CS5244 Introduction to Cyber-Physical Systems
Project # 1 Indoor Localization, Due Nov. 11th, 2013

Introduction

What's the reason that indoor localization is so different? The answer is that GPS, the ordinary localization tool, has no function indoor while it works precisely outdoor at an open area. Hence, we need to figure out an alternative instead of GPS. Wi-Fi is a good solution, since most smartphones or tablets are equipped with Wi-Fi. Besides, Bluetooth can be also considered as an alternative solution in small range indoor localization.

In this project, we need to implement a localization system based on Bluetooth signal strength and other useful sensors, such as ultrasonic, or acceleration. RSSI of Bluetooth decay with distance from the transmitter, so we can easily formulate an interpretation between distance and RSSI. The goal of the system is to provide an accurate position of either static or moving objects with your best effort.

Implementation (7%)

1. Basic movement control, using RegulatedMotor and DifferentialPilot [1]   1.0%
2. Build a Bluetooth connection on NXTs (sender and receiver)   1.0%
3. Build an Android Bluetooth sender with GUI and NXT receiver   1.5%
4. Measure RSSI value between Bluetooth sender and receiver   0.5%
5. Implement your own localization system which is robust enough to tolerate noise in measurement [2]. You can choose one of the following options to improve your system.
    I.   Implement a Discrete Bayes Filter.   2.5%
    II. Implement a Kalman Filter or a Particle Filter.   4.0%
    III. Implement the above options   5.0%

Report (3%)

Describe how you implement the Bluetooth connections and evaluate the performance of your localization system.

Reference

[1] Tutorial http://www.lejos.org/nxt/nxj/tutorial/WheeledVehicles/WheeledVehicles.htm
[2] Fox et al. "Bayesian Filters for Location Estimation" IEEE Pervasive Computing. pp 10-19. July 2003