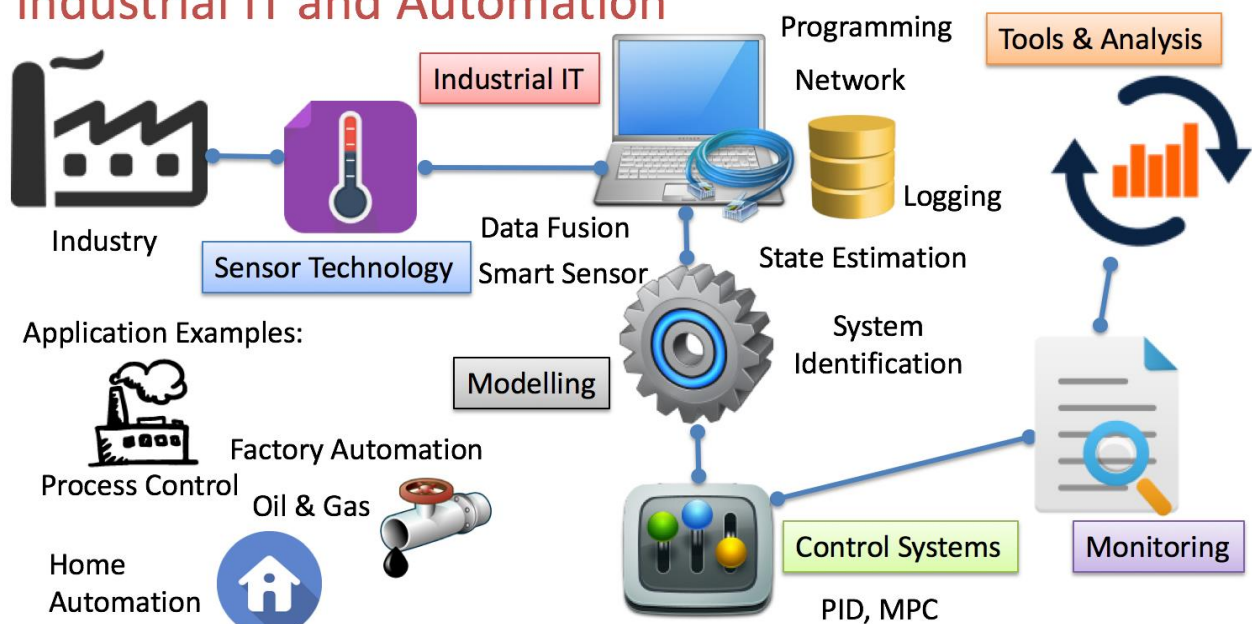


Work Portfolio

Showcase of Creative Work within Teaching, Research and Development

Hans-Petter Halvorsen, 2019.04.04

Industrial IT and Automation



Preface

This document describes my work portfolio, i.e., it is a showcase of my creative work within teaching, research and development (R&D) within the area Industrial IT, Automation and Software Engineering.

I have been working within the field system engineering, industrial IT and automation for the last 20 years. My background is from the industry where I was working with Industrial IT, Automation and Software Engineering tasks for about 12 years.

The last 10 years I have been working in academia within the same field. Currently I work at University of South-Eastern Norway. Research and development activities are within Software Engineering, Automation Systems, the Internet of Things (IoT), Industry 4.0, Cloud services, Mobile and Smart technology.

My special expertise is the practical use of information technology and connect it to applications within the fields of industrial IT, automation and software engineering, as well as teaching facilities, teaching activities and research and development projects, with great emphasis on e-learning and digitization within the above-mentioned disciplines. The research and development projects are strongly linked to local industry. My publications are characterized by international cooperation, but also close collaboration with local industry.

I develop and maintain a web site/blog, where all my work is published, both teaching material, and research and development material, including more than 100 videos within Industrial IT, Automation and Software Engineering.

Technology Blog:

<http://www.halvorsen.blog>

Hans-Petter Halvorsen



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Part 1 : Overview

This part will introduce my work, my working fields, overview of work experience, Curriculum Vitae, my Blog and the contents. My main working area is within Software Engineering, Industrial IT and Automation.

1 Introduction

I work at University of South-Eastern Norway (from 4th May 2018).

At University of South-Eastern Norway, I work with teaching, research and development, programming and system development, laboratory work and data acquisition within the area Industrial IT, Automation and Software Engineering.

Figure 1-1 shows a so-called “Word Cloud” of my work.



Figure 1-1: Word Cloud of my Work

All my work is published on my Blog:

<https://www.halvorsen.blog>

This document has the following structure:

- Part 1: Introduction and Overview
- Part 2: Teaching
- Part 3: Research and Development
- Part 4: Detailed Overview of Selected R&D Projects

The different parts contain the following:

Part 1: Overview

This part contains the following topics:

- Introduction
- Curriculum Vita
- Work Experience from Industry
- Technology Web Site
- Technology Blog
- Industrial IT and Automation
- Software Engineering

Part 2: Teaching

This part contains the following topics:

- Teaching Activities
- E-learning
- Teaching at Bachelor Level
- Teaching at Master Level
- Practical Teaching Methods
- Using Videos in Teaching
- Flexible Teaching Facilities
- Agile and Scrum Methodology
- Programming
- Programming for “Kids”

Part 3: Research and Development (R&D)

This part contains the following topics:

- Research Activities
- International Publications
- Research Groups
- Projects at Bachelor Level
- Projects at Master Level

Part 4: R&D Project Examples and Applications

This part contains information about some of the main areas of R&D projects I am involved in:

- Environmental Public Health Information Management Systems
- Smart Houses and Buildings, Home Automation and Smart Technology
- Automation Systems and Industry 4.0
- Weather Systems
- Health and Welfare Technology
- Software Engineering and Project Planning and Management

The different parts and the different chapters in this document may be read independently of each other.

1.1 Industrial IT and Automation

I work with teaching, research and development within Industrial IT, Automation and Software Engineering. See Figure 1-2.

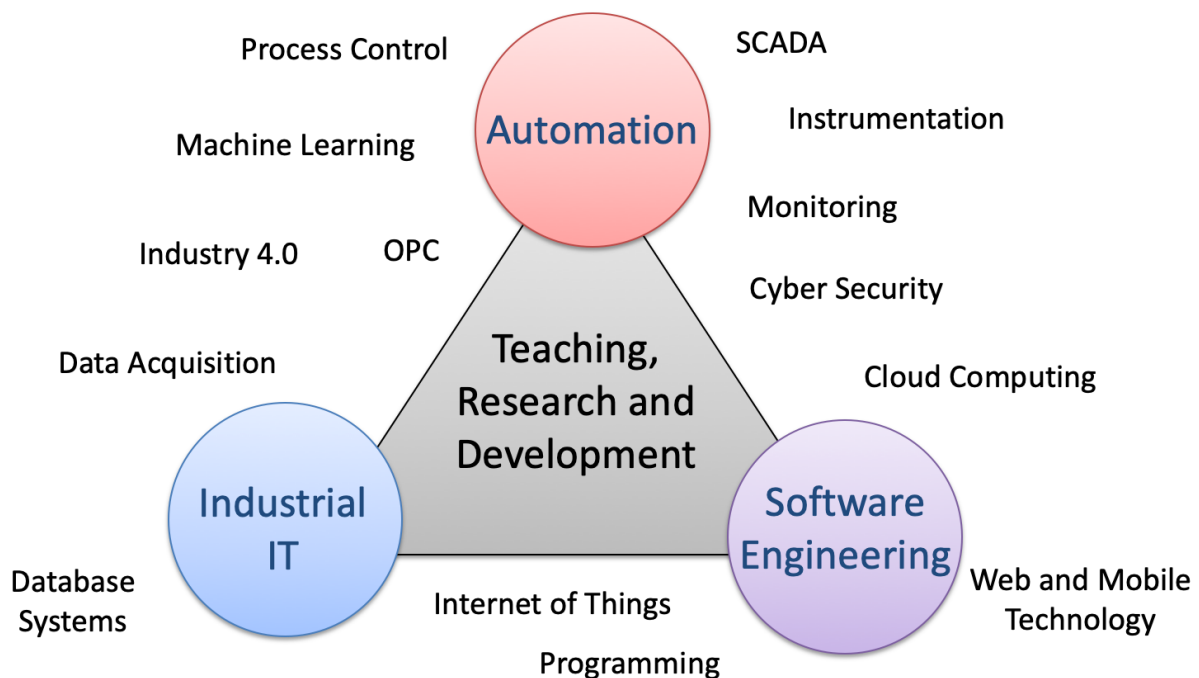


Figure 1-2: Teaching, Research and Development within Software Engineering, Industrial IT and Automation

In Figure 1-3 we see an overview of my main working fields within these areas:

Industrial IT and Automation

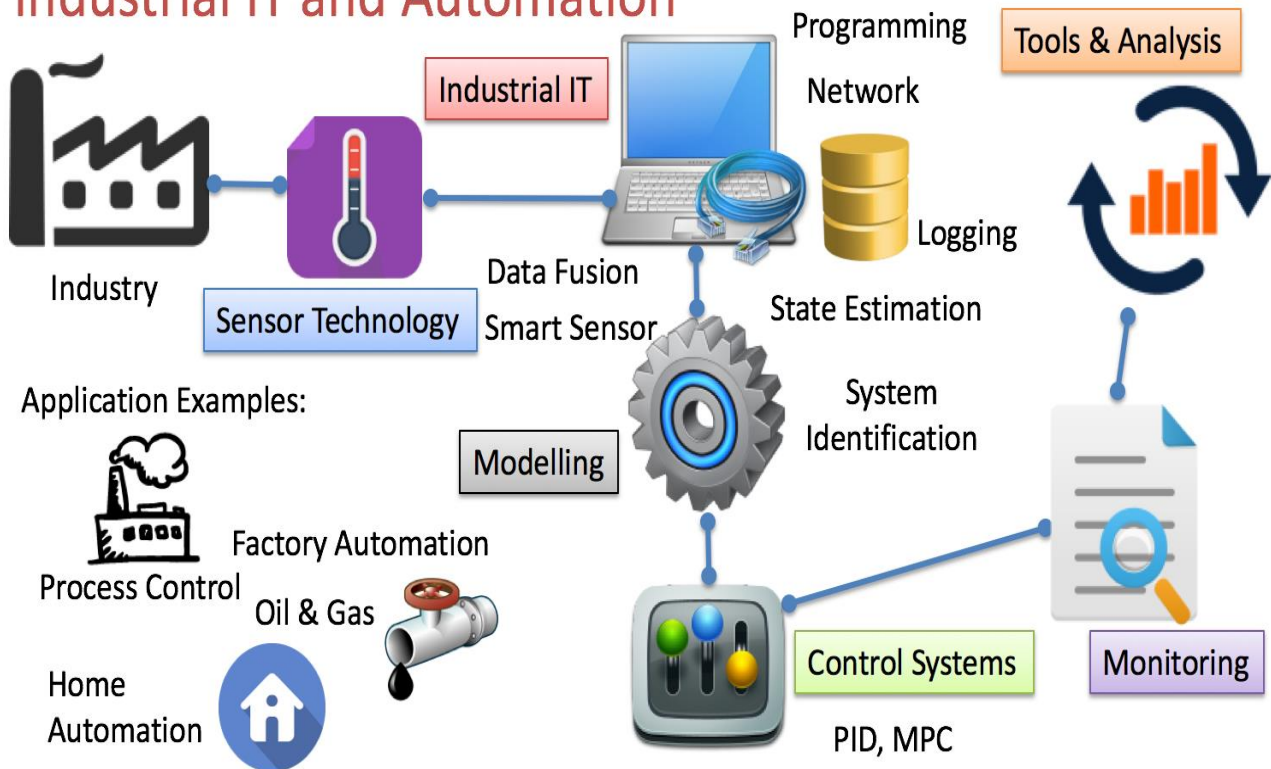


Figure 1-3: Working Fields

For more information, see the following web page:

http://www.halvorsen.blog/documents/technology/industrial_it_automation.php

and

https://www.halvorsen.blog/documents/programming/software_engineering/software_engineering.php

At the University of south-Eastern Norway, we have 5 years' study within Industrial IT and Automation, i.e., a 3-year Bachelor study within "Informatikk og Automatisering" (in Norwegian) or "Informatics and Automation" (the study is taught in Norwegian) and a 2-year Master study in "Industrial IT and Automation" (the study is taught in English).

System engineering and software engineering is the foundation if you want to develop solutions within Industrial IT and Automation.

http://www.halvorsen.blog/documents/programming/software_engineering/software_engineering.php

I am teaching system engineering/software engineering at Bachelor level, but I also use and apply that area in other courses and in research and development projects, because it is the fundamental for all other activities.

I have relevant background (more than 12 years) from industry within the fields Industrial IT, System/Software Engineering and Automation which I rely on in my teaching and research and development projects.

1.2 Web Site/Blog

I develop and maintain a web site/blog, where all my work is published, both teaching material, and research and development material.

My web site/blog <http://www.halvorsen.blog> are my channel for publishing the teaching material, R&D material, etc. to a broad audience. In addition, the web site/blog are sources to national and international collaboration, because I daily meet peers worldwide through my web site/blog.

The web site/blog has more than 200 (typically between 200-400) daily visitors from all over the world. Totally, this is more than 1400 weekly visitors and about 75.000 yearly visitors. This way I have a broad audience for my published work, either if its teaching or research and development. By publishing all my work on the Blog, I get a broad audience for my work and I get in contact with people with common interests all over the world.

So far, visitors from 100 different countries have been visiting my web site/blog, so we can talk about internationalization in a large scale.

The web site/blog is for those who are interested in technology, teaching and research and development. In addition, it is my main portal for all my teaching activities at the university. It is a portal for all my teaching material, either it is written documents I have made available online, or additional resources like videos, lab assignments, previous exams, etc. course schedules, etc. are all also available online for the students. The course schedules are highly interactive with syllabus, videos, exercises, lab assignments, etc. just a click away.

All my work is published on my web site/blog.

Technology Blog:

<http://www.halvorsen.blog>

You could say the web site/blog is a hub that collects all my work within teaching and research and development. See Figure 1-4.



