
Wireless EEG amplifier for brain-computer interface



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Brain-computer interface

A brain–computer interface (BCI) is a direct communication pathway between the brain and an external device.

BCI separates into two categories: invasive and non-invasive.

Invasive BCI	Non-invasive BCI
brain implants	electroencephalography (EEG)
electrocorticography	magnetic resonance imaging (MRI)

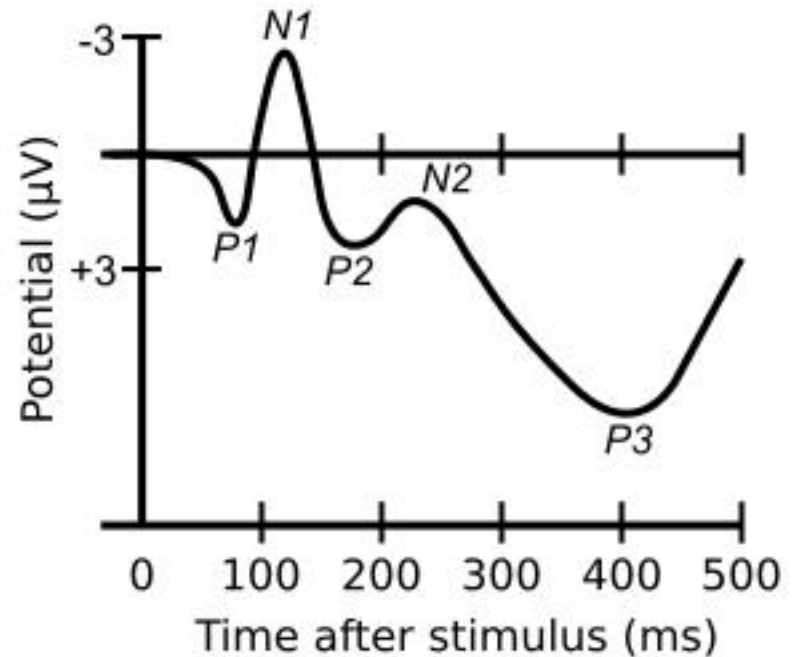
The most popular non-invasive BCI based on EEG signals processing. Special software detects P300 brainwave response, also called event related potential.

Event related potential

Event related potential measures response to an internal or external stimulus. Usually this potentials are taken from parietal lobe of brain.

For example, this stimulus can be presented as a matrix of letters that flash one at a time, and the user selects a specific letter by producing a P300 evoked potential when that letter flashes.

This type of BCI allows people with serious neuromuscular disabilities to communicate, to use PC keyboard and etc.

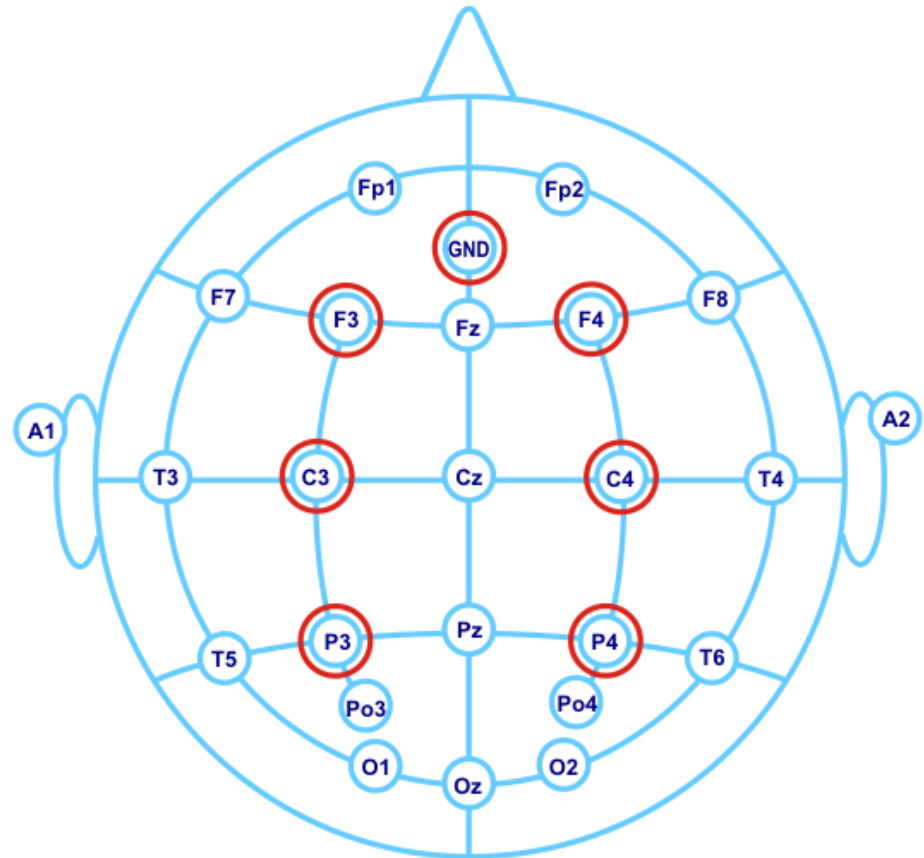


Electrode schemes

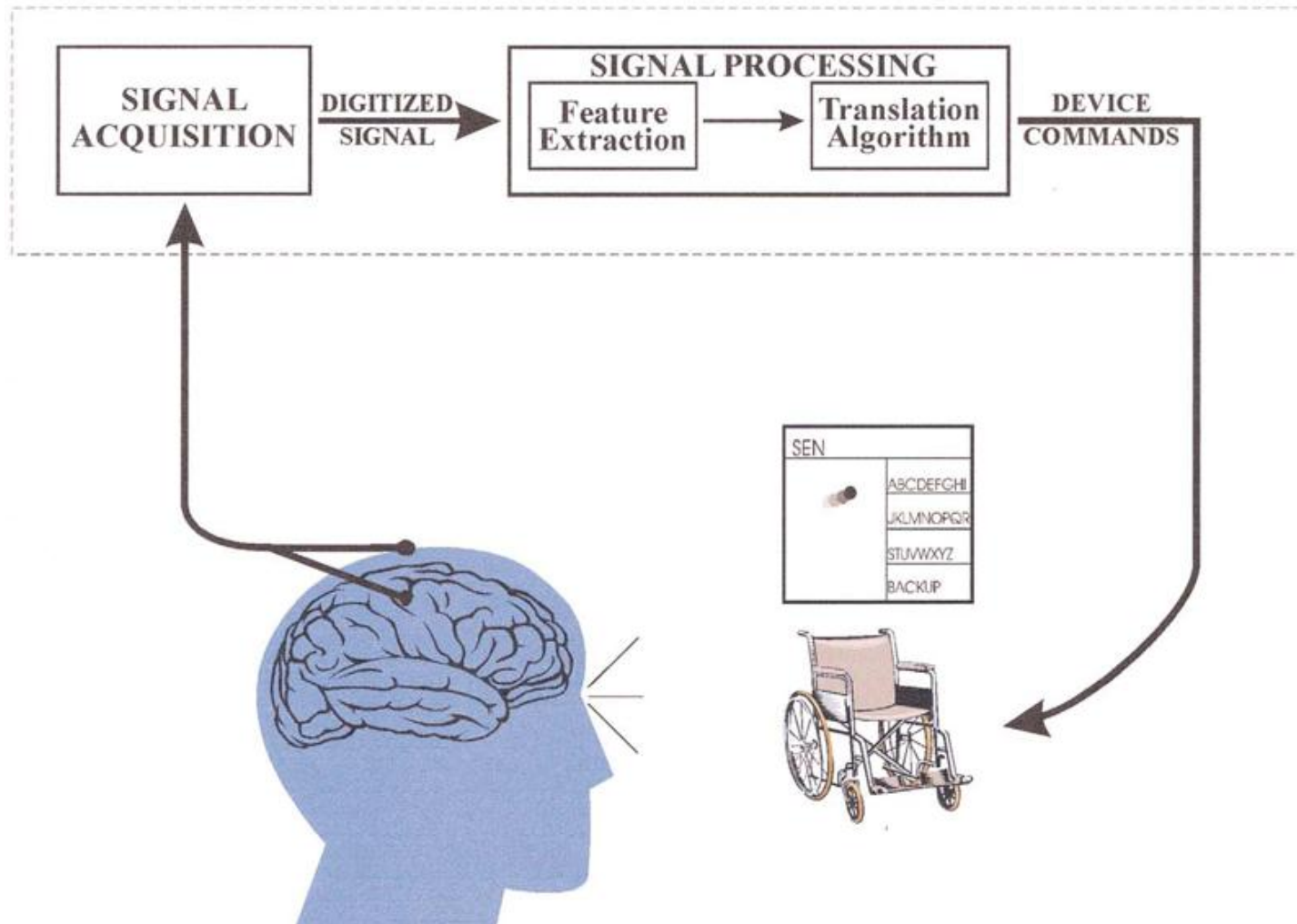
There aren't need a large number of EEG leads for event related potential's processing.

Using 6 leads from standard scheme of electrode arrangement (10-20) can provide a good P300 brainwave processing.

