**Requirements Analysis and Specifications Document**

Figure 1: Politecnico di Milano

**1.Introduction**

**1.1Identifies the product :**

car-sharing is a model of car rental where people rent cars for short periods of time, often by the hour. They are attractive to customers who make only occasional use of a vehicle.

•Car-sharing is defined by its environmental and social purpose, more than business and financial objectives.

•Car-sharing system is designed for local user who is environmentalist. It aims at decreasing personal car ownership, reducing vehicle distance travelled, providing affordable access to vehicles, as well as motivating residents to walk, cycle and take buses and trains, and decreasing dependence on fossil fuels while reducing the emission of greenhouse gases.

Car-sharing is primarily designed for shorter time and shorter distance trips as an extension of the transportation network, providing a public service designed to enhance mobility options. it help members save money over the cost of individual car ownership by encouraging members to drive less often, plan trips more, use other modes of transportation more, and share fuel efficient vehicles when a car is needed.

The main purpose of this system is that to provides environmental and social benefits to the communities in which it operates. As a business service, it reduces the number of vehicles driven in our cities, eases the burden on the public road infrastructure, reduces greenhouse gas emissions and other pollutants, and reduces the cost of transportation for the local populace. Car-sharing is a reliable and flexible alternative to car ownership and is becoming an increasingly important factor in the transportation equation, aiming to assume the role of a new service of public interest as part of a sustainable transportation network.In addition car-sharing implements the efficient, convenient and affordable way off renting a car.It simplifies the artificial mechanism of renting a car.

**1.2Description of the system**

The project that we implement named Car-Sharing Service, Users can reserve and use a car through the platform .Besides the service based on mobile application.with one targets of people:

• users

Users can use their credentials and payment information to register an account in this system, and access the system.

When users need a car, they need to locate their current location, then they can see the information about available cars nearby.After selecting a car ,user can reserve the car up to one hour.when a user reaches the car reserved , system will unlocks the car.As soon as the engine ignites,users can see current charge through the screen on the car.After user get off of the car,system stop charging and locks the car.

System in order to restrain the behaviour of users , and to encourage virtuous behaviours of users, will carry out some reward and punishment measures.

**1.3Actual system**

This Car-sharing company is able to has a systems, according to the user's location provide them with near the available car’s information and location.After selecting a car by user, the system will provide a route that users can approach to the position of the car.

when a user reaches the reserved car, tell the system she already arrived, then system unlocks the car for user.System also has automatic charging function, the charge of per minute will appear on the screen in the car.When users leave the car,system stop charging and locks the car.

System according to the finally parking location of the user, as well as rest of electricity of the car,there are discounts or fines would be given to users .

This system stores information both of users and cars into a Mysql database.

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**2.Goals:**

**1)** **User can access the system from smartphone, using app.**

*Reqs:*

- System must be compatible with IOS, Android mobile operating systems.

- System must provide a user with registration. Or sign up procedure.

- While registering system must ask for user’s credentials and payment information, username and password#1 to access the system

- After signing up and car reservation, system must ask user to guess 4-number password#2

- password#2 must be entered in the app every time user picks up the phone after unlocking the screen-lock (in terms of security)

- system must ask user to guess the recovery question with correct answer (in case of user’s bad memory and in terms of security as well), e.g. “what is your mother’s maiden name?”. Recovery question can be guessed once while registering.

*Da:*

- user already has credentials and payment method, like credit card or paypal.

- user’s smartphone has either IOS or Android operating system

**2)** **Registered users can locate all unoccupied electric cars parked nearby or within the specific zone**.

*Reqs:*

- The system must acquire information about location of all unoccupied cars within the certain area

- The system must notify user to turn on the GPS on smartphone while using the app

- System must send GPS data to google maps app for routing

*Da:*

- All electric cars have GPS navigators

- Users have google maps installed on the smartphone

**3)** **Registered users can see the information about battery fulness of each unoccupied electrical car.**

*Reqs:*

- The system must acquire information about car’s battery fulness

-provide user with an expected drive time. System can measure the distance the car can ride, until she gets run out of energy.