Figure 1-4: Web Site/Blog – A Hub for Creative Work within Teaching, Research and Development

On the web site/blog you will find:

- Teaching Resources
- Research and Development
- overview of Projects, both previous and ongoing projects, including student projects and research and development projects
- Different technical resources like videos, textbooks, tutorials and examples
- Innovative ideas within different aspects
- Blog posts, news and discussions within Industrial IT, Automation and Software Engineering

- Apps and Services – lots of applications and services within different areas are available for free (open access and open source). These Apps and Services have been made from scratch.

Everything web site/blog are open access and open source, which means students, educators, researchers, etc. can use it in their teaching or research or development projects.

In Figure 1-5 we see an example number of visitors and where they are located.

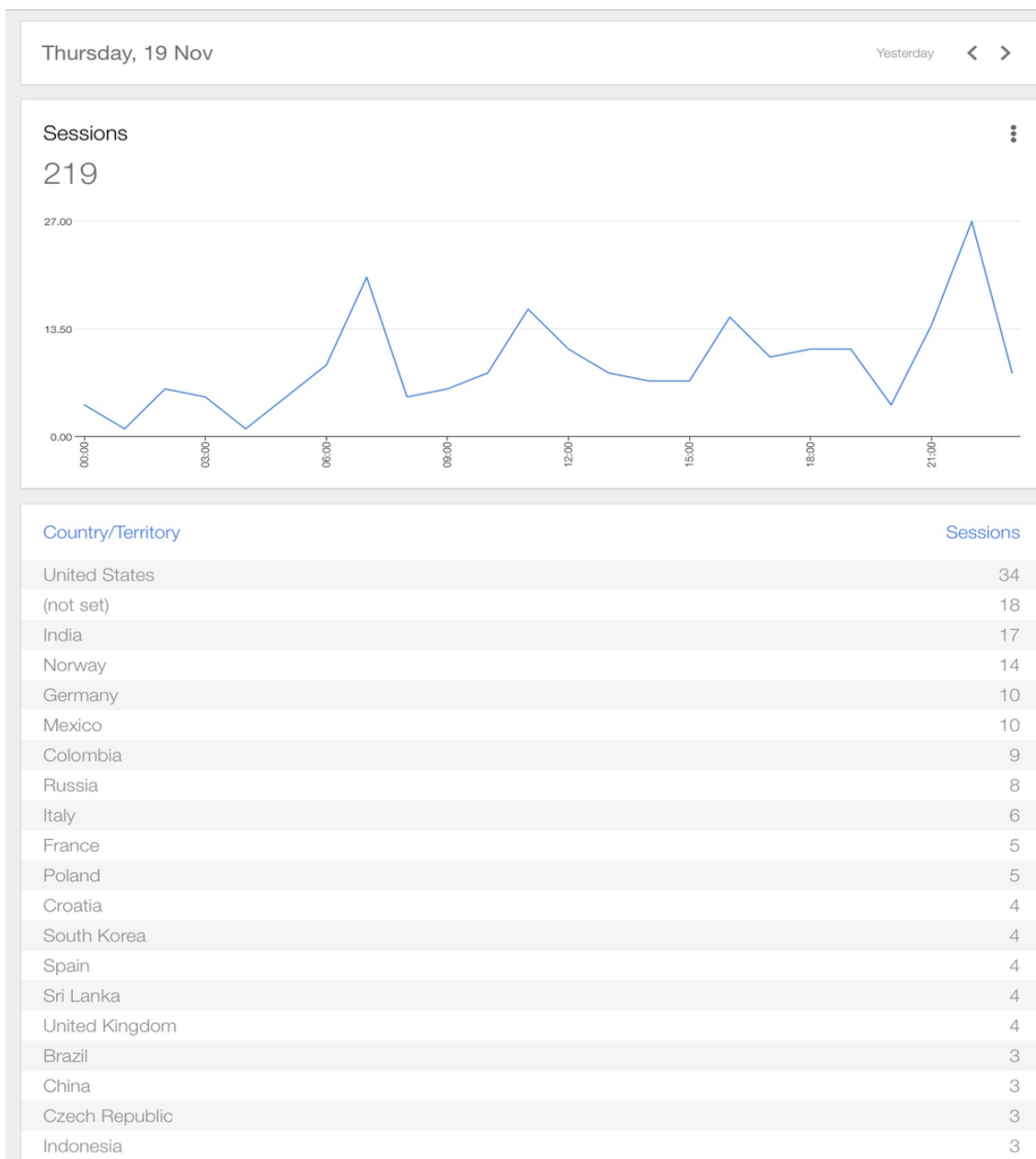


Figure 1-5: Daily Visitors at my Blog grouped by Country

2 Curriculum Vitae (CV)

2.1 Personal Information

Name: Hans-Petter Halvorsen
Date of Birth: 1972.01.06
E-mail: hans.p.halvorsen@usn.no
Technology Blog: <http://www.halvorsen.blog>

2.2 Work Information

Present Work: University of South-Eastern Norway

Title: Assistant Professor

Web: <http://www.halvorsen.blog/documents/portfolio>

2.2.1 Work History

Time	Work
2018 -	University of South-Eastern Norway Assistant Professor within Software Engineering, Industrial IT and Automation
2016 - 2018	University College of Southeast Norway Assistant Professor within Software Engineering, Industrial IT and Automation
2009 - 2016	Telemark University College

	Worked as a Senior Engineer within the fields System Development, Cybernetics and Industrial IT and Data Communication.
2005 - 2009	Baze Technology AS Worked with Software, System Development and Software Architecture. Software Engineer, Software Architect, Product Owner.
1997-2005	CARDIAC AS Worked with Software, System Development and Software Architecture. Software Engineer, Software Architect.

I have been working as a System Developer, System Architect and Product Manager within leading Software Companies for about 12 years. I have been working with subjects such as:

- Software Development, Software Engineering, Project Management for Software Projects, Software Architecture
- LabVIEW Programming
- Microsoft .NET Platform (Visual Studio with C#, VB.NET) and ASP.NET
- Database Applications and Microsoft SQL Server Applications
- Web Programming (ASP.NET, PHP, HTML, JavaScript, CSS, etc.)
- Software Design (Software Architect) and Testing
- Team Systems and the Team Foundation Server
- Virtualization
- Project and Product Management

I have been involved in many deliveries (Software/System Engineering Projects) to leading Norwegian and International Companies, such as Yara, Statoil, Norske Skog, Norsk Avfallshåndtering, AHUS, St. Olavs Hospital, etc.

2.2.2 Educational Information

Time	University
1995-1997	Telemark University College

	M.Sc. in Systems and Control Engineering/Process Automation/Cybernetics
1992-1995	Østfold University College B.Sc. in Systems and Control Engineering

2.3 Working Fields

These are my main working/research/teaching fields:

- **Software Engineering:** System Development, Software Development, Programming and Software Architecture, Software Engineering, Programming, .NET, Visual Studio, VB.NET, C#, LabVIEW, MATLAB, Database Systems, SQL, etc.
- **Smart Technology**
- **Home Automation Systems:** Home Automation and Smart House solutions, Internet of Things (IoT). Cloud Computing. Industry 4.0 and Smart Factory Solutions.
- **Automation, Cybernetics and Process Control:** Control Theory, Data Acquisition Systems, Process Control Systems such as DeltaV, etc.
- **Mobile Technology for Measurement and Control:** Wireless Sensor Network, Wireless Data Acquisition, Tablets and Smartphones, etc.
- **Industrial IT and Data Communication:** OPC, Real-Time Systems, Wireless Sensor Networks (WSN), etc.
- Research and development within Data Management, Logging, Control and Monitoring Applications.

Industrial IT and Automation

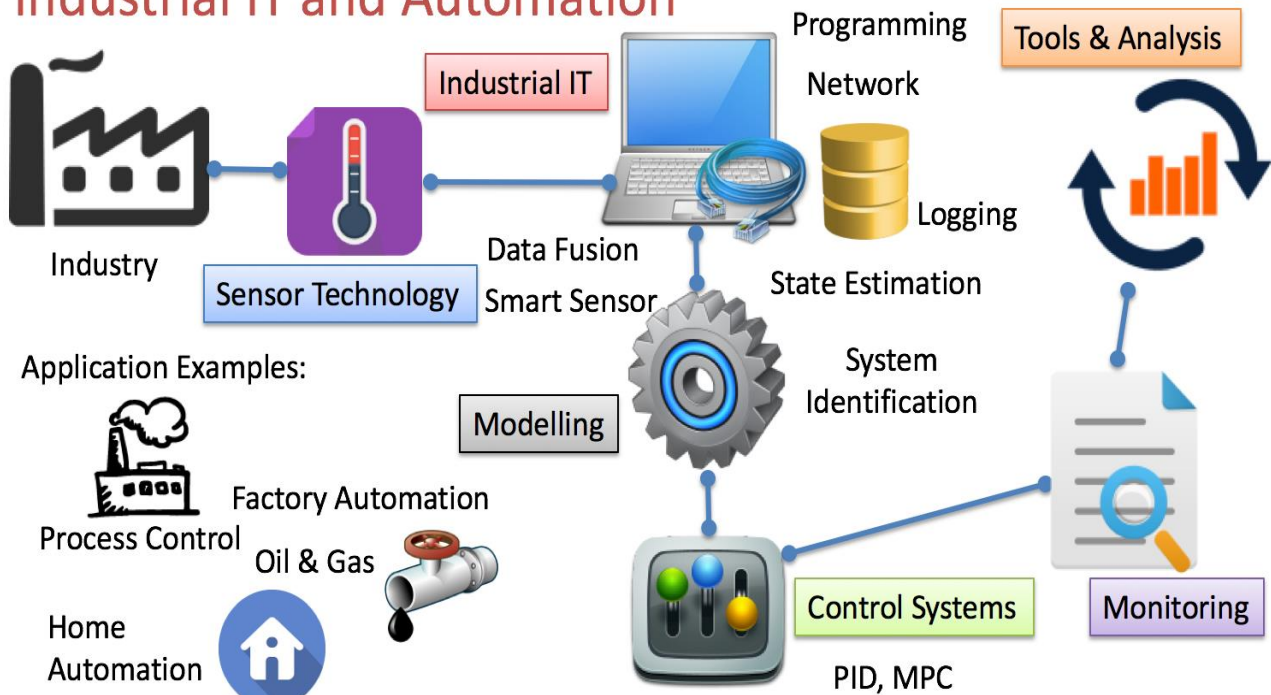


Figure 2-1: Working Fields

For more details about these topics and my work, see web site/blog.

Technology Blog:

<http://www.halvorsen.blog>

2.4 Teaching

I have the necessary educational studies within “Høgskolepedagogikk”. Within my teaching, I use modern teaching principles such as PBL/PBBL methodology, Flipped Classroom, etc.

2.4.1 E-learning

Digital tools, Blogs, Videos, Interactive boards (SmartBoard, ActivBoard, iPad), etc. are used within my teaching.

I also use Agile methods and Scrum methodology known from System/Software Engineering within my teaching to provide a simplified project model and interaction with the students.

I use Educational Software such as MS Office, MS Word, Excel, PowerPoint, Visio, Skype for Business, Camtasia Studio, ActivInspire, NoteBook for SmartBoard, EndNote, EverNote, OneNote, OneDrive, DropBox, Fronter, YouTube (Video), Kahoot, Google Forms, etc.

2.4.2 Practical Teaching

My teaching platform is to involve lots of practical work for the students such as PBL/PBBL, Projects and Laboratory Work in ALL aspects of the teaching, i.e., Learning by doing. I have the last 5 years systematically built up from scratch modern and flexible classrooms for such teaching methods, where the students can sit in groups, have access to necessary equipment, data network and electricity. Interactive boards, chalkboards/Whiteboards and other e-learning aids are present within the same rooms using all the walls available in room.

All teaching material, etc. are published here: <http://www.halvorsen.blog>

2.4.3 Study Programs

I am involved in the following Study Programs at University of South-Eastern Norway (previously Telemark University College and University College of Southeast Norway):

- Informatikk og Automatisering (IA) (Informatics and Automation), Bachelor
- Industrial IT and Automation (IIA), Master (Campus Study Program)
- Industrial IT and Automation (IIA), Master (Online Study Program)

I am/have been involved in the following Courses at University of South-Eastern Norway (previously Telemark University College and University College of Southeast Norway):

2.4.4 Bachelor Level

I am/have been involved in the following Bachelor courses at University of South-Eastern Norway.

Current Courses:

- IA4412 - Software Engineering (Course coordinator)
- PRH606 - Main Project (Supervisor)

Previous Courses:

- IA3112 - Automation Systems (“Automatiseringsteknikk”) (Laboratory Work, LabVIEW Training, etc.)
- IA4212 - Instrumentation (“Instrumenteringsteknikk”) (LabVIEW Training)
- EE4007 - Cybernetics Foundation (Laboratory Work)
- EE4107 - Cybernetics Advanced (Course coordinator, Lab Work + Project)
- EE3107 - Cybernetics Project (Course Coordinator)
- PRG106 - 1. Semester Project (F1 project) (Supervisor)
- IA6209 - Industrial Communication and Computer Network (Lab Work/Project)
- IA5106 – “Automatiseringsteknikk og praktisk modellering” (Lab Work/Project)
- EE4209 – Model-based Control (Course coordinator, Teaching, Lab Work)

Most of these previous courses no longer exist at University of South-Eastern Norway due to changes in the curricula and the study programs.

2.4.5 Master Level

The Master courses are taught in English. I am involved in the following Master level courses at University of South-Eastern Norway:

- MATLAB Course (course coordinator and instructor)
- SCE4206 - Systems and Control Laboratory (course coordinator)
- SCE2006 - Industrial Information Technology (Lab Work/Projects)
- SCE4006 - Project (Supervisor)
- FMH606 - Master's Thesis (Supervisor)
- SCE1213 - Hard/Soft Sensors in Process Measurements

For more details about these courses, see my Web site:

<http://www.halvorsen.blog/documents/teaching/teaching.php>

2.5 Published Teaching Material

I have published Teaching Material in these Categories:

- Lecture Notes, see http://www.halvorsen.blog/documents/teaching/teaching_material.php
- Tutorials within Programming, Industrial IT, Databases, Control & Simulation, DAQ, etc.
- Lecture Notes within Cybernetics, Automation, Control and Simulation
- Teaching material within Software Engineering
- MATLAB Training
- LabVIEW Courses and LabVIEW Training
- Industrial IT and Automation
- Videos, more than 100 videos used in teaching and R&D within Industrial IT, Automation and Software Engineering.

