Sensor Fused Indoor Positioning System

Lab: Communication Systems
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Background

Nowadays smart devices are equipped with a variety of sensors that provide them sensing, hearing, vision, and communication capabilities where some of these capabilities are comparable or even better than those of human beings. However, for utilizing these sets of raw data and communication capabilities significant improvements in the processing and networking capabilities are required. Efficient and effective design of these tasks is the key requirement for successful deployment of any autonomous network underlying a cellular or WLAN infrastructure, e.g. Device-to-Device (D2D) communication capability in the cellular networks which provides direct connection among users, and grouped-robots over WLAN in which a task is given to a group of connected robots. Although there are several mature techniques for outdoor based positioning, e.g. GPS system, there is still no standardized criteria for the indoor-positioning due to the fact that the environment is much more complicated inside a building than the outdoor and the GPS signals are poor inside the building due to the attenuation. Then, in this project we focus on providing an accurate estimation of both own and neighbor's positions in each connected device.

Problem Formulation

Recently, an indoor positioning project has been done in the applicant’s research group. The goal was to develop an android-based application that could detect the current location of devices inside a certain building, i.e. the ground hall in the Electrum Building, with the best possible accuracy. In that project, the received signal strength (RSS) of the WiFi signals, and the data from the on-board sensors of a commercial smart-phones, e.g. accelerometer, gyroscope, and compass, are processed and fused to contribute to the final accuracy. As mentioned above, indoor environment is much more complicated than the outdoor and then, the achieved accuracy from the previous project must be improved by signal processing techniques. Signal processing for position estimation, sensor data fusion, and object tracking is well studied in literature. Then, we expect from student to survey available techniques and apply them to the current platform for improving the position estimation accuracy.

Type of Project:
Analysis, implement, and experiment.

Required background:
Wireless networks or equivalent, good background in signal processing and java programing (android) is preferred.

Related projects:
Can be found here
References