Personal electromyograph „MyMyo“

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Innovation description and application

A lightweight and portable system for measuring and displaying the intensity of muscle contraction on the basis of measurements of surface myoelectric signals is presented. The system is powered by a rechargeable Li-Po battery with integrated charging system in the device. The system is wirelessly connected to a mobile phone, for which a user interface that allows real-time visualization of the muscles electrical activity is developed.

The user can monitor muscle activity on the screen of his mobile phone and compare it with the target parameters of exercise he performs. Graphical user interface on the phone can be adapted to the needs of rehabilitation, sports or body shaping. The basic idea is the use in physiotherapy, where physiotherapist determines the exercises for the patient, and he can perform them independently and unsupervised at home.

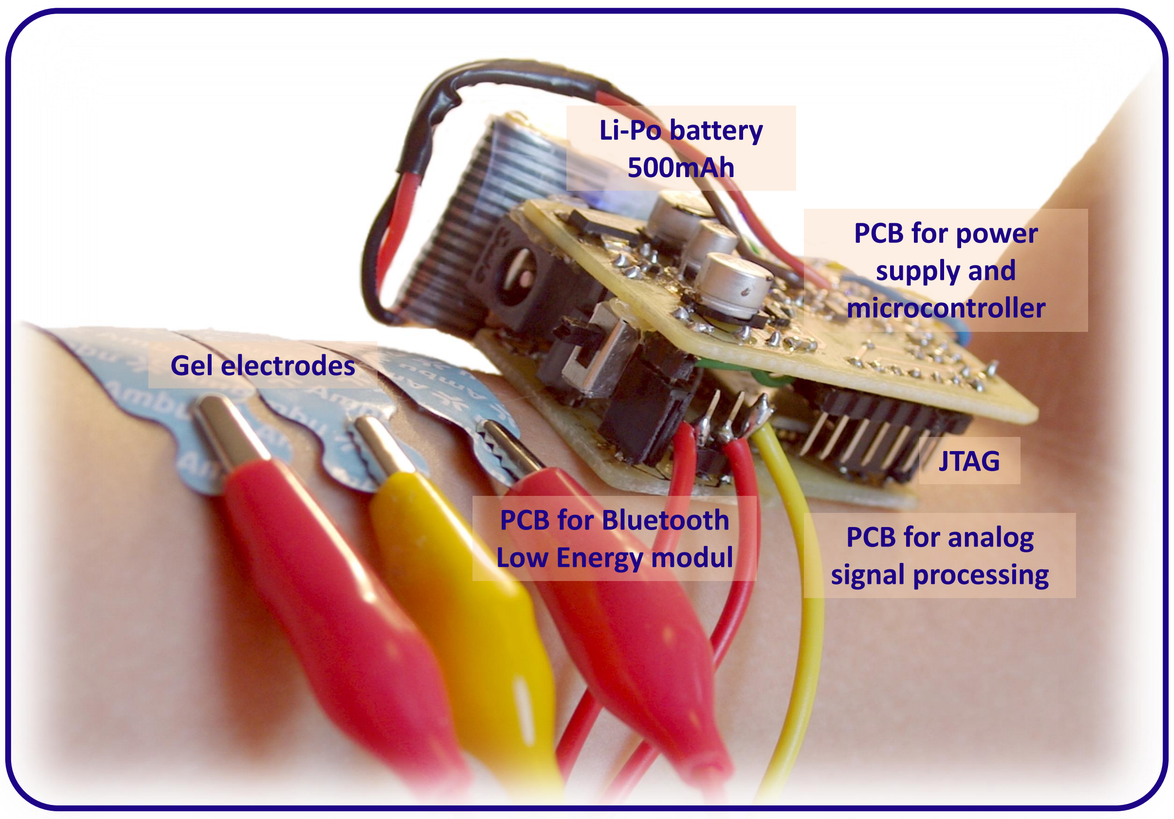
Other EMG devices	„MyMyo”
central unit to which more EMG channels are connected with wires	every EMG channel is **independent** device
common reference electrode , placed further away on bonny tissue	reference electrode **separate** for each channel, placed **between** signal electrodes
specifically designed graphical user interface device	graphical interface **on mobile phone**
wire or wireless data transfer	**wireless** data transfer, Bluetooth Low Energy (**BLE**)
relatively large and movement limitative	**small, lightweight, simple**
very expensive for personal needs	**affordable** for personal needs

INNOVATION

The **innovation consists of**:

- analog processing (amplifiers and filters, A/D conversion)
- communication protocol to transfer data to a mobile phone via Bluetooth Low Energy
- application for the Android system, designed for the specific needs of users, which receives, processes, displays and stores data