See Web site <http://www.halvorsen.blog> for all published teaching material (documents, tutorials, web sites, videos and other resources).

2.6 Research and Development (R&D)

I'm involved in the following **Research Groups** available at University of South-Eastern Norway:

- SMART Technology
<https://www.usn.no/research/our-research/technology/smart/>
- Telemark Modeling and Control Centre (TMCC)
<https://www.usn.no/english/research/our-research/technology/telemark-modeling-and-control-center/>

More about these research groups later in the document. Below you see some of the publications that has been carried out as part of these research groups.

2.6.1 List of Publications

Below you find a list of official R&D Publications.

Scientific Articles

- **Monitoring of selected Numeric Water Quality Criteria (NWQC) using IoT Platform – Digitalizing Water Care System (WCS)** - Hans-Petter Halvorsen, Colin Dubreuil, F. Hansen, R. Bakke, J. Timmerberg, J-M. Thiriet, S. Mylvaganam, 2019.
- **Modelling of Anti-icing System for Airplanes** - Maths Halstensen, Joachim Lundberg, Hans-Petter Halvorsen, 2019.
- **Sandboxing for Cross-Platform Applications of Robots** - Hans-Petter Halvorsen, Alexander Jonsaas, Lilly Eikehaug, Saba Mylvaganam - 2019 IEEE International Symposium on RObotic and Sensors Environments (ROSE), June 17-18, 2019, Ontario, Canada.
- **Constructive Alignment with Student in Centre and Front - Experience from Case-projects and Intensive Summer Courses** - Hans-Petter Halvorsen, Josef Timmerberg, Saba Mylvaganam - MNT Conference, March 28-29, 2019, Tromsø, Norway.
- **Fusion of Body Sensors' Data and Video Images in Assistive Technology** - Hans-Petter Halvorsen, Karina Kaspersen, Alexander Jonsaas, Saba Mylvaganam - IEEE Sensors Applications Symposium (SAS), March 11-13, 2019, Sophia Antipolis, France.
- **Environmental Monitoring with focus on Emissions using IoT Platform for Mobile Alert** – Hans-Petter Halvorsen, Ola Anton Grytten, Martin Veel Svendsen, Saba Mylvaganam – EAEEIE, The 28th EAEEIE Annual Conference, September 26-28, 2018, Reykjavík.
- **Case Studies in IoT - Smart-Home Solutions** - Hans-Petter Halvorsen, Alexander Jonsaas, Josef Timmerberg, Saba Mylvaganam - EAEEIE 2017, The 27th EAEEIE Annual Conference, June 7-9, 2017, Grenoble.
- **Industrial IT and Automation - Curricula and Experience at USN in the context of Industry 4.0** - Hans-Petter Halvorsen, Nils Olav Skeie, Saba Mylvaganam - EAEEIE 2017, The 27th EAEEIE Annual Conference, June 7-9, 2017, Grenoble.
- **Remote control of a robotic arm - A cross-platform study using LabVIEW and DeltaV** - Hans-Petter Halvorsen, Alexander Jonsaas, Lilly Eikehaug, Sondre Mogård, Håkon Viumdal, Rune Andersen, Saba Mylvaganam. ITEN2015 Conference, Łódź, Poland, September 2015.

- **Project/Problem Based Learning in Electrical Engineering, IT and Automation** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam. ITEN2015 Conference, Łódź, Poland, September 2015.
- **Experience with Case-projects in Bachelor and Master Studies in Electrical, IT and Systems & Control Engineering** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam - EAEEIE 2013, 24th EAEEIE (European Association for Education in Electrical and Information Engineering) Annual Conference, Chania, Greece 30 - 31 of May, 2013.
- **Intermediate Measurement Node for Extension of WSN Coverage** - Rabin Bilas Pant, Hans Petter Halvorsen, Frode Skulbru, Saba Mylvaganam - Journal of Cyber Security and Mobility, Vol. 2, 2013. Available from River Publishers.

Textbooks

- **Python Programming** - Hans-Petter Halvorsen. ISBN: 978-82-691106-4-7. 2019.
- **Programmering with Arduino** - Hans-Petter Halvorsen. ISBN: 978-82-691106-3-0. 2018
- **Arduino Programmering** (in Norwegian) - Hans-Petter Halvorsen. ISBN: 978-82-691106-2-3. 2018.
- **Software Development - A Practical Approach!** - Hans-Petter Halvorsen. ISBN: 978-82-691106-0-9. 2017.
- **Industrial IT and Automation - A Practical Approach!** - Hans-Petter Halvorsen. ISBN: 978-82-691106-1-6. 2017.

In addition, I have published lots of R&D material, see my Web site

<http://www.halvorsen.blog> for all published work.

2.6.2 Development

Here are some Examples of different areas and fields within development tah I am working with:

- Environmental Public Health Information Management System - Measure, Collect and Monitoring of Environmental Data
- Smart Houses and Buildings - Data Management, Data Logging, Automation and Monitoring within Houses and Buildings using Internet of Things (IoT) Technology

- Automation Systems and Industry 4.0 - Industrial Internet of Things (IIoT), Control and Automation Systems, Model Predictive Control using DeltaV, etc.
- Mobile Technology for Measurement and Control - Wireless Sensor Network, Data Acquisition, Development Technology for Mobile Devices such as Tablets and Smartphones, Software Engineering, etc.
- Datalogging, Management and Monitoring (DMM) Platform - with Applications within Industrial IT, Automation, Industry 4.0, Smart Houses and Buildings - An extensive platform with many applications within Smart Houses and Buildings, Automation and Data Acquisition
- Software Engineering and Project Management - Project Planning and Project Management is important in all projects, also in in projects involving development of Software.

See Web site <http://www.halvorsen.blog/documents/projects/projects.php> for more details about my R&D Projects.

2.7 Software

I am working with software such as:

2.7.1 Programming and Simulation Tools and Software

As part of my teaching and research work, I work daily with lots of programming languages, simulation tools, and other relevant software. Below some of these tools are listed:

- Microsoft Visual Studio and the .NET product family including C#, Visual Basic
- Database Systems, including Microsoft SQL Server, MySQL and MariaDB
- LabVIEW
- MATLAB and Simulink
- Python
- Web Programming using techniques and software such as ASP, ASP.NET, FrontPage and Expression Web, Dreamweaver, PHP, HTML, JavaScript, CSS, Bootstrap, Internet Information Services (IIS), etc.
- Team Systems, the Team Foundation Server and Azure DevOps
- Virtualization using VMware and Virtual PC

- InstallShield (software tool for creating installers or software packages)
- Visual Studio Code
- Anaconda and Spyder
- etc.

2.7.2 Educational Software

In addition to creating different tools from scratch, many other tools are used (or have been used) in my daily teaching. Below some of these tools are listed:

- MS Office, MS Word, Excel, PowerPoint, Visio, etc.
- Skype for Business
- ActiveInspire
- NoteBook for SmartBoard
- EndNote
- EverNote, OneNote
- OneDrive, DropBox
- Camtasia Studio
- Fronter, Canvas
- Radix (Video Server)
- Kahoot
- YouTube
- Google Documents, Google Forms for making quizzes, etc.
- etc.

2.8 Web Site/Blog

My web site/blog <http://www.halvorsen.blog> are my channel for publishing the teaching material, R&D material, etc. to a broad audience. In addition, the web site/blog are sources to national and international collaboration, because I daily meet peers worldwide through my web site/blog.

I get request on weekly basis from people from other universities world-wide where they want to use my teaching material, etc. in their courses. I also get lots of

requests and feedback from Companies and Universities all over the world regarding Collaboration, Teaching, Research and Development, Referencing to my work, etc.

The web site/blog are for those who are interested in technology, teaching and research and development.

The web site/blog have more than 200 daily (200-400) visitors from all over the world. Totally, this is more than 1400 weekly visitors and about 75.000 yearly visitors.

So far, visitors from 100 different countries have been visiting my web site/blog, so we can talk about internationalization in a large scale.

Here are some examples of feedback from users all over the world:

“I had gone through your blog. Your web page is a neat showcase of your innovative idea, sincerity and honesty towards the teaching profession. It clearly proves your degree of involvement and extent of dedication in teaching.”

“One of the best professor webpages I ever seen. Thank you for sharing.”

“I have watched almost all of your tutorial videos about LabVIEW which helps me to build my knowledge. It was amazing. Your videos are well prepared and clear and easily understandable.”

“It is not easy to get such a quality free educational videos and a person like you who is willing to share his knowledge without cupidity.”

“I found your Blog and for me it was like an oasis in the middle of the desert. Extremely thankful to you and really appreciate the detailed and in depth explanation you provide in your Videos and the Material you share on your Blog.”

“My name is ... and I work at Dura Automotive in Auburn Hills, Michigan USA. I am learning LabVIEW here, and I would like to tell you how much all the information and tutorials you have on your site are fantastic for me as a beginner. I have also looked around at some of your other topics, and I am very impressed. You have a wealth of information only clicks away on my mouse.”

“I found on the internet your tutorial for data acquisition and it helped me so much!”

“I recently found your work on the internet. I am teaching an experimental physics course and would like to use your work. I cannot find any commercially available manuals.”

“I am just after finishing looking at the content on your website and would like to thank you for you very well written content. I am three years using ... and ... also dabble in ... and really enjoy finding sites like yours. Just said I would drop you a line to say thanks.”

“It is written in such a nice way that I wanted to give you my compliments for your work. Also, thank you for putting it on the internet, it really helps me forward.”

“My name is ... and I teach MATLAB at the Weizmann Institute, Rehovoth, Israel. ... I would like to ask your permission to use parts of it in my course with due credits of course to you and your institute.”

“Thank you for the excellent resources you have put together for your university.”

“Thank you for posting your It is one of the better guides I have found.”

“Hei Hans Petter. Ville bare si at hjemmesiden din er helt unik og takk for at du lar alt dette være åpent.” (in Norwegian).

“Hello, Professor! I am an Electrical Engineering student from Brazil. I found this blog randomly on the internet and I found it incredible. I wish I could be a TUC student to be able to use all of the tools you talk about here. I just wanted to congratulate you because you are doing a great job! Best regards!”.

“I found your blog and refereed many tutorials and other resources. Thank you so much for your resources and your useful work. I used to refer your resources for my research work.”

“It's really nice that this kind of mathematics was being shared in order for this kind of thing to be learned and understood by a lot of people who wanted to gain some techniques about it. Through this, it would surely be an easy thing for them to achieve some good scores in mathematics.”

“I like your tutorial on Microsoft SQL Server. So simple, easy to digest, understandable, and with very good examples.”

“Hi, was wanting to write on this blog for a while now and show my appreciation and gratitude :) This blog helped me to get on my feet in the LabVIEW world two years ago. Right from the basics of front panel and block diagrams to OPC communication using shared variable engine and visualization in NI-MAX :). I am doing my PhD on predictive control of microscale trigeneration systems for grid reactivity and using LabVIEW on the field level of a building automation architecture. This blog has helped me a lot and now I am also using it for developing a State-Machine Control.”

“I am all praises for you Hans-Petter Halvorsen and this blog. Hip-Hip Hurray!!”

“I want to say a very big thank you for the Introduction to Visual Studio and C# Guide you developed. I had tried to understand the OOP concepts since 2011, but it’s always been difficult. Reading your manual explained everything to me in details, and broaden my understanding of OOP. I’m very delighted to have come across your guide. Thanks a lot.”

“I teach MATLAB at a small college in Nebraska, USA, and I am trying to provide good quality free textbooks for my students. May I have permission to use your textbook for my course?”

3 Work Experience from Industry

I have been working as a System Engineer, System Architect, Project and Product Manager within leading Software Companies for about 12 years.

I have been working with technical topics such as:

- Software Development, Software/System Engineering
- Project Management for Software Projects
- Software/System Architecture
- LabVIEW Programming
- Microsoft .NET Platform (Visual Studio with C#, VB.NET) and ASP.NET
- Database Applications and Microsoft SQL Server Applications
- Web Programming (ASP.NET, PHP, HTML, JavaScript, CSS, etc.)
- Software Design (Software Architect) and Testing
- Team Systems and the Team Foundation Server
- Virtualization
- Project and Product Management

I have been involved in many relevant customer projects and deliveries (Software/System Engineering Projects) to leading Norwegian and International Companies, such as Yara, Statoil, Norske skog, Norsk Avfallshåndtering, AHUS, St. Olavs Hospital, etc.

A part of previous work I have also been planned and established a “Techno Center” for pupils at elementary school who wants to learn more about technology. This center established at “Herøya” in Porsgrunn, Norway.

This background, and my previous work at CARDIAC and Baze Technology is ideal for my present work in academia. Here I learned system engineering, industrial IT and Automation from the ground and in a very practical way with a lot of existing and highly relevant projects within these areas.

3.1 Baze Technology AS

In Baze Technology I have been working as a System Engineer, System Architect, Project and Product Manager.

The main working field was within Industrial IT, Software Development and Automation. See Figure 3-1, Figure 3-2 and Figure 3-3 for some examples and applications I have been involved with.

