

KROHNE Diploma Thesis Proposals

In the context of the frame cooperation with UPT, KROHNE is proposing the following projects as part of the Diploma Thesis activities. Each topic will be guided by a person assigned from the KROHNE team and special funding can be awarded to support publication activities in conferences and journals.

1. Energy Profiling for Bluetooth Low Energy communication for industrial measurement devices

Industrial measurement devices are getting more and more interconnected with the outside world using various wireless technologies. In spite of the growing demand for complex interconnectivity, well established constraints like extremely high reliability as well very low power consumption must be preserved.

This project aims to investigate the impact of enabling BLE communication for interconnecting industrial measurement equipment with external clients like mobile phones and tablets. Starting from a basic test setup consisting of a KROHNE measurement device and reference mobile client, an evaluation methodology has to be developed which shall provide information on energy consumption for the following main use cases:

- Standard BLE communication
- Sleep mode
- Data tunneling over BLE
- Enabling different profiles over BLE

2. Multi-device Simulation using KSIM simulated measurement devices

A KROHNE device is used in an industrial environment for measuring different characteristics of a fluid (gas or liquid). The KROHNE Simulator (KSim) is a software simulator that mimics the behavior of KROHNE devices. It is built in a modular way, so that each of the simulated modules can be developed independently. Each individual module is fully configurable via XML files. Multiple modules form a device which is also described by an XML file. The communication between modules is performed using the proprietary internal bus. Multiple simulated devices form a Simulated System. The communication between the devices and with a Control Application is performed via external field buses. Also the Simulated System is configurable via XML files.

The project objective is to design the simulation system that should allow running a simulation for multiple devices connected in a system via device external buses (field buses) in a specified topology.

If interested in our projects, please contact us at:

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The simulated system will be described in a XML file which contains:

- Devices in the simulated system
- Buses in the simulated system
- Connection of the components in the simulated system.

The project should be developed in C#.

3. Windows scheduler customization for real-time aspects in KSIM simulated measurement devices

A KROHNE device is used in an industrial environment for measuring different characteristics of a fluid (gas or liquid). The KROHNE Simulator (KSim) is a software simulator that mimics the behavior of KROHNE devices. It is built in a modular way, so that each of the simulated modules can be developed independently. The communication between modules is performed using the proprietary internal bus.

Each of the modules composing a device contains a firmware code that is run on top of a HAL (Hardware Abstraction Layer) that contains the specific simulation of the underlying hardware (MCU + other hardware components). The firmware is organized in threads which are currently run in the same process and the time-base for the simulation is implemented using a time quantum which is used to increment local module time base in a round robin way. The current implementation of the time base has a few limitations:

- The simulator has some limitation of the time quantum, since the threads are scheduled by the Windows OS and the control of the scheduling is limited
- KSim limits the interaction of the KSim with the external hardware (emulators) due to the Real-Time constraints of the communication layer.

The project proposal consists of finding a way of eliminating the two limitations described above. This should provide the following advantages:

- Control the simulation speed and CPU load depending on the host machine according to configuration
- Allow communication with real-time components (components simulated on embedded hardware)
- Get speed and load related metrics (help in detecting and profiling communication)

4. Visual Designer for KSIM simulated systems

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The communication between the devices and with a Control Application is performed via external field buses. Also the Simulated System is configurable via XML files.

The project proposal will be to design a visual tool that should allow:

- Detection of the existing module plugins and configuration files for each individual module
- Configuration of a specific module
- Assembly and configuration of specific device: the device consists of:
 - o Module plugins
 - o Module configuration
 - o Buses
 - o Bus configurations
 - o Overrides of specific properties of the modules
- Assembly and configuration of Simulated System: the simulated system consists of
 - o One or multiple devices
 - o Connection configuration
 - o Inter-device connections (the topology of devices)

The application should be developed in C#, using WPF and MVVM model.

5. Custom Visual Studio code analyzer with Roslyn

The .NET Compiler Platform ("Roslyn") provides open-source C# compilers with rich code analysis APIs. Given a Visual Studio solution containing a large amount of projects, create custom code analyzers (for example, dynamically list all methods that match a given definition pattern). Propose a design that allows for easy extensibility and configurability.

6. Custom visualization controls in Xamarin

The aim of this project is to design and implement two custom controls in Xamarin.Forms and evaluate their behavior and performance in iOS and Android systems. The first control is a custom bar graph having advanced features to visualize out of range and previous values. The second control is a custom analog gauge with animation support, like the ones in modern automotive HMIs.

The controls shall be implemented in C# using Xamarin.Forms technologies.

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