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Guidance Providing Navigation in Target Tracking For Wireless Sensor Networks

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Abstract: ***Target tracking is a well known application of sensor networks. The guidance provided vehicle is used for intercept the target. An objective is the guidance provided vehicle can move towards the target in minimum possible time and also it predict the current area or position of target. In this paper the guidance for predicted/detected position of target and guidance for detection of proportional target have been developed.***

Keywords: WSN, Guidance Navigation, void, cluster, continuous object.

1. Introduction

Wireless Sensor networks(WSNs) is heterogeneous system consist large number of sensor nodes. Target tracking detects target and location of the object area. Tracking an animal in forest or tracking enemy soldier in military battlefield are some of applications in wireless sensor networks. To monitor specific mobile events, the continuous objects, such as forest fires, mud flows and oil spills [2]. Wireless Sensor networks consist set of nodes. In which only one node is base station sometimes it is called as sink node. Sometime target tracking predicts the future boundary area. The boundary area is very useful for predict or detect area. It has assumed that in the network, the sensor nodes locations are known.

A large number of sensor nodes in wireless sensor networks are randomly deployed in a wide irregular area and some sensor nodes may fail due to energy depletion. Furthermore it is hard to deploy the sensors with uniform density in actuality. It may be has a *void area* where sensor nodes are not exists. If a void area is in the next activation area then it blocks a signaling message between the sensor nodes. In this situation, the selective wakeup scheme cannot operate correctly. Namely, if the sensor nodes are inactive, then the exact tracking is impossible. Moreover, most of the continuous objects are dangerous substances. The detection errors for the continuous objects tracking can be result in serious harm to people.

Sensor networks are of different types sensor nodes such as magnetic, thermal, radar which are used for monitor variety condition. Sensor networks is heterogeneous system consist number of detection stations. Target tracking detects target and location of the object area. The predict area is different from the individual area. To identify the object of shape, firstly the boundaries area of the target is very useful for predicting the object. And this is possible when sensor nodes nearby of the boundary of target. In Grid based structure the target area is divided in sensors of grid, active-sleep smart-cluster are used for tracking the target area and named as Continuous Object Tracking using Smart-cluster (COTS)[3].

1.1 These frameworks are used in target tracking

In WSNs many network architectures are used for target tracking. In most literature research these networks are used for tracking: distributed cluster based approches, hierarchical, decentralized [4], [11], [12], [13].

1)Data Collection Tree Architecture: A Data Collection Tree Routing protocol used for data collection [18] or aggregation may be used to support target tracking communications.

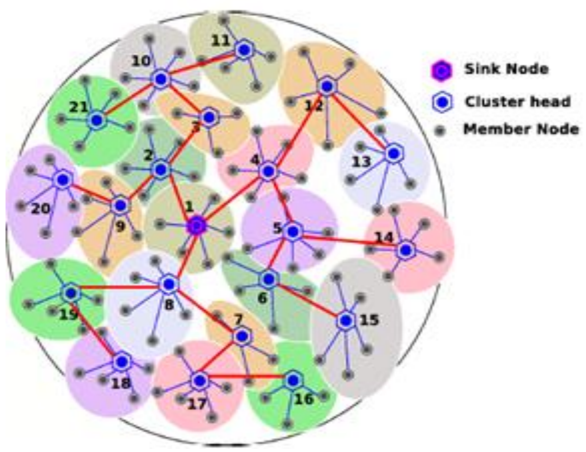


Figure 1: Hierarchical clustered architecture.

2)Hierarchical Clustered Architecture: A clustered architecture has better suited for distributed processing [11], [12].The group of small nodes form within close area. And such area is known as cluster. And High capacity of node known as CH. The nodes in close vicinity form clusters, which is followed by formation of tree over CHs alone with the sink node as base station.

2. Literature Review

2.1 A Continuous Object Tracking Protocol Suitable for Practical Wireless Sensor Networks[1]

Studied on wireless network in which chaining selective wake up scheme is used for tracking the continuous objects.

By using the selective wakeup scheme for energy efficient continuous object tracking. They predict the next activation area with numerical calculation or prediction.

