

FABRIC

Feasibility analysis and development of on-road charging solutions for future electric vehicles

Italian Test Site: Control Room

The charging procedure and the status of each actor involved in the charging process can be constantly monitored from the control room

Overview

In the Italian test site **two on-road charging solutions** are present: the **SAET** solution and the **POLITO** solution. The two tracks are evidenced in the Fig 1.
From the control room is possible to monitor the charging process over the both tracks.

ICT Charging Infrastructure

The **charging infrastructure** involves an actor responsible for the **booking** and the economic management of the electric energy provided for the recharge, a Charging Station Control Unit (**CSCU**) responsible for the communication control of all the actors of the charging area, a **PE management unit** (Single Board RIO) and a **control unit on vehicle** board that interfaces with the PE on board and communicates the information about the vehicle thanks to the **CHODA** (through a **Wi-Fi** communication).

The charging infrastructure communications are based on the **CAN protocol**. The CAN bus network on the vehicle and the CAN bus network of the charging station can see each other during the charging process thanks to the CHODA Wi-Fi communication. The PE management unit is connected by LAN to the host PC of the control room and allows to monitor the charging process.

Charging Process

The charge procedure starts with a first phase of booking. The EV, during the approach to the recharge area, gives information about its characteristics for the authentication and authorization to access the area. The charging process phases, shown in Fig.2, according with the position of the vehicle, are:

- **FAR** No vehicle is approaching: normal execution of tests about PE health are performed.
- **FAR BEFORE** A vehicles requested to recharge: procedure for authorization starts and this state does not change if the vehicle is out of the COHDA communication range.
- **NEAR BEFORE** The presence of the vehicle is detected by COHDA: the vehicle is approaching to the charging area. The authorization, authentication and accounting process starts in the CSCU.
- **AAA** The vehicle characterized by an ID number is authorize. An Automatic Number Plate Recognition (ANPR) camera detects the ID of each vehicle that is direct in the Charging Zone: the transition to the next stage occurs only if the detected ID corresponds to the ID of the authorized vehicle (Fig. 7).
- **WV** (Wait For Vehicle). The vehicle is approaching the charging line. The first power electronic on ground starts the **recognition procedure**;
- **CWD** The vehicle is above the charging zone (the coil). **The PE on ground identifies the actual presence of the vehicle and transmits power.**
- **EOC** (End Of Charge). The **recharge procedure is complete** the vehicle is out of the charging zone
- **NEAR AFTER**. The vehicle passed the Charging Zone but remains detected by the COHDA. There are data exchanges between sbRIO and CSCU about the charging process ended.
- **FAR AFTER**. The vehicle is out of the COHDA detection range (the vehicle exit the charging area) .

An **error handling** of all expected malfunctioning or not correct behaviour of the EV driver or system components in order to guarantee the safety.

Achievements

The charging infrastructure actors and the charging procedure can be monitored constantly from the Control Room for both the tracks. The communication protocol chosen, the CAN bus, has been chosen for its simplicity and its aptitude to put easily in communication the different actor of the system. The system must to be scalable for different number of vehicles. It is worth noticing that the control of the charging process, during the states WV,CWD,EOC, is not based on a communications link between vehicle and charging station.

Partners involved



Fig 1. Italian test site, Control room, track SAET, track POLITO

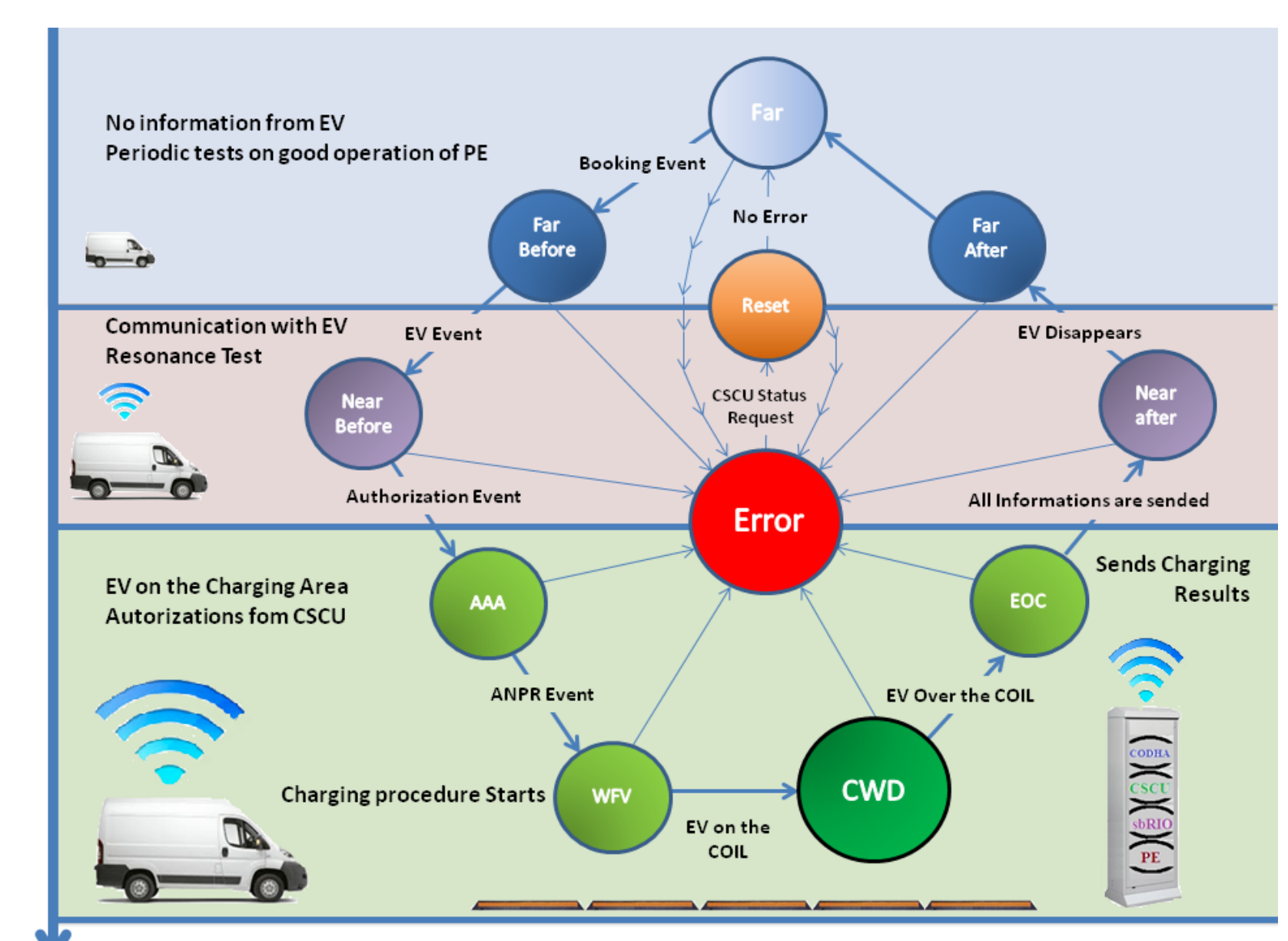


Fig.2 Italian test site, Charging Process State Machine

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