Ultrasound positioning based on the strength of the signal using transducers of narrow beamwidth on a wireless nodes network

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The objective of this paper is to analyze the performance of an indoor positioning system based on ultrasound RSSI. This paper builds on past experiences where RSSI-values from beams sent in different directions were compared (Holm, Nilsen 2010). There relative values of RSSI was measured but herein we go one step further and do localization based on absolute values of RSSI.

The use of RSSI could potentially mean a simplification of the traditional positioning systems design in relation to other methods such as TOF, being an alternative and interesting method for positioning. The distance between nodes (transmitter and receiver) is estimated from RSSI values using a signal propagation model in which the power losses due to the spherical divergence and atmospheric absorption are considered.

However in real conditions, other factors related to the characteristics of the nodes have their impact on RSSI-measurements. One of them has to do with the beamwidth of the transducers. The signal strength will be conditioned by the orientation of the transducers when these have a narrow beamwidth. On the other hand, the common use of wireless nodes in the deployment of these systems leads to the RSSI-measurement to be affected by the battery level in the nodes. This introduces significant errors in the distance estimation and therefore on the localization precision.

Herein we propose a mechanism for modeling the loss of energy due to the orientation of the ultrasonic transducers, as well as an algorithm to compensate for the effect of the variations in the battery level on RSSI measurements. Some experimental results have been obtained with 5 nodes (4 transmitters and 1 receiver) to show the goodness of our compensation using a real positioning system. Location errors lower to 10 cm for each coordinate are obtained in contrast to errors of several meters which are normally attained in this kind of systems based on RF RSSI-values.