CS 4400 – Spring 2013 Class Project
GT 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 Georgia Tech Car Rental (GTCR). You are required to use the Classical Methodology for Database Development (as defined in the slide presentation called "Database Design Methodology" under resources on T-square). The system should be implemented using a relational DBMS that supports standard SQL queries. Class administrators will provide you with information about how to access a college-managed MySQL server in order to implement your database and the application. The professors must approve other alternative implementations. *In no circumstances can you use a tool that automatically generates SQL or automatically maps 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 (see notes on database design methodology under resources).

Phase		Due Date
I	Analysis & Specification	February 15
II	Design	March 15
III	Implementation & Testing	April 23
	Demonstrations	Dead Week

Groups

Project groups may have 3-4 members. Please avoid having smaller groups. 5 or more members will not be acceptable.

A group may remove a member from further participation in the group when Phase I is turned in or when Phase II is turned in. A written notification must be provided to the professor at that time. Students from Section A, B, and C cannot form groups with students from section D. Slides on database design methodology will be useful for phases I and II:

Phase I (hard copy)

The deliverables include:

1. A cover page listing all members in the team with their respective sections and email addresses and Tsquare username.
2. Enhanced Entity Relationship (EER) Diagram
3. Information Flow Diagram
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, 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, i.e. 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 in class

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, we would ask you to 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.**

Lightweight: Write a set of working SQL statements to perform all of the tasks specified in the project description. Each task will be checked independently.

Heavyweight: Implement a working application with all functionality described in this document. Your source code should be mailed to the respective TA who grades your project 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

Grading

The project will consist of three phases (deliverables) as well as a final demonstration to the TA. Phase I and Phase II of the project are each worth 10% credit. Credit for phase III depends on the implementation option you choose:

Heavyweight Phase III Option (20% credit): We will use the embedded SQL feature of MySQL which allows you to embed SQL statements in a Java program or web application.
Lightweight Phase III Option (5% credit): We will use the phpMyAdmin interface or the MySQL Query Browser, which allows you to execute SQL statements directly on your database.

APPLICATION DESCRIPTION

GT Car Rental

GT Car Rental is a simple online Georgia Tech car rental service application. We will now be referring to GT Car Rental as GTCR from here onwards. There are primarily 3 types of users of this system : **Employees, Members and Administrators** .Using this application the Georgia Tech students / faculty can become members and rent a car anywhere on campus on an hourly basis. The Employees use this application to manage the cars, their location 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 GTCR application along with some screen mockups. The 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 we have 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. You may implement the project as a traditional standalone application (e.g., using Java GUIs) or as a web application (e.g., using a web scripting language like PHP). There is no restriction on the choice of language.

ALSO NOTE THAT REQUIREMENTS FOR THE PROJECT MAY CHANGE IN DUE COURSE OF TIME . PLEASE CONSTANTLY LOOK OUT FOR POSTINGS OF REVISIONS OF THE PROJECT.

Logging into GT Car Rental

Fig.1 shows the GTCR 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.

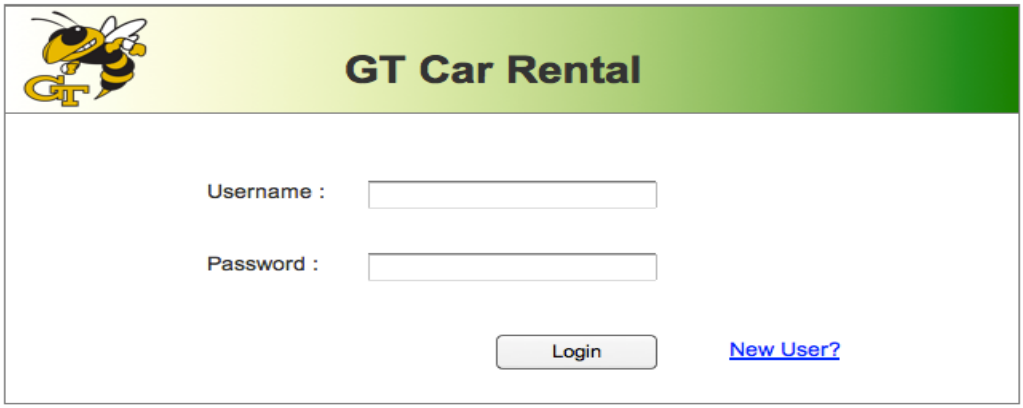


Fig.1 Login Screen

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 GTCR. This applies only for Georgia Tech students / faculty and GTCR 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 Fig. 2. Retrieving a forgotten password is an optional functionality but is not required to be implemented.

