Webology (ISSN: 1735-188X)
Volume 19, Number 2, 2022

Relative Analysis Of PBERR And LPRV Routing Technique To Enhance Network Lifetime For VANET

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Abstract: This paper teaches about Vehicular Ad-hoc Networks (VANETs) including the creation of a traffic prediction framework with a novel prediction model for traffic conditions. A prediction is then made based on ad-hoc data generated in each vehicle, particularly each vehicle travelling speed along with road side intersections. Under a reliability requirement, the least energy route is used to increase the lifespan of Adhoc networks. The probability of a packet reaching the base station must always be a certain probability. By selecting nodes for multi-hop packet forwarding under information, the most evenly distributed energy state throughout the network will be acquired after the packet has reached the base station. The creation of a traffic message delivery algorithm with a real-world city mobility scenario also discussed. Furthermore, based on the parameter approach, is used to analyse and assessment of affecting aspects which improves network lifespan via an efficient and dependable routing algorithm.

Keywords: LPRV, PBERR, VANET, Routing, Energy efficiency

Introduction

The vehicle self-organization network has unique characteristics such as an open channel, rapid speed, and dynamic change, all of which pose a threat to its security. Add in the fact that the Vehicular Ad-hoc NETwork (VANET) relates to a large number of vehicle nodes, collect the messages sent between them in the VANET, particularly in the city scope which has some background traffic. The issue of traffic load has emerged as a major VANET concern.

VANET is a relatively recent technology in the mobile wireless network that plays a key role in ITS by allowing data to be shared between cars having wireless interfaces (Martinez, et al. 2011). A mobile network is made up of moving vehicles and transportation infrastructure that employ wireless communication technologies. Vehicles will serve as wireless nodes or wireless routers in this network. As demonstrated in Fig. 1, vehicles within a short or medium distance form a link to form a large-scale network. When a vehicle is out of signal range, other cars in the network can still join and link to form a new mobile network.

Routing protocols in VANETs may be divided into six categories:

1) Topology-based protocols: They discover routes between central hub locations and with the exception of them in a routing database beforehand delivering data.

2) Protocols based on Position: This group of protocols varieties usage of geographic location data with the goal of locating gradual sending hub sites, eliminating the need to plan and including a path between sender and receiver.

3) Cluster-based protocols: In these protocols, nearby vehicles endeavour to form a cluster with one another. One of these vehicles is preferred as the gathering group's leader, and is in charge of broadcasting and managing inter/intra-group messages. The major advantage of group-based protocols is scalability, which leads to a lot of overhead.

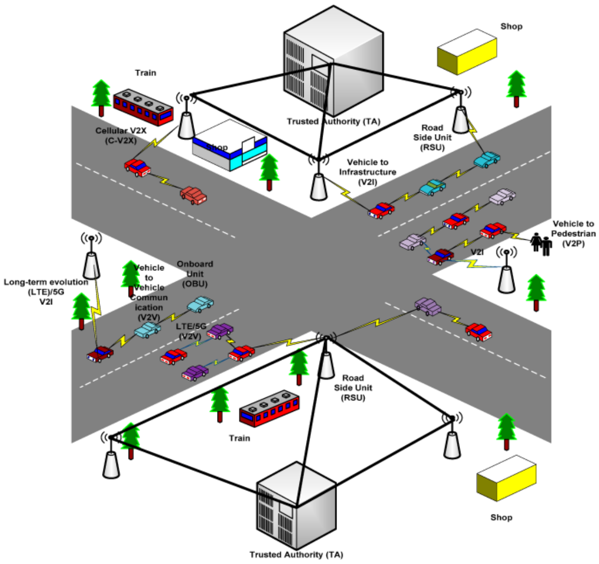

Fig. 1 Model diagram of VANET

4) Geo-cast routing protocols: Herein this sort of protocol, nodes attempt to convey data to a group of cars in a certain geographical region. They mimic multicast routing in appearance. Partitioning and forwarding to an appropriate node, which are two shortcomings in Geo-cast routing protocols, can be avoided by using bothersome neighbor centers.

5) Broadcast routing protocols: These protocols are primarily utilised in VANETs for a variety of purposes, including traffic information or data exchange, emergency news, and advertisement news.

