Description of the problem

PowerEnjoy is a car sharing service that exclusively employs electric cars. The company is in need of a system that allows users to find the locations of available cars located in the geographical areas they choose to explore. Then, they may complete the reservation of a car among those found with the research tool. After that, if the user who made the reservation launches the car doors unlock command and the system detects he is nearby, then the car doors are actually unlocked. During the ride, the driver is notified of the current bill in real-time through the screen. At the of the ride expenses are automatically charged on the driver’s count. Since all the vehicles are electric, it is fundamental to keep them properly charged, so the users will be incentivized in being virtuous through discounts and penalty fees. A saving option will be provided in order to help users make the right choices both to save money and to help the PowerEnjoy maintain its high quality service.

Goals

PowerEnjoy has to provide these main features:

* [G1] Let users drive a car when needed.
* [G2] When a user wants to use a car, nobody else can use that car at the same time.
* [G3] Let users find and reach car.
* [G4] Let drivers find and reach locations.
* [G5] Encourage the share of a single car.
* [G6] Most of the time cars have battery level such that they can be used.
* [G7] Cars are always well distributed on the territory.
* [G8] Make sure that most of the cars are ready to use and in a good condition.

Domain properties

We suppose that these properties hold in the analyzed world:

* [D1] Sign up personal information is true.
* [D2] Cars are always connected to PowerEnjoy VPN (Virtual Private Network).
* [D3] Cars’ GPS is never neither switched off nor damaged.
* [D4] Accurate cars’ locations are known by GPS.
* [D5] Users who have an open reservation are properly located by GPS through their mobile devices.
* [D6] Available cars are ready to serve.
* [D7] Payment issues are delegated to a third party company.
* [D8] All technical sensors report correct information and they are neither switched off nor damaged.
* [D9] Each power plug is linked to exactly one car at the same time.
* [D10] Power grid stations always work.
* [D11] Cars’ screens are never switched off nor damaged.

Glossary

In this paragraph, we go through some recurrent terms that deserve a complete definition to avoid misunderstandings along the discussion:

* **Budget**: maximum amount of money acquirable from the payment information.
* **Car**: the electric vehicles considered available by the stakeholders.
* **Company**: people who work to\*.
* **Driver**: user that has made the reservation, boarded and then drives the car.
* **Fee**: amount of money the user must pay whether he does not pick up the car within one hour from the reservation.
* **Guest**: we use this term when referring to an unlogged user.
* **Operator**: person who works for the company in order to give support to the drivers\*.
* **Passenger**: person who enter the car.
* **Payment information**:
  + Payment method name
  + Surname and name of the owner
  + Card number
  + Valid through date
  + CVV
* **Personal information**:
  + Surname and name
  + Nationality
  + Date of birth
  + City of birth
  + Personal id
  + Phone number
  + E-mail address
  + Username to log in
* **Power grid station**: the energy turrets where the users can leave cars to refill their batteries. These stations are located only in special parking areas.
* **Power plug**: it is about a power plug located in a power grid station.
* **Ready to serve car**: a car which has at least 10% of the battery charged and there is not any technical issue.
* **Reservation**: service concerning the possibility to exclusively reserve a car for a user.
* **Ride**: time between the car doors’ unlock due to the fact that the user is close to the car and the car doors’ lock due to the fact the user stops the engine and all the passengers exit the car.
* **Safe parking area**: a parking area included by the system in a list of “recommendable” places to leave cars at. Safe parking areas are the only places where a car can be left in order to have the system automatically stop charging expenses to the user for the car use.
* **Screen**: system terminal connected to the central one used in order to communicate to the driver.
* **Special parking area**: we use this expression to point out a subset of safe parking areas where a power grid station is present.
* **System**: infrastructure which realizes the goals.
* **Technical issue**: every kind of issues sensor detectable.
* **User**: person who provided personal and payment information which have been verified and recognized. User has access to the full set of services of the system.

Assumption

There are few points that are not very clear in the specification document, so we will have to assume some facts. We assume that:

* A guest can only register, surf the list of available cars on the map and consult the service’s rules.
* \*discount a\* can be applied if and only if the number of passengers is greater or equal to three, both at the beginning and at the end of the ride.
* Each special parking area is associated to one and only one power grid station.
* Insurance renewal is company’s administration competence.
* Road fines are affair between traffic corps and company’s legal department.
* The validity of the driving license number associated with the user’s profile will have to be verified by the driver licensing authority.
* The validity of the payment information associated with the user’s profile will have to be verified by the payment company.
* Once a request is made, the user may cancel it.
* Payments are charged at the end of each ride.
* Despite the possibility of encouraging users to behave well, periodically an operator will take care about cars’ repositioning.
* A driver cannot temporary park his car and exit from it [1].
* To enable power saving option, the driver has to enter to the screen his final destination.
* A discount regarding power grid stations is applied if and only if the car is in a special parking area and the car is actually charging.

