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كفاءة الطاقة المجاورة للبث المباشر والانتظار في شبكة الهاتف المحمول المتخصصة

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الخلاصـة

الشبكة المتخصصة للهاتف المحمول هي شبكة الاتصالات بدون بنية تحتية والتي بنيت بموارد محدودة. واستخدمت آلية البث في شبكة الاتصالات لبناء الهيكل الذي يحافظ على البنية التحتية الافتراضية للاتصالات. وشبكة الهاتف المحمول المتخصصة لها دور حاسم لكفاءة الطاقة وهناك حاجة لوضع نموذج للبث الفعال لتحسين كفاءة الشبكات في استخدام الطاقة. وتقترح هذه الورقة خوارزمية إعادة البث المعززة حيث تم اتخاذ قرار من إعادة بثها إلى المستوى المجاور التالي مع الوضع المباشر أو الانتظار. وهذا النهج يساعد في زيادة سرعة تغطية النقاط والتي لم يتم الوصول إليها، ويقلل من عدد إعادة بثها في الشبكة مما يقلل بدوره من استهلاك الطاقة في الشبكة. وقد تم تحليل نتائج المحاكاة من الطريقة المقترحة ومقارنتها مع النتائج الحالية. أثبتت النتائج أن الطريقة المقترحة تعطي أعلى نسبة تسليم حزم بمتوسط 99.964 مئوية في أوقات الوقف المختلفة. وكما تم تقليل استهلاك الطاقة في حدود 0.0617 جول في التجربة. وتم تخفيض تأخير في المعاملات الحزمة إلى 0.00634 متر في الثانية الواحدة في الخوارزمية المقترحة.

Energy efficient neighbor coverage-based probabilistic rebroadcasting in MANET

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ABSTRACT

Mobile Ad hoc network is an infrastructureless communication network built with limited resources. Broadcasting mechanisms were used in the network to build a structure that maintains a virtual infrastructure for communications. Mobile ad hoc network has a critical issue of energy efficiency and there is a need of developing an efficient broadcasting model to improve network's energy efficiency. This paper proposes an enhanced rebroadcasting algorithm, where the decision of rebroadcasting was made for the next level neighbor nodes with immediate or wait state. This approach helps in increasing the speed to cover unreached nodes and reduces number of rebroadcast in the network, which in turn reduces the energy consumption in a network. Simulation results of the proposed approach were analyzed and compared with the existing works. Results proved that the proposed work has higher packet delivery ratio with an average of 99.964 percentage at different pause times. It has also reduced energy consumption of the network to an average of 0.0617 joules for the experimented scenario. Delay in packet transactions was reduced to an average of 0.00634 meters per second in the proposed algorithm.

Keywords: Broadcasting; computer networks; mobile ad hoc networks; neighborhood based; routing protocols.

INTRODUCTION

Mobile Ad-hoc NETworks (MANET) is capable of building a network without any fixed infrastructures. In MANET, nodes act as a router as well as host, which allow multi-hop transactions with rebroadcasting the received packets. This network has a wide range of applications in the fields like emergency situations, disaster rescue operations, collaborative group meetings and military operations (Sandeep & Satheesh Kumar, 2012). In wireless networks, the information packets can be transmitted by means of broadcasting or rebroadcasting. Broadcasting is a widely used dissemination technique in which packet transmitted by a node is simultaneously received by all its neighbors. This mechanism is effectively used for route discovery and network maintenance. Simplest way of broadcasting is flooding in which every node rebroadcasts the received packet in the network. In large mobile environments, flooding has the overhead of redundant retransmission, contention and collisions (Abdulai *et al.,* 2007; Tseng *et al.,* 2002). It also raises several other issues like its inefficiency in terms of resource consumption such as bandwidth and energy (Tseng *et al.,* 2002; Tonguz *et al.,* 2006). Mobile ad hoc network devices rely on exhaustive means of energy like batteries. In such networks with limited energy, the design of architecture requires less power consuming approaches. An energy efficient rebroadcasting mechanism in the network demands for optimized approaches which can achieve significant reduction in retransmissions of packets. Jacobsson *et al.,* (2011) investigated blind flooding, counter-based broadcasting (CBB) and a neighbor knowledge-based flooding protocol called prioritized flooding with self-pruning (PFS) in real time wireless multi-hop network. The results indicated that the optimized approach has achieved significant reduction in retransmission of packets. Hence, optimization of broadcasting algorithms for required network will be much effective solution to improve the performance (Mohammed *et al.,* 2007).

