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PERFORMANCE EVALUATION OF FLYING WIRELESS NETWORK WITH VANET ROUTING PROTOCOL

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Abstract: The growing amount of vehicles on roadway is the key motivating the establishing of the road safety with comfort and undisturbed traffic flowing. Vehicular adhoc network is a trending wireless methodology that enable an unwired connection between the automobiles to have a highly secured driving with comfort. The vehicles connected wirelessly communicates with its nearby vehicle with the help of an on road circuitry and the mobile circuitry inside the automobile, sharing information either as caution preventing from unwanted fatalities or a guidance in travel. These automobile networks are crafted using the vehicles as their motile nodes and are instantaneously framed on the availability of the automobiles without the support of the ground stations may also be noted as flying wireless network due to their high motility. The conveyance between the vehicles is subjected to two strides. As a conveyance between automobile to automobile and the automobile to ground station. These wireless communication are to be pillared by the proper entrenchment of the message path to evade the unnecessary incidents. The prevailing methods of finding the path and to have formal delivery, suffers loss either by delaying incurred or the high bandwidth usage or reduced network life span with message losses. The proposed provides a well-engineered methodology to have enhanced reliable information sharing ensuring an infallible functioning with minimized delay, extended network lifespan, and an unfailing handing over to avoid the information losses provided with the optimized road safety and comfort. The proposed system is evaluated on the grounds of delay, network lifespan, and packet delivery ratio to confirm its well-ordered functioning when compared to the existing methods.

Keywords VANET, Flying wireless network, Routing protocol, Packet delivery ratio, Network lifetime and Delay

1. Introduction

Though the outstanding advancements in the technology of automation has ensured a better road safety, but the disquieting number of accidents that takes place has never abbreviated. The effective use of the upcoming technologies is believed to evade the disasters occurring on the roadway during transportation by extending

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communication between vehicles using wireless medium or the personal communication device of the driver and base station. This communication offered between the vehicles turns out to be a safety measure in eluding the fatality incidents providing protection and environmental benefits. The communication enables the vehicles to know about the very close and the possible dangers that are caused by the vehicles or the natural disasters. This communication to offer safety measure for on roadway vehicles is known as Vehicular adhoc network (VANET). Vehicular Adhoc network are a part of mobile Adhoc network where the vehicle take the place of mobile node or the data points. These vehicular wireless communication allows an instantaneous information exchange between the vehicles by the electronic circuitries that support the communication. The electronics circuitries found inside the vehicle and the sides of the roadway help the vehicular communication to take place between the vehicles and to extend the communication from vehicle to its road side electronic circuitry. The communication extended between the vehicles are known as vehicle to vehicle communication and that which is extended between the vehicle and the road side circuitry is called vehicle to infrastructure communication. The vehicular Adhoc network similar to the mobile adhoc network are formed by the instantaneously available vehicles without any frame work. They possess the same properties of mobile adhoc network that they are patterned on their own, and can perform the restoration of their lost network and rearrange them and protect them on their own. The vehicle communication is entailed in great degree for the roadways that suffer from heavy traffic and increased number of fatality rates. The communication enables the operator of the car to have knowledge of the vehicle coming on the opposite side, the traffic, damages caused in the roadway taken, and the best roadway to be taken and even more. The communication from one automobile is passed to the other by transferring the messages using the inbuilt electronic circuitry in the automobile (ECV) to the roadway side circuitry and from the roadway side circuitry (ECR) to the next vehicle or node through its electronic circuitry that is inbuilt. The information passed is usually contained with the location of the automobile, its swiftness and the type of the automobile. The information required for the next automobile is processed from these particulars and sent as either warning or an alarm to the automobile. The nodes involved in the vehicle adhoc network are highly mobile with a predictable traffic metering. The roadway safety is ensured by the swift warning message transmission without any loss of data or delay in the conveyance. The loss of the data would result in improper message delivery and the delay incurred would make the system inefficient resulting in fatal accidents. This reveals the essentiality for the proper routing of the device to have a befitting timely delivery of the information and a proper changeover. The failure in proper handing over also would end up with the endangered scenarios. There are few types of routing that can be used in the vehicular networks are categorized based on the way of methods used for discovering the pathway. The information sharing to be extended without seam is the significant part of the route establishment. Some of the techniques available for routing are either based on the location of the vehicle, by using the diverse topology methods, cluster based and routing based on flooding methods. The available conventional methods of routing for VANET would present a timely delivery at the cost of increased bandwidth and overhead or delayed delivery with minimization on the lifespan of the system with So inclination of the routing that best suits the application would assure an improvised lifespan for the network and packet delivery

ratio causing a reduced overhead and delay management with a proper handing over so as to reduce the packet loss when the vehicle is subjected to move from one ground station to the other.

