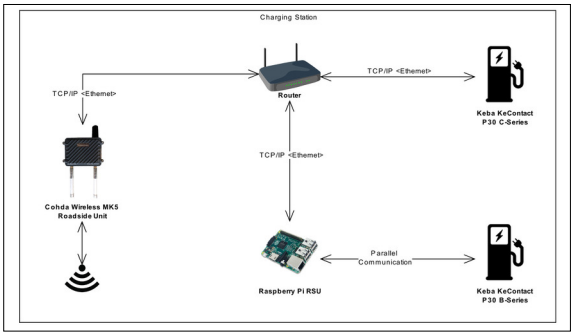
Jonas Loris Gschwend

Gian-Reto Wiher

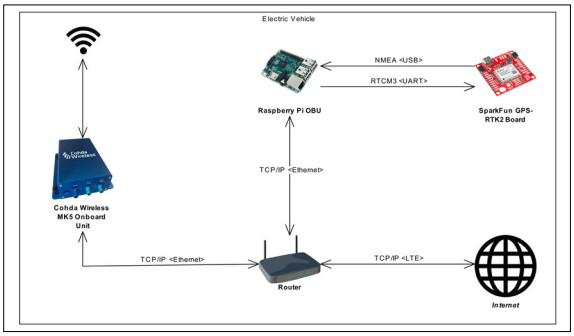
Graduate Candidates	Jonas Loris Gschwend, Gian-Reto Wiher
Examiners	Prof. Dr. Heinz Mathis, Dan Mugioiu
Co-Examiner	Stefan Hänggi, VBS / armasuisse, Bern, BE
Subject Area	Wireless Communications
Project Partner	Micaro AG, Pfäffikon, SZ

Automatic EV Charging-Point Authentication Using V2X Communication

Fully autonomous and wireless authentification system for vehicle charging solutions



System Structure of the Charging Station
Own presentment



System Structure of the Electric Vehicle
Own presentment

The Roadside unit with a GNSS antenna and two V2X antennas
Own presentment

Initial Situation:

In the future the market share of electric vehicles will increase further and therefore the needs for charging possibilities rise as well. These days there are a lot of different solutions from different companies. Today there are several authentication solutions, which are not compatible with each other. The goal of this thesis is to develop a system for autonomous wireless authentication at charging stations. With this approach no interaction by the driver is needed.

In the future, wireless charging solutions will appear on the market. Then authentication and paying methods will have to be fully autonomous and wireless, too.

Approach / Technology:

There are several existing standards about communication between vehicles (V2X), which had to be considered for this thesis. The provided hardware communicates over IEEE 802.11p, an amendment of the WLAN standard optimized for vehicular environment.

The system consists of two similar modules. One is in the vehicle with an external antenna, which can be mounted on the vehicle roof, for localization and communication with other cars and infrastructure. The other module is mounted next to a charging station in a waterproof housing including an antennas attached. The two units facilitate the communication channel between the charging station and the vehicle. Two Raspberry Pi units control the system on each side and communicate over the V2X communication channel with each other.

Initially, both units search for each other. After a connection has taken place and the vehicle is in the parking area, the authentication process starts. If it succeeds the vehicle can be parked on a parking lot and the associated charging port will be released.

To determine the position, the stand-alone GNSS module was not precise enough to detect a single parking lot, if there are several next to each other. A more precise solution had to be implemented. With a differential GNSS system a single parking lot can be detected.

Conclusion:

This thesis shows an autonomous authentication system for parking areas with several lots. The vehicle can be located within a few centimeters and therefore the right parking lot can be determined.

The communication occurs over Basic Transport Protocol, which is a part of the European Intelligent Transport System. This wireless authentication system can also be used for private garage entries or restricted parking areas.