INTERNATIONAL STANDARD

ISO/IEC 23005-5

First edition
2011-08-01

Information technology — Media context and control —

Part 5: Data formats for interaction devices

Technologies de l'information — Contrôle et contexte de supports —

Partie 5: Formats des données pour dispositifs d'interaction

Reference number
ISO/IEC 23005-5:2011(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

ISO/IEC 23005-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 23005 consists of the following parts, under the general title *Information technology — Media context and control*:

— *Part 1: Architecture*

— *Part 2: Control information*

— *Part 3: Sensory information*

— *Part 4: Virtual world object characteristics*

— *Part 5: Data formats for interaction devices*

— *Part 6: Common types and tools*

— *Part 7: Conformance and reference software*

Introduction

ISO/IEC 23005 (MPEG-V) provides an architecture and specifies associated information representations to enable interoperability between virtual worlds, e.g. digital content provider of a virtual world, gaming (serious), simulation, DVD, and the real world, e.g. sensors, actuators, vision and rendering, robotics (e.g. for revalidation), (support for) independent living, social and welfare systems, banking, insurance, travel, real estate, rights management and many others.

Virtual worlds (often referred to as 3D3C for 3D visualization and navigation and the 3Cs of Community, Creation and Commerce) integrate existing and emerging media technologies (e.g. instant messaging, video, 3D, VR, AI, chat, voice, etc.) that allow for the support of existing and the development of new kinds of social networks. The emergence of virtual worlds as platforms for social networking is recognized by businesses as an important issue for at least two reasons:

1) it offers the power to reshape the way companies interact with their environments (markets, customers, suppliers, creators, stakeholders, etc.) in a fashion comparable to the Internet;

2) it allows for the development of new (breakthrough) business models, services, applications and devices.

Each virtual world, however, has a different culture and audience making use of these specific worlds for a variety of reasons. These differences in existing Metaverses permit users to have unique experiences. Resistance to real-world commercial encroachment still exists in many virtual worlds, where users primarily seek an escape from real life. Hence, marketers should get to know a virtual world beforehand and the rules that govern each individual universe.

Although realistic experiences have been achieved via devices such as 3D audio/visual devices, it is hard to realize sensory effects only with presentation of audiovisual contents. The addition of sensory effects leads to even more realistic experiences in the consumption of audiovisual contents. This will lead to the application of new media for enhanced experiences of users in a more realistic sense.

Such new media will benefit from the standardization of control and sensory information which consists of sensory effect metadata, sensory device capabilities/commands, user sensory preferences, and various delivery formats. The MPEG-V architecture can be applicable for various business models for which audiovisual contents can be associated with sensory effects that need to be rendered on appropriate sensory devices.

This part of ISO/IEC 23005 contains the tools for exchanging information for interaction devices. To be specific, it specifies normative command formats for controlling sensory devices and data formats for receiving information from sensors. It also specifies some non-normative examples.

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

ISO and the IEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured ISO and the IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and the IEC. Information may be obtained from the companies listed in Annex B.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified in Annex B. ISO and the IEC shall not be held responsible for identifying any or all such patent rights.

Information technology — Media context and control —

Part 5:
Data formats for interaction devices

1 Scope

This part of ISO/IEC 23005 specifies syntax and semantics of the data formats for interaction devices, i.e., Device Commands and Sensed Information, required for providing interoperability in controlling interaction devices and in sensing information from interaction devices in real as well as virtual worlds as depicted in Figure 1.

This part of ISO/IEC 23005 aims to provide data formats for industry-ready interaction devices: sensors and actuators. The same data formats for interaction devices can be utilized by various applications supported by different MPEG technologies. Not only ISO/IEC 23005 but also other International Standards such as ISO/IEC 23007 (MPEG-U) and scene representation specifications (for example ISO/IEC 14496-20) can simply refer to this part of ISO/IEC 23005 to use the defined data formats.

Two cases can occur for controlling a virtual world by using the MPEG tools. When the virtual world is using a scene description defined by MPEG tools (BIFS, Laser, etc.), the sensors and actuators can be directly connected to it through an MPEG-U interface. When the virtual world is defined by non MPEG tools, an adaptation engine and common formalism for effects are needed. In Figure 1, the first case is illustrated by VirtualWorld2 and the second by VirtualWorld1.

When this part of ISO/IEC 23005 is used in the context of pure ISO/IEC 23005, the adaptation engine (RV or VR engine), which is not within the scope of standardization, performs bi-directional communications using data formats specified in this part of ISO/IEC 23005. The adaptation engine can also utilize other tools defined in ISO/IEC 23005-2, which are user's sensory preferences (USP), sensory devices capabilities (SDC), and sensor capabilities (SC), for fine controls of devices in both real and virtual worlds.

On the other hand, the defined data formats (Sensed Information and Device Command) can be mapped to MPEG-U defined interfaces when this part of ISO/IEC 23005 is utilized in the context of other standards such as MPEG-U Framework. For example, the interface can be provided as ISO/IEC 23007-2 in the context of MPEG-U. Also defined, Sensed Information can be used by scene representation specifications as input data formats for a scene. The Device Command data format can also be used as output data formats to communicate with the outer world by mapping onto the interfaces defined in specific specifications.

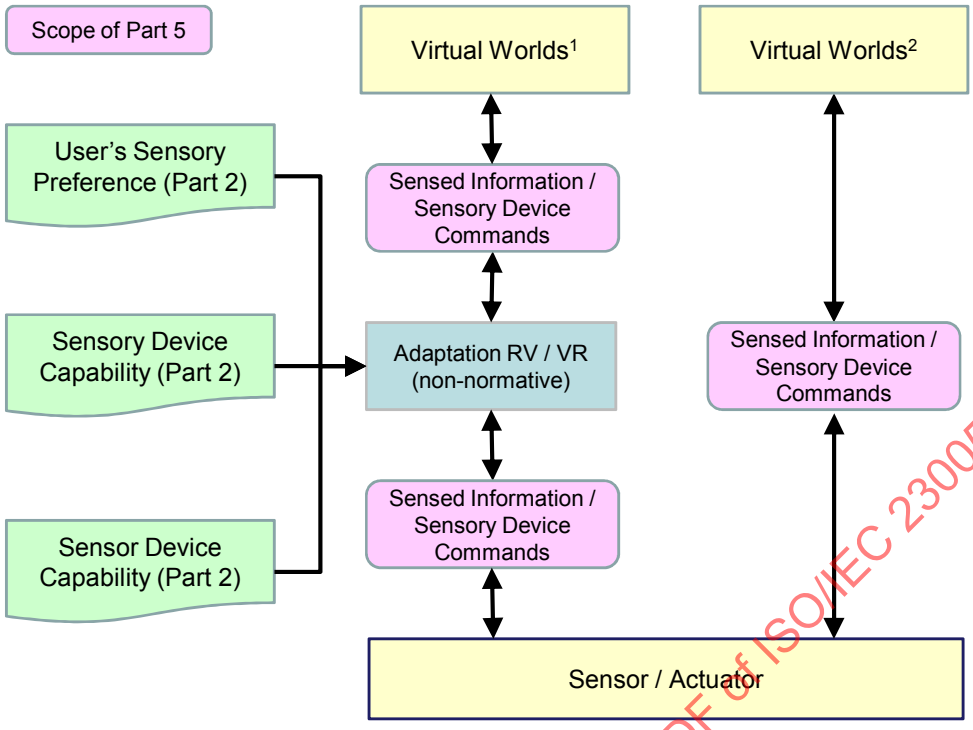

Figure 1 — Scope of the Data formats for interaction devices

2 Normative references

The following referenced documents are indispensable the application of this document. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15938-5, *Information technology — Multimedia content description interface — Part 5: Multimedia description schemes*

ISO/IEC 23005-6, *Information technology — Media context and control — Part 6: Common types and tools*

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO/IEC 23005-6 apply.

3.1 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

CS: Classification Scheme (see ISO/IEC 15938-5)

DAC: Digital-to-Analog Conversion

RV: Real to Virtual

URI: Uniform Resource Identifier (see RFC 2396)

VR: Virtual to Real

XML: Extensible Markup Language (see XML)

4 Interaction Information Description Language

4.1 Introduction

This Clause describes basic structure of the tools in this part of ISO/IEC 23005 in the form of interaction information description language including the schema wrapper conventions, basic data types, root element, and top-level elements.

