Suitability analysis of commercial open-source driven motion sensor devices applied to exergames for the elderly

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Join-In
Senior citizens overcoming barriers by joining fun activities
Introduction

• About Join-In
• The paper
  – Exergames and sensors
  – Wii vs Kinect
  – A prototype
About Join-In

• **Join-In** aims to support home-bound elderly people to **socialise** by providing tools and activities for social networking

• This includes social **games** and **exergames**

• Our main focus is exergames
Exergames and sensors

• Sensors for exergames:
  – Remotes
  – Balance boards
  – Dance mats
  – Cameras
  – Etc

• We have looked at Wii and Kinect
Sensors-considerations

- Price
- Development possibilities
- Ease of handling
  - Batteries
  - Number of items
  - Buttons
  - Wires
- Movement registration
Wii vs. Kinect

• Technical
  – Connection
  – Library / development

• Motion detection

• Usage
  – Space
  – Challenges
## Comparisons

<table>
<thead>
<tr>
<th>Device</th>
<th>Kinect</th>
<th>WiiMote-Nunchuk</th>
<th>Wii board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>$150</td>
<td>$60</td>
<td>$100</td>
</tr>
<tr>
<td>Maintenance in game</td>
<td>No ingame maintenance</td>
<td>Wiimote must be calibrated</td>
<td>No ingame maintenance</td>
</tr>
<tr>
<td>Connection</td>
<td>USB port</td>
<td>Wireless - bluetooth</td>
<td>Wireless - bluetooth</td>
</tr>
<tr>
<td>Sensors</td>
<td>Microphone, array, RGB camera, depth sensor</td>
<td>WiiMote: accelerometer, IR camera, 10 buttons WiiMotionPlus: gyroscope Nunchuk: Accelerometer, analog joystick, 2 buttons</td>
<td>4 weight sensor detectors</td>
</tr>
<tr>
<td>Output features</td>
<td>13-colour LED, Tilt motor</td>
<td>41 colour LED, vibrator, speaker</td>
<td>11-colour LED</td>
</tr>
</tbody>
</table>
### Comparisons cont.

<table>
<thead>
<tr>
<th>Device</th>
<th>Kinect</th>
<th>WiiMote-Nunchuk</th>
<th>WiiBoard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elderly usage problem</td>
<td>Selecting options not intuitive</td>
<td>Buttons too small and too many</td>
<td>Heavy</td>
</tr>
<tr>
<td></td>
<td>Difficult to hold hand still long enough</td>
<td>Difficult to know what is what</td>
<td>May fall off</td>
</tr>
<tr>
<td></td>
<td>Wrong selection because hand is held still too long</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used in wheelchair</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Library used</td>
<td>OpenNI (modified)</td>
<td>Wiigee plugining wiimote (modified)</td>
<td>Wiiboard simple</td>
</tr>
<tr>
<td>Library constraints</td>
<td>Fails detecting user</td>
<td>Sound not supported</td>
<td>Has to be connected with synchronisation button</td>
</tr>
<tr>
<td></td>
<td>Only 15 joints available</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microphone not supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involved limbs</td>
<td>All the body</td>
<td>Arms, legs if in pocket</td>
<td>Legs only</td>
</tr>
</tbody>
</table>
Prototype development

• Chose Kinect
• Developed SANDRA
  – Multiplatform application
  – Unifies sensor handling under single system
  – Uses OpenNI as underlying library
  – Using Java
• Game is browser-based
• Exercises common for elderly
Game Story – Antique collection

A group of seniors are collecting items for an antique market.
An old friend has given a lot of nice things that is in a big old house.
They meet outside together with an expert on antiques
Starting game

Lobby: meet

Start of warming up
They all hug (embrace yourself)
Reach for the house key!

Hall: warmup

They enter a hall with many shelves.
They lift items carefully down and put them on a table.
More scenes

Possible to have many scenes with different exercises
Prototype

http://www.youtube.com/watch?v=bAZoLjDxsI4