6) Infrastructure-based Protocols: These protocols employ their infrastructure in the routing process, hence the name.

Literature Survey

Localization Prediction based Routing for VANETs (LPRV) is a one of the algorithm in routing system. The suggested LPRV algorithm's basic concept is to use knowledge of a vehicle's expected position and a digital map as metrics to send data packets without the need for extra control messages.

One of the issues with VANET is reliable data delivery. The minimal hop-count is a frequent measure in routing methods. However, because it ignores the link quality between the node pairs, it cannot maintain a satisfactory throughput on a VANET. R.C. Shah et al. used the routing measure of the cost of communication between the node pairs and the power remaining in the node. The suggested approach may reduce energy consumption and extend the life of the entire VANET, but it ignores maintaining a high throughput.

S. J. Douglas et al. introduced Excepted Transmission count Metric (ETX), a novel statistic that combines forward and reverse delivery ratios to determine a route. It has the smallest number of deliveries and the maximum throughput. ETX, on the other hand, is unable to pick between two routes with the same ETX value but differing forward and reverse delivery ratios. As a result, ETX may opt for a route that allows for a lot of retransmission. D.W. Cheng et al. enhanced the ETX by adjusting RF power to match transmission demand. However, in order to maintain a high throughput, the chosen nodes will maintain a high RF power, causing the nodes to rapidly perish.

A number of VANET applications, notably those linked to security, have expressed interest in the Geocast technique, which is based on position-based routing (accident alerts and prevention). Messages are likewise routed based on location information in geo cast, but packets are sent to all nodes in a specified geographical region. Flooding is a common routing approach that may also be used to send packets to a geo cast region. A packet is distributed through all network nodes in this technique until it reaches its final destination.

Savita Yadav, et al. explains VANETs are ideal for relaying information among automobiles because drivers do not need to be attentive while driving. Due of the inherent aspects of the automotive environment, it is extremely challenging to develop an expedient routing protocol among cars. R. Shiddharthy, identified the problems related to the broadcast storm, and it impacts inter-vehicle communications with increased contention and collision due to the rebroadcasting of a message between the cars. Abdul Karim Kazi, et al. proposed an efficient routing protocol named Reliable Group of Vehicles (RGoV) to provide a reliable routing system for VANETs. The clustering approach only adds to the establishment of a number of trustworthy nodes, resulting in a reduction of unnecessary broadcast storm transmission.

Methodology

The proposed methodology is used to select based on the distance between two successive nodes, free buffer space, energy level, and hop count, a trustworthy link between the transmitting and receiving nodes is created. Packet loss happens when a node's energy falls below a certain threshold, preventing the packet from being sent. As a result of inadequate buffer space at nodes to retain packets, packets may be discarded at an intermediate step. As a result, choosing a node with suitable energy levels is crucial to minimise packet loss and hop count. The following characteristics are taken into account while choosing a trustworthy path from a source to a destination node: (i) free buffer space availability, (ii) minimal energy level, (iii) hop count should be kept to a minimum, and (iv) distance between source and destination nodes.

Initially define the input nodes along with source and destination nodes. Thereafter, define the initial energy of each nodes and transmission range between them. Calculate the distance using the greedy technique and the Euclidian formula (Fig. 2). Once the node distance has been computed, identify the highest parameter node as the beginning energy node and determine whether or not the destination is within the transmission range. Update the source and destination locations if the destination node is within the transmission range. Then, based on the threshold value, choose the node within transmission range that is closest to the destination node. If the destination distance is more than the threshold value, the procedure is repeated with another node state as the highest parameter. Check the buffer size availability and compute the energy levels for each node, then select the node as a router based on these values to forward packets. Choose the router node as the parent node and create the tree structure for all deployed nodes after the buffer size has been set.

