Improving Energy Efficiency of Manets using Protocol Driven by CPE (Coordinate based, Pheromone Level and Energy Efficient Technique)

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Abstract: The formation of the path tends to be the first step in the network before data transfer can begin. In Mobile ad hoc networks, various protocols such as AODV, DSR etc. lays out the rules of creating the path by first broadcasting the route request messages in the network, then the phase of route reply and finally the creation of path. However, the broadcasting of the route request messages generally requires many more messages to be exchanged among the nodes, sometimes also referred to as flooding of the route request messages. In this study the work has been done on saving the energy of the nodes by reducing the number of the route request messages being flooded in the network and optimizing the path selection procedure in MANETS. The performance of the network has been analyzed on the basis of throughput, routing overhead and energy consumption.

Keywords: MANET, AODV, broadcasting, throughput, routing overhead,CPE.

Introduction

Mobile Ad Hoc Network (MANET) is a self-composed network of portable devices without having any intended framework to connect those devices to wired networks. Since there is no framework, all essential network operations such as routing and sending must be handled by the mobile nodes i.e each node behaves both as a router and as a host. Mobile ad hoc networks are very flexible and can be established rapidly and effectively utilizing ease supplies. Because of restricted radio range of mobile nodes, the way between a couple of nodes may consist of numerous mobile nodes. Mobile ad hoc network has a large number of applications such as collaborative, distributed mobile computing, disaster relief operations (e.g., earthquake, flood), war front activities and communication between automobiles on highways. The vast majority of these applications demand multicast or group communication [8].

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The nodes in the mobile ad hoc network are moving constantly unlike the wireless sensor networks where the nodes are fixed. The constant topology changes in mobile ad hoc network cause many problems such as link breakage, packet loss etc. which must be given importance to improve the quality of service of the networks. Another importance issue which must be given prime importance is the lifetime of the network. The lifetime of the network depends on the remaining energy levels of the nodes. Thus if the energy levels of the mobile nodes in the network are preserved, the network tends to work for a longer duration of time. The energy efficiency is achieved by balancing the load over the nodes in the network. If the load is equally distributed among the node, they tend to perform for more amount of time.

This paper first gives a review of the past study in section 2, then presents the proposed scheme and the results have been shown.

Related Works

Junhai L. et al. [1] focus on the classification of the multicast routing protocols, their properties and style options. A mobile ad-hoc network made up of mobile nodes without any structure. The goal of MANETs is to increase quality into the realm of independent, mobile and wireless domains, wherever a collection of nodes type the network routing infrastructure in associate degree ad-hoc fashion. There is bulk of applications of MANETs in many areas. These embody military battlefields, emergency search, rescue sites, lecture rooms and conventions, wherever participants share data dynamically

mistreatment their mobile devices. These features lend their selves well to multicast operations. Additionally, inside a wireless medium, it's crucial to cut back the transmission overhead and power consumption. Multicasting will improve the potency of the wireless link once causing multiple copies of messages by exploiting the inherited broadcast property of remote transmission. Therefore, reliable multicast routing plays a major role in MANETs. However, to supply effective and efficient multicast routing is tough and difficult. In recent years, various multicast routing protocols are planned for MANETs. These protocols have identifying options and use completely different recovery mechanisms. to supply a comprehensive understanding of those multicast routing protocols and higher organize existing ideas and work to facilitate multicast routing style for MANETs.

Nagaraju C. et al. [2] examine a simulation and analysis study of performance of MAODV and PUMA Routing Protocol. It also compares the routing protocols PUMA with MAODV, which area unit representatives of mesh-based and tree-based multicast routing in ad hoc networks that specialize in the effects of changes like increasing range of multicast receivers or sources, varied application causing pattern, and increasing range of nodes within the impromptu network. Multimedia Communications plays vital role in close to future Mobile ad hoc Networks. Unicast and Multicast routing protocols were helpful to produce this kind of communication. It's helpful to transmit knowledge packet to multiple receivers perpetually profitable to use multicast instead of unicast within the impromptu atmosphere, wherever information measure utilization comes at a premium. Finally simulation results shows cougar achieves a more robust knowledge delivery quantitative relation with restricted management overhead than MAODV, which is nearly constant for a large vary of network conditions.

