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OPEN-SOURCE LOW-COST WEARABLE PHYSICAL ACTIVITY TRACKER

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Introduction

Physical inactivity is one of the most important risk factors affecting global health [WHO, 2015]. Physical activity and good sleep reduce occurrences of cardiac [Yusuf, 2004], bone and joint diseases [Warburton, 2006], and are linked to occurrences of diabetes [Lee, 2016] and Alzheimer’s [Spira, 2013]. Long-term tracking of physical activity could help in early detection of emerging senescence [Fried, 2001] as well as help track the progress of rehabilitation in patients. Devices used for tracking physical activity in clinical settings are too expensive for ubiquitous and long-term use, while low-cost consumer devices fail to replicate the performance of their clinical counterparts. Furthermore, commercially available devices lack transparency in data processing, and hence, limit their suitability for conducting objective research.

Methods

We have developed a low-cost physical activity tracking platform consisting of a 3-axis accelerometer module and a mobile app (Fig). The wearable device can be wirelessly configured with algorithms optimized for a particular type of physical activity and sensor placement (e.g., wrist, waist, ankle). Device hardware and algorithms are open-sourced to offer maximal transparency. The device features an exchangeable coin battery and 16 MB internal memory, offering up to 6 months of standalone operation. Additionally, the data can be streamed via Bluetooth to the mobile app.

Results

The open-source hardware and software allow for developing novel applications and configuring the device with customized, user-specific algorithms. The open-source design enables novel research and citizen-science applications, as well as device personalization, which is particularly useful in clinical use. The low cost device offers possibility of conducting a wide-range of studies and wide-range patient monitoring in, e.g., course of rehabilitation or early diagnostics of emerging senescence. Real-time data streaming to a secure data server offers the possibility for the clinicians to remotely track the patient’s activity. Moreover, methods for an automatic tracking of changes in activity can be implemented in order to reduce clinician’s workload.

Discussion

The developed actimeter offers the performance of a clinical-grade device in a price range of a consumer device; this makes it particularly suitable for research and clinical use where full transparency is needed.

References