PARTE 1 - INTRODUCTION

Description of the given problem
According to the assignment document the problem consists in the definition and implementation of a system that manages the activity of an electric car sharing. The activity itself doesn't need to be explained because car sharing is a largely spread out costume.
More in depth, the system have to allow people to join a community of car sharers by registering into the system and after this, they can share cars with neighbors and friends in order to save money together and reduce pollution made by public means of transport and private cars.

Goals
In this section of the document, we are presenting the main goals that the software-to-develop must fulfill in order to satisfy the requirements:
- Users must have the possibility to register to the system to become part of the community. They must provide their credentials (such as first name, last name email address and so on) and a valid method of payment that can be an IBAN code or a credit card code. After the online registration, users will receive a confirmation email that includes a password for the access to the system and a link that will conclude the registration task and will show the user his personal area from where he/she can decide to do stuff.
- The user can select the parking lot from a subset of them where to pick the car. The user's position or the input of an address will be the base on which the system will show a subset of parking lots: the system will choose the parking lots with at least one available car in a range of 100 meters from the given position.
- The user will be able to reserve a car for up to one hour from the pickup, from the list of the available ones in the selected parking lot. Then the system will lock automatically the selected car to everyone until the reservation time, with except to the user that will use his mobile device to identify himself and let the system know that he's picking up the car.
- The system must control that every reserved car will be picked in the time range: if this condition is not satisfied, it will assign an extra fee of 1€ to the owner of the unpicked car and then it will set the car as available in order to allow other people to pick that car.
- The system must charge the user by a certain amount of Euros per minute. The time outside the predefined areas will contribute to calculate the final amount for the user to pay and a built-in-car screen will show this information to the user/driver. This amount can be decreased or increased by:
  - The number of passengers of the car (a sensor will count the passengers in order to apply a 10% discount on the final amount);
  - The battery charge remaining (if the battery has more than 50% of the charge, the system must apply a 20% discount);
  - If the car is parked in a charging station and the user plugs the car BEFORE he/she registers the exit, a 30% discount will be applied;
  - If the car has less than 20% of the battery charge or the user leaves it in a parking area further that 3 Km from a charging station, a 30% extra free will be applied;
- The system must provide the user the possibility to select the money saving mode: with this option activated, the user has to input the final destination and the system will tell the user the best charging station where to leave the car in order to receive a discount. The system chooses the right charging station based on the position of the other cars and on the availability of power plugs to provide a balanced number of vehicles on each zone of the city.
- To close the bill, the user must park the car in one of the predefined parking areas, exit the car and lock it with his credentials. This action will notify the system that the user has left the car in a secure area and he/she terminated the trip. Then the system will detract the correct amount of money from user's payment method. The car will then set as available again.

Domain properties
Since the world is the base of the software, we assumed it in this way:

- Users reserve always the cars at most one hour before they pick it up;
- Users have all a smartphone from where they can use the mobile application or the web version of the service and their smartphones have GPS;
- Users have always internet connection from their devices in order to tell to the system that he/she is nearby;
- GPS give always precise information about car position;
- GPS cannot be faked or modified by anyone;
- All cars have GPS and the system can track them;
- All cars are the same and they consume the same amount of battery charge;
- If a car has a failure, it can't be used until it is repaired.
- When in maintenance, a car is unavailable;
- Cars have a screen only to show battery charge, the system will show all information (such as user charge, nearest charging station, user charge and so on).
- Cars have different sensors such as charging sensor and battery level sensor;
- To check if there is more than 1 passenger in the car, car seats have a sensor that observes a passenger's weight: if it gets a value greater that 40 Kg, the system will evaluate it as a passenger.
- There are 2 different kinds of parking: "safe areas" and "special parking areas";
- Special parking areas have sensors that measure the number of in-use plugs;
- The only compatible chargers for the cars are in the special parking areas.

Glossary
- Agreed zone: general name that identifies both the safe area and the special parking area (explained later).
- Charging spot: is a parking slot provided with an electrical plug used to charge the car battery.
- Charging station: synonym for special parking area.
- Credentials: these are the personal information of a user. They include first name, last name, email address, password, IBAN (explained later) or credit card number and geographical position.
- GPS (Global Positioning System): is a positioning system based on triangulation with satellites in order to give the exact position of a device in the world.
- IBAN (International Bank Account Number): is a unique string that locates a bank account.
- Parking lot: synonym for safe area.
- Safe area: is a parking agreed by the car sharing company where users should park rented cars. There are a certain number in the city and they are equally distributed in the territory.
- Special parking area: is a parking with charging spots agreed by the car sharing company where users should park rented cars. Users can park cars here and they can charge them.