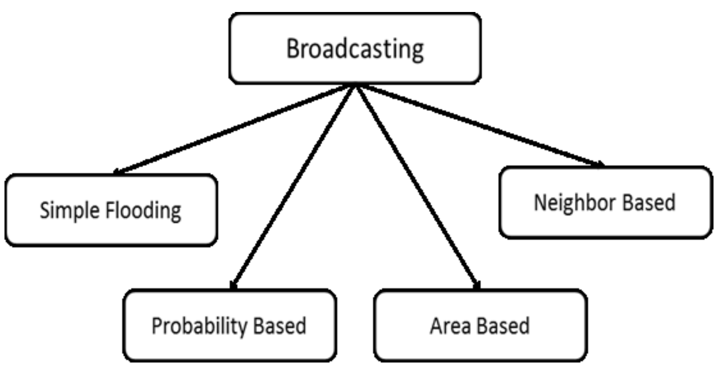


Fig. 1. Categories of broadcasting

The broadcasting protocols are categorized into four classes such as, simple flooding, probability based methods, area based and neighbor information based methods, as shown in Figure 1 (Williams & Camp, 2002). According to Kim *et al.,* (2004) the performance of neighbor based methods were better than area based methods and the performance of an area based were better than probability based methods. There are many probability based rebroadcasting approaches available in the literature (Reina *et al.,* 2015). Some of the probability based approaches take the advantages of neighbor information as next-hop coverage and node density for their broadcasting decisions. Lee & Ko, (2006) proposed flooding based on one-hop neighbor information and adaptive holding (FONIAH), which takes the information from its one hop neighbor to rebroadcast the packet for selective neighbor. In this paper, enhanced neighbor coverage-based probabilistic rebroadcasting (ENCPR) approach is proposed, which takes the advantage of two hop neighborhood information for rebroadcasting. This approach reduces the collusion rate and energy consumption in the network and improves network performance, which are compared and analyzed based on different scenarios.

LITERATURE REVIEW

Many route discovery protocols were available in literature to optimize route discovery in MANET (Kim *et al.,* 2012; Khabbazian *et al.,* 2012; Harutyunyan & Wang., 2010). Earlier work done in wired network for latency constrained broadcasting has also favored the continuation of radio networks (Salama *et al.,* 1997). Popularity of radio network demanded for new approaches. Blind flooding was one of the straightforward approaches of broadcasting in which the node rebroadcasts a packet, whenever it receives the same for the first time (Lim & Kim, 2001). This method generates many redundant transmissions and broadcast storm problems, which leads to contention and collision. The wave expansion approach was proposed to efficiently broadcast in multi-hop radio networks (Chlamtac & Weinstein, 2002). In the year 2002, a gossip-based approach was proposed, where nodes forward the packet with probability, which reduces the overhead of flooding to certain extents (ie., up to 35 percent) (Haas *et al.,* 2002; Abdulai *et al.,* 2007).

Selective forwarding (Calinescu *et al.,* 2001), location aided routing (Young-Bae & Vaidya, 2009) and positional attribute based next-hop determination approach (PANDA) (Jian & Mohapatra, 2006) have been proposed to avoid broadcast storm problem (Tseng *et al.,* 2002). AlAamria proposed on-demand tree based routing protocol (OTRP), where the network dynamically discovered route based on the idea of hop-by-hop routing and tree based optimized flooding. Here the flooding is done selectively to limited set of nodes referred as branches (AlAamria *et al.,* 2013). In Reina's hybrid approach, two flooding based methods were combined to overcome broadcasting storm problem encountered by simple flooding scheme. This approach focuses on node density and forwarding zone criterion. Results have shown enhanced performance of the hybrid approach over simple flooding (Reina *et al.,* 2013). Researchers discovered several other approaches which were mainly probability based, functional based, birds and insect behavior based and counter based. Neighborhood information used to select particular nodes to broadcast were also widely experimented (Stojmenovic *et al.,* 2002; Basagni *et al.,* 2004; Orecchia *et al.,* 2004). Scalable broadcast algorithm (SBA) was a neighbor knowledge scheme where rebroadcasting was based on the fact that whether the rebroadcast will reach additional unreached nodes (Peng & Lu, 2000). Kim *et al.,* (2004) proposed a probabilistic method where the rebroadcasting was based on coverage area and neighbors conformation for the guaranteed reachability. Stenn *et al.,* (2006) proposed a robust broadcast propagation (RPB) protocol to provide high reliability for flooding in the wireless network. In this protocol, the upper layer invoked flooding was reduced to improve the overall performance of the network. Timer based broadcasting schemes such as dynamic reflector broadcast (DRB) and dynamic connector-connector broadcast were proposed to claim full reachability over the idealistic lossless MAC layer and robust at node failures and higher mobility (Keshavarz-Haddady *et al.,* 2007).

Abdulai *et al.,* (2010) proposed dynamic probabilistic route discovery (DPR) which was neighbor coverage based scheme, where each node determines forwarding probability based on the neighbors covered by the previous nodes. Mostafa *et al.,* (2014) proposed a scheme for vehicular ad hoc networks called Collision-Aware REliable FORwarding (CAREFOR). The rebroadcasting decision was made on predefined probability based on the factors from environment which includes density of nodes in the vicinity, distance between the sender and receiver and the transmission range of next hop. In another approach (Trindade & Vazao, 2014), routing protocol uses the stored and disseminates topological information through a specific type of bloom filter. This filter enables to discard old elements. The network constructs a logical overlay which indicates the distance and destination nodes. This approach limits the number of control message in large network but delay is again an issue. According to Hakami & Dehgan, (2014) the broadcasting was performed under slow fading, thus the link qualities can vary over the broadcasting periods. The broadcast problem was modeled as a game in which each node is equipped with regret based learning strategy. In this approach, node learns to reach equilibrium in their forwarding strategies for each global channel state. Nodes also proactively adapt their strategies so that their collectively forwarding behavior actively tracks the equilibrium, since there was a fading of channel state. In this algorithm, only the subset of nodes with good channel states will rebroadcasts the message. This approach improves the network performance with efficient use of good channels but has overload of tracking the equilibrium. Zhang *et al.,* (2013) proposed a neighbor coverage-based probabilistic rebroadcasting (NCPR) method where rebroadcasting probability was set based on coverage ratio and connectivity factor.

Goal of the proposed algorithm was to reduce the rebroadcasting overhead with much quicker dissemination of neighbor knowledge and pre-planning the execution from one hop ahead, while broadcasting. To achieve the goal of optimum rebroadcasting in MANET, 2-hop neighbor information was used by the node for rebroadcasting decisions. This paper is organized as follows. Methodology of optimized rebroadcasting section represents different approaches to enhance rebroadcasting in the network. This section also includes optimization of search and reaches operation, calculation of rebroadcasting wait and identification of immediate rebroadcasting neighbor node. Results and discussion section focuses simulation environment and performance measures used to study the performance of proposed work. The simulation results were also discussed with graphical representation and concluded with findings.

METHODOLOGY OF OPTIMIZED REBROADCASTING ALGORITHM

A detailed description of proposed scenario has been presented in this section which focuses on rebroadcasting wait and delay calculation mechanism based on the neighbor information discovery. In the proposed approach, network rebroadcasting was optimized with an efficient use of neighborhood information. In Figure 2, Node 'm' identifies its best neighbor 'n', which has more unreached neighbors, when it receives a route request (RREQ) from a source node 's'. It uses neighbor and neighbor of neighbor list information to identify the neighbors of 'n' which were not covered by 'm' and 's'.

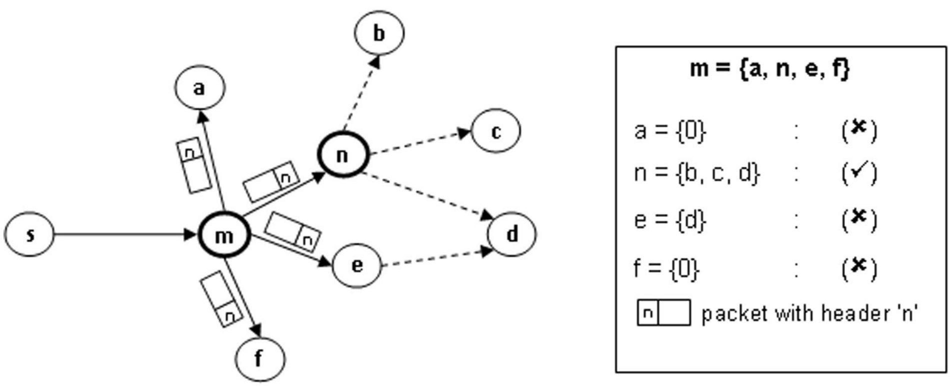


Fig. 2. Rebroadcasting based on neighbor coverage

The node 'm' forwards the RREQ with an "immediate" rebroadcasting header for the best 'n' nodes and rest of the nodes were imposed for calculated wait. The network has two different sets of operations such as search of specific destination or to reach every node in the network. Proposed algorithm distinguishes the uncovered neighbor set for two operations based on the requirement.

The search operation

In this operation, it needs the node to find particular destination and ignore all the leaf nodes, which are not a destination. The search operation was applied for the packets, which arrive with a header "search". The uncovered neighbor set for node 'n_i' has been represented in Equation 1.

$$U(n_i) = N(n_i) - [N(n) \cap N(n_i)] - [N(n_i) \cap N(s)] - n - s - L(n_i) \quad (1)$$

where ‘n’ is a rebroadcasting node, N(n) is a neighbor set of rebroadcasting node, ‘n_i’ is a neighbor of the rebroadcasting node , N(n_i) is the neighbor sets of ‘n_i’ and L(n_i) is the leaf node connected to ‘n_i’ (Refer Algorithm 1). Node B, on receiving any request (REQ) packet checks for its type “Search” or “Reach” and continues search operation, if the packet type is “Search”. This operation searches for destination within the neighbor list or neighbor of neighbor list to unicast the REQ packet. If the destination is not in the list, it identifies the neighbors to become next immediate node and rebroadcast in the network. In this process, it neglects the leaf nodes to reduce the manipulation and identifies the neighbor nodes with highest number of uncovered neighbors.

Algorithm1. The Search operation

If PKT_TYPE = “Search” then

If (Dest (D) in N(B) or N(N(B)) then Uni-cast for (D)

// where, ‘D’ is Destination; N(B) is Neighbors of ‘B’; N(N(B)) is neighbor of N(B)

Else M[N(B)] = N(B) – L(B) //where M[N(B)] is selective neighbors; L(B) is Leaf Node from ‘B’

For (i = 1 to n) // where ‘n’ is number of selected neighbor nodes

// where, n = max value of | M [N(B)] | P(M[N(B_i)]) the number of unreached nodes of M[N(B)]

P(M[N(B_i)]) = N (M[N(B_i)]) - { N (M[N(B_i)]) ∩ N(B)} – {N (M [N (B_i)]) ∩ N(S) } – B - S

// from equation 1: N(S) is the neighbor of source node ordering the ‘P’ into descending order which generates a list ‘S’

S = [P_1, P_2, P_3…P_n]

Im(B) = N(B) with highest ‘P’

// where Im(B) : Selected Immediate nodes; N(B)with no common uncovered neighbors were selected to-//increase the range of broadcast

For t= 1 to m // where ‘m’ is number of elements of ‘S’

If [Im(B) ∩N(B(P_t))] <= 0

Im(B) = Im(B) + N(B(P_t))

Broadcast

End If

This algorithm assigns more number of immediate neighbors to increase the range of reachability with less collusion for immediate rebroadcasts.

The reach operation

Reach operation was applied for the packets which arrived with header labeled as "Reach". The update mechanism used in the network generates update packets with header as "reach". Usual update packets carrying the network node status information and covers every node in the network. This operation is also applicable for security update mechanisms used by the network. In the "reach" operation, leaf nodes were considered as other member nodes to identify the immediate node. The immediate node to rebroadcast next is identified among the neighbors and other nodes were made to wait. The uncover neighbor set for 'n_i' when reach packet arrives at 'n' has been represented in Equation 2.

$$U(n_i)=N(n_i)-[N(n)\cap N(n_i)]-[N(n_i)\cap N(s)]-n-s \tag{2}$$

Algorithm 2. The Reach operation

If PKT_TYPE = "Reach" then

For (i = 1 to n) // where n = number of neighbors of 'B'

Compute $P(N(B_i)$

$P(N(B)i) = N (N(B_i) - \{ N (N(B_i) \cap N(B)\} - \{ N (N(B_i)\cap N(S)\} - B - S$

$S = [P_1, P_2, P_3 \ldots P_n]$

Im(B) = N(B) with highest 'P' // Im(B) is the selected immediate neighbor for node 'B'

For t= 1 to n

If $[Im(B) \cap N(P_t)] <= 0$ //for multiple immediate neighbors to rebroadcasts

$Im(B) = Im(B) + N(P_t)$

Broadcast

End if

The rebroadcasting wait

In order to avoid channel collision in the network, the rebroadcasting nodes need to set a delay. The delay time has been calculated, when the node receives the RREQ with packet processing (PKT-PRO) state as “wait”. Calculation of delay was made based on the unreached neighbor lists. The rebroadcasting delay (T_d) calculation for node ‘n_i’ was represented in Equations 3 and 4. Delay ratio (T_p) for ‘n_i’ is detected based on the ratio of unreached neighbors (U) among all the neighbors (N) of ‘n_i’. In Equation 4, a small time constant is used as Max_delay.

$$T_p(n_i) = 1 - \frac{|U(n_i)|}{|N(n_i)|} \quad (3)$$

$$T_d(n_i) = Max\_delay \times T_p(n_i) \quad (4)$$

Delay value was based on neighbor information, where the node with more unreached neighbors reduces its delay time. This reduces delay results into faster rebroadcasting by the nodes and unreached regions were reached faster.

Algorithm 3 presents a scenario where node B receives RREQ packet from node A. Node B computes its unreached neighbors and sets wait time for rebroadcast process when it’s PKT-PRO is set as “wait”. If the RREQ is a duplicate packet, then the node adjusts its unreached neighbor information and sets the new wait time. The node discards the RREQ packets with same identity number when there are no unreached nodes from ‘B’. If the PKT-PRO value set by ‘A’ which is “immediate” for ‘B’, then it executes search or reach operations and rebroadcast the packet.

Algorithm 3. Explains the wait operations

// $RREQ_i$ is Current route request, UN(B) is the uncovered neighbors of node 'B', N(A) is neighbor of node 'A'

$RREQ_i$ (A,B) from node A to node 'B',

While (PKT_ID duplicate) then

Adjust UN(B)= UN(B) – [UN(B) ∩ N(A)] – {A}

Go to timer

// where, UN(B) is Unreached neighbor of 'B' and N(A) is neighbor of 'A' and {A} is the source node itself

If UN(B) = 0 then // $RREQ_j$ is the previous route request under 'wait' state

Discard $RREQ_i$ & $RREQ_j$

Else Discard $RREQ_i$

end if

End While

If (PKT_PRO = "Immediate") then

GOTO "REBROADCAST PROCEDURE"

Else if (PKT_PRO = "Wait") then

Compute UN(B) = N(B) – [N(B) ∩ N(A)] – {A}

Go to timer

End if

TIMER

$$T_p(B) = 1 - \frac{UN(B)}{N(B)}$$ // refer from equation 3

$T_d(B)$ = Max-delay × $T_p(B)$ // refer from equation 4

SET Timer ($T_d(B)$)

If (Timer reaches "0") then

GOTO "REBROADCAST PROCEDURE"

End If

Identification of immediate nodes

Before broadcasting, node identifies its best neighbors (with more number of unreached neighbors), which will immediately rebroadcast without any contention and collision. These immediate nodes were selected to fasten the process of rebroadcasting and reaching maximum unreached nodes with minimum contentions. The selection of immediate neighbor from the neighbor list was done in descending order of their unreached neighbors count. One or more nodes can rebroadcast as immediate, if there was no common unreached neighbor between them. All other neighbor nodes were labeled as wait nodes. When a node receives a packet, rebroadcasting wait time or drop decisions were made by the node based on their neighbor list information.

