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A DELAY AWARENESS IN VEHICULAR AD-HOC NETWORKS BY USING CROSS LAYERED AND COMMUNICATION BASED PROTOCOL

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Abstract- In VANETs (vehicular ad hoc networks), it is very important to make sure consistent and realistic data packet relaying over multiple hops, which is dangerous to many VANET applications. Vehicular communication systems facilitate communication devices for exchange of information among vehicles and between vehicles and roadside equipment. These systems are used to provide a numerous of services ranging from traffic safety application to expediency applications for drivers and passengers. Key challenges in designing protocols for vehicular access networks include quick flexibility to frequent changes in the network topology due to vehicular mobility and delay awareness in data delivery. This paper focus on the design of communication protocols for vehicular access networks where vehicles access a wired backbone network by means of a multi-hop data delivery service. Cross-layer protocol design is another approach to address the mobility issue of the vehicular networks. The pattern of cross-layer design has been introduced as an option to pure layered design to develop communication protocols. Cross-layer design allows information to be exchanged and shared across layer borders in order to enable well-organized and robust protocols. PROMPT is a cross-layer position-based delay-aware communication protocol. It adopts a source routing mechanism that relies on positions independent of vehicle movement rather than on specific vehicle addresses. The position-based routing mechanism of PROMPT helps to eliminate negative effects of high node mobility rates.
Keywords- Confusion matrix, Data Mining, Decision tree, Neural Network, stacking ensemble, voted perceptron.

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Introduction

In recent years, the responsiveness of transportation problems has increased due to rising fuel costs, air pollution,and increased number of accidents. In urban environments, where the population density is high, these problems are more distinct. To improve these problems, Intelligent Transportation Systems (ITS) are proposed to utilize information about vehicle traffic through a communication structure. Such systems are useful in many applications including emergency warning systems, vehicle traffic management, and traveler information. An important component of ITS is the vehicular communication network called VANET that enables information exchange among vehicles. VANET is a self-configuring mobile ad hoc network of vehicles interconnected via wireless link. VANETs' services can be classified as Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V). V2I communication provides connectivity between roadside equipments and vehicles. We propose a new protocol called PROMPT, which is a cross-layer position-based delay- aware protocol that addresses these challenges and delivers packets over minimum delay paths. PROMPT adopts a position-based routing approach to get rid of negative effects of high node mobility rates. Paths are resolute at source nodes based on network traffic statistics collected during propagation of service advertisements of base stations. Taking advantage of the fact that data traffic along roads vary much slower than vehicles' positions, statistics collected in individual nodes are mapped to locations. We introduce analytical methods to map such statistics to delay estimations at source nodes, which allows us to distribute the traffic over all available paths. Protocol overview The PROMPT is designed for V2I systems consisting of vehicles and base stations (BS), each of which is identified with a unique ID. BSs are gateways installed at fixed locations along the road. All vehicles and BSs are equipped with wireless radios for communication. Vehicles are also equipped with Global Positioning Systems (GPS) to aid in location discovery and with digital roadmaps to assist with street information. In this paper, we assume that the location information provided by GPS is accurate. This is a reasonable assumption as GPS error is typically within 15 m range [7].

System Architecture and Protocol overview-

The system supports multi-hop communication to connect base stations with distant vehicles. Vehicles are also prepared with Global Positioning Systems (GPS) to aid in location discovery and with digital roadmaps to assist with street information. In this paper, we assume that the location information provided by GPS is accurate. A BS advertises its services by periodically broadcasting beacon messages in its immediate service area, which is determined by the BS's communication range. This process is referred to as Service Advertisement (Fig. 1). Beacons are propagated outside a BS's communication range (extended service area) via a directional multi-hop broadcasting protocol (Section 4.1). In an urban road network, a vehicle may receive the same beacon over multiple paths. Our protocol determines whether to forward the received beacons based on the path traversed so far rather than the BS information alone. Before forwarding, the vehicle updates the beacon with its current location and local data traffic statistics so that the receivers can obtain detailed knowledge about the path to BS. We follow a location-based source routing approach to send packets to a BS during Data Delivery process (Fig. 1).

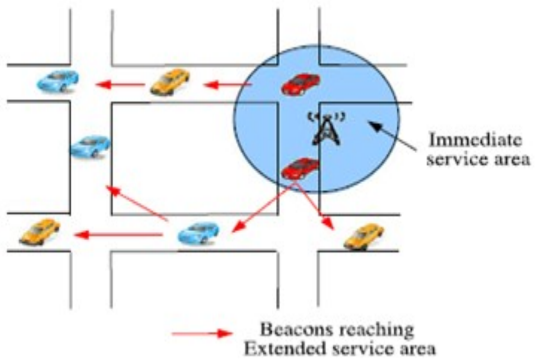

Fig. 1- System Architecture

Whenever a vehicle has a packet to send, it initiates the route selection process to select the best possible route in terms of total path delay from its path information table (Section 5.2). The vehicle leverages the traffic load information collected via beacons in estimating the total delay along a given path. The selected route is then transformed into a path on the roadmap that consists of streets and directions, and the resulting path is attached to the data packet. The MAC layer then sends packets by selecting the relay nodes along the directions contained in packets .