Assumptions
- The only actor is the User: we decided to assume that all the system management and bureaucracy part (intended as fine payment, car maintenance, car retrieve and stuff like this) will be handled by a third party, so it concerns another system that will not be developed.
- There is a limited number of cars, stations and plugs so, if a user selects the money saving options and there are no available plugs, he/she will not receive a discount.
- The discounts can be accumulated and the system applies them stacking the values e.g. if the user brings 2 passengers and uses less than 50% of the battery, the final amount will be decrease first by 10% and the result will be reduced by 20% and so on.
- When the user uses the service from mobile application or web browser, he/she has to share his/her location.
- Users can park the car outside the two kinds of parks.
- If a user wants only to park the car, he has to select the "park" option on the screen and than he can take the car again within 1 hour if it is parked in an agreed parking or within a day if it is parked outside of the predefined zones. Otherwise he can define a time range where he can retrieve the car without extra fees.
- When a user wants to rent a car, the system will show only the full charged ones;

- The employees can use their credentials to unlock only locked cars that are outside of parking lots and charging stations.
- Users behave unpredictably so they can park in parking areas that are not owned by the car sharing company and leave cars outside parking spots, with the battery fully discharged (in this case the employee has the task to bring back the car in the special parking area);
- When a user parks the car in a charging station but he/she doesn't plug the car in, an employee will plug in the car and the system won't apply the discount to the final amount due to the user; he must check also that the car is operative and has no damage. If it has failures the employee has to evaluate the damages and the previous user will be sanctioned.

Constrains

The system can run on a mobile device (such as smartphones and tablets via the mobile app) and a PC: the mobile device should have GPS, internet connection and some storage space where to install the application. When users access the service from a PC, they have to share their position through the web in order to allow the system to show up the nearest parking.

Other important constraints to the system are the DBMS, that will store all user data, such as their credentials, payment method and email address, and the access to a SMTP server that allows the system to send email to the users

Proposed System

We think that the best solution for the implementation is to build the software for a web platform and a mobile application in order to allow everyone to use the service anywhere and anytime.

This implementation will allow users to benefit of the service everywhere in order to allow maximum accessibility in any condition.

On the maintenance aspect, the website will be more advanced on new feature releases that the mobile application: in this case every new feature will be available first on the web platform as a preview of the mobile update to come.

Identifying Stakeholders

In case this software has to be released, the stakeholders could be a car sharing company that needs a software system to manage the activity of the enterprise, but in this particular case, where the software has to be developed to demonstrate the ability to find requirements, test and other things, the stakeholders are the professors.

Our main goal is to demonstrate that we are capable of a work like this and that we can organize ourselves to perceive the same objective, even if we cannot encounter in real life due to different personal obligations.

Talking about the final user of this kind of system, we think that the most probable is the common citizen that lives in a city with a lot of traffic that doesn't want to use public means of transport for delays and other discomforts. Our solution could resolve a lot of people's problems.

PARTE 2 - ACTORS IDENTIFYING

Actors identifying
- The only actor that will use our system is the User. It is the representation of the common citizen that uses the service for moving/traveling purpose. It will use the system by registering an account, renting cars, notifying the system that it is nearby the car, locking and unlocking the car, checking out and eventually call assistance;

PARTE 3 - REQUIREMENTS

Functional requirements
[...]

Non-functional requirements
[...]

PARTE 4 - SCENARIO IDENTIFYING
[...]

PARTE 5 - UML MODELS

Use case diagrams

Name: Insert registration credential
Actors: Unregistered User
Entry conditions:
-    The user selects to register himself into the system from the main page
Flow of events:
-    The user inserts his credentials in the featured form.
     His credentials include:
     First Name
     •   Last Name
     •   Date of birth
     •   Username
     •   E-Mail
     •   Driving license info
     •   Payment method
-    The user clicks the registration button
-    The user is successfully registered
-    The system sends a welcome mail to the user that contains his password
Exit conditions:
-    The user is redirected to the login page.
Exceptions:
-    Some of the information the user provided are incorrect. The user is not redirected but is notified
     of the error fields.

