ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 2, February 2016

Sleep Scheduling Technique for Geographic Routing in MANET

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ABSTRACT: MANETs are collections of wireless nodes that can dynamically establish a network at any time at any place without using any fixed infrastructure. Due to dynamically changing topology routing in such network is very difficult. Traditional routing algorithms like distance vector and link state consumes more energy and less scalable. So we go for location based routing algorithms. Geographic routing is one of the most promising routing schemes in wireless sensor networks (WSNs), due to its simplicity, scalability, and efficiency. Unlike topological routing algorithms, they do not need to exchange and maintain routing information and work nearly stateless. This makes geographic routing attractive for wireless ad hoc and sensor networks. Most geographic routing algorithms use a greedy strategy that tries to approach the destination in each step. Even though they are scalable and simple energy consumption is very high. Here we introduce one new algorithm called GDBN sleep scheduling algorithm to reduce energy consumption. And compare the energy consumption with the normal geographic routing.

KEYWORDS: Mobile Ad Hoc Network, Geographic Distance Based Neighborhood sleep scheduling algorithm.

I. INTRODUCTION

MANETs are collections of wireless nodes that can dynamically establish a network at any time at any place without using any fixed infrastructure. This unique feature of MANETs has led to its growing popularity over these years. Applications of MANETs vary from commercial use, private sector to military and emergency purposes. MANETs do not have a centralized control and every node in the network will have to act as a router to find out the optimal path to forward a packet. All the nodes in the network may be mobile, entering and leaving the network at any time and thus the topology changes continuously. As the medium of the communication is wireless, only limited bandwidth is available. Another important constraint is energy due to the mobility of the nodes in nature.

MANETs have gained a great deal of attention because of its significant advantages brought about by multi-hop, infrastructure-less transmission. However, due to dynamic network topology and error prone wireless networks, the reliable data delivery in network, especially in challenging environments with high mobility remains an issue. Routing protocols in conventional wired networks are usually based up on either distance vector or link state routing algorithms. Both of these algorithms require periodic routing advertisements to be broadcast by each router. In distance vector routing, each router broadcasts to all of its neighboring routers its view of the distance to all other nodes; the neighboring routers then compute the shortest path to each node. In link-state routing, each router broadcasts to its neighboring nodes its view of the status of each of its adjacent links; the neighboring routers then compute the shortest distance to each node based upon the complete topology of the network.

These conventional routing algorithms are clearly not efficient for the type of dynamic changes which may occur in an ad-hoc network. In conventional networks, routers do not generally move around and only rarely leave or join the network. Geographic routing has become one of the most suitable routing strategies in wireless mobile ad hoc network mainly due to its scalability and better performance in these dynamic networks. The main advantage with geographic routing protocols is that it does not need to maintain explicit routes. The main approach used in this routing algorithm is greedy forwarding. Geographic Routing (GR) uses location information to forward data packets, in a hop-by-hop routing fashion making use of the broadcast nature of wireless networks. Greedy forwarding is used to select next hop forwarder with the largest positive progress toward the destination while void handling mechanism is triggered to route around communication voids No end-to-end routes need to be maintained, leading to GR's high efficiency and scalability. One of the main issues with GR is that it is very sensitive to the inaccuracy of location information. In the

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operation of greedy forwarding, the neighbor which is relatively far away from the sender is chosen as the next hop. Even though there are so many advantages, energy consumption becomes an issue in geographic routing. So our aim is to reduce energy consumption within the geographic routing.

II. RELATED WORKS

Chunsheng et al (2012) Explained a Geographic Routing Oriented Sleep Scheduling Algorithm .ie, Geographic routing is assumed to be the most potential routing scheme in wireless sensor networks due to its scalability and efficiency .Recently more and more research work about geographic routing pay attention to its application scenarios in duty-cycled WSNs because of the natural advantage of saving energy consumption with duty-cycling. However, it may cause significant latency issue when applying geographic routing in duty-cycled WSNs and almost all current researches try to handle the latency problem from the point of changing the geographic forwarding mechanism, apart from the connected-k neighborhood (CKN) algorithm which focuses on sleep scheduling. This Work discuss and analyze the first transmission path's performance of the two-phase geographic forwarding (TPGF) in a CKN based WSN and further propose a geographic routing oriented sleep scheduling (GSS) algorithm to shorten the first transmission path of TPGF in duty-cycled WSNs [4].

