Implementation of the Target Tracking in Mobile Sensor Networks

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Abstract: *The problem being tackled here relates to the target tracking problem in wireless sensor networks. It is a specific problem in finding location of target. Localization primarily refers to the detection of spatial coordinates (location) of a node or an object or target. Target tracking is used to finding spatial coordinates of a moving object and being able to track movements of the object. Target Tracking is an important problem in wireless sensor networks, where it dictates how accurate a targets position can be measured and found. In recent surge of interest in mobile sensor applications, in this paper studies the target tracking problem in a mobile sensor network (MSN). This problem becomes specifically challenging given the mobility of both sensors and targets (objects), in which the trajectories of sensors and targets need to be captured or find location. We derive relationship between the tracking resolution and a set of crucial network system parameters including sensor density, sensing range, sensor and target mobility. The implementation results demonstrate that the tracking performance can be improved by an order of magnitude with the some number of sensors when compared with that of the static sensor environment.*

Keywords: - Target Tracking, Spatial Resolution, Mobile Sensor Network

INTRODUCTION

Recently, there has been growing interest in the deployment of multiple wireless mobile sensors for target tracking applications. For example, progress in the development of unmanned terrestrial or aerial vehicles and some of their specific advantages have rapidly improving their use in applications such as search, surveillance and adversarial target tracking for any objects. Important applications of sensor networks is that of tracking mobile targets(objects). This could be crucial for tracking an enemy vehicle, intruders, own troops, animals etc. Tracking mobile objects involves the detection and localization of the targets of interest by processing or sharing the information provided by the sensing nodes along with the location coordinates. The tracking data may then be sent to the base station for further processing. The essential components that are required for target tracking applications are as follows:

Node Localization: It is used to enable the sensor nodes to determine their location with coordinators.

Target Localization: It determines the target's location at regular intervals of times using techniques such as tri-angulation and tri-lateration.

Timing Synchronization: Synchronization in time domain among node and target. Often, it may be necessary to send time synch.

Given the mobility of the targets and sensors mobility, it is particularly challenging to WSN model such an ambiguous problem for multiple moving targets (objects). Furthermore, we are also interested in determining the minimum number of wireless sensors that needs to be deployed in order to provide the spatial resolution in mobile sensor networks. It turns out that this problem is very similar to the collision problem in classical theory kinetic i.e. molecules theory of gas in physics, which allows to establish and derive the inherently dynamic relationship between moving targets and mobile network sensors. The binary sensing model of tracking for wireless sensor networks has been already studied in several prior works. The work in [3] showed that a network of binary mobile sensors has geometric (geometric coordinators) properties that can be used to develop a solution for tracking with binary sensors. Other works [4] also considered a binary sensing model. It employed piecewise linear path detection computed using variants of sensors algorithm, and obtained good tracking performance if the trajectory is smooth enough. A follow-up work explored fundamental performance of tracking a target in a 2D field of binary proximity sensors, and designed algorithms that attained those limits in [5]. Prior works in stationary wireless sensor have studied the fundamental limits of tracking performance in term of spatial resolution. The implementation focus in this paper is completely different from all prior works. There are different distinctive features of our work: 1) Will try to identify and categorized the dynamic aspects of the target tracking that depend on both sensor and target mobility; 2) We consider tracking performance metrics: spatial resolution in a mobile network. By leveraging the theory of kinetic physics, we model the dynamic problem, and examine its sensitivity under different network parameters and configurations. To the best of our mobile sensor knowledge, we believe this is a completely new study of target tracking in mobile sensor networks [10].

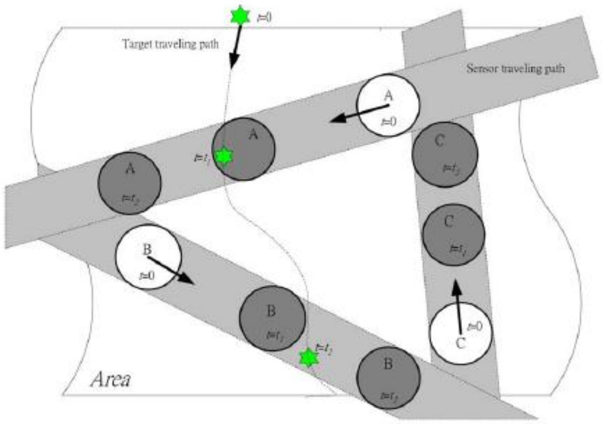

Figure 1: target tracking problem in a mobile sensor network [10]

PROPOSED WORK

Firstly we are interested in target tracking by considering the moving targets and mobile sensors as shown in Figure 1. Specifically, our main interaction towards the spatial resolution for localizing a target's trajectory. The spatial resolution refers to how accurate a target's position can be measured by sensors, and defined as the worstcase difference between the estimated and the actual calculated paths in wireless sensor networks [2]. Our main objectives are to establish the theoretical framework for target tracking in mobile sensor networks, and quantitatively demonstrate how we can be exploited the mobility to improve the tracking performance. In initial sensor deployment over area of region and a sensor mobility patterns and targets are assumed to cross from one boundary of the region to another. We define the spatial resolution as the deviation between the estimated and the actual target sensing and traveling path, which can also be explained as the distance that a target is not covered by any mobile sensors.

