



X3D Physical Sensors

Web3D Korea Chapter Meeting at SIGGRAPH Web3D BoF

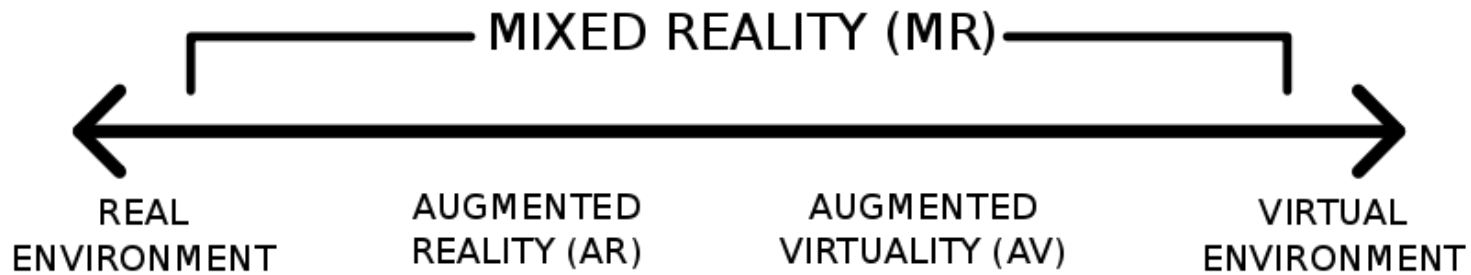
Vancouver, Canada

August 11, 2014

Myeong Won Lee

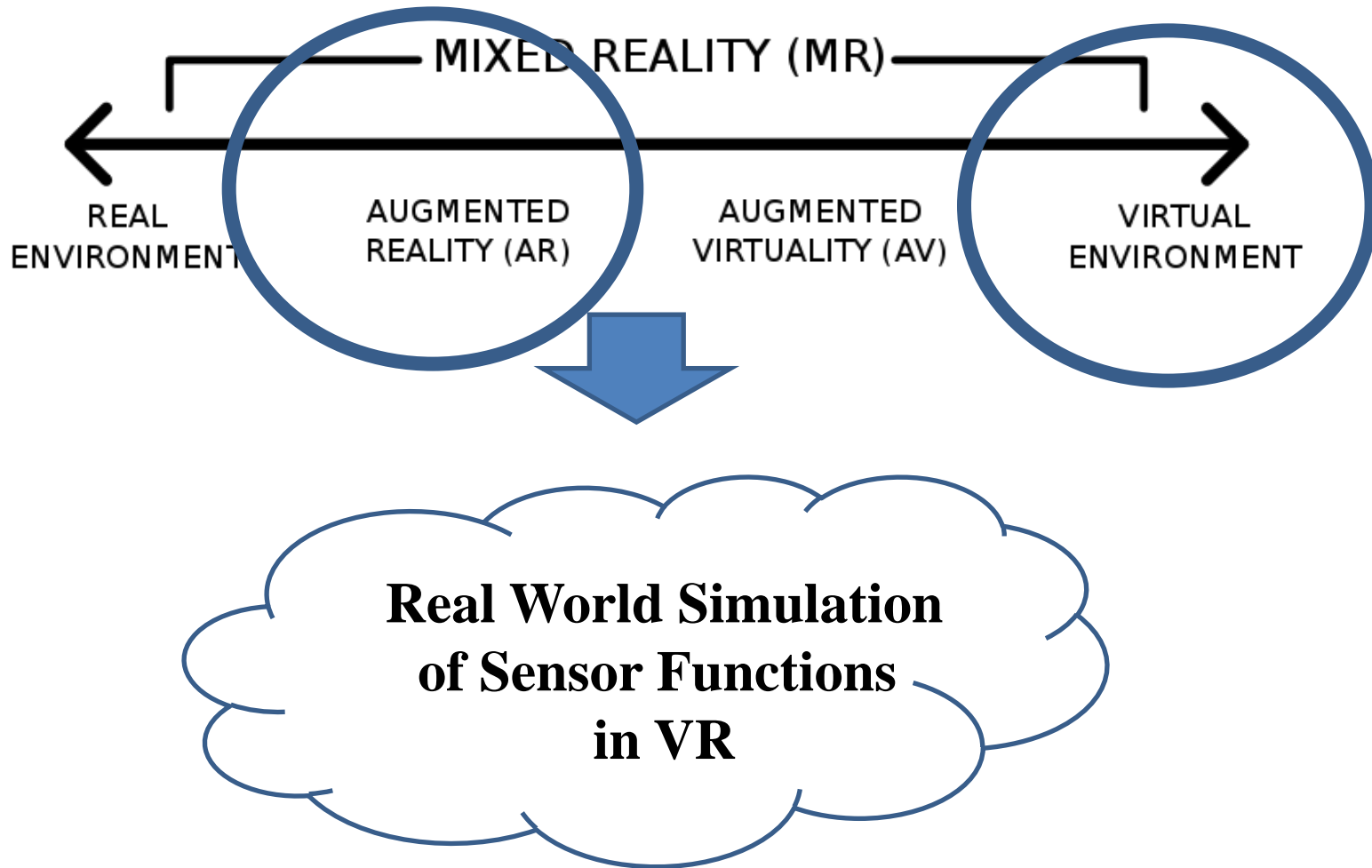
The University of Suwon

Physical Sensor Representation in X3D

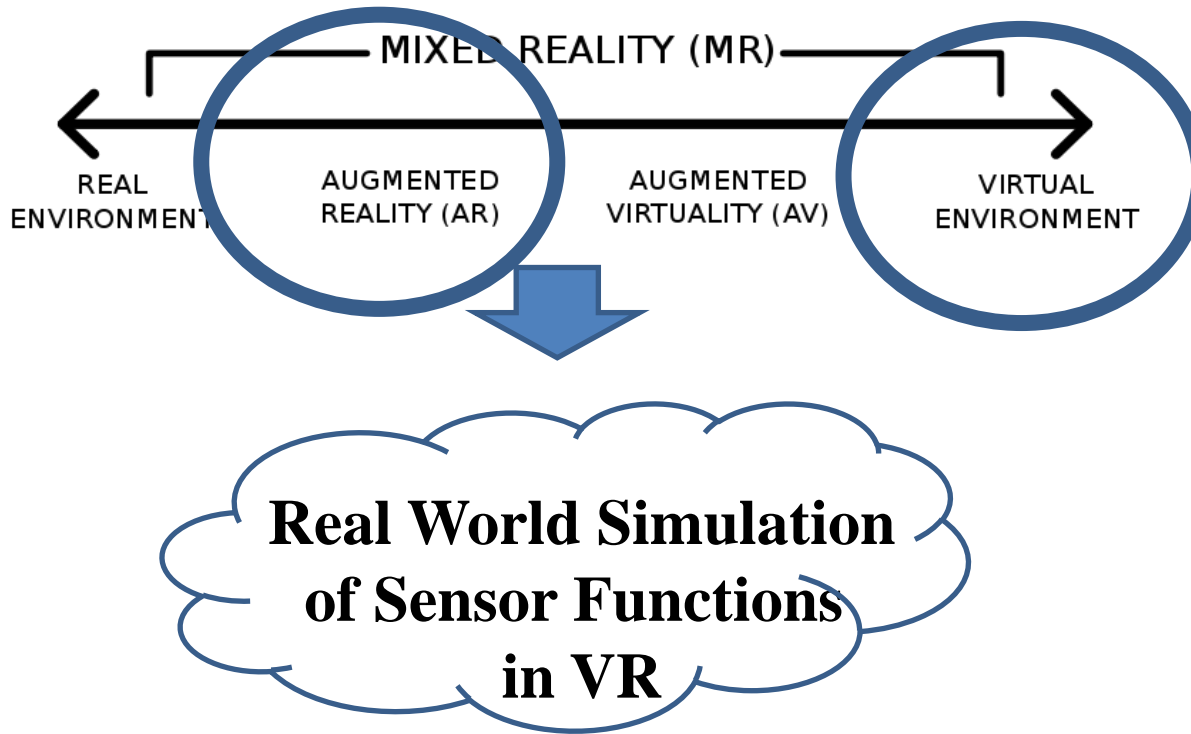


**Real World Simulation
in VR**

Physical Sensor Representation in X3D



Physical Sensor Representation in X3D



GOAL:
Physical Sensor Management Using 3D VR Scenes

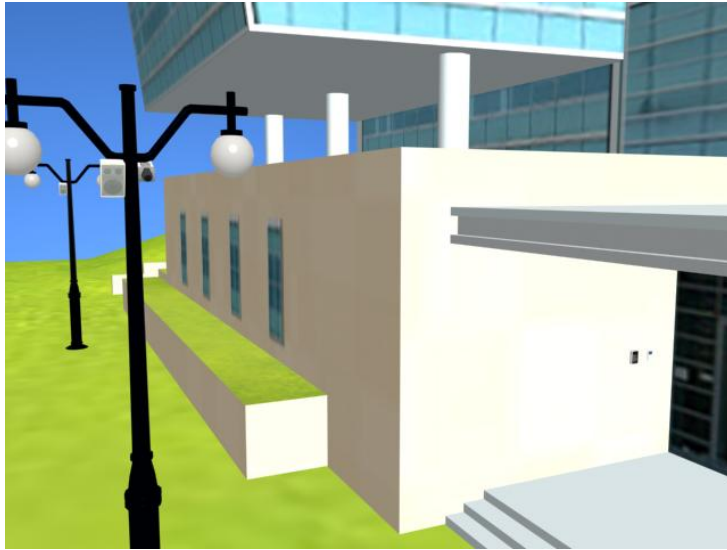
Before and After in X3D VR

- Before
 - 3D representation of real object appearance
 - Modeling, rendering, and animation for 3D appearance in VR
 - Focus on appearance as in the real world
- After
 - 3D simulation and representation of real object functions
 - Modeling, rendering, and animation for 3D simulation in VR
 - Focus on real world simulation and 3D functional representation

X3D Physical Sensor and ISO/IEC NP 18521-2

- ISO/IEC NP 18521-2
 - Augmented reality continuum concepts and reference model - Part 2: Physical sensors
 - ISO/IEC JTC 1/SC 24/WG 9 NWIP
- X3D Physical sensor
 - X3D definition and implementation of the concepts in the WG9 physical sensors reference model