RESULTS AND DISCUSSION

ENCPR algorithm was implemented using network simulator version 2.34 and compared with other widely used protocols such as Ad hoc On-Demand Distance Vector (AODV), Destination-Sequenced Distance-Vector (DSDV) and NCPR in order to evaluate the performance.

Simulation environment

Wireless mobile nodes were randomly placed in an area of 1000 × 1000 meters. Nodes transmission range were fixed and assumed that two nodes can communicate, if they were within the transmission range of each other. Parameters used in most of the experiments were summarized and presented in Table1 along with their values and description. Energy model based simulation environments were set for the simulation. Initially the nodes were allotted with 100 joules of energy. The transmission and receiving of a packet consumed 0.2 and 0.1 joules by the node for every unit of transactions. Traffic was generated by UDP based CBR connection set. Scenarios were generated using a Random waypoint model.

Performance measures

Performance of the algorithm has been evaluated by experimenting with different working scenarios and computing the output with following metrics.

Table 1. Simulation parameters

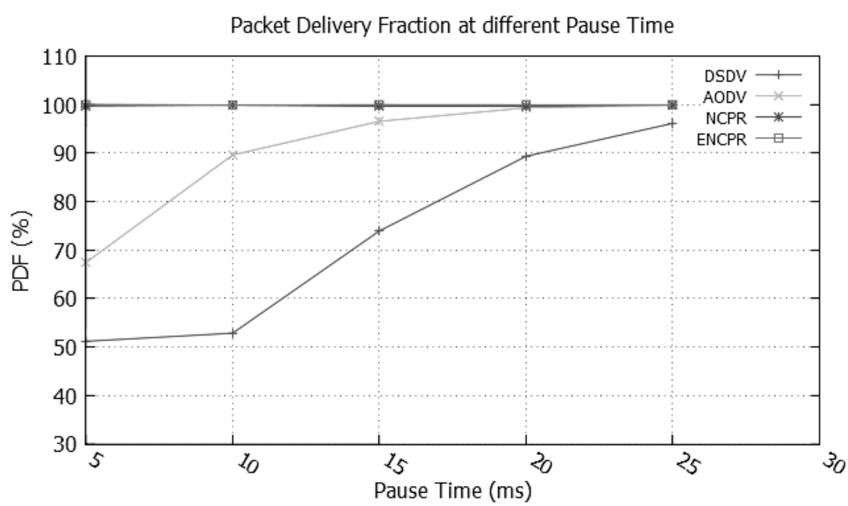
Parameters	**Values**	**Description**
Simulation Time	200 secs.	According to simulation clock
Simulation Area	1000 × 1000 m	XY dimension
Number of Nodes	50-100	Simulation nodes
Transmission Range	15 m	Nodes power range
Movement Model	Random waypoint	Nodes distribution & movement
Maximum Speed	4 m/s	Movement
Mobility interval	2-10 secs.	Pause time of node
Packet Size	512 bytes	Data packet size
Packet Rate	4 pkt/s	Packets interval
MAC	IEEE 802.11	MAC layer protocol
Network	NCPR, ENCPR	Network layer
Transport	CBR (UDP) & TCP	Transport layer
Bandwidth	2 Mbits/Sec	Bandwidth
Antenna	Omni antenna	Antenna type
Radio Propagation	Two ray ground	Radio layer setting
Transmission Energy	2×10^{-1}joules / pkt.	Energy to transmit a packet
Receiving Energy	1×10^{-1}joules / pkt.	Energy to receive a packet

- **Packet delivery ratio.** The ratio of number of packets successfully received at destination to the number of packets generated at the source end.
- **Energy consumption.** Total energy consumed by the network for all its transactions. The Energy consumption includes the energy consumed for receiving packet (Er), the energy consumed to transmit a packet (Et) and energy consumed to forward a packet (Efw). The energy required to forward a packet is represented by Efw = Er + Et.
- **Normalized routing overheads.** Total number of control packets exchanged in a network for its data packet transactions.
- **Average end-to-end delay.** The average delay time between the successful transfer and delivery of a packet from source to destination. It includes all the delay caused by traffic and intermediates.
- **Jitter.** Variation in the delay of received packets caused by the networks traffic, congestion and mobility.