T. Yang et al (2014) developed a promising routing scheme in wireless sensor networks in which sensors are sleep scheduled to reduce energy consumption. However, except the connected-k neighborhood (CKN) sleep scheduling algorithm and the geographic routing oriented sleep scheduling (GSS) algorithm, nearly all research work about geographic routing in wireless networks has focused on the geographic forwarding mechanism; further, most of the existing work has ignored the fact that sensors can be mobile. This work focuses on sleep scheduling for geographic routing in duty-cycled WSNs with mobile sensors and propose two geographic-distance-based connected-k neighborhood (GCKN) sleep scheduling algorithms. The first one is the geographic-distance-based connected-k neighborhood for first path (GCKNF) sleep scheduling algorithm. The second one is the geographic-distance-based connected-k neighborhood for all paths (GCKNA) sleep scheduling algorithm. By theoretical analysis and simulations, result show that when there are mobile sensors, geographic routing can achieve much shorter average lengths for the first transmission path explored in WSNs employing GCKNF sleep scheduling and all transmission paths searched in WSNs employing GCKNA sleep scheduling compared with those in WSNs employing CKN and GSS sleep scheduling [9].

Methaq jasam et al (2013) has clearly explained about energy efficiency in MANET. It is a collection of nodes that is connected through a wireless medium forming rapidly changing topologies. MANETs don‘t need of any centralized base station and can be set up anytime, anywhere. In MANETs, the nodes are mobile and battery operated. As the nodes have limited battery resources and multi hop routes are used over a changing network environment due to node mobility, it requires energy efficient routing protocols to limit the power consumption, prolong the battery life and to improve the robustness of the system. The author presents a comparison and evaluation study of Reactive routing protocols; Ad Hoc On-Demand Distance Vector Routing (AODV), Proactive routing protocols; routing information protocol (RIP2) and Position-based routing protocol; Location- Aided Routing (LAR1). And the evaluation of their performance was based on energy consumption metric. The evaluation study performed using QualNet v5.1 simulator [8].

May Cho Aye et al (2014) proposed energy efficient multipath routing for mobile ad hoc networks, describes about energy consumption.ie, Energy consumption is a significant issue in ad hoc networks since mobile nodes are battery powered. In order to prolong the lifetime of ad hoc networks, it is the most critical issue to minimize the energy consumption of nodes. So the author proposes an energy efficient multipath routing protocol for choosing energy efficient path. This system also considers transmission power of nodes and residual energy as energy metrics in order to maximize the network lifetime and to reduce energy consumption of mobile nodes. The objective of our proposed system is to find an optimal route based on two energy metrics while choosing a route to transfer data packets. This system is implemented by using NS-2.34. Simulation results show that the proposed routing protocol with transmission power and residual energy control mode can extend the life-span of network and can achieve higher performance when compared to traditional ad-hoc on-demand multipath distance vector (AOMDV) routing protocol [10].

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III. GEOGRAPHIC ROUTING

Geographic routing (also called geo routing or position-based routing) is a routing principle that relies on geographic position information. It is mainly proposed for wireless networks and based on the idea that the source sends a message to the geographic location of the destination instead of using the network address. The idea of using position information for routing was first proposed in the 1980s in the area of packet radio networks. And interconnection networks. Geographic routing requires that each node can determine its own location and that the source is aware of the location of the destination. With this information a message can be routed to the destination without knowledge of the network topology or a prior route discovery. In geographic routing mobility support can be facilitated. Since each node sends its coordinates periodically, all its neighbors update their routing tables accordingly thus all nodes aware of its alive neighbor nodes. It is scalable. The size of routing table depends on network density not on network population. Hence wider networks consisting of thousands of nodes can be realized without cluster formation. Minimum overheads are introduced. The only information needed is the location of neighbors. Only localized interactions take place. Hence bandwidth is economized. The processing and transmission energy is saved and the dimensions of routing table are decreased.

