

# CS 4400 Database Project

## RenToGo.com (Online Car Rental)

### Fall Semester 2003

## 1. Purpose of the Project

Analyze, specify, design, implement, document and demonstrate an information system application to support the operation of RenToGo.com, an online car rental service. You are required to use the Classical Methodology for Database Development. The system must be implemented on ORACLE available at ACME.

## 2. Project Phases

The three phases of the project cover the following work processes from the Methodology for Database Development:

Phase		Due Date
I	Analysis and Specification	September 26
II	Design and Database Load	October 24
III	Implementation and Testing	December 1
	Demonstration	December 2-5

## 3. Groups

Projects with Lightweight Phase III may have three members.

Projects with JDBC/Java GUI may have three or four members.

In no case a group can have less than 3 members or more than 4 members. If you have difficulty in finding enough members, proceed with Phase 1 and we will help you with group formation later.

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.

## 4. Reports

A typed report is handed in for grading at the end of each phase.

The Phase I Report must contain a description of the purpose of the project and the purpose of this phase of the project. It must describe the problems encountered in the technical requirements of this phase and justify the solutions. It must contain all documentation produced in this phase, including Information Flow Diagrams, E-R Diagrams, and Task Forms.

The Phase II Report must contain a description of the purpose of this phase of the project. It must contain the Phase I Report and must describe any revisions made to the specification described in the Phase I Report. It must further describe the problems encountered in Phase II and justify the

solutions. It must contain all documentation produced in Phase II with the addition of a relational schema, and abstract code with SQL (for each task). The relational schema specification should include integrity constraints, foreign keys, primary keys, and domain constraints.

The Phase III Report must contain a description of the purpose of this phase of the project. It must contain the Phase I and Phase II Reports and must describe any revisions made to the specification described in the Phase II Report. It must describe the problems encountered in this Phase III and justify the solutions. It must contain all documentation produced in Phase III, including the schema definition, a source program listing (well documented), and a short description on your decision on creating indexes (see note on “Task Statistics at the end). It must contain a brief users’ manual for the system. Also, the specific contribution of each member must be indicated.

## 5. 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:

**GUI/JDBC Phase III Option (20% credit):** We will use the embedded SQL feature of ORACLE, called JDBC, which allows us to embed SQL statements in a Java program.

**Lightweight SQLPLUS Phase III Option (5% credit):** We will use the SQLPLUS feature of ORACLE, which allows us to execute SQL statements.

## 6. Overview of RentToGo.com

For this project, you will develop RentToGo.com, an information management system that supports some of the services involved in an online car rental service (e.g., Alamo.com, Hertz.com).

RentToGo.com will have three types of users, namely, *customer*, *clerk on duty*, and *system administrator*. Customer is any user willing to rent a car. Clerk on duty represents the employee responsible for checking out and checking in a rental. System administrator is responsible for operating the system.

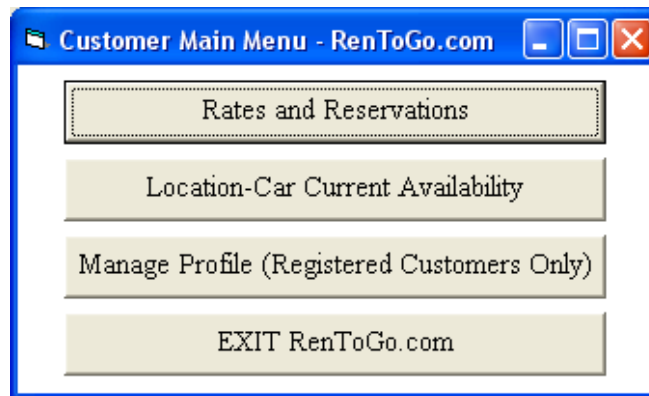
In the rest of this document, we first describe the system interface for each customer type. Then, we present aspects of the system as a whole. Throughout the document, we assume that RentToGo.com has the entry point shown in Figure 1.