4.2 Schema wrapper conventions

The Syntax defined in this Clause assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-
XSI-NS" xmlns:iidl="urn:mpeg:mpeg-v:2010:01-IIDL-NS"
xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS" xmlns:ns1="urn:mpeg:mpeg-v:2010:01-
DCV-NS" xmlns:ns2="urn:mpeg:mpeg-v:2010:01-SIV-NS"
targetNamespace="urn:mpeg:mpeg-v:2010:01-IIDL-NS" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="ISO/IEC 23005-x" id="MPEG-V-
IIDL.xsd">
    <import namespace="urn:mpeg:mpeg7:schema:2004"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
7_schema_files/mpeg7-v2.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-CT-NS"
schemaLocation="CommonXSD.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-DCV-NS" schemaLocation="DCV.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-SIV-NS" schemaLocation="SIV.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

4.3 Root element and top-level tools

4.3.1 Introduction

This Subclause specifies the root elements and the top-level tools which can follow a root element in interactive information. The root elements are the only elements, one of which can appear as the topmost element when the interactive information specified in this part of ISO/IEC 23005 is instantiated. The top-level tools are defined as the elements which are allowed to appear as the topmost element within the root element.

4.3.2 Syntax

```
<!-- ################################################ -->
<!--  Root and Top-Level Elements                     -->
<!-- ################################################ -->
<element name="InteractionInfo" type="iidl:InteractionInfoType"/>
<element name="DeviceCommand" type="iidl:DeviceCommandBaseType"/>
<element name="SensedInfo" type="iidl:SensedInfoBaseType"/>

<complexType name="InteractionInfoType">
   <choice>
      <element name="DeviceCommandList" type="iidl:DeviceCmdListType"/>
      <element name="SensedInfoList" type="iidl:SensedInfoListType"/>
   </choice>
</complexType>

<complexType name="DeviceCmdListType">
   <sequence>
      <element ref="iidl:DeviceCommand" maxOccurs="unbounded"/>
   </sequence>
</complexType>

<complexType name="SensedInfoListType">
   <sequence>
      <element ref="iidl:SensedInfo" maxOccurs="unbounded"/>
   </sequence>
</complexType>
```

4.3.3 Semantics

Semantics of the `InteractionInfo` type:

Name	*Definition*
`InteractionInfo`	One of the root elements that serve as the topmost element in the interaction information description. This element may have `DeviceCommandList` and `SensedInfoList` as its subelements.
`DeviceCommand`	One of the root elements that serve as the topmost element in the interaction information description. It specifies a single command for a certain device. This element can be instantiated as a root element or subelements of `DeviceCommandList`.
`SensedInfo`	One of the root elements that serve as the topmost element in the interaction information description. It specifies a single description of information acquired through a sensor. This element can be instantiated as a root element or subelements of `SensedInfoList`.
`InteractionInfoType`	The root type provides basic structure that the interaction information description should follow through the root element.
`DeviceCommandList`	Optional wrapper element that serves as the placeholder for the sequence of device commands.

Name	*Definition*
SensedInfoList	Optional wrapper element that serves as the placeholder for the list of information acquired through sensors (SensedInfo).
DeviceCommandBaseType	DeviceCommandBaseType is an abstract type providing a base for individual command (DeviceCommand).
SensedInfoBaseType	SensedInfoBaseType is an abstract type providing a base for description of individual type of sensor.

4.3.4 Examples

The following shows two use cases of InteractionInfo element, which are for listing device commands and for listing sensed informations.

The first example shows the case when the InteractionInfo is used for DeviceCommandList.

```
<iidl:InteractionInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SIV-NS SIV.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS" xmlns:ns1="urn:mpeg:mpeg-v:2010:01-
DCV-NS"   xmlns:iidl="urn:mpeg:mpeg-v:2010:01-IIDL-NS"   xmlns:siv="urn:mpeg:mpeg-
v:2010:01-SIV-NS">
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand          xsi:type="dcv:FogType"          activate="true"
deviceIdRef="fdc1" id="command1" intensity="20"/>
      ...
      <iidl:DeviceCommand xsi:type="dcv:..." .../>
      ...
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

The second example shows the case when the InteractionInfo is used for SensedInfoList.

```
<iidl:InteractionInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SIV-NS SIV.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS" xmlns:ns1="urn:mpeg:mpeg-v:2010:01-
DCV-NS"   xmlns:iidl="urn:mpeg:mpeg-v:2010:01-IIDL-NS"   xmlns:siv="urn:mpeg:mpeg-
v:2010:01-SIV-NS">
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="a_type_derived_from_SensedInfoBaseType" .../>
      ...
      <iidl:SensedInfo xsi:type="siv:AccelerationSensorType" .../>
      ...
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

The third example shows the case when the DeviceCommand is used directly as the root element.

```
<iidl:DeviceCommand  xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SIV-NS SIV.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS" xmlns:dcv="urn:mpeg:mpeg-v:2010:01-
DCV-NS" xmlns:iidl="urn:mpeg:mpeg-v:2010:01-IIDL-NS" xmlns:siv="urn:mpeg:mpeg-
v:2010:01-SIV-NS" xsi:type="dcv:LightType" id="light1" color="urn:mpeg:mpeg-v:01-
SI-ColorCS-NS:red" intensity="5">
   <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
</iidl:DeviceCommand>
```

The fourth example shows the case when the SensedInfo is used directly as the root element.

```
<iidl:SensedInfo     xsi:schemaLocation="urn:mpeg:mpeg-v:2010:01-SIV-NS  SIV.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS" xmlns:ns1="urn:mpeg:mpeg-v:2010:01-
DCV-NS"   xmlns:iidl="urn:mpeg:mpeg-v:2010:01-IIDL-NS"   xmlns:siv="urn:mpeg:mpeg-
v:2010:01-SIV-NS" xsi:type="siv:LightSensorType" id="LS001" sensorIdRef="LSID001"
activate="true" value="200" color="#FF0000">
   <iidl:TimeStamp     xsi:type="mpegvct:ClockTickTimeType"     timeScale="1000"
pts="600000"/>
</iidl:SensedInfo>
```

Note that these examples are only showing a part of the complete XML description to show the use of the root element, InteractionInfo, with the choice of DeviceCommandList or SensedInfoList.

4.4 Device commands

4.4.1 Introduction

This Subclause specifies tools for describing actions that each individual device (actuators) is supposed to take. Instances of following device commands defined in the Clause may be generated as an output of the VR engine and used to drive actuators. The following Subclause defines an abstract complex type of DeviceCommandBaseType, which the device command types of individual device should inherit.

4.4.2 Reference coordinate system

The origin of the reference coordinate for sensory devices is located at the position of the user. Each axis is defined as follows. X-axis is in the direction of the right hand side of the user facing the screen. Y-axis is in the reverse direction of gravity. Z-axis is in the direction of the user's facing the screen. The x-, y-, and z-axis are depicted in Figure 2.

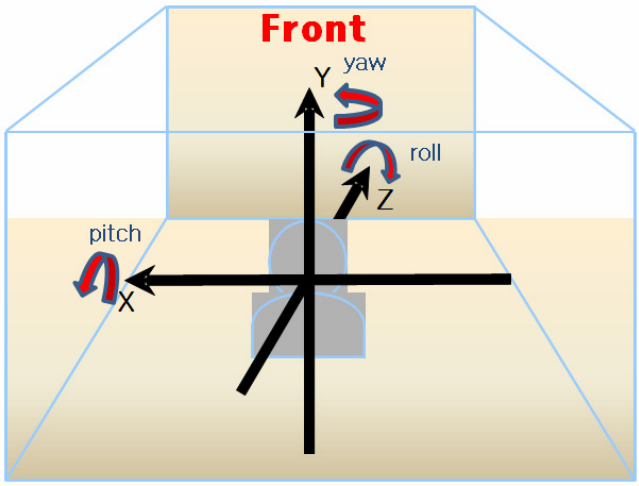

Figure 2 — Reference Coordinate System for Sensory Devices

4.4.3 Device command base type

4.4.3.1 Syntax

```
<!-- ################################################ -->
<!--  Device command base type                        -->
<!-- ################################################ -->
<complexType name="DeviceCommandBaseType" abstract="true">
   <sequence>
      <element name="TimeStamp" type="mpegvct:TimeStampType"/>
   </sequence>
   <attributeGroup ref="iidl:DeviceCmdBaseAttributes"/>
</complexType>
```

4.4.3.2 Semantics

Semantics of the `DeviceCommandBaseType`:

Name	*Definition*
`DeviceCommandBaseType`	Provides the topmost type of the base type hierarchy which each individual device command can inherit.
`TimeStamp`	Provides the timing information for the device command to be executed. As defined in ISO/IEC 23005-6, there is a choice of selection among three timing schemes, which are absolute time, clocktick time, and delta of clock tick time.
`DeviceCmdBaseAttributes`	Describes a group of attributes for the commands.

