EE436 - Class Project - Spring 2015
UET Car Rental

GENERAL DELIVERABLES FOR THIS PROJECT

Purpose of the Project

Analyze, specify, design, implement, document, and demonstrate an information system application to support a car rental system called UET Car Rental (UETCR). You are required to use the Classical Methodology for Database Development (as defined in the slide presentation called "Database Design Methodology"). The system should be implemented using a relational DBMS that supports standard SQL queries.
In no circumstances, you can use automatically generated SQL queries or automatically mapped programming objects into the database.

Project Phases

The three phases of the project cover the following work-processes from the Classical Methodology for Database Development.

Phases		Due Date
I	Analysis and Specification	April 7 till 12:30pm
II	Design	April 27*
III	Implementation and Testing	May 16*
	Demonstration	May 18*

*Exact time will be notified afterwards

Phase I (hard copy)

The deliverables include:

1. A cover page listing names and roll numbers of all of the members in the team with their respective sections and email addresses.
2. Enhanced Entity Relationship (EER) Diagram.
3. Information Flow Diagram *(can be found in "Database Design Methodology")*
4. A list of logical constraints that will be enforced. Do not include any constraints that can be shown in the ER diagram, but rather semantic and business logic related constraints. **You are required to include at least five constraints, although a fully-specified system will have more than that. Constraints that can be specified directly using ER notation will not count toward the five required.**
5. Any assumptions made including explanations.

Notes:

1. The EER must capture the constraints of the system that can be modeled in EER as much as possible whenever applicable, that is, total participation, super/sub class, weak entities.
2. The design of your system must satisfy all the constraints. You are allowed to make up additional assumptions and constraints as long as they do not conflict with the specified constraints and requirements. If possible, those additional assumptions and constraints

should be modeled and included in the ER diagram. You must turn in a hard copy of your report.

Phase II (hard copy)

1. Cover Page
2. Copy of the ER Diagram (either from phase I (with any revisions) or from the solution provided).
3. Copy of the Information Flow Diagram from phase I (either from phase I (with any revisions) or from the solution provided).
4. Relational Schema Diagram (with primary and foreign keys identified, referential integrity is shown by arrows).
5. Create Table statements, including domain constraints, integrity constraints, primary keys, and foreign keys.
6. SQL statements for each task (***follow the template in the phase II design methodology***).

Notes:
A set of SQL statements may be required in order to complete one task. However, in such cases, the last SQL statement should show the output according to the specification. Views and nested queries may be used to support the tasks.
A nested query can be broken down into views to make the query more readable.

Phase III

Prior to the demo, create your own data set. The database has to be populated with this data set prior to the demo.
5% will be deducted from the grade otherwise.

Implement a working application with all functionality described in this document.
Your source code should be mailed by the deadline.
Deliverables for Phase 3 are:

1. Copy of the Create Table statements from phase II (with any revisions).
2. Source code (documented) for your system (soft copy).
3. A set of working SQL statements for all project tasks.
4. A functional application with embedded SQL statements that accesses your database.
5. Tasks performed by each group member.

Grading

The project will consist of three phases (deliverables) as well as a final demonstration. Phase I and Phase II of the project are each worth 10% credit and phase III is worth 20% credit.

APPLICATION DESCRIPTION

UET Car Rental

UET Car Rental is a simple online car rental service application. UET Car Rental will be referred as UETCR from here onwards. There are primarily 3 types of users of this system: Employees, Members, and Administrators. Using this application, the UET students/faculty can become members and rent a car anywhere on the campus on an hourly basis. Employees use this application to manage cars, their locations if need be, informing the members in case of delay, etc. The administrator can view administrative reports as explained in the later sections. Employees, members, and administrators are mutually exclusive.
The following sections contain a functional description of the UETCR application along with some screen mockups. User interfaces depicted in this project description merely serve as examples to guide your thinking. Your project's interface may look completely different and that is fine - even encouraged! For example, you might choose to split up some interfaces shown on a single screen into multiple screens. You might choose to use popup windows instead of refreshing the page. A complete reorganization of the user interface is acceptable as long as your application supports the same functionality as described below.

Logging into UET Car Rental

Figure 1 shows the UETCR login screen. All users are uniquely identified by his or her **Username.** A valid Username and Password combination is required to log in to the system. If the user provides invalid login credentials, an error message should be displayed and the user should be redirected / returned to the login screen.

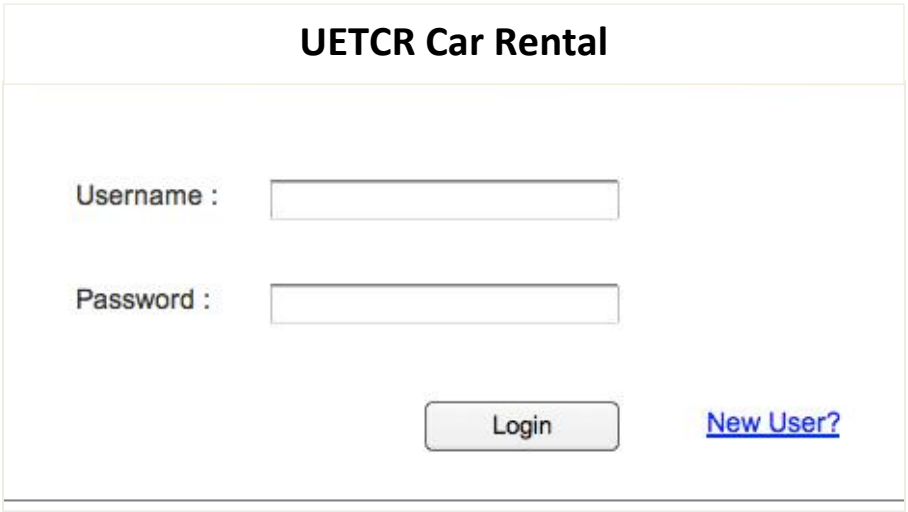


Figure 1: Login Screen

New User Registration

If someone is a new user, who doesn't have an account with the system, needs to create an account by clicking 'New User?'. He / She needs to register before using the UETCR. This applies only for UET students / faculty and UETCR employees and NOT for administrators. We assume that the administrator already has his credentials in the database. A new user can enter his basic information using the screen shown in Figure 2.

