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Research

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Abstract

The vehicular ad hoc network (VANET) topology will change the mobility of the nodes and the data delivery will be efficient in the vehicle environment. This technique uses the density, mobility, dissemination in the requirements of emergency message broadcasting. The emergency message is broadcast on the road causes many issues like reliability, latency and scalability. Beacons are used in the VANET to broadcast messages and get the information from neighbours. When more vehicles transmit the messages in equal time lead a frequent broadcast storm the vehicles are faced the message delivery failure. Adaptive Scheduled Partitioning and Broadcasting technique (ASPBT) is used in our paper for message reliability, and the transmission efficiency will adjust the partitions and beacon automatically for reducing retransmissions. The partition size is determined using the density of network transmission of each partition schedule is estimated using the Black Widow Optimization (BWOA). The emergency message gets low delay and redundancy of the message is reducing, ASPBT include the forwarding of novel with the selection of optimal partition. The performance analysis is done with the existing methods for the determination of efficiency, redundancy, collision, and delay. The efficiency of proposed technique as 98% comparing with existing broadcast schemes of VANET.

Keywords: Vehicular ad hoc network (VANET), Broadcasting messages, Beacon, black widow optimization, adaptive partition scheme, network.

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1. Introduction

Technological development that the world contain experienced today affects an entire areas, especially the area of communications that is undergoing considerable evolution due to advances in wireless technology that have moderately solved problem of traffic accidents [1]. Our work comes at this context. For solving the vehicle crashes issue, investigators plan to take advantage of this technology that allows vehicles for establishing direct (or indirect) links among them to be responsive of potential critical situations such as imminent accident or dangerous obstacles [2]. Activation technology refers to VANET. In fact, a promising application of such networks for allowing vehicles able to specific sensors for detecting direct environment and warn vehicle drivers in advance of an accident risk [3, 4].

VANET may be carried out in two ways as comfort communication: Periodic Safety Message (referred to beacon in sequel) and Event-driven Message (referred to Emergency Message). Two types of messages share a single control channel [5]. Beacon messages are messages regarding the sending vehicle status. Status information enables place, speed, heading towards, and so on ... regarding to sender [6]. The beacons give forwarded or updated information from the sending vehicle to entire vehicles grant at network that supports knowing the status of current network and anticipating vehicle movement [7]. Due to the significance of such messages swapped among vehicles, is essential for ensuring such messages reach greatest number of vehicles with minimal delay. This emergency message is delivered by broadcast; here entire vehicles within sender coverage area must get messages [8].

In high-density networks, dependable data transmission implies important issue. By VANET, information linked to safety, infotainment and multimedia data is tiled at open access environment [9]. A malicious vehicle may interrupt on network and misbehaviour can occur at data transmission, leading to serious traffic accidents [10]. At VANET, transmission may be complete devoid of Road Side Unit (RSU), i.e., direct communication among vehicles is probable. Vehicle mobility acts a significant role at broadcasting. Every vehicle consist it own speed [11]. A variable range of mobility guides to vehicles less percentage gets vital information. For fixing an issue, effectual retransmission plan is needed. It identifies a vehicle that is missing an emergency message and requests its retransmission [12]. A message would be redirected if essential will evade redundancy and improve channel operation. Subsequent to first transmission, entire vehicle did not obtain emergency messages inside transmission range owing to poor link quality as well as packet collision [13].

1.1 Objective of the work

- In this work, It is intend to propose that the message prioritization technique is used for prioritizing emergency messages, common Messages, and Entertainment messages.
- At first, all messages are prioritized depend on their requirements. Then, priorities to message are allocated interms of message's priority and dissemination distance for preserving a message QoS.
- Here, Emergency message broadcasting may be complete through an adaptive scheduled partitioning and broadcasting technique [23] based on distance of nearby nodes as well as network density is suggested for recognizing the partition, which will transmit the emergency message first.
- In our proposed method, partition size is resolute by network density, and transmission plan for every partition is evaluated by Black Widow optimization algorithm[24].
- The effectiveness of our investigation work is evaluated by metrics like Success ratio, Dissemination Efficiency, Delay, and Number of broad casted message, Broadcast speed, distance and time.

1.2 Organization of the work

Rest of the manuscript is depicted as below: Section 2 explains recent research work Section 3 portrays an overview of proposed method. Section 4 and 5 include the experimental outcomes and the conclusion.

2. Related Work: A Brief Review

Various investigation works have already existed at bibliography that depends on broadcasting approach. Some of them are reviewed here.

Yuanguo et.al in [14] has introduced urban multi-hop broadcast protocol (UMBP) for broadcasting emergency messages in this paper. For reducing the delay in transmitting emergency messages and decrease message redundancy, UMBP has new forwarding node selection method, which uses repetitive partitioning, mini-slot, and black-burst to rapidly choose remote neighbor nodes, asynchronous successfully chose a unique forwarding node contention between them. Then two-way broadcast, multi-directional and directional broadcast were intended interms of positions of senders of emergency messages. At particular, initial hop, the bidirectional or multidirectional broadcast performs forwarding node selection method at various directions concurrently, and unique forwarding node was effectively selected at every direction. After that, directional broadcast was accepted in every hop of message propagation direction till emergency message arrives at intersection area where multi-directional broadcast was implemented once more, al last allow emergency message for covering a target area no problem. Analysis and simulation outcomes displays, which UMBP considerably enhance a multi-hop broadcast performance based on one-hop delay, message propagation speed, as well as message reception rate.

The emergency broadcast strategy was introduced by Chou et.al [15] in this manuscript, while a car accident happens; vehicle's sensors notice crash and directly send emergency messages for informing another nearby vehicles. Additionally, they introduce a method for removing redundant transmissions and guarantee an emergency message may be transmitted correctly. They introduce a stability function for evaluating transponder reliability. Back off procedure of established technique allocates adequate waiting times to dissimilar forwarders. The planned method was performed by NS2 simulator interms of WAVE / DSRC standards. The simulation outcomes display that introduced protocol show exceptional performance based on forwarding counts, packet loss rate, as well as delay time at dissimilar environments. Additionally, its protocol preserve stability on diverse vehicle density scenarios consequently every vehicle gets emergency messages and maintains less latency for ensuring that driver consists of sufficient safety response time for improving traffic safety.

Tian et.al in [16] has introduced an enhanced position-based protocol for broadcasting emergency messages between large-scale vehicle networks in this manuscript. Particularly, defined using suggested protocol, messages are transmitted next to its Region of Interest (ROI), and retransmission of message interms of information included on message that was arrived. Simulation outcomes shows that suggested protocol may significantly decrease needless rebroadcasts and collisions may be efficiently mitigated.

Shah et.al in [17] has introduced a data broadcast method that uses a time barrier mechanism for decreasing message overhead that may clutter the network in this paper. The proposed solution was depends on super-node to disseminate messages concept in a timely manner. Also, to evade unnecessary transmissions that may cause the broadcast storm issues, time barrier method was modified for dealing the issue. So, furthest vehicle rebroadcasts message that may cover the most distance. So, message may arrive at furthest node on fewer times, therefore improving coverage and reducing delay. The proposed method was compared by traditional probabilistic methods. An evaluation section displays that reduction at message overhead, transmission delay, enhanced coverage, and packet delivery ratio.

Multi-hop broadcast protocols interms of black bursts were effectual method of broadcasting Emergency Messages (EM) on VANET. Though, Clear to Broadcast (CTB) collision would happen the propagation speed would be reduced. In order to address this issue, Libing et.al in [18] has introduced a multi-hop broadcast protocol based on multi-channel and Black-burst in this paper. Vehicles through multiple antennas may transmit and detect black bursts on dissimilar channels at the same time according to multi-channel technology. Compared to previous black burst-based techniques, Black-burst based and multi-hop broadcast (BMMB) shortens the repetitive procedure for finding an optimal segment. A relief vehicle may be quickly choosen to optimal collision free segment of CTB. BMMB allows alternative broadcast techniques, i.e. unidirectional and multi-directional broadcast for straight roads and intersections, correspondingly. A theoretic analysis was carried out BMMB performance, and the simulation outcomes shows a BMMB carry out best based on average one-hop delay and propagation speed.

Lyu et.al in [19] has introduced a capable broadcast authentication method named Prediction Based Authentication (PBA) not only defend against computational-depend DoS attacks, other than oppose packet loss cause through high mobility of vehicles on this paper. Unlike the existing authentication methods, PBA was well-organized and lightweight method, as relied mainly on symmetric cryptography. Moreover, verification delay decrease for few emergency applications, PBA was intended to take advantage of sending vehicle's capability for forecasting future beacons at advance. Furthermore, for DoS attacks based on preventing memory, PBA stores abbreviated and re-encrypted Message Authentication Codes (MAC) of signatures devoid of compromising security.

Rajput et.al [20] has suggested a method to authentication that preserves privacy at VANET. Its hybrid method combines the helpful aspects of pseudonym-based and group-signature-based approaches for avoiding its own disadvantages. The suggested scheme did not need vehicle for handling a certificate revocation list, nor does it allow vehicles on any group management. A suggested scheme uses well-organized and lightweight pseudonym, which is not only employed for message authentication, other than serve as hatch for giving conditional anonymity. The grant several attack scenarios, which display the resilience of suggested method to several security as well as privacy threats. They also give calculation and communication overhead analysis to display the competence of suggested method. Moreover, they run extensive simulations to grant a brief analysis of network performance. An outcomes display that feasibility of proposed method based on end-to-end delay and package delivery ratio.

Saeed et.al in [21] has introduced simple models of single-lane and multi-lane road models for designing effective probabilistic flood methods of VANET in this paper. The proposed analytic framework presents a new and common tool that may cover as count of lanes, vehicle transmission range as well as density. They obtain dissimilarity equations whose solutions give up the probability that entire vehicles will receive an emergency alerting message as function of retransmission probability, count of neighbours of every vehicle, and broadcast distance. The models were evaluated through simulations that realistically represent traffic and network features were employed as baseline for designing two information dissemination methods that use probabilistic floods. This method were analyzed by simulations and establish to attain important performance development compared with blind flood regarding to attained accessibility, end-to-end delay and count of retransmissions, comparable to performance reached with optimal flooding, get through brute force.

3. Proposed Methodology

Information technology and communication is the main thrust of possibly the most necessary improvements at automotive industry and in our people. During last two decades, mobile communication is distorted our life way and allowed us for exchanging data. It consists of two types of ad hoc networks in portable exchanges, known "mobile ad hoc network (MANET)" and VANET. Of these, VANET is an increasingly common remote ad hoc network and proposed method is designed as VANET applications. Messages are transmit from one vehicle to another and the emergency message is transmit by using warning messages. The density and distance are optimally fixed the values by using the Black widow optimization algorithm. The target of this technique is transmitting the messages without delay, solve the issues which was hidden and disconnect the network while storm broadcasting and then transmit the messages in both of directional and uni-directional of the density of vehicle.

3.1 Adaptive Scheduled partitioning scheme

This scheme divides the area interms of density of vehicle, and this density is evaluated through beacon messages arrived from neighbouring vehicles and evaluates the density by transmitting the status.

When an emergency message is received by a vehicle it transmits a message to nearby nodes. The emergency message is transmitted as shown in Figure 1. Partitions and back-end solutions for the emergency dispatcher give priority to each partition. Priorities may be resolute using the BWOA. It depends on vehicles waiting times at furthest vehicle for the short waiting time. Timer minimized on channel when idle, and channel is connected with the timer freezes to recombine.

The Figure 1 shows the message broadcasting of VANETS [25] the vehicles are communicate to the road side unit (RSU) using the wireless technology known wireless access on vehicular environment. This communication will ensure the passengers safety for the information and traffic flow and safety of driver. This will improve the efficiency and traffic flow in the management system. The VANET architecture has OBU (on board unit), RSU, and TA (trusted authority). The RSU used for the communication, OBU used for collect the information as acceleration, speed, etc. the RSU is a fixed side of the road in the location to provide the connection of vehicles.

This method uses both the density and distance schedule of the partition network. These choose the partition, which would give alerting messages. The first partition select the contention window Au from Au=[1,2,….au] are randomly and au represent contention window size. The list cannot be overlap because it selects the list separate by each partition. In this scheme the sender area is divided into many partitions as static or dynamic. The network density will depend on the partitions. If the select a static partition in this scheme then it have to use the static partitioning for all network density. It will cause the partitions into empty with low density and the contention gets slow down the process this results the message delivery to delay.

If the choice of choosing the dynamic partition size will be change depend upon density of vehicle. The partition size is increase the covering of node and the packet collision of vehicles between them. The emergency message broadcast is vehicle to vehicle communication (V2V) the vehicle is considered as node that transmit the beacons message to the vehicle density, location, and acceleration, so on.While the emergency situation arises the vehicles like accident, damage and so on, vehicle sends critical message by the observer (i.e.. the vehicle who met incident). The critical message is send and it denote as r and the time waiting is t the sender will give a busy tone if the time is extends more and the tone is denote as BT in the band. If the busy tone given by the sender, the band will generate another message time and repeat the process. If the busy tine is given by two times and it is denoted as 2D-BT.

The data packet contains some details about the ID, location and time of the sender broadcast (RTB) transmission. It sends an emergency message and the Network Assignment Vector (NAV) to prevent conflicts, and then the sender risks waiting to receive the tone from the receiver by turning off the 2D-BT.

If the vehicle area arrive RTB packet, then turns tone in vehicle transmission as well as emergency message would be waiting. Sender can found RTB from the receiver and broadcast the message as emergency and the message contains formats header, size, position, partitions etc. The packet is shown in the Figure 2 the EM-id denotes information id for the message broadcasting, the original senders position is the location of source, the senders position denotes the vehicle location for message transmission, congestion window is represent as A_u the use of sender, in fifth column the partition is given that how many numbers are used, last distance is given as $dist_{\min}$ and $dist_{\max}$ for the partition 0 to partition M. th3 partition number is denoted as N_p where the p is utmost partition of sender its range is $0 \le p \le N_p - 1$. The contention window is given as

$$A_u = \{p.a_u, p.a_{u+1}, p.a_{u+2}, ...(p+1).a_{u-1}\} \tag{1}$$

After receiving the RTB the node stay for message and if message is arrived it checks that it come from partition and chooses the contention window as random to message forward. If the broadcast is finished then sender sends WIN packet to id and turn off the R-BT.

