Computer and Communication Systems
(Lehrstuhl für Technische Informatik)

Master's Thesis

Assessing the impact of road-side units on distributed beacon-based traffic information systems

Intelligent Transportation Systems (ITS) are a promising solution to today's problem of ever increasing volumes of road traffic. Most recent approaches for inter-vehicular communication rely on the exchange of knowledge via broadcast or using peer-to-peer like systems. We are mainly interested in broadcast-based approaches, specifically relying on **periodic beaconing**. ITS rely on accurate and timely information to enable informed decisions for routing and accident prevention, thus, a major challenge that periodic beaconing approaches face is incorporating the needs for both delay-sensitivity and congestion awareness. In other words, a protocol for ITS has to always **trade channel load for speed of information dissemination** – a tradeoff which should be optimal for any combination of traffic density, penetration rate, and network utilization.

In order to make the approaches more robust even at low penetration rates, researchers therefore consider the introduction of two main types of supporting network elements: First, simple **Stationary Support Units (SSUs)** to serve as stationary members of the network, storing and relaying information. Secondly, intelligent **Road-Side Units (RSUs)** that at the same time participate in the vehicle-facing wireless network and a separate (e.g., wire-bound) backbone, which can in turn be connected to one or more traffic information centers. Reliable data on quantifiable benefits of SSU and RSU introduction, however, is still lacking.

Addressing these issues, we have designed the **Adaptive Traffic Beacon (ATB)** protocol, which is adaptive in two dimensions: network conditions and infrastructural support. ATB uses a **variable beacon period**, which dynamically adapts the frequency of information exchange to a wide range of parameters such as vehicle density, vehicles' speed, radio communication reliability, and delay. Furthermore, ATB is able to rely on fully decentralized information exchange among participating vehicles.

Based on this work, we are targeting the following research objective: **Quantification of the impact of SSUs/RSUs**. We further aim to quantify the optimization potential related to a targeted introduction of SSUs and RSUs. Beside assessing this fundamental issue for different approaches to information dissemination, we are particularly interested in its impact on beaconing solutions such as ATB. Thus, we are going to evaluate benefits of such SSU and RSU supported ITS for information dissemination in urban environments.

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