*Da:*

- all electric cars have battery fulness sensors

**4) Registered user can reserve 1 chosen unoccupied electric car for up to 1 hour.**

*Reqs:*

- System must provide 3 states of occupation to each car: reserved, occupied, available

- when 1 hour after reservation is up, system must state that the car is available

- when 1 hour after reservation is up, system must charge user for 1 euro

- the system must state that the car is occupied when user starts engine (not correct, as user can start engine from any point by using the app). watch *scenario 1*

- buttons can only be used, when user’s GPS location states that he is near the car (problem of car theft is reduced, watch scenario 2)

- engine must be started from app by pressing special button.

- app buttons can be used only when the user

**5)** **User can park the car for later usage without missing the “occupied” status.**

*Reqs:*

- the system must charge user less, when the engine is turned off

- user must have an opportunity to “tell” the system that he quitted using the car

*Da:*

- cars have detectors that states whether the engine is working or not

**6)** **User can access car locks and car engine via app.** (not reasonable to use systems inside the car, as user have to have access into the car from outside)

*Reqs:*

*-* system locks/unlocks the car ⇔ user presses the button “lock/unlock car” in the app

- system starts/kills car’s engine ⇔ user presses the “start/kill the engine” button in the app

*Da:*

- user has a stable and continuous internet connection, e.g. 3G or 4G

- car has emergency unlock button inside, if something goes wrong with the system, a user’s smartphone or internet connection

**7) User is notified about driving charges on the screen in the car.**

*Reqs:*

*- User is charged* by energy consumed while driving and the time the car was left unused.

-System must display charging information on the screen in the car.

*Da:*

-Car has a screen that is driven by inner OS

**8) User is encouraged to behave properly**

**8.1) User has a 10% discount when he picks at least 2 more passenger onto the car.**

*Reqs:*

- User should to tell the system there are two passengers will get on the cars. Unsafe, user can cheat and tell the system he have 2 passengers, but in reality he doesn't(cuz users may put some luggages or bags on other seats to add the weight),then system will start discount timer for this period ride.when the other two passenger get off car,user ought to also tell system.

- system must acquire information from sensors to detect the number of persons inside

- system must provide 10% discount when it gets information that there are 2 more passengers in the car (What if e.g. user uses the car the whole day, but he drove 2 passenger only for 2h? The discount affects only on the period of charging when the car was sensing these 2 passengers.)

*Da:*

- car has detectors of persons inside it (what kind of sensor??? Maybe pressure sensors embedded into the seats. Not good, user can have a discount if he carries luggage on the back seats. Maybe car has cameras and system can recognise persons inside the car)

**8.2)** **User has a 20% discount on the ride if he left the car with no more than 50% battery empty.**

*Reqs:*

-System must provide 20% discount ⇔ user states that the car is no more needed + battery’s capacity is not less that 50% full

*Da:*

**8.3)** **User has a 30% discount on the ride if he left the car on the special parking area with the power grid station and plugged car to it.**

*Reqs:*

-System must provide 30% discount ⇔ user states that the car is no more needed + the car is on the special area + car’s battery is charging

- Car can state whether the battery is charging or no.

*Da:*

- System must acquire information about battery’s charging state.

- There is a sensor that help the system of the car distinguish whether the car be recharged.

**8.4**) **Users would be charged 30% more,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, to compensate for the cost required to re-charge the car on-site.**

Reqs:

-System charge 30% more as compensation⇔user states that the car is no more needed+The car is left at more than 3 KM from the nearest power grid station or battery’s capacity is not less than 50% full

Da:

-System can detect the distance between car and the nearest power grid when user press “stop using” button.

-System can obtain the information about the battery

-System can analyse that once one of the situation as below two happen,user have to pay for compensation.