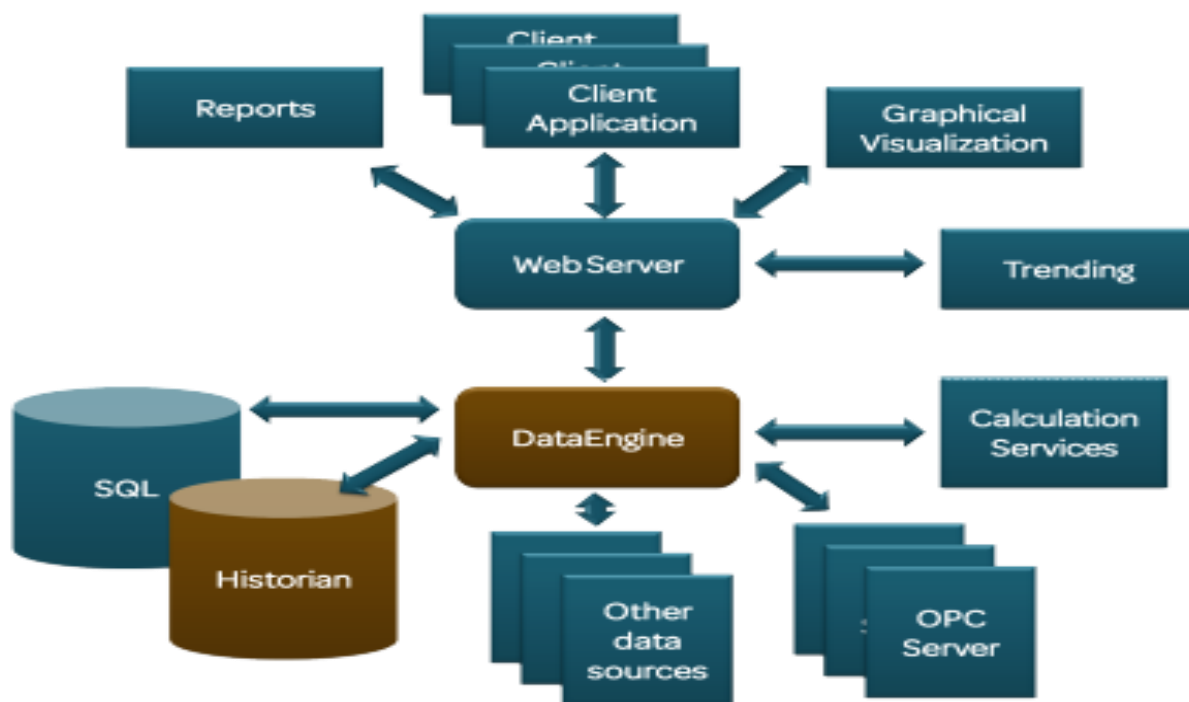


Figure 3-1: Technical Platform [<http://bazetechnology.com>]

Figure 3-1 shows the technical platform we developed and used in many installations for large customers like Norske Skog, Yara, Statoil, etc.



Figure 3-2: Applications [Baze Technology]

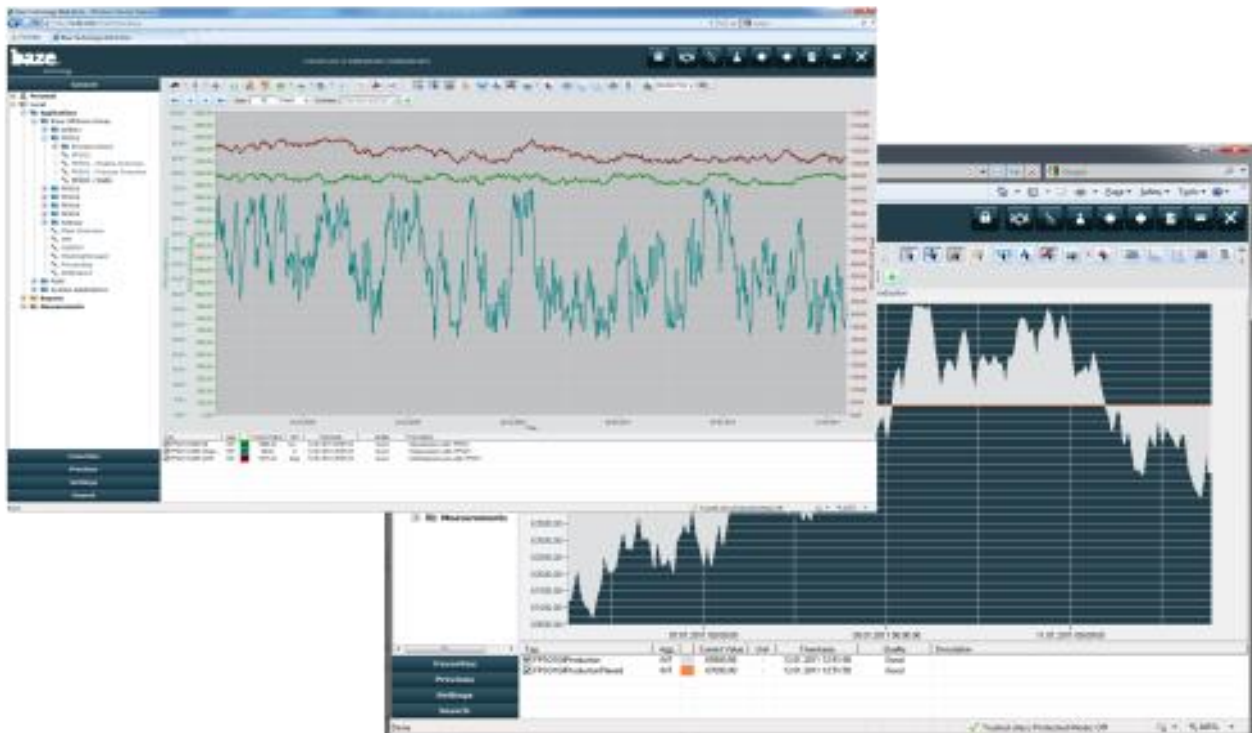


Figure 3-3: Front-end Portal [<http://bazetechnology.com>]

Today, Baze Technology has changed focus and Baze Technology has split into multiple companies, such as BazeField and BazePort.

Web Sites:

<http://www.bazeport.com>

<http://bazefield.com>

Other relevant links:

<http://heroya-industripark.no/Aktuelt/Vind-i-seilene-for-vekstbedriften-Baze-Technology>

<http://www.varden.no/nyheter/betyr-flere-arbeidsplasser-til-porsgrunn-1.1526843>

3.2 CARDIAC AS

In CARDIAC I was working as a System Engineer, System Architect, Project and Product Manager for several years.

The main working field was within Industrial IT, Software Development and Automation. See Figure 3-4 for some examples and applications I have been involved with.

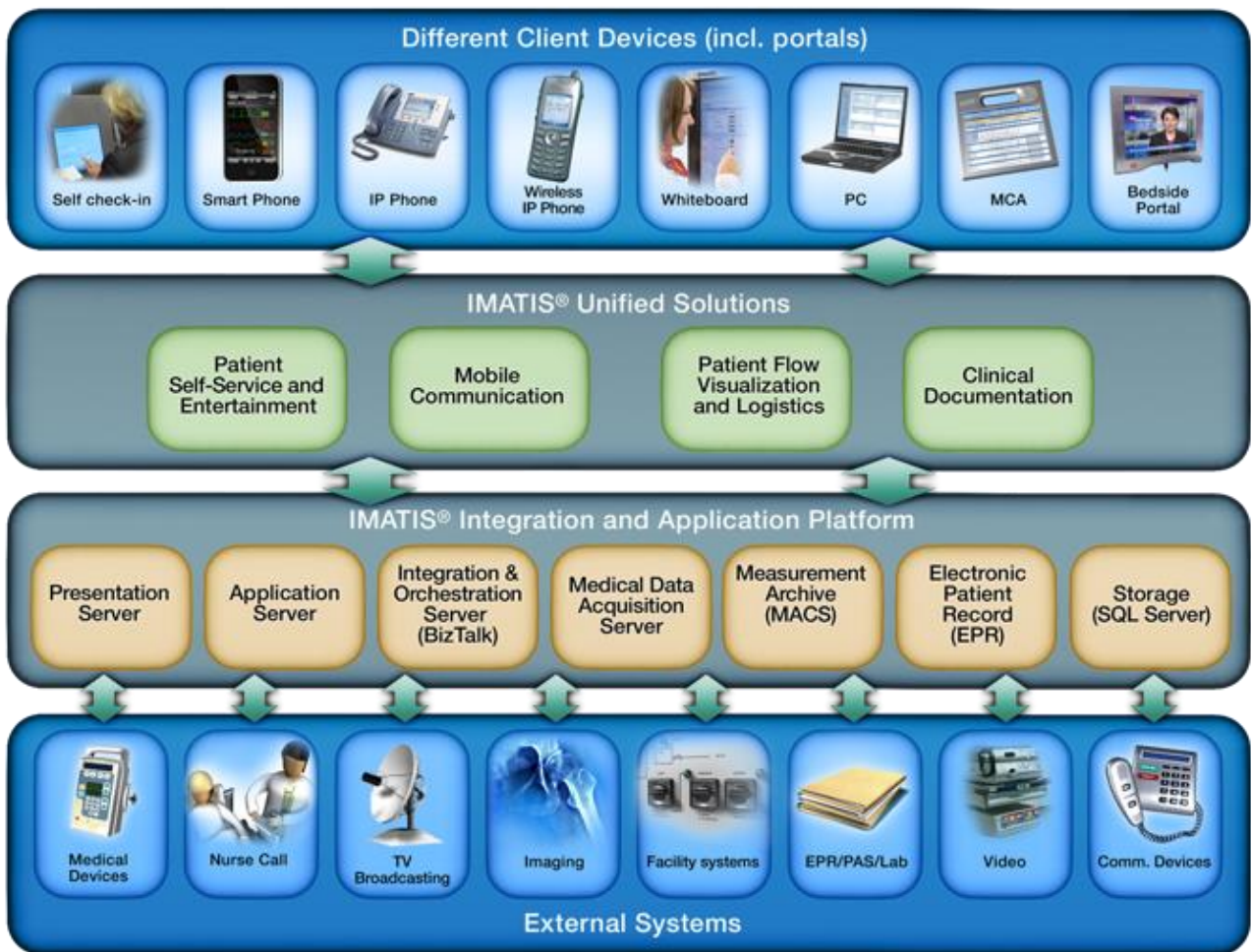


Figure 3-4: Industrial IT and Automation Platform [CARDIAC AS]

We developed advanced systems for the process industry, laboratories and hospitals.

Today, CARDIAC no longer exists and previously CARDIAC has been split into multiple companies, such as Imatis AS. The focus is now purely within health and medical IT.

See <http://imatis.com> for more details.

4 Web Site/Blog

4.1 Introduction

My web site/blog <http://www.halvorsen.blog> are my channel for publishing the teaching material, R&D material, etc. to a broad audience. In addition, the web site/blog is a source to national and international collaboration, because I daily meet peers worldwide through my Blog.

So why use a blog or web site for my research and development work?

The Blog has between 200-400 daily visitors from all over the world. The web site/blog is for those who are interested in technology, teaching and research and development.

So far, visitors from about 100 different countries have been visiting the web site/blog, so we can talk about internationalization in a large scale.

The web site/blog is a result of systematic work for many years. All the contents and the platform itself has been made from the ground.

You could say the web site/blog is a hub that collects all my work within teaching and research and development, see Figure 4-1.

Typical readers of the web site/blog are:

- Students
- Teachers and educators
- Scientists
- Etc.

They use the available resources in their studies and work, and most of the users are from outside Norway. The resources are built up in a pedagogical way, and I get lots of feedback from the users.



Figure 4-1: Web Site/Blog - Hub of Creative Work within Teaching, Research and Development

On the web site/blog you will find:

- Teaching Resources
- Research and Development
- overview of Projects, both previous and ongoing projects, including student projects and research and development projects
- Different technical resources like videos, textbooks, tutorials and examples
- Innovative ideas within different aspects
- Blog posts, news and discussions within Industrial IT, Automation and Software Engineering
- Apps and Services – lots of applications and services within different areas are available for free (open access and open source). These Apps and Services have been made from scratch.

Everything web site/blog are open access and open source, which means students, educators, researchers, etc. can use it in their teaching or research or development projects.

Figure 4-2 shows the main page of the web site/blog:

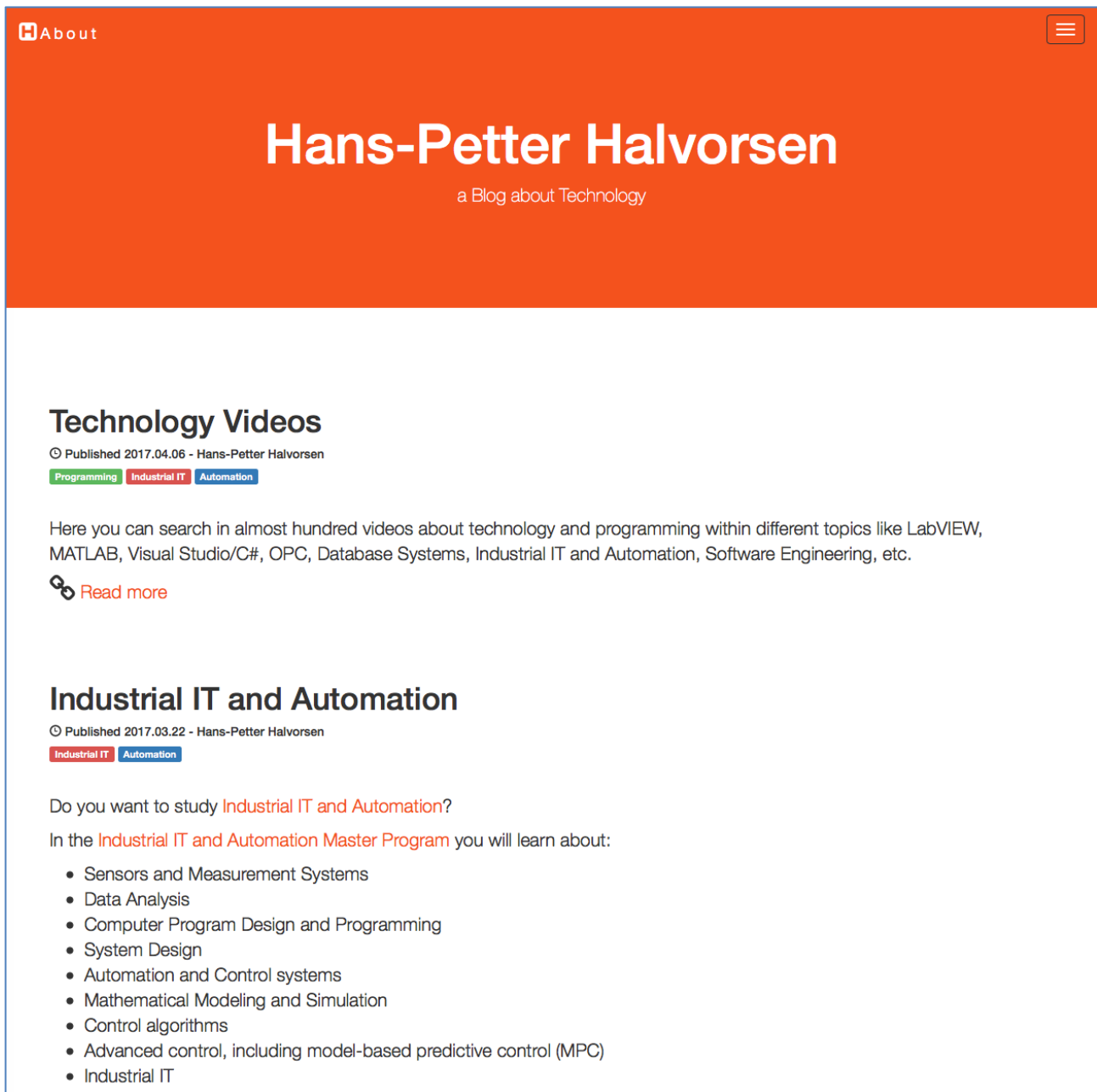


Figure 4-2: Blog [http://www.halvorsen.blog]

I get request on weekly basis from people from other Universities world-wide where they want to use my teaching material, etc. in their courses. I also get lots of requests and feedback from companies and universities all over the world regarding collaboration, teaching, research and development, referencing of my work, etc.

