IPSN 2014 Indoor Competition: FUBLoc - Accurate Range-based Indoor Localization and Tracking

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1. ABSTRACT

The system we use for the indoor localization contest is a time-of-flight based radio range measurement system. The system consists of one mobile node and multiple deployed anchor nodes with a fixed and known position. Due to error prone measurements in indoor environments, the system uses a specialized ranging filter implementation, a variety of indoor localization algorithms which can be exchanged depending on the current scenario and an applied Kalman filter to smooth estimated positions.

Our system was developed for a rescue scenario which means that we assume to be able to place some anchor nodes close to a disaster area and estimate their position by using Global Positioning System (GPS), or a similar system. In an indoor only area we have to measure the positions of the anchors before we can start to localize the mobile node. As soon as the anchor nodes are set up a mobile device can be located.

1.1 System setup

All nodes consist of a modified version of the Modular Sensor Board (MSB) A2 [1] node which is equipped with a Nanotron nanoPAN 5375 [2] transceiver. This hardware enables the nodes to measure inter-node ranges using time-of-flight in the 2.4 GHz frequency band. The signal of the transceiver might interfer with regular 802.11 WiFi traffic but will not jam any devices because of a large idle time between ranging frames.

Our software implements different kinds of indoor localization algorithms (i.e. different probalistic and geometric algorithms) which are partly fitted to the error distribution of the nanoPAN system. As the performance of the algorithms depends on several parameters as anchor count, spatial distribution of the anchors and radio transmission conditions we will choose the algorithm depending on the setup of the contest area.

As we carried out dozens of real world experiments using our hard- and software and will be able to show a robust indoor localization system. In close range and line of sight scenarios we will not be able to outperform ultra wideband (UWB) or radar based system as they tend to get more accurate ranging values than the nanoPAN. We expect our system to outperform other platforms in relative accuracy as well as stability at the contest.

1.2 Deployment Requirements

Depending on the layout of the contest site, we will deploy up to 9 fixed anchor nodes next to the walls, at roughly the same height as the mobile node will be held. The 10th device will be the mobile node. The localization result will be displayed using a graphical user interface (GUI) software wich is also able to show the current measured coordinates to estimate the localization accuracy using a third party device. Our system works autonomously so that we do not need a power supply during the contest.

To present the results as well as for easier anchor placement it would be convenient to have a map of the contest site before the contest takes place.

2. REFERENCES

[1] M. Baar, H. Will, B. Blywis, T. Hillebrandt, A. Liers, G. Wittenburg, and J. Schiller. The scatterweb msb-a2 platform for wireless sensor networks. Technical Report TR-B-08-15, Freie Universität Berlin, Department of Mathematics and Computer Science, Institute for Computer Science, Telematics and Computer Systems group, Takustraße 9, 14195 Berlin, Germany, Sept. 2008.

[2] Nanotron Technologies GmbH. Nanopan 5375 RF module datasheet, 2009.