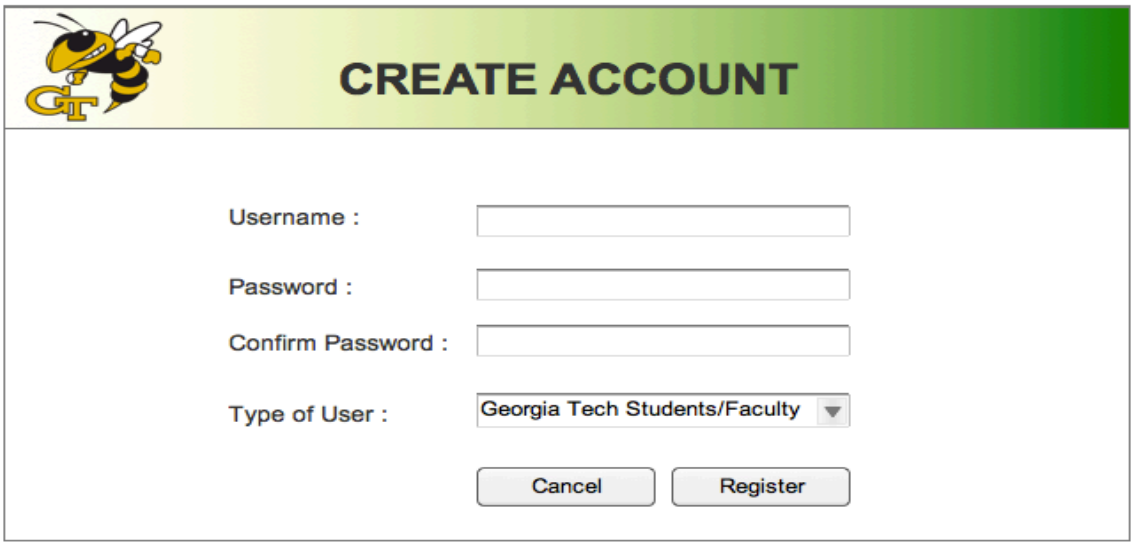


Fig. 2 Create Account

Once a user logs into the system he would be directed to the 'Homepage' screen which would be different for GT Students/faculty (Fig 3) and GTCR employees (Fig 9). The

homepage for the GTCR 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).

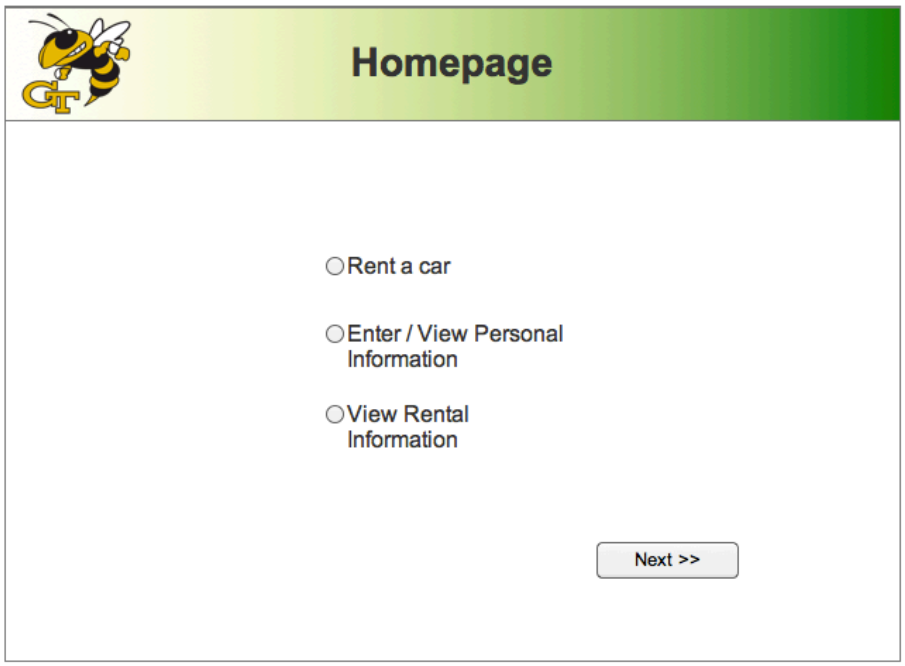


Fig 3. Homepage for GT Student/Faculty

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 (Fig 4).

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 basic information like First Name, Middle Initial, Last Name, Email Address, Phone Number, Address. The Membership Information section requires the user to choose a driving plan which are 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 (Fig 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.