2.2 DCTC: Dynamic Convoy Tree-Based Collaboration for Target Tracking in Sensor Networks[2]

Worked on sensor networks concentrates on finding efficient ways to forward data from the information source to the data centers, and not much work has been done on collecting local data and generating the data report. This paper defined this issue by proposing techniques to detect and track a mobile target. Introduce the concept of dynamic convoy tree-based collaboration, and formalize it as a multiple objective optimization problem which needs to find a convoy tree sequence with high tree coverage and low energy consumption.

2.3 GPSR: Greedy Perimeter Stateless Routing for Wireless Networks[3] Studied greedy Perimeter Stateless Routing (GPSR), a novel routing protocol for wireless datagram networks that uses the positions of routers and a packet's destination to make packet forwarding decisions. GPSR makes greedy forwarding decisions using only information about a router's immediate neighbors in the network topology. When a packet reaches a region where greedy forwarding is impossible, the algorithm recovers by routing around the perimeter of the region. By keeping state only about the local topology, GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases.

2.4 Dynamic Clustering for Acoustic Target Tracking in Wireless Sensor Networks[4]

Evaluated a fully decentralized, light-weight, dynamic clustering algorithm for target tracking. Instead of assuming the same role for all the sensors. In this paper a hierarchical sensor network that is composed of 1) a static backbone of sparsely placed high-capability sensors which will assume the role of a cluster head (CH) upon triggered by certain signal events and 2) moderately to densely populated low-end sensors whose function is to provide sensor information to CHs upon request.

3. System Implementation

Figure2 shows the system architecture. In this system architecture main is base station. Firstly, the member nodes Are connected to the cluster heads. The number of different member nodes connected to the different cluster heads.

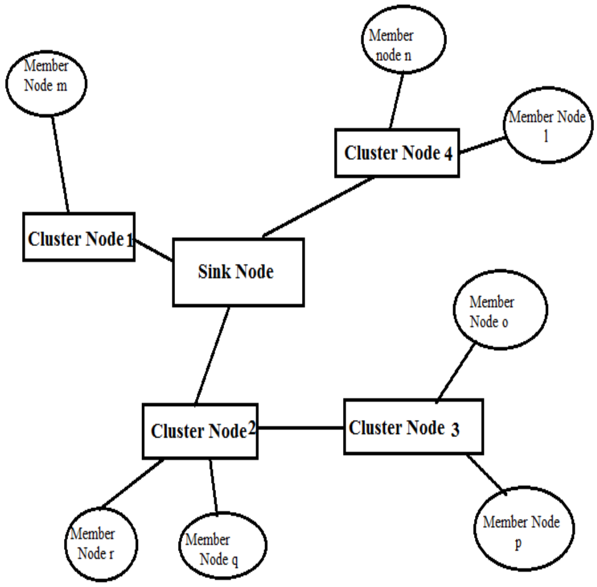


Figure 2: System Architecture

And then cluster nodes connected to the main base station.

1) Cluster Head: Small groups of node within close vicinity of each other form clusters. A higher capacity node may be deployed uniformly in the area to act as CH or the cluster nodes chose to elect their CH locally on rotational basis.

2) Sink: Sink is nothing but the base station. All the cluster nodes are connected to the base station. All cluster nodes and the member nodes can communicate with sink.

3.1 Proposed System

These mathematical expressions are used in the proposed system:

Two parameters are important for guidance of an interceptor vehicle. First one is the target and second is interceptor object. Consider that interceptor vehicle has sensors for self orientation. The sink node communicates with interceptor of target using high power antenna to calculate direction of interception. The interceptor location *A(xg(t), yg(t))* to current target location *B(x(t), y(t))* The current position of target location is *B(x(t), y(t))* and guided object is *A(xg(t), yg(t))* at time *t*. The predicted position of the target for next localization instant *t + 1* is

$$\Theta f = tan^{-1}(y(t) - y_g(t)) / (x(t) - x_g(t)) \quad (1)$$

The velocity in time V_t reaches to point V_f The target of current position is Θ_{tg} By using the triangle sine law direction if interceptor object is calculated:

$$V_F * T / SIN^{-1}(\Psi) = V_T * T\,SIN^{-1}(\Psi) \quad (2)$$

To calculate direction of intercept object shown below:

$$\Theta_f = \Theta_{gt} - sin^{-1}(V_t / V_f * sin(\Theta_t - \Theta_{tg})) \quad (3)$$

The angles varies depending on target of location and interceptor object as quadrants.

