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1 Introduction

- Aggiungere nei world phenomena il ChargingType
- Inserire password nell'UML nella classe utente
- Nell'UML al posto di "best" in strategia mettere "cheapest"
- Inserire "car type" all'interno dell'attore auto
- Controlla che gli Scenarios siano coerenti con l'UML
- Aggiorna Requirements con spiegazione di EnergySourceStrategy
- Update Scenarios with "Giochini di Emilio" - Better explain in Requirements(not sure) how the system suggest a charge

1.1 Purpose

Paragrafetto che spiega il progetto

- G1 The eMSP shall help the user to select the station; [W1,W2] [S1,S5]
- G2 The eMSP shall allow the user to book/cancel a charge; [W1,W2] [S4]
- G3 The eMSP shall allow the user to perform a charge; [W1,W2,W3] [S2,S6]
- G4 CPMSs shall handle the car charging cycles; [W1,W5,W6] [S7]
- G5 CPMSs shall manage the car charging stations; [W4,W5,W6] [S3, S7]

1.2 Scope

- W1 People charge electric cars;
- W2 People use web calendar;
- W3 People pay for the charging service;
- W4 Distribution System Operatorss (DSOs) supply energy to Charging Point Operatorss (CPOs);
- W5 Some CPOs own batteries;
- W6 CPOs decide whether to use batteries or DSO supplied energy;
- S1 The eMSP suggests the user to charge the vehicle;
- S2 The eMSP notifies the user when the charging process is finished;
- S3 CPMSs acquire information about energy prizes from DSOs;
- S4 The user books a charge using the eMSP;
- S5 The user asks the eMSP for suggestions about charging station;
- S6 The user pays for the service using the eMSP;
- S7 CPOs gather the energy source through the CPMS;

1.3 Definitions, Acronyms, Abbreviations

eMSP e-Mobility Service Providers

DSO Distribution System Operators

CPO Charging Point Operators

CPMS Charge Point Management System

API Application Programming Interface



1.4 Revision history

1.5 Reference Documents

1.6 Document Structure

cancel, and press the Cancel button, a popup appear asking confirmation, if it is pressed the booking is removed, the station returns available and a confirmation email is sent to the user; otherwise the booking is still valid.

S6 User charges the car:

Mary, after booking a charge, arrives at the station, she parks her car at the designed socket and plugs her car in, Mary then inserts the confirmation pin in the socket to start the charge. The socket displays on a monitor the status and the finishing time of the charge. Once the charge is finished Mary receives a notification of finished charge, she gets her car and complete the charge.

S7 User gets charging suggestion based on his calendar:

Josh is a very busy man, is also an avid google calendar user, setting up every event with correct time and location. The service accessing his calendar finds the closest available charging station to each car movement, it connects to the car while driving and stores the last charge level and once the battery is below fifty percent Josh gets notified about the possibility to charge his car in an available time-slot and near his movement. Josh liking the idea open the app and confirms the booking.

S8 Cpo subscribes to the system:

Judy, the CEO of a famous CPO, wants to subscribe it to EMAll to improve sales and to access the CPMS feature. She opens a Website and select to sign up, she inserts the name, partita iva, a master password and the stations of the CPO. For each station she has to insert the number of charging port, the presence of batteries and, if there are any, whether to use the CPMS automatic source selector or to choose the preferred energy source.

S9 Cpo updates info about its system:

The sysadmin of a CPO, Andy, after logging in with the master password has access to his CPO. Here he can change the number of stations, for each station he can update the number of socket and the energy source. He can also create and update maintainer account inserting the ID and password. For each maintainer he can choose which station the maintainer can maintain.

S10 Cpo employee logs in the service:

Brett a CPO employee wants to access the service, he connects to the site and inserts the ID and password, if correct he logs in; otherwise the procedure fails and must be repeated.

S11 Maintainer maintains his assigned stations

Lisa, a maintainer at a cpo logs in the service, here she can see the info of each station assigned to her. For each station she can: check the status(functioning or not), choose the energy source, update the number of available sockets. She can monitor the consumes, profitability and the usage of a specified station.

2.2 Product functions

In the following subsections the functions of each subsystem are described.

2.2.1 eMSP

Accessing the eMSP In order to have a personalized experience the system needs accounts. So a registration and login process is present. When registering it's required to give the system Name, Surname, e-Mail, Password and a Payment Method. For the login, an authentication with e-Mail and password is required.

