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Fuzzy Logic Decision Making by Localization and Recursive Algorithm in Vehicular AdHoc Network

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Vehicular AdHoc Networks are the most prominent and efficient technology nowadays. It achieves a high gain by using intelligent transportation systems due to their advanced version. Generally, all vehicle users expect low traffic jams and high degree of safety and security during their travel. It can be achieved by technique called Prediction Based Authentication. We present a fuzzy logic based decision making process by localization and recursion algorithm. It satisfies all the above user expectations like availability of alternative path when the travel route is busy and time minimization with low packet loss. In this algorithm we use two metrics namely position and distance metric for the purpose of easy data transmission. In this approach we do not generate any keys for transmitting the data packets. It will be done by using binary values. By creating adversary nodes the information can easily be transmitted to the neighbour nodes so that data loss can be minimized. Here, the system can operate in both online and off line modes.

Keywords: VANETs, Fuzzy logic, Position metric, Distance metric, On the Board Unit (OBU), Road Side Unit (RSU).

Introduction

Vehicular AdHoc Network (VANET) is an emerging wireless ad-hoc network that enables vehicular communication. In general, Ad-hoc networks are decentralized networks that do not rely on pre-existing infrastructure like routers. The routing process is dynamic in nature where each node participates in routing. In Vehicular AdHoc Network (VANETs), each vehicle is built with networking device called On-Board Unit (OBU) to enable V2V and Road Side Units (RSU) are spread along the road side to allow vehicles within the range. In addition to general wireless and AdHoc characteristics, such as decentralization and Short Transmission range, Here, we use a fuzzy logic method to avoid accidents and find the alternate paths for vehicles at the time of network traffic. In this technique, we use binary values instead of keys used in Prediction Based Authentication (PBA) scheme.[1–3]

Proposed system

The proposed system helps to overcome the drawbacks in PBA. It helps to minimize the verification of time delay for vehicles and it avoids the wrong key generation or replication. This method does not miss any beacon in the given interval of time due to zone splitting approach. It involves the following steps:

- Clustering of vehicles within the boundary region.
- Speed and distance covered by the vehicle in the network are taken into account.
- By using localisation algorithm, location of the vehicles in the network are divided into two zones namely intra zone and inter zone.
- Recursive algorithm helps to update the routing information[4] to the user both in offline and online modes.

Fuzzy system: Fuzzy system is a many valued logic in which the truth values may be any real number and it lies between only 0 and 1. In VANETs, the major function of the fuzzy logic helps to improve the performance by Fuzzylogic greedy algorithm. We use a fuzzy method[4–6] to determine the neighbour node which can produce the best results. These above two metrics are used as an input to fuzzy decision making process. It will lead to selecting the next hop node for sending the data packets effectively. Here, the first step is the process of converting the classical data into numerical value or variable stored in the fuzzy set defined by fuzzy knowledge base system called fuzzification. Defuzzification helps to convert the fuzzy output into classical value using fuzzy set. The system comprises of three processes namely:

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- Interference engine
- Fuzzification and Defuzzication
- Rule based

This is used to remove the false node with the help of advisory node. It helps to identify the node travels in a wrong path. Under such circumstances the advisory node creates a group of clone nodes within the network to monitor routing process and covey the details to all users associated.

B) Algorithm

Methodology

In this work, based on analysis of greedy routing for packet forwarding, we have proposed a Fuzzy Logic based Greedy Routing (FLGR) protocol. FLGR is a multi-hop routing protocol which is used to select the best next-hop node in multi-hop VANETs using fuzzy logic concept. We have considered two characteristics of a vehicle as an input metrics to fuzzy decision making systems. Based on the optimum function of simulation results, the FLGR effectively select the best next-hop node for further packet transmission in the network.

The architectures of system architecture is shown in Fig. 1. Initially all the vehicles in a network can be formed as clustering or grouping based on their zone. The nodes within the zone are called as intra zone vehicles and beyond the zone are called as inter- zone vehicles.

Recursive algorithm: Initially all the vehicles in a network can be formed as clustering or grouping based on their zone. The nodes within the zone are called as intra zone vehicles and beyond the zone are called as inter-zone vehicles.

Action of advisory node: In clustering process, if any one of the node moves away from the zone, the central network sends the signal to the adversary node to indicate the specific node which is not in the zone for the purpose of avoiding traffic or any other critical issues caused by a specified node. This adversary node has a checker ID for communicating with all the nodes in a network. The removing of unnecessary nodes is shown in Fig. 2.

Using localization algorithm: In prediction scheme like PBA, we use keys for data transmission. They are operating only in online mode and these keys can be easily misused. In the proposed approach, the binary values can be used which lies between 0 and 1 and it can be used in both online and offline modes. By using appropriate localization algorithm, it helps to find the vehicle's information like speed and distance between the neighbouring vehicles. It also helps to track the location of vehicles.

