

FlashLife™: A Context Aware Solution for Everyday Life

H. Nezamfar^{1*}, S. Salehi¹, M. Moghadamfalahi¹, A. Ten Pas¹, D. Sinyukov², U. Orhan¹,
M. Higger¹, F. Quivira¹, M. Ackakaya³, T. Padir¹, R.J. Platt¹, D. Erdogmus^{1*}

¹Northeastern University, Boston, MA, USA

²Worcester Polytechnic Institute, Worcester, MA

³University of Pittsburgh, Pittsburgh, PA, 15621, USA

*409 Dana Research Center, 360 Huntington Avenue, Boston, MA 02115. E-mail: {nezamfar@ece.neu.edu, erdogmus@ece.neu.edu}

Introduction: Brain Computer Interfaces (BCIs) have been under research and development for decades. Different brain responses are utilized such as Event Related Potentials (ERPs), P300, Visually Evoked Potentials (VEPs) and Event Related Synchronization / Desynchronizations (ERSDs). Every response has its own strengths and weaknesses. Mostly, BCIs have been utilized for specific tasks such as typing or control. However, every system needs some training, and it takes time to build the habit to use it comfortably.

FlashLife™; A system capable of supporting different applications through the same stimulation method. The main applications supported by FlashLife™, are [FlashType™](#), [FlashNav™](#), [FlashGrab™](#), and [FlashPlay™](#). FlashLife™, provides fast, reliable, robust classification while using only a single EEG electrode placed on the center of the visual cortex, at Oz. Taking advantage of code Visually Evoked Potentials (c-VEPs) and stimuli optimization [1], decision rate of 1 Hz and accuracies in the high 90s, a reliable channel for the participants is provided to interact with their target applications. In addition, calibration only takes less than three minutes and it is not required frequently. Individuals with gaze control can use FlashLife™ with eye tracking as an alternative input modality. A battery of *Calibration* sessions can be used for every user to optimize system parameters such as presentation rate and stimuli size and color and boost the performance even further. Stimuli roles play a key role in adaptability of FlashLife™.

FlashType™; A context aware language independent typing brain interface [2]. It provides the user with a cursor, capable of navigating throughout a grid of symbols. The number of symbols is adjustable based on user preferences; default setting provides 28 symbols including the 26 English alphabet letters and space and backspace symbols. This keyboard consists of three main parts, *Static Keyboard*, *Character Suggestion*, and *Word Prediction*. By default, using a 6-gram language model and typing history, 7 highly probable characters and 3 most probable words are estimated and presented to the user. FlashType™, incorporates all the EEG collected from the user while navigating throughout the keyboard to make every selection. The separation among the keyboard and the stimuli makes the keyboard language independent. Users can rearrange the symbols in the *Static Keyboard* as they prefer. In the initial study, novice users have been able to reach rates of 6 seconds per character and build the habit of using different parts of the keyboard in just a few minutes.

FlashNav™; A context aware navigation brain interface. It can be used to navigate a wheelchair or control a robot remotely. Information such as environment map, objects and locations of interest and user habits can be used to boost the probabilistic decision making performance. In addition, destination selection along with autonomous navigation and collision avoidance mechanisms can decrease the cognitive load on the user.

FlashGrab™; A context aware object manipulation brain interface. Using Baxter, a low cost humanoid robot, and image processing techniques, graspable objects are detected[3] and labeled with numbers. A video feed shows the robot perception with the overlaid labels to the user. Depending on the number of graspable handles, a direct or a multistep decision will be made by the user.

FlashPlay™; An interface to a virtual environment such as a maze or a floor map. Training and entertaining the user are the main goals. Using a virtual environment makes the setup much simpler. A series of Mastery tasks have been designed with different difficulty levels, taking advantage of the probabilistic classifier and the virtual environment, to help the users to build the habit of using the system and attending to the stimuli effectively.

Significance: FlashLife™, considering user comfort, is the first its kind capable of providing means for the major needs in everyday life of a person i.e. control and communication, all through the same stimulation method.

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References

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