SUMMARY

The industry and the market are slowly starting to implement previously development-stage ideas like cooperative robots in practical set-ups, coming to terms with the growth this concept has experienced over the last decade, this leads to the further diversification of cooperative robot's capabilities, as more research goes into developing more practical solutions at lower cost, which in turn resulted in an environment that is dynamically changing in response to the demand for more universal software tools and methods that can employ cobot's strength.

This project asserts that ROS can be employed as a centrepiece for the developers who wish to provide a more modular and a more universal solution for their robot stations. Such ROS-based solutions gain from a variety of ROS tools available through open-source libraries and create a common baseline for new companies, who use the universality of ROS to jump into a highly fluid industry that is still forming and lacks established and dominant competitors.

The solution developed for this project gives an example of the ROS capabilities as a tool, providing a remote-control system for OMRON TM5-900 that was used as its practical use-case, succeeds in implementing the Digital Twin of the use-case and verifies that the architecture of the robot control system used in this project is indeed practical and applicable to be used with other similar robots with little changes.

The final solution consists of an app developed on Unity3D, containing the user controls of the system, that can be used on any capable PC from any geographical location reachable by the server, and the ROS package installed in a local network with the robot which employs MoveIt and further scripting for calculation and execution of the commands it receives.

The general architecture of the solution has changed during the time spent developing this project as further research was carried in ROS capabilities and it was determined that employing MoveIt as a part of the solution would only benefit the system in comparison to developing a limited standalone approach that would offer only some of the tools available in MoveIt if it were to be based only on TM ROS Driver that was initially provided by the developer. These limitations have been determined and considered, resulting in a better final system.

The current solution is practically employed with the real case OMRON TM5-900 present at the IVAR Laboratory, it has been tested extensively and assessed by other students, who agreed to its practicability and applicability. It, however, of course, can be further expanded to include more features via additional development. The Unity3D side of the project can be further improved to support different types of UI control, future integration into the VR environment of the IVAR Laboratory and additional cross-platform support.

The main ROS side of the project would benefit from further testing and application to other robot and cobot models as well as further support for different working tools that cobot's can support, potentially this would allow the system to become even more universally applicable and possibly build a working library/portfolio of pre-made model-blind setups that can be chosen based on robot's geometry, with additional path planner improvements.

As a conclusion, it can be confirmed that ROS-based control systems centred around the modular structure of ROS nodes are a practical solution to the variety of existing company approaches in the robot industry, which will see further improvements and use in the future.