



Implication of Extended Reality in Visual Effects Industry for Virtual Production

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Abstract. In this paper, the author addresses the process of achieving visual effects aesthetics with the new extended reality technology that is escalating in the creative media and film industry to execute virtual production. It draws importance of the technical and creative decisions in the very early stage of production known as previsualization to real time in camera visual effects for completion and thus shortening and advancing the process of traditional production. The author signifies three major aspects of virtual production here as part of the objectives which are the XR system, LED screen and real time in-camera visual effects creation.

Keywords: Virtual Production · Extended Reality · Unreal Engine 5 · Visual Effects · Virtual Filmmaking

1 Introduction

In a virtual production, LED wall has revolutionized the mechanism for effective creative film production [1]. There are several issues to address since it is very recently introduced to the creative media & film industry. Currently the production is practically and technologically compromised with a derivative percentage of both on set. As it is an experimental production which will keep evolving in the future, this paper addresses on researching and learning more about the endless possibilities of visual effects and aesthetics with the implication of extended reality.

The research articulates on virtual production bringing the in-camera effects promising visual effects process to be done on set real time, stated by visual effects supervisor, Sam Nicholson. He emphasizes on NVIDIA GPU and Epic Games Unreal Engine providing the solution to achieve at least 50% of the finished piece [2]. The author aspires to investigate and analyse the use of extended reality in visual effects creation for potential virtual production in the creative industry which involves the implementation and usage of unreal engine.

The virtual technologies such as the newly introduced extended reality is implemented in the process of creating visual effects in the creative industry, it will advance the process of pre-production, production, and postproduction in creative filmmaking. Extended reality is the umbrella term used for Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), as well as future realities immersive technologies

might create. XR covers the full spectrum of real and virtual environments [3]. Augmented reality (AR) enhances our view of the real world by overlaying what we see with computer-generated information. Virtual reality (VR) completely replaces a user's view, immersing them within a computer-generated virtual environment. Mixed Reality (MR) is somewhere between AR and VR, as it blends the real-world environment with computer-generated objects. Extended Reality (XR) encompasses augmented reality (AR), virtual reality (VR), and mixed reality (MR). It is continuously developing in human-computer interactions to a new immersive experiential solution for potential virtual productions.

Extended reality Virtual production encompasses all the different phases in which having a shared vision complements the production cycle. Visualization includes pitch-viz (pitch and treatment), previz (pre-visualization), tech-viz (technical visualization), stunt-viz (stunt visualization), and post-viz (postproduction visualization). The post-viz happens during the postproduction to alter the pacing of the projects in editing [7]. Virtual production has often led the charge in leveraging remote collaboration techniques [4]. The core issues to be critically analysed are the technical limitations which concerns LED screen calibration to match the foreground, solving the appearance of moiré and achieving in-camera visual effects with real time feedback that involves the server thus hardware specifications alongside the evolving software, Unreal Engine virtual production tool.

The aim of this research is to critically analyse virtual production widely to be considered for creative filmmaking. It investigated the application of extended reality system on the practice of visual effects in virtual production using LED walls and volumes for real time production.

2 Significance of the Study

The creative industry is escalating by the virtue of technological advancement. This paper investigates on the implications of latest technology i.e., VR & XR immersive virtual environment in creation of real time limitless visual aesthetics for films which is widely known as visual effects in the creative media and film industry. As an avid visual effect practitioner, it will help the author to stay updated by researching, discovering and be able to provide creative solution to the industry.

Visual Effects practitioners are diving into making the postproduction process more efficient and aesthetically pleasing than ever. The case study for this research concentrates on the impact of technology in visual effects.

It focuses on new technologies such as extended reality and virtual reality which has been introduced in the creative industry and the effect of new updates on the old tools and software. It is important to understand the involvement of technology from every aspect in the creative industry since the entertainment world is now driven by audience's high preferences and expectations.

Technological innovation and enhancement are elevating the execution of creative content creator's unique visualization. Here the implication of unreal engine plays a crucial role given the introduction of virtual production in the system as in-built and real time.

3 Literature Review

The evolution of technology has increased the recognition of visual effects in the huge budget movies as well as regional cinema. The visual effects market is getting improved and broader with cinema & television, video games, and advertising incorporating technology to widen their tactics. Additionally, project mapping is the latest main technique for driving the visual effects market that is being implied by both national and international companies during product publications. This technique heightens the user's experience by the combination of displaying artwork, light, and sound thus rapidly becoming a preferred choice for billboard [5].