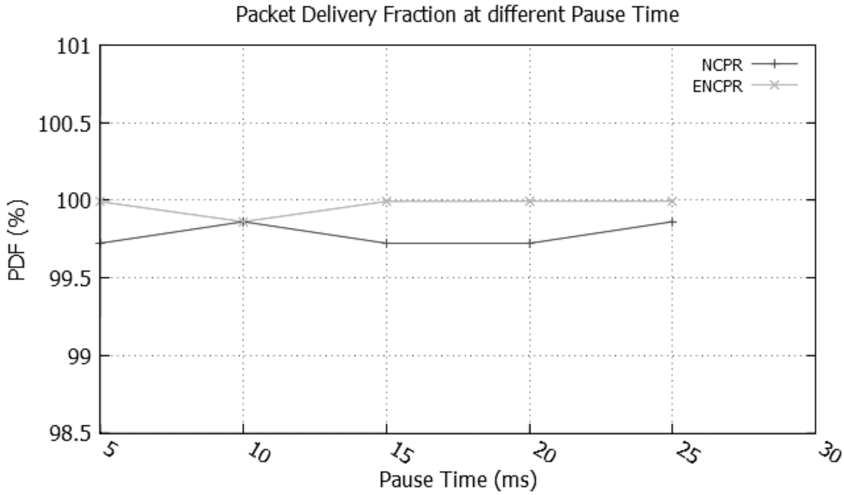
The network was simulated for different scenarios, which includes varied mobility, size and traffic. Pause time varied between 5 to 25 m/s for generating the scenario starts with low mobility to higher mobility. Number of nodes in the network varied from 50 to 100 as experimented at different network sizes. Measures were evaluated to study the impact of variations in different parameters on the performance of proposed algorithm.

RESULTS AND ANALYSIS

The comprehensive simulation based evaluation of proposed algorithm was presented using NS-2 simulator. Algorithms were compared for different scenarios and parameter sets. Traces of the simulation were taken and presented with their results. In the first experiment, common known protocols AODV, DSDV and NCPR were compared with the proposed algorithm. Algorithms were compared for their performance for transferring packets across the network at various mobile environments as shown in figure 3 and 4. Packet delivery ratio and jitter in the network were compared for four protocols. Result shows that the performance of DSDV was not appreciated at higher mobility scenarios. AODV also performed low, compared to the NCPR and proposed protocol as shown in Figures 3 and 4. Comparison of NCPR and the proposed protocol suggested that the proposed protocol performed slightly better compared to NCPR as shown in Figures 3(a) and 4(a).



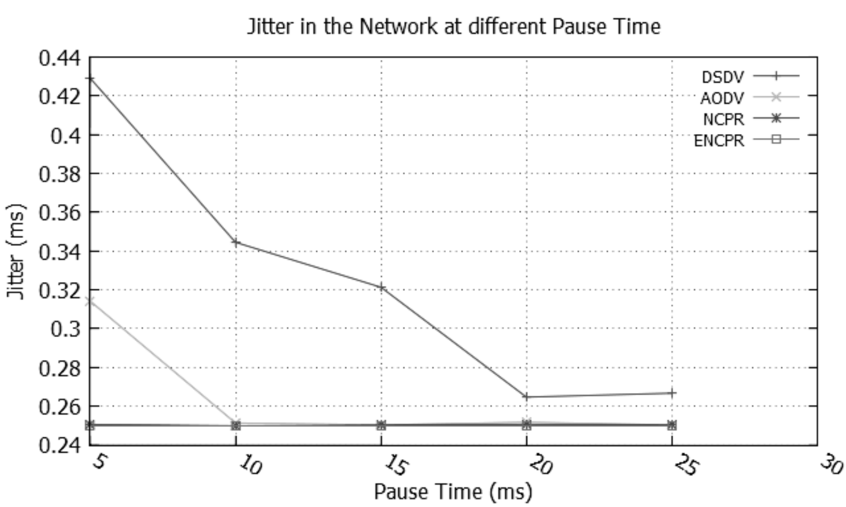
(a)



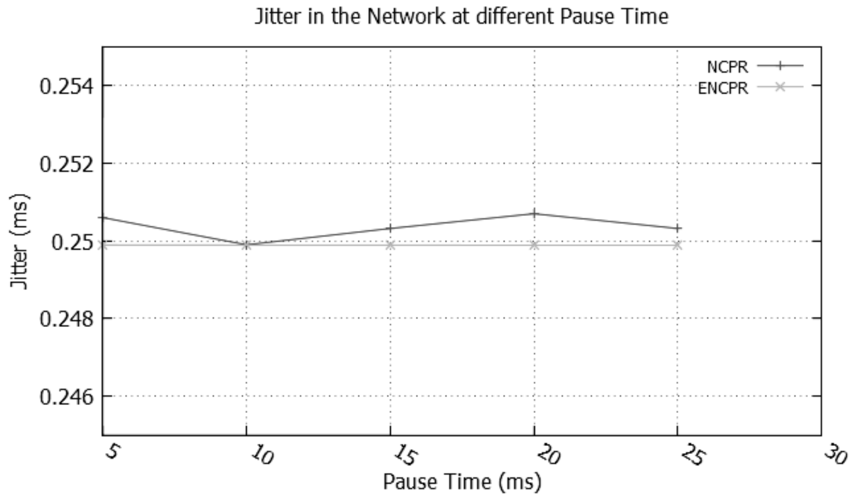
(b)

Fig. 3. (a) Packet delivery ratio in the network with the different protocols at various Pause Time **(b)** An extension of NCPR and ENCPR

Result obtained shows an increase in the packet delivery ratio for all the approaches with reduced mobility. Proposed protocol was able to achieve higher performance at high mobility scenarios. Simulation result of the proposed ENCPR protocol shows an average of 99.964 % packet delivery ratio for the varied pause time.