[1] It is important to remark that a possible improvement to PowerEnjoy would provide this functionality. However it may be though as a future extension to the one with all the necessary functionalities.\*

Proposed system

The best solution to carry on the project is to develop a web platform, both in the form of a website and of a mobile application. The requisite of portability is fundamental, since one of the wanted features is the that cars should be found opened and ready to serve when they are near enough. A plugin for wearable devices could also serve to this functionality. \*what will we use to make it possible to use the system? / hardware and software of machines\*

Stakeholders

The one and only stakeholder for this project is represented by the professor who defined the assignment. The deadline for the submission of the complete document is the end of the current semester. The final submission should provide a clear and complete documentation for the development of the system, along with use cases analysis and tests.

The completeness of the document will be compromised by the need of focusing on the major features of the system. Nonetheless we’ll try to maintain a high level of consistency all along the dissertation and to develop as many aspects as possible.

Concerning the target of the application, we can think of the standard user as a stable user: the aim of the system should be to convince the customers to use it more than just once.

Other considerations about the system

Some considerations based on the last sentence in the previous paragraph can be made. If the aim of the system is to be used daily, a great effort must be spent on the user experience, in particular we require the following characteristics:

• Usability: since the set of functionalities usable by the user is quite limited it should not be difficult to make them so intuitive that no documentation will be necessary to fully understand them at a first glance

• Security: the manipulation of sensible data like payment methods requires a strong focus on security matters and the customers must be aware that they are placing their money in good hands

• Stability: it’s a major characteristic since the service must be available h24 7/7dd

• Look & feel: an essential design is necessary to catch the customers’ attention and bound them to the service

Actors identifying

The actors involved in our system are:

• Guest: a person who can access a limited number of the system’s features, e.g. the research tool. They can neither make reservations nor access to any features that require the possibility of online payments\*.

• User: a person who has registered and therefore has provided his personal and payment information.

• Driver: a user who has made a reservation for a car and now is driving it.

• Operator: a person who takes care of cars’ maintainability both for technical and legal issues.

Requirements

Thinking that the domain properties, written in paragraph 1.3, holds, from the goals, written in paragraph 1.2, we can derive our requirements. We write below, for each goal, what we can derive:

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1. **[G1] Let users drive a car when needed.**
   1. [R1] Sign up functionality.
   2. [R2] Verification of driving license and payment information.
   3. [R3] Log in functionality.
   4. [R4] Prevent car doors from unlocking unless the user is nearby.
   5. [R5] During the ride, the driver is notified of the current bill in real-time through the screen.
   6. [R6] Charge expenses on the user’s account after the end of the ride.
2. **[G2] When a user wants to use a car, nobody else can use that car at the same time.**
   1. [R1] Make reservations valid for a single car at the same time.
   2. [R2] The reservation expires by one hour and a fee is charged, then the car is again available.
   3. [R3] Cars in use are marked as unavailable.
   4. [R4] Lock car doors after each ride.
   5. [R5] Restore cars’ availability after each ride.
3. **[G3] Let users find and reach cars.**
   1. [R1] Find cars located nearby or specifying an address.
4. **[G4] Let drivers find and reach locations.**
   1. [R1] Guide each driver to a chosen location.
   2. [R2] If money saving option is enabled, then guide the driver to a special parking area where to leave the car to get a discount according to driver’s final destination.
5. **[G5] Encourage the share of a single car.**
   1. [R1] \*\*\*\*apply a discount on the last ride if there are at least three passengers\*\*\*\*.
6. **[G6] Most of the time cars have battery level such that they can be used.**
   1. [R1] Show the battery level during the ride.
   2. [R2] Show special parking areas.
   3. [R3] Apply a discount on the last ride if more than a certain percentage of battery.
   4. [R4] Apply a discount if the driver plugs the car to a power grid station before ending a ride.
   5. [R5] Periodically, if the system detects a low battery level, a notification will be sent to operators who will intervene.
   6. [R6] Charge a fee when a driver leaves a car with more than a certain percentage of the battery empty.
   7. [R7] \*\*money saving option\*\*.
7. **[G7] Cars are always well distributed on the territory.**
   1. [R1] Charge a fee when a driver leaves a car at more than a certain distance from the nearest special parking area.
   2. [R2] Periodically, if the system detects a non-uniform cars’ distribution, a notification will be sent to operators who will intervene.
   3. [R3] Show safe parking areas.
   4. [R4] \*\*money saving option\*\*.
8. **[G8] Make sure that most of the cars are ready to use and in a good condition.**
   1. [R1] When an issue is detected, a notification will be sent to operators who will intervene.
   2. [R2] Notify whether an issue has been discovered by the driver.

Functional requirements

* Guest:
  + Sign up
  + Consult safe parking areas
  + Consult special parking areas
* User:
  + Log in
  + Make a reservation
  + Find a car
* Driver:
  + Search for a destination
  + Enable money saving option
  + Consult battery level
  + Notify an issue
* Operator:
  + Consult list of notification
  + Take charge of solving an issue
  + Wrap up the issue procedure
* Sensor agent:
  + Notify a technical issue
* System:
  + Send driving license information to the driver licensing authority
  + Send payment information to the payment company
  + Unlock car doors
  + Lock car doors

Scenario identifying

**Scenario 1**

Sebastian always reach his office by bus but today is scheduled a strike. So, the day before he discovers PowerEnJoy and he signs up. The day of the strike, he uses PowerEnJoy’s app to make a reservation. He finds a car around and reaches it. Once near to the reserved car, the system unlocks car doors and then Sebastian enter it. The system