

## Assessing the feasibility of using a commercially available bracelet to detect motor symptoms for home telemonitoring in patients with Parkinson's disease

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Parkinson's disease (PD) patients with deep brain stimulation (DBS) implants require a highly fragile stabilization period, to optimize their therapy immediately after DBS implant, and then would benefit from constant monitoring and support at home aimed to anticipate significant worsening in their clinical condition. However, the assessment of the patient in a homecare environment is usually followed by untrained personnel (caregivers or family) and without specific commercially available supporting systems. The objective is to study the feasibility of a commercially available bracelet with a three-axis accelerometer sensor paired with a mobile phone or tablet for 1) providing a correct time-based estimate of the status of the patient (ON and OFF states) in a homecare environment, and for 2) automatically detecting the motor symptoms of the PD patient during daily living activities. The device used is a Pebble Time Smartwatch that is a wearable bracelet platform with the capability to have custom apps developed on the device. The bracelet includes a three-axis accelerometer and a Bluetooth connection with a mobile device (Android Phone). A dedicated App was developed to acquire data and to provide a clinical diary to be filled in by the patient at predefined times. An offline Matlab algorithm was implemented adapting a patented and proven algorithm [1] to assess the clinical state of the patient (bradykinesia and dyskinesia). The system will be tested on 5 patients undergoing surgery for DBS electrode placement during a long-term monitoring with an external DBS device in an ecologic environment.

The bracelet acquires the data with sample frequency of maximum 100Hz, one session of data collecting lasts at least 8 hours. Every hour the app on the mobile phone asks the patient a simple questionnaire regarding the perceived motor status. At the end of the session the data is anonymized and uploaded to a cloud service (e.g. Google Drive for the prototype system). A Matlab algorithm elaborates the data remotely to find the Bradykinesia and Dyskinesia indexes in data bins of 4-10 minutes and compares them with the hourly questionnaires results. Our results provide a time-based assessment of the bradykinesia or dyskinesia indexes (denoting ON-OFF states) during daily living activities of the PD patients usable in a homecare environment paired with a diary that assesses the perceived status of the patient. This assessment can be used to optimize drug treatment (i.e. L-DOPA) and DBS therapy over time.

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1. Griffiths, R. I., & Horne, M. K. (2009). *U.S. Patent Application No. 12/997,540*.