 - New proposal for ISO/IEC JTC 1/SC 24/WG6 NWIP

Physical sensors in VR



Camera sensor



Chemical sensor



Electric sensor



Environment sensor



Flow sensor



Light sensor

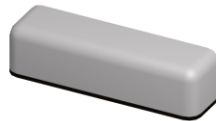


Navigation sensor

2014-8-11



Pressure sensor



Proximity sensor



Sound sensor



Temperature sensor



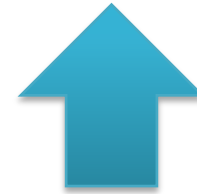
Objectives of X3D Physical Sensors

- Representation of physical properties of each physical sensor
- Define X3D objects with physical sensors using physical properties
- Event processing for each physical sensor using the state of the physical sensor device

Physical Sensors

- Camera Sensor
- Chemical Sensor
- Electric Sensor
- Environment Sensor
- Flow Sensor
- Force Sensor
- Light Sensor
- Movement Sensor
- Navigation Sensor
- Particle Sensor
- Position Sensor
- Pressure Sensor
- Proximity Sensor
- Sound Sensor
- Temperature Sensor

Representation
of physical
functions
of each physical
sensor in a 3D scene

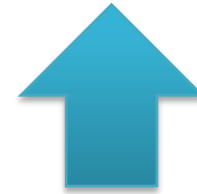


GOAL

Physical Sensors in X3D

- Camera Sensor
- Chemical Sensor
- Electric Sensor
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- Temperature Sensor

