

# **Object Oriented Programming Final Project**

Lecturer: Jude Joseph Lamug Martinez MCS

Class L2AC

Student ID: 2702255981 Student Name: Rafael Anderson

#### Introduction

### 1. Background

In today's world, almost everything is involved with digital systems. From ordering foods in a restaurant to booking travel accommodations, digital systems have become very involved, aiming to enhance user experience, making processes more efficient and user-friendly. The usage of digital systems is crucial to help businesses remain competitive and meet customer's expectations.

Car rental businesses in particular, can benefit by implementing these digital systems. Usually, customers are required to meet employees face to face, do paperworks, check if the cars are available, which may lead to an inefficient process with errors.

#### 2. Solution

The solution to solve these inefficiencies and error prone processes is to implement a digital system. I came up with a digital system, allowing both employees and customers to use it. Where users are able to sign in or login, making it easier for them to access the program if they have logged in.

This digital system will be extremely useful for the businesses, benefiting both the business and the customers, making all the processes significantly faster than before. For this project, this program will be a car rental management system for a car rental shop called FleetFlex.

#### **Libraries Used**

### 1. Java Swing

Java Swing is used to create the graphical user interface for the program. It provides a user-friendly design, allowing users to navigate through the program easily.

#### 2. Java Util

Java Util is used to store all of the necessary data needed for the program to function. Where arraylist is used to store cars, employees, and customers. While the hash tables are used to store a key value pair of user, employee and user, customer.

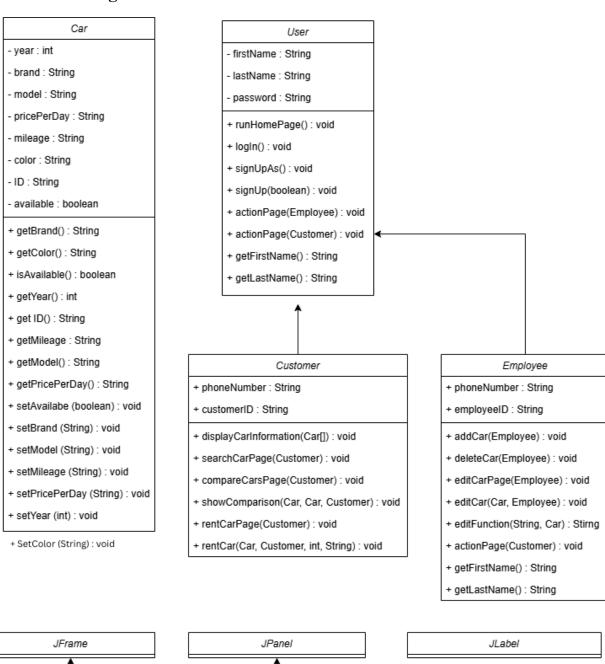
In addition to that, java util random is also used to generate a random integer, that is used in the generation of the car ID.

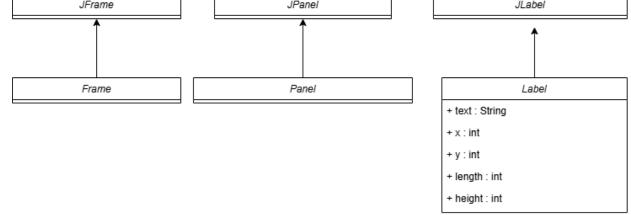
#### 3. Java awt

In this program, java awt is used mainly in designs. For example, it is used to create a color for the background, set a new font, etc.

