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Authoring Software for Augmented Reality applications for the use of maintenance and training process

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Abstract

Augmented Reality (AR) in the last decade has increased the popularity on various areas, such as education, advertising, maintenance, marketing and entertainment. On the area of maintenance and education specially we have been researching the benefits of the use of augmented reality bring us, and we have discover that the transfer of knowledge is faster than the traditional methods, and help to companies to train their employees faster and better. Many of the AR applications are custom made to the client needs, and to make an application of AR involves different types of skills such as programming, designing, modeling, animating, texturing. Given the high cost of these or the lack of some of these abilities, the need of programs of "authoring" has increase that permit to users create AR processes using just the GUI without having learn how to program.

This papers describes the program developed "ManAR" an authoring program that permits the user to create an AR process for maintenance and training. The application permit to companies to create process assisted by augmented reality to train and use on the field. The application links tridimensional models to a mark, and make use of pictures, texts and videos, to enhance the experience, and finally visualize the final product on tablets. Also other benefit is to access relevant information such as times, errors of the employees to improve AR process or to know how the users are progressing with their training.

Keywords: Augmented Reality; PLM, Authoring; Maintenance

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1. Introduction

Companies seek new ways to provide additional value to customers and gain a competitive edge over their competitor. The design of the product and clear focus on the management of the entire product lifecycle (PLM), and this become an area where companies have invested [1].

One of the most important parts of PLM is maintenance, which serves to extend the life of the product, but is one that cost more to the companies, for example companies that focus on provide maintenance and repair to aircrafts reports that spend US$38 billion in operation, and has in stock parts that together ascend to US$50 billion in 2005, and for 2015 this will increase to US$54 billion for operation [2].

Also industries reports that 70% percent of the accident are caused by human error, because the operator didn't know how to proceed [3]. There is also the possibility that staff are very rotational, and have to continually train new professionals to handle the machines.

Because of this companies try to find new techniques to speed up this process but always trying to do it right. Studies show that augmented reality helps to perform a maintenance task up to 50% faster than the traditional way [4]. Also for companies with constant rotation helps train their technicians to be more efficent asset to the company.

Nomenclature

PLM (Product Life Management), is the process of managing the entire lifecycle of a product.

AR (Augmented Reality), position virtual elements over the real world.

Authoring Software, application that permits to the user create content in it.

GUI (Graphical User Interface), allow to user to interact with computational systems.

1.1. What is augmented reality?

Augmented Reality (AR), is a technology that has gained popularity in recent years, thanks to the improvement of mobile devices, this consist of over positioning visual aids on the real world to give more information to the user, see Fig. 1, this is different from the virtual reality who tries to immerse to a virtual world. These applications have been successful in various areas besides maintenance and training such as education, entertainment, advertising, medicine, etc.

This normally use one or more sensors to align the virtual objects with real world, such as RGB cameras, depth cameras, digital compass, GPS, RFID, accelerometers. Also the objects are visualized on HMD, computer monitors, and portable devices.

1.2. How is made an AR application?

This consists of several steps, but the main ones are:

- Modeling the virtual pieces and texturizing it.
- Animate them
- Integrate and code the sensors that will help to align the virtual objects to the real world.
- Create the GUI and his behavior that the user will interact.

- Finally integrate the virtual elements to the application

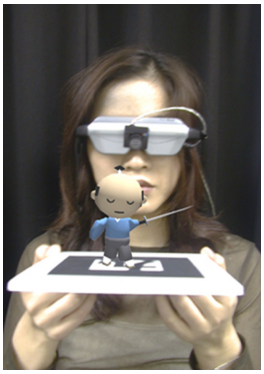

Fig 1: Image showing a 3d object over a marker [5].

1.3. Augmented Reality applications on industry

There are already AR applications that are being used in industry, for example metaio has created an augmented reality system, which helps technicians to carry out the operation and maintenance faster leaning RGB camera and mobile devices [6]. There is also another project that also supports video calls with an expert for support in real time, so companies do not need to be moving staff from one place to another and saving costs [7].

