FRAMEWORKS PERFORMANCE ANALYSIS FOCUSED ON AUGMENTED REALITY FOR LOCAL ENVIRONMENT.

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Abstract: Looking for innovation and implementation of Augmented Reality (AR) in heavy laboratories in industries and universities, four AR frameworks are analyzed to create a portable Starter Kit (SK), combining hardware and software responsible for increasing and optimizing AR performance in computers, smartphones, and tablets. Four levels of implementation are investigated starting with the configuration of a NAS, creation of 3D models, continuing with the production of QR's identifiers and ending with cross-platform development.

Keywords: Augmented Reality, Frameworks AR, Starter Kit AR.

1 INTRODUCTION

The application of one of the pillars of Industry 4.0 called augmented reality (AR) in industrial training contexts is increasingly a reality, but with certain difficulties. RA refers to the implementation of digital elements through a screen in the real environment, simulating that these two scenarios belong to one (José et al., 2020). Several markets have benefited from the application of this technology in different areas of their companies, with promotion, sales and entertainment strategies are popular. However, AR still has a long way to go in environments where it has already been implemented but not fully adopted, in this case the focus is on training personnel in the industry.

It is important to comment that AR has weaknesses for current technology, one of them being the lack of adequate networks to support the download of models in real time (Braud et al., 2017).

Due to the difficulties of using AR especially in the field of industry, it is proposed that this study has a focus on the use of affordable hardware and software that can implement the optimal AR in the industry for personnel training.

2 THEORETICAL AND CONCEPTUAL FRAMEWORK

Android and iOS are used for the implementation of AR. In this case, iOS and iPadOS utilize the operating system (OS) for Apple mobile devices and recently iPad uses iPadOS based on iOS (Rocío García, 2021).

Some examples where AR has been applied are in tourist centers (Callejas et al., 2011) and in learning environments for three-dimensional spaces (Cantero et al., 2013). While, due to its size, iPad has been preferred for teaching, especially English language (Martínez & Galván, 2013).

Android, a free OS for mobile devices, developed by Google company (Gonzalez, 2011), has some examples of uses such as children's reading with AR (Arellano, 2020), video game development for elementary education (Marín et al., 2020). Additionally, the training usage of reinforced concrete (Almeida & Cabero, 2020) and the practice simulators for future teachers with autism students (Cerdá & Lledó, 2021).

Another example is Vuforia AR, AR-oriented software development kit (SDK) with Unity, recognizing images, text, directions, and target tracking (Taban, 2018), used in AR development for museums (Purnomo et al., 2018) and realistic interactions with AR (Imbert et al., 2013).

Besides, Easy AR is an engine specialized in the creation of AR (Vegas, 2020), having as its function a promising research area for students (Bilous et al., 2020), as well as in learning about the solar system (Ramauli & Siddik, 2021).

Moreover, ARJS is a JavaScript-based framework, which aims to facilitate AR development and improve performance, allowing old equipment to work at 60 frames per second (Ramírez, n.d.), implemented in molecular visualization and modeling (Abriata, 2020) and in dynamic development web content (KURT & İNCE, 2020).

Finally, Google <model-viewer>, special Google tag that allows you to understand different components, including AR modeling (Google, n.d.).

3 METHOD

As an implemented method, tests are generally carried out with the different AR frameworks using four of them as a base, which are ARJS, Easy AR, Vuforia, Google <model-viewer>.

Derived from this, the documentation, practical examples, requirements for their development, response times, implementation for network availability and adaptability to local environments are analyzed.

Afterwards, the development of a NAS as a 3D model server and the coding of a mobile application with Vuforia and Easy AR utilities is carried out with a Raspberry pie.

In addition, QR codes are created with Unity 3D, 3D models of CNC machinery designed in Blender and for mobile development AFrame-ARJS and <model-viewer> are used.

To validate the duplication of the framework use, it was necessary to work with a student from the Multiplatform Software Development career, who had no prior knowledge of the tools.

It is important to mention that the documentation provided by the official pages was enough to develop the application and / or website with AR.

4 RESULTS

The easy AFrame ARJS documentation allows to create applications with simple interaction. To work with AFrame it is necessary an HTML file to call the 3D model in "glb" format and finally it is required an image as the identifier of the element to be called.

On the other hand, the problem presented in Android devices is the lack of permissions to be able to use the camera, requesting the meta-view.

Besides, Model-Viewer offers practicality and simplicity to create projects and easiness to manage it online through the glitch.com platform.

The version used for this study is only able to consult the “glb” files online, since locally is complicated.

The completion of simple prototypes in Easy AR framework is simple to manage and adapt within the Unity environment, while the compatibility with the 3D modeling files management is complicated, so its use may require additional development steps or even conversions.

Another framework to try is Vuforia, which is simple to implement, one of the conditions is the account validation stage, but once this step is finished it is ready to work with.

	Language	Time of answer	Resource use	Software additional	Software	Application	Multi-platform
ARJS	JavaScript	1sec a 2sec	800KB	*	-	-	*
Model-Viewer	HTML JavaScript	.8sec	100KB	*	-	-	-
Easy-AR	C# JavaScript	1sec a 2sec	21.5KB	*	93.8MB	65.8MB	Only apps
Vuforia-AR	C# JavaScript	.8sec	26.1KB	*	202.43MB	78.48MB	*

Comparative table.

5 CONCLUSIONS

AR tools generates opportunities that allows working in easy ways, some with greater simplicity than others, but thanks to these, the development of AR today is totally possible. The learning curve for the management of tools is short and useful the scientific research about this topic. It should be discriminated which of these frameworks require less training, better adaptation, and a higher response speed of the 3D models in the devices. Also, it is important to consider the strategies that are adapted to use in real time to make the AR possible

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