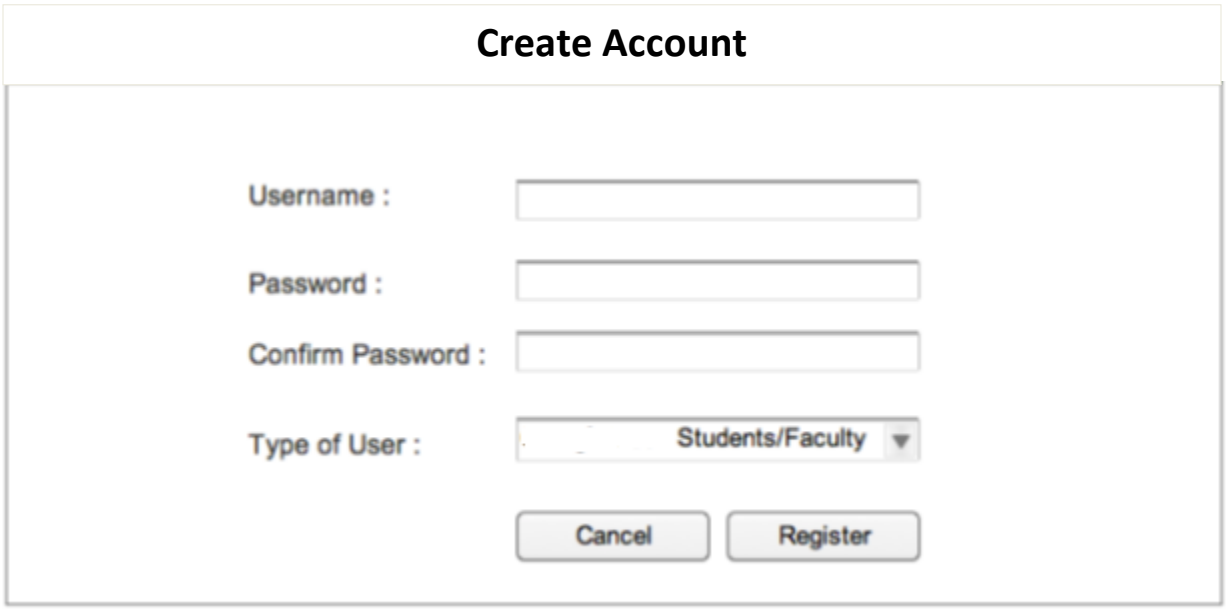


Figure 2: Create Account

Retrieving a forgotten password is an optional functionality but is not required to be implemented. Once a user logs into the system, he would be directed to the 'Homepage' screen which would be different for UET Students/faculty (Figure 3) and UETCR employees (Figure 9). The homepage for the UETCR employees would be shown later. Henceforth, we will refer to the user as 'he' without any intended bias. When an administrator logs in, he should be directly navigated to the reports page (explained later).
This homepage would give the user options of renting a car, entering and viewing personal information, and viewing his rental history. Please note that it is mandatory for the user to enter his personal information for the first time before he can use the 'Rent a car' functionality. Thus, he should be prompted to do so if he tries to rent a car without entering his personal information. On selecting 'Enter Personal Information', the user would be directed to the 'Personal Information' screen (Figure 4).

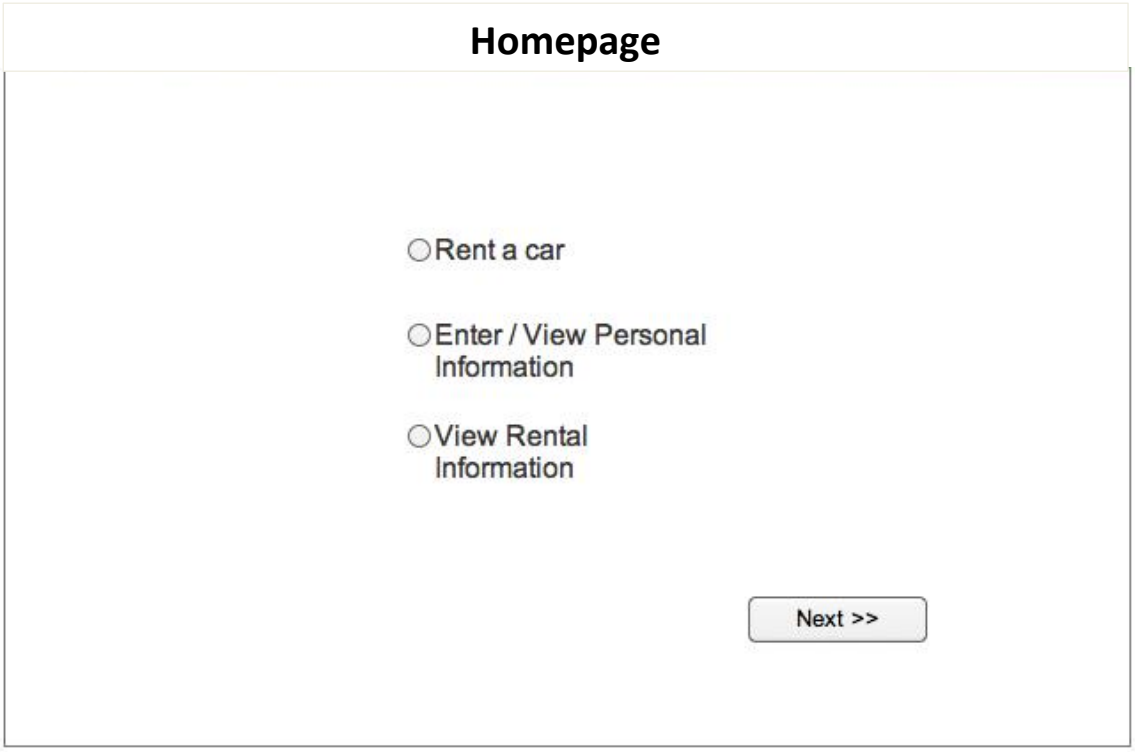


Figure 3: Homepage for UET Student/Faculty

Personal Information

The personal information page will consist of 3 sections: General Information, Membership Information, and Payment Information. In the General Information section, the user would be required to enter basic information like First Name, Middle Initial, Last Name, Email Address, Phone Number, and Address. The Membership Information section requires the user to choose a driving plan which is of 3 types: Occasional Driving plan, Frequent Driving plan, and Daily Driving plan. The plan details can be viewed by clicking on 'View Plan Details' link which navigates the user to the Driving Plans screen (Figure 5). Each driving plan may or may not have a monthly payment, some percentage of discount on the hourly cost of the car being rented, and annual fees. A user cannot choose more than one driving plan. After making this selection, the user moves on to the payment information section where he is required to enter his card details such as Name on the card, Card Number, CVV, Expiry Date, Billing Address. Note that the user should not be allowed to proceed forward without filling in the payment information. Clicking 'Done' saves all this information in the database. All this information can be updated at any time by changing the details on this page and clicking done again.