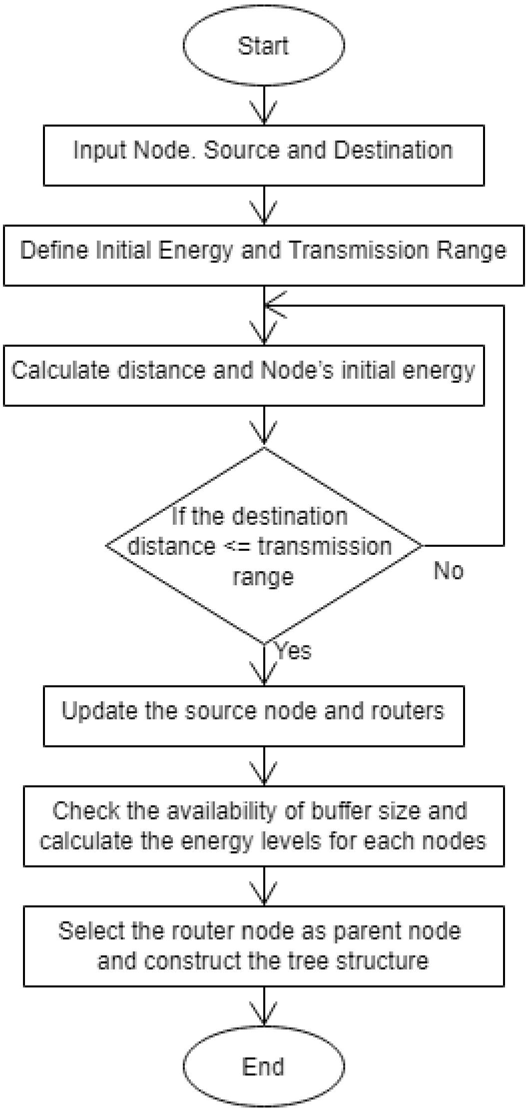

Fig. 2 Flowchart shows the proposed routing algorithm

Performance metrics are introduced to equate the performance of the various paths from node A to node D, there are a number of different routes to take., whereas node A is source node and node D is destination node. The Packet Received Rate (PRR) is defined as follows.

$$PRR = \frac{N_{dr}}{N_{sd}} \qquad \dots 1$$

The total number of packets received at the destination node is Ndr, while the total number of packets transmitted at the source node is Nsd. Data should be transmitted to neighbour nodes with the highest residual energy as much as possible to balance network energy. In order to prevent broadcasting to the energy empty area, the energy state around the next hop node should also be checked. For this reason, the index of the node's energy density factor is established, and the equation is as follows:

$$J(a) = \frac{E_a}{E_o} \cdot \frac{1}{0.5\pi l^2} \left(\sum_{a \in FN(i), t \in FN(a)} E_t \right) \quad \dots 2$$

where max distance between node i and the nodes of forward neighbour node say FN(i) is l; E - energy status of the node ‘a’ say residual energy E_a of the forward neighbour node a; E_t - transmission energy and initial node E_0; J(a) - energy density factor is benefit index, which is, the higher J(a) is, and the higher residual energy and energy density node determination be situated in choosing the next hop.

Consider Euclidean graph G for VANET i.e., G = (V, E, r), where r is the communication range and the number of nodes is |V | = n;

$$V = \{v0, v1, v2, \dots, vn-1\}, \quad \dots 3$$

where {v0, v1, . . . , vn−1} is the set of vehicles; (i, j) ∈ E iff v_i reaches v_j, such that v_i is within the node v_j of the communication range r; E is the collection of transmission lines between pairs of nodes known as edges, as well as the calculated location of nodes vi i.e., using a localization system is $\forall v_i \in V, (Xc_i, Yc_i, Zc_i) \in R^3$ as shown in Fig 3.

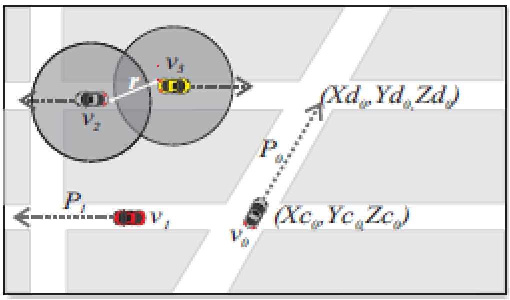

Fig. 3 Location, network nodes and trajectory

Using the Euclidian formula stated in eq.1, specify the beginning energy and transmission range, and compute distance.

