.5	Đổi garage
BMW X3 xDrive 35d	FWR-67214	High-range	2014	5	★★★★☆ 3.2	Đổi garage
BMW X1	FWR-52214	High-range	2016	7	★★★★★ 4.1	Đổi garage

Đang hiển thị 1 đến 4 trên tổng cộng 4 dòng
- Vehicle History:**
 - Thông tin xe: 4
 - Thông tin đặt xe: 5
 - Thời gian thanh toán: 7
 - Hiển thị: 10 dòng
 - Tim kiếm

Tên khách hàng	Tên xe	Biển số	Giá thuê	Đặt cọc	Thuê từ	Thuê đến	Đánh giá	Tình trạng	Thao tác
Phạm Cường 8	Toyota Camry SE	FFF-65266	5000000	500000	T4, 26/10/2016, 21:22	T5, 27/10/2016, 21:22	-	Đã qua	Chi tiết
Phạm Cường	Toyota Camry SE	FFF-65266	5000000	500000	T4, 02/11/2016, 21:52	T5, 03/11/2016, 21:52	★★★★☆	Đã qua	Chi tiết

Figure 51 : Garage detail page UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
4	garageName	Field for input garage name	No	No	Textbox	String
7	searchData	Search data from table	Yes	No	Textbox	String
10	allRadio	Checks to choose all time	Yes	No	Radio	String
11	pastRadio	Checks to choose pass time	Yes	No	Radio	String
12	comingRadio	Checks to choose in coming	Yes	No	Radio	String
13	canceledReceipt	Checks to choose cancel receipt	Yes	No	Combobox	String
14	selfBookingReceipt	Checks to choose self-booking receipt	Yes	No	Combobox	String

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
1	editGarageInformation	Edit garage information	N/A	Show field for edit
2	Active/deactiveGarage	Active or deactivate garage	N/A	Garage become deactivate/active
3	deleteGarage	Delete garage	N/A	Delete confirm
4	vehicleInfoTab	Clicks to show vehicle information tab	N/A	Show vehicle information tab
5	bookingInfoTab	Clicks to show booking information tab	N/A	Show booking information tab
6	addVehicleToGarage	Add vehicle to this garage	N/A	Show add vehicle confirm popup
8	linkToVehicleDetail	Clicks to go to that vehicle detail page	N/A	Go to vehicle detail page

9	changeGarage	Clicks to transfer the vehicle to another garage	N/A	Show change garage confirm popup
15	detailButton	Clicks to show detail information	N/A	Show detail information

5.12.1. Edit garage information

Thông tin garage

The screenshot shows a user interface for editing garage information. The form is divided into several sections:

- Address:** Labeled 1, includes fields for city (Hà Nội) 2, street (112 Pasteur, quận Cầu Giấy) 3, and email (lebienservicehn@gmail.com) 4.
- Phone Numbers:** Includes fields for main phone (0913337777) 5 and secondary phone (0987777777) 6.
- Operating Hours:** A table titled "Thời gian mở cửa" (Operating Hours) showing daily opening and closing times (e.g., Thứ hai: 08:00 - 17:00) across 7 days of the week. Red numbers 7, 8, and 9 are placed above the table.
- Description:** A large text area labeled "Mô tả" (Description) containing placeholder text 10.
- Note:** A note at the bottom left: "Vào ngày nhận xe, chúng tôi sẽ đến tận nơi để rước bạn, vì vậy xin vui lòng liên hệ bằng điện thoại hoặc email và để lại địa chỉ để chúng tôi có thể phục vụ bạn tốt nhất." (When picking up the car, we will come to your location to pick you up, so please contact us by phone or email and leave your address so we can serve you better.)
- Buttons:** At the bottom right are two buttons: "Hủy bỏ" (Cancel) 14 and "Lưu lại" (Save) 15.

Figure 52 : Edit garage information UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
----	------------	-------------	-----------	-----------	--------------	-----------

1	garageName	Field for input garage name	No	No	Textbox	String
2	Location	Field for input location	No	No	Textbox	String
3	address	Field for input garage address	No	No	Textbox	String
4	email	Field for input garage email	No	No	Textbox	String
5	phoneNumberMain	Field for input main phone number	No	No	Textbox	String
6	phoneNumberSub	Field for input sub phone number	No	No	Textbox	String
10	detailInformation	Filed for input detail information	No	No	Textbox	String
7	openTime	Field for input open time	No	No	Textbox	Integer
8	closeTime	Field for input close time	No	No	Textbox	Integer
9	dayOff	Choose day off day	Yes	No	Combobox	String
11	policy	Field for input policy of garage	No	No	Textbox	String

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
12	Active/deactiveGarage	Active or deactivate garage	N/A	Garage become deactivate/active
13	deleteGarage	Delete garage	Must be no vehicle in that garage	Delete confirm
6	addVehicleToGarage	Add vehicle to this garage	N/A	Show add vehicle confirm popup
14	cancelButton	Clicks to cancel	N/A	Go to garage detail page
15	saveButton	Clicks to save	Validate all require field	Reload page

5.13. Manage vehicle group page

Quản lý nhóm giá

The screenshot shows a table of vehicle groups with the following columns: Tên nhóm (Name), Ký hạn thuê tối đa (Max rental period), Đặt cọc (Deposit), Giá theo ngày (Daily price), Số lượng xe (Number of vehicles), Trạng thái (Status), and Thao tác (Actions). The table contains three rows of data:

- Giá xe bất 1 (Row 4): Ký hạn thuê tối đa: 30, Giá theo ngày: 1200000, Số lượng xe: 2, Trạng thái: đang hoạt động (Active), Thao tác: Thông tin chi tiết (Detail), Ngừng hoạt động (Deactivate), Xóa (Delete).
- Giá xe bất 2 (Row 5): Ký hạn thuê tối đa: 30, Giá theo ngày: 2100000, Số lượng xe: 2, Trạng thái: đang hoạt động (Active), Thao tác: Thông tin chi tiết (Detail), Ngừng hoạt động (Deactivate), Xóa (Delete).
- Giá xe bất 3 (Row 6): Ký hạn thuê tối đa: 30, Giá theo ngày: 4420000, Số lượng xe: 3, Trạng thái: đang hoạt động (Active), Thao tác: Thông tin chi tiết (Detail), Ngừng hoạt động (Deactivate), Xóa (Delete).

At the top right, there is a green button labeled '+ Thêm nhóm mới' (Add new group). Below the table, there is a search bar labeled 'Tim kiếm' (Search) and a dropdown menu for 'Hiển thị' (Display) set to 10. At the bottom, there is a message 'Đang hiển thị 1 đến 3 trên tổng cộng 3 dòng' (Showing 1 to 3 of 3 rows) and a navigation bar with 'Trang trước' (Previous page), a green button labeled '1', and 'Trang sau' (Next page).

Figure 53: Manage vehicle group page UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
2	numberOfDataShow	List of how many result user want to see in table	No	No	Dropdown list	Integer
5	showOptionUserCanDo	List things provider can do to that vehicle group	No	No	Dropdown list	Integer

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
1	createNewVehicleGroup	Create new vehicle group	N/A	Create vehicle group popup
4	linkToVehicleGroupDetail	Go to vehicle group detail page	N/A	Go to vehicle group detail page
6	showVehicleGroupDetail	Go to vehicle group detail page	N/A	Go to vehicle group detail page
7	deActiveVehicleGroup	Deactive vehicle group	N/A	Deactive vehicle group

8	deleteVehicleGroup	Delete vehicle group	N/A	Delete vehicle group
9	previousButton	Show previous data page	N/A	Show previous data page
10	numberPage	Clicks to show data in choose page	N/A	Show data in choose page
11	nextButton	Show next page	N/A	Show next data page

5.13.1. Create new vehicle group popup

The screenshot shows a modal window titled "Tạo nhóm mới" (Create new group). The form contains the following fields:

- Tên nhóm ***: Input field containing "1".
- Đặt cọc ***: Input field containing "2".
- Giá theo ngày ***: Input field containing "3".
- Kỳ hạn thuê tối đa**: Input field containing "4" and dropdown "ngày".
- Số Km tối đa một ngày**: Input field containing "6" and dropdown "Km".
- Số tiền trả thêm**: Input field containing "8" and dropdown "đ/Km".
- Bảng giá theo giờ**: A table with columns: Thời gian (giờ), Giá tiền (VND), Số Km tối đa (Km), and Không giới hạn số km tối đa.
- + Thêm hàng mới**: Button labeled "9".
- Thời gian (giờ)**: Input field containing "10".
- Giá tiền (VND)**: Input field containing "11".
- Số Km tối đa (Km)**: Input field containing "12".
- Không giới hạn số km tối đa**: Checkbox labeled "13".
- Đang hiển thị 1 đến 1 trên tổng cộng 1 dòng**: Status message.
- 14**: Button labeled "Đóng" (Close).
- 15**: Button labeled "Tạo nhóm" (Create group).

Figure 54 : Create new vehicle group UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	Vehicle group name	Allow user input name of vehicle group	No	Yes	Textbox	String

2	Deposit	Input deposit for booking vehicle	No	Yes	Textbox	Number
3	Price per day	Input money per day	No	Yes	Textbox	Number
4	Limit time	Input number day for rent vehicle	No	Yes	Textbox	Number
6	Limit Km	Input number km for rent vehicle	No	Yes	Textbox	Number
8	Money will pay by over the limit km.	Input money by over the limit km	No	Yes	Textbox	Number
9	Time(hours)	Input time (hour) to apply price for hours	No	No	Textbox	Number
10	Price for hour	Input price per hour to apply price for hours	No	No	Textbox	Number
11	Limit Km of price for hour	Input limit KM to apply price for hours	No	No	Textbox	Number

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
14	Cancel add new command	Cancel action add new vehicle group	N/A	Close pop up add new vehicle group
15	Create new vehicle group	Send create command to controller	N/A	Create new vehicle group.
9	To add price per hour	Allow user input price per hour.	N/A	Show field allow user input price per hour.
5	Disable Limit time	Disable limit time field	N/A	limit time field will be disabled
7	Disable Limit Km	Disable Limit Km	N/A	Limit Km field will be disabled
13	Disable Limit Km of price for hour	Disable Limit Km of price for hour	N/A	Limit Km of price for hour field will be disabled

5.14. Vehicle group details page

Thông tin nhóm giá

The screenshot shows a web-based car rental portal interface. At the top, there's a green header bar with the title "Giá xe bật 1" (Active Price) and a status "dang hoạt động" (Active). On the right of the header is a button "Chỉnh sửa thông tin" (Edit Information) with a red number "1" above it. Below the header, there's a table with vehicle group details:

Đặt cọc	20 %
Giá theo ngày	1200000 ₫
Kỳ hạn thuê tối đa	30 ngày
Số Km tối đa một ngày	300 Km
Số tiền trả thêm	10000 ₫/Km

To the right of this table is a section titled "Bảng giá theo giờ" (Price per hour) with a table:

Thời gian (giờ)	Giá tiền (VND)	Số Km tối đa (Km)
6	560000	60
12	890000	120

Below these sections are two numbered buttons: "2" (Ngừng hoạt động - Deactivate) and "3" (Xóa nhóm - Delete Group).

The main content area shows a table of vehicles in the group:

Tên	Biển số	Garage	Năm	Số chỗ	Danh giá	Thao tác
Toyota Tundra CrewMax	FFF-62222	Garage Trần Bảo Hồ Chí Minh	2014	4	-	Đổi nhóm Xóa khỏi nhóm
Corolla Altis 1.8G MT	FFF-56218	Garage Trần Bảo Hồ Chí Minh	2016	4	-	Đổi nhóm Xóa khỏi nhóm

Below the table, there are navigation controls: "Hiển thị 10 dòng 4" (Display 10 rows 4), a "Thêm xe vào nhóm" (Add vehicle to group) button with a red number "5", and buttons "Đổi nhóm" (Change group) and "Xóa khỏi nhóm" (Delete from group) with red numbers "7" and "8" respectively.

At the bottom, there are more buttons: "Đang hiển thị 1 đến 2 trên tổng cộng 2 dòng" (Showing 1 to 2 of 2 rows), "Trang trước" (Previous page) with a red number "9", a green page number "1", and "Trang sau" (Next page) with a red number "10". To the right of the page number is a red number "11".

Figure 55: Vehicle group details page

Fields:

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
4	Filter number of record in data table	Choose the number will be displayed in data table	Yes	No	Drop down list	Number
10	Current Page Of Table	Current page of table	Yes	No	Text Box	String

Buttons/Hyperlinks:

No	Function	Description	Validation	Outcome
2	Deactivate vehicle group	Vehicle group will be deactivated.	N/A	Vehicle group will be deactivated.
1	Edit vehicle group	Show edit form for edit vehicle group	N/A	Show edit form for edit vehicle group
3	Delete vehicle group	Vehicle group will be deleted	N/A	Vehicle group will be deleted
5	Add vehicle to this vehicle group	Add vehicle to vehicle group	N/A	Show pop up allow user choose then add vehicle to vehicle group
7	Switch vehicle to another vehicle group	Change vehicle group of vehicle	N/A	Show pop up allow user choose new vehicle group of vehicle

8	Delete vehicle from vehicle group	Delete vehicle from vehicle group	N/A	Delete vehicle from vehicle group
6	View vehicle in detail	View information of vehicle	N/A	Redirect to vehicle detail page
9	Show Previous Record Of Table	Show previous record of table	N/A	Show previous record of table
11	Show Next Record Of Table	Show next record of table	N/A	Show next record of table

5.14.1. Edit vehicle group information

Thông tin nhóm giá

The screenshot shows the 'Edit vehicle group information' interface. At the top, there's a green header bar with the title 'Tên nhóm' (Group Name) and a placeholder 'Gia xe bắt 1'. Below this is a section for 'Đặt cọc' (Deposit) with a value of '20' and a percentage field '2'. There's also a 'Giá theo ngày' (Price per day) field with '1200000' and a 'Ký hạn thuê tối đa' (Maximum rental period) field with '30' days. Further down are fields for 'Số Km tối đa một ngày' (Maximum distance per day) with '300' and 'Số tiền trả thêm' (Extra cost) with '10000'. A table titled 'Bảng giá theo giờ' (Rate table) shows two rows of rates: one for 6 hours at 560000 VND and another for 12 hours at 890000 VND. At the bottom left are buttons for 'Ngừng hoạt động' (Stop operation) and 'Xóa nhóm' (Delete group). On the right are buttons for 'Hủy bỏ' (Cancel) and 'Lưu lại' (Save changes). Below the main form is a table titled 'Hiển thị 10 dòng 18' showing two vehicle entries: 'Toyota Tundra CrewMax' and 'Corolla Altis 1.8G MT'. Each entry has columns for 'Tên' (Name), 'Biển số' (License Plate), 'Garage' (Garage), 'Năm' (Year), 'Số chỗ' (Number of seats), 'Danh giá' (Rating), and 'Thao tác' (Actions). The first entry is highlighted with a red border. The actions column contains buttons for 'Đổi nhóm' (Change group) and 'Xóa khỏi nhóm' (Delete from group). At the bottom right of the table area are buttons for 'Trang trước' (Previous page), page numbers '1', '24', and '15', and 'Trang sau' (Next page).

Figure 56 : Edit vehicle group information UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	Vehicle group name	Allow user input name of vehicle group	No	Yes	Text box	String
2	Deposit	Input deposit for booking vehicle	No	Yes	Text box	Number
3	Price per day	Input money per day	No	Yes	Text Box	Number

4	Limit time	Input number day for rent vehicle	No	Yes	Text Box	Number
5	Limit Km	Input number km for rent vehicle	No	Yes	Text Box	Number
6	Money will pay by over the limit km.	Input money by over the limit km	No	Yes	Text Box	Number
8	Time(hours)	Input time (hour) to apply price for hours	No	No	Text Box	Number
9	Price for hour	Input price per hour to apply price for hours	No	No	Text Box	Number
10	Limit Km of price for hour	Input limit KM to apply price for hours	No	No	Text Box	Number
18	Filter number of record in data table	Choose the number will be displayed in data table	Yes	No	Drop down list	Number
24	Current Page Of Table	Current page of table	Yes	No	Text Box	String

Buttons/Hyperlinks

No	Function	Description	Validation	Outcome
7	Add new field to input price per hour of vehicle group	Show text box to input money per hour	N/A	Show text box field allow user input price per hour
11	Disable Limit time	Disable limit time field	N/A	limit time field will be disabled
12	Disable Limit Km	Disable Limit Km	N/A	Limit Km field will be disabled
13	Disable Limit Km of price for hour	Disable Limit Km of price for hour	N/A	Limit Km of price for hour field will be disabled
16	Deactivate vehicle group	Vehicle group will be deactivated.	N/A	Vehicle group will be deactivated.
17	Delete vehicle group	Vehicle group will be deleted	N/A	Vehicle group will be deleted
14	Cancel edit vehicle group	Disable all field to edit vehicle group	N/A	User can not edit vehicle group
15	Update vehicle group	Send request to controller	N/A	Vehicle group will be updated
19	Add vehicle to this vehicle group	Add vehicle to vehicle group	N/A	Show pop up allow user choose then

				add vehicle to vehicle group
21	Switch vehicle to another vehicle group	Change vehicle group of vehicle	N/A	Show pop up allow user choose new vehicle group of vehicle
22	Delete vehicle from vehicle group	Delete vehicle from group	N/A	Delete vehicle from vehicle group
20	View vehicle in detail	View information of vehicle	N/A	Redirect to vehicle detail page
23	Show Previous Record Of Table	Show previous record of table	N/A	Show previous record of table
25	Show Next Record Of Table	Show next record of table	N/A	Show next record of table

5.15. Admin's dashboard

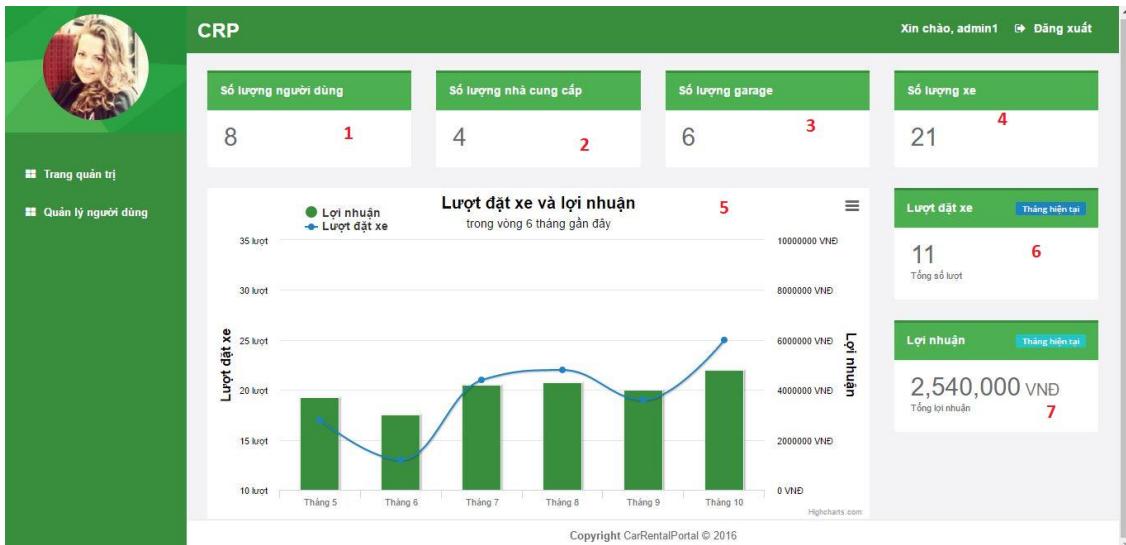


Figure 57: Admin's dashboard UI design

Fields

No	Field Name	Description	Read Only	Mandatory	Control Type	Data Type
1	numberOfUser	Show number of user	Yes	No	Textbox	String
2	numberOfProvider	Show number of provider	Yes	No	Textbox	String
3	numberOfGarage	Show number of garage	Yes	No	Textbox	String

