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

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Dynamic wireless EV charging system design for efficient e-mobility

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A multitude of functions are required to implement and furthermore commercialize such systems; power transfer efficiency optimization, booking, payment and billing, power system integration. Novel challenges, stemming from the nature of dynamic wireless power transfer, span all functions and require a reconsideration of both charging infrastructure and EV design.

Necessity

- Grid operators avoid overloads on cables and transformers
- The owners of local renewable use the locally produced energy to charge EVs

Approach

- Distributed, agent based load balancing
- Minimal communication and processing latencies
- Approach in line with the 802.11p DSRC standard.

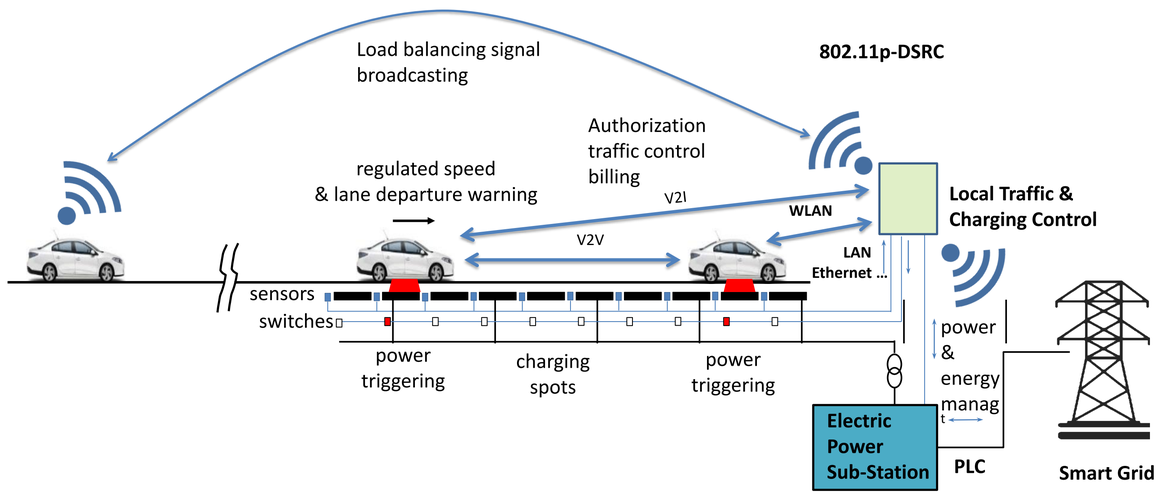
Outcome

- Fair charging among all EVs.
- Demand-supply balance in RES, microgrid environments.
- System wise cost efficiency

Objectives

- ✓ Scalable architecture for massive dynamic charging rollout
- ✓ ICT infrastructure for highly responsive adaptation to DSM events
- ✓ Assessment of the load balancing approach under demanding traffic conditions

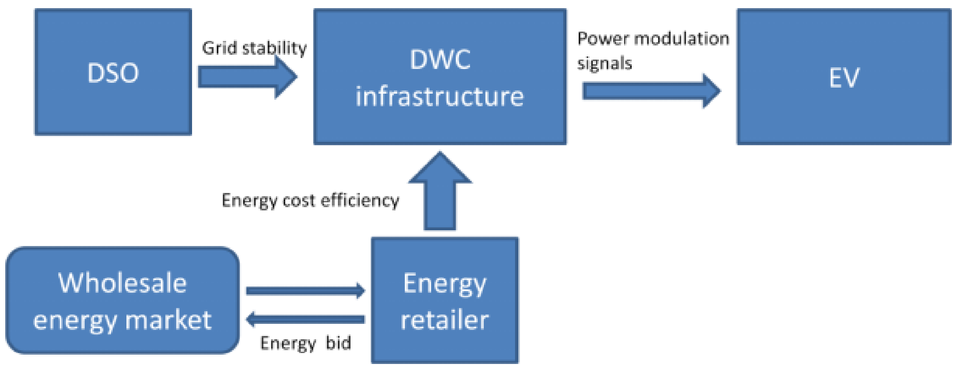
Architecture



Technical Approach

The AIMD algorithm is 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.

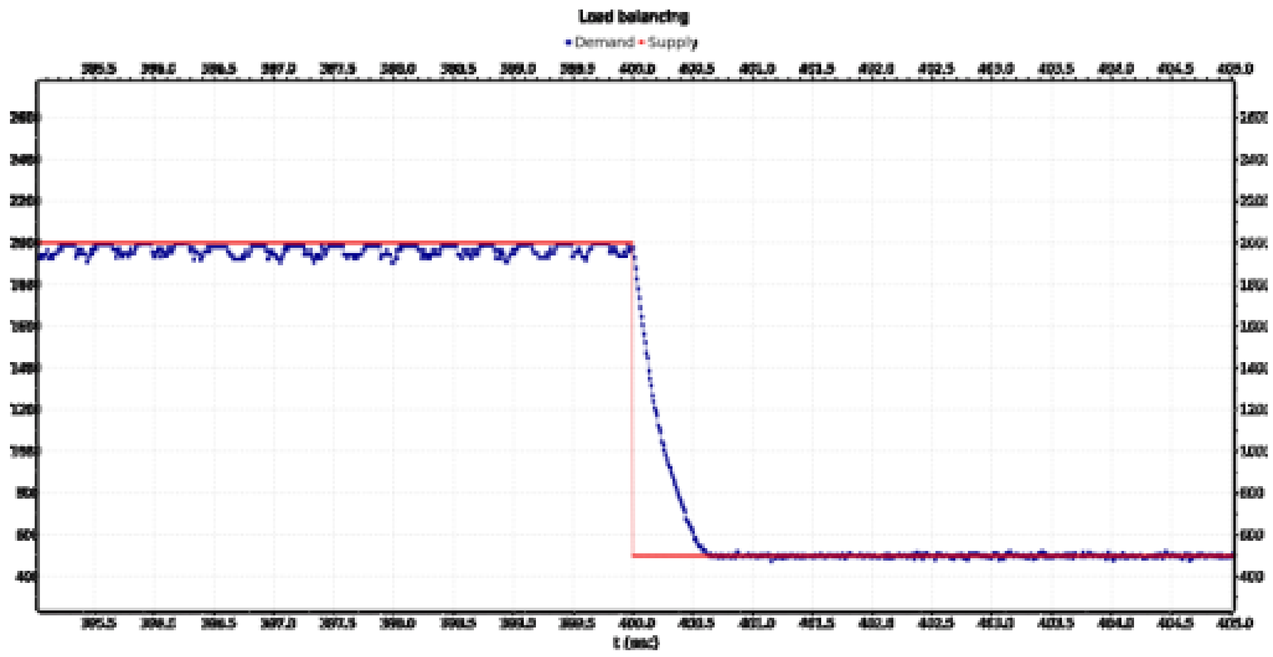
On the other hand price based charging rate modulation additionally provides the possibility to differentiate charging allocation to vehicles according to a willingness to pay criterion, thus ensuring that vehicles can be charged with priority given an increasing order to of willingness to pay criteria



Results

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



Project Facts

Budget	9 M€	**Funding**	6.5 M€
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Coordinator	Angelos Amditis, ICCS	**Contact**	a.amditis@iccs.gr

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