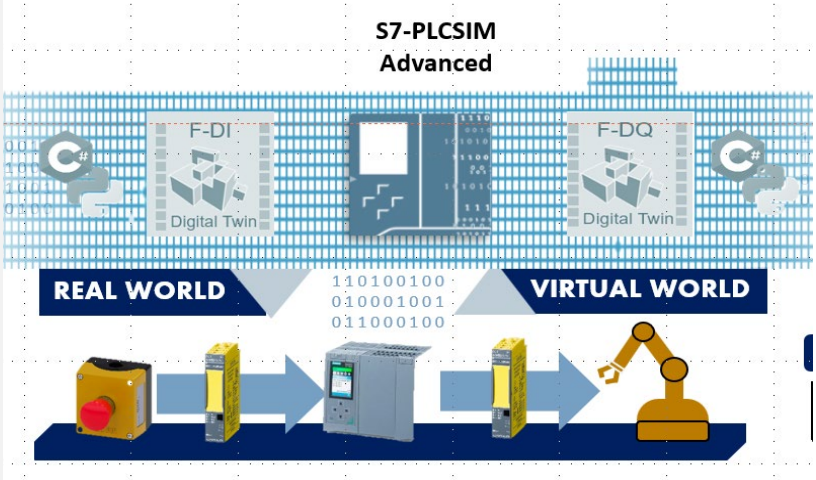
SUCCESS STORY

Pro²Future :: Products and Production Systems of the Future

Programme: COMET – Competence Centres for Excellent Technologies

Programme line: COMET-Centre K1

Type of project: TWIN-Solution, 4 years, multi-firm



OPTIMIZING AUTOMATION WITH DIGITAL TWINS FOR FAILSAFE COMPONENTS

LEVERAGING DIGITAL TWIN TECHNOLOGY FOR REDUCED COMMISSIONING AND MAINTENANCE EFFORTS WHILE ENSURING SYSTEM SAFETY AND RELIABILITY

As automation systems continue to evolve, they are becoming increasingly complex and challenging to design and deploy. During the installation, commissioning, or maintenance phases, significant on-site engineering effort is necessary to ensure a valid composition of the new system, compliance with required norms and regulations, and smooth interaction with other systems. Moreover, systems must be designed and tested to ensure that they are reliable and safe: free from failures that could cause harm or injury to people or the environment.

In the last period, digital twins have gained recognition for their potential in enhancing industrial systems in general but also for safety-critical application. One of the key advantages of digital twins lies in their ability to simulate and analyze various scenarios without affecting the actual system. By creating a virtual replica of the system, engineers and operators can thoroughly test and assess potential risks, identify vulnerabilities, and validate safety measures. Given the lack of digital twins for fail-safe components, Pro²Future developed a digital twin that will simulate the behavior of these components to support system and safety engineers during their work. Such a digital twin should replicate the behavior of the fail-safe device to some extent.

The digital twins are developed in the virtual platform SIMIT tool, made by Siemens. In the background, the SIMIT tool relies on the S7-PLCSIM Advanced virtual controller, which is a digital representation of Siemens PLCs. The components are implemented in the Framework “Component-Type-Editor”, based on in SCL (Structure Component Language), which relies on C#. They introduced new features that can simulate the performance of the real fail-safe input-output modules. To fully develop and later use Digital Twin,

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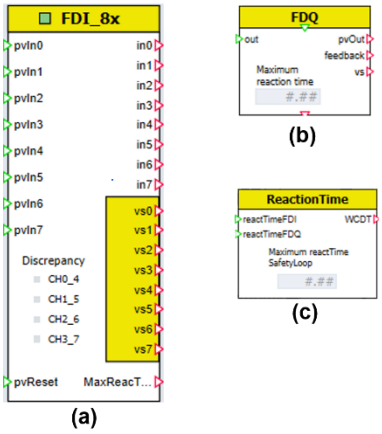
we need to collect data that is important for creating the digital twin. In our case, we needed two types of data via the API:

- Module-specific data: collected manually from the manuals and documentation.
- Confidential data: collected from internal documents and processes.
- User configuration data: collected from the TIA portal configuration via the Openness library.

The developed digital twin presents an analytical model that can simulate two additional safety features: discrepancy analysis for fail-safe digital input modules and calculation of the maximum reaction time of the entire safety loop.

Impact and effects

The digital twins developed using Siemens' SIMIT tool offer several key benefits. They enhance efficiency by reducing commissioning time and ensuring smoother system startups. Additionally, they improve safety and reliability through comprehensive safety analysis and early detection of potential failures. Cost reduction is another advantage, as digital twin lower operational costs by minimizing the need for on-site expertise and reducing system stoppages. Real-time insights provided by digital twins enable informed decision-making and optimizing operations. In the end, digital twins can serve as valuable educational tools for training safety engineers without impacting real systems.



Developed digital twin of the fail-safe modules: (a) Fail-safe digital input with 8 inputs. The yellow box in the components marks the value status bits – bits that signal errors in the given channel. (b) Fail-safe digital output module that shows maximum reaction time and (c) block that summarizes all maximum reaction times.

These advanced simulation tools are now available to customers through the official Siemens website, making them accessible for enhancing industrial operations such as deployment and testing.

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