RASD

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Contents

1 Introduction

1.1 Description of the given problem

The system we are going to develop is a car–sharing service called *PowerEnJoy*, based on mobile application and which has a website. The system allows users to locate and reserve a car to drive in their geographical region using mobile application. Geographical region is identified using GPS on user's smartphone, he can also insert it manually. User can drive a car only inside one chosen geographical region. People in the system are not considered as registered until they fill an online form on the website or on the main page of the mobile application and until their driving license are not checked by the system as valid ones.

The main purpose of the system is to be efficient, reliable and easy to use to fulfill the will of users and the customer.

1.2 Actual system

There is nothing created until now, and we suppose that we have to create the entire application, depending only on the problem given by the customer.

1.3 Scope

1.4 Actors

- Guest: all guests can only see the login page of the application or of the website, where they can complete the registration form to be able to login from mobile application as registered users.
- Registered User: after logging in to the system users can "use" (change this word) the application, where they can see map with available cars, reserve one and get notifications from the system and also can see their profile and make some changes in it.

1.5 Goals

- **G1** Guest are able to register to the System. Each guest must fill a profile to become a user.
- **G2** To complete the procedure of registration the system sends password to the guest as an access key.
- **G3** The system enables the registered user to find the locations of an available car within a certain distance from user's location or from specified address.
- **G4** The system enables user to reserve a single available car in a certain geographical region for one hour before the user picks it up.

- **G5** If the reserved car is not picked up within one hour from the reservation time, the reservation expires and the system tag this car as available. The system charges user a fee of 1 EUR.
- **G6** User tells the system that he's near the reserved car. The system unlocks the car to let the user enter.
- **G1** The system charges the user for a predefined amount of money per minute.
- **G2** The system starts charging the user as soon as the car ignites.
- **G3** The system stops charging the user when the car is parked in a safe area and the user exits the car. The user must confirm the operation, otherwise the system keeps charging them.
- **G4** A screen on the car notifies the user of the current charges.
- **G5** The system locks the car automatically when the user exits the car.
- **G6** The system allows the user to open the car through a bluetooth system when the user has reserved it.
- **G8** If the user has chosen to keep being charged, the system allows them to exit and close and re-open the car through a bluetooth system.
- **G9** If the user has chosen to stop being charged, the system keeps a 10–minutes window of time when they are allowed to re-open the car if it has not already been reserved by someone else.
- **G10** The set of safe parking areas is pre–defined by the management system.
- **G11** The system allows the user to earn a 10% discount for the current ride if there are at least two other passengers in the car.
- **G1** The system applies a 20% discount on the current ride if the car is returned by the user with more than 50% of power charge.
- **G2** If a user returns a car to a recharging safe area and plugs it into the power grid, the system applies a 30% discount on his current ride.
- **G3** The system applies a 30% sanction on the current ride if the car is returned in a safe area at more than 3 km from the nearest recharging safe area.
- **G4** The system applies a 30% sanction on the current ride if the car is returned with less than 20% of power charge.

- **G5** The system provides an option (*money saving*) to get information about the best safe area where the user can leave the car. The best safe area ensures a uniform distribution of cars among the city and takes into account the destination and the nature of the safe areas (recharging or not).
- **G6** In *money saving option*, the system applies a certain discount for the current ride if the car is returned in the suggested safe area.
- **G6** Cars returned with less then 20% of power charge are recharged within 1 day.

1.6 Domain properties

We assume that the following properties hold in the analyzed world:

- A tablet is permanently installed in every car.
- The tablet is alimented through the car and cannot be switched off.
- All cars are equipped and located with a GPS system provided by the tablet.
- All GPS systems always give the right position.
- GPS tracking is always on.
- All cars has sensors to detect the presence of passengers in each seat.
- The system is always able to tell how many people occupy a car.
- All cars are equipped with a Bluetooth system provided by the tablet.
- The Bluetooth system is always on.
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- A user can always provide his location, either by GPS or by giving their position themselves.
- The safe areas are predefined and within the municipality of Milan.
- The payments of all services are managed by an external company, which guarantees fulfillment.
- The cars always ignite when they have more than 3% of power charge.
- The cars cannot be reserved by more than one user at any given time.