Lee C. et al. [3] propose a fair energy saving probabilistic node control algorithm, which is the modified version of LARBC, employing a factor to indicate how long a certain node status holds. It may change the path depending on the status of nodes in the path. Each node counts the number of active neighbor nodes. If a node believes that there are enough active nodes around itself, it changes its status to passive and keep silence while keep counting the number of active neighbor nodes. Those passive nodes will not participate in the RREQ-like control packet forwarding. It reduces the number of RREQ-like control packets causing contention and energy waste. Simulation result shows that FES is providing energy saving mechanism. FES solely works in distributed manners. It meets the requirements for small mobile devices.

Kumar M.J. et al. [12] propose a technique to minimize the duplication of route requests (MIDURR) in MANET. Energy consumption is one of the main issues in MANET. The outcome of the MIDURR techniques minimizes the route request packets to save the energy. Firstly it identify the network topology, and then determine the source and destination of the network, construct the RREQ with all neighbor node's IP address, source node sends the RREQ to its neighbor nodes then sender's neighboring nodes receives the RREQ packet and forwards to its neighbor nodes except the nodes that are in the constructed packets. It repeats these steps until the route is established. MIDURR saves energy and increases the lifetime of the nodes in the network.

Kaur K. et al. [15] discuss the power consumption of nodes and power-aware routing metrics for power conservation. Some important issue of energy efficiency and power management in mobile wireless communication has been provided. Then, some protocols for preserving energy resources of mobile nodes such as minimum battery cost routing (MBCR) and min-max battery cost routing (MMBCR)are described. The design of Transport level protocols proficient of reducing the power usage of the communication devices have been described.

Utkarsh et al. [18] propose Energy Saving Ad hoc Routing (ESAR) algorithm targets to achieve better energy efficient with a longer network life time by using the strengths of both the AODV algorithm and EEAODR algorithm. The shortest path in terms of minimum hop counts is chosen by AODV for packet routing ensures that the transmission delay is reduced whereas the network life time is compromised. At the same time EEAODR chooses an alternate path for packet transmission to save the energy of the shortest path while compromising the delay in transmission. This algorithm selects a route for routing by considering the actual distance between the source and destination along with the minimum available energy of a node in the path. This selected route is selected as the best path for packet transmission till any node in the pathway exhausts battery power beyond a threshold value. At this point of time, a backup path is selected as an alternate path for packet communication. The process is repeated till all the paths from the same source to destination are exhausted with their battery power. The simulation outcome of the proposed algorithm ESAR indicates that the network life time is improved upon the existing routing algorithms.

Proposed Work

We focus to optimize the path from source to destination using the pheromone value of the nodes during the route reply phase and using the coordinate based method while broadcasting the route request messages.

According to coordinate based method, the node while forwarding the route request messages towards the destination node checks its coordinates with respect to destination node coordinates. If the nodes are located towards the destination node, then it forwards the route request message. In this way instead of broadcasting the route request messages to all the neighbour nodes, the broadcasting is restricted towards the destination node. Also in order to further optimize the performance of the network, the concept of EENCP [7] will also be taken into account so that energy of the nodes is also considered while making path from source to destination. In our work the coordinate based method will be used along with pheromone value