4	numberOfVehicle	Show number of vehicle	Yes	No	Textbox	String
5	numberOfBookingAndProfit	Show graph display number of booking and profit	Yes	No	Graph	String
6	numberOfBooking	Show number of booking	Yes	No	Textbox	String
7	profit	Show number of profit	Yes	No	Textbox	String

5.16. Manage user page <Excluded>

6. Database Design

6.1 Entity relationship diagram

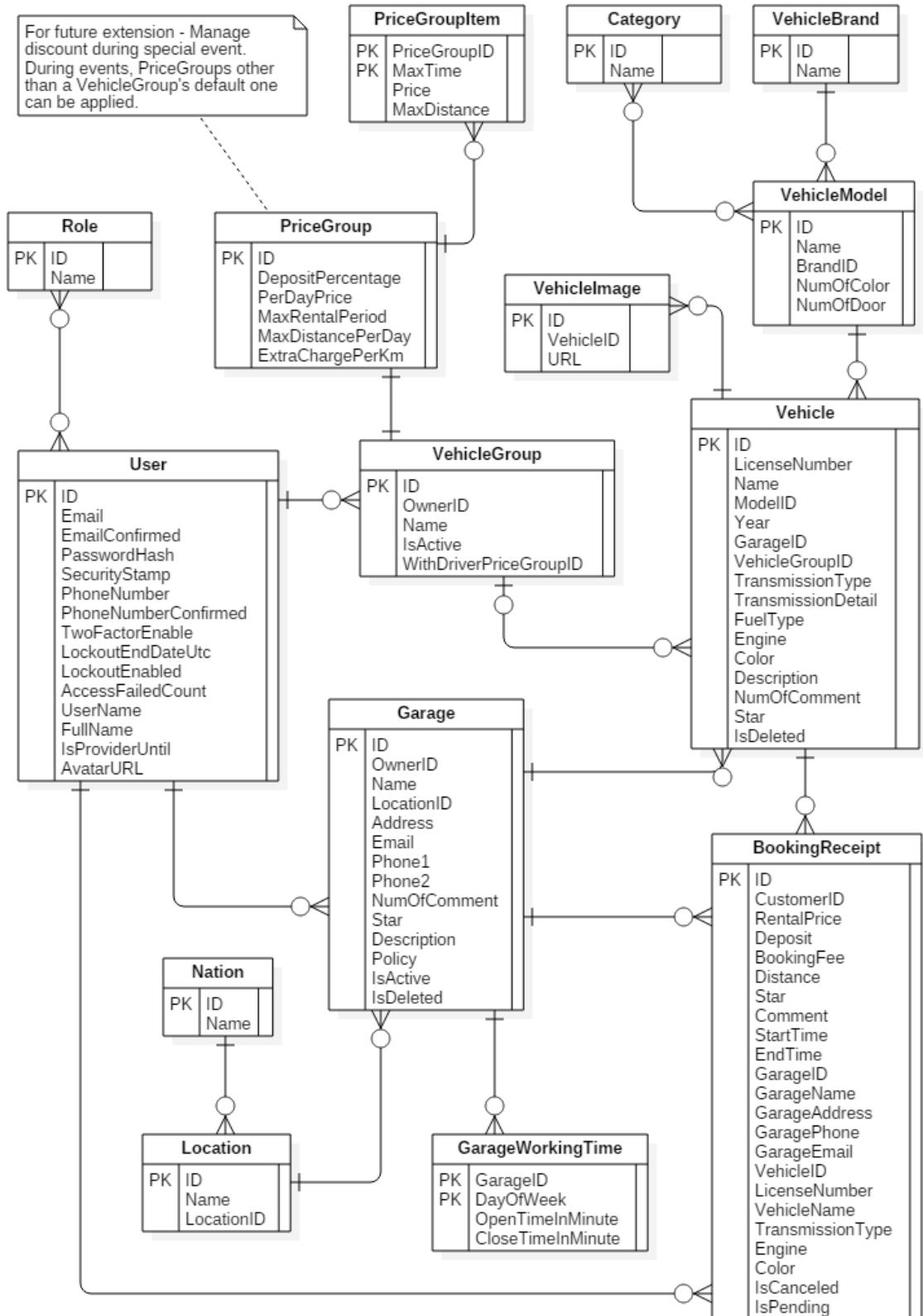


Figure 58 : Entity Relationship Diagram

6.2 Entity Dictionary

Entity dictionary	
Entity Name	Description
User	Abstract entity, represent user in system
Provider	User with provider role
Customer	User with customer role
Vehicle	Represent vehicle in system
VehicleImage	Represent image of vehicle
VehicleModel	Represent vehicle model
VehicleBrand	Represent vehicle brand
Category	Represent vehicle category
Garage	Represent garage
GarageWorkingTime	Describe working time constraints of garage each day of week
Location	Represent location inside a country
Nation	Represent nation
VehicleGroup	Represent group of vehicles with the same rental constraints
PriceGroup	Describe rental constraints of a vehicle group
PriceGroupItem	Describe rental constraints of each daily rental option of price group
BookingReceipt	Represent booking receipt in system

Table 45 : Entity dictionary

6.1.1. User

Attribute	Domain	Allows null	Description
Id	nvarchar(128)	No	Unique identifier of user.
Email	varchar(256)	No	Email of user.
EmailConfirmed	bit	No	Status indicating whether email has been confirmed.
PasswordHash	nvarchar(MAX)	Yes	Encoded password of user.
SecurityStamp	nvarchar(MAX)	Yes	Stamp used to authenticate user's cookies and session.
PhoneNumber	nvarchar(MAX)	Yes	Phone number of user.
PhoneNumberConfirmed	bit	No	Status indicating whether phone number has been confirmed.
TwoFactorEnabled	bit	No	Status indicating whether two-factor sign-in is enabled.
LockoutEndDateUtc	datetime	Yes	Date until which this user is locked out if lockoutEnable is true.
LockoutEnable	bit	No	Status indicating whether lockout is enabled.
AccessFailedCount	int	No	Number of failed access for this account.
UserName	nvarchar(256)	Yes	Username
FullName	nvarchar(200)	Yes	Full name of user
IsProviderUntil	datetime	Yes	Date until which this user has provider role.
AvatarURL	varchar(200)	Yes	URL of user's avatar

Table 46: User entity – Attributes

6.1.2. Role

Attribute	Domain	Allows null	Description
Id	nvarchar(128)	No	Unique identifier of AspNetRole
Name	nvarchar(256)	No	Name of role

Table 47: Role entity - Attributes

6.1.3. Vehicle

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of vehicle
LicenseNumber	varchar(50)	No	License number of vehicle
Name	nvarchar(100)	No	Name of vehicle
ModelID	int	No	Model of vehicle
Year	int	No	Year in which this vehicle was produced
GarageID	int	No	ID of Garage containing this vehicle
VehicleGroupID	int	Yes	ID of VehicleGroup containing this vehicle
TransmissionType	int	No	Transmission type of vehicle
TransmissionDetail	nvarchar(100)	Yes	Detailed description about transmission of vehicle
FuelType	int	Yes	Fuel type of vehicle
Engine	nvarchar(100)	Yes	Description about engine of vehicle
Color	int	No	Color of vehicle
Description	nvarchar(1000)	Yes	Description about vehicle
NumOfComment	int	No	Number of customer's feedback this vehicle has received
Star	decimal(2, 1)	No	Rating of vehicle
IsDeleted	bit	No	Status indicating whether this vehicle was deleted

Table 48: Vehicle entity – Attributes

6.1.4. VehicleImage

Attribute	Domain	Allows null	Description
ID	varchar(100)	No	Unique identifier of image returned by cloudinary
VehicleID	int	No	ID of Vehicle which this image belongs to
URL	varchar(200)	No	URL of image

Table 49: VehicleImage entity - Attributes

6.1.5. VehicleModel

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of vehicle model
Name	nvarchar(50)	No	Name of role
BrandID	int	No	ID of Brand of this model
NumOfDoor	int	No	Number of door on this vehicle
NumOfSeat	int	No	Number of seat in this vehicle

Table 50: VehicleModel entity – Attributes

6.1.6. VehicleBrand

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of vehicle brand
Name	nvarchar(50)	No	Name of brand

*Table 51: VehicleBrand entity - Attributes***6.1.7. Category**

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of category
Name	nvarchar(50)	No	Name of category

*Table 52: VehicleBrand entity - Attributes***6.1.8. Garage**

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of garage
OwnerID	nvarchar(128)	No	ID of AspNetUser owing this garage
Name	nvarchar(100)	No	Name of garage
LocationID	int	No	ID of Location of garage
Address	nvarchar(200)	No	Address of garage
Email	varchar(256)	No	Email of garage
Phone1	varchar(50)	No	Primary phone number of garage
Phone2	varchar(50)	Yes	Secondary phone number of garage
NumOfComment	int	No	Number of customer's feedback this garage has received
Star	decimal(2, 1)	No	Rating of garage
Description	nvarchar(1000)	Yes	Description of garage
Policy	nvarchar(1000)	Yes	Policy of garage
IsActive	bit	No	Status indicating whether this garage is active.
IsDeleted	bit	No	Status indicating whether this garage was deleted.

*Table 53: Garage entity - Attributes***6.1.9. GarageWorkingTime**

Attribute	Domain	Allows null	Description
GarageID	int	No	ID of Garage which this working time constraint is applied to.
DayOfWeek	int	No	Day of week which this working time constraint represents.
OpenTimeInMinute	int	No	Opening time of this garage in this day of week.
CloseTimeInMinute	int	No	Closing time of this garage in this day of week.

Table 54: GarageWorkingTime entity - Attributes

6.1.10. Location

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of location.
Name	nvarchar(50)	No	Name of location.
NationID	int	No	ID of Nation to which this location belongs.

*Table 55: Location entity - Attributes***6.1.11. Nation**

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of nation
Name	nvarchar(50)	No	Name of nation

*Table 56: Nation entity - Attributes***6.1.12. VehicleGroup**

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of vehicle group
OwnerID	nvarchar(128)	No	ID of AspNetUser whom this group belongs to
Name	nvarchar(50)	No	Name of group
IsActive	bit	No	Status indicating whether this group is active
WithDriverPriceGroupID	int	No	ID of default PriceGroup which is applied for driver-included rent.

*Table 57: VehicleGroup entity - Attributes***6.1.13. PriceGroup**

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of price group.
DepositPercentage	decimal(3, 2)	No	Percentage of total rental price which customer has to pay to provider when booking.
PerDayPrice	float	No	Pricing of daily rental.
MaxRentalPeriod	int	Yes	Maximum days a rental can last.
MaxDistancePerDay	int	Yes	Maximum km that customer can travel in 1 days without being charged extra fee with the rented vehicle.
ExtraChargePerKm	int	Yes	Extra fee for every 1 km outside allowed travel distance.

Table 58: PriceGroup entity - Attributes

6.1.14. PriceGroupItem

Attribute	Domain	Allows null	Description
PriceGroupID	int	No	ID of PriceGroup to which this hourly rental option belongs.
MaxTime	int	No	Rental duration of this rental option.
Price	float	No	Rental price of this rental option.
MaxDistance	int	Yes	Maximum km that customer can travel without being charged extra fee with the rented vehicle using this rental option.

Table 59: PriceGroupItem entity - Attributes

6.1.15. BookingReceipt

Attribute	Domain	Allows null	Description
ID	int	No	Unique identifier of receipt.
CustomerID	String	No	ID of AspNetUser who is the customer of this receipt.
RentalPrice	float	No	Total rental price.
Deposit	float	No	Deposit paid by customer to provider when booking.
BookingFee	float	No	Fee paid by customer to system when booking.
Distance	int	Yes	Maximum distance customer can travel without being charged extra fee with the rented vehicle.
Star	int	Yes	Rating from customer for this rental period.
Comment	nvarchar(200)	Yes	Feedback from customer about this rental period.
BookingTime	datetime	No	Time when this booking is made.
StartTime	datetime	No	Time when rental period starts.
EndTime	datetime	No	Time when rental period ends.
GarageID	int	No	ID of Garage to which this booking belongs.
GarageName	nvarchar(100)	No	Name of Garage at booking moment.
GarageAddress	nvarchar(200)	No	Address of Garage at booking moment.
GaragePhone	varchar(50)	No	Phone1 of Garage at booking moment.
GarageEmail	varchar(50)	No	Email of Garage at booking moment.
VehicleID	int	No	ID of booked Vehicle.
LicenseNumber	varchar(50)	No	License number of Vehicle at booking moment.
VehicleName	nvarchar(100)	No	Name of Vehicle at booking moment.

TransmissionDetail	nvarchar(200)	Yes	TransmissionDetail of Vehicle at booking moment.
Engine	nvarchar(200)	Yes	Engine of Vehicle at booking moment.
Color	int	No	Color of Vehicle at booking moment.
IsCanceled	bit	No	Status indicating whether this booking has been canceled.
IsPending	bit	No	Status indicating whether this booking has not been paid.

Table 60: BookingReceipt entity - Attributes

7. Algorithms

7.1. Recommender Engine

7.1.1. Introduction

As a car rental solution, CRP has to be able to introduce the most suitable vehicles to customers. This will help improve not only the customers' but also the providers' satisfaction, and ultimately gaining more transactions, as well as interest for our application. Consequently, a recommender engine is necessary.

7.1.2. Common approaches

Two common approaches on designing recommender solution are *Collaborative filtering* and *Content-based filtering*.

Collaborative filtering methods are based on collecting and analyzing a large amount of information on users' behaviors, activities or preferences and predicting what users will like based on their similarity to other users. [3]

Content-based filtering methods are based on a description of the item and a profile of the user's preference. In a content-based recommender system, keywords are used to describe the items and a user profile is built to indicate the type of item this user likes. In other words, these algorithms try to recommend items that are similar to those that a user liked in the past (or is examining in the present). [4]

Collaborative approach does not require analyzing the content of item that it recommends since it is based entirely on the user's information. However, exactly because it depends solely on the data generated by users, it suffers the three common problem of computing, namely *cold start* (Lack of user's interaction in the beginning), *scalability* (Scale badly when the number of user and their interaction increase), and *sparsity* (The number of item is much bigger than the number of user). Considering the low-number-of-transaction nature of car rental service when compared to other kind of services, scalability and sparsity issues can be evaded.

Content-based approach works well even under scarce user's interaction environment since its recommendations are based on the items' description. Its issue of not being able to recommend items with different content type (For instance, car and phone) is also not a problem, since CRP only has one type of item.

7.1.3. Solution's approaches

CRP's recommender design takes a hybrid approach between content-based and collaborative. We score vehicles based on how each of them is similar to the vehicles the customer has booked in the past and how many other customers that have booked this vehicle also have booked a similar vehicle as this customer in the past. Vehicles with higher score will have higher priority in recommendation.

Since our system's recommended targets, namely vehicles, have many attributes that we can take advantage of (Brand, number of seat, color...), we initially tackles the problem using content-based methods. These includes *Vector space model* and *tf-idf*.

7.1.3.1. Represent items using vector space model

We first abstract the vehicles and their attributes by applying *Vector space model* [\[5\]](#), an item presentation algorithm.

Each vehicle is modeled as a vector (Refer to as *master vector* from now) in a multi-dimension space (Refer to as *vector space* from now), with each dimension corresponds to an attribute. If a vehicle has an attribute, the component vector (Refer to as *attribute vector* from now) corresponding to that attribute will have non-zero length.

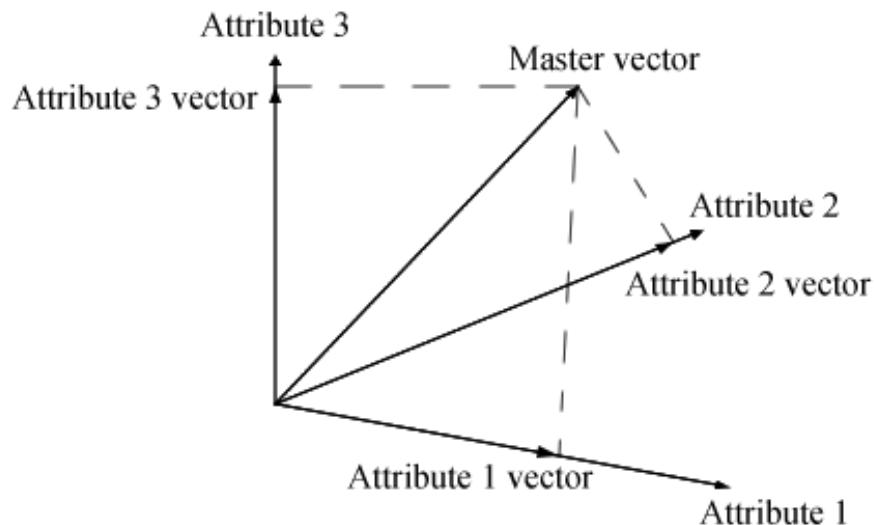


Figure 59 – Example for 3-dimensional vector space

There are several weighting scheme that can be used to calculate the attribute vector's length. Amongst them, the most popular one is *tf-idf* (Term frequency – Inverse document frequency) [\[6\]](#), which. In our solution, tf-idf is applied with *binary scheme* (Further explanation will be given in *solution's design* section).

7.1.3.2. Customer profile

A customer profile is another vector in the *vector space* which indicate a particular customer's interest in vehicle, like which color or which fuel type that he has more affinity with.

In vector space model, the angle between 2 vectors determine the similarity between them. This means the smaller the angle between a vehicle's *master vector* and a customer profile, the more similar that vehicle is to the customer's reference.

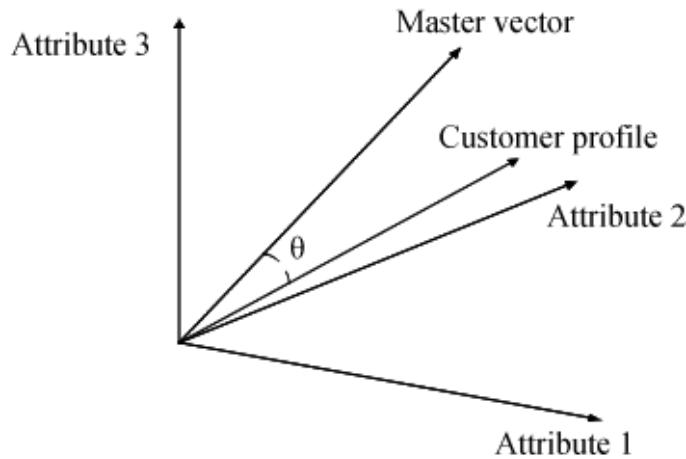


Figure 60 – Example for customer profile vector

It is common to use the cosine of this angle to represent their similarity, since their values are between 1 and -1. This form allows us to tell at how many percent a customer will like a vehicle (Positive value), or dislike it (Negative value). Our recommender engine will find the cosine between each vehicle's *master vector* and a customer profile, then recommend vehicles with the highest cosine value to that customer.

7.1.3.3. Mix in collaborative element

To further improve the diversity of our solution's recommendation, we apply collaborative methods into our content-based solution. Our collaborative approach work under the assumption that other customers that has booked the same vehicle with this customer (Refer to as neighbor from now) will have similar vehicle reference; and the more *neighbors* a vehicle has, the more similar it is to this customer's reference.

Our collaborative approach introduces new attributes into the *vector space*. Each of these new attribute represent a neighbor and whether the item has been booked by this neighbor before.

	Neighbor 1	Neighbor 2	Neighbor 3	Neighbor 4
Vehicle 1	Yes	Yes	No	No
Vehicle 2	No	Yes	No	No
Vehicle 3	Yes	Yes	Yes	No

Table 61 – Example of vehicle with 4 neighbor attributes

7.1.4. Solution's design

7.1.4.1. How to calculate cosine of angle between 2 vectors

Cosine of the angle θ between 2 vectors $a = [a_1, a_2, \dots, a_n]$ and $b = [b_1, b_2, \dots, b_n]$ in n-dimension *vector space* can be calculated as follow:

$$\cos \theta = \frac{a \cdot b}{\|a\| \|b\|}$$

where $a \cdot b$ is dot product of 2 vectors, $\|a\|$ and $\|b\|$ is the norm of each vector.