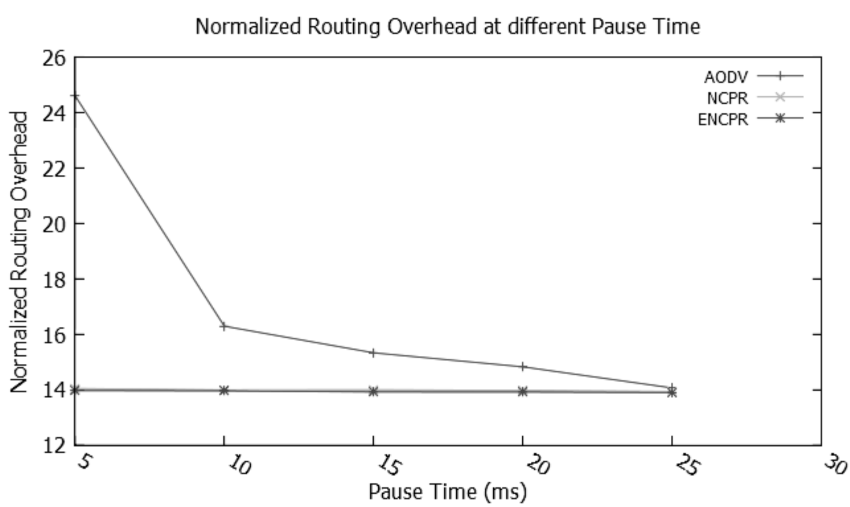
(a)



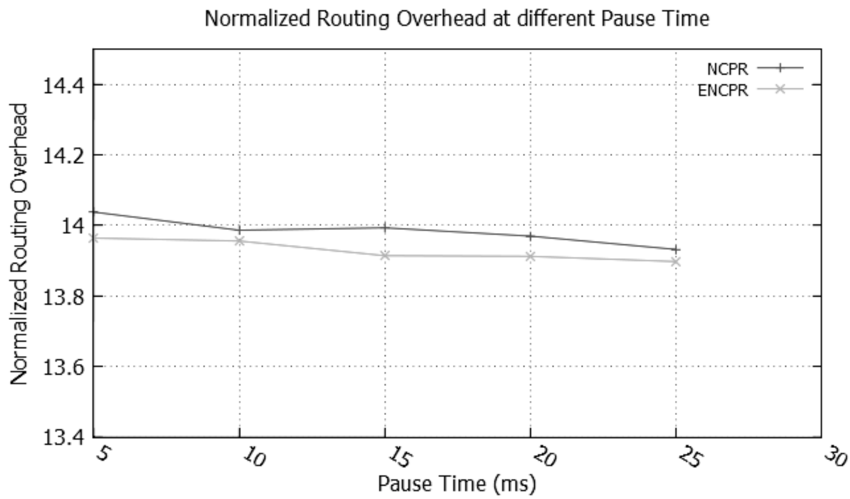
(b)

Fig. 4. (a) Comparison of Jitter in the network for different protocols at varying Pause Time **(b)** An extension of NCPR and ENCPR

In a second experiment, comparison was made for normalized routing overhead of the protocols at different mobility scenarios as shown in Figure 5. DSDV was skipped from the comparison of normalized routing overhead, as it was a proactive protocol and not preferred much for dynamic routing. The comparison result shows that the performance of NCPR and the proposed protocol were better than AODV as shown in Figure 5 (a). Extracted view of the plot is shown in Figure 5 (b).



(a)



(b)

Fig. 5. (a) Comparison of normalized routing overhead in the network for the different protocols at varying pause time. **(b)** An extension of NCPR and ENCPR

Plots also show that the proposed algorithm performed better with reduced normalized routing overhead in the network, compared to NCPR protocol. Detailed comparison of energy consumption and end to end delay were conducted for the NCPR and the proposed algorithm. To study the effect of mobility, network was simulated for different pause times, which were varied between 5 m/s to 25 m/s for movements starting from "low" to "high".

