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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Publication

- Jong Hyun Lim, I-Jeng Wang, Andreas Terzis, Tracking A Non-cooperative Mobile Target Using Low-power Pulsed Doppler Radars.