FABRIC

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

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Novel challenges, stemming from the nature of dynamic wireless power transfer (DWPT), require a reconsideration of load balancing algorithms

Why load balancing?

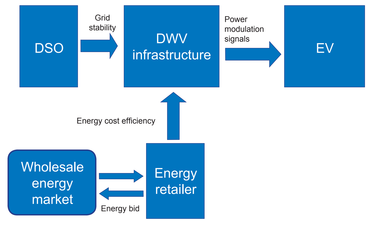
As electrification of transport ultimately targets CO2 emissions reduction, increased utilization of renewable energy sources is likely to provide the means for reaching the decarbonisation objectives. Load balancing (LB) enables the increased penetration of intermittent power sources by providing techniques that ensure grid stability. While complete frameworks for LB deployment in static charging have been designed, these approaches have been reevaluated with focus on dynamic Electric Vehicle (EV) charging.

Partners involved

ENIDEY ICCS · FCA FIAT CHRYSLER AUTOMOBILES · CRF · POLITECNICO DI TORINO · TU berlin

Objectives and principles

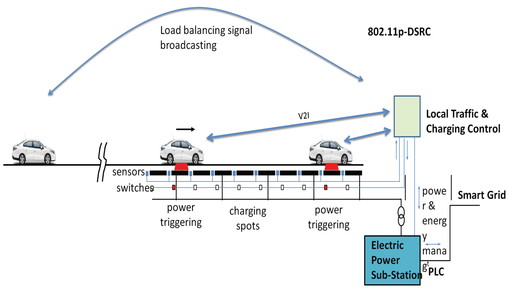
- ✓ Grid operators avoid overloads on cables and transformers;
- ✓ The owners of local renewable use the locally produced energy to charge EVs;
- ✓ Scalable architecture for massive dynamic charging rollout;
- ✓ ICT infrastructure for highly responsive adaptation to DSM events;
- ✓ Distributed, agent based load balancing;
- ✓ Minimal communication and processing latencies;
- ✓ Approach in line with the 802.11p DSRC standard.



LB Grid actors

Core idea and technical approach

The Load Balancing algorithm can be based on a simple concept; EV charging power is increased additively when no power constraints occur at the infrastructure side. On the occurrence of a power constraint, EVs multiplicatively decrease, their charging power. Such price based charging rate modulation additionally provides the possibility to differentiate charging allocation to vehicles according to a willingness to pay criteria, thus ensuring personalized charging.



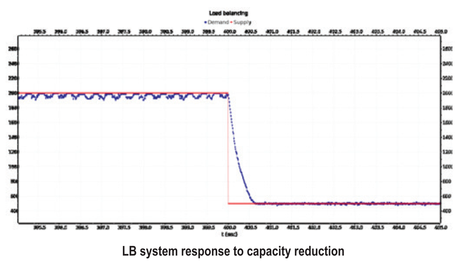
LB Communications architecture

FABRIC HMI prototype

Examples of ICT modules developed

Simulations over various traffic patterns over a 1km charging lane have revealed:

- ✓ Sub second balancing given DSRC V2I communications and a 10ms demand measurement period;
- ✓ High frequency demand metering further enhances event responsiveness;
- ✓ Fair shares for charging across all EVs;
- ✓ Demand-Supply mismatch can be further minimized by super-capacitors installed at the primary side of the charging lane.



LB system response to capacity reduction

Final Event & Demonstration | 21-22 June 2018 Italy

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Consortium

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