1.7 Glossary

User We will refer to all people who are registered to the system as 'users'. All users have personal profiles which contain the following information:

- First name;
- Family name;
- Email;
- Username;
- Password;
- Payment information; this in particular includes:
  - Credit card number;
  - Credit card expiration date;
  - CVV number.
- Driving license information; this in particular includes:
  - License number;
  - Issued date;
  - Expiration date;
  - Status.

And, optionally:

- Personal photo;
- Telephone number.

Users should be able to locate, reserve and drive the cars offered by the service.

Guest We shall call 'guests' all people who are using the interface of the system without being registered or logged in. Guests can't access any functionality of *PowerEnJoy* except for the registration process or the log in.

Parking areas Also called *Safe areas*, parking areas are predefined parking slots within the municipality that are reserved for the car–sharing system *PowerEnJoy*.

Special parking areas , or *recharging areas* are *Parking areas* that provides a plug to recharge the car. Recharging parking areas are a subset of Parking areas (parking areas *may* be recharging areas, while the contrary doesn't apply).

Reserved car We will call 'reserved car' a specific car that is booked by current user,not taken by other users, and is located in the same geographical region as him.

Available car is the car that is not reserved by other users.

Power grid

Standard price We shall call 'standard price' the price per minute charged to the user, without any discount or sanction applied.

Discount A discount is a deduction of a given percentage from the standard price. It is applied every time a user has a virtuous behavior.

Sanction A sanction is an increase of a given percentage to the standard price. It is applied every time a user has a wasteful or incorrect behavior.

Money saving option An option offered to the users by the system. The user inputs their final destination and the system indicates them the best close station where to leave the car.

1.8 Assumptions

The assignment document was unclear and ambiguous on some points of the specifications. Hence, we will make the following assumptions:

- Parking areas and special parking areas are two different things; however, common sense suggests that it isn't logical to charge users if they plug the car to the power grid in a recharging area but are not parked in a safe area. Neither it makes sense to sanction them if they park it in a safe area that is 3 km far from the power grid. Having the two areas separate would lead to the consequences above, so we decided that while a safe area may not be a recharging area, recharging areas are always safe areas. Furthermore, assuming that a city has many safe areas, so that users can enjoy the service all around the city, it is reasonable to think that just a few of them have been equipped with a power grid connection, for economic and infrastructural reasons.
- The system is completely autonomous and can manage emergencies (such as the car breaking down, or street accidents) without the need of an administrator.
- User is able to reserve an available car only from his geographical region.
- There is a "manual" way to close and open the car, i.e. that the user is allowed to temporarily park the car – while still being charged –, get out, close the car, and then get back and open it again. This means that the system can be used not only for one-way travels, but also when more stops or a round trip is needed.
- Parking areas and special parking areas are allotted and private parking spaces owned by *PowerEnJoy* and distributed throughout the urban area.

1.9 Constrains

1.10 Proposed system

1.11 Identifying Stakeholders

Main stakeholders are the inhabitants of Milan willing to use an ecologic and comfortable mean of transport, without the need to buy and maintain a personal car. The system can be adopted in any other city, so the inhabitants of other cities too can become stakeholders. In Milan, the project is promoted and participated my the city council as minor investor.

1.12 Reference documents

2 Actors Identifying

The system involves as main external actors:

User The final target of the system. Once registered, they can reserve a car and use it in respect of the agreements established with *PowerEnJoy*. They are charged for the usage of the car. It is expected

Guest A potential user not registered in the system yet.

The following actors have also been identified inside *PowerEnJoy* as needed by the system:

Admin Back-office administrators, they have access to a control panel.

Operator Maintenance operators who provide field-based assistance and ensures cars are always ready to be used.

Car The car provided to users. It interacts with the system to be develop to provide information about usage and status and to receive commands.

The system has moreover to interact with the following external service provider:

Payment service Provider of every service related to users payment management.

3 Requirements

4 Scenario identifying

4.1 Scenario 1: Registration

Anakin has just moved to Milan and has rented a flat; however, he couldn't afford a place close to the city centre, where he works; he also doesn't have a car, so he's been going back and forth with public transport. Because of that, he needs to wake up half an hour earlier and usually gets home very late, and he's getting tired. He then decides to look for a solution on Google, and he finds the car–sharing service of *PowerEnJoy*, which has a parking place close to his home. The *PowerEnJoy* web page has all the information readily available, pricing, features and an approximated map of the parking areas included, so Anakin decides to sign up. He completes a form, where he writes his complete name, personal information, personal email and payment information; the system accepts his registration, so he can access the private area of the system.