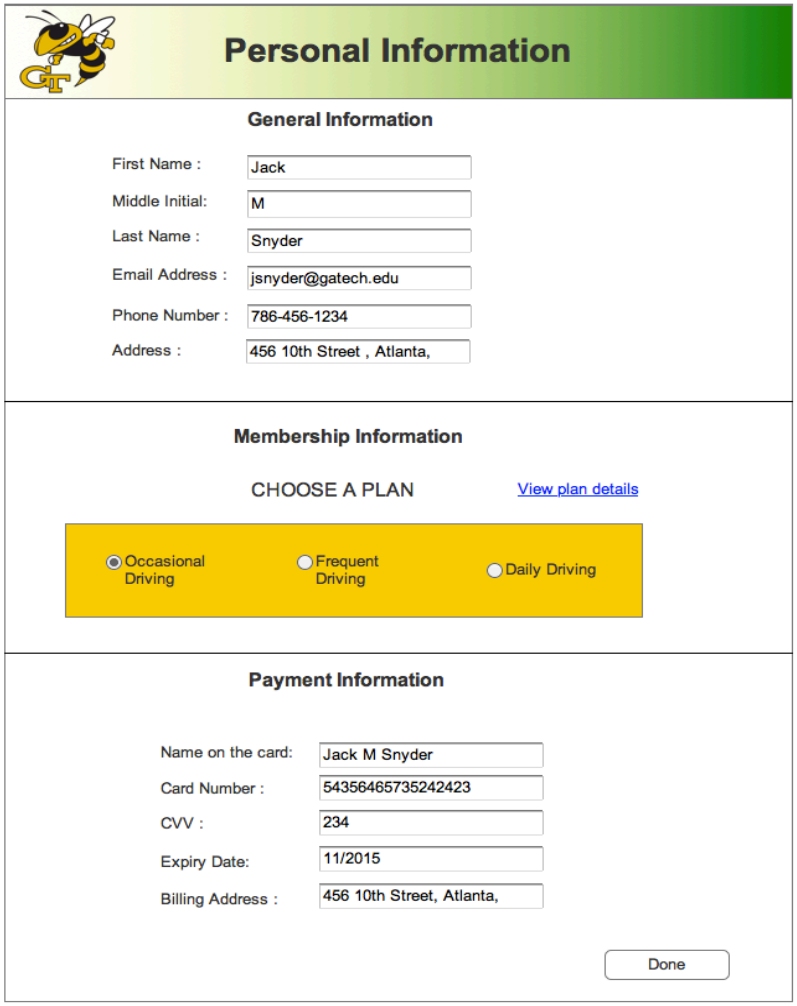


Fig.4 Personal Information Page

Fig 5. Driving Plan Details page

Rent a Car

Each car identified by a vehicle serial number , has a model name (Audi A3, Infinity G37, Ford Escape, etc.) , a type (Hatchback, Hybrid, Convertible, SUV, Sedan), color, location, hourly rental rate, daily rental rate, seating capacity, transmission type, may or may not have blue tooth connectivity, may or may not come with an auxiliary cable. 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 pick up time, return time and choosing the location from a drop down list which would show all the locations at which cars are kept on campus. Selecting the pick up 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 i.e Hatchback, Hybrid, Convertible, etc. (Fig 6.). Clicking 'Search' would navigate the user to the Car availability page (Fig 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 GTCR customer service about being late.

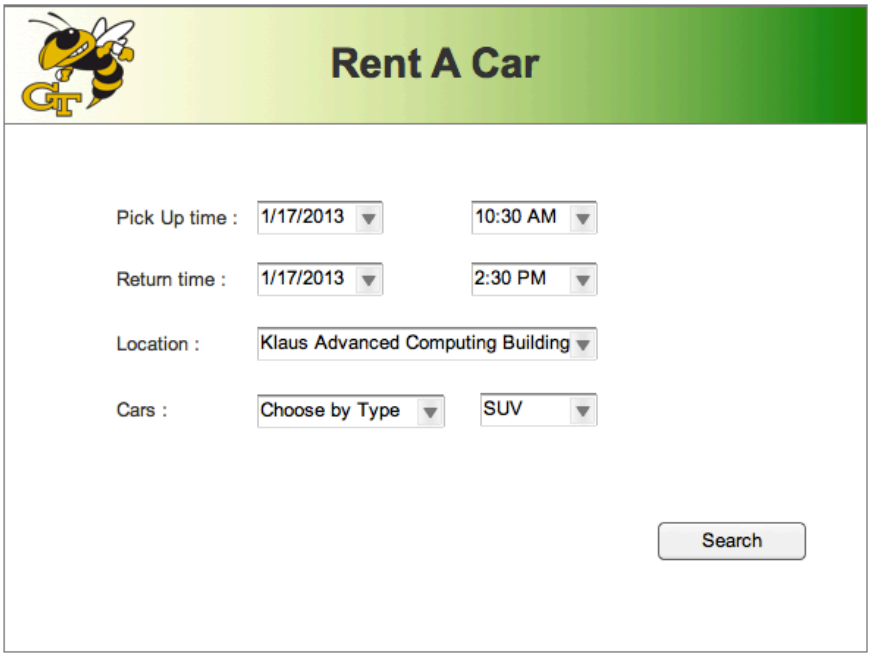
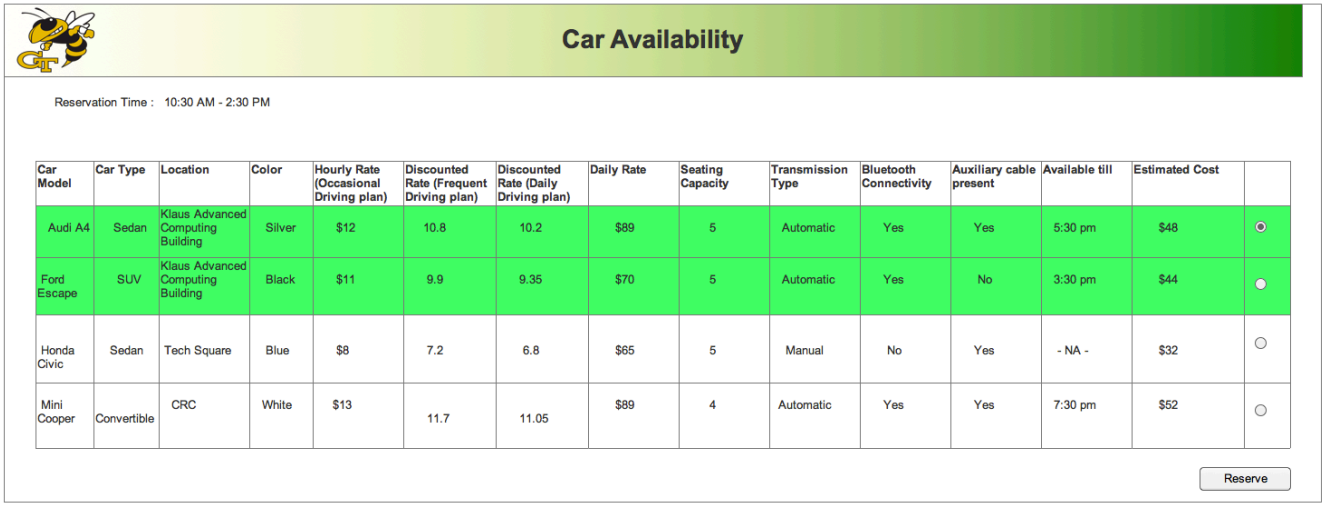


