TRAFFIC MANAGEMENT USING INTELLIGENT TRANSPORTATION SYSTEMS AND VANET FUZZY ALGORITHMS

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Abstract— Traffic congestion, Traffic Jams, densified number of vehicles near some busy overcrowded areas is one of the main problems to be solved in order to decrease latency in locomotive movement, for faster movement of vehicles and prevent jams. This issue can be resolved using some techniques. Traffic congestion in the absence of permanent infrastructure, moving cars can communicate with wireless communication devices within a limited geographic area using a kind of mobile ad hoc network called a vehicular ad hoc network. Additionally, it functions as an intelligent system for traffic management and road safety by disseminating data among moving cars via a wireless sensor ad hoc network, that offers a great deal of opportunities and issues because routing protocols are semi-organized with rules within the restricted physical connectivity for vehicle movement and road topological restrictions. A successful broadcasting is a difficult endeavor given the tools available. Rebroadcasting is hindered by the availability of the node density in a range, which may be overcome by lowering the number via a fuzzy logic-based forwarder selection algorithm.

Keywords—VANET Algorithm, Fuzzy algorithm, ITS.

I. INTRODUCTION

Controlling Traffic and ease in movement of vehicles is one of the most sought problems which need a solution. The following project model uses a technology named VANET for desired output. Vehicle to vehicle (V2V) or Roadside Unit (RSU) to vehicle communication, also known as vehicular ad hoc network or VANET, is a smart network in which moving cars exchange data with one another. We used network simulator for this. The goal of this area is to expand VANET applications, protocols, usage of simulation tools by bringing academics from many fields together on a single platform. In order to effectively disseminate data, a fuzzy broadcast is preferred for Dedicated Short-Range Communication (DSRC) of cars, for which the 5.9 GHz band is developed. The DSRC has enabled a variety of safety applications, including cooperative collision warning, lane change warning and alerting, intersection collision warning, approaching emergency vehicles, and inter-vehicle communications.

The VANET, which enables data interchange between cars, is a crucial component of an Intelligent Transportation System (ITS). In VANET, the cars are equipped with wireless connectivity and computing power to form an impromptu network while moving through the streets. It is possible to exchange information between the cars directly wirelessly even when there is no communication base. Due to the frequently changing speeds of automobiles on roadways, connection topology fluctuates in VANETs. In VANETs, there are primarily two communication nodes: automobiles and roadside base station equipment sometimes referred to as Road Side Units, or RSUs. Either vehicle to vehicle communication or vehicle to roadside base station unit communication occurs. Cars are mobile nodes, whereas RSU are fixed, immobile nodes that are connected to the internet for message transmission and also utilized to provide the geographic position of vehicles given by[1]. Street authentication mechanisms, traffic flow surveillance and administrational applications, in addition to entertainment facilities, are the three major applications offered by VANETs.

An effective forwarding technique is required to send the data to the correct location in order to complete the aforementioned applications. When choosing an effective communication channel, the following issues need to be taken into consideration: (1) choosing an effective multi-hop path; and (2) offering consistency in information transmission to the subsequent forwarding node.

II. METHODOLOGY

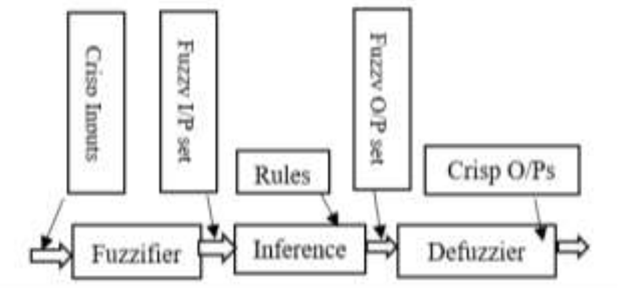
Enhancing traffic safety by communicating emergency information to other vehicles. However, it is difficult to deliver a viable broadcast service in VANETs due to the continual mobility of vehicles. Therefore, we suggest a method that employs network coding to cut down on the number of retransmissions while also using fuzzy logic to select the forwarding nodes with the use of the fuzzy logic toolbox in the network simulator.

