Wireless Senssor Network
Comprihansive Study of Mobility Representation And Model

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Abstract

A wireless sensor network (WSN) is the growing technology that is using in various areas like defense, tracking, companies and medical area. For self configuration and self healing the WSN is a demanding network. A study of Mobility models are represented in this paper that are used in the simulations of network that is of sensor type. Several models are detailed in this research that shows the nodes that are mobile in nature whose movements are sometime dependent or sometime independent of each other depending upon the situation. The main concern of this paper is to present variety of models that are mobile in nature and their pros and cons. After the discussion on various motilities model researchers get alternative to decide the best suited mobility model.

I. Introduction

Wireless sensors have suffer from the inadequate resources that are the speed of processor, its capacity of storing data, the way in which data is transferred, message sending technique and supply of energy. Coverage and energy efficiency are the main concern regarding network and protocols planning. To form a random topology various dynamic and static sensor nodes are connected wirelessly and the networks are self configuring and self healing. As the nodes will enhance in a network then domain of a particular network will enlarge which ensure higher network connectivity which is reliable and also consume lower energy as well as increase the life of sensor nodes. The latest way to identify these factors is utilizing mobile devices that caries data and information collected by Sensor nodes. Mobility models are used for simulating the displacement method of mobile sensor nodes. On the basis of simulation and displacement methods, it needs to consider the appropriate mobility model for the specific application. [1].

II. Related Works

Survey of different mobility models has been done and effect of survey is studied in [1]. Number of factors affects the performance like varying node densities and number of hops. Various mobility models, density of nodes and data path length are the conclusion of performance of the routing protocol. The infrastructures less network that are mostly used under unattended mode are the Mobile wireless ad hoc networks. So for better understanding and implementation of different routing protocol, it is required in carrying out a comparison of the routing protocols that are different in nature [7]. Various Routing protocols like LANd Mark Ad hoc Routing protocol (LANMAR), Dynamic Source Routing (DSR), Ad hoc On-Demand Vector routing (AODV), Source Tree Adaptive Routing (STAR) protocol, Dynamic MANET On-demand (DYMO), Bellman Ford, and Location Aided Routing protocol (LAR), Routing Information Protocol (RIP) are discussed.

III. Mobility Models

Number of development and evaluation of wireless routing protocol has been done [7] with the help of different network simulators and derivative models for data patterns and mobility [5]. For wireless sensor networks, much consideration presently focused on the evaluation and development of

wireless routing protocols. These types of models will have a significant effect upon the outcome of the simulation as well as the assessment of the protocols. There are various kind of models in my research work, are given below.

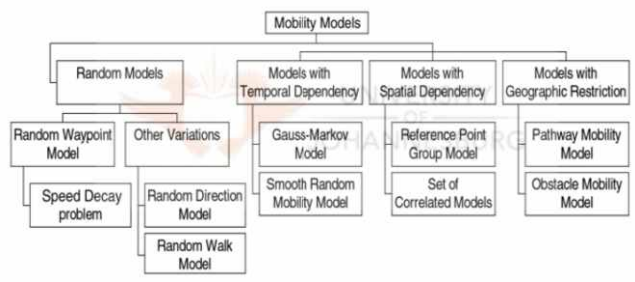

Figure1: Mobility Models

1.1 Random Waypoint Model

The mobile users generally use the random waypoint model for the movement of mobile users. The random waypoint model also emphasized how their location, speed, velocity and acceleration changes time to time. The main aim of Mobility models is to do simulation once evaluations of new network protocols have been done. Johnson and Maltz were first proposed the random waypoint model. Random waypoint model is the most accepted mobility model for the evaluation of mobile ad hoc network (MANET) routing protocols. The popularity was increased because of its simplicity, mechanism, working and wide availability.

The mobile nodes move freely, at random and without any restriction in random-based mobility simulation models. In a nutshell, we can define it like to be more precise, the target, tempo and direction as well as the route are all chosen independently and randomly of other nodes. This kind of model has been used in many simulation studies.

Two variants, the random walk model and the random direction model are variants of the random waypoint model.