Fig 6. Rent a car screen

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), the 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. E.g, If the user searches for SUVs at Tech Square, then the table should show details of all the SUVs at Tech square 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 Fig 7. The estimated cost would be calculated based on the pick up 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'. E.g of 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.



Car Model	Car Type	Location	Color	Hourly Rate (Occasional Driving plan)	Discounted Rate (Frequent Driving plan)	Discounted Rate (Daily Driving plan)	Daily Rate	Seating Capacity	Transmission Type	Bluetooth Connectivity	Auxiliary cable present	Available till	Estimated Cost	
Audi A4	Sedan	Klaus Advanced Computing Building	Silver	$12	10.8	10.2	$89	5	Automatic	Yes	Yes	5:30 pm	$48	◉
Ford Escape	SUV	Klaus Advanced Computing Building	Black	$11	9.9	9.35	$70	5	Automatic	Yes	No	3:30 pm	$44	○
Honda Civic	Sedan	Tech Square	Blue	$8	7.2	6.8	$65	5	Manual	No	Yes	- NA -	$32	○
Mini Cooper	Convertible	CRC	White	$13	11.7	11.05	$89	4	Automatic	Yes	Yes	7:30 pm	$52	○

Fig 7. Car availability.

View Rental Information

On the homepage the user can select the 'View Rental Information' option to see his rental history (Fig 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 GTCR 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.