The dot product can be calculated as follow:

$$\mathbf{a} \cdot \mathbf{b} = \sum_{i=1}^n a_i b_i$$

The norm of a vector $\mathbf{v} = [v_1, v, \dots, v_n]$ can be calculated as follow:

$$\|\mathbf{v}\| = \sqrt{\sum_{i=1}^n v_i^2}$$

7.1.4.2. Apply tf-idf weighting scheme

Applying tf-idf, length, or ‘weight’ of each *attribute vector* of $\mathbf{v} = [v_1, v, \dots, v_n]$ can be calculated as follow:

$$v_i = tf_i \cdot idf_i$$

idf (Inverse document frequency) can be calculated as follow:

$$idf_i = \log \frac{|D|}{|df_i| + 1}$$

with $|D|$ being the total number of item and $|df_i|$ being the total number of item that has attribute i.

The scheme to calculate tf will be discussed in the next section.

7.1.4.3. Binary representation of attributes

In our approach, raw attributes can only either appear or does not appear in an item. This leads to representing them as binary values. Under this form, we can apply *binary tf weighting scheme* of *tf-idf*, where tf weight equals the raw binary value.

	4-seat	7-seat	Gasoline	Diesel	Neighbor 1	Neighbor 2
Vehicle 1	1	0	1	0	1	1
Vehicle 2	1	0	0	1	0	1
Vehicle 3	0	1	1	0	1	1
Vehicle 4	0	1	1	0	1	0
Vehicle 5	1	0	0	1	0	0

Table 62 – Example tf values of vehicles with 6 binary attributes

With this approach, there is also no need to apply normalization to eliminate item’s size bias (For document-like item, the total number of ‘word’ in them varies, meaning bigger document will more likely to have more ‘hit’(tf) for each search term/attribute. However, with binary attributes, an item either ‘has’ or ‘does not have’ an attribute. In other words, tf is limited to 1 and 0, and therefore has no such bias).

attribute		4-seat	7-seat	Gasoline	Diesel	Neighbor 1	Neighbor 2
tf	Vehicle 1	1	0	1	0	1	1
	Vehicle 2	1	0	0	1	0	1
	Vehicle 3	0	1	1	0	1	1
	Vehicle 4	0	1	1	0	1	0
	Vehicle 5	1	0	0	1	0	0
df		3	2	3	2	3	3
idf (With D = 5)		0.097	0.222	0.097	0.222	0.097	0.097
weight	Vehicle 1	0.097	0	0.097	0	0.097	0.097
	Vehicle 2	0.097	0	0	0.222	0	0.097
	Vehicle 3	0	0.222	0.097	0	0.097	0.097
	Vehicle 4	0	0.222	0.097	0	0.097	0
	Vehicle 5	0.097	0	0	0.222	0	0

Table 63 – Example weight of 5 vehicles with 6 binary attributes

7.1.4.4. Build the customer profile

We can build a user profile by using that user's booking history as reference. Every booking has all the necessary data to construct an item vector similar to vehicle vector.

#	Vehicle	4-seat	7-seat	Neighbor 1	Neighbor 2	Star
1	Vehicle 1	1	0	1	1	2
2	Vehicle 5	1	0	0	0	1
3	Vehicle 3	0	1	1	1	4
4	Vehicle 2	1	0	0	1	5
5	Vehicle 3	0	1	1	1	-

Table 64 – Example of 5 bookings with 4 attributes

The bookings also have star-rating, which we can utilize to determine whether the customer liked or dislike the booking. In our approach, we assume that a rating lower than 3-star indicates *dislike* (-1), higher than 3-star indicates *like* (1) and equals 3 or empty rating means *neutral* (0).

#	Vehicle	4-seat	7-seat	Neighbor 1	Neighbor 2	Star	Like
1	Vehicle 1	-1	0	-1	-1	2	-1
2	Vehicle 5	1	0	0	0	1	-1
3	Vehicle 3	0	1	1	1	4	1
4	Vehicle 2	1	0	0	1	5	1
5	Vehicle 3	0	0	0	0	-	0

Table 65 – Example tf of 5 bookings with 4 attributes applying like-dislike scheme

tf of each of the customer profile's *attribute vector* can be calculated as tf of sum of tf of every booking's attribute vector of the same dimension. Since these sum are no longer binary, we calculate customer profile's tf_i of dimension i using *log normalization* scheme instead:

$$tf_i = tf\left(\sum_j^m tf_j\right) = \begin{cases} 1 + \log \sum_j^m tf_j, & \text{if } \sum_j^m tf_j > 0 \\ -\left(1 + \log\left(-\sum_j^m tf_j\right)\right), & \text{if } \sum_j^m tf_j < 0 \\ 0, & \text{otherwise} \end{cases}$$

In this equation, m is the total of booking. This equation has been modified from the original scheme to accomlice negative value. The customer profile's vector can be calculated using our default tf-idf weighting scheme.

Attribute	#	Vehicle	4-seat	7-seat	Neighbor 1	Neighbor 2
Booking's tf	1	Vehicle 1	-1	0	-1	-1
	2	Vehicle 5	-1	0	0	0
	3	Vehicle 3	0	1	1	1
	4	Vehicle 2	1	0	0	1
	5	Vehicle 3	0	0	0	0
df		3	1	2	3	
idf (D=5)		0.097	0.398	0.222	0.097	
Customer profile	tf	-1	1	0	1	
	weight	-0.097	0.398	0	0.097	

Table 66 – Example weight for attribute vectors of a customer profile

7.1.4.5. Calculate vehicle's score

As mentioned, the score used to recommend vehicle will be the cosine between the vehicle master vector and the customer profile.

$$\cos \theta = \frac{a \cdot b}{\|a\| \|b\|} = \frac{\sum_{i=1}^n a_i b_i}{\sqrt{\sum_{i=1}^n a_i^2} \cdot \sqrt{\sum_{i=1}^n b_i^2}}$$

Attribute		4-seat	7-seat	Neighbor 1	Neighbor 2
Customer profile		-0.097	0.398	0	0.097
Vehicle	tf	Vehicle 1	1	0	1
		Vehicle 2	1	0	0
		Vehicle 3	0	1	1
		Vehicle 4	0	1	0
		Vehicle 5	1	0	0
	df		3	2	3
		idf (D=5)	0.097	0.222	0.097
		Vehicle 1	0.097	0	0.097
		Vehicle 2	0.097	0	0.097
		Vehicle 3	0	0.222	0.097
Score	weight	Vehicle 4	0	0.222	0.097
		Vehicle 5	0.097	0	0
		Vehicle 1			0
		Vehicle 2			0
		Vehicle 3			0.889907
Score	Score	Vehicle 4			0.866331
		Vehicle 5			-0.23042

Table 67 – Example score for 5 vehicles with 4 attributes

A positive value shows us the probability the customer will like the vehicle, while a negative one shows us the probability the customer will dislike the vehicle.

7.1.5. Algorithm's time complexity

Considering a *vector space* with n attributes, k vehicles, and a customer with m bookings in her booking history; assuming all n attributes of an item (either a vehicle or a booking) has been ready before-hand, C#'s `Math.Log10(double)` and `Math.Sqrt(double)` have O(1) time complexity, we can estimate the time complexity of this recommender algorithm as follow.

7.1.5.1. Build customer profile

Step	Complexity
Calculate each attribute vector a_i of the profile α	O(m)
• Calculate idf_i	O(m)
❖ Calculate $ df_i $	O(m)
❖ Calculate $idf_i = \log \frac{ D }{ df_i +1}$	O(1)
• Calculate tf_i	O(m)
❖ Calculate $\sum_j^m tf_j$	O(m)
❖ Calculate $tf_i = \begin{cases} 1 + \log \sum_j^m tf_j, & \text{if } \sum_j^m tf_j > 0 \\ -(1 + \log(-\sum_j^m tf_j)), & \text{if } \sum_j^m tf_j < 0 \\ 0, & \text{otherwise} \end{cases}$	O(1)
• Calculate $a_i = tf_i \cdot idf_i$	O(1)
Total	O(nm)

Table 68 – Time complexity of Build customer profile step

7.1.5.2. Build vehicle vectors

Step	Complexity
Calculate each vehicle vector v	$O(nk)$
• Calculate each attribute vector v_i of v	$O(k)$
❖ Calculate idf_i	$O(k)$
Calculate $ df_i $	$O(k)$
Calculate $idf_i = \log \frac{ D }{ df_i +1}$	$O(1)$
❖ Calculate $v_i = tf_i \cdot idf_i$	$O(1)$
Total	$O(nk^2)$

Table 69 – Time complexity of *Build vehicle vectors* step

7.1.5.3. Score vehicles

Step	Complexity
Calculate norm $\ a\ = \sqrt{\sum_{i=1}^n a_i^2}$	$O(n)$
Calculate each vehicle's score	$O(n)$
• Calculate norm $\ v\ = \sqrt{\sum_{i=1}^n v_i^2}$	$O(n)$
• Calculate dot product $a \cdot v = \sum_{i=1}^n a_i v_i$	$O(n)$
• Calculate vehicle's score $\cos \theta = \frac{a \cdot b}{\ a\ \ b\ }$	$O(1)$
Total	$O(nk)$

Table 70 – Time complexity of *Score vehicles* step

7.1.5.4. Overall time complexity

The overall time complexity of our algorithm is $O(n(k^2 + k + m))$. This complexity has 2 pain points. The first being k^2 , which can somehow be reduced by applying normal filtering first to lessen the number of vehicle in vector space. The second pain point is the number of collaborative attributes in n .

n is the sum between the content-based attributes presented naturally on every vehicle and the collaborative attributes which are the neighbors a vehicle has. The more booking the customer makes, the more neighbors he may have, and the bigger n will become. However, as a car rental solution, our transactions tend to be big in value but small in quantity. The average number of booking a single customer makes may just stop at a few dozen. Further conclusion can only be drawn with concrete statistics, however.

Conclusively, this algorithm's scalability is quite poor, but this is common and is still very acceptable as a recommendation solution, especially those follow collaborative approach. In the future that the system will increase in size, there will be a need for either an upgrade of hardware and software to increase computing power, or the development of a new engine.

7.2. Rental payment procedure

CRP not only helps customer to place booking but also helps provider to take advance payment for each booking.

To place a booking, customer must first pay an *AdvanceFee* to the system. This includes the booking *Deposit*, which is advance payment part of total *RentalPrice*, and *BookingFee*, which is the fee paid for our service.

$$\text{AdvanceFee} = \text{Deposit} + \text{BookingFee}$$

Provider can specify how many percent of the total *RentalPrice* customer has to pay in advance using VehicleGroup's *DepositPercentage*.

$$\text{Deposit} = \text{RentalPrice} * \text{DepositPercentage}$$

The rest of the *RentalPrice* can be paid later either at the start or the end of rental period, depending on provider's rental policy.

The *BookingFee* is calculated base on *RentalPrice*. As our solution is new, we propose that the *BookingFee* should be low (1% of *RentalPrice*). We can raise *BookingFee* later as our service becomes more mature and successful.

E. システムの展開とテスト

1. はじめに

1.1 概要

本節、物理データベースの詳細とその記述は表れています。その上、CRP のテストの方法やテストプランやテストケースも記載されています。

1.2 テストアプローチ

- ゴール: 要求を満たすため、すべてのシステムが正常に実行されること。
- 方法: システムテスト、ブラックボックステスト。

2. データベース関係ダイアグラム

2.1 ウェブアプリケーション物理的なダイアグラム

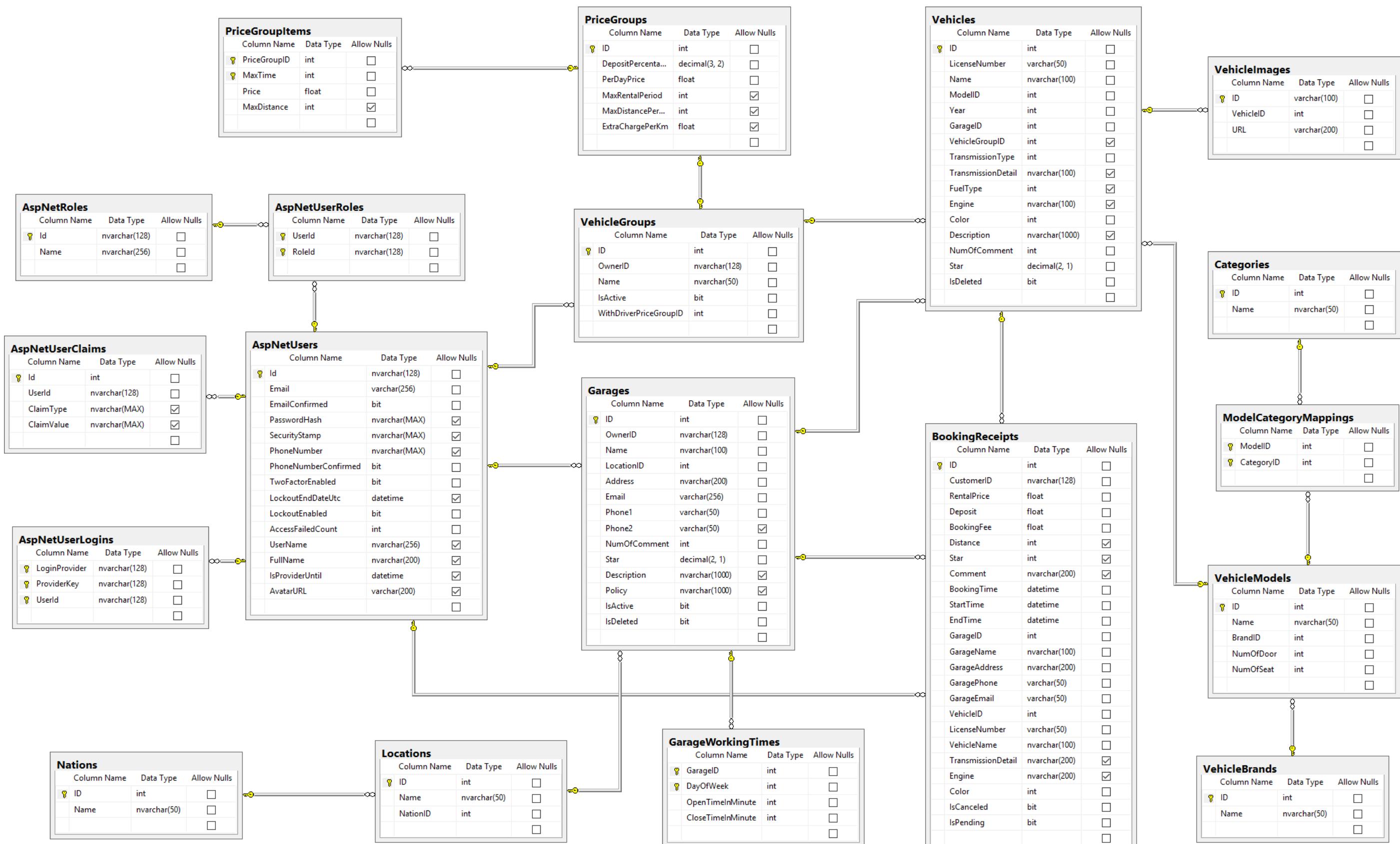


Figure 61: ウェブサイトアプリケーション物理的なダイアグラム

2.2 ウェブアプリケーションデータ辞書

データ辞書		
数字	実体名	記述
01	AspNetUsers	システムでユーザを含有しています
02	AspNetRoles	システムでロールを含有しています
03	AspNetUserRoles	システムでユーザがロールに関係付けることを含有しています
04	AspNetUserClaims	システムでユーザのデータを含有しています
05	AspNetUserLogins	システムでユーザのログインする管理を含有しています
06	Vehicles	システムで乗り物を含有しています
07	VehicleImages	システムで乗り物のイメージを含有しています
08	VehicleModels	システムで乗り物モデルを含有しています
09	VehicleBrands	システムで乗り物ブランドを含有しています
10	Categories	システムで乗り物のタイプを含有しています
11	ModelCategoryMappings	システムで乗り物モデルが乗り物のタイプに関係付けることを含有しています
12	VehicleGroups	システムで乗り物のグループを含有しています
13	PriceGroups	システムで乗り物の賃料を含有しています
14	PriceGroupItems	システムで時間によって乗り物の賃料を含有しています
15	Garages	システムでガレージを含有しています
16	GarageWorkingTimes	システムでガレージのスケジュールを含有しています
17	Locations	システムでロケーションを含有しています
18	Nations	システムで国家を含有しています
19	BookingReceipts	システムで予約のレシートを含有しています

Table 71 : データ辞書

2.2.1. AspNetUsers

属性	ドメイン	記述
Id	nvarchar(128)	AspNetUser のユニークな識別子
Email	varchar(256)	ユーザのメール
EmailConfirmed	bit	電子メールが確認されたかどうかを示すステータス。
PasswordHash	nvarchar(MAX)	ユーザーの暗号化されたパスワード。
SecurityStamp	nvarchar(MAX)	ユーザーのクッキーとセッションを認証するために使用されるスタンプ。
PhoneNumber	nvarchar(MAX)	ユーザの電話番号
PhoneNumberConfirmed	bit	電話番号が確認されたかどうかを示すステータス。

TwoFactorEnabled	bit	二因子ログインが使用可能かどうかを示すステータス。
LockoutEndDateUtc	datetime	lockoutEnable が true の場合、このユーザーがロックアウトされるまでの日。
LockoutEnable	bit	ロックアウトが使用可能かどうかを示すステータス。
AccessFailedCount	int	このアカウントのアクセスに失敗した回数。
UserName	nvarchar(256)	ユーザの名
FullName	nvarchar(200)	ユーザのフルネーム
IsProviderUntil	datetime	このユーザーがプロバイダールを持つまでの日付。
AvatarURL	nvarchar(200)	ユーザのアバターの URL

Table 72 : AspNetUsers テーブル

2.2.2. AspNetRoles

属性	ドメイン	記述
Id	nvarchar(128)	AspNetRole のユニークな識別子
Name	nvarchar(256)	ロールの名

Table 73 : AspNetRoles テーブル

2.2.3. AspNetUserRoles

属性	ドメイン	記述
UserId	nvarchar(128)	ユーザーの唯一の識別子
RoleId	nvarchar(128)	ロールの唯一の識別子

Table 74 : AspNetUserRoles テーブル

2.2.4. AspNetUserClaims

属性	ドメイン	記述
Id	int	ユニークな識別子のクレーム
UserId	nvarchar(128)	クレームが属する AspNetUser の ID
ClaimType	nvarchar(MAX)	クレームのドメイン
ClaimValue	nvarchar(MAX)	クレームのバリュー

Table 75 : AspNetUserClaims テーブル

2.2.5. AspNetUserLogins

属性	ドメイン	記述
LoginProvider	nvarchar(128)	第三者ログインプロバイダの名
ProviderKey	nvarchar(128)	第三者のサービスが提供するユーザのログインキー
UserId	nvarchar(128)	このログインを使用してログインできる AspNetUser の ID

Table 76 : AspNetUserLogins テーブル

2.2.6. Vehicles

属性	ドメイン	記述
ID	int	乗り物のユニークな識別子
LicenseNumber	varchar(50)	乗り物のライセンス番号
Name	nvarchar(100)	乗り物の名
ModelID	int	乗り物のモデル
Year	int	この乗り物が生産された年
GarageID	int	この乗り物を含むガレージの ID
VehicleGroupID	int	この乗り物を含む乗り物のグループの ID
TransmissionType	int	乗り物のギアドメイン
TransmissionDetail	nvarchar(100)	乗り物のギアに関する詳細記述
FuelType	int	乗り物の燃料ドメイン
Engine	nvarchar(100)	乗り物のエンジンに関する詳細記述
Color	int	乗り物の色
Description	nvarchar(1000)	乗り物の記述
NumOfComment	int	この乗り物が受け取った顧客の数
Star	decimal(2, 1)	乗り物の評価
IsDeleted	bit	この乗り物が削除されたかどうかを示すステータス

