Novel Protocol for Location Tracking of Sensor Nodes in Ad hoc Network

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ABSTRACT
Mobile node positioning technology has become an important area of research. In mobile wireless sensor networks, sensors nodes randomly move in the monitored area at any direction and at any speed. Identifying the location of sensor nodes is vital to know from where the data is exactly coming.

In this paper, the algorithm is introduced to find out the location of sensor nodes at regular time interval, where their X and Y coordinates are traced out. Protocol is named as *Location Tracking Protocol at Regular Time Interval (LTPRTI).*

Keywords
MANET, Nodes Position, Protocol Definition

1. INTRODUCTION

Mobile Ad hoc network (MANET) is a combination of autonomous mobile nodes that can interact with each other by means of radio waves. The mobile nodes that are in radio range of each other can directly communicate, whereas others are multihopped through intermediate nodes. MANETs are used in disaster recovery, rescue operations, military communication and many other applications.

Routing is an integral aspect in mobile ad hoc network. Routing protocols identify a path to be followed by data packets from a source node to a destination node. The routing protocols are divided into three categories based upon the routing information update mechanism: Proactive, Reactive and Hybrid."Resource Constraint" is an extreme challenge faced by a routing protocol designed for ad hoc wireless networks. Gadgets used in the ad hoc wireless networks in most cases require portability and hence they also have size and weight constraints along with the restrictions on the power source. Enhancing the battery power results in bulkier and less portable nodes. Hence energy efficiency becomes an acute design consideration for these networks. Control overhead increases due to mobility of the nodes resulting in bandwidth constraint. Mobility also affects end to end delay as well as packet delivery ratio. Therefore in real time applications there is a reduction in quality due to Bandwidth constraint. As a result, ad hoc network routing protocol must optimally balance these contradictory aspects and hence many algorithms [2] have been developed to reduce the complexity.

2. LITURATURE SURVEY

In **Location-Aided Routing** (LAR) [7] protocol the overhead of route discovery is decreased by utilizing location information of mobile nodes. The Global Positioning System (GPS)[8] is used for obtaining such location information.

Using location information, LAR protocol reduces the search space for a desired route. Reducing the search space results in fewer route discovery messages. By contacting a location service provider which knows the positions of all the nodes, the source node should first get the position of the destination mobile node when it wants to send data packets to a destination. To localize the ad hoc network a wide variety of routing protocols [9-11] have been proposed over the years. Some techniques use GPS but for very few nodes. These nodes are often referred as anchor nodes or reference nodes. 'Completely GPS Free Localization [12-15] or 'Using Very Few Anchor Node' [16],[17] are the two types of localization approaches that provide techniques to localize the network in a GPS Less or GPS-Scarce area (LACBER). The GPS-less localization [18] approaches establish a virtual coordinate system and try to localize the network in that coordinate System. On the basis of distance measurement (using ToA or AoA or RSSI) or hop count these coordinate systems are established**. U**sing the above coordinate systems the exact location of the node cannot be determined due to absence of GPS.

Location Aided Cluster Based Energy-efficient Routing (LACBER) [19] is a location aided routing protocol proposed for GPS scarce ad hoc networks. There are three types of nodes: G-nodes, CG-nodes, and N-nodes in LACBER protocol as shown in figure1. In the network only a few nodes need to be G-nodes which are GPS enabled and are capable of finding their own location using GPS. The rest of the network can find their positions in a process which is described later in this section. The CG-nodes are equipped with antennas which are capable of receiving signals from other nodes and can measure the received signals strength indicator (RSSI) and the angle of arrival (AOA) of received signals from other nodes.

3. PROPOSED ALGORITHM

In NS 2, Protocol like AODV, DSDV, DSR etc. are already available. Before writing a new protocol definition, it's a good practice to understand existing protocol in details.

Following are the steps needed to follow for creating new routing protocol for tracking nodes position***."Location Tracking Protocol on Regular Time Interval(LTPRTI)"***

- Create new folder with protocol name under root/ns 2.34/ LTPRTI
- Create Header and Class file(LTPRTI.h, LTPRTI.cc) and after protocol compilation its object file will be created(LTPRTI.o).
- In an order to create a new protocol, we also need to modify few files of NS 2 architecture itself.
- So, to create object file after compilation of the protocol, modify makefile as LTPRTI/ LTPRTI.o
- priqueue.cc: case PT_ LTPRTI
- packet type has to be defined in packet.h file.

static const packet_t PT_ LTPRTI = 62;
static packet_t PT_NTYPE = 63; // This MUST be the LAST one In the same file type == PT_ LTPRTI has to be included name_[PT_ LTPRTI] = " LTPRTI ".

3.1 LTPRTI Header file

In protocol header files ,include needed header file along with cmu-trace.h, priqueue.h This file included the information of route sequence number, route to destination , X and Y position of nodes, next hop to reach destination, State of Route whether it is Expires, Current(Newly formed), Broken.

