ELEC5882M Scoping Document

A Raspberry Pi based multi-sensor array recording device, for stand-alone data EMG data capture

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Submitted in accordance with the requirements for the degree of  
Master of Science  
in <ELEC5882M MSc Individual Project>

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<14/December/2023>

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**Project Summary**

Electromyography (EMG) is a neuro-muscular assessment method that involves detecting, monitoring, and evaluating biopotentials produced by motor units inside a muscular tissue during voluntary or involuntary actions.[1] These non-invasive approaches become more and more popular in recent years such as the electroencephalography (EEG) and electrocardiography (ECG). However, the EMG signals still don’t gain much attention.

Our project aims to unlock the clinical promise of sEMG by implementing advanced methods for signal processing. Additionally, we will create a user-friendly graphical interface on the Raspberry Pi platform for seamless control over EMG signal acquisition. The project extends to include various sensors like temperature, force, and pressure sensors, drawing inspiration from the open e-phys style interface.

**Project Aim**

To begin with, we'll establish a WIFI communication protocol to enable seamless interaction between the Raspberry Pi 4 Model B and the STM32. Following that, we'll integrate a Muscle Sensor with the STM32 to assess the connectivity between Muscle Sensor, the STM32, and the Raspberry Pi 4 Model B. In the final stage, we'll connect the EMG sensor to the STM32 through wireless, facilitating data transmission through ADC to the STM32. Subsequently, the data will be transmitted wirelessly to the Raspberry Pi 4 Model B. Ultimately, the data will undergo transformation into a diagram, which will be visualized within the Open Ephys GUI.

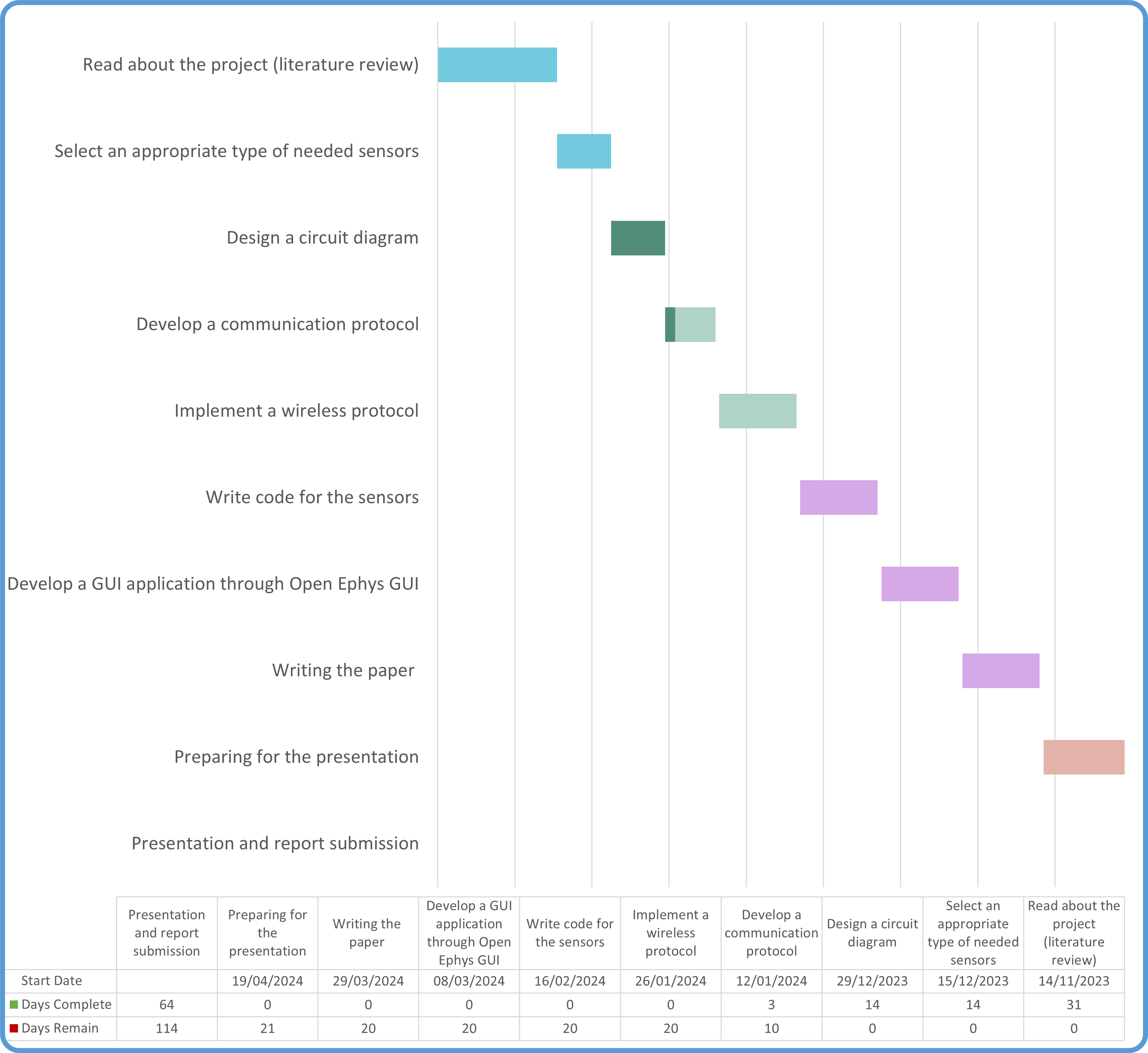
**Project Objectives**

* Learn the details of the EMG sensor, and operating principles, Open Ephys, and the architecture of the Raspberry Pi to gain a comprehensive understanding of the project.
* Select an appropriate type of STM32 and EMG sensor.
* Design a circuit diagram that fulfils the project's requirements.
* Develop a communication protocol between the STM32 and Raspberry Pi 4 Model B.
* Implement a wireless protocol to ensure seamless communication between the STM32 and the Raspberry Pi 4 Model B.
* Write code for the EMG sensor.
* Develop a GUI application through Open Ephys GUI to visualize the transmitted sensor data.

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| **Task Name** | **Start Date** | **End Date** | **Duration (Days)** | **Days Complete** | **Days Remaining** | **Percent Complete** |
| Read about the project (literature review) | 14/11/2023 | **14/12/2023** | 31 | **31** | **0** | 100% |
| Select an appropriate type of needed sensors | 15/12/2023 | **28/12/2023** | 14 | **14** | **0** | 100% |
| Design a circuit diagram | 29/12/2023 | **11/01/2024** | 14 | **14** | **0** | 100% |
| Develop a communication protocol | 12/01/2024 | **25/01/2024** | 14 | **3** | **10** | 20% |
| Implement a wireless protocol | 26/01/2024 | **15/02/2024** | 21 | **0** | **20** | 0% |
| Write code for the sensors | 16/02/2024 | **07/03/2024** | 21 | **0** | **20** | 0% |
| Develop a GUI application through Open Ephys GUI | 08/03/2024 | **28/03/2024** | 21 | **0** | **20** | 0% |
| Writing the paper | 29/03/2024 | **18/04/2024** | 21 | **0** | **20** | 0% |
| Preparing for the presentation | 19/04/2024 | **10/05/2024** | 22 | **0** | **21** | 0% |
| Presentation and report submission | 14/11/2023 | **10/05/2024** | 179 | **64** | **114** | 36% |

**Gantt Chart**

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