Table 77 : Vehicles テーブル

2.2.7. VehicleImages

属性	ドメイン	記述
ID	varchar(100)	イメージのユニークな識別子
VehicleID	int	このイメージが属する乗り物の ID
URL	varchar(200)	イメージの URL

Table 78 : VehicleImages テーブル

2.2.8. VehicleModels

属性	ドメイン	記述
ID	int	乗り物モデルのユニークな識別子
Name	nvarchar(50)	ロールの名
BrandID	int	このモデルのブランドの ID
NumOfDoor	int	この乗り物のドア
NumOfSeat	int	この乗り物のシート

Table 79 : VehicleModels テーブル

2.2.9. VehicleBrands

属性	ドメイン	記述
ID	int	乗り物ブランドのユニークな識別子
Name	nvarchar(50)	ブランドの名

Table 80 : VehicleBrands テーブル

2.2.10. Categories

属性	ドメイン	記述
ID	int	カテゴリの唯一の識別子
Name	nvarchar(50)	カテゴリの名前

Table 81 : Categories テーブル

2.2.11. ModelCategoryMappings

属性	ドメイン	記述
ModelID	int	モデルの唯一の識別子
CategoryID	int	カテゴリーの唯一の識別子

Table 82 : ModelCategoryMappings テーブル

2.2.12. Garages

属性	ドメイン	記述
ID	int	ガレージの唯一の識別子
OwnerID	nvarchar(128)	ガレージのユーザーの唯一の識別子
Name	nvarchar(100)	ガレージの名前
LocationID	int	ガレージの場所の唯一の識別子
Address	nvarchar(200)	ガレージの住所
Email	varchar(256)	ガレージのメール
Phone1	varchar(50)	ガレージの主電話番号
Phone2	varchar(50)	ガレージの電話番号
NumOfComment	int	顧客からコメントの量
Star	decimal(2, 1)	ガレージの評価
Description	nvarchar(1000)	ガレージの説明
Policy	nvarchar(1000)	ガレージの規則
IsActive	bit	ガレージの状態
IsDeleted	bit	ガレージの削除したの

Table 83 : Garages テーブル

2.2.13. GarageWorkingTimes

属性	ドメイン	記述
GarageID	int	ガレージの唯一の識別子
DayOfWeek	int	作業時間制約によって表される曜日。
OpenTimeInMinute	int	ガレージの開館時間
CloseTimeInMinute	int	ガレージの閉館時間

Table 84 : GarageWorkingTimes テーブル

2.2.14. Locations

属性	ドメイン	記述
ID	int	場所の唯一の識別子
Name	nvarchar(50)	場所の名前

NationID	int	国家の唯一の識別子
----------	-----	-----------

Table 85 : Locations テーブル

2.2.15. Nations

属性	ドメイン	記述
ID	int	国家の唯一の識別子
Name	nvarchar(50)	国家の名前

Table 86 : Nations テーブル

2.2.16. VehicleGroups

属性	ドメイン	記述
ID	Int	乗り物グループの唯一の識別子
OwnerID	nvarchar(128)	乗り物グループのユーザーの唯一の識別子
Name	nvarchar(50)	乗り物グループの名前
IsActive	Bit	乗り物グループの状態
WithDriverPriceGroupID	Int	既定運転手の唯一の識別子

Table 87 : VehicleGroups テーブル

2.2.17. PriceGroups

属性	ドメイン	記述
ID	int	価格グループの唯一の識別子
DepositPercentage	decimal(3, 2)	保証金の割合
PerDayPrice	float	1日当たりの価格
MaxRentalPeriod	int	借りられる最大時間
MaxDistancePerDay	int	1日当たりの借りられる最大距離
ExtraChargePerKm	float	1 km当たりの追加の費用

Table 88 : PriceGroups テーブル

2.2.18. PriceGroupItems

属性	ドメイン	記述
PriceGroupID	int	価格グループの唯一の識別子
MaxTime	int	借りられる最大時間
Price	float	価格
MaxDistance	int	借りられる最大距離

Table 89 : PriceGroupItems テーブル

2.2.19. BookingReceipts

属性	ドメイン	記述
ID	int	予約のレシートの唯一の識別子
CustomerID	nvarchar(128)	顧客の唯一の識別子
RentalPrice	float	合計借りる費
Deposit	float	保証金
BookingFee	float	予約費
Distance	int	距離
Star	int	評価

Comment	nvarchar(200)	コメント
BookingTime	datetime	予約する時刻
StartTime	datetime	予約の始まる時間
EndTime	datetime	予約の終わる時間
GarageID	int	ガレージの唯一の識別子
GarageName	nvarchar(100)	ガレージの名前
GarageAddress	nvarchar(200)	ガレージの住所
GaragePhone	varchar(50)	ガレージの電話番号
GarageEmail	varchar(50)	ガレージのメール
VehicleID	int	乗り物の唯一の識別子
LicenseNumber	varchar(50)	乗り物のライセンス番号
VehicleName	nvarchar(100)	乗り物の名前
TransmissionDetail	nvarchar(200)	情報の変速機.
Engine	nvarchar(200)	乗り物のエンジン
Color	int	乗り物の色
IsCanceled	bit	予約の状態
IsPending	bit	払ったの

Table 90 : BookingReceipts テーブル

3. パフォーマンス対策

一般的に、結果はユーザが要求を提出した後、5秒未満を現されます。

4. テスト計画

4.1 テストする機能

システムテストはコアワークフローに基づいて行うことになります。

テストする機能:

- 乗り物を探索します
- 顧客:
 - 乗り物を借ります
 - サービスを評価します
 - 予約を取り消します
- プロバイダー
 - 新しい乗り物グループを作成します
 - 乗り物グループを削除します
 - 新しいガレージを作成します
 - ガレージを削除します
 - 新しい乗り物を作成します
 - 乗り物のイメージをアップロードします
 - 乗り物のイメージを削除します
 - 自己予約します

