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 3)
submitted in partial fulfillment of the requirements for the course module
EN4203/BM4201

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

1.1 Gammune D.J.T

During this month, I focused on the practical development of the signal processing pipeline for artifact removal. I began by analyzing the 256-channel HydroCel layout of the MAMEM dataset, which was necessary to isolate the specific electrode signals we need for our 8-channel setup. My main task was to study the "ICA with CNN" artifact removal approach used by the Braineocare group. I am now in the process of analyzing and changing this approach to make it suitable for our selected MAMEM dataset. This involves understanding their model architecture and adapting it to our data, which is a crucial step before we can effectively clean the EEG signals for feature extraction.

1.2 Kumarasinghe R.D

My work this month focused on iterating the physical headset design to match our validated hardware. I encountered a significant problem: the existing 3D-printed electrode holder structure was not compatible with the active electrode circuits we planned to use. To solve this, I redesigned the electrode holder structure from OpenBCI, going through two iterations to get it right. The final design now properly and stably holds the active electrode PCB on top of the holder. I also began the initial design work for the custom, ventilator-friendly headset that will be our next major iteration.

1.3 Weerasinghe C.N

My main task was to acquire, test, and validate all available hardware from previous batches to determine if it meets our project's precise requirements. I successfully tested the Analog Front End (AFE) boards, confirming that **2 out of the 3 acquired PCBs are working correctly**. I also evaluated the active electrode circuits from two prior batches and **verified that the stable '19 batch system is functional**. During this process, I investigated the hardware requirements for the impedance check and discovered a major problem: the **previous year's PCBs are not compatible** with that process. After analysis, I made the decision to postpone designing a completely new PCB for this feature and instead focus on acquiring a signal with the hardware we have now validated.

1.4 Wijewickrama W.K.D.D

This month, I worked on testing the core microcontrollers (MCUs) and analyzing the existing firmware. I acquired two MCU PCBs from the previous batches and began a **deep dive into the complete design files and firmware repositories** from the previous teams to understand their implementation. I then studied and tested both MCU circuits. The result was a success: **both MCU boards are fully functional** as implemented.
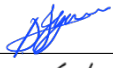
2 Overall Project Monthly Update

This month was mainly focused on intensive hardware acquisition, testing, and refinement. The team's strategy was to validate all usable hardware from previous batches to begin implementation while awaiting grant-funded components. This effort was highly successful: we confirmed that **2 out of 2 MCU boards** and **2 out of 3 AFE boards are fully functional**. We also validated the '19 batch active electrode circuit, which is stable and ready for testing.

During this hardware deep dive, a major roadblock was identified. The previous year's PCBs are **not compatible with the required impedance checking process**.
In parallel, the headset design was iterated. The **electrode holder was redesigned** to be compatible with the active electrode PCBs. On the software side, the team began analyzing the MAMEM dataset's 256-channel map and started adapting an ICA with CNN approach for artifact removal.

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