Target localization in WSNs (Wireless Sensor Networks) has been an active research area due to its importance and wide range of applications. Most of the proposals so far, however, have focused on cooperative targets that in one way or another work with the localization infrastructure. For example, mobile targets can emit RF or acoustic signals either on purpose (ActiveBadges) or by their nature (e.g., bird chirps). Instead, we focus on localizing non-cooperative targets using active sensors. Specifically, we use a network of mono-static low-power, pulsed, Dopper radars that independently estimate the target's Doppler velocity with respect to each radar. These measurements are then used to estimate the target's location and true velocity using an Extended Kalman filter. We have built a prototype of this system using TelosB motes and BumbleBee radars.

Overview

Target localization in WSN(Wireless Sensor Networks) has been an active research area due to its importance and wide range of applications. Most of the proposals so far, however, have focused on cooperative systems that requires targets to cooperate with the localization infrastructure. Instead, we consider a non-cooperative approach requiring zero help from the targets. Specifically, we use Radar Sensor Network (RSN), a group of Pulsed Doppler radars interfacing with Tmotes for target tracking.

Platforms

- Bumblebee: A Pulsed Doppler radar manufactured by Samkrash Company for low-power operation. This small, 5cm x 3cm, device is specially designed for interfacing with WSN devices, such as the Telos or Mica platforms. The radars operate in the 5.8 GHz range and transmit signals in a 60 degree conical pattern. The maximum detection range is approximately 10m. The minimum and maximum radial velocities this device can measure are between 2.6 cm/s and 2.6 m/s, respectively.

- IRobot Create: one of the the most challenging problem in target localization is to provide error-free ground truth values that can be used to estimate the accuracy of the the localization mechanism. Human beings are not good targets mainly because it is hard to walk or run at a constant and predetermined speed. To overcome this challenge, we use the iRobot Create robot connected to an embedded Linux PC, which is programmable and controllable. More specifically, the iRobot provides a set of libraries for scheduling the robot's trajectories or controlling the robot's speed and orientation programmatically. Furthermore, the iRobot Create provides useful information, such as the distance it has moved or speed the robot has traveled.

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