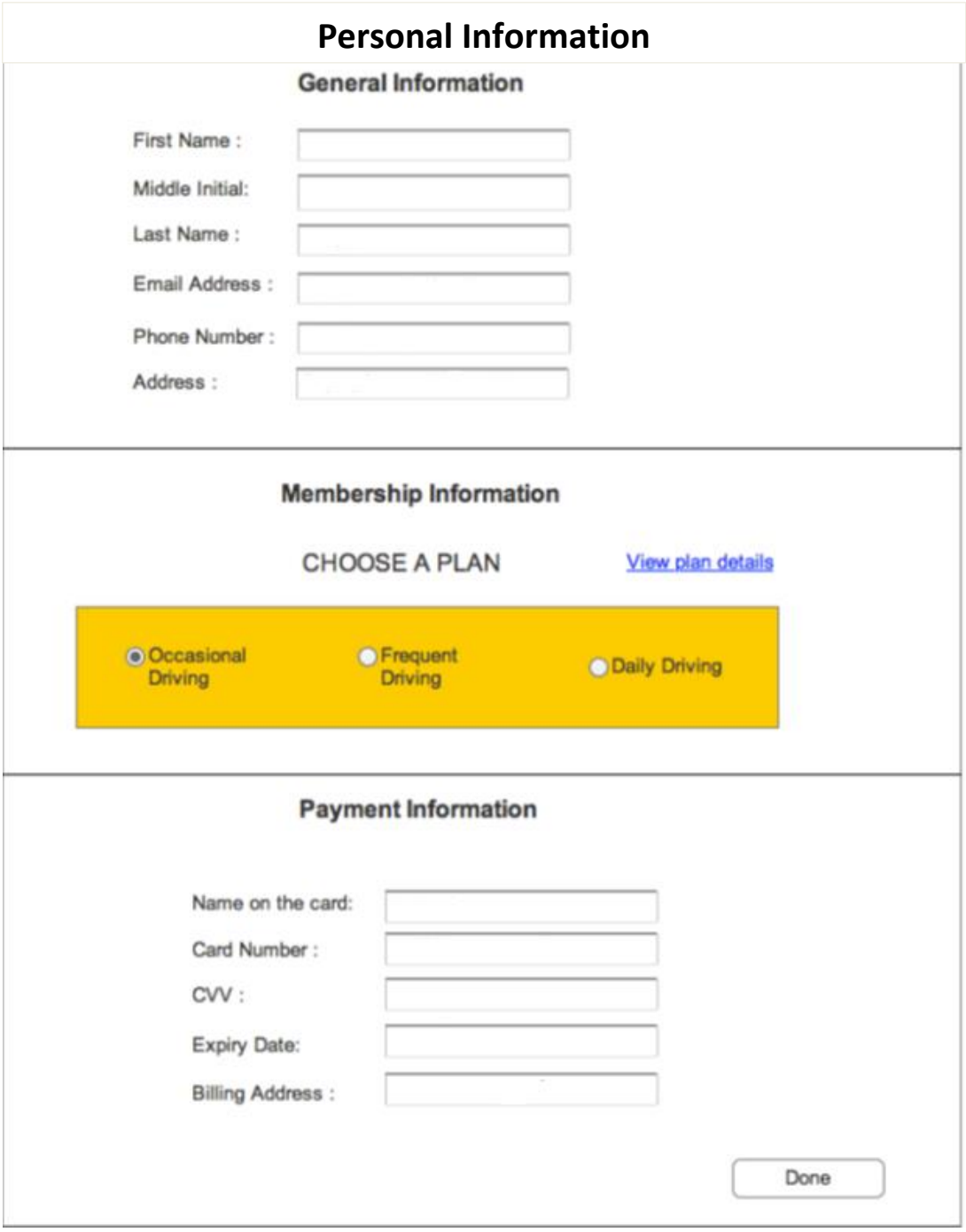


Figure 4: Personal Information Page

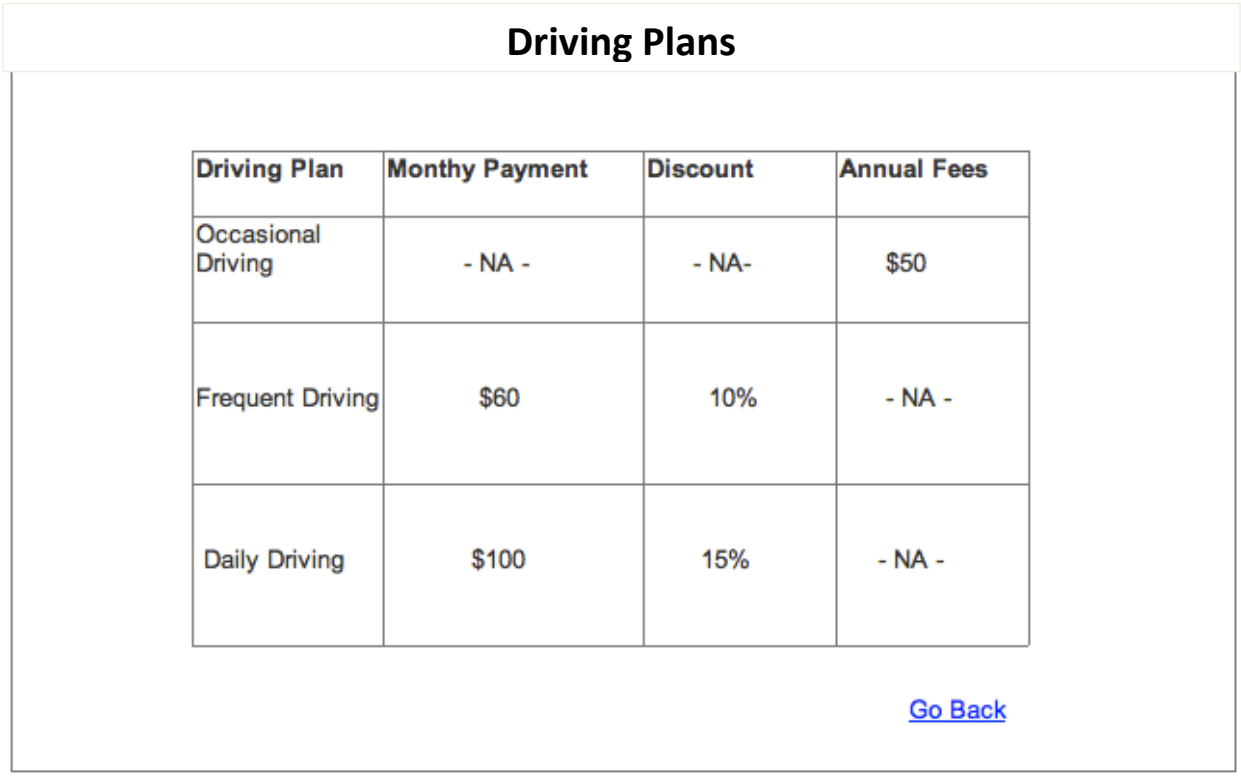


Figure 5: Driving Plans Details Page

Rent a Car

Each car, identified by a vehicle serial number, has a model name (Honda Civic, Audi A3, Suzuki Alto, Infinity G37, Ford Escape, etc.), a type (Hatchback, Hybrid, Convertible, SUV, Sedan), color, hourly rental rate, daily rental rate, seating capacity, transmission type, bluetooth connectivity(optional), an auxiliary cable (optional). Each location has a 'car capacity', which is the number of cars it can hold in its parking space. (We are assuming that all the locations have a parking lot where the cars would be kept). Every location would have at least one car. There may be multiple models of cars available for a particular type and for a particular model, there can be many units of cars. A user can rent a car by selecting a pickup time, return time, and location. The location is chosen from the drop down list, which would show all the locations at which cars are kept on campus. Selecting the pickup time, return time, and location is mandatory. Also a user cannot book a car for more than 2 days. If the user does not make a selection for the car he wants, he should be shown all the cars in the chosen location. To make a selection, he can either 'Choose by model' or by 'type'. Based on this selection, another dropdown box would list all the cars for that particular model or type. For example, if the user selects the option 'Choose by type' then the drop down box next to this one should list all the different types, that is, Hatchback, Hybrid, Convertible, etc. (Figure 6.). Clicking 'Search' would navigate the user to the Car availability page (Figure 7). Also note that we are assuming that the user returns the car to the same location at the selected return time in case he hasn't extended his reservation (explained later) or informed the UETCR customer service about being late.