### **Solution Design**

### 1. UML Diagram





### **Algorithms**

1. **Field Validation:** It checks whether all of the fields are filled in pages that require the users to enter data into the text fields. It is also used to check if the data entered in the password and confirm password fields are equivalent or not.

```
// List of all text fields
final JTextField[] textFields = {firstNameTextField, lastNameTextField, phoneNumberTextField, passwordField,
boolean reminder = false; // To make sure a maximum of 1 reminder is shown per iteration

// Goes through all the text field and make sure they are not empty. If it is, will show a reminder
for (JTextField field : textFields) {
    if (field.getText().isEmpty() && !reminder) {
        JOptionPane.showMessageDialog( parentComponent: null, message: "Please fill in all of the fields");
        reminder = true;
    }
}
```

It goes through all of the text fields stored in an array, and checks if they are empty or not. If they are, it will check whether the reminder is false, so it only gives the error message once per iteration.

```
// Get the strings from the password field
String passwords = new String(passwordField.getPassword());
String confirmPasswordString = new String(confirmPasswordField.getPassword());

// Compares the password and the password confirmed strings to see if they are the same
if (!passwords.equals(confirmPasswordString) && !reminder){
    JOptionPane.showMessageDialog( parentComponent: null, message: "Please confirm that the Passwords are equivalent");
    reminder = true;
}
```

For the signup page, it checks whether the string filled in the password field and the confirm password field whether they are equivalent or not and if the reminder is false, so it will give an error message if all the fields are filled. If they aren't, the system will produce an error message.

2. **User Authentication:** The user authentication checks whether the user is valid or not. For example, when the user has successfully signed up and wants to log in, it checks if the account is already registered or not. It checks by comparing the first name, last name, and the password entered.

```
Employee employee1 = new Employee(firstNameString, lastNameString, phoneNumberString, passwordString);
User user = new User(firstNameString, lastNameString, passwordString);
Main.employeeList.add(employee1); // Add to the employee list
Main.employeeHashtable.put(user, employee1); // Add to the employee hashtable used in login process
```

```
Customer customer = new Customer(firstNameString, lastNameString, phoneNumberString, passwordString); // Creates new Customer User user = new User(firstNameString, lastNameString, passwordString); // User Main.customerList.add(customer); // Add to the customer list Main.customerHashtable.put(user, customer); // Add to the customer hashtable
```

When a user signs up as an employee or customer, a user object is created along with the employee or customer objects. A hash table is used to store the user object as the key and the customer or employee object as the value.

```
// Goes through the users of customers

for (User users : Main.customerHashtable.keySet()) {

    // Checks if the user is equals to any of the registered user

    if (user.firstName.equals(users.firstName) && user.lastName.equals(users.lastName) && user.password.equals(users.password)) {

        userFound = true;
        Customer customer = Main.customerHashtable.get(users); // Get the customer value from the user key
        actionPage(customer); // Goes to the customer action page
        frame.dispose();
   }
}
```

It goes through the user key in the hash tables, it compares the user properties between the user object created from the data entered in the textfields of the login page. If they are equal, it will redirect the user to the action page either as a customer or employee. But if the user is not found, the system will display an error message.

3. **Adding Car:** Employees are prompted to enter the necessary information regarding a car like brand, model, etc. After all of the necessary information is obtained, the car will be added to the arraylist containing the list of cars.

```
// Get attributes
String brand = carBrandTextField.getText().substring(0,1).toUpperCase() + carBrandTextField.getText().substring( beginIndex: 1).toLower
String model = carModelTextField.getText().substring(0,1).toUpperCase() + carModelTextField.getText().substring( beginIndex: 1).toLower
String colour = colorTextField.getText().substring(0,1).toUpperCase() + colorTextField.getText().substring( beginIndex: 1).toLowerCase
int yearValue = Integer.parseInt(yearTextField.getText());
double pricePerDay = Double.parseDouble(priceTextField.getText());
double mileageValue = Double.parseDouble(mileageTextField.getText());

// Create new car and add it to the car list
Car car = new Car(randomID, brand, model, colour, yearValue, pricePerDay, mileageValue, available: true);
Main.carList.add(car);

// Show a message stating that the car is added successfully
JOptionPane.showMessageDialog( parentComponent: null, message: "Car " + brand + " " + model + " has been successfully added!");
```

Based on the necessary textfields the user needs to enter regarding the car, the system will retrieve all of the data entered in each text field once the add button is clicked, and create a new car object using the data, then adding it to the list of cars. This is done by using an action listener on the button.