The vehicle receives the WIN packet then other vehicles are contention phase. The acknowledgement will send the sender r will turn off R-BT. The winner vehicle will be sender and forwards the position to utmost partition. Broadcast is successful when mobile density and mobility are in good condition. First, the sender transmit an emergency message to a nearby partition, the high mobility vehicle is too far away it will move rapidly to another vehicle so one vehicle will miss the chance to broadcast. The best broadcast emergency messages can be found in the message broadcast partition. It will be selected near or far position by the back widow optimization algorithm. The input of the optimization algorithm is density, mobility speed of vehicle etc.

3.2 Partition length estimation

The partition size is calculated the partition in the vehicle that is at least scheduled in the contention window Au in the particular period.

The Figure 3 shows the partition length estimation [26] the vehicles receive the message from the sender, the received vehicles are ensure the message is not forward to others the partition from 0 to 3 are the effective portion that is divide into partitions, and allocate the priorities for forwarding. Forwarding priorities will determine the received vehicles are farthest or neighbour.

The vehicle contains the collision possibility and congestion between vehicles that automatically delay the transmission. At traffic condition, partition size is unpredicted and calculated as

$$P_{least} = P(len \leq l \mid len \leq R) = \int_0^1 \frac{\partial . e^{-\partial len}}{1 - e^{-\partial R}} dlen = \frac{1 - e^{-\partial len}}{1 - e^{-\partial R}} \tag{2}$$

Here ∂ refers the average density vehicles nearby. For calculating farthest vehicle of partition length the vehicle exits the final of the transmission range in sender and the size of position l in which the virtual probability of the vehicle is P_{least} and the farthest partition is equal to R.

$$P_{least} = P(len \leq l \mid len \leq R) = \frac{1 - e^{-\partial len}}{1 - e^{-\partial R}} \geq P\_Thr \tag{3}$$

The P_{least} is the farthest vehicles partition with the virtual probability and the partition length is measured with the density and it is given as

$$\rightarrow l \geq -\frac{\ln\left(1 - P\_Thr.\left(1 - e^{-\partial R}\right)\right)}{\partial} \tag{4}$$

$$P\_Thr = \frac{1 + \frac{e - 1}{e^{-\left(1 - e^{\partial R}\right)}}}{2} \tag{5}$$

The partition length is applied for the partitions in equal length of extreme partition at equation 3 and the number of partition is below:

$$M_r = \frac{E}{l} \tag{6}$$

Partition size is varied in the density and the threshold for e.g. The transmission range is 360m as fixed value the network varies from 0 to 1 it represents minimum to maximum density. The range of the transmission is R and density is in the unit of 1 and the vehicle dense of network is 36, thresholds from 0 to 1. The partition length is increased when the threshold increases and the value varies from 0.7 to 0.9. So for the network density varied 0 to 0.15. Partition length denotes the transmission range of the network in the high probability thresholds and the density network. The probability of the threshold in partition size has high density value.

The above Figure 4 shows the partition length l in the changes of rate value of probability of the threshold from equation (4) and (5) in the actual length of one variable function. The threshold value is P_Thr and density function ∂ and it ranged 0 to 0.15, the threshold value is 0.815 to 0.84, the length is varied from 11.29 to 156.62 m.

3.3 Black Widow Optimization

The black widow optimization is used as the black widow spider inspiration in the Meta heuristic function in the species of optimal solutions is shown in Figure 5. Meta heuristics has better heuristics function and the implementation is popular in the potential of the solutions.

3.3.1 Initialization

To solve an optimization issue, the variables value of the issue should form a suitable structure of solution for current problem. GA and PSO terminologies, this structure known as "Chromosome" and "Particle position", correspondingly, other than BWO algorithm it named as "widow". At BWO, potential solution for every issue is assumed from black widow spider. The probable solution for the issue has been deal with black widow spider and it exhibits the issues of the variable values.

In optimization problem the dimensional value is M_{var} and the array of widow is 1* Mvar for the problem solution. The array is defined as

$$widow = [x_1, x_2, \ldots\ldots x_{M\,\text{var}}] \tag{7}$$

Each variable are $(x_1, x_{2,} \ldots\ldots x_{M\,\text{var}})$ floating number, fitness widow is determined using fitness function f in widow $(x_1, x_{2,} \ldots\ldots x_{M\,\text{var}})$ so,

$$Fitness = f(widow) \tag{8}$$

The widow refers the propagation of every node at partition over the message receiving and M_{var} is represents as the total number of partition used for the space, the $(x_1, x_2, \ldots x_{M\,\text{var}})$ are used for the partition number for which the vehicles transmit the messages.

The optimization algorithm start with the candidate widow matrix size $M_{pop} * M_{\text{var}}$ is generating by spiders first population. The parents are choosen randomly for implementing the procreating through mating; male black widow is eating through female.

3.3.2 Procreate

As pairs are autonomous for everyone, it begin to mate for reproducing the novel generation, in parallel, and nature, every pair mate on their web, individually from others. At real world, about 1000 eggs are created at every mating, other than eventually few spider babies survive, that is stronger. This algorithm is reproduce the array with alpha which is created with the widow array of random numbers contains the offspring produces the equation that x_1 and x_2 denotes parents and the offspring refers y_1 and y_2.

$$
\begin{aligned}
y_1 &= \alpha \times x_1 + (1-\alpha) \times x_2 \\
y_2 &= \alpha \times x_2 + (1-\alpha) \times x_1
\end{aligned} \tag{9}
$$

The process is repeat for the $\frac{M_{\text{var}}}{2}$ times, in randomly choosen numbers, the children and parents are add to the array by the fitness value based on cannibalism rating for the best individuals that are newly generate the population.

3.3.3 Cannibalism

It has three types of cannibalism. Initial one implies sexual cannibalism that black widow woman eats her husband during or behind mating. With this algorithm, it would identify women and men via its fitness values. Other type is sibling cannibalism that strong spiders eat its weaker siblings. This algorithm, establishes cannibalism rating based on count of survivors, is solved. The utilize the fitness value for evaluating spider hatchlings, whether it is strong or weak.

3.3.4 Mutation

At this stage, arbitrarily choose Mute pop number of individuals as population. Each of the selected solutions replaces approximately two components at array. The mutation value indicates that the message is broadcasted to vehicles without delay and retransmission is neglected as shown in Figure 6.

The mutation is used for the population of chromosomes values in the BWO; the mutation is employed to send a value of emergency broadcast to the vehicles. The mutation and diversity in the sample population used to bypass the local minima by blocking the number of chromosomes to stop the optimization of the global optimal value will prevent the chromosome from stopping the optimization.

3.3.5 Convergence

As with another evolutionary algorithm, the three stopping conditions may be assumed: (A) predefined repetitions. (B) Observation that there is no modify at fitness value of better widow used for various repetitions. (C) Achieve a certain level of accuracy. In following section, BWO would be used for few benchmark optimization issues.

3.4 Parameter setting

In BWO algorithm, it consists of few parameters that are necessary to obtain better outcomes. Such parameters contain procreation rate (PP), cannibalism rate (CR), and mutation rate (PM). Parameters must be adjusted suitably to enhance the success of the algorithm on ruling superior solutions. Best adjustment of parameters, greater opportunity to exit any local optimization, and greater capability for exploring the search space globally.

The pseudo code of the black widow optimization
Input: Iteration, procreating, cannibalism, mutation. **Output:** optimal solution for the objective function

// Initialization
The initial population of black widow spiders
Each pop is a D-dimensional array for the chromosomes in the dimensional problem
// Loop until terminal condition
The procreating rate calculates the reproduction of the spiders as ms;
Based on the solution the best ms is select in pop and save as pop 1;
// Procreating and Cannibalism

```
    for $i = 1$ to $ms$ do
    Select randomly two solutions from pop1;
    Using eqn (9) the children solutions are generated;
Further the father solutions will destroy;
The cannibalism rate will neglect the children's solution for getting the new solution;
Save the remaining solution into the pop 2;
End for
// Mutation
The mutation rate calculate the mutation children solutions as $mn$
for $i = 1$ to $mn$ do
Select the solution from the pop 1;
Mutate the chromosome value randomly in the solution and generate a new solution;
Save the new solution into pop 3;
End for
// Updating
    Update the solution pop=pop 2+pop 3;
Returning the best solution;
Return the best solution from the pop;
```

The pop solution from the pseudo code is the best message broadcast to vehicles, the number of beacons that parents and children pass chromosomes are transmitted. The best solution is the vehicles that are transmitted the best message.

Step 1 Initialization

The initial population of black widow is chosen as D-dimensions

Step 2 Procreating and Cannibalism

For i=1 to ms do

Select two solutions from pop 1 as randomly

Step 3 mutation

Select the mutated value for the best solution of chromosome in the randomly selected solution

Step 4 updating

The best solution is updated in the pop which is the sum of two pop solutions.

4. Result and Discussion

This section covers simulation settings and parameters, performance metrics and comparison, performance analysis by existing techniques. A proposed research was being implemented using the network simulator, NS2 [27]. Vehicle speed is 110 km / h, length is selected as 12 km for direct path, and four-way direction path is selected. The network density is designed as 500, 800, 1000 and 5000 for the vehicles per hour. In the simulation, the analog model with bidirectional interference is choosen and nodes are arbitrarily selected as given in the Table 1. An investigation is experimented for urban and highway road and emergency aware is propagated with vehicles on high roads.

4.1 Performance analysis

The performance analysis can be used as delay, efficiency, redundancy rate and collision. The performance evaluation is compared with the existing methods as Y. Bi [14], Y. Hsin [15], U. Rajput [20], and T. Saeed [21]. The performances metrics is used in the evaluation

Redundancy rate: The replicated messages are used in the transmission ratio between the messages. This method has achieved minimal overhead / redundancy

$$RR = \frac{numberofduplicatemessages}{numberofsourcemessages} \tag{10}$$

Collision rate: The collision rate is also called as packet loss, which is the performance data of the MAC layer of the collision in the proportion of transmission/transmitted packets. The ratio of data loss is minimal in the effective protocol.

$$CR = \frac{numberofcollisionpackets}{numberofsendpackets} \tag{11}$$

Delay: Time is measured as end-to-end propagation time or delay; time required for transmission of sending nodes to the receivers is evaluated. For emergency messages broadcast, the delay will be low

$$PT = receivedmessagetime - initialtime \tag{12}$$

Dissemination efficiency: The extreme of the data may be broadcasted via network in unit of time, and then efficiency value increases in message distribution in the farthest neighbor as quicker with the large success rate and redundancy.

$$DE = \frac{propagationdis\tan ce * successrate}{PT * RR} \tag{13}$$

Success Rate: The ratio of delivery message with successful delivery of message with the number of vehicles that has high reliable technique has the highest ratio as 100%.

$$SR = \frac{numberofvehiclesreceivedmessgae}{numberofvehiclesnetwork} \tag{14}$$

Total number of beacons: Beacons are generated with messages transmitted over the network density, the amounts of beacons reduces the dense efficiency.

$$TB = \frac{numberofbeacons}{numberofsendpackets} \tag{15}$$

The Figure 7 shows that the analysis success rate of different protocols in various traffic flow. The experiment analysis shows that proposed technique gets best results compared to existing methods such as Y. Bi is 28% lower than the proposed, Y. Hsin is 30% lower than the proposed, U. Rajput is 40% lower than the proposed, T. Saeed is 50% lower than the proposed method. Our proposed results are better achieved by usage of separate message dissemination in the undelivered message in problem time arise in the network partitioning and coverage is maximized for applications with the sparse and dense network.

The minimum number of nodes for vehicles flow reaches a reasonable success rate. The rate is better for the proposed method, while flowing at the slightest change in performance in the transmission of vehicles. The success rate is not continuously increased, which makes slight difference. The performance of the success rate on each flow occurs at the vehicles rate of message broadcast in the delivered number of packets that the emergency message transmitted.

The Figure 8 shows the propagation distance being analysed for vehicles flow. Our proposed method gets better results when compared to other existing techniques. As it consist of message monitoring scheme with sparse and dense network density. When the vehicles flow higher the distance also gets higher than other methods. The proposed method gets higher than Y. Bi is 18%, Y. Hsin is 25%, U. Rajput is 27%, T. Saeed is 30%.

For the propagation distance the presence of a road side unit during the vehicles flow in the message transmission of informed vehicles will consists the message of subsequent vehicles that must be transmitted in long-distance vehicles. The length of the long-distance vehicle is represented in the position variable, which sends an emergency message after measuring the distance of vehicles that have high density in first sender vehicles. The flow of the vehicles increases the propagation distance also increases according to the vehicle distance.

The proposed method uses fewer f beacons than other existing methods. Because it congestion controls with the network density. It is noted that BWO technique will reduce a beacon level at network. This technique regulates the line among beacon retransmission over the node density in broadcast storm.

In Figure 9 the number of beacons decreases as the vehicle flow increases. The beacon are very small in size on the message broadcast and the payload size will compared with the data messages that use of beacon information for routing decisions. The beacon used in the information for decision making. The large number of broadcasting data packets will cause the bandwidth losses. The beacon information is independent of the routing algorithm that reduces the number of data packets broadcast in vehicles use of the route discovery of the destination vehicle.

Figure 10 displays the proposed method end to end delay between all methods that gets better results because the delay is low when the number of vehicles is increased in road for message transmission. Our proposed method show better results for the reliable message delivery and the information received by the receiver.

The deviation of simulation and analytical may observed in the graph by receiving the processing of packets in message broadcast of processing time the vehicles flow increases the delay gets low to our proposed method because the density and distance are fixed optimally by optimization method. The end delay is obtained towards upper bound of probability distribution in density distribution of the delay of the VANET.

Figure 11 shows the redundancy rate of traffic vehicles flow. In our proposed method has suppression mechanism to rebroadcast the message. All our proposed method gets better results, Y.Bi [14] is 97% higher than the proposed, Y.Hsin is 45% higher, U.Rajput is 75% higher, and T.Saeed is 80% higher than the proposed method.

The redundancy rate is a consistent error in the mechanism that requires the synchronization between the sender and the receiver vehicle in the communication for information broadcast in the entropy for retrieving the vehicles information, while the broadcast of the message corresponds to the redundant data in the source information. Entropy, which increases the packets in the number of beacons of packet loss in the partition encoded in the original network code, is the same size as in the broadcast transmission in the information of the segments in the code encoded in packets of same size.

Figure 12 describes the collision rate with the various traffic of vehicle and our method gets the better value. The collision rate is same to the redundancy rate, which is the protocol with the maximum number of collisions when it doesn't broadcast the message and it gets storm problem while broadcasting. Our proposed gets better results, Y.Bi is 95% higher than the proposed, and Y.Hsin is 80% higher U.Rajput is 75% higher; T. Saeed is 85% higher than the proposed method.