$$\text{Dist}(p,q) = \text{sqrt}((p_2 - p_1)^2 + (q_2 - q_1)^2) \quad \dots 4$$

Where in the Euclidian plane, q = (q1, q2) and p = (p1, p2). Once the distance has been computed, the node's starting energy should be calculated. If the transmission range is exceeded, update the source node and routers by picking a node within the transmission range that is close to the destination node based on energy level and buffer size. Further, the destination should be checked to see whether it is within the transmission range. If the distance is less than the threshold range, then the threshold is equal to the distance, and the new source is assigned as the next source, and the destination range is checked again. The process initiates and completes packet transfer between the source and destination.

Consider the drive of a vehicle I from its present location to a future calculated point as a vector. This trajectory might be a straight line, a curved line, or any other mathematically described trajectory. For the purpose of simplicity, we assume a vehicle will follow a straight line trajectory. This line is defined as Pi = ((Xci, Yci, Zci), (Xdi, Ydi, Zdi)) (as shown in Figure 3), where (Xci, Yci, Zci) is the current vehicle location, (Xdi, Ydi, Zdi) is the next estimated position direction, and si is the displacement speed. Calculate minimum distance based on trilateral algorithm.

Initially create a data packet for transmission to a target location. Thereafter select the destination Di, which refers to area where collision occurred or monitoring station area such as a car collision can be reported. This packet comprises, among other things, the node's future position and displacement speed Pi and si (Node future position and speed), as well as the original vertex on the map from which the packet was formed. Further broadcast to all nodes in the one-hop vicinity.

Broadcast packet (pktidi, srci, Di, Pi, si, startMi, data) …5

Once a node receives a packet, it verifies a node that nodes are in position of the current node is within the packets destination area. Whether this is the case, the packet has been received and is now in the receiving phase. If not, the forward phase begins with a check to see if the present node has ever forwarded this packet. Based on the Euclidian geometry calculates the shortest distance between each line and a point. This process is repeated until the packet reaches its destination.

Results and Discussion

A VANET area is formed by taking into consideration the vertical minimum (vermin) node, horizontal minimum (hormin) node, vertical maximum (vermax) node, and horizontal maximum (hormax) node, as shown in Figs. 4a and 4b. MATLAB is used to accomplish the performance evaluation.

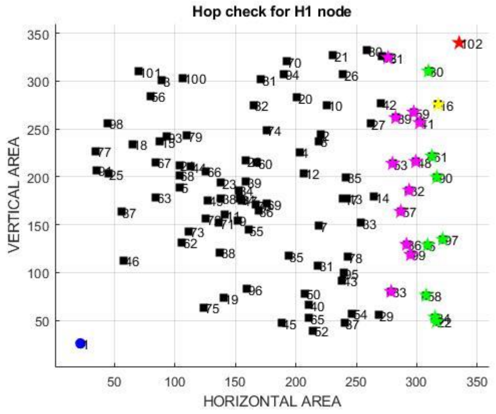

Fig. 4a VANET creation

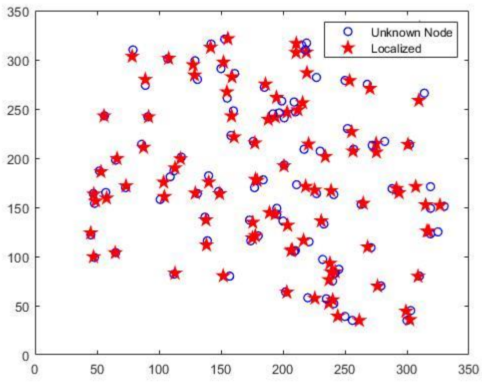

Fig. 4b Localized and Unknown node in VANET

One hop delay is set at 0.1 second by default. The suggested routing algorithm achieves a lesser average number of hops in delivered packets due to its characteristic of decide on only predicted future sites positioned based on shortest path designed for vehicles in the middle of destination and source. Figure 5 shows the hop check for the H1 node, whereas Figure 6 shows the hop shift for all node verification. The cyan colour in Figure 6 represents the parent node, the green colour represents the clear node, and the pink colour represents the child node.