4. **Delete Car:** Employees are given a combo box, where they choose a car of their choice. If the employee clicks the delete button, the system will go through the arraylist containing the list of cars to find the targeted car and delete it.

```
// Creation of combo box
String[] carIDs = new String[Main.carList.size()];
int i = 0;
for (Car C : Main.carList){
     carIDs[i] = C.getID() + "/" + C.getBrand() + " " + C.getModel();
     i ++;
}

// Combo box
JComboBox carChoice = new JComboBox(carIDs);
carChoice.setBounds( x: 190, y: 160, width: 150, height: 30);
```

For the deletion of cars, the system utilizes a combo box that allows the user to choose a car of their choice to delete.

```
// Get selected car
String carName = String.valueOf(carChoice.getSelectedItem());

// Goes through the car list to see if it exists
for (Car C : Main.carList){

// If yes, will ask for confirmation
if ((C.getID() + "/" + C.getBrand() + " " + C.getModel()).equalsIgnoreCase(carName)) {
    int confirm = JOptionPane.showConfirmDialog( parentComponent: null, message: "Confirm Delete Car " + C.getBrand()

// If user confirms, will remove the car and displays a message
if (confirm == 0){
    Main.carList.remove(C);
    JOptionPane.showMessageDialog( parentComponent: null, message: "Car " + C.getBrand() + " " + C.getModel() + "
    deleteCar(employee);
    frame.dispose();

// Otherwise, will cancel the removal
} else JOptionPane.showMessageDialog( parentComponent: null, message: "Removal Canceled");
}
```

By using an action listener on the button, the system will get the selected item once the delete button is clicked. Then, it goes through the list of cars and compares them one by one to find the car of choice. Once found, the system will ask the user for confirmation first. If the user confirms, the car object will be removed from the list of cars, and a message will be displayed.

5. **Edit Car:** Employees need to choose a car first from the combo box. Then they need to choose a feature that they want to edit. After choosing a feature, they are prompted to enter an input that will change that specific feature of the car to the input the user entered.

```
// Brand Button

JButton brandButton = new JButton( text: "Brand");
brandButton.setBounds( x: 30, y: 150, width: 90, height: 50);

brandButton.addActionListener(e->{
    String brand = editFunction( feature: "Brand", car);
    if (brand != null) car.setBrand(brand);
});
```

In the edit page, there are all buttons representing the car feature. An example is the brand button, if clicked, it will run the editFunction with a parameter "Brand", along with the car. The edit function will return a string that the user changed to, but if it is null, it means that there were no changes made.

```
// Get the feature string
String carFeature = switch (feature) {
   case "Brand" -> car.getBrand();
   case "Model" -> car.getModel();
   case "Year" -> String.valueOf(car.getYear());
   case "Price" -> car.getPricePerDay().substring( beginIndex: 1);
   case "Mileage" -> car.getMileage().substring(0, car.getMileage().length() - 3);
   case "Color" -> car.getColor();
   default -> null;
};
```

Based on the feature entered, the carFeature will represent that particular feature of the car.

There is a special case if the user wants to change the status feature of the car, where they are required to enter Available or unavailable, or it will raise an error otherwise. But for other features, the system will get the string entered by the user and will ask for confirmation. If the user confirms (showConfirmDialog = 0), changes will be made.

