

The Opportunities of Applying the 360° Video Technology to the Presentation of Cultural Events

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Abstract. The opportunities of applying virtual reality technologies to the presentation of cultural events (musical concerts, city excursions, theatrical performances, and others) in virtual reality devices are described in this work. Challenges that appear during shooting video 360° and their solutions are analyzed. The experience of shooting more than 50 different videos is generalized. The opportunities of further development of practice described within the frames of the International Technology Cluster “Infocommunication and Optical Technologies in Culture and Arts” are analyzed. The example of realization interactivity in video 360° connected to the virtual reconstruction is described.

Keywords: Virtual reality · Multimedia technologies · Interactivity · Video 360°

1 Introduction

At the present time virtual reality technologies and their applications have developed intensively [1]. Using these technologies for Arts and Culture [2] allows for a wide variety of opportunities due to providing the user with the effect of presence in the very center of cultural events. One of the most prospective approaches of creating content for virtual reality systems is the 360° Video Technology [3]. This technology allows the creation of panoramic videos with different grades of interactivity where the users changes an angle shot (a camera angle) of the video accordingly to their desire. The video can be viewed through virtual reality headsets (for example, Oculus Rift [4]) as well as on a smartphone, via a special app when the user rotates the video “around himself” by moving his head (Fig. 1) or turning a smartphone. The video can be watched on computers also. In this case, the user manages the foreshortening by using a mouse or a keyboard.

Many big companies (Facebook, Nokia, Samsung, Google and others) develop video cameras for shooting video 360°, virtual reality garnitures for different smartphones and personal computers as well as audio recording devices that provide the binaural sound and the realization of the technology Multimedia 360°.



Fig. 1. Watching 360° through garniture Samsung Gear VR

Using the 360° Video Technology is actual especially viable in the field of education. The interaction with the user is realized in interactive video 360°. This is the reason why this method can be widely applied to education of experts in different fields, where presence in the center of actions is necessary for gain the experience. The 360° Video Technology allows for analyzing of teamwork during solving different tasks that leads to enhance the quality of the educational process.

The panoramic video plays an important role for preservation and provision of access to cultural heritage. The technology provides the unique opportunity to see not only closed for public access archives of museums but also reconstructed historical monuments that were destroyed by time or circumstances (3D virtual reconstruction). Moreover, virtual reality provides disabled people a unique chance for exploring to different parts of the planet.

As for entertainment in the field of video 360°, viewers can visit biggest cultural festivals, be on stage near favorite musicians or watch a theatrical performance from the royal lodge.

The project of development and applying of the 360° Video Technology to culture and arts has been realized in the Center for Design and Multimedia of ITMO University [5]. Certain results that are necessary for creating high-quality content for virtual reality were achieved within the frames of the project, starting with original devices for filming video 360° and recording audio to software for special task solutions in this field [5, 6].

2 The 360° Video Technology

At present video cameras for filming video 360° are only being developed. However, it is possible to use regular video cameras with special equipment and software for this purpose.

One of the outstanding examples of this approach is the project 360Heros (<http://www.360heros.com/>) that offers special rigs (video gears) for GoPro cameras HERO 4. The amount of cameras dependent on the tasks in the rig is from 6 to 14 (the stereo version). After a shooting video streams are combined into one spherical video with the help of the special software (Fig. 2).

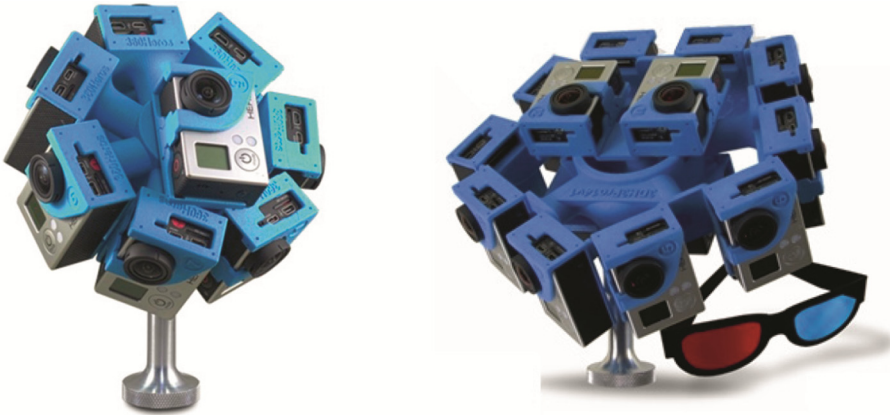


Fig. 2. Mono (on the left) and stereo (on the right) rigs for GoPro HERO 4

Moreover, several big IT-companies and electronic manufacturers have announced their own fully-automated solutions for shooting content for virtual reality – Google Jump + GoPro Odyssey (<https://gopro.com/odyssey>), Samsung Beyond (<http://think-tankteam.info/beyond/>), Nokia Ozo (<https://ozo.nokia.com/>) (Fig. 3).



