EVALUATING SHORTEST PATH in VANET by USING DIJKASTRA and BELL MANFORD

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ABSTRACT: **Vehicular ad hoc network (VANET), a subclass of mobile ad hoc networks (MANETs), is a promising approach for future intelligent transportation system (ITS). Various techniques have been proposed so far to calculate shortest path in VANET by different researchers. This paper presents comparison has been drawn between bellman ford algorithm and Dijkastra's algorithm to calculate the best available path which reduces the problem of delay. Calculating best shortest path gives useful information to registered users to travel on best available path. In this research work is done to evaluate the performance of proposed algorithms. The results of algorithm are compared to travel on best available path.**

*Keywords-***Vehicular Ad-Hoc network, Connection Availability, algorithms, Performance Evaluation, Route Planning**

I. INTRODUCTION

VANET is a form of Mobile ad-hoc network, to provide communications among nearby vehicles and between vehicles. It is a technology that uses moving cars as nodes in a network (mobile network) so each vehicle can receive and transmit others messages through the wireless network, Evaluating shortest path in VANET deals with calculating best available path from source to destination for registered users. For calculating best available path an effective approach is needed. Computing the shortest path between two locations in road networks is a challenging task in vehicles routing area and related transportation, distribution and logistics industry. Choosing a suitable route planning algorithm from the numerous algorithms proposed. VANET has main two applications which are related to route planning and traffic safety. Route planning aims to provide drivers with real-time traffic information. As shown in Fig 1.

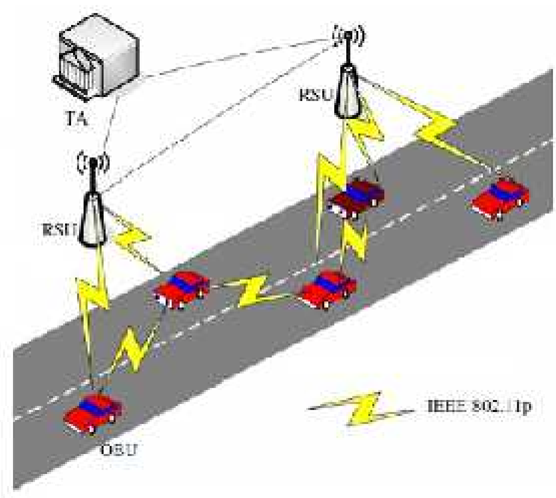

fig1: vanet model

In the recent years, vehicular networking has gained a lot of popularity among the industry and academic research community and is seen to be the most valuable concept for improving efficiency and safety for transportations. VANETs can be utilized for a broad range of safety and non-safety applications, allow for value added services such as vehicle safety, automated toll payment, traffic management, enhanced navigation, location-based services such as finding the closest fuel station, restaurant applications such as providing access to the Internet. Vehicle-to-vehicle communication systems are an important component of VANET and useful for a wide variety of applications that include incident detection, crash reporting, congestion warning and traveller information dissemination.

Fig2 will show the working scenario of evaluating best available shortest route in VANET. This will be adapted from Vi Tran Ngoc Nha et al. [16].

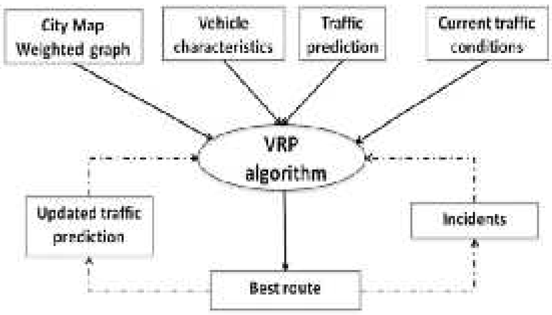

fig2: vehicles' route planning model

II. RELATED WORK

Anuj Puri et al. [1] have suggested wireless Token Ring Protocol (WTRP) is a medium access control protocol for wireless networks in Intelligent Transportation Systems. WTRP is efficient in the sense that it reduces the number of retransmissions due to collisions.

Jawalkar D.M et al. [2] has described Improving Road Accidence Monitoring Using Road Traffic Simulation in VANET in which the Intelligent Transportation Systems (ITS) are aimed at addressing critical issues like passenger safety and traffic congestion, by integrating information and communication technologies into transportation infrastructure and vehicles.

