ARCHITECTURAL DESCRIPTION OF ERS
ANALYZING IMPLICATIONS OF SHORT AND LONG ELECTRIC ROAD SEGMENTS

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ERS architecture - 2018
The Need of Architecture - Winchester “Mystery” House

- 38 years of construction
  - 147 builders, 0 architects
- 160 rooms, 40 bedrooms, 6 kitchens, 2 basements, 950 doors
- 65 doors to blank walls
- 13 staircases abandoned
- 24 skylights in floors
- No architectural blueprint exists
Architecture – subsystem level

Electric Road System

Electricity supply  Road  Power transfer  Road operation  Vehicle
Electric roads creates a growing systems-of-systems
ERS architecture - 2019
Meetering and access control
Power Consumption Monitoring

- **approvedIn**: ER access request approved
- **start metering**: Boolean
- **effect usage**: PowerConsumptionPerSecond
- **stop metering**: Boolean
- **Store Vehicle data**
- **approvelOut**
- **totalEffectUse**: ER effect Use For Vehicle
Electric Road Connection and Monitoring Handling
Short segment - Authorized power consumption

Access approved
Segment activated
Short segment - Authorized power consumption

Consumption monitoring ends
Long segment - Authorized power consumption

Access approved
Segment activated
Long segment - Authorized power consumption

Consumption monitoring ends
Unauthorized power consumption

Access approved
Segment activated
Unauthorized power consumption

Unauthorized power consumption
Unauthorized power consumption ends
Consequences of unauthorized usage

- No payment
- Risk of damage of infrastructure due to un-certified and checked power receiver
- Risk of increased load that is not projected for
- Legitimacy
Possible solution
Possible solution
In order to identify the unauthorized vehicle there must be surveillance of a large portion of the segment.
Challenges and solutions

Challenges for short segment
- High number of power switches
- More sensitive communication failure

Possible solutions for long segment
- Maintenance scheme
- On-board licence

Challenges for long segment
- Unauthorized power consumption
- Sensitive for communication failure

Possible solutions for long segment
- Surveillance system (drones, camera, patrol cars)
- Flat-rate
- Toll-road
Suggested future work

- Cyber security
- Standardized interface of charging systems
- ERS and Intelligent Transport System
- Real use of the architecture
  - The full model can be found [here](http://www.electricroads.org/project/) and is free to use (rename file extension from .pdf to .mdzip)
  - A presentation (140 pages..) of many of the views can be found [here](http://www.electricroads.org/project/).
Suggested future work – System simulation of ERS expansion