4.4.3.3 Examples

For the examples of the `DeviceCommandBaseType`, please see the examples of individual types of device commands.

4.4.4 Device command base attributes

4.4.4.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of Device Command Base Attributes    -->
<!-- ################################################ -->
<attributeGroup name="DeviceCmdBaseAttributes">
   <attribute name="id" type="ID" use="optional"/>
   <attribute name="deviceIdRef" type="anyURI" use="optional"/>
   <attribute name="activate" type="boolean" use="optional" default="true"/>
</attributeGroup>
```

4.4.4.2 Semantics

Semantics of the `DeviceCmdBaseAttributes`:

Name	*Definition*
`DeviceCmdBaseAttributes`	Specifies the common attributes for any type inherits from the `DeviceCommandBaseType`.
`id`	To be used to identify each individual device command.
`deviceIdRef`	To specify an individual device to which the command is associated.
`activate`	Describes whether the effect shall be activated. A value of `true` means the device shall be activated (switch on) and `false` means the device shall be deactivated (switch off).

4.4.4.3 Examples

The following is a snippet of an XML document showing the use of the DeviceCmdBaseAttributes. It shows a device command specified by the identifier of `command1` to activate a device type *`any_specific_device_command_type`* with device identifier `fdc1`.

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand          xsi:type="dcv:any_specific_device_command_type"
activate="true" deviceIdRef="fdc1" id="command1"/>
      ...
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```


4.5 Sensed information description tools

4.5.1 Introduction

This Subclause specifies tools for describing information acquired through each individual sensor. Instances of following sensed information defined in the Clause may be generated as an output of the sensors. The following subclause defines an abstract complex type of `SensedInfoBaseType`, which the sensed information types for each individual sensor should inherit.

4.5.2 Global coordinate for sensors

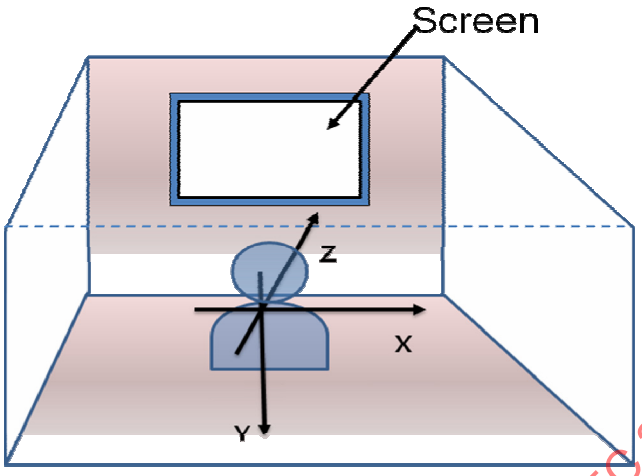

Figure 3 — Reference coordinate for sensors

The reference coordinate for sensors is defined adapting the right handed coordinate system. Each axis is defined as follows: Y-axis is in the direction of gravity; Z-axis is in the direction of user's front (in common sense) which is orthogonal to the y-axis; X-axis is in the direction of user's right side which is also orthogonal to both y-axis and z-axis. The x-, y-, and z-axis are depicted in Figure 3. The default origin of the reference coordinate for sensors is the position of the user. The origin of the coordinate system differs depending on the type of the sensor.

4.5.3 Sensed information base type

4.5.3.1 Syntax

```
<!-- ################################################ -->
<!--  Sensed information base type                    -->
<!-- ################################################ -->
<complexType name="SensedInfoBaseType" abstract="true">
   <sequence>
      <element name="TimeStamp" type="mpegvct:TimeStampType" minOccurs="0"/>
   </sequence>
   <attributeGroup ref="iidl:sensedInfoBaseAttributes"/>
</complexType>
```

4.5.3.2 Semantics

Semantics of the `SensedInfoListType`:

Name	*Definition*
`SensedInfoBaseType`	Provides the topmost type of the base type hierarchy which each individual sensed information can inherit.
`sensedInfoBaseAttributes`	Describes a group of attributes for the sensed information.

Name	*Definition*
TimeStamp	Provides the time information at which the sensed information is acquired. As defined in ISO/IEC 23005-6, there is a choice of selection among three timing schemes, which are absolute time, clocktick time, and delta of clock tick time.

4.5.4 Sensed information base attributes

4.5.4.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of Sensed information Base Attributes   -->
<!-- ################################################ -->
<attributeGroup name="sensedInfoBaseAttributes">
   <attribute name="id" type="ID" use="optional"/>
   <attribute name="sensorIdRef" type="anyURI" use="optional"/>
   <attribute name="linkedlist" type="anyURI" use="optional"/>
   <attribute name="groupID" type="anyURI" use="optional"/>
   <attribute name="activate" type="boolean" use="optional"/>
   <attribute name="priority" type="nonNegativeInteger" use="optional"
default="0"/>
</attributeGroup>
```

4.5.4.2 Semantics

Semantics of the `sensedInfoBaseAttributes`:

Name	*Definition*
sensedInfoBase Attributes	Describes a group of attributes for the commands.
id	Unique identifier for identifying individual sensed information
sensorIdRef	References a sensor device that has generated the information included in this specific sensed information.
linkedlist	Describes the multi-sensor structure that consists of a group of sensors in a way that each record contains a reference to the ID of the next sensor.
groupID	Identifier for a group multi-sensor structure to which this specific sensor belongs.
activate	Describes whether the sensor shall be activated. A value of "true" means the sensor shall be activated and "false" means the sensor shall be deactivated.

Name	*Definition*
priority	Describes a priority for sensed information with respect to other sensed information sharing the same point in time when the sensed information become adapted. A value of one indicates the highest priority and larger values indicate lower priorities. The default value of the priority is one. If there are more than one sensed information with the same priority, the order of process can be determined by the Adaptation engine itself. NOTE 1: The priority might be used to apply the sensed information on the virtual world object characteristics – defined within a group of sensors – according to the capabilities of the adaptation VR. EXAMPLE 1: The adaptation RV processes the individual sensed information of a group of sensors according to their priority in descending order due to its limited capabilities. That is, the sensed information with the lower priority might get lost.

4.5.4.3 Examples

The example of the BaseAttributes is given in the examples of sensed information vocabulary.

5 Device Command Vocabulary

5.1 Introduction

This Clause describes syntax and semantics of the device command vocabulary to implement commanding of individual devices.

5.2 Schema wrapper conventions

The Syntax defined in this Clause assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:dcv="urn:mpeg:mpeg-v:2010:01-DCV-
NS" xmlns:iidl="urn:mpeg:mpeg-v:2010:01-IIDL-NS" xmlns:mpegvct="urn:mpeg:mpeg-
v:2010:01-CT-NS" targetNamespace="urn:mpeg:mpeg-v:2010:01-DCV-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-x" id="MPEG-V-DCV.xsd">
   <import namespace="urn:mpeg:mpeg-v:2010:01-IIDL-NS"
schemaLocation="IIDL.xsd"/>
   <import namespace="urn:mpeg:mpeg7:schema:2004"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
7_schema_files/mpeg7-v2.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2010:01-CT-NS"
schemaLocation="CommonXSD.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

5.3 Light type

5.3.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Light Type                    -->
<!-- ################################################ -->
<complexType name="LightType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <attribute name="color" type="mpegvct:colorType" use="optional"/>
         <attribute name="intensity" type="integer" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.3.2 Semantics

Semantics of the `LightType`:

Name	*Definition*
`LightType`	Tool for describing a command for a lighting device to follow.
`color`	Describes the list of colors, which the lighting device can provide, that shall be used either as a reference to a classification scheme term using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003 or as RGB value. A CS that may be used for this purpose is the `ColorCS` defined in A.2.2 of ISO/IEC 23005-6. EXAMPLE `urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue` would describe the color Alice blue.
`intensity`	Describes the intensity that the lighting device shall emit in percentage with respect to the maximum intensity that the specific device can generate.

