

## I. IDENTIFICATION DATA

<b>Thesis name:</b>	<b>IO-Link OPC UA Integration for Siemens SIMATIC</b>
<b>Author's name:</b>	<b>Rustambek Bekmukhamedov</b>
<b>Type of thesis :</b>	master
<b>Faculty/Institute:</b>	Faculty of Electrical Engineering (FEE)
<b>Department:</b>	Department of Microelectronics
<b>Thesis supervisor:</b>	Ing. Zbyněk Kocur, Ph.D.
<b>Supervisor's department:</b>	Department of Telecommunication Engineering

## II. EVALUATION OF INDIVIDUAL CRITERIA

<b>Assignment</b>	<b>ordinarily challenging</b>
<i>Evaluation of thesis difficulty of assignment.</i>	
The thesis was focused on integrating the part of the standard for OPC UA into the IO-Link Siemens Simatic system. An integral part of this work is a verification and evaluation based on implementation into the real device.	

<b>Satisfaction of assignment</b>	<b>fulfilled with major objections</b>
<i>Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.</i>	
Compared to the previous version of the paper, the student added some information. It is mainly a more formal division of chapters. Additional tests have also been added to the theoretical and practical part of the thesis. However, the chapters describing the student's work and aptitude have not been substantially expanded. Concerning its rework, they consider the assignment's fulfillment to be debatable.	

<b>Activity and independence when creating final thesis</b>	<b>F - failed.</b>
<i>Assess that student had positive approach, time limits were met, conception was regularly consulted and was well prepared for consultations. Assess student's ability to work independently.</i>	
The student showed his independence, especially in programming. Due to the minimal number of consultations, it was not easy to guide the student to complete all the required tasks. The second submission of the work was also not consulted by me as a supervisor.	

<b>Technical level</b>	<b>E - sufficient.</b>
<i>Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.</i>	
The work presented demonstrates the student's ability to understand the function of a particular system and to modify and extend it according to their needs. However, the diploma thesis is no longer evident in work due to the ability to design a more complex system and, in particular, to implement it and verify its correct function. The thesis is dominated by study, and only a tiny part of the thesis is devoted to the thesis proposal and primary objectives. The student is very active in describing how to work with the OP UA SDK but does not sufficiently explain the design and implementation in real HW. The thesis also lacks verification of the impact of OPC UA integration on the target system (binary code profiling, response, reliability, etc. ).	

<b>Formal and language level, scope of thesis</b>	<b>D - satisfactory.</b>
<i>Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.</i>	
The work is written clearly. The language level of the work is average. Many embedded images are low resolution and, therefore, harder to read.	

<b>Selection of sources, citation correctness</b>	<b>E - sufficient.</b>
<i>Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished</i>	

*from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.*

The student tries to cite all used sources. However, the format of citations is not fully in line with the requirements. The theoretical and design part is very closely focused on Siemens systems, although the OPC UA standard is a general solution with many commercial and free implementations (open62541 - <https://github.com/open62541/open62541>). These sources could also be included in the analysis. The student has incorporated the industrial protocol PROFINET into the text compared to the previous version. It is illogical to place it in chapter 3 when it should be correctly set in chapter 2 as a description of IO-Link and OPC UA protocols.

### **Additional commentary and evaluation**

*Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.*

As a supervisor, I went to the diploma thesis with the proviso that a proposal for the implementation of the integration of IO-Link OPC UA into the Siemens system will be developed and the verification of this integration will also be proposed. To better identify the problems and limitations, I envisioned creating a simple demonstrator to verify the implementation issues, performance, or reliability of the entire solution. Thanks to the use of the Linux OS and several tools, it was possible to perform various measurements both from the communication network and within the internal activities of the developed solution (SW). The verification itself ended only with the flashing of LEDs, although the original discussions also led to the possibility of reading the states of a given endpoint and performance evaluation

The thesis does not elaborate on the system design. The student only implements and focuses on the detailed description of individual implementation steps without knowing the overall concept and rules for designing complex systems. The verification itself is narrowed down to the ability to read or write data. Still, the impact on the running system and how the system can affect the OPC UA infrastructure itself is not verified.

### **III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION**

*Summarize thesis aspects that swayed your final evaluation.*

The presented work could be a very nice demonstration of how to implement inter-protocol cooperation, which is characteristic of Industry 4.0 technologies' successful deployment. I don't know if it was a COVID pandemic or just a student approach, but its elaboration remained somewhere in the middle of the way. It's a shame.

I evaluate handed thesis with classification grade **E - sufficient**.

Date: **17.1.2022**

Signature: