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SIMULATION OF REDUCING SENSOR COVERAGE AREA OF WIRELESS LAN USING TIME OFF SCHEME

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Abstract*:* There are several localized sensor area coverage protocols for heterogeneous sensor, each with arbitrary sensing and transmission radii. The approach has a very small communication overhead since prior knowledge about neighbour existence. Each node select a random time out and listen to message send by other nodes before the time out expire. Sensor node whose sensor area is not fully covered, when the deadline expire decide to remain active for the considered round and transmit an activity message announcing it. Covered nodes decide to sleep, with or without transmitting a withdrawal message to inform neighbours about the status. After hearing from more neighbours, active sensors may observe that they became covered and may decide to alter their original decision and transmit a retreat message. Our simulations show a largely reduced message overhead while preserving coverage quality for the ideal MAC/physical layer.

Keywords: Sensor networks, Area coverage, Network connectivity, localized algorithm**,** ART, TGJD

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INTRODUCTION

The problem considered is about sensors making decisions whether or not to turn off so that the whole area remains fully covered and the subset of active nodes remains connected. Therefore, the sensor area coverage problem is to determine a small number of active and connected sensors that still cover the same area as the fully deployed set. In centralized solutions, the information about topological changes in dynamic networks must be propagated throughout the network to maintain the information needed for each node to make a decision. In distributed solutions, protocols relax this information propagation and use memorization at nodes. It also used unbounded delays. In a Localized solutions have significantly lower communication overhead since no global view of the network is required. In a localized protocol, each node makes its activity status decision solely based on the decisions made by its communication neighbours. Moreover, in a fully localized protocol, decisions are not impacted by distant nodes Our solutions rely on an extremely reduced communication overhead[07] in order to be suitable also for highly dense networks. No neighbour discovery is needed. Nodes wait for random time-out duration while receiving decision messages from neighbours. The sensor evaluates its coverage and connectivity by active neighbours and decides whether or not to be active when the time out expires. Active sensors inform neighbours, whereas decisions to sleep may or may not be announced. After making a decision to be active, nodes may hear from more active neighbours, and their sensing area may then become fully covered. Such nodes may then change their minds by sending a retreat message to their neighbours.

1.1 Problem Definition

A sensor network[05] consists of sensor nodes with a short-range radio and on-board processing capability. Each sensor can also sense certain physical phenomena like light, temperature, vibrations, or magnetic field around its location. The purpose of a sensor network is to process some high-level sensing tasks in a collaborative fashion, and is periodically queried by an external source to report a summary of the sensed data/tasks. For example, a large number of sensors can be scattered in a battlefield for surveillance purposes to detect certain objects of interest, say tanks. A typical query could be: Report the number of tank sightings at 10 minute intervals for the next 24 hours in a specific region within the battlefield. Several new design themes have emerged for sensor networks. On one hand, the network must be self-configuring and highly fault-tolerant as the sensors may be deployed in an “ad hoc” fashion. On the other hand, as each sensor has only limited battery energy, the network as a whole must minimize total energy usage in order to enable untethered and unattended operation for an extended time. One technique to optimize energy usage during query execution would be for the network to self-organize, in response to a query, into a logical topology involving a minimum number of sensor nodes that is sufficient to process the query. Only the sensors in the logical topology would participate (communicate with each other) during the query execution. This is a very effective strategy for energy conservation, especially when there are many more sensors in the network than are necessary to process a given query.

1.2 System Design

We have simulated only homogeneous sensor networks. Experimental results were obtained from randomly generated connected networks with a discrete-event simulator. Nodes are deployed over a 50X 50 rectangle area. The communication range CR is fixed at 10, whereas the sensing radius SR varies to observe the compared algorithms under two conditions: SR<=CR < 2SR (SR=10) and 2SR <= CR (SR = 4). Simulations were launched over densities varying from 40 to 90, with a step of 10. At density 40, the simulated networks are composed of 380 nodes, whereas there are roughly 860 nodes at density 90. For each density, the number of performed iterations is adjusted so that 95 percent of the results are in a sufficiently tight confidence interval. Each iteration consists of rounds. Nodes compute time-outs [06] at the beginning of each round. Then, a round starts, and every node decides about its activity status as per the corresponding protocol, following block diagram Fig. 01, illustrates the architecture of the system.