5.3.3 Examples

This example shows the description of a device command of light effect with the following semantics. The dispaying device for the light effect is “light1”. The intensity shall be 5% with the color “red” from the classification scheme described in A.2.2 of ISO/IEC 23005-6.

```
<iidl:InteractionInfo>
  <iidl:DeviceCommandList>
    <iidl:DeviceCommand            xsi:type="dcv:LightType"            id="light1"
color="urn:mpeg:mpeg-v:01-SI-ColorCS-NS:red" intensity="5">
       <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
    </iidl:DeviceCommand>
  </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.4 Flash type

5.4.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Flash Type                    -->
<!-- ################################################ -->
<complexType name="FlashType">
   <complexContent>
      <extension base="dcv:LightType">
         <attribute name="frequency" type="positiveInteger" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.4.2 Semantics

Semantics of the `FlashType`:

Name	*Definition*
`FlashType`	Tool for describing a flash device command.
`intensity`	Describes the intensity of the flash effect in terms of illumination in percentage with respect to the maximum light intensity that the specific device can generate.
`frequency`	Describes the number of flickering in percentage with respect to the maximum frequency that the specific flash device can generate.
`Color`	Describes the color of the flash effect as a reference to a classification scheme term or as RGB. A CS that may be used for this purpose is the `ColorCS` defined in A2.2 of ISO/IEC 23005-6.

5.4.3 Examples

This example shows the description of a device command of flash effect with the following semantics. The displaying device for the flash effect is “flash1”. The intensity shall be 5% of the maximum intensity of “flash1”, while the frequency is 10 % of the maximum frequency of “flash1”.

```
<InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:FlashType" id="flash1"
         color="urn:mpeg:mpeg-v:01-SI-ColorCS-NS:red" intensity="5"
         frequency="10">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</InteractionInfo>
```

5.5 Heating type

5.5.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Heating Type                  -->
<!-- ################################################ -->
<complexType name="HeatingType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <attribute name="intensity" type="integer" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.5.2 Semantics

Semantics of the `HeatingType`:

Name	*Definition*
`HeatingType`	Tool for describing a command for heating device.
`intensity`	Describes the intensity of the temperature effect of heating in percentage with respect to the capable range of temperature control. If the intensity is not specified, this command shall be interpreted as turning on at the maximum intensity. Example: If the device can control temperature between 20 and 40 degrees Celsius, intensity of 20 percent means the intensity of 24 degrees Celsius.

5.5.3 Examples

This example shows the description of a device command of heating effect with the following semantics. The identifier for this command is “heater1” and the identifier for the heating device for which this command is issued is “heater001”. The intensity shall be 28% of the maximum intensity of “heater001.”

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:HeatingType" id="heater1"
         deviceIdRef="heater001" activate="true" intensity="28">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.6 Cooling type

5.6.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Cooling Type                  -->
<!-- ################################################ -->
<complexType name="CoolingType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <attribute name="intensity" type="integer" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.6.2 Semantics

Semantics of the `CoolingType`:

Name	*Definition*
`CoolingType`	Tool for describing a command for cooling device
`intensity`	Describes the intensity of the temperature effect of cooling in percentage with respect to the capable range of temperature control. The larger intensity value the `CoolingType` description has, the cooler the environment is intended to be driven. If the intensity is not specified, this command shall be interpreted as turning on at the maximum intensity. Example: If the device can create cooling effect from 30 to 10 degrees Celsius, intensity of 20 percent means the intensity of 26 degrees Celsius.

5.6.3 Examples

This example shows the description of a device command of cooling effect with the following semantics. The identifier for this command is “cooling01” and the identifier for the cooling device for which this command is issued is “cooler001”. The intensity shall be 40% of the maximum intensity of “cooler001.”

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:CoolingType" id="cooling01"
         deviceIdRef="cooler001" activate="true" intensity="40">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.7 Wind type

5.7.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Wind Type                     -->
<!-- ################################################ -->
<complexType name="WindType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <attribute name="intensity" type="integer" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.7.2 Semantics

Semantics of the `WindType`:

Name	*Definition*
`WindType`	Tool for describing a wind device command.
`intensity`	Describes the intensity of the wind effect in terms of strength in percentage with respect to the maximum intensity of the specified device. If the intensity is not specified, this command shall be interpreted as turning on at the maximum intensity.

5.7.3 Examples

This example shows the description of a device command of wind effect with the following semantics. The identifier for this command is “wind01” and the identifier for the wind device for which this command is issued is “wind001”. The intensity shall be 30% of the maximum intensity of “wind001.”

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:WindType" id="wind01"
         deviceIdRef="wind001" activate="true" intensity="30">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.8 Vibration type

5.8.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Vibration Type                -->
<!-- ################################################ -->
<complexType name="VibrationType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <attribute name="intensity" type="integer" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.8.2 Semantics

Semantics of the `VibrationType`:

Name	*Definition*
`VibrationType`	Tool for describing a vibration device command.
`intensity`	Describes the intensity of the vibration effect in terms of strength in percentage with respect to the maximum intensity of the specified device. If the intensity is not specified, this command shall be interpreted as turning on at the maximum intensity.

5.8.3 Examples

This example shows the description of a device command of vibration effect with the following semantics. The identifier for this command is “vibe01” and the identifier for the vibration device for which this command is issued is “vibe001”. The intensity shall be 60% of the maximum intensity of “vibe001.”

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:VibrationType" id="vibe01"
         deviceIdRef="vibe001" activate="true" intensity="60">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.9 Sprayer type

5.9.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Sprayer Type                  -->
<!-- ################################################ -->
<complexType name="SprayerType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <attribute name="sprayingType" type="mpeg7:termReferenceType"/>
         <attribute name="intensity" type="integer" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.9.2 Semantics

Semantics of the `SprayerType`:

Name	*Definition*
`SprayerType`	Tool for describing a liquid spraying device command.
`sprayingType`	Describes the type of the sprayed material that shall be ussed as a reference to a classification scheme term using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. A CS that may be used for this purpose is the `SprayingTypeCS` defined in Annex A.2.7 of ISO/IEC 23005-6.
`intensity`	Describes the intensity that the liquid is sprayed in percentage with respect to the maximum intensity described in the device capability. If the intensity is not specified, this command shall be interpreted as turning on at the maximum intensity.

5.9.3 Examples

This example shows the description of a device command of sprayer effect with the following semantics. The identifier for this command is “sprayer01” and the identifier for the sprayer device for which this command is issued is “sprayer001”. The intensity shall be 50% of the maximum intensity of “sprayer001.” The material to be sprayed is pure water as specified in the `SprayingTypeCS` of A.2.7 of ISO/IEC 23005-6.

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:SprayerType" id="sprayer01"
         deviceIdRef="sprayer001" activate="true" intensity="50"
         sprayingType="urn:mpeg:mpeg-v:01-SI-SprayingTypeCS-NS:water">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.10 Scent type

5.10.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Scent Type                    -->
<!-- ################################################ -->
<complexType name="ScentType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <attribute name="scent" type="mpeg7:termReferenceType" use="optional"/>
         <attribute name="intensity" type="integer" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.10.2 Semantics

Semantics of the `ScentType`:

Name	*Definition*
`ScentType`	Tool for describing a scent device command.
`intensity`	Describes the intensity of the scent effect in percentage with respect to the maximum intensity described in the device capability. If the intensity is not specified, this command shall be interpreted as turning on at the maximum intensity.
`scent`	Describes the scent that shall be used as a reference to a classification scheme term using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. A CS that may be used for this purpose is the `ScentCS` defined in the Annex .2.4 of ISO/IEC 3005-6.

5.10.3 Examples

This example shows the description of a device command of scent effect with the following semantics. The identifier for this command is “scent01” and the identifier for the sprayer device for which this command is issued is “scentdevice001”. The intensity shall be 30% of the maximum intensity of “scentdevice001.” The scent is defined to be the scent of acacia according to the definition of ScentCS of A.2.4 of ISO/IEC 3005-6.

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:ScentType" id="scent01"
         deviceIdRef="scentdevice001" activate="true" intensity="30"
         scent="urn:mpeg:mpeg-v:01-SI-ScentCS-NS:acacia">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.11 Fog type

5.11.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Fog Type                      -->
<!-- ################################################ -->
<complexType name="FogType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <attribute name="intensity" type="integer" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

5.11.2 Semantics

Semantics of the `FogType`:

Name	*Definition*
`FogType`	Tool for describing a fog device command.
`intensity`	Describes the intensity of the fog effect in percentage with respect to the maximum intensity described in the device capability. If the intensity is not specified, this command shall be interpreted as turning on at the maximum intensity.

5.11.3 Examples

This example shows the description of a device command of fog effect with the following semantics. The identifier for this command is “fog01” and the identifier for the sprayer device for which this command is issued is “fog001”. The intensity shall be 50% of the maximum intensity of “fog001.”

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:FogType" id="fog01" deviceIdRef="fog001"
         activate="true" intensity="50">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.12 Color correction type

5.12.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Color Correction Type         -->
<!-- ################################################ -->
<complexType name="ColorCorrectionType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <sequence minOccurs="0" maxOccurs="unbounded">
            <element name="SpatialLocator" type="mpeg7:RegionLocatorType"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

5.12.2 Semantics

Semantics of the `ColorCorrectionType`:

Name	*Definition*
`ColorCorrectionType`	Tool for commanding a display device to perform color correction.
`SpatialLocator`	Describes the spatial localization of the still region using `SpatialLocatorType` (optional), which indicates the regions in a video segment where the color correction effect is applied. The `SpatialLocatorType` shall be used as defined in ISO/IEC 5938-:2003.
`activate`	Describes whether the color correction effect should be used or not.

5.12.3 Examples

This example shows the description of a device command of color correction effect with the following semantics. The displaying device for the color correction effect is “tv1”. The color correction effect is applied only to the region defined by the `SpatialLocator`.

