M.Sc. Project Topic Description for Malek Jendoubi

Feasibility Study of Human Activity Recognition with Air Pressure Sensors

Description:

In recent technological advancements, air pressure sensors have emerged as a promising modality for human activity detection when strategically affixed to the human body. This master's project focuses on harnessing the potential of air pressure sensors, offering a novel perspective on activity monitoring. Similar to accelerometers and magnetometers, air pressure sensors fabricated in Micro-Electro-Mechanical Systems (MEMS) technology feature a low power consumption, making them particularly suitable for wearable applications where energy efficiency is paramount. Additionally, the availability of new sensor technology with enhanced accuracy opens avenues for more precise and reliable human activity recognition. Notably, the use of air pressure sensors represents a relatively unexplored territory in research, providing an opportunity for the student to contribute to the growing field of sensor-based human-computer interaction.

In the proposed topic, a given microcontroller board should be programmed to read sensor data via I2C or SPI from an attached state-of-the-art MEMS air pressure sensor. The acquired data should be transmitted via the microcontrollers integrated Bluetooth Low Energy (BLE) chip to a recording device. In order to verify the functionality of the setup, first datasets of human activities like walking on level ground, up stairs, and downstairs with a few different placements of the sensors on the human body, e.g., foot and wrist, should be recorded. Finally, the quality of acquired datasets and the different sensor placements should be discussed regarding their usefulness for the anticipated activity recognition purpose.

The following tasks should be done within the scope of this work:

- familiarization with the air pressure sensor, the microcontroller board, and its development tools

- implementation of the sensors driver and the reading of sensor data via I2C or SPI

- implementation of a Bluetooth Low Energy transmission of the sensor data

- recording of air pressure signals for different walking scenarios when the sensor is attached to the shoe or wrist

- discussion of the acquired sensor signals regarding its usefulness for activity recognition

- documentation of the acquired results

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