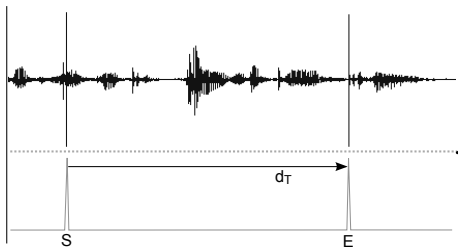# Bachelor Thesis

« Multilateration using Commodity Hardware »

Background

Knowledge of the position of an entity enables an important class of services: Navigation and location based services. In modern vehicle navigation systems, this class of services is used to determine routes to a chosen destination or for example to the nearest gas station relative to current position. For the outdoor area, GPS is a commonly used infrastructure which has become a de-facto standard. Currently, no such standard exists for indoor areas.

In pursue of a possible standard infrastructure, mobile handheld devices have to be considered, too. Even if a common infrastructure for buildings is found, users have to be provided a hardware base of mobile devices to use that infrastructure. Establishing such a standard becomes a lot more feasible, if users do not have to buy new devices but can use existing ones.
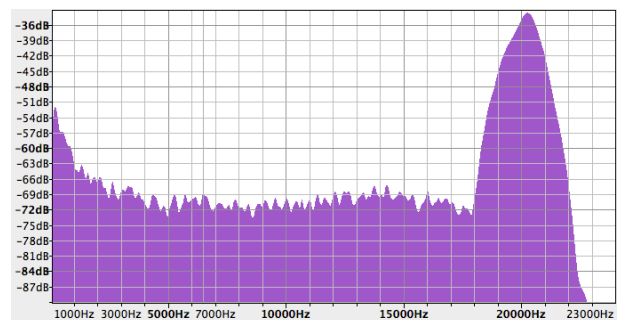
Work Description

With known positions of so called anchors, and the *distances* from the anchors to an unknown position X, it is possible to determine the position X. This process is called *multilateration*. Depending on the characteristics of the signal, especially its propagation speed, distances can be derived from the time a signal needs to travel from a sender to the receiver.

This work aims at estimating the position of the receiver in a room using ultrasonic sound signals only. In order to not rely on other technologies such as radio or light for measuring, different sound signals have to be differentiated. Additionally, taking the *Doppler effect* into account, one can calculate the relative speed the receiver moves with.

The detector which is recording the sound signal will be commodity hardware such as a smart phone which is able to record audio files or process the signals in real time. For the sender, a computer will be used, which sends the signals using suitable speakers.

Requirements

Requirements: Digital signal processing (in software), programming in C / Java.

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