```
<iidl:InteractionInfo>
  <iidl:DeviceCommandList>
    <iidl:DeviceCommand xsi:type="dcv:ColorCorrectionType" id="tv1"
       activate="true">
       <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
       <dcv:SpatialLocator>
          <mpeg7:Polygon>
             <mpeg7:Coords dim="8">5 25 0 -2 15 0 0 2 </mpeg7:Coords>
          </mpeg7:Polygon>
       </dcv:SpatialLocator>
    </iidl:DeviceCommand>
  </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.13 Initialize color correction parameter type

This command delivers the parameters supporting the color correction effect to devices.

5.13.1 Syntax

```
<!-- ################################################################ -->
<!--  Definition of SDCmd Initialize Color Correction Parameter Type -->
<!-- ################################################################ -->
<complexType name="InitializeColorCorrectionParameterType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <sequence>
            <element name="ToneReproductionCurves"
               type="mpegvct:ToneReproductionCurvesType" minOccurs="0"/>
            <element name="ConversionLUT" type="mpegvct:ConversionLUTType"/>
            <element name="ColorTemperature" type="mpegvct:IlluminantType"
               minOccurs="0"/>
            <element name="InputDeviceColorGamut"
               type="mpegvct:InputDeviceColorGamutType" minOccurs="0"/>
            <element name="IlluminanceOfSurround" type="mpeg7:unsigned12"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

5.13.2 Semantics

Semantics of the `ColorCorrectionType`:

Name	*Definition*
`InitializeColorCorrectionParameterType`	Tool for describing an initialize color correction parameter command.
`ToneReproductionCurves`	This curve shows the characteristics (e.g., gamma curves for R, G and B channels) of the input display device.
`ConversionLUT`	A look-up table (matrix) converting an image between an image color space (e.g. RGB) and a standard connection space (e.g. CIE XYZ).
`ColorTemperature`	An element describing a white point setting (e.g., D65, D93) of the input display device.
`InputDeviceColorGamut`	An element describing an input display device color gamut, which is represented by chromaticity values of R, G, and B channels at maximum DAC values.
`IlluminanceOfSurround`	An element describing an illuminance level of viewing environment. The illuminance is represented by lux.

5.13.3 Exmaples

Examples of the color correction parameters.

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:InitializeColorCorrectionParameterType">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
         <dcv:ToneReproductionCurves>
            <mpegvct:DAC_Value>0</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.0000 0.0000 0.0000</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>16</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.0093 0.0087 0.0076</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>32</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.0304 0.0312 0.0274</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>48</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.0595 0.0633 0.0557</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>64</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.0947 0.1026 0.0957</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>80</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.1391 0.1486 0.1388</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>96</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.1864 0.1974 0.1863</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>112</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.2400 0.2555 0.2426</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>125</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.2907 0.3082 0.2960</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>144</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.3759 0.3951 0.3841</mpegvct:RGB_Value>
            <mpegvct:DAC_Value>160</mpegvct:DAC_Value>
            <mpegvct:RGB_Value>0.4582 0.4778 0.4673</mpegvct:RGB_Value>
```

```
                <mpegvct:DAC_Value>176</mpegvct:DAC_Value>
                <mpegvct:RGB_Value>0.5491 0.5666 0.5576</mpegvct:RGB_Value>
                <mpegvct:DAC_Value>192</mpegvct:DAC_Value>
                <mpegvct:RGB_Value>0.6510 0.6653 0.6528</mpegvct:RGB_Value>
                <mpegvct:DAC_Value>208</mpegvct:DAC_Value>
                <mpegvct:RGB_Value>0.7503 0.7644 0.7635</mpegvct:RGB_Value>
                <mpegvct:DAC_Value>224</mpegvct:DAC_Value>
                <mpegvct:RGB_Value>0.8483 0.8644 0.8654</mpegvct:RGB_Value>
                <mpegvct:DAC_Value>240</mpegvct:DAC_Value>
                <mpegvct:RGB_Value>0.9445 0.9546 0.9438</mpegvct:RGB_Value>
                <mpegvct:DAC_Value>255</mpegvct:DAC_Value>
                <mpegvct:RGB_Value>1.0000 1.0000 1.0000</mpegvct:RGB_Value>
            </dcv:ToneReproductionCurves>
            <dcv:ConversionLUT>
                <mpegvct:RGB2XYZ_LUT mpeg7:dim="3 3">
                    .6000 67.6000 38.0000
                    .0000 137.0000 16.5000
                    .3650 19.4100 203.9000
                </mpegvct:RGB2XYZ_LUT>
                <mpegvct:RGBScalar_Max>0.9910 0.9860 0.9820</mpegvct:RGBScalar_Max>
                <mpegvct:Offset_Value>0.2150 0.2050 0.4250</mpegvct:Offset_Value>
                <mpegvct:Gain_Offset_Gamma mpeg7:dim="3 3">
                    .0228 -0.0228 1.6222
                    .0242 -0.0242 1.5624
                    .0220 -0.0220 1.6180
                </mpegvct:Gain_Offset_Gamma>
                <mpegvct:InverseLUT mpeg7:dim="3 3">
                    .0155 -0.0073 -0.0023
                    .0052 0.0099 0.0002
                    .0003 -0.0009 0.0049
                </mpegvct:InverseLUT>
            </dcv:ConversionLUT>
            <dcv:ColorTemperature>
                <mpegvct:xy_Value x="0.3127" y="0.3290"/>
                <mpegvct:Y_Value>100</mpegvct:Y_Value>
            </dcv:ColorTemperature>
            <dcv:InputDeviceColorGamut>
                <mpegvct:IDCG_Type>NTSC</mpegvct:IDCG_Type>
                <mpegvct:IDCG_Value mpeg7:dim="2 3">
                    .6700 0.3300
                    .2100 0.7100
                    .1400 0.0800
                </mpegvct:IDCG_Value>
            </dcv:InputDeviceColorGamut>
            <dcv:IlluminanceOfSurround>180</dcv:IlluminanceOfSurround>
        </iidl:DeviceCommand>
    </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.14 Rigid body motion type

5.14.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of Rigid Body Motion Type            -->
<!-- ################################################ -->
<complexType name="RigidBodyMotionType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <sequence>
            <element name="MoveToward" type="dcv:MoveTowardType"
minOccurs="0"/>
            <element name="Incline" type="dcv:InclineType" minOccurs="0"/>
         </sequence>
         <attribute name="duration" type="float"/>
      </extension>
   </complexContent>
</complexType>

<complexType name="MoveTowardType">
   <attribute name="directionX" type="float"/>
   <attribute name="directionY" type="float"/>
   <attribute name="directionZ" type="float"/>
   <attribute name="speedX" type="float"/>
   <attribute name="speedY" type="float"/>
   <attribute name="speedZ" type="float"/>
   <attribute name="accelerationX" type="float"/>
   <attribute name="accelerationY" type="float"/>
   <attribute name="accelerationZ" type="float"/>
</complexType>

<complexType name="InclineType">
   <attribute name="pitchAngle" type="mpegvct:InclineAngleType" use="optional"/>
   <attribute name="yawAngle" type="mpegvct:InclineAngleType" use="optional"/>
   <attribute name="rollAngle" type="mpegvct:InclineAngleType" use="optional"/>
   <attribute name="pitchSpeed" type="float" use="optional"/>
   <attribute name="yawSpeed" type="float" use="optional"/>
   <attribute name="rollSpeed" type="float" use="optional"/>
   <attribute name="pitchAcceleration" type="float" use="optional"/>
   <attribute name="yawAcceleration" type="float" use="optional"/>
   <attribute name="rollAcceleration" type="float" use="optional"/>
</complexType>
```


