Wearable system for gait assessment during physical rehabilitation process

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Metadata

Abstract:
A system for gait assessment based on smart insoles instrumented with flexible sensors as part of ZigBee network nodes and Bluetooth inertial measurement nodes is presented. The system was developed to objectively record and measure ground reaction force, acceleration and direction of feet in order to provide information to physiotherapists for objective evaluation of rehabilitation effectiveness. Gait characterization is made using time domain and time-frequency domain analysis of the signals. A small, light and portable wireless sensor network for quantitative gait impairment measurements in a more natural environment was designed.

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Introduction

Gait analysis is mainly carried out by visual observation or using laboratory-based instruments such as laboratory video/optical cameras, floor sensors, sensors placed on the body or integration of these technologies. Such technologies are designed mainly for hospital and laboratory research and are expensive both in equipment and personnel support. Moreover, these gait lab technologies have limitation of exploring the impact of type of surface on gait alteration or examining gait on ample walking distances. It is also known that when a patient is examined in a specially arranged environment the motor performance may not be the same as that in a more natural environment such as home or daily environments. Evidence on gait pattern changes when subjects walk outside a gait laboratory environment was published [1]. It is the gait in everyday life that matters most to evaluate whether a treatment is effective or not in improving patients' movements. Thus, it is definitely desirable the usage of technologies for long term gait monitoring able: to identify adverse rehabilitation outcomes, as well as risk factors associated with poor outcome; to provide and share information for individuals with gait impairments, their family and friends, and physiotherapists; to allow in-home physiotherapy tailored specifically to the patients' needs, functioning and disability; to increase effectiveness of various interventions provided by physiotherapists.