3.1 Visual Effects as the Dynamic Element of Industry Success

The creative industry is flourishing with the adoption of visual effects locally and globally. Visual effects play the vital role in the success of media and entertainment industry. Based on the component, the global visual effects market is divided into software, hardware, and service. Based on the form, the global visual effects market is classified into matte painting, simulation effects, compositing, editing and others. Movies, advertisement, and television shows are the application segment of the global visual effects market. All the segments are analysed based on present and future trends and the market is estimated from 2018 to 2024 [6]. In every sector of the media, entertainment and advertising industries visual effects play the most essential role that ascends the game of the industry's success. Today, the significance of advanced technologies and new techniques in the creative industry is so immense that their economy is under the influence on it (Fig. 1).

3.2 The Process of Virtual Production

The process of virtual production starts with a pitch-viz & treatment where ideas are generated, and brainstorming takes place. However, crews get involved during the pitch-viz to get a clear idea of the entire process to execute in-camera complete picture. The VCAM during the previsualization editorial is prepped after visualization as a navigating camera for shooting in the LED Volume or wall for potential virtual production after undergoing post visualization [4] (Table 1).

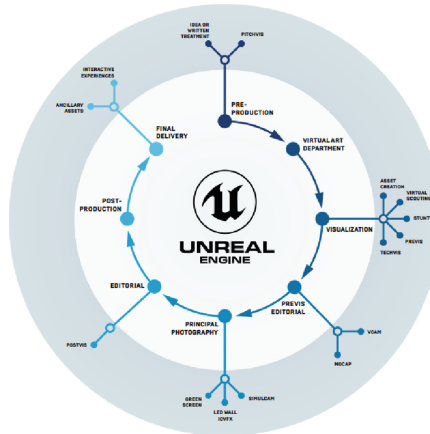


Fig. 1. Virtual Production Workflow by Unreal Engine4 Virtual Production Field Guide. It explains the process of virtual commercial or filmmaking starting from previsualization to completion. *Virtual Production Hub*. (2022). Unreal Engine. <https://www.unrealengine.com/en-US/virtual-production>

Table 1. Infrastructure needed to produce in camera visual effects by Unreal Engine4 Virtual Production Field Guide which addresses on the key technical features required to execute virtual production. *Virtual Production Hub*. (2022). Unreal Engine. <https://www.unrealengine.com/en-US/virtual-production>

Stage and virtual production	
LED Display Wall	LED modules, processors, rigging, high-end workstations
Brain Bar	High-end workstations, video assist
Tracking	Inertial, optical, and encoder-based solutions
Networking Infrastructure	Used for production and editorial to move media/loads. For data-intensive workflows like mocap, an isolated network with high bandwidth switches is needed
Sync/Timecode	Genlock and time code hardware required to keep all acquired data in sync and lined up
Lens Data	Tracking of focus, iris, and zoom to determine lens distortion, field of view, camera nodal point

4 Research Methodology

The research aims to address the findings using mixed method. The author chose Concurrent Nested as an interpretivist prioritizing qualitative analysis while nesting the quantitative data which is to be conducted in the future. The findings refer to the expert's experiences from different perspective encircling phenomenology by using qualitative method as major via interview, discussions, and observation. In the coming phase, quantitative data analysis will be conducted to address the issues in virtual production from audience perspective.

The qualitative interviews allowed the author to research in depth on the impact of technological advancement in the visual effects industry. Industry experts have been involved to support the research with solid information based on their experiences. The author contacted technical experts from both the local and international companies which are recognized well in the entertainment industry such as the Epic Games, Disguise & XRSTAGE by 3Particle.

The interview questions prepared were based on the background of the interviewees specifically versed with the XR Technology and Virtual Production. Therefore, thorough research has been done on the studios and the experts before approaching them. The author has provided a summary of the case study to all the interviewees besides the 15 questions on the topic so that the interviewees have a clear idea about the intention of the author to conduct the interview. Besides the directed questions on the topic, the author has also asked additional questions based on the expert's experiences in the industry.

4.1 Panel Questions to Epic Games, Disguise and xR Stage Malaysia by 3Particle

See Table 2.

Table 2. Qualitative panel interview key questions to the extended reality experts in the creative industry

1. What is your speculation of VP practice in commercials and filmmaking?
2. Do you think extended reality is at the plateau of real time technology?
3. What has sparked your interest in diving into XR?
4. What are some challenges you faced in XR production?
5. The best things about XR and VP which you have experienced as a specialist?
6. Technical barriers you face which you might think are some cons of XR VP production?
7. What does it take for an enthusiast to pick up XR VP industry level skills to run the show?
8. How smooth is the coordination of pre pro and post pro team in XR VP production?
9. How accurate is the In-cam tracking of the real life and CGI background that composites the final frame?

