H-Anim Motion Data Definition

Updates

August 8, 2012

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Agenda

• H-Anim motion definition
  – Topics
  – Scope
  – Concept

• The design method of H-Anim models
Topics (ISO/IEC 19774:2005)

- Foreword
- Introduction
- 1 Scope
- 2 Normative references
- 3 Definitions
- 4 Concepts
- 5 Abstract data types
- 6 Object interfaces
- 7 Conformance
- Annexes
  - A Nominal body dimensions and levels of articulation
  - B Feature points for the human body
  - C VRML binding
  - D X3D binding
  - E Guidelines for H-Anim in VRML and X3D worlds
- Bibliography
Topics (New version)

- Foreword
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  - D X3D binding
  - E Guidelines for H-Anim in VRML and X3D worlds
- F H-Anim Character Modeling Method
- G H-Anim Character Animation Examples

Bibliography
Scope

• Definition of a humanoid character model capable of generating motion from captured motion data
• Definition of a humanoid character model capable of generating motion using 3D scanner data
• Definition of a humanoid character model capable of generating motion using a general motion definition such as keyframe, interpolation, kinematics, and dynamics for human figures
• Definition of motion parameters for transferring or exchanging motion between different human character models
• Definition of a motion data interface for including motion data
• Definition of a motion viewer’s functionality
Definition of a Motion Data Component

- Joint node (update)
  - Define additional fields for motion parameters

- Motion node
  - Define motion captured data for an H-Anim character model
  - Define the motion node after adjusting the center of each joint to the H-Anim character model
Interface Joint {
// the same as the existing joint node
float[3] bboxCenter 0 0 0
float[3] bboxSize -1 -1 -1
float[3] center 0 0 0
sequence<Object> children []
sequence<Object> displacers []
sequence<float[3]> llimit []
float[4] limitOrientation 0 0 1 0
string name ""
float[4] rotation 0 0 1 0
float[3] scale 1 1 1
float[4] scaleOrientation 0 0 1 0
float[3] translation 0 0 0
sequence<float[3]> ulimit []

// define additional fields
int[2] ChannelsNumber
sequence<string> Channels
float[3] Offset
}
Define additional fields: Offset, Channels, ChannelsNumber (new fields)

Interface Joint {

...{
  float[3] Offset
  int[2] ChannelsNumber
  sequence<string> Channels
}

ChannelsNumber: Number of channels at a joint
Channels: Identifiers for channels
Offset: the center of a joint

Example

Joint {
...
Offset [ 1, 3 ]
ChannelsNumber [ 1, 3 ]
Channels “Xrotate Yrotate Zrotate”
}

Web3D Standards Meeting, LA
Definition of Motion Node (a new node)

- Define fields of Frames, FrameTime, transformation Channels

```c
interface Motion {
    int Frames;
    float FrameTime;
    sequence<float> Transformation;
}
```

- Frames: Number of frames for an animation sequence
- FrameTime: Specifies a sampling rate
- Transformation: Transformation values of a joint for each frame

Example

```c
Motion {
    Frames = 601;
    Frametime = 0.033333;
    transformation = [11.623, 31.312, 64.121, -0.700, -4.023, ...,
                     11.616, 31.313, 64.107, -0.696, -3.954, ...,
                     ... ];
}
```
<Scene>
  <NavigationInfo speed="1.5" type="EXAMINE" "ANY"/>
  <HAnimHumanoid DEF="girl1" name="girl1" version="1.1"/>

  <HAnimJoint DEF="hanim_HumanoidRoot" center="0.0 0.0 0.0"
  containerField="skeleton" name="HumanoidRoot"/>

  <HAnimJoint DEF="hanim_sacroiliac" center="0.0 0.0 0.0" name="sacroiliac"
  containerField="children"
  Offset="0.000000 0.000000 0.000000"
  Channels="6, Xposition, Yposition, Zposition, Zrotation, Xrotation, Yrotation" />

