Onshape based digital twin use case at the digital miniature factory from the UAS Technikum Wien

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Introduction:

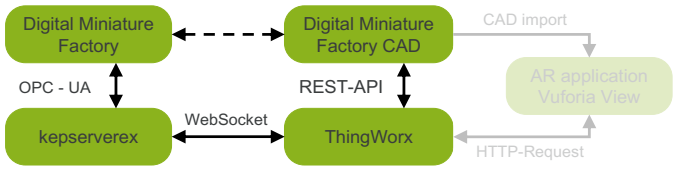
Digital twins (DT) applications offer a wide range of possibilities that are used in various industrial fields. To be able to explore the possible uses of such applications, the digital miniature factory (DMF) at the UAS Technikum Wien has been developed. The DMF is a miniaturized smart manufacturing system in which color-customized 3D printed carabiners are automatically packaged. The communication and networking of the individual stations are based on the IIoT platform PTC Thingworx as well as the communication standard OPC UA. The functions of the individual stations within the plant are already represented by digital twins or within augmented reality applications, which can be used for demonstration or teaching purposes. Another essential component is the representation of the flexible manufacturing process realized with mobile robots. This process is currently not yet visible in any visual representation and is to be developed during this project.

Problem-Description:

To keep any digital representation used for digital twins (Augmented or Virtual Reality or simulation software like Visual Components) up to date each time the CAD Model is changed an according update procedure has to be performed on each model used in DT visualization. Therefore, the question arises whether the process flow can be visualized directly within the CAD. The main advantage here would be that the CAD data, which is available anyway, would not have to be exported first and then imported into another software, since the real-time data of the miniature factory could be linked directly to the CAD.

Methods:

To enable interaction between the real production plant and the CAD, the existing REST-API interface of Onshape needs to be used. This interface should be accessed and controlled by the Thingworx instance of the production plant. Therefore, different functions must be implemented there, which either transfer information to the CAD or receive user commands from it. The figure shows the topology of the system.



To enable the CAD as a suitable interface between the plant operator and the real production plant in the future, the following functionalities need to be implemented:

- Textual display from the status of each station
- Visual display of further status information's
- Influence of the possible transport routes
- Sending control commands

Results:

During this project, various functionalities for interaction between the production plant and the Onshape Assembly have been realized.

On the one hand, the status of the individual stations can now be viewed textually. On the other hand, all stations are highlighted in color to indicate if they are currently online or offline, or whether an error has occurred. This is shown in this figure.

Within the assembly the transport routes of the robot can also be activated or deactivated, whereby the real transport routes of the mobile robot changes automatically. Finally, it was possible to implement functions, which allow to send the production commands directly to the individual stations. In the last figure, the entire digital twin can now be seen.