INTERNATIONAL STANDARD

ISO/IEC 18040

First edition
2019-05

Information technology — Computer graphics, image processing and environmental data representation — Live actor and entity representation in mixed and augmented reality (MAR)

Technologies de l'information — Infographie, traitement de l'image et représentation des données environnementales — Représentation d'acteurs et d'entités réels en réalité mixte et augmentée (MAR)

Reference number
ISO/IEC 18040:2019(E)

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 24, *Computer graphics, image processing and environmental data representation*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document defines the scope and key concepts of a representation model for a live actor and entity (LAE) to be included in a mixed and augmented reality (MAR) world. The relevant terms and their definitions, and a generalized system architecture, together serve as a reference model for MAR applications, components, systems, services and specifications. It defines representing and rendering an LAE in an MAR scene, and interaction interfaces between an LAE and objects in an MAR scene. It defines a set of principles, concepts and functionalities for an LAE applicable to the complete range of current and future MAR standards. This reference model establishes the set of required modules and their minimum functions, the associated information content, and the information models that shall be provided and/or be supported by a compliant MAR system. It includes (but is not limited to) the following content:

— an introduction to the mixed and augmented reality standards domain and concepts;

— a representation model for including an LAE in an MAR scene;

— 3D modelling, rendering and simulation of an LAE in an MAR scene;

— attributes of an LAE in an MAR scene;

— sensing representation of an LAE in an MAR scene;

— representation of the interfaces for controlling an LAE in an MAR scene;

— functionalities and base components for controlling an LAE in an MAR scene;

— interactive interfaces between an LAE and an MAR scene;

— interface with other MAR components;

— relationship to other standards;

— use cases.

The objectives of this document are as follows:

— provide a reference model for LAE representation-based MAR applications;

— manage and control an LAE with its properties in an MAR environment;

— integrate an LAE into a 2D and/or 3D virtual scene in an MAR scene;

— achieve interaction of an LAE with a 2D and/or 3D virtual scene in an MAR scene;

— provide an exchange format necessary for transferring and storing data between LAE-based MAR applications.

This document has the following document structure:

— Clause 4 describes the concepts of LAE-based systems represented in MAR.

— Clause 5 illustrates how a sensor captures an LAE in a physical world and a virtual world.

— Clause 6 describes mechanisms to track the position of an LAE and specifies the role of a spatial mapper between physical space and the MAR space.

— Clause 7 describes mechanisms to recognize the behaviour of an LAE and specifies an association or event between an MAR event of an LAE and the condition specified by the MAR content creator.

— Clause 8 describes a scene, which consists of a virtual scene, sensing data, a spatial scene, events, targets and so on, for an LAE.

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— Clause 9 describes how the MAR scene system renders the scene, LAE mapping, event and so on for presentation output on a given display device.

— Clause 10 describes types of displays, including monitors, head mounted displays, projectors, haptic devices and sound output devices for displaying an LAE in an MAR scene.

— Clause 11 identifies and describes virtual LAE, such as virtual 3D model (avatar) and virtual LAE, such as real human model in an MAR system.

— Clause 12 makes statements regarding any system performance related issues of an LAE in MAR.

— Clause 13 makes statements regarding any operational safety related issues of an LAE in MAR.

— Clause 14 makes statements regarding any conformance related issues of an LAE in MAR.

— Annex A gives examples of representative LAE representation systems in MAR.

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Information technology — Computer graphics, image processing and environmental data representation — Live actor and entity representation in mixed and augmented reality (MAR)

1 Scope

This document defines a reference model and base components for representing and controlling a single LAE or multiple LAEs in an MAR scene. It defines concepts, a reference model, system framework, functions and how to integrate a 2D/3D virtual world and LAEs, and their interfaces, in order to provide MAR applications with interfaces of LAEs. It also defines an exchange format necessary for transferring and storing LAE-related data between LAE-based MAR applications.