Jing Zhao et al. [3] have suggested the multi-hop data delivery through vehicular ad hoc networks is complicated. The idea adopted is carry and forward.

Ashutosh et al. [4] has suggested Application For Marketing Executives Implementing Dijkstra's Shortest Path Algorithm in Android Device which is used to find out the shortest path between two places on Google map. Dijkastra's algorithm is very fastest and easy to implement where there are no negative weights. GPS gives the current location of device.

Zhang, Mingliu et al. [5] has described a border node based routing protocol for partially connected vehicular ad hoc networks in which the challenges of VANETs in sparse network conditions, review alternatives including epidemic routing and propose a Border node Based Routing (BBR) protocol for partially connected VANETs.

Massimiliano et al. [6] has suggested traffic monitoring system implemented through Wireless Sensor Network (WSN) technology. Which provide a flexible, robust, low-cost and low-maintenance wireless solution for obtaining traffic-related data that can be used for automatically generating safety warning.

Khatri et al. [7] has suggested the behavioural study of VANET protocols in which several unexpected disastrous situations are encountered on road networks daily, many of which may lead to congestion and safety hazards. Main challenges in Vanet are of searching and maintaining an effective route for transporting data information.

Zongwei et al. [8] have suggested Ubiquitous Query for Travel Information (UQTI) in Intelligent Transportation System over Mobile Relay Network (MRN) to facilitate the needed information access for drivers on the road. Design can achieve much higher packet delivery ratio in network with poor connectivity with tolerant delay.

Rajive Bagrodia et al. [9] have suggested the accurate and efficient evaluation of vehicular network applications such as Intelligent Transportation System (ITS) is based on simulation which integrates transportation simulation and wireless network simulation. Simulation provides dynamic interaction between two simulation domains, which control the vehicles at runtime.

Yuh-Shyan et al. [10] has suggested Routing Protocols in Vehicular Ad Hoc Networks: A Survey and Future Perspectives in which the unicast protocol, multicast protocol, geocast protocol, mobicast protocol, and broadcast protocol is discussed which observed that carry-and-forward is the new and key consideration for designing all routing protocols in VANETs.

Izzat Alsmadi et al. [11] has suggested the security issues and how security can be improve in mobile banking services by using RFID. RFID enabled phone for mobile banking security, which solve problems of identity or credit card thefts or security.

Vahid et al. [12] has described Vehicular Ad-Hoc Networks (VANET) applied to Intelligent Transportation Systems (ITS). Research work has focused on specific areas including routing, broadcasting, Quality of Service (QoS), and security, making VANETs a reality in the near future.

Rizzoli.et al. [13] has suggested A Simulation Tool for Combined Rail/Road Transport in intermodal Terminals. The presented terminal simulator plays the important role of the bimodal node in the transport network.

Karnadi et al. [14] has suggested Rapid generation of realistic mobility models for VANET a tool MOVE which is based on an open source micro-traffic simulator SUMO. MOVE allows user to quickly generate realistic mobility models for vehicular network simulations.

K Sampigethaya et al.[15]has suggested the CARAVAN: providing location privacy for VANET in which it is possible to locate and track a vehicle based on its transmissions, during communication with other vehicles or the road-side infrastructure. This type of tracking leads to threats on the location privacy of the vehicles. Ngoc Nha et al. [16] has suggested 'A comparative study of vehicles' routing algorithms for route planning in smart cities which identifying major issues and challenges associated with different protocols and selecting the optimal protocol. One of the main challenges in Vehicular ad-hoc network is of searching and maintaining an effective route for transporting data information.

Ying et al. [17] has suggested Privacy preserving broadcast message authentication protocol for VANETs

in which simulation results demonstrate that PPBMA has superior performances in terms of packet loss rate and message delivery latency when compared to existing solutions.
Sona et al. [18] has suggested identifying major issues and challenges associated with different protocols and selecting the optimal protocol for future work. One of the main challenges in Vehicular ad-hoc network is of searching and maintaining an effective route for transporting data information.

