

TECHNOLOGY OFFER

Localisation and Range Finding: New Features for Low-cost Narrowband Transceivers



Narrowband radio frequency (RF) transceivers are widely applied in System-on-Chip (SoC) applications such as remote controls, electronic shelf labels, or smart sensor applications such as home automation or fitness tracking devices.

These low-cost chips were not designed for applications that require wider bandwidths, such as localisation techniques. However, with this new method, it is now possible to generate broadband RF signals of legacy narrowband RF transceiver chips. These signals can be used for localisation and distance estimation indoors and in gated surroundings.

BACKGROUND

Methods used nowadays for a precise localisation of objects usually require ultrawideband systems with short pulses, spread-spectrum and the like. In the case of low-cost RF transceivers, field strength measurement (RSSI), phase measurement for different channel center frequencies, or angle of arrival (AoA) methods are used. For narrowband systems, however, these methods are not very precise and lack an impulse response of the channel.



Shelf Labels (CC-BY-1.0 <https://commons.wikimedia.org/w/index.php?curid=168816>)

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Using fast updates of narrowband SoC's radio registers during an ongoing transmission allows the generation of wideband signals. Although being a non-intended mode of operation of a typical RF SoC, it can be shown that typical commercially available SoCs support the proposed technology. Ultimately, the wideband signals are received by nodes of a fixed infrastructure which is also in charge of calculating the localisation estimate. Thus, for a typical setup with thousands of low cost devices but only a few access points, only the access points need to be changed while the device to be localised only requires a firmware update.

A self-calibration algorithm was developed allowing channel impulse responses to be determined from a unidirectional link, improving localisation accuracy.

In a test setup, 95 % of the position errors were well below one metre. We are currently developing advanced signal processing methods, performance analysis in challenging radio environments and porting the method to different SoCs.

ADVANTAGES

- Localisation and distance measurement at low power and low cost
- Much higher accuracy and reliability than narrowband RSSI or AoA methods
- Additional features for shelf labels, smart sensors, fitness trackers and the like
- New applications for legacy transceivers from golf range finder to patient position detection

REFERENCE:
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DEVELOPMENT STATUS:
Basic software and test setup with TI CC2510 SoC transceiver

APPLICATIONS:
Home & building automation
Security, business & industrial, sports & leisure, health care appliances

KEYWORDS:
Localisation
Distance estimation
Narrowband SoC transceiver
Wideband signal generation

IPR:
Patent filed in EP and US

OPTIONS:
R&D co-operation
License contract

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