COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

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for the degree of Doctor of Philosophy (Ph.D.)

"Geographic Routing Reliability Enhancement in Urban Vehicular Ad Hoc Networks"

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ABSTRACT OF DISSERTATION

Geographic Routing Reliability Enhancement In Urban Vehicular Ad Hoc Networks

Vehicular Ad hoc Networks (VANETs) have the potential to enable various kinds of applications aiming at improving road safety and transportation efficiency. These applications require uni-cast routing, which remains a significant challenge due to VANETs characteristics. Given VANET dynamic topology, geographic routing protocols are considered the most suitable for such network due to their scalability and low overhead. However, the optimal selection of next-hop nodes in geographic routing is a challenging problem where the routing performance is highly affected by the variable link quality and bandwidth availability. This work has been undertaken to enhance the reliability of geographic routing in urban VANETs. To minimize packet losses, we consider the direction and link quality of next-hop nodes using the Expected Transmission Count (ETX) to select links with low loss ratios. To further improve the routing reliability, dynamic cross-layer measurements have been taken into account to estimate the available bandwidth. We present a novel model of the dynamic behavior of a wireless link. It considers the loss ratio on a link, in addition to transmission and queuing delays, and it takes into account the physical interference effect on the link. Then, we propose a cross-layer geographic routing protocol, in which we consider the link dynamic behavior, in addition to the urban mobility model. To intelligently combine multiple metrics, we design a fuzzy logic decision system, which considers four routing metrics: distance, direction, ETX, and achievable throughput. These metrics are combined using fuzzy rules in order to select more reliable next-hop nodes for packet forwarding. Finally, we propose a novel link utility aware geographic routing protocol, which extends the local view of the network topology using two-hop neighbor information. We present our model of link utility, which measures the usefulness of a two-hop neighbor link by considering its minimum residual bandwidth and packet loss rate. The proposed protocol can react appropriately to increased network traffic and to frequent topology changes in VANETs. To evaluate the performance of the proposed protocols, extensive simulation experiments, using network and urban mobility simulation tools, are performed. Results confirm the advantages of the proposed schemes in dense networks with high traffic loads.

BIOGRAPHICAL SKETCH
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CONCERNING PERIOD OF PREPARATION & QUALIFYING EXAMINATION

Time in Preparation: 2012 - 2018

Qualifying Examination Passed: Fall 2013

Published Papers:

O. Alzamzami and I. Mahgoub, "An Enhanced Directional Greedy Forwarding for VANETs using Link Quality Estimation", *IEEE Wireless Communications and Networking Conference (IEEE WCNC)*, April 2016.

O. Alzamzami and I. Mahgoub, "Geographic Routing Enhancement for Urban VANETs using Link Dynamic Behavior: A Cross Layer Approach", *IEEE Transactions on Mobile Computing (IEEE TMC)*, (Under Review).

O. Alzamzami and I. Mahgoub, "Fuzzy Logic based Geographic Routing for Urban Vehicular Networks using Link Quality and Achievable Throughput Estimations", *IEEE Transactions on Intelligent Transportation Systems (IEEE T-ITS)*, (Under Review).

O. Alzamzami and I. Mahgoub, "Link Utility Aware Geographic Routing in Urban VANETs using Two-Hop Neighbor Information", *Ad Hoc Networks*, (Under Review).