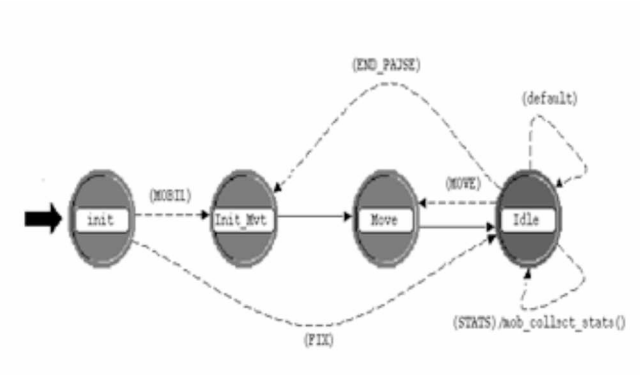

Figure2: Process Model

In every time slot the speed and direction of Random Direction and walk nodes change. New direction from θ is selected arbitrarily between $(0,2\pi]$ in this model. Gaussian distribution is purposely used for the speed chosen which a uniform type of distribution.

1.2 Manhattan Grid Model

A grid topology uses in the Manhattan mobility model [2] and purposely used for the movement and association in urban area. There are only two directions in which mobile nodes are allowed to move that are horizontal and vertical and where the streets are in planned and ordered way.

Mobile node can shift left, right or go straight with assured possibility. A Freeway model that is going to be used in next section is very much similar to inter-node and Intra-node relationship which is used in the Manhattan model. Mobile Ad-hoc Networks (MANNET) and Vehicular Ad-hic Networks (VANNET) are good examples of Manhattan model.

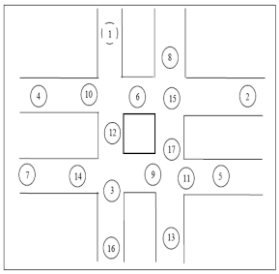

Figure 3 Topography showing the movements of nodes for Manhattan Mobility model

In this Figure 3 seventeen nodes of sample topography shows the movement of nodes for Manhattan Mobility Model. Along the nodes the map defines the roads.

1.3 Gauss-Markov Model

Each and every mobile node in the Gauss-Markov Mobility Model activated with a route or direction and it speed in that particular direction. The upgrading and updating these various types of nodes at a fixed time interval is very much required. There are two factors that affect the speed and direction of node

1. Calculation based upon, the value of speed and direction at the nth instance of time with the value of speed and direction at the n - 1st instance
2. The random variable that also affect the speed and direction of nodes.

1.4 Freeway Model

The movement behavior of mobile nodes is emulated by the Freeway model. The freeway model can be used for exchanging the status of traffic when an object in on the move. Tracking a vehicle is the good example of Freeway model. Various types of Map can be made by using this model. The map contains various freeways with lane in both directions in each freeway. Restriction is imposed on each mobile node so that each node can only travel only its lane. The velocity of temporary dependency of mobile node is dependent on its previous velocity.

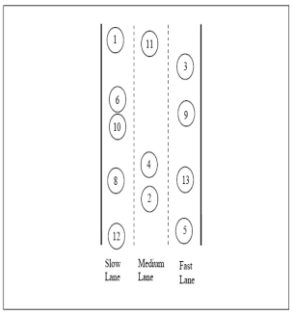

Figure 4 Freeway Mobility Model Shows the Movements of Nodes

Topography movements of different nodes for freeway model having 12 nodes. Because of the use of maps, nodes traveling in one line can't move to the other line.

2.1 Reference Point Group Mobility Model

Reference Point Group model is generally used in battlefield of military. RPGM model nodes are fractioned into groups and each of the group must have a leader described [3] by Jayakumar et al. Each and every node has rapidity and route that is specified by arbitrarily different from each and every group leader. The variety of models can be created by the general description of group mobility such as various seminar, conferences, meetings, Emergency squad, salvage group, Military**.** RPGM is used as common way for treatment of group mobility.

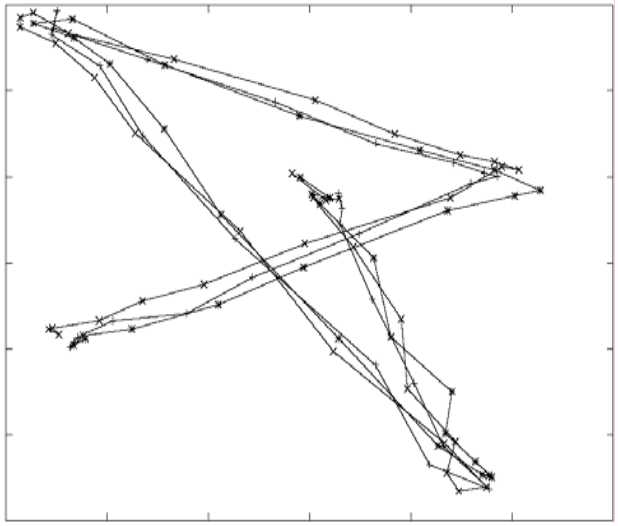

Figure 5 Traveling Pattern for RPGM Model

In figure 5 for RPGM model, progress and movement of a set of three mobile nodes is shown. It is self-explanatory in above figure that nodes which are individual can randomly move concerning to their already defined reference point. The movement of RPGM is based on the group movement.

