**Department of Electronic and Telecommunication Engineering**
**University of Moratuwa, Sri Lanka**


# Brain-Computer Interface for Locked-In Pediatric Patient

Main Supervisor:

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| Members: | Group 21 |
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**Final Year Project Monthly Report (Month 1)**
submitted in partial fulfillment of the requirements for the course module EN4203/BM4201

**October 23, 2025**

# 1 Summary of Individual Work Carried Out, Problems Encountered and Solutions

## 1.1 Gammune D.J.T

During this month, I focused on defining the BCI paradigms and implementation strategy based on our initial patient visit. We observed that while the patient has good visual focus and can respond to stimuli, which strongly supports the use of SSVEP, he is not yet able to identify his left/right arm and requires simpler instructions. This poses a challenge for implementing Motor Imagery (MI) immediately.

To address this, I proposed a phased implementation plan. We will begin with **Phase 1**, focusing on training and deploying the SSVEP paradigm, which relies on the patient's confirmed visual-focus abilities. Once he is comfortable with the system, we will move to **Phase 2** and gradually introduce MI training. I also mapped out the planned 8-channel setup to support all three paradigms (SSVEP, P300, and MI). This approach allows us to start with a viable system and scale its complexity as the patient's training progresses.

## 1.2 Kumarasinghe R.D

This month, my work mainly focused on the initial design of the custom headset. I began by reviewing several existing headset designs and editing open-source 3D models from OpenBCI repositories.

During this process, I faced a major challenge identified during the patient visit: the patient has a tracheostomy and a ventilator connection. This is a critical constraint, as any headset design must be comfortable, safe, and must not interfere with this medical equipment. I made several evaluations of different designs and ultimately selected an initial head cap concept that is suitable for these specific comfort and safety needs, which we will use as the basis for our first 3D-printed prototypes.

## 1.3 Weerasinghe C.N

My main task this month was to secure and evaluate the hardware required for our Analog Front End (AFE). I reviewed the hardware available from a previous FYP and also held a meeting with the BraiNeocare team to discuss their available hardware. After careful evaluation, I confirmed their AFE structure matches our needs, and we decided to use their hardware as an analog front end for our system.

I then retrieved the hardware from the previous FYP, which included soldered active electrode circuits, an AFE, and a wireless communication module. I found that the previous headset and electrode mechanism itself was broken, confirming that we cannot rely solely on self-built hardware. This work provides a solid foundation for our dual-hardware strategy: we will test and integrate these salvaged custom circuits while simultaneously applying for grants to purchase new OpenBCI kits.

### 1.4 Wijewickrama W.K.D.D

This month, I worked on the project's administrative foundation and initial firmware assessment. I began by organizing and finalizing the complete ethics application for submission. This involved compiling the updated ethics form, consent forms in both English and Sinhala, project information sheets, the project proposal, and securing the signed parental and professorial approval letters.

In parallel, I supported the hardware team by drafting the grant proposals required to fund the purchase of OpenBCI kits. I also performed a preliminary analysis of the retrieved FYP hardware, specifically the wireless communication module, to understand its existing firmware and capabilities. This groundwork is essential to plan the firmware development needed to integrate the custom hardware, the BraiNeocare AFE, and the OpenBCI kits into one system.

## 2 Overall Project Monthly Update

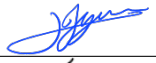
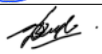
This month was mainly focused on establishing the foundation for the project through patient assessment, strategic planning, and administrative setup. Early in the month, the team conducted the initial patient visit, which was critical for defining the project's scope. The visit confirmed the patient is an excellent candidate for a BCI system, as he is in good condition, has no intellectual disabilities, and is comfortable wearing a helmet. His ability to visually focus affirmed the decision to use an SSVEP paradigm.

During this period, significant progress was made in defining the hardware and software strategy. The team decided to implement SSVEP, P300, and MI paradigms in phases, starting with SSVEP. A key hardware strategy was established: we will use a hybrid approach by integrating the BraiNeocare AFE, testing and using salvaged circuits from a previous FYP, and applying for grants to purchase new OpenBCI kits. Initial concepts for the 3D-printed headset were also developed, specifically prioritizing designs that accommodate the patient's ventilator.

In parallel, all documentation required for the ethics committee application was finalized and compiled for submission. Overall, the project progressed well this month, achieving all planned objectives. With the core strategy, hardware sources, and administrative requirements established, the team is now ready to begin initial prototyping and dataset exploration.

## Declaration

We declare that the information provided in this report is a true and accurate record of the work carried out during the stated month.

| Name | Signature | Date |
|---|---|---|
| Gammune D.J.T |  | 24/10/2025 |
| Kumarasinghe R.D |  | 24/10/2025 |
| Weerasinghe C.N |  | 24/10/2025 |
| Wijewickrama W.K.D.D |  | 24/10/2025 |

## Supervisor's Comments and Signature

**Comments:**

24/10/2025

**Dr. Pranjeevan Kulasingham**
Supervisor Signature

Date