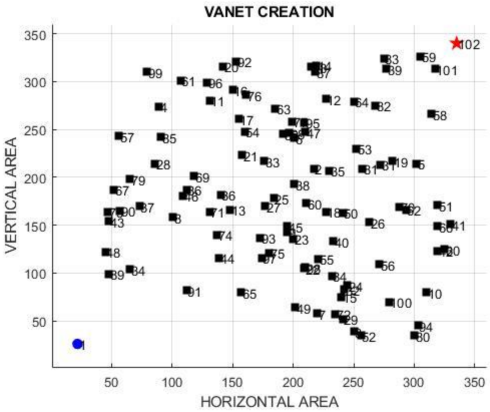

Fig. 5 Hop check for H1 node

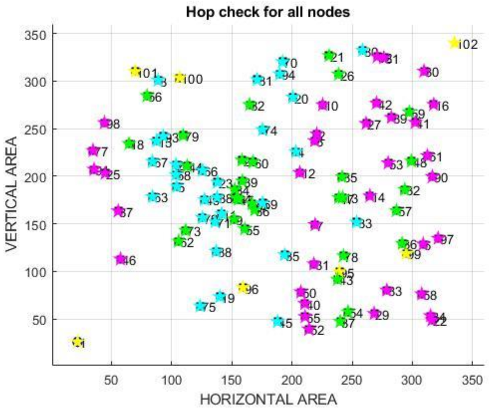

Fig. 6 Hop check for all nodes

For the channel coefficient that defines the influence of fading, and shadowing, and the Rayleigh fading channel is employed. If there is no uniform lineage, the nodes tend to occupy each route evenly. The average rate of nodes in relation to the number of neighbor nodes, for example, consider H1, H2 for example initial hop H1 to subsequent hop H2 for the accompanying Z set and nodes H2, H3 for example from H2 hop to H3 hop i.e, child for the corresponding Q set, as illustrated in Fig. 7.