4.2 テストされない機能

- ログインします
- 登録します
- 個人の情報を更新します
- 管理者の機能
- プロバイダー登録
- ガレージを更新します
- 乗り物グループを更新します

5. コミュニケーションダイアグラムとシステムテストのテストケース

5.1 コミュニケーションダイアグラム

Figure 62 : <ゲスト>ログイン<Excluded>

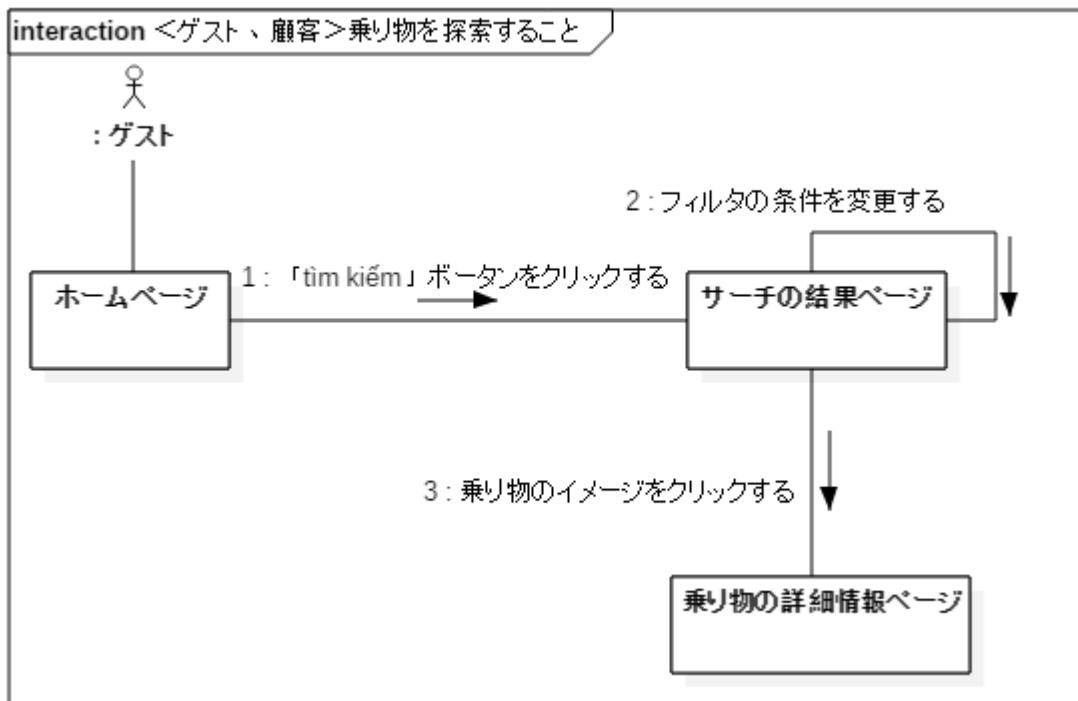


Figure 63 : <ゲスト、顧客>乗り物を探索すこと

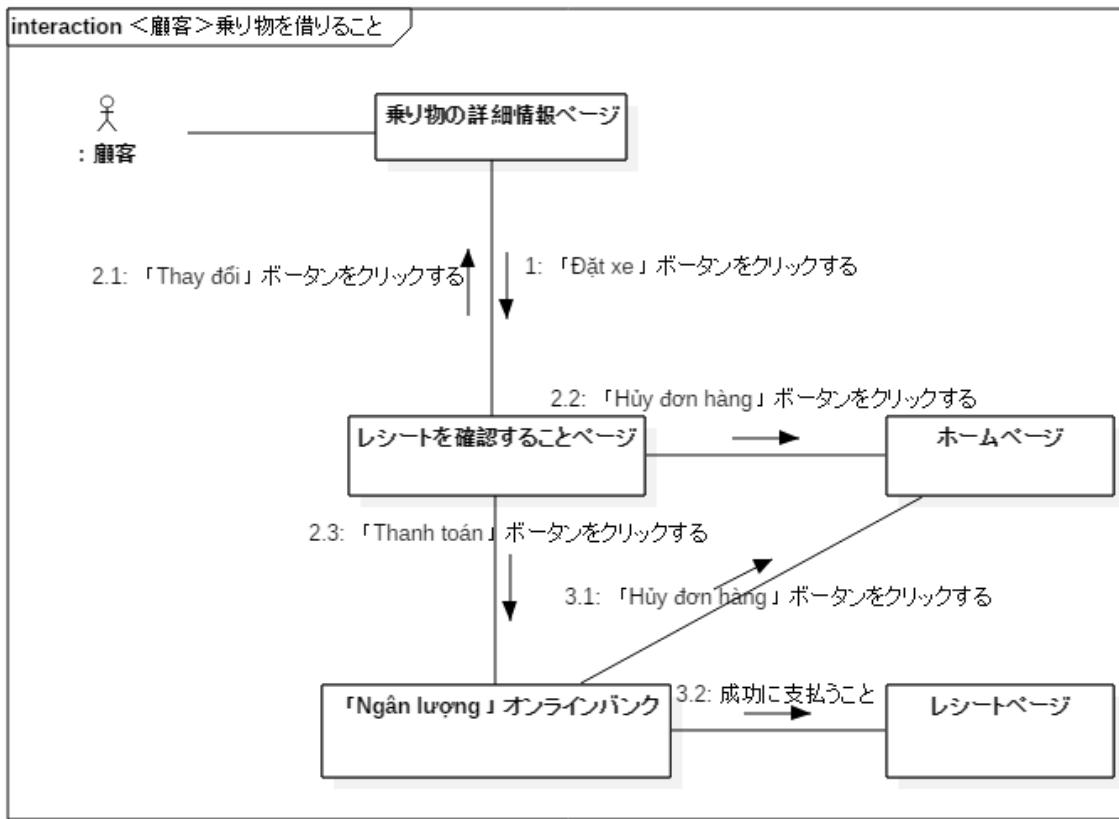


Figure 64 : <顧客>乗り物を借りること

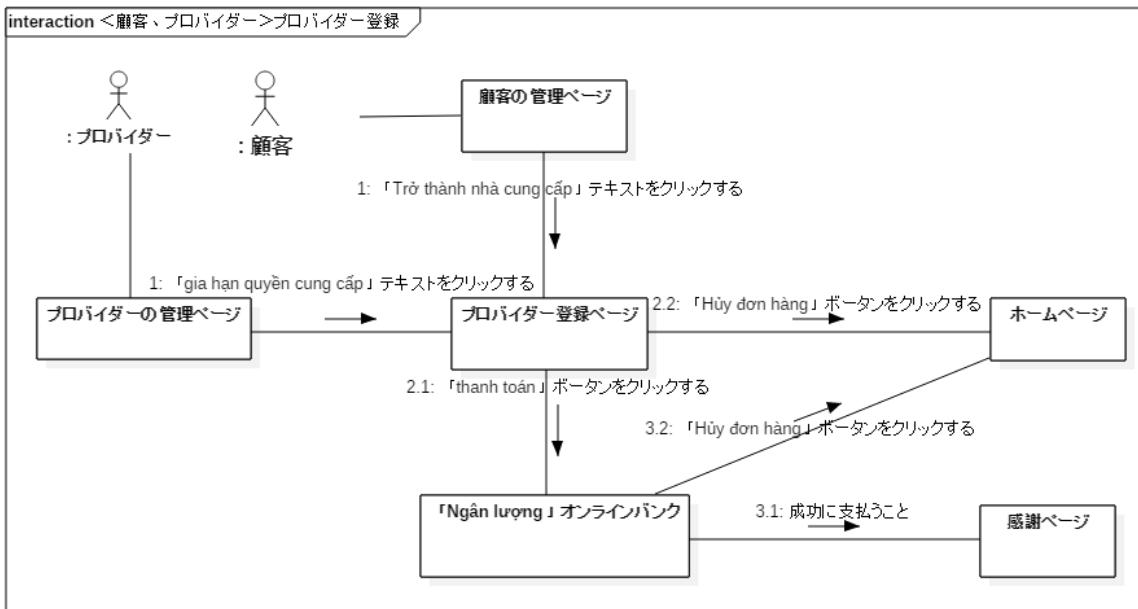


Figure 65 : <顧客、プロバイダー>プロバイダー登録

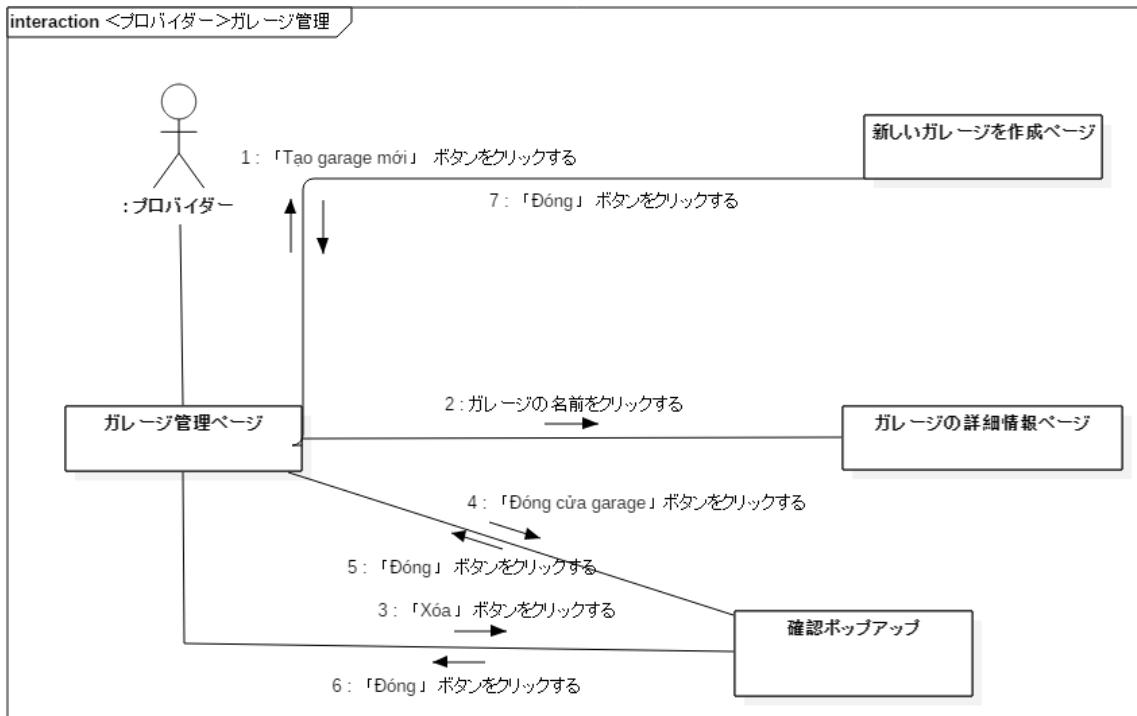


Figure 66 : <プロバイダー>ガレージ管理

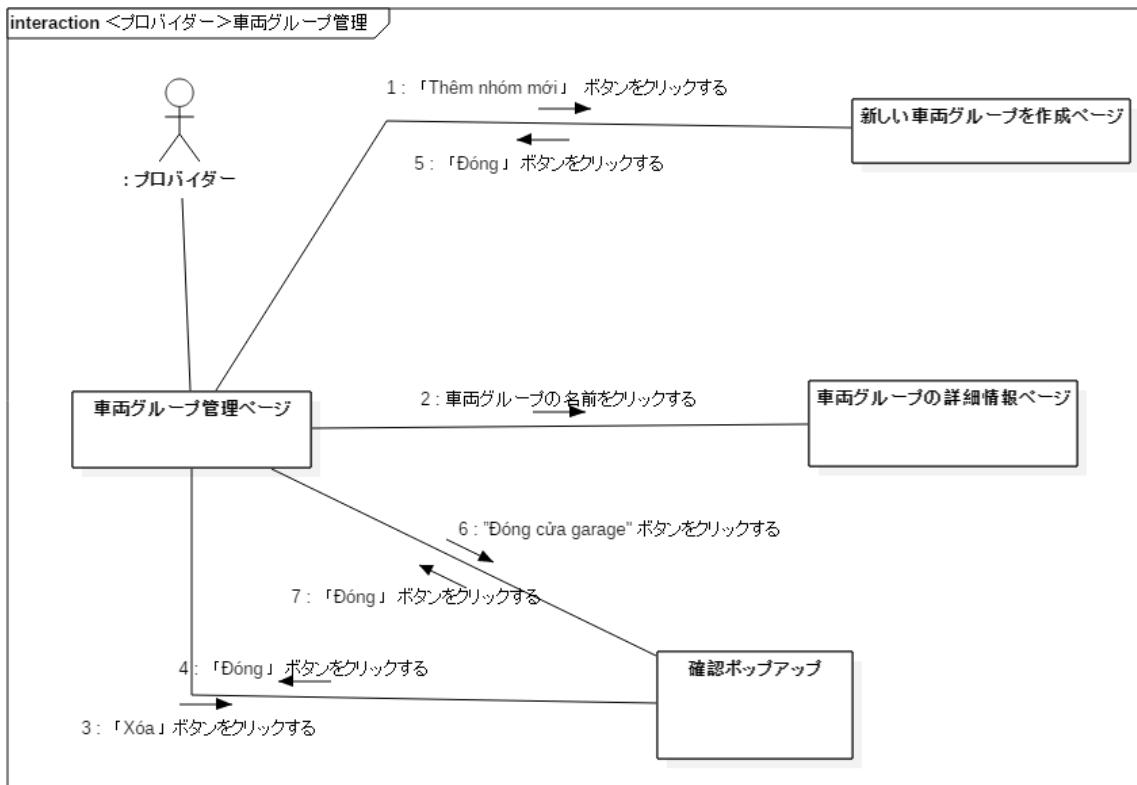


Figure 67 : <プロバイダー>乗り物グループ管理

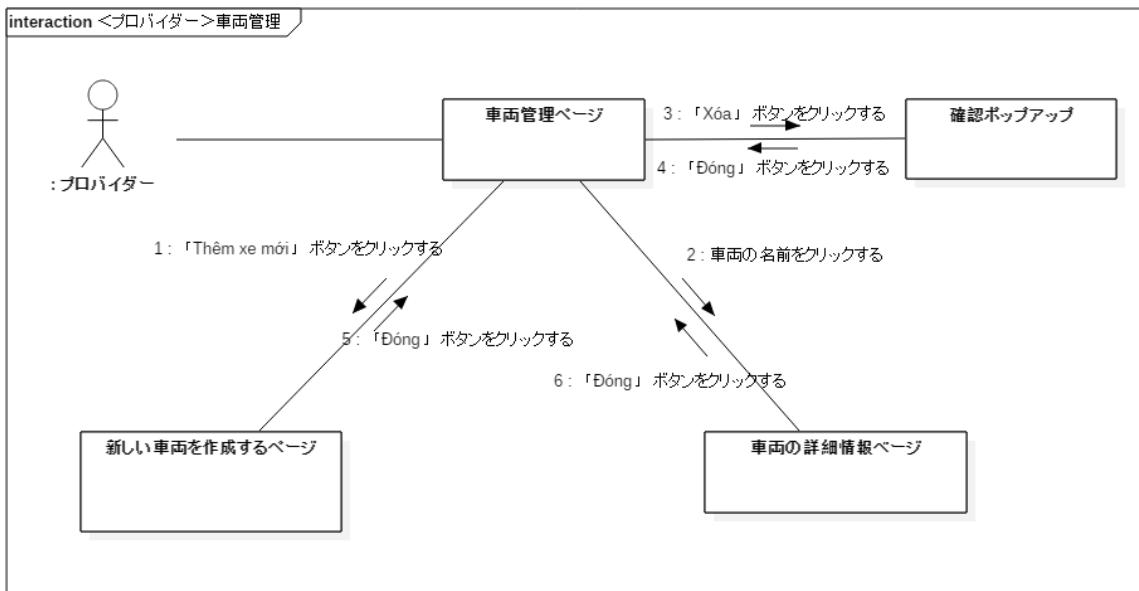


Figure 68 : <プロバイダー>>乗り物管理

5.2 ウェブシステムのテストケース

5.2.1 乗り物を探索する

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈
TC001	基本探索するページから高度探索するページにリダイレクトする	1. 「Tim kiém」ボタンをクリックして	高度探索するページにリダイレクトする	なし	合格	22/11/2016	なし
TC002	「Hồ Chí Minh」に乗り物を探索する	1. 「Địa điểm」のテキストボックスに「Hồ Chí Minh」を選んで	「Hồ Chí Minh」に借りられる乗り物が表示される	なし	合格	22/11/2016	なし
TC003	8席がある乗り物を探索する	1. 「8 chỗ」を選んで	8席がある乗り物が表示される	なし	合格	22/11/2016	なし
TC004	「Audi A4 Avant」を探索する	1. 「Dòng xe」のテキストボックスに「Audi A4 Avant」を選んで	「Audi A4 Avant」だけが表示される	なし	合格	22/11/2016	なし

Table 91: 「乗り物を探索する」 テストケース

5.2.2 <顧客>乗り物を借りる

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈
TC005	乗り物のガレージの連絡予報が表示される	1. 「Nhấn vào đây để lấy thông tin liên lạc」ボタンをクリックして	乗り物のガレージの連絡予報のポップアップが表示する	なし	合格	22/11/2016	なし

TC006	予約の情報をみると支払う	1. 「Đặt」ボタンをクリックして	予約を確認するページにリダイレクトする	なし	合格	22/11/2016	なし
TC007	予約をキャンセルする	「Thay đổi」ボタンをクリックして 「Hủy đơn hàng」ボタンをクリックして	乗り物の情報ページにリダイレクトする	なし	合格	22/11/2016	なし
TC008	予約を支払う	1. 支払うの方法を選べて 2. 「Thanh toán」ボタンをクリックして	「Ngân lượng」ページにリダイレクトする	なし	合格	22/11/2016	なし
TC009	5分以上に「Thanh toán」ボタンをクリックさないとき、乗り物の情報のページに振り返ります。	1. 乗り物の情報のページに「Đặt xe」ボタンをクリックして 2. 5分以上に「Thanh toán」ボタンをクリックさない	乗り物の情報のページに振り返る。	なし	合格	22/11/2016	なし
TC010	「Thanh toán」ボタンをクリックする後に5分以上に支払わないとき、予約が取り消される	1. 「Thanh toán」ボタンをクリックして 2. 5分以上に支払わない	予約が取り消される	なし	合格	22/11/2016	なし

Table 92: 「乗り物を借りる」テストケース

5.2.3 <顧客>サービスを評価する

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈

TC011	「Đánh giá」テキストボックスがブランクされる場合	1. 「Đánh giá」 テキストをクリックする。 2. 「Gửi」 ボタンをクリックする。	エラー「 Hãy nhập」を通知する	なし	合格	19/11/2016	なし
TC012	「Đánh giá」テキストボックスに「abc」を入力する場合	1. 「Đánh giá」 テキストをクリックする。 2. 「Đánh giá」 テキストボックスに「abc」を入力する。 3. 「Gửi」 ボタンをクリックする。	エラー「 Hãy nhập ít nhất 20 kí tự trở lên.」を通知する	なし	合格	19/11/2016	なし
TC013	「Đánh giá」テキストボックスに 201 字を入力する場合	1. 「Đánh giá」 テキストをクリックする。 2. 「Đánh giá」 テキストボックスに 201 字を入力する。	入力できない。	なし	合格	19/11/2016	なし
TC014	「Đánh giá」テキストボックスに 20 字を入力する場合	1. 「Đánh giá」 テキストをクリックする。 2. 「Đánh giá」 テキストボックスに「Tôi thấy dịch vụ tốt」を入力する。 3. 「Gửi」 ボタンをクリックする。	「 Gởi đánh giá thành công.」を通知する	なし	合格	19/11/2016	なし

Table 93: 「サービスを評価する」 テストケース

5.2.4 <顧客>予約を取り消す

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈
TC015	「Hủy đặt xe」 ポップアップで「Đóng」	1. 「Hủy đặt xe」 テキストをクリックする。	「Hủy đặt xe」 ポップアップが閉じられる	なし	合格	19/11/2016	なし

	ボータンをクリックする場合	2. 「Đóng」 ボータンをクリックする。					
TC016	「Hủy đặt xe」 ポップアップで「Hủy」 ボータンをクリックする場合	1. 「Hủy đặt xe」 テキストをクリックする。 2. 「Hủy」 ボータンをクリックする。	「Hủy đặt xe」 ポップアップが閉じられる。そして、「Hủy đặt xe thành công.」 を通知しながら状態が 「Đã hủy」 になる	なし	合格	19/11/2016	なし

Table 94: 「予約を取り消す」 テストケース

5.2.5 <プロバイダー>新しい乗り物グループを作成する

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈
TC017	新しい乗り物グループのポップアップが表示される	1. 「Thêm nhóm mới」 ボタンをクリックして	新しい乗り物グループのポップアップが表示する	なし	合格	22/11/2016	なし
TC018	乗り物グループを作成することをキャンセルする	「Đóng」 ボタンをクリックして	乗り物グループのポップアップが表示されない	なし	合格	22/11/2016	なし
TC019	間違いデータを入力する（乗り物グループの	1. 「Thêm nhóm mới」 ボタンをクリックして 2. 乗り物グループの名前が入力さない	「Tên vehicle group không được trống」 エラーメッセージが表示する	なし	合格	22/11/2016	なし

	名前が空白)	3. 預金のテキストボックスに400を入力して 4. 1ひ当たりの費のテキストボックスに800を入力して 5. 最大期限のテキストボックスに5を入力して 6. 1日当たりの最大距離のテキストボックスに70を入力して 7. 余分費のテキストボックスに100を入力して					
TC020	間違いデータを入力する（乗り物グループの預金が空白）	1. 「Thêm nhóm mới」ボタンをクリックして 2. 乗り物グループの名前のテキストボックスに[GarageA]を入力して 3. 預金のテキストボックスが入力さない 4. 1ひ当たりの費のテキストボックスに800を入力して 5. 最大期限のテキストボックスに5を入力して 6. 1日当たりの最大距離のテキストボックスに70を入力して 7. 余分費のテキストボックスに100を入力して	「Só tiền đặt cọc không được trống」エラーメッセージが表示する	なし	合格	22/11/2016	なし
TC021	間違いデータを入力する（乗り物	1. 「Thêm nhóm mới」ボタンをクリックして	「Giá theo ngày không được trống」エラー	なし	合格	22/11/2016	なし

	グループの 1ひ当たり の費が空 白)	<p>2. 乗り物グループの名前のテキストボックスに[GarageA]を入力して</p> <p>3. 預金のテキストボックスに5を入力して</p> <p>4. 1ひ当たりの費のテキストボックスが入力さない</p> <p>5. 最大期限のテキストボックスに5を入力して</p> <p>6. 1日当たりの最大距離のテキストボックスに70を入力して</p> <p>7. 余分費のテキストボックスに100を入力して</p>	メッセージが表示する			
TC022	正しいデータを入力して、新しい乗り物グループを作成する	<p>1. 「Thêm nhóm mới」ボタンをクリックして</p> <p>2. 乗り物グループの名前のテキストボックスに[GarageA]を入力して</p> <p>3. 預金のテキストボックスに5を入力して</p> <p>4. 1ひ当たりの費のテキストボックスに5を入力して</p> <p>5. 最大期限のテキストボックスに5を入力して</p> <p>6. 1日当たりの最大距離のテキストボックスに70を入力して</p> <p>7. 余分費のテキストボックスに100を入力して</p>	新しい乗り物グループが追加された	なし	合格	22/11/2016

TC023	間違いデータを入力する（乗り物グループの名前は200字のほうが長いだ）	1. 「Thêm nhóm mới」ボタンをクリックして 2. 乗り物グループの名前のテキストボックスに200字のほうが長い名前を入力して 3. 預金のテキストボックスに5を入力して 4. 1ひ当たりの費のテキストボックスに5を入力して 5. 最大期限のテキストボックスに5を入力して 6. 1日当たりの最大距離のテキストボックスに70を入力して 7. 余分費のテキストボックスに100を入力して	「Tên vehicle group không lớn hơn 200 ký tự」エラーメッセージが表示する	なし	合格	22/11/2016	なし
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Table 95: 「新しい乗り物グループを作成する」テストケース

5.2.6 <プロバイダー>乗り物グループを削除する <Excluded>

5.2.7 <プロバイダー>新しいガレージを作成する

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈
TC026	新しいガレージのポップアップが表示される	1. 「Tạo garage mới」ボタンをクリックして	新しいガレージのポップアップが表示する	なし	合格	22/11/2016	なし
TC027	ガレージを作成することを	「Đóng」ボタンをクリックして	ガレージのポップアップ	なし	合格	22/11/2016	なし

	キャンセルする		プが表示されない				
TC028	間違いデータを入力する (ガレージの名前が空白)	1. 「Tạo garage mới」ボタンをクリックして 2. ガレージの名前が入力さない 3. 場所のテキストボックスに「An Giang」を入力して 4. 住所のテキストボックスに「A AA」を入力して 5. メールのテキストボックスにsss@mail.comを入力して 6. 電話番号のテキストボックスに9 0 9 0 9 0を入力して 7. 説明のテキストボックスに[aa]を入力して	「Tên garage không được trống」エラーメッセージが表示する	なし	合格	22/11/2016	なし
TC029	間違いデータを入力する (ガレージの住所が空白)	1. 「Tạo garage mới」ボタンをクリックして 2. ガレージの名前が入力さない 3. 場所のテキストボックスに「An Giang」を入力して 4. 住所のテキストボックスに「A AA」を入力して 5. メールのテキストボックスにsss@mail.comを入力して 6. 電話番号のテキストボックスに9 0 9 0 9 0を入力して 7. 説明のテキストボックスに[aa]を入力して	「Địa chỉ garage」エラーメッセージが表示する	なし	合格	22/11/2016	なし

TC030	間違いデータを入力する (ガレージのメールが空白)	<ol style="list-style-type: none"> 1. 「Tạo garage mới」 ボタンをクリックして 2. ガレージの名前が入力さない 3. 場所のテキストボックスに「An Giang」を入力して 4. 住所のテキストボックスに「A AA」を入力して 5. メールのテキストボックスに sss@mail.com を入力して 6. 電話番号のテキストボックスに 9 0 9 0 9 0 を入力して 7. 説明のテキストボックスに[aa]を入力して 	「Email không được trống」 エラーメッセージが表示する	なし	合格	22/11/2016	なし
TC031	正しいデータを入力して、新しいメールを作成する	<ol style="list-style-type: none"> 1. 「Tạo garage mới」 ボタンをクリックして 2. ガレージの名前テキストボックスに「garage A」を入力して 3. 場所のテキストボックスに「An Giang」を入力して 4. 住所のテキストボックスに「A AA」を入力して 5. メールのテキストボックスに sss@mail.com を入力して 6. 電話番号のテキストボックスに 9 0 9 0 9 0 を入力して 7. 説明のテキストボックスに[aa]を入力して 	新しいガレージが追加された	なし	合格	22/11/2016	なし

TC032	間違いデータを入力する (ガレージの電話番号が空白)	1. 「Tạo garage mới」ボタンをクリックして 2. ガレージの名前が入力さない 3. 場所のテキストボックスに「An Giang」を入力して 4. 住所のテキストボックスに「A AA」を入力して 5. メールのテキストボックスに sss@mail.com を入力して 6. 電話番号のテキストボックスに 909090 を入力して 7. 説明のテキストボックスに[aa]を入力して	「 Số điện thoại không được trống」エラーメッセージが表示する	なし	合格	22/11/2016	なし
TC033	間違いデータを入力する (ガレージのメールは形式と違う)	1. 「Tạo garage mới」ボタンをクリックして 2. ガレージの名前テキストボックスに「garage A」を入力して 3. 場所のテキストボックスに「An Giang」を入力して 4. 住所のテキストボックスに「A AA」を入力して 5. メールのテキストボックスに s s s を入力して 6. 電話番号のテキストボックスに 909090 を入力して 7. 説明のテキストボックスに[aa]を入力して	「 Email không đúng format」エラーメッセージが表示する	なし	合格	22/11/2016	なし

Table 96: 「新しいガレージを作成する」テストケース

5.2.8 <プロバイダー>ガレージを削除する <Excluded>

5.2.9 <プロバイダー>新しい乗り物を作成する

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈
TC036	ガレージと 乗り物のト ランスマッ ションタイプ と乗り物 の色と乗り 物のイメー ジがブラン クされる	1. プロバイダーは 「Thêm xe mới」ボータ ンをクリックする。 2. ガレージと乗り物 のトランスマッショ ンタイプと乗り物の色と 乗り物のイメージがブ ランクする 3. 「OK」ボタン をクリックする	ステップ 3 には、エラー 「Vui lòng chọn garage xe」と 「Vui lòng chọn loại hộp số」と 「Vui lòng chọn màu xe」と 「Bạn phải upload ít nhất 4 hình」を通知する	なし	合格	19/11/2016	なし
TC037	全部でブラ ンクされる	1. プロバイダーは 「」ボタンをクリッ クする。 2. 「OK」ボタン をクリックする	ステップ 2 には、エラー 「Tên xe không được để trống」 と「Biển số xe không được để trống」と「Vui lòng chọn dòng xe」と「Năm sản xuất của xe không được để trống」と「Vui lòng chọn garage xe」と「Vui lòng chọn loại hộp số」と「Vui lòng chọn màu xe」と「Bạn phải upload ít nhất 4 hình」を通 知する	なし	合格	19/11/2016	なじ

TC038	成功に乗り物を造る	1. 乗り物の情報を入力する。 2. 「OK」ボタンをクリックする	「Tạo xe thành công」を通知しながら乗り物のリストをリロードする	なし	合格	19/11/2016	なじ
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Table 97: 「新しい乗り物を作成する」 テストケース

5.2.10 <プロバイダー>乗り物のイメージをアップロードする

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈
TC039	イメージは3つだけある場合	1. プロバイダーは「Thêm xe mới」ボタンをクリックする。 2. 乗り物の情報を入力してイメージを3つアップロードする。 3. 「OK」ボタンをクリックする	ステップ3には、エラー「Bạn phải upload ít nhất 4 hình」を通知する	なし	合格	19/11/2016	なし
TC040	イメージは4つある場合	1. プロバイダーは「Thêm xe mới」ボタンをクリックする。 2. 乗り物の情報を入力してイメージを4つアップロードする。 3. 「OK」ボタンをクリックする	「Tạo xe thành công」を通知しながら乗り物のリストをリロードする	なし	合格	19/11/2016	なじ
TC041	イメージは10ある場合	1. プロバイダーは「Thêm xe mới」ボタンをクリックする。 2. 乗り物の情報を入力してイメージを10アップロードする。 3. 「OK」ボタンをクリックする	「Tạo xe thành công」を通知しながら乗り物のリストをリロードする	なし	合格	19/11/2016	なじ
TC042	イメージは	1. プロバイダーは「Thêm xe mới」ボタンをクリックする。s	イメージを最初の10アップロ	なし	合格		

	1 1 ある場合	2. 乗り物の情報を入力してイメージを 1 1 アップロードする。 3. 「OK」ボタンをクリックする	ードする。そして「Tạo xe thành công」を通知しながら乗り物のリストをリロードする				
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Table 98: 「乗り物のイメージをアップロードする」 テストケース

5.2.11 <プロバイダー>乗り物のイメージを削除する <Excluded>

5.2.12 <プロバイダー>自己予約する

ID	説明	テストケース順序	出力	インター テストケース 依存性	結果	テスト期日	注釈
TC045	予約がない間	1. 「Tạo đặt xe」ボタンをクリックする。 2. 適当の時間を選択する 3. 「Tạo」ボタンをクリックする。	乗り物のリストをリロードしながら「Tạo đặt xe mới thành công」を通知する	なし	合格	19/11/2016	なし
TC046	顧客の予約がある間	1. 「Tạo đặt xe」ボタンをクリックする。 2. 説明の要求に時間を選択する。 3. 「Tạo」ボタンをクリックする。	エラー「Xe đã được đặt trong khoảng thời gian này」を通知する	なし	合格	19/11/2016	なし
TC047	自己予約がある間	1. 「Tạo đặt xe」ボタンをクリックする。 2. 説明の要求に時間を選択する。 3. 「Tạo」ボタンをクリックする。	エラー「Xe đã được đặt trong khoảng thời gian này」を通知する	なし	合格	19/11/2016	なし

Table 99: 「自己予約する」 テストケース

F. 番 6 のレポート。ソフトウェアユ ーザーズマニュアル

1. インストレーションガイド

1.1. サーバ側の環境を設定

1.1.1 ハードウェア要件

スムーズにウェブサイトを実行するためには、以下の要件を備えたコンピュータが必要になります:

- オペレーティングシステム: ウィンドウ XP またはウィンドウのそれ以降のバージョン。
- プロセッサ: 1 GHz 以上。
- メモリ: 2GB 以上。
- ハードウェア: 2GB 以上のハードドライブスペース。
- Wi-Fi インターネット(> 2Mbps)。