1.4. AR Authoring

As explained above to develop an AR application involves different professionals, such as programming, modeling, and animators. These areas are so specific that a company may not have some who can cover them, and if they want to implement it, they will have to outsourcing this.

Authoring applications can solve this, where one user who is not expert on these areas can develop an AR application using just GUI without programming or modeling simple things.

There already other authoring applications, for other uses like education, magazines, for example there's a project that can create children books in AR, one can create their own markers of the pages, and position the models over book with animations, also create some interactions, without having the need to code [8].

2. Development

Knowing that some companies can't hire professionals develop their own AR content, authoring tools are a great solution. So we notice that almost all maintenance processes are compose of sequential steps with some bifurcations. So we can create an authoring tool that can recreate these kinds of apps where one can use a mark to position a 3d object over a machine, or use the GPS and compass and have a video call with an expert.

2.1. Development Platform

Because augmented reality projects need to display virtual models in real time so is needed a 3d engine, and also use several sensors to align the model, also for markers is needed a library that support augmented reality with the 3d engine, and all this push the content to principal mobile platforms.

Unity met these requirements and can publish the app on the principal mobile devices, and also works with Vuforia an augmented reality that can tracks 2d markers [9] [10].

2.2. ManAR

The application is divided on three parts (Fig. 2), the first one is the Viewer App, where one can visualize the maintenance process and download new content that has been created by the content creator, also this can record the performance of the technicians, and last use it to make video calls with the expert to have support.

This application show the instruction of the step on the top side of the screen, and on the top right side it shows the tools that are need to use, and on the bottom right side it shows the best practices or the piece that is involve on the process for better understanding of the step.

The second is the Content Creator App; with this one the expert can create new process for the company. The expert can input the text that will show above each step, also if some step is needed an input from the user to advance to next, and freely move the virtual elements to be aligned to the real ones. For the AR that uses GPS, he can locate and create the locations to be seen by the technician and also input a text, link and additional images if he desire.

Also if he the leader of a group of technicians, he can check the performance of their subordinates to know how well are doing their tasks.

And the last one is the Server System, where is in charge to make the connections between the first two, and record the performance of the users, to be examined later on the content creator app by the expertise.

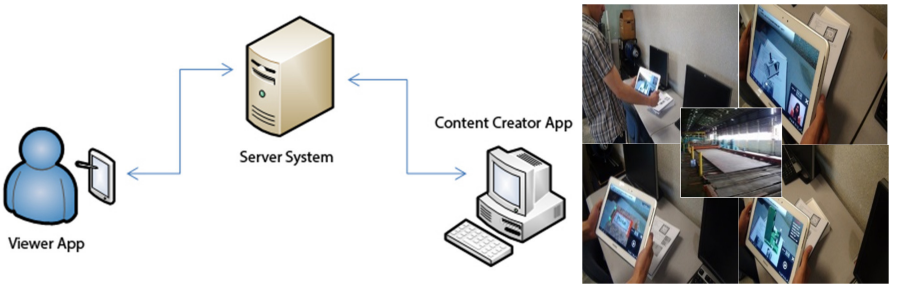

Fig. 2 (a) ManAR Network Diagram; (b) Viewer App

We have to clarify that the project is currently on development, but having the expertise of past projects we notice some of the needs that are more needed, like show best practices that are not on the official manual, or to record the performance of the users, to be later review by the expertise and check how to increase the performance of the technicians.

3. Conclusion and future work

In this paper, we have proposed that an authoring tool for maintenance is very important for the companies that don't have the staff to fill the areas needed to develop a custom AR solution and the important improve the maintenance on the companies, to reduce costs.

Also the next step is to finish the project and test it with technicians that can create new content and use it on field and check how difficult is to use it, and implement an easy method to calibrate the objects, to be corrected aligned the objects. And last compare if the AR app is developed on the traditional way.

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