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A Wearable BCI Mediated Generative AI System for Conversational Interactions

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Introduction: There are many existing speech generation systems that utilize BCI for individuals with severe motor impairments such as ALS [1][2][3]. This work presents a novel SSVEP based BCI system that is realized in a fully mobile and wearable form factor incorporating EEG sensing and an augmented reality heads up display. The system also incorporates a novel conversational copilot system that uses generative AI technologies to personalize conversational interactions. The system was evaluated with a cohort of ALS users in both acute and chronic use.

Material, Methods and Results: The generative AI system was developed using the Axon-R system from Cognixion. This system includes an optical see through augmented reality display, Android 13 based wearable computer and an 8 channel EEG wet sensor array. A novel interaction framework was developed in Unity to enable lower accuracy SSVEP based BCI stimulus-response classification user selection. The heads-up display interface is shown in Figure 1. The system incorporates a set of personalized generative AI conversation and word completion models to enable users to engage in near real-time communication with others using speech or a chat style interface. The system was evaluated and refined in a usability study in preparation for a longitudinal study, which is ongoing. Metrics captured included information transfer rate (ITR), system usability scale (SUS) [4] and clinical quality of life measures. Results indicate that the refined interface, once users become proficient, provides a compelling conversational system for users that have no current technological options.

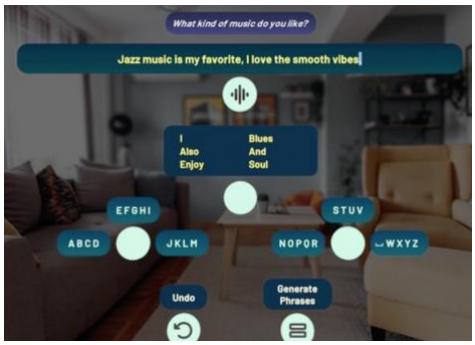

Figure 1: Heads up generative AI driven conversational user interface.

Conclusion: These results demonstrate that a near real-time conversational pace is possible for BCI interfaces augmented with generative AI capabilities.

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