The paper proposes the enhanced routing, for this highly motile vehicles that is established whenever a route is necessitated, to elude the unwanted entrenchment of pathways that are not used, for ensuing a diminished overhead and limited bandwidth usage as well as to attain a reduced delay in the conveyance with heightened packet delivery ratio and increased life span and a assured handing over so the vehicle could decide with the appropriate ground station providing a highly safe and stable communication that is reputable. The performance measure of the proposed system is done on the grounds of the delay, packet delivery ratio, network lifetime and throughput to assure the system efficiency.

The remaining paper is devised with 2 related works on the vehicular network and its routing methodologies, 3 proposed work on the enhanced on demand routing protocol, 4 giving the result evaluation 5 the conclusion

2. Related Works

Zeadally et al [1] the tremendous advancements for the improvisation of the road safety and efficient traffic handling, convenience and comfort is caused due to the standardization of VANET. The novel architectures of VANET for wireless access standards to have ubiquitous VANET is given. Hartenstein et al [2] is survey on the VANET that is a remarkable area of wireless communication to provide over view of the system flow patterns, licensed spectrum, and challenges involved in the wireless environment for Vehicle Adhoc. Raya et al [3] provides with the security measures to elude the threats constructing an efficient architecture to analyze the robustness enabling protection and privacy. Liu et al [4] address the problem on co-operative data scheduling maximizing the number of vehicles that retrieve the data under requisition and construct a polynomial time reduction using weight sum of maximum possible values. To show that co-operative data scheduling is NP-Hard. It builds a simulation model for the traffic in real time and communication features to explain the scalable and superior nature of the system. Ahuja et.al [5] gives the usage of the efficient routing protocol to minimizing of the traffic congestion and vehicle crashes for the VANET that is without frame work and analyses the working based on the throughput and end to end delay comparing it with the proactive routing protocols. Eze et.al [6] provides current research and challenges faced by the vehicle adhoc network and the remedies for them envisaging improvement in the road safety, causing less traffic congestion by developing an intelligent transport system by using internet of vehicles with wireless access on IEEE 802.11p. He et.al [7] SDN enabled swift vehicle adhoc communication including heterogeneous wireless devices, road side units that are been set as a SDN switches to enjoy the advantages of

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deploying adaptive protocol and isolation of the multi user and are evaluated to find the feasibility and effectiveness by traffic tracking based simulation. Li et.al [8] is an attack resistant trust management scheme to evade the threats caused by communication and control methodologies providing unique security and privacy with the ability to detect and protect for dangerous attacks and evaluated through experiments to offer road safety, motility, and environmental protection. Rajesh et al [9] is a path observation routing protocol with the relative distance, direction and midrange forwarder node to avoid the packet drops and high delay and establish stable links. Wagh et al [10] is an intelligent transport system that discovers the route with the help of the ant-lion optimization to provide with the better quality of service reducing the complexities in the system and have a minimized routing cost. Jagatheeswari et al [11] uses an efficacious message authentication three hop protocol by replacing of the certificate verification list by revocation process of checking using hash message protocol. Singh et al [12] uses time division multiple access for entrench of the path between vehicles allowing each vehicle to communicate in the time slots given. This system uses a time lay technique by synchronizing clocks by dividing the network into zones and selecting a zone heads. The evaluation of the system functioning empowers the system in having a high packet delivery ratio, enhanced route life time. Sun et al [13] the obstacles faced by the VANET is overcome using the vehicle as relay agent to effectively reduce the shadowing effect in the communication enhancing the quality of the information sharing, delay and rate of success. Liu et al [14] considers the use of the spatial and temporal motion and forms a least overhead and causes a message broadcast based on the location for the purpose of route discovery with enhanced accuracy.

