Course Work

ITS1114 – Advanced API Development

BSc (Hons.) in Computer Science via GDSE

Final Examination

Total Marks: 200

Objectives

Getting an approach to develop enterprise-level applications using Spring Web MVC

- Usage of frameworks for application development.
- Creating user interfaces for web applications.
- Handling Asynchronous requests.
- Handling REST-based services.
- Simplifies java application development process with Spring.

Coursework Requirements and Instructions

- You have to focus on how to implement this system using your knowledge in Web application development and Spring MVC.
- You are required to implement all the layers given in the application architecture. (Refer Appendix)
- This coursework consists of 2 parts, Part A and Part B.
- Both parts carry marks and you are required to successfully attempt both parts to be able to face the viva-voce at the end of this coursework. Sample questions are given to you in Part B for you to prepare yourself for the viva.
- Refer to the Coursework Guidelines at the end of each part to understand the specific guidelines to be followed.

Submission

- You should submit the deliverables of the coursework on or before the due date specified.
- All project work must be committed to GitHub.

Car Rental System

Introduction

Easy car rental private limited is a car rental service with 5 years of history. This company has about 50 cars and 40 drivers working for them in regular shifts. This company is located at No. 200, Galle Road, Panadura, and well known for their services. Usually, people who don't own a car, people who are waiting for their car to be repaired and, travelers or tourists seek their services.

Easy car rental was operated so far by a senior manager quite advanced in age and followed the good old-fashioned methods to do business. The business process so far was carried out by customer calling the car rental through the phone for inquiries and after getting the details of the car, the customer had to come in person to the car rental shop, provide a copy of their Identity Card or Driving License, and the Loss Damage Waiver to the counter and get his/her car.

However, the Easy Car Rental owner decided to hire a new manager for the rental services due to the declining sales from month to month. As such, the new manager did his research and found out that their business process is kind of old fashioned and people are getting used to renting cars online. He realized, considering the trend, they are at a disadvantage. With the facts at hand, the manager proposed that they buy a Software Solution for the problem at hand and was accepted by the shop owner.

Roles

Following types of people accessing the system:

Users	Will be Referred as
Regular customers who want to rent cars by registering to the website.	Registered user
Customers who are just browsing for cars and haven't registered yet.	Guest user
The staff appointed to manage the system by the newly appointed manager.	Admin
Drivers of the Easy Car Rental	Driver

Business Process.

The following business process when a customer renting a car from the system:

1. A customer comes to the website and register.
2. When registering, the customer has to upload a driving license or an identity card to the system.
3. Then, the customer can select a car, Pick up time and date, and other required details.
4. The customer has to make the Loss Damage Waiver payment to the given bank account information of the car rental and upload the bank slip or the bank confirmation to the dedicated field in the renting view. (Loss Damage Waiver payment for is 10,000.00 LKR for general cars, 15,000.00 LKR for Premium cars, and 20,000.00 LKR for Luxury cars)
5. If a driver is requested by the customer, a driver is randomly assigned to accommodate the customer. (Drivers can view their weekly schedule from the website.)

6. After the customer completed the above steps, the admin can confirm or deny the rental request. However, the Loss Damage Waiver payment will be returned to the customer after handing over the car or if the customer cancels the rental request.
7. After the customer returns the car, he/she has to make the payment and the rental process will be finalized.
8. After the customer returns the car, a brief inspection will be done to the car and if the car is damaged or harmed, an appropriate amount will be deducted from the Loss Damage Waiver payment and the rest will be returned to the customer.
9. If the vehicle is unharmed the Loss Damage Waiver will be returned in full to the customer.
10. Engine faults and malfunctions in the car will not count when deductions are made from the Loss Damage Waiver.

System Requirements

Admin Should be able to:

1. Have full access to the system.
2. Add and manage the details of the cars with the system. A car can have the following attributes.
    - Brand (make. Ex: Toyota, Suzuki)
    - Type (ex mini, luxury)
    - Four images of the car. (Front View, Back View, Side View, Interior)
    - Number of passengers
    - Transmission type. (Manual, Auto)
    - Fuel Type. (Ex. Diesel, Petrol)
    - Prices for the rent durations.
        - Daily rate
        - Monthly rate
    - Free mileage for the price and duration.
    - Price for extra KM.
    - Registration number.
    - Color
1. Verify customer details with the Identity card or driving license by viewing them.
2. Either accept a rent request or deny it. However, if the request is denied, the customer should be notified with an acceptable reason for the denial.
3. Change the driver who is randomly assigned to a rental request and admin should be able to view the schedule of the driver by a specified time duration.
4. View the schedule for vehicles and should be able to sort them as available vehicles and rented vehicles by date.
5. View the details of the customers and only the management should be able to view the customer details due to the customer privacy policy.
6. Calculate the payment through the system after the vehicle is returned. Loss Damage Waiver and the rental fee will be calculated as two separate payments in the same rental case.

7. Have a dashboard with a daily summary when they log in. The daily summary should include:
   - The number of registered users.
   - Total bookings for the day.
   - The number of available and reserved cars.
   - The number of bookings active for the day.
   - The number of available and occupied drivers.
   - The number of cars that need maintenance and under maintenance.
8. Calculate daily, weekly, monthly, and yearly income from the car rental. This will be helpful for the company to make further decisions and the owner of the car rental has agreed to pay 3% of the monthly increase of income as a bonus to the newly appointed manager if he can salvage the currently decreasing revenue.
9. Mark the damaged or defective vehicles unavailable until they are repaired and back to service.
10. Notified to run maintenance for the cars, for every 5000km that car completes and should be able to view the details of the car through the admin panel.

Registered Users should be able to:

1. Log into the system using their user name and password.
2. Place a rental request. When placing a rental request, the customer should be able to view/specify the car he needs, enter the pick-up and return date and time. The customer can specify pick up and return venues as either Easy Car Rental Premises or any other location according to his/her preference. Additionally, the customer should be able to specify whether he needs a driver or not.
3. Book more than one car. However, The Loss Damage Waiver should be paid separately for each car and the bank confirmations should be submitted for verification.
4. View the status of the rental request, whether it is accepted or not and he/she should be provided with the contact information of the driver.
5. Update his/her username, password, contact information, and his driving license.

Guest users should be able to:

1. Register as a customer for the car rental service online. When registering, the customer should provide the following information.
   - Email.
   - New Password.
   - NIC Number and a photo of customers NIC should be uploaded.
   - Driving License number and a photo of customers driving license.
   - Address.
   - Contact Number.
2. View the details of the cars.

A driver should be able to:

1. View the work schedule and the details of the rental requests that he/she is assigned to by logging into the system.

You are requested to develop the software solution for easy car rentals private limited. The manager specially requested that you should pay attention to the customers' experience so that they could increase their sales because the future advancement of the company lies with the car rental system.

PART A

1. Draw the following diagrams in accordance with the system.
    a. Entity Relationship Diagram
    b. Class Diagram

2. Develop a system that satisfies the requirements of the manager of Easy Car Rental Pvt Ltd.

NOTE: EMAIL THE GIVEN DIAGRAMS TO THE GIVEN EMAIL ADDRESS BEFORE THE DUE DATE AND THE DATE OF THE VIVA FOR EVALUATING THE SYSTEM WILL BE INFORMED TO YOU FORMALLY BY THE ACADEMIC SECTION OF IJSE. ADDITIONALLY, YOU SHOULD BRING THE REQUIRED DIAGRAMS WHEN YOU ATTEND THE VIVA.

PART B

You should be knowledgeable in the following areas when attending the VIVA.

1. What is Spring?
2. Why does it become a framework?
3. Why is it popular?
4. What does it do?
5. How does Spring Simplify the Development Process?
6. What are the parts that we have to learn in Spring?
7. What are the advantages of using Spring?
8. What is “POJOs” in Spring?
9. What is the Application Context?
10. What are hooking processes and how does the register shut down hook work?
11. What does declarative programming mean in spring.?
12. How does spring use DI?
13. What are the DI methods in Spring?
14. What is an aspect?
15. What is a configuration class?
16. Explain the difference between Spring Bean and Java Bean?
17. What are the lifecycle methods of a spring bean?
18. What is Full Mode and Light Mode in Spring?
19. What is Java EE?
20. Explain how Java EE came to the Society.
21. What is an enterprise-level application?
22. What are the advantages of using Spring than Java EE?
23. What is a configuration class in Spring?
24. What are the two methods of putting a bean in a context?
25. When would we use Bean Annotation?
26. What are the two ways of configuring an application context in Spring.?
27. What are the context types in Spring?