3.2 LTPRTI Class File

Main logic need to write in class file is:

Create object of MobileNode as MobileNode *pNode; Later with the help of get_node_by_address(index))event will get pointer to the node, I have written a function to update nodes postion LTPRTI ::(update_position) updates the nodes position at requested time and puts X and Y position to locx,locy respectively. pNode->update_position()..

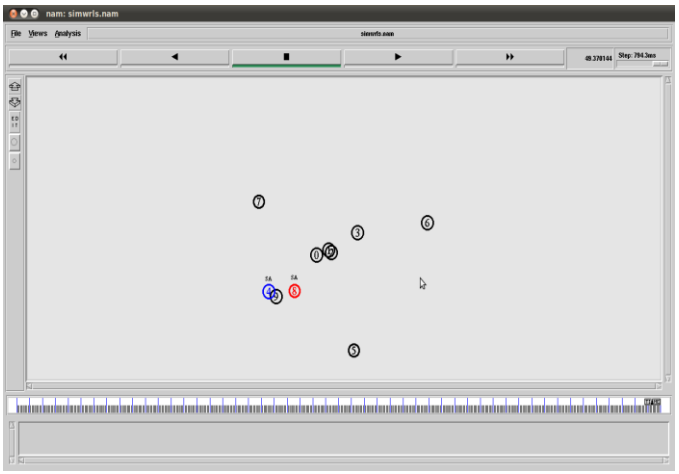
4. ANALYSIS & SIMULATION RESULTS

We have evaluated the performance of the above mentioned routing protocols for mobile ad hoc networks using ns-2. We took 10 nodes communicating over simulation area of 1000 x 1000. Total simulation time is 1000 sec. Table 1 shows all the parameters used for simulation.

Table 1. Simulation Parameter And Values

Parameters used in Scripting	**Value**
Movement Model	Random way point
MAC layer protocol	IEEE 802.11
interface queue type	Queue/DropTail/PriQueue
Link layer Protocol	LL
Antenna model	OmniAntenna
Max packet in Interface Queue	50
Number of mobilenodes	10
Simulation Area	1000
Routing Protocol	***LTPRTI***
Simulation time	1000 sec

In TCL script, simulation starts at 0.1 & stop at simulation stop time which is specified. Using LTPRTI protocol, we traced out the location at 0, 50,100,150,200,250,350,450,550 sec resp. The scenario of above discussion is noted down in Figure 3.



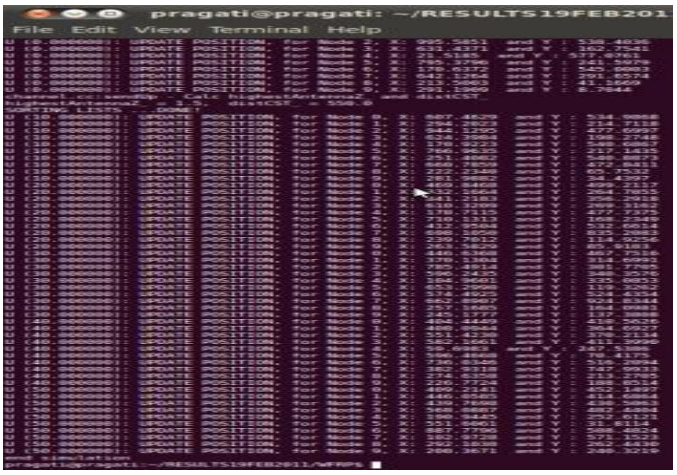
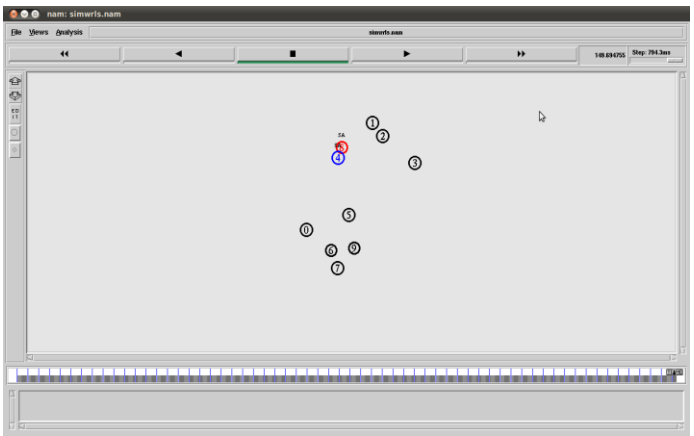


Fig 1:TCL and Trace file for the Scenario at 50 sec

Above scenario is recorded at 50 sec, so that the sink node will come to know where the nodes are exactly located and from where the data is coming.