3. Proposed Methodology

The vehicular adhoc network that functions supported by the basics of the mobile adhoc network is a significant part of the intelligent transport systems and are also known as the intelligent transport frame work. This intelligent transport network of VANET provided with the inter-automobile communication is the network of flying devices that have high motility. The frame work crafted for these on-the-fly devices are instantaneous and is not supported the existing structures used in the normal wireless communication methodologies. The instantaneously available automobile are the nodes that are to be engaged as source, recipient and intermediary point for re broadcasting of the information's. This framework of vehicular network is characterized with the highly motile nodes that are in random movement making the predictability of the location hard as the location changes frequently causing swift changes in the formation of the frame. These wirelessly connected networks are boundless extending the communication from cities to countries gathering and conveyancing enormous information's deprived of a support to be laid on.

The highly accelerated auto motives entails a frequent direction modifications and also alteration in the distance causing continuous changes in the conveying juncture. As the automotive starts to leave one conveyance juncture

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and enters into the other it eludes the conveyed message of the passed juncture and accepts the message of the new juncture entered. This conveyance is usually supported by altering the actual path taken and configuring a new path for conveyance. The re-crafting of the previous entrenched path either depends on the next available on road circuitry or the availability of the very near auto motives. The re-crafting of the transmission path would be incurred by delay due to the time taken in finding the alternative juncture or the auto motives in reach. So the safe and a perfect handing over is inevitable for continuously communicating.

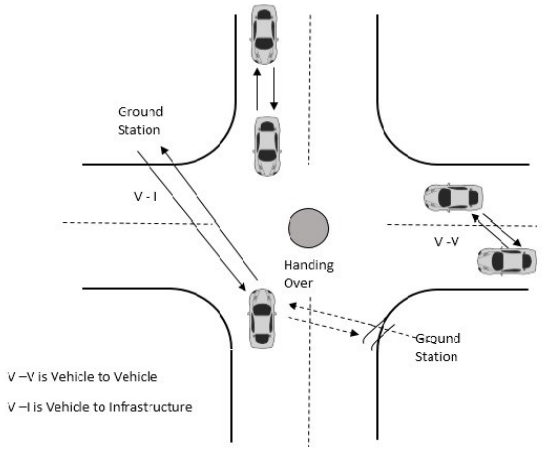

Fig 1 Vehicular Adhoc Network

The perfect decision in the spotting of the automobiles, the handing over and the pathway initiation becomes challenging for these vehicles flying at increasing speed causing a difficulties in motility administration.

So the proposed methodology of pillaring these flying wireless infrastructure (VANET) as shown in Fig 1 with a perfect instituting of the path for the continuously communicating includes model free machine learning algorithm (MFML) along with the method of computing the crisp and the possible weighted path to ensure a unbreakable lane that are undisturbed by the often handing over and altering pathways.

Considering a heterogeneous frame work involving the transmission between automobile to automobile and automobile to infrastructure initiates and accepts messages on-the-fly to/from an automobile or a ground station so these bundle of automobiles are also taken as flying wireless network since they are connected without wires. The

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proposed method initiates the routing to be taken by perceiving the very closely present automobile on the move and garner their details for further use, then assures by transferring updates included in the routing to determining the more suitable paths. Further the repeated computations for the identification of the optimized possible path is performed.

3.1 Perceiving the close Automobile

The proposed methodology offers a dynamic way of routing by starting the initial computation by recording the present status of the automobile and performing multiple computations by pursuing the change endured in the status and revise the output. For handling the requisition for transmission call by an automobile on the move the initiation starts by recording the automobile close by and then extending the path.

Let the automobiles on the move be recorded as A= $\{a_1,a_2\ldots a_n\}$ with its initial position being documented as a_i and its altered status is given as Δa_i. The alteration in the status is interdependent on the time and the moving speed of the automobile. So the prevailing status of the automobile is calculated using equation (1) as

$$a_i = \Delta a_i * T*Sp \text{ or } a_i = \Delta a_i * D \quad (1)$$

Where T is the time and the Sp is the speed and D is the distance. The space between the ground station and the automobile is given as in equation (2) by subtracting the automobile present status from the location of the ground station.