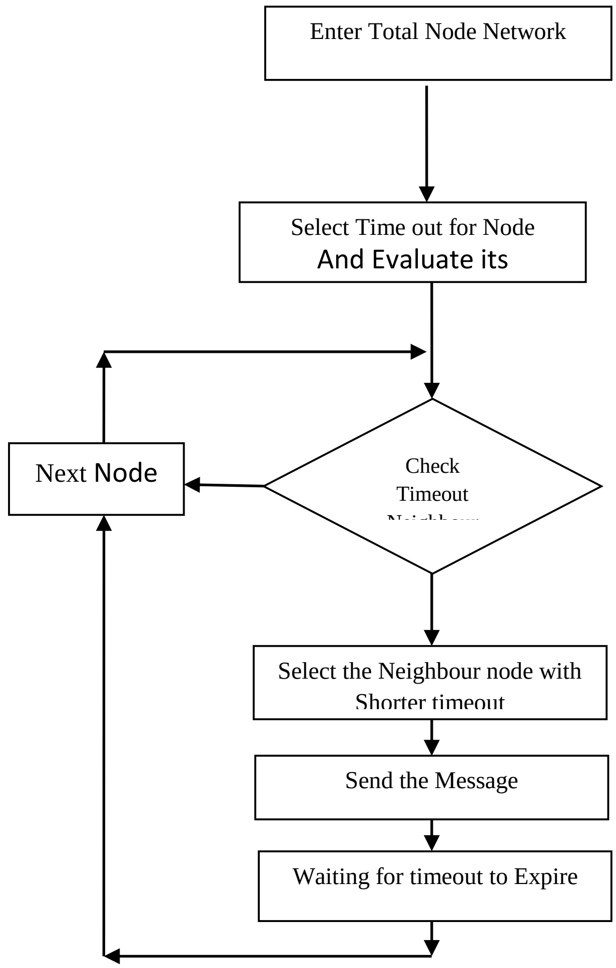

Fig 01:-.Flow-Diagram of the system

1.3 Detailed Design Structure

We describe here three specific ways denoted as,

Random Time out (RT)

Extendable Random Time out (ERT)

Activity-Aware Time out (AAT)

The simplest way for deciding the time-out duration is to select a random number in a fixed interval [0, TOW],[ ] where TOW is the integer number of slots denoting the maximum possible duration for any node (assumed to be fixed and the same for all nodes). This method will be referred to as the RT method. It is anticipated that the need to be active will decrease after receiving activity decisions from sensing neighbours. Such messages can be incorporated into a time-out function to modify it "on the fly" in various ways. One way is to observe the amount of sensing area overlap [08]. Since exact calculation is time consuming for an actual implementation, we considered a simplified version where the node chooses a number of random points inside its own sensing area. It then evaluates if any of its already known neighbours is able to sense it. Nodes initially select random time outs in [0, M]. After each received activity message from its sensing neighbours, a node calculates the ratio R (thus, R is in [0, 1]) of the random points that becomes covered by them. The time-out duration is then modified to M +R (TOW-M). Thus, the time out is extended after each received message. This method is referred to as method ERT. We used M= $\frac{TOW}{2}$ in our experiments, which appeared best after trying several options. Our third method AAT is motivated by the expected energy balance of previously active nodes when the new round starts. In the first round, nodes select random time outs in [0, TOW], as in method RT. Nodes active in the previous round should attempt to avoid repeating this by selecting longer time-out durations. A node u that has been active during a > 0 consecutive rounds will pick up its time out within the last $1/a+1$ portion of the time-out window. The node selects Random within [0, 1] and then, as time duration, selects the rounded value of **$timeout_u$= TOW - Random x TOW/ a + 1**

In a symmetric manner, the longer nodes are passive, the shorter their time outs should be in order to incite them to get active. Then, a node u that has been passive during p consecutive rounds will pick up its time out within the first $\frac{1}{p+1}$ portion of the time-out window. In this case, u will compute its time out as follows:

$timeout_{u=}$ Random x TOW/ p + 1

We used several approaches for the activity counter evolution. Basically, when a node changes its status, it can reset every counter or not. We opted for a variant with an overall counter, which is incremented when the node is active and decremented when the node decides to be passive. Therefore, in our implementation, we actually had one variable, whose absolute value was used as a value for "a" or "p", according to its sign.

After verifying the coverage condition, each node decides whether or not to send a message. We use the following four new protocols

@ Activity only (AO). Only nodes that decide to be active send a (exactly one) message.

@ Activity and withdrawal (AW). Every node sends exactly one message, which corresponds to its decision, an activity acknowledgment for an active status or a withdrawal before entering a sleep mode.

@ Activity and retreat (AR). Nodes that decide to be active send their decisions, whereas nodes that decide to sleep do not. Active nodes, however, can later on learn that they are covered with the help of newly announced active nodes and may decide to “change their minds” and to enter the sleep mode; such nodes send also one retreat message.

@ Activity, withdrawal, and retreat, (AWR). All decisions by all nodes are transmitted; thus, each node sends one message corresponding to the original decision on the active or sleep status. Nodes with an originally active decision may reconsider it later on and switch to the sleep mode and possibly send one retreat message..

2.0 IMPLEMENTATION

Our protocols aim at preserving the connectivity of the set of active nodes by enhancing the decision rule. Any node can decide to be passive provided that its sensing area is fully covered by a connected set of neighbours. Otherwise, it should remain active in order to still guarantee the multihop communication among its disconnected neighbours. We have observed as to what extent the studied protocols were able to preserve connectivity. We computed the percentage of connected active node topologies. We have looked at how well the connectivity was preserved if messages could collide and thus prevent nodes from gathering all the information concerning their neighbourhood. As already observed for area coverage, connectivity likewise suffers from the retreat process of TGJD[13]. Indeed, a node u may decide to retreat thanks to a connected subset of covering neighbours, but this set may actually contain nodes that have already decided to retreat. Nevertheless, corresponding retreat messages were not received due to some collisions. Our experiments indicate that protocol TGJD[13] never builds a connected active node set when collisions are modelled Experimental results with the ideal MAC layer[07] show that for a similar number of selected active sensors, our methods significantly reduce the number of messages to decide the status compared to an existing localized protocol where nodes send hello message followed by retreat messages from nodes before sleeping. We also consider message losses, induced by a MAC layer with collisions and/or a realistic physical layer, and show that the existing compared method, for dense networks, fails to cover the area reasonably with a connected set of active nodes. Here we set a physical area for topography is 1000 X 1000 and provide initial position of node. Set a TCP/IP connection between the all 25 nodes when one node change the position, it colour will change while moving. Observe all node position with respective original location of node. Followings are some screenshots which are simulated in nam animator gives visualation effect of tcl file.

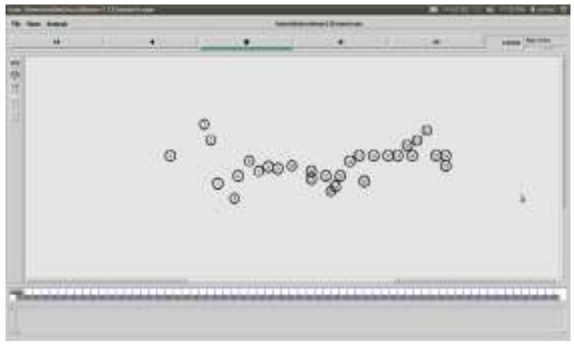

Fig 02:- Display of Nodes placement in NS-2

The fig.02 provides display and position of nodes. The nodes are placed with respect to values provided in tcl file.