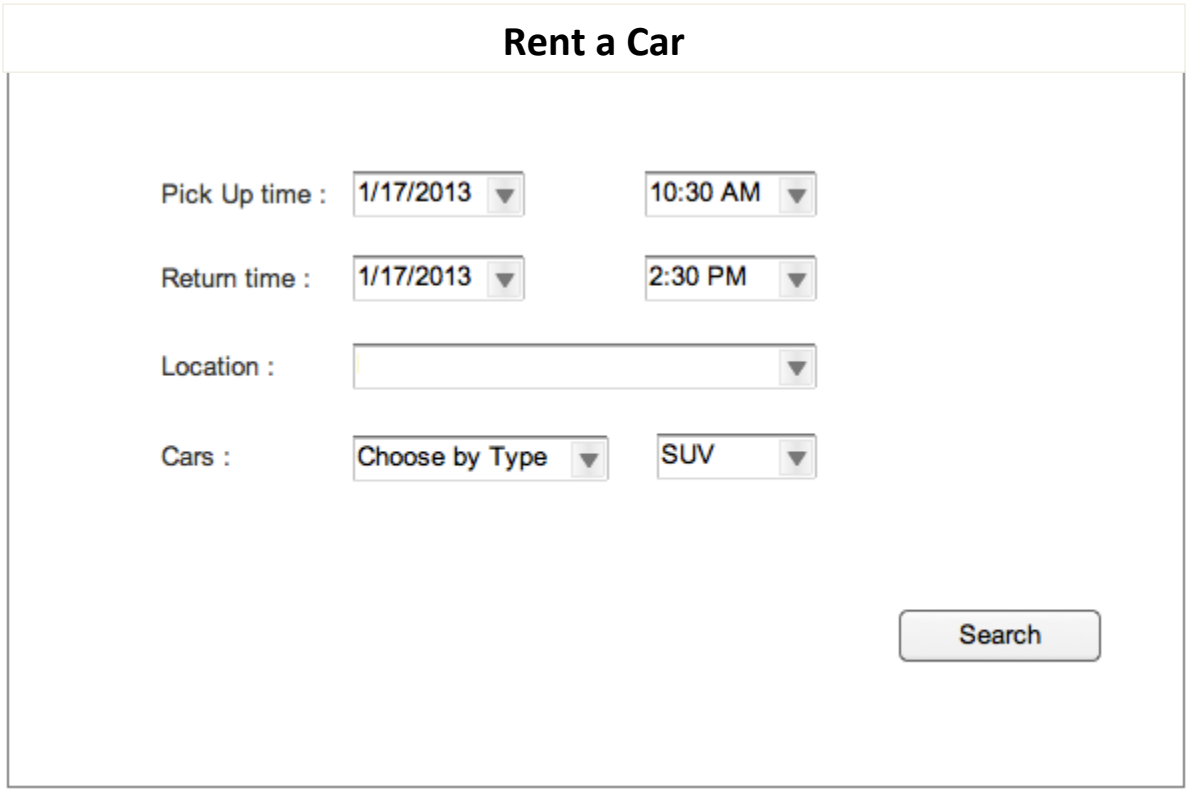


Figure 6: Rent a Car Screen

Car Availability

This page will show a list of all the cars available at the location entered along with other cars at other locations. If a car at the selected location has already been booked by some other user, it should not show up on this page. Please note that the cars at the selected location should be shown first (highlighting the rows is optional) and cars at other locations can be shown after that. All the cars at a particular location need to be shown together. If the user has searched the cars by type / model then all the cars of that particular type / model for the selected location should be shown together. For example, if the user searches for SUVs at Main Block then the table should show details of all the SUVs at Main block followed by SUVs at other locations. The table should show the car model, car type, location, color, hourly rate, daily rate, seating capacity, transmission type, Bluetooth connectivity availability, Auxiliary cable availability. The table also needs to show the time until which it is available for renting. If the car is available for more than 12 hours after the return time the 'Available till' column would be 'Not Applicable' as shown in Figure 7. The estimated cost would be calculated based on the pickup time, return time and the hourly rate (or the discounted hourly rate based on the user's driving plan). If the user chooses to rent the car for a whole day then the estimated cost would be the daily rate (Note that driving plan discount doesn't apply on the daily rate since it is anyways discounted). On making the selection, the user needs to click on 'Reserve' to confirm his reservation. The user should be prompted with a message confirming his reservation. The user can make multiple reservations but the reservation time of the multiple reservations

should not overlap. In case of a conflict, the user should not be allowed to make the reservation which conflicts with the previous one. The screen shown below is for a user who is on an 'Occasional driving plan'. For example, the estimated cost for Audi A4 in case of 'Frequent driving plan' would be $10.8 multiplied by 4 hours = $43.2 in the example shown below.

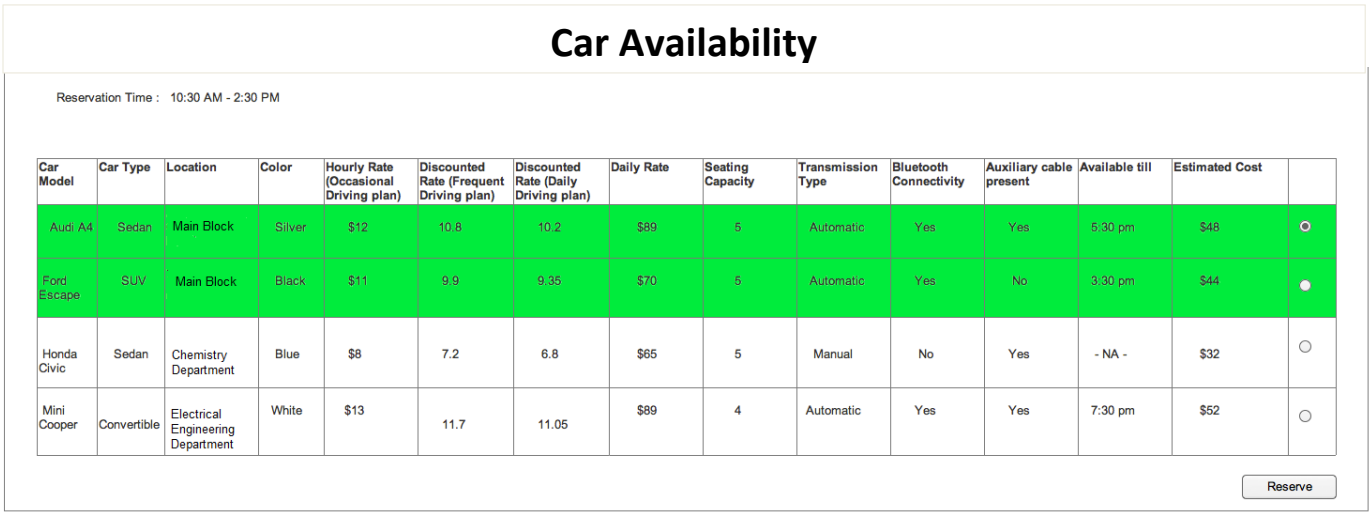


Figure 7: Car Availability

View Rental Information

On the homepage, the user can select the 'View Rental Information' option to see his rental history (Figure 8) and his current reservation, if he has one. The current reservation shows the date of reservation, reservation time, the car rented, location, and amount. There is an option to extend his reservation to another time. He can choose a different date and a return time, and update his reservation. The user should not be allowed to extend this reservation if some other user has already reserved the same car. Every time a user extends his reservation, the system should store all the 'previous return times'.
This page also shows his rental history, which shows in addition to the aforementioned details the 'Return Status'. The return status is 'On Time' by default unless the user has called the UETCR customer care informing them about him being late. In the latter case, the return status should also show the number of hours he is late by. A penalty is also charged as late fee in this case which would be explained in a later section when we talk about the Employee's functionality.

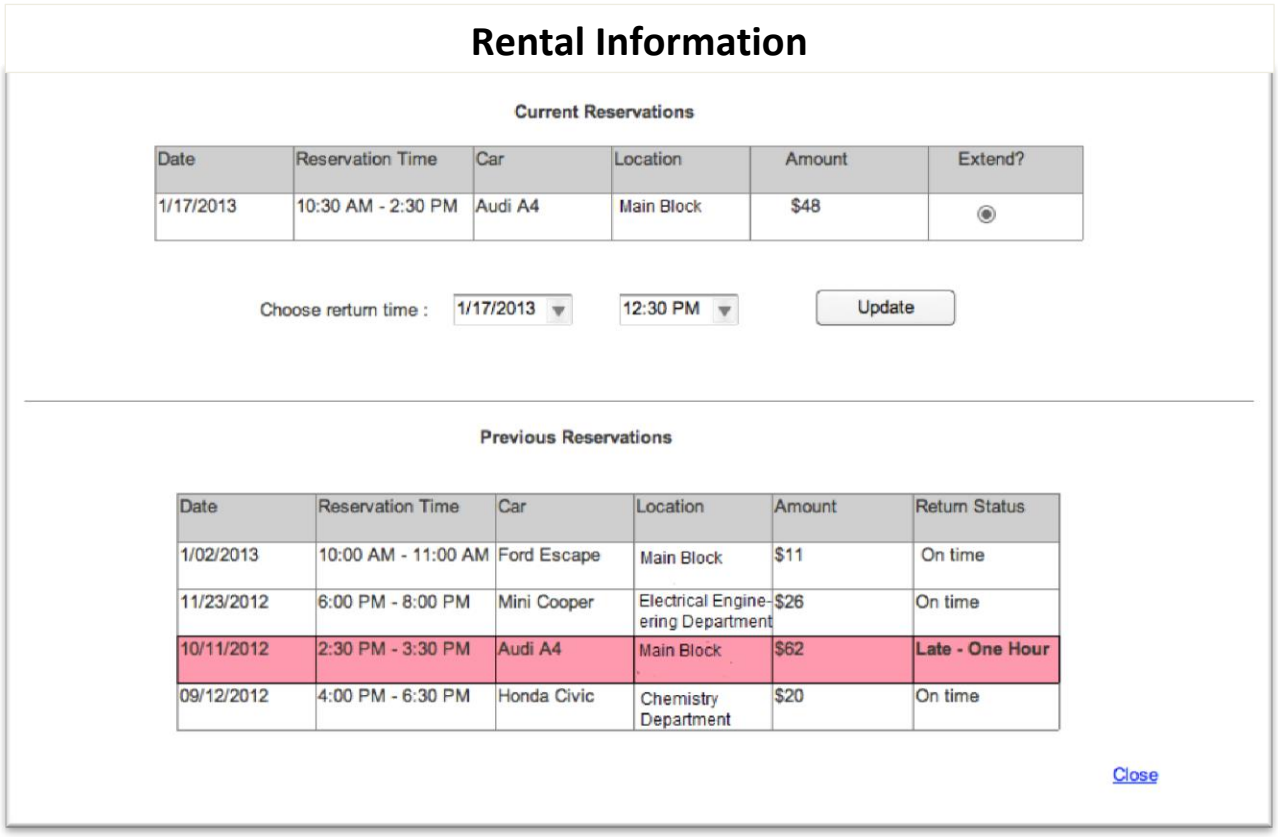


Figure 8: User's Rental Information

UETCR Employee

The employees who work for UETCR have a different set of functions available to them. When an employee logs in to the system, he can use the homepage shown in Figure 9 to manage cars which involves adding new cars and changing existing car locations. He can also put in service requests for maintenance of cars. We are assuming that if a user knows that he cannot return the car in time then he would call the UETCR customer care and inform them about it. The user is also supposed to give a time by which he would arrive. The employee needs to add a charge of minimum 50$ per hour as late fee on the user's account. So if a user is going to be 2 hours late there would be a charge of $100 on his account. Also if there is another member who had booked the car, which is now going to be late, then the employee needs to inform this other member and show him other available options. To do this, he needs to view user information by selecting the 'Rental Request Change' option and make appropriate changes.