Representation
of physical
functions
of each physical
sensor in a 3D scene



GOAL

Camera Sensor

- Requires a 3D object to represent the camera sensor and a camera functions user interface to control and change the 3D scene
- Simulation procedure
 - Process the state of the camera with On/Off
 - Represent a camera event
 - Process an intelligent camera event
 - Represent and process physical properties of the camera
- Examples
 - CCTV, phone camera, standard camera

Environment Sensor

- Requires a 3D object to represent the environment sensor and a functions user interface to display and control the sensor and to change the scene
- Simulation procedure
 - Process the state of an environment sensor device with On/Off
 - Acquire and represent changing weather information from the device, including temperature and humidity
 - Represent and process physical properties of the device
- Examples
 - Thermometer, hygrometer

Light Sensor

- Requires a 3D object to represent the light sensor and a light functions user interface to control and change the 3D scene
- Simulation procedure
 - Represent the state of the physical light sensor
 - Represent light information such as physical intensity, location, orientation, material, etc.
 - Event processing from a physical light
- Examples
 - Fluorescent light, streetlight

Navigation Sensor

- Requires a 3D object to represent or include the navigation sensor and a functions user interface to control and change the 3D scene
- Simulation procedure
 - Process the state of the navigation sensor with On/Off
 - Acquire navigation information events such as GPS
 - Represent and control navigation information from the sensor
- Examples
 - Magnetic compass, GPS

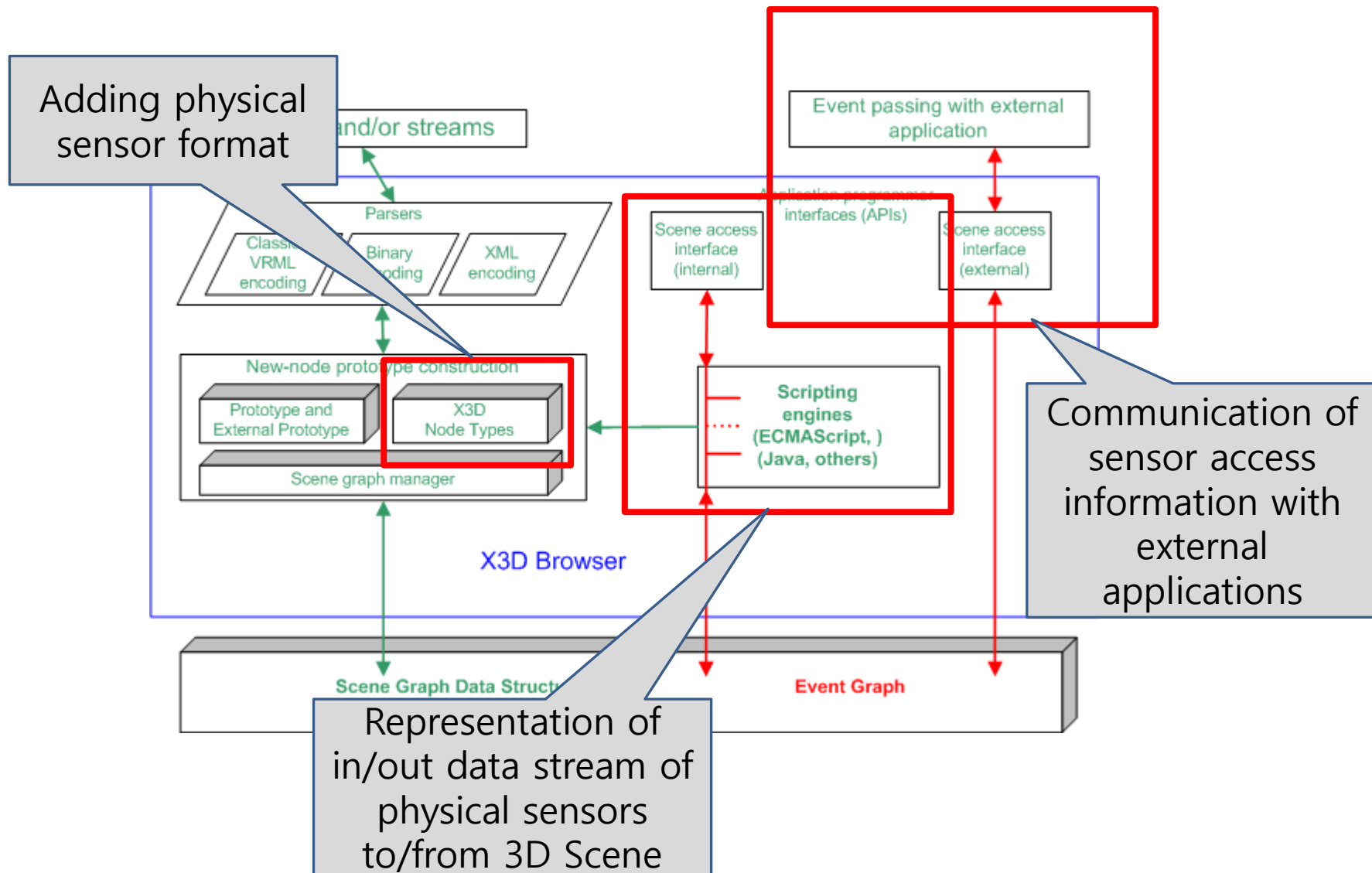
Position Sensor

- Requires a 3D object to represent or include the position sensor and a functions user interface to control and change the 3D scene
- Simulation procedure
 - Process the state of the position sensor with On/Off
 - Acquire location information events
 - Represent and control location information from the position sensor
- Examples
 - Range finder, telemeter, angle finder, measuring instrument

