**Section Introduction:**

Noninvasive brain stimulation (NIBs) methods have quickly gained popularity for there potential to modulate human brain activity with no need for invasive procedures like surgery or implants. The standard equipment for NIBs based techniques like transcranial magnetic stimulation and direct current stimulation have been show to (**Positive effects, treat depression, increase neural activity hence treating chronic pain and depression).** These positive side effects however do not come without their downsides. NIBs can be high cost, requiring trained personnel and bulky equipment. Furthermore, many patients have reported discomfort with use including headaches, itching and skin irritation. Further medical risks can even occur for those with medical devices such as pace makers, which can be disrupted by external electric or magnetic fields. Resultingly, there is a need for a noninvasive low cost procedure with potential therapeutic cognitive impact.

Binaural beats have recently gain popularity as a potential low cost noninvasive alternative. This technique entail playing two frequencies in each ear via headphones with a slight mismatch in frequency ranging from 10-30 Hz. This frequency mismatch is hypothesized to **(Detail how this is suppose to be therapeutic from a theoretical perspective)**. Studies have validated the potential for therapeutic effect against a potential placebo effect, showing potential to enhance learning capacity, reduced anxiety, and reduced pain perception. Conflicting studies have however noted. These effect are not always perceived in use cases, suggested the potential for person to person variance in the effectiveness of binaural beats, and the need for calibration in these systems to achieve the desired effect.

In an attempt to fully take advantage of the reported positive effect reported in the binaural beat literature we have devised a machine learning algorithm which predicts beat frequencies and frequency differences to reduce **(CHOOSE ANXIETY, DEPRESSION, PAIN PERCEPTION, ETC.)**. We calibrate the algorithm using our wearable headset integrated with real time EEG, EOG, EDG and temperature sensors. A various frequency and delta frequencies are exposed to the patient followed by a questionnaire to assess the utility of the therapeutic system. Subsequent use then relies on these sensor reading to predict the desired therapeutic outcome.

**Methods:**

* **Probably a double-blind study where only the participant can hear frequencies and must them report mental state afterwards**
* **We can randomize the frequencies and deltas used and test within the standard frequency ranges** 
  + **Delta (0.5 – 4 Hz)**
  + **Theta (4 – 8 Hz)**
  + **Alpha (8 – 14 Hz)**
  + **Beta (14 – 30 Hz)**
  + **Gamma (30 – 100 Hz)**
    - **NEED TO CHOOSE A WAVE STARTING FREUENCY F AND ADD THESE TO IT. RESEARCH THE MOST COMMONLY USED.**
    - **SET SOME STANDARD EXPOSURE TIME**
  + **Use Sam’s already made questionnaire and fit to each reported measurement. Probably report the best ones, potentially report which outcomes are the hardest to predict and hypothesize why.**

**Results:**