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Energy optimized routing for E-Vehicles

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Abstract:
The demand for routing tailored to electric vehicles will increase in the future due to the increasing number of users of electric vehicles. A growing number of people will face the same problem. What is the fastest energy-optimized route for my electric car to my destination? This paper describes the factors that influence the energy-optimized routing of electric vehicles. In particular, it shows how the influencing factors are used in routing and how they can be mathematically combines to obtain a general description. The influencing factors: topology of charging stations, energy consumption, topology of infrastructure, seasonal dependency and individual driving behaviour are described. Furthermore, this paper shows the interactions between the factors. A new method for determining necessary edge weights is then presented mathematically in general. This weighting function was developed in the DLR project "Vehicle Intelligence and Smart Gearing" using empirical data analysis. The resulting equation can be applied iteratively to existing routing graphs to determine qualified edge weights. Existing current methods for routing are using the manufacturer information for the power consumption per 100 kilometers to generate a weight for their edges on the routing graph. Since consumption is only measured by the distance travelled, the shortest distance is always the one with the lowest energy consumption and this one is always constant for the same distance. This does not correspond to reality, the consumption can increase or decrease with temperature differences. In addition, manufacturers of electric vehicles produce standardized consumption values that are generated under laboratory conditions and cannot be reproduced in reality. This paper shows how a single function can look like that mathematically combines different influencing factors. This result can be applied to existing routing systems to generate new, more qualified edge weights for energy-optimized routing.

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