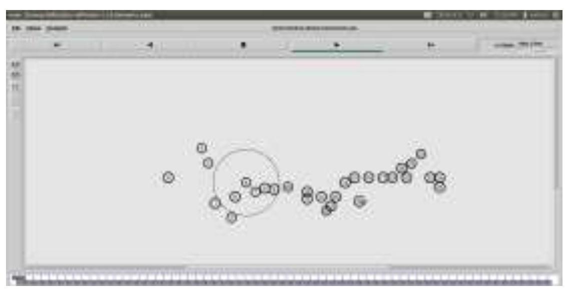

Fig. 03:- Nodes broadcasting data-packets

As per the fig.03, the nodes are broadcasting the data packets within the region. All nodes are transferring the packets to other nodes within the region.

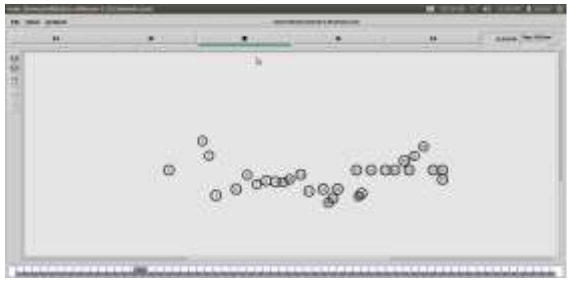

Fig.04:-Nodes displacement from their positions

The fig.04 provides explanation of nodes displacement from their positions. The nodes are moving within the region as well as transferring data.

Fig.05:- Node is shown as deleted

In the fig. 05, node is displayed as deleted node although displaying in the plane. The yellow color displays its deletion from the region.

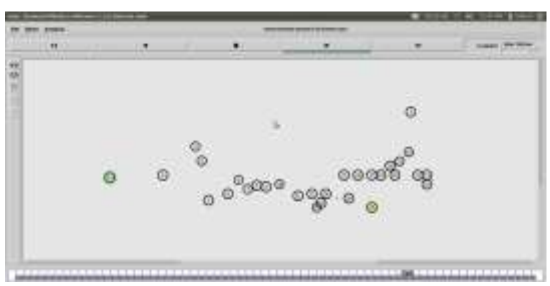

Fig.06:- Node changing the region while making movement.

The fig. 06 displays the green color for node 14, since it is changing the region while making the movement.

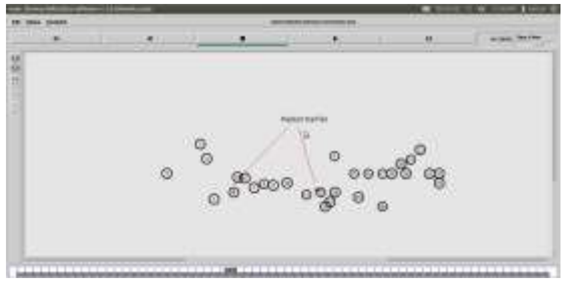

Fig.07:- : Packet transfer within nodes

The figure shows the packet transfer from various nodes. In this figure, p-it displays the transfer from node12 to node 0.

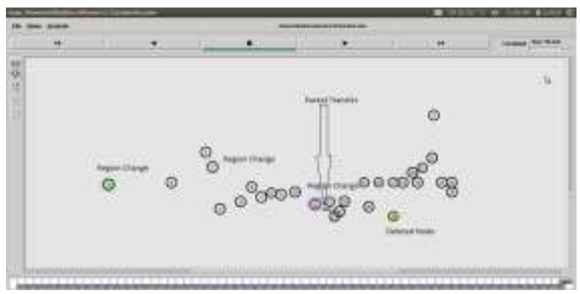

Fig.08:- Summary of display regarding nodes.

The fig.08 shows the packet transfer, deleted node and node changing region.

2.1 Result

Calculating the different result for 5 node, 10node, 15node, 20node, 25 node of sensor Network by simulation process, showing the result which are tabulated in Table 1.

