Seamless integration of augmented reality into digital workflow of virtual commissioning

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1 Introduction

The digital workflow of virtual commissioning is a process of developing and commissioning a plant or a line, based on customer requirements and needs. Before a plant is commissioned there are several design stages that must be done. This includes Concept Design stage, Mechanical Design stage, Electric Design stage, Automation Design stage and Virtual Commissioning stage. The process is shown on the following figure 1 (Siemens AG (2017)).
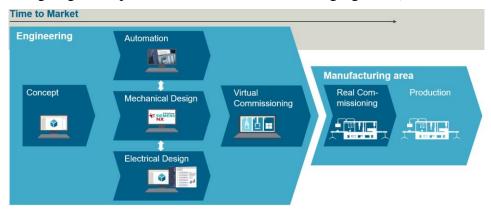

Figure 1: Workflow of Virtual Commissioning

The Siemens company provides software solutions to take full advantage of the potential of this workflow. The company provides solutions such as NX which is a specialized Siemens CAD, CAE, CAM software, TIA Portal which allows to easily program PLC control systems, PLCSIM Advanced that simulates the behavior of a PLC, and other simulation solutions (Siemens AG (2017)).

The goal of this work is to investigate possible use cases that integrates augmented reality into the Siemens Workflow of Virtual Commissioning using a Microsoft HoloLens (1st gen) smartglasses and then implement the proposed use case. The developed solution should use game engine called Unity.

2 Use case

The proposed use case integrates a workspace zones that are defined in the TIA Portal and propagates these zones to other Siemens software such as NX and to HoloLens application. The workspace zones are zones in space that define a work space of a machine using one of the three zone types: Work Zone, Signal Zone and Blocked Zone. The Work Zone defines where the robot can move, the Signal Zone defines zones in space that trigger a signal when entered and the Blocked zones that trigger an alarm and stop the machine. The user can visualize and

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adjust the workspace zones using the HoloLens application and synchronize the data between these solutions in real time.

3 Developed solution

The developed solution consists of a server application that runs on PC and a frontend HoloLens application. The server application extracts data from TIA Portal using TIA Openness, then the application generates .dae 3D model from the NX 3D model and using the Unity editor it creates a specialized Asset Bundle file, containing the 3D model, that can be send over network. The server application then listens at a specified IP address and port for incoming requests.

The frontend HoloLens application was created in Unity using a HoloToolkit framework made by Microsoft. The application is then exported to Visual Studio as UWP application that can be uploaded to HoloLens. The application communicates with the server via Wi-Fi using TCP sockets and it downloads the 3D model Asset Bundle and XML data describing the workspace zones. The application then visualizes the downloaded data and allows the user to adjust these workspace zones using hand commands. The user then has the possibility to upload the changes back to TIA Portal project and NX model using the server application that runs on PC. An image from the HoloLens application is shown in the following figure 2.
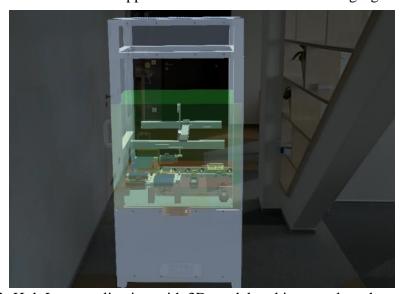

Figure 2: HoloLens application with 3D model and imported work space zones

4 Conclusion

This work aimed to integrate augmented reality into the digital workflow of virtual commissioning. The application described in the chapter 2.2 was successfully developed and implemented. Therefore, the thesis fulfilled the defined target. The created application satisfy the defined use case and it is fully integrated in workflow of virtual commissioning.

We plan to upgrade the application to the new framework version called MRTK because the HoloToolkit is now deprecated. The next idea is to import data about kinematics zones that represent a part of the machine that is used for calculation when entering zones. Furthermore, to be able to use it in practice, it is recommended to use OPC UA standard for communication because the current solution does not use encryption and it is vulnerable to any attacks.

References

Siemens AG. Virtual Commissioning (internal document). *Siemens Industry Online Support.* February 1, 2017. [Cited: May 8, 2019.]