• Users must be able to register to the system by providing their credentials and payment information. They receive back a password that can be used to access the system.

Register request

Password response

Information verification

Create an account

Password generation

Database update

Driving license

Credit card

Register action

Network communication

G1: For every user who sends a well-formed register request, the PEJ system should generate a login password automatically and send it back to the user via the contact information provided by the user.

Domain Assumption:

1. All users use their own driving license and credit card for registration; there is no misappropriation of documents. The owner of these two documents must be the same.
2. The information provided by the user is correctly typed without any spelling mistake.
3. The system generates and sends the password through an encryption algorithm, which is safe and secure.
4. The network communication between users and the system is in a good condition; hence all data are accurate delivery.

Scenario1:

Alice has just download a application of PEJ system on her smart phone, and as a new user, she is briefly notified by the system about the car sharing rules. Before starting using the system, Alice is asked to register to the system. Alice clicks the button “Register Now”, and receives a register form. She inputs carefully the request information, including her driving license ID and credit card number. For the contact information, Alice chooses to insert mobile phone number between two options: mobile phone number and email address. After finishing all the typing work, Alice checks her inputs again trying to find an error. After checking, she clicks the “Confirm” button. The page jumps to a login page. About 3 seconds later, Alice receives a message from the system containing a password.

• Registered users must be able to find the locations of available cars within a certain distance from their current location or from a specified address.

Location info

Available vehicle

User login

GPS positioning

Address specified

Database query

Vehicle distance sorting

G2: Once registered users position their current location or input a specified address, the PEJ system should send back a list of available vehicles sorted by distance.

Domain Assumption:

1. GPS positioning system is running well, providing accurate location information.
2. The location information provided by the user is complete and identifiable by the system.

Scenario2.1:

Bob opens the PEJ application on his smart phone and clicks on the “Login” button. There appears a login page. Bob inputs his driving license ID as well as the password sent by the system, and then he clicks on the “Confirm” button to access the system. After entering the system successfully, Bob tries to find the available cars around him by clicking the “Positioning” button on the main page. The system gives back a map, which contains Bob’s current location marked as a red flag, as well as several green points to denote the available cars nearby. Under the map there is also a list, which shows the available cars sorted by distance.

Scenario2.2:

John is now on a train to the central railway station, he wants to reserve a car via PEJ system and drive it to the airport. He clicks the “Insert an address” button on the main page, and inputs the complete name of the station, which is Milan central railway station. After confirming his input, Bob receives a page with two parts, a map showing the specific address and available cars around, and a list of available cars sorting by the distance to the specific address.

• Among the available cars in a certain geographical region, users must be able to reserve a single car for up to one hour before they pick it up.

Database query

Reservation record checking

Database update

Car reserving request

Car state response

Locking countdown

Car selecting

Picking up a car

G3: Once the user select to reserve a car among the available vehicle list, the system will check the reservation record of this account, and send back the basic information as well as the locking countdown of the single reserved car.

Domain assumption:

1. The vehicle is equipped with a GPS positioning system and is connected to the network.
2. All the users are able to make a reasonable option among the available vehicle according to their current position.

Scenario 3:

After requesting for the available cars, Bob chooses one of the green points on the map, which seems to be the nearest car in the direction he prefers. Bob views a brief description of the basic information for that car, and then clicks on the “Reserve” button. After that he is notified with a 1-hour countdown for his reservation.

• If a car is not picked up within one hour from the reservation, the system tags the car as available again, and the reservation expires; the user pays a fee of 1 EUR.

User coming late

Credit card

Car state changing

Database update

Reservation expires

Fee payment

G4: Once a reservation is out of time, the system should change the state of the car into available, and charge a fee of 1 EUR from the credit card registered by that account.

Domain assumption:

1. All valid credit cards can be charged a fee.

Scenario4:

John has reserved a car an hour ago, however he cannot pick up the car before the timeout because of the traffic jam. John is notified by the system that the reservation has terminated and he is charged a fee of 1 EUR.

c) If a car is left at special parking areas where they can be recharged and the user takes care of plugging the car into the power grid, the system applies a discount of 30% on the last ride.

Car positioning

Charge state detection

Discount applying

Location info matching

Parking the car

Plugging into power grid

Credit card payment

G5: After the user parked and left the car, the system should detect the car position info and charging state. If the parking location matches a special parking area preset in the system and the car is in a charging state, the system will apply a discount of 30% on the last ride.

Domain Assumption:

1. The company has defined a set of special parking areas.
2. Special parking areas are equipped with charging equipment and can plug into the power grid.
3. There exists a charge state detector on each car.

Scenario5:

Bob is driving the car, and he observes a power station close to his destination. Bob notices that the car battery is 50% empty; he decides to park the car in that station. After parking, Bob plugs the car into the power grid before he leaves. Bob is notified by the system that he gets a discount of 30% on the last ride.

d) If a car is left at more than 3 KM from the nearest power grid station or with more than 80% of the battery empty, the system charges 30% more on the last ride to compensate for the cost required to recharge the car onsite.

Search for nearest power station

Parking location verification

Car positioning

Battery state detection

Compensation applying

Parking the car

Credit card

G6: After the user parked and left the car, the system should detect the car position info and battery state. If the parking location is 3KM far away from the nearest power station or the battery state is more than 80% empty, the system will apply a compensation of 30% on the last ride.

Domain Assumption:

1. The company has defined a set of power stations.
2. There exists a battery state detector on each car.

Scenario6:

Alice had just finished a long ride, and she noticed that the car battery is 85% empty. Alice could not find a power station nearby, thus she parked the car in a safe area and left. Alice is notified by the system that she is charged a compensation of 30% on the last ride.