Here are some examples:

“I had gone through your blog. Your web page is a neat showcase of your innovative idea, sincerity and honesty towards the teaching profession. It clearly proves your degree of involvement and extent of dedication in teaching.”

“One of the best professor webpages I ever seen. Thank you for sharing.”

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“I recently found your work on the internet. I am teaching an experimental physics course and would like to use your work. I cannot find any commercially available manuals.”

“I am just after finishing looking at the content on your website and would like to thank you for you very well written content. I am three years using ... and ... and also dabble in and really enjoy finding sites like yours. Just said I would drop you a line to say thanks.”

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“My name is ... and I teach MATLAB at the Weizmann Institute, Rehovoth, Israel. ... I would like to ask your permission to use parts of it in my course with due credits of course to you and your institute.”

“Thank you for the excellent resources you have put together for your university.”

“Thank you for posting your It is one of the better guides I have found.”

“Hei Hans Petter. Ville bare si at hjemmesiden din er helt unik og takk for at du lar alt dette være åpent.” (in Norwegian)

“Hello, Professor! I am an Electrical Engineering student from Brazil. I found this blog randomly on the internet and I found it incredible. I wish I could be a TUC student to be able to use all of the tools you talk about here. I just wanted to congratulate you because you are doing a great job! Best regards!”.

“I found your blog and refereed many tutorials and other resources. Thank you so much for your resources and your useful work. I used to refer your resources for my research work.”

“Hi, was wanting to write on this blog for a while now and show my appreciation and gratitude :)”

This blog helped me to get on my feet in the LabVIEW world two years ago. Right from the basics of front panel and block diagrams to OPC communication using shared variable engine and visualization in NI-MAX :). I am doing my PhD on predictive control of microscale trigeneration systems for grid reactivity and using LabVIEW on the field level of a building automation architecture. This blog has helped me a lot and now I am also using it for developing a State-Machine Control.

I am all praises for you Hans-Petter Halvorsen and this blog. Hip-Hip Hurray!!”

“Dear Mr Havorsen! This is about your book: "Introduction to Visual Studio and CSharp”

I have translated it in Persian language (Farsi). This is done for free, and now may be provided for everyone who need.

I would appreciate you again and again...! And the best thanks.”

“I want to say a very big thank you for the Introduction to Visual Studio and C# Guide you developed. I had tried to understand the OOP concepts since 2011, but it's always been difficult. Reading your manual explained everything to me in details, and broaden my understanding of OOP. I'm very delighted to have come across your guide. Thanks a lot.”

4.2 Statistics

The web site/blog has about 200 daily visitors (typically between 200-400) from all over the world. Totally, this is more than 1400 weekly visitors and about 75.000 yearly visitors.

In Figure 4-3 we see an example number of visitors and where they are located.

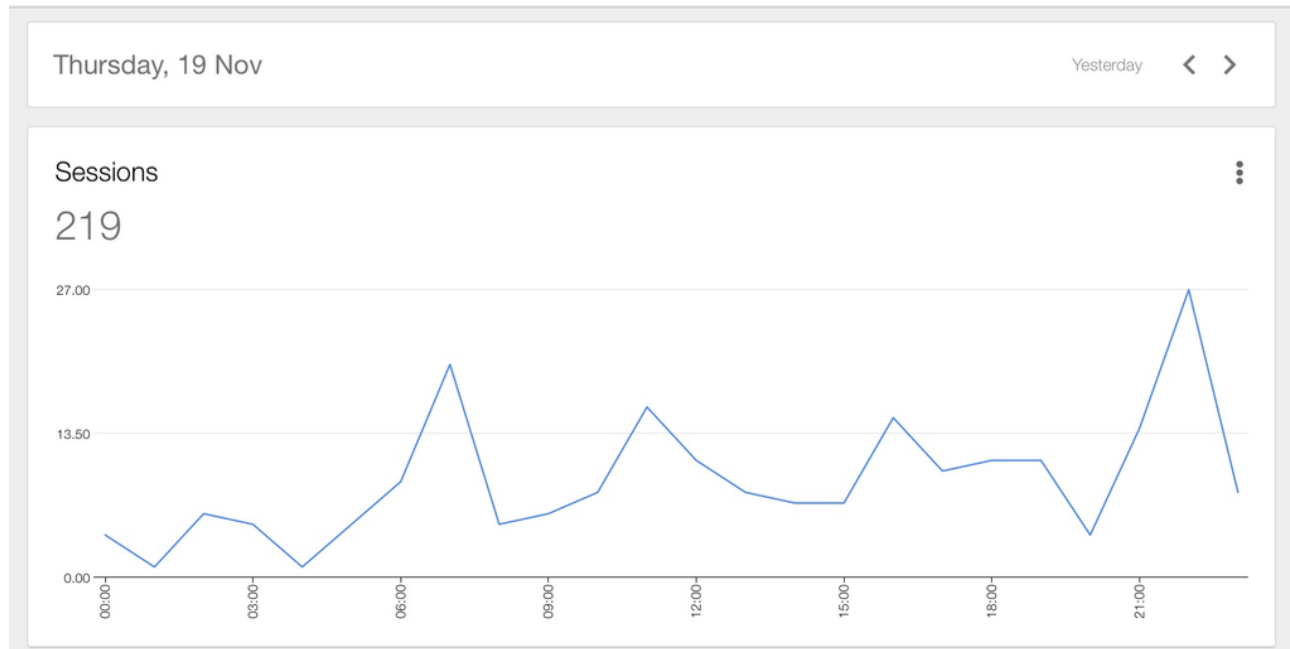


Figure 4-3: Daily Visitors for a given random day [Google Analytics]

So far, people from more than 100 different countries have been visiting my blog. Figure 4-4 displays a list of countries that most visit my blog/web site.

Country ?	Acquisition			Behavior			Conversions		
	Sessions ? ↓	% New Sessions ?	New Users ?	Bounce Rate ?	Pages / Session ?	Avg. Session Duration ?	Goal Conversion Rate ?	Goal Completions ?	Goal Value ?
	1,284 <small>% of Total: 100.00% (1,284)</small>	78.04% <small>Avg for View: 77.88% (0.20%)</small>	1,002 <small>% of Total: 100.20% (1,000)</small>	46.26% <small>Avg for View: 46.26% (0.00%)</small>	4.02 <small>Avg for View: 4.02 (0.00%)</small>	00:03:08 <small>Avg for View: 00:03:08 (0.00%)</small>	0.00% <small>Avg for View: 0.00% (0.00%)</small>	0 <small>% of Total: 0.00% (0)</small>	\$0.00 <small>% of Total: 0.00% (\$0.00)</small>
1. United States	197 (15.34%)	88.32%	174 (17.37%)	54.82%	2.69	00:01:04	0.00%	0 (0.00%)	\$0.00 (0.00%)
2. Norway	179 (13.94%)	31.84%	57 (5.69%)	37.99%	6.98	00:07:01	0.00%	0 (0.00%)	\$0.00 (0.00%)
3. India	85 (6.62%)	88.24%	75 (7.49%)	36.47%	3.81	00:02:38	0.00%	0 (0.00%)	\$0.00 (0.00%)
4. Mexico	59 (4.60%)	93.22%	55 (5.49%)	66.10%	2.34	00:02:00	0.00%	0 (0.00%)	\$0.00 (0.00%)
5. Germany	49 (3.82%)	73.47%	36 (3.59%)	55.10%	3.02	00:02:27	0.00%	0 (0.00%)	\$0.00 (0.00%)
6. Brazil	37 (2.88%)	78.38%	29 (2.89%)	32.43%	4.68	00:04:40	0.00%	0 (0.00%)	\$0.00 (0.00%)
7. United Kingdom	33 (2.57%)	81.82%	27 (2.69%)	42.42%	2.45	00:02:25	0.00%	0 (0.00%)	\$0.00 (0.00%)
8. Poland	26 (2.02%)	100.00%	26 (2.59%)	46.15%	4.50	00:02:53	0.00%	0 (0.00%)	\$0.00 (0.00%)
9. Spain	25 (1.95%)	80.00%	20 (2.00%)	52.00%	5.40	00:03:37	0.00%	0 (0.00%)	\$0.00 (0.00%)
10. Italy	25 (1.95%)	76.00%	19 (1.90%)	40.00%	4.72	00:04:21	0.00%	0 (0.00%)	\$0.00 (0.00%)
11. South Korea	24 (1.87%)	87.50%	21 (2.10%)	45.83%	3.88	00:01:48	0.00%	0 (0.00%)	\$0.00 (0.00%)
12. France	22 (1.71%)	90.91%	20 (2.00%)	50.00%	5.09	00:03:56	0.00%	0 (0.00%)	\$0.00 (0.00%)
13. Russia	22 (1.71%)	59.09%	13 (1.30%)	45.45%	3.27	00:04:55	0.00%	0 (0.00%)	\$0.00 (0.00%)
14. Thailand	19 (1.48%)	89.47%	17 (1.70%)	52.63%	2.32	00:01:54	0.00%	0 (0.00%)	\$0.00 (0.00%)
15. Turkey	19 (1.48%)	94.74%	18 (1.80%)	21.05%	4.79	00:05:00	0.00%	0 (0.00%)	\$0.00 (0.00%)
16. Canada	18 (1.40%)	100.00%	18 (1.80%)	55.56%	1.94	00:01:28	0.00%	0 (0.00%)	\$0.00 (0.00%)
17. Belgium	16 (1.25%)	81.25%	13 (1.30%)	43.75%	6.62	00:05:59	0.00%	0 (0.00%)	\$0.00 (0.00%)
18. Egypt	16 (1.25%)	75.00%	12 (1.20%)	12.50%	4.94	00:03:51	0.00%	0 (0.00%)	\$0.00 (0.00%)
19. Netherlands	16 (1.25%)	100.00%	16 (1.60%)	56.25%	2.50	00:00:10	0.00%	0 (0.00%)	\$0.00 (0.00%)
20. Romania	16 (1.25%)	81.25%	13 (1.30%)	43.75%	5.75	00:08:01	0.00%	0 (0.00%)	\$0.00 (0.00%)
21. Colombia	15 (1.17%)	100.00%	15 (1.50%)	60.00%	2.67	00:04:03	0.00%	0 (0.00%)	\$0.00 (0.00%)
22. Ecuador	15 (1.17%)	93.33%	14 (1.40%)	33.33%	3.13	00:01:56	0.00%	0 (0.00%)	\$0.00 (0.00%)
23. Saudi Arabia	15 (1.17%)	80.00%	12 (1.20%)	26.67%	4.47	00:01:22	0.00%	0 (0.00%)	\$0.00 (0.00%)
24. Denmark	14 (1.09%)	92.86%	13 (1.30%)	50.00%	3.07	00:02:20	0.00%	0 (0.00%)	\$0.00 (0.00%)
25. Iran	14 (1.09%)	85.71%	12 (1.20%)	7.14%	6.71	00:03:03	0.00%	0 (0.00%)	\$0.00 (0.00%)
26. Malaysia	14 (1.09%)	78.57%	11 (1.10%)	35.71%	4.21	00:02:44	0.00%	0 (0.00%)	\$0.00 (0.00%)
27. Pakistan	13 (1.01%)	76.92%	10 (1.00%)	46.15%	3.85	00:02:51	0.00%	0 (0.00%)	\$0.00 (0.00%)
28. Finland	12 (0.93%)	75.00%	9 (0.90%)	50.00%	5.58	00:05:25	0.00%	0 (0.00%)	\$0.00 (0.00%)
29. Philippines	12 (0.93%)	100.00%	12 (1.20%)	66.67%	3.08	00:00:25	0.00%	0 (0.00%)	\$0.00 (0.00%)
30. Switzerland	11 (0.86%)	81.82%	9 (0.90%)	54.55%	2.36	00:00:05	0.00%	0 (0.00%)	\$0.00 (0.00%)

Figure 4-4: The origin (Country) of the people visiting my blog/web page (Top 30) [Google Analytics]

Figure 4-5 shows a world map where we can see which country or region the visitors are from. The darker the color, the more visitors from this country. Most of the world are covered, except Greenland and some countries in Africa.