III. PROBLEM DEFINITION

This method deals with calculating best available path in VANET by using Dijkastra and Bellman ford algorithm. The main goal of this research work is to reduce the problem of delay due to congestion and providing best available route to the registered users. To achieve the objectives we have taken RSUs as nodes in a graph and apply different shortest path technique on it. To evaluate the quantized difference between Dijsktra and Bellman ford different parameters will be used as distance, optimal route, cost of the route, time complexity etc.

IV. RESEARCH METHODOLOGY

The main goal of query is concentrated on find best available path from source to destination by comparative study of algorithms. Three main steps are taken to find out best route which are explained as follows in flowchart. The proposed method is implemented using MatLab

Step 1: calculate an initial best route from the origin location of the vehicle to its desired destination according to a chosen algorithm (e.g. Dijkstra Algorithm etc.) as shown in fig3.

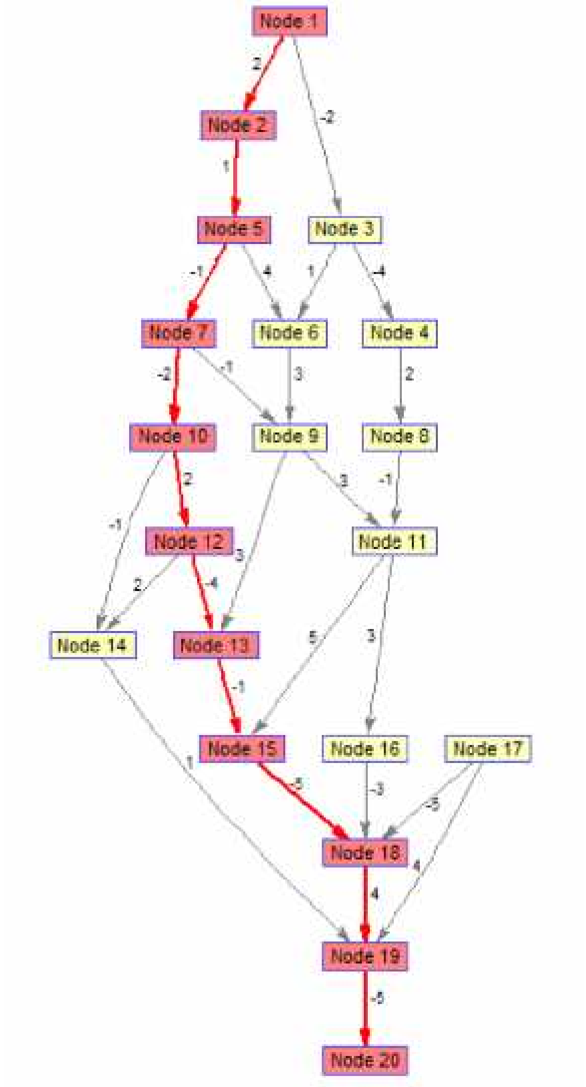

fig3: Best available shortest path which shows small distance covered in less time

Step 2: Re-calculate the best route due to an update in traffic conditions. In this case, whenever a vehicle reached an intersection, the traffic conditions are checked for any update. If there is an update impacting at least on link in the best route, the affected links are removed and the route planning algorithm is re-applied to calculate a new best route for the vehicle. Otherwise, the vehicle carries on its journey.

Step 3: Is the destination location reached? If no, the step 2 is repeated until the vehicle reaches its last intersection and arrives at its desired destination.

The flowchart in Fig 4 shows research methodology.