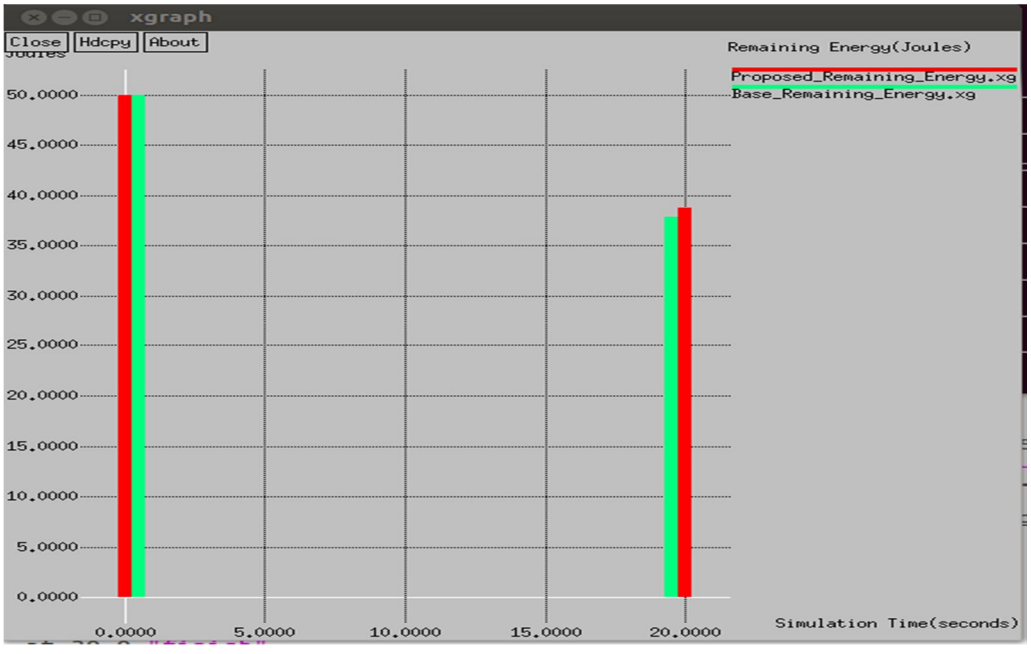
concept. This concept is derived from food searching behaviour of the ants. When ants go in search of food, they leave a trail behind them known as pheromone. After locating their food source, the ants tend to traverse the paths having highest pheromone value. This concept will be used to optimize the path. When the request reaches destination, the destination node will check pheromone level of all the nodes in the path. Then destination will choose two paths having highest pheromone value and highest energy, and will reply back to the source node through which the source node will send data.

Results and Discussion

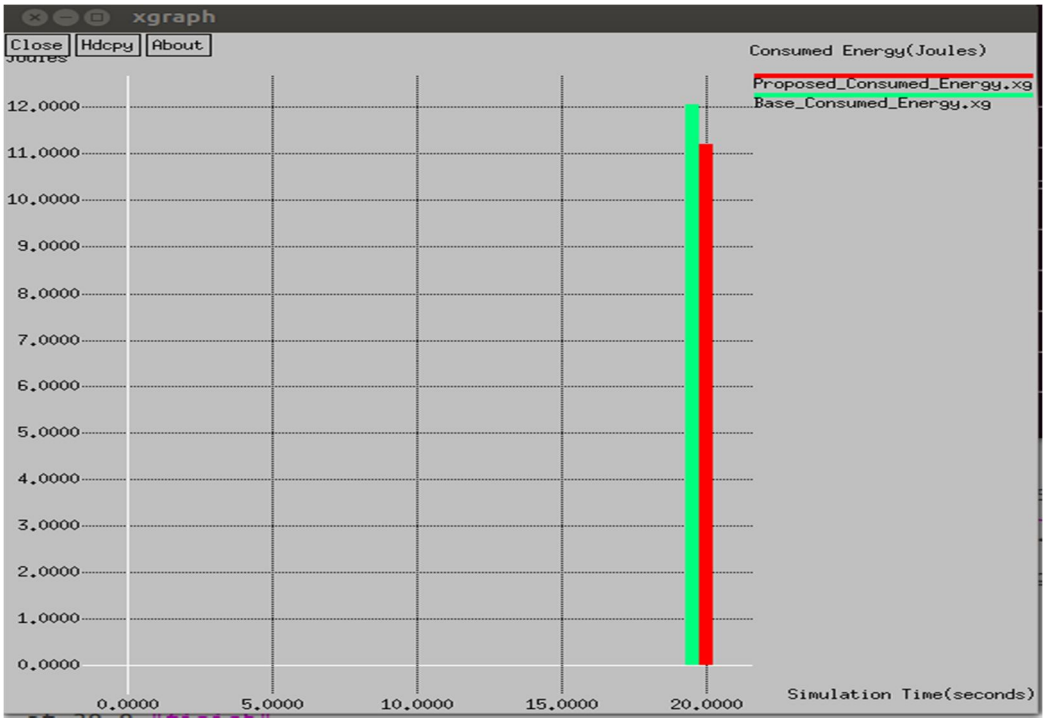
The proposed scheme has been implemented in NS2.35. The simulation parameters used in the work are defined below:

Table 1 : Simulation Parameters

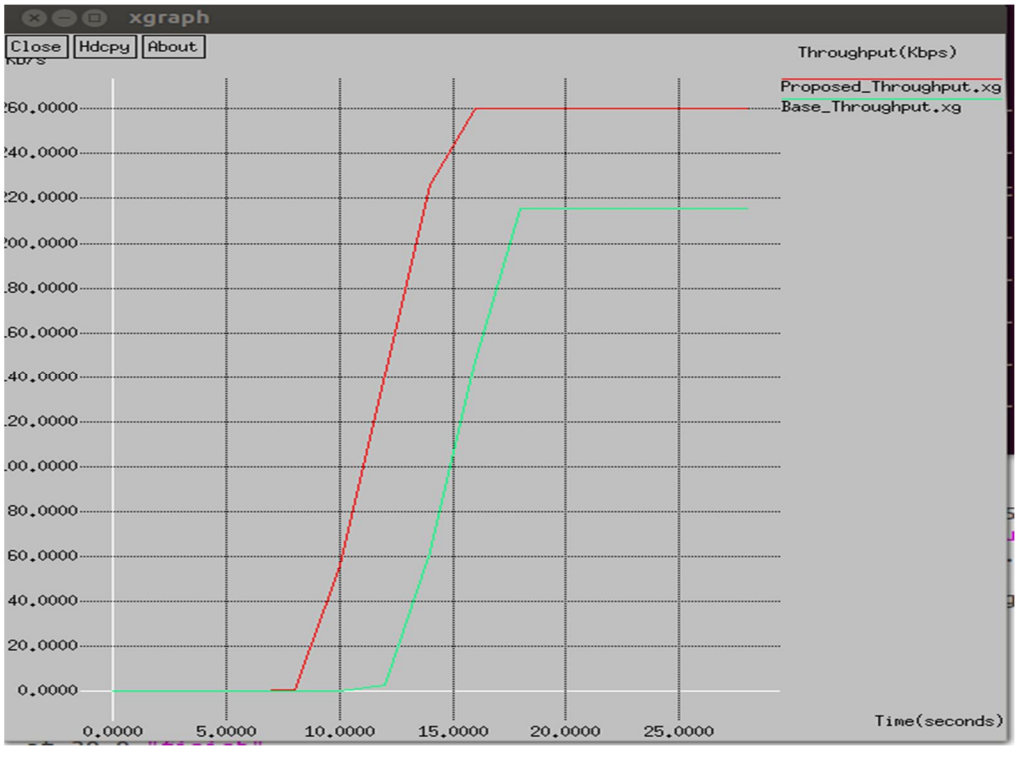
Parameter	Value
Channel	Wireless
Propagation Model	Two Ray Ground
Mobility Model	Random Way Point
Routing Protocol	AODV
Number of nodes	50
Mac	802.11
Antenna	Omni Directional
Initial Energy	50 Joules
Network Area	1300m * 1300m
Queue	Drop Tail
Transmission Range	250 m
Traffic Type	CBR
Packet Size	512 bytes
Min Speed	1m/s
Max. Speed	10m/s
Bandwidth	10 Mbps