Fig. 3. Nokia OZO (on the left) and Samsung Project Beyond (on the right)

The team of project “video360production.com” films 360° videos with the help of its own invention – the camera 360°. This camera provides spherical quality up to 24 K and creates several video streams that are afterwards combined into one panoramic video with the help of a special sequence of algorithms developed by programmers. This

approach provides a high quality product decreasing parallax errors in panoramic videos that is a complex issue to resolve. In the field of video content for virtual reality, “stitching” quality is the most challenging feature to maintain with the only help of the software. Often parallax errors can be eliminated only during the postproduction.

The team of project “video360production.com” unites experts from two fields - engineering (engineers, programmers, hardware and software experts) and art (stage directors, videographers). While one part of the team develops solutions for maintaining a high quality of video 360, the other part provides a creative approach to every case during the film production. It means that the employees of the Center for Design and Multimedia do not use only the unique equipment and software but also a unique approach for every video shooting depending on a set of factors such as interior, exterior, weather, season, time of day and people in a shot.

Video 360° is a new and upcoming trend that doesn't have any standard direction. It gives a wide variety of opportunities for new ideas and methods. The effect of full immersion is achieved due to the camera 360° that shoots everything happening around with the help of several lenses. However, it causes some challenges – for instance, a vast majority of film editing rules and film grammar do not exist in video 360 (for example, screen direction). The main distinction of video 360° in virtual reality glasses is the fact that the audience has the opportunity to look in any direction “around itself” which means that the producer will give an opportunity of dynamic choice of viewing angle without focusing the viewer on a specific part of the screen.

One of the solutions is a detailed scriptwriting with special attention to changes of paradigm – 3D filming. Every video project requires not only a standard preparing (such as setting up lights, choosing the best camera angle, creating a scenario and a composition) but also individual approaches (unique for every case camera mounts, binaural audio recorders, and special ideas for video 360°). For instance, for videos of musical concerts, the recorded production sound track from a camera or stereo microphones is often combined with other elements such as effects or noise of the audience in order to reach full immersion into a video story.

The team has filmed more than 50 different events for virtual reality glasses such as concerts, musical festivals, excursions in historical places, performances in theaters, different cultural events and technological processes. One example is the video 360° of a jazz concert (Fig. 4) [5, 7].

During the shooting of this concert, there were about 20 musicians with musical instruments on stage at the same time which leads to some difficulties with the camera installation. It was necessary to find a place where the camera angle was good enough but the device did not disturb musicians and moreover didn't attract the attention of the audience. The camera was placed in front of the first row of musicians among other equipment. The final product provides musicians with a great opportunity to see not only how they play and analyze their locations with musical instruments on stage but also the reaction of the audience. Viewers are able to view in detail each of the musicians and enjoy the atmosphere created by a classical orchestra with the help of this video.



Fig. 4. Jazz Philharmonic Orchestra – 360° video

There were other difficulties during the filming of a concert of the Russian group “Picnic”. It was in a dark music hall with bright spotlight. These conditions are far from being ideal. Even with a usual professional video camera it is quite challenging to make the color depth transmission realistic. Partly this problem can be overcome by using special lens filters that enhance colors. In addition the team worked with foreign groups too: HIM, D12, Skindred, GusGus, Hollywood Undead, etc.

The videos of musical shows in the format of 360° have a huge advantage over standard recordings because the viewer has full independence and freedom over what to look at – to observe the genius playing of a guitarist, to admire the singer or to see the concert with the “eyes” of the musicians, turning his back to the stage and watch the reaction of the audience.

To achieve the effect of the full immersion a high-quality image and a “live” sound are required. There is no denying the fact that the “technical” sound on stage is far from what is heard in the hall. Sound engineers combined the sound of a stereo microphone with studio recording. As a result, the quality of audio is rather high but the recording does not lose its liveliness, which means that while watching the recording, you can hear the audience sing.