IMPLEMENTATION

Module 1: Sensing and Mobility Model
Here we assume all sensors have a *sensing region* and can only sense the environment and detect events within region area. A target is the any object that is subject to sensor detection and tracking as it travels in the region. It is to be *covered* or *detected* by a sensor if it is located inside the sensing region of the sensor. In the target tracking modulation in this paper, we essentially define realistic object tracking. Ideally, a probabilistic sensing model such as the one in implementation will be more appropriate. For simplification and mathematical tractability, we use the disc based sensing model in this work.

Module 2: Tracking Measurement
In the spatial resolution the approximate deviation between the estimated and the actual target travel paths which extend the wireless sensor network and also find out the distance between the source server and target object. The average distance is calculated by the average travel time.

Module 3: Spatial resolution
The spatial resolution is calculated using the average travel time distance between successive

the sensor coverage. The dynamic sensor can be written as follows

$$\lambda = \frac{1}{(n_A) \cdot (2R + \pi R^2 / v_i \Delta t)},$$

Server Module: Figure 2 shows the screenshot about server. Whenever admin enter the sensor node number and locate the map then automatically map is going to be located with whole location information.

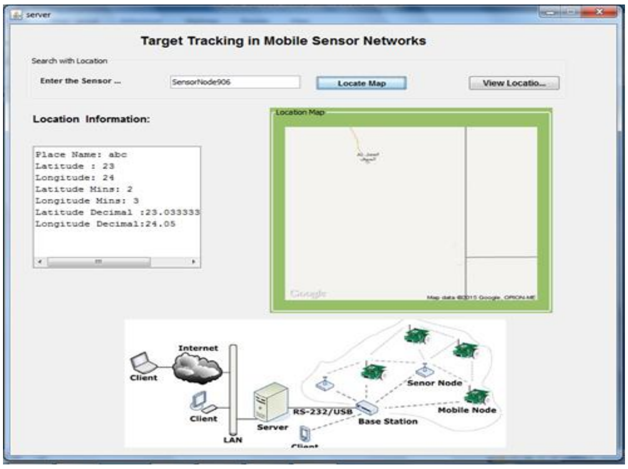

Figure 2: Server Screen to locate map (server)

As shown in figure 3 the server module will able to see the location data which is stored in the server database

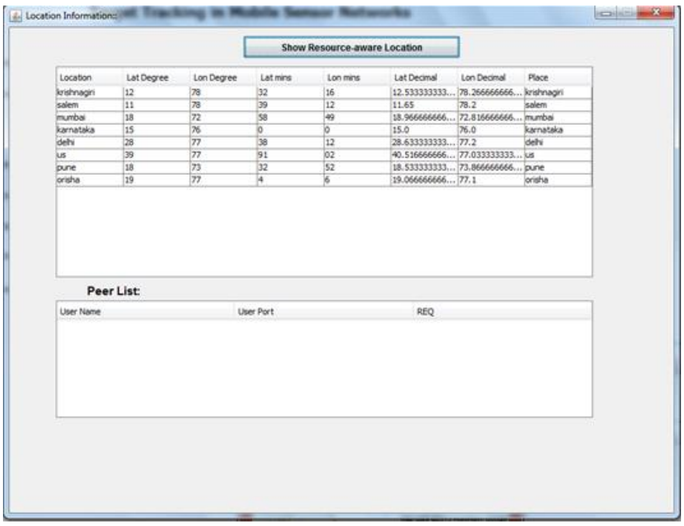

Figure 3: To view the location already stored in database (for server)

Module for User: As shown in figure 4, User will generate the map according to the latitude, longitude scale and whatever data entered by user will be sending to the server. Once it is sent, message box will popup saying new location data inserted successfully.

