

Personal electromyograph „MyMyo“



Una Pale¹, Mario Cifrek¹, Igor Krois¹, Stanislav Peharec²

¹ University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia ² Polyclinic Peharec, Pula, Croatia



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.

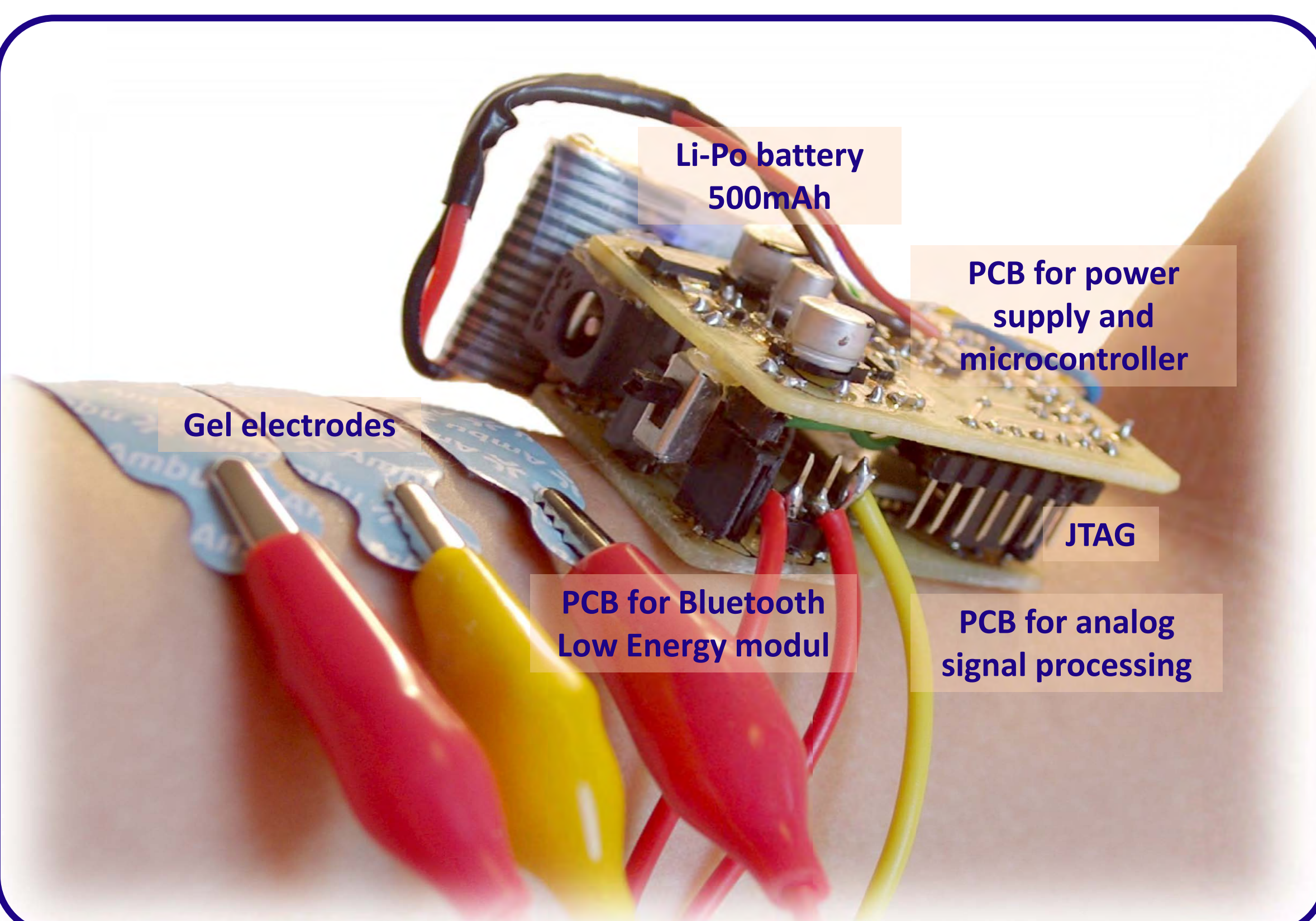
Other EMG devices	„MyMyo“
central unit to which more EMG channels are connected with wires	every EMG channel is independent device
common reference electrode, placed further away on bonny tissue	reference electrode separate for each channel, placed between signal electrodes
specifically designed graphical 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

