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ITU Focus Group on metaverse
(FG-MV)

FGMV-04

Requirements of accessible products and services in the metaverse: Part I – System design perspective

Working Group 8: Sustainability, Accessibility & Inclusion

Technical Specification ITU FGMV-04

Requirements of accessible products and services in the metaverse: Part I – System design perspective

Summary

This Technical Specification provides high-level requirements for designers and developers to create an accessible immersive experience in the metaverse. This document considers the common accessibility requirements for the design and development phases of born accessible products and services in the metaverse. The document is related to "Requirements of accessible products and services in the metaverse: Part II – User perspective" and provides common accessibility requirements.

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Requirements of accessible products and services in the metaverse: Part I – System design perspective

1 Scope

This Technical Specification provides high-level requirements accessible products and services in metaverse which need to be considered during the design and implementation stages of metaverse products and services to allow and assist all users to engage in an accessible immersive experience.

Note: Specific guidance on user needs is provided under ITU-T FG-MV Technical Specification on "Requirements of accessible products and services in the metaverse: Part II – user perspective".

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Technical Specification. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Technical Specification 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 Technical Specification does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T F.791]   Recommendation ITU-T F.791 (2015), *Accessibility terms and definitions*.

3 Definitions

3.1 Terms defined elsewhere

This Technical Specification uses the following terms defined elsewhere:

3.1.1 Artificial intelligence [b-ISO/IEC 2382]: An interdisciplinary field, usually regarded as a branch of computer science, dealing with models and systems for the performance of functions generally associated with human intelligence, such as reasoning and learning.

3.1.2 Augmented reality [b-ITU-T J.301]: A type of mixed reality where graphical elements are integrated into the real world in order to enhance user experience and enrich information.

3.1.3 Avatar [b-ISO/IEC 23005-4]: entity that can be used as a (visual) representation of the user inside the virtual environments.

3.1.4 Diverse users [b-ISO/IEC 71]: Individuals with differing abilities and characteristics or accessibility needs.

3.1.5 Easy-to-understand language [b-ISO/IEC 23859]: Any language variety which enhances comprehensibility. Note 1 to entry: Easy-to-understand language includes plain language, easy language and any intermediate variety. These varieties share many recommendations, but the extent of comprehensibility is different as they address different user needs.

3.1.6 Extended reality: [b-ITU-T P.1320]: An environment containing real or virtual components or a combination thereof, where the variable X serves as a placeholder for any form of new environment (e.g., augmented, assisted, mixed, virtual or diminished reality).

3.1.7 Internet of Things [b-ITU-T Y.4000]: A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies.

3.1.8 Mixed reality [b-ISO/IEC 18038]: Merging of real and virtual worlds to generate new environments where physical and synthetic objects co-exist and interact.

3.1.9 Product [b-ISO/IEC 9241-11]: Item that is made or created by a person or machine.

3.1.10 Service [b-ISO/IEC 9241-11]: Means of delivering value for the customer by facilitating results the customer wants to achieve.

3.1.11 System [b-ISO/IEC 9241-11]: Combination of interacting elements organized to achieve one or more stated purposes.

3.1.12 Task [b-ISO/IEC 9241-11]: Set of activities undertaken in order to achieve a specific goal.

3.1.13 User interface [b-ISO/IEC 9241-11]: All components of an interactive system (software or hardware) that provide information and/or controls for the user to accomplish specific tasks with the interactive system.

3.1.14 Virtual reality [b-ISO 9241-394]: Set of artificial conditions created by computer and dedicated electronic devices that simulate visual images and possibly other sensory information of a user's surrounding with which the user is allowed to interact.

3.2 Terms defined in this Technical Specification

None.

4 Abbreviations and acronyms

This Technical Specification uses the following abbreviations and acronyms:

AI   Artificial Intelligence

AR   Augmented Reality

IoT   Internet of Things

VR   Virtual Reality

5 Conventions

In this Technical Specification:

- The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance with this Recommendation is to be claimed.

- The keywords "is recommended" indicate a recommendation which is not absolutely required. Thus, this requirement need not to be fulfilled to claim conformance.

- The keywords "should" or "may" indicate an optional requirement which is permissible. This term is not intended to imply that the vendor's implementation must provide the option, and the feature can be optionally enabled by the vendor. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Introduction

This Technical Specification is aimed at providing a high-level overview of requirements on accessible products and services that need to be considered by designers and developers, with the objective of highlighting the benefits of accessibility and inclusion, as primary drivers of innovation, and key factors for the improvement of the user's satisfaction and quality of experience.

Designers and developers of products and services in the metaverse need to be aware of existing guidelines and requirements [b-W3C XAUR] to ensure an accessible environment, also considering requirements related to user representation.

6.1 Motivation

The metaverse will open unprecedented user participation in the virtual world encompassing different technologies such as AR, VR, and AI, to name but a few, through interconnected devices making up the Internet of Things (IoT) and interrelated services.

