National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Link-quality and load-based routing schemes for Software-Defined Vehicular Networks
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Venue	: Convention Hall (CS Dept.)
Date and Time	: 04 Dec 2024 (11:00 AM)

Abstract : Vehicular ad hoc networks (VANETs) play an important role in enhancing the performance of Intelligent Transportation Systems by enabling real-time communication among vehicles. This capability improves traffic management, enhances road safety, and provides greater convenience and comfort for both drivers and passengers. However, despite these advantages, VANETs face significant challenges in ensuring efficient and reliable data transmission due to rapidly changing network topologies, intermittent link connectivity among vehicles, and lack of scalability, flexibility, and programmability features. To address these limitations, we incorporate Software-Defined Networking (SDN) principles, such as centralized network control and programmability features with VANETs. This approach simplifies the management of highly dynamic VANETs by decoupling the architecture into control and data planes. The SDN-enabled VANETs architecture, also known as Software-Defined Vehicular Networks (SDVN), leverages SDN features to determine the most efficient routing path using real-time vehicle information such as location, speed, and real-time vehicle density. Additionally, the traditional ad hoc routing protocols often rely on hop-count as a routing metric to determine the shortest path between the source and destination vehicles. However, this approach often neglects the quality of link for the selected routing path, leading to packet losses that necessitate multiple packet retransmissions. Therefore, relying solely on hop-count for route selection may not always ensure an optimal path. This limitation highlights the need for an efficient routing scheme that can account for quality of link, paving the way for advanced approaches like SDVN to maintain a comprehensive global view of the link-state information across the vehicular network to determine a better routing path. Thus, a routing scheme is proposed that incorporates link-quality routing metrics such as Expected Transmission Count (ETX) and Expected Transmission Time (ETT) to find a better path. Considering the need for efficient routing schemes focused on selecting a routing path with better link quality, a link-quality-aware grouping-based routing scheme is proposed that employs a grouping mechanism based on vehicle velocity vectors and cartesian coordinates, utilizes an ETX routing metric, and incorporates real-time vehicle information such as location, direction, speed, and vehicle density to establish a robust path between source and destination vehicle with superior link quality. As the load at the control plane also affects the routing performance, a hierarchical SDVN (HSDVN) involving multiple controllers at different levels is introduced. Finally, a load-aware efficient routing scheme for HSDVN is proposed. The proposed schemes are simulated using OpenStreetMap (OSM), Simulation of Urban MObility (SUMO), and Network Simulator-3 (NS-3). The simulation results show that the proposed schemes perform better as compared to the existing works in terms of average throughput, delay, jitter, and packet delivery ratio.