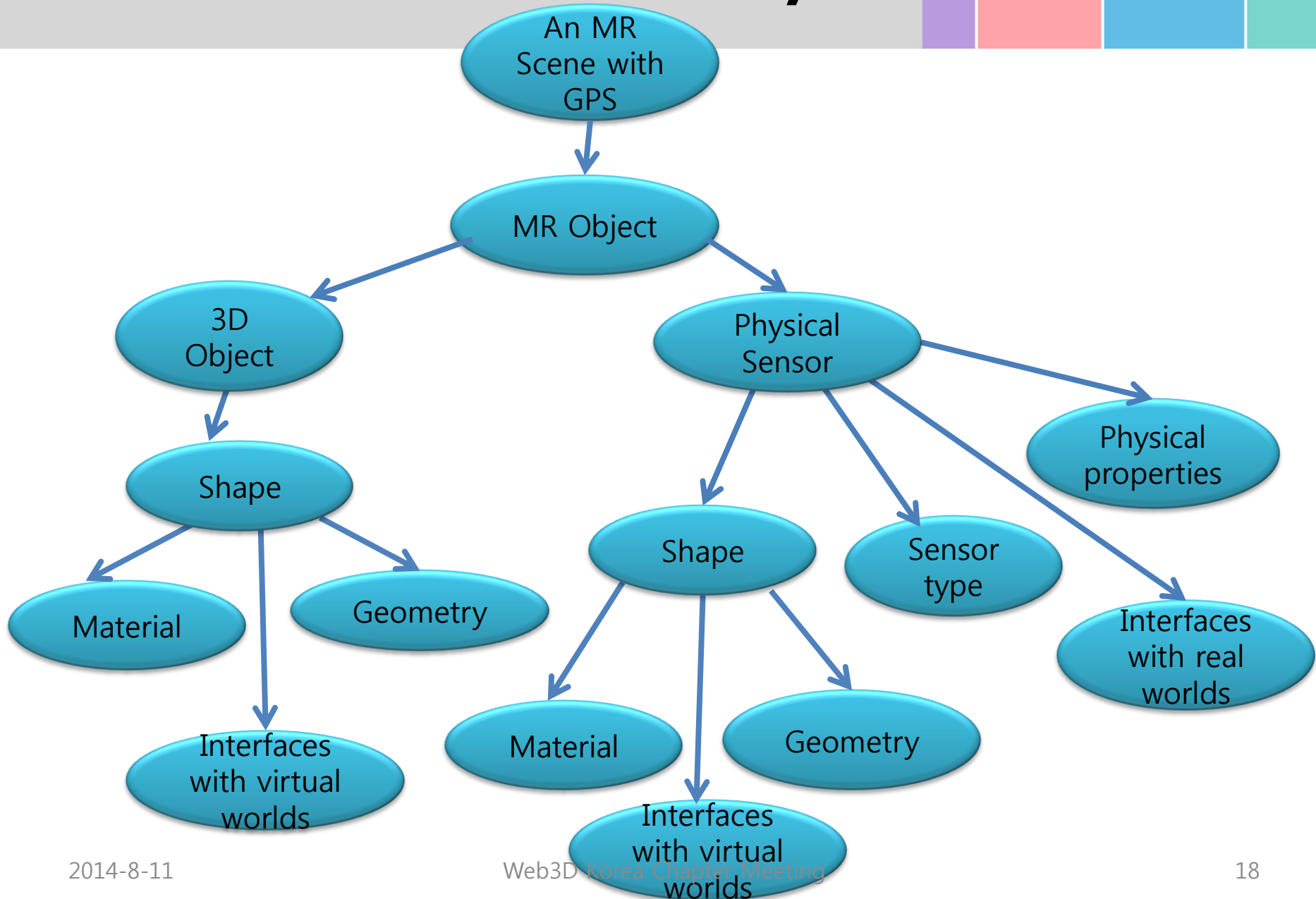
Sound Sensor

- Requires a 3D object to represent the sound sensor and a sound functions user interface to control and change the 3D scene
- Simulation procedure
 - Process the state of the sound with On/Off
 - Represent and control sound device events
 - Represent sound information through sound devices such as speakers or microphones
- Examples
 - Speaker, microphone

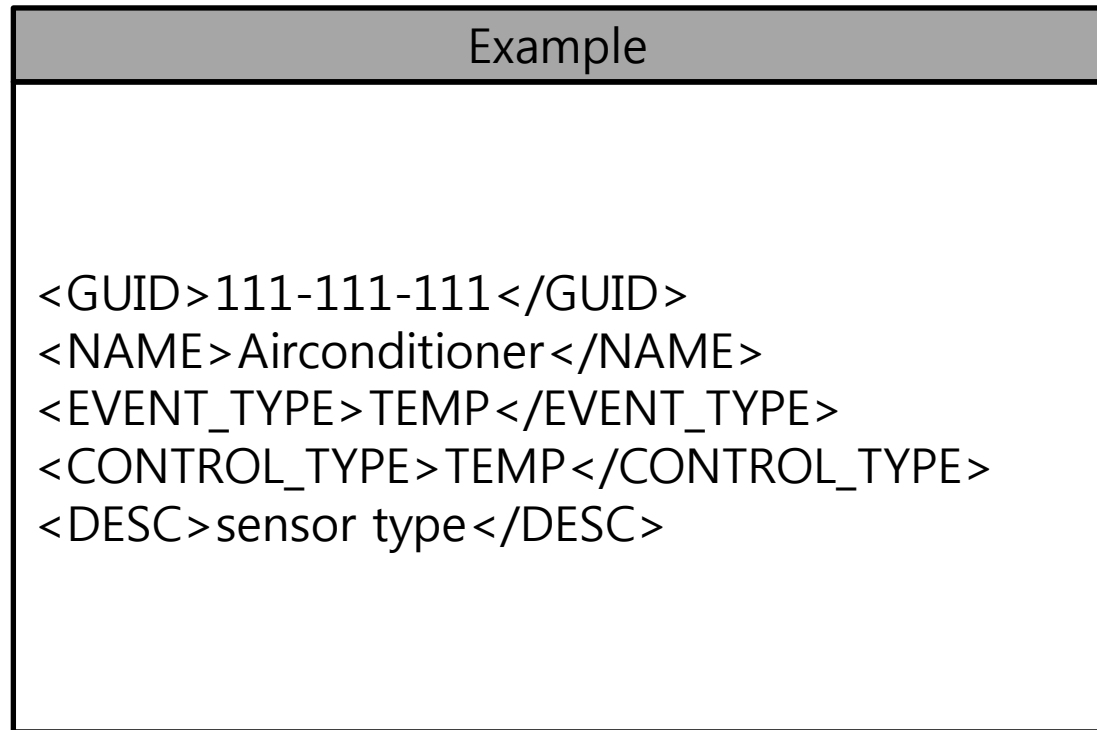
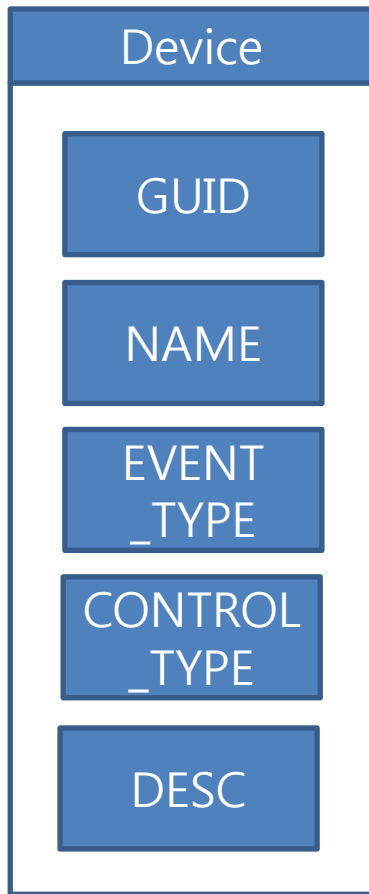
X3D Physical Sensor Architecture