Table 1 — Fuzzy Logic based greedy algorithm

1	A network can be constructed with N nodes
2	Represent the Source Node as N and Destination Node as D
3	Define present Node=S
4	While present Node<> Destination Node
5	Identify the list of neighbour nodes to Present Node (i.e.) N (1), N (2).....N (M)
6	For J=1 to K
7	Identify the parameter to be analysed for every Neighbour (i.e.) Packet Loss rate, Data Rate
8	Sender terminates fuzzy logic
9	above steps are to Fuzzify under the technique called fuzzification
10	If (Fuzzy (data rate (N (J)), High) and Fuzzy (Packet loss rate (N (J)), Low)
11	Set (N (J)) =High, should be given priority
12	Else If
13	(Fuzzy (rate of Packet Loss is medium (N (J)))

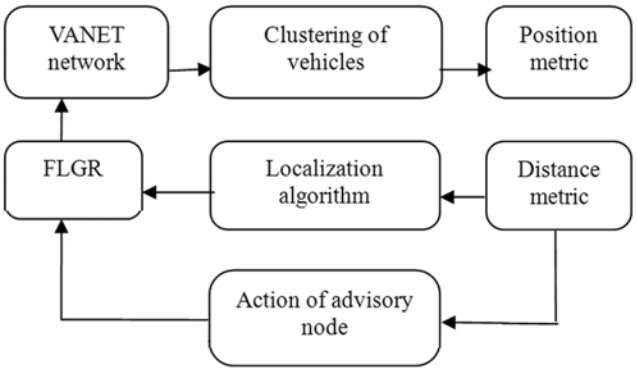

Fig. 1 — System Architecture

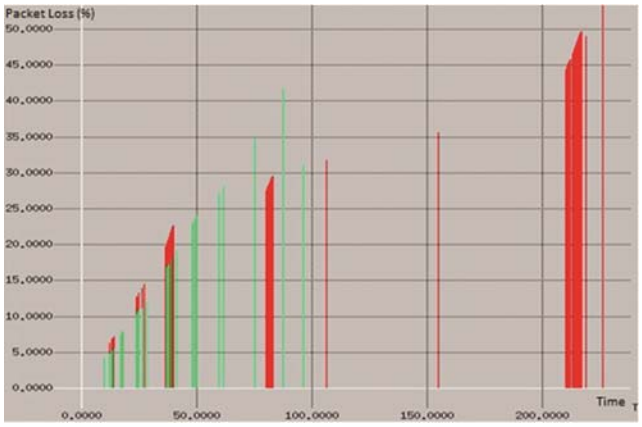

Fig. 2 — Comparison of packet loss between PBA and Fuzzy logic

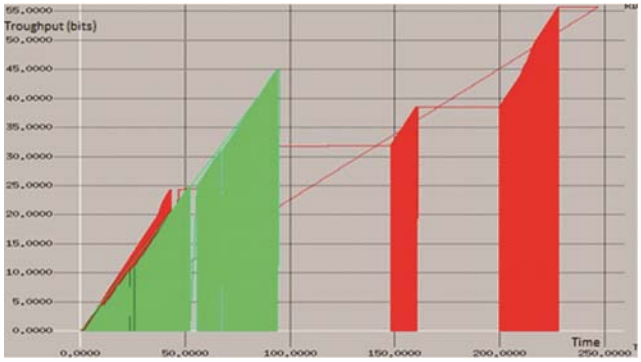

Fig. 3 — Comparison of throughput between PBA and Fuzzy

Results and Discussion

In V2V communication process, the next hop can be selected by a routing path. In this algorithm, all the nodes in the network predict to broadcast their beacons. A sender node tends to receive the beacons from the nodes inside the transmission range and should collect the details about the neighbour nodes. Then, the current node transmits a packet of data to its destination through intermediate node. The process of selecting next hop should consider the two routing metrics—the distance of neighbour node from source and its position from source to destination of every neighbour node. These two metrics are treated as an input for the fuzzy logic process where output is measured for all neighbours. The neighbour node with the maximum value should be given priority to select as a next hop node from the source.

A) Packet Loss

In fuzzy system, collision of packet loss is low compared to PBA. It helps to prevent the packet loss up to 20% so that the life time of a network can be increased as shown in Fig 3.

B) Throughput

C) Route availability status:

The route information can be predicted in three states namely low, good, and expensive. The fuzzy values are 0.5, 0, 1 in low, good, and expensive states. The route information's are named as busy, less traffic and no traffic with respect to route states. Here, users can identify busy routes and it helps to identify the path which is not suitable to travel that is in low state. Whereas good status indicates less traffic, the expensive state indicates no traffic in the route so that they can be easily travelled without traffic jams.

Conclusion

By adapting the above system, the time-critical travellers in vehicular networks can reach timely within a short time span avoiding accidents, traffic jams etc. The goal of the fuzzy logic method in this system is to improve the performance of VANET by using original greedy routing algorithm. By using this system, all vehicle users can easily find the alternate paths instead of busy routes. By this, they can also be safeguarded against road accidents and feel safe while travelling.

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