The vehicles are informed the collision rate during the transmission and the forwarded message will send an emergency message already passed by the road side unit. The collision rate is encountered in the area of vehicles in the equipped OBU with information around the road side unit. The collision is a common problem when the message broadcasting occurs, but the usage of optimization and partition length in our proposed method reduces conflict in our method. The location of the vehicles to transmit the message is clearly searched along the length of the partition, the message in the communications of the flow beacons of the vehicles.

The efficiency is shown in Figure 13. The proposed method to calculate the efficiency of the method with 4 other methods gets better results. The efficiency is calculated with the message of overhead, reliability and reaches ability. The slot time is selected for transmission as the vehicle increases, so efficiency gets the better value. The efficiency of our method is 98% better when compared to other methods.

A VANET with infrastructure requires a useful network for vehicle communication. The network that determines efficiency interms of flow of vehicles for vehicles density the efficiency is measured under redundancy rate, collision, success and delay with the propagation density with the existing method. The proposed result gets 98% while other methods get less than our method.

5. Conclusion

The usage of mobile communication systems is considered in our system of vehicle communication. In this research, time reliable and time efficiency with multiple messages broadcast technique is used. The proposed ASPBT network with black widow optimization technique works well in density simulation. This reduces the message retransmission and message delay. This method uses an adaptive scheme to control the beacon congestion for reducing the storm problem during broadcast. The performance has been analysed with other existing methods in that our proposed method gets better results and the efficiency is 98% in our proposed method.

In future the VANET will be used for security of issues in privacy and safety related applications. This work is done with the new optimization algorithm and considers cryptographic algorithms. Simulation will also be improved through practical research in the future.

List of abbreviations

VANET: Vehicular Adhoc Network; ASPBT: Adaptive Scheduled Partitioning and Broadcasting Technique; BWOA: Black Widow Optimization; RSU: Road Side Unit; UMBP: urban multi-hop broadcast protocol; ROI: Region of Interest; EM: Emergency Messages; CTB: Clear to Broadcast; BMMB: Black-burst based and multi-hop broadcast; PBA: Prediction Based Authentication; MAC: Message Authentication Codes; MANET: mobile ad hoc network; OBU: on board unit; TA: trusted authority; V2V: vehicle to vehicle communication; NAV : Network Assignment Vector

Availability of data and materials

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Competing interests

The authors declare that they have no competing interests

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Authors' contributions

RD involved in Partitions and back-end solutions for the emergency dispatcher give priority to each partition; JSJ measured the performance analysis is done with the existing methods for the determination of efficiency, redundancy, collision, and delay. RD and JSJ is the contributor in writing the manuscript. All the authors read and approved the final manuscript.

