A 4D MULTIMEDIA PLAYER ENABLING SENSORY EXPERIENCE

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ABSTRACT

Lately, 3D is gaining momentum in cinemas and home environments. However, 2D and 3D video content only stimulates senses like hearing and seeing. In this paper we focus on a more enhanced level of entertainment by presenting a 4D multimedia player and a corresponding demonstration setup, which stimulates further senses such as haptics using the MPEG-V: Media Context and Control standard. The presented demonstration setup uses stereoscopic 3D and sensory devices, i.e., fans, vibration panels and lights. The combination of conventional 3D content with tailored sensory effects allows us to further enhance the viewing experience of the users.

Index Terms—3D, 4D, Sensory Effects, Sensory Experience, MPEG-V

1. INTRODUCTION

In the last years, 3D gained more and more commercial importance either in cinema or home theaters. Additionally, most of the current television sets support 3D, either stereoscopic using additional glasses, or multiple viewpoints. Moreover, Web platforms such as YouTube provide the possibility to watch content in 3D [1]. 3D already provides an enhancement of Quality of Experience of the viewer, compared to traditional multimedia content, but still only stimulates two senses, i.e., hearing and seeing.

In our research, we go beyond 2D/3D by adding additional effects tailored to the content to further stimulate available senses such as haptics or olfaction. That is, we add an additional dimension to the content which is then called 4D content. Research in the area of sensory experience is already taken up by other researchers. For example, the authors in [2] provide vibration and light effects for ringtones on mobile devices. In [3], the influence of scents on the viewer of multimedia content is evaluated and challenges are presented. In [4], we have investigated the impact of light, wind, and vibration effects on the viewing experience and on the perceived emotions. We detected that the viewing experience is enhanced using additional effects and have a positive influence on the perceived emotions. In previous work, we and others only used 2D content for enhancing the viewing experience. Hence, in this work, we go further by using 3D content in addition to sensory effects for enhancing the viewing experience.

To describe sensory effects, the Moving Picture Experts Group (MPEG) ratified the MPEG-V: Media Context and Control [5] standard, in particular in our work, we focus on Part 3: "Sensory Information". This part provides descriptions to present sensory effects such as wind, vibration, light, scent etc. Additionally, for each effect, there is a number of parameters such as intensity, duration, location etc. Descriptions that are compliant to Part 3 are called Sensory Effect Metadata (SEM) descriptions. These descriptions can be used to steer devices such as lamps, fans, or vibration chairs and, thus, enhancing the viewing experience.

2. 4D VIDEO PLAYER

The *4D Video Player* is based on the already existing Sensory Effect Media Player (SEMP) [6] which is open-source and can be downloaded from [7]. SEMP is a DirectShow-based multimedia player that can render audio/video (A/V) content and enrich it with additional sensory effects such as light, wind, vibration, and scent. For rendering additional effects, SEMP uses SEM descriptions consisting of the desired effects with their intensities and durations. As MPEG-V allows the specification of automatic extraction of sensory effects, SEMP includes an automatic average color calculation algorithm. The color calculation algorithm uses a so-called SampleGrabber for retrieving the currently displayed frame and splits it into three parts (left, middle, and right). From each part the average color is calculated and used for rendering light effects on available devices. In the case of 3D, only the left image of a 3D video frame is used to calculate the average color for the three parts. Note that only for light effects are extracted automatically due to the ease of extracting color information from the content. Other effects (i.e., wind and vibration) are annotated manually using the Sensory Effect Video Annotation tool [6] and are provided as SEM description. As SEMP is based on DirectShow, it supports several codecs and formats and can be extended using, e.g., so-called codec packs, such as the K-Lite Codec Pack[1]. For rendering 3D videos, SEMP incorporates the DirectShow

[1] http://codecguide.com/

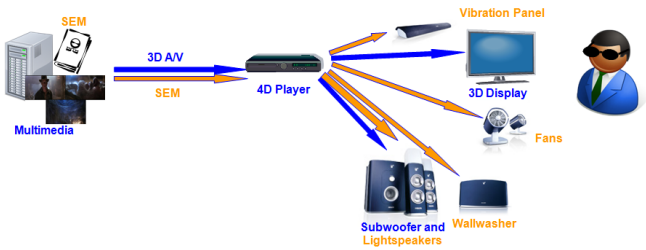

Figure 1. Overview of Enriched 3D Multimedia Playback.

filters of the commercial Stereoscopic Player [8]. The Stereoscopic Player provides a number of different 3D modes such as side-by-side, interleaved, anaglyph, or NVIDIA 3D Vision/AMD HD3D.

Figure 1 illustrates the enriched multimedia playback using SEMP and different rendering devices. As already mentioned SEMP supports several sensory effect devices and, thus, provides the users a new and enhanced viewing experience.

3. DEMONSTRATION SETUP

In our demonstration, we will present a 3D video enriched with sensory effects (i.e., light, wind, and vibration) using the 4D Media Player presented in Section 2.

For rendering sensory effects, we use the amBX System [9]. It is designed to enrich multimedia content and games with additional effects such as light, wind, and vibration. For rendering these effects, the amBX System comprises a wall washer light with a controller unit, a 2.1 sound system consisting of left and right sound speakers with lights on top, a sub-woofer, a set of fans, and a wrist rumbler. The wall washer and the lights of the speakers contain high power RGB LEDs with over 16 million additive RGB colors (8 Bit per component). The LEDs provide instant response and one can vary the intensity. The integrated 2.1 sound system provides 160 W music power through the two speakers (2x 40 W) and the subwoofer (80 W). All devices operate in the frequency range of 35 Hz to approx. 20 kHz. The two fans have a variable speed control with up to 5,000 rotations per minute (rpm). Finally, the wrist rumbler consists of two integrated motors that allow variable rotation speed with different patterns.

For watching 3D video content, we use the Fujitsu P23T-6 FPR 3D 23” widescreen display [10]. This display is designed for professional 3D CAD and for home entertainment. It provides a polarized stereoscopic panel with 3D polarized filter glasses and resolutions up to 1920x1080 pixels. The display provides 16.7 million colors and a response time of 5 ms.

Participants will be able to watch 3D stereoscopic video sequences (i.e., “The World’s Toughest Downhill Ski course in 3D-Red Bull Streif” [11]) enriched with additional sensory effects (i.e., light, wind, and vibration). For showing the 3D video, we will use the polarization glasses in combination with a vertical interlaced presentation of the content. We believe that the possibility to experience enriched 3D first hand will trigger discussions on this research. An example of the demonstration is depicted in Figure 2.

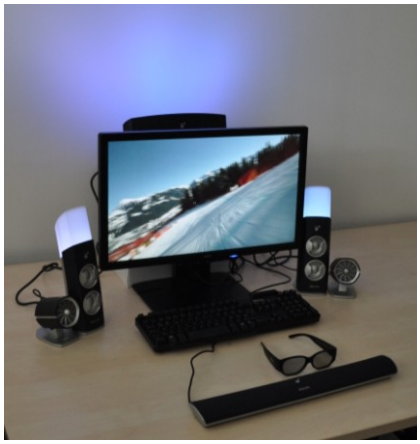

Figure 2. Enriched 3D Multimedia Playback.

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