Blinks to Speech: Using EEGs to Detect Eye Blinks for Morse Code Communication

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An EEG (electroencephalogram) is a device that records electrical patterns in the brain. Deliberate eye blinks are very apparent in an EEG reading, meaning they can be used for various application purposes. Specifically, the left/right blinks and looks can be used for communication purposes.
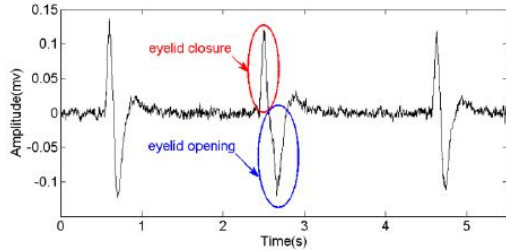

Figure 1: Eye blinks on an EEG output (Abo-Zahhad, 2015)

Morse code is a system of communication that uses a series of dots and dashes to represent letters and words and has been communicated by blinks in the past.

Our project aims to create a system that uses an EEG to detect eye blinks and translate them into morse code and then text to speech. We hope this can serve as a means of cheaper and generalizable Augmentative and Alternative communication (AAC) for individuals who have certain afflictions such as cerebral palsy, motor neuron disease, quadriplegia, and locked-in syndrome.

We used the EMOTIV Epoc X EEG for our project, which came with a BCI-OSC extension to deliver raw data. OSC (Open Sound Control) streams are usually used to send audio between programs across different networks, but can also be used to transmit EEG data. With the python OSC package, this data could then be manipulated and translated in self-serving python scripts.

Essentially, we can detect when the user blinks with their left and right eye and when they look to the left and right. We use this to represent dots and dashes and a new letter and word, respectively. We write this data to a text file, where it can be read by our Python translation script.

We then create a morse code string with these blinks/looks and then translate this morse code to English using a simple dictionary. This translation is updated in real time as we received input from the OSC server.

Then, using a Turbo-Flask server, we can read these translated words and output them in real time on a User Interface written in HTML (with CSS for formatting). The translation can be spoken aloud using Google Text to Speech when the user prompts at the click of a button.

Blinks to Speech

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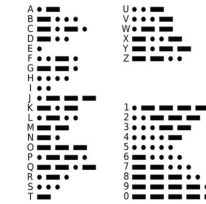
Left Blink = dot (.)
Right Blink = dash (-)
Look Left = new letter
Look Right = new word

Current translation: I blinked this

Read Aloud Translation

Figure 2: Our User Interface

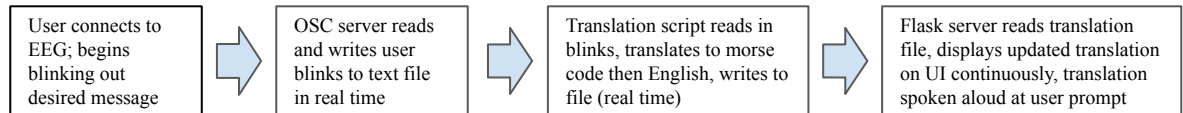| User connects to EEG; begins blinking out desired message | OSC server reads and writes user blinks to text file in real time | Translation script reads in blinks, translates to morse code then English, writes to file (real time) | Flask server reads translation file, displays updated translation on UI continuously, translation spoken aloud at user prompt |

Figure 3: Flowchart of Entire System