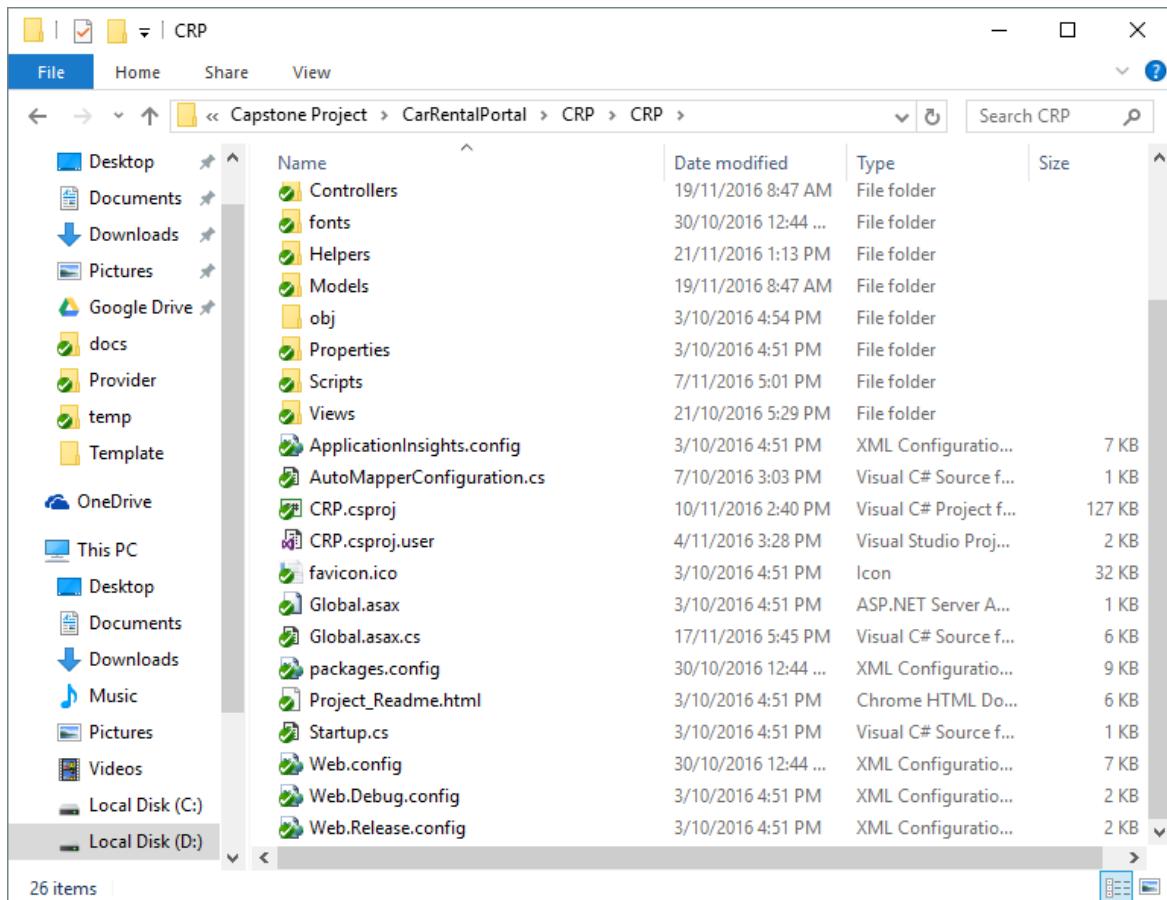
1.1.2 ソフトウェア要件

- ウェブサーバー : Internet information system – IIS 8 With MVC5 enable
- Microsoft Windows Server 2014 (Server Pack 1 64 bit): オペレーティングシステム
- .Net Framework 4.6
- SQL Server 2014

1.2. サーバ側で展開

1.2.1 展開パッケージの準備

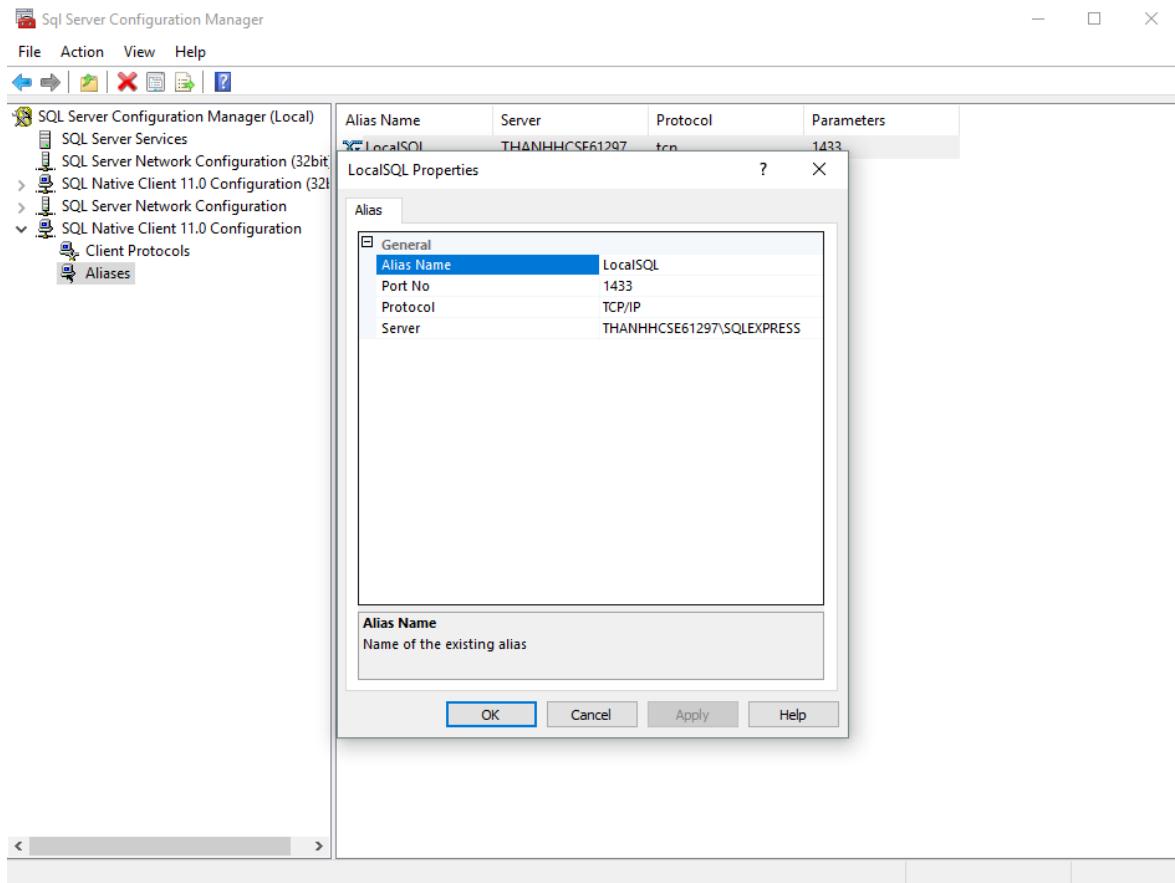
- データベースファイル: CRPDB.bak
- サーバーでのフォルダにソースコードファイル (CRP) をコピーする。



- 例えば : D:\Capstone Project\CarRentalPortal\CRP\CRP

1.2.2 サーバの構成前に展開

- データベースの構成 :



- **Alias Name:** LocalSQL
- **Port No:** 1433
- **Protocol:** TCP/IP
- **Server:** ユーザのサーバ名

```

<connectionStrings>
    <add name="DefaultConnection" connectionString="Data
Source=LocalSQL;Initial Catalog=CRPDB;Integrated Security=True"
providerName="System.Data.SqlClient" />

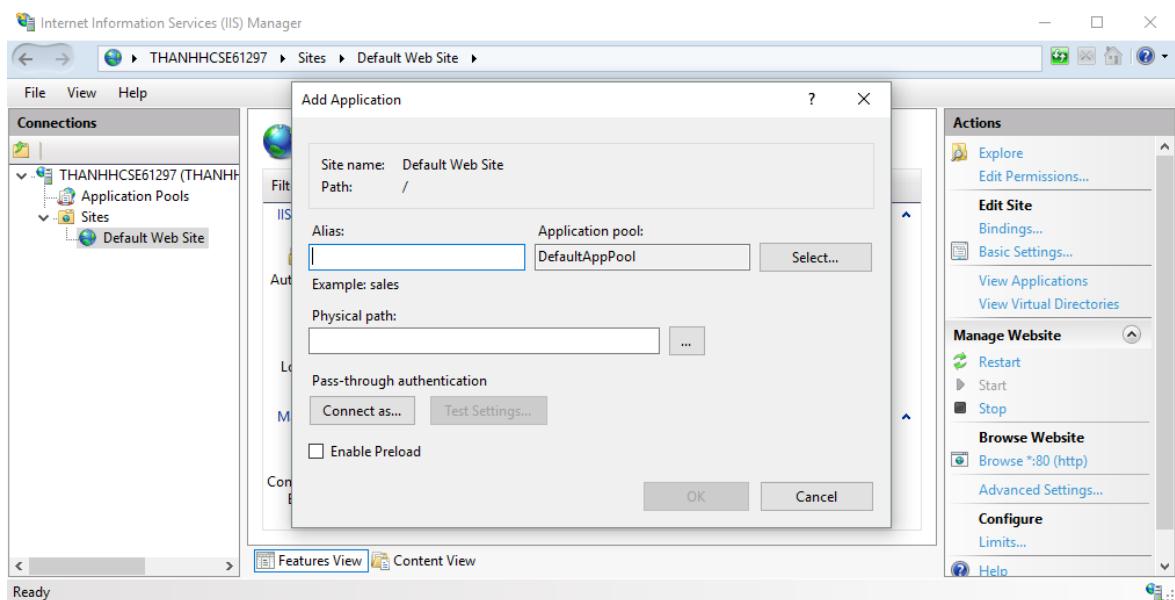
    <add name="CRPEntities"
connectionString="metadata=res://*/Models.Entities.CRP.csdl|res://*/Mod
els.Entities.CRP.ssdl|res://*/Models.Entities.CRP.msl;provider=System.Da
ta.SqlClient;provider connection string="data
source=LocalSQL;initial catalog=CRPDB;integrated
security=True;MultipleActiveResultSets=True;App=EntityFramework&q
uot;" providerName="System.Data.EntityClient" />
</connectionStrings>

```

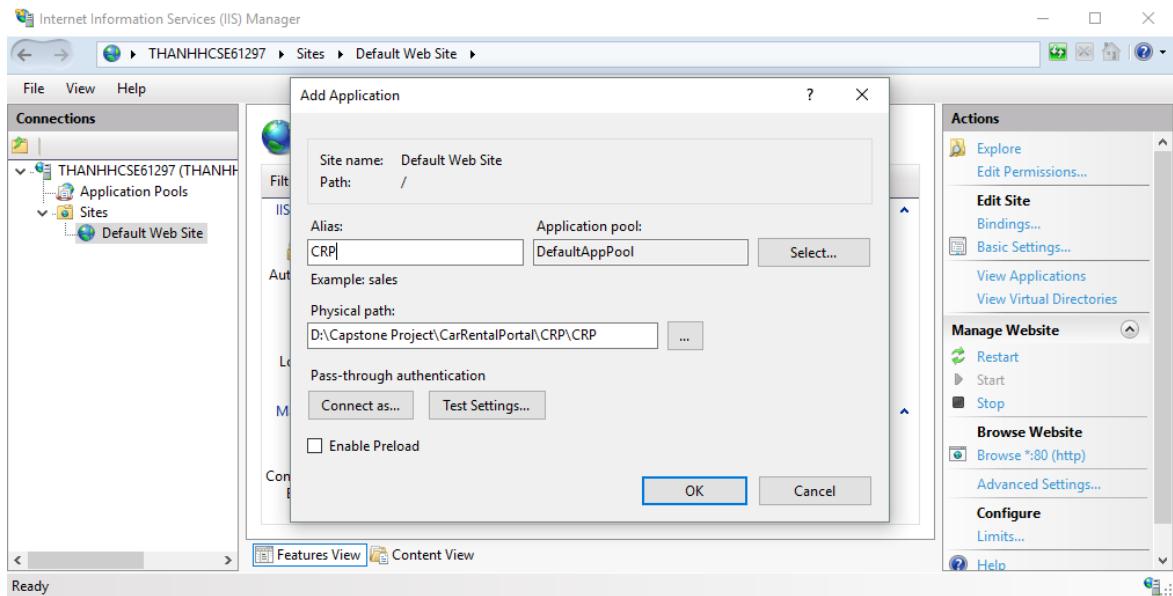
- Catalog: データベース名。

1.2.3 サーバ側でウェブアプリケーションの展開

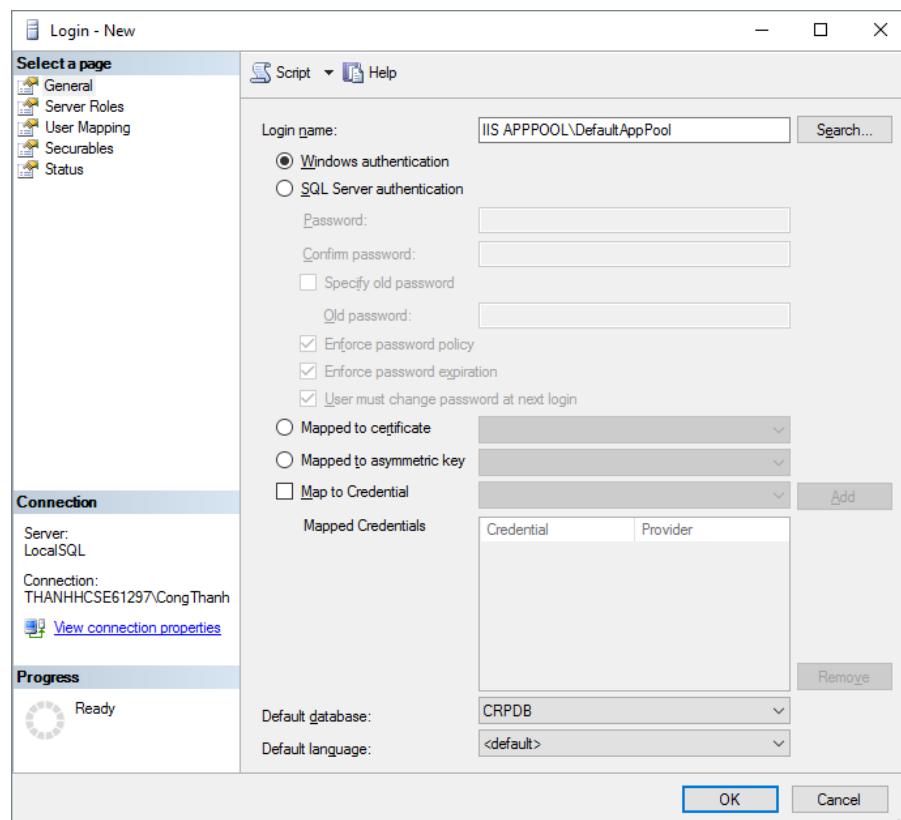
- データベース展開 :
 - SQL Server 2014 に CRPDB.bak をアタックしてください。
- ソースコードの展開 :
 - オープン IIS マネージャ
 - 「Default Web Site」にマウスを右クリックします。 「Add Application」を選びます。

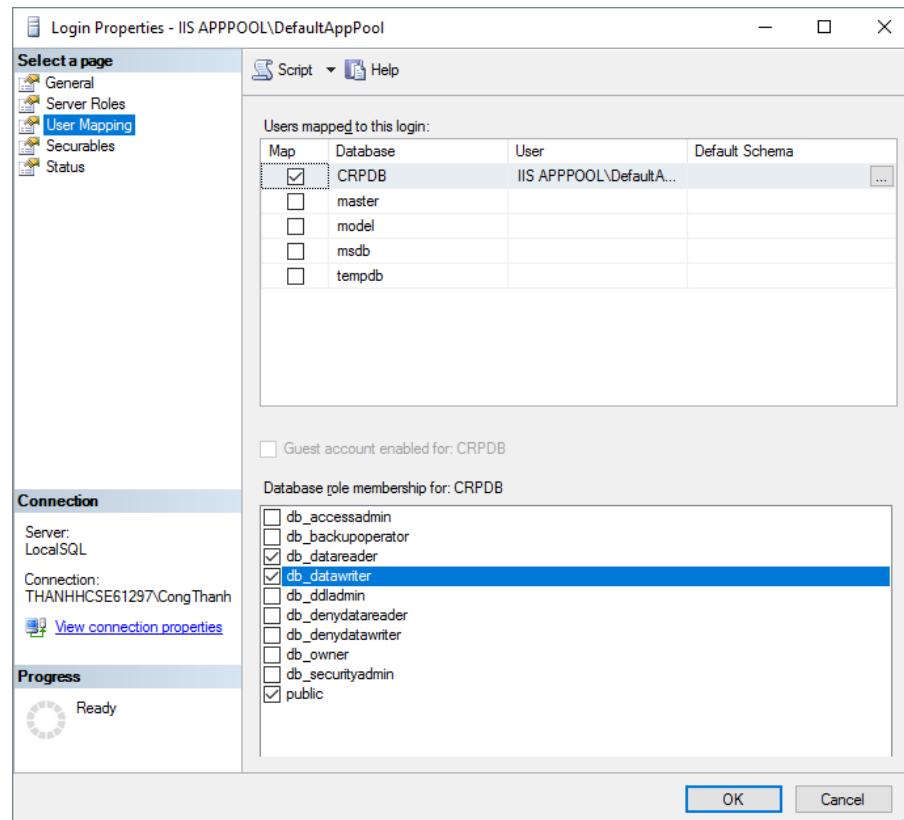


- Alias: Alias を入力してください。例えば : CRP
- Application pool: ASP.NET v4.0 を選んでください
- Physical path: サーバーのソースコードファイルを選んでください
(D:\Capstone Project\CarRentalPortal\CRP\CRP)

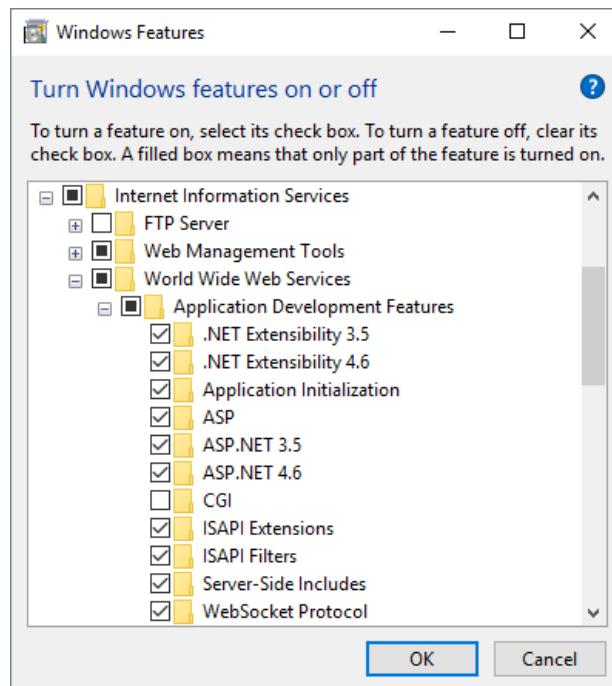


- “OK”ボタンをクリックしてください。
- データベース管理システムで「IIS APPPOOL\DefaultAppPool」を造つて「User Mapping」に「db_datareader」と「db_datawrite」をチェックする

