DISPLACEMENT DETECTION AND MEASUREMENTS FOR HUMAN ACTIVITY RECOGNITION USING MAGNETIC FIELD SENSOR

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One of the most fundamental and also crucial aspects related to physical activity recognition and preliminary classification is motion detection. In the basic human activity recognition (HAR) solution, motion is treated as displacement, which at the basic level requires detection and counting of steps in a given period of time. Currently available devices use signals from inertial sensors sometimes augmented with various additional measurement units (e.g. gyroscopic or magnetic) to provide a pedometer as one of their basic functions. However, activity detection and recognition using only a magnetic field sensor has not yet been directly considered.

We propose a different approach based on real-time analysis of magnetic field variation caused by walking. We integrated the commercial magnetic field sensor (MAG3110) with an embedded microcontroller platform (STM32F334R8T) to record the magnetic field variation. The recorded field shows significant changes during walking. Processing of these changes (in software blocks implemented in the embedded platform) shows a direct correlation between the local extrema of the signal and the steps taken (Fig. 1). Outdoor experiments have shown that the proposed approach can correctly detect and count steps performed during a walk at constant and variable speed.

We anticipate that our magnetic sensor-based approach to displacement detection and measurement has significant potential for the development of single sensor pedometers or as a complement to improve the accuracy of currently available systems based on inertial and gyroscopic sensors.

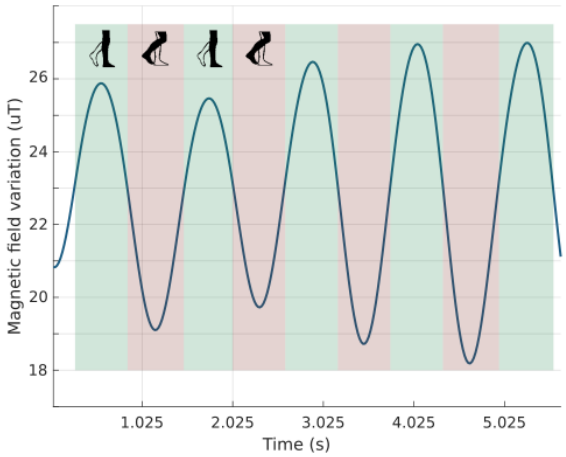

Fig 1. Magnetic field signal variations during walking. The signal extrema correlate with legs movement.