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Machining and Dimensional Validation Training using Augmented Reality for a Lean Process

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Abstract

Quality control does not concern only to a finished product, nowadays measuring technologies control all the fabrication process in an active way. If product quality does not meet the customer specifications exists the risk of even lose projects. When multiple or complex operations are required in the fabrication process of a part and its dimensional validation is primordial and also happens that the operator has doubts about which step to follow or that the expert supervisor is not at the workshop for some reason, that is why comes the opportunity of implementing Augmented Reality (A.R.) technology in education and in a lean manufacturing process, as support for technician operators of machine-tools and coordinate-measuring machines, with the objective of helping the technician to perform, in a proper and timely manner, the step sequence of the process. It was proved that having A.R. as ally in the technician's education, the mistakes and time required to fulfill the machining and dimensioning of a part can be considerably reduced, as well as eliminate operator's dependency to the experts. At the end of the implementation, savings were found in the three stages analyzed, generating 27.36% savings in lathe process, 26.54% in milling and 45.16% in dimensional validation.

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1. Introduction

Nowadays, the fabrication and dimensional validation of parts in the machine-tools area are important factors for the elaboration of checking fixtures, and having the certainty that the process is being held correctly is guarantee that a job will be delivered meeting the specifications required, without risk of having to remanufacture because a wrong machining or a wrong dimensioning was held at an early stage and, at the end, it implies to reprocess the part.

Having a support tool that interacts with the operator, the machines and the measuring equipment, can stop an error before it advances more, which is why it is required to have auxiliary aids, training or guides of the right fabrication and dimensioning method.

This study evaluates the use of A.R. technology in machine-tools workshops to make the part lean machining and validation processes more efficient. Being able to dimensionally inspect a part when it is still mounted over the machine is an advantage, since it makes possible react while the part is being machined. The tools that will intervene in this evaluation study are the FARO Gage (Coordinate-Measuring Machine, CMM) and the machine-tools (lathe and milling machine).

The mind map in Fig. 1 shows some of the functionalities that Augmented Reality can have. We divide the AR applications in three main branches: *Info visualization*, *Educational*, *Real time practice*. It is important to mention that many classifications of AR have been made since the concept was coined by John Doe Boeing researchers in 1994. This mind map shows the classification that the personnel of Automated Data Systems S.A. de C.V. (ADS) uses to address the development of Augmented Reality systems.

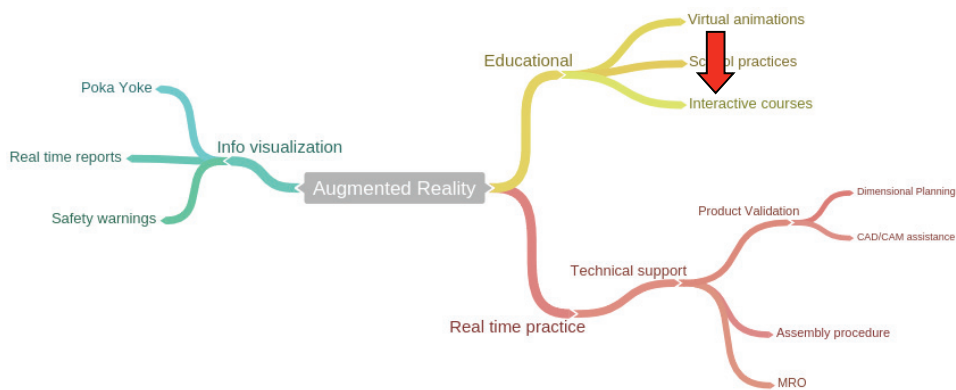


Fig. 1. Augmented Reality mind map of its principal functionalities
Source: Automated Data Systems S.A de C.V. (2015)

ADS' fabrication department, looking for making its machining and validation processes more efficient, bets on improving by educating its employees in using best practices.

Even though people knows how machine-tools works, always is good to guide the operator in the efficient manner of fulfilling the machining and validation processes. Dimensional validation is necessary to meet the customer's specified tolerances. Talking about checking fixtures and measuring devices fabrication, production criteria are very strict, requiring tolerances as small as 0.05 mm, 0.02 mm, etc., so it needs to be guaranteed that the measurements are right.

This is why the idea of creating a support system with Augmented Reality and taking advantage of the benefits this technology offers for knowledge transference emerged.

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