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**“Global” domain assumption:**

**•Car has an inner OS, that process information from sensors(cameras, engine state, battery fulness), starts/kills engine, locks/unlocks doors, display information on the screen**

**“Global” requirement:**

**•System must be able to communicate with car’s inner OS to acquire processed information from car’s sensors, send signals to start/kill engine, lock/unlock door, to display information on the screen**

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**Scenario identifying**

Here some possible scenarios of usage of this application.

**Fairytale 1:** Distant occupy cheating

John reserved the car using the app and is up to be late for “occupying” the car and willing to avoid being charged and lose the reservation. He presses the “start/kill engine” button being far from car, thus occupies it. This problem is solved by (If John really don't want to lose the opportunity to use the car ,he can press “Arrive” button,but doesn’t press “unlock” button,because once user press “Arrive” button,user start to be charge by time.)

**Fairytale 2:** Car theft reduce

Winter. John parked the electric car near his working place. After the the end of the day, before walking off in the street, he decides to warm the car and starts the engine via app. When John go outside, he unlocks the car, being in 15 meters from it. Suddenly some person ran into the car and drived it away. Due to the fact that John has a remote access to the car control system, he kills the engine, locks doors and calls the police. ( car is more than 15 meters when it is driven away! John can’t access the car no more to kill the engine and lock the car! Add an emergency button. When pressed it kills the engine and locks the car from any distance. Must be done with confirmation question to avoid accidental touch. OR with confirmation with password enter(better))

**Fairytail 3:** Why it is important to use have an opportunity to leave the car without “missing” it.

Jeremy lives outside the city. At the end of the working day his car has broken and he gave it for a repair. The only way to get to the city to his working place is to use the car. Jeremy found available electric car and reserved it. He parked it near his house. The next day he uses this car to get to job. At the end of the working day he drives to the repair station, parks the electric car and picks his one. (Company wastes money if the user suspends the car for a long time and after that states that the car is no more needed. Must be some kind of punishment in terms of charging, e.g. if such situation occurs, system must charge user proportionally to the time the car was suspended)

Fairytail 4:

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**Domain properties**

We suppose that these properties hold in the analysed world :

-Actual users are already registered in the car-sharing system.

-There are sufficient available cars could be reserved.

-Users’ smartphone has GPS function.

-The GPS of the users cannot be switched off.   
 -All the GPS always give the right position.

-Background system can provide all information about unoccupied cars within 10 seconds.

-User pay the system directly for each trip.

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**Glossary**

**User**: he is a client of car-sharing service who always send requests to system.He is able to register and access the system,reserve and use available cars as well. he should insert the following information:

-Name

-credentials and payment information

-Position, it can be taken automatically from GPS

-Number of passengers

-Time (for reservation and time using )

**Background System**:It’s responsible to respond to the requests or commands from users.The request from users.

**Inner OS:(connect to background system)**

-provide information to background system

-respond requires from background system

-with a screen that notifies user of the current charges

-with sensors which do help for background system

**“Arrive” button:(**in app)To tell back ground system user already arrived. Once user click this button,he started to be charged.

**“Unlock” button:**(in app)This button can unlock the door of car.

**“Start engine” button:**(in app)This button can ignite engine.

**“Kill engine” button :**(in app)This button can makes engine flame out.

**“Lock” button:(i**n app)When her need to get off the car,press this button to lock the doors of car.

**“Stop” button:(i**n app)That means user has already finish this trip,will doesn’t use it any more, and system stop charging for user.

**Reservation:**User makes a reservation before use it.Then this car couldn’t be reserved by other users.

**Trip:**The period from user start to use the car until finish this drive.

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**Lucia**

**26/10, 2h**

**27/10, 2h**

**28/10, 1h**

**29/10, 1h**

**30/10, 2h**

**02/11,1h**

**03/11,2h**

**Artemiy**

**26/10, 1h**

**28/10, 2.5h**

**29/10, 3h**

**31/10, 2h**

**2/11, 1h**