

**ISO/IEC JTC1 SC24 WG6**

# Supporting AR & MR Visualization in X3D Standard – Updates

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# AR WG in Web3D Consortium

- Started up and running since June 2011
- Co-chairs:
  - Gun Lee (HIT Lab NZ), Yvonne Jung (Fraunhofer IGD)
- Final goal is to produce a unified proposal to extend X3D specification for AR and MR applications
- Tasks
  - Requirement and use cases – August 17, 2011 - Done
  - Comparison of X3D AR proposals - Final editing March, 2012 - Done
  - From March 2012, developing plan to merge proposals – Done
  - Develop unified proposal - Doing

[http://www.web3d.org/x3d/wiki/index.php/X3D\\_and\\_Augmented\\_Reality](http://www.web3d.org/x3d/wiki/index.php/X3D_and_Augmented_Reality)

# Web3D AR WG – Requirements & Use cases

[http://www.web3d.org/x3d/wiki/index.php/X3D\\_AR\\_Requirements\\_and\\_Use\\_cases](http://www.web3d.org/x3d/wiki/index.php/X3D_AR_Requirements_and_Use_cases)

## ■ Requirements

- Functional requirements
  - Supporting image (camera) sensors, live video background and textures, tracking camera motion, camera calibration, correct image synthesis
- Non-functional requirements
  - Simplicity and extensibility

## ■ Use cases

- Augmented Reality applications,
  - where live video stream is shown on the background and the 3D scene is shown as registered in the physical space of the live video stream.
- Augmented Virtuality (or virtual studio) applications,
  - where live video stream of physical objects can be placed within the 3D scene.

# Web3D AR WG – Compare & merge proposals

[http://www.web3d.org/x3d/wiki/index.php/Comparison\\_of\\_X3D\\_AR\\_Proposals](http://www.web3d.org/x3d/wiki/index.php/Comparison_of_X3D_AR_Proposals)

- Comparison of X3D AR proposals from Korea Chapter and Fraunhofer IGD
  - Trade off between simplicity and flexibility/extensibility
    - KC proposes on higher level AR/MR focused features, while Instant Reality has lower-level multi-purpose nodes
- Based on this comparison, currently, AR WG is discussing how to merge the X3D AR proposals.

# Comparison Table (1/2)

Table 1. Comparison of X3D AR proposals ( <b>Bold</b> : newly proposed nodes, <i>Italic</i> : modification to standard nodes)			
	<b>Proposal KC1</b>	<b>Proposal KC2</b>	<b>Proposal IR</b>
Using Live Video stream as a texture	<i>MovieTexture</i> node ( or optionally with routing from <b>CameraSensor</b> node)	<b>LiveCamera</b> node, routing to a <i>PixelTexture</i> node	<b>IOSensor</b> node, routing to a <i>PixelTexture</i> node
Using Live Video stream as a background	<b>MovieBackground</b> node ( or optionally with routing from <b>CameraSensor</b> node)	<b>LiveCamera</b> node + <i>TextureBackground</i> node	<b>IOSensor</b> node + <b>PolygonBackground</b> node (or optionally <b>ImageBackground</b> node)
Supporting color keying in texture	<i>MovieTexture</i> node	N/A	N/A (use general shader support)
Retrieving tracking information	<b>CameraSensor</b> node	<b>ImagePatch</b> and <b>GPSSensor</b> node	<b>IOSensor</b> node
Using tracking information to change 3D scene	routing tracking data from <b>CameraSensor</b> node	routing tracking data from <b>ImagePatch</b> and <b>GPSSensor</b> nodes + events generated by <b>VisibilitySensor</b> and <b>RangeSensor</b> nodes	routing tracking data from <b>IOSensor</b> node

# Comparison Table (2/2)

Table 1. Comparison of X3D AR proposals ( <b>Bold</b> : newly proposed nodes, <i>Italic</i> : modification to standard nodes)			
	<b>Proposal KC1</b>	<b>Proposal KC2</b>	<b>Proposal IR</b>
Retrieving camera calibration (internal parameters) information	<b>CameraSensor</b> node	<b>LiveCamera</b> node	<b>IOSensor</b> node
Using calibration information to set properties of (virtual) camera	<b>MatrixViewpoint</b> node	<i>Viewpoint</i> node	<b>Viewfrustum</b> and <i>Viewpoint</i> nodes (alternatively <b>MatrixTransform</b> node)
Specifying nodes as physical object representatives	<b>GhostGroup</b> node	N/A	<b>ColorMaskMode</b> and <i>Appearance</i> nodes (together with sortKey field)

- Not only overlapping, but also complementing

# Common fundamental features

- ImageSensor
  - HTML5 navigator.getUserMedia()
  - X3DOM
- ImageBackground
  - Or video background
- Viewfrustum
  - Detailed control of projection parameters
- Tracking Sensors
  - PositionSensor, OrientationSensor
- High-Level Interaction
  - Reuse environmental Sensors
    - VisibilitySensor, ProximitySensor, etc.

# Plans for Merging Proposals

- [http://web3d.org/x3d/wiki/index.php/Plans for Merging X3D AR Proposals](http://web3d.org/x3d/wiki/index.php/Plans_for_Merging_X3D_AR_Proposals)

## 1. Discuss general strategy/policy/guidelines

- Revise non-functional requirement

## 2. Produce a merged proposal for each functional components

- Investigate each functional features stepwise:
  - Camera video stream image into the scene (texture and background)
  - Tracking (including support for general tracking devices)
  - Camera calibration (viewpoints)
  - Others (color-keying, depth occlusion)

## 3. Check Integrity of the merged proposal

- Check and resolve conflicts between individual functional components
- Merge overlapping features between individual functional components

## 4. Specification writing

## 5. Review

# Strategy/Guidelines for Merging

- Try to reuse/extend existing nodes as much as possible
  - Specify a default value/behavior for new field/feature backward compatibility.
  - For consistency, mixing multiple functions into a single node should be avoided.
- Device independence must be kept
  - The scene description should be independent from the hardware/software environment (type of tracker, camera device, browser, etc.)
  - Detail hardware configuration should be adopted to or reconfigured by the users' hardware/software environment
  - The scene description should only specify generic type/role of interface (e.g. position tracker, orientation tracker, video source)
  - Identifying devices by high level feature (usage or generic setup, e.g. main camera, front facing camera, back facing camera), not by low level features (e.g. UUID, device number, port)
- Balance between simplicity and detail control
  - Specify default values/behaviors to provide simplicity with detailed control.
- Follow the naming convention in current specification
- New features must include examples/use cases that show the validity of its compatibility with other features of X3D.

=> Fed into Non-functional Requirements

# Web3D AR WG – Summary and Next Steps

- Use cases and requirement specification ✓
- Comparison between proposals ✓
- Merge multiple proposals into one
  - Discuss general strategy/policy/guidelines => NFR ✓
  - Produce a merged proposal for each functional components
  - Check Integrity of the merged proposal
  - Specification writing and review
- Trying to be included in X3D v3.4

Thank you!