Name: Insert payment method
Actors: Unregistered user
Entry conditions: No entry conditions
Flow of events:
-    The user chooses the payment between the available options and completes the related fields:
-    If he chooses IBAN, he inserts the IBAN code
-    If he chooses credit card, he fills up the following fields:
     •   Credit card number
     •   CVV
     •   Holder name
     •   Expiration date
Exit conditions:
-    The system displays a notification of the correctness of the information provided and enables the
     registration button.
Exceptions:
-    The system displays an error notification associated to the incorrect fields and disables the
     registration button.

Name: Insert login credentials
Actors: User
Entry conditions:
- The user is registered and has received the password
Flow of events:
- The user opens the app for the first time
- The user inserts his credentials
  His credentials include:
    - Username or e-mail
    - Password
Exit conditions:
- the user is redirected to the research page of the app where he can now book a car.
Exceptions:
- Some of the information the user provided are incorrect. The user is not redirected but is notified of the error fields.

Name: See own account information
Actors: User
Entry conditions:
- The user is successfully logged
Flow of events:
- The user clicks on the account button of the app
- The user sees his information and eventually edits them
Exit conditions:
- The user successfully goes on another page.
Exceptions: there are no exceptions

Name: Find available car
Actors: User
Entry conditions:
- the user is successfully logged
Flow of events:
- The user goes into the research section
- The system shows the available cars near his current position
- If the user inserts a different position or place, then the system displays the available cars near that position
Exit conditions:
- The user changes page
- The user selects an available car from the system displayed options
- The user presses "book" button
- The user presses "map" button
Exceptions:
- The GPS is not activated: The system doesn't display any car but an option link that redirect the user to the device settings in order to activate the GPS
- The user inserts an unrecognized position or place. The system displays a message that no available cars are found.

Name: Book car
Actors: User
Entry conditions:
- The user selects an option from the research page
Flow of events:
- The user sees the information related to the car
- The user can eventually activate the money saving option
- The user clicks on the book button
- The system checks the availability of the payment method
- The system checks for previous not yet payed trips.
Exit conditions:
- The system notifies the user of the successful booking, starts 1-hour countdown visible on the app as picking up threshold, redirects the user to the "car" page where he can see the vehicle information.
Exceptions:
- The user inserts incorrect information. The system notifies the user about the incorrect fields.
- There's a pending payment related to a previous trip not payed yet. The system redirects the user into the payment details section.

Name: Unlock car
Actors: User
Entry conditions:
- The user has booked the car less than an hour ago
- The user has parked the car and less than the pit stop time limit of the car has passed
Flow of events:
- The user accesses to the system
- The user goes on "car" page
- The system checks the user position by GPS and enables the unlock button if the user is near the car.
- The user clicks on the unlock button
Exit conditions:
- The user can now use the car.
Exceptions:
- the GPS is not working. The system notifies the user and redirects him to the device settings in order to activate it.
- The internet connection is not available. The system notifies the user to activate the Bluetooth and to put the device near the car in order to unlock it.
- The user cannot unlock the car using his device. The user could ask for support to the authorized personnel.

Name: Pay for a car
Actors: User
Entry conditions: The user has to pay the last ride but an error occurs during the automatic checkout
Flow of events:
- The user goes into the payment section
- The user clicks on "Pay" button
- The system checks that the method of payment is correct
- The system detracts the amount of money of the last ride
Exit conditions: the system notifies the user of correctness of the transaction
Exceptions:
- The check of the method of payment fails: the system notifies the user about it and redirect him to the account settings
- The system cannot detract the amount of requested: it notifies this to the user suggesting to control the residual

Name: contact assistance during trip
Actors: User
Entry conditions:
- The user is using the car
Flow of events:
- The user selects the assistance from the display in the car
- The system notifies the personnel of the call
Exit conditions:
- The user is contacted by the personnel immediately
Exceptions:
- The internet connection or the telephone network does not reach the car.
- The personnel will contact the user as soon as an internet or telephone connection will be available.

Name: Activate money saving option
Actors: User
Entry conditions:
- The user has booked a car
Flow of events:
- The user access to the system
- The user selects the money saving option from the "car" page
- The system shows a form where the user chooses the final destination
- The system provides information about the nearest station to the final destination where to leave the car to get a discount
Exit conditions:
- Deactivate the money saving option
- Drive to the station indicated by the system.
- The user makes a pit stop in an unsafe area and passes the time limit
Exceptions:
- The internet connection is not available.
- The system shows a connection error and allows the user to retry.
- The user inserts an unrecognized position or place. The system shows a "not found" error asking the user to check if the destination in correct.
- The user parked in the right place but doesn't receive a discount. The user could contact the personnel for more information.