Information and Communication Technologies

Collaborative Project

"V-Charge"

Autonomous Valet Parking and Charging for e-Mobility

Grant Agreement Number 269916

Deliverable Number	D6.6
Deliverable Name	Demonstration of single vehicle (non e-car) at TUBS campus
Dissemination Level	Public
WP Number	WP 6
Date of Preparation	25/03/2013
Date of Submission	18/04/2013
Editor/Beneficiary	W. Derendarz / Volkswagen AG

Deliverable 6.6:
Demonstration of single vehicle (non e-car)

Executive summary

The main part of this document is a video that demonstrates the current capabilities of V-Charge test vehicles. The accompanying written document consists of three parts: (i) description of the current functionality, (ii) description of the internal project presentation in Zurich, (iii) description of the documentation video.

Deliverable 6.6:
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1 Current system capabilities

The current V-Charge system is capable of basic vision-based automated navigation. More specifically:

- Given a *mission goal* (like an ID of a parking spot, or charging station) the system is capable of computing of a high-level route, a kinematically feasible reference path, and set of *tasks* to be performed by the individual *task processors* (driving on lane, parking)
- Sensor information from ultrasonic and stereo systems is integrated in an online grid map and is used by the local path planning
- Given an a-priori localization map the online localization system provides systematic pose updates
- The system computes and follows local trajectories. Static obstacles can be avoided

2 Internal project demonstration

On 22nd of January 2013 an internal presentation of the capabilities of the V-Charge system was performed. More than 30 team members gathered to watch the vehicle and server systems in action. The presentation was a result of the outcomes of all individual partners and integration work performed especially during the Integration Week 2 (Zurich, 19-23.11.2012) but also the following weeks.

The presentation consisted of two parts: offline and online.

In the offline part the process of semantic map generation from raw (mainly image) data was presented.

In the online part a fully automated drive from drop-off zone to a parking spot and back to pick-up zone was presented. “Kermit” test vehicle was used. The demonstration consisted of the following elements:

- Driver arrives with the car at the drop-off zone and activates the V-Charge system (at this stage the driver would leave the car; in our setup a safety driver remained in the car)
- Parking Lot Manager (see Figure 1) transmits the mission goal to the test vehicle via WiFi
- Boot-up of the localization system and route planning to the parking spot designated by the Parking Lot Manager
- Fully automated drive towards the parking spot using visual localization and local trajectory planning

- Collision avoidance maneuver based on the stereo camera obstacle information accumulated in the online grid-map
- Forward parking-in into the parking spot and turning the engine off
- “Waking up” of the vehicle by the Parking Lot Manager module and route planning back to the pick-up zone
- Parking out and automated drive to the pick-up zone (see Figure 2)
- Deactivation of the system, driver is again in control of the car

