

## SUMMARY

Augmented reality (AR) is starting to play a more important role in the development of Industry 4.0. It is believed that it will become a crucial link between machine and man as we are creating more advanced cyber-physical systems. By developing AR applications to use with industrial robots, we are creating a new approach that is needed inside the future smart factories.

The current technology available to the public does come with some drawbacks, slowing down the development processes. The sensors and power sources used in modern AR headsets are still not precise enough to be used in a manufacturing environment, although the research is still being done. Another issue can be resulted from the fact that to interact with the AR environment, the user has to keep their hands visible to the AR headset's field of view.

This bachelor thesis aimed to develop a user interface in which a user is able to see and control the movement of an industrial robot model. To fix one of the drawbacks of AR, the movement input would be taken by using haptic gloves. This would allow the user to keep their hands wherever they feel comfortable while controlling the robot arm model.

This paper also gives a short summary about the principles used while developing the project. Inverse kinematics is used while controlling the robotic arm and Dynamic-Link Libraries (DLL) are used when connecting the haptic gloves program to the main user interface program.

The actual development of the project started with the Manus VR Gloves, where the author created a basic C++ project for getting the data out of the sensor on the glove's wrist. The wrist sensor was chosen based on the fact that the finger sensors were too prone to error and that they did not allow readings when moving a finger up from an open palm position. Also, only one glove was used because reading only movement data would not require the use of two gloves.

The next step was to develop a prototype of the user interface with a simple robot arm model. That was done inside the Unity 3D engine, where the model's movements were based around inverse kinematics principles. The DLL file intended to import the project for the haptic gloves was then added to the script of the Unity project.

The author started to come across multiple errors at that point surrounding the importing of the DLL file, one of which is still not resolved. That is why the project as of presentation of this thesis is still ongoing. The problem is that the Entry Point of the function needed to use is not found properly inside the Unity project.

In conclusion, this thesis can be evaluated as partly accomplished. While it did manage to create an idea and theoretical architecture of the user interface, and a program with which it is possible to receive data from the haptic gloves, in the end, a complete user interface prototype was not

finished due to problems that happened during development. More work would needed to be done in the future to fix the issues found during the process.

As for future development, the first step would need to be either resolving the DLL file issue or moving the whole project to another development platform. After that, it would be possible to create a more specific user interface based on where it would be used. Changes could also be made in the hardware used during this project, creating devices that would be more suitable for use cases inside the manufacturing field that follow strict safety guides.