

**Tracking a mobile target using energy constrained wireless sensor
network**

by

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Department of Computer Science and Engineering

Submitted

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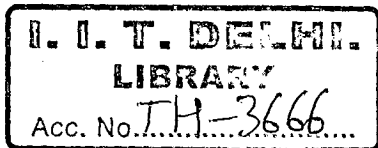
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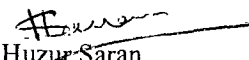
Certificate

This is to certify that the thesis titled "Tracking a mobile target using energy constrained wireless sensor network" being submitted by Vaishali Yeshwant Paithankar to the Indian Institute of Technology Delhi, for the award of the degree of Doctor of Philosophy in Computer Science and Engineering, is a record of bona-fide research work carried out by her under our supervision. The work presented in this thesis has not been submitted to any other university or institute for the award of any other degree or diploma.



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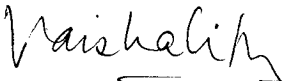
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(VAISHALI Y. PAITHANKAR)

ABSTRACT

We consider the problem of estimating the location of a moving target 'T' in a 2D plane. We assume that it is possible for sensors to detect the presence of the target in its vicinity and to (possibly) measure the distance from/to the target. Given that available energy in sensors is at a premium, we propose that energy be conserved by (a) requiring that a sensor switch to an 'inactive' mode whenever feasible, and (b) selecting fewer and adequate number of sensors that measure distance and communicate with the central tracker. A reduction in the number of messages communicated can significantly reduce power consumption.

We have proposed protocols for target detection and route activation. This task is particularly challenging given that a route needs to be activated using intermediate sensors that may be in inactive mode.

Given an adequate spread of sensors, and an ability to *only* detect presence or absence of the target within its vicinity in a timely manner, it is feasible to obtain an approximate trajectory of a mobile target as a function of time. Alternatively, distance measurements from several such sensors may be used to estimate the location of the target T at a point of time. Clearly, the latter approach is expected to track the target more accurately.

The error in estimating location of the target using distance measurements from multiple sensors is shown to be dependent on two measures viz. proximity of sensors to the target, and colinearity of sensors. We also propose a new measure, *ideal direction* for selecting a 3rd sensor, given locations of 2 sensors and the location of the target. We propose algorithms to estimate the track of the target by using distance measurements from sensors selected on the basis of the above measures. Further, we evaluate all the protocols and algorithms using simulations.

CONTENTS

ACKNOWLEDGMENTS	vii
ABSTRACT	ix
LIST OF FIGURES	xv
LIST OF NOTATIONS	xxi
LIST OF ALGORITHMS	1
1 Introduction	1
1.1 Applications	4
1.2 Model for motion of the target	5
1.3 Energy conservation	6
1.4 Mobile target tracking	8
1.5 Problem definition	9
1.6 Major Contributions	11
1.7 Outline of the thesis	12
2 Literature review	13
2.1 Detection of a mobile target	13
2.2 Sensor sleep schedules	14
2.3 Sensor selection	16

2.4	Distance measurement	17
2.5	Routing for communication between the sensors and the central tracker	17
2.6	Location estimation	18
2.7	Tracking of a mobile target	19
3	Target detection using different sleep schedules	23
3.1	Introduction	23
3.2	Random wake-up schedule for detection of a target	27
3.2.1	Probability of success on first attempt	27
3.2.2	Probability of success on subsequent attempts	30
3.2.3	Uniform probability distribution of τ_s	33
3.2.4	Average number of attempts and delay to detect the target	35
3.2.5	Discussion and analysis	38
3.2.6	Validation	41
3.3	Periodic wake-up schedule for detection of target	43
3.3.1	Bound on the number of attempts and delay to detect the target	47
3.3.2	Comparison between Periodic-S wake-up and Periodic-NS wake-up schedules	53
3.4	Comparison between random wake-up and periodic wake-up schedules	53
3.5	Conclusion	55
4	Tracking based solely on detecting presence of target	59
4.1	Introduction	59
4.2	Tracking based solely on detecting presence of target	61
4.3	Estimating t_E^i and t_X^i	65
4.3.1	Estimating t_E^i	65
4.3.2	Estimating t_X^i	66
4.3.3	Error in tracking the target	67
4.4	1 -coverage of \mathcal{R}	68

4.5	Route activation and data transmission	69
4.5.1	<i>l</i> -connectivity of a network	69
4.5.2	Protocol for data transmission over a link	71
4.5.3	Delay in end-to-end data transfer	74
4.5.4	Periodicity, T_t , of ACT-ROUTE requests	74
4.6	Overall tracking algorithm and simulation results	79
4.6.1	Simulation environment and results	80
4.7	Summary and conclusion	84
5	Location estimation using multiple measurements	87
5.1	Trilateration	88
5.2	Least square error estimation	95
5.3	Error model for distance measurements	96
5.4	Simulation results	97
5.5	Node density	100
5.6	Sensor position and estimation error	101
5.7	Measures for selection of sensors	102
5.7.1	Proximity of sensors to the target	104
5.7.2	Colinearity	106
6	Measures for sensor selection	111
6.1	Region of uncertainty	111
6.2	Colinearity	114
6.2.1	Region of colinearity	116
6.3	<i>Ideal direction</i>	131
6.4	Proximity of sensors to the target	143
6.5	Where are the first two sensors preferably placed?	145
6.5.1	Deviation of visual angle of two sensors from $\frac{\pi}{2}$	145
6.5.2	Multi-objective sensor selection algorithm	147

6.6	Algorithm for selection of the 3 rd sensor	148
6.7	Simulation environment and results	150
7	Tracking mobile target using selected sensors	153
7.1	Introduction	153
7.2	Mobile target tracking	153
7.3	Computation of \hat{L}^k using subset of selected sensors	155
7.4	Simulation environment and results	157
8	Conclusion	169
8.1	Introduction	169
8.2	Target detection using different sleep schedules	169
8.3	Tracking based on target detection by a sensor	171
8.4	Route activation	172
8.5	Location estimation using multiple measurements	173
8.6	Measures for sensor selection	173
8.7	Tracking the mobile target using distance measurements	175
8.8	Major Contributions	178
A	Multi-objective function optimization	179
A.1	Introduction	179
A.2	Candidate selection	179
	REFERENCES	183