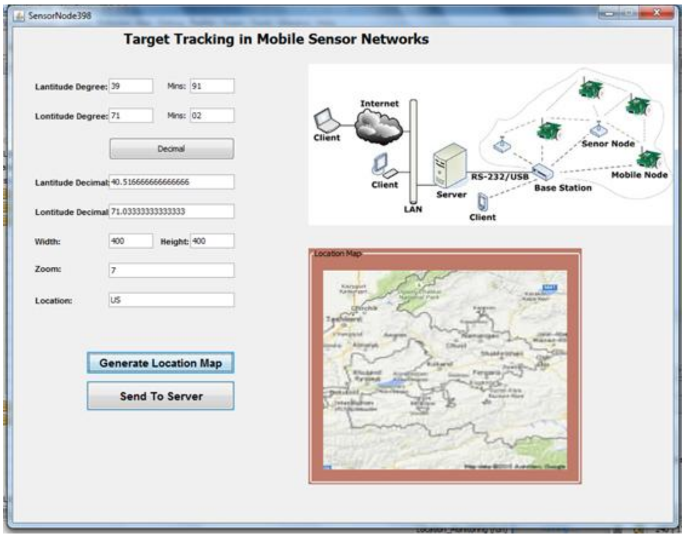

Figure 4: Sensor Node (user)

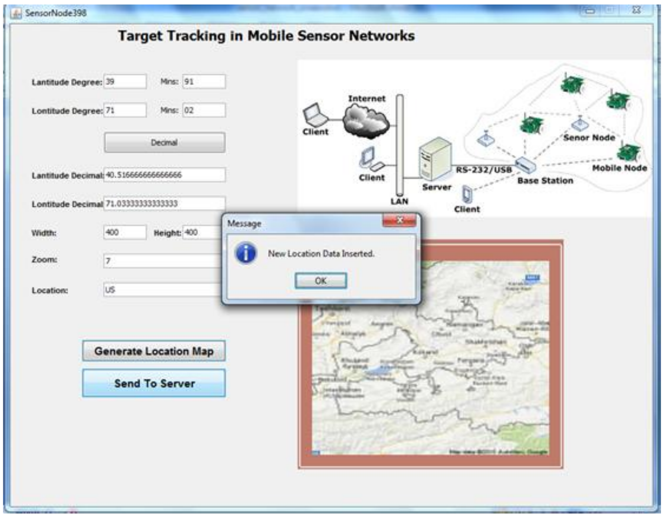

Figure 5: After sending data to server

CONCLUSIONS

In this research implementation, we done studied and implemented the target tracking problem in mobile sensor networks. Specifically, we implemented performance metrics for spatial resolution and we done investigate the resolution against moving targets and also information sharing. By modeling and implementing the dynamic aspects of the target tracking that depends upon the sensor and target mobility, here we derive the inherent relationship between the spatial resolution and a set of crucial system parameters including sensor density, sensing range, target moving path, information sharing , sensor and target mobility. The demonstrated results that mobility can be exploited to obtain and result out the better spatial resolution. There are two avenues for implementation on this problem: (1) to consider the error detection of mobile sensors under varying sensor speeds. This is to be formulated into an optimization problem for target tracking; (2) to re-implement the mobile sensor mobility model, the network model, and the communication model among sensors in order to enable effective detection and tracking. For example, a practically distributed mobile target tracking and sensing information exchange protocol becomes implemented and the mobile sensors are required to trace the target paths

REFERENCES

[1]Greenpeace challenges japanese whaling industry with new satellite tracking system. In http://www.dailymail.co.uk/news/article-486608/, October 2007.

[2] N. Shrivastava, R. Mudumbai, U. Madhow, and S. Suri. Target tracking with binary proximity sensors: Fundamental limits, minimal descriptions, and algorithms. In Proc. of SenSys. ACM, October 2006.

[3] J. Aslam, Z. Butler, F. Constantin, V. Crespi, G. Cybenko, and D. Rus. Tracking a moving object with a binary sensor network. In Proc. Of SenSys. ACM, November 2003.

[4] W. Kim, K. Mechitov, J.-Y. Choi, and S. Ham. On target tracking with binary proximity sensors. In Proc. of IPSN. IEEE, April 2005.

[5] J. Singh, U. Madhow, R. Kumar, S. Suri, and R. Cagley. Tracking multiple targets using binary proximity sensors. In Proc. of IPSN. ACM, April 2007.

[6] H. Zhang and J. C. Hou. Maintaining sensing coverage and connectivity in large sensor networks. Ad Hoc and Sensor Wireless Networks, 1(1-2):89–124, March 2005.

[7] M. Hefeeda and H. Ahmadi. Probabilistic coverage in wireless sensor networks. In Conference on Local Computer Networks (LCN). IEEE, November 2005.

[8] T. Camp, J. Boleng, and V. Davies. A survey of mobility models for ad hoc network research. Wireless Communications and Mobile Computing, 2(5):483–502, September 2002.

[9] R. Present. Kinetic Theory of Gases. McGraw-Hill Book, New York and London, 1958.

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