

I. IDENTIFICATION DATA

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

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	ordinarily challenging
<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.	

Satisfaction of assignment	fulfilled with major objections
<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>	
The original intention of integration into IO-Link Siemens was not fulfilled because the pandemic situation of COVID-19 did not allow working on the given HW in the Siemens laboratory. As a replacement for the IO-Link device, the student chose a single-board computer Raspberry PI and implemented communication using OPC UA. However, the LED's implemented flashing does not fully cover the integration aspects associated with the implementation of IO-Link. The possibility of reading values from the terminal device (GPIO pin status, system load, etc.) is completely missing. The student did not reflect these facts even after the appeal again. The thesis also did not deal with the verification of its implementation design - the flashing of LEDs is not verification. The overall work is conceived as a guide for building an application written using the OPC UA SDK. Concerning the type of work (diploma thesis), they consider the assignment's fulfillment to be debatable.	

Activity and independence when creating final thesis	E - sufficient.
<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 mainly in programming. Due to the minimal number of consultations, it wasn't easy to lead the student to complete all the required tasks. The student did not actually communicate from mid-April 2020 until the first submission in August 2020. The first submission of the work was also not consulted by me as a supervisor.	

Technical level	D - satisfactory.
<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 presented work demonstrates the student's ability to understand a particular system's function and modify and expand it according to their needs. However, the work no longer sees the ability to design a more complex system and especially implement this system and verify its proper function. Concerning his education, this activity should be a matter, of course. The student used many sources in solving the work, mostly from the Internet and public repositories. Keeping the list of literature is not fully following the requirements of the diploma thesis.	

Formal and language level, scope of thesis	C - good.
<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.	

Selection of sources, citation correctness

D - satisfactory.

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 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.

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. However, this was not realized. I do not know if it was a COVID pandemic, but the student did not show a willingness to consult and after the first 4 consultations he did not respond at all for 3 months. Subsequently, he tried to hand over the insufficient work. After no less problematic completion, the work is presented in this form.

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.

Question:

1. How would the implementation of the work differ if a real system with IO-Link were available?
2. What demands on HW and SW does the deployment of OPC UA require?

I evaluate handed thesis with classification grade **D - satisfactory**.

Date: **15.1.2021**

Signature: