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Information technology — Information modelling for virtual, augmented and mixed reality based education and training systems

Technologies de l'information — Modélisation de l'information pour les systèmes d'éducation et de formation basés sur la réalité virtuelle, augmentée et mixte

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Foreword

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Introduction

Virtual, augmented, and mixed reality (VR/AR/MR) systems that are used for education and training require approaches that support systems integration with various industry areas. Because the integration aspects should include common functionalities, unique information modelling requirements are necessary. Use cases for education and training have been reviewed to determine education and training technologies that are in common use and to determine an information model that can be used to support these types of activities supported by VR/AR/MR technologies. This document includes these use cases.

VR/AR/MR based education and training systems have requirements related to learning and teaching approaches, representation, exchange, data, and interaction, in the following ways. First, existing learning and teaching approaches can be integrated with the use of VR/AR/MR technology and form the basis for user interactions with the systems and its elements. Based on differences in learning and teaching methods when using VR/AR/MR, requirements that support interaction and simulation should be included. For example, the use of haptics can be added to support user interaction with the system. Second, visual and interactive representation should be provided to enhance the effectiveness of education and training. Simulation can be an important aspect in representing information and in understanding education and training content. Third, information should be exchangeable over heterogeneous computing environments so that it is accessible to users to support their education and training activities anytime and anywhere. Fourth, education and training information and data should be organized, transferred, stored, and managed securely. Fifth, interfaces for interacting with devices and sensors should be included and should meet the requirements of users.

This document provides requirements and recommendations for developing VR/AR/MR based education and training systems to meet the requirements listed above. The requirements and recommendations include concepts, information modelling architecture, standards based functional components, and implementation components for VR/AR/MR based education and training.

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Information technology — Information modelling for virtual, augmented and mixed reality based education and training systems

1 Scope

This document provides requirements and recommendations for developing education and training systems using virtual, augmented and mixed reality (VR/AR/MR) technology. It specifies how to organize the information and data necessary for the development of VR/AR/MR integrated systems for education and training. It includes procedures for the development of VR/AR/MR integrated systems.

This document includes several topics for consideration when developing VR/AR/MR based education and training systems, as follows. First, it defines concepts of VR/AR/MR based education and training. Second, it defines an information modelling architecture for the systems. Third, standards based functional components for the systems are specified. Fourth, framework components for implementing the systems are specified. And, finally, use cases for the systems based on the information modelling architecture are included.

Device hardware technology for education and training systems is excluded from this document.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1 Terms and definitions

3.1.1
augmented reality
AR
interactive experience whereby virtual objects are superimposed upon or embedded within the physical world

3.1.2
education
process of receiving or giving systematic instruction, especially at a school or university

[SOURCE: ISO/IEC 19896-1:2018, 3.3]

3.1.3
gyro sensor
sensor that measures angular velocity

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3.1.4
learning
acquisition of knowledge, skills or attitudes

[SOURCE: ISO/IEC 2382-36:2019, 3.1.1]

3.1.5
mixed reality
MR
merging of real and virtual worlds to generate new environments where physical and synthetic objects co-exist and interact

Note 1 to entry: *Augmented reality (AR)* (3.1.1) and *virtual reality (VR)* (3.1.9) are considered to be on the mixed reality continuum.

[SOURCE: ISO/IEC 18038:2020, 3.14, modified — Note 1 to entry was added.]

3.1.6
physical sensor
internet of things (IoT) sensor which has the functionality of a physical device in a 3D virtual world

[SOURCE: ISO/IEC 18038:2020, 3.20]

3.1.7
system integration
process of bringing together the component sub-systems into one cohesive system to meet specified requirements

[SOURCE: ISO 16484-1:2024, 3.14]

3.1.8
training
activities designed to facilitate the learning and development of knowledge, skills, and abilities, and to improve the performance of specific tasks and roles

3.1.9
virtual reality
VR
interactive and immersive technology generated experience taking place in an artificial and simulated environment

3.1.10
virtual, augmented and mixed reality based education
VR/AR/MR based education
act or process of imparting or acquiring theoretical knowledge during immersive and interactive experiences using virtual, augmented and mixed environments where real and synthetic objects generated by *virtual reality (VR)* (3.1.9), *augmented reality (AR)* (3.1.1), and *mixed reality (MR)* (3.1.5) technologies co-exist and interact

3.1.11
virtual, augmented and mixed reality based training
VR/AR/MR based training
teaching or developing skills, behaviours, or fitness that relate to specific useful competencies using virtual, augmented and mixed environments where real and synthetic objects generated by *virtual reality (VR)* (3.1.9), *augmented reality (AR)* (3.1.1), and *mixed reality (MR)* (3.1.5) technologies co-exist and interact

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3.2 Abbreviations

3D	3-dimensional
AFX	animation framework eXtension
AR	augmented reality
ARAF	augmented reality application format
AVC	advanced video coding
BIFS	binary format for scenes
DRM	data representation model
EDCS	environmental data coding specification
EVC	essential video coding
G-PCC	geometry-based cloud compression
GUI	graphical user interface
HDR	high dynamic range
HEVC	high efficiency video coding
HNSS	hybrid natural/synthetic scene
HAnim	humanoid animation
ICT	information and communications technology
IT	information technology
ITLET	IT-enhanced learning, education, and training
JPEG	joint photographic experts group
LOA	level of articulation
MAR	mixed and augmented reality
MLR	metadata for learning resources
MPEG	moving picture experts group
MPEG-A	MPEG augmented reality application format
MR	mixed reality
OMAF	omnidirectional media format
SAI	scene access interface
SEDRIS	synthetic environment data representation and interchange specification
SRM	spatial reference model
STF	SEDRIS transmittal format

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