IV. METHODOLOGY

Geographic routing (also known as position-based routing or geometric routing) is a technique to deliver a message to a node in a network over multiple hops by means of position information. Routing decisions are not based on network addresses and routing tables; instead, messages are routed towards a destination location. With knowledge of the neighbors' location, each node can select the next hop neighbor that is closer to the destination, and thus advance towards the destination in each step. The fact that neither routing tables nor route discovery activities are necessary makes geographic routing attractive for dynamic networks such as wireless ad hoc and sensor networks. In such networks, acquiring and maintaining routing information is costly as it involves additional message transmissions that require energy and bandwidth and frequent updates in mobile and dynamic scenarios. In contrast, there are geographic routing algorithms that work nearly stateless and can provide high message delivery rates under mobility. All this applies under the following assumptions:

1. A node can determine its own position.
2. A node is aware of its neighbors' positions.
3. The position of the destination is known.

With GPS or other satellite based navigation systems, position information can be made available to even small mobile devices. The second assumption requires broadcasting the position information locally to other participants in the network. With this information a node is able to determine the next hop that is closer to the destination. The third assumption can be met by means of a location service that maps network addresses to geographic locations. In some cases, the destination is inherently known to the nodes, e.g. in some sensor network applications where a single sink node collects all the data measurement information.

The main prerequisite to meet the three assumptions is a positioning system. If this is available, geographic routing provides an efficient and scalable solution for routing in wireless and mobile networks. Mainly there are four procedures, identification of neighbor nodes i.e. one hop distant nodes are considered as neighbor nodes. Beacon signals are sending from source to all nodes. Each node calculates the distance to destination. Next hop selection is based on this distance, the neighbor closest to destination is considered as next hop. Next is sleep scheduling, each node have more than one neighbors but it can select only a particular node as next hop. Transmitting node send a status message one to the selected node so that it turns into awake mode and send status message zero to all other neighbor nodes that means they can go to sleep state. Data transmission take place between two awake neighbors and this process continues until destination reaches.

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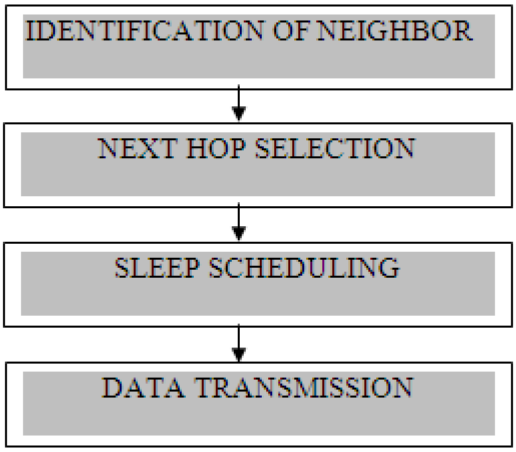

Figure1: Process follows the proposed method

A. IDENTIFICATION OF NEIGHBOR

The goal of Geographical location-based routing protocol is to reach a specific host. However, as geographic routing is based on the coordinates, not the identifier, one can't directly reach the intended target without knowing that intended target`s location. Thus, geographic routing must be augmented with a service that can translate identifiers into locations. The GPS system provides a scalable and elegant solution to this problem. Geographical location-based protocols make it possible to have larger networks without scalability problems. Geographical location-based routing algorithms use position information for making packet forwarding decisions. They do not need to exchange and maintain routing information and work nearly stateless. This makes geographic routing attractive for wireless ad hoc and sensor networks. Most geographic routing algorithms use a greedy strategy that tries to approach the destination in each step. Geographic routing is a technique to deliver a message to a node in a network over multiple hops by means of position information. Routing decisions are not based on network addresses and routing tables; instead, messages are routed towards a destination location. In geographic routing one hop distant nodes are selected as neighbor nodes. Usually more than one neighbor nodes are existing for a source node

B. NEXT HOP SELECTION

Next hop is selected based on the distance calculation. From each node distance to the destination is calculated using the known coordinates. In geographic routing each node knows its own position, position of neighbors and the destination position. Let X1 and Y1 be the coordinates of a particular node and X2 and Y2 be the position of destination so that we can calculate the distance between that particular node and destination using the equation 1. And next hop is selected as a neighbor closest to destination.

