PsychoPy:

PsychoPy is an open-source cross-platform software, which is used to create experimental setups in behavioral sciences. The PsychoPy Builder, widely used throughout the project, possesses a flow-diagram-based structure, where the built routines serve as the nodes of the diagram. By building routines, it is possible to give visual and audio queues to the subjects. These routines are then joined using arrows and loops that shape the flow of the experiment. All of the routines run during their assigned timeframes making the PsychoPy experiments time-sensitive.

PsychoPy also provides the option to compile the experiment into a Python script for further development of the experiment. The compiled Python script can then be run on the PsychoPy Runner software. Using this conversion feature, we were able to communicate with our data acquisition server from the converted experiment script to signal the start-end times of the routines.

For our experiment, we have built eight different routines, which correspond to the seven different states for our subject: eyes open, eyes closed, left hand, right hand, walk, idle and wait. These routines will be thoroughly explained during the "Experiment Setup" chapter.

EEGNet:

As the neural network model for our project, we used the EEGNet model based on the paper " An Accurate EEGNet-based Motor-Imagery Brain--Computer Interface for Low-Power Edge Computing".

The aim of this neural network is to classify the given data into 4-MM (Motor-Movement) classes. The EEGNet was given an input of shape (N\_trials, N\_channels = 8, N\_datapoints = 1000) as the training set from the preprocessed data. Each trial consists of data from 8 channels for a duration of 4 seconds, which corresponds to 1000 datapoints, with a sampling frequency of 250 Hz. The outputs are one-hot encoded with shape (N\_trials, N\_one\_hot\_encoding = 4) and represent the four movement classes. Furthermore, the EEGNet model was compiled using the "Categorical Crossentropy" loss function, the "Adam" optimizer and trained with a "StratifiedKFold".