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Figures

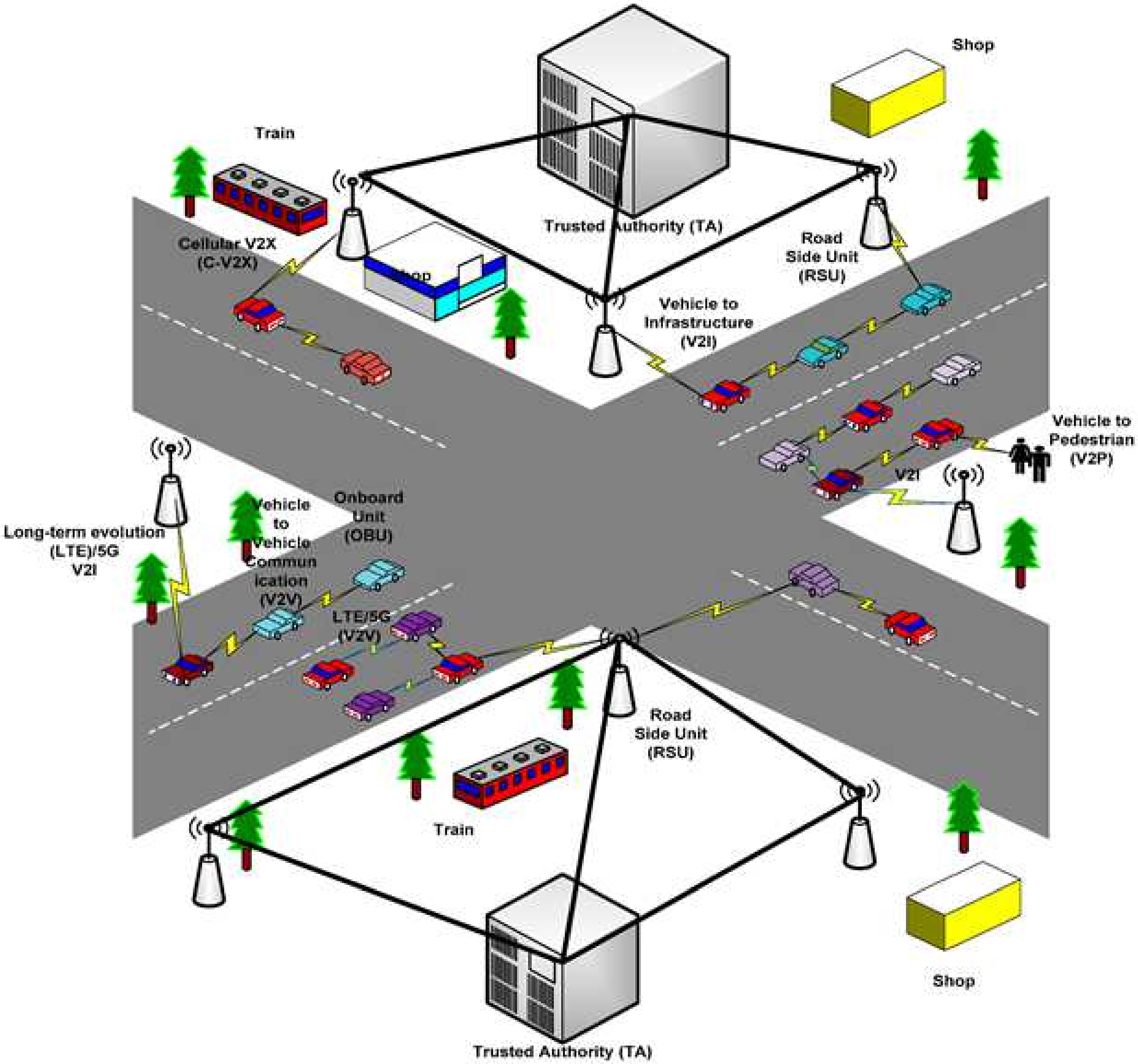

Figure 1

Message broadcast

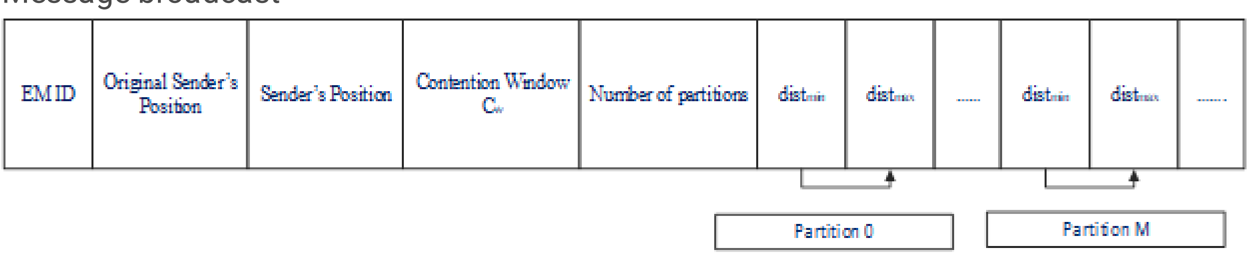

Figure 2

RTB packet format

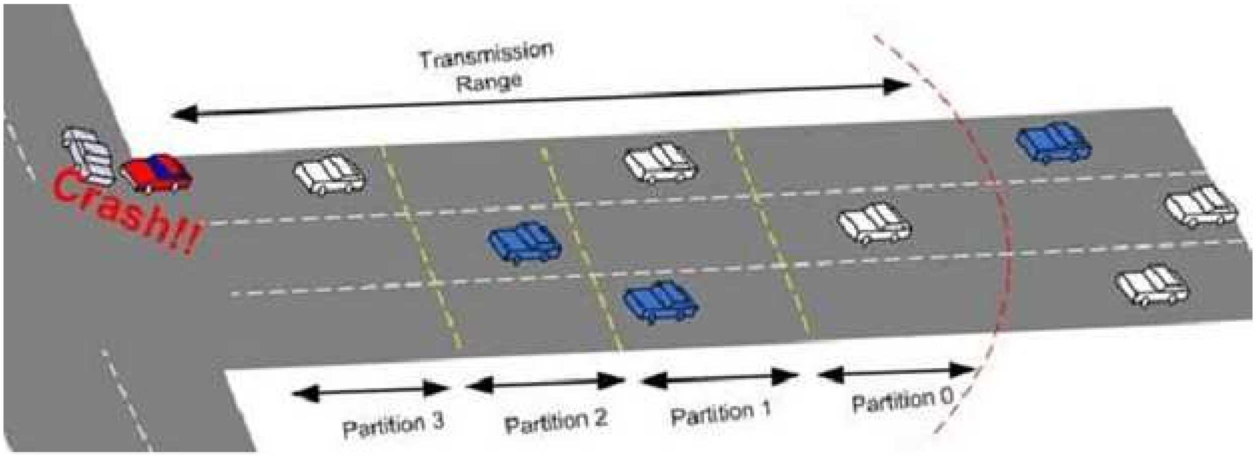

Figure 3

Partition length estimation

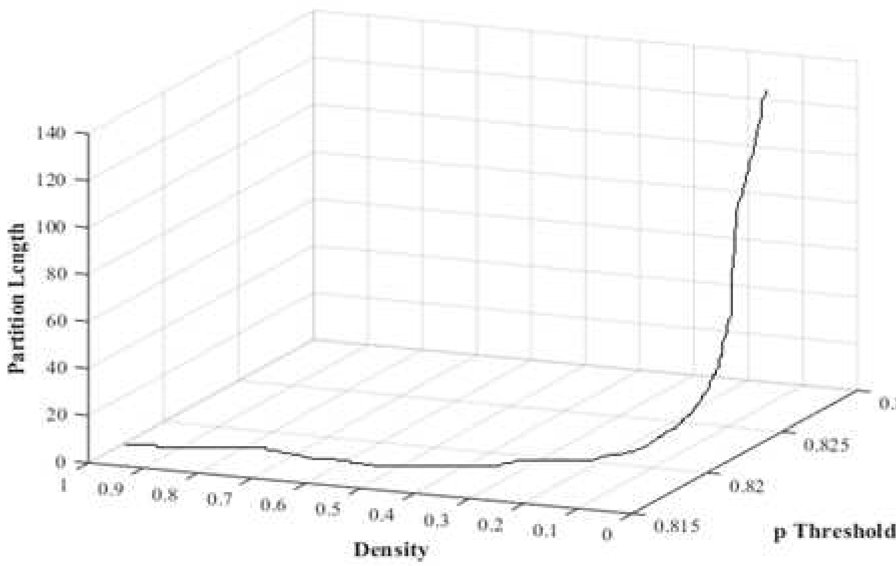

Figure 4