  <HAnimSegment DEF="hanimPelvis" name="pelvis" containerField="children"/>
  <Transform translation="0.0 0.0 0.0" rotation="0 0 0 0" scale="0.0 0.0 0.0"
  scaleOrientation="0 0 0 0">
    <Appearance>
      <Material diffuseColor="0.537300 0.196100 0.196100"/>
      <ImageTexture url="girl1.bmp"/>
    </Appearance>
  </Transform>
</Scene>
...  
...  
<HAnimMotion>
<FrameInformation frames ="392" frametime = "0.033333">
<SegmentTransform transform = "
196.1625 71.7332 -58.9121 25.9900 9.3900 -76.6700 29.9100 -61.7800 39.3900 0.1500 30.8300 -
...  
...  
0.3300 -14.2200 -0.2300 2.1900 -4.9100 -21.1400 -5.5400 8.5100 13.4900 -10.7700 ">
</HAnimMotion>
</Scene>
</X3D>
1. Schema definition for Motion data

```xml
<xs:group name="ChildContentModelHumanoidAnimation">
  <xs:annotation>
    <xs:appinfo>Child-node content model corresponding to X3DChildNode for HumanoidAnimation component.</xs:appinfo>
  </xs:annotation>
  <xs:choice>
    <xs:element ref="HAnimHumanoid"/>
    <xs:element ref="HAnimJoint"/>
    <xs:element ref="HAnimSegment"/>
    <xs:element ref="HAnimSite"/>
    <!-- added -->
    <xs:element ref="HAnimMotion"/>
    <!-- added -->
  </xs:choice>
</xs:group>
```
Schema Extension for H-Anim Character Animation (2)

2. Schema definition for the updated Joint node

```xml
<xs:element name="HAnimJoint">
    <xs:annotation>
        <xs:appinfo/>
    </xs:annotation>
    <xs:complexType mixed="false">
        <xs:complexContent mixed="false">
            <xs:extension base="X3DGroupingNode">
                <xs:attribute name="name" type="jointName"/>
                <xs:attribute name="center" type="SFVec3f" default="0 0 0"/>
                <xs:attribute name="rotation" type="SFRotation" default="0 0 1 0"/>
                <xs:attribute name="scale" type="SFVec3f" default="1 1 1"/>
                <xs:attribute name="scaleOrientation" type="SFRotation" default="0 0 1 0"/>
                <xs:attribute name="translation" type="SFVec3f" default="0 0 0"/>
                <xs:attribute name="skinCoordIndex" type="MFInt32"/>
            </xs:extension>
        </xs:complexContent>
    </xs:complexType>
</xs:element>
```
<xs:attribute name="skinCoordWeight" type="MFFloat"/>
<xs:attribute name="llimit" type="MFFloat"/>
<xs:attribute name="ulimit" type="MFFloat"/>
<xs:attribute name="limitOrientation" type="SFRotation" default="0 0 1 0"/>
<xs:attribute name="stiffness" type="MFFloat" default="0 0 0"/>

<!- added -->
  <xs:attribute name="Offset" type="SFVec3f"/>
  <xs:attribute name="ChannelsNumber" type="MFInt32"/>
  <xs:attribute name="Channels" type="MFString"/>

<!- added -->
</xs:extension>
</xs:complexType>
</xs:element>
3. Schema definition for the Motion node

```xml
<!- added -->
<xsl:element name="HAnimMotion">
  <xsl:annotation>
    <xsl:appinfo/>
    <xsl:documentation source="...">
  </xsl:annotation>
</xsl:element>
<xsl:complexType>
  <xsl:attribute name="DEF" type="xs:ID" use="required"/>
  <xsl:attribute name="Frames" type="SFInt32" use="required"/>
  <xsl:attribute name="Frametime" type="SFFloat" use="required"/>
  <xsl:attribute name="Transformation" type="MFVec3f" use="required"/>
  <!- -->
  <xsl:attribute name="Transformation" type="MFRotation" use="required"/>-->
</xsl:complexType>
</xsl:element>
```
H-Anim Characters

