Towards Optimal Near Infra-Red (NIR) Sensor to Detect Functional Brain Activity

Hemodynamic changes in the blood vessels of the scalp and the skull can reduce the signal qualitywhen monitoring functional brain activity using NIR sensors. NIR light emitted into the brain is expected to follow a curved path. Therefore, we suggest two approaches to improve the signal quality:

1. **The NIR light penetration depth depends on the distance between thelight emitting diode and the photodiode detector**:
   Using two photodiodes (PD) per each NIR channel, where a PD located further away from the light emitting diode is expectedto detect backscattered light from a longer path as compared to the closer PD. In NIR sensors the closer PD is designed to detect the NIR light, which passes through the scalp and skull, while the more distant PD will detect the NIR light that passes through the scalp, the skull and the brain. Subtractingclose PD signal from far PD we expect to get signals from the brain with minimum external effects. This can improve the signal quality.

2.The NIR light penetration depth depends on the time span:

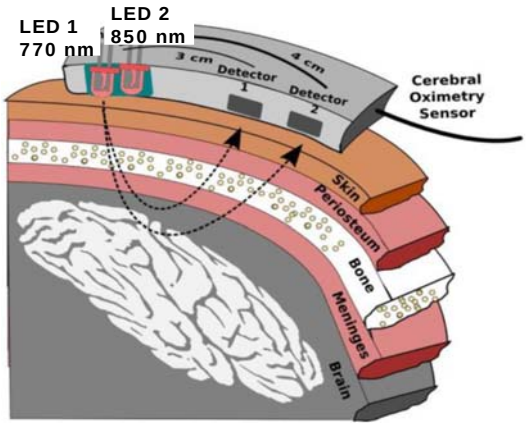
Using one PD per each NIR channel, where the earlier detected signal is attributed to the backscattered NIR light from a shorter path. Signals detected later are attributed to the backscattered NIR light from a longer path. Subtracting the former from the later, we would expect to be able to measure signals from the brain with minimum external effects.

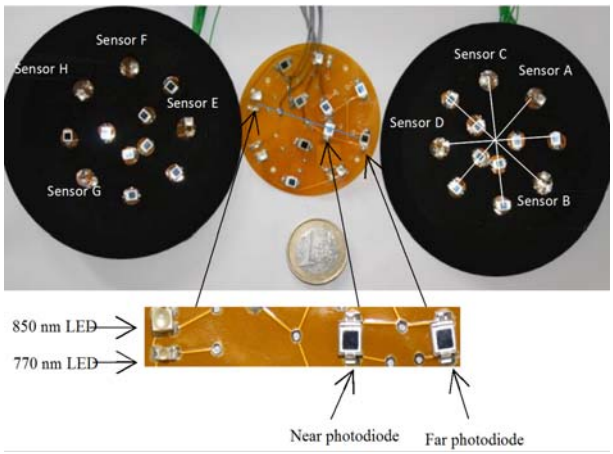
Both projects can be realized usingNIR sensors and the controlling circuit, whichwere designed by one of the NES group members. Sensors testing will be done using dynamic brain-tissue phantom, which wasalso developedhere.

BSc or Master Project

The candidate'smainwork loadis to test the second approach then compare its results with the first approach results (which are onging).

Requirements:Good programing skills.





Source:A GMohammedani (2011). MiniaturizedOximetry Modules for Daily-lifeHealth Monitoring. Master Thesis in Biomedical Engineering, University of Luebeck. 2011.