Performing a charge The principal feature of the system is the ability to help the people to plan a charge for their cars efficiently. For this, people can see the availability of charging stations and choose where and in which time slot to charge the vehicle. Also, if a user changes his mind, there is the possibility to delete a previously booked charge with no charge. When the user arrives in the booked socket of the charging station, he has to insert the pin that the application displays in order to let the charging process begin. Always through the application, the user is able to pay for the service thanks to the previously inserted payment method. The system also notifies the user when the charging process is completed.

Retrieving informations about charging stations Whenever a user selects a charging station, various informations are shown in order to help the user to make a decision on which station to choose. Informations regard location, price, a parameter on how green the energy provided is, special offers and availability of sockets in the station.

Get suggestions about the recharge of the vehicle An additional feature the system offers regards a proactive suggestion about the recharge of the vehicle. Thanks to the connection of the application with the car and with the electronic calendar, the system is able to suggest to the user where and when to charge the vehicle in order to satisfy certain parameters chosen by the user. These may involve minimizing the cost of the recharge, minimizing the environment impact of our recharge, minimizing the distance from the scheduled appointments.

2.2.2 CPMS

Accessing the CPMS as CPO

Manage the energy source for a charging station

Providing charging station informations for utilizators

Providing charging station informations for maintainers

Acquire informations about DSOs price

2.3 User characteristics

2.4 Assumptions dependencies and constraints

2.4.1 Assumptions

DA1 Users insert genuine data in the forms

DA2 Users(Including CPOs) do not use the system with malicious intent

DA3 All the electric vehicles can be charged by all the stations (no incompatibility)

DA4 All the user have an active internet and GPS connection always available while using the service

2.4.2 Constraint

C1 If a User wants to change the time slot of a charge he is required to cancel and re-book the charge

3 Specific Requirements

3.1 External interfaces requirements

3.1.1 User interfaces

- R1 The **eMSP** must allow the users to register (providing email, password, payment method and his infos);
- R2 The **CPMS** must allow the **CPOs** to register (providing email, password, id-station, partita iva, number of possible charging slots);
- R3 The system must allow the **CPOs** to modify the possible charging slots in their stations;
- R4 The system must verify the correctness of the identification data for the **CPOs**;
- R5 The system must allow the user to login;
- R6 The system must allow the user to choose a specific station, a timeslot;
- R7 The system must notify the user when the charging process is finished via a notification;
- R8 The **CPMS** must allow the **CPOs** to choose the mode (manual or automatic) of operation

3.1.2 Hardware interfaces

3.1.3 Software interfaces

3.1.4 Communication interfaces

3.2 Functional requirements

- R1 The system must provide information () about the stations nearby;
- R2 The system must reserve a position for a user who registered for a charge through the application;
- R3 The system mustn't have collisions in the booking of charges; (non si possono registrare più di X user per timeslot sovrapposti)
- R4 The system must take the service money from the user payment method after the charging is finished;



3.3 Performance requirements

3.4 Design constraints

3.4.1 Standards compliance

3.4.2 Hardware limitations

3.4.3 Other constraints (TODO MAYBE)

3.5 Software system attributes

3.5.1 Reliability

3.5.2 Availability

3.5.3 Security

3.5.4 Maintainability

3.5.5 Portability

3.6 Requirements

3.6.1 External Interface Requirements



4 Formal Analysis Using Alloy

5 Effort Spent

5.1 Effort Spent

- 15/11/2022: 15:00 - 18:00 Federico, Emilio and Matteo
- 16/11/2022: 08:30 - 10:00 Emilio
- 17/11/2022: 21:00 - 23:00 Federico, Emilio and Matteo
- 18/11/2022: 10:00 - 12:00 Emilio and Federico
- 21/11/2022: 19:00 - 20:00 Matteo
- 22/11/2022: 14:30 - 16:00 Matteo
- 23/11/2022: 10:30 - 11:30 Matteo
- 24/11/2022: 21:30 - 22:30 Matteo and Federico
- 25/11/2022: 09:00 - 09:30 Federico
- 25/11/2022: 19:00 - 19:30 Matteo
- 26/11/2022: 08:30 - 09:00 Federico
- 26/11/2022: 16:00 - 17:00 Federico, Emilio and Matteo
- 28/11/2022: 08:30 - 09:00 Federico
- 28/11/2022: 10:00 - 12:00 Emilio
- 30/11/2022: 22:00 - 23:00 Emilio
- 28/11/2022: 08:00 - 08:30 Federico
- 01/12/2022: 16:00 - 17:30 Matteo
- 01/12/2022: 20:30 - 21:30 Emilio
- 01/12/2022: 21:30 - 23:00 Federico, Emilio and Matteo
- 04/12/2022: 19:00 - 20:00 Emilio
- 05/12/2022: 09:00 - 09:30 Federico
- 05/12/2022: 11:00 - 11:45 Emilio