SWOT Analysis of Virtual Reality Creation Equipments

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Abstract

In conditions of isolation, quarantines, and lockdowns under the coronavirus pandemic, technology became the main means of pupil/student-teacher connection and communication, as well as an essential tool for schools to offer continuous education possibilities. A very specific problem, which the secondary vocational schools were facing, was practical vocational training and excursions, which are an important part of apprentices` learning experiences. To help secondary vocational schools to solve this problem the authors have started to consider the development of a virtual reality application, which would enable at least partially to replace personal forms of excursions with their virtual forms. In context of the stated intention, there was elaborated a SWOT analysis of virtual reality creation equipment, at particular cameras with their possible software facilities. In the paper, the authors describe the methodology of the analysis and summarize its main results.

1   Introduction

As the phenomenon of globalisation still goes on, we witness worldwide tendencies to transform educational processes at all levels, so that they could fulfill the current requirements of a modern world. Here, the development of didactic tools for modern education plays an important role. Schools all over the world face the crucial question – of how to manage the development of didactic tools so that they are good enough not just for a moment in the present, but also to have a sense in the future. The transformation of educational processes from so-called classical or traditional forms toward virtual reality forms represents a strong signal of a serious change in the school environment. The Importance of this challenge has become evident also during already several waves of the coronavirus pandemic. In conditions of quarantines, social isolation and the phenomenon of homeschooling, technologies have become the most dominant tool of communication between pupils or students and teachers. And what is more, they also have become a fundamental tool for providing a continual, ceaseless education (ECLAC-UNESCO, 2020; UN, 2020; Di Pietro, 2020). One specific problem that must have been solved mainly by secondary vocational schools was the execution of practical vocational training and school excursions. To solve this problem, authors started to think about the application of virtual reality that might at least partially substitute real school excursions by their virtual forms. In this context, SWOT analysis of selected camera systems was done. This analysis also included a review of software accessories from the point of view of their suitability regarding the creation of virtual reality for specific educational purposes.

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2 Methodology of the analysis of the camera systems technical parameters

Gaining vocational skills and work experience during practical preparation and school excursions is an important part of the vocational education of apprentices at secondary vocational schools (Behrendt et al., 2014). These skills and experience cannot be obtained in the environment of traditional school classrooms. A problem regarding the transfer of educational processes from the presence platform into the online one occurred during the pandemic situation. This problem was quite easily solvable when compared to the issue of providing vocational training, school practice and excursions in conditions of a lockdown. The answer to that question and a possible solution to the problem lies in the use of virtual reality (VR) systems (Kuna, Hašková, Borza, 2021). Despite the fact, that these systems were originally developed especially for entertaining purposes, nowadays (also due to the pandemic of coronavirus) they are widely accepted as a didactic tool with a high potential for usability in educational processes. (Kuna, Hašková, Mukhashavria, 2020; Akram et al., 2021).

In our case, we started to deal with the possibility of developing such VR applications that can at least partially substitute real excursions and thus it can offer invaluable support within vocational education. There are technical devices galore for creation of the virtual reality on the market, so our first task was to specify and pick up the most suitable camera systems. Out of all commonly accessible systems, we have analysed just five. These are: Insta360 One R, Insta360 One X, GoPro Max, RicohTheta Z1 and Theta SC (Table 1).

Camera type	Video resolution	Photography resolution	Device/ tele-phone supp.	Battery endurance	Memory	Waterproof + dustproof
Insta360 One R	5.7K 5760 ×2880 30 FPS	18.8 MP 6080 x 3040	Android, iOS	1 hour	MicroSD	YES
Insta360 One X	5.7K 5760 x 2880 30 FPS	18 MP 6080 x 3040	Android, iOS	1 hour	MicroSD	NO
GoPro Max	5.6K 4992x2496 30FPS	18MP 5760 x 2880	Android, iOS	1-2 hours	MicroSD	YES
RicohTheta Z1	4K 4096 x 2160 29.97 FPS	20MP 3840×1920	Android, iOS	4 hours	Internal memory 19GB	NO
Theta SC	FullHD 1920×1080 29.97 FPS	14.4MP 5376×2688	Android, iOS	25 min	Internal memory 8GB	NO

Table 1: Technical parameters of the selected camera systems.