1. Jin
2. Chul
3. Hyun
4. Young
5. Ju
6. Ga
7. No
8. Da
9. Ru
10. Mi
A Procedure for Modeling an H-Anim Character Using General Graphics Tools

- Modeling guideline
- Character modeling
- General graphics tools such as 3ds Max or Maya
- wrl

- H-Anim modeling part
- Motion definition part
- New H-Anim format
1. Uniquely identify each segment according to the naming scheme of H-Anim.
2. Integrate all the segments to form a complete character.
3. Store the designed character as a wrl or x3d file if the general graphics tool has the capability to save the file in either of these formats. Otherwise, use a converter to store the data in the appropriate format.
4. Convert the wrl character file into an H-Anim character file in the H-Anim format (an x3d H-Anim file). This x3d file is different from other general X3D objects because it has the H-Anim structure format. It includes all the segments and joints with their identified H-Anim component names.
H-Anim modeling file

```xml
<Scene>
  <HAnimHumanoid DEF="sample" name="humanoid" version="1.1">
    <HAnimJoint DEF="hanim_HumanoidRoot" center="0 -0.9232 -82.4" containerField="skeleton" name="HumanoidRoot">
      <HAnimJoint DEF="hanim_sacroiliac" center="0 -3.596 -91.49" name="sacroiliac" containerField="children">
        <HAnimSegment DEF="hanim_pelvis" name="pelvis" containerField="children">
          <Transform translation="-7.927 75.275 9.033">
            <Shape>
              <IndexedFaceSet coordIndex="0, 1, 2, -1, 3, 4, -1" creaseAngle="1.14">
                <Coordinate point="-10.56 -10.15 0.8157, 5.137 -10.15 2.444, -10.07 -10.15 -4.413, 5.137 -10.15 -2.444"/>
              </IndexedFaceSet>
            </Shape>
            <Appearance>
              <Material diffuseColor="0.3412 0.8784 0.5608"/>
            </Appearance>
          </Transform>
        </HAnimSegment>
      </HAnimJoint>
    </HAnimJoint>
    <HAnimSegment DEF="hanim_l_thigh" name="l_thigh">
      <Transform translation="4.586 74.82 20.263">
        <Shape>
          <IndexedFaceSet coordIndex="2, 0, 3, -1, 1, 3, 0, -1, 9, 8, 11, -1, 10, 11, 8, -1,
```
5. Read a motion capture file and apply it to the H-Anim character model. Our H-Anim motion viewer includes the function of motion retargeting which can applies the motion of each joint of the motion captured model to the motion of a corresponding joint of the designed H-Anim character model. The motion viewer displays an animation sequence from the H-Anim character model and a motion capture file.
6. The motion viewer can save the animation sequence as an animation file (hanim extension) which has the format of the H-Anim motion data definition. The following figure shows the interface to save an H-Anim animation file after generating an animation sequence.
<table>
<thead>
<tr>
<th>Motion Capture (BVH)</th>
<th>H-Anim Animation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Motion Capture" /> <img src="image2" alt="Motion Capture" /> <img src="image3" alt="Motion Capture" /> <img src="image4" alt="Motion Capture" /></td>
<td><img src="image5" alt="H-Anim Animation" /> <img src="image6" alt="H-Anim Animation" /> <img src="image7" alt="H-Anim Animation" /> <img src="image8" alt="H-Anim Animation" /></td>
</tr>
</tbody>
</table>

H-Anim Character Animation Example
H-Anim Motion Viewer

- Read an H-Anim character model and motion captured data
- Adjust segment lengths of the mocap character to the H-Anim character
- Generate and display the motion captured animation for the H-Anim character
- Generate an H-Anim animation file including the H-Anim character model with the motion captured data

Hanim.x3d

Motion.bvh

Hanim Viewer

NewHanim.hanim