$$G_{SD} = a_i - G_{NDs} \quad (2)$$

Where the ground station is given as GNDs and its interval space to the automobile by G_{SD} . The automobile as conveyed earlier either uses its very close automobile or the ground station for the information to be traversed. The space interval between the very close automobile is calculated so as to confirm that the search is extended within the particular bounds. The space interval alteration with respect to time is given as in equation (3)

$$D' = ((a'_{1i} * D)+(a'_{2i} * D))^{1/2} \quad (3)$$

Where D' is the space interval between the two automobiles and the a' is the difference between the prevailing and the changed status of the automobile. The perfect perceiving of the automobile at proximity is attained by the length of the transmission. This is determined by calculating the lowest bandwidth requirement and the highest stability

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inevitable to enable a transferal. Where the lowest bandwidth entailed over a finite number of transferal is obtained as shown in equation (4)

$$B_{min}=P_c*(1-(T_T-R_T)/R_T) \quad (4)$$

Where lowest bandwidth is B_{min}, P_c the capacity that can be handled by the path, T_T transferal time and the receiving time R_T , the extreme level of stability(ST_{max}) inevitable is gained as shown in equation (5)

$$ST_{max} = (1/ (S'p_{1i} + S'p_{2i}))*(a'_{1i} S'p_{1i} + a'_{2i} S'p_{2i}) \pm ((S'p_{1i} + S'p_{2i}) - (a'_{1i} S'p_{1i} + a'_{2i} S'p_{2i})^2)^{1/2} \quad (5)$$

$S'p_{1i}$ is the change in the speed of the automobiles. Based on the above shown equations (4) and (5) the optimized nearby automobiles are determined and the automobiles constituted with weaker stability is ignored by computations performed using the equation (4) and (5). The decreased number of proximity automobile are directly proportional to the re-crafting to be done on frequent bases allowing an extended handing over. The essential number of the automobiles that are at proximity can be perceived by the equation (6)

$$P_a (t) = \sum_{i=1}^{n} P_{a_{j,i}}^{b_{j,i}} (t) \quad (6)$$

Where the P_a (t) is the number of nearby automobiles and the $P_{a_{j,i}}^{b_{j,i}}(t)$ is the maximum expected number of nearby automobiles to be connected for having a continuous transferal even after the handing over. On conditions when the essential number proximity automobiles exceeded by the actual number of automobiles (P_{actual}) in connection causes more re-crafting causing a handing over. The number of wirelessly connected automobile either equal or below the range of the essential number of automobiles enables in having a route crafted with negligible failure causing a continuous connectivity. The search extended in perceiving a path enriched with reputable automobiles is shown in Fig 2. The each garnered particulars regarding the automobiles at proximity are upgraded progressively to the ground station.

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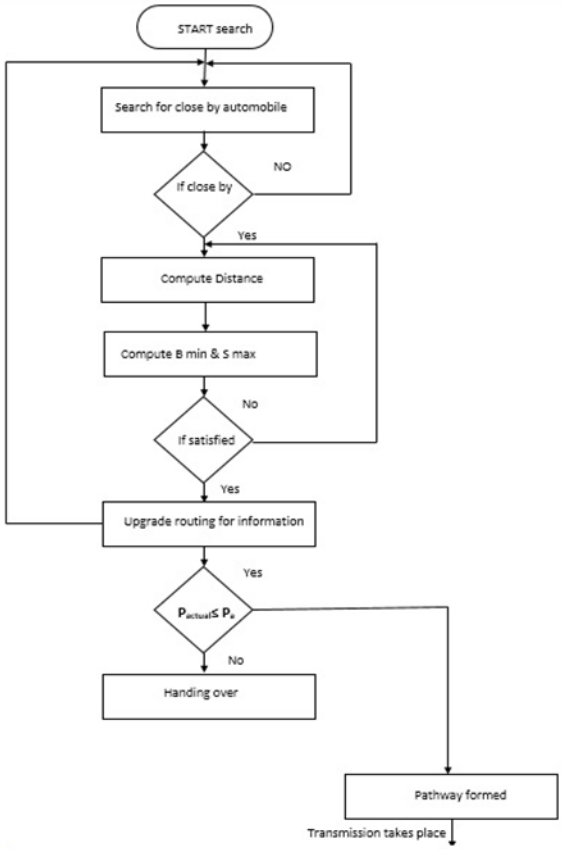

Fig 2 Flow chart for Search of Closer Automobiles

3.2 Handing over using MFML algorithm

The perceiving process enabled the identification of the optimized automobiles at proximity. The identified automobiles where garnered and updated in the table for routing, for the process of selecting using the model free machine learning algorithm. The MFML algorithm entitle the election of the path enriched with reputable nearby automobile that extend help out in the swift and efficient re-crafting during handing over. The most effective selection depends on the computation of the nearby automobiles based on their sustainability in the previous handing over and the highly reputable automobiles are selected based on its previous participation in the traversing using the shortest number of strides. The possibility of an automobile identifying a reputable auto mobile is by counting the number of strides, calculating the expense of obtaining a traversed contents and by estimating the total storing ability where the expense for getting a traversed content which is few strides away is given by equation(7) .

