Accurate Range-Only Tracking in Wireless Sensor Networks

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INTRODUCTION

This work presents initial results from a novel Range-Only Tracking System tailored for implementation in Wireless Sensor Networks. The system utilizes range estimates from a number of anchor nodes, positioned in known locations to infer the trace and velocity of a moving target. To include support for manoeuvring targets, the target's movement is modeled using a multiple model state-space representation. A Particle Filter inspired tracking algorithm operates on the acquired ranging data to online estimate the target's position and two-axis velocity [1]. Preliminary results from simulating the system under realistic conditions, reveal that good accuracy (<10m) can be achieved, even under cluttered conditions.

SYSTEM OVERVIEW

An overview of the proposed system is depicted in Figure 1. Four anchor nodes are considered to be deployed and a mobile node to be the target. Since WSN nodes are devices with limited processing abilities and energy supply, the measurements obtained will inherently contain an amount of noise. For the scenario considered here, ranging between two wireless nodes can be achieved by employing techniques like Received Signal Strength Indication (RSSI), or Time of Flight (ToF).

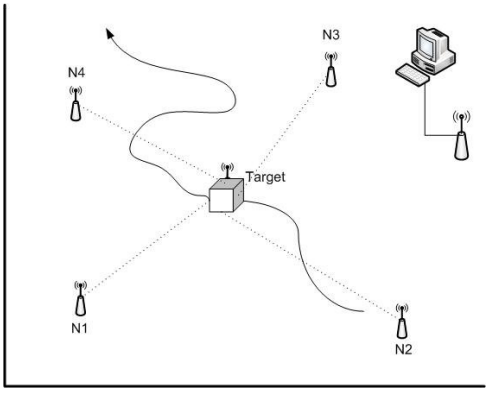

Figure 1. Tracking System Overview

SIMULATION RESULTS

The system is evaluated through simulations. Robustness to noise is considered to be an important aspect. In order to evaluate the accuracy of the proposed system, the Root Mean Square Error (RMSE) is used. In Figure 2 results from simulating a scenario are presented. To evaluate the robustness of the system, a heavy cluttered scenario is simulated for 100 times. As illustrated in Figure 3, the RMSE remains low (<50m) in all executions, while in 93% of the executions, the RMSE is lower than10m.

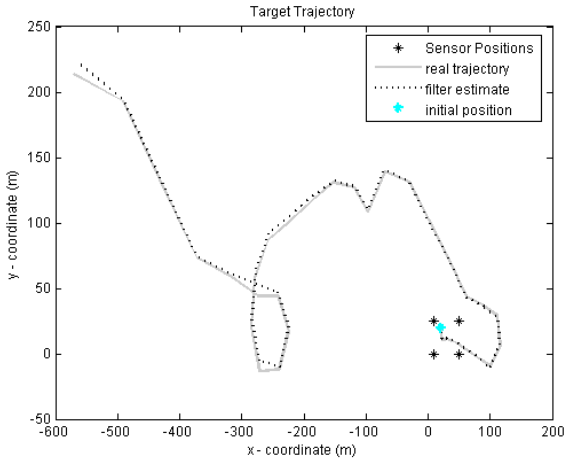

Figure 2 Trajectory Estimation

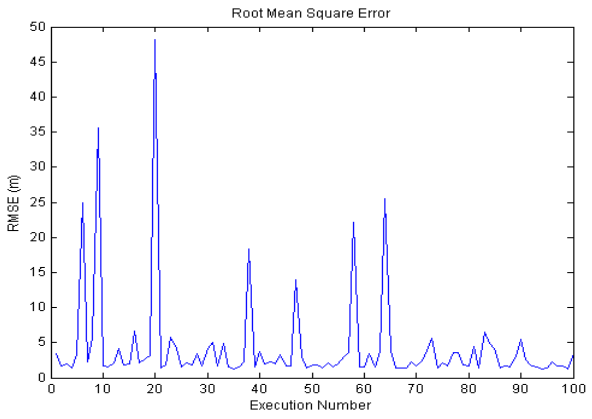

Figure 3. RMSE for 100 runs

REFERENCES

[1] Arulampalam, M.S. and Maskell, S. and Gordon, N. and Clapp, T., "A tutorial on particle filters for online nonlinear/non-Gaussian Bayesian tracking". *IEEE Trans on Signal Processing.vol 50*,num 2 (Feb. 2002), pp. 174 -188.