

EMLi individual presentation portfolio correction guide

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Introduction

This document constitutes the correction guide for the Embedded Linux (EMLI) 5 ECTS course, MSc. level “individual presentation portfolio” which must be graded according to the 7-point grading scale.

Learning objectives

Knowledge

- Linux architecture
- Embedded Linux
- Distributed embedded linux computers wired and wireless networks
- I/O interfacing to sensors and actuators

Skills

- Integrate embedded Linux computers into relevant applications
- Apply appropriate communication and message passing architectures for data exchange and remote management, use version control systems

Competences

- Leverage and adapt existing embedded Linux design patterns to new applications.
- Create generic embedded Linux computers that can be combined to solve specific cyber-physical problems

Individual presentation portfolio

The individual presentation portfolio contains:

- 1) **A report describing the project.** Report pages must be A4 format and have 2 cm margins. Any pages beyond the stated maximum number of pages will not be read. Add images, sketches etc. as applicable. Page numbering must be present but no other headers or footers on the pages. Font must be Times New Roman, Liberation Serif or similar at 12pt. The report consists of two individual pdf documents described in the following:
 - a) **a team document (11 pdf pages)** following the structure:
 - Front page: clearly stating project group number, group member names and SDU email addresses. No other report content at this page.
 - Solution approach: Describe the high level solution approach, the overall architecture and design, including advantages and drawbacks. Use sketches and diagrams.
 - Solution description: Describe solutions to key tasks and concepts in the project.
 - Tests and results: Describe how the embedded system was tested and present the results of those tests.
 - Conclusion: Short conclusion summarizing the achieved solution and results.
 - b) **an individual document (4 pdf pages)** following this structure:
 - Front page: clearly stating student name and SDU email address. No other report content at this page.
 - Discussion: Compare the achieved solution, results, demonstration to the functional requirements. Discuss to what extent the solutions achieve the nonfunctional requirements, and if not, why not.
 - Conclusion: Summarize and outline how the achieved solution and results can be improved in future work.
- 2) **A team video** presenting the outcome of the project:
 - a) The video will be a combination of illustrations, recorded video of the physical system and any interactions, relevant screen recordings etc.
 - b) The video length must be maximum 90 seconds.
 - c) The video must be formatted as MP4 encoded using H.264/AAC with a maximum file size of 25 Mb. If not, the video may not be included in the assessment. Use of `ffmpeg` to convert to this format is recommended, the following parameters appears to work well for different sizes and formats:
 - `ffmpeg -i input.mov -c:v libx264 -vf scale=-1:1080 -crf 23 -maxrate 2M -bufsize 4M output.mp4`
- 3) **A link to a git repository** containing relevant scripts, configuration files etc. created by the team for solving the project.
 - a) The git repository must provide a quick and intuitive access to the relevant material.

Functional requirements

The functional requirements for the embedded plant watering system are:

- a) The water pump must be controllable
- b) The described sensors must be readable
- c) The wireless remote functionality must be accessible
- d) The water pump must run once at an interval of 12 hours.
- e) The water pump must additionally run maximum once per hour if the soil moisture falls below a certain threshold
- f) The water pump must run once if the farmer presses the button once within a period of two seconds.
- g) In case of an active pump water alarm or a plant water alarm the water pump may not run under any circumstances.
- h) The wireless remote must light the red LED in case of a pump water alarm or plant water alarm.
- i) The wireless remote must light the yellow LED in case the soil moisture is below a certain threshold
- j) The wireless remote must light the green LED otherwise
- k) The RPi must provide web access to historical information about soil moisture, ambient light, pump activations and water alarms. The data should be available as both graphs and downloadable data
- l) The RPi must be able to function both with and without an active internet connection via the RPi ethernet port
- m) The RPi must become fully operational after at power failure without requiring user interaction
- n) The RPi system and internet performance and health must be monitored and logged

Nonfunctional requirements

- a) The embedded system must be designed with the main tenets of the Unix philosophy in mind
- b) Where applicable shell scripts should be used rather than other programming or scripting languages
- c) Either MQTT or ROS2 must be used as message passing system for the embedded linux system. All sensors, the pump actuator, the wireless remote functionality, the logic control etc. must be represented as message topics
- d) Where applicable the embedded system must be scalable towards handling multiple plants (disregarding the limitation of serial port interfaces).
- e) The RPi must to the extent possible be secured against malicious cyber attacks from both the internet connection, when active, and the local wifi

Main tenets of the Unix philosophy

Small is beautiful.

Make each program do one thing well.

Build a prototype as soon as possible.

Choose portability over efficiency.

Store numerical data in flat ASCII files.

Use software leverage to your advantage.

Use shell scripts to increase leverage and portability.

Avoid captive user interfaces.

Make every program a filter.

Rubrics

The rubrics below define the grading criteria for the individual presentation portfolio. The rubrics will be used as a qualitative measure, and the individual topics are not weighed equally.