Partition length versus network density

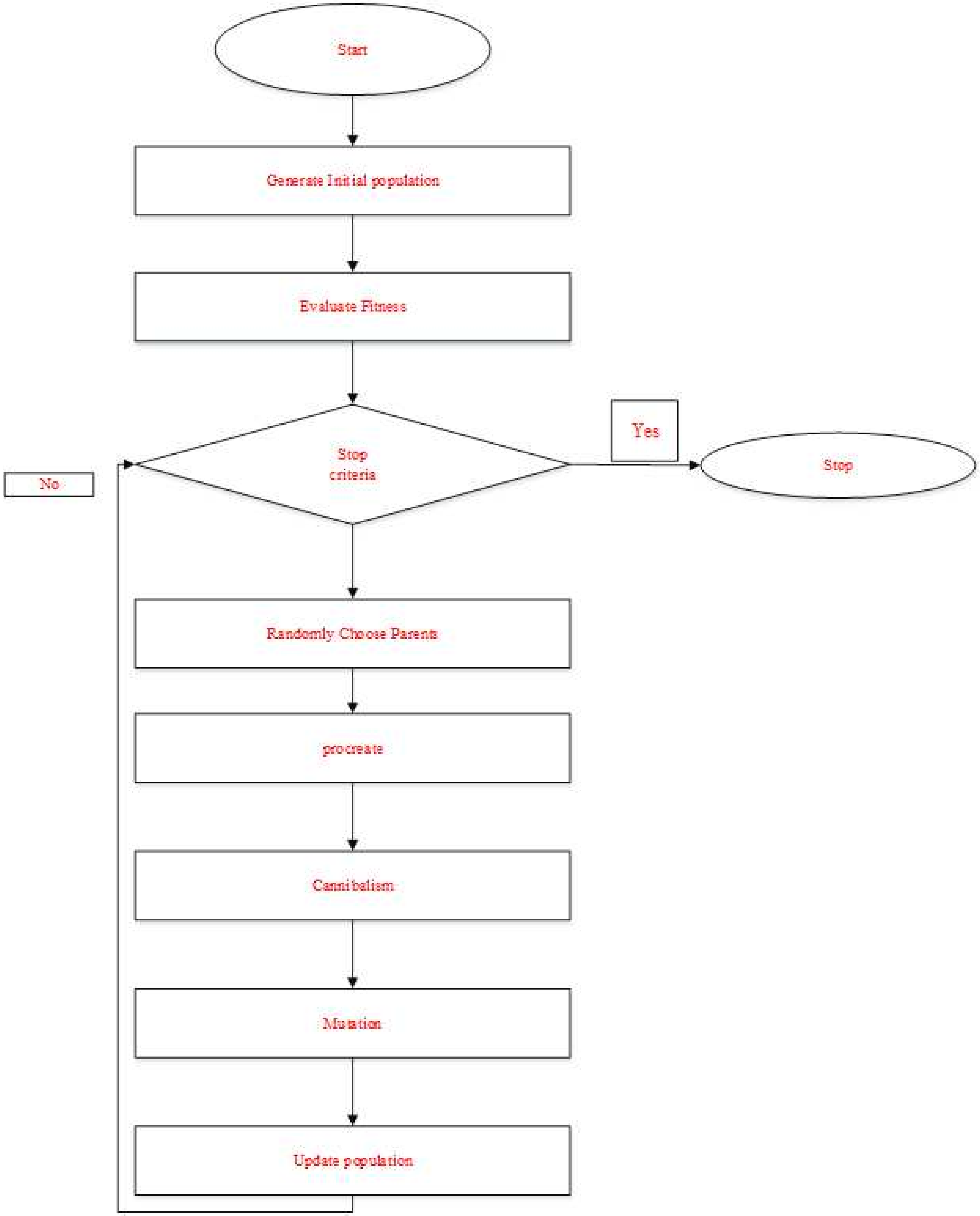

Figure 5

Basic block of black widow optimization

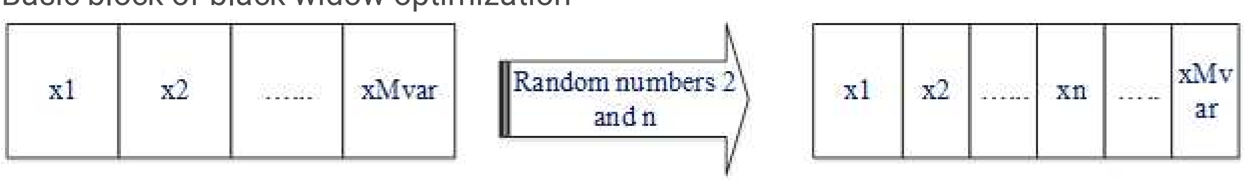

Figure 6

Mutation

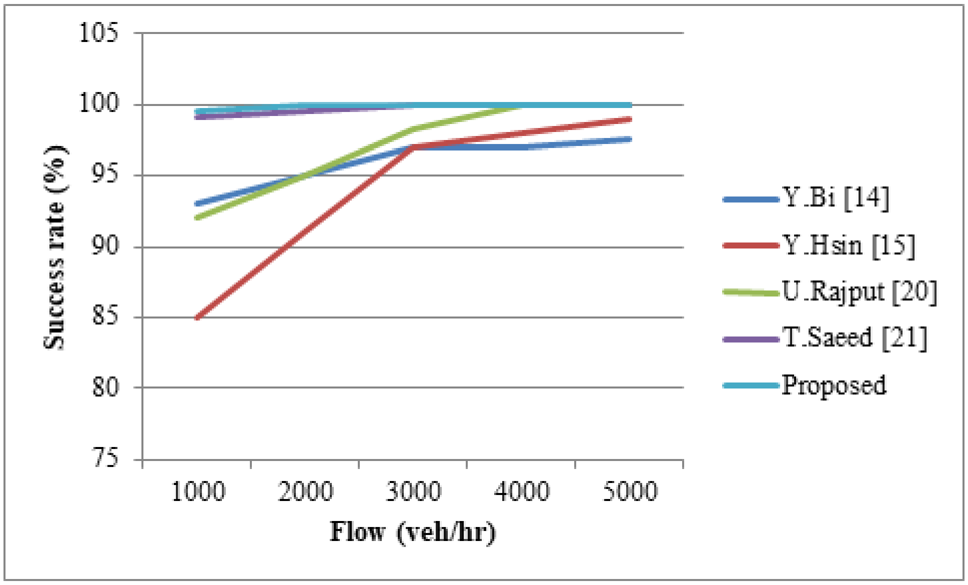

Figure 7

Success rate

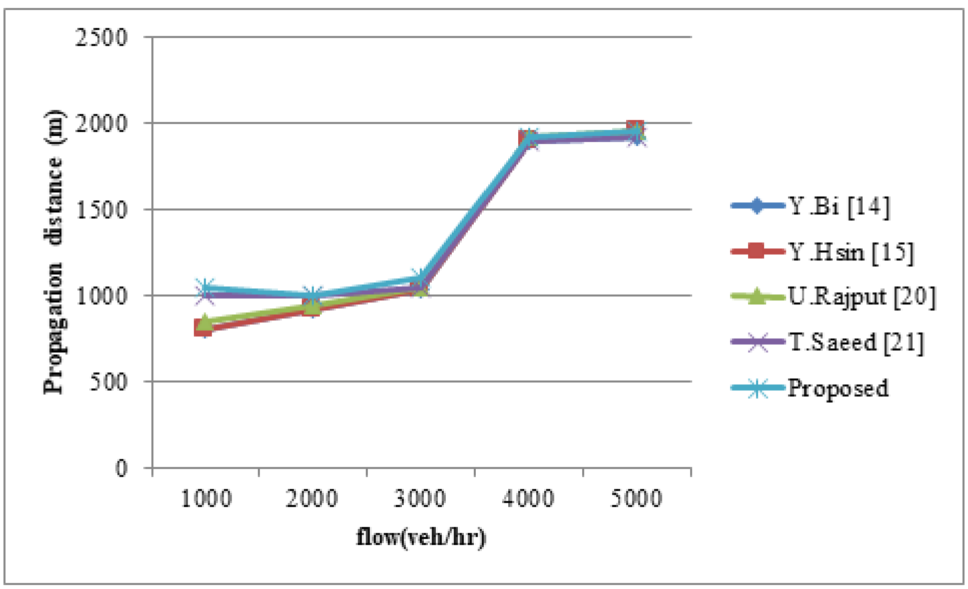

Figure 8

Propagation distance