4.2 Scenario 2: Login in the app

Padmé has registered on the *PowerEnJoy* website and now has downloaded the app on her smarphone. Opening the app, she finds a screen asking her to log in. The username Padmé registered with is *Naboo_princess*, and the password she received in her email is *7aKmm93s*, so she fills the login form with this information. The first time she tries, she writes the password wrong, so the login is rejected and the app asks her to try again. The second time she gets the password right, so the system accepts the login and shows the main page of the app.

4.3 Scenario 3: Reserving and using a car

Luke must reach his aunt and uncle for the usual sunday roast. He doesn't have a car, and usually he just takes the subway. However today the public transport workers are on strike, and the metro is out of order. Luke is a distracted kid, always with his head in the clouds, so he forgot about the strike and has walked for the fifteen minutes needed to reach the metro. He is nevertheless smart and resourceful, and so he remembers that he's signed in the *PowerEnJoy* system. He opens the app and presses the "find car" button. He has the GPS activated, so the system locates him and tells him that there's a parking area with an available car next to the metro station. The app gives him the choice of reserving the car or cancel the operation, and Luke reserves the car.

4.4 Scenario 4: Parking and regular fees

Leia needs to get to the american consulate ASAP. She's a frequent user of the car–sharing service, so she already knows all the safe areas where she can park around the diplomatic block in the city centre, since she often needs to go there. While she drives, the smart display in her car tells her how much the system

is currently charging: the fee per minute is 0,50 EUR, and she's been driving for half an hour, so her fee currently is 15 EUR. She reaches the diplomatic area after two more minutes, and she knows that the parking area is around the corner from the consulate, so she reaches there. This particular safe area is not a recharging area, and Leia left the car with a 60% battery, so the system charges her 16 EUR. The display notifies her that she's parked in a safe area and that no sanction applies to her fee. The system also asks her if she wants to keep the car reserved and keep being charged, and she declines. She exits the car and the system locks it automatically.

4.5 Scenario 5: Power grid and discounted fees

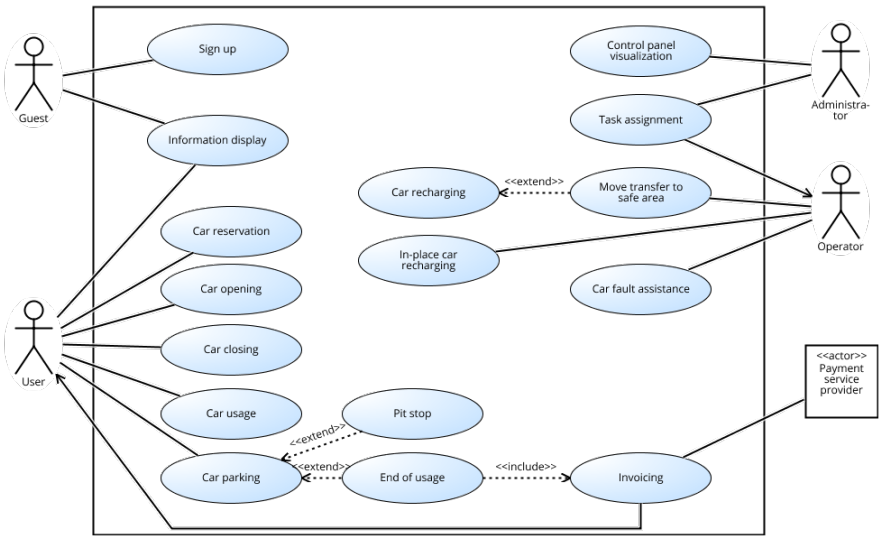
4.6 Scenario 5: Parking and sanctioned fees

Han, Leia's husband, is also a regular user of the system. He's however less abiding to rules and is a bit of a free spirit, so he generally never gains any discount and is often sanctioned for wasteful behaviour. For example, last monday he needed to reach his bank in Porta Genova for a meeting with his broker. He was very late, so he parked right outside the bank, outside any safe area. It took him twenty minutes to get there, so the system had charged him 10 EUR. As soon as he stops the car, the display notifies him that

5 UML models

5.1 Use case diagram

A global picture of the system interaction with actors is provided here by means of use case diagrams. Following, an analysis of the most interesting use case situations derived from scenarios is presented.