VANET Technology

Vehicular Ad-Hoc Network, often known as VANET, is a technique for building mobile networks that uses moving automobiles as network nodes. We may argue that VANET transforms each vehicle into a wireless node, enabling vehicles to communicate to one another even when they are 100–300 meters apart and therefore building a vast network. As vehicles leave the current network owing to signal range limitations, additional vehicles can join in to interconnect automobiles to one another in order to form a mobile Internet. It is anticipated that police and fire trucks would be the first systems to incorporate it in order to communicate with each other and ensure safety. So that safety and security of the vehicles are moved collectively in an ordered fashion which ensures well being of vehicles movement.

A.Algorithm

In the traditional routing techniques, each sender node specifies a single forwarding node (next hop) for



Block Diagram 2.1

disseminating the data around the network. For each primary forwarding node, the suggested method specifies a secondary forwarding node. The primary node selects the secondary node. The secondary node advances the packet in support of the primary node if a packet is lost at the primary node. Using the fuzzy logic method, we examine several variables of inter-vehicle distance, node mobility, and signal intensity to determine the principal forwarding node. Each node keeps an evaluation result for each adjacent nodes in this way. When choosing the major and secondary forwarding nodes, these assessment results are taken into consideration. This study chooses the precise number of nodes to forward messages using the fuzzy approach. They can effectively deal with ambiguous issues. The fuzzy logic elements can be changed depending on the street scenario and traffic patterns in the VANET system as explained in [2].

By modifying the inclusion functions and fuzzy rules, fuzzy logic may be configured to fit any VANET scenario. Fig 1 depicts Greedy driving by dis- patching the highest number of packets (D max) from the source (S) to the destination (D) via the nearest - neighbor node. N. However, due to its proximity to the source node, N is suitable for taking part in this process even if C is also present in level-1 next to node S. In terms of anticipated transmission process, this methodology offers superior trans-mission quality.

- The nearest neighbor to the target receives packets from the source node. When a node receives packets from a neighbor, it immediately sends them in that direction to the closest closer. Up until a high hit ratio is achieved, this process is repeated. Comparisons between the multipoint relay (MPR) broadcast scheme and the flooding scheme are made in terms of mobility, range, and RSI (RSSI). The MFR (Most Forward Within Radius) technique forwards packets to the closest neighborhood in accordance with the node's maximum progression. According to the comparison, these types of procedures belong to the non-fuzzy category as explained in [3].

- There are four inferences: A, B, C, and D. When the rebroadcasting node is chosen based solely on grade A, it can occasionally exhibit behavior similar to that of non-fuzzy algorithms. There can be a broadcasting node chosen that is at least C or greater to avoid this issue.

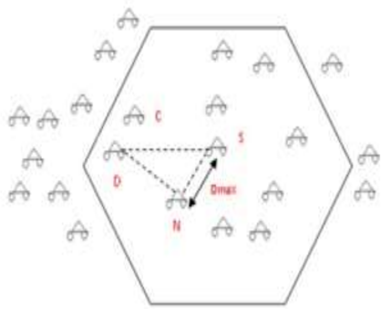


Fig 2.2 Source node A in figure transmits the message through

intermediary nodes C, F, and J to destination node L. Grade "C=good" is appropriate for choosing the rebroadcasting nodes in Table 2 to minimize the number of hops.
To complete the challenge, grades of A (perfect) and B (very excellent) can be used, however hop count is increased by inferences.

Input parameters with calculation from fuzzy algorithm
TrafficCI = Traffic Control system
get present speed ( ).x = max speed
x = horizontal direction
Get WSM data ().x = wave short message data = 1
n = no` of surrounding nodes
range = 300mts
range effective distance = 294mts
bet= Bernoulli trial
example: 1.Range - effective Distance less than or equal 10 then N =3
300-294 less than or equal 10 then bet=1
2. 300-292 greater than or equal 6 and less than or equal 8 then N = 6, bet= 0.9

Table 2.1

Range effective Distance (mts)	Bernouli trail (bts)
20	1
30	0.9
40	0.8
50	0.7
60	0.6
70	0.5
80	0.4
90	0.3
100	0.2
110	0.1

The above table 2.1 depicts the Range effective bet value

Similar evaluations can be made for the following values up to the actual distance of 276 m, or bet is 0.1.