**Figure 1:** Welcome Screen

## 7. The Customer

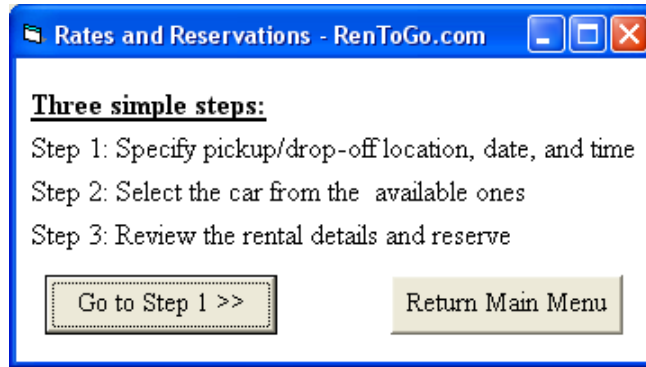
The customer enters the system by selecting “Car Rental Service” option in the Welcome screen (Figure 1) and clicking “ENTER.” RenToGo.com then pops up the screen in Figure 2.



**Figure 2:** Customer Main Menu screen

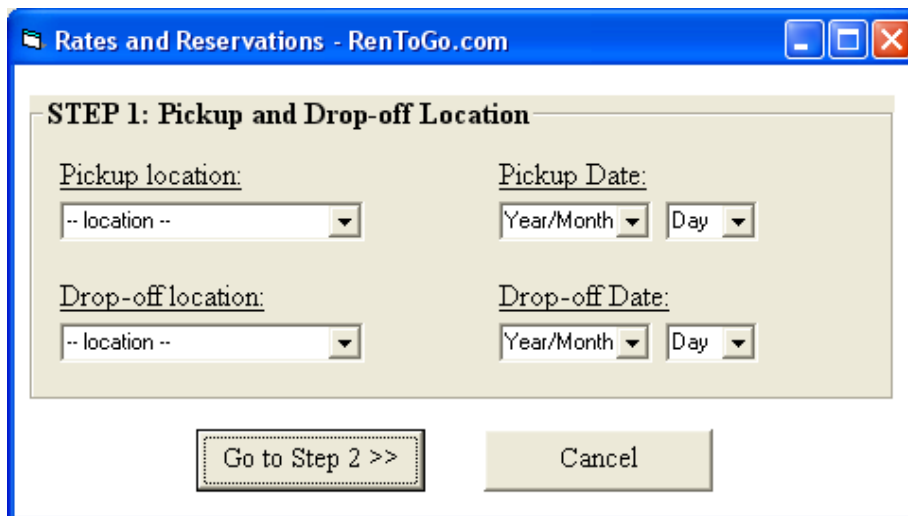
### 7.1 Rates and Reservation

If the user clicks on “Rates and Reservation” button, the system will display the screen shown in Figure 3, which explains the three simple steps for checking on car rates and making a reservation.



**Figure 3:** Simple explanation for checking on car rates and making reservation

As shown in Figure 4, for the first step in the car reservation process, the user must indicate when and where she will pick and return the car. For this project, we consider that there are only five locations: Atlanta, Macon, Savannah, Birmingham, and Montgomery. Each location must keep information of which cars it has (or it will have) available for rental. However, we will assume that the database is centrally managed from one location, say Atlanta. Based on this information, the system is able to provide the rental availability information in Step 2.



**Figure 4:** Step 1: Pickup and drop-off location.

In Step 2 (Figure 5), the user selects the car that she wants to rent from a list of available ones. For each car option, the system presents the total cost and the respective daily rate. For this project, you don't need to worry with the sales tax. The total cost is calculated by just multiplying the number of days by the respective daily rate. The daily rate will be \$\$.*cc* in dollars and cents.