I
N
N
O
V
A
T
I
O
N

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

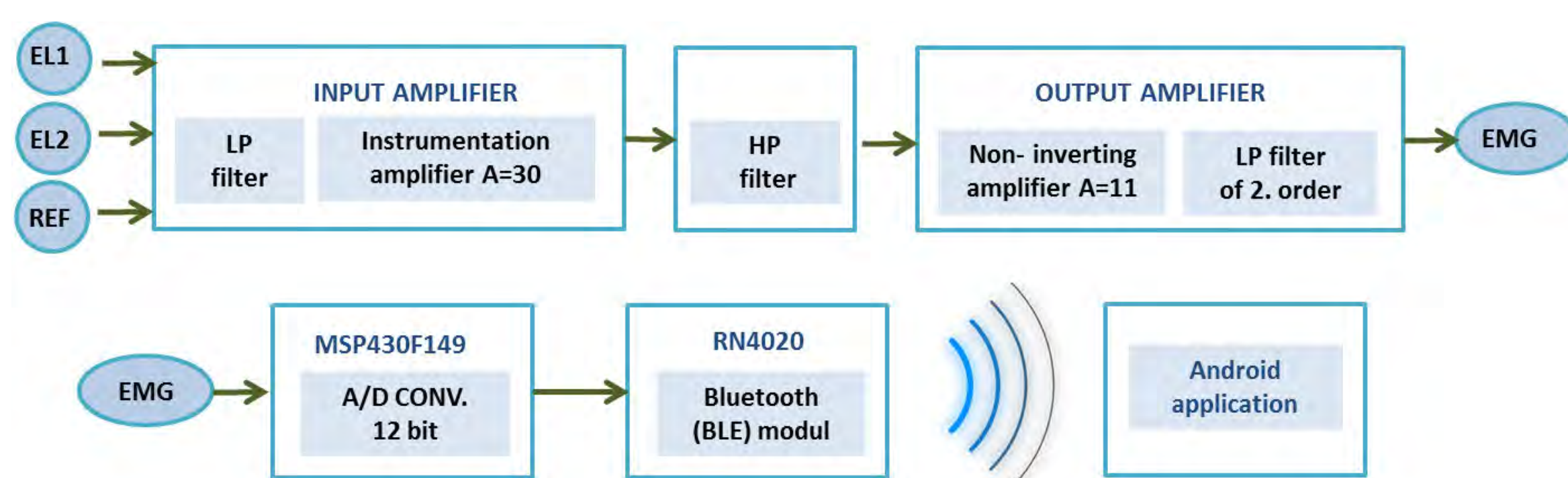


The system consists of three parts:

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

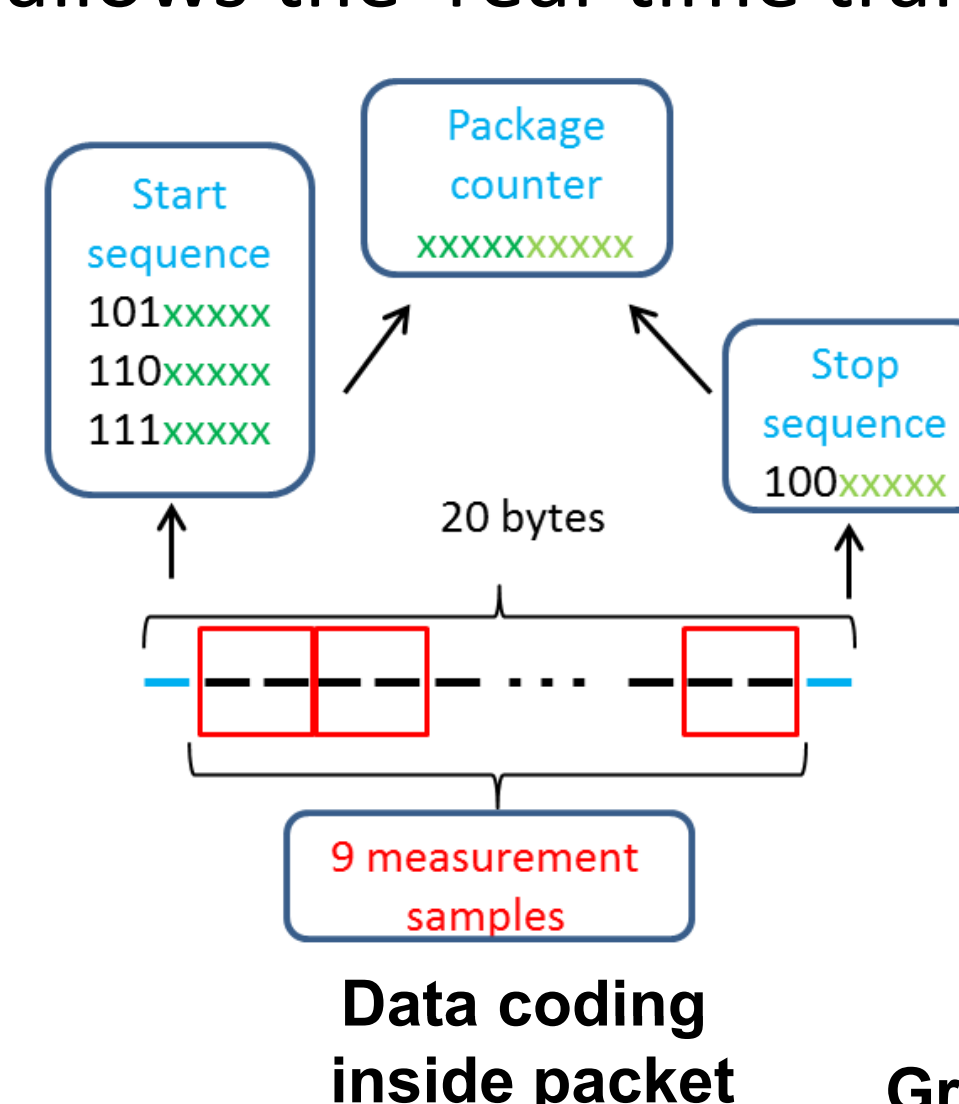


Device in 3D printed casing



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 ($1 \text{ kHz} \times 2 \text{ byte}$) 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.

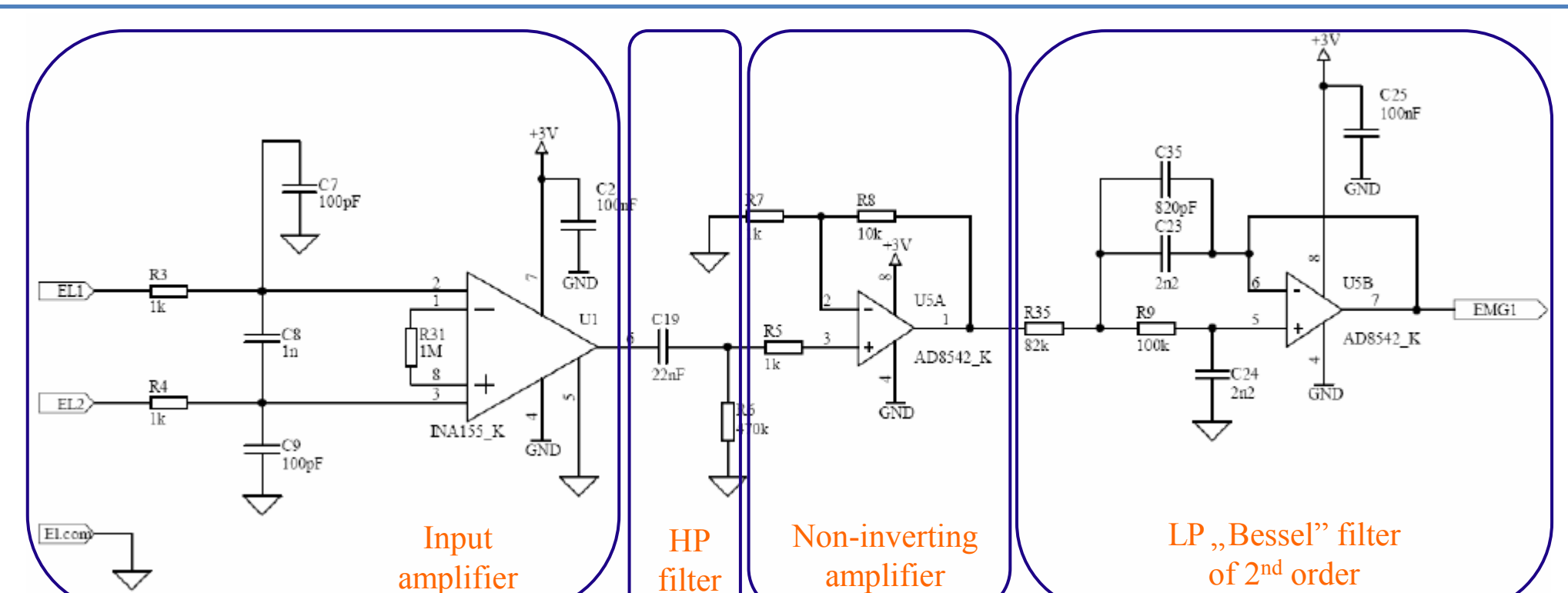


Data coding inside packet



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)