Assignment - Full-stack developer

Problem I: Measuring brain activity using the IDUN EEG device

Neuroimaging studies are typically small in sample size. Having a system like the IDUN Guardian EEG device would enable us to acquire data from a large population cohort. There are efforts in trying to find EEG markers that are sufficiently robust for real-world measurements. Established paradigms such as the alpha induction experiment or auditory steady state response (ASSR) have shown to be robust. Moreover, there is an interest in other validated tasks such as the so-called auditory oddball paradigm. Specifically, in the auditory oddball paradigm the user is exposed to a stream of repetitive tones (of the same frequency) where once in a while a different tone appears (in other words the oddball which has a different frequency than the sequence of repetitive tones). Interestingly, the brain reacts unconsciously to the oddball after adapting to the tone sequence even when focusing on something else (e.g., for example focusing the gaze towards a cross centered on the screen). The design of the experiment might look like this:

- Total duration of experiment: 2 minutes
- Two tones with different frequencies (e.g., 200 Hz and 500 Hz) and tone duration: 60 ms
- The appearance of the oddballs happens at random timepoints

Your tasks:

- Sketch the experiment graphically
- Design and implement the experimental task in a webApp using any frontend web development frameworks, the experiment starts with a button press and ends after 2 minutes with the screen text "Experiment complete"
- What do you think is important for designing an experiment when you care about excellent signal quality? (1 or 2 sentences)

Problem II: API development

Now, the data that was recorded from an experiment should be transformed such that the customer/user is able to integrate them with their products. For example, one could change the volume of the TV based on your focus level measured from brain activity. For this, we would like to develop an API for the customer for her/him to access specific data. Attached you will find a file **task2_data.json** which includes (artificial) data from subjects (or users) with a set of features (e.g., from brain signals).

Your tasks:

- Store the JSON file in a data storage and motivate your choice of technologies
- Implement a REST/GraphQL API (any language) in order to enable CRUD operations and test functionality:
  - List feature 2 for all subjects
  - Get feature 1 for subject 52
  - Edit all features for subject 11 to 1
- Demonstrate the usage of HTTP responses with codes: 200, 404, 500
- Describe the steps on how you want to deploy your application
- What do you consider relevant factors for the design of a scalable API design? (1 or 2 sentences)

Problem III: Demo showcase

In the final step, we would like to design a demo space for customers to present our neurointelligence platform. The aim is to demonstrate the IDUN full-stack product. Consider the following:

- You have unlimited resources and can include any technology that you deem relevant to highlight the product
- You don't need to restrict yourself to the paradigms mentioned above but it can be any in the domain of brain computer interface

Your tasks:

- *Sketch the demo space graphically*
- *What do you think are important factors that would highly attract customers in highlighting the hardware and software?*