



Review report of a final thesis

Reviewer: Ing. Roman Knížek
Student: Bc. Jakub Zahradník
Thesis title: Integration of the safety certified PXROS-HR real-time operating system in ROS2 robotic system.
Branch / specialization: Design and Programming of Embedded Systems
Created on: 5 June 2023

Evaluation criteria

1. Fulfillment of the assignment

- ▶ [1] assignment fulfilled
- [2] assignment fulfilled with minor objections
- [3] assignment fulfilled with major objections
- [4] assignment not fulfilled

The thesis assignment was rather complex, involving the mastery of multiple software frameworks, a diverse skill set encompassing software engineering, build tools, networking, and the debugging of mixed software/hardware systems.

2. Main written part

93 /100 (A)

The written part of the thesis appropriately matches the problem's complexity. It presents a logical flow, starting with a detailed description of the ROS system, its architecture, and the communication framework, followed by analysis and verification of the proposed solution.

The student's effort to clarify the differences between ROS 2 and Micro-ROS throughout the work is commendable. Overall, the language and formal layout of the thesis are satisfactory and clean.

Only for Chapter 3.1 Building Micro-ROS Library, I would appreciate additional clarification on the need to download both ROS 2 and Micro-ROS sources and their possible dependencies.

3. Non-written part, attachments

95 /100 (A)

The non-written part of the thesis primarily focuses on the implementation using the C language. The student successfully utilized an existing in-house framework and adhered to company guidelines and source code management practices while implementing the missing components.

The written code demonstrates a logical structure, cleanliness, and functional capabilities, showcasing the student's proficiency in software development.

4. Evaluation of results, publication outputs and awards 100/100 (A)

The presented work is part of the initial phase of an R&D project centered on assessing and integrating PXROS-HR and ROS 2. The outcome is a functional prototype that encompasses multiple components necessary for encapsulating the PXROS-HR API within Micro-ROS.

Additionally, the student developed an alternative approaches to address functionalities not directly supported by PXROS-HR, such as Mutexes. The student also successfully tackled the non-trivial challenge of data synchronization in a multi-core environment and demonstrated the solution using various working examples.

In summary, this comprehensive work yields outcomes that will be leveraged in subsequent development stages.

The overall evaluation 96/100 (A)

Mr. Zahradník successfully tackled a complex problem that demanded a comprehensive understanding of various aspects of embedded software development. His work demonstrated the feasibility of integrating the PXROS-HR real-time operating system into the Robot Operating System. The results of his work include a functional demonstration that can be directly utilized in future development efforts.

Throughout the project, Mr. Zahradník exhibited a high level of independence, proficiency in software architecture, and the ability to debug intricate multicore systems. Furthermore, he showcased his problem-solving skills by looking for alternative solutions in case of unexpected or unsatisfactory first results.

Instructions

Fulfillment of the assignment

Assess whether the submitted FT defines the objectives sufficiently and in line with the assignment; whether the objectives are formulated correctly and fulfilled sufficiently. In the comment, specify the points of the assignment that have not been met, assess the severity, impact, and, if appropriate, also the cause of the deficiencies. If the assignment differs substantially from the standards for the FT or if the student has developed the FT beyond the assignment, describe the way it got reflected on the quality of the assignment's fulfilment and the way it affected your final evaluation.

Main written part

Evaluate whether the extent of the FT is adequate to its content and scope: are all the parts of the FT contentful and necessary? Next, consider whether the submitted FT is actually correct – are there factual errors or inaccuracies?

Evaluate the logical structure of the FT, the thematic flow between chapters and whether the text is comprehensible to the reader. Assess whether the formal notations in the FT are used correctly. Assess the typographic and language aspects of the FT, follow the Dean's Directive No. 52/2021, Art. 3.

Evaluate whether the relevant sources are properly used, quoted and cited. Verify that all quotes are properly distinguished from the results achieved in the FT, thus, that the citation ethics has not been violated and that the citations are complete and in accordance with citation practices and standards. Finally, evaluate whether the software and other copyrighted works have been used in accordance with their license terms.

Non-written part, attachments

Depending on the nature of the FT, comment on the non-written part of the thesis. For example: SW work – the overall quality of the program. Is the technology used (from the development to deployment) suitable and adequate? HW – functional sample. Evaluate the technology and tools used. Research and experimental work – repeatability of the experiment.

Evaluation of results, publication outputs and awards

Depending on the nature of the thesis, estimate whether the thesis results could be deployed in practice; alternatively, evaluate whether the results of the FT extend the already published/known results or whether they bring in completely new findings.

The overall evaluation

Summarize which of the aspects of the FT affected your grading process the most. The overall grade does not need to be an arithmetic mean (or other value) calculated from the evaluation in the previous criteria. Generally, a well-fulfilled assignment is assessed by grade A.