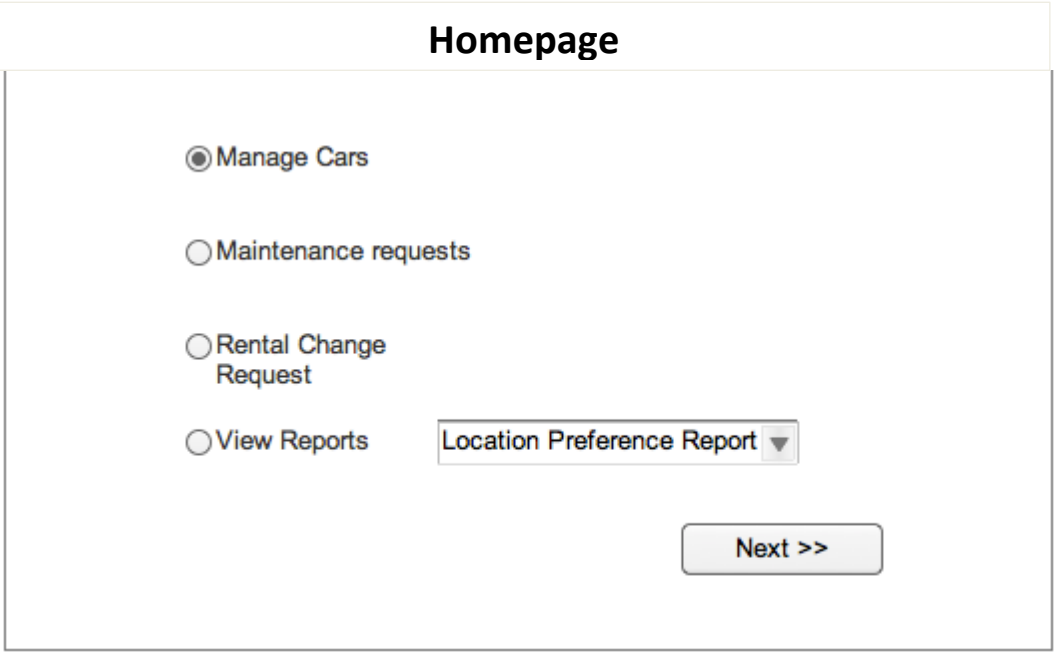


Figure 9: Homepage of UETCR Employee

Manage Cars

The employees can use the manage cars option to add a new car or change car locations. To add a car, the user needs to enter all the details shown in Figure 10. Multiple cars of the same model cannot be kept at the same location. The same screen can also be used to change the locations of cars. To do this, the employee needs to choose the current location of the car. Once the location has been selected, he needs to select a car from the dropdown list which auto populates with the names of cars in that location. Once the employee selects the car, he wants to move, the Brief Description section below will auto-populate with the car details such as car type, color, seating capacity, and transmission type. Finally, a new location is selected and the changes are updated. The system should not allow the employees to add cars or change car locations if the car capacity of the location is getting exceeded.

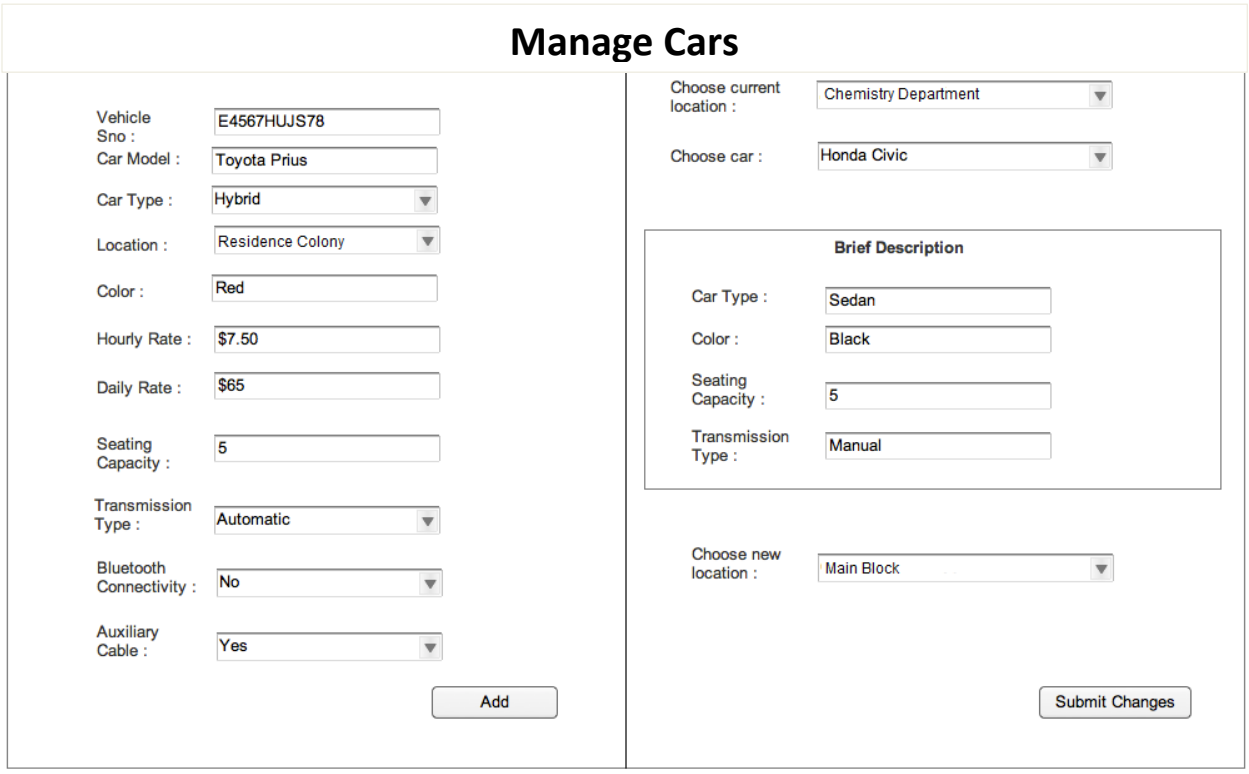


Figure 10: Manage Cars – Add a Car and Change a Car Location

Employees can also put in maintenance requests for cars as shown in Figure 11. They need to choose a location, which would pull up all the cars in that location. They need to select a car and write a brief note describing the problem with the car to help the maintenance company deal with the problem. There may be multiple problems for a car. Once a maintenance request has been submitted for a particular car then that car should not show up in the search results for the members. A maintenance request report would be required (explained later).