6. **Show Cars:** Customers are able to show all of the cars the car rental shop offers, along with the complete information of the car. The algorithm takes in a list of cars that will be shown, and will display the information of cars present in the list.

```
public static void displayCarInformation(Car[] cars){

UIManager.put("OptionPane.messageFont", new Font( name: "Monospaced", Font.BOLD, Size 15)); // Make all letters occupy equal sp

// String builder is used as the information will be displayed using JOptionPane
StringBuilder print = new StringBuilder("\nCar ID: Car Brand: Car Model: Color: Year: Mileage:

for (Car C : cars){

String available;
  if (C.isAvailable()) available = "Available"; // So it will not display true or false
  else available = "Unavailable";

print.append("\n");

// List of features
String[] lengths = new String[]{C.getID(), C.getBrand(), C.getModel(), C.getColor(), String.valueOf(C.getYear()), String.valueOf(C.getYear()),
```

The system shows the information of all the cars available by executing the displayCarInformation and putting the list of all cars present in the system. The method utilizes a string builder in which the car information is appended, separated with a conditional number of spaces depending on the length of the string, making the printing format structured. It uses a string builder because the result will be printed using JOptionPane.

The UIManages is used to make all of the elements / alphabets take the same amount of space, allowing structured printing.

7. **Search Cars:** Customers are able to search cars, by first choosing a feature they want to search by. After choosing a feature, they are prompted to enter a string that they want to search in that specific feature. After clicking the search button, all of the cars within the criteria will be displayed

```
boolean present = false;
String carBrand = JOptionPane.showInputDialog("Enter a Car Brand:"); // Takes in brand input
ArrayList<Car> targetCars = new ArrayList<>();

// Compares the brand of cars with the input, if it's the same, add car to the targetCars list and set present to true.
for (Car C : Main.carList) {
    if (C.getBrand().equalsIgnoreCase(carBrand)) {
        targetCars.add(C);
        present = true;
    }
}

// Display carInformation of the target cars
if (present) displayCarInformation(targetCars.toArray(new Car[0]));

// If none is found, display error message
else JOptionPane.showMessageDialog( parentComponent: null, message: "There are no Cars with the brand " + carBrand);
```

For example, the user chooses to search cars by brand. The system will take an input from the user, and go through the list of cars to find cars fitting the criteria set by the user. Cars that fit the criteria will be added to the targetCar list, which will be used as a parameter in the displayCarInformation method.

8. **Compare Cars:** Customers are able to compare one car with another. By choosing both cars on a combo box, a comparison table will be displayed using JTable, presenting the data of both cars side by side.

```
compareButton.addActionListener(e -> {
    Car carNo1 = null;
    Car carNo2 = null;

// Get selected cars
    String carName1 = String.valueOf(carChoice1.getSelectedItem());
    String carName2 = String.valueOf(carChoice2.getSelectedItem());

// Displays an error message if cars are equivalent
    if (carName1.equalsIgnoreCase(carName2)) JOptionPane.showMessageDialog( parentComponent null, message: "Please Choose Diffelse {
        // Get the cars
        for (Car C : Main.carList){
            if ((C.getID() + "/" + C.getBrand() + " " + C.getModel()).equalsIgnoreCase(carName1)) carNo1 = C;
            if ((C.getID() + "/" + C.getBrand() + " " + C.getModel()).equalsIgnoreCase(carName2)) carNo2 = C;
        }

        // Show the comparison
        showComparison(carNo1, carNo2, customer);
        frame.dispose();
    }
}
```

The compare car feature utilizes 2 combo boxes. When the compare button is clicked, it finds the 2 cars selected and compares them if they are equal or not. If yes, an error message will be displayed asking the user to choose 2 different cars. Otherwise, the showComparison method is executed, with the cars and the customer object as the parameters.

Based on the information of the 2 cars obtained, a JTable is initialized containing the information of both cars, setting the row height, size, and the coordinates. Where the table will be added to the frame later.