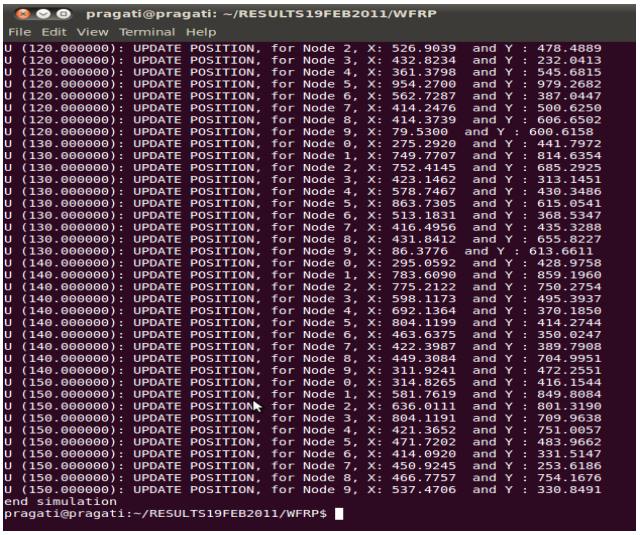
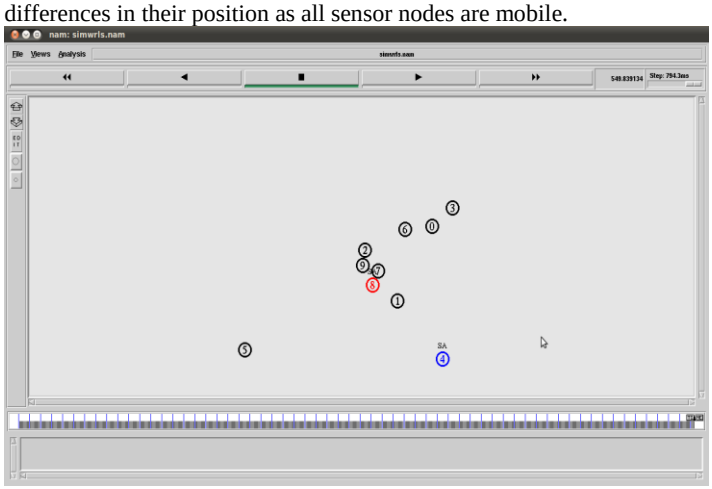
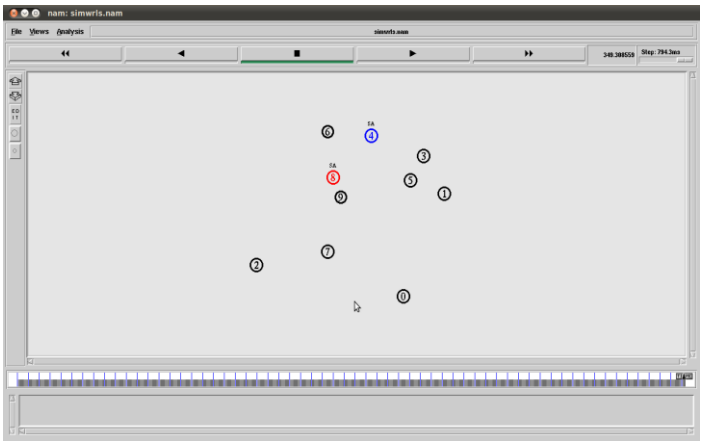


Fig 2: TCL and Trace file for the Scenario at 150 sec

The above figure shows the location of 10 nodes when are captured at 350 sec. It also displayed the updated position for each of the node with their X and Y coordinates details. Likewise at regular time interval, the updated position of nodes can be taken to know their exactly location in a network.

Following snaps are showing the position of 10 nodes at 550 sec. if we compare each nodes position, we definitely find out the differences in their position as all sensor nodes are mobile.