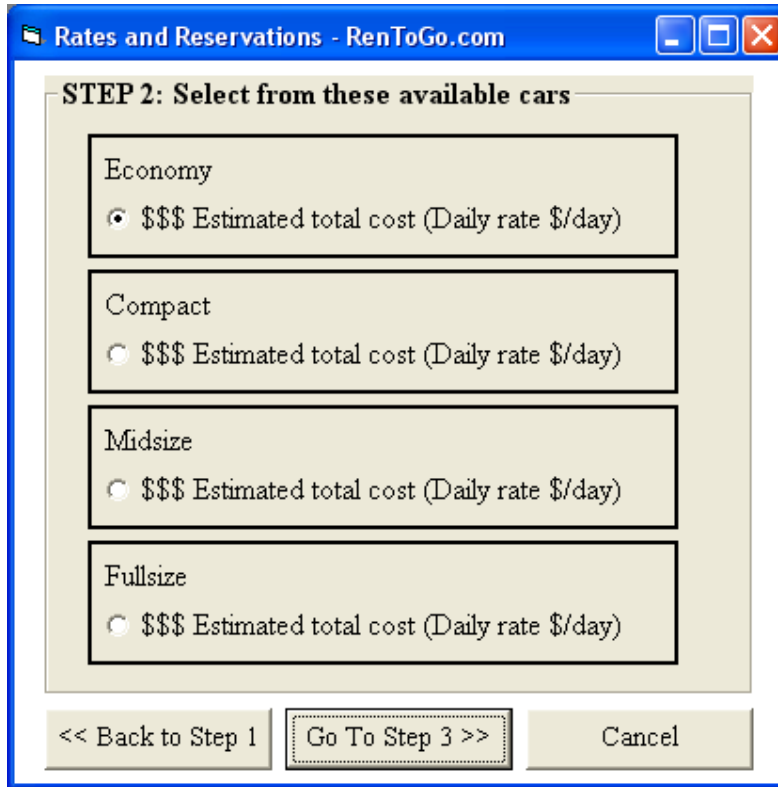


Figure 5: Step 2: Car selection screen.

In Step 3, the system presents a summary of the rental reservation to the customer. If the customer agrees with the summary, she then clicks on “Complete Reservation” button. Alternatively, she can go back to Step 2 or decide to cancel the reservation at once. We observe that up to this point, no modification has been made to the underlying database. Reservations are only committed when the customer clicks on the “Complete Reservation” button.



Figure 6: Step 3: Reservation Summary screen.

If the customer decides to complete the reservation, the system will pop up the screen in Figure 7. For this project, if a customer wants to make a reservation, she will need to register to RenToGo.com first. In case she has already registered to the system, she needs just to enter her e-mail and password and then click the “Login” button. As we discuss next, the system identifies each registered customer by his or her e-mail address.

Customer Registration - RenToGo.com

To complete your reservation, you need to be a registered customer.

Registered Customers

E-mail:  Login

Password:

NEW Customer

Register

CANCEL

**Figure 7:** Customer Login/Registration screen.

If the user is a new customer, when she clicks on the “Register” button, the system shows the screen depicted in Figure 8.

NEW Customer - RenToGo.com

E-mail address:  Confirm e-mail address:

Password:  Re-type password:

FIRST Name:  LAST Name:

Driver's License No.:  State:

File Credit Card Information

Register!

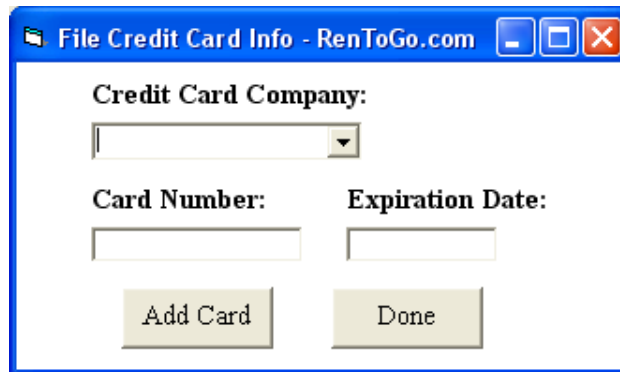
Cancel

**Figure 8:** New Customer registration screen.

The system uses the e-mail address of the customer to uniquely identify her. We will assume that the e-mail address is a valid one. Therefore, there should not exist any duplication. But the system should still check whether the e-mail address provided by the user has been used before. If this is

the case, an error message is displayed, and the customer is requested to enter another e-mail address. The password can be anything that the customer provides.

When the customer comes for picking up the car at the selected location, the clerk-on-duty will ask her for a credit card, which will be charged when the car is returned. The customer may decide to provide information on her credit card at pick-up time or at registration time. In case she decides for providing the credit card information at registration time, she clicks the “File Credit Card Information” button in Figure 8, and the system pops up the screen in Figure 9.



