Process and Safety

Part of the minor Industrial Automation MINAU

Course owner:	Bas de Bruijn
Lecturers:	Bas de Bruijn
Number of credits for this course:	5 EC
Place in the ME-programme:	Y3 / Q 1
Course code:	L.29594
Examination code:	T.
Date/Version:	20230901

1. Course description

By dividing a total process in its functional steps and modules, the interfaces can be determined and analyzed. Providing insight in interaction for the various disciplines and physical connections. By taking safety into account when looking at the process a substantiated choice for components and methods should provide early insight in risks.

2. Scope

We will discuss the topics Process, Components, Interface and Information and how these are tied together in the Industrial Automation environment but we will not go into the technical details of PLC and Robot programming, Vision and Connectivity.

3. Learning objectives

After successful completion of this module the student:

- Can divide a process or machine into modules and interfaces (mechanical, electrical, control, information) and explain their interaction.
- Can create a risk assessment and substantiate a chosen Performance Level (Safety).

4. Organization

This module is roughly divided into 3 subjects, each consisting of a block of 2 lessons (3x2 hours per week). Next to lessons about Process and Safety we'll work practically with creating and reading electrical schematics. Thus we'll bind knowledge about interfacing of hardware and choosing of components into a schematic.

4.1. Schedule

Week	Process	Safety	Components
1.1	Introduction about Process, Components, Interface and Information Installing tools Docker & PlantUML & VS Code Introduction to Robot + assignment describing the process to be developed.	Exercise: define the most unsafe way of making and consuming a pizza.	Practical building a backplane from schematic Installing Eplan Displacement/Time diagrams. History of automatization with relays and valves
1.2	GIT: practical exercise in defining a development process	Knowledge session by SICK	Introduction Eplan Displacement/Time diagrams.
1.3	Visualizing: Flowcharts, State machines and Sequence diagrams.	Inherent safe design	Meet various components and draw them into the schematic
1.4	Interfaces and Information Push/pull production Bottlenecks	Risk assessment	Reading manuals: Delta EtherCAT servo drive and Nanotec EtherCAT servo drive
1.5	Looking at ISA88	Performance Level	Safety components
1.6	Implementation on hardware		
1.7	Implementation on hardware		

Table 1, Schedule

5. Assignment

You'll be given an assignment to analyze, document and implement an assembly process. You'll have to implement the process by constructing an assembly jig, programming a PLC, have it communicate with an industrial robot. During this process you'll have to apply your recent acquired knowledge on electrical components, electrical drawings, risk assessment, safety and defining processes and interfaces.

Final details will be given at the start of the course

6. Examination

- The assignment must be made as a group.
- Since you'll learn how to work with Git in this module, Git will be the tool with which we will check if everybody has done its part.
- During the module you will start building your documentation.
- During the last 2 weeks of the module, the implementation on the actual hardware will be done.
- At the end of the module a presentation of the implementation will be given by the team. Afterwards reflection and conclusions may be finalized in the documentation.
- The assignment consists of a repository containing the content which should be rendered as a local webpage by mdBook. Learning how this works and applying this is part of the examination.
- For examination you'll provide a link to the repository containing the produced work.
- Examination will be done with a Holistic Rubric where a grade will be given for the entirety of the work. This grade will be substantiated by the rating criteria in the rubric.

6.1. Holistic Rubric

The final result of the project will be assessed holistically, using the rating criteria stated in the rubric in Table 2 on page 4. It is not necessary for all rating criteria to be of at least Adequate level to pass the overall rating requirements.

Next to the instructor giving this course, another (external) instructor will grade the criteria per row and if needed will provide specific feedback. This setup will provide a four-eyes principle.

Levels (from low to high) with corresponding Bison grades:

- Inadequate < 5.5
- Adequate 6
- Good 7 - 8
- Perfect 9 - 10

Rating criteria	Argumentation of assessment by instructor
Process	
The process of the case has been functionally analyzed	
A flow chart of the process under analysis has been made	
Interfaces in the process and interaction between parts/modules/systems are defined and substantiated.	
Interfaces are graphically depicted.	
The collaboration "contract" of the process of programming together has been defined and applied by the group.	
Git	
A description of for example the team process workflow, pull requests, merge commits, sequence diagrams are documented and visualized.	
Each team member has added an equal amount of content.	
Visualization quality	
Diagrams of processes, sequences, state machines are shown at a level of meaningful details.	
Diagrams are visualized in such manner that they are understandable for peers outside your project group.	
Safety	
Chapter of definition of Performance level	
Chapter of Risk assessment.	
Risk assessment has been done in a timely manner so that the implementation has been adjusted.	
Components	
Work is substantiated with time-displacement diagrams.	
Connecting components are visualized by electrical diagrams.	
Implementation	
A professional approach to the implementation has been seen.	
The implementation has been carried out as planned.	
A review of the implementation process has been evaluated.	
Future improvements are discussed.	

Table 2, Holistic rubric