No of Nodes	Total Sending(p)	Total Received(p)	Route packets	PDF (In %)	NRL	Delay
05 Node	44313	10008	63411	22.58 %	1.43	1000
10 Node	37163	7967	52077	21.44 %	1.40	1000
15 Node	27581	3581	33601	12.98 %	1.22	1000
20 Node	26191	3685	32433	14.07 %	1.24	1000
25 Node	26527	3729	32658	14.06 %	1.23	1000

Table 1: Comparative Analysis for different number of nodes

The Terminology related with table is as under:

Packet delivery Fraction: The ratio of the number of delivered data packet to the destination. This illustrates the level of delivered data to the destination.

$\sum$ (Number of packet received) / $\sum$ (Number of packet send

The greater value of packet delivery ratio means the better performance of the protocol.

End-to-end Delay: The average time taken by a data packet to arrive in the destination. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destinations that counted.

$\sum$ (Arrive time – send time) / $\sum$ (Number of connections)

The lower value of end to end delay means the better performance of the protocol.

Packet Lost: The total number of packets dropped during the simulation.

Packet lost = Number of packet send – Number of packet received. The lower value of the packet lost means the better performance of the protocol.

Normalised Routing Load: The number of routing packets "transmitted" per data packet "delivered" at the destination. It is the sum of all the control packets sent by all the sensor nodes in the network to discover and maintain routes to the SINK node. The Following graph shows the relations between numbers of node with respect to route packet, total received packets, total sending packets, Packet delivery fraction and Normalised Routine Load.

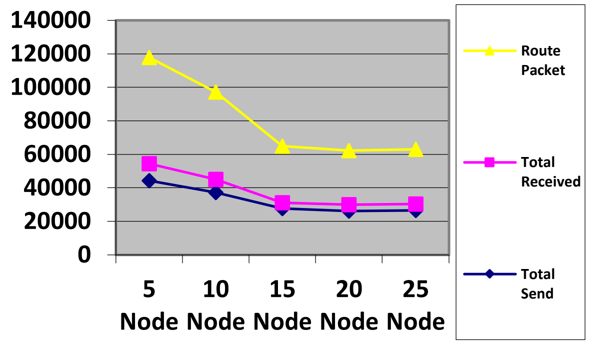

Fig 09:- Analysis Graph between Total Send, Receive and Route packet

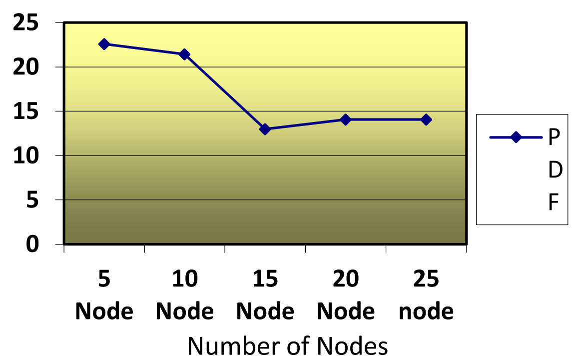

Fig 10:- Analysis Graph between No of Nodes and PDF

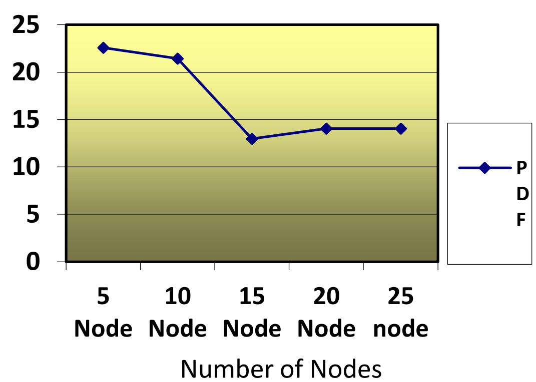

Fig. 11:- Analysis Graph between No of Nodes and NRL

3.0 CONCLUSION

We have proposed a localized algorithm for maintaining connected area coverage under various ratios of communicating and sensing radii. In addition to providing different number of node in sensor Network. When there was a large nodes are present in network, the route packet delivery from source to destination is high, but it was reduces even though the number of node is may increased in network. When we apply the scheme of time delay for each node, we observed NRL factor of network is reduces. It means low collision in network. Here we plan to extend the work by given exact placing location of node in large network so it work as a active agent and normalised the communication overheads.

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