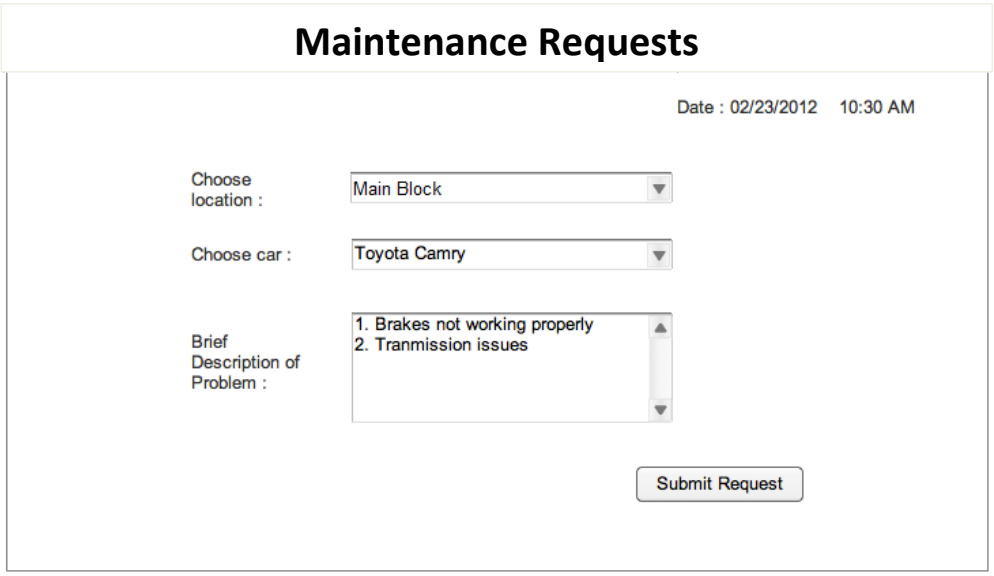


Figure 11: Maintenance Requests

Rental Request Change

Employees need to use this option when a member calls the UETCR customer care informing them that he is going to be late. This functionality has been provided if the user is not able to access the system to extend his reservation. We are assuming that when this happens the user gives an approximate time by which he will be back with the car. The job of the employee is to add a minimum late fee of $50 per hour as explained before if the car cannot be extended. In case another member has the same car booked, he needs to be informed that the car would not be available and should be given other options. The employee would be required to enter the username of the member in order to pull up his current rental information. If he has multiple reservations, the system should pull up the reservation, which has its pick up time before the current system time. The employee would be able to see the model of the car, location, and the original return time. Based on the information provided by the member, the employee needs to enter a new arrival time and update the system. Based on the new arrival time entered, the late fee should be calculated and added to the member's account. On the right side, the screen would show the details of the user who may have gotten affected by the previous member being late. This would show up as soon as the 'Update' button is clicked. If no user gets affected then the fields would remain blank and the new arrival time can be updated without charging any late fee since it is equivalent to an extension. In the 'User Affected' section (right side of the screen), the username of the other member, original pick up time, original return time, email address, and phone number should get auto-populated. This would help the employee call the user up and inform him about unavailability of the car. The employee can either cancel his reservation or reserve another car for him based on his choice. In case he chooses to reserve another car, the employee would click on 'Show car availability' which would pull up the Car availability screen shown in Figure 7. The new reservation would be made by the employee on behalf of the member.

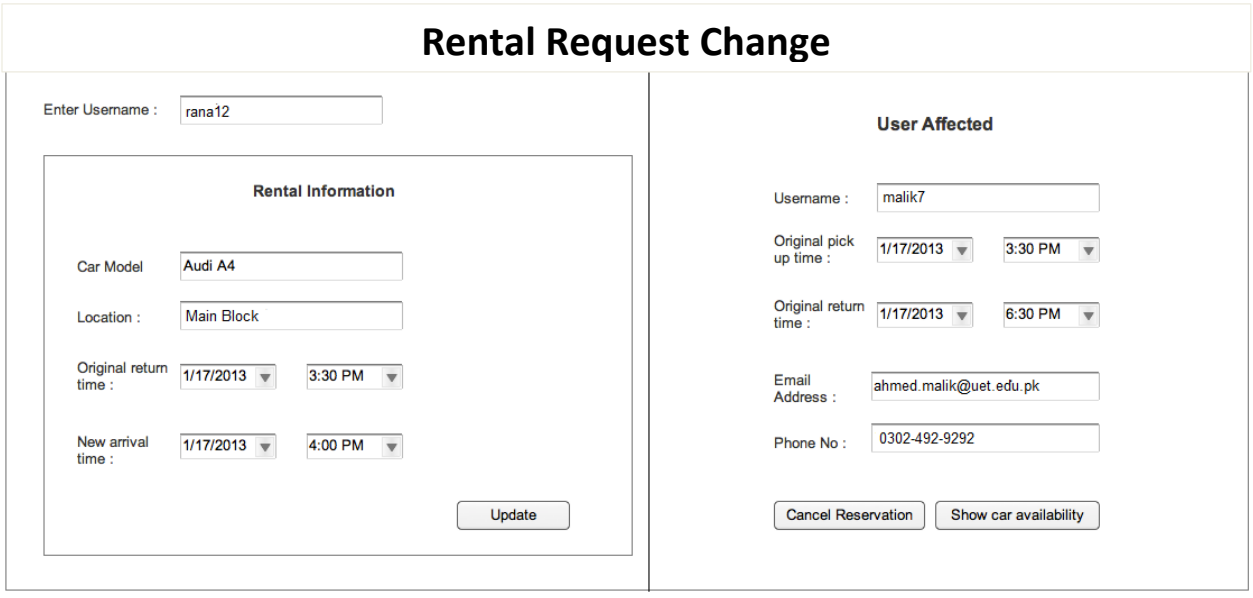


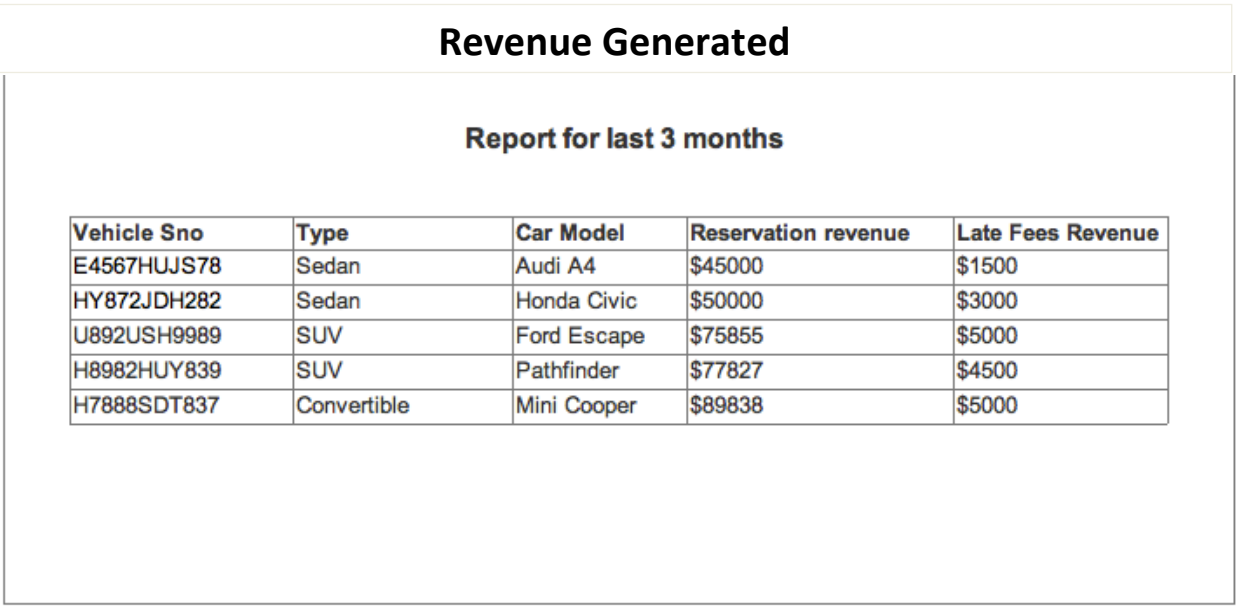
Figure 12: Rental Request Change

Reports

There are 3 reports, which are required:
– one Administrative report
– UETCR Employee reports

While writing SQL statements for these reports, use as few SQL statements as possible. In some cases, you might need to use a separate SQL statement to calculate totals. The important thing to remember is to let the database do the work. Don't simply pull in all the needed information and do the grouping/aggregation using programming language constructs. The query processor can do it much more efficiently than you can by hand. In other words, you want the output returned from your SQL query to be as close as possible to the information in the final report.

