SSVEP

- A sinusoid like waveform that is measured from the Occipital and Parietal areas.
- Is elicited by a repetitive visual stimulus
- The SSVEP waveform is typically at the same frequency (or its harmonic) of the driving stimulus

EMOTIV EEG Acquisition Device

- 14 sensor EEG cap, uses saline to increase conductivity
- Relevant sensors at O1, O2, P7 and P8 of the international 10-20 system.
- Digital sampling rate of 128 samples per second → can meaningfully extract frequency information up to 64 Hz (nyquist frequency)

Brain-Computer Interface (BCI)

- A system that uses input from a users brain and translates it to a computer command
- Goal is to create a SSVEP based BCI
- Four flashing stimuli tagged with different frequencies used to control a character in a 2 dimensional maze (up, down, left, right)

BCI Signal Processing Chain

Raw EEG → Preprocessing
→ Dimensionality Reduction
→ Feature Extraction → Classification

Proposed Method and Apparatus

- Stimulus Array→ User →Raw EEG →Butterworth bandpass filter (between 5 and 30 hz) → Common Spatial Pattern → Fast Fourier Transform → Fisher's Linear Discriminant Analysis or Support Vector Machines → Computer Command → User Feedback

How will it be implemented?

- Using either open source software such as openvibe or BCI2000, or programmed in C# with the help of friends and open source libraries to implement different signal processing methods and classification

Experiment

- Compare BCI performance in both a quiet laboratory setting and in a naturalistic setting with background noise
- Since spatial attention modulates SSVEP amplitude and phase, one would expect the user to have a harder time evoking a strong SSVEP in the naturalistic setting
  - Hypothesize that BCI performance would be better in the quiet lab