5.1.1 Use case 1: Reserve a car

Name Reserve a car

Actors

User The user who wants to reserve a car.

Entry condition The user decides to reserve a car to take in the next hour.

Flow of events

1. The user logs in into the mobile app and goes to the reservation section.
2. The system automatically retrieves and displays the location of the user, but they can specify a different location if needed.
3. The system displays the position of the available cars close to the selected location.
4. The user selects a car and confirm the reservation.

Exit condition The system reserves the car for the user.

Exceptions

- **The system is not able to locate the user automatically.** The user is required to insert a position manually.
- **The system is not able to find a position inserted manually.** The user is informed and the operation is aborted.
- **There are no available cars.** The user is informed and the operation is aborted.
- **The user cancels the operation before confirming.** The reservation process is not completed and the car remains available to other users.

Special Requirements None.

5.1.2 Use case 2: Park in known safe area

Name Park in known safe area

Actors

User The user of the car.

Car The car in use.

Entry condition The user is driving and has reached their destination. They know a safe area close to the destination.

Flow of events

1. The safe area is free and the user parks in it.
2. As the car is turned off, the system detects it is in a safe area.
3. The system asks the user if he wants to keep the car or to end the ride.
4. The user selects to end the ride.
5. The user exits the car.
6. The system closes the car.
7. The system charges the user for the ride.

Exit condition The user leaves the car and the car becomes available to other users.

Exceptions

- **The safe area is taken.** The user can't end their ride and this operation is aborted.
- **The car is badly parked.** ???
- **The user selects to keep the car when prompted.** The user keeps being charged and the car is not made available for other users.

Special Requirements None.

5.1.3 Use case 3: Park with money saving option

Name Park with money saving option

Actors

User The user of the car.

Car The car in use.

Entry condition The user selects the *money saving option* at some point of their ride and insert their destination.

Flow of events

1. The system indicates the user the suggested safe area for their destination.
2. The user parks in the suggested safe area.
3. As the car is turned off, the system detects it is in a safe area.
4. The system asks the user if he wants to keep the car or to end the ride.
5. The user selects to end the ride.
6. The user exits the car.
7. The system closes the car.
8. The system charges the user for the ride. A discount is applied for using the *money saving option*.

Exit condition The user leaves the car and the car becomes available to other users.

Exceptions

- **The suggested safe area becomes taken while the user is driving.** The system selects another safe area and notifies the user of the new suggestion.
- **The user parks in another safe area.** The system notifies the user that they will not receive a discount. If the user decides to end the ride anyway, the system charges them without applying the *money saving option* discount.
- **The destination of the user changes.** The user selects a new destination and the system indicates another suggestion.
- **The user disables the *money saving option* while driving.** The suggested safe area stops being displayed and the ride continues as normal.

Special Requirements The *money saving option* must be selected before stopping the car in a parking area.

5.1.4 Use case 4: Park in a recharging area

Name Park in a recharging area

Actors

User The user of the car.

Car The car in use.

Entry condition The user is about to park in a recharging area.

Flow of events

1. The user parks the car in the recharging area.
2. As the car is turned off, the system detects it is in a safe area.
3. The system asks the user if he wants to keep the car or to end the ride.
4. The user selects to end the ride.
5. The user exits the car.
6. The system closes the car.
7. The system charges the user for the ride.
8. The user plugs the car into the power grid through the supply point installed in the parking space.
9. The system detects the car is recharging.
10. The system modifies the charge applied to the user for the ride. A 30% discount is applied to promote virtuous behaviors.

Exit condition The user leaves the car and the car becomes available to other users.

Exceptions

- **The user does not plug the car into the power grid.** The user is charged as if they parked in a safe area.

Special Requirements The user plugs in the car within 5 minutes from the moment they exits the car. Otherwise the discount is not applied.

6 Alloy modeling

7 Appendix

List of Figures

List of Tables

7.1 Used tools

For this assignment, we used the following tools:

Alloy

LaTeX The group used LaTeX to structure the final document and to help with versioning.

Github We leaned on Github for versioning and coordinating synchronized work.

Toggl We used toggl to keep track of work hours.

Slack

7.2 Hours of work