5.14.2 Semantics

Semantics of the `RigidBodyMotionType`:

Name	*Definition*
`RigidBodyMotionType`	Tool for describing a rigid body motion device command.
`MoveToward`	Describes the destination axis values of move toward effect. The type is defined by `dcv:MoveTowardType`.

Name	*Definition*
`Incline`	Describes the rotation angle of incline effect. The type is defined by `dcv:InclineType`.
`duration`	Describes time period during which the rigid body object should continuously move. The object which reaches the destination described by the description of `RigidBodyMotionType` should stay at the destination until it receives another command with activate="false".
`MoveTowardType`	Tool for describing `MoveToward` commands for each axis
`directionX`	Describes the position command on x-axis in terms of centimeter with respect to the current position.
`directionY`	Describes the position command on y-axis in terms of centimeter with respect to the current position.
`directionZ`	Describes the position command on z-axis in terms of centimeter with respect to the current position.
`speedX`	Describes the desired speed of the rigid body object on the x-axis in terms of percentage with respect to the maximum speed of the specific device which also be described in the device capability as defined in ISO/IEC 23005-2.
`speedY`	Describes the desired speed of the rigid body object on the y-axis in terms of percentage with respect to the maximum speed of the specific device which also be described in the device capability as defined in ISO/IEC 23005-2.
`speedZ`	Describes the desired speed of the rigid body object on the z-axis in terms of percentage with respect to the maximum speed of the specific device which also be described in the device capability as defined in ISO/IEC 23005-2.
`accelerationX`	Describes the desired acceleration of the rigid body object on the x-axis in terms of percentage with respect to the maximum acceleration of the specific device which may be described in the device capability as defined in ISO/IEC 23005-2.
`accelerationY`	Describes the desired acceleration of the rigid body object on the y-axis in terms of percentage with respect to the maximum acceleration of the specific device which may be described in the device capability as defined in ISO/IEC 23005-2.
`accelerationZ`	Describes the desired acceleration of the rigid body object on the z-axis in terms of percentage with respect to the maximum acceleration of the specific device which may be described in the device capability as defined in ISO/IEC 23005-2.
`InclineType`	Tool for describing Incline commands for each axis.

Name	*Definition*
pitchAngle	Describes the angle to rotate in y-axis, Θ(pitch) in degrees between -180 and 180. NOTE The pitch angle is increased with counter-clock wise.
yawAngle	Describes the angle to rotate in z-axis, Ψ(yaw) in degrees between -180 and 180. NOTE The yaw angle is increased with counter-clock wise.
rollAngle	Describes the angle to rotate in x-axis, φ (roll), in degrees between -180 and 180. NOTE The roll angle is increased with counter-clock wise.
pitchSpeed	Describes the desired speed (command) of rotation for pitch in terms of percentage with respect to the maximum angular speed of the specific device which may be described in the device capability as defined in ISO/IEC 23005-2.
yawSpeed	Describes the desired speed (command) of rotation for yaw in terms of percentage with respect to the maximum angular speed of the specific device which may be described in the device capability as defined in ISO/IEC 23005-2.
rollSpeed	Describes the desired speed (command) of rotation for roll in terms of percentage with respect to the maximum angular speed of the specific device which may be described in the device capability as defined in ISO/IEC 3005-2.
pitchAcceleration	Describes the desired acceleration (command) of rotation for pitch in terms of percentage with respect to the maximum angular acceleration of the specific device which may be described in the device capability as defined in ISO/IEC 23005-2.
yawAcceleration	Describes the desired acceleration (command) of rotation for yaw in terms of percentage with respect to the maximum angular acceleration of the specific device which may be described in the device capability as defined in ISO/IEC 23005-2.
rollAcceleration	Describes the desired acceleration (command) of rotation for roll in terms of percentage with respect to the maximum angular acceleration of the specific device which may be described in the device capability as defined in ISO/IEC 23005-2.

5.14.3 Examples

This example shows the description of a MoveToward device command. This device will be moved 10cm on x-axis with 2cm/sec speed and no acceleration.

```
<iidl:InteractionInfo>
    <iidl:DeviceCommandList>
        <iidl:DeviceCommand xsi:type="dcv:RigidBodyMotionType">
            <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
            <dcv:MoveToward directionX="10" speedX="2" accelerationX="0"/>
        </iidl:DeviceCommand>
    <iidl:InteractionInfo>
<iidl:DeviceCommandList>
```

This example shows the description of a Incline device command. This device will be rotated 60degree on y-axis with constant 10% of its maximum speed.

```
<iidl:InteractionInfo>
    <iidl:DeviceCommandList>
        <iidl:DeviceCommand xsi:type="dcv:RigidBodyMotionType">
            <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
            <dcv:Incline yawAngle="60" yawSpeed="10" yawAcceleration="0"/>
        </iidl:DeviceCommand>
    </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.15 Tactile type

5.15.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Tactile Type                  -->
<!-- ################################################ -->
<complexType name="TactileType">
    <complexContent>
        <extension base="iidl:DeviceCommandBaseType">
            <sequence>
                <element name="ArrayIntensity" type="mpeg7:FloatMatrixType"
                    minOccurs="0"/>
            </sequence>
            <attribute name="tactileDisplay" type="mpeg7:termReferenceType"
                use="optional"/>
        </extension>
    </complexContent>
</complexType>
```

5.15.2 Semantics

Semantics of the `TactileType`:

Name	*Definition*
`TactileType`	Tool for describing array-type tactile device command. A tactile device is composed of an array of actuators.
`ArrayIntensity`	Describes the intensities of array actuators in percentage with respect to the maximum intensity described in the device capability. If the intensity is not specified, this command shall be interpreted as turning on at the maximum intensity.
`tactileDisplay`	Describes the `tactileDisplay` that shall be used as a reference to a classification scheme term using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. A CS that may be used for this purpose is the `TactileDisplayCS` defined in the Annex A.2.11 of ISO/IEC 23005-6.

5.15.3 Examples

An example of the `TactileType` to provide commands to actuate a tactile device is provided as follows. When tactile data formed as an array are given, these data are mapped to tactile devices with 3-by-3 array (note that tactile data are formed with i-by-j array can be resized to map with the 3-by-3 array of a tactile device. The command data are given as MxN matrix as shown in the example.