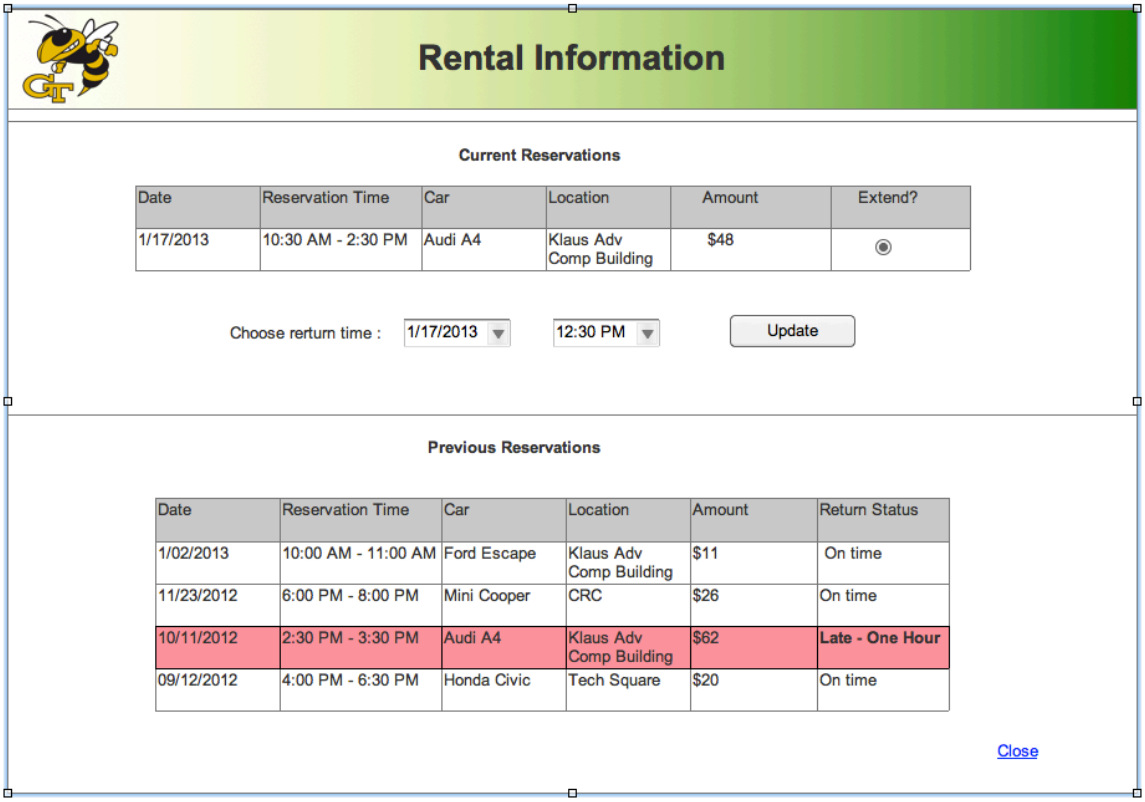


Fig 8. User's Rental Information

GTCR Employee

The employees who work for GTCR have a different set of functions available to them. (We again refer to the employees as a 'he' with no intended bias). When an employee logs in to the system he can use the homepage shown in Fig 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 GTCR 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.

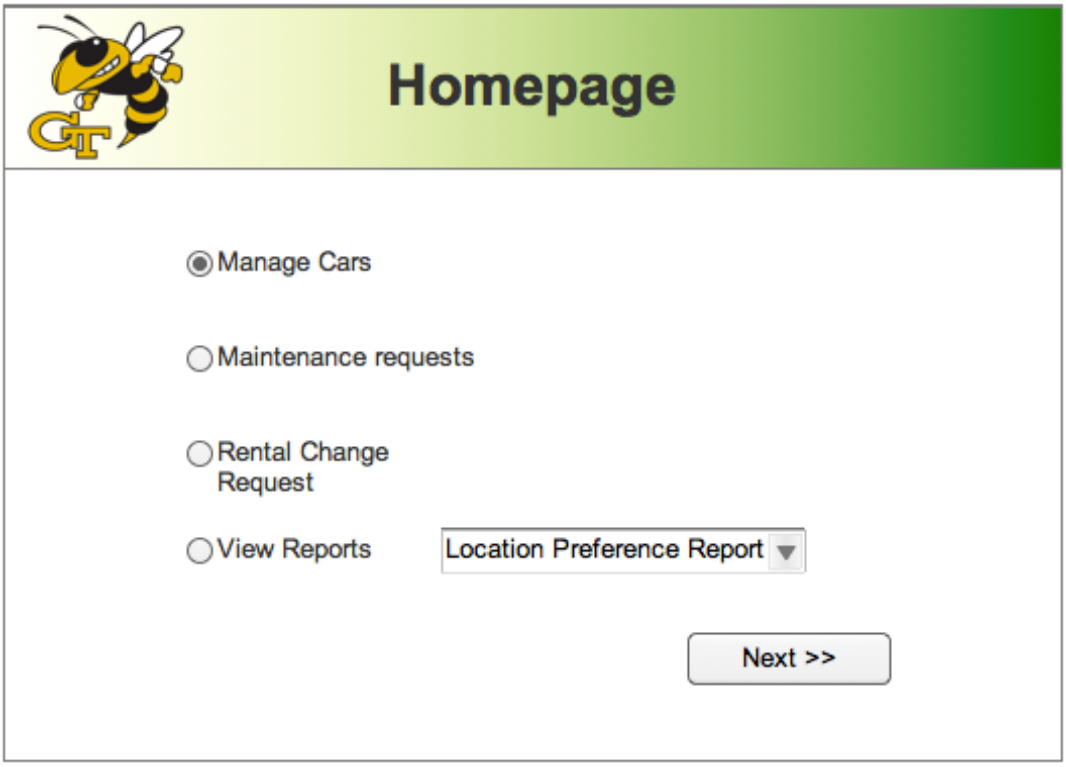


Fig 9. Homepage of GTCR Employee

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 Fig 10. Multiple cars of the same model cannot be kept at the same location. The same screen can also be used to change 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.