9. **Rent Cars:** Lastly, customers are able to rent cars, by choosing a car from the combo box. And entering the date and the amount of rental days. The system will check whether the car is available or not, if it's unavailable, the process will be canceled. The system will ask the customer for confirmation, if the user confirms, the car will be rented and the availability will be set to false.

```
for (Car C : Main.carList){

// Car information, with space separating to make it structured

Label carID = new Label(C.getID(), x: 100, y, length: 850, height: 100, fontSize: 15, center: false);

Label carInformation = new Label( text: C.getBrand() + " " + C.getModel(), x: 250, y, length: 500, height: 100, fontSize: 15, center

JButton button = new JButton( text: "Rent"); button.setBounds( x: 420, y: y + 38, width: 80, height: 25); // Add a rent button fo

button.addActionListener( e-> {

// If the car is currently unavailable, will display an error message

if (!C.isAvailable()) JOptionPane.showMessageDialog( parentComponent: null, message: "The car " + C.getBrand() + " " + C.getBrand() + C.get
```

It goes through the list of cars, and prints the car information, along with a rent button. If the user clicks on it, it checks whether the car is available or not. If not, it will display an error message.

If the car selected is available, the system will prompt the user to enter the number of days they would like to rent. It will continue to loop until the number of days is valid.

```
white (!validDate) {
    date = JOptionPane.showInputDialog("Enter the date of rent (dd/mm/yyyy)");

String[] dates = date.split(regex: "/");

if (dates.length == 3) { // Ensure that the format is correct

    // Ensure dates are valid
    if (Integer.parseInt(dates[2]) != 2024 || Integer.parseInt(dates[1]) > 12 || Integer.parseInt(dates[0]) >
        JOptionPane.showMessageDialog( parentComponent: null, message: "Please enter a valid date");
    } else {
        validDate = true;
    }

    // Error message
    } else JOptionPane.showMessageDialog( parentComponent: null, message: "Please enter a valid date");
}
rentCar(C, customer, days, date); // If there are no more errors, car will be rented
```

After a valid number of days is entered, the user is prompted to enter a date for the rental. The system makes sure that the date entered is in the correct form which is dd/mm/yyyy. The string entered is split by "/" which is put into an array, and is checked whether it has 3 values. It also checks whether the date entered is valid or not. After validating, the system runs the rentCar method, putting necessary information as the parameter.

```
cancel.addActionListener( e-> {
    User.actionPage(oustomer);
    frame.dispose();
});

// Confirm button
JButton confirm = new JButton( text: "Confirm");
confirm.setBounds( x: 235,  y: 330,  width: 90,  height: 30);

// Will display that the process was successful, and make the car.available to false
confirm.addActionListener( e-> {
    car.setAvailable(false);
    JOptionPane.showMessageDialog( parentComponent: null,  message: "Car Rented Successfully!");
    User.actionPage(customer);
    frame.dispose();
});
```

Lastly, it asks the user for confirmation. If the user confirms, the car's availability will be set to false and the system redirects the user back to the actionPage. Else,

the system will just redirect the user back to the action page without causing any changes.

#### **Solution Scheme**

### **Classes and Objects**

- 1. User: Contains the common attributes of the customer and employee classes. It has some methods that the customer and employee objects can perform.
- **2. Customer:** The customer class is a derived class from the user class with additional attributes such as customer ID and phone number. It contains all of the methods that customers are able to perform such as show, compare, search, and rent cars.
- **3. Employee:** The employee class is another derived class from the user class. Also having extra attributes such as employee ID and phone number. It contains all of the methods employees can perform such as add, delete, and edit cars.
- **4.** Car: The car class is a class to declare the cars stored in the system, containing attributes such as brand, model, ID, color, mileage, price, and availability. The class has basic setters and getters, allowing data to be displayed and edited.
- **5. Panel:** The panel class is extended from JPanel, which makes it easier to initialize JPanels. By having this class, it doesn't require repetitive code lines.

- 6. **Frame:** The panel class is extended from JFrame, which makes it easier to initialize JFrames. By having this class, it doesn't require repetitive code lines.
- **7. Label:** The panel class is extended from JLabel, which makes it easier to initialize JLabels. By having this class, it doesn't require repetitive code lines.