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:TactileType">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
         <dcv:ArrayIntensity mpeg7:dim="3 3">
            25 25 25 0 0 0 15 12 15
         </dcv:ArrayIntensity>
      </iidl:DeviceCommand>
   </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

5.16 Kinesthetic type

5.16.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of DCV Kinesthetic Type              -->
<!-- ################################################ -->
<complexType name="KinestheticType">
   <complexContent>
      <extension base="iidl:DeviceCommandBaseType">
         <sequence>
            <element name="Position" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
            <element name="Orientation" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
```

```
            <element name="Force" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
            <element name="Torque" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
```

5.16.2 Semantics

Semantics of the `KinestheticType`:

Name	*Definition*
`KinestheticType`	Describes a command for a kinesthetic device.
`Position`	Describes the position that a kinesthetic device shall take in millimeters along each axis of X, Y, and Z, with respect to the home position of the device.
`Orientation`	Describes the orientation that a kinesthetic device shall take in degrees along each axis of X, Y, and Z, with respect to the home orientation of the device.
`Force`	Describes the force of kinesthetic effect in percentage with respect to the maximum force described in the device capability. If the `Force` is not specified, this command shall be interpreted as turning on at the maximum force. This element takes `Float3DVectorType` type defined in ISO/IEC 23005-6.
`Torque`	Describes the torque of kinesthetic effect in percentage with respect to the maximum torque described in the device capability. If the `Torque` is not specified, this command shall be interpreted as turning on at the maximum torque. This element takes `Float3DVectorType` type defined in ISO/IEC 23005-6.

5.16.3 Examples

An example of the `KinestheticType`, to provide commands to actuate a kinesthetic device, is provided as follows. This example provide position, $P_{x,y,z}$(40mm, 60mm, 120mm) and orientation, $O_{x,y,z}$(5degree, 7 degree, 19 degree) information that a kinesthetic device may be moved to.

```
<iidl:InteractionInfo>
   <iidl:DeviceCommandList>
      <iidl:DeviceCommand xsi:type="dcv:KinestheticType">
         <iidl:TimeStamp xsi:type="mpegvct:AbsoluteTimeType" absTime="1:30:23"/>
         <dcv:Position>
            <mpegvct:X>40</mpegvct:X>
            <mpegvct:Y>60</mpegvct:Y>
            <mpegvct:Z>120</mpegvct:Z>
         </dcv:Position>
         <dcv:Orientation>
            <mpegvct:X>5</mpegvct:X>
```

```
                <mpegvct:Y>7</mpegvct:Y>
                <mpegvct:Z>19</mpegvct:Z>
            </dcv:Orientation>
        </iidl:DeviceCommand>
    </iidl:DeviceCommandList>
</iidl:InteractionInfo>
```

6 Sensed Information Vocabulary

6.1 Introduction

This Clause describes syntax and semantics of the sensed information vocabulary to implement exchange of information acquired from individual sensors.

6.2 Schema wrapper conventions

The Syntax defined in this Clause assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema" xmlns:siv="urn:mpeg:mpeg-
v:2010:01-SIV-NS" xmlns:iidl="urn:mpeg:mpeg-v:2010:01-IIDL-NS"
xmlns:mpegvct="urn:mpeg:mpeg-v:2010:01-CT-NS" targetNamespace="urn:mpeg:mpeg-
v:2010:01-SIV-NS" elementFormDefault="qualified"
attributeFormDefault="unqualified" version="ISO/IEC 23005-x" id="MPEG-V-SIV.xsd">
    <import namespace="urn:mpeg:mpeg-v:2010:01-IIDL-NS"
schemaLocation="IIDL.xsd"/>
    <import namespace="urn:mpeg:mpeg-v:2010:01-CT-NS"
schemaLocation="CommonXSD.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

6.3 Light sensor type

6.3.1 Syntax

```
<!--################################### -->
<!--Definition of Light Sensor type      -->
<!--################################### -->
<complexType name="LightSensorType">
    <complexContent>
        <extension base="iidl:SensedInfoBaseType">
            <attribute name="value" type="float" use="optional"/>
            <attribute name="unit" type="mpegvct:unitType" use="optional"/>
            <attribute name="color" type="mpegvct:colorType" use="optional"/>
        </extension>
    </complexContent>
</complexType>
```

6.3.2 Semantics

Semantics of the `LightSensorType`:

Name	*Definition*
`LightSensorType`	Tool for describing sensed information with respect to a light sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`value`	Describes the sensed intensity of the light with respect to Lux.
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6
`color`	Describes the list of colors which the light sensor can sense either as a reference to a classification scheme that shall be using the `meg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003 or as RGB value. A CS that may be used for this purpose is the `ColorCS` defined in A.2.2 of ISO/IEC 23005-6. EXAMPLE `urn:mpeg:mpeg-v:01-SI-ColorCS-NS:alice_blue` would describe the color Alice blue.

6.3.3 Examples

This example shows the description of a light sensing with the following semantics. The sensor has an ID of “LS001” and references “LSID001”. The sensor shall be activated and the value shall be 200 (LUX) with the color #FF0000. The sensor shall be sensed at system clock tick of 600000 where there are 1000 ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:LightSensorType" id="LS001"
         sensorIdRef="LSID001" activate="true" value="200" color="#FF0000">
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="1000"
            pts="600000"/>
         </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.4 Ambient noise sensor type

6.4.1 Syntax

```
<!--########################################## -->
<!--Definition of Ambient Noise Sensor type  -->
<!--########################################## -->
<complexType name="AmbientNoiseSensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <attribute name="lifespan" type="float" use="optional"/>
         <attribute name="value" type="float" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.4.2 Semantics

Semantics of the `AmbientNoiseSensorType`:

Name	*Definition*
`AmbientNoiseSensorType`	Tool for describing sensed information using an ambient noise sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`lifespan`	Describes the duration taken to measure the information based on the timestamp. The unit of lifespan is the internal clock count.
`value`	Describes the sensed value of the ambient noise with respect to decibel (dB).
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6

6.4.3 Examples

This example shows the description of an ambient noise sensing with the following semantics. The sensor has an ID of “ANS001” and references “ANSID001”. The sensor shall be activated and the value shall be 10 (dB). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second with a lifespan of 5 seconds.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:AmbientNoiseSensorType" id="ANS001"
         sensorIdRef="ANSID001" activate="true" value="10" lifespan="500">
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" pts="100"/>
      </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.5 Temperature sensor type

6.5.1 Syntax

```
<!--##################################### -->
<!--Definition of Temperature Sensor type  -->
<!--##################################### -->
<complexType name="TemperatureSensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <attribute name="value" type="float" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.5.2 Semantics

Semantics of the `TemeratureSensorType`:

Name	*Definition*
`TemperatureSensorType`	Tool for describing sensed information with respect to a temperature sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit (Celsius) is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.
`Value`	Describes the sensed value of the temperature with respect to the Celsius scale.

6.5.3 Examples

This example shows the description of a temperature sensing with the following semantics. The sensor has an ID of “TS001” and references “TSID001”. The sensor shall be activated and the value shall be 36.5 (°C). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:TemperatureSensorType" id="TS001"
         sensorIdRef="TSID001" activate="true" value="36.5">
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
            pts="60000"/>
      </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.6 Humidity sensor type

6.6.1 Syntax

```
<!--##################################### -->
<!--Definition of Humidity Sensor type  -->
<!--##################################### -->
<complexType name="HumiditySensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <attribute name="value" type="float" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.6.2 Semantics

Semantics of the `HumiditySensorType`:

Name	*Definition*
`HumiditySensorType`	Tool for describing sensed information with respect to a humidity sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `unitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.
`value`	Describes the value sensed by the humidity sensor with respect to percentage (%).

6.6.3 Examples

This example shows the description of a humidity sensing with the following semantics. The sensor has an ID of “HS001” and references “HSID001”. The sensor shall be activated and the value shall be 60 (%).The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:HumiditySensorType" id="HS001"
         sensorIdRef="HSID001" activate="true" value="60">
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
            pts="60000"/>
      </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.7 Distance sensor type

6.7.1 Syntax

```
<!--##################################### -->
<!--Definition of Distance Sensor type   -->
<!--##################################### -->
<complexType name="DistanceSensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <attribute name="value" type="float" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.7.2 Semantics

Semantics of the `DistanceSensorType`:

Name	*Definition*
`DistanceSensorType`	Tool for describing sensed information with respect to a length sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.
`value`	Describes the sensed value from the length sensor with respect to meter (m).

6.7.3 Examples

This example shows the description of a length sensing with the following semantics. The sensor has an ID of "LS001" and references "LSID001". The sensor shall be activated and the value shall be 5 (m). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:DistanceSensorType" id="DS001"
         sensorIdRef="DSID001" activate="true" value="5.0" >
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
            pts="60000"/>
      </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.8 Atmospheric pressure sensor type

6.8.1 Syntax

```
<!--################################################ -->
<!--Definition of Atmospheric pressure Sensor type  -->
<!--################################################ -->
<complexType name="AtmosphericPressureSensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <attribute name="value" type="float" use="optional"/>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.8.2 Semantics

Semantics of the `AtmosphericPressureSensorType`:

Name	*Definition*
`AtmosphericPressure SensorType`	Tool for describing sensed information with respect to an atmospheric pressure sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.
`value`	Describes the sensed value from the humidity sensor with respect to hectopascal (hPa).