(continued)

Table 2. (continued)

-
10. Is there more post processing involved from what we see in camera?
-
11. How would you increase the awareness of XR VP without making it seem like as a replacement to Traditional production?
-
12. Are you limited by technology, idea, or budget for a potential virtual production?
-

4.2 Virtual Production Interview in Extended Reality Stage

The qualitative research interview took place at the first extended reality stage in Malaysia known as XRSTAGE by 3particle solution. The production was sponsored by Director's Think Tank, Malaysia (Figs. 2, 3, 4, 5 and 6).



Fig. 2. Behind the scenes capture of individual expert interview



Fig. 3. Behind the scenes capture of the group interview.

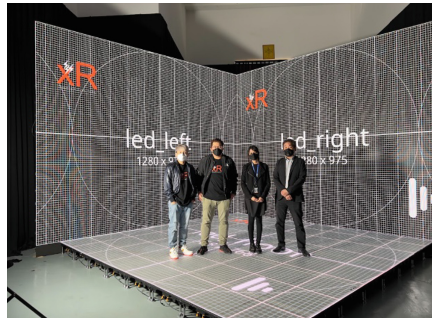


Fig. 4. Extended reality LED stage



Fig. 5. The Virtual Production cinematographer explaining the virtual camera specification and settings to be used for extended reality production

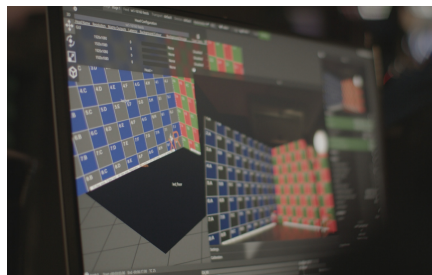


Fig. 6. CGI projection preparation powered by Disguise software for XR solution in virtual production

5 Result and Discussion

5.1 Extended Reality Technology Tracking System

Extended reality technology first embarked as immersive solution for architectural discipline. Introducing the technology to the creative film and media industry elevates the process and experience of practitioners and visual consumers.

The most difficult and challenging part is that it requires mathematical calculations based on the set. However, once the calibration process is set-up correctly, the in-camera tracking becomes almost 100% accurate consisting of a parallax effects based on camera

perspective with the CGI background instead of a flat projection, as quoted by 3particle solutions virtual production specialist.

5.2 LED Screen and Volume

The incorporation of LED screens and volumes advances the process of previsualization not only for practitioners but also for talents during production. It provides an immersive experience to the creative team which is absent in traditional filmmaking and complete visual aesthetics achieved much later after postproduction process.

The limitation factor is the moiré (repetitive details that exceed sensor resolution of a scene), as director of photography or cinematographer shoots in LED volume they are required to be involved in the very early stage of pre-production analysing on the type of camera and lenses suitable to be used for the LED screen configuration.

5.3 In-Camera Real Time Visual Effects

The implication of in-camera visual effects in virtual production shortens the process of creative and immersive filmmaking. It is the benefit of ICVFX (In-Camera VFX) which leaves the postproduction team to only do colour grading and correction.

As it is a turnkey solution, practitioners can turn around and deploy anywhere to a different setup according to the production brief. However, the higher quality is the 3D or CGI, the more hardware system is required as it is fully real-time production.

6 Conclusions

The incessant updates and development of new systems such as the extended reality (XR Technology) not only gives visual effects supervisors more control on the process but also makes it more challenging for them to showcase their imagination as realistic output with correct calibration of the background and foreground. Advanced visual effects practice in conjunction with innovation of new technology and visual effects supervisor's more control over the process as technology advances and producing tangible work. The effects of regularly updated tools and software plays immense role in the practice of visual effects. Hence, it involves creative industry's experts' opinions and views on technology affecting visual effects. New insights and evaluation on the research will be presented through further interviews and data analysis in the future as it is an emerging technology in the current timeline. This topic is relatively new to be addressed in a paper with research finding and discussions on extended reality virtual production for creative media and film industry. Extended Reality technology is currently being used in the Asia pacific region for live events, television commercials however rarely used for full feature films and storytelling. Considering the new technology with pros and cons and the difficulty level to achieve full filming experience with extended reality technology, finding the scopes and limitations thus proposing a creative solution with in-camera visual effects and creative calibration for a potential virtual production.

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Authors' Contributions. Zubaida Nila: Analysis and writing. Hushinaidi Bin Abdul Hamid and Dendi Permadi: Review and and structure of the writing.

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