#### **Data Structures Used**

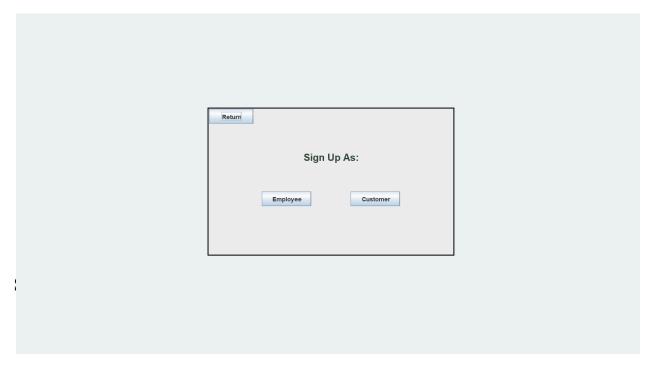
- 1. Arraylist: This program utilizes arraylists to store users, customers, employees, and cars. This allows users to go through the list and check if targeted objects are present or not.
- 2. Hash Tables: Hash tables are mainly for the login process of users, it stores the User object as the key, and Customer or Employee object as the value. When users initially sign in as an employee or customer, a new User object is created with the first name, last name, and password inserted as parameters. Thus, when users login and enter their information, it checks for equivalent user objects in the hashtable keys. If it's equivalent, it gets the value which is either customer or employee, and runs the action page with it as the parameter.

# **Evidence of working program**

# **Home Page:**

FleetFlex
FLEETFLEX
Welcome to FleetFlex, a modern car rental shop that provides various types of car. Our mission is to provide an unforgettable car rental experience, bringing joy towards our customers.
Join Us! Sign Up Log in
Mail: Fleetflex@yahoo.co.id