A) Administrative Report



Revenue Generated

Report for last 3 months

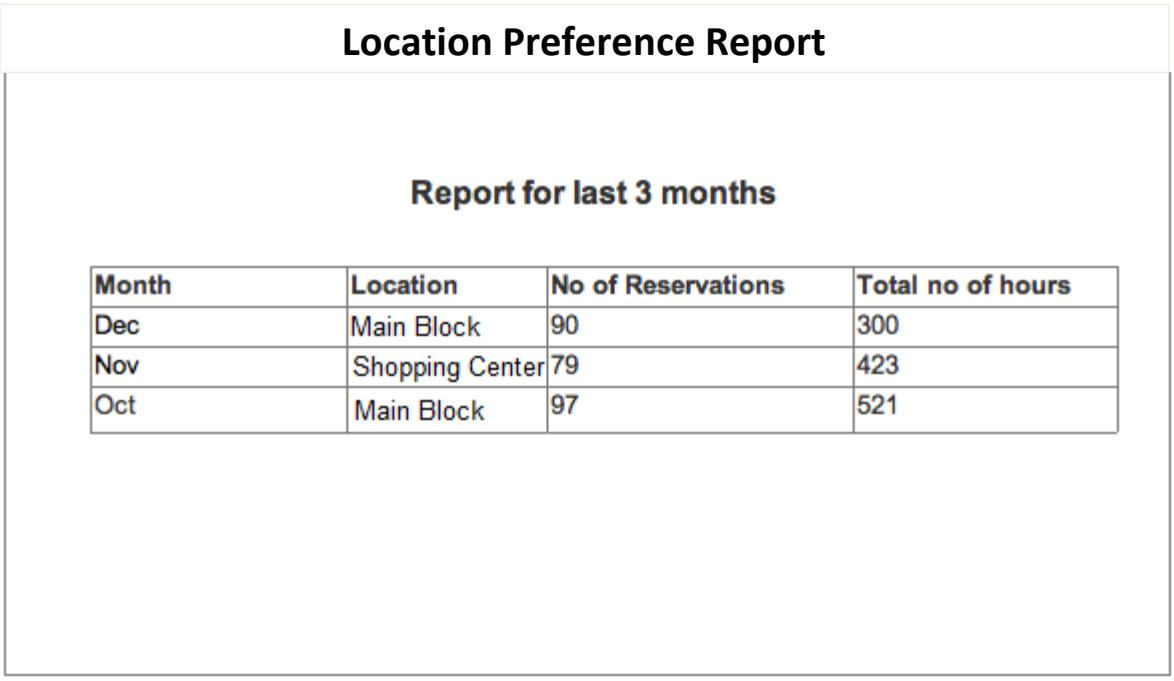
Vehicle Sno	Type	Car Model	Reservation revenue	Late Fees Revenue
E4567HUJS78	Sedan	Audi A4	$45000	$1500
HY872JDH282	Sedan	Honda Civic	$50000	$3000
U892USH9989	SUV	Ford Escape	$75855	$5000
H8982HUY839	SUV	Pathfinder	$77827	$4500
H7888SDT837	Convertible	Mini Cooper	$89838	$5000

Figure 13: Revenue Generated Report

An administrator would like to know how much revenue was generated for a particular car in the last 3 months. The revenue generated consists of the cost incurred to the user for reserving that car as well as the late fees incurred if the car was dropped later than the return time. The report should be grouped by the car type. See Figure 13.

B) Employee Report – Location preference report

The employees would like to know which location is the busiest in a particular month in the last 3 months, that is, which locations on campus are highly preferred for picking up cars during a particular period. This would help the employees in making sure to increase the capacity of that location for that particular period (Figure 14). The total number of hours is the total number of hours of reservation made from a particular location.



Location Preference Report

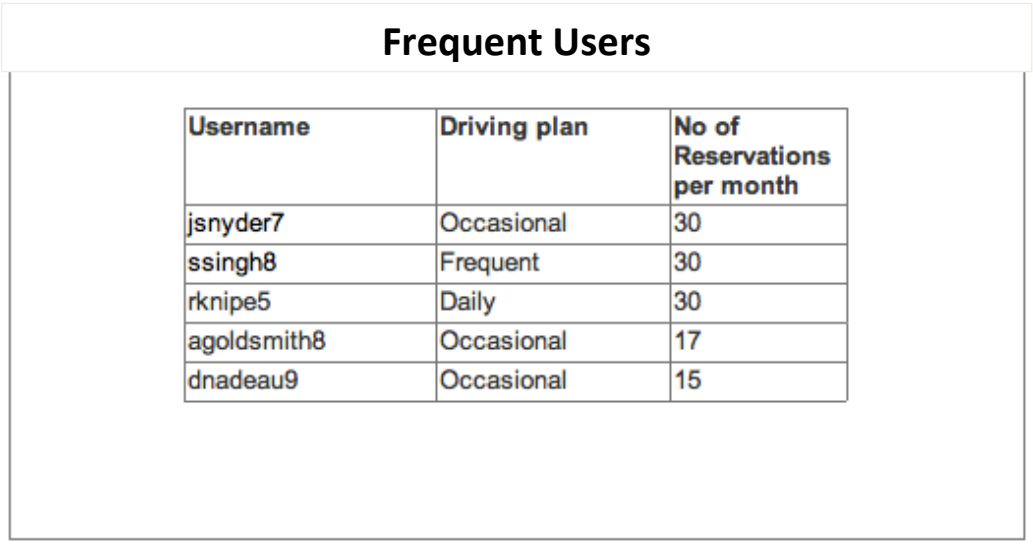
Report for last 3 months

Month	Location	No of Reservations	Total no of hours
Dec	Main Block	90	300
Nov	Shopping Center	79	423
Oct	Main Block	97	521

Figure 14: Location Preference Report

C) Employee Report - Frequent Users Report

The employees would like to know the top 5 most frequent users along with the driving plan they are on and the average number of reservations they have made per month in the last three months. The results should be sorted by the number of reservations in a descending manner. This report would help the employees suggest a different plan to the members to help them save money, e.g., in Figure 15 we see that the user jsnyder is on an 'Occasional Driving Plan' but he books a car quite frequently. So the employees can suggest a different plan to him. (The suggesting functionality is not supposed to be implemented).



Frequent Users

Username	Driving plan	No of Reservations per month
jsnyder7	Occasional	30
ssingh8	Frequent	30
rknipe5	Daily	30
agoldsmith8	Occasional	17
dnadeau9	Occasional	15

Figure 15: Frequent User Report

D) Maintenance History Report

The maintenance history report should consist of the car name, Date-Time of the request, employee who sent the request, and the problem(s) with the car. Note that this report should be ordered by the number of problems with the car, that is, the car with the maximum number of problems should be shown first and then the others.

Maintenance History Report

Car	Date-Time	Employee	Problem
Audi A3	02/21/2012 10:30 AM	rsingh29	Brake Pads not working
Audi A3	02/21/2012 10:30 AM	rsingh29	Water leakage at the bottom of the car
Ford Escape	02/21/2012 11:30 AM	rdunlap3	Engine knocking
Ford Escape	04/14/2012 2:30 PM	mjane23	Wheel Alignment
Toyota Corolla	11/11/2012 5:30 PM	jlee21	Engine light on
Toyota Camry	10/25/2012 1:30 PM	rdunlap3	Transmission
Nissan Altima	10/25/2012 1:35 PM	mjane23	Wheel Alignment

Figure 16: Maintenance History Report