ENERGY AWARE TARGET TRACKING SCHEME IN WIRELESS SENSOR NETWORKS

S S Gayathri@vishnupriya 1,3, T Mahalakshmi 1, T Mathakshmi 2, M Monisha Evangelin 3, Ms R Saranya 4
1,2,3 Student Final Year (ECE) 4 Asst Professor(ECE)
gayathri0178@gmail.com, mahalakshmi1985@gmail.com, emonisha57@gmail.com
2,3,4 P S R Rengasamy College of Engineering for Women, Sivakasi

ABSTRACT - Wireless sensor networks (WSNs) have emerged as an interesting and important technology. In existing methods focuses on fusing data at the cluster heads and uses CAICS (Coordinated and Adaptive Information Collecting Strategy) in which during the selected node is in tracking state, every nodes surrounding the target selected node will be in active state. This will lead to an increase in energy consumption. Our proposed paper utilizes QAICS (Quality Aware Information Collecting Strategy), where target node is initially selected and then the node which ignore close to the target node only will be in active state and all other nodes will enter into quasi-active state or monitor state automatically. This leads to a dramatic reduction in the energy consumption. Our experimental results demonstrate that the proposed approach reduces the computational complexity of node selection without degrading tracking accuracy and achieves a significant energy consumption reduction and network lifetime extension compared to the CAICS approaches. One of the main issues in wireless sensor network is energy conservation problem for much application. In our existing work, cluster heads(CHs) gathering data in a clustered sensor network, it leads to redundant data transmission from CHs to the sink so as to waste much energy. The main goal of this paper is to reduce the redundant data transmission. In this paper, clated as Quality Aware Information Collecting Strategy (QAICS) for target tracking in clustered WSNs. In QAICS, considering the node selection, Adaptive aggregation node selection and data transmission. QAICS performs better in terms of Packet Delivery Ratio (PDR).

INDEX TERMS - QAICS; energy efficiency; quality; adaptive; WSN

INTRODUCTION

Wireless sensor networks (WSNs) have emerged as an attractive technology which can gather information by the collective effort of numerous sensor nodes. In WSNs, one of important application is target tracking, such as vehicle tracking and migration tracking of animals. A wireless sensor network is a group of specialized transducers with a communications infrastructure that uses radio to monitor and record physical or environmental conditions. Commonly monitored parameters are temperature, humidity, pressure, wind direction and speed, illumination intensity, vibration intensity, sound intensity, power-line voltage, chemical concentrations, pollutant levels and vital body functions.

WSN is spatially distributed, collection of sensor nodes for the purpose of monitoring physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. Nowadays this field has attracted the significant attention of many researchers. In such application scenarios, the sensor nodes collectively monitor the roaming path of moving targets in the deployed area. Since the sensor nodes are always deployed in an unattended environment, it is very difficult to...
replace their battery after the deployment. As a result, energy efficiency is the most critical design issue for WSNs. Clustering is an important approach to organize a densely deployed network. The clustering algorithms keep only a portion of nodes (CHs) active and save the energy for the rest of the nodes. Nevertheless, in a target tracking application, due to the random movement of the target and large overlapped sensing area between clusters, the target will often be detected by the nodes in multiple clusters at the same time. When all the nodes report their data to the respective CHs, each involved CH has to send the data to the sink.

II RELATED WORK

For tracking nodes selection, the simplest approach is to select the closest nodes which have the shortest distance to a target[5]. This kind of methods have simple calculation, but low tracing accuracy. In [8], the authors proposed a weighted distance based node selection method for bearing only sensors. The sensor with minimum weighted distance is activated for tracking mission. Although weighted distance method needs less computation, it chooses only one sensor each time and does not consider the spatial correlation of node. In [6] the authors propose to aggregate the data hop by hop through a multihop path. Using this scheme, the route must be established in advance. It is applicable for application where the source nodes are known at design time but not for target tracking application.

In [9] an adaptive scheme in proposed to control the degree of data aggregation with respect to the reliability requirement but it requires more energy cost and time delay. In [1] the tracking node selection is proposed. It reduces the computational complexity and energy consumption but it does not able to change the transition state. In [2] load balancing is proposed. It controls the congestion and secure delivery but nodes failure has been occurred.

III EXISTING WORK

In our existing system use the coordinated and adaptive information collecting strategy (QAICS) for target tracking in cluster WSNs. In this method consists of 1) coordinated tracking node selection 2) adaptive AN(re)-selection and 3) data aggregation and transmission. Each CH selects and wakes up its CMs for tracking mission considering the spatial correlation of the nodes. Then the selected CMs convert their state from the detecting to tracking. The AN for data gathering is selected from the nodes in tracking state. Finally, the data aggregation and transmission module can transmit the data to the sink node via route.

