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TECHNICAL REPORT

Virtual reality equipment and systems – Market, technology and standards requirements

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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VIRTUAL REALITY EQUIPMENT AND SYSTEMS – MARKET, TECHNOLOGY AND STANDARDS REQUIREMENTS

FOREWORD

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The text of this Technical Report is based on the following documents:

DTR	Report on voting
100/3484/DTR	100/3519/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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INTRODUCTION

Virtual reality (VR) is an interactive computer-generated experience, which allows the user to feel he is in a virtual world where he can interact in and control a virtual environment. The interaction between the user and the virtual world is mainly through auditory and visual stimuli, but it can also include other types of sensory feedback, such as haptic technology.

This Technical Report focuses on VR equipment and systems that are within the scope of TC 100. Firstly, the ecosystem of VR is described, based on a brief view of market trends and analysis of some typical use cases of VR equipment and systems. Then technologies used in VR equipment and systems are listed, in order to introduce a C-P-N-D (Content, Product, Network and Device) based VR system model. Finally, after studying the standardization activities of related standards developing organizations (SDOs), some suggestions are given, including potential standardization topics within the scope of TC 100.

VIRTUAL REALITY EQUIPMENT AND SYSTEMS – MARKET, TECHNOLOGY AND STANDARDS REQUIREMENTS

1 Scope

This document discusses the market of virtual reality (VR) and the technical domains pertaining to a VR system. This document provides clarity on how existing standards can be used and highlights further requirements for standards within the scope of TC 100.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
head mounted device
HMD
type of computer display device or monitor which is worn on the head or is built in as part of a helmet

3.2
virtual reality
VR
simulation of the physical presence of the user, which is primarily experienced through two of the five senses such as sight and sound, in an environment produced with the help of a computer, enabling the user to interact with this environment

4 Markets for VR equipment and systems

4.1 Overview of VR markets

In the 1980s, the arrival of stereoscopic '3D' games such as Virtuality and Virtual Boy drew attention to virtual display techniques. Even some films, like Lawnmower Man and Virtuosity, and books, such as Snow Crash, demonstrated the powerful potential of VR. But the technology at the time could not match people's imagination or their expectations; poor image quality, significant latency and high device prices made the first trials of VR products fail in the end.

Since 2014, there has been a second wave of VR technology, and, like most new technologies, VR has had a rocky – but predicable start.

According to the predictions of business intelligence, the market of VR hardware will continue to grow. In 2020, cheaper and high-quality VR headsets rolled out to the market, improving the quality in virtual world experiences. In 2021, the same trend will continue [1][1].

4.2 Customer requirements

Compared with other media, such as film, which intent is also to show a 'real' world to the audience, customers have additional special requirements when it comes to VR experiences. These requirements are similar to other 3D techniques.

– Immersive: Immersive is the basic feature for VR equipment and systems. VR needs to engage both the body and the mind of the viewer: to feel real and to respond as if it was real.

– Believable: VR equipment and systems need to give the feeling of complete belief in the virtual world. This can be achieved through consistent use of logic, physics, and narrative. If the experience is not consistent with user expectations for that virtual world, then the illusion of virtual reality will disappear.

– Interactive: VR equipment and systems can encourage the interaction between the user and the virtual world. As the user moves around, the virtual world needs to move with them. This is a quite unique experience compared with watching a 3D film, the latter cannot provide any interactive experience.

– Response time: Any delay will make the user uncomfortable with the illusion of the virtual world. A powerful processor is required in order to deal with high quality 3D computer graphics. The processor should be powerful enough to provide a believable, interactive, alternative world that changes in real time.

4.3 Typical VR ecosystem

Figure 1 shows a typical VR ecosystem.