This document specifies the following functionalities:

a) definitions for an LAE in MAR;

b) representation of an LAE;

c) representation of properties of an LAE;

d) sensing of an LAE in a physical world;

e) integration of an LAE into a 2D/3D virtual scene;

f) interaction between an LAE and objects in a 2D/3D virtual scene;

g) transmission of information related to an LAE in an MAR scene.

This document defines a reference model for LAE representation-based MAR applications to represent and to exchange data related to LAEs in a 2D/3D virtual scene in an MAR scene. It does not define specific physical interfaces necessary for manipulating LAEs, that is, it does not define how specific applications need to implement a specific LAE in an MAR scene, but rather defines common functional interfaces for representing LAEs that can be used interchangeably between MAR applications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 18039, *Information technology — Computer graphics, image processing and environmental data representation — Mixed and augmented reality (MAR) reference model*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 18039 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

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— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
augmented object
object with augmentation

3.1.2
geographic coordinate system
coordinate system which is provided by sensor devices for defining a location of *LAE* (3.1.4)

3.1.3
head mounted display
HMD
device which displays stereo views of virtual reality

Note 1 to entry: It has two small displays with lenses and semi-transparent mirrors which can adapt to the left and right eyes.

3.1.4
live actor and entity
LAE
representation of a living physical or real object, such as a human being, animal or bird, in the MAR content or system

Note 1 to entry: A live actor can be animated, moved and interacted with virtual objects in an MAR scene by capturing gesture from a camera. Entity refers to 3D objects and entities that exist in MAR content.

3.1.5
LAE recognizer
MAR component that recognizes the output from an *LAE capturer* (3.1.6) and an LAE sensor, then generates MAR events based on conditions indicated by the content creator

3.1.6
LAE capturer
MAR component that captures an *LAE* (3.1.4) in a virtual world and a physical world, which includes depth cameras, general cameras, 360° cameras and so on

Note 1 to entry: LAE's information can be processed by an LAE recognizer and an LAE tracker to extract background or skeleton.

3.1.7
LAE tracker
MAR component (hardware and software) that analyses signals from *LAE capturers* (3.1.6) and sensors and provides some characteristics of a tracked *LAE* (3.1.4) (for example position, orientation, amplitude, profile)

3.1.8
physical camera coordinate system
coordinate system which is provided by a camera for capturing *LAE(s)* (3.1.4) in physical world

3.1.9
physical coordinate system
coordinate system that enables locating an *LAE* (3.1.4) and is controlled by a geospatial coordinate system sensing device

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3.1.10
virtual actor and entity
VAE
virtual reality representation of an *LAE* (3.1.4)

Note 1 to entry: The virtual actor and entity is obtained by a 3D capturing technique and can be reconstructed, transmitted or compressed in the MAR scene. A virtual actor and entity can be captured in one place or transmitted to another place in real time using holography technology.

3.1.11
world coordinate system
universal system in computer graphics that allows model coordinate systems to interact with each other

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO/IEC 18039 and the following apply.

DDR	dance dance revolution
EID	event identifier
FOV	field of view
GNSS	global navigation satellite system
LAE-MAR	live actor and entity representation in mixed and augmented reality
RGB	red, green, blue
SDK	software development kit
SID	sensor identifier
UI	user interface
UTM	universal transverse mercator
VR	virtual reality

4 Concepts of LAE representation in MAR

4.1 Overview

As illustrated in ISO/IEC 18039, MAR represents a continuum which encompasses all domains or systems that use a combination of reality (for example live video) and virtuality representations (for example computer graphic objects or scene) as its main presentation medium[1][2]. Figure 1 illustrates the MAR that is defined according to a mixture of reality and virtuality representations excluding pure real environment and pure virtual environment with viewpoints of an LAE representation. The real environment refers to the physical world environment where an LAE and physical objects are located. Virtual environment commonly refers to virtual reality, that is the computer-generated realistic images and hypothetical world that replicate a real environment. Augmented reality refers to the view of the real-world environment whose elements include LAE and objects that can be augmented by computer-generated sensory, and augmented virtuality is the virtual environment within which physical world elements including LAE can be mapped and interacted. In Figure 1, an LAE wears an HMD device to see the virtual world and interacts directly with virtual objects.

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