This selection represents such types of cameras that are undoubtedly essential in the field of VR and all of them are of the approximately same price. For displaying 360-degree photographs and videos we need to have an application or a special program. Just a short time ago not even Windows itself was able to display 360-degree photographs. The situation has fortunately changed, since every 360-degree camera system has got its Android and iOS application. Thanks to them, it can display, adjust and share created pictures. All we need is a Wi-Fi or Bluetooth that nowadays are present in any modern smartphone.

If we want to display the pictures (photographs, videos) in a computer in a spherical mode, it is needed to upload them into a special program that enables us to show all 360-degree photographs, and as an extra added value the photographs can be sent as a link, plus they can be downloaded and also inserted. All the mentioned parameters were included in our SWOT analysis where we compared the five types of camera systems. A Survey of all basic technical parameters is presented in Table 1.

3   Summary of the SWOT analysis of the selected sample of camera systems

Theta SC is the cheapest spherical camera of all. Its functions and specifications do not reach the required standards. It has got quite a simple usage and in case of need, it offers the manual control of an exposition. In comparison with other cameras, here the videos are only in FullHD, which after export of the video does not bring the expected result. This device does not have any display, just some LED indicator diodes that serve to emphasize the selected functions (360KAMERY, 2020).

Processing of photographs and videos created via the Theta SC camera is done in the RICOH THETA application. It is a user-friendly environment and its functionality is at a good level. The processing of videos is not of very good quality due to the bad hardware components of the Theta SC camera.

Ricoh Theta Z1 is a camera at a higher professional level. It offers very good pictures even in weak light which is practical when making photographs in dark spaces. Just for this reason, it is suitable for usage in internal places. Static 360-degree photographs are done in quite high resolution. Mobile application THETA+ enables picture cutting, adding effects and also a music background (THETA, 2020).

RICOH THETA+ application enables watching 360-degree photographs and videos after their loading into the main application. There it is possible to perform various adjusting operations with the pictures and videos. After its final upgrade, THETA+ can support conversion and playing video files in 4K resolution. One error of this application is an unexpected change of video size that in Windows 7 changes into 2K resolution. Depending on the number of microphones on the body of the camera, it is possible to deploy 360-degree recording and playing of the space sound. The application offers the video publishing directly on its website theta360.com and also on social networks (Meta, Twitter, Tumblr). One disadvantage is that the space sound can be shared only on the YouTube channel. THETA+ automatically corrects both upper and bottom parts of a picture and displays it without any distortion or slope (THETA, 2020).

GoPro Max is a solid 360-degree camera, ideal for making dynamic pictures. It offers sharp details, exact colours and a big dynamic range. It is compact and compatible with tripod holders. It has a touch interface, automatic connection to 360-degree video and an in-built stabilizing system. Picture adjustments can be easily done thanks to a powerful application directly from the camera GoPro Max producer. The fact that the camera is waterproof enables the wide range of its deployment.

Video processing is done via GoProQuik and Splice applications that are freely available on the Internet both for PC and mobile platforms. Having Android on your phone, you can use just the Quik application. The difference between the two mentioned applications lies in the way they process video recordings. While Quik can adjust videos automatically thanks to its advanced algorithms, Splice enables the user to make changes on their own. Notwithstanding the fact that these programs are suitable for working with video recordings that were created by the cameras of the same trademark, they have some troubles dealing with the videos from other brands. One serious problem is the video processing in a slow mode, where the software is not able to reach adequate quality since the camera does not have such skill (ALZA, 2021).

