VR medical gamification for training and education

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VR, AR and Gamification
State of the art

- Virtual reality Therapy for Adults Post-Stroke
- Virtual reality as an adjunctive pain control in burns caring for adolescent patients
- VR technology may serve as an effective non-pharmacological analgesic to aid pain management.
- Leap Motion supporting medical education – Skedu
System architecture
SkeduVR

- complex mobile application supporting medical students to manipulate and learn the bones of a virtual human skeleton displayed in a virtual 3D scene

- development process
- results
Tools

- Unity 5.4 and C# scripts
- Google VR SDK
- SQLite
Objects

- Gvr Reticle
- Gvr MainCamera
- Bone
- Plane
- Point light, Text and Menu (3 buttons)
Main functionalities

• Turning On and Off the spin of the skeleton
• Selected bone information
• Movement in 3D space.
• Reset current position in the virtual 3D space
Methods

• *Spinning equation (rotating the object):*

\[ R = m_i + k; \]

where:

\( m_i \) - represents the measure of the angle of rotation at moment \( i \) (\( i = 1 \rightarrow n; \ n = 8 \));
\( k \) - *constant angle of 45°*;
\( R \) - measure of the angle of rotation.

*Table 1. Measure of the angle of rotation \( R \) for one rotation:*

<table>
<thead>
<tr>
<th>i</th>
<th>( m_i )</th>
<th>k</th>
<th>( m_i + k )</th>
<th>R</th>
<th>Rotation number ( i/n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0°</td>
<td>45°</td>
<td>0° + 45°</td>
<td>45°</td>
<td>1/8</td>
</tr>
<tr>
<td>2</td>
<td>45°</td>
<td>45°</td>
<td>45° + 45°</td>
<td>90°</td>
<td>2/8</td>
</tr>
<tr>
<td>3</td>
<td>90°</td>
<td>45°</td>
<td>90° + 45°</td>
<td>135°</td>
<td>3/8</td>
</tr>
<tr>
<td>4</td>
<td>135°</td>
<td>45°</td>
<td>135° + 45°</td>
<td>180°</td>
<td>4/8</td>
</tr>
<tr>
<td>5</td>
<td>180°</td>
<td>45°</td>
<td>180° + 45°</td>
<td>225°</td>
<td>5/8</td>
</tr>
<tr>
<td>6</td>
<td>225°</td>
<td>45°</td>
<td>225° + 45°</td>
<td>270°</td>
<td>6/8</td>
</tr>
<tr>
<td>7</td>
<td>270°</td>
<td>45°</td>
<td>270° + 45°</td>
<td>315°</td>
<td>7/8</td>
</tr>
<tr>
<td>8</td>
<td>315°</td>
<td>45°</td>
<td>315° + 45°</td>
<td>360°</td>
<td>8/8</td>
</tr>
</tbody>
</table>
Methods

• Spinning off equation *(not rotating the object)*:

\[ R = m_f + k; \]

where:
- \( m_f \) - is the measure of the angle of rotation in the final moment \( f \) (\( f = 1 \rightarrow n; n = 8 \));
- \( k \) - *constant angle of 0°*;
- \( R \) - measure of the angle of rotation (angle equal measure when finally \( m_f \)).

• Movement equation:

\[ P_{fc}(x_f, y_f, z_f) = P_{ic}(x_i, y_i, z_i) \times s; \quad (x_f > x_i, y_f = y_i, z_f > z_i) \]

where:
- \( P_{fc}(x_f, y_f, z_f) \) - the final position of the camera on coordinates \( x, y, z \);
- \( P_{ic}(x_i, y_i, z_i) \) - the initial position of the camera on coordinates \( x, y, z \);
- \( s \) - constant vector speed
Discussions and conclusions

• **Android 4.2 << Android 5.1 << Android 6.1**

• The distance between headset and the mobile phone and the distance between the two lenses -> mechanically buttons

• Installing the application on mobile phones is easy, being the same as for any other regular applications
Discussions and conclusions

• Gamification, the concept that the application is based on, offers to users the possibility to learn and control the bones of the human skeleton in a realistic mode.

• The application enables the users to learn the bones of the human skeleton in an interactive way and a realistic 3D environment.

• App.apk 1.1 (VR) -> App.apk 2.1 (AR)
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