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Active Aggregation Node Selection for Multiple Targets Tracking in Static WSN

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Abstract: The main aim of a wireless sensor network is to provide accurate and reliable information about the area in which the sensor nodes are deployed. From the various application of a sensor network, target tracking is the recent advance. Target tracking is a challenging task due to the failure of sensor nodes because of the energy reduction, processing of data, redundancy at the sink and the mobility of the target. Path loss is another problem of a wireless network. Many algorithms have been developed to reduce the issues of target tracking. But they are note dealing with the redundancy of data at the sink due to the detection of target by multiple clusters. And multiple target tracking is the major problem that is faced by the WSN. In this paper, we present a mechanism for tracking multiple targets using a special aggregation node based on the message utility of the received signal.

Key words: Multiple target tracking, WSN, aggregation node (AgN).

I. INTRODUCTION

Wireless sensor network is used to make easy communication between human and the environment. WSN is mainly developed for the detection and observation of the unattended area. The sensors will deploy in the region where human interaction is not possible. This application can be used in military applications, health care, remote monitoring, and industrial application etc. Now, introduce the WSN to the target tracking application. Detection of movement through an unattended area was a difficult task. But now a days, by the introduction of WSN to the target tracking application makes detection possible. Self organizing network is created by deploying wireless sensor nodes in an unattended area and they will communicate with the neighbored nodes. [1].

Tracking consists of detecting and monitoring locations of moving objects. Tracking is applicable for the real world application such as traffic control, fleet tracking, habitat monitoring and mobile telephony etc.

We are interested I the design of efficient tracking for the wildlife detection in the unattended area and the movement detection in the country birders which needs high security. Making a target tracking mechanism with optimum usage of energy is the main challenging task while designing the algorithm. The existing methods only considering a single movement inside the WSN. If there is a multiple movement inside the WSN, they will fail to provide the accuracy, reliability and energy efficiency.[2].

It is possible to use different types of topology for the application. Mainly there are three types of topology:- tree topology, cluster based and hybrid topology. Most efficient method that can use for the target tracking application is the cluster based topology. After the deployment of the sensor nodes, create cluster head based on the threshold distance and remaining energy of each node. Cluster head is responsible for the communication with the sink and the co-ordination of the cluster member. The main issue of this application is the detection of target by multiple cluster and due to this, create redundant information in the sink. It will cause high consumption of energy and wastage of the available band width. If the number of target through the network increases, energy consumption also increases and reduces the efficiency of the network.

So we are proposing a new algorithm for the multiple target application through a static network by using a set of active nodes and aggregation node to reduce the redundancy at the sink.

II. RELATED WORKS

For the target tracking application, there are different protocols for the efficient communication. But they are not dealing with the redundancy of data at the sink.

For the tracking node selection, the simplest approach is selecting the closest nodes having the shortest distance from the moving object. This type of mechanism having simplest calculation, but the accuracy becomes very low. [3]. There is another method called entropy based selection approach. It is used for optimizing the message utility function. This approach have a good tracking accuracy but computationally complex. [4]. there is another method based on the weighted distance based node selection.

A data collection technique for WSN varies with different types of topologies. Here we only discuss about the mechanism used for the cluster based topology. Here we only discuss about the mechanism used for the cluster based topology. In a typical cluster based WSN like LEACH, each cluster head is responsible for the aggregation of data. Aggregated data will transmit to the sink for the further processing. [5].

In another work, data aggregation carried out by hop by hop manner through a multiple path. For this type of

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approach, the rout should be established in advance. It is only applicable for the destination aware movement.

III. SYSTEM MODEL

Network model

We are considering a static and clustered WSN which having a sink outside the network. The sensor nodes in the network will be randomly distributed in an A×B sensing area. The sink or the base station always has infinite power supply. Cluster head will send the sensed data to the sink.

Cluster selection is base on the threshold distance between the neighbour nodes. After the selection of cluster, select the cluster head based on the remaining energy in each node. Node has highest energy will successfully elected ad the cluster head (CH). CH will be responsible for the controlling of the cluster member (CM). CH will always keeps active for the tracking mission. When an external moving object is entering into the network, sleeping nodes will detects the movement and send a message to the CH. Then the cluster head is responsible to select a set of active nodes based on the shortest distance from the moving object and based on the message utility. Keeping the sensor node in a sleep condition during the condition in which nothing is to detect will reduce the energy consumption successfully. A set of nodes which is very near to the target will be active for a threshold time and these set of nodes will collects the location and direction details of the moving object. The set can be represented by equation (1)

$$S = [A^1_{ij}, A^2_{ij}, A^3_{ij} \ldots\ldots A^n_{ij}] \quad (1)$$

'A' represents the corresponding nodes. For every transmission and reception of the message from any sensor node will cause a small amount of energy consumption based on the transmission distance. So we have to consider that the algorithm should choose a minimum distance path for every communication. Energy required for every transmission and reception can be consider with the help of electron energy for every transmission, reception and the distance. Energy will be directly proportional to the distance and the path loss component. This can be represented as the equation 2&3.

