

## Abstract

To increase the utilization of test resources in software testing of robotics, a heterogeneous test stand composition is a favourable approach as it allows deploying slimmed down test hardware, where individual tests can target specific features of a test stand. Consequently, more test stands can be deployed within the same budget and space constraints. This project introduces a novel solution to dynamic scheduling in the field of software testing of robotics defined through three field notation. Leveraging the state of the art test framework, PyTest, the project provides a pragmatic Domain Specific Language(DSL) for both specifying feature requirements and advanced deployment strategies for software tests through high-level configuration. To enable test scheduling to a heterogeneous network of test stands, the features provided by the test stands have been derived through three novel categories of feature elicitation: Manual, static, and dynamic.

The scheduler itself is architected to be robust and stateless by eliminating all single point of failures and separating business logic from state. Observability has been provided with a custom dashboard of the application state and traceability is possible through Event Driven Architecture while maintaining end to end type safety through encoding. The software was tested successfully against the production environment of Universal Robot's test facilities and yielded promising results for future development. This project provides a vital cornerstone in the implementation of the Industrial 4.0 revolution by introducing feature-oriented test scheduling for heterogeneous networks to enable lean operations in the scaling of modern test facilities of robots. Though the current implementation of the scheduler is simple and rule-based, it is envisioned that the path to near global-optimal test scheduling is through collaborative Multi Agent System with distributed decision making based on Reinforcement Learning where data locality and edge computing will ensure low-latency.

**Keywords:** Heterogeneous Test Scheduling, Robotics, Testing, Industry 4.0, I4.0, Internet of Robotic Things, IoRT, Open Shop