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IEEE Sensors Journal
Volume 19, Issue 15, 1 August 2019, Article number 8685196, Pages 6437-6444

Feasibility of a Gait Phase Identification Tool for Transfemoral Amputees Using Piezoelectric- Based In-Socket Sensory System (Article)

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Abstract

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Gait detection is crucial especially in active prosthetic leg control mechanism. Vision system, floor sensors, and wearable sensors are the popular methods proposed to collect data for gait detection. However, in active prosthetic leg control, a tool that is practical in its implementation and is able to provide rich gait information is important for effective manipulation of the prosthetic leg. This paper aims to ascertain the feasibility of the piezoelectric-based in-socket sensory system that is hypothesized to be practical in implementation and provide sufficient information as a wearable gait detection tool for transfemoral prosthetic users. Fifteen sensors were instrumented to the anterior and posterior internal wall of a quadrilateral socket. One transfemoral amputee subject donned the instrumented socket and performed two walking routines; single stride and continuous walking. The sensors' responses from both routines were analyzed with respect to the gait phases. The results suggested that the sensors output signal corresponds to the force components behavior of the stump while performing gait. All sensors were seen active during the first double support period (DS1). The anterior sensors were prominent during the initial swing (Sw), while posterior sensors were active during terminal Sw. These findings correspond with the muscle activity during the respective phases. Besides, the sensors also show significant pattern during single support and the second double support (DS2) phase. Thus, it can be deduced that the proposed sensory system is feasible to be used as a gait phase identification tool. © 2019 IEEE.

SciVal Topic Prominence

Topic: Prosthetics | Artificial limbs | Prosthetic leg

Prominence percentile: 97.245

Author keywords

Gait analysis | piezoelectric | prosthetic | sensory system | transfemoral

Indexed keywords

Engineering controlled terms: Artificial limbs | Gait analysis | Pattern recognition | Piezoelectricity | Prosthetics | Sensory analysis

Engineering uncontrolled terms: Control mechanism | Force component | Muscle activities | piezoelectric | Sensory system | Significant patterns | Transfemoral | Vision systems

Engineering main heading: Wearable sensors

Funding details

Funding sponsor	Funding number	Acronym
	SLAB-831129145858	

Funding text

Manuscript received January 17, 2019; revised March 6, 2019 and March 23, 2019; accepted March 27, 2019. Date of publication April 11, 2019; date of current version July 3, 2019. This work was supported in part by the Ministry of Education Malaysia under SLAB scheme (SLAB-831129145858). The associate editor coordinating the review of this paper and approving it for publication was Dr. Edward Sazonov. (Corresponding author: Nur Azah Hamzaid.) F. Jasni is with the Mechatronics Engineering Department, Kulliyyah of Engineering, International Islamic University Malaysia, Selangor 53100, Malaysia (e-mail: farahiyahjasni@iium.edu.my).

ISSN: 1530437X
Source Type: Journal
Original language: English
DOI: 10.1109/JSEN.2019.2910161
Document Type: Article
Publisher: Institute of Electrical and Electronics Engineers Inc.

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