Team project, document, video, git repository

	Excellent	Good	Needs improvement
Portfolio elements: Are the element listed in the description of the individual presentation portfolio present?	All required elements are present	One or two less critical elements are missing	Several or critical elements are missing
Project functional requirements: Are the functional requirements implemented and tested?	All functional requirements are implemented and tested	Most functional requirements are implemented and tested	Less than half of the functional requirements are implemented, tested and demonstrated
Project nonfunctional requirements: Does the solution design comply with the main tenets of the Unix philosophy. Are shell scripts used where applicable? Is MQTT or ROS2 integrated into the design? Is the system design scalable towards handling multiple plants? Is the RPi secured against malicious cyber attacks?	The solution design comply with the main tenets. Shell scripts are used where applicable, MQTT or ROS is well integrated into the design, which is scalable towards handling multiple plants. The RPi is well protected against malicious cyber attacks with multiple layers of security	The RPi is protected against malicious cyber attacks with mostly a single layer of security.	The solution design comply only partly with the main tenets, few shell scripts are used, MQTT or ROS is only limited integrated, the system is not scalable towards handling multiple plants. The RPi is not well protected against malicious cyber attacks.
Document organization and structure: How well-organized is the document? Is it following the requested structure? Are the main points presented in a logical order?	The document is well organized, following the requested structure and all main points are presented in a logical order.	The document is reasonably well organized, mostly following the requested structure, most main points are presented in a logical order.	The document is less well organized, not fully following the requested structure, few main points are presented in a logical order.
Document writing style and visuals: Is the document content easily readable? Is the writing clear and concise? Does the report include relevant and effective visuals, such as images, graphs, tables, to help	The document is easily readable, relevant and effective visuals are used where applicable and are well explained	The document is readable, in most cases relevant visuals are used where applicable and are explained	The document is less readable, visuals are used to a limit extent, and are only partially explained

convey information? Are the visuals properly explained?			
Document content and accuracy: Does the document contain relevant and accurate information? Are sources properly cited? Is the information presented in a clear and understandable way?	The document contains relevant and accurate information with proper citations. The information is presented in a clear and understandable way	The document contains mostly relevant and accurate information with citations. The information is presented in an understandable way	The document contains less relevant and accurate information with few or no citations. The information is presented in a less understandable way
Solution approach: Are best practice approaches used for the overall architecture and design? Are advantages and drawback described?	Best practice approaches are used for the overall architecture and design. Advantages and drawbacks are well described.	Some best practice approaches are used for the overall architecture and design. Advantages and drawbacks are mostly described.	Few best practice approaches are used for the overall architecture and design. Advantages and drawbacks are vaguely or not described.
Solution description, test, results and conclusion: Are solutions to key tasks and concepts described, tested and concluded upon?	The solutions to key tasks and concepts are well described, tested and concluded upon.	Most solutions to key tasks and concepts are described, tested and concluded upon.	Few solutions to key tasks and concepts are described, tests are limited, and conclusion is superficial.
Video: Does the video present and document the key outcomes of the project?	The video presents and documents all key outcomes of the project.	The video presents and documents most key outcomes of the project.	The video presents and documents few key outcomes of the project.
Git repository: Does the git repository provide a quick and intuitive access to the relevant material? Does it contain relevant scripts, configuration files etc. created by the team for solving the project?	The git repository provides a quick and intuitive access to the relevant material. It contains all relevant scripts, configuration files etc.	The git repository provides a reasonably quick and intuitive access to the relevant material. It contains most relevant scripts, configuration files etc.	The git repository does not provide a quick and intuitive access to the relevant material. It contains only some relevant scripts, configuration files etc.

Individual document

	Excellent	Good	Needs improvement
Organization and structure: How well-organized is the document? Is it following the requested structure? Are the main points presented in a logical order?	The document is well organized, following the requested structure and all main points are presented in a logical order.	The document is reasonably well organized, mostly following the requested structure, most main points are presented in a logical order.	The document is less well organized, not fully following the requested structure, few main points are presented in a logical order.
Writing style and visuals: Is the document content easily readable? Is the writing clear and concise? Does the report include relevant and effective visuals, such as images, graphs, tables, to help convey information? Are the visuals properly explained?	The document is easily readable, relevant and effective visuals are used where applicable and are well explained	The document is readable, in most cases relevant visuals are used where applicable and are explained	The document is less readable, visuals are used to a limit extent, and are only partially explained
Content and accuracy: Does the document contain relevant and accurate information? Are sources properly cited? Is the information presented in a clear and understandable way?	The document contains relevant and accurate information with proper citations. The information is presented in a clear and understandable way	The document contains mostly relevant and accurate information with citations. The information is presented in an understandable way	The document contains less relevant and accurate information with few or no citations. The information is presented in a less understandable way
Discussion: Does the discussion compare the achieved solution, results and demonstration to the functional requirements? Is it discussed to what extent the solutions achieve the nonfunctional requirements?	The discussion presents an excellent comparison of the achieved solution, results and demonstration to the functional requirements. There is an excellent discussion of to what extent the solutions achieve the nonfunctional requirements. Excellent arguments are presented to substantiate this.	The discussion presents a good comparison of most of the achieved solution, results and demonstration to the functional requirements. There is a good discussion of to what extent the solutions achieve the nonfunctional requirements. Arguments are presented to substantiate this.	The discussion presents a limited comparison of most of the achieved solution, results and demonstration to the functional requirements. There is a limited discussion of to what extent the solutions achieve the nonfunctional requirements. Few arguments are presented to substantiate this.
Conclusion: Does the conclusion summarize	The conclusion summarizes well the	The conclusion summarizes most of the	The conclusion summarizes to a limited

the achieved solutions and outline how the solutions and results can be improved in future work?	achieved solutions and outlines well how the solutions and results can be improved in future work	achieved solutions and outlines how the solutions and results can be improved in future work	extent the achieved solutions and outlines to a limited extent how the solutions and results can be improved in future work
Learning goals: Does the student in the discussion and conclusion sections provide reflections based on knowledge and demonstrate application of the skills and competences defined in the learning goals?	The student provides excellent reflections based on learning goal knowledge and demonstrates excellent application of the learning goal skills and competences	The student provides reflections based on learning goal knowledge and demonstrates application of the learning goal skills and competences	The student provides few or no reflections based on learning goal knowledge and demonstrates limited application of the learning goal skills and competences