

18 October 2007

Brainwave with Image Offers Access to Second Life®
Keio University Developed of Technology to Stroll Virtual World by Using Brainwaves

Assistant Prof. Junichi Ushiba of Laboratory for Biomedical Engineering, Department of Biosciences and Informatics, Faculty of Science and Technology succeeded to develop Brain-Computer Interface (BCI) technology that enable people stroll through the virtual world of Second Life® (*1) using their own imagination. Previous studies have proved that people can move computer cursors through brain waves, but this project is the first to apply the technology to an Internet virtual world.

This Biomedical Research Project (*2) has been owned by following three faculties in Keio University, Japan: Department of Biosciences and Informatics, Faculty of Science and Technology, Tsukigase Rehabilitation Center and Department of Rehabilitation Medicine, School of Medicine. The technology would enable people suffering serious paralysis (*3) to communicate with others or conduct business in a virtual world. In the future, we plan to develop the technology to apply to the rehabilitation field by cooperating with the medical researchers.

1. About the Technology

A brain-computer interface, which allows people use their thoughts to control the movements of their Second Life® avatars has been developed. A user controls his/her avatar by wearing a headset which is equipped with electrodes that monitor activity in a field of the brain that controls the movement of limbs (Figure 1, Table 1).

The system detects and processes brain activities which comes from the sensory-motor cortex, and automatically decodes users' hand and foot imagery. When a user thinks about moving his own feet, the avatar walk forward. When a user thinks about moving his arms either right or left, that avatar turns that way (Figure 2 and 3).

2. Development in the Future

The technology that enables more complex movements and gesture in Second Life® will be developed in the future. It is intended to test the technology on real helping patients in paralysis patients to see how the technology is capable of the virtual world by collaboration with the medical team. We examine how active brain activity through stroll in Second Life® effects to the brain and the nerve, and investigate a possibility of application in the rehabilitation field.

The technology would enable people suffering from paralysis to communicate with others or conduct business in a virtual world.

3. Demonstration at the 8th Keio's science and technology exhibition, KEIO TECHNO-MALL 2007

Please refer to the details of a moving image of the experiment: <http://www.bme.bio.keio.ac.jp/eng/01news/>

We plan to demonstrate of this experiment at KEIO TECHNO-MALL 2007 as follows:

Date: 5 December (wed) 2007, 10:00-17:00

Venue: Tokyo International Forum - B block 7th floor, Hall B
3-5-1 Marunouchi Chiyoda-ku Tokyo 100-0005, Japan

Website: <http://www.kll.keio.ac.jp/ktm/en/>

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***1: Second Life® 3-D virtual community**

Second Life® is a 3-D virtual community, created and operated by U.S.-based Company Linden Lab, with a rapidly growing population from 100 countries around the globe. Residents of the Second Life® metaverse themselves create and build the world that includes homes, vehicles, nightclubs, stores, landscapes, clothing, and games. Second Life® has its own economy and a currency referred to as Linden Dollars (L\$). Residents regularly create new goods and services, and buy and sell them in the Second Life® virtual world.

***2: Biomedical Research Project**

Collaboration research project of Brain Science by following researchers:

Assistant Prof. Junichi Ushiba: Department of Biosciences and Informatics, Faculty of Science and Technology

Associate Prof. Yoshihisa Masakado: Tsukigase Rehabilitation Center

Prof. Meigen Liu: Department of Rehabilitation Medicine, School of Medicine

***3: Serious Paralysis**

Patients suffering from paralysis such as amyotrophic lateral sclerosis (ALS), spinal cord injury, or stroke.



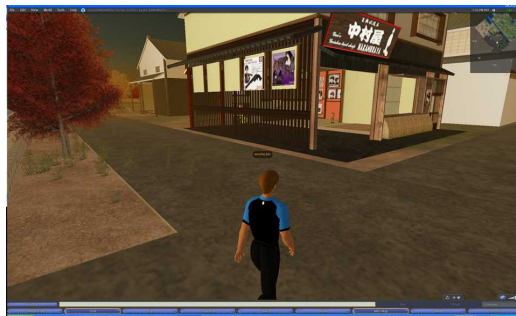
Figure 1. A snapshot during experiments

The subject (right) is imaging foot movement. The BCI system analyzes brain activity (middle panel), and sends control signal to Second Life® (left panel).

(a) Going forward



(b) Turning left



(c) Going forward again



(d) Approaching to a temple



Figure 2. An example of avatar's movement controlled by users' thought.

Newly Developed headset



Second Life



(Display)
←

(Brain wave)
↓

↑
(Second Life control signal)



(Amplification and noise cut)
→



Commercial electroencephalograph

Brain-Computer Interface System developed by Dr. Ushiba et al.

(with originally developed brain wave analysis and keyboard emulator)

Figure. 3. A schematic diagram of our BCI system.

Table 1. User's thought and Avatar's movement

User's motor imagery	Avatar's movement
Fictive walking	Going forward
Shaking right hand	Turning right
Shaking left hand	Turning left