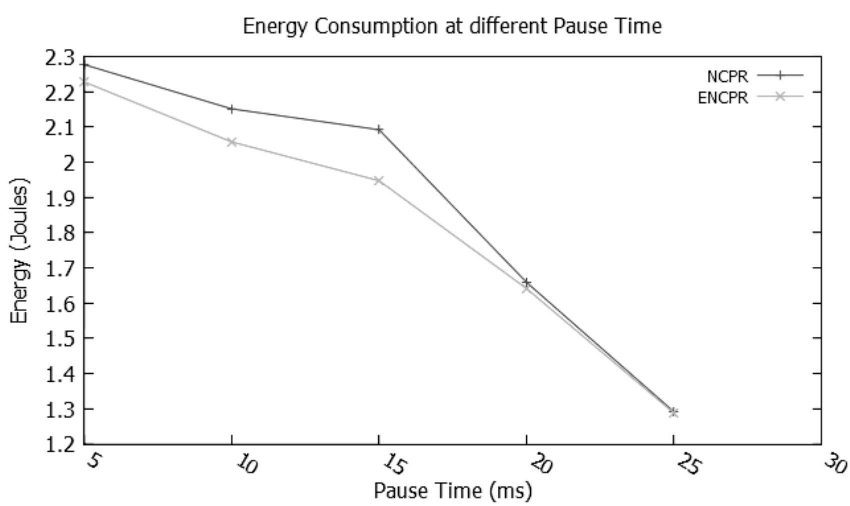


Fig. 6. Energy consumed by the network at various pause time of the mobile nodes

Simulation results were shown in Figure 6, which proved that the proposed algorithm has reduced energy consumption, where networks energy consumption was reduced to an average of 0.617 joules for different pause times. It was also noted that the difference in energy consumption of two algorithms was more at higher mobility than low mobility. Results revealed that the proposed work has made the transactions with minimum end-to-end delay, when compared with NCPR as shown in Figure 7. Obtained result of the experiments conducted for different pause time shows that the performance of proposed algorithm was better at high mobility in terms of energy consumption and end-to-end delay. Algorithms were also compared for different size of the network as shown in Figure 8. Proposed method reveals that the energy consumption of a network has increased with the enlargement of its size as shown in Figure 8. It also proves that the proposed algorithm has performed better in terms of reduction in energy consumption for different size of the network. There was an average of 0.209 joules difference in energy consumption between two approaches.

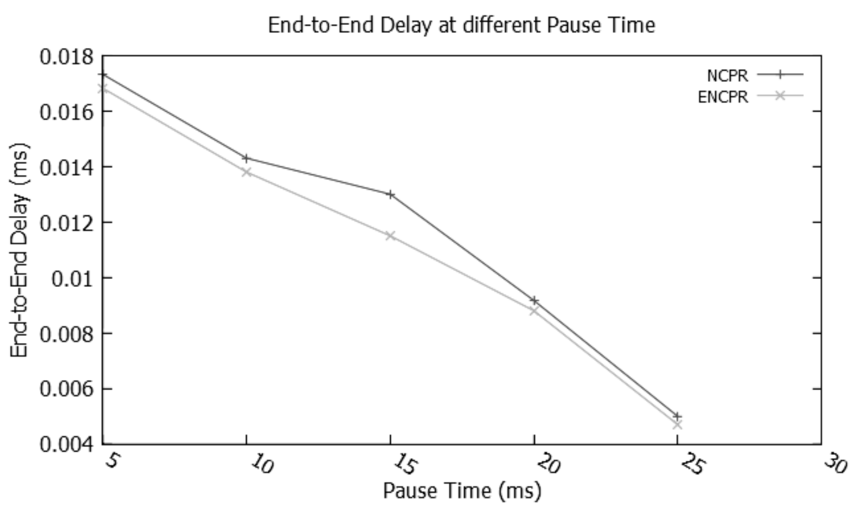


Fig. 7. End-to end delay for the transaction in the network was measured and plotted for different pause times

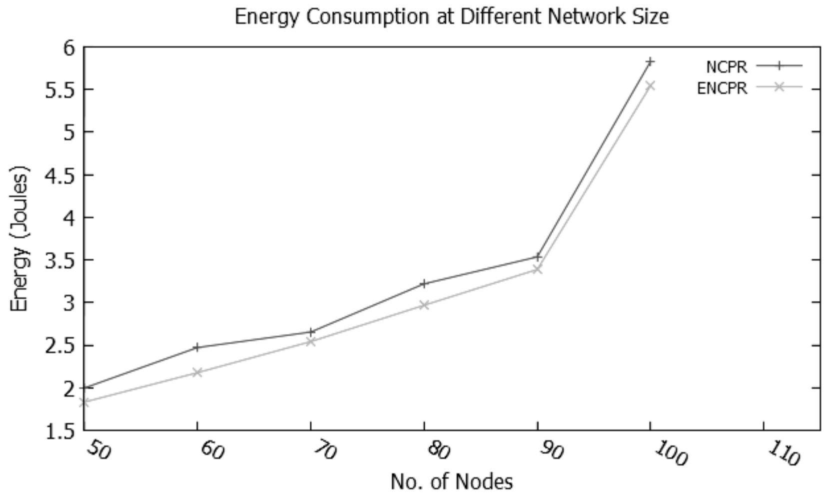


Fig. 8. Energy consumed by the network on varying the size of the network

Networks energy consumption has increased from an approximate of 2 joules to 5.5 joules by doubling the size of network. This shows an impact of network size over energy consumption for the maintenance of the network.

CONCLUSION

A new neighbor based broadcasting algorithm for mobile ad hoc network is proposed to reduce routing and maintenance overhead of the network. This method included neighbor coverage and timer based approach to identify the immediate rebroadcasting and wait nodes. This proposed method exploited the neighbor knowledge more efficiently to improve the performance of network. Simulation results proved that the proposed algorithm has less control overhead and better performance in terms of energy consumption and end to end delay. Proposed approach reduces the energy consumption at an average of 0.209 joules for different size of networks. It has also reduced the energy consumption of network by an average of 0.617 joules for different pause times.

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