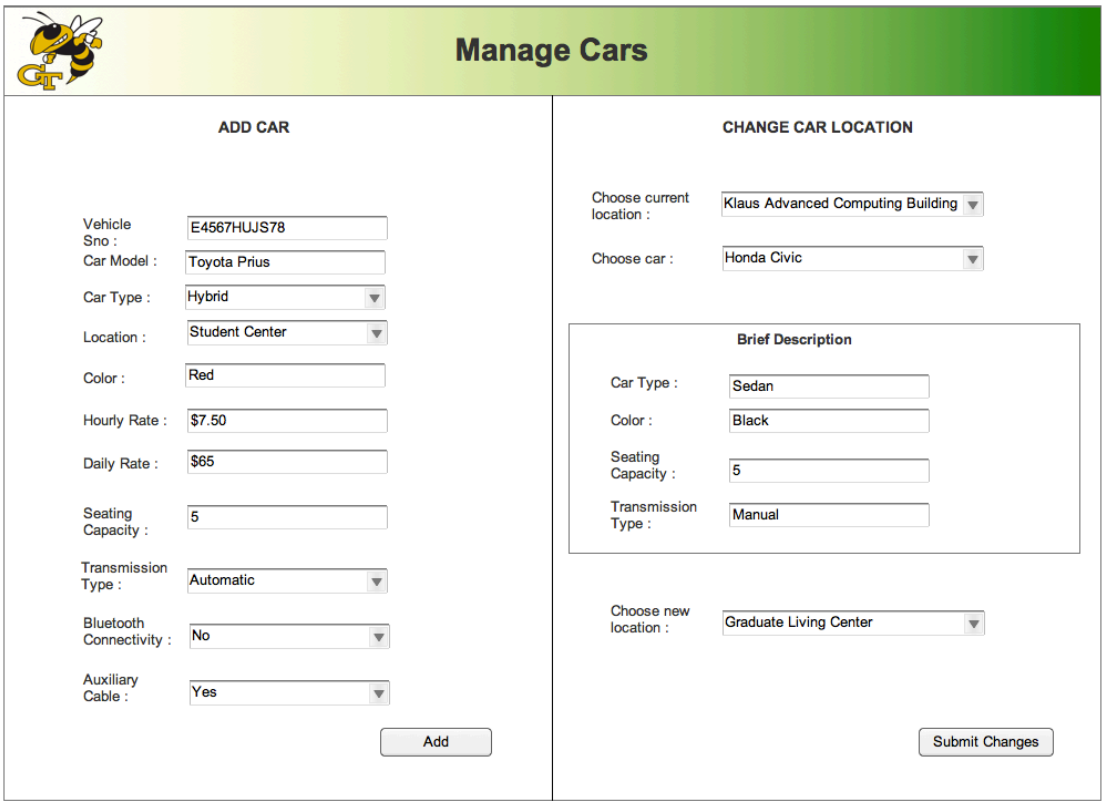


Fig 10. Manage Cars

Employees can also put in maintenance requests for cars as shown in Fig 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)

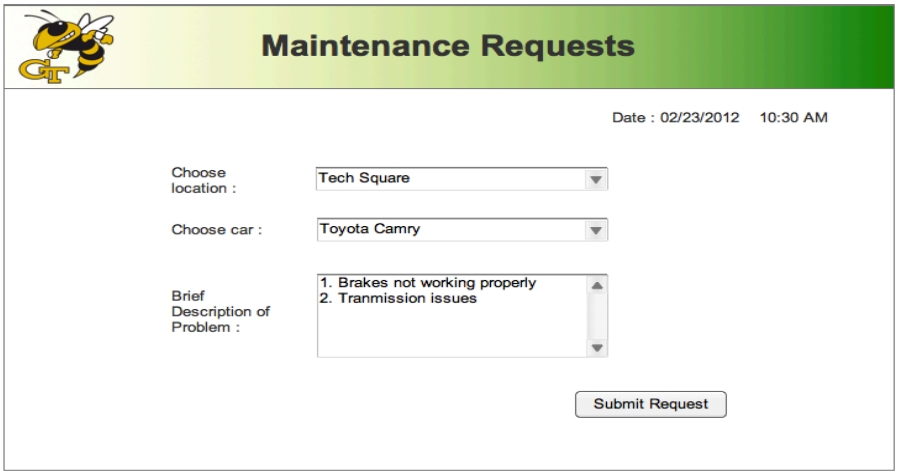


Fig 11. Maintenance Requests

Rental Request Change (Fig 12)

Employees need to use this option when a member calls the GTCR 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 fees 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 Fig 7. The new reservation would be made by the employee on behalf of the member.