Products and services in the metaverse can present barriers to users from diverse backgrounds, and with different kinds of accessibility needs that range from a complete loss of a sense to an occasional need for assistance.

Accessible products and services in the metaverse need to consider accessibility requirements in the design phase and also the production phase, in order to ensure that an accessible immersive experience is granted to all users regardless of their needs and expectations.

Accessibility requirements include, but are not limited to, people with learning and reading difficulties, neurodiverse users, people with sight or hearing loss, older people, and non-native language speakers.

6.2 System considerations

Although devices such as a smartphone or a computer may be sufficient to experience the metaverse to some extent, navigating and fully engaging in it may require the use of specific hardware components such as augmented reality smart glasses, a virtual reality headset and a device equipped with IMT-2020 (5G).

Different types of software components and platforms are used in the metaverse. Software is used for scene and object recognition, for sound and speech recognition, for scene and object generation, for sound and speech synthesis, and for motion rendering [b-Park], among other AI and machine learning applications.

To allow users to access, perceive, navigate, and interact in the metaverse with other avatars, products and services, it is important to consider how access and engagement are granted to users to allow them accomplishing a task and/or receive feedback.

EXAMPLE 1: A user enters a cafeteria in the metaverse through a virtual reality headset device in the form of an avatar. It is required that the user is able to place an order in different forms (voice, text, sign language interpreting), and to receive feedback in the desired form (voice, text, sign language interpreting).

7 Designing accessible products and services in the metaverse: opportunities and challenges

The metaverse will open unprecedented possibilities and opportunities for users to access and engage in and with various social meanings in an immersive environment.

Making the metaverse an environment of equal opportunities without leaving anyone behind remains a major challenge. Considering accessibility already in the design phase of products and services in the metaverse will help to create meaningful experiences for all users. To this aim, it is required that

accessibility and inclusion are considered from an initial design phase and be iterative. This will ensure that products and services in the metaverse meet the accessibility needs and requirements of all users. It is equally important to ensure that safety measures apply to the designed experiences, to avoid any possible harm related to seizures and dizziness.

The following sections provide general guidance on the main questions to consider when designing accessible products and services in the metaverse.

8 Requirements for designing accessible products in the metaverse

Products in the metaverse are virtual items created by a person or machine. To ensure that these products are accessible to all users, the following common accessibility requirements are considered.

EXAMPLE 2: A user may want to buy a virtual book. The product needs to be described and properly labelled to allow the user to access and interact with it.

8.1 Common accessibility requirements when designing products in the metaverse

Products available in the metaverse need to consider the following requirements:

It is required to provide an accessibility requirements data set which defines user needs and how these needs are addressed when designing the user interface.

It is required to adopt a user-centric perspective during the functional design of a product.

It is required to use easy-to-understand information on product instructions and functionalities.

It is recommended to include a diverse user representation in all design stages in terms of intersectionality, disabilities, and diversity-based options.

It is recommended to use a common or universal icon representation to signal the product.

9 Requirements for designing accessible services in the metaverse

Services in the metaverse are means of delivering value for the customer by facilitating results the customer wants to achieve. To ensure that services are accessible for all users to accomplish a task and receive the corresponding feedback, it is required that the following common accessibility requirements are considered.

9.1 Common accessibility requirements when designing services in the metaverse

Services in the metaverse need to consider the following accessibility requirements:

It is recommended to use a common or universal icon to signal the service.

It is required to provide services in multiple ways according to the user's needs.

It is required to include alternative options for users to activate/deactivate/pause/adjust the service in multiple ways according to their needs.

EXAMPLE 3: A user may want to order a meal in a virtual cafeteria. The service needs to provide enough time for the user to accomplish the task.

It is required to include alternative options for users to receive feedback especially for critical messaging and alerts.

It is required to include both the customization and personalization of services.

It is required to provide inclusion and adaptability to the user's needs through translation and accessibility services including:

- o transcripts: text size, text colour, text position, when possible, interactive text (interactive transcripts).

- subtitling/captioning: text size, text colour, text position, delivery speed, text segmentation.

- audio description: relative loudness to content, language, choice of voice type.

- audio subtitles/spoken captions: delivery speed, relative loudness, choice of voice type (as per audio description).

- signing language interpreting: position and size relative to user, language, choice of avatar.

- oral language interpreting: language, choice of voice type, relative loudness.

- easy-to-understand language: language complexity, text size, text colour.

- haptic representation: sound and music, tactile alerts.

Note: Specific guidance on user needs through translation and accessibility services is provided under ITU-T FG-MV Technical Specification "Requirements of accessible products and services in the metaverse: Part II – user perspective".

It is required that interfaces and navigation related to accessibility services are adaptable to the user's specific needs including:

- personalisation: voice, gaze or tactile control.

- choice of open or closed options for each of the previous accessibility services presented (subtitles/captions, transcripts, sign language interpreting).

- connection or interfacing directly to bespoke user aids or devices.

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