The screenshot shows a web browser window titled "File Credit Card Info - RenToGo.com". The window contains a form with the following elements:

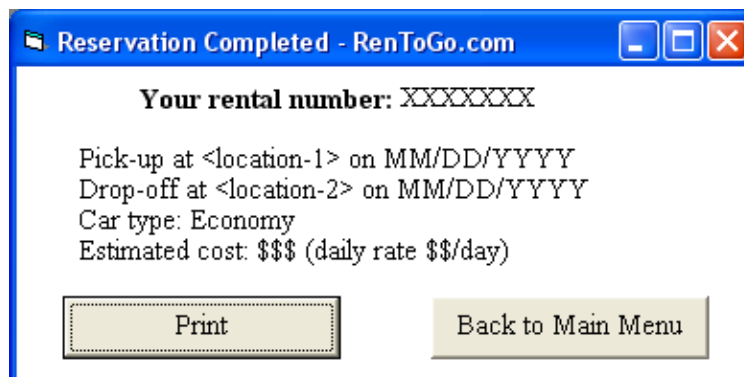
- A label "Credit Card Company:" followed by a dropdown menu.
- Two labels, "Card Number:" and "Expiration Date:", each followed by a text input field.
- Two buttons at the bottom: "Add Card" and "Done".

**Figure 9:** File Credit Card Information screen.

The customer can file as many credit cards as she wants. Credit card information can then be deleted or updated using the “Update Profile” option shown in Customer Main Menu screen (see Section 7.3-).

To file a credit card, the customer enters the requested information and clicks “Add Card” button. The system then includes the credit card data and display again the screen shown in Figure 9, this time with the fields cleared. Once the customer has finished entering the credit card information, she clicks “Done” and the screen in Figure 8 is displayed again. The system needs to guarantee that the customer will not enter more than once the same credit card information.

If the customer decides to cancel her registration, no reservation will be made, and the Customer Main Menu screen is displayed. However, if the customer clicks the “Register” button in Figure 8, the system will display the screen depicted in Figure 10 and complete the rental reservation.



The screenshot shows a web browser window titled "Reservation Completed - RenToGo.com". The window displays the following information:

- "Your rental number: XXXXXXXX"
- "Pick-up at <location-1> on MM/DD/YYYY"
- "Drop-off at <location-2> on MM/DD/YYYY"
- "Car type: Economy"
- "Estimated cost: \$\$\$ (daily rate \$\$/day)"

At the bottom, there are two buttons: "Print" and "Back to Main Menu".

**Figure 10:** Reservation Completed screen.

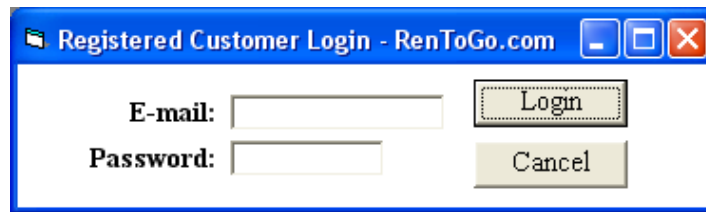
Before displaying Reservation Completed screen, the system updates the underlying database with the reservation. We observe that the system will only change the database when the reservation is completed.

## 7.2 Location-Car Current Availability

This option presents a snapshot of the current available cars of each type at each location. Using this option, the user can have a general idea of what is available at RenToGo.com at a given moment.

## 7.3 Manage (Customer) Profile

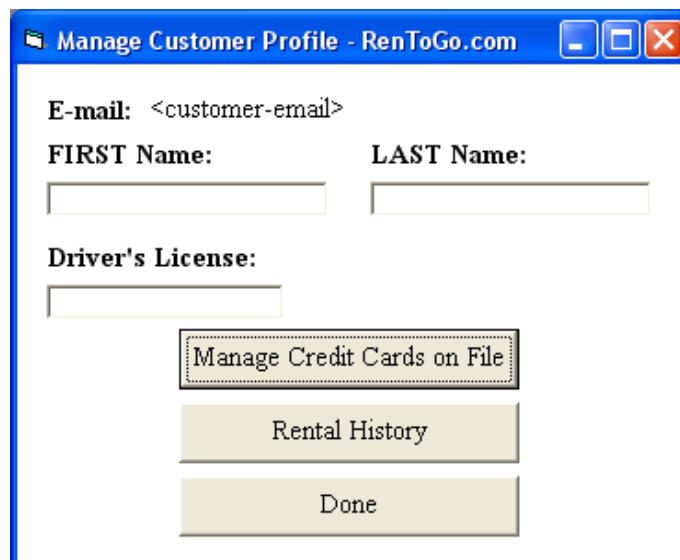
When the customer selects the “Edit Profile (Registered Customers Only)” option from the Customer Main Menu screen, the system pops up the following screen:



The screenshot shows a window titled "Registered Customer Login - RenToGo.com". It features two text input fields: "E-mail:" and "Password:". To the right of the "E-mail:" field is a "Login" button. Below the "Login" button is a "Cancel" button.