# Sign Up As:

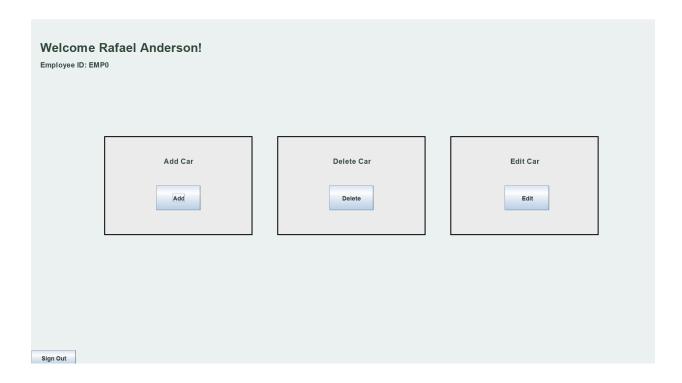




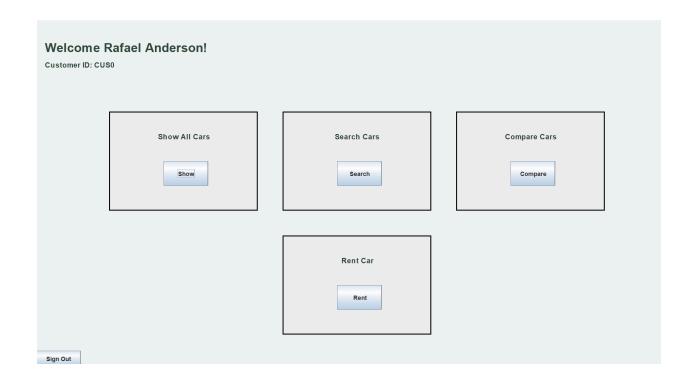
## **Login (After Signing Up)**



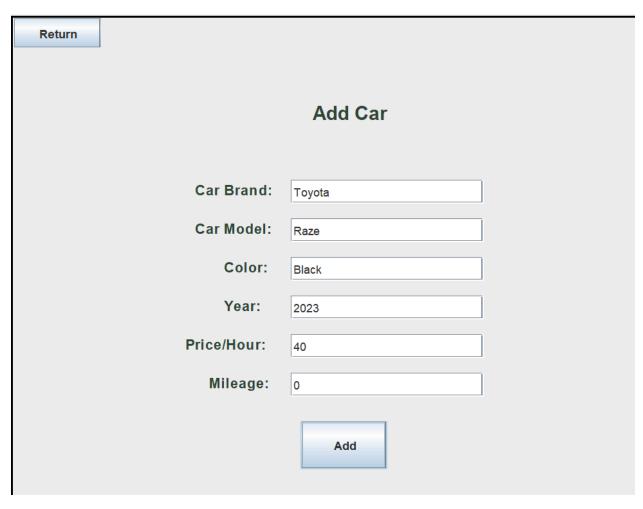
# **Employee HomePage**

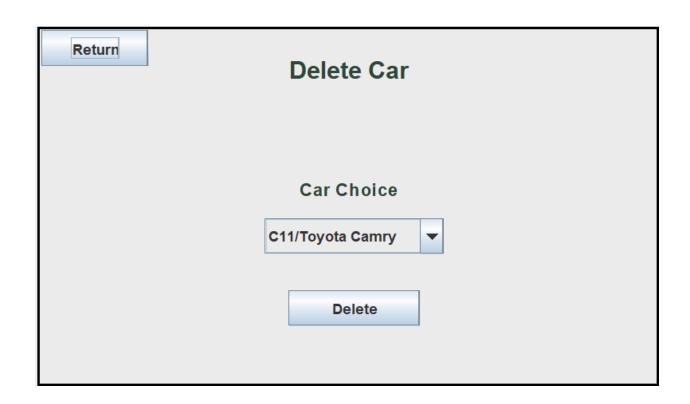


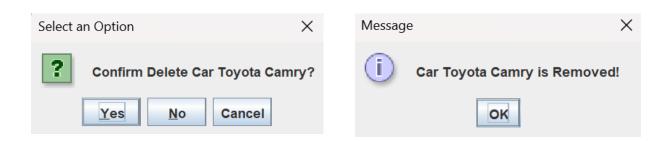
# **Customer HomePage**



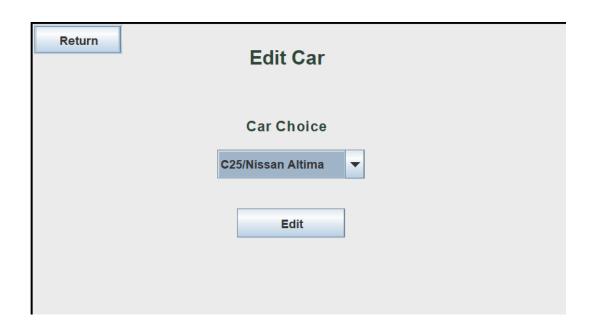
### Add Car

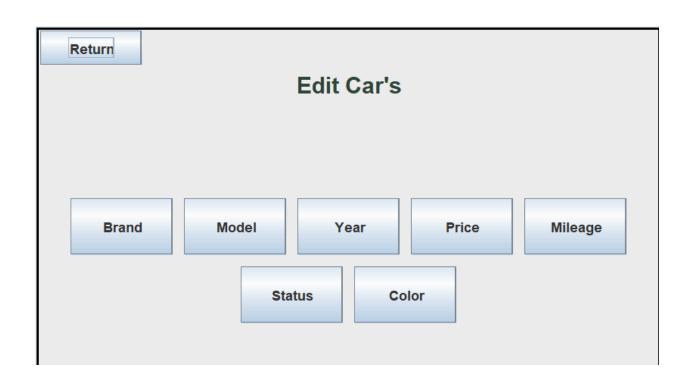


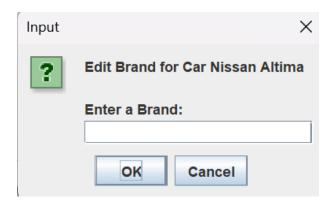


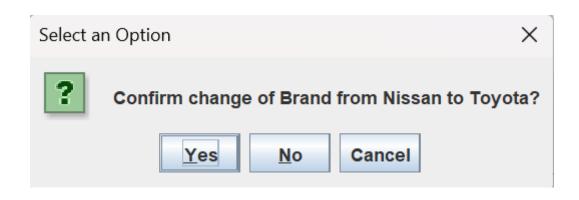


**Edit Car** 

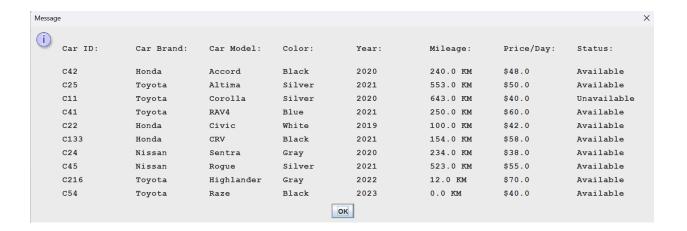






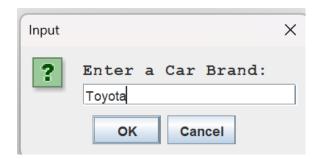


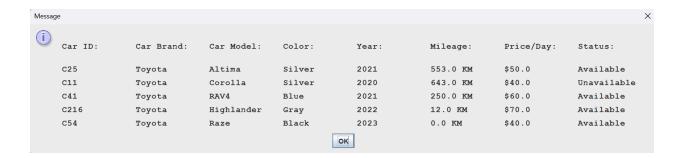
#### **Show Cars**



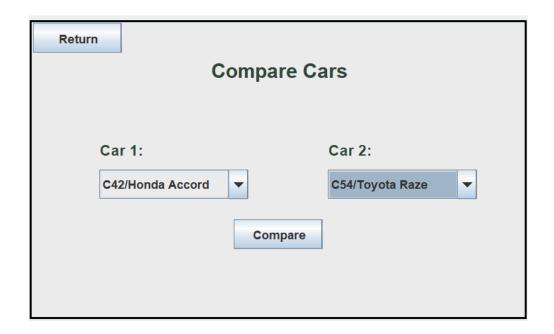