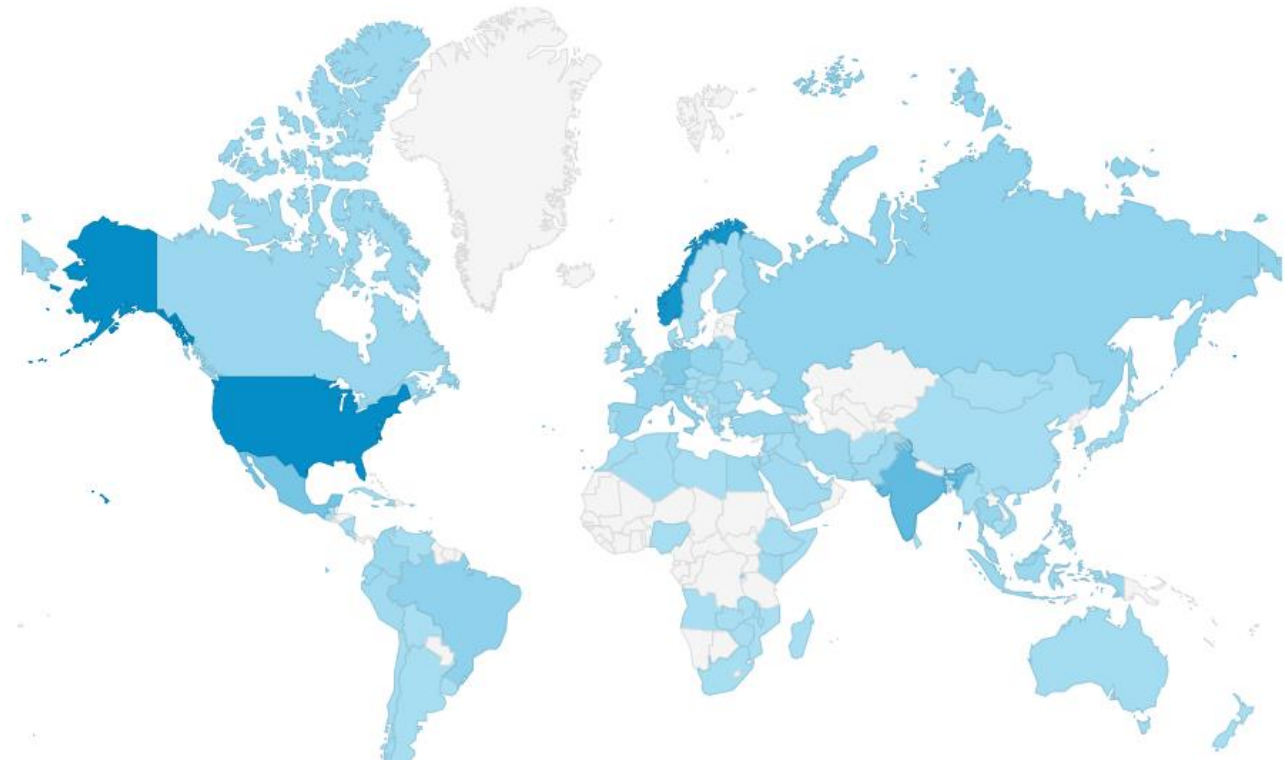


Figure 4-5: World Map – which Country or Region are the Visitors from? [Google Analytics]

4.3 Technical Platform

The Blog is created from scratch using web programming technics such as HTML, CSS, JavaScript and PHP. The web site is hosted on an Apache Web Server.

The Blog is created and maintained with Adobe Dreamweaver, which is part of the Creative Cloud suite from Adobe.

I also have courses where the students learn these things (web development and software development). This means both the contents and the technical development of the web site itself is important in my teaching and research and development.

“Disqus” (Figure 4-6) has been integrated in the Blog for interaction with the users, both local students an all others that are visiting my Blog.

About ☰

Questions and Comments

42 Comments halvorsen.blog Login

Recommend 6 Tweet Share Sort by Best

Join the discussion...

LOG IN WITH OR SIGN UP WITH DISQUS

D f t G

Refka Nhari · a month ago
 Bonjour Mr.Halvorsen
 Merci beaucoup pour vos tutoriels.
 Je suis débutante et j'ai besoin de savoir comment installer SQLTOOLKIT dans Labview pour l'utiliser , en fait je ne trouve pas dans le menu de labview : "Catégorie" et "vi.lib" pour copier les deux fichiers.
 merci d'avance.
 ^ | v · Reply · Share

Hans-Petter Halvorsen Mod → Refka Nhari · a month ago
 Please use English language :-)
 ^ | v · Reply · Share

Refka Nhari → Hans-Petter Halvorsen · a month ago
 Morning Mr.Halvorsen
 Thank you very much for your tutorials,
 I am beginner and I need to know how to install SQLTOOLKIT in Labview to use it, in fact I do not find in the menu of labview: "Category" and "vi.lib" to copy the two files.
 thank you in advance
 ^ | v · Reply · Share

[Show more replies](#)

Max Yaffe · a month ago
 Are the VI's for your very interesting Labview controller tutorial available?
 ^ | v · Reply · Share

Hans-Petter Halvorsen Mod → Max Yaffe · a month ago
 Can you be more specific?
 ^ | v · Reply · Share

Max Yaffe → Hans-Petter Halvorsen · a month ago
 I'd like to look at and play around with your code. The tutorial goes too fast for me to see what you're doing. With the VI's I can work along side.
 ^ | v · Reply · Share

Figure 4-6: Questions and Discussions

What is “Disqus”? It is a community platform that makes it possible for visitors to comments on and discuss topics on my Blog. It makes it possible to have an interactive dialog with the visitors.

In teaching I use it as a feedback system and a forum for questions and answers. Then I can answer questions when I have time (and not get disturbed getting to many e-mails from the students/visitors). The students/visitors can also answer or comments each other’s questions and comments, etc.

4.3.1 Google Analytics

Using Google Analytics, a detailed overview over numbers of users, where they come from, what kind of browser they are using, etc. are available. Google Analytics is a web analytics service offered by Google that tracks and reports website traffic. Google Analytics is the most widely used web analytics service on the Internet.

These statistics from Google Analytics makes it possible to tailor-made the platform. Where are the visitors from? What kind of browsers are they using? Which web pages are most visited? etc.

Figure 4-7 shows an overview of the most popular Web Browsers used to visit the Blog.

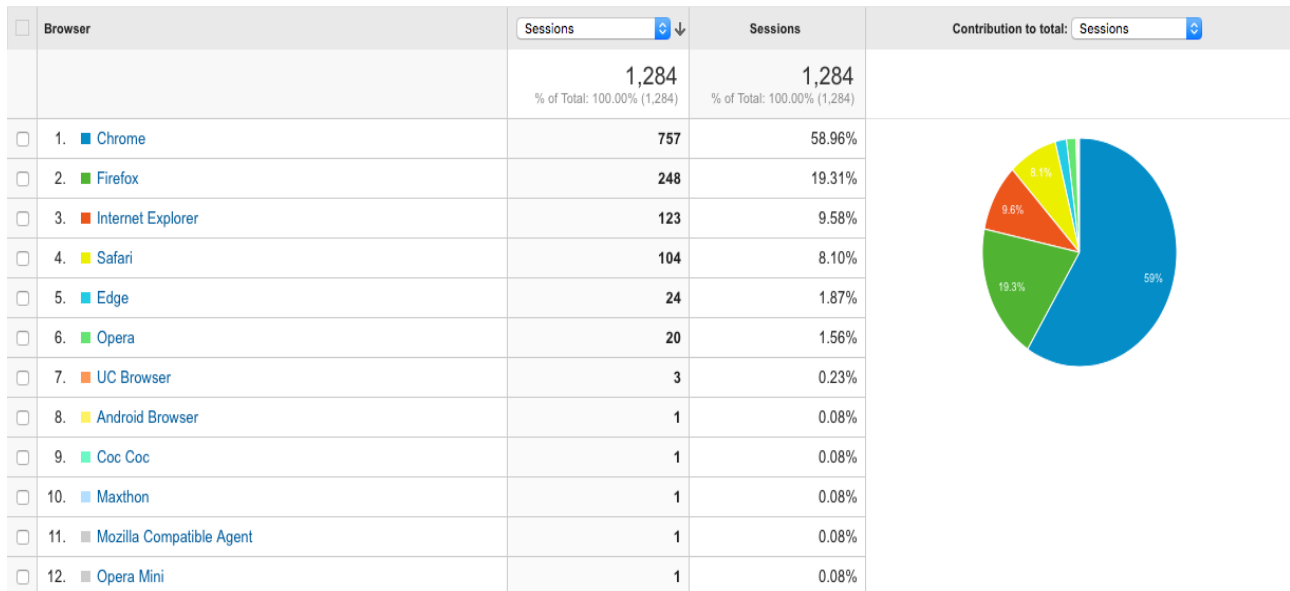


Figure 4-7: Overview of the most popular Web Browser used to visit the Blog [Google Analytics]

Figure 4-8 shows an overview of the most popular OS used to visit the Blog.

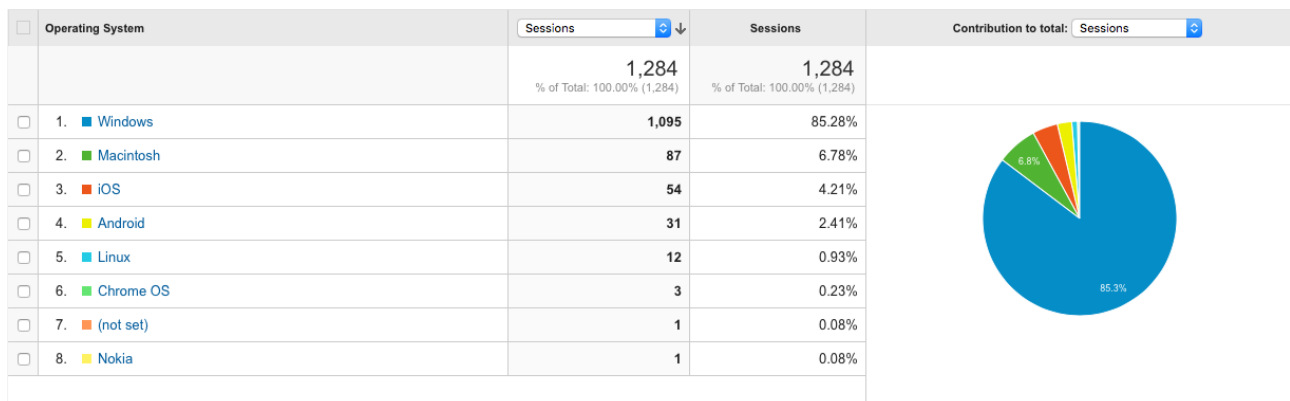


Figure 4-8: Overview of the most popular OS used to visit the Blog [Google Analytics]

Figure 4-9 shows an overview of the most popular device categories used to visit the Blog.

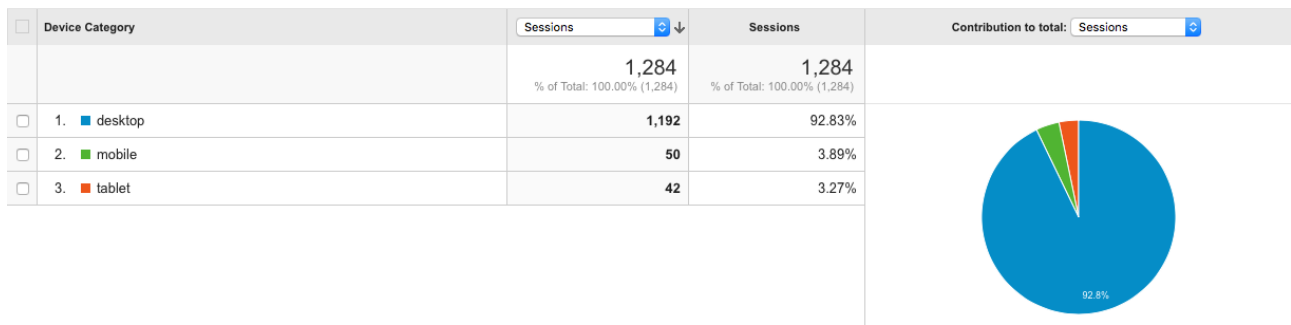


Figure 4-9: Device Categories used to visit the Blog [Google Analytics]

All this information is important for further development and maintenance of the Blog.

It is crucial to know what kind of web browser, OS and devices the visitors are using, so I can focus on a good user experience for the most used web browsers, operating systems and platforms.

4.4 Web Site/Blog Topics

My working areas are within Industrial IT, Automation and Software Engineering, so the topics you find are within these areas, here are some examples:

- Industrial IT
- Automation and Control
- Software Engineering
- Programming Languages, such as Visual Studio/C#, LabVIEW and MATLAB
- Internet of Things (IoT)
- Industry 4.0
- Database Systems
- Data Acquisition (DAQ)
- Datalogging and Monitoring
- SCADA Systems
- OPC
- Advanced Control, including Model Predictive Control (MPC)
- etc.

4.5 Apps and Services

The web site is far more than a traditional blog or web site. The web site is also a host for professionally made applications that I have made using different development tools and programming languages. As mentioned earlier the web site/blog is a hub that collects all my work within teaching and research and development, see Figure 4-1.

Some of them are built using the latest web technology (HTML5, CSS, JavaScript, PHP, ASP.NET, Bootstrap, etc.), while others are developed using Visual studio/C#, LabVIEW and Python.

The purpose with the applications is twofold; one aspect is to learn and use these technologies in teaching and research and development projects, another aspect is to create professional applications that can be used by me personally and my students in different R&D projects.

Another thing is that these apps are part of my R&D work within Software Engineering, User Interface design and interaction and Cyber Security.

