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DETECTION AND TRACKING OF CHEATER NODES IN WIRELESS SENSOR NETWORKS

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Abstract

In wireless sensor networks it is important to manage the mobility of the nodes in order to improve the performances of the network. In this paper military application is focussed like force protection. In this paper the proposed method is Ant colony optimization (ACO). Ant colony optimization gives the current position of the target. For the detection and tracking of the target two special types of nodes are used. They are static sensor and mobile sensor nodes. Static sensor sends the approximate position of the target to all the mobile sensors. After getting information from the static sensor, mobile sensor gives the exact position of the target and also track the target based upon the shortest path. AODV (Ad-hoc on demand distance vector) routing protocol is used in this paper. It is a type of reactive protocol. So if the signal is jammed at any node then automatically the alternate shortest path will be selected. Here the comparison of various parameters like delay, average delay, packet to delivery ratio (PDR) and throughput are done and the graphs are obtained. In this paper the simulation is done by the help of NS2 (Network Simulator).

Keywords: Target Tracking, WSN (Wireless Sensor Network), Cheater nodes, Static sensor and Mobile Sensor.

1. Introduction:

The nature of ad hoc network is to make it more available to wireless attacks. Generally the ad hoc nodes are wireless. The mobile hosts forming a group called mobile ad hoc network (MANET). So MANET can transfer the data to one another even if there is no fixed infrastructure. Mobile ad hoc network are independent and dynamic in such a way that each and every host in this network can move freely in any direction and can change their connection to other devices also. Each device in MANET can be used as router. To build a MANET the challenge involved is that each host in the network should contain the information properly to route the traffic. This kind of network can be operated by them and can also be connected to the larger internet. The features of MANET are multihop routing, scalability, decentralised administration and changes in network topologies. During the transformation of data from

source to destination if the intermediate node is failed to transfer the data then the data will be returned to the source. This process is done by proactive protocol. But in reactive protocol even the intermediate node is failed to transfer the data it will find some other shortest path to transfer the data to the destination. Hence the reactive routing protocol is better than proactive protocol. Generally the attacker wants to attack and destroy the cooperation among the ad hoc nodes The wireless sensor network consist of many sensors distributed to verify the physical and environmental conditions. The data which are collected by the sensors are sent to the base stations. Wireless sensor networks have many tiny sensor nodes for the observation of cheater nodes. Hence the cheater nodes which are surrounded by the sensors can be easily identified. This was reported to static sensor and this sensor can be able to communicate with the outer environment like mobile, laptop and base stations. The centralised approach is followed by the target tracking methods. By increasing the number of sensors we can transfer more data through the static sensor and it also uses additional bandwidth. In target tracking the node which is sensing the target is sensor node and it should be kept in active mode and rest of the nodes should be in inactive mode. As each node is having only limited power we are following the above process to use the power of the nodes in an efficient manner. Group of sensors should be turned ON to the active mode to supervise the mobile target continuously. This should be done prior to the target reaches the sensors. The group of sensors which are in active mode works based on the velocity, energy and bandwidth. In this paper we are going to compare some of the target tracking algorithms which currently used in wireless sensor network.

2. Existing Work:

2.1 Face tracking algorithm:

Face Tracking Algorithm is used in tracking the target. Face can be defined as the nodes of a spatial region which surrounds a target. In this method researchers were able to find the target's movement towards each face rather than only locating the target. Face tracking uses polygon tracking to detect the movement of the target. In this paper edge detection algorithm is also introduced.

In this method the nodes can be made ahead of the target's movement. Face Tracking creates a polygon which is known as an active polygon and the edge detection algorithm is used to create a new polygon next to the active polygon. When the target is moved to the edge then it is spotted at a point which is known as follow spot. There are 3 phase detection spot inside a follow spot. They are as follows:

a. Square detection: In this the target can be identified by any two nodes.

b. Rectangular detection: It means that the target can cross the edges between the two different nodes.

c. Crossing: It means that the target is about to cross the edges between the two different nodes.

From this paper we can conclude that edge tracking algorithm is used to recover from sensor faults and loss of tracking and it also tracks the target in timely order.

2.2 Static clustering:

In this static clustering the nodes are arranged in such a way that they are stable. So that the parameters like size, area and members should also be stable. There are two divisions of static clustering. They are as follows:

a. Prediction-based or pro-active clustering:

This prediction- based clustering is used in the network which is having many sensor nodes in sleep mode. If a target moves from one region to other region then the cluster head which is having the target should pass the information to the next region.

b. Non-Prediction based clustering:

This non-prediction clustering is used in the network which is having many non-sleep sensors. So the sensors in the network will consume more energy but the energy consumption is not a big problem instead the lifetime of the cluster is a problem. So according to this the nodes themselves select the cluster head.

From this paper we conclude that we can easily track target which is moving from one region to other region but if the cluster head fails due to less power or energy then all the nodes in that cluster will be failed.

2.3 Dual prediction reporting:

Dual prediction reporting method reduces the longer distance communication between the sensor and base station so that the energy can be used in an efficient manner. If the any of the sensor node finds any cheater node in its range then it will detect the movement of that target and the information collected by the sensor node is passed to the base station.

So the base station also tracks the movement of the detected target and the information collected by the base station is saved temporarily. And this collected information is not transferred to the sensor nodes. If the prediction of both sensor nodes and base station is same then transmission cannot be there. These same predictions are stored in the base station so the transmission of data from the sensor node to base station is reduced. Hence the energy of the sensor node is saved.

From this paper we conclude that the energy used by the sensor nodes can be reduced.

3. Proposed Algorithm:

In this paper ant colony algorithm (ACO) is proposed for detection and tracking of cheater nodes in wireless sensor networks. This algorithm gives the current position of the nodes. Ant colony algorithm is also used for tracking of the target. This algorithm is based on the behaviour of ants. Ant colony algorithm uses static sensor and mobile sensor to detect the terrorist node. Static sensor gives approximate position of the terrorist node to the mobile sensor nodes. All mobile sensor nodes get the information regarding the target by static sensor nodes. Mobile sensor nodes calculate the distance D from their own position to the target node. The distances calculated from each and every mobile sensor to the target are compared and then the minimum distance from the position of the target to the mobile sensor node is selected to track the target. Ant colony algorithm is used to find the coverage of the target from the position of the mobile sensor nodes. To track the target the following properties are used like speed, energy, delay, throughput, PDR (Packet to delivery ratio), average delay and position. Ant colony algorithm is a technique which can solve various computational problems and it can find the good paths through the graphs. Ant colony optimization helps us to get the exact information about the node.Ant colony algorithm is based on the foraging behaviour of ants.

In this paper AODV (Ad hoc on demand distance vector) routing protocol is used for routing. This protocol controls how nodes decide which path to select to route packets in a mobile ad hoc networks between various computing devices. In ad hoc networks the nodes are unfamiliar with the topology of their respective networks. They have to discover that. Ad hoc on demand distance vector routing protocol is a type of reactive protocol for mobile ad hoc networks and other wireless ad hoc networks. It means that it establishes a path to the destination only on demand. AODV protocol avoids the problem of counting to infinity of other distance vector protocols as it uses sequence numbers on the route updates. AODV can be used for both multicast and unicast routing. In AODV protocol the network remains silent until unless a connection is needed. At that point of time the network node broadcastsa request for connection as it needs a connection.

There are four phases of AODV protocol. They are as follows

- Route lookup phase
- Data transfer phase
- Reputation phase
- Time out phase

Route lookup phase: This phase deals with the authenticated discovery of routes and route set up phases of the normal AODV protocol. In this phase the source node broadcasts route discovery packets (RDP) for a path from source node to destination node.

Data transfer phase: In this phase the source node selects the highly reputed next half node for the transfer of its data. If the two next half nodes has the same reputation then the source node will select one of them randomly and also stores its information.

Reputation phase: In this phase when an intermediate node receives a DACK (Data acknowledgement packet), it gets the record which is inserted in the data transfer phase which corresponds to this data packet then the reputation is incremented for the next half node. Once the DACK packet reaches the source node then this entry is deleted from the sent table.

Timeout phase: In this phase if the expiry of the timer for a given data packet takes place at a node then the node retrieves the entry which corresponds to this data transfer operation which is returned by the timer from its sent table. Here the negative recommendation of (-2) to the next half node and it deletes the entry from the sent table.

Step by procedure for ant colony algorithm:

1. First of all 'n' number of nodes are created.
2. Then the positions are initialized as X_ pos, Y_ pos.
3. Energy is initialized as 100 joules.
4. Wireless link and routing are established.
5. Initialize time t="a".
6. Then the simulation is started.
7. Decrement till t=0.
8. Then the energy of each node is measured.
9. Position of each node is measured.
10. Stop simulation.

4. Result:

The network of 25 nodes is created and the network has four static sensors and four mobile sensors. The static sensor is indicated by blue colour, mobile sensor is indicated by brown colour, normal nodes are indicated by green colour and the terrorist node is indicated by red colour.

The following four parameters are analysed and the graphs are obtained using ant colony optimization and it is shown below. It is compared to the existing method and it is shown that the proposed algorithm is better than the existing method.

- Delay
- Average delay
- PDR (Packet Delivery Ratio)
- Throughput

Delay:

The delay is calculated by the following formula

Delay=Received time-sent time

Average delay:

The average delay is calculated by the following formula

Average delay=Delay/ (Number of received packets).

PDR (Packet to delivery ratio):

The packet delivery ratio (PDR) is calculated using the following formula

PDR= r/s *100

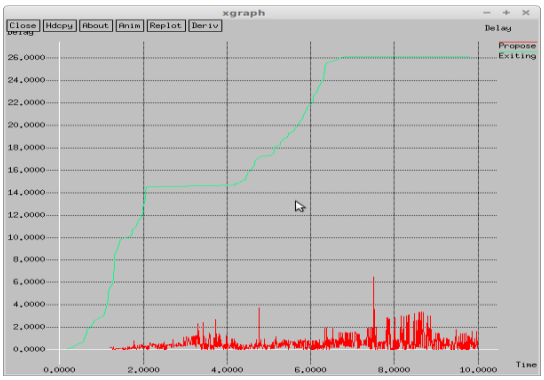
r = number of received packets

s = number of sent packets.

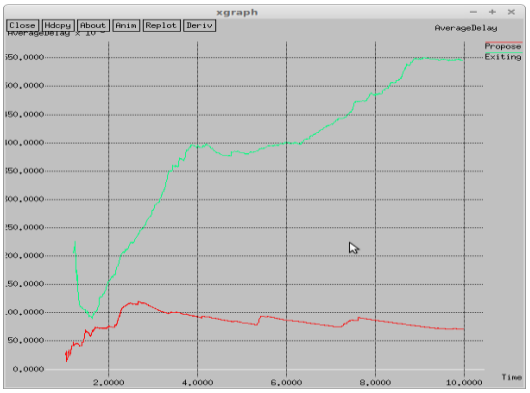
Throughput:

The throughput is calculated using the following formula

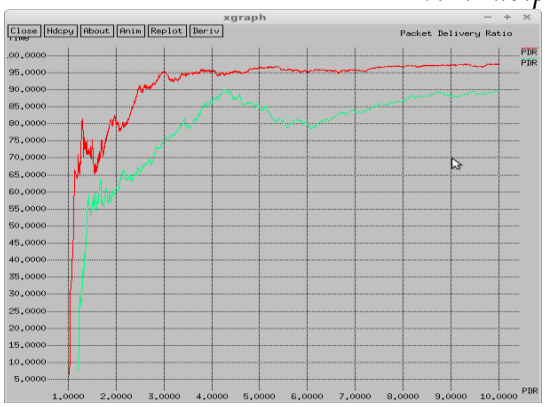
Throughput = (number Of Received Bytes*8)/(Time*1000).