Distance d = Sqrt $((X2-X1)^2-(Y2-Y1)^2)$

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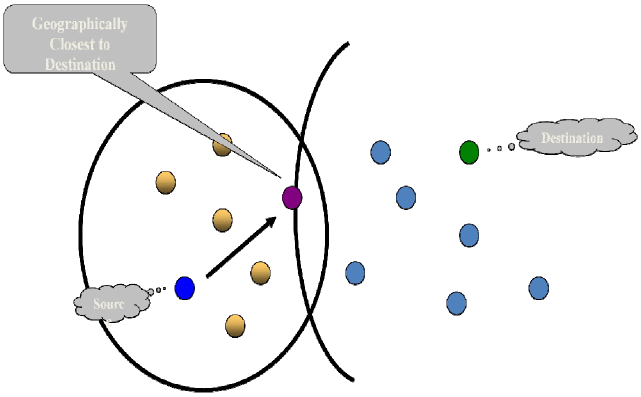

Figure 3: Next Hop Selection

C. SLEEP SCHEDULING

The essential method for sleep scheduling is to decide a sub-set of nodes to be awake in a given period while the remaining nodes are in sleep position to minimize energy consumption. Sleep scheduling in mobile adhoc networks typically concentrates on two targets: point coverage and node coverage. For point coverage, the awake nodes in each period are chosen to cover each position of the deployed field. In node coverage awake nodes are designated to assemble a globally associated network such that each sleeping node is an immediate neighbor of at least one awake node. This work uses GDBN (Geographic Distance Based Neighborhood) sleep scheduling algorithm. Earlier it was mentioned that each node calculates the distance to destination so that source node can select next hop as a neighbor closest to destination. There are many neighbor nodes for a source node. The source selects a particular node as next node which sends a status message “one” to that particular selected node. This means that the particular node should be in awake mode to receive the packets. All other neighboring nodes get a status message of zero so that they can go to sleep state. After sending the packet, awake node changes to sleep state to save its energy. This process continues until packet reaches the destination.

D. DATA TRANSMISSION

Geographic routing is composed of two main components:

1. A location service
2. A geographic forwarding process.

The location service determines the position of the packet destination in order to improve the routing process for creating the path with source node, using intermediary nodes. Consequently, the position of the packet destination can be added in the packet header so that intermediate hops can know where the packet is destined for. Likewise, geographic forwarding is performed in two modes, namely, geographic greedy-forwarding mode and void-handling mode1. The greedy-forwarding mode defines a next-hop node for packet forwarding taking into account the positions of the current node, its neighboring nodes, and the destination node. A node can obtain its own position via a GPS receiver. The positions of the neighboring nodes can be acquired either from a distributed method via contention among neighboring nodes. At last, the position of the destination node is included in the packet header sent by the source node. However, if some intermediate node knows a more accurate position of the destination, it is able to update the position in the packet header before forwarding the packet. In this method data is transmitted from source to destination using awake nodes. Each node transmits data to the node which is closest to destination. By awaking such nodes data is transmitted. To save energy all other nodes continues its sleep state.

