# Connected System for Measuring Joints in Rehabilitation

Degree programme: BSc in Micro- and Medical Technology | Specialisation: Medical technology
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**Currently, professionals working with patients affected by limb movement disorders, base their resources mainly on manual and visual tests. Our aim is thus to develop an electronic system, which can measure joint angles to reduce the workload of the therapist and to downsize the rehabilitation period of patients by offering additional support. The final device will provide experts with accurate and reproducible data to verify patients' improvements during the treatment.**

## Introduction

The therapist's work for limb rehabilitation includes the assessment of mobility limitation by performing manual tests and documenting the results at the end of every therapy session. This can be tedious, time consuming and error-prone, especially when written on paper as it often is still the case. Furthermore, the therapist's manual assessments suffer from low precision and reproducibility.
Our electronic and sensor-based system will thus not only enhance the precision, reproducibility and repeatability of the assessment of rehabilitation parameters but also simplify and expedite this process compared to the current state-of-the-art.

## Concept

The system receives orientation data from sensors that use accelerometers and gyroscopes to determine their relative orientation. Using wireless technology, these data are sent to a software running on a computer or a mobile application that manages a graphical user interface. A microcontroller is used to manage up to 16 joints at a time which allows to measure any human limb by placing sensors around the joint. A series of LED is used to give instant feedback from the device to the user (for example: battery charge, wireless signal strength) without having to look at the computer's or mobile's interface. Finally, a battery is used as power supply for the whole device.

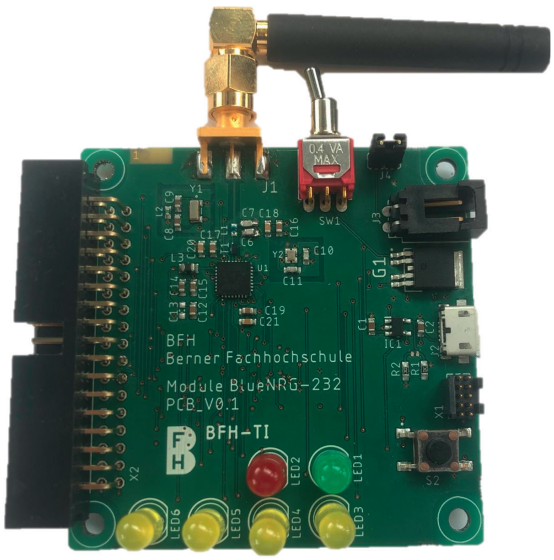


**FIGURE 1 - PCB with BlueNRG-232 as microcontroller, LEDs as user interface and connectors for sensors, battery and SWD.**

## Goals

The Bachelor work is part of the overall project and focuses on the electronic conception of the main unity which includes the following tasks:

- Integration of a microcontroller for the collection of general data by the system
- Wireless data transfer
- Integration of a system's power supply battery
- Potentially an appropriate housing concept

## Results

The electronic board (PCB, Fig. 1) was developed to improve an existing prototype and to include all the necessary features to meet the goals mentioned above. This PCB is powered by a battery and will be able to read the data generated by the sensors. These in turn are connected to the board and the data are sent to a computer or mobile application via Bluetooth technology. Subsequently, these data will be processed by a software and displayed in a graphic interface in order to have real-time feedback of the mobility parameters to support the therapy.

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