**Figure 11:** Customer Login screen.

Upon successful login, the customer will be presented with the screen shown in Figure 12, from which she will be able to update her first and last name, manage her credit card on file, and check on her rental history. The customer cannot update her e-mail because RenToGo.com uses it as a mechanism for uniquely identifying her within the system.

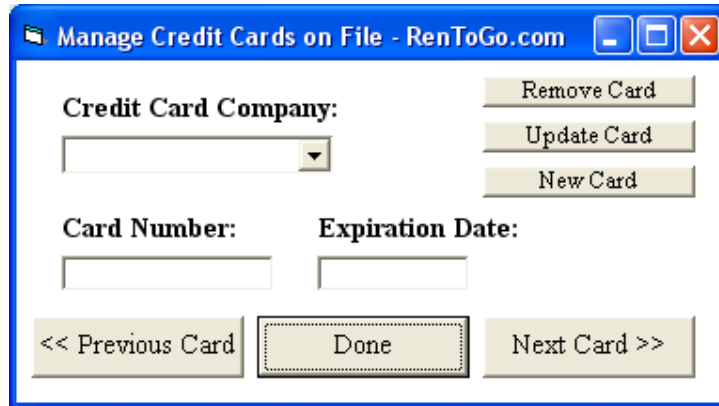


The screenshot shows a window titled "Manage Customer Profile - RenToGo.com". It displays the "E-mail:" field with the value "<customer-email>". Below this are two input fields for "FIRST Name:" and "LAST Name:". Underneath is a "Driver's License:" input field. At the bottom of the window are three buttons: "Manage Credit Cards on File", "Rental History", and "Done".

**Figure 12:** Manage Customer Profile screen.

If the customer clicks the “Done” button, the system first commits the changes to her name and driver’s license (if any) and then shows the Customer Main Menu screen.

If the customer clicks on “Manage Credit Cards on File”, the system pops up the screen depicted in Figure 13. From this screen, she can browse through all her credit cards on file and update or delete any of them. If she clicks the “Update” button, the system updates the credit card with the new information and remains on the same screen. If the customer clicks the “Delete” button, the respective credit card is removed from the database, and the next filed credit card (if any) is displayed. Finally, if the customer clicks on the “New” button, the system clears all the fields in the screen so she can enter the information for the new credit card. The new credit card will be stored in the database when the customer clicks the “Update” button. If the customer clicks on the “Done” button, the system shows the Manage Customer Profile screen again.



**Figure 13:** Manage Credit Cards on File screen.

If the customer clicks on “View Rental History” button on Manage Customer Profile screen, the system pops up the screen shown in Figure 14, which shows the customer rental history in the last month. The status of a rental is one of the following:

- *Pending*: the customer has completed the reservation but hasn’t picked up the car yet.
- *In-process*: the customer is using the car.
- *Completed*: the customer has returned the car.



**Figure 14:** View Rental History screen.

Observe that a customer may have rented a car from RenToGo.com more than once in the last month. The View Rental History screen should display *all* rentals (note the scroll bar on the right of the rental history in Figure 14).

When the customer clicks the “Done” button in screen of Figure 14, the system shows the Manage Customer Profile again.

## 8. The Clerk on Duty

Up to this point, we have described how the customer makes a rental reservation and manage her profile stored in RenToGo.com. In this section, we describe how RenToGo.com handles the car pickup and drop-off processes. We refer to the clerk on duty as the person (user) responsible to taking care of these processes.

### 8.1 Pick-up Rental

When the customer arrives at the location for picking up the rental, the clerk on duty, who from now on we refer as the *clerk*, logs in to the system by selecting “Clerk on Duty” in the Welcome screen and providing his login and password information in the Login screen shown in Figure 15. Upon successful login, the system pops up the Clerk on Duty Main Menu screen depicted in Figure 16.



Figure 15: Clerk on Duty screen.

