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FUZZY LOGIC-ASSISTED GEOGRAPHICAL ROUTING OVER VEHICULAR AD HOC NETWORKS

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Abstract. *Vehicular Ad Hoc Networks (VANETs) is a type of ad hoc network that allows vehicles to communicate with each other in the absence of fixed infrastructure. Inter-vehicle geographic routing has been proven to perform well in high speed vehicular environments. In connected and reliable vehicular scenarios, greedy based geographical routing protocols could forward data packets efficiently and quickly towards the destination. However, extremely dynamic vehicular environments and uneven distribution of vehicles could create unreliable wireless channels between vehicles and disconnected vehicular partitions. On the one hand, in connected vehicular networks, an intelligent multi-metric routing protocol must be exploited in consideration of the unreliable nature of wireless channels between vehicles and vehicular mobility characteristics. On the other hand, a mechanism must be utilized to create a virtual bridge between vehicles in disconnected vehicular scenarios. To this end, we firstly propose a novel Stability and Reliability aware Routing (SRR) protocol that forwards packets with a high degree of reliability and stability towards the destination. That is, the SRR protocol incorporates fuzzy logic with geographical routing when making packet forwarding decisions. Routing metrics, such as direction and distance, are considered as inputs of the fuzzy decision making system so that the best preferable neighbour around a smart vehicle is selected. We then utilize a mechanism to cache data packets once the network is disconnected and then switch back to SRR in a connected vehicular scenario. Traffic density is considered as an input when estimating network dis-connectivity. After developing an analytical model of our protocol, we implemented it and compared it with standard protocols. In a realistic highway vehicular scenario, the results show that the proposed protocol performs better than Greedy Perimeter Coordinator Routing (GPCR) with increases of up to 21.12 %, 29.34 % and 3.98 % in packet delivery ratio in high lossy channel, sparse, and dense traffic conditions respectively. In terms of average packet delay, SRR performs better with performance increases of up to 23.92 % in dense traffic conditions. But, GPCR performs better in sparse traffic conditions by up to 36.30 %. Finally, SRR has less control overhead than the state of the art protocols.*

Keywords: Vehicular ad hoc networks, Fuzzy logic, Packet caching, Geographical routing, Reliability, Stability

1. **Introduction.** Recently, the growth in the number of vehicles on the road has put great stress on transportation systems. This abrupt growth of vehicles has made driving unsafe and hazardous. Thus, existing transportation infrastructure requires improvements