3.2 Algorithm Strategy

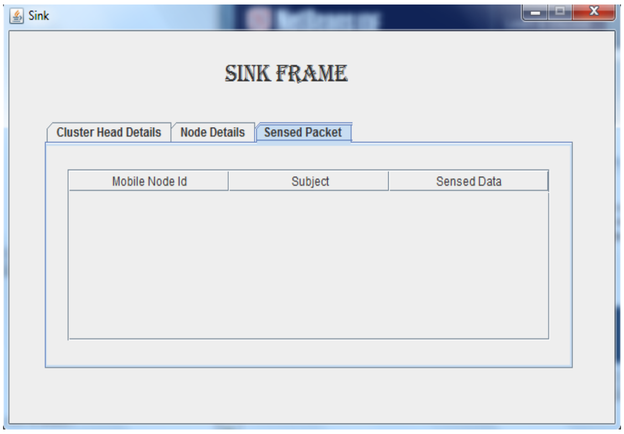
In this guidance navigation algorithm the target position is Q considered at time t and V_t is velocity reaches at same point V_f. And Θ_{gt} angle of target position . For target prediction $f()$ is used.

Step1:**Proc** Guidance Navigation$(Q\ (x(t),y(t))\ ,\ \Theta_t\ ,V_f)$
Step2: **while** $T\neq$ target is not reached **do**
Step3: At every ΔT
Step4: send :$Q(x(t),y(t))$ to an intercept object
Step5: $Q(x(t),y(t)) \leftarrow f\ (x(t),y(t))$
Step6: Θ_{gt} is angle with target position.
Step7:Target is REACHED
step8 : **return** 1
step10: **end while**
step11 **return**
step12 :**end proc**

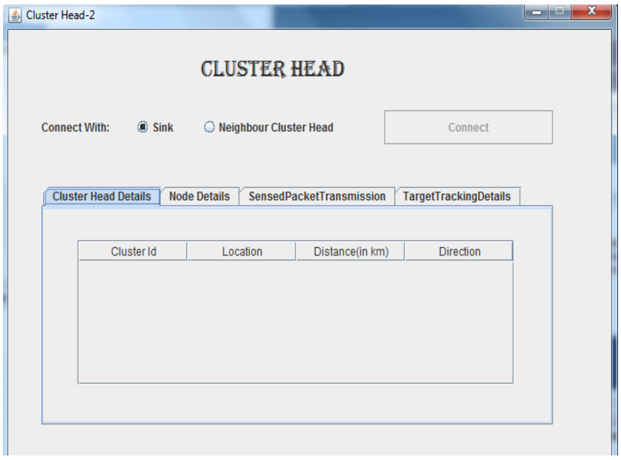
4. Results

The system is developed by using JAVA (Version JDK). The development tool used is NetBeans for this application. The results are shown below in snapshots:

4.1 Base station consist of cluster head details, node details

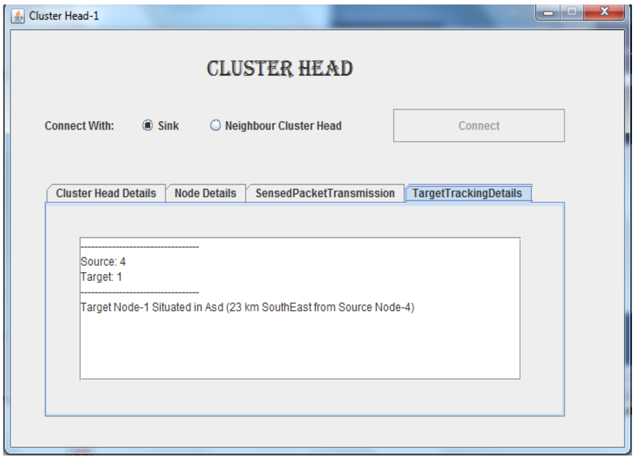


4.2 Below figure shows that when node is created the connection has given to sink or any other node:



4.3 All Mobile Nodes individually gives information in detail:

4.4 Target tracking details shown in below figure:



5. Conclusion

The proportional and predicted navigation scheme used for predict the target. When target is far from interceptor, proportional scheme is used and when target is near of target predicted scheme is used. The proportional navigation scheme suited for linear motion of target.

Future work of this paper includes building a fully scaled up, and provide the target/navigation information to the interceptor object.

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References

[1] Seungmin Oh, Jeongcheol Lee, and Sang-Ha Kim, Continuous Object Tracking Protocol Suitable for Practical Wireless Sensor Networks in IEEE Wireless Communications and networking conference(WCNC)NETWORKS, 2013,pp.2351-2356
[2] Y. Xu, W. Bao, H Xu, An Algorithm for Continuous Object Tracking In WSNs,in Proc. IEEE International Conference Research Challenges in Computer Science, 2009.(ICRCCS 09), pp.242-246
[3] I.F. Akyildiz, S. Weilian, Y. Sankarasubramaniam, and E. Cayirci, A Survey on Seonsor Networks, IEEE Communications Magazine, Vol. 40, pp. 102-114, Aug. 2002.
[4] W. P. Chen, J. C. Hou, and L. Sha, Dynamic Clustering for Acoustic Target Tracking inWireless Sensor Networks, in Proc. IEEE International Conference on Network Protocols (ICNP03), pp. 284-294, Nov. 2003.
[5] S. Goel and T. Imielinski, Prediction-based Monitoring in SensorNetworks: Taking Lessons from MPEG, ACM ComputerCommunication Review, vol. 31, no. 5, October 2001.
[6] W. Zhang and G. Cao, DCTC: Dynamic Convoy Tree BasedCollaboration for Target Tracking in Sensor Networks, IEEE Transactions on Wireless Communications, Vol. 3, No. 5, Sept. 2004.
[7] W. Chang, H. Lin, and Z. Cheng, CODA: A Continuous Object Detection and Tracking Algorithm for Wireless Ad Hoc Sensor Networks, in Proc. IEEE Consumer Communications and Networking Conference(CCNC) 2008, pp. 168-174, Jan. 2008.
[8] J. Kim, K. Kim, S. H. Chauhdary, W. Yang, and M. Park, DEMOCO: Energy-Efficient Detection and Monitoring for Continuous Objects in Wireless Sensor Networks, IEICE Transaction on Communications, Vol. E91-B, No. 11, pp. 3648-3656, Nov. 2008.
[9] S. Hong, S. Noh, E. Lee, S. Park, and S. Kim, Energy Efficient Predictive Tracking for Continuous Objects in Wireless Sensor Networks, in Proc. IEEE Personal Indoor and Mobile Radio Communications(PIMRC) 2010, pp. 1723-1728, Sep. 2010.
[10] W. Lee, S. Park, J.Lee, and S. Kim, A Cluster-based Continuous Object Tracking Scheme in Wireless Sensor Networks, in Proc. IEEE Vehicular Technology Conference (VTC-Fall) 2011, pp.1-5, Sep. 2011
[11] H. Yang and B. Sikdar, A protocol for tracking mobile targets using sensor networks, in IEEE International Workshop on Sensor Network Protocols and Applications, May 2003, pp. 71 81.
[12] D. Yan, J. Wang, L. Liu, and J. Gao, Collaborative Signal Processing Cluster-Based in Wireless Sensor Network, in International Conference on Wireless Communications, Networking and Mobile Computing, Oct. 2008, pp. 1 4.
[13] K. Akkaya and M. Younis, A survey on routing protocols for wireless sensor networks, Ad Hoc Networks, vol. 3, pp. 325349, 2005.

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