Extension of Twistturn to Support Hardware-in-the-Loop Testing

(Master Thesis)

STEFAN RAKEL

Motivation

System failures of industrial plants can be expensive and safety-critical. The avoidance of such system failures is an important aspect of developing and operating an industrial plant. Therefore, testing of software for industrial controllers is a crucial step in avoiding failures. In addition to testing on software level, Hardware-in-the-Loop (HiL) tests should be performed. The goal of HiL testing is to perform test on the target hardware in an environment as close as possible to the application environment. Mobile HiL solutions allow the testing of System under Tests (SuT) in their target environment and are thus beneficial to achieve high quality testing.

State of the art

Existing HiL solutions differ in many aspects including the specification of the industrial plant. Most existing solutions need a stationary computer to test the SUT. In addition, real-time enabled operating systems should be employed to ensure correct testing. Real-Time Android (RTAndroid) is a real-time capable operating system based on the Android. It enables mobile devices to provide Soft PLC capabilities using the application Twistturn. Twistturn utilizes the capabilities of RTAndroid to allow the development and execution of Structured Text and Function Block Diagram programs.

Objective

The objective of this thesis is to extend the Twistturn application on RTAndroid, currently capable of executing PLC code, with HiL capabilities. The resulting prototype should be able to test PLCs connected to the mobile platform through previously developed wireless adapters. The prototype must allow the specification of test and acceptance criterions. It should test the conformity of the SUT utilizing the real-time capabilities of RTAndroid to ensure best possible test accuracy. In addition, the prototype must log the returned data of the PLC under test to allow post-simulation analysis.

Approach

After analyzing existing HiL concepts it must be determined how a HiL simulation module can be embedded into Twistturn. In addition, it must be evaluated to what extend the real-time capabilities of RTAndroid and its existing wireless adapters can be utilized to achieve correct testing of SUTs. A prototype will be developed allowing the specification and execution of test cases. The functionality will be evaluated to examine the achieved performance on mobile devices through wireless technology in comparison to the required performance for accurate HiL testing.

Advisor: David Thönnessen
15.11.2016

Informatik 11
Embedded Software

RWTH AACHEN
UNIVERSITY