6.8.3 Examples

This example shows the description of an atmospheric pressure sensing with the following semantics. The sensor has an ID of “APS001” and references “APSID001”. The sensor shall be activated and the value shall be 1000 (hPa). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:AtmosphericPressureSensorType" id="APS001"
         sensorIdRef="APSID001" activate="true" value="1000.0" >
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
            pts="60000"/>
      </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.9 Position sensor type

6.9.1 Syntax

```
<!--##################################### -->
<!--Definition of Position Sensor type  -->
<!--##################################### -->
<complexType name="PositionSensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <sequence>
            <element name="Position" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.9.2 Semantics

Semantics of the `PositionSensorType`:

Name	*Definition*
`PositionSensorType`	Tool for describing sensed information with respect to a position sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`Position`	Describes the 3D value of the position sensor in the unit of meter (m). The origin of the coordinate shall be the position of the object sensed at the time of sensor activation. If a calibration has been performed on the position of the sensor, the origin shall be the position after the calibration. If this sensed information is used with the `PositionSensorCapability` information defined in ISO/IEC 23005-2, the origin of the coordinate shall be defined in the `PositionSensorCapability`.
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.

6.9.3 Examples

This example shows the description of a position sensing with the following semantics. The sensor has an ID of “PS001” and references “PSID001”. The sensor shall be activated and the value shall be Px="1.5" (m), Py="0.5" (m), and Pz="-2.1" (m). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:PositionSensorType" id="PS001"
         sensorIdRef="PSID001" activate="true" >
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
            pts="60000"/>
         <siv:Position>
            <mpegvct:X>1.5</mpegvct:X>
            <mpegvct:Y>0.5</mpegvct:Y>
            <mpegvct:Z>-2.1</mpegvct:Z>
         </siv:Position>
      </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.10 Velocity sensor type

6.10.1 Syntax

```
<!--##################################### -->
<!--Definition of Velocity Sensor type    -->
<!--##################################### -->
<complexType name="VelocitySensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <sequence>
            <element name="Velocity" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.10.2 Semantics

Semantics of the `VelocitySensorType`:

Name	*Definition*
`VelocitySensorType`	Tool for describing sensed information with respect to a velocity sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`Velocity`	Describes the sensed velocity by the sensor in three dimensional vector with respect to meter per second (m/s).

Name	*Definition*
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.

6.10.3 Examples

This example shows the description of a velocity sensing with the following semantics. The sensor has an ID of “VS001” and references “VSID001”. The sensor shall be activated and the value shall be Vx="10.0" (m/s), Vy="5.0" (m/s), and Vz="0.1" (m/s). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:VelocitySensorType" id="VS001"
         sensorIdRef="VSID001" activate="true" >
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
            pts="60000"/>
         <siv:Velocity>
            <mpegvct:X>10.0</mpegvct:X>
            <mpegvct:Y>5.0</mpegvct:Y>
            <mpegvct:Z>0.1</mpegvct:Z>
         </siv:Velocity>
      </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.11 Acceleration sensor type

6.11.1 Syntax

```
<!--################################### -->
<!--Definition of Acceleration Sensor type  -->
<!--################################### -->
<complexType name="AccelerationSensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <sequence>
            <element name="Acceleration" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.11.2 Semantics

Semantics of the `AccelerationSensorType`:

Name	*Definition*
`AccelerationSensorType`	Tool for describing sensed information with respect to an acceleration sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`Acceleration`	Describes the value of the acceleration sensor in three dimensional vector with respect to m/s^2.
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.

6.11.3 Examples

This example shows the description of an acceleration sensing with the following semantics. The sensor has an ID of “AS001” and references “ASID001”. The sensor shall be activated and the value shall be Ax="9.8" (m/s^2), Ay="4.9" (m/s^2), and Az="-4.9" (m/s^2). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:AccelerationSensorType" id="AS001"
         sensorIdRef="ASID001" activate="true" >
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
            pts="60000"/>
         <siv:Acceleration>
            <mpegvct:X>9.8</mpegvct:X>
            <mpegvct:Y>4.9</mpegvct:Y>
            <mpegvct:Z>-4.9</mpegvct:Z>
         </siv:Acceleration>
      </iidl:SensedInfo>
   </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.12 Orientation sensor type

6.12.1 Syntax

```
<!--################################### -->
<!--Definition of Orientation Sensor type  -->
<!--################################### -->
<complexType name="OrientationSensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <sequence>
            <element name="Orientation" type="mpegvct:Float3DVectorType"
```

```
                minOccurs="0"/>
            </sequence>
            <attribute name="unit" type="mpegvct:unitType" use="optional"/>
        </extension>
    </complexContent>
</complexType>
```

6.12.2 Semantics

Semantics of the `OrientationSensorType`:

Name	*Definition*
`OrientationSensorType`	Tool for describing sensed information with respect to an orientation sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`Orientation`	Describes the sensed value by the orientation sensor in three dimensional vector in the unit of degree. The orientation shall be measured as the inclined degree (orientation) with respect to the original pose. The original pose shall be the pose of the object sensed at the time of sensor activation. If a calibration has been performed on the orientation of the sensor after activation, the orientation after the calibration shall be considered as the original pose of the object.
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.

6.12.3 Examples

This example shows the description of an orientation sensing with the following semantics. The sensor has an ID of “OS001” and references “OSID001”. The sensor shall be activated and the value shall be Ox="6.0" (degrees), Oy="-3" (degrees), and Oz="3" (degrees). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
    <iidl:SensedInfoList>
        <iidl:SensedInfo xsi:type="siv:OrientationSensorType" id="OS001"
            sensorIdRef="OSID001" activate="true" unit="radian" >
            <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
                pts="60000"/>
            <siv:Orientation>
                <mpegvct:X>6.0</mpegvct:X>
                <mpegvct:Y>-3</mpegvct:Y>
                <mpegvct:Z>3</mpegvct:Z>
            </siv:Orientation>
        </iidl:SensedInfo>
    </iidl:SensedInfoList>
</iidl:InteractionInfo>
```

6.13 Angular velocity sensor type

6.13.1 Syntax

```
<!--################################################ -->
<!--Definition of Angular Velocity Sensor type  -->
<!--################################################ -->
<complexType name="AngularVelocitySensorType">
   <complexContent>
      <extension base="iidl:SensedInfoBaseType">
         <sequence>
            <element name="AngularVelocity" type="mpegvct:Float3DVectorType"
               minOccurs="0"/>
         </sequence>
         <attribute name="unit" type="mpegvct:unitType" use="optional"/>
      </extension>
   </complexContent>
</complexType>
```

6.13.2 Semantics

Semantics of the `AngularVelocitySensorType`:

Name	*Definition*
`AngularVelocitySensorType`	Tool for describing sensed information with respect to with respect to an angular velocity sensor.
`TimeStamp`	Describes the time that the information is acquired (sensed).
`AngularVelocity`	Describes the sensed value by the Angular Velocity sensor in three dimensional vector with respect to degree per second.
`unit`	Specifies the unit of the sensed value, if a unit other than the default unit is used, as a reference to a classification scheme term that shall be using the `mpeg7:termReferenceType` defined in 7.6 of ISO/IEC 15938-5:2003. The CS that may be used for this purpose is the `UnitTypeCS` defined in A.2.1 of ISO/IEC 23005-6.

6.13.3 Examples

This example shows the description of an angular velocity sensing with the following semantics. The sensor has an ID of “AVS001” and references “AVSID001”. The sensor shall be activated and the value shall be AVx="6" (degree/s), AVy="-4" (degree/s), and AVz="15" (degrees/s). The sensor shall be sensed at timestamp="60000" where there are 100 clock ticks per second.

```
<iidl:InteractionInfo>
   <iidl:SensedInfoList>
      <iidl:SensedInfo xsi:type="siv:AngularVelocitySensorType" id="AVS001"
         sensorIdRef="AVSID001" activate="true" unit="radpersec">
         <iidl:TimeStamp xsi:type="mpegvct:ClockTickTimeType" timeScale="100"
            pts="60000"/>
         <siv:AngularVelocity>
            <mpegvct:X>6.0</mpegvct:X>
```