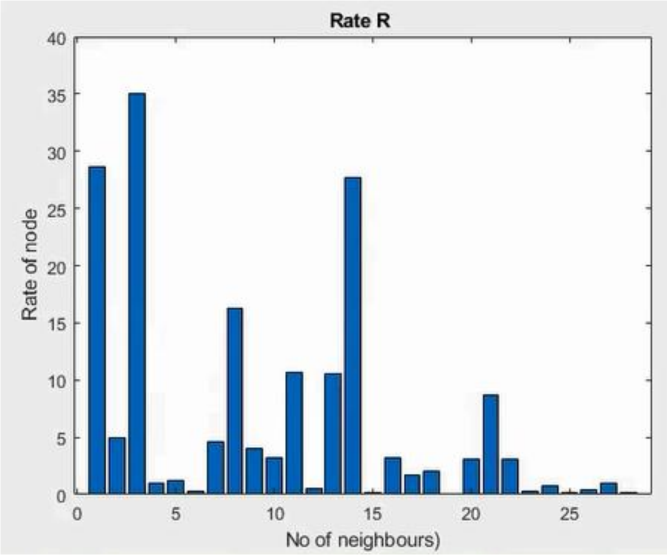

Fig. 7 Shows Number of neighbor nodes with respect to Rate R of node

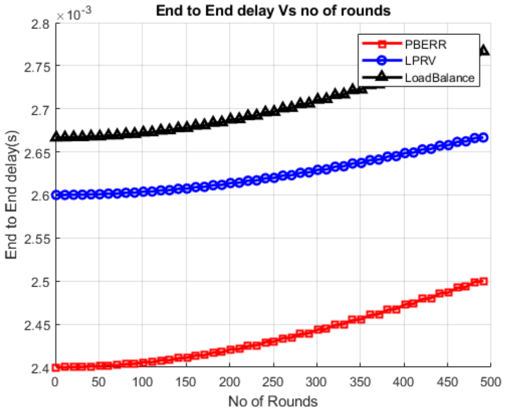

Fig. 8 End to End delay v/s No. of rounds

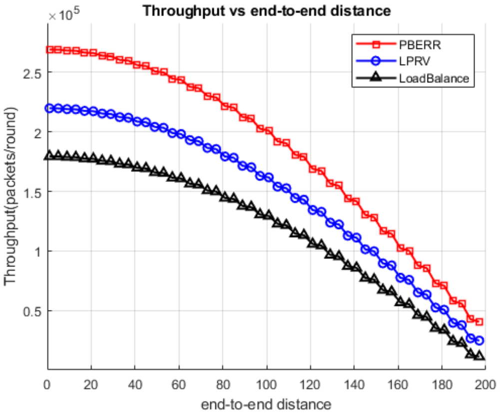

Fig. 9 Throughput v/s end-to-end distance

End-to-end latency vs. number of rounds, and throughput vs. end-to-end distance are demonstrated in Figures 8 and 9. The suggested approach shows positive results with respect to number of rounds increases from 0 to 500. For example, delay varies from 2.4s to 4.48s in PBERR routing delivery packet when a hop delay is raised, where as in LPRV routing varies from 2.6s to 2.65s. Throughput packets per round rise from 500 to 5000, as seen in Fig. 9. The simulation result for network throughput is presented in Fig.9. When the PBERR algorithm is compared to the LPRV technique, the network performance is 8 percent higher.

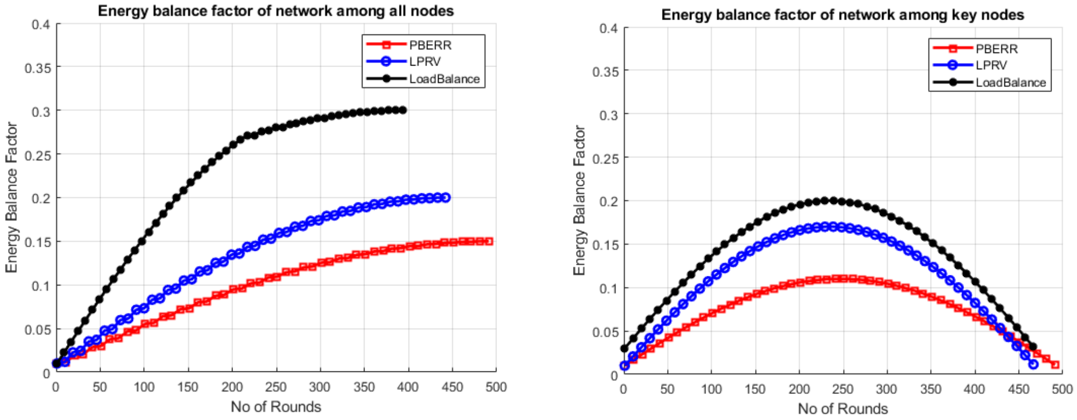

Fig. 10 Energy balance factor of network (a) among all nodes and (b) key nodes

When equated to the number of rounds, the energy balance factor of the network a) among all nodes and b) among critical nodes in PBERR routing consumes less energy. Fig. 10a depicts the fluctuation in the network's energy balancing factor among all nodes, and it delivers great efficiency in terms of reduced energy use. It was discovered that the energy usage is 4% lower when compared to the LPRV algorithm. The energy balancing factor reduces as the number of rounds grows among critical nodes in the case of the routing algorithm as compared to load balance, which gives superior efficiency, i.e., roughly 0.1 energy when compared to LPRV and load balance, as shown in Fig. 10b. Figure 11 depicts the simulation result for energy usage. The PBERR algorithm is contrasted with the LPRV algorithm. It was discovered that the energy usage is lower when compared to the LPRV algorithm.

