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

Brain-Computer Interface for Locked-In Pediatric Patient

Main Supervisor:

Dr. Pranjeevan Kulasingham

Members:	Group 21
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Final Year Project Monthly Report (Month 4)
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 analyzing and testing an advanced artifact removal model. I began by studying the approach of a previous group, which combined three Deep Neural Networks (DNNs). I encountered a problem when I found their GitHub repository was missing the actual pretrained model. To overcome this, I **analyzed the reference paper they used (Lopes et al.)** and found a similar 51-layer pretrained model known as the **DeepIC Classifier**. I successfully ran our test data through this model, and the results show its ability to classify and separate artifact components from the clean EEG signal. For the mid-evaluation, I have been assigned the task of **Initial Interface Development with Digital Filters for Signal Visualization**.

1.2 Kumarasinghe R.D

This month, my work focused on designing the final, patient-specific headset. I designed a **custom headset with four key features** for our use case: **(1)** it is ventilator-compatible with no structural parts near the chin or mouth; **(2)** it has an elastic top structure for a secure fit; **(3)** each electrode can be positioned independently; and **(4)** it is designed to hold the active electrode PCBs directly. This design is critical for our "Mid Evaluation Plan." For this evaluation, I have been assigned the task of **Signal Acquisition from the Head**, where I will be responsible for fitting this new headset to the user to test for alpha waves.

1.3 Weerasinghe C.N

My main task this month was to define the hardware configuration for our first complete system test. I have finalized the plan to **implement and test a 5-electrode system** using the hardware we validated last month. The system will be configured with **3 signal channels** placed on the back of the head, one **Right Leg Drive (RLD)** connected to an earlobe, and one **Reference (REF)** connected to the other earlobe. My goal for the upcoming week is to assemble this full setup with the custom headset. For the mid-evaluation, I am assigned the **Analog Front-End Hardware Design** task.

1.4 Wijewickrama W.K.D.D

This month, I worked on preparing the firmware needed to run the 5-electrode system. My work is based on the plan set by the hardware team, which requires the MCU to acquire data from the 3 signal channels plus the RLD and REF channels. I am developing the firmware to manage this signal acquisition from the ADS1299 AFE and transmit the data. This development is in line with my assigned task for the mid-evaluation, which is **Analog Front-End Firmware Development**.

2 Overall Project Monthly Update

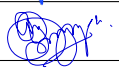
This final month was focused on integrating all validated components and defining a clear plan for the mid-point evaluation. The team designed a **new, custom ventilator-compatible headset** with key features for patient comfort and signal quality, such as adjustable electrodes and integrated PCB holders.

Significant progress was made in the signal processing pipeline. The team analyzed a sophisticated DNN-based artifact removal model. After discovering the original model files were missing from a previous project, they analyzed the core reference paper and successfully ran test data through a similar **pretrained "DeepIC Classifier"**. The results confirmed the viability of this approach for separating artifacts.

The project has now culminated in a defined **"Mid Evaluation Plan"**. The goal is to use our custom-designed headset and validated hardware to **demonstrate the appearance and disappearance of alpha waves** based on the user's eyes being open or closed.

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