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Efficient Charging Station Scheduling for an Autonomous Parking and Charging System

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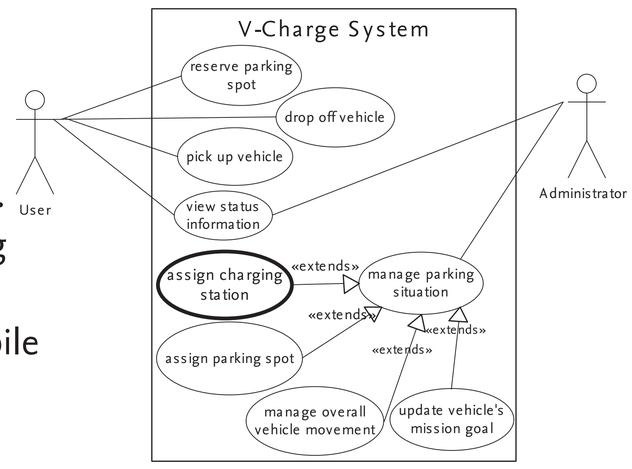
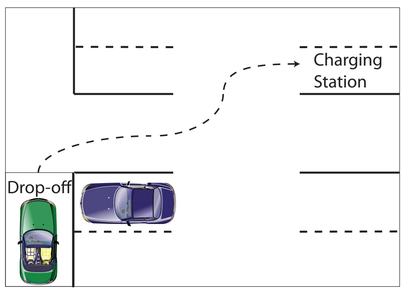
Overview

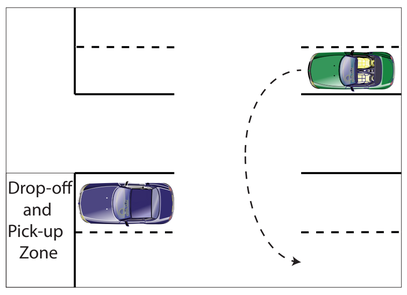
- The EU FP7 project V-Charge (www.v-charge.eu) combines autonomous valet parking with e-mobility.
- V-Charge proposes a solution for charging autonomous electric vehicles in parking places and efficiently using scarce charging resources, thus supporting the customer and increasing the feasibility of electric vehicles.
- For the management of parking lots and charging resources, V-Charge provides a server back-end and a communication infrastructure.
- We present our design of scheduling concepts for a coordinated charging strategy that is implemented by this back-end.
- Through intensive simulations we show that the V-Charge Server performs well in fulfilling customer requirements, e.g., energy demand for the next driving tasks.

Use Cases

- Automatic drop-off and recovery of a car.
- Autonomous parking and recharging.
- Status check via mobile device and Web site.



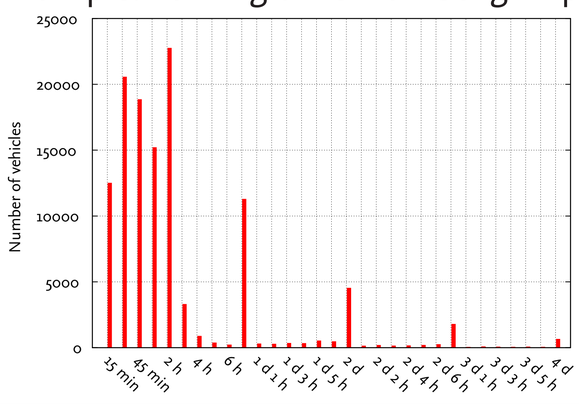




Parking Statistics

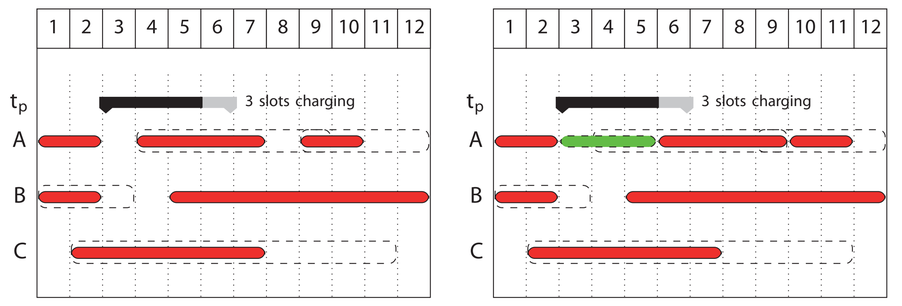
Real-world parking statistics from Hamburg Airport and the City of Braunschweig were used to derive simulation parameters for typical mission scenarios.

Example: Parking time Hamburg Airport



CS Scheduling Strategies

- We propose several static (Scanning, Shifting, Greedy, Flexible) and one dynamic (EDF) scheduling algorithms for charging station (CS) assignment.
- Algorithms take arrival time, and optionally, charging energy and departure time as input parameters.
- Example: Shifting



Conclusion

- The V-Charge Server is able to efficiently handle realistic parking volume.
- Schedulers' suitability in two very likely scenarios were compared.
- Flexible and Scanning are the most efficient schemes:
  - > 99% accepted
  - only few CSs required
  - few to none CS switches
  - high CS utilization

Evaluation