### **Search Car**







### **Compare Cars**



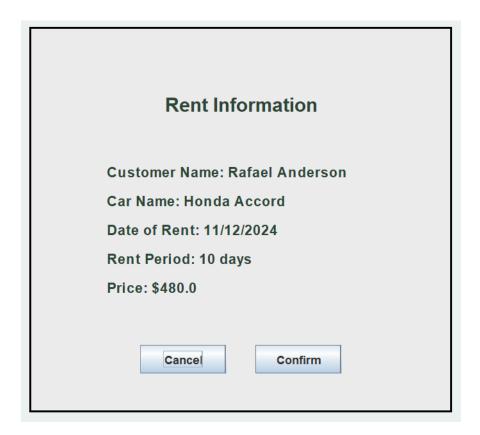
Car ID	C42	C54	
Car Brand	Honda	Toyota	
Car Model	Accord	Raze	
Color	Black	Black	
Year	2020	2023	
Price Per Day	\$48.0	\$40.0	
Mileage	240.0 KM	0.0 KM	

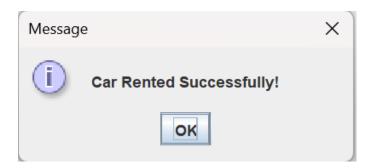
## Rent Car

Return			
	Car ID:	Car Name:	
	C42	Honda Accord	Rent
	C25	Toyota Altima	Rent
	C11	Toyota Corolla	Rent
	C41	Toyota RAV4	Rent
	C22	Honda Civic	Rent
	C133	Honda CRV	Rent
	C24	Nissan Sentra	Rent
	C45	Nissan Rogue	Rent
	C216	Toyota Highlander	Rent
	C62	Toyota Raze	Rent









### **Resources:**

Github Link: <u>Rafael23082/OOP-FP: Object Oriented Programming Final Project (github.com)</u>