Insta360 One X records videos in 5.7K that can be easily adjusted by an application for smartphones. It also has a more complex program for Windows and Mac OS X. The fact that this camera has many accessories that cannot be found on any other camera makes just this camera one of the best of its kind. Insta360 One X represents a good compromise for anybody who just wants to start with making 360 degrees pictures or those who already have some experience (INSTA, 2021).

Insta360 One R is a unique 360-degree camera that offers high-quality performance and resolution not only when making a video but also when processing the photographs. This waterproof camera offers three independent cameras that are mutually replaceable. Besides deployment for making 360-degree pictures, the camera enables the change of dual object lens for classical action cameras e.g. GoPro that enables recording in 4K resolution. The body of the camera enables the change of one camera with a one-inch LEICA sensor. Insta360 ONE R has the IPX8 certificate and it is waterproof up to 5 metres without any need of deploying extra accessories. It has got a GPS, microphone or headphones can be connected wirelessly and with extra accessories, it is possible to attach it to drones (INSTA360, 2021).

Insta360 Studio 2021 enables the adjusting of videos and photographs that were taken on ONE R, ONE X2, X, EVO, GO, ONE, NanoS, Nano and Air devices. Obviously, this application is pretty universal, but it is not the only advantage. It can deal also with videos and photographs from other competitive trademarks. It has an Insta360 add-on for Adobe Premiere Pro (2019/2020) and FinalCut Pro X (only for panoramic ONE R files) that enable to open and close of mp4 files in Adobe Premiere and FinalCut Pro X. Insta360 Studio application is also in version 2020 and 2021 which are principally quite similar, still, it is worth mentioning that the newer one has been enriched by several new functions and it is less burdensome for operating systems. Parameters of adjustments

can be saved before making the export of video for easier further adjustments. If we are not satisfied with crosses between objective lenses, we can use so-called stitching calibration that can adjust them.

All the main conclusions that result from the SWOT analysis are summarized in Table 2.

Camera	Strengths	Weaknesses	Opportunities	Threats
Insta360 One R	✓ high quality of 4K and 360° picture in 5.7K ✓ high quality of recorded sound (2 microphones) ✓ good quality of display that enables direct view ✓ compatibility of holders	✗ small display	➢ practical control panel for video and photograph adjustments ➢ modular design (3 cameras in one) ➢ HDR mode	⊠ lenses can be easily damaged
Insta360 One x	✓ many useful functions ✓ good picture quality ✓ compatibility of holders	✗ small display for showing basic information about camera settings ✗ no water resistance without accessories	➢ practical control panel for video and photograph adjustments ➢ HDR mode	⊠ lenses can be easily damaged
GoPro MAX	✓ Water resistance ✓ Dynamic range ✓ Manual control of exposition ✓ compatibility of holders	✗ application for video processing has a negative effect on PC activity ✗ low quality in weak light	➢ stabilization	⊠ absence of slow-motion for 360-degree video
RicohTheta Z1	✓ good picture in weal light ✓ robust, easily usable design ✓ good-quality videos	✗ high price ✗ 2 applications for cutting needed	➢ simple control	⊠ no microSD
Theta SC	✓ Intuitive control ✓ commercially affordable ✓ manual control of exposition	✗ videos in a less-quality standard ✗ small internal memory ✗ weak battery endurance ✗ slow transfer of video into a telephone	➢ adequate price	⊠ problem with the compatibility of camera and application by producer

Table 2: SWOT analysis outcomes.

4 Conclusion

Based on the presented results of SWOT analysis of the selected cameras with particular software for processing photographs and video recordings, the INSTA360 One R was chosen as the best type of camera for making didactic aids – the virtual environments of school excursions. This camera has the best video recording and offers the possibility of connecting different external devices that help to increase the quality of recorded pictures and sound. It is worth mentioning that the camera itself has several in-built microphones for better recording of the surrounding space sound. Another advantage is a freely accessible program INSTA360 Studio (in 2020 and 2021 versions) that is suitable for further adjustments and export of video recordings. The application has got a huge interface for adjustments that are easily understandable and deployable also for beginners.

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