Telemark University College

Faculty of Technology

# FMH606 Master's Thesis

Title: Home Automation

TUC supervisor: Hans-Petter Halvorsen

External partner: National Instruments

Task description:

Home automation has greatly increased in popularity over the past several years. Home Automation may include centralized control of lighting, heating, ventilation and air conditioning, appliances, security locks of gates and doors and other systems, to provide improved convenience, comfort, energy efficiency and security.
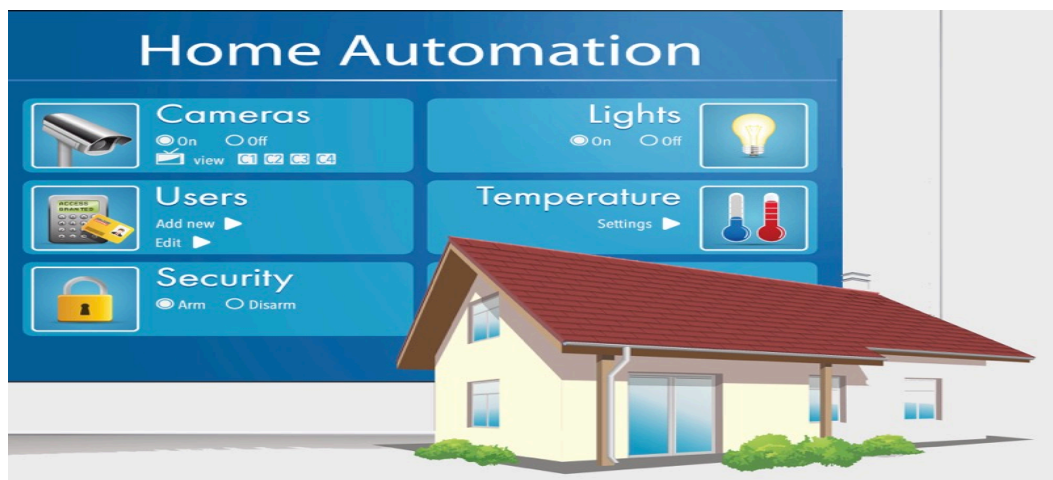
The following topics (in prioritized order) could be investigated in this project:

1. Study of existing Home Automation Systems and explore the Arduino and the Raspberry Pi platforms to see how they can be integrated and used for Home Automation
2. Logging, Monitoring and Control of typical Data in Homes, e.g., Temperature, etc.
3. A Web based logging service similar to e.g., Xively or Temboo should be developed. A Web Service in C# should be created together with an Arduino Library for communication with the library.

4. Using Arduino/Raspberry Pi for Monitoring and Datalogging using Web Services and "Data Dashboard for LabVIEW" (App for Smartphones and Tablets)
5. Development of PID control (or other control strategies like MPC) for temperature control in houses.
6. Create a Home Automation Prototype based on Arduino/Raspberry Pi (Temperature Logging and Control)
7. Explore integration with Apple HomeKit, Android Home Automation or Microsoft HomeOS. These are frameworks for communicating with and controlling connected accessories in a user's home.
8. Explore Wireless Communication, such as WiFi, Bluetooth, XBee, RFID together with Raspberry Pi and Arduino for Publishing and Monitoring Home Data
9. Using OPC UA together with Raspberry Pi
10. Use of e.g., the ZigBee Home Automation standard for Sensor Integration
11. Using Arduino within LabVIEW; LabVIEW LINX

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

References:

- Smart Homes (in Norwegian): http://www.dinside.no/931315/smarthjem-i-kraftig-vekst
- The Arduino platform: http://arduino.cc
- The Raspberry Pi platform: http://www.raspberrypi.org, http://www.raspberrypi.org/tag/home-automation/
- Apple HomeKit: https://developer.apple.com/homekit
- Microsoft HomeOS: http://research.microsoft.com/en-us/projects/homeos/
- ZigBee Home Automation: http://www.zigbee.org/Standards/ZigBeeHomeAutomation/Overview.aspx
- LabVIEW LINX (using Arduino with the LabVIEW platform): https://www.labviewhacker.com/doku.php?id=learn:libraries:linx:getting_started
- Xively: https://xively.com

Task background:
Home Automation Systems have been very popular today and many vendors have solutions within this area. This must also be seen in connection with Internet of Things (IoT).

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.

Student category: SCE students
Practical arrangements: None

Signatures:
Supervisor (date and signature):
Students (date and signature):