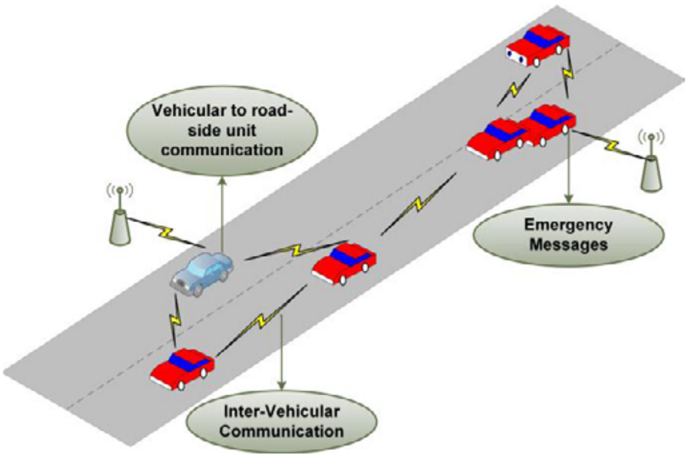
Improving Transport and Infotainmentby Vehicular Ad-hoc Networks

LogDynamics
International Graduate School

Vehicular networking has become a significant research area due to its specific features and applications such as standardization, efficient traffic management, logistics, transportation and road safety, but also regarding online gaming and infotainment. Vehicles are expected to become systems with onboard computing facilities, storage and increased sensing power. Hence, several technologies have been deployed to maintain and promote Intelligent Transportation Systems (ITS).



Vehicular Ad-hoc Network

Vehicular Ad-hoc Network (VANET) is one of the technologies for achieving new goals of safety and efficiency. Engaging in amalgamation of Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communications, this sort of network is known as a VANET and provides early notification of hazards and incidents to both drivers and possible logistics coordinators. Each vehicle in the V2V system is normally accountable for gathering information on the incidents based on the feedback from neighboring vehicles. Apart from the ITS usage, potential application scenarios include, but are not limited to, networks to disseminate safety related information like emergency notification, traffic condition, road jam and collision avoidance. The disseminated information can be used for fleet coordination or rerouting of vehicles, but also for advertisements, networks to distribute multimedia content, and monitoring networks to collect data. In all these cases, multi-hop wireless broadcast is an important component in vehicular networks. With the increase of the number of intermediate vehicles, link breakage due to speed of vehicles, the network topology changes frequently. Therefore the big challenges are dynamic topology, QoS provisioning and multimedia data streaming without too much delay. Since many applications may potentially use this type of network, efficient routing methods are critical for their success.

Problem Definition

To make VANET applications possible, it is necessary to design networking protocols that can overcome relevant issues arising in vehicular environments. The high mobility and speed of vehicles with respect to one another and with respect to roadside units is responsible for a highly dynamic network topology and short contact durations. Limited transmission ranges due to radio coverage, physical obstacles like buildings in urban environments, and interferences make these networks prone to disruption and intermittent connectivity issues. As a result, these networks may be partitioned due to the large distances usually involved as well as the variable node densities. This may result in discontinuities along the path from source to destination. Conventional routing and forwarding protocols are designed for fully connected vehicular networks, called VANETs. Their aim is to establish end-to-end connectivity among network nodes and support end-to-end semantics of existing transports and applications. Thus, they fail with regards to data delivery in sparse, intermittent, partially connected, and opportunistic vehicular net-works. Hence, we need an efficient routing protocol for multi-hop communication. To handle the abovementioned problem, we require a model to handle the highly dynamic network environments and short contact durations through an efficient routing protocol. The

Dr.-Ing. Kishwer Abdul Khaliq
M.Sc.

Faculty of Production Engineering

Islamabad, Pakistan
Finished in July 2019

International Graduate School for Dynamics in Logistics
Contact: Dr.-Ing. Ingrid Rügge

Universität Bremen
Hochschulring 20
28359 Bremen, Germany

www.logistics-gs.uni-bremen.de
info@IGS.LogDynamics.de

Universität Bremen

model shall enable us to get the routing decisions at data link layer by extracting important routing metrics. On the bases of these metrics, each vehicle node will take decisions for establishing a path between sources to destination and deliver information on the shortest path with possibly less delay.

Proposed Solution

In VANET, the channel condition information can be very helpful for decision making while establishing a routing path. If we consider the quality channel parameter as a routing metric then the results will be very different than the traditional routing protocols. So, there is need to make a link layer routing protocol for VANET. The performance of this method depends heavily on the value of the decision threshold, but it is difficult to choose a value that results in good performance across all scenarios. Node density, spatial distribution pattern, and wireless channel quality all affect the optimal value. Broadcast protocols tailored to vehicular networking must be adaptive to variation in these factors. In this work, we address this design challenge by creating a decision threshold function that is simultaneously adaptive to the number of neighbors, the node-clustering factor, and the Rician fading parameter. The proposed protocol will work on the data link layer and it will consider different channel parameters. The selection of the parameters depends upon the targeted scenarios. Furthermore, the protocol will be adaptive to the channel quality and the distance method. The resulting protocol will meet the challenges of this type of network topology and improve the efficiency of the network in terms of throughput of the network with minimum delay and reliable information.

Dynamic Application: Online Gaming

Applications

Vehicular applications are usually classified into two categories, road safety applications and non-safety applications. The road safety applications are used to avoid the risk of road accidents by alert reception through wireless communications. They also focus on optimizing flows of vehicles by reducing travel time and avoiding traffic jam situations. Applications like enhanced route guidance and coordination by logistics providers, but also traffic light optimal scheduling and lane merging assistance by public coordinators are intended to optimize routes, while also providing a reduction of gas emissions and fuel consumption.

The non-safety applications are expected to create commercial opportunities by increasing the number of vehicles equipped with on-board wireless devices. Comfort and infotainment applications aim to provide the traveler with information support and entertainment to make the journey more pleasant. It can also be employed to provide connectivity to catastrophe hit areas or remote rural communities lacking a conventional communication infrastructure. Here the benefit from the deployment of a vehicular network is to provide support for communication in humanitarian logistics, e.g., between rescue teams or other emergency services, or enabling non-real time services such as file-transfer or electronic mail. Our proposed protocol will help to improve both types of vehicular applications. The path selection on MAC layer will allow reliable message delivery to the neighboring vehicles, and shortest path selection between sources and destinations will improve information dissemination and interactive applications.