Analysis of Wireless Communication and Networking Needs for Implementation of V2G Technology

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Background

- The vehicle-to-grid (V2G) concept integrates battery vehicles (BV) as effective resources and loads into the grid
- An aggregator is needed to make V2G on a scale that can impact the grid
- Communication control and information network is a key requirement in effective implementation
- Application of Zigbee to BV aggregator network has been studied for single BV

Research Plan

- Define requirements, formulate the problem, consider constraints, and develop a proposed solution approach
- Model the real-world scenario
- Learn lessons about router placement from UIUC internetwork technology
- Simulate test set-up and observe effect of various parameters on performance

Research Results

For most parking lots, Zigbee is a low-power, low-complexity protocol
a) Star topology usable for small lots up to 100 vehicles
b) Cluster tree topology useful for up to 1000 vehicles

Zigbee simulation results

- For larger lots (up to 100,000) use 802.11 protocols (DSRC) or mobile technologies (3G)
- All these technologies can be integrated as a part of ITS (Intelligent Transportation System) or Vanet (Vehicular Ad-hoc Networks)

Goals

- Assess feasibility and quantify performance of particular technologies, i.e., wireless protocols and networking topologies for meeting needs of aggregations in parking lots of different sizes
- Studying scalability issues in terms of performance and economics

Fundamental Questions/Challenges

Optimal cluster head placement in the cluster tree topology such that:
1) Each node (b.v.) lies within the range of a cluster head
2) Each cluster head lies within the range of the parking lot PAN (Personal Area Network) coordinator

Related Work/Interaction with Other Projects

Performance Analysis of IEEE 802.15.4 and ZigBee for Large-Scale Wireless Sensor Network Applications: Mikko Kohvakka, Mauri Kuorilehto, Marko Hannikainen, Timo D. Hamalainen

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