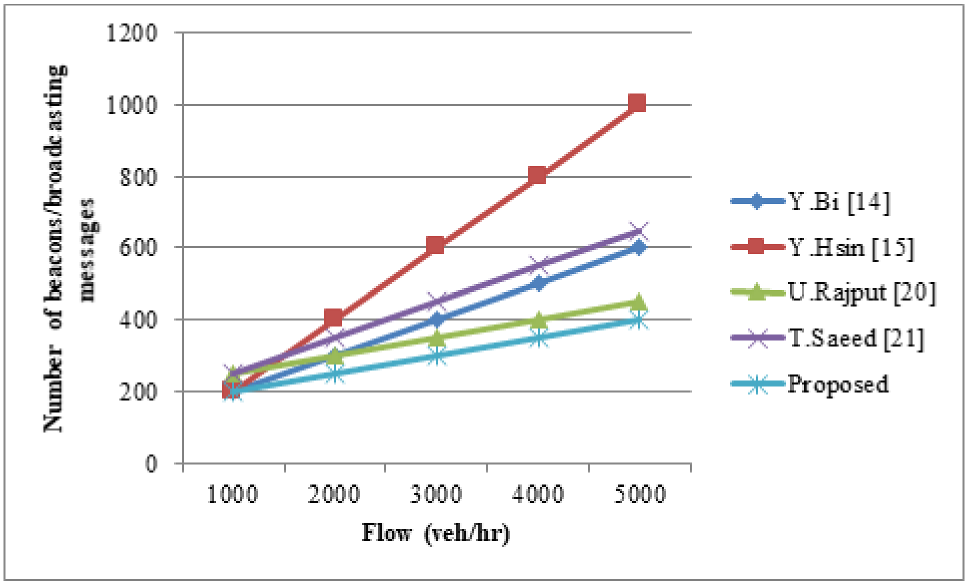

Figure 9

Number of beacons

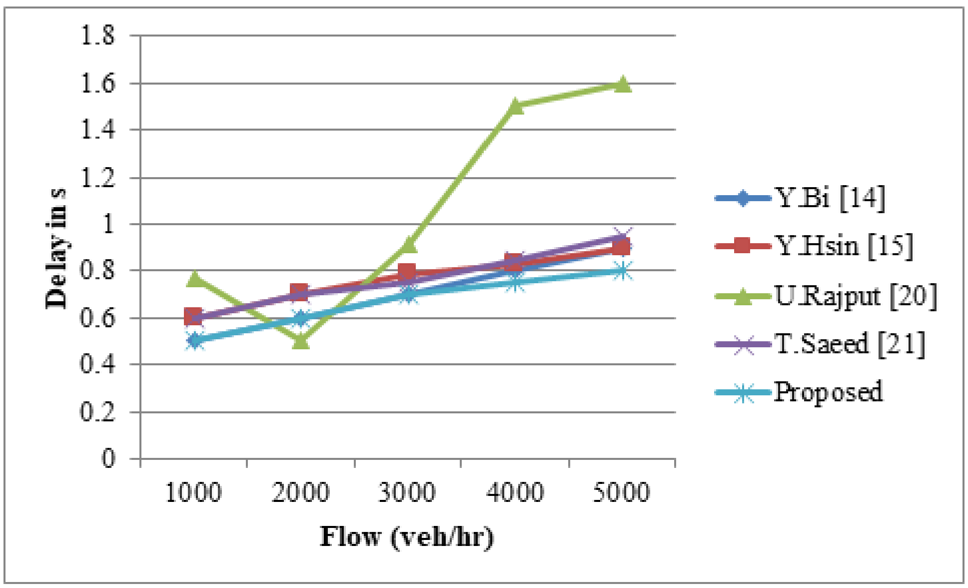

Figure 10

Delay

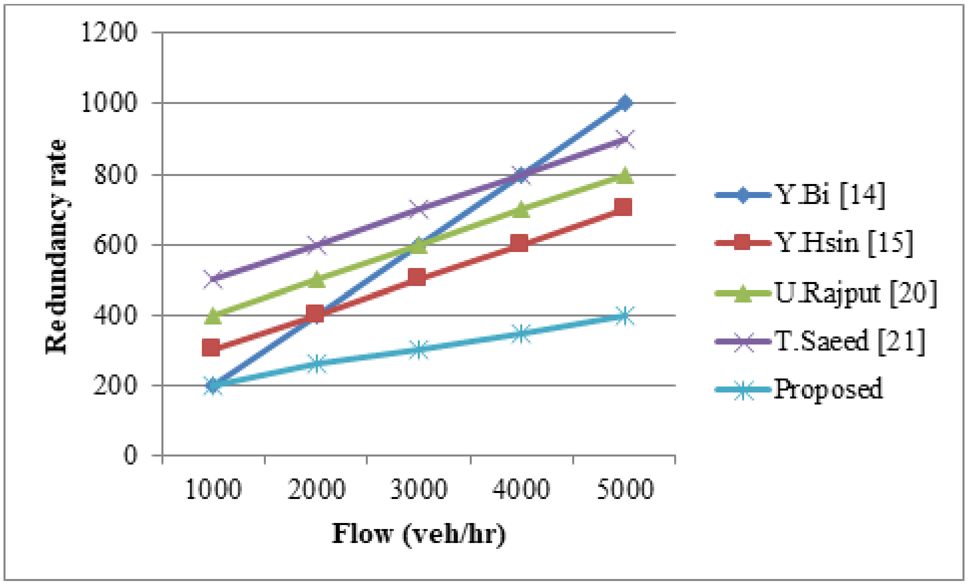

Figure 11

Redundancy rate

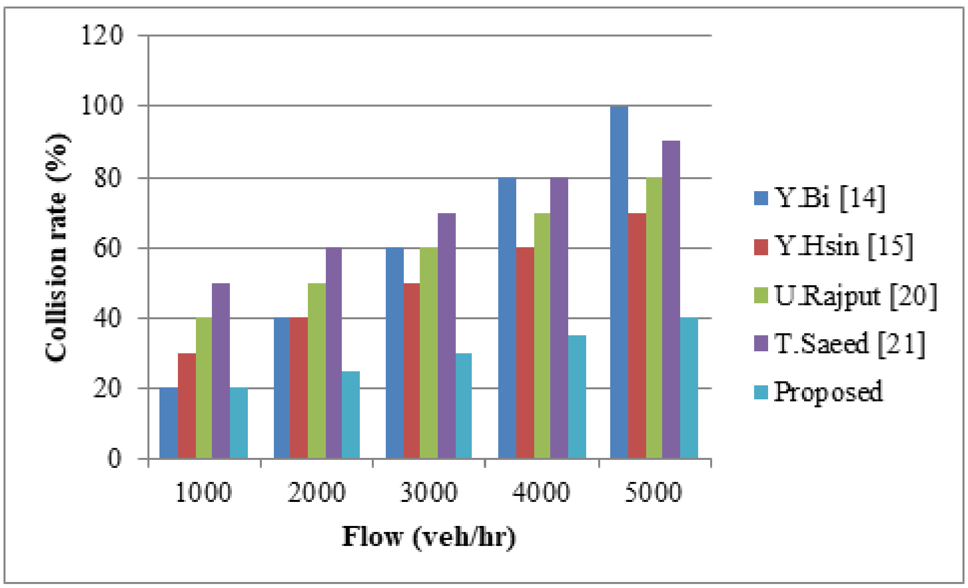

Figure 12

Collision rate

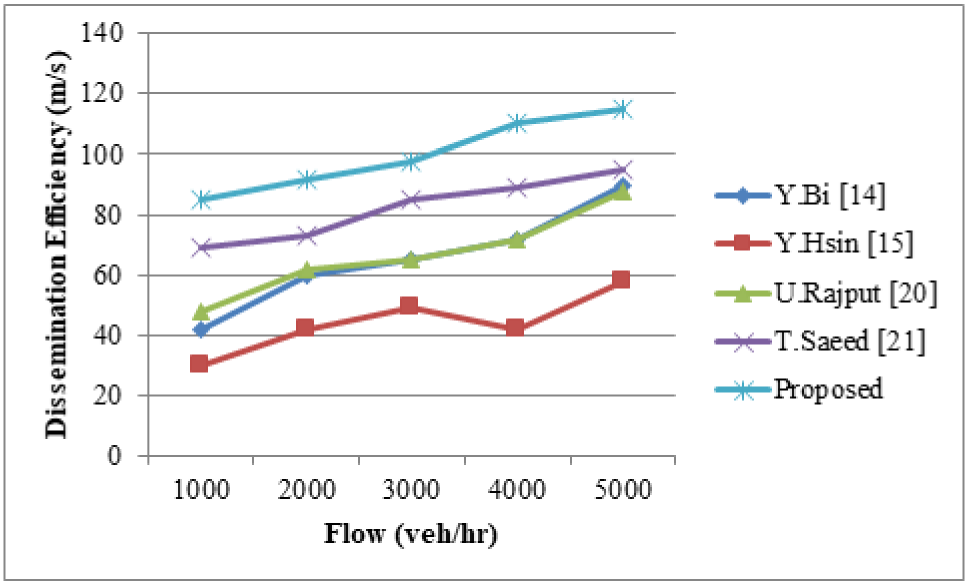

Figure 13

Dissemination Efficiency