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Development of human interface for spinal cord injury patient to enhance quality of life

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A physical damage to spinal nerves that emerge from the spinal cord is called spinal cord injury which causes a paralysis of any part of the body depending on which part of spinal cord is destroyed. The spine in our body is comprised of about thirty vertebral bones, and they are sequentially joined in a line. It is well known that a severity of the paralysis is determined by both a location and a degree of injury. For example, in a case of injury at the fourth vertebral bone from the top (named C4) a patient is paralyzed from the neck down, and needs a caregiver to help almost all activities of daily life (ADL) [1-3].

Recently, a quality of life (QOL) for such patients is considered to be important, and various welfare devices have been proposed to realize a better QOL. Regarding C4 patients, we want to develop a human interface that can be manipulated without damaging them.

In this paper, we propose a human interface for tablet devices by detecting breath pressure and facial motions of C4 patients in order to realize touchless tablet. Our human interface has three steps. First, breath pressure is detected by an air pressure sensor (Fig.1) and then the tablet is released from its sleep mode. Next, by detecting the direction of the face movement based on the calculation of optical flow, the mouse cursor is moved vertically or horizontally depending on the movement direction. Finally, based on the size of the mouth in their face detected by the Haar-like feature [4], the mouse cursor is clicked.

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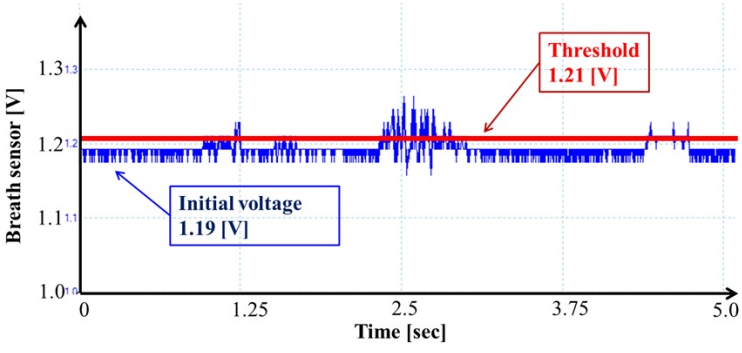

Fig.1 Time series of breath pressure.