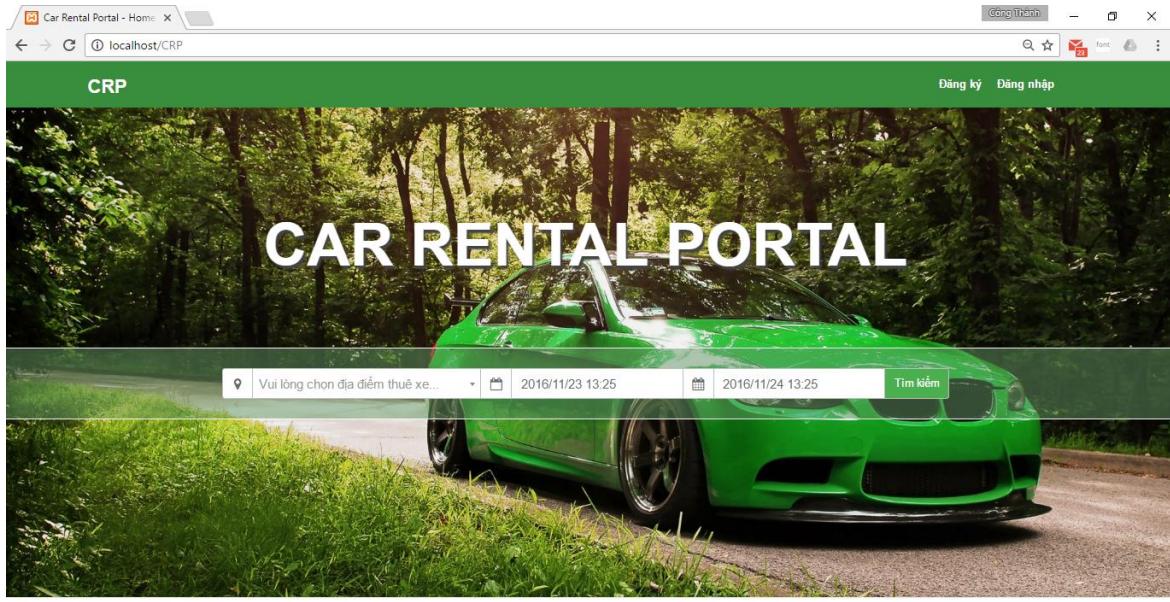




- 「Application Development Features」の中で「CGI」以外全部をチェックする



- オープン : <http://localhost/CRP>



1.3. クライアント側の環境の設定

1.3.1 コンピュータのための設定

- クライアントデバイスは、ウェブサイトを起動するには、以下のブラウザのいずれかを持っている必要があります：
 - Google Chrome(ダウンロードリンク):
 - <http://www.google.com/Chrome>
 - Coc Coc (コックコック) :
 - <http://www.coccoc.com/>

2. ユーザーガイド

2.1. ログイン <Excluded>

2.2. ホームページ <Excluded>

2.3. サーチページ

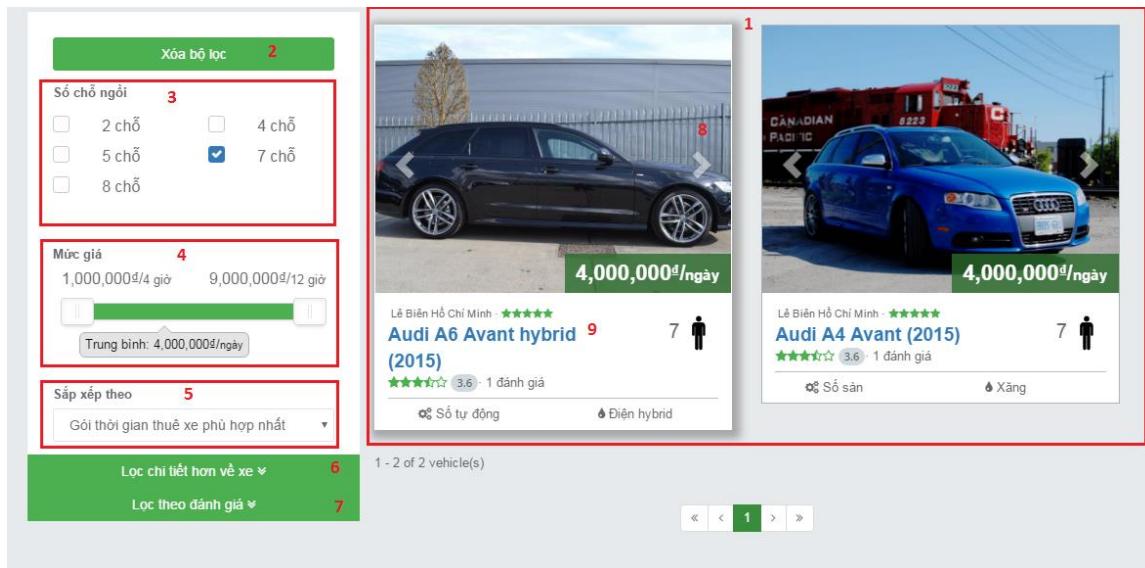


Figure 69 : ベーシックサーチ

ステップ 説明	
1	探して乗り物の結果. この結果はフィルタによると変わります
2	フィルタをリセットしたいとき、「Xóa bộ lọc」をクリックして
3	シートを選んで
4	価格を選んで
5	ソートのタイプを選んで
6	もっと詳細情報で探したいなら、「Lọc chi tiết hơn về xe」タブをクリックして
7	評価のソートで探したいなら、「Lọc theo đánh giá」タブをクリックして
8	写真を動かして
9	乗り物の名前をクリックして、乗り物のディテールページを行きます。

Table 100 : ベーシックサーチ

Lọc chi tiết hơn về xe ▾

Dòng xe
 1

Năm sản xuất
 2013 **2** 2016 **3**


Hộp số
 Số tự động Số sàn **4**

Loại nhiên liệu
 5

Loại xe
 6

Màu sắc
 **7**

Figure 70 : アドバンスサーチ

ステップ	説明
1	乗り物のブランドを選んで
2	スライダーに右に引かされて、最小の年が上がります
3	スライダーに左に引かされて、最小の年が下げます
4	ギアを選んで

5	燃料タイプを選んで
6	乗り物の種類を選んで
7	乗り物の色を選んで

Table 101 : アドバンスサーチ

Lọc theo đánh giá ↴

Đánh giá xe

—
1
▼

Đánh giá của hàng xe

—
2
▼

Figure 71 : 評価サーチ

ステップ	説明
1	乗り物の評価を選んで
2	ガレージの評価を選んで

Table 102 : 評価サーチ

2.4. 乗り物の情報

Thông tin xe	Đánh giá	Cửa hàng	Lịch đặt xe
1	2	3	4

Thông tin liên lạc Địa chỉ: 23 CMT8, quận 10, Hồ Chí Minh

Liên lạc: **5** Nhấn vào để lấy thông tin liên lạc

Thời gian làm việc	Thứ 2	00:00 đến 24:00
	Thứ 3	00:00 đến 24:00
	Thứ 4	00:00 đến 24:00
	Thứ 5	00:00 đến 24:00
	Thứ 6	00:00 đến 24:00
	Thứ 7	00:00 đến 24:00
	Chủ nhật	00:00 đến 24:00

Figure 72 : 一般的な情報

ステップ	説明
1	[必要ない] 乗り物の情報をみたいなら、「Thông tin xe」をクリックします
2	[必要ない] 評価を見たいなら、「Đánh giá」をクリックします
3	[必要ない] 店の情報をみたいなら、「Cửa hàng」をクリックします
4	[必要ない] オーだの履歴を見たいなら、「Lịch đặt xe」をクリックします
5	[必要ない] 「Nhấn vào để lấy thông tin liên lạc」をクリックして、プロバイダーのメール、主要電話番号と副電話番号見えます

Table 103 : 一般的な情報

Lịch đặt xe

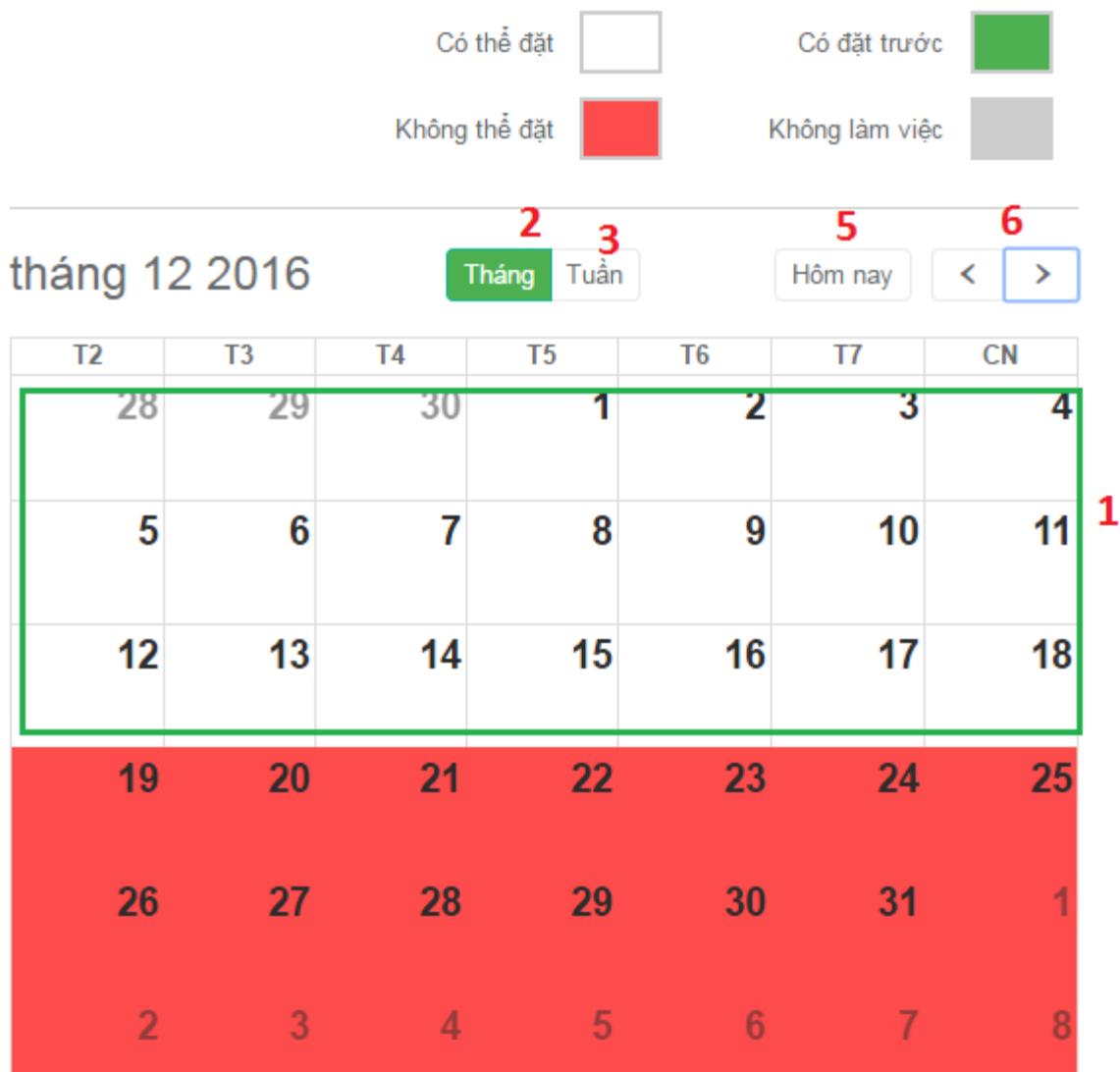


Figure 73 : 予約のスケジュール

ステップ	説明
1	カレンダーの中に日がしろですから、ユーザはその日を借りれます
2	[必要ない] 月でカレンダーが表示したいから、「Tháng」クリックします
3	[必要ない] 週でカレンダーが表示したいから、「Tuần」クリックします
4	[必要ない] オーだの履歴を見たいなら、「Lịch đặt xe」をクリックします

5	[必要ない] 「」をクリックして、カレンダーの今日は表示されます
6	[必要ない] カレンダーの前のページと次のページを表示します。

Table 104 : 予約のスケジュール

The screenshot shows a booking summary page. At the top, it says "4,000,000đ/ngày 9". Below that, it lists the rental period ("Gói thời gian thuê") as "Thuê theo ngày 1" and the number of days ("Số ngày thuê") as "2 1". Under "Thời gian nhận xe", the pickup time is listed as "2016/11/19 14:20 3". The breakdown of fees includes:

- Phí thuê xe ? 4 4,000,000đ
- Đặt cọc ? 5 800,000đ
- Phí dịch vụ ? 6 40,000đ
- Tổng phí phải trả trước ? 7 840,000đ
- Quãng đường ? 8 300 km

At the bottom, there is a green button labeled "Đặt xe 10".

Figure 74 : レンタルの費

ステップ 説明	
1	借りるパッケージを選んで
2	日パッケージを選んだから、何日を入力しなければなりません

3	始まる時間を選んで
4	借りる費を表示されます。この費は1日当たりや1時当たりを表示されて、日や時で増加します
5	預金を表示されて、日や時で増加します。
6	サービス費を表示されて、日や時で増加します。
7	合計費を表示されて、日や時で増加します。
8	最大距離を表示されます。レンタルの距離はこの距離のほうが長いですから、余分費を払わなければなりません
9	1日当たりや1時当たりの費を表示されます
10	「Đặt xe」ボタンをクリックして、払い確認ページへ行きます

Table 105 : レンタルの費

2.5. 予約確認

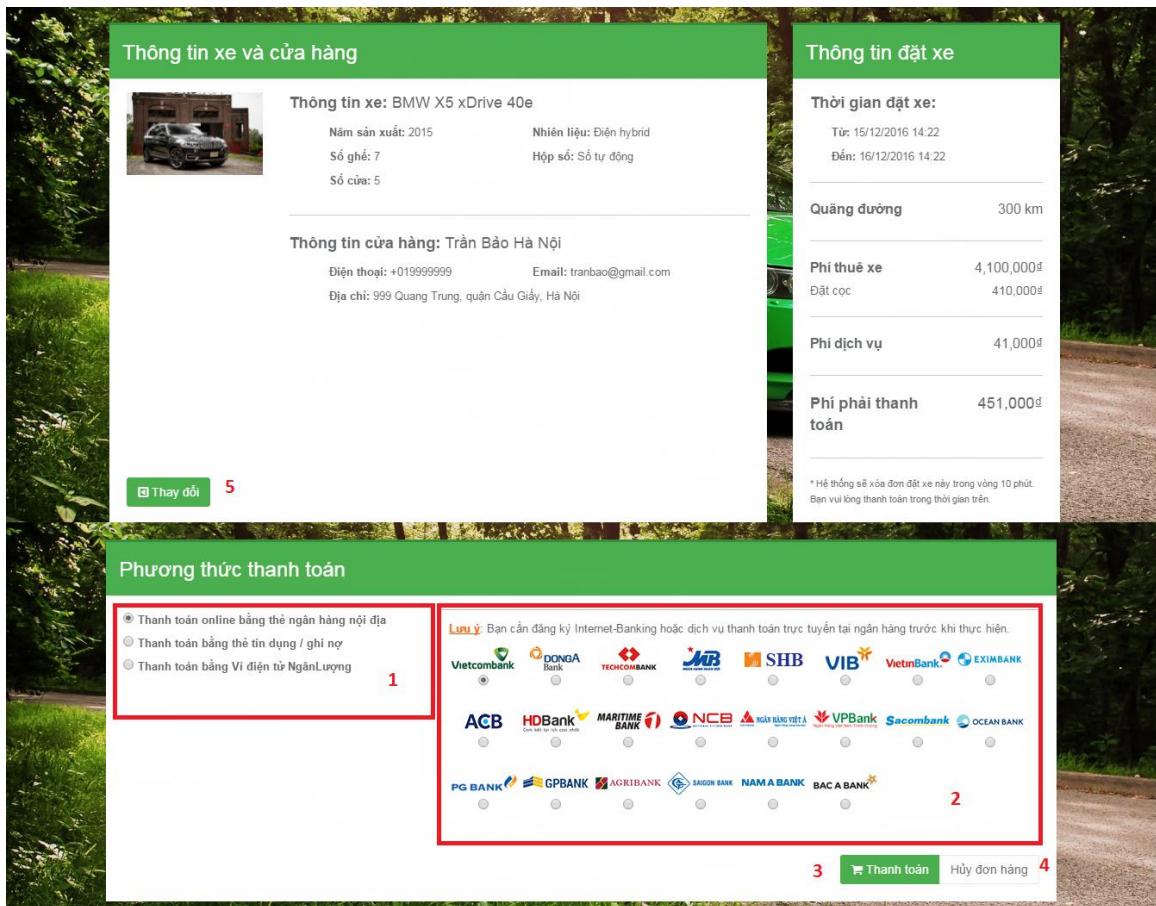


Figure 75 : 予約確認

ステップ 説明	
1	国内現金カードやビザカードや NganLuong 電子ウォレットを選んで
2	国内現金カードを選んだから、現金を選んで
3	「Thanh toán」ボタンをクリックします。 <ul style="list-style-type: none"> - このページで選ぶ時間は5分のほうが長いですから、この乗り物の情報ページに帰ります。 - NganLuong ページで払う時間は5分のほうが長いですから、エラーを出ます。
4	キャンセルしたいなら、「Hủy đơn hàng」ボタンをクリックします
5	変わりたいなら、「Thay đổi」ボタンをクリックします

Table 106 : 予約確認

2.6. レシートページ

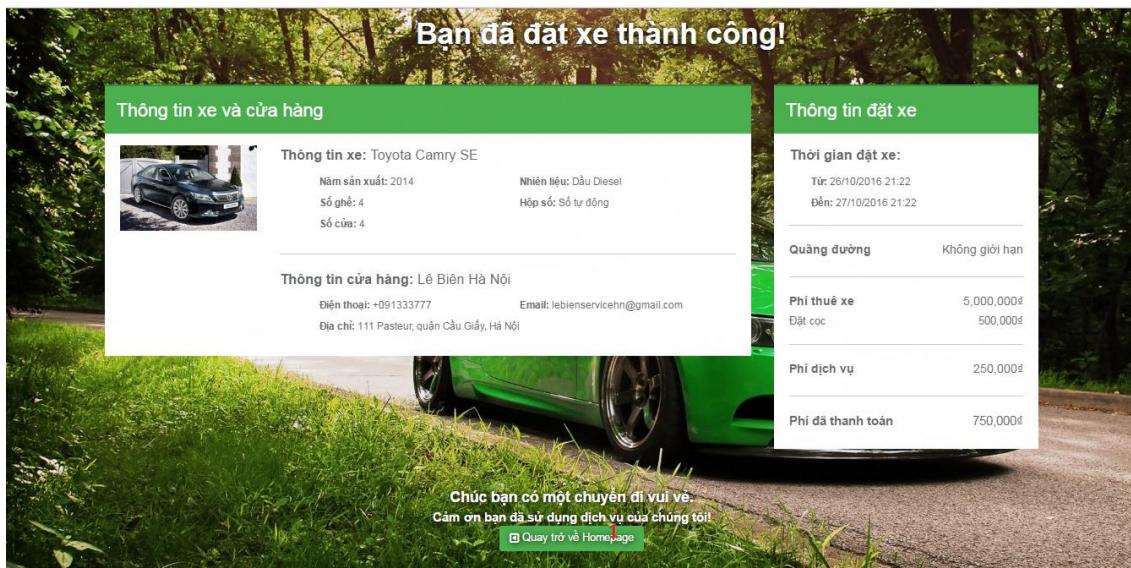


Figure 76 : レシートページ

ステップ 説明	
1	払い後に予約の情報を表示されます。「Quay trở về Homepage」ボタンをクリックして、ホームページへ行きます。

Table 107 : レシートページ

2.7. フィードバック

The screenshot shows the 'CRP' interface. On the left sidebar, there is a user profile picture and two menu items: 'Lịch sử đặt xe' (1) and 'Trở thành nhà cung cấp'. The main content area is titled 'Lịch sử đặt xe' (History of bookings). It displays a table of 7 entries for Toyota Camry SE rentals from November 2016. Each entry includes the rental period, location, and status buttons ('Đã hủy' or 'Đã kết thúc'). A context menu is open over the second entry, showing options like 'Chi tiết', 'Đánh giá', 'Thao tác' (with three sub-options), and 'Tính trạng'. At the bottom, there are navigation buttons for 'Trang trước' (1) and 'Trang sau'.

