

Tagless indoor human localization and identification using capacitive sensors

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Indoor human detection, localization and identification is at the base of many automation and monitoring systems.

Capacitive sensors operating in load mode can be small, inexpensive, easy to install and to operate on new building or as retrofit to existing ones. However, the accuracy of their measurements is influenced by environmental conditions and their sensitivity can be strongly limited by noise.

We will present several capacitance measurement techniques suitable for capacitive sensors that are used to detect persons at distances much longer than the dimension of their transducers. We will also present the experimental results obtained from using these sensors, and compare their performance in terms of sensitivity, noise rejection, stability and suitability for our target applications.

The measurement methods range from determining the capacitance from the measurement of the charge-voltage dependency of the capacitor, to the measurement of the reactive effects of the capacitance on a carrier frequency (either combined, from amplitude and phase modulation, or only due to phase modulation).

We apply these measurement methods to determine the distance of the person from sensor, to 2D person localization using several sensors and machine learning algorithms, and for person identification based on the unique body capacitance response pattern when measured at different frequencies.

Moreover, we analyze the performance of a wide selection of machine learning classification algorithms for indoor 2D human localization in terms of accuracy, precision and recall, sensitivity to training size and resource utilization during training and inferring.

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