MSc-thesis project in magnetic-field based indoor localization

BACKGROUND

Magnetic-field based simultaneous localization and mapping (SLAM) has shown great potential as a technique for infrastructure independent indoor positioning. Fundamental to successful operation of all types of SLAM system is access to reliable dead-reckoning data so that a geometrically correct map can be constructed and loop-closer performed. One of the most commonly used dead-reckoning techniques is inertial navigation. However, inertial navigation systems (INS) constructed using low-cost inertial sensors experience an error growth rate proportional to the cube of the operation time. Therefore, in SLAM aided INS the allowable duration of the exploration phase is limited and already mapped areas most be frequently revisited.

The maps created in magnetic-field SLAM are based upon medium to long scale spatial variations in the magnetic field, and short scale variations are generally suppressed. However, short scale variations in the magnetic field can, using an array of spatially distributed magnetometers, be use for speed estimation. Hence, if a magnetic-field SLAM aided INS is constructed around an array of magnetometers, the short scale variations in the magnetic field can be used as a source of speed information in the dead-reckoning process. This reduces the error growth rate during the exploration phase from cubic to linear. Hence, magnetic-field based speed estimation is a potential game changer for magnetic-field SLAM aided INS, as it enables much longer exploration phases.

PROJECT DESCRIPTION

The aim of the project is to develop and experimentally validate signal processing and sensor fusion techniques for magnetic-field based odometry. Focus will be one developing techniques for magnetic-field learning and odometry using polynomial, dipole, and Gaussian-process models. Collection of experimental data and evaluating the performance of the methods using real-world data will also be a part of the project.

NEEDED SKILLS

The potential candidate needs to have *good* knowledge in

- Sensor fusion
- Digital Signal processing

CONTACT

If you find the described project interesting or have any questions, please contact Isaac Skog at isaac.skog@liu.se or 0708186805

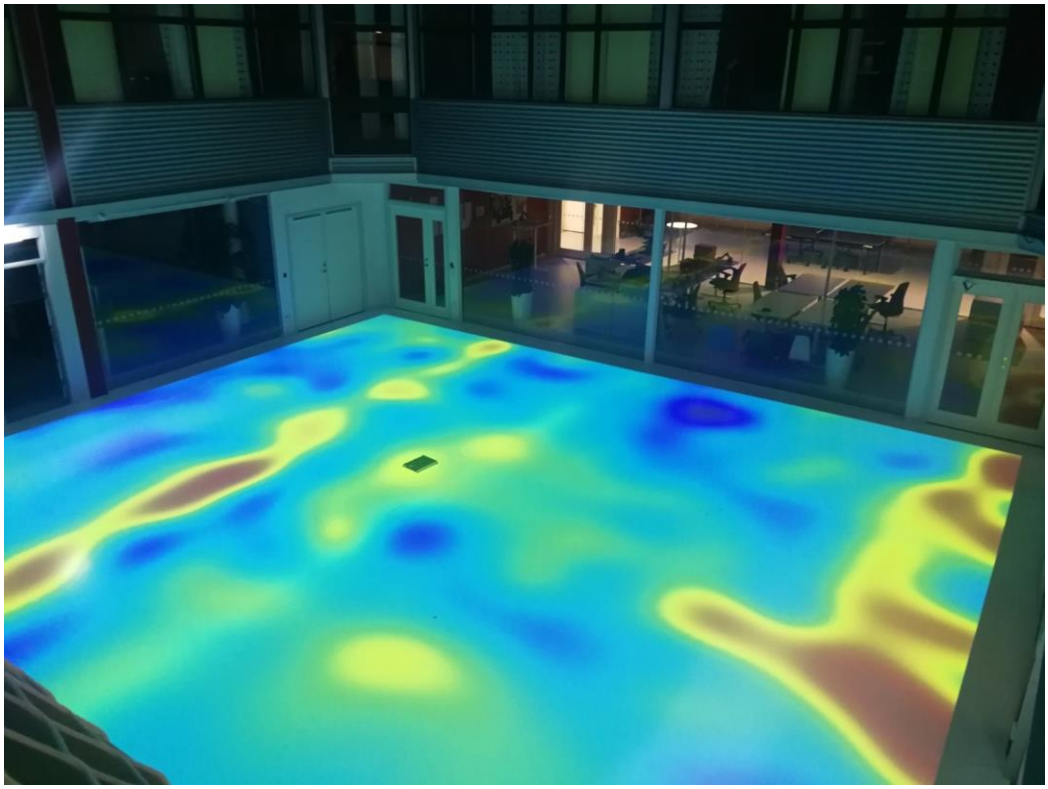

Figure 1: Example of magnetic field variations measured in Visionen