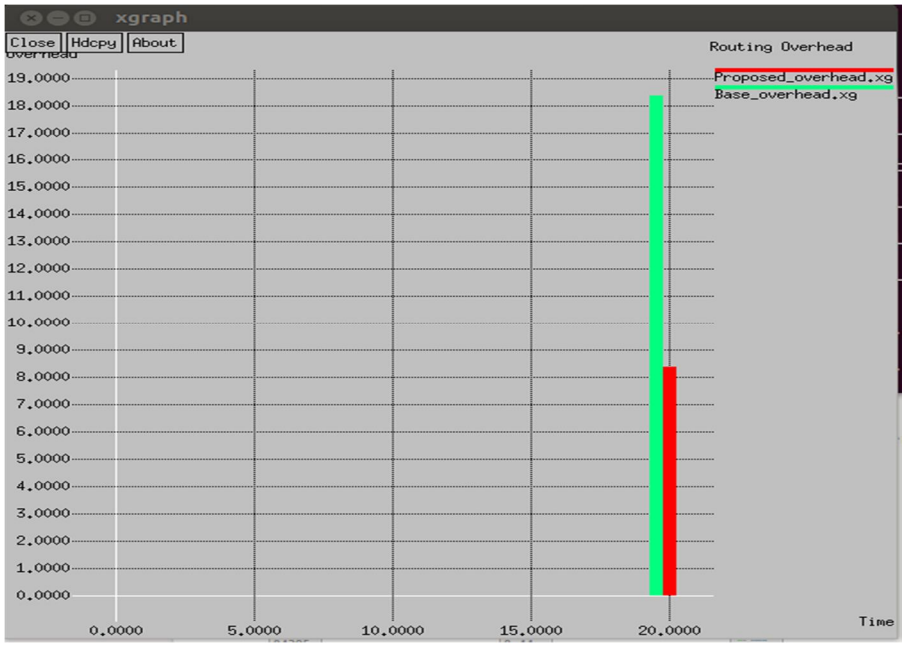
The above figure shows the comparison of the energy consumption for both the schemes. Initial energy of 50 joules was provided to the nodes. By applying the 3 conditions defined earlier in the work, the remaining energy for the proposed scheme has been found to exhibit more values at 39 Joules as compared to existing scheme having value at 37.5 Joules.



Our scheme has lead to consumption of 11 Joules whereas the existing scheme causes energy consumption of 12.5 Joules in the network.



The above figure shows the comparison of throughput which is amount of data received at the destination node in the network. The values of the throughput for the proposed scheme at 260 Kbps are higher than the existing scheme at 210 Kbps indicating better performance of the network.



This figure shows the comparison of the routing overhead for both the schemes. The values for the routing overhead for the proposed scheme is found to be 8.5 and for the existing scheme it is 18.5 approx. Lesser value for the routing overhead is again the indicator for better performance of the network.

Conclusion

The proposed scheme was implemented on NS2.35 and the performance of the network was analyzed in terms of throughput, energy consumption and routing overhead. The main reason behind improved performance with proposed scheme can be attributed to the fact that when the broadcasting of the route request messages is reduced by forwarding request messages to only those node whose remaining energy is more than average energy of the network, whose neighbour count is more than average neighbour count and which is lying towards the destination node. These three conditions when combined together helped to reduce the energy consumption in the broadcasting phase thus increasing the lifetime of the network.

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References

[1] Luo Junhai ; Xue Liu ; Ye Danxia, “Research on multicast routing protocols for mobile ad-hoc networks,” ELSEVIER, December 2008.

[2] C. Nagaraju; Suresh Babu; MHM Krishna Prasad, “A Comparative Study of Tree based Vs. Mesh based Multicast Routing Protocols in Mobile Ad hoc Networks,” International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 2, Issue 6, November – December 2013.

[3] C.M.Lee;H.K.Kahng; S.Cheung, “Fair Energy Saving (FES) algorithm in MANET,” 2014 International Conference on Information and Communication Technology Convergence (ICTC) Busan, 2014.

[4] M. Jayak kumar; P. C. Newton; A. Dalvin Vinoth Kumar, “MIDURR: A technique to minimize the duplication of route requests in Mobile Ad-Hoc Networks,” International Conference on Soft-Computing and Networks Security (ICSNS), Coimbatore, 2015.

[5] K. Kaur ; I. K. Aulakh, “Power aware metrics and routing techniques in MANETs,” International Conference on Emerging Trends in Networks and Computer Communications (ETNCC) Udaipur, pp. 369-373, 2011.

[6] Utkarsh; M. Mishra; S. Chinara, “ESAR: An energy saving ad hoc routing algorithm for MANET,” Fourth International Conference on Advanced Computing (ICOAC), Chennai, pp. 1-5,2012.

[7] RagulRavi.R, Jayanthi.V, "Energy Efficient Neighbor Coverage Protocol for Reducing Rebroadcast in MANET" Procedia Computer Science 47 (2015) 417 – 423.

[8] D.P.I.Ismail; M.H.F.Ja'afar, “Mobile ad hoc network overview,” Asia-Pacific Conference on Applied Electromagnetics (APACE) Melaka, 2007.