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# DEVELOPMENT OF AUGMENTED REALITY VIDEO APPLICATION

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## Introduction

New technology allows us more real and concrete experiences with all our senses (Marshall, 2018). Extended reality is a virtual extension of our current reality. Subgroups of extended reality are (Marr, 2021): Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR).
Perhaps all of these technologies can be better understood in their proper context within the "virtuality continuum". The continuum of virtuality is essentially the span between the real world and physical reality on the one hand and entirely virtual reality on the other (Figure 1) (Gutiérrez, Vexo & Thalmann, 2021).


*Figure 1*
*Virtuality continuum*

Augmented reality is an interactive experience of a real-world environment in which objects in the real world are augmented with computer-generated perceptual information, usually via multiple sensory modalities, including visual, auditory, haptic, somatosensory, and olfactory (tom Dieck & Jung, 2019). Marker-based augmented reality was used for the development of this application. This type of AR works on the principle of tracking and recognition. In this type of AR, a marker must be used to perform the augmentation process. Tracking in AR creates a specific pattern or image that the AR application can recognize. Once the app finds the pattern, it constantly tracks the position of the pattern in the real world so that the app can precisely place the digital object on the tracked marker. Markers are generally square and may also use a black-bordered image within the white main frame. It helps to separate the marker from the background frame. Internal marker graphics often appear distorted or pixelated. Unwrapping an image is returning a part of an image to its original position. When recognizing images, it is necessary to apply image unwrapping (Linowes, 2021). Similar research on the topic of augmented and virtual reality has been conducted by Đurđević and associates (2019), as well as Đurđević, Novaković and Zeljković (2020) in their papers (Đurđević et al., 2019; Đurđević, Novaković & Zeljković; 2020).

## Materials and Methods

For creating design and interaction through an application, the program Unity was used in combination with SDK (Software Development Kit) Vuforia (Wise, 2018). The idea was to create an application that will enable the user to control video content augmented in augmented reality. Recognizing the target image will provide video content about the company compared to the basic information that can be found in real-world images. After scanning the target image, the application will load a specific video with a complete description, such as a company marketing video.
Also, the user can stop, pause or play this video content using provided user interface.
To understand the application development process, we need to understand the architecture of augmented reality (Figure 2). In this architecture, the camera image is sent to the tracking module and then to the rendering module, where the real and augmented objects are combined. And the output is the enlarged image that appears on the screen. The virtual and real-world components are merged in the Rendering module.
Capture Module - captures the image from the camera. Tracking Module is the core of the AR system, and it calculates the relative position of the camera in real-time. The term "position" basically means 6 degrees of freedom, i.e., the 3d location and orientation of the object. The Rendering module helps us to combine the virtual components and the real image into one image using the calculated position, and after all that, it displays the enlarged digital object on the image, projective geometry is a mathematical model for estimating the position (Doerner et al., 2022).

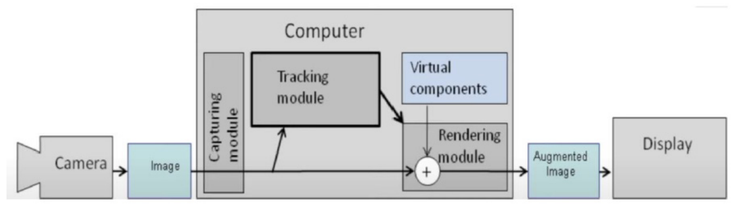


*Figure 2*
*Augmented Reality Architecture*

To create an Augmented Reality application, we have visited the website https://developer.vuforia.com/ and we created an Vuforia account. After downloading, it was necessary first to set everything essential in the web version of Vuforia. We have started the Basic service by clicking Get Basic. The page opened where we enter the name of the license and accepted the terms of use. We clicked on the created license, where we get the license status and the code that needs to be copied. Target Manager – stores markers that we will use in applications. The marker base is created as follows: By clicking on Add Database, defining the name, choosing the Device type and by clicking on Create.
After adding the marker, we notice the stars that represent the quality of the marker. Our marker had five stars. Clicking on button "Show Features" shows the points "+" that follow the marker when it moves. Our marker has great contrast so there was a lot of marker points (Figure 3).

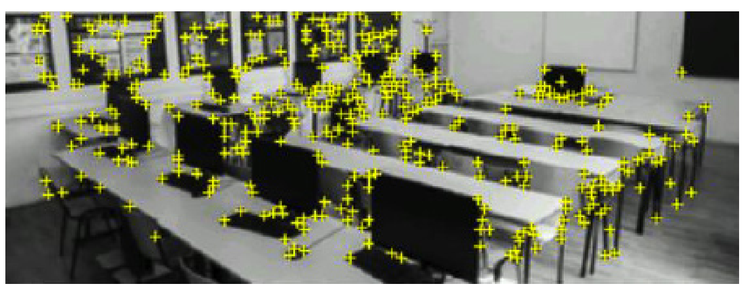

*Figure 3*
*Marker points*

In Unity software we set the application functionality. We selected the Play button, and at the bottom of the inspector panel, we found the On Click() function and added it with the "+" button. Next, we dragged the Video Player object into the None field. Finally, we added the function Video Player - Play(). We repeated the procedure for Pause and Stop (Figure 4).


*Figure 4*
*The final application testing*

## Discussion / Conclusion

There is a growing need of the user for technologies that more easily and quickly lead the user to the desired and additional information. In addition to these benefits, the user becomes dissatisfied with the basic information we can find in the real world printed products and thus augmented reality becomes a platform to overcome that. In combination with the newly created application, more detailed and extensive information is offered. Unity with Vuforia SDK are becoming a revolutionary combination to create augmented reality content.

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