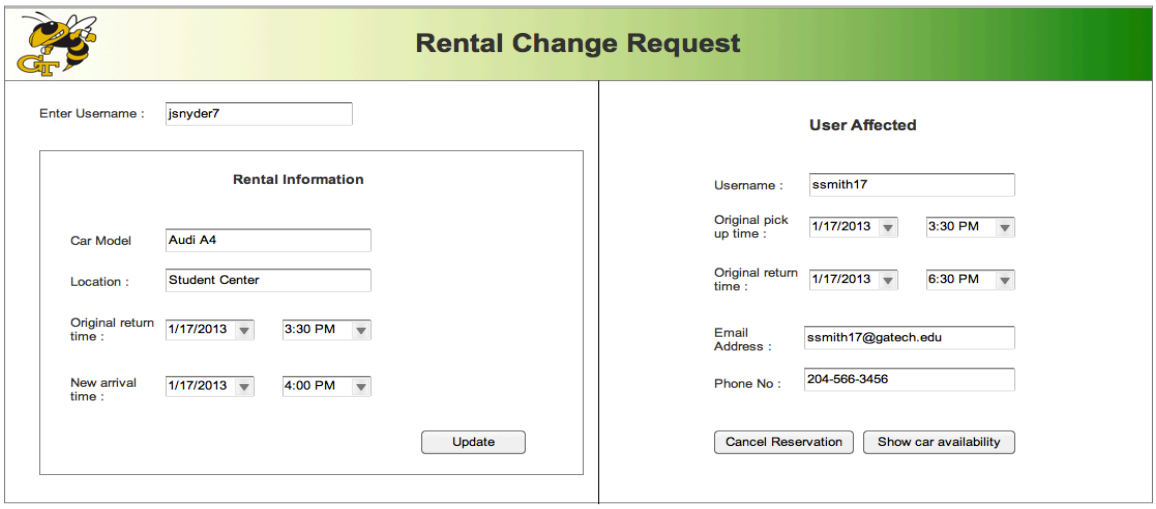


Fig 12. Rental Change Request.

Reports

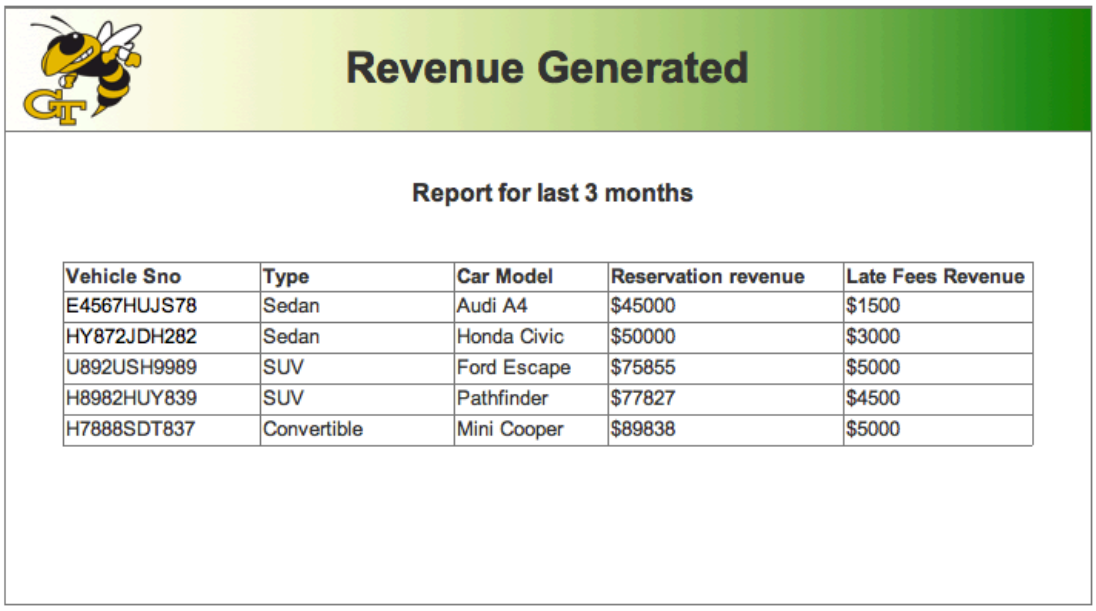
There are 4 reports, which are required:

- one Administrative report
- three GTCR Employee reports

When 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

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 Fig 13.



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

Fig 13. Revenue Generation Report

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. i.e 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. (Fig 14). The total number of hours is the total number of hours of reservation made from a particular location.

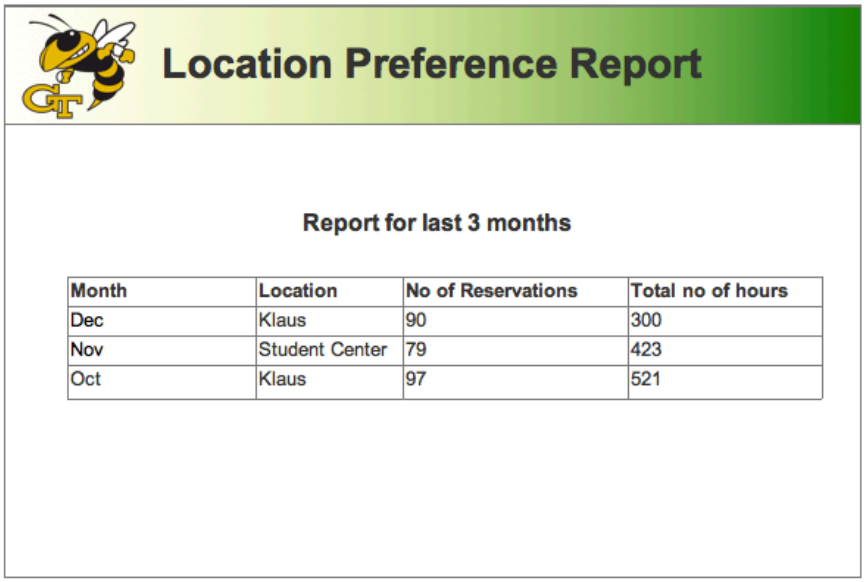
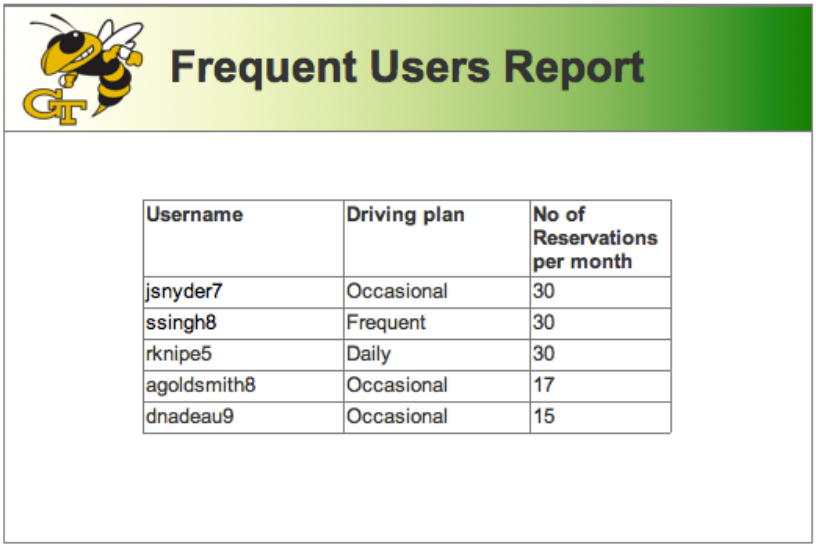


Fig 14. Location Preference Report

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 Fig 15 we see that the user jsnyder7 is on an 'Occasional Driving Plan' but books a car quite frequently. So the employees can suggest a different plan to him. (The suggesting functionality is not supposed to be implemented). (Fig 15)



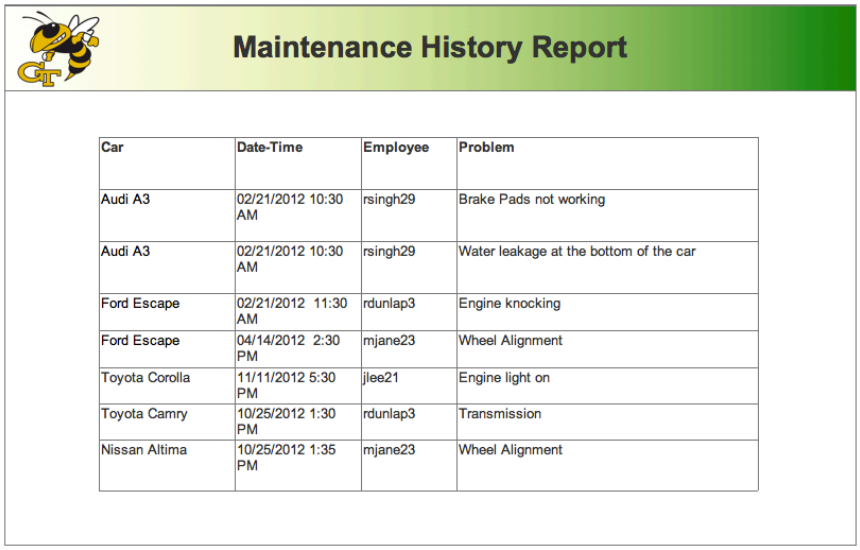
Frequent Users Report

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

Fig. 15 Frequent Users 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, i.e 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

Fig 16. Maintenance History Report

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Version	Notes	Date
1.0	Original project document	01/25/2013
1.1	1. Employees, Members, Administrators are mutually exclusive 2. Personal Information Section- Payment information is mandatory 3. Rent a Car section – 'Car capacity' of a location has been added. 4. View Rental Information section – All the previous return times for a particular reservation needs to be stored. 5. Manage Cars section – Restriction on the adding a car / changing car location based on location capacity 6. Maintenance Request screen modified (Fig 11) 7. Maintenance History report added. 8. Task Decomposition Diagram removed from the requirements section of Phase II.	02/04/2013