DRAMCO

Accurate Indoor Positioning with Ultrasonic, Distributed Microphones

Submitter
Promoter
Co-promoter(s)

Contact information organisation

Organisation	KU Leuven - DRAMCO
Domain organisation	Draadloze en mobiele communicatie
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Proposed Topic

Working Title

Accurate Indoor Positioning with Ultrasonic, Distributed Microphones

Background

The aging of the population in many countries results in overcrowded rest homes and hospitals, which does not benefit the provision of healthcare. Assisted living is a dream come true allowing the elderly or sick patients to continue living at home as they are virtually watched over. An important aspect to provide assisted living is indoor positioning. If the position of the person is known, home automation can respond to this and, in addition, suspicious behaviour of the person can also be observed, for example when the person stays in the same place for a long time.
There are many ways to achieve indoor positioning. This master's thesis focuses on indoor positioning using sound waves which are picked up by a large number (> 6) of distributed microphones. Due to privacy legislation, ultrasonic sound is used to ensure that people cannot be eavesdropped. As a transmitter, the person can, for example, wear a collar with an ultrasonic speaker in it. Considerations should be made to make this as low-power as possible. The 2D and in the second phase 3D positioning should be as accurate as possible in order to be able to observe small movements as well. Within DRAMCO, we have developed some indoor positioning solutions, including a hybrid RF-acoustic solution

that performs ranging of low-energy nodes with cm-accuracy. Current ranging system still uses proprietary RF communication which requires too much power on the energy constrained nodes. This new full acoustic setup can take place in Techtile. We already have a couple of microphones available that were measured in a semi-anechoic chamber. We also plan to place a number of microphones in Techtile that can be used for this. Own choices and hardware are of course always welcome.

Research Question

How well does the indoor positioning based on ultrasonic sound and many distributed microphones perform? What are the best algorithms in order to achieve accurate positioning? Is machine learning an option? What is the influence of the amount and the position of the microphones? Is this a good technique to provide indoor positioning, or are there better options? Can the setup be expanded from 2D to 3D indoor positioning? Which ultrasonic transmitter can be used/designed taking into account a strong enough sound signal in combination with low-power properties and a good form factor? Furthermore, it can be examined whether it is possible to expand the indoor positioning to track several people or objects.

Final Output

A working accurate indoor positioning setup is expected as final output in combination with a literature study about indoor positioning techniques and technologies. A DAQ can be used to record and process the data. The minimum output is a 2D indoor positioning system where different positioning algorithms can be compared. As an extension, the setup can be adapted to also provide 3D localisation.

Profile of the Master Student

Electronics-ICT

Main Activities

Theoretical division:

Literature	25%
Hardware design	5%
Software	25%
Experiments	25%
Writing	20%

Contact Person

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