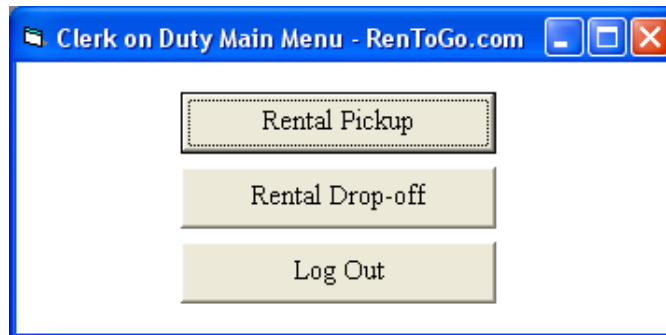


Figure 16: Clerk on Duty Main Menu screen.

The rental pickup process consists of two main steps:

**Step 1:** Get customer e-mail address and rental number (Figure 17).

**Step 2:** Get customer credit card information to be used for this rental (Figure 18).

Step 1 is straightforward. In Step 2, the clerk asks for the customer to provide the credit card number to be used with this rental. If the credit card has been filed before, then the system pops up the file rental contract shown in Figure 19. Before handing the contract to the customer, the clerk asks the customer for her driver's license to do a final check. If everything looks ok, the customer signs the contract, and the clerk gives her the car keys and directions to where the car is parked in the parking lot.

If in Step 2 the system indicates that the credit card number does not exist in the customer profile, the clerk asks the customer if she wants to provide another credit card number, or if she would like to file this new number in her profile. In case she decides to file the new number, the clerk enters the respective credit information through a screen similar to the one shown in Figure 9.



Rental Pickup - RenToGo.com

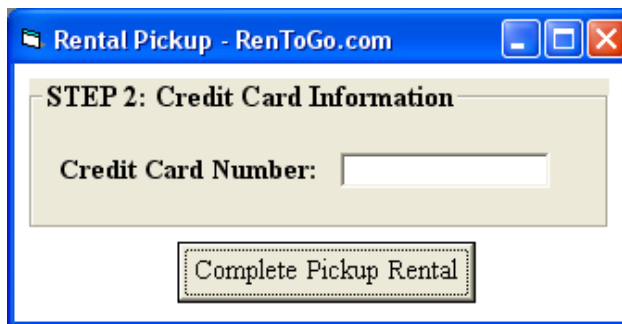
**STEP 1: Customer Information**

Customer E-mail:

Rental #:

Continue >>

Figure 17: Step 1 for rental pickup.



Rental Pickup - RenToGo.com

**STEP 2: Credit Card Information**

Credit Card Number:

Complete Pickup Rental

Figure 18: Step 2 for rental pickup.

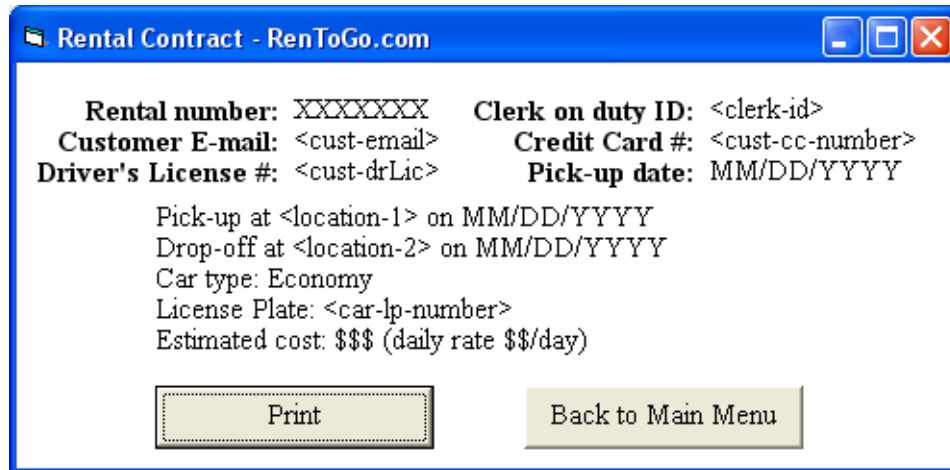


Figure 19: Rental Pickup Contract.

## 8.2 Drop-off Rental

When the customer arrives at a location for dropping of the car, the clerk clicks on the “Rental Drop-off” button in Clerk on Duty Main Menu screen and follows two simple steps:

**Step 1:** Get customer e-mail address and rental number (similar to screen in Figure 17)

**Step 2:** Print the final receipt for the rental (Figure 20)

Before printing out the final receipt, the system needs to check whether the following penalty fees should be applied:

- **Late fee:** The customer returns the car on a later day.
- **One-way rental fee:** The customer returns the car at a different location.

