

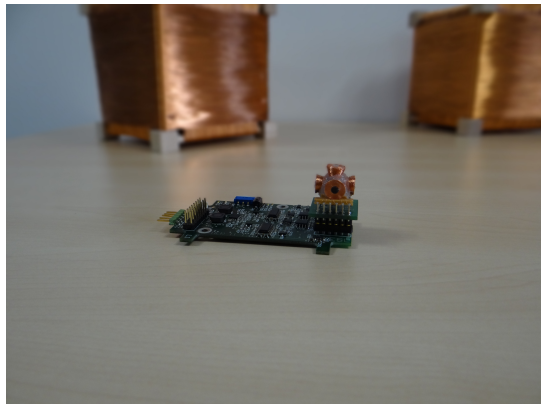
Indoor localisation based on resonant oscillating magnetic fields

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Our system uses oscillating magnetic fields to determine the position of wearable receiver units. The system consists of three components: stationary transmitters, wearable receivers and a processing computer. The processing computer time synchronizes the components and processes the gathered magnetic field information. A transmitter coil consists of 3 perpendicular transmit-



ter axes which are sequentially pulsed. 3 perpendicular coils on the receiver PCB measure the voltages induced by the oscillating magnetic fields. The voltage levels depend on the position of the receiver in the magnetic field and the orientation of the receiver. The transmitter and the receiver coil use oscillating circuits with a resonant frequency of 20kHz to maximize the field output and minimize electromagnetic distortions.

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The generated oscillating magnetic field permeate most materials, ferromagnetic obstacles in the field locally alter the fieldline trajectories but do not change the overall layout of the field. In former publications([1]) we showed that even bigger metal objects only change the signal within the boundaries of 10 percent.

The transmitters are connected to the power lines installed in buildings, time synchronization is achieved using ethernet over powerline adapters(which reduces the installation effort). A single transmitter covers an circular area with a radius of 4.5m.

A wearable receiver has approximately the size of a cigarette box, it is battery powered and transfers the gathered magnetic field information using wifi or zig-bee based communication technology. An onboard inertial measurement unit senses acceleration, gyroscope and earth magnetic field information, this data is fused at the processing computer to stabilize the position and orientation estimation. The uptime of the receiver is up to 8 hours.

The localization system has a maximum sampling rate of 40 Hz depending on the number of transmitters. The transmitters are triggered using a round robin based approach. The number of receivers is only limited by the bandwidth of the used RF technology.

In several publications(e.g. [1]) we showed the robustness of the system in every day life environments like apartments or offices. The system is able to distinguish between up to 30 regions of interests which are more than 50 cm apart. Our localisation framework runs on a laptop, the estimated positions can be presented on a wearable tablet (e.g. Ipad or Nexus 7).

1. REFERENCES

- [1] G. PirkI and P. Lukowicz. Robust, low cost indoor positioning using magnetic resonant coupling. In *Proceedings of the 2012 ACM Conference on*