28. Explain About Spring Environment?
29. Why do we need Runtime value injection In Spring?
30. What is Spring MVC?
31. How does spring MVC work?
32. Why Spring MVC is dependent on Servlet API?
33. What is a servlet?
34. Explain the lifecycle of a servlet.
35. Why we need a connection pool in an enterprise-level application?
36. What is a dispatcher servlet?
37. What does the front controller design pattern do?
38. What are the handler methods?
39. What are the two types of controllers in spring MVC? Explain the difference.
40. What are headers in request?
41. What is ambiguous mapping and how to resolve ambiguous mapping?
42. What does @RequestBody annotation do?
43. What are converters in Spring MVC and what they do?
44. What are the mime types?
45. What is Spring Data JPA?
46. How ORM works with Spring?
47. What is Spring Boot, what does it do?
48. What are starters in Spring Boot?
49. Can we use Spring for Desktop Application?
50. What is an interbean dependency?

Guidelines

1. All the input tools should be validated.
2. Payments are calculated to the given criteria after returning the vehicle. (Refer to appendix for the payment criteria)
3. Since the payments are settled after returning the vehicle and the Loss Damage Waiver is verified using manual methods, there is no need for online transactions.
4. Cars should be able to be sorted by the following criteria when browsing.
    a. No of passengers
    b. Transmission type
    c. Brand (Make)
    d. Type
    e. Price
    f. Fuel type.
5. User experience, color psychology, and neatness should be especially concerned.
6. The customer password should be verified in case the customer might forget his/her password.
7. The application must at least have 8 views.
8. The application must have a minimum of 5 entity models and 5 controllers.
9. All the possible exceptions of the application should be handled.
10. Technologies you can use for the application:
    a. Front End: HTML, CSS, CSS-Frameworks, JS, jQuery, AJAX
    b. Bach End: Spring MVC, Spring Data JPA, MySQL, Lombok, ModelMapper, Jackson.
11. You are not allowed to use Spring Boot to develop this application.

12. The application should contain an easy to access and attractive presentation of all the vehicles that Easy car rental Pvt Ltd.
13. The customers who have an ongoing rental will not be allowed to update any other details except for the contact number in his/her customer profile until the vehicle is returned.
14. A car will be left in the parking space at least 24 hours until it is washed and cleaned after it is returned after renting until its next appointment.
15. An additional cost of 1000.00 LKR per day will be added to the charges if the customer hires a driver along with the car.
16. There are three types of cars. General Cars, Premium Cars, and Luxury Cars.
17. The number of cars Easy Car Rental Pvt Ltd. is 30.

Research

You will have to learn how to upload files using the Spring framework to implement the given application. Click *HERE* to learn.

