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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

Multimedia Quality of Service and performance – Generic
and user-related aspects

Quality of experience influencing factors for augmented reality services

Recommendation ITU-T G.1036

ITU-T G-SERIES RECOMMENDATIONS
TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100–G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200–G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300–G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400–G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450–G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600–G.699
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
MULTIMEDIA QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000–G.7999
PACKET OVER TRANSPORT ASPECTS	G.8000–G.8999
ACCESS NETWORKS	G.9000–G.9999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T G.1036

Quality of experience influencing factors for augmented reality services

Summary

Recommendation ITU-T G.1036 lists typical use cases of augmented reality (AR) services and identifies the key quality of experience (QoE) factors within them, and also gives a suggested scheme for AR QoE assessment in future work.

History

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Table of Contents

		Page
1	Scope.....	1
2	References.....	1
3	Definitions	2
	3.1 Terms defined elsewhere	2
	3.2 Terms defined in this Recommendation.....	2
4	Abbreviations and acronyms	2
5	Conventions	3
6	Augmented reality system configuration and taxonomy	3
	6.1 Overview	3
	6.2 Typical augmented reality service use cases	3
	6.3 Technical classification	4
7	Augmented reality quality of experience influence factors	4
	7.1 Human factors	5
	7.2 System influence factors.....	5
	7.3 Context influence factors.....	12
	7.4 General factors.....	13
8	Augmented reality quality of experience assessment	14
	8.1 Presentation quality	15
	8.2 Combination quality	15
	8.3 Quality of interaction.....	16
	Appendix I – Augmented reality services use cases	17
	I.1 Face augmented reality use scenario	17
	I.2 Space-based augmented reality use scenario.....	17
	Bibliography.....	19

Recommendation ITU-T G.1036

Quality of experience influencing factors for augmented reality services

1 Scope

This Recommendation describes two main types of augmented reality (AR): face AR and space AR. Face AR refers to a service that superimposes the AR effect in and around the human face. Space AR refers to a service in which an AR effect is superimposed on a natural space, such as a tabletop, a wall surface, a common object, an indoor space or an outdoor open space.

In order to measure the quality of experience (QoE) that users perceive in face and space AR services, benchmarking is critical. Due to addition of new ways to locate the self-position of users and a new display mode of perceptual information, a set of new requirements for QoE assessment presents itself. The challenge is to characterize immersive video, spatial audio and interactivity of AR. It is also important to address the requirements and basic factors affecting virtual reality (VR) QoE before work is benchmarked. This Recommendation identifies the taxonomy of the two AR services and key factors affecting user-perceived experience.

This Recommendation includes:

- face and space AR service taxonomy and corresponding use cases;
- QoE-influencing factors for face and space AR services.

AR is an immersive experience of a real-world environment in which objects within it are "augmented" by computer-generated perceptual information, e.g., one or several visual, auditory, haptic, somatosensory and olfactory factors can be included. AR differs from VR, which aims to completely replace the user's real world environment with a simulated one; AR keeps the real world and adds information to the natural environment. The value of AR is to integrate immersive sensations into the natural environment, thus deepening perception when compared to actual reality. The first AR application systems were used for military training; subsequently, its functional scope has been expanded to gaming, education, navigation, etc.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

None.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 quality of experience (QoE) [b-ITU-T P.10]: The degree of delight or annoyance of the user of an application or service.

3.1.2 QoE influencing factors [b-ITU-T P.10]: Include the type and characteristics of the application or service, context of use, the user's expectations with respect to the application or service and their fulfilment, the user's cultural background, socio-economic issues, psychological profiles, emotional state of the user, and other factors whose number will likely expand with further research.

3.1.3 cybersickness or simulator sickness [b-ITU-T G.1035]: A physiological condition arising when exposed to a virtual reality environment.

NOTE – Definition based on combined information in [b-Kennedy] and [b-Stanney].

3.1.4 degree of freedom (DoF) [b-ITU-T G.1035]: Represents the ways an object can move within a space, which is a key element in helping create an immersive environment for a user.

3.1.5 immersion [b-ITU-T G.1035]: A psychological state characterized by perceiving oneself to be enveloped by, included in and interacting with an environment that provides a continuous stream of stimuli and experiences.

NOTE – Definition based on [b-Witmer].

3.1.6 motion-to-photon latency [b-ITU-T G.1035]: The time it takes between the user moving their head and this motion being reflected on the screen of the head-mounted display (HMD).

NOTE – Definition based on [b-Brandenburg].

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 geometric consistency: The degree of similarity of registration and tracking, to ensure that virtual content has correct locating relationship with the real environment as time changes.

3.2.2 illumination consistency: The degree of similarity of texture and lighting being simulated by augmented reality devices to those of the surrounding environment.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

3D	three Dimensional
A/V	Audio and Video
AR	Augmented Reality
BCI	Brain-Computer Interface
CG	Computer Graphics
DoF	Degree of Freedom
FoV	Field of View

HCI	Human-Computer Interaction
HDR	High Dynamic Range
HMD	Head-Mounted Display
ID	Identifier
OST	Optical See-Through
QR	Quick Response
SAR	Spatial Augmented Reality
SDR	Standard Dynamic Range
VP _n	Video Payload type <i>n</i>
VR	Virtual Reality
VST	Video See-Through

5 Conventions

Within the scope of this recommendation, AR services are sorted into three kinds, namely: optical see-through (OST); video see-through (VST); and spatial augmented reality (SAR), mainly depending on their difference in display method. People using and experiencing these AR services are referred to as users or players.

6 Augmented reality system configuration and taxonomy

6.1 Overview

To achieve an ideal and realistic AR effect, an AR service application system is usually composed of the support of AR mobile device, network and platform(s). It should be noted that at the current stage, the AR service locally processed on a device occupies a large part of the form, and in such applications, network and platform support may not be needed [b-3GPP TR 26.998].

AR device: AR glasses, smart phone, model acquisition device (depth camera, camera group, infrared transceiver), interactive facilities.

Network: (low-delay) wireless local area network, fourth or fifth generation network.

AR platform: content authoring platform, audio and video (A/V) stream-forwarding platform, content recognition platform, A/V rendering platform, geographic model storage platform.

6.2 Typical augmented reality service use cases

There are two typical AR services: face and space based. A face AR service mainly processes and displays augmented information on the human face, while a space-based AR service is suitable for other objects and spaces remaining.

6.2.1 Face augmented reality service

There are two main types of face AR service: user local and remote call. User local services are designed for the user to experience AR effects in real time on the capture device itself, while the processing workflow is completed inside the device in most cases. Remote call services deliver