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$$E_S = Ts * \sum T_{prev} * A_{max} \quad (7)$$

Where the Ts is the possible strides taken, is the possible strides taken in the previous transferal T_{prev} and the A_{max}maximum number of reputable automobile that are garnered. The next metric to be evaluated is based on the storing ability of the nearby automobile, where the fully exhausted storing capability shows the maximum number of the handing over taken place. The storing ability of the automobile at proximity is significant as to have a knowledge regarding its acceptance and the discordance of the handing over requisition. The storage exploitation of the garnered automobiles are calculated using the equation (8)

$$ST_{exploitation} = (-T_{cost} - 1) * (S_{capacity} + T_{cost}) \quad (8)$$

The $ST_{exploitation}$ is the exploited amount of storage, T_{cost} is the total weight of the conveyance and $S_{capacity}$ is the initial storage capacity of the automobile. The MFML algorithm on estimating the expense based on strides and the storage exploitation expects for the heightened expense and storage exploration along with the garnered number of automobiles exceeding the actual number of automobiles essential for the connection. Satisfying the above conditions the perfect handing over takes place without any disruptions. The handing over is engaged only when the following equation (9) is satisfied.

$$Handing_{over} = \text{maximum } (ST_{exploitation} \text{ and } E_S) \text{ when } (P_{actual} > P_a) \quad (9)$$

Prevailing status regarding every automobile that was in the process is updated to the ground station for guidance in the further handing over taking place. The MFML algorithm enables a routing path to be furnished using the automobiles that are reliable discarding the service of weaker automobiles, the updation table for routing in ground station records the particulars of highly reliable automobiles to be utilized in future.

The Fig 3 shows the search for highly reputable automobiles for the process of handing over in the transmission.

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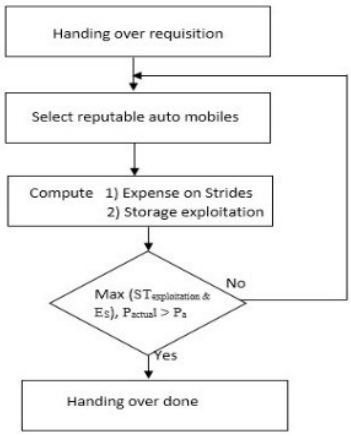

Fig 3 Handing Over

The MFML algorithm thus enables in having a continuous transmission with reduced delay and improvised network life span and lossless delivery of information with the minimum band width utilization and the extreme level of stability.

4. Result Evaluation

The performance of the proposed methodology is evaluated using the network simulator -2 on the grounds of delay incurred, packet delivery ratio, network life time and throughput, with the number of automobiles in the range of 50-100, and channel modelled with two way diffused power fading. The band width utilization and the stability calculation causes major significance in the delay incurred by the network, the delivery ratio, the network life span and the throughput.

Table 1 Parameter Definition

Parameters	Value
simulator	NS-2
Number of automobiles	50-100
Automobile speed	60-80km/h
Packet size	1024bits
Allotted area	50-500m
Packet data rate	I packet /second

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The result evaluation of the proposed is compared with the existing routing algorithms that conduct handing over using a vertical and burst methods and confirms to be efficient.

a) Packet Delivery Ratio (PDR)

Packet delivery ratio gives the total delivered information for the given amount of information without any loss. In Vehicle adhoc network as the automobiles are considered as the wirelessly connected node the graph shown in Fig 4 is plotted for the number of vehicles on the move. The packet delivery ratio using a model-free machine learning