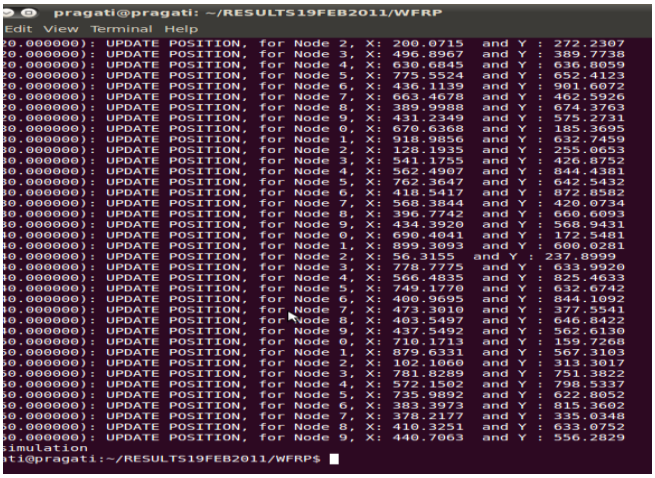


Fig 3: TCL and Trace file for the Scenario at 350 sec

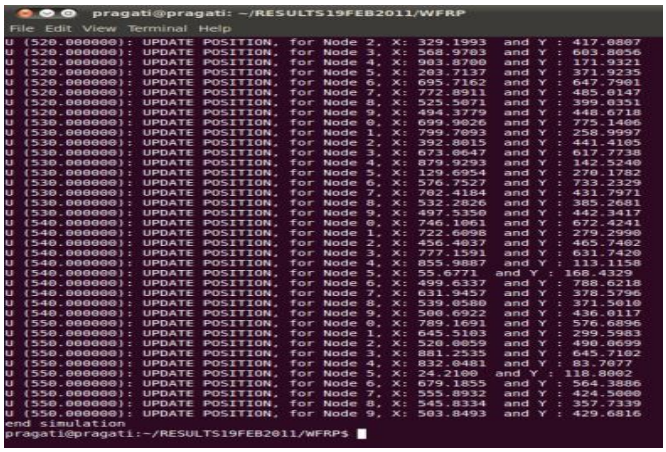


Fig 4: TCL and Trace file for Scenario at 550 sec

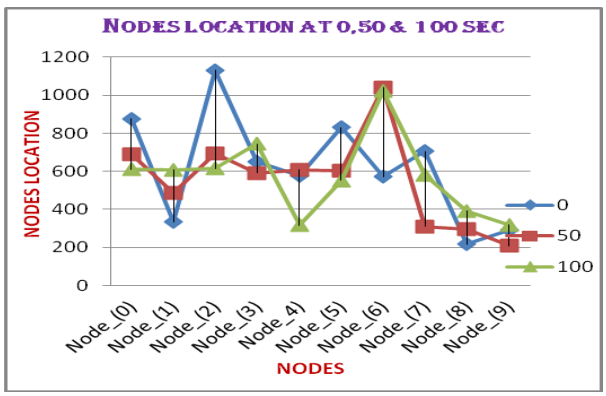


Fig 5: Position od nodes at 0, 50, 150sec

Above figure depicts the position of 10 nodes at three different time interval. Blue line indicating position of nodes captured at 0 sec , red line is used for 50sec and green is used for 100 sec. Its clearly stating the different location of each nodes at different time interval.

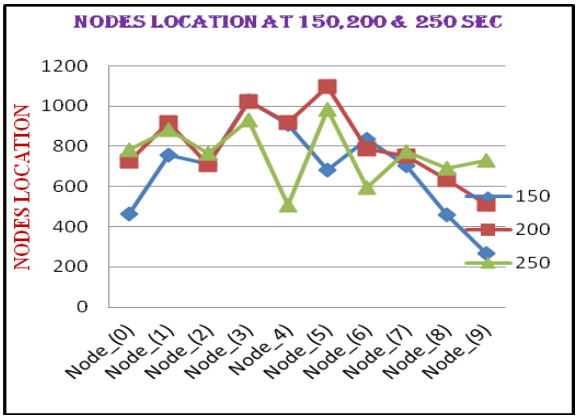


Fig 6: Position od nodes at 150, 200, 250sec

The above figure notes down the postion of nodes at time of 150,200, & 250 sec.

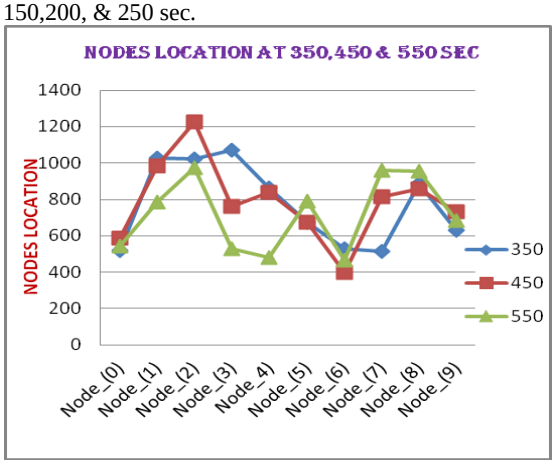


Fig 7: Position od nodes at 350, 450, 550sec

When will compare previous position of nodes with the locations captured at 350 sec , we find out their exact location at that moment, which will become beneficial for sink node to keep a track of each of the sensor nodes.

5. CONCLUSION

The motivation to introduce this protocol is to fully support the mobility feature of sensor nodes in wireless network. Many times it's a necessity to know the exact position of the nodes so that the operator or sink node could keep a track of them. This protocol also facilitate sink node to keep on continuous communication with the sensor nodes, by knowing their exact location of sensor node, wherever the node moves in the network.

6. REFERENCES

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