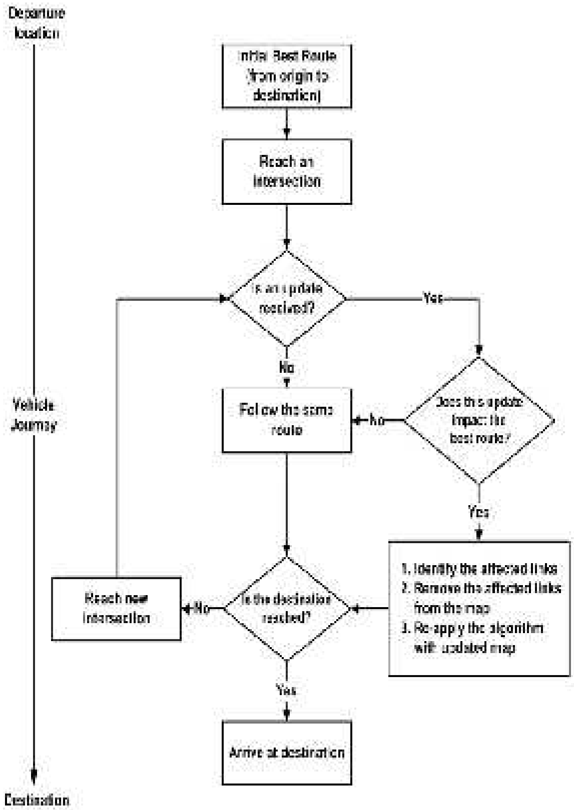

Fig4: Research methodology

V. PERFORMANCE ANALYSIS

The main goal is to find the shortest distance from source to destination by comparative study of algorithms. This will give us the best available path or route to reach at destination so that the problems of delay can be reduced.

In this we have to check following parameters:-

1**)** *Optimal path*: RSU should provide user information about safer and more comfortable driving route. Based on this metric, route planning algorithm aims to find a vehicle route satisfying driver's preference the most.
2) Travel distance: Finding the shortest path means searching the route from the origin location to the destination through which the vehicle travels the shortest distance.
3) Travel cost: The travel cost defines the total cost from source to destination. Suppose cost unit is Rs 2 per kilometre.
Cost= Distance x Cost unit
4**)** *Elapsed time*: The travel time is another criterion for route planning algorithm. The fastest route is the path through which the vehicle can reach its destination with within minimum travel time.

VI. COMPARISON BETWEEN DIJKASTRA AND BELLMAN FORD

Table 1: difference between Dijkastra and Bellman ford algorithm

Parameter	**Dijkastra**	**Bellman ford**
Overheads	Less	More
Scalability	Easy	Complex
Quality of the best route.	Less	More
Negative edges	No	Yes
Delay	More	Less

1) Overheads: Overhead consists of extra computations that are to be performed to get the results. Bellman ford gives better results than Dijkastra's.
2) Scalability: Another factor is scalability. The scalability of an algorithm reflects the decrease of performance when the size of the road network gets larger.
3) Quality of the best route: This is used to compare the different best routes in order to determine which algorithm is calculating the closest solution to the optimal route.
4) Negative Edges: Dijkastra's does not work on negative values but bellman ford work on negative values.
5) Delay: The time taken by Bellman ford algorithm is small as compare to Dijkastra's algorithm.

VII. RESULT AND PERFORMANCE ANALYSIS

The experiment is performed by taking 20 nodes. The results show that the bellman ford gives better results as compared to the Dijkastra's to reach at destination. By Bellman ford algorithm the distance covered by a vehicle is smaller as compare to Dijkastra's and time it takes to reach at destination is also less as compare to Dijkastra's. Bellman ford work works on negative as well as positive edges but Dijkastra's only work for positive edges. We have concentrated on finding shortest path in small time. The table illustrates the performance of Bellman ford and Dijkastra's algorithms. As a result best available path is found in less time.

Table 2: Bellman ford algorithm vs Dijkastra's that shows the optimal path

Source	**Destination**	**Bellman ford path**	**Dijkastra's path**
1	20	1,2,5,7,10,14,19,20	1,3,4,8,11,15,18,19,20
1	19	1,3,6,9,11,16,18,19	1,2,5,7,10,12,14,19
1	17	1,3,6,9,13,15,17	1,2,7,10,12,13,15,17

1	16	1,2,5,6,9,11,16	1,3,4,8,11,16
1	15	1,2,7,9,13,15	1,3,4, 8, 11, 15
1	14	1,2,5,7,10,14	1,2,7,10,14
1	12	1,2,7,10,12	1,2,7,10,12
1	10	1,2,7,10	1,2,7,10
1	9	1,3,6,9	1,2,7, 9
1	7	1,2,7	1,2,7

