BME 445-513

Educational Software

#Software Description

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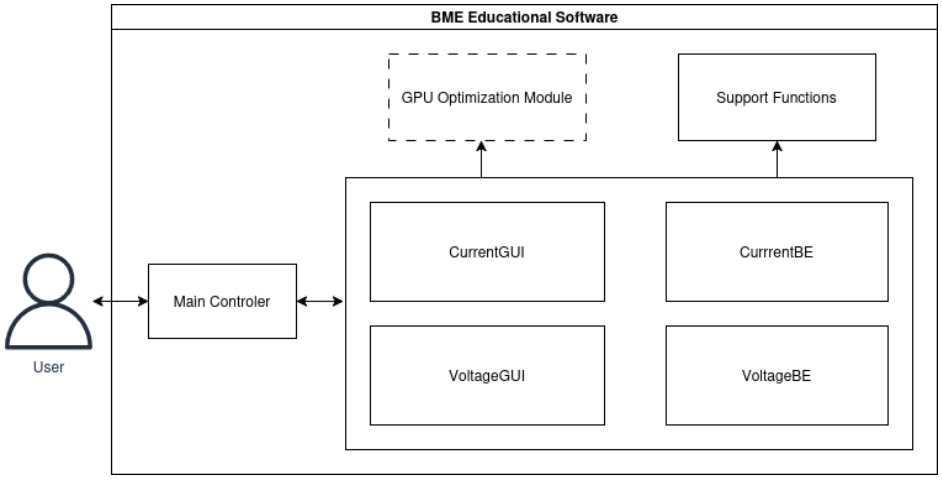
The software

This program is an educational software developed for BME students 445 and 513. The software is designed to introduce to the students to different areas of interest.

- **BME-445**: Introduce the BME students to software development principles and show a practical implementation of them.
- **BME-513:** Introduce the 513 students with an Information Technology background to software implementation with BME purposes. Give a GPU optimization implementation as an introduction to CUDA parallelization in MATLAB

Architecture of the Software

The software follows a modular design. Each component is structured into separate files that handle specific responsibilities, allowing clear separation between the user interface, backend, utility functions and GPU optimization.



Advantages of the Modular Design for this Software

- Ease of maintenance and debugging: Each module can be tested or modified independently without affecting others.
- Code reuse: Mathematical models like Nernst and Goldman equations are encapsulated in standalone files and can be reused across simulations.
- Team collaboration: Developers can work on the GUI, simulation backend, and data visualization and GPU parallelization without problems.

Modules:

Main controller: The main controller is the starter module that will be shown to the students when they run the code. The main objective of this module is to add to the Matlab path the different sub directions so that they can be used and offer a GUI for the user to select the software to run.

Backend Modules: The backend modules are the different functions that contain the backend of the experiment we try to run. In these modules we will have the calculations and logic.

GUI Modules: The purpose of these is to separate the GUI code from the logic of the code that is encapsulated in the Backend Modules. The code stored in these modules will give the user a way to interact with the system. Using figures and uicontrol functions from Matlab, once a button is pressed the Backend Function is invoked and fed the data to run the experiment.

GPU Modules: Some Backend modules has a GPU module. This are there to help run the code using NVIDIA GPUs. The files in this module are .cu files, with the kernel code and the mex wrapper inside. Before using them, they must be compiled.

Support Functions Modules: This module has the different support functions that might be needed in different backend functions. Like the goldman equation, Nernst, etc...