



Student Topic: Cognitive safety for dynamic industrial environments (Master Thesis / Bachelor Thesis)

The dynamic environment of current and future smart factories is characterized by active collaboration between humans and machines, rapid tool change, and the potential reconfiguration of manufacturing processes. For such an environment, traditional static safety approaches are not well suited, as the safety concept must be re-evaluated from scratch each time a change occurs. This requires a significant amount of time and development effort. To meet these challenges in such dynamic environments, the process of conducting safety concepts needs to evolve to adapt to or anticipate these dynamic changes ensuring that safety properties are always maintained. The student(s) will research innovative approaches and technologies to address this challenge by developing what is known as cognitive safety, which ultimately reduces the time and effort required to maintain safety in such environments. The research will be part of the project carried out between Pro2Future GmbH, Tu Graz, and Siemens AG Graz. Therefore, giving students the opportunity to extend their knowledge by closely working with Siemens experts and being employed by Siemens as working students (Not Obligatory).

Goals and Tasks:

- Getting familiar with Siemens hardware and software portfolio and simulation models;
- Developing Safety concepts for different configurations using simulation models;
- Determining the appropriate safety functions for specific scenarios;
- Identifying technologies and/or approaches that could simplify Safety Concept creation (e.g., language models);
- Specifying inputs and outputs for the methodologies chosen in step d. and model training;
- Generating test cases and conducting tests.

Recommended Prior Knowledge:

- Experience or a high interest in learning Safety Concept development and Functional Safety, including HARA and FMEA analysis;
- Experience in working with automation technology, particularly PLCs and modules;
- Interest in working with simulation models of smart factories such as Fischer Lernfabrik
- Familiarity with Siemens equipment and PLC programming, especially using the TIA portal;
- Basic programming skills, such as Python, C, or C++;
- An interest in language models, like GPT-3, and their applications.

Contact:

- Amer Kajmakovic amer.kajmakovic@pro2future.at
- Michael Krisper michael.krisper@pro2future.at