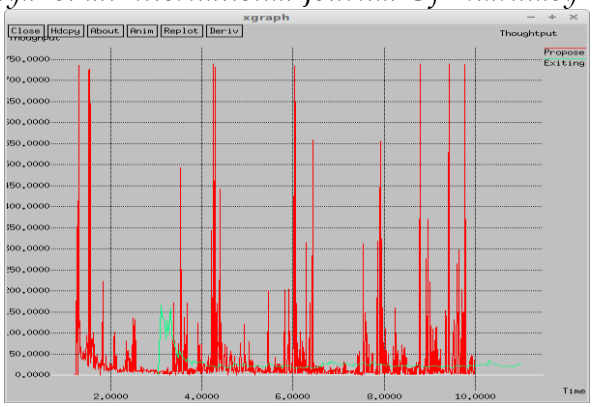
Delay



Average delay



PDR (Packet to delivery ratio)



Throughput

4. Conclusion:

In this paper ant colony optimization was proposed. The Static Sensor Nodes are used to optimize the target tracking. The method examines the recent position of target and its next position as well. The static sensors are distributed among the network.

The position of sensor node is important in such a way that to extract the approximate position of target. The proposed method in this paper is useful in target tracking in military applications.The proposed method finds the current location of target and predicts the next position of target as the target is moving in the network. A relocation of sensors is then performed. Each sensor is then assigned one position of the set using an ant colony optimization algorithm. Hybrid sensor network is used by the ant colony algorithmwhich consists of both static and mobile sensor nodes.

Mobile sensor nodes are used for optimizing the target tracking, static nodes gives the total coverage of the network. Simulation results shows the efficiency of the proposed method compared to existing algorithms developed for static sensor networks. In future there is scope for, locating nodes displaced outside the given network and ignoring malicious node and routing packets in alternate path and to find solutions for the problem of multi target tracking.

References:

1. Wensheng Zhang and Guohong Cao Published in the IEEE Transactions on WirelessCommunications “DCTC: Dynamic Convoy Tree-Based Collaboration for Target Tracking in SensorNetworks.
2. Lin, C.Y., Peng, W.C., Tseng, Y.C.,"Efficient in-network moving object tracking in wireless sensornetworks", Department of Computer Science and Information Engineering-National Chiao TungUniversity, 2004.
3. Chih-Yu Lin and Yu-Chee Tseng “Structures for In-Network Moving Object Tracking inWirelessSensor Networks” Proceedings of the IEEE.

4. H.-W. Tsai, C.-P.Chu and T.-S. Chen, "Mobile Object Tracking In Wireless Sensor Networks,"Computer Communications 30, 2007.
5. Tran, S.P.M., Yang, T.A."OCO: Optimized Communication & Organization for Target Tracking inWireless Sensor Networks", Proceedings of the IEEEE International Conference on Sensor Networks.
6. W.-R. Chang; H.-T. Lin and Zong-ZhiCheng,"CODA: A Continuous Object Detection and TrackingAlgorithm for wireless Ad Hoc Sensor Networks," Consumer Communications and NetworkingConference, 2008. 5th IEEE, vol., no., pp.168-174, 10-12 Jan. 2008.
7. MohsinFayyaz**,**Wireless Sensor Network, 2011**, "**Classification of Object Tracking Techniques inWireless Sensor Networks".
8. Chan, H, Luk, M, Perrig,"Using clustering information for sensor network localization", inProceedings of the International Conference on Distributed Computing in Sensor Systems (DCOSS'05),2005.
9. Feng Zhao1 and JaewonShinEt al IEEE Signal Processing Magazine, March 2002, "Information-Driven Dynamic Sensor Collaboration for Tracking Applications ".
10. M. Walchli, P. Skoczylas, M. Meer and T. Braun, "Distributed Event Localization and Trackingwith Wireless Sensors," in Proceedings of the 5th international Conference on Wired/Wireless internetCommunications, May 23 - 25, 2007.
11. E. Olule, G. Wang, M. Guo and M. Dong, "RARE: An Energy Efficient Target Tracking Protocol for Wireless Sensor Networks," 2007 International Conference on Parallel Processing Workshops (ICPPW 2007), 2007.
12. H. Yang and B.Sikdor, "a protocol for tracking mobile targets using sensor network, sensornetwork protocols and applications", in First IEEE International Workshop on Sensor Network Protocolsand Applications, Anchorage, Alaska, pp. 71-81, 2003.

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