Late fee is calculated by multiplying the number of late days by \$2.50. One-way rental fee is \$10.00. The system determines whether the drop-off is late by comparing the information on the rental contract and the system current date.

After calculating the final rental cost, the customer credit card is charged and the clerk gives the customer the final receipt (Figure 20).

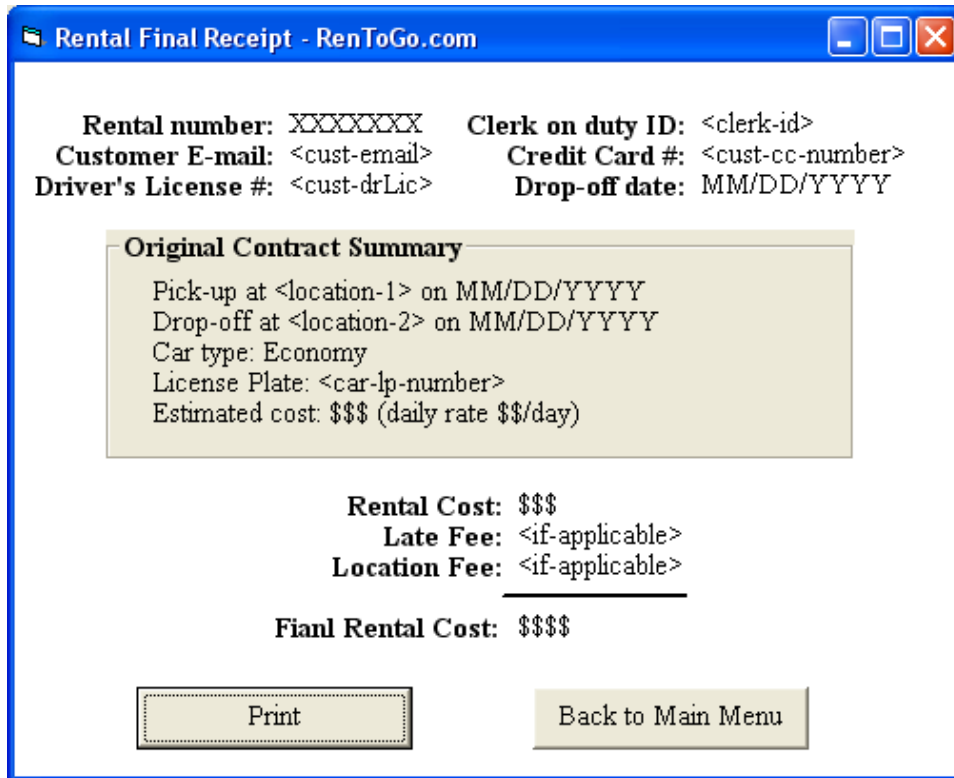


Figure 20: Rental Final Receipt.

When the clerk finishes the pickup and/or drop-off process, he logs out by clicking on the “Logout” button in the Clerk on Duty Main Menu screen (Figure 16).

## 9. The System Administrator

The third type of RenToGo.com user is the system administrator, who is responsible for operating the online car rental system. The screen on Figure 21 lists all the administrator tasks. The administrator enters the system by selecting “System Administrator” in the Welcome screen and providing his login information. Login information for the administrator is determined by the DBA.

