



Telemark University College
Faculty of Technology

FMH606 Master's Thesis

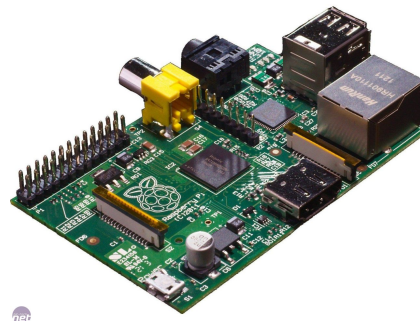
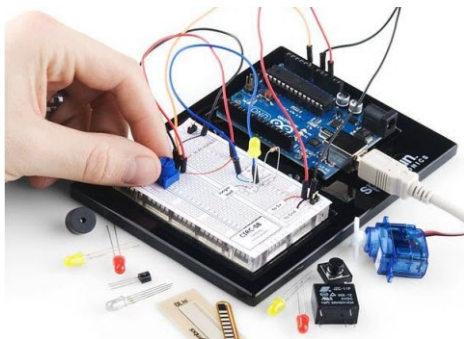
Title: Process Control and Monitoring using Arduino and Raspberry Pi

TUC supervisor: Hans-Petter Halvorsen

External partner: National Instruments

Task description:

The Arduino and Raspberry Pi platforms have become very popular today among hobbyists and in education. In this project we will explore how we can use the Arduino and Raspberry Pi platforms for industrial applications such as Process Control and Monitoring Applications.



The following topics (in prioritized order) could be investigated in this project:

1. Explore the Arduino and the Raspberry Pi platform in general and explore how they can be integrated in Process Control and Monitoring Applications.
2. Create an Arduino/Raspberry Pi embedded PID Controller (replacing e.g., the Fuji PXG5 PID controllers or myRIO devices that we have at TUC) and do practical experiments on small-scale process models. The code should be implemented as an Arduino Library.
3. A web-based logging service similar to e.g., Xively or Temboo should be developed. A Web Service should be created together with an Arduino Library for communication with the library.
4. Using Arduino/Raspberry Pi for Process Monitoring and Datalogging using Web Services and “Data Dashboard for LabVIEW” (App for Smartphones and Tablets)
5. Using OPC UA together with Raspberry Pi



6. Using Arduino and Raspberry Pi within MATLAB and Simulink
7. Implement other Control strategies, such as MPC (Model Predictive Control), Feedforward Control, Cascade Control, etc. And State Estimation methods like Kalman Filter.
8. Using Arduino within LabVIEW; LabVIEW LINX
9. Explore Wireless Communication, such as WiFi, Bluetooth, XBee, RFID together with Raspberry Pi and Arduino for Publishing and Monitoring Process Data
10. Explore possibilities for using Raspberry Pi together with the LabVIEW platform
11. Explore the possibilities to combine Raspberry Pi and Arduino, i.e. control the arduino from the Raspberry Pi device together with e.g., Python, using Raspberry Pi as a Web Server, etc.

Based on the students interest, he should select some of the topics above in collaboration with the supervisor for further investigation.

References:

- The Arduino platform: <http://arduino.cc>
- The Raspberry Pi platform: <http://www.raspberrypi.org>
- LabVIEW LINX (using Arduino with the LabVIEW platform): https://www.labviewhacker.com/doku.php?id=learn:libraries:linx:getting_started
- Arduino Support from MATLAB: <http://www.mathworks.se/hardware-support/arduino-matlab.html>
- Arduino Support from Simulink: <http://www.mathworks.se/hardware-support/arduino-simulink.html>
- Raspberry Pi Support from MATLAB: <http://www.mathworks.se/hardware-support/raspberry-pi-matlab.html>
- Raspberry Pi Support from Simulink: <http://www.mathworks.se/hardware-support/raspberry-pi-simulink.html>
- Learning Python with Raspberry Pi: <http://www.raspberrypi.org/learning-python-with-raspberry-pi/>
- Xively: <https://xively.com>

Task background:



Arduino is a low cost open-source electronics prototyping platform. The Arduino has analog and digital I/O.



The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and may be used with a standard keyboard and mouse. It does not include a built-in hard disk or solid-state drive, but it uses a SD card for booting and persistent storage.

Student category: SCE students

Practical arrangements: None

Signatures:

Supervisor (date and signature):

Students (date and signature):