The Model of RPGM represents the different mobility scenarios

1. **In-Place Model:** The various regions are come across by the entire field and single groups occupy a particular region. Battlefield situation is an example of this model, where various groups of army personnel are carrying out similar operations (e.g., land mine search). The other area of application is large scale disaster recovery.

2. **Overlap Model:** Various tasks having various groups move on the identical field in an overlapping way. For example, in a disaster healing area, the rescue team, the medical assistant team and the psychologist team will be randomly spread out over the area. Yet, each group has a unique motion pattern, speed, scope etc..

3. **Convention Model:** This situation is to follow the mobility model in the convention. A large area is partitioned into various regions as well as most of the groups are permitted to travel between regions.

2.2 Column mobility Model

A set of mobile nodes is represented by the Column Mobility Model that travels in assured predetermined direction which is used in scanning and searching activity for example demolish mines by robots of military.

2.3. Nomadic Community Model

For travelling a group of nodes in mobility situations the Nomadic Mobility Model is used. Conference and military applications are the example of Nomadic mobility model that can be functional in mobile communication. From one place to another place the mobile nodes or entire mobile nodes travel randomly.

2.4. Pursue Model

Various nodes try to capture solitary mobile node ahead in Pursue Mobility Model. Tracking of target and enforcement of law are the examples of Purse mobility model.

3. Exponential Correlated Random model

To make movements that employ a motion function a group mobility model is used.

Pathway Model:

In a Pathway model several geographic constraints are integrated into the mobility model for the purpose of restricting the movement of node in the map of pathways. In the simulation area the predefined type of map is generally used. A map of metro city is being modeled by the Tian, Hahner and Becker et al [4] utilize a random graph and based on assured map of an existent city the graph can be randomly generated. There are set of edges, vertices and freeways represents-:

Vertices represents- Building of the city
Edges represents- Streets
Freeways represent –Connection between buildings

At first, nodes are positioned arbitrarily on the edge. The node travel through the shortest path to a destination that is randomly chooses and this task is done for each and every node repeatedly until all nodes reach to the specified destination. The mobile nodes in Pathway model are only permitted to travel on the specified pathways whereas in the Random Waypoint model the nodes can travel source to destination freely. On the other hand, as the target of each motion phase is randomly selected, randomness still exists at certain level for this model. Fig.6 illustrates the maps used for Freeway, Manhattan and Pathway Models.

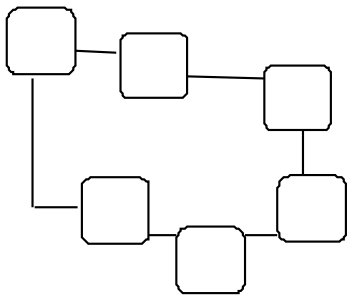

Fig6: The Pathway Graphs Used in the Freeway, Manhattan and Pathway Model

IV. Importance of Choosing a Mobility Model

There are various model have been studied in which three model Random waypoint Mobility Model, the Random Walk Mobility Model or the Gauss-Markov Mobility Model [6] are mostly used. The choice of using mobility model can have an important effect on the performance, examination of a sensor network protocols. With suitable parameters the Reference Point Group Mobility Model should be used.

V. Conclusion

In Wireless network Protocol the Mobility Model are very much crucial and plays a significant role. After studying different mobility models, an attempt is to perform a survey of the mobility modeling and analysis method in a detailed and organized manner. There are different Mobility model such as temporal dependency, spatial dependency or geographic dependency other than the Random Waypoint model are discussed. The main objective of the research is to make the platform for the introduction of some other mobility models like Gauss-markov, Manhattan, RPGM, Random Waypoint, obstacle Mobility models with DSR routing protocols and NS2/NS3 simulation tool.

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