

# Masterarbeit Exposé

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## Execution and Simulation of PLC Programs on RTAndroid

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### Topic

Programmable Logic Controllers (PLCs) are established in automation of technical processes. One of their characteristic features is real-time capable robust hardware, which can be programmed using standardized programming languages like Structured Text (ST) and Ladder Diagram.

In the past, design, construction and testing stage of PLC program development<sup>1</sup> incorporated different systems to plan and implement a PLC program before it was tested on real hardware. This process requires expensive hardware.

Android is a popular open source platform for mobile and embedded devices. It is developed by Google in cooperation with the Open Handset Alliance. Android-based devices provide lots of computing power in small form factors at low prices. To fulfill real-time requirements, this platform has been extended into RTAndroid in previous projects. RTAndroid is equipped with techniques to allow real-time program execution including real-time process scheduling and a compatible garbage collector.

### Objective

Primary goal of this thesis is the design and integration of a method to run PLC programs on Android-based devices. This includes an editor for PLC programs, an environment to run these programs and an abstraction for input and output (I/O) devices. These I/O devices are represented by an interface to choose either interaction via a virtual control interface or connect the Android device to physical external hardware. This interface and the virtual control panel will be developed whereas the interaction with external hardware is left to a later extension.

### Approach

There are basically two approaches for execution of ST programs on an Android device:

- Parsing the ST program and transforming it into executable code for the Android platform.
- Provide a runtime environment that interprets the ST program at runtime. This could include the transformation into an intermediate code or direct interpretation of ST code.

In both cases, execution of the ST program will run in a process with real-time priority. Since runtime interpreter always lead to overhead during execution of a program, the first approach appears to offer a better performance and will be considered first. The executable or the runtime interpretation will use a specified interface to communicate either with the virtual control interface or the external hardware. This interface, a GUI to edit ST programs and the virtualization of input and output components are part of this thesis.

Finally, the systems performance will be evaluated under RTAndroid with a focus on PLC cycle times and scalability.



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<sup>1</sup> M. A. Laughton, D. F. Warne, electrical Engineer's Reference book, 16th edition, Oxford, Newnes, 2003 Chapter 16

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