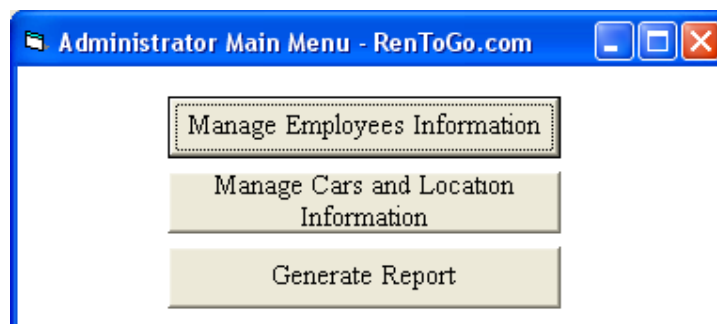


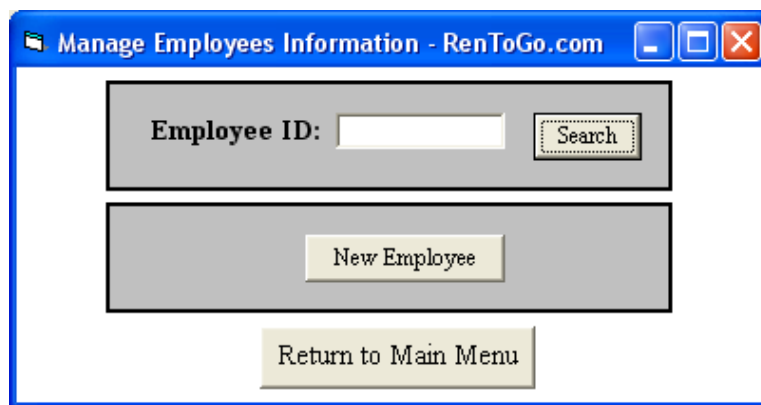
Figure 21: Administrator Main Menu screen.

## 9.1 Manage Employees Information

When the administrator clicks on “Manage Employees Information” button shown in Figure 21, the system pops up the screen in Figure 22. Using this screen, the administrator can either enter the ID of an existing employee or request for creating a new one. If the administrator enters the employee ID and clicks the “Search” button, the system will first check whether there exists an employee with the provided ID. If there is, then the system displays the associated information as shown in the screen of Figure 23. If there is no employee with the provided ID, the system displays a message indicating that the ID is invalid and pops up again the screen in Figure 22.

If the administrator wants to insert a new employee into the system, he clicks on the “New Employee” button. The system then automatically generates the ID for the new employee and displays the screen in Figure 22 with the blank fields. Once the administrator has entered the information of the new employee, he clicks the “Update” button to store the data in the system database.

We cannot delete information of an employee from the database because we associate this information with each pick-up and drop-off rental (see Figure 19 and Figure 20, respectively). If the system deletes an employee, the database will become inconsistent.



The screenshot shows a window titled "Manage Employees Information - RenToGo.com". It contains a search form with an "Employee ID:" label, a text input field, and a "Search" button. Below this is a "New Employee" button, and at the bottom is a "Return to Main Menu" button.

**Figure 22:** First step for the managing employee data.



The screenshot shows the same window as Figure 22, but now displaying employee details. The "Employee ID:" field contains the placeholder text "<empID>". Below it are three input fields: "FIRST Name:", "LAST Name:", and "Location:" (which is a dropdown menu). To the right of these fields are two buttons: "Update Employee" and "Cancel".

**Figure 23:** Second step for managing employee data.

## 9.2 Manage Cars and Location Information

When RenToGo.com acquires new cars or expand its business for servicing new locations, then administrator needs to update the system accordingly. When the administrator clicks on “Manage

Cars and Location Information” button shown in the Administrator Main Menu screen, the system pops up the screen shown in Figure 24. Through this screen, the administrator can also insert new car types and add or update the daily rates of each car type. Observe that any of the information inserted and/or manipulated in this screen cannot be removed from the database for the same reason that we cannot delete employee data.

The screenshot shows a web application window titled "Manage Cars and Location Info - RenToGo.com". The window contains the following elements:

- Location:** A text input field, a dropdown menu, and an "Add" button.
- Car Type:** A text input field, a dropdown menu, and an "Add" button.
- Car:** A "Type" dropdown menu, a "License Plate" text input field, and an "Add" button.
- Daily Rate:** A "Car Type" dropdown menu, a "Rate" text input field, an "Add" button, and an "Update" button.
- Done:** A button at the bottom center of the window.

**Figure 24:** Manage Cars and Location Information screen.

### 9.3 Generate Reports

Finally, when the administrator wants to check on how the company is doing, he can request the system to generate one of the following reports:

- For the last month, the average number of cars that were picked and returned to the same location, grouped by location and car type.
- For the last month, the average number of cars that were picked in one location and returned in another, grouped by car type. Also, indicate the location that the car was picked and the location that it was returned.
- For the last month, the average number of cars that were dropped off late, grouped by car type and location that received the car.
- Number of new registered users in each location in the last month
- For each location, which car type was the most rented and which car type was the least rented in the previous month

- Total sales for each car type, in each location in the previous month

## 10. General Comments

- For this project, we assume that all data for RenToGo.com including availability of cars and rental transactions at the five cities is stored in a central database at Atlanta.