Project title : Hybrid EEG-fNIRS – Electrode Holders	
Institution/faculty/course	Biomedical Engineering
Project supervisor	Peyman Mirtaheri
Co supervisor	Haroon Khan
3D-lab contact person	Adam Aske: 2429

Introduction

- Group members
- short introduction to the project (which course/project)
- The background for the project
- What is the purpose of the project.

Members: Adam Emile Aske, Azadeh Hajian
We are merging the neuroimaging technologies EEG and fNIRS.

Description

Give a brief description of the project:

- What problem will the group solve.
- Issues and/or hypotheses
- How would you solve it?
- Is the project part of other projects/measures?
- Any collaboration partners.
- System sketch

We are using a NIRx Nirssport2 and a g.Tec Nautilius which are not designed to be used together. Thus the design for the small plastic pieces holding EEG electrodes to the scalp are 3 times thicker than those for the fNIRS optodes. This results in the fNIRS optodes being lifted upwards and lose contact with the scalp, thus we consistently experience poorer fNIRS signal quality. Additionally, EEG requires conductive gel to function, this gel we commonly find is leaking out beneath the electrodes and contacting the optodes. fNIRS passes light into the scalp and brain via optodes, however once gel in contact with the optodes scatters the light and ruins the fNIRS signal.
To solve this, we aim to design new EEG holders (and potentially fNIRS holders) with a lower profile and enables tighter seal to the scalp and implement them into the EEG-fNIRS system via 3D printing. This EEG-fNIRS system is a part of 3 master's theses and will be used in experiments in March 2025.

Implementation

- Time plan and progress overview.
- any competence needs.
- List of Materials and equipment for 3D printing

This project is planned to be completed by 7.03.2025.

PURPOSE

- Overall goals

- Impact

The primary goal of this project is to increase fNIRS signal quality when combined with EEG. SecThe NIRx Nirsport2 and g.Tec Nautilus are two of the most used EEG and fNIRS systems. Thus, the project has potential to enable wider use and more effective EEG-fNIRS hybridization for many labs.

ECONOMY

- Estimated cost framework
- Financing (how will the project be financed)
- Materials and equipment

3D Printing

- General description of the object
- What material (Pla, petg, nylon, nyloncf, TPU, other)
- Object(s) Size (Width, Depth, Hight)
- Timeline (when do you need the finished prototype)
- Groups experience with 3D printing

The piece to be 3D printed is a small donut with an edge which grips fabric.
Initial prototypig is conducted in PLA to save complexity and cost, each piece is 2-3 grams thus with a total of 5 prototypes planned a total of 10-15 grams of PLA is required. Atleast 32 pieces of the final design is required (1 per EEG channel). To enable comfort and easier attachment we wish to print the final versions in a softer/more comfortable material such as TPU. The pieces are very small with fine details thus other 3D printing technologies may be advantageous. The group (Adam & Azadeh) has experience with 3D printing from courses in the Biomedical Engineering masters course and are familiar with the proper handling of the X1 Carbon printers.

EVALUATION

- How will the project be evaluated?
- REFERENCES, ADDITIONAL INFORMATION, APPENDICES

The final product will be considered successful if the new electrode holders are functional, meaning the EEG system works normally, while the fNIRS optodes remain in contact with the scalp. Spillage of the conductive gel can still occur for other sources such as user error, thus the effectiveness of this mechanism is difficult to gauge.

The form must be sent to 3d-lab coordinator Morten Ødegård (morode@oslomet.no)