

## SUMMARY

Virtual and Augmented Reality technologies are indeed becoming the practical tools of Industry 4.0 and rapidly expanding their markets. While AR enhances the way industry workers can interact with the real-world equipment, VR presents another breakthrough concept — Digital Twin, a technology which allows to manage existing manufacturing systems from a safe yet highly intuitive and interactive real-size stereo simulation. The goal of this thesis was to implement such system on the example of real industrial robot — Yaskawa Motoman GP8, and it was fulfilled successfully.

The simulation system developed in this work implements a universal software base which can be extended to control and program Digital Twins of different industrial robots by the means of Unity game engine. It also presents a new idea on how Digital Twin can improve the spatial awareness of its real-world counterpart using the collision prediction system inside the simulation — a viable alternative to cost- and time-consuming physical sensor solutions.

The Digital Twin robot created is currently a part of the TUT IVAR Laboratory digitalization project, where it works in tandem with the real Motoman GP8 robot located in the actual Laboratory. The solution was already assessed and tested by several students and a robotics specialist, who confirmed the fact of its applicability for demo and educational purposes.

This project, however, can be extended and improved to fit a much greater usability scale. The Unity script base of the project is built in a modular manner, which can allow industrial robot manufacturers to extend current program and add support of their machines without exposing the internal control protocols, and still leaving the solution compatible with the interfaces used in this application. The project code development itself will be continued after this work to improve stability and add new useful features.

As a conclusion, it should be stated that Digital Twin concept is actually a practically viable industrial solution, which can start driving control and management systems of enterprises in the nearest future.