Gesture Control in a Virtual Environment

Presenter: Zishuo Cheng (u4815763)
Supervisors: Prof. Tom Gedeon and Mr. Martin Henschke
Outline

• Background
• Motivation
• Methodology
• Result & Discussion
• Conclusion
Background

• NUIs are increasingly becoming an essential part of the contemporary HCI.
  – The concept of NUI was developed by Steve Mann in 1990s [1].
  – NUI enables human-machine interaction via the people’s common behaviours such as gesture, voice, facial expression, eye movement, etc.
Background (continued)

- Electromyography (EMG) signal recognition and vision-based gesture recognition plays important roles in NUI.
Motivation

• Identify the limitation and defects of EMG and Vision-based gesture recognition

• Explain the dominance of traditional input devices (i.e. keyboard and mouse)

• Summarise some lessons in HCI
Methodology

- Select two devices as the typical examples to be analysed
Methodology (continued)

• Assessment on general aspects
  – Training time for novice users
  – User-friendliness

• Assessment on gesture control in virtual environment
  – Navigation
  – Precise Manipulation

Experiment 1
Experiment 2
Experiment 3
Experiment 1

• Demo video for using MYO armband and Kinect sensor is shown to each subject.
• Ask the subject to perform all the gestures.
• Evaluate their degree of proficiency.
  - Only if the degree of proficiency is acceptable, the subject is allowed to do the next two experiments.
Data collected in Experiment 1

- Training time
- Error rate
- Subjective impression of MYO armband and Kinect sensor
Experiment 2

• Map each gesture in MYO and Kinect into the interaction events.
• Ask subjects to reach a specific destination in the virtual maze.
• Test the performance of MYO, Kinect, and keyboard.
Data collected in Experiment 2

- Time
- Error rate
  - Incorrect operation (human error)
  - Recognition problem (device limitation)
- Times of changing gestures
Experiment 3

• Map each gesture in MYO and Kinect into the interaction events.
• Ask subjects to grab the keys and use them to open the doors.
• Test the performance of MYO, Kinect, and mouse.
Data collected in Experiment 3

• Time
• Error rate
  – Incorrect operation (human error)
  – Recognition problem (device limitation)
• Times of changing gestures
• Movement range of subject’s arm
  – Calculate Euler angles in 3D Euclidean space
Result & Discussion

• Experiment 1
  – MYO has much longer training time than Kinect.
  – Subjects rate higher mark for Kinect.
Result & Discussion (continued)

- Experiment 2
  - $Time_{Keyboard} < Time_{Kinect} < Time_{MYO}$
  - $Error_{Keyboard} < Error_{Kinect} < Error_{MYO}$
  - $Error_{Keyboard} \approx 0$
  - $\#Gesture_{Keyboard} < \#Gesture_{Kinect} << \#Gesture_{MYO}$
Result & Discussion (continued)

- $Time_{Mouse} < Time_{MYO} << Time_{Kinect}$
- $Error_{Mouse} < Error_{MYO} < Error_{Kinect}$
- $#Gesture_{Mouse} < #Gesture_{MYO} \approx #Gesture_{Kinect}$
- $MovingRange_{Mouse} < MovingRange_{MYO} < MovingRange_{Kinect}$
Conclusion

• MYO is less user-friendly than Kinect, but performs better in precise manipulation.
• Kinect is much simpler than MYO, but it requires larger body movement. This leads to the low accuracy in precise manipulation.
• Traditional input devices are far more reliable than EMG and Vision-based devices.
Conclusion

• MYO is less user-friendly than Kinect, but performs better in precise manipulation.

• Kinect is much simpler than MYO, but it requires larger body movement. This leads to the low accuracy in precise manipulation.

• Traditional input devices are far more reliable than EMG and Vision-based devices.

Any Questions?
Reference

Thank You!