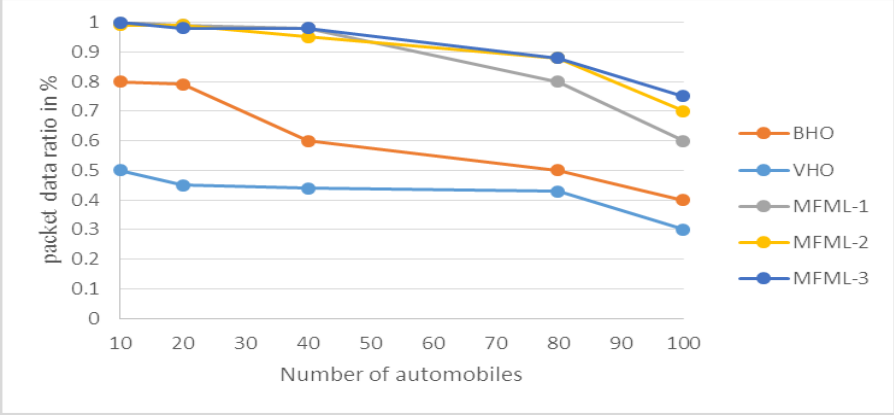

Fig 4 Packet Delivery Ratio

Algorithm in the on-the fly network causes an enhanced packet data delivery due to its minimum band width calculated and its extended stableness. The performance evaluation compared with the previously existing technologies show the efficiency rate and the reputability of the network employed with MFML algorithm and the decreased data loss incurred in the network compared to the prevailing methods.

b) Delay Incurred

The delay incurred by a system is estimated by calculation of the difference between the transmitted and the delivery time. The using the flying nodes that incurred little bandwidth exploitation for the transmission of the information

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the proposed algorithm enables in having a less delay incurred nodes (automobiles) by employing nodes with less bandwidth exploitation. Evaluation on the delay experienced by the network is shown in Fig 5 shows the graph plotted against the number of automobiles gives the delay calculation of the proposed on different set of traffic densities and compared with the prevailing methods to show the performance upgrade by employing MFML algorithm. The delay

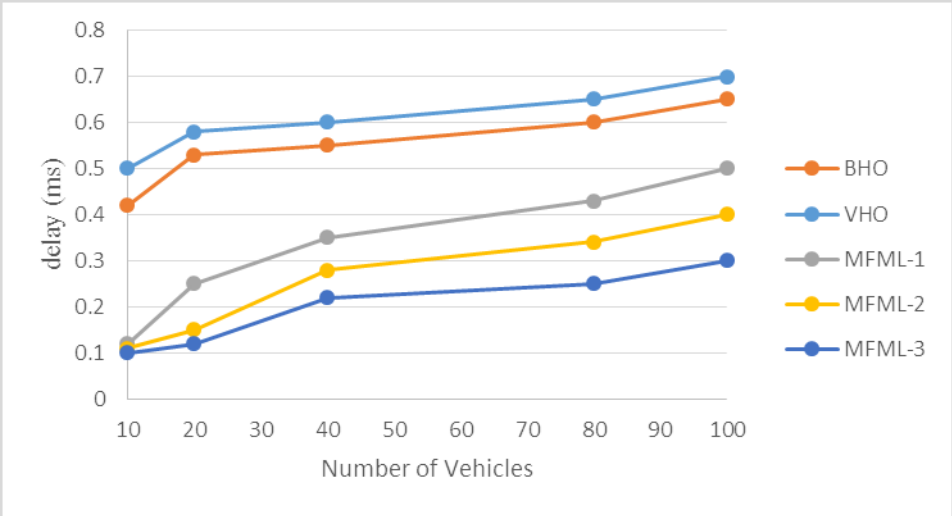

Fig 5 Delay Measurement

measurement of the prevailing methods are very high compared to the proposed methodology as the communication and the handing over takes without any disruption and frequent re-crafting due to the inclusion of highly reputable nodes (automobiles)in the pathway for transferal.

c) Throughput

The throughput measurement of the proposed is analyzed by the number of successful deliveries for the number of packets transmitted the throughput achievement of the proposed shown in Fig 6 gives the high capability of the proposed network constructed using the MFML algorithm . The comparison performed with the prevailing technologies prove that the unreliableness of the prevailing methods that do not employ the proposed algorithm.

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The evaluation of throughput calculation is done under different traffics and with variations in the availability of the vehicles on different roadways with the ground stations established at different distance. The successful conveying of the proposed is found to be efficient and reputable compared to the previous existing methodologies.