IV PROPOSED WORK

In our proposed method propose the Quality Aware information collecting strategy(QAICS) for target tracking in cluster WSNs. In this method consists of node selection, adaptation and state transition, adaptive aggregation node selection and data transmission. At first the node selection method dynamically selects the best set of node for tracking missions by using the spatial correlation of sensing nodes. Secondly, The selected sensor node is active state, which is sends continuous updates at each time interval to the sink module. An update packet consists of the sensor reading, timestamp and state of the sensor (e.g. energy statistics) and tracking information. When the sensing measurement falling below a threshold then sensor now makes a transition to monitoring state.

Moreover, the adaptive aggregation node is selected for data collection to reduce the redundant data transmission and balance the energy cost. Finally, the data aggregation and transmission module can transmit the sensing data from the aggregation node to the sink node via route.
Dynamically choose the best set of sensor nodes for tracking task can reduce the network energy consumption and improve tracking accuracy. Generally, CHs should select their members which can bring more information among the candidate nodes in a cluster. In this work, each CM has detecting and tracking state. In the detecting state, it is in the sleep modes most of the time and wakes up for a fraction of time to react to the control messages from its CH. In the tracking state, a CM keeps active to track the target until the target is out of its sensing range. Thus, when the sink obtains the estimated position of the target \((x', y')\), it informs each CH to select and awake the sensor nodes to the tracking state. All the nodes whose sensed range includes \((x', y')\) are regarded as candidate nodes in each cluster. Each CH first choose a node \(N_0\) which has the most residual energy among the candidate nodes. Then, the joint information utility of \(N_0\) and the other candidate nodes is calculated respectively. And the node that has the largest joint information utility is chosen as tracking node. The procedure is continued until enough tracking nodes are selected.

b) Adaptation and state transition

A sensor may be triggered by an external event to move from a monitor state \(S_0\) to an active state \(S_1\). An external event in a tracking application was a change in the target within the visible radius of a sensor node. In its active state, a sensor sends continuous updates at each time interval to the sink. An update packet consists of the sensor reading (tracking node information), timestamp and state of the sensor's energy statistics. The sink module may decide to transit the sensor to a quasi-active state \(S_1\) by sending the measurement tolerance corresponding to the desired application tolerance track. The sensor now makes a transition to a quasi-active state, and sends an update to the sink module only if its reading exceeds its previous reading by the measurement tolerance \(\Delta I\). The sink on receiving the value update will make the corresponding update for the sensor measurement in its sensor database. A sensor may transit from the active or quasi-active states to the monitor state due to either an external event (e.g., sensing measurement falling below a threshold), or a message from the sink. If the transition happens due to an external trigger, the sensor sends a corresponding message to the sink.

c) Aggregation node selection

When a target is detected, the sensor nodes around it will be woken up by their CHs and get into the tracking node set \(D\). The set \(D\) contain the \(m\) number of nodes in the tracking state. Since all nodes in \(D\) are in vicinity area, they can directly communicate with each other. Therefore, AN can be elected by the internal negotiation of its nodes in \(D\) without the participation of any CHs. To achieve load balance, the node that has the most residual energy and consumes the least energy for communication in \(D\) is selected as AN. The AN is dynamically selected according to the changing position of the moving target. If the distance between the AN and the target is larger than a defined threshold \(d_{th}\), the AN will broadcast a message "reselect AN" with time flag to the other nodes in \(D\) to start the next round AN election. During this process, all tracking nodes in \(D\) are kept under the management of respective CHs. When they finish the tracking task, their CHs will get them back to the detecting state.

d) Data Aggregation and Transmission

After AN is selected, it will periodically broadcast the flag message "gather data" to the other nodes in \(D\) to request sensed data. When the nodes receive this message, they will wait for a random time before reporting their sensed data to the AN, in order to avoid data collision. Although this random waiting time reduces the possibility of collision, it cannot totally eliminate it. This is mainly due to the transmission delay of the data packets. An underlying carrier-sense MAC protocol is still needed to mitigate collision at the MAC level. The sensed data in local area have strong correlations and can therefore be effectively aggregated by AN. In addition, CAICS utilizes local communication with low cost to accelerate data aggregations and to reduce the number of data packets transmitted over long distances.

---

**V. EDGE'S ALGORITHM**

- Creation of node formations of clusters and assigning Cluster Head(CH), Cluster Members(CMs).
- Tracking nodes selection (largest joint information utility)
- When a target comes along with in the visible radius of a sensor nodes an external event is triggered.
- When the sensor node is in active state, it sends the continuous updates at each time interval to the sink node.
- The sink node may decide to transit the sensor to a quasi-active state by sending the measurement tolerance corresponding to the desired application tolerance track.
- The sensor now makes a transition to quasi-active state and sense an update to the sink module only if its reading exceeds its previous reading by the measurement tolerance.