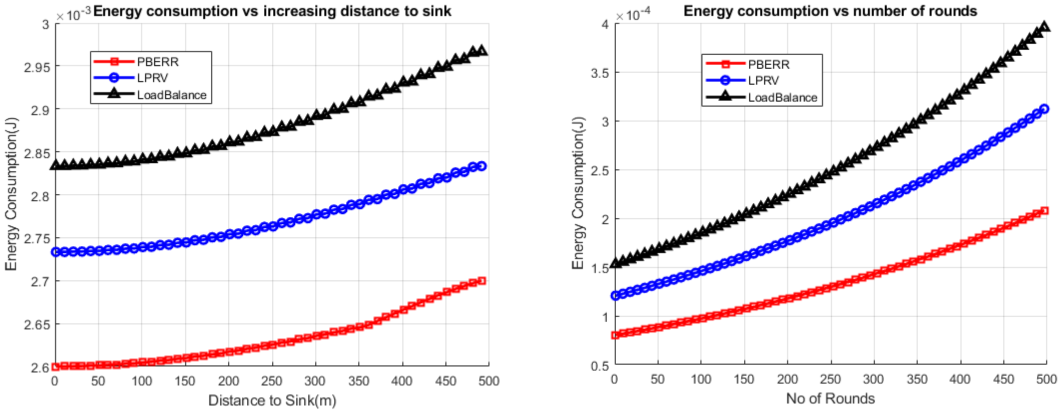

Fig. 11 Energy consumption v/s increasing distance to sink and number of rounds

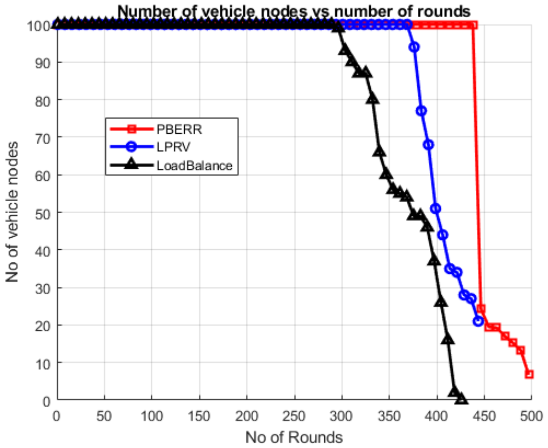

Fig. 12 Number of vehicle node v/s number of rounds

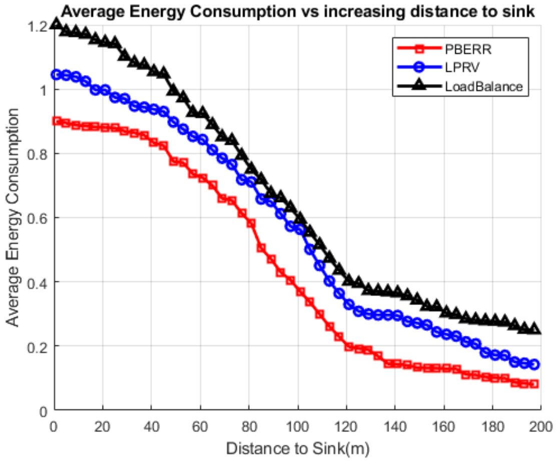

Fig. 13 Average energy consumption v/s increasing distance to sink

Fig. 12 shows the comparison between the numbers of vehicle node with number of rounds for all the three algorithm say PBERR routing, LPRV and load-balance. It is observed that as number of rounds increase from 300 or above, load-balance will shows decrease results whereas in PBERR routing gives better results up to 450 rounds and no. of vehicles will be 100. Fig. 13 shows the average energy consumption variation with respect to increasing distance to sink from 0 to 200 and the energy consumption is calculated based on the mean of the available nodes in the network. Initially calculate the energy consumption at each and every node and then calculate average of all the nodes in the network. It is observed that in PBERR routing shows less energy consumption say <0.2 when compared with LPRV and load-balance.

Conclusion

The simulation findings demonstrate that, when compared to LPRV, load balancing, and PBERR algorithms, PBERR can effectively minimize network energy consumption, extend network lifetime, and improve packet loss rate, resulting in high transmission reliability. This technique may be used to find an alternate routing when malicious nodes are spotted during message delivery. The information is encrypted and decoded using the RSA technique to increase security. It is feasible to discover improvements in system performance when simulation results are compared to the LPRV approach. The suggested method is an iterative technique that uses fewer relay nodes to achieve the required connection in a particular VANET. Furthermore, when the suggested parameter-based method is compared to the LPRV algorithm and load balancing, it is discovered that the energy consumption and average latency are much lower when compared to the LPRV algorithm and load balance. And also improvement in packet loss rate and network throughput, showing a good performance in transmission reliability.

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