$$E_{TRANSMIT} = [E_{tx-electron} + E_{amp} * d^{\alpha}] * n \quad (2)$$

'n' is the total number of bits that are transmitted.

$$E_{receive} = [E_{rx-electron}] * n \quad (3)$$

Overall energy that is going to be reduced by a single transmission and reception can be calculated by equation 4.

$$E = [2E_{electron} + E_{amp} * d^{\alpha}] * n \quad (4)$$

In this work, it is trying to reduce the redundancy at the sink while tracking multiple movements through a single network. By using any one of the existing algorithm, it will not give accurate information about all the movements through the network. Because the node will die out easily by detects the target. In the proposed work, the CM keeps sleeping condition for all time. When a target entered into the network only the node keeps awake and will be in the tracking mode for a particular threshold time. There is a possibility to select the active nodes which is from the different centers. It will also leads to the problem of redundancy. To avoid this we are introducing a new method. In which the algorithm select an aggregation node(AgN) from the set if active nodes. After that it will be responsible for the data gathering and aggregation. It will collect all data from the active nodes and aggregate this data. Then it will send the data to the corresponding CH.

This algorithm uses ADOV protocol to choose an optimum path for the communication to reduce the energy consumption. Using this method the CH will send the information to the sink and the sink will process the received data.

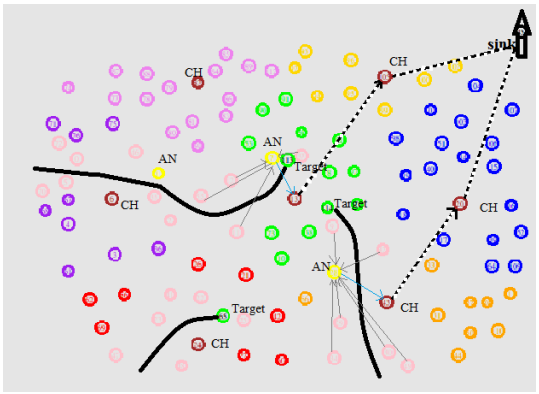

Fig:1 Simulation output of multiple target tracking mechanism

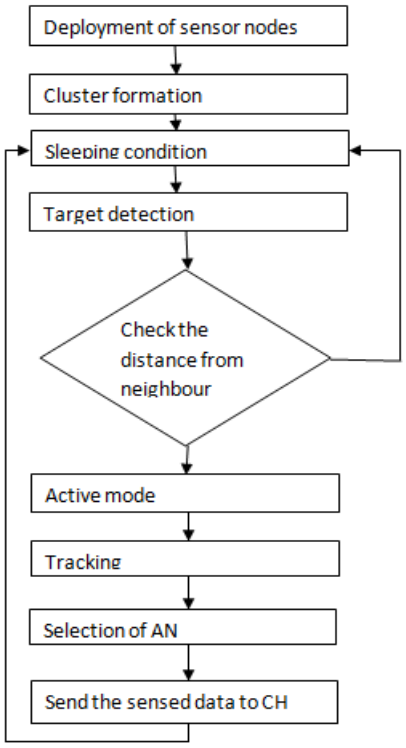

Fig 2: flow chart representation of the proposed algorithm

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The simulation result shows the multiple target detection using the proposed work. It detects the movement of external objects through the network accurately and efficiently. The nodes will be active only for the time of tracking and then it will return to the state of sleep mode. For each round, the election of cluster head will be based on the remaining energy of the node.

The proposed work can be represented by the following flowchart

Thus the energy of sensor node are conserved due to the introduction of active node for a particular threshold time. So it can reduce the node die out with less number of rounds and helps to increase the efficiency and accuracy.

IV.CONCLUSION

One of the main applications of WSN is to track an unauthorized target in an unattended area. Energy is one of the most important constraints in any network. We proposed a mechanism for tracking multiple targets using a special aggregation node based on the message utility of the received signal. Proposed frame work is energy efficient as the nodes are made to keep into sleep state when they are not in the tracking mission. It is reliable and robust against the node failure and produces more accuracy at the sink.

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