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Information technology — Computer graphics, image processing and environmental representation — Constructs for visual positioning systems in mixed and augmented reality (MAR)

Technologies de l'information — Infographie, traitement de l'image et représentation des données environnementales — Constructions pour les systèmes de positionnement visuel en réalité mixte et augmentée

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Foreword

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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*.

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Introduction

Mixed and augmented reality (MAR) refers to the contents and the underlying technology that can overlay/insert (or augment) and display information over/in the real world. The augmentation means certain "virtual" or "artificial" information is spatially registered in a proper position and orientation within the 3D real world. To realize this "spatial" registration, the MAR system includes a functionality, called "positioning", that can recognize and understand the real world in 3D, track the position and orientation of the user so that the mixed reality scene can be composed and displayed to the user in the right way. When the positioning function implementation is based primarily on the camera images, it is referred to as the "Visual" positioning system (VPS).

This document outlines the basic reference MAR architecture, especially the detailed system components for the VPS and relevant informational constructs. Such a reference model can serve as a basis for discovering opportunities for future MAR standardization.

The focus is given to the system components and information constructs for image (visual) based scene recognition and tracking. The document also provides definitions for terms as related to pertaining domains, and illustrate typical VPS/MAR use cases. Note that the detailed processes or algorithms for different system components are out of scope.

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Information technology — Computer graphics, image processing and environmental representation — Constructs for visual positioning systems in mixed and augmented reality (MAR)

1 Scope

This document specifies the concept of visual positioning system (VPS) in the context of mixed and augmented reality (MAR) and describes a reference model for it in terms of the essential system components and information constructs.

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 18039:2019, *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 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/

3.1.1
image based map
map which is created from only images without pre-existing map

3.1.2
image registered map
map annotated with camera images taken from key locations in it

3.1.3
pre-existing metric map
conventional geographical map in standard distance unit and scale

3.1.4
positioning system
mixed and augmented reality subsystem that tracks the location and orientation of the user/client or specific designated object

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3.2 Abbreviated terms

AI	artificial intelligence
GNSS	global navigational satellite system
IMU	inertial measurement unit
MAR	mixed and augmented reality
SfM	structure from motion
SLAM	simultaneous localization and mapping
VPS	visual positioning system

4 Concept: Visual positioning system in mixed and augmented reality

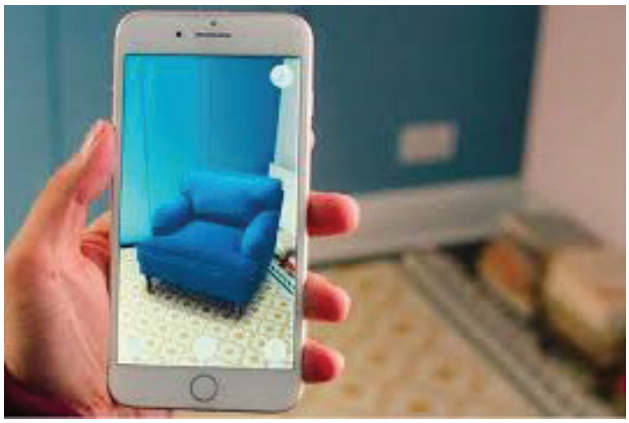
4.1 VPS and MR

MAR refers to a spatially coordinated combination of media/information components that represent on the one hand the real world and its objects, and on the other those that are virtual, synthetic and computer generated. In other words, MAR content overlays/inserts (or augments) and displays information over/in the real world (see Figure 1). The term overlaying in effect means certain "virtual" or "artificial" information (e.g. a virtual sofa in Figure 1) is spatially registered and placed in a proper position and orientation in the real space (e.g. corner of the living room in Figure 1) with respect to the user's view and display. This makes MAR distinguished from e.g. a close captioned system where certain information is overlaid on a designated location on the display screen, and not in relation to the content.

Thus, any MAR system includes, as one of its system functionalities, a way to recognize the target object of interest which is to be augmented, and at the least be able to track its location and orientation relative to the user. In this case, the MAR system would offer an "object" centric service – that is, augment a particular object at the relative location from the user (usually in a small local space). See the example in Figure 1.



a) An object (marker)



b) Landmark (corner of the room)

Figure 1 — Small scale MAR system/content

NOTE Small scale MAR system/content in which an object (a) or landmark (b) is detected, recognized and its position/orientation tracked (with respect to the moving user) on to which a virtual object (e.g. house, sofa) is spatially registered.

However, the tracking of the target object of interest and the user can be relative to another reference coordinate system and associated with a larger environment map. This way, the scope of the MAR system can become much larger (e.g. city scale) with the augmentation based on both object type and its location.

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