The applications can be freely used or downloaded from my website:

<https://www.halvorsen.blog>

Some examples of apps are:

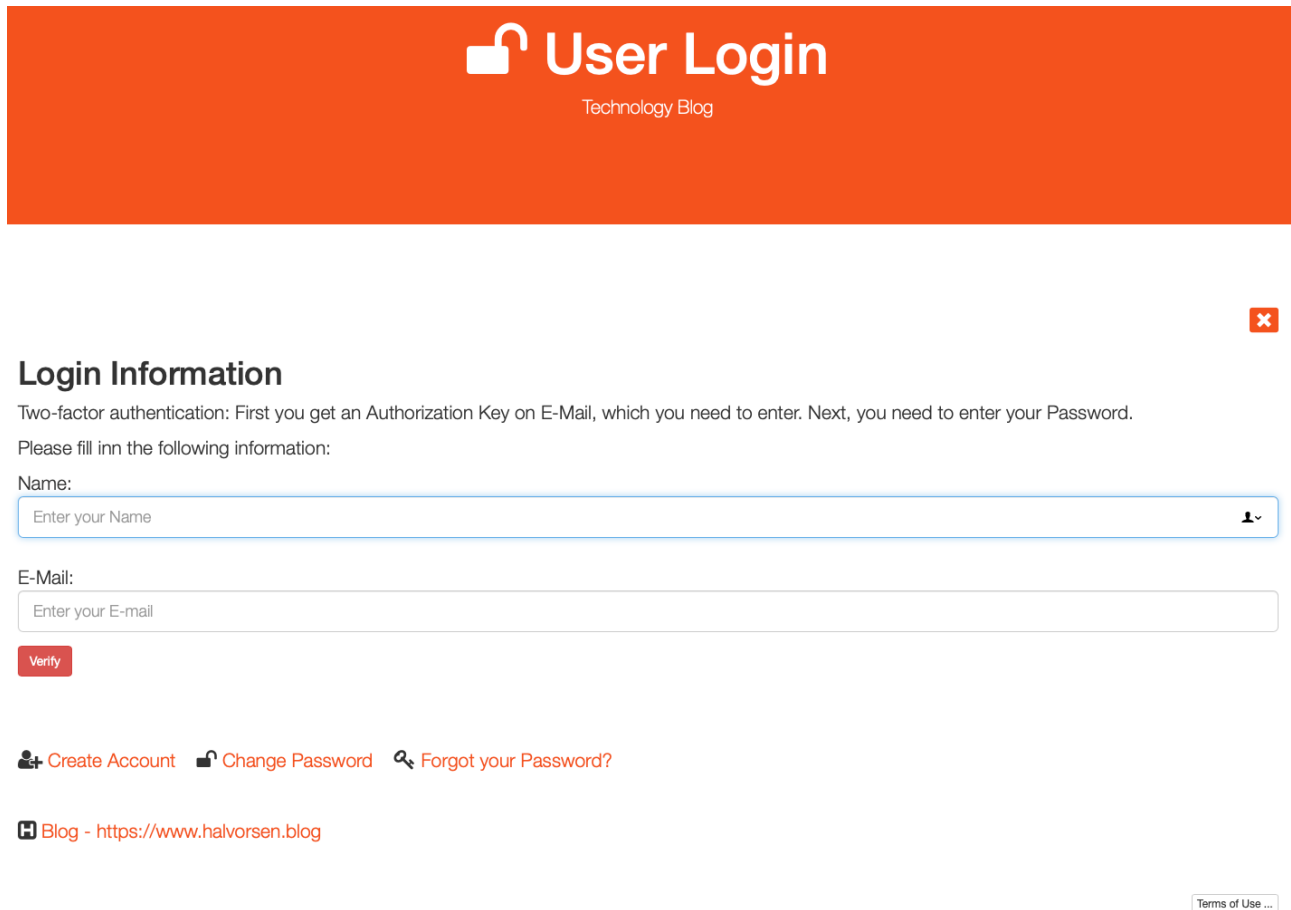
- User Management
- Project Management System
- Work Management System
- Event and Attendance System
- Quiz and Questionnaire System
- Notes
- Datalogging and Data Monitoring Apps and Services

Below some of these applications (apps) are presented.

4.5.1 User Management

The User Management keep track of all the users, makes it possible to login, logout, change password, etc.

Figure 4-10 shows the User Login page, while in Figure 4-11 we see the Account page where you can see and update your personal information. From this page you can also start and open the different apps you have access to.



User Login
Technology Blog

Login Information

Two-factor authentication: First you get an Authorization Key on E-Mail, which you need to enter. Next, you need to enter your Password. Please fill inn the following information:

Name:
Enter your Name

E-Mail:
Enter your E-mail

Verify

[Create Account](#) [Change Password](#) [Forgot your Password?](#)

[Blog - https://www.halvorsen.blog](https://www.halvorsen.blog)

[Terms of Use ...](#)

Figure 4-10: User Login

The passwords are encrypted (hashed) and stored in a secure manner. It is impossible to transform the encrypted password back to its original form, so your password should be safe. Still, you should not use a Password that you have already used for other systems, and especially not the same password that you use for your email system. Your E-mail address is your unique User Name, and it will only be used for verification of your account.

HTTPS and SSL and are used for secure and encrypted communication between the server and the client.

Two-factor authentication: For critical parts, the system uses Two-factor authentication, which means you need to verify your identity by receiving an Authorization Key by E-Mail in addition to enter your Password.

In Figure 4-11 we see the Account page where the user can get access to all their apps, services and data in one place. Here you can start apps that they have access to, change password, etc.

Account
Hans-Petter Halvorsen

[Recommend](#) [Home](#)

Account Information

Control, protect, and secure your Account, all in one place. Here you can see and update your account information. Your Account page gives you quick access to settings, services and tools that let you safeguard your data, protect your privacy, and get access to other relevant information.

Personal Information

Name: Hans-Petter Halvorsen
E-Mail: hans.p.halvorsen@usn.no

[Change Account Information](#) [Logout](#)

Apps

You have access to the following Apps:

- Adm
- DMM
- Event Management
- Notes
- PMS Manager
- Project Management System
- Quiz Management
- Remember
- User Manager
- Workless

Sign-in and Security

- [Logout](#)
- [Change Password](#)

Figure 4-11: Account Information

4.5.2 Project Management System

Project management System is a web application made from scratch that handles all aspect of planning and managements of projects. You can set up requirements, create calendar and meeting activities, etc.

In Figure 4-12 you see some of the features in the Project Management System.

The system is used within my student projects and other research and development activities. The system is also used by external users.



Figure 4-12: Project Management System

See Chapter 28 and Chapter 32 for more information about the Project Management System.

4.5.3 Work Management System (Workless)

See Chapter 32 for more information about the Work Management System.

4.5.4 Event and Attendance System

See Chapter 32 for more information about Event and Attendance System.

4.5.5 Quiz and Questionnaire System

See Chapter 32 for more information about the Quiz and Questionnaire System.

4.5.6 Notes

See Chapter 32 for more information about the Notes System.

4.5.7 Data Monitoring

See Chapter 32 for more information about the Data Monitoring System

5 Industrial IT and Automation

My main working topic is within Industrial IT and Automation. In Figure 5-1 we see an overview of my main working fields within that area:

Industrial IT and Automation

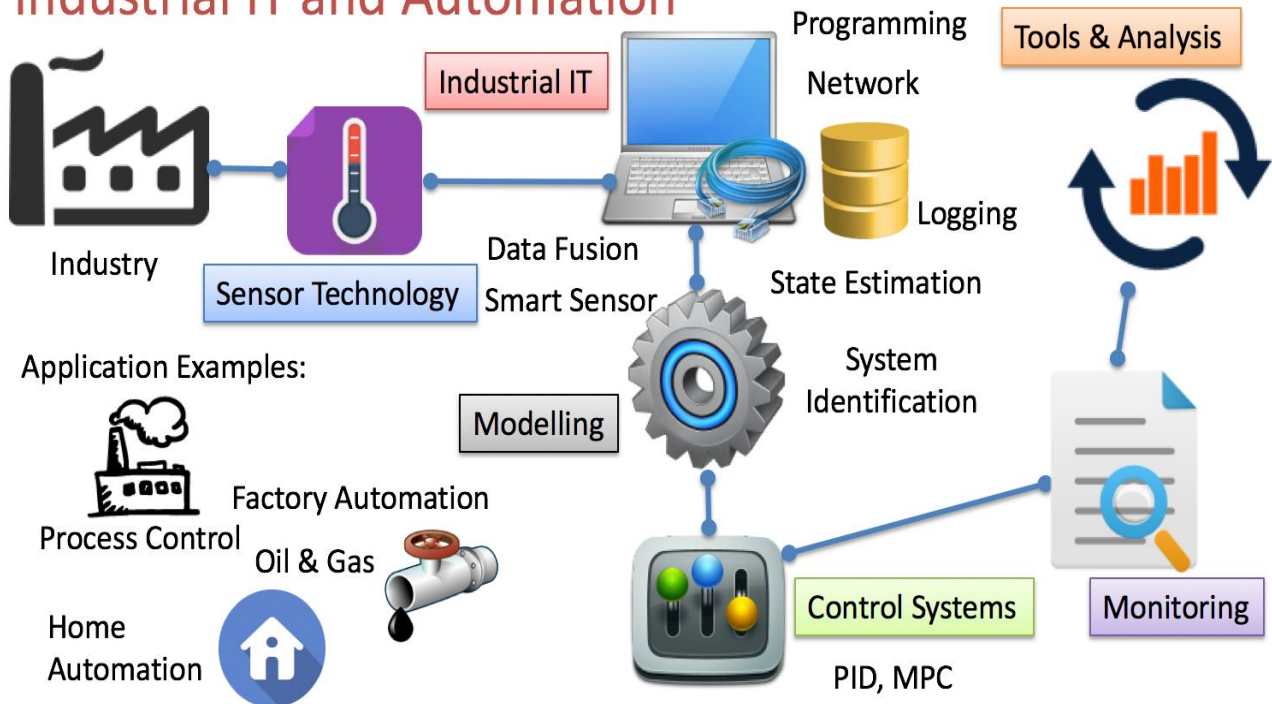


Figure 5-1: Working Fields within Industrial IT and Automation

Industrial IT is the integration of Automation and Information Systems across the business. You could say Industrial IT is use of IT in industrial applications, everything from Process Control Systems, Sensor Technology, Data Acquiring, Data Logging and Monitoring and Software and Systems Engineering. You need to have knowledge of Data Acquisition, Database Systems, Data Communication and Networks, Automation and Control, etc. Terms such as Internet of Things (IoT), Cloud Computing, Smart Technology and Industry 4.0 are very popular these days.

Below some topics within Industrial IT and Automation are listed (see also Figure 5-2):

- System Engineering
 - Visual Studio Team Services
 - Programming

- Industrial IT
 - DAQ
 - Wireless Systems
 - Database Systems
 - Web Services
 - Modbus
 - Vision Systems
 - Virtualization
 - Cloud Computing
- Automation
 - OPC
 - SCADA Systems
 - Hardware-in-the-Loop (HIL) Simulation and Testing
- Internet of Things (IoT)
 - Home Automation
 - Arduino
 - Raspberry Pi
- Applications and Examples
 - Weather System
 - DeltaV Training and Research Center
 - Data Management and Monitoring Platform
 - Home Automation & Smart Houses Solutions

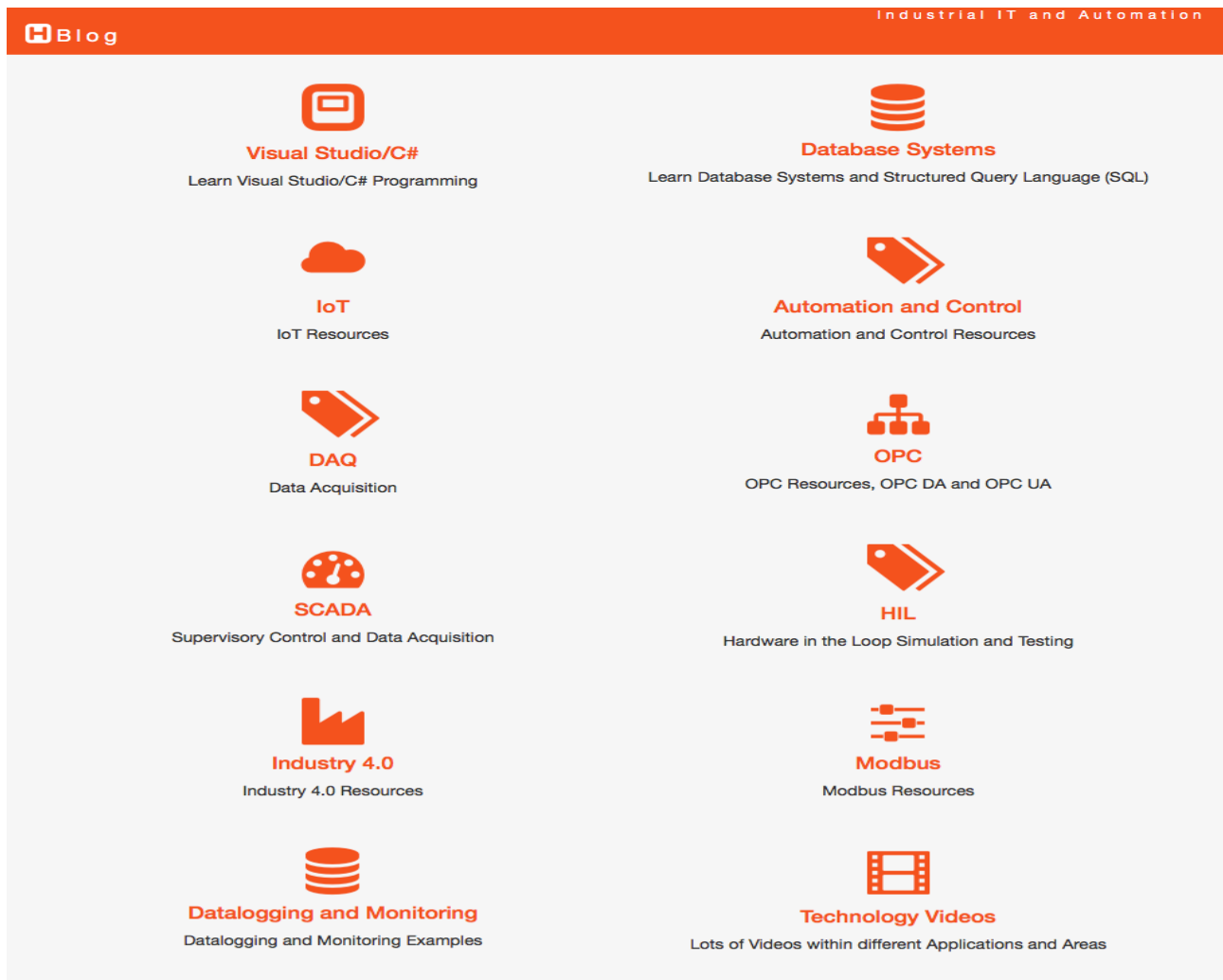


Figure 5-2: Selected Industrial IT and Automation Topics

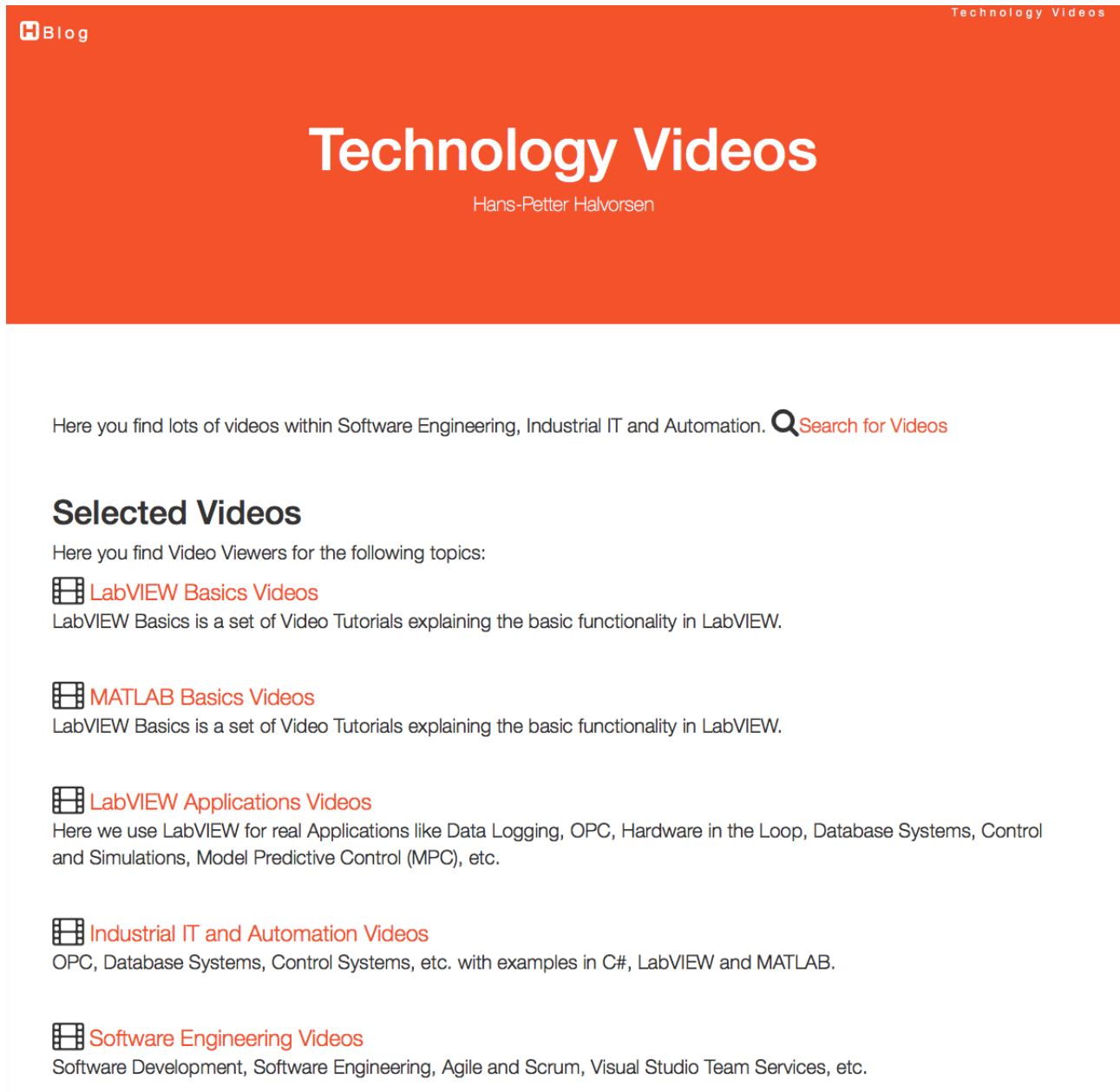
For more information about these topics, please see the following web page (a fragment of the web site is shown in Figure 5-2):

http://www.halvorsen.blog/documents/technology/industrial_it_automation.php

The web site, including documents, videos, example code, above discusses these topics within Industrial IT and Automation with focus on practical examples. The different topics will introduce relevant software and different examples how to implement it in different programming languages like LabVIEW, Visual Studio/C# and MATLAB.

The Industrial IT and Automation is used as a common resource in many of my courses, both at Bachelor and Master level. In addition, it is a resource for thousands of others visiting the web site.

To explain the topics with practical examples, lots of videos have been prepared. Figure 5-3 shows the “Industrial IT and Automation Video Viewer”.



Here you find lots of videos within Software Engineering, Industrial IT and Automation. [Search for Videos](#)

Selected Videos

Here you find Video Viewers for the following topics:

- [LabVIEW Basics Videos](#)
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
- [MATLAB Basics Videos](#)
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
- [LabVIEW Applications Videos](#)
Here we use LabVIEW for real Applications like Data Logging, OPC, Hardware in the Loop, Database Systems, Control and Simulations, Model Predictive Control (MPC), etc.
- [Industrial IT and Automation Videos](#)
OPC, Database Systems, Control Systems, etc. with examples in C#, LabVIEW and MATLAB.
- [Software Engineering Videos](#)
Software Development, Software Engineering, Agile and Scrum, Visual Studio Team Services, etc.

Figure 5-3: Technology Videos

At University of South-Eastern Norway, we have 5 years' study within Industrial IT and Automation, i.e., a 3-year Bachelor study within “Informatikk og Automatisering”/ “Informatics and Automation” (the study is taught in Norwegian) and a 2-year Master study in “Industrial IT and Automation” (the study is taught in English).

At Bachelor level, I am involved in courses like “Industrial Communication and Computer Network” (“Industriell kommunikasjon og datanett”), Automation Systems (“Automatiseringsteknikk”), System Engineering (“Systemutvikling”)

At Master level, I am involved in courses like “Industrial IT” and “Systems and Control Laboratory”.

The Master program are taught in English, while the Bachelor program is taught in Norwegian, except 5. Semester which is taught in English.

A lot of R&D projects have been carried out the last years within this area.

6 System Engineering

System Engineering and Software Engineering is the foundation if you want to develop solutions within Industrial IT and Automation.

I have developed lots system/software engineering resources, including a textbook called “Software Development – A Practical Approach” (see Figure 6-2).

The textbook and additional resources are published and available here:

https://www.halvorsen.blog/documents/programming/software_engineering/

Figure 6-1 shows the main web site for this area.



Software Engineering

Software Engineering is the discipline for creating software applications. A systematic approach to the design, development, testing, and maintenance of software.

The main parts or phases in the Software Engineering process are:

- Planning
- Requirements Analysis
- Design
- Implementation
- Testing
- Deployment and Maintenance

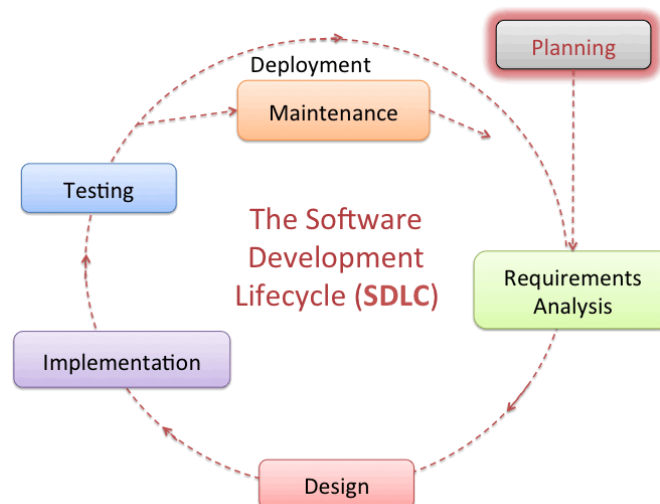


Figure 6-1: System Engineering/Software Engineering Web Site

I have relevant background from industry within the fields Industrial IT, System/Software Engineering and Automation which I rely on in my teaching and research and development projects. I have also worked with software development, industrial IT and automation projects for more than 12 years in the industry.

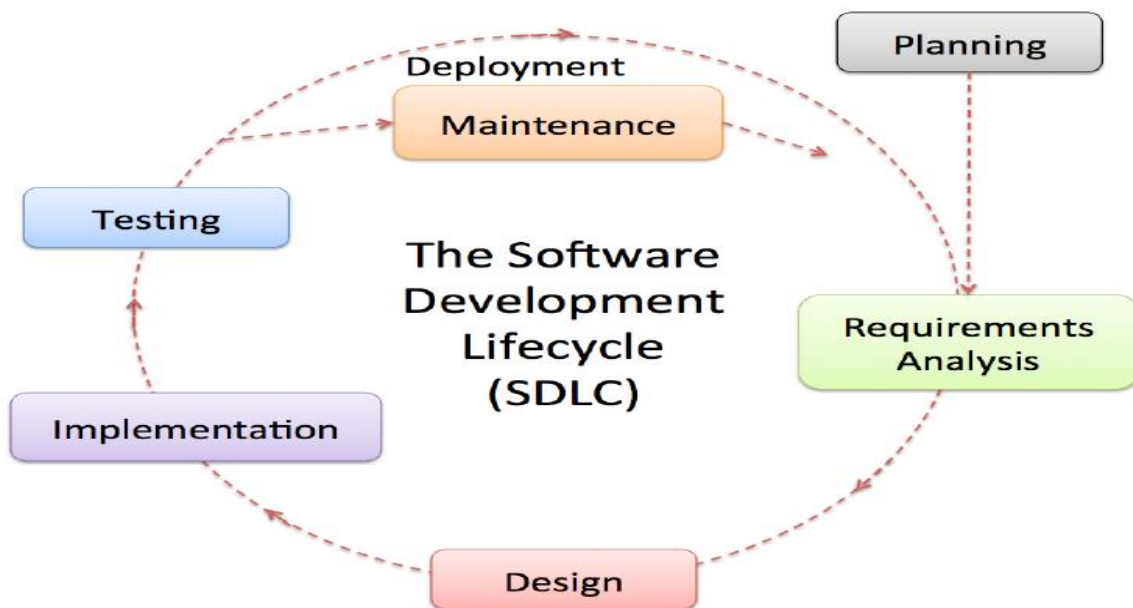
University College of Southeast Norway



Software Development

A Practical Approach!

Hans-Petter Halvorsen, 2016.11.30



<http://home.hit.no/~hansha>

Figure 6-2: Textbook: Software Development – A Practical Approach!

6.1 Teaching

I am teaching system engineering/software engineering at Bachelor level, but I also use and apply that area in other courses and in research and development projects, because it is the fundamental for all other activities.

Figure 6-3 shows the web page (a small part of it) for this course.

Course Schedule

[Course Registration](#) (first time only!) [Quiz System](#)

Office Hours: Tuesdays 10:15-14:00 and Fridays 10:15-14:00 @ Room C-139a

[Software Engineering Topics - Week by Week](#)

Time	Topics	Work
Part I - Planning		
Week 2	1. Project Kick-off and Planning	Week Assignment
Tue 9.1	Project Start & Project List	
Fri 12.1		Quiz
Part II - Requirements Engineering		
Week 3	2. Requirements Engineering	Week Assignment
Tue 16.1	Planning Review	
Fri 19.1		Quiz
Part III - Software Design		
Week 4	3. Database Systems	Week Assignment
Tue 23.1	Requirements Engineering Review	
Fri 26.1		Quiz
Week 5	4. Unified Modeling Language (UML)	Week Assignment
Tue 30.1	Database Review	
Fri 2.2		Quiz
Week 6	5. Software Development Processes and Scrum	Week Assignment

Figure 6-3: Excerpt from the Web Site for the System Engineering Course

The course is organized as a project, i.e., the learning occurs through a large team project and there are few traditional lectures! This requires active participation from the students from start to finish. Learning is ensured by so-called “week

assignments” that defines the focus, goals, tasks and work effort from week to week.

The course has a mix of short introduction lectures, project work, team work, Scrum meetings, project meetings, problem solving, exercises, reviews, discussions, quizzes, independent work, etc. The course is based on Project and Problem based learning methods (PPBL). In addition, the course is highly research-based with focus on the latest technology (this also means that the teachers don’t have all the answers!).

When clicking the topics overview in the schedule (Figure 6-4) you will get access to a more detailed overview of the specific topic (Figure 6-4).

Database Systems - This week's Highlights

Database Systems: This weeks topic is Database Design, Modelling and Implementation. We will use **ERwin** for Database Design and Modelling. Then we will implement our database model in **SQL Server**.

Olav will give a short overview of:

1. ERwin
2. SQL Server and basic SQL (Structured Query Language)
3. How we can communicate with a SQL Server database from Visual Studio (using **ADO.NET**).

Database Modeling (ERwin), SQL Server and Database Communication with C# (using ADO.NET) should be known from previous course, but since these 3 topics are crucial for our project, there will be a short repetition of these topics with some *hands-on examples*. In addition, basic knowledge of the **Structured Query Language (SQL)** is necessary knowledge for this project. See also **SQL Server and ADO.NET**.

⚠ Software: Make sure to install both **ERwin** and **SQL Server** in advance, otherwise you cannot follow the examples and tasks given in class! You need to apply for ERwin - so it may take 2-5 days before you are able to use it!

For more details, see the [Week Assignment](#).

1. Preparations

🕒 2-3h. Main focus: Prepare to participate in class activities. It is important that you are prepared when you come to class.

[Database Systems - This week's Highlights](#)

Software

You need the following Software (make sure to install them before you come to class!):

- **ERwin** ERwin Academic Edition. Note! You need to apply for it, so make sure to do this in good before you need it.
- **SQL Server** Express Edition is recommended. Note! You need to install both SQL Server + SQL Server Management Studio.

Figure 