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V. RESULT AND DISCUSSION

In the fig 4, it shows the graph of node number Vs energy. Energy consumption of each node without sleep scheduling is shown below. Initially each node is inputted with energy of 50J

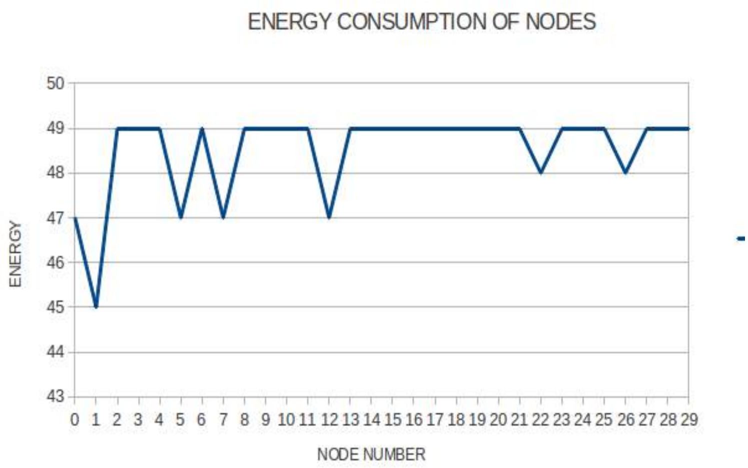

Fig. 4 Node number vs Energy consumption of existing system

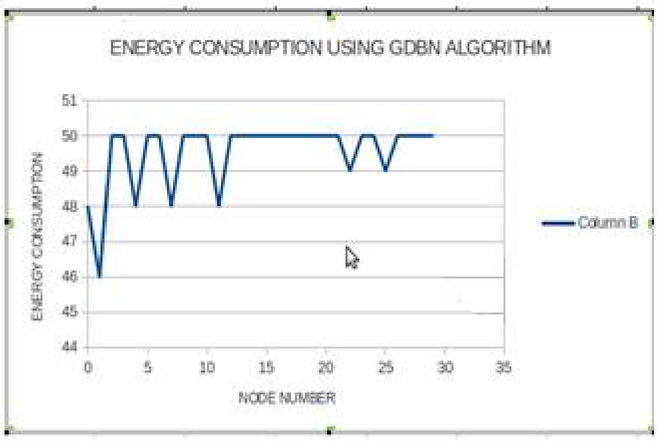

Fig. 5 Node number vs Energy consumption of proposed system

In the fig 5, it shows the graph of node number Vs energy using GDBN sleep scheduling algorithm. Consumed energy is reduced up to 30J compared to existing work

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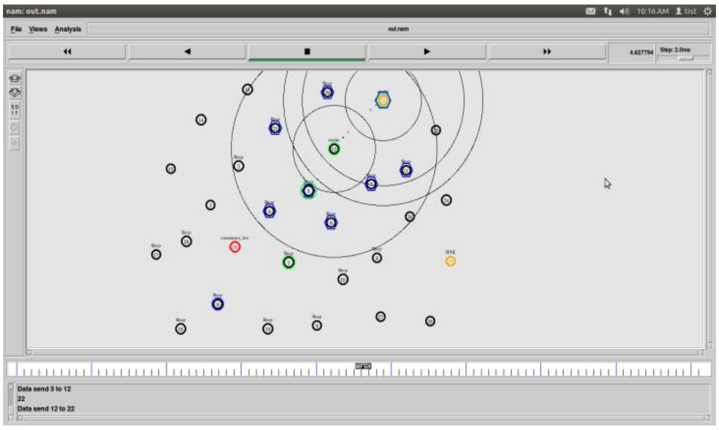

Figure 6: Simulation Results in NS2

VI.CONCLUSION

This work is aims at reducing the energy consumption of geographic routing. Geographic routing is a prominent routing scheme for wireless networks. Geographic routing algorithms use position information for making packet forwarding decisions. Unlike topological routing algorithms, they do not need to exchange and maintain routing information and work nearly stateless. This makes geographic routing attractive for wireless ad hoc and sensor networks. Most geographic routing algorithms use a greedy strategy that tries to approach the destination in each step. Even though they are scalable and simple, energy consumption is very high. Hence the aim is to reduce the energy consumption. Sleep scheduling algorithm is implemented to improve the performance of geographic routing. A subset of nodes is kept awake in a given epoch while the remaining nodes are in the sleep state. This minimizes power consumption, so that the overall energy consumption can be reduced.

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