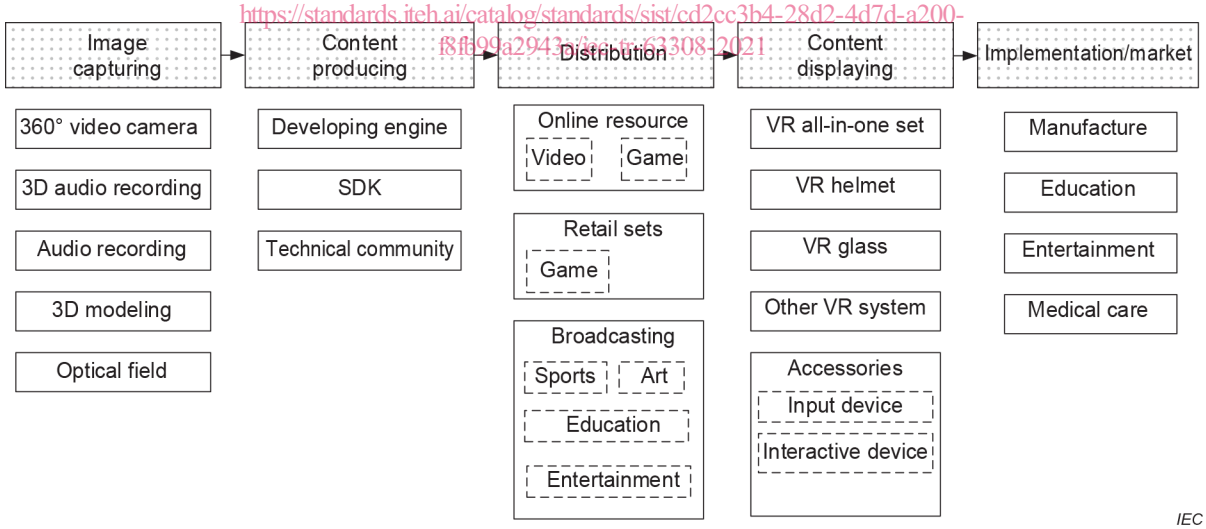

Figure 1 – VR ecosystem

A VR ecosystem normally consists of image capturing, content producing, content distribution and displaying, which explains how users can reach VR contents.

Analysing a VR ecosystem can be helpful to focus on the audio and video equipment and systems, and other related technologies that are within the scope of TC 100, in order to conduct further studies, so that the standardization gap can be filled.

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1 Numbers in square brackets refer to the bibliography.

5 Typical use cases of VR

In the past 30 years, VR equipment and systems have been used by scientists, doctors, dentists, engineers, architects, archaeologists, and the military, and have been well known to common customers.

In 4.2, the key unique features of VR, which made VR one of the preferred solutions in many specific use cases, are listed.

Table 1 – Typical use cases of VR

Used area	Examples[2]
Design and manufacture	Airbus uses VR programmes to carry out verifications in a virtual space, which can save up to 80 % time compared with traditional methods. Boeing used VR systems in designing the shape and architecture of the B-777. Rolls Royce uses VR technology to observe the detail of engines in its developing steps.
	Neusoft uses VR systems to assemble and debug a whole manufacture system without establishing real plant and equipment. VR systems are used to estimate and calibrate the assembly procedure in Audi vehicles.
	JLIANCO uses VR systems to check the failure of boilers, in order to ensure standard operation and reduce maintenance costs.
Education	IBM and Google developed VR systems which can allow teachers and students to create a virtual world for education, in a vivid and interesting way. VRSCHOOL used VR to set up a VR classroom which is used in physics, astronomy and biology experiments.
	JD used VR systems to train the delivery men for the sorting of goods. NASA used VR systems to train their astronauts on how to perform spacewalking, and what it is like to work with tools in space. The VR systems also simulated a zero-gravity environment in outer space.
Art and entertainment	VR was used to produce a film to introduce Luoyang ancient city and DunHuang MoGao grottoes in the 2019 Smart China Expo. BNC broadcast a TV series called "Halcyon".
	BBC provided VR live broadcasting for the Russian World Cup. CCTV has been providing VR live broadcasting for the Spring Festival party since 2017. www.huajiao.com is a live broadcasting platform, it used VR technology in online live broadcasting to give users more immersive experiences.
	China built a VR theme park in Nanchang, which used VR equipment and systems to provide immersive experiences to users. The Forbidden City in China provided 6 VR tour plans for visitors, including a building introduction, a cultural relic show and ancient history interactive.
	Meiwu365 is a decoration design company in China, it used VR in the design and modification process of their costumes before construction started.
	The new launched VR games such as Batman: Arkham VR and Superhot VR. These are based on games designed for normal controllers, but these versions change so many mechanics and scenarios, that they have essentially become brand new experiences.

2 This information is given for the convenience of users of this document. This information does not constitute an endorsement by IEC of the products named.

Used area	Examples[2]
Medical care	Taipei Medical University used VR anatomy courses which achieved better results compared with using traditional 2D paper material. Japan Jikei University established a VR operation simulation system, which can give physical feedback.
	Japan Nagasaki Institute uses VR to establish recovery treatment plan for patients, including biological status simulation and movement positioning.
	A drug addiction treatment centre in China used VR for psychotherapy purposes for addicts to help them get rid of the effects of drugs. Applied VR was used by some hospitals to release the pain and anxiety of patients during treatment and operation.
	Shenzhen People Hospital in China used a VR+5G system to perform remote biliopancreatic surgery together with an expert group in Beijing, with a physical distance of over 1 000 km.

Besides the existing use cases listed in Table 1, VR will be used more widely in future, which will bring more attention to this area.

6 Technologies of VR

6.1 Technical domains of VR equipment and systems

VR is an integrated technology that consists of 3D modelling, 3D display, sensor technology, real time graphic processing, etc. The VR equipment and systems are designed to provide an accurate, real and interactive experience to the customer.

The relationship between the different technical domains is shown in Figure 2.