Contest Abstract: IMU-Aided Magneto-Inductive Localization

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ABSTRACT

In this work, we propose an infrastructure-based indoor localization system that exploits the predictable spatio-temporal features of a local magnetic field. The system also relies on inertial data in order to map the environment and track the user's location. Additionally, WiFi access points may be used to improve the performance.

1. INTRODUCTION

The proposed localization system fuses two different types of sensor measurements: the three-axes Received Signal Strength Indicator (RSSI) corresponding to a locally generated low-frequency magnetic field, and the outputs of an inertial measurement unit (IMU) that includes accelerometer, magnetometer and gyroscope. In addition, WiFi RSSI may also be used, if available. Sequential Bayesian estimation with map matching is used for location tracking.

2. SYSTEM DESCRIPTION AND OPERATION

Our system consists of magnetic transmitters (TX) and receivers (RX) (see Figure 1). One particularity of our system is that both TX and RX are equipped with tri-axial coils, which makes the RSSI invariant to the relative rotations of TX and RX [1]. The RSSI is estimated based on the energy of a known preamble. RX is also equipped with an IMU that provides acceleration, angular speed, and orientation information. RX is connected to a computer via the USB, where the data is fused in order to track the user's location.

The system operates in two phases. In the first phase, a "magnetic map" representing the spatial distribution of the magnetic field is constructed. This tedious process is substantially simplified by using the IMU. Unlike, for example, the WiFi RSSI, the magnetic field RSSI exhibits very good stability both in space and time, even in the presence of moving people. Therefore, the magnetic field is sampled just sparsely, and interpolated offline on a denser grid. In the second phase, the magnetic map (and potentially the WiFi RSSI) is used together with the IMU and the floor plan to estimate the location.

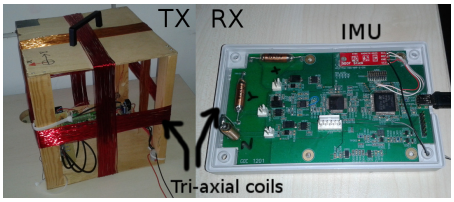

Figure 1: Magnetic TX (left) and RX (right).

3. DEPLOYMENT REQUIREMENTS

The system requires the deployment of several magnetic TXs, depending on the area, and a floor plan.

4. CONCLUSIONS

We propose a localization system that relies on the desirable space-time predictability of the magnetic field and benefits from an IMU to reconstruct the magnetic map and track the user's location.

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5. REFERENCES

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