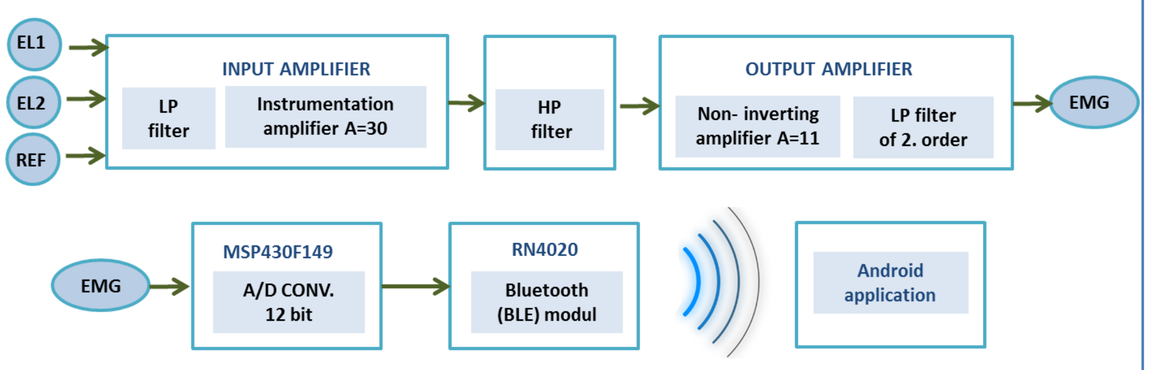
Device design and construction



The system consists of three parts:

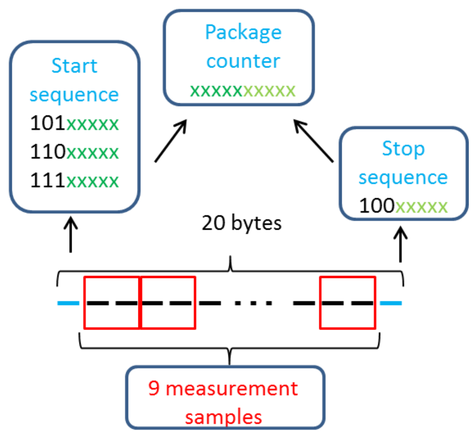
- analog signal processing part
- MSP430 family microcontroller for data sampling and communication
- Bluetooth Low Energy (BLE) module RN4020

Device in 3D printed casing



The block diagram of the entire measurement system

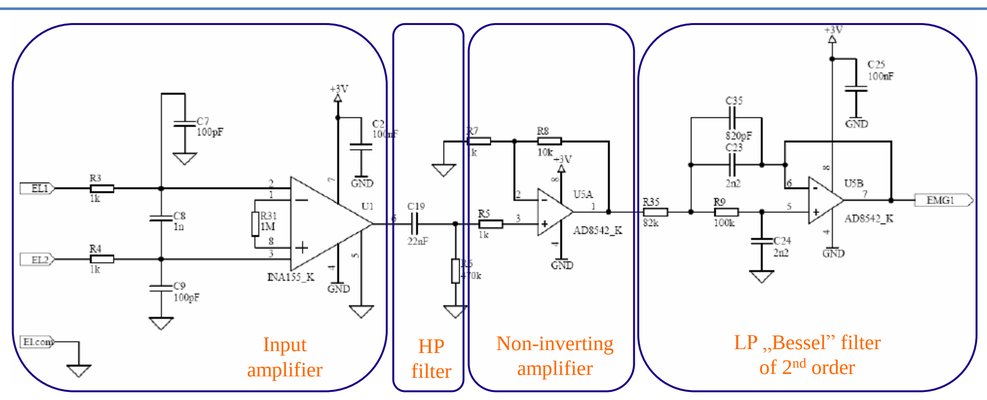
BLE can transmit data in packets (max. 20 bytes) every 7.5 ms. Thus transfer rate of 2 kbyte/s (1 kHz × 2byte) can be achieved so that the 9 samples are coded and sent within a single package. The package includes a start sequence which also defines the meaning of the information sent, stop sequence and package counter, which allows the real-time transfer and packet loss detection.



Data coding inside packet

Graphical user interface in Android application

Android application receives signals at speed ≈770 samples/s, decodes them and displays them in real-time via two graphical interfaces. One GUI (S) is to track the signal in time, and the other (A) visualizes the current amplitude, giving feedback to the user during exercise.



Design of analog processing part (amplification and filtering)

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