Furthermore, the project video360production works with leading St. Petersburg theatres. For instance, a number of plays and musical performances in Mariinsky and Alexandrinsky Theater were filmed. Videos of historical attractions in the city and excursions to museums provide a unique opportunity for users to see the main sights of the city at any time. As for the Museum of Anthropology and Ethnography that is one of the biggest museums in Saint Petersburg, a hall with the Greater Academic Globe, a diplomatic gift to Peter I on the Holstein Duke Carl Friedrich during the Northern War, was filmed before closing for reconstruction (Fig. 5) [8]. Consequently, now it is the only chance to visit this hall. In addition, the tour was filmed during the excursion on the rivers and canals of St. Petersburg (Fig. 6) [5, 9, 10].



Fig. 5. Filming of the Greater Academic Globe in the format of video 360°



Fig. 6. Filming of excursion of the rivers and canals in the format of video 360°

3 Interactivity in the Format of Video 360°

Despite the fact that watching video 360° through various virtual reality headsets provides high-quality immersion into video content, the next step is adding different interactive elements to the video 360°.

These elements can include the following:

- Active tags within the virtual space for the movement along different paths previously filmed as the video 360°;
- Different additional content (images, videos, hyperlinks, etc.) - the function PiP ("Picture-in-picture");
- Switching from video 360° to the simulated 3D reconstructed reality.

On the basis of the system Unity3D, the interactive tour of Korela Fortress Museum was realized as video 360° [11]. This panoramic video excursion with interactive control elements was developed for watching through virtual reality headset Oculus Rift.

Interactive communication allows selecting the route: at certain points (forks) the user is given the opportunity to select the desired continuation of the tour or go back (Fig. 7). The user can point at the interactive elements by turning the head, which is monitored by a gyroscope in Oculus Rift. By keeping a look at the selected item for a few seconds, the user activates this element and the respective segment of video 360° plays. In order to increase the visibility of interactive, the circular progress bar appears when the user looks at the interactive elements.

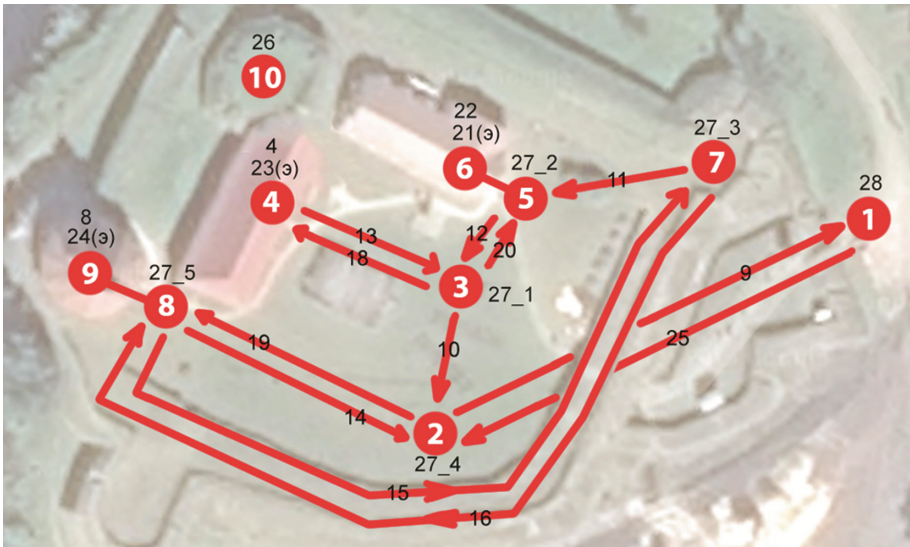


Fig. 7. Interactive map of Korela Fortress Museum

There is a professional tour guide who describes exhibits when the user “moves” along the path in the forward direction. As for the reverse direction, there is no guide in order not to repeat the same information twice. The user can skip a part of the video by using a keyboard or with the help of an interactive element if desired.

The second form of interactivity is the possibility to switch the video 360° to a virtual three-dimensional reconstruction of the fortress. The reconstruction of the fortress Korela was performed within the project “Multimedia information system “The ancient fortress of North-West”” [12, 13]. There is an interactive element in fixed points of the video-excursion which can be activated by the user in order to switch to the 3D reconstruction. The user can “move” freely inside the virtual 3D reconstruction due to using the functions provided by Unity3D. There are the luminous portals at the points where the virtual reconstruction coincides with the real filmed places. Going into this portal, the user returns to the respective point of the video excursion.

4 Conclusion

Multimedia Technology 360° is a new and perspective technological direction, which allows the creation of high quality innovative content for virtual reality in all areas of human activity (culture, arts, education, science, public administration, etc.).

As for the perspective of the entertainment industry, especially the creation of feature films as the video 360°, a number of new approaches and methodologies of creative and technological processes are expected to be developed in order to provide the user deeper immersion into a video content at a new virtual and interactive level to have more holistic perception.

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