fahrE

Concepts of multi-modal micro mobility using local renewable energies

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structure

1. Presentation of the professorship
2. The research group fahrE
3. fahrE how does it work
4. Charging-management
1. Presentation of the professorship
Presentation of the professorship

Chair of Energy- and High-voltage engineering

- Holder of the chair: Prof. Dr.-Ing. W. Schufft
- Staff of 20 people
  - 4 PHD-Students funded by scholarships
  - 11 PHD-Students funded by projects and university
- We coach the theses of about 10 students
Presentation of the professorship

fields of research

- decentralized supply und storage units in power system
- grid integration of electric vehicles
- grid integration of large wind farms (HVDC)
- transient behaviour of power systems (modelling)
- diagnostics of electrical equipment
- asset-management of electrical equipment

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### Presentation of the professorship

#### early stage research groups

- early stage research group IDE „intelligent decentralised energy-storage-systems“
- early stage research group fahrE

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2. The research group fahrE

fahrE - *Concepts of multi-modal micro mobility using local renewable energies*
multi-modal mobility

individual movement with the use of different means of transport for a trip

micro mobility

in context of traffic- and transport-research different mobility-strategies for short and medium range trips

local renewable energy

Renewable energy-production near to the consumer. Elimination of lossy and expensive transportation
The research group fahrE

The mobility-platforms of fahrE

- e-mobility is in the focus of the mobility-concept
- additional integration of public transport

Mobility-platforms:
- 8 pedelecs
- 4 electric vehicles
- public transport (CVAG)
Mr. Müller is employee at Chemnitz University of Technology and work at the site of Erfenschlag.

Today he has a meeting at the site of W.-Raabe-Straße.

As participating user of fahrE he now would like to book a vehicle.

How does it work?
fahrE how does it work?

Booking of a vehicle

Besides he has two opportunities:

- Browser based web application
- Mobile application based on Android
Choosing of the mobility platform

Backend does a preselection:

- availability
- state of charge
- weather
- ecology

Mr. Müller can choose, depending on the preselection, which means of transport he would book or reserve at a later date.
fahrE how does it work?

Mr. Müller arrive at the fahrE-Station

Authentication at the charging point with the fahrE-Application
fahrE how does it work?

The booked or reserved vehicle will unlock automatically.

Disconnect charging cable and start!
The research group fahrE

The pillars of the mobility-concept

Mobility platform

infrastructure and periphery

energy management

mobility assistant

TECHNISCHE UNIVERSITÄT CHEMNITZ
The research group fahrE

The pillars of the mobility-concept

Mobility platform

infrastructure and periphery

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TECHNISCHE UNIVERSITÄT CHEMNITZ
3. Charging-management
Charging-management

state of the art

- historical grown distribution grid structures
  - not dimensioned for new high loads (e.g. EV)
  - mainly in low voltage grids:
    - damage of the voltage range
    - overload of the electrical equipment

- electric vehicles only ecologically sustainable, when the used energy is produces in renewable power generation plants
  - just in time usage of renewable energy

Quelle: www.b4bostbayern.de
Charging-management

requirement of a charging-management

- ecological charge of the electric vehicles
  - without restriction on energy-ratio
  - selective use of excess and real existing renewable energy

charging-management necessary!

- allocation of negative regulating power

prevention of:

| lossy transport of local produced renewable energy | shutdown of renewable power plants |
Charging-management

structure of the signal of the charging-management

- characteristic of power generation unit
  - meteorological data
  - availability of renewable energy

- location of charging
  - university-intern
  - public
  - network load

- probable next departure time
  - bookings
  - next route
  - state of charge
  - critical state of charge

charge-signal
Charging-management

data-collection of renewable energy

- based on legal grounds no real-time capture of power data
- simulation based meteorological data and characteristic curve

![Graph of wind speed and power output](image)

- Wind speed v in m/s
- power P in kW
- month
- wind speed
- average of wind speed
- nominal power of a wind turbine
Charging-management

exemplary week for wind power supply

power output of a wind plant

wind speed

- simulated
- metered
- wind speed

Monday    Tuesday    Wednesday    Thursday    Friday    Saturday    Sunday

day
Charging-management

monthly average wind power supply

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<td>Apr.</td>
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<td>Oct.</td>
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<td>Dec.</td>
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- metered
- simulated
Next steps

next steps

- next steps for the charging-infrastructure for fahrE
- data-collection of the produced photovoltaic energy
- develop the charge-signal
- test the charging-management simulative
- field test in fahrE for the electric vehicles
Thank you for your attention!
Charging management

first try with one formular for the hole signal

\[ E_{SOC} = 0 \cdot E_{SOC\text{max}}; 0.5 \cdot E_{SOC\text{max}}; 1 \cdot E_{SOC\text{max}} \]
first try with one formular for the hole signal

\[ P_{\text{Last}} = 0 \cdot P_{\text{Lastmax}}; 0.5 \cdot P_{\text{Lastmax}}; 1 \cdot P_{\text{Lastmax}} \]
first try with one formula for the hole signal

\[ P_{EE} = 0 \cdot P_{EE\text{max}} : 0.5 \cdot P_{EE\text{max}} : 1 \cdot P_{EE\text{max}} \]
Communication concept between EV, charging point, Backend an user

- **user**
  - GSM/3G, W-LAN or Bluetooth at a smartphone
  - Ethernet at a PC
  - identification: (MiFare)/Bluetooth

- **electric vehicle**
  - (MiFare)
  - GSM/3G
  - Bluetooth
  - W-LAN

- **charging point**
  - GSM/3G
  - Bluetooth
  - (MiFare)

- **Backend**
  - Ethernet
  - GSM/3G

- **GSM/WLAN/Ethernet**
  - Link via IEC 62196-2 (mechanical lock)

- **identification**
  - W-LAN

- **renewable energy**

- **energy**

- **information** (internet)

- **GSM/WLAN**