Figure 77: 予約のヒストリ

The screenshot shows a 'Đánh giá xe Toyota Camry SE' (Review car Toyota Camry SE) dialog box. It features a 5-star rating system with 4 stars highlighted (4). Below it is a text input field for the review content, which contains the number 5 (5). At the bottom right are two buttons: 'Đóng' (Close) and 'Gửi' (Send) (6). Above the 'Gửi' button are two red numbers: 7 and 6.

Figure 78: フィードバック

ステップ 説明	
1	「Lịch sử đặt xe」をクリックして
2	「Tình trạng」のカルマは「Đã hủy」や「Đã kết thúc」ですから、「Thao tác」ボタンをクリックして
3	「Đánh giá」をクリックして
4	星の数は多くされて、評価が上がります。
5	詳細評価を入力して
6	「Gửi」ボタンをクリックして、評価を出します

7

「Đóng」ボタンをクリックして、評価を閉まる

Table 108 : フィードバック

2.8. プロバイダー登録

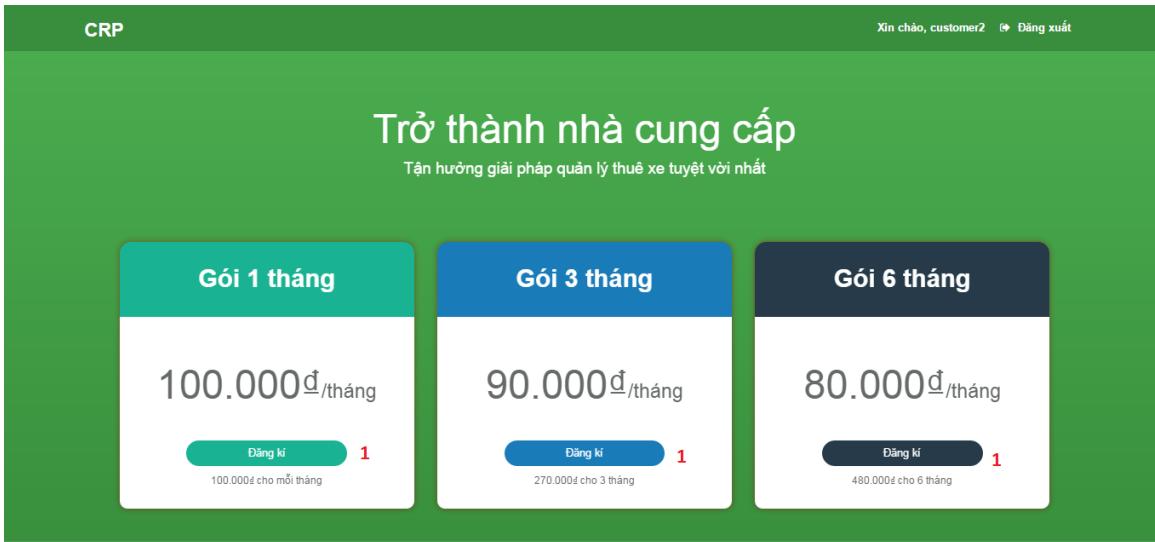


Figure 79 : パッケージ選択

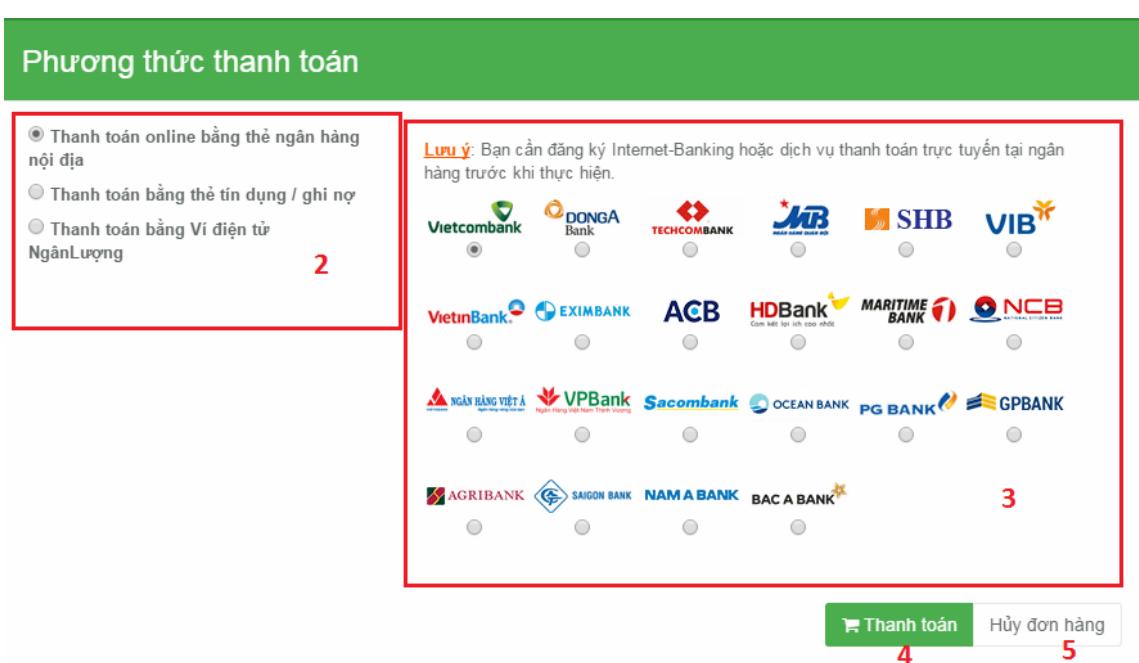


Figure 80 : 支払形式

ステップ 説明

1	「Đăng ký」 ボタンをクリックして
2	国内現金カードやビザカードや NganLuong 電子ウォレットを選んで
3	国内現金カードを選んだから、現金を選んで
4	「Thanh toán」 ボタンをクリックして
5	キャンセルしたいなら、「Hủy đơn hàng」 ボタンをクリックします

Table 109 : プロバイダー登録

2.9. <プロバイダー>ガレージ作成

Figure 81 : ガレージ管理ページ

Thêm một garage mới ×

<input type="text"/> Tên garage 3						
Địa điểm * 4						
An Giang	Thứ hai	Từ	08:00	Đến	17:00	<input checked="" type="checkbox"/> Nghỉ
Địa chỉ * 5	Thứ ba	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Email * 6	Thứ tư	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Số điện thoại (mặc định) * 7	Thứ năm	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Số điện thoại (bổ sung) 8	Thứ sáu	Từ	08:00	Đến	17:00	<input type="checkbox"/> Nghỉ
Mô tả 9	Thứ bảy	Từ		Đến		<input checked="" type="checkbox"/> Nghỉ
Điều khoản 13						
15 14						
Đóng Tạo garage						

Figure 82 : ガレージ作成ポップアップ

ステップ	説明
1	「Quản lý garage」をクリックして
2	「Tạo garage mới」ボタンをクリックして
3	ガレージの名を入力して
4	場所を選んで
5	住所を入力して
6	メールを入力して
7	電話番号を入力して
8	[必要ない] 電話番号を入力して
9	[必要ない] ガレージの説明を入力して
10	休みの日ではないから、営業時間を入力して
11	休みの日ではないから、終業時間を入力して

12	休みの日ですから、「Nghi」ボスをチェックして
13	政策を入力して
14	「Tạo Garage」ボタンをクリックします
15	キャンセルしたいなら、「Thoát」ボタンをクリックします

Table 110 : ガレージ作成

- 2.10. <プロバイダー>ガレージを閉じる <Excluded>
- 2.11. <プロバイダー>ガレージを削除する <Excluded>
- 2.12. <プロバイダー>ガレージに乗り物を置く <Excluded>
- 2.13. <プロバイダー>他のガレージへ移動する <Excluded>
- 2.14. <プロバイダー>グループ作成

Tên nhóm	Ký hạn thuê tối đa	Đặt cọc	Giá theo ngày	Số lượng xe	Trạng thái	Thao tác
High-range	30	10%	4100000	5	đang hoạt động	Thao tác
Mid-range	30	20%	3000000	2	đang hoạt động	Thao tác

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Figure 83 : グループ管理ページ

Tên nhóm *

3

Đặt cọc *

4 %

Giá theo ngày *

5 ₫

Kỳ hạn thuê tối đa

ngày **6** Không giới hạn

Số Km tối đa một ngày

Km **7** Không giới hạn

Số tiền trả thêm

Được áp dụng khi vượt số Km quy định **8** ₫/Km

Bảng giá theo giờ

+ Thêm hàng mới **9**

	Thời gian (giờ)	Giá tiền (VNĐ)	Số Km tối đa (Km)	Không giới hạn số km tối đa
13	10	11	12	<input checked="" type="checkbox"/>

Đang hiển thị 1 đến 1 trên tổng cộng 1 dòng

15 **14**

Đóng **Tạo nhóm**

Figure 84 : グループ作成ポップアップ

ステップ	説明
1	「Quản lý nhóm giá」をクリックして
2	「Thêm nhóm mới」ボタンをクリックして
3	グループの名を入力して
4	預金を入力して
5	1日当たりの費を入力して
6	[必要ない] 無制限なチェックボックスをチェックしなくて、借りる日の極限を入力して
7	[必要ない] 無制限なチェックボックスをチェックしなくて、1日当たりの距離の極限を入力して
8	[必要ない] 余分費を入力します。レンタルの距離は距離の極限のほうが長いですから、余分費を払わなければなりません。

9	[必要ない] 價格表を作りたいなら、「Thêm hàng mới」ボタンをクリックして、新しい行を作ります。
10	[必要ない] 時を入力して
11	[必要ない] 費を入力して
12	[必要ない] 無制限なチェックボックスをチェックしなくて、1日当たりの距離の極限を入力して
13	[必要ない] 行を消したいなら、「-」ボタンをクリックします
14	「Tạo nhóm」ボタンをクリックして、新しいグループを作ります。
15	キャンセルしたいなら、「Đóng」ボタンをクリックします

Table 111 : グループ作成

- 2.15. <プロバイダー>グループを閉じる <Excluded>**
- 2.16. <プロバイダー>グループを削除する <Excluded>**
- 2.17. <プロバイダー>グループに乗り物を置く <Excluded>**
- 2.18. <プロバイダー>他のグループへ移動する <Excluded>**
- 2.19. <プロバイダー>このグループから削除する <Excluded>**
- 2.20. <プロバイダー>乗り物作成**

Tên	Biển số	Nhóm	Năm	Số chỗ	Đánh giá	Thao tác
BMW X1	FWR-52214	High-range	2016	7	★★★★★ (4.1)	<button>Thêm xe tương tự</button> <button>Xóa</button>
BMW X3 xDrive 35d	FWR-67214	High-range	2014	5	★★★★☆ (3.2)	<button>Thêm xe tương tự</button> <button>Xóa</button>
BMW X6	FWR-22110	High-range	2016	5	★★★★★ (4.5)	<button>Thêm xe tương tự</button> <button>Xóa</button>
Porsche Cayenne S	PPP-219391	Mid-range	2014	7	★★★★★ (4.1)	<button>Thêm xe tương tự</button> <button>Xóa</button>

Figure 85 : 乗り物管理ページ

Tạo xe mới

Tên xe*	3	Biển số xe*	4
Dòng xe*	5	Năm sản xuất*	6
Garage*	7	Nhóm xe	8
Loại hộp số*	9	Chi tiết về hộp số	10
Số tự động	Số sàn	Chi tiết về loại hộp số	10
Loại nhiên liệu	11	Đặc tả động cơ	12
Màu xe*	13	Chi tiết về động cơ xe	12
Mô tả xe	14		
Hình ảnh*	15	Thả ảnh hoặc nhấn vào đây để upload.	
		17	16
		Thoát	OK

Figure 86 : 乗り物作成ポップアップ

ステップ 説明	
1	「Quản lý xe」をクリックして
2	「Thêm xe mới」ボタンをクリックして
3	乗り物の名を入力して
4	ライセンス番号を入力して
5	乗り物のブランドを選んで
6	乗り物の年を選んで
7	ガレージを選んで
8	[必要ない] 乗り物のグループを選んで
9	ギアを選んで
10	[必要ない] ギアの情報を入力して
11	[必要ない] 燃料タイプを選んで
12	[必要ない] エンジンの情報を入力して
13	乗り物の色を選んで
14	[必要ない] この乗り物を入力して
15	イメージをアップロードして
16	「Ok」ボタンをクリックします
17	キャンセルしたいなら、「Thoát」ボタンをクリックします

Table 112 : 乗り物作成

- 2.21. <プロバイダー>乗り物を削除する <Excluded>
- 2.22. <プロバイダー>フィードバックを見る <Excluded>
- 2.23. <プロバイダー>自己予約する

The screenshot shows a web-based car rental management system. At the top, there are two tabs: 'Thông tin đặt xe' (Booking Information) and 'Thông tin đánh giá' (Review Information). The 'Thông tin đặt xe' tab is active. Below the tabs, there is a section titled 'Thời gian thanh toán' (Payment Time) with three radio button options: 'Tất cả' (All), 'Đã qua' (Past), and 'Sắp đến' (Coming soon). There are also two checked checkboxes: 'Hiện hóa đơn đã hủy' (Show canceled invoices) and 'Hiện hóa đơn tư đặt' (Show self-booking invoices). On the right side of this section is a green button labeled '+ Tạo đặt xe' with a red '1' indicating new bookings. Below this is a search bar with the placeholder 'Tim kiếm' and a dropdown menu set to 'Hiển thị 10 dòng'. To the right of the search bar is a 'Tìm kiếm' button. Underneath these controls is a table header row with columns: 'Tên khách hàng' (Customer Name), 'Giá thuê' (Rental Price), 'Đặt cọc' (Deposit), 'Thuê từ' (From), 'Thuê đến' (To), 'Đánh giá' (Review), 'Tình trạng' (Status), and 'Thao tác' (Actions). A message 'Không tìm thấy dữ liệu' (No data found) is displayed below the table. At the bottom of the page are navigation buttons for 'Trang trước' (Previous page) and 'Trang sau' (Next page).

Figure 87: 乗り物管理ページの予約情報

This screenshot shows a modal window titled 'Tạo đặt xe' (Create Booking). The window has a green header bar with a close button 'x'. The main area contains five numbered steps: 1. 'Từ' (From) with the date '2016/11/21 15:31', 2. 'Đến' (To) with the date '2016/11/22 15:31', 3. 'Đến' (To) with the date '2016/11/22 15:31', 4. A green 'Tạo' (Create) button, and 5. A white 'Đóng' (Close) button. The background of the modal is light gray.

Figure 88: 選択ポップアップ

*プロバイダーは特別の時間に貸されないと、このを造ってください。

ステップ 説明	
1	「Quản lý đặt xe」をクリックして
2	始め借りる時間を入力して
3	終わり借りる時間を入力して

4	「Tạo」ボタンをクリックします
5	キャンセルしたいなら、「Đóng」ボタンをクリックします

Table 113 : 自己予約する

2.24. <プロバイダー>借りる情報を見る

Xin chào, provider2 → Đăng xuất

Quản lý đặt xe

Lọc theo garage 2
Lê Biên Hà Nội 3

Thời gian thanh toán
Tất cả 4
Đã qua 5
Sắp đến 6

Hiện hóa đơn đã hủy 7
Hiện hóa đơn tự đặt 8

Tên khách hàng	Tên xe	Biển số	Giá thuê	Đặt cọc	Thuê từ	Thuê đến	Đánh giá	Tình trạng	Thao tác
Phạm Cường	Toyota Camry SE	FFF-65266	5000000	500000	T4, 26/10/2016, 21:22	T5, 27/10/2016, 21:22	-	Đã qua Thành công	Chi tiết 9
Phạm Cường	Toyota Camry SE	FFF-65266	5000000	500000	T4, 02/11/2016, 21:52	T5, 03/11/2016, 21:52	★★★★★	Đã qua Thành công	Chi tiết
Phạm Cường	Toyota Camry SE	FFF-65266	5000000	500000	T4, 26/10/2016, 21:22	T5, 27/10/2016, 21:22	★★★★★	Đã qua Thành công	Chi tiết

Figure 89 : 予約情報管理ページ

Thông tin xe Thông tin đặt xe 3

Thời gian thanh toán
Tất cả 4
Đã qua 5
Sắp đến 6

Hiện hóa đơn đã hủy 7
Hiện hóa đơn tự đặt 8

Tên khách hàng	Tên xe	Biển số	Giá thuê	Đặt cọc	Thuê từ	Thuê đến	Đánh giá	Tình trạng	Thao tác
Phạm Cường	Toyota Camry SE	FFF-65266	5000000	500000	T4, 26/10/2016, 21:22	T5, 27/10/2016, 21:22	-	Đã qua Thành công	Chi tiết 9
Phạm Cường	Toyota Camry SE	FFF-65266	5000000	500000	T4, 02/11/2016, 21:52	T5, 03/11/2016, 21:52	★★★★★	Đã qua Thành công	Chi tiết
Phạm Cường	Toyota Camry SE	FFF-65266	5000000	500000	T4, 26/10/2016, 21:22	T5, 27/10/2016, 21:22	★★★★★	Đã qua Thành công	Chi tiết
Phạm Cường	Toyota Camry SE	FFF-65266	5000000	500000	T5, 27/10/2016, 21:22	T6, 28/10/2016, 21:22	★★★★★	Đã qua Thành công	Chi tiết

Figure 90 : ガレージ詳細ページ

Thông tin đặt xe		Thông tin đánh giá	
Thời gian thanh toán <input checked="" type="radio"/> Tất cả 4 <input checked="" type="checkbox"/> Hiện hóa đơn đã hủy 7 <input type="radio"/> Đã qua 5 <input checked="" type="checkbox"/> Hiện hóa đơn tự đặt 8 <input type="radio"/> Sắp đến 6			
Hiển thị 10 dòng		Tim kiếm	
Tên khách hàng	Giá thuê	Đặt cọc	Thuê từ
Lê Biên	4000000	800000	T6, 18/11/2016, 17:57
Lê Biên	4000000	800000	T7, 19/11/2016, 17:57
Lê Biên	0	0	T5, 15/12/2016, 16:02

Figure 91 : 乗り物詳細ページ

ステップ 説明	
1	<ul style="list-style-type: none"> - 「Quản lý đặt xe」をクリックして - 「Quản lý garage」をクリックして - 「Quản lý xe」をクリックして
2	<ul style="list-style-type: none"> - [必要なない] 「」チェックボックスをクリックして、テープルはガレージで示す。 - ガレージの名をくつりくして - 乗り物の名をクリックして
3	<ul style="list-style-type: none"> - [必要なない] 「2」をチェックしたら、ガレージを選んで - 「Thông tin đặt xe」タブをクリックして - 「Thông tin đặt xe」タブをクリックして
4	[必要なない] 全部示す
5	[必要なない] 過去で示す
6	[必要なない] 到来で示す
7	[必要なない] 「Hiện hóa đơn đã hủy」チェックボックスをクリックして、テープルはキャンセル領収書を示す。
8	[必要なない] 「Hiện hóa đơn tự đặt」チェックボックスをクリックして、テープルは自己予約を示す。

9	[必要ない] 領収書の情報を見たいなら、「」ボタンをクリックします
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Table 114 : 借りる情報を見る

2.25. <プロバイダー>ダッシュボード <Excluded>

G. Appendix

1. UML 2.0 standard
<http://www.omg.org/spec/UML/2.0>
2. Sashimi – Modified Waterfall Model:
<http://www.waterfall-model.com/sashimi-waterfall-model>
3. Collaborative filtering approach
https://en.wikipedia.org/wiki/Recommender_system#Collaborative_filtering
4. Content-based approach
https://en.wikipedia.org/wiki/Recommender_system#Content-based_filtering
5. Vector space model
https://en.wikipedia.org/wiki/Vector_space_model
6. tf-idf
<https://en.wikipedia.org/wiki/Tf%E2%80%93idf>