SpeakUp: A Machine Learning-Based Speech Aid to Enable Real-Time Silent Communication for the Paralyzed by Translating Neuromuscular EMG Signals to Speech

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There are upwards of 7.5 million people suffering from speech impairment caused by conditions such as stroke, ALS, and cerebral palsy. These paralyzed patients can't speak, as they can't use muscles in the throat and mouth. However, even when a person tries to speak silently, their brain sends neurological signals to the speech system which causes the muscles to generate EMG signals. Current technological solutions consist of eye/cheek trackers which are inefficient and expensive. Recent advancements in AI/ML have added lots of new ways in which EMG signals can be processed. Using modern sensors such as the "Myoware muscle sensor" these signals can be recorded. These recorded EMG signals are in a waveform and are quite predictable in their pattern depending on the word spoken. SpeakUp, an ML-based speech aid, uses these EMG signals in combination with computer algorithms (ML) to help paralyzed/ALS patients communicate voicelessly, merely by articulating words without producing any sounds. SpeakUP has 3 main components: an EMG recorder, a computer with a trained ML model, and a portal to display predicted speech. SpeakUp uses a Myoware Muscle sensor to capture EMG signals from the submental triangle (throat). The Arduino microcontroller is used along with a radio transmitter to process and wirelessly send data to a computer. A trained SVM ML model was then used by the computer to predict and display the silently spoken words on a python-based display portal built using Streamlit. SpeakUp was able to translate EMG signals into speech in real-time. Unlike other currently available speech aids, SpeakUp can be used by all paralyzed/ALS patients, irrespective of their level of disability. This device has an accuracy of 80.1% and was developed for less than $100.

Awards Won:
Fourth Award of $500