---

**Algorithm Format:**

1. **Indext:** 1
2. **First Line:** 0.5
3. **Font:** (Default) Times New Roman, 10 pt, No underline, Font color: Auto
4. **List Paragraph:** Numbered + Level: 1 + Numbering Style: a, b, c,... + Start at: 1 + Alignment: Left + Aligned at: 0.25" + Indent at: 0.5"
5. **Font:** 10 pt
6. **List Paragraph**
7. **Font:** 10 pt, No underline, Font color: Auto
8. **Indent:** First line: 0.5"
A sensor may transit from the active or quasi-active states to the monitor state due to either an external event (e.g., sensing measurement falling below a threshold), or a message from the sink.

Finally select the aggregate node and transmit the data.

VI. SIMULATION RESULT AND DISCUSSION

a) Simulation scenario

NS-2.34 is used in simulation 50 sensor nodes are assumed they are randomly deployed in a square area of

Four performance metrics are measured such as packet delivery ratio, delay, energy consumption and throughput.

b) Simulation results

1) Packet delivery ratio (PDR): It denotes the ratio of number of data packets successfully received by the total number of data packets transmitted. PDR is able to reflect the reliability.

\[ \text{PDR} = \frac{\text{Number of data packets successfully received}}{\text{Number of data packets transmitted}} \]

2) Delay: It includes the buffering time, queuing time retransmission time at the MAC layer, propagation time and transfer time.

\[ T_{\text{delay}} = T_{\text{queue}} + T_{\text{retrans}} + T_{\text{prop}} \]

3) Throughput: It denotes the amount of data received by the destination per unit amount of time. It is represented in kbps.

\[ \text{Throughput} = \frac{\text{amount of data received by destination}}{\text{per unit amount of time}} \]

4) Energy Consumption: Energy model is defined in a node has an initial value of energy the node has at the beginning of the simulation. Anode loss, a particular amount of energy for every packet transmitted and every packet received.

Fig 3. Packet Delivery Ratio

Fig 4. Throughput

Fig 5. Delay

Fig 6. Energy Consumption
Fig 3 shows the packet delivery ratio in which we simulated performance of proposed QAICS algorithm with CAICS algorithm. The proposed QAICS algorithm shows a higher packet delivery ratio by reducing energy consumption.

Fig 4 shows the End Delay of QAICS and CAICS algorithm. From the simulation we can see that QAICS algorithm shows a lower end to end delay compared to CAICS. QAICS schedules the cluster head according to energy residual of each non-cluster head member node for data transfer to sink node which is base station node.

Fig 5 shows the Energy consumption of the QAICS algorithm from that we can see that CAICS provide lower energy consumption when compared to QAICS algorithm.

Fig 6 shows Throughput of two algorithms, It can be shown that compared to CAICS algorithm QAICS algorithm provide the significant performance improvement due to that transition state.

VIII. CONCLUSION

This paper proposed Quality Aware Information Collecting Strategy (QAICS) for target tracking in clustered WSNs. In QAICS, a coordinated spatial-correlated node selection algorithm is proposed. It uses a joint distance weighted measurement to estimate the information utility of sensing nodes. Moreover, the AN is dynamically selected to gather and aggregate the sensed data. Simulation results proved that the proposed approach outperformed the existing approaches by reducing computational complexity and guaranteeing the tracking accuracy and achieved a significant energy consumption reduction and network lifetime extension.

VIII. REFERENCES


Existing work: In our existing system use the coordinated and adaptive information collecting strategy (CAICS) for target tracking in clustered WSNs. In this method consists of 1) coordinated tracking nodes selection, 2) adaptive AN (re-)selection and 3) data aggregation and transmission. Each CH selects and wakes up its CMs for tracking mission considering the spatial correlation of the nodes. Then the selected CMs convert their state from the detecting to tracking. The AN for data gathering is selected from the nodes in tracking state. Finally the data aggregation and transmission module can transmit the data to the sink node via route.

Proposed work: In our proposed method propose the Quantity aware information collecting strategy (QAICS) for target tracking in clustered WSNs. In this method consists of three steps they are node selection, Adaptive aggregation node selection and data transmission. At first the node selection method dynamically selects the best set of nodes for tracking missions by using the spatial correlation of sensing nodes. The selected sensor node in active state, which is sends continuous updates at each time interval to the sink module. An update packet consists of the sensor reading, timestamp and state of the sensor (e.g., energy statistics) and tracking information. When the sensing measurement falling below a threshold then sensor now makes a transition to monitoring state. Secondly the adaptive aggregation node is selected for data collection to reduce the redundant data transmission and balance the energy cost. Finally the data aggregation and transmission module can transmit the sensing data from the aggregation node to the sink node via route.