AUGMENTED REALITY AS VISUAL AID FOR A MANUFACTURING ASSEMBLY STATION PROTOTYPE USING SMART GLASSES

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***Abstract:** In this work an AR application implemented using the Google Glass smart glasses is presented. The application deployed displays the assembly steps for a manufacturing assembly station prototype.*

***Keywords:** smart glasses, augmented reality, manufacturing industry*

1 INTRODUCTION

In the manufacturing industry, complex processes can still be found, compromising the quality of the product, slowing processes, and affecting the delivery to customers. In some factories, there are still production manuals to visualize the information with very specific instructions which should be memorized; and in large processes is not possible to check if each step is performed correctly, but only the critical ones (Doshi et al., 2017).

For these reasons, one of the main challenges of the manufacturing industry, related to the high performance, is the visualization of information and instructions. To solve this issue, Augmented Reality (AR) based-systems should overcome one of their most important challenges, which is to line up

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the virtual objects with the real-world objects.

The literature shows AR applications in the manufacturing industry environment, although, most of them were deployed in electronic devices like computers, smartphones, or tablets; few of them have been implemented using smart glasses, and almost all are still in the prototype stage (Bottani & Vignali, 2019).

Kohn and Harborth (2018) mentioned that smart glasses AR applications shown up as an alternative to integrate the AR in the manufacturing processes due to speeding tasks and reducing error rates.

2 THEORETICAL AND CONCEPTUAL FRAMEWORK

AR is one of the enabling technologies that strengthen Industry 4.0 (Uva et al., 2018). Although AR has been applied mainly in the entertainment industry, in other areas it is shown as a technology that allows facilitating tasks (Rohrer & Hendrix, 2018). Pace et al. (2018) mentioned that AR could be applied in five areas: as human-robot collaboration; maintenance, assembly and repair; training; product inspection; and building monitoring.

Smart glasses are the one of the most known wearable devices for AR in the world (Goke et al., 2016). Some of the smart glasses are equipped with features like a transparent display, is located on the users eyeline (Lee & Hui, 2018). Smart glasses have competitive tools against smartphones, also, allow users to have their hands free letting perform any other activity.

Some manufacturing industries are already implementing smart glasses for AR based-systems; in these environments, the Microsoft HoloLens are the most used (Kohn & Harborth, 2018).

3 METHOD

Smart glasses features could facilitate the accomplishment of manual assembly actions in the manufacturing industry. For example, the integrated camera could take pictures to establish the process that would be performed; while the components, and the subassemblies that would be used would be displayed in the screen.

In this work, an AR application implemented using the Google Glass Enterprise 2 (Google, n.d.) smart glasses is presented. The application shows the assembly steps for a manufacturing station after reading a QR code. This AR based-system is designed to be used on a manual assembly station in a controlled environment.

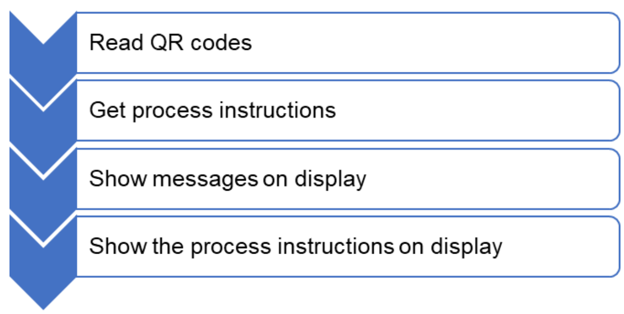

Figure 1. Methodology Flowchart.

In fig. 1 the stages followed to accomplish the system are listed. First, a QR code is read through the smart glasses camera to determine the process that will be performed. Second, the instructions are retrieved after ensuring that the QR code read is correct. Third, once the process is established, the assembly instructions that should be followed are shown in the smart glasses display, also the materials are displayed at the beginning of the task to facilitate the recognition of them by the user. Finally, when the assembly is totally assembled, the final product is shown in the smart glasses display, giving the opportunity of comparing the model with the physical product.

4 RESULTS

The result is an application deployed in the smart glasses.

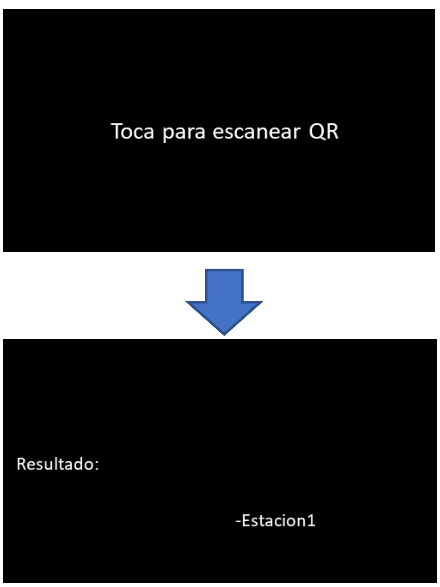

Figure 2. QR scan with glasses camera.

The fig. 2 (upper image) shows the message the smart glasses display when the application asks the user to scan the QR code with the message "Tap to scan QR code". Once the user places the camera close enough to scan the QR code, the smart glasses display shows the station name, for this case it shows "Estacion 1" as the fig 2. (lower image).

Figure 3. Assembly steps.

Fig. 3 shows (up to down) the instructions to follow in this assembly station. The components reference images were taken from a paper instruction. To pass from one screen to another, the user swipe forward or backward. The upper image is the start screen, the second image shows the components needed, the third and fourth images are the tasks to perform and the lower image asks the user to compare the assembly accomplished with a reference image.

5 CONCLUSIONS

With this AR based-system, the user observed the instructions to follow in the smart glasses display, avoiding the use of paper instructions, and allowing the user to have both hands free for the accomplishment of the tasks. In a further study, smart glasses could facilitate the tasks performed by the assembly station operators and decrease the error rate.

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