Figure 1 - User interface of the Parking Lot Manager

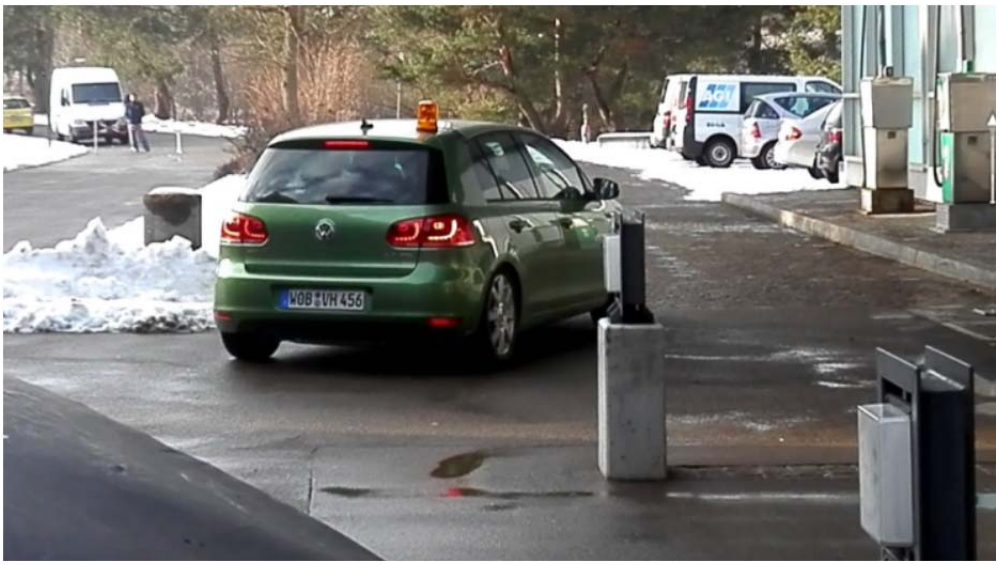

Figure 2 - V-Charge test vehicle on its way back to the pick-up zone

3 Demonstration video

The demonstration video was created based on the video material registered in February 2013 in Wolfsburg using the “Grobi” test vehicle. Essentially a subset of the online scenarios of the demonstration in Zurich was replicated: global path planning, local collision avoidance, parking. The technical differences to the Zurich scenario include

- DGPS was used instead of visual localization
- At the planning stage parking spot and the area in front of it was assumed to be free - collision checking was performed during the maneuver only

The video consists out of four input streams (see Figure 4 and Figure 5):

- View from outside of vehicle (top left)
- “Computer system view”: gridmap, road network, ego-pose (top right)
- Image from the front fish-eye camera of the monocular system (bottom left)
- Image from inside the vehicle (bottom right)

Please note that the V-Charge system is in full control of the vehicle – safety driver and a Remote Kill-Switch operator assist the experiment.

Selected frames of the video are presented below for reference:

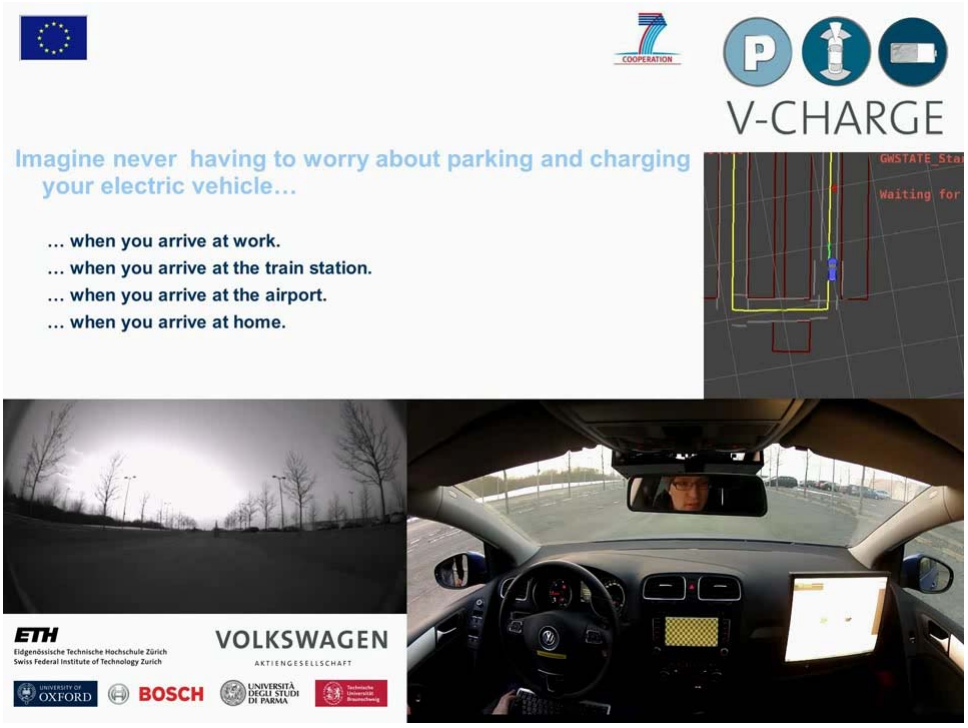

Figure 3 - Activation of the system

Figure 4 - Obstacle avoidance

Figure 5 - Parking maneuver