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Die App für das Management des Ladevorgangs im „Innotruck“

Rapid development of an HMI application and accompanying network infrastructure

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Kurzfassung

Eine Apple iPad Anwendung für die Visualisierung, Fernüberwachung und Steuerung des Ladevorgangs von Elektrofahrzeugen wurde entwickelt. Der Verbrauch individueller Elektrofahrzeuge durch Zeit wird intuitiv dargestellt. Die Teilnehmer können ihre Fahrzeugleistung mit der von den anderen Fahrzeugen und Fahrzeug-Klassen vergleichen und eigene Auswirkung auf die Umwelt analysieren.

Abstract

An Apple iPad application for visualizing and remote management of the charging process of electrical vehicles connected to Innotruck was developed. The individual energy consumption is tracked through time and is being intuitively presented to users. The users can compare their performance with other vehicles and other vehicle types, in order to analyse their impact on the environment.

1. Introduction

The Innotruck is an experimental serial hybrid vehicle built-up in the scope of the "Diesel Reloaded" project on the Technische Universität München. Its purpose is to serve as a test bed for various new concepts in the field of human-machine interfaces and driver assistance systems, system architecture and energy management.

This work is focused almost exclusively on one aspect of the Innotruck - the charging stations. They are capable of charging up to 8 electric vehicles and are described in detail further on in text. Emphasis is placed on the development of an Apple iPad App for consumption tracking and charging management.

2. Motivation

There are currently two real life use-cases for the Innotruck in the role of a charging station. The first occurs while presenting various electric mobility ideas and concepts on technology fairs and manifestations throughout Germany. There is always a collection of E-Vehicles driven at nearby test tracks and the Innotruck provides the charging infrastructure.

The second is planned during the World Advanced Vehicle Expedition, an E-Vehicle tour initiated by the adventurer Louis Palmer, who first rode around the world in his own solar taxi. The Innotruck was prepared to operate as a fleet support vehicle, while also serving as a meeting point during the pauses in various cities.

Fig. 1: First participation of the Innotruck on the WAVE in 2011

3. The charging station

The truck is able to charge up to 8 electric vehicles through two custom-made Mennekes charging stations (CS), positioned left and right on the semi-trailer. Each CS can charge 4 electrical vehicles.

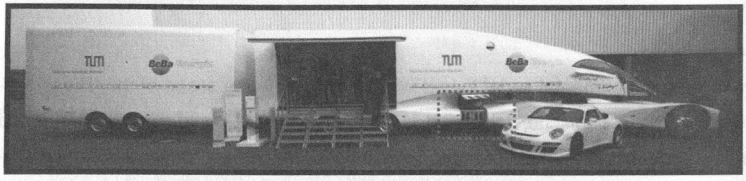

Fig. 2: Location of the charging station on the semi-trailer

The CS is running a lightweight linux distribution and offers both web interface and low-level ethernet interface with proprietary protocol. The messages containing energy measurements are formatted according to Mode D of the standard DIN EN 62056-21.

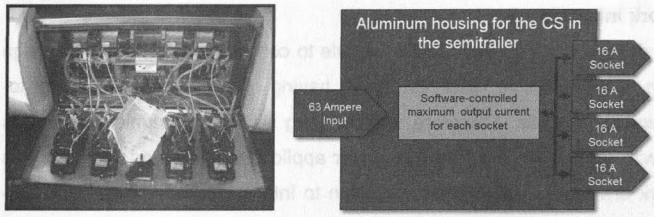

Fig. 3: Open CS on the left, basic energy flow diagram on the right

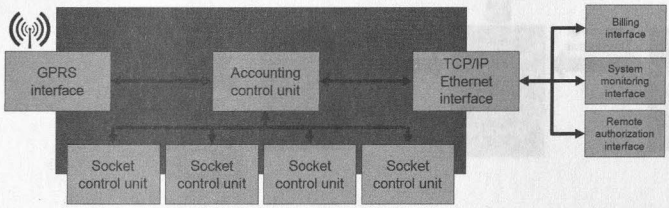

Fig. 4: Basic data flow and interfaces inside the CS

The energy for the charging stations can be provided in three ways:

- Through a direct cable connection to the infrastructure
- From the vehicle's Li-Ion battery
- From solar panels and small wind generator on the roof

The possibility of running the range extender in stationary mode in order to generate electricity for other electric vehicle exists, but is to be avoided and is not discussed in detail.
In this phase of the vehicle development, only the infrastructure mode was implemented and tested.

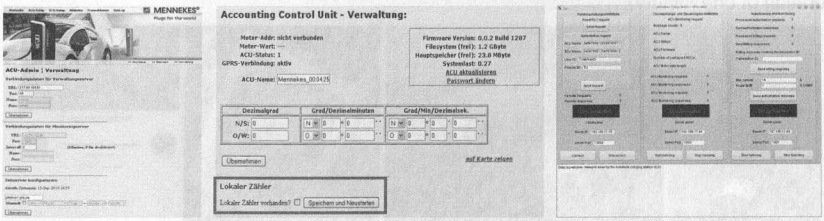

Fig. 5: Web Interface on the left, custom developed QT control panel on the right

4. Supporting network infrastructure

The charging station does not use its own GPRS module to connect to internet. One design principle behind the entire vehicle was to avoid having multiple separated car-to-infrastructure communication points. Therefore, the charging station communicates over its Ethernet connector with the Innotruck's "network driver application" developed only for this purpose. The network driver establishes the connection to internet and the data bank containing energy measurements, which is accessed by the iPad App on the other side.

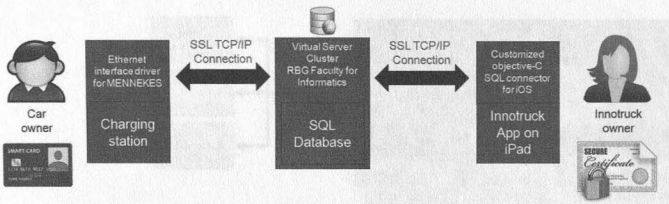

Fig. 6: Actors involved in data transfer from the charging station to the App

5. System usage

The participants are given 8 colour-coded access cards, which uniquely identify their vehicles. The data stored on the cards by default was not modified in any way - the original unique identification string was only being read.

The identification is performed by placing the RFID card in front of the desired charging socket. The socket is unlocked and the charging cable can be attached. The charging is terminated by unplugging the cable from the socket. It can also be terminated remotely, from the operator side of the Innotruck. The charging is also terminated if there is no load on the charging cable for a predetermined amount of time (for example, no energy is flowing for the duration of one minute).

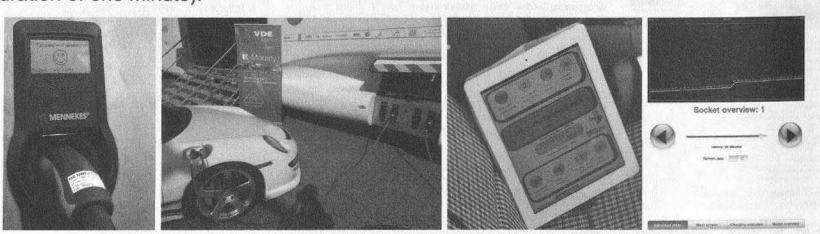

Fig. 7: On-going charging process with the application shown on the right

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