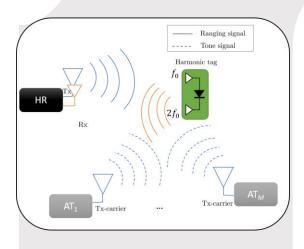**Radio Systems Group, EEMSC**

USE OF AUXILLARY TRANSMITTERS FOR INCREASING READOUT RANGE OF HARMONIC RADAR TAGS

MSc/Bsc project

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Use of auxiliary transmitters for increasing readout range of harmonic radar tags

Keywords: harmonic tags, transponders, harmonic radar

Introduction: Harmonic radar (HR) is a type of non-linear radar that uses passive transponder tags to create a harmonic response from a target that would otherwise be unlikely to produce a distinguishable radar response on its own. It's used in such applications as wildlife tracking, wearable sensors for health monitoring, and industrial monitoring. A typical harmonic tag is a passive battery-less transponder that consists of a non-linear element, such as a low-voltage diode, attached to an antenna/s that is tuned to the fundamental transmission frequency and its second harmonic. The diode absorbs the energy of the signal received by the antenna and produces its replica at the double frequency, which is then re-transmitted and detected at the HR receiver.

Main challenge in the design of harmonic radar systems is low power conversion efficiency of harmonic tags which translates into low system power efficiency/readout range. We have recently proposed an approach for increasing readout range of harmonic tags that employs additional tone transmitters with a feedback loop to adjust their phases. In this project, we investigate this approach further aiming towards a proof-of-concept implementation.

Project description: The aim of this project is to investigate the applicability of using additional tone transmitters for increasing detection range in harmonic radar. It consist of

- an algorithmic simulation-based study that focuses on the analysis of different transmission schemes and the effect the tone signal combining has on the range estimation performance,

- a proof-of-concept implementation using software defined radio (SDR).

Requirements: You are a motivated student looking for a Bachelor or Master thesis topic in the field of radio systems. You have interest in wireless ranging systems, have strong Matlab programming skills, and have knowledge of signal theory and signal processing basics, e.g., terms such as correlation function, Fourier transform and probability density function are familiar to you.

Both a Master or a Bachelor project is possible on this topic.

If you are interested, please contact **Dr. A. Lavrenko** at a.lavrenko@utwente.nl