AN INPUT INTERFACE ASSESSMENT SYSTEM FOR ACCESS AND CONTROL OF ASSISTIVE TECHNOLOGY DEVICES

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ABSTRACT

An input interface assessment system was developed to facilitate less experienced clinicians to perform evaluation on the selection and use of assistive technology devices. This system utilized various sensors and measurement tools to quantify the functional movement of potential body sites for switching. In addition, the system also measures the activation power that can be generated. Based on these information, suitable switches and/or input devices can be identified. Besides, the system also incorporated a programmable module to assess the user's ability to perform correct selections under single switch scanning control. To ensure an effective use of the input device, this module also helps to optimize the scanning speed for best operation.

BACKGROUND

Many individuals with serve disabilities were constrained by their physical limitations to communicate with others and participate in information acquisition and exchange. Despite of the many available computer access technology (CAT) on the market, a major challenge in providing successful computer access service delivery to these needed individuals is associated with the experience of the assessor and his/her understanding on the technical performance of the available input devices. In literature, there are many different assessment tools available [1] for CAT service delivery. While it is understandable that the computer access assessment process should be client focused, matching the user's ability to available technology is of equal importance. In clinical practice, an experienced clinician can easily integrate user's demand/ability with a vast possibility of available technologies, and come up with the "best suitable" input device for the user. However, such a task becomes extremely difficult for the less experience individual. Therefore there is a need to develop an input interface assessment system which can facilitate clinicians to deliver input control selection in a systematic and effective manner.

PURPOSE

The purpose of this work is to develop an input interface assessment system for computer access and control. The specific objectives included:

1. Development of a hardware module that can interface with various sensors and switches for performance measurement.
2. Development of a software module that guides the assessor to perform evaluation and determine the suitable options for device input.
3. Development of a performance evaluation system to assess the effectiveness of input selection and optimize the timing for single switch control operation.

METHOD

The building block of this system consists of three parts: the hardware interface module, the software system and the performance evaluation module.

Hardware interface module

In order to perform a switching action for input selection/control, the end user needs to perform some kind of movement of his/her body parts to trigger such an action. This trigger may or may not be forceful. In clinical situation, it is difficult to have all different sensors/switches make available for trial. Besides, it is impractical to go through such a long process. Therefore, in this new system, we aim to measure the functional movement of

individual body sites that can elicit a trigger and document whether such a movement can lead to a forceful action. Based on the measured range of movement and activation force, a suitable sensor/switch can be selected from a product database. Figure 1 shows the hardware interface module. This module can connect with digital and analogue devices as well as any ability switches with a 3.5mm connector.

Figure 1: Hardware module

Software module

The software module is comprised of three parts: a device database, a client database and an assessment process manual. In the assessment process manual, the system will guide the clinician to perform measurement on functional movement and triggering force. This clinician still needs to professionally observe the user to determine which body site(s) should be assessed. Then, by connecting the hardware module with suitable sensors or with the use of webcam(s), the range of movement of the body site can be measured. If the assessee can produce a forceful trigger, his/her activation force will also be measured. These information will be fed onto the device database for recommendation of a suitable sensor/switch.

Performance evaluation system

With the suitable input device identified, it is important to assess of the performance of the user during use. The build in evaluation system aims to measure the activation time of each selection and compared to its correctness. To lessen the complication of selection, the system is programmable. Clinician can start with simple selection like YES and NO, and move to more complex one (i.e. more choice to select) as needed. Since serve physical disabled individuals are the targeted recipients, the evaluation system was built with scanning selection mode. To allow more effective selection, the scanning speed can be optimized to fit the ability of the user. Figure 2 shows the screen layout of this system.

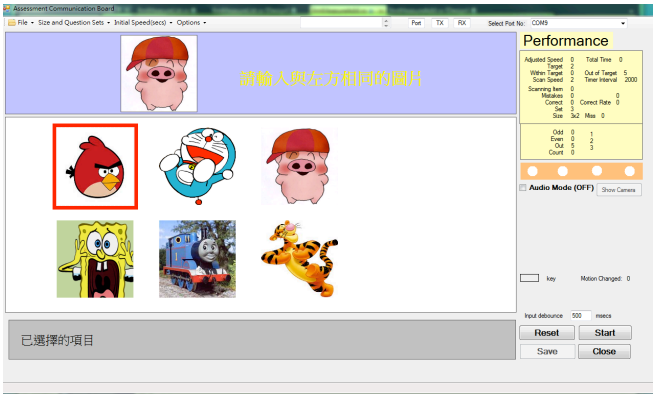

Figure 2: Screen layout of the evaluation system. Graphics can be selected by the clinician and audio prompting was made available to visual impaired users

DISCUSSION

In computer access technology assessment, a major challenge for a less experienced assessor is to determine whether the user has the required movement to perform switching. The current system provides the assessor with a set of tools to objectively quantify functional movements and his/her ability to elicit a forceful action for switching. For gross movements of limbs, the system will measure the translation movement and its speed. This is particular important if an accelerometer switch is being considered. Besides, the amount of force that the end user can exert on the sensor/switch would determine which types of ability switches/sensors are suitable. Since the targeted users are those who suffered from severe physical limitations, the system also incorporates sensors that do not require any forceful action. These included proximity sensors, gyroscope sensor, optical switches…etc. Besides, the system also has a webcam based system for eye movement analysis. This helps to determine whether eye blinking or eye ball movement can be used as an input control.

To ensure that this newly developed system is of practical use, we have started to conduct field studies with potential users suffering from spinal muscular atrophy. The results of such evaluations will be presented at the conference.

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