Evaluation Criteria

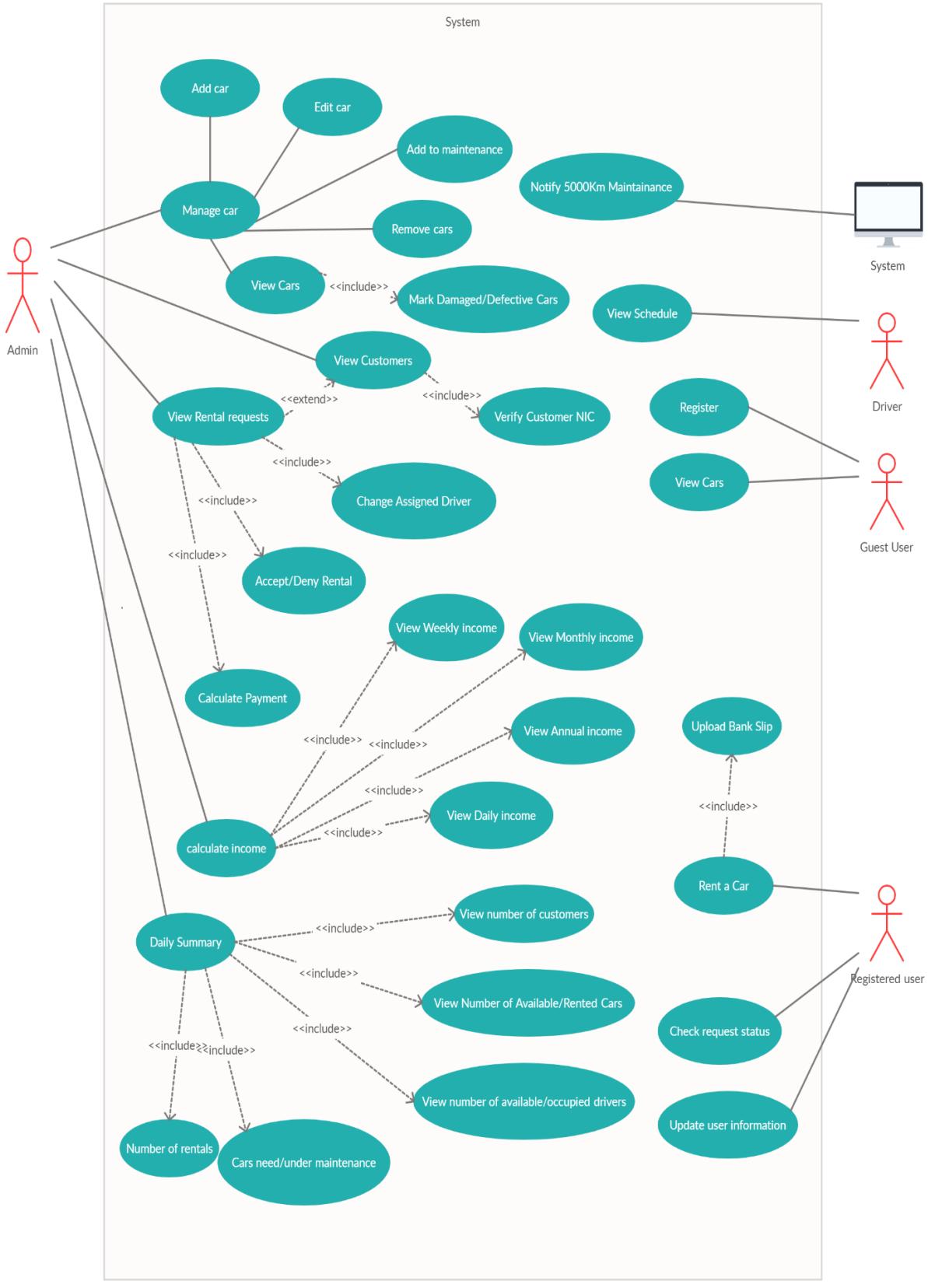
Method	Marks
Deliverables	30
Application	70
Viva	100

Pass Mark: 100

Appendix

1. The application architecture

2. Use Case Diagram



3. Car rental rates.

General Cars Rates (30)

Make and Number of cars available	Daily Rate (Rs)	Free Km for a Day	Monthly Rate (Rs)	Free Km for a month	Price per Extra Km (Rs)
Suzuki Alto - Premium - Manual * 7	2500	100	64,350.00	2400	30.00
Suzuki Alto K10 - Auto * 8	3000	100	71,390.00	2400	35.00
Suzuki Celerio - Auto * 5	3300	100	77,220.00	2400	35.00
Perodua (Daihatsu) Axia - Auto * 2	3800	100	90,200.00	2400	35.00
Toyota Prius C/ Aqua - Auto * 8	5000	100	110,330.00	2400	49.50

Premium Cars (14)

Make and Number of cars available	Daily Rate (Rs)	Free Km for a Day	Monthly Rate (Rs)	Free Km for a month	Price per Extra Km (Rs)
Toyota Corolla Axio/ NZE141 * 4	5500	100	120,330.00	2400	49.50
Perodua Bezza Prime Sedan - Auto (2017) * 5	5500	100	120,330.00	2400	49.50
Toyota Allion NZT 260 * 3	5800	100	155,760.00	2400	60.00
Toyota Axio NKR 165 * 2	6000	100	175,230.00	2400	65.00

Luxury Cars (6)

Make and Number of cars available	Daily Rate	Free Km for a Day	Monthly Rate (Rs)	Free Km for a month	Price per Extra Km (Rs)
Toyota Premio * 2	10,000	100	227,150.00	2400	85.00
Mercedes * 2 BMW i8 * 2	18,000	100	300,000.00	2400	100.00