- Data for the fuzzy algorithm can be gathered from pre-existing works and various network contexts. The emergency message received for the car has a great distance, a high speed, and less density (within the transmission range of 300 m) from the vehicle met with an accident, and this is made abundantly evident. Then, it can be treated as bet (Bernoulli-trial) = 100%; otherwise, bet percentage can be decreased in accordance with the algorithm's stated requirements. The algorithm used to choose a forwarding node has three separate parameters: the distance between vehicles, the mobility of the node, and RSSI (Received Signal Strength Indication). Relay nodes algorithm is used to choose necessary forwarding nodes as follows.

B.Performance Analysis

Performance analysis here is measured in three factors, as listed below

1.Distance

Anode calculates distance factor (DF) upon receiving a message from neighbour X1 indicating an emergency . The distance between the existing node and node X1 is represented in this equation by d(X1). The maximum range that reliable communication can be established is R1. Let's assume that each node has a shared signal strength and attenuation.

$$DF(X1)=\begin{cases} d(X1)/R1 & \text{when } d(X1) \le R1 \\ 1 & \text{when } d(X1) \ge R1 \end{cases} \quad (1)$$

2.Mobility

When a node receives an emergency message from a surrounding X1, it computes a mobility factor (MF1) .

MF1 shows the mobility level of the surrounding\snodes.

The adjacent node's consistency increases with MF1 value. The length between the present and the surrounding nodes at time t;beta with the smoothing factor 0.7 is represented here by dt (X1). The exponential average function of MF1 appears to smooth out various mistakes when MF1 = 0 . The MF1 did an intensive analysis using a variety of samples, and it was agreed that the SS value should be 0.7.

$$MF1(X1) \leftarrow (1-\beta)\, MF1(X1) + \beta(1- (dt(X1) - dt-1\, (X1)R1)/\,) \quad (2)$$

3.Density

The density of a road is the number of vehicles per unit length. The amount of vehicles per km per lane, or 10Veh=km=Lane (for four lanes= 40vehicles), when the delay time is 0.37 s, and for 30Veh=km=Lane (for four lanes= 120Vehicles), where the delay time is 0.58 s, can be used to assess density. According to analysis, there must be a delay in the broadcasting of emergency messages when the sender nodes send them to their destinations. The vehicle with the shortest delay may be given top priority.

$$WaitTime1 = (Maxw1T1/Range1).d1 + Maxw1T1 \quad (3)$$

III. PROCESS AND REQUIREMENTS

A. Simulation Parameters:

There are certain Parameters for Simulation to run. Some of them are desired to be in specific range of values.

1. Area Dimensions :100m*100m is the coverage area of our working model
2. Number of nodes: Each individual node represents the vehicle in the network maximum and minimum no nodes connection occurs between 40 to 240 nodes for effective broadcast among them.
3. Mobility generation: Broadcast take place among the nodes in arbitrary mode based on requirement of nodes data exchange
4. Number of packets Communication between nodes occur by exchange packets maximum 200 packets can utilized where each packet capacity range is 512 bytes
5. Data rate Data transmission rate among the node are two packets per rate
6. MAC IEE 802.11, WAVE Standard is used.

B.Software Requirements

NETWORK SIMULATOR-2

The event-driven modelling programme known as Network Simulator (Version 2), or NS2, has proven beneficial in researching the dynamic behavior of communication networks. Using NS2, it is possible to simulate both wired and wireless network operations and protocols (such as routing algorithms, TCP, and UDP). Generally speaking, NS2 gives users a mechanism to define these network protocols and simulate the related behavior. Some Salient features of this software are:

- Version 2 of the network simulator is intended to facilitate networking research as well as teaching.
- Simulation is also used in protocol design, traffic research, and other areas.
- In Network 2, it is also possible to compare protocols
- Moreover, modern architectural designs support.
- To foster a cooperative atmosphere
- The network version is open source and available for free.
- Boost confidence in the simulation's findings.
- The network also serves to create the network topology and structure.
- The environment of your simulation, which is also only its surface,
- Even in network simulation, configuring your network parameters is simple.

IV. RESULTS

After executing the written code in Network Simulator-2 Software, we can obtain these results:

Fig 4.1 and 4.2 depicts shows the model before broadcasting and each green circle represents individual vehicle's energy. All of them are at their initial positions or coordinates. Each node represents a vehicle which moves randomly in traffic and speed, mobility can be scaled accordingly.