Scene Structure for Physical Sensors



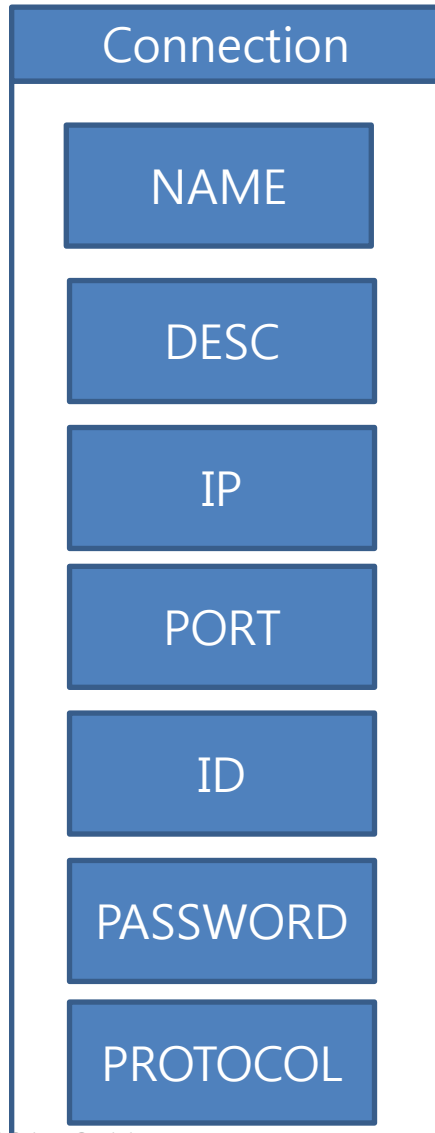
Physical Sensor Device Information



Physical Sensor Device Description

Device Info Fields	Device Properties
GUID	Unique ID for recognizing a device (Globally Unique Identifier, Implementation of universally unique identifier (UUID))
NAME	Device name
EVENT_TYPE	Available data type that can access a physical sensor device
CONTROL_TYPE	Available data type that can send to a physical sensor device
Description	Additional description of a physical sensor device

Physical Sensor Connection Information

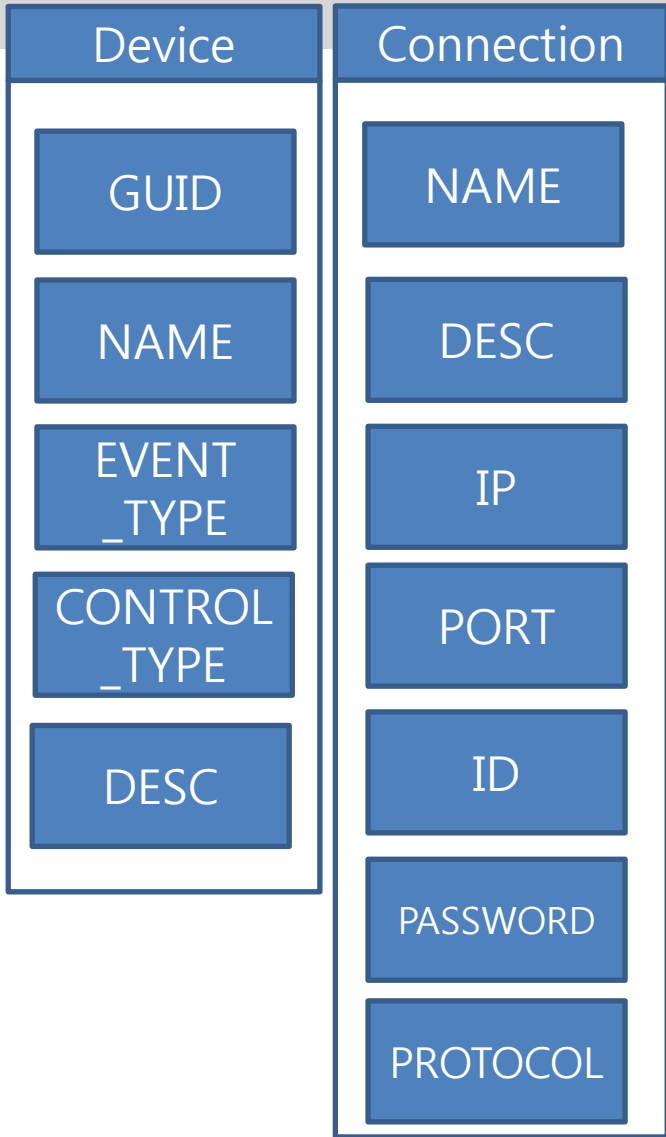


Example
<pre><NAME>Airconditioner manager</NAME> <DESC>Connection info</DESC> <IP>1.1.1.1</IP> <PORT>8080</PORT> <ID>user1</ID> <PASSWORD>pass1</PASSWORD> <PROTOCOL>TCP</PROTOCOL></pre>

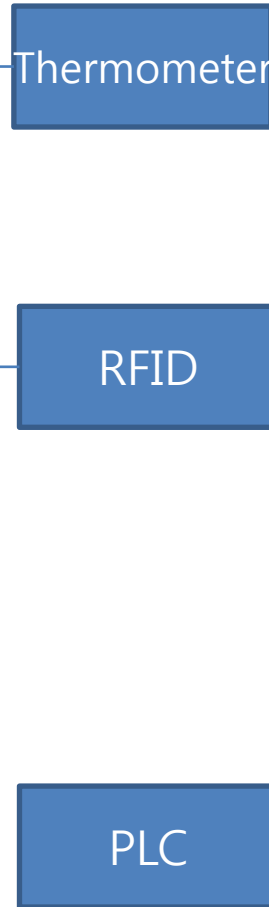
Physical Sensor Connection Description

Connection Info Fields	Physical Sensor Device Connection Information
NAME	Name related to connection information
DESC	Description of connection information
IP	IP address for a physical sensor device
PORT	Port for a physical sensor device
ID	User account for accessing a physical sensor device
PASSWORD	User account password for accessing a physical sensor device
PROTOCOL	Communication protocol

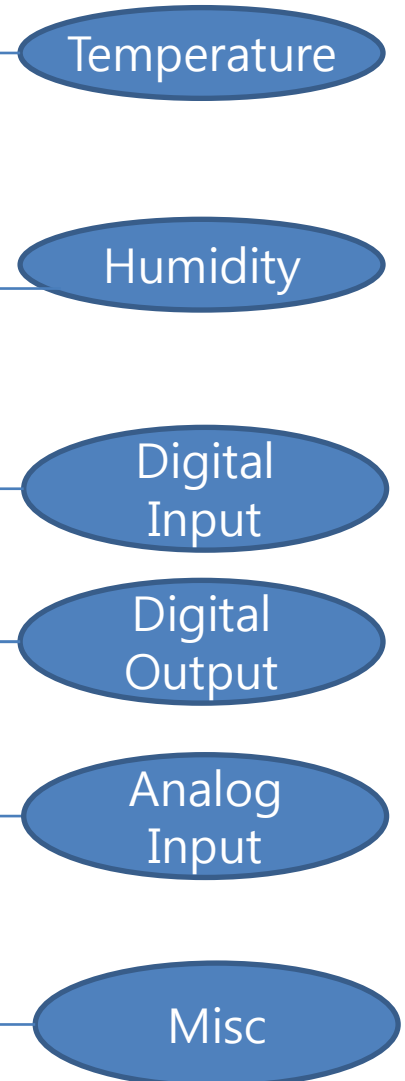
Physical Sensor's Physical Info



User Defined

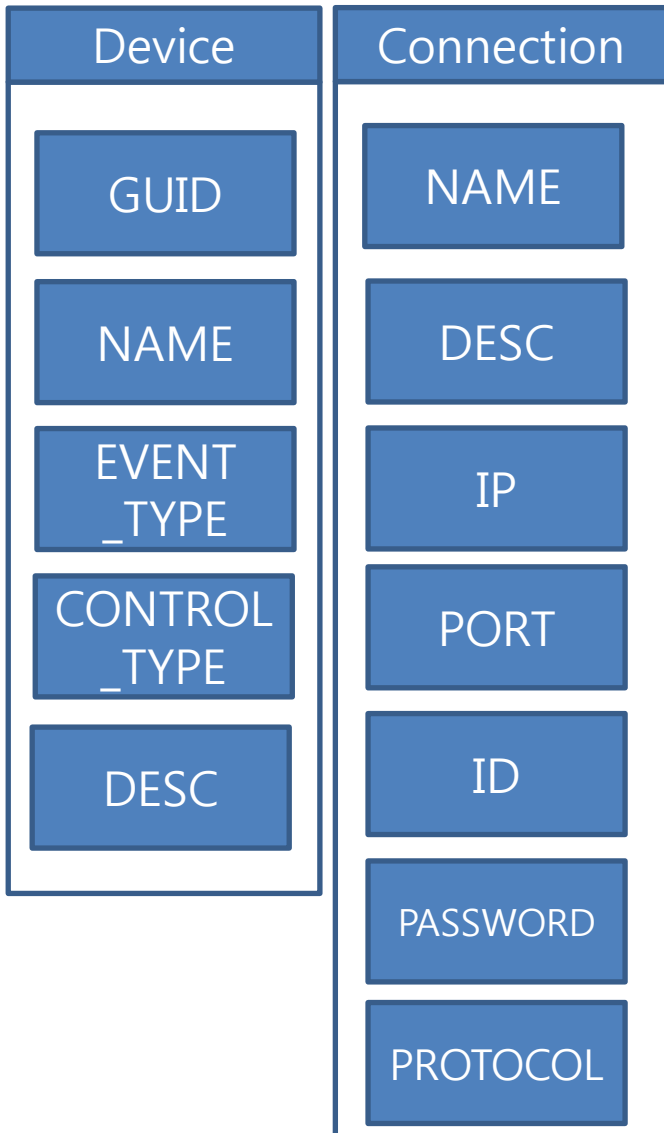


Detailed Type Definition



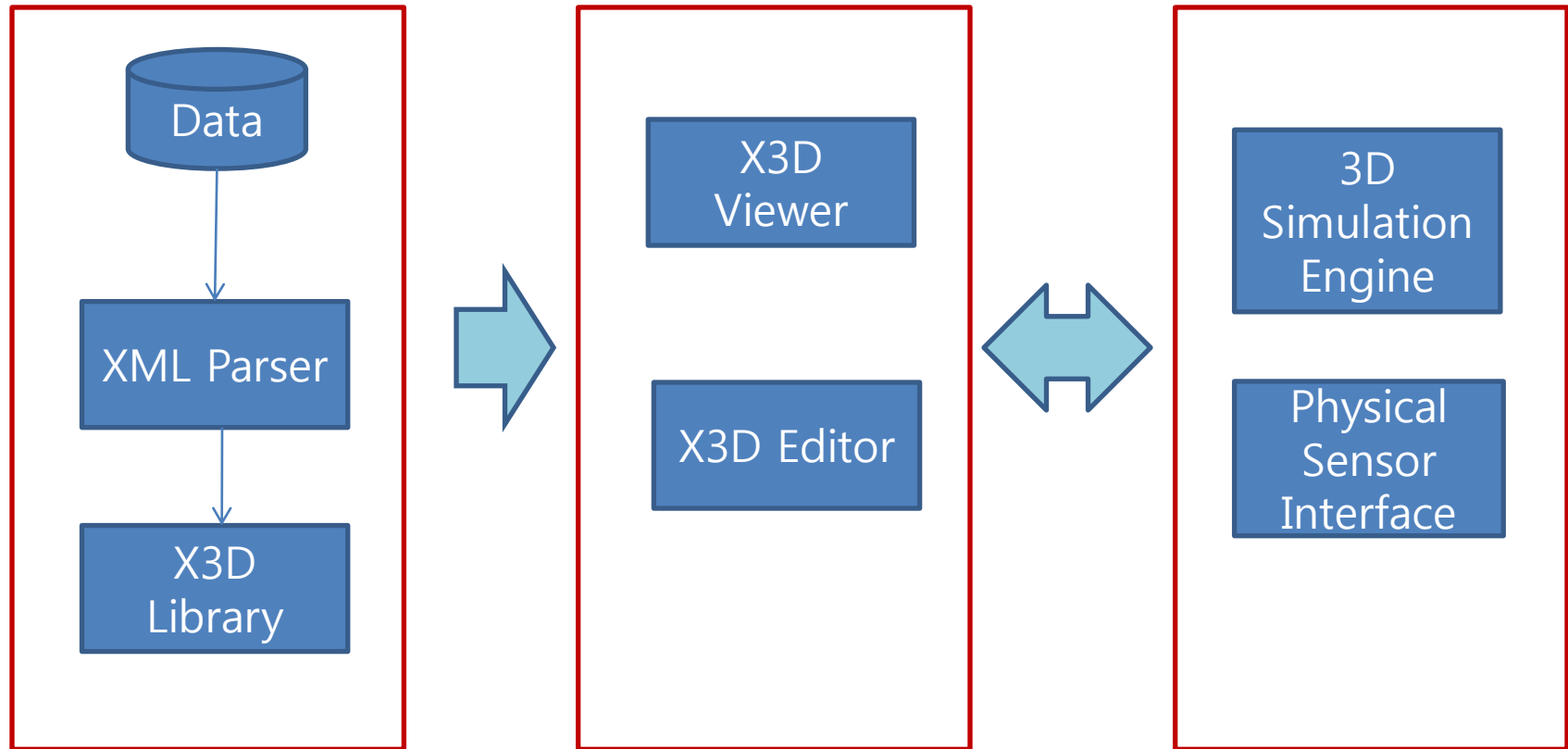
Data Structure of Physical Sensor Properties in a Scene

Physical Sensor's Physical Info



```
<Physical Properties of a Physical Sensor>  
  <Device>  
    <GUID>  
    <Name>  
    <EventType>  
    <ControlType>  
    <Desc>  
  <Connection>  
    <Name>  
    <Desc>  
    <IP>  
    <Port>  
    <ID>  
    <Password>  
    <Protocol>
```