Software analyzing 4 differential channels based on next leads: F3-C3, C3-P3, F4-C4, C4-P4

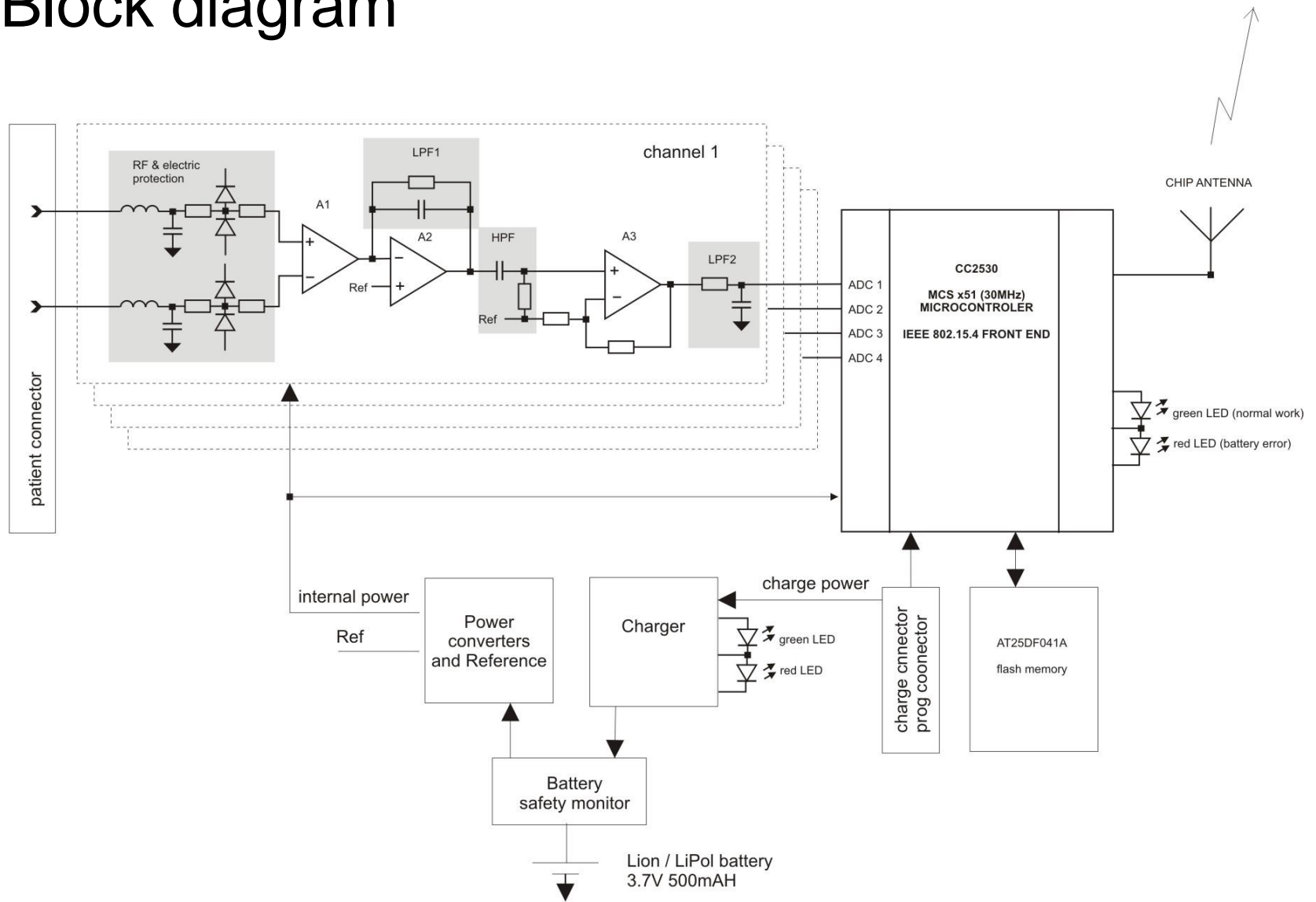


BCI system application



J.R. Wolpaw et al. «Brain–computer interfaces for communication and control» Clinical Neurophysiology 113 (2002) 767–791

Block diagram



Wireless EEG amplifier's parameters

- Number of EEG channels: 4 differential
- Analog gain: 2080
- Passband: 1 – 50 Hz
- Sample rate: 122 Hz
- Working area: up to 200 m²
- Wireless protocol: IEEE 802.15.4 / ZigBee
- Dimensions: 55x35x15 mm
- Time in stand-by mode: 10 days
- Time in transmission mode: up to 10 hours
- Charging by USB from PC



Conclusion

Using a small wireless amplifier can provide a great opportunities in area of EEG based BCI systems. Low weight of a device allows to attach it to the electrode cap. This fastening method is very comfortable and reduces noise from cable displacement.

Also this device can be used in biological feedback systems, computer games and operator's condition monitoring.

Thank you for attention