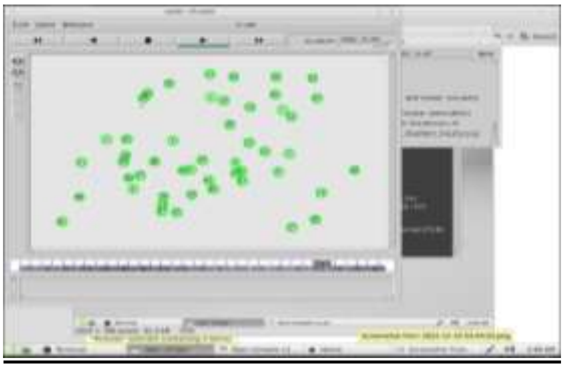


Fig 4.1 Network deployment

Fig 4.3 represents the VANET Model after broadcasting. Here program is made to run, so we can see each vehicle is under broadcasting which is depicted by circles around each vehicle. Here before running it, we can adjust Step Size according to the requirement.

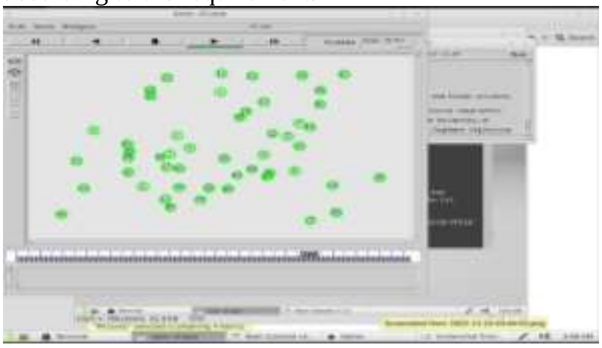


Fig 4.2 Network environment before broadcasting

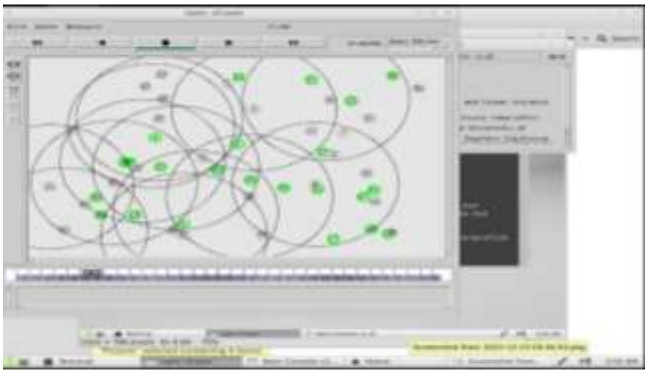


Fig 4.3 Broadcasting process in network

After completion of broadcasting, with the help of FUZZ Algorithm the vehicle itself finds the best and optimized route to travel for reaching final destination in least possible time.

V. CONCLUSION

The following measures must be taken into consideration while choosing an ideal forwarder node in a fuzzy logic-based algorithm: vehicle in comparison to non-fuzzy approaches, distance, mobility, and density are used to choose the next forwarder node for the best performance in terms of latency, hop reduction, rebroadcast counts, data packets received, packet dissemination ratio, and broadcast packets received. The effectiveness of the suggested method is demonstrated by comparing it to existing protocols and by lowering the number of nodes in diverse networks of varying sizes. A fuzzy broadcast performs better when different parameters are used in various situations. For the rapid dissemination of emergency signals with minimal confusion, a smart and effective selection of supernumerary nodes is necessary.

To offer broadcasting in VANETs, an effective and trustworthy choosing of forwarding nodes is absolutely necessary. In this case, the fuzzy system is utilized to choose forwarding nodes so that the data packets may be sent through more precise and dependable paths to their final destination. Additionally, network coding is implemented, which reduces the need for retransmissions. In this study, random nodes between 100 and 600 are created, and their properties are assessed. The fuzzy logic system receives three inputs, including the inter vehicle distance, signal strength, and movement, and outputs the rank for selecting the optimal forwarding node for message transmission. MATLAB software was used to evaluate the system.

VI.FUTURE SCOPE

1.We can further improve the project by adding speed of the vehicle parameter. So, with that inclusion, dynamically measure speeds of vehicles and we can use it accordingly to control it or to communicate other vehicles about speed.

2.We can assign priority to some Emergency service vehicles and Disaster management teams in order to move them faster to the destination by alerting and making the other vehicles to give space for those vehicles.

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