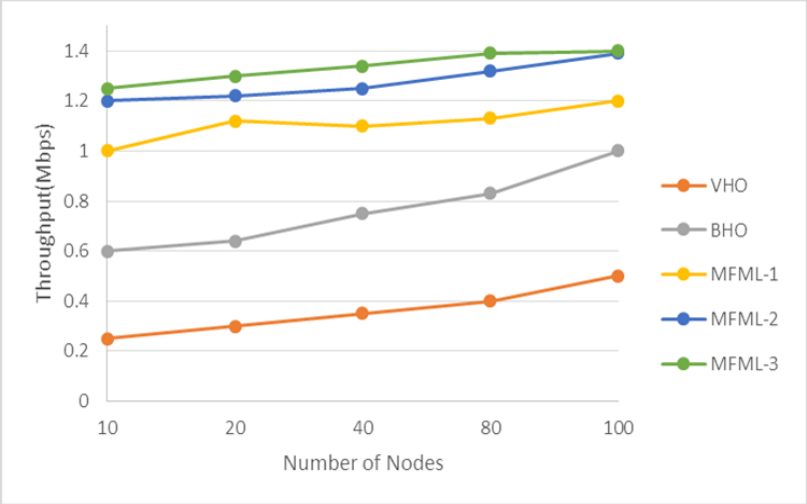

Fig 6 Throughput

d) Network Life Span

The network life span is evaluated with the number of alive vehicles in the network the calculation of the storage exploitation and the expense on the strides taken by the vehicles. The proposed method enables the network

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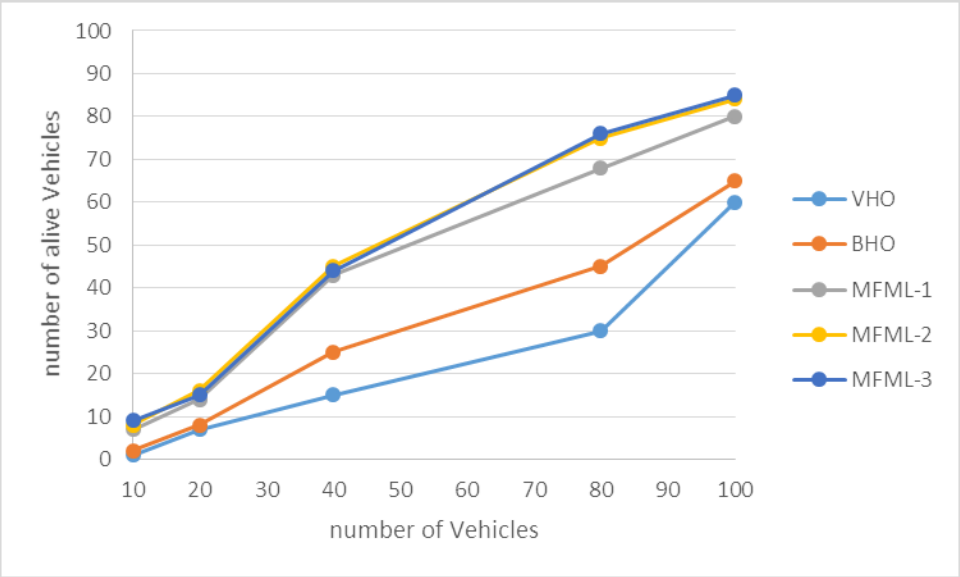

Fig 7 Network Life Span

To have an extended life as it decides with the nodes with higher stability reduced bandwidth and better storage ability and weight for transmission. The comparison curve shown in the graph in Fig 7 is shows the prevailing methods are with much low reliableness compared to the proposed method.

5. Conclusion

The vehicular Network that is formed by the instantaneously available vehicles without any supporting structure to be laid on, is pillared using the proposed methodology that ensures a perfect lane establishment using the model free machine learning and establishes a path enriched with highly stable and trusted automobiles that are on the fly with better bandwidth optimization and storage abilities. The vehicular network that are used for preventing of the unwanted sudden incidents and providing better comfort ability by giving information regarding the congested roads and the safe roads to be taken is a trending entailment for the cities experiencing heavy traffic. The proposed algorithm, in this on the fly network would make it even more promising as it provides a non-breakable communication with high stability. The performance evaluation based on the grounds of delay incurred, throughput, packet delivery ratio and network life span proves the MFML algorithm in the on –the-fly network to be reliable and efficient.

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