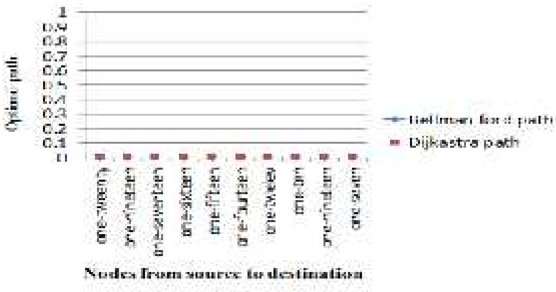

fig5: Nodes from source to destination vs optimal path

Table 3: Bellman ford algorithm vs Dijkastra that shows the distance covered

Source	Destination	Bellman ford Distance	Dijkastra's Distance
1	20	-10	15
1	19	4	13
1	17	3	22
1	16	-15	16
1	15	-13	11
1	14	-4	14
1	12	-7	7
1	10	-2	7
1	9	1	8
1	7	-8	10

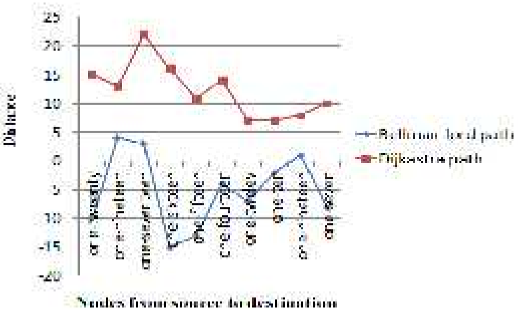

fig6: Nodes from source to destination vs distance covered

Table4: Bellman ford algorithm vs Dijkastra that shows the cost of best available path

Source	Destination	Bellman ford route cost	Dijkastra's route cost
1	20	20	30
1	19	8	26
1	17	6	44
1	16	30	32
1	15	26	22
1	14	8	28
1	12	14	14
1	10	4	14
1	9	2	16
1	7	16	20

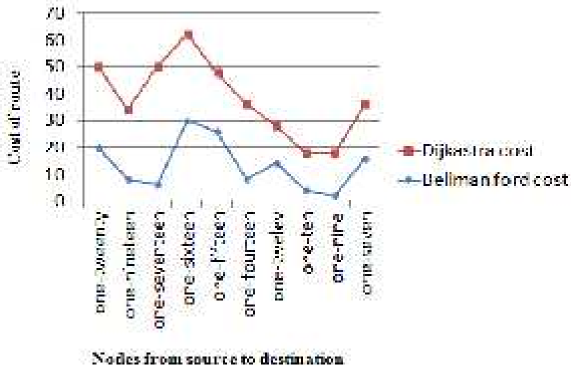

fig7: Nodes from source to destination vs cost of best available route

Table 5: Bellman ford algorithm vs Dijkastra that shows the elapse time

Source	Destination	Bellman ford time	Dijkastra's time
1	20	0.34	3.19
1	19	0.79	1.96
1	17	0.30	4.62
1	16	0.29	20.96
1	15	0.82	2.94
1	14	0.79	37.35
1	12	0.32	4.55
1	10	0.30	4.03
1	9	0.33	4.62
1	7	4.73	6.19

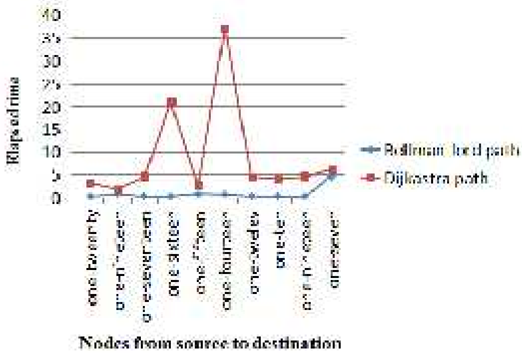

fig8: Nodes from source to destination vs Elapsed time

VIII. CONCLUSION

It is shown that "Evaluating shortest path in VANET by using Dijkastra's and bellman ford" algorithms that provides better results. Suitable simulation is done in MATLAB by considering the problem of delay during computing the best available path. A comparison has been drawn among available shortest path algorithms in VANET. To achieve the objectives we have taken RSUs as nodes in a graph and apply different shortest path technique on it. It is shown in the results that bellman ford provides better results than the Dijsktra's algorithm. The time and distance covered by Bellman ford is less as compare to Dijkastra's.

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