Implementation of an X3D Physical Sensor Viewer

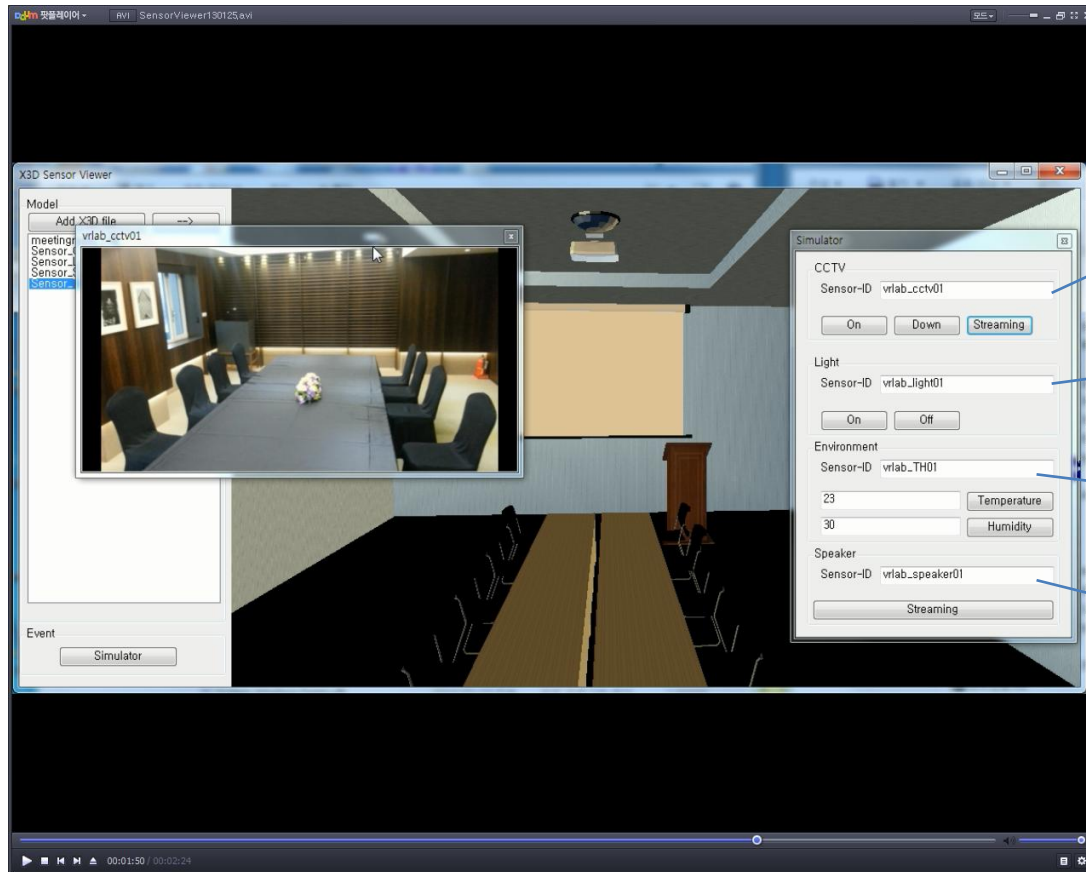


- X3D document parsing
- Generate X3D geometric data for 3D representation using X3D library

- Display X3D geometric data
- Edit X3D and physical sensors

- Include all libraries for displaying X3D data
- Physical sensors interface
- UI library

X3D Physical Sensor Viewer (1)



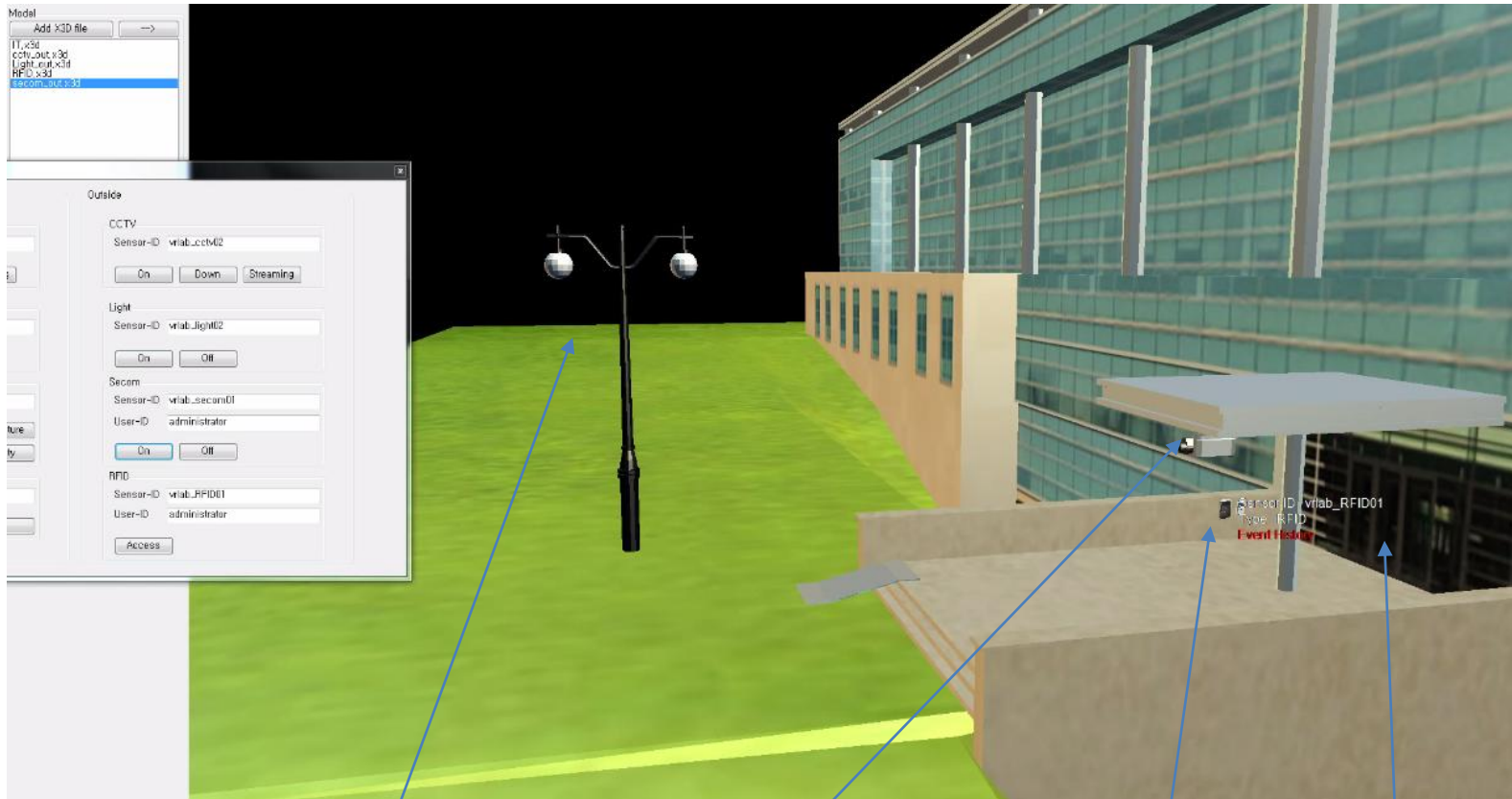
Camera sensor

Light sensor

Environment sensor

Sound sensor

X3D Physical Sensor Viewer (2)



Light sensor

Camera sensor

Electric sensor

Proximity sensor

Conclusions

- X3D based physical sensor representation
- Extended data definition for representing and simulating physical sensors in X3D
- Scene graph definition including physical sensors
- Definition of physical properties of each physical sensor
- Implementation of a physical sensor viewer and user interface for each type of physical sensor