Beacon message handling

Consider a vehicle Vi which receives a beacon Bi whose information is represented as a tuple ðbs; seq; ttl; path, pathinfo), where bs is the id of the base station, seq is the sequence number of the packet, ttl is the TTL; path contains the location of relay nodes, and pathinfo contains statistics collected by relay nodes. These statistics capture the traffic information along the path from Vi to base station Bi. The location of relay nodes is obtained from a GPS system.

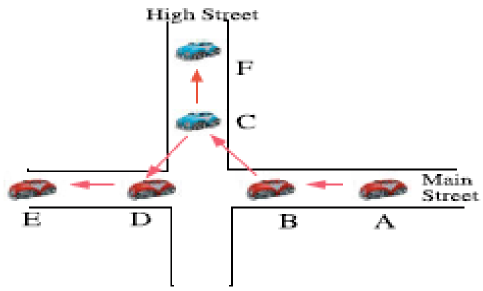

Fig. 2- Beacon propagation example

We then reduce the path to remove redundant (street, direction) pairs. This process consists of three steps: (i)We trim the map path by removing identical consecutive pairs. Consider a case where the beacon is propagated on a single long street s in a single direction d. The map path in such a scenario consists of a sequence of redundant ðs; dÞ pairs, which are reduced to a single pair. (ii) We avoid triangular paths which may occur around intersections, as illustrated in Fig. 2. Such paths can arise since we allow vehicles that are not on source street also to accept the beacons. (iii) Finally, we eliminate loops.

Data Delivery

The data delivery process starts with a sender selecting an available mapPATH from the path information table. We propose a position-based source routing approach which is a combination of source routing and geographic routing. Following source routing principles, packet route is attached to the data packets. However, we use geometric information (street and direction) instead of node IDs to indicate routes. In this section, unless mentioned otherwise, a packet refers to a data packet that is to be sent to the base station. The PathInfo obtained from the path information table is used to estimate the path delay for route selection. In Sections 5.1 and 5.2, we define PathInfo, introduce the delay estimation model, and their relation to the route selection

Result and Output

In this scenario (Fig 3) there are total 19 nodes are stated. Circles represent the geographical area. And dotted line shows the data transfer link between them. In a first circle the data is transferred between node 1 and node 3. Where node 1 is a source node and node 3 is a destination node. And as the AODV protocol is used in this project,so whenever the client will request for the data packets then only the source node will transfer that packets. In this scenario, as the node 3 is in range of node 1 so there will be a reliable data transfer between two nodes. And this will be same with node 14,16 and 15,13.

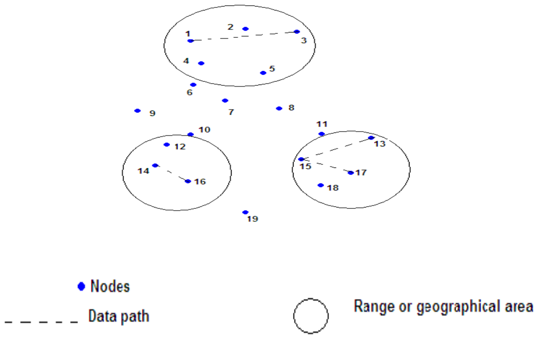

Fig. 3- Data transfer between two nodes in a particular range

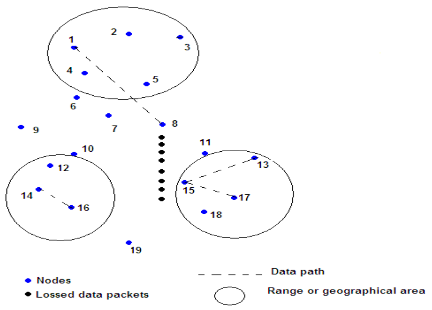

Fig. 4- Delay measurement and Packet loss due to misallocation of node.

In the second illustration (Fig 4) the node 8 is not in range with node 1. So when data get transferred from node 1 to 8 it get lossed due to its mislocation. The data loss is shown by the black dots. So in this way whenever any node who is not in range with source node will fail to receive the data packets. And when source node will come to know that the destination node is not in range then it will retransmit that data again whenever the destination node will come to particular range. It means retransmission will be take place in case of unsuccessful data transmission. And as the node is not in range so the delay time will be measured. So from all this discussion we can say that whenever the destination node will not be in range with source node the delay time will get measured.

Conclusions and future work

In this paper, we propose a cross-layer protocol for VANETs that improves end-to-end delay based on the path information gathered while propagating beacon messages. We show through simulations that such local traffic data can be used to estimate end-to-end delays. Our extensive results show that our model predicts the delay with high accuracy, and hence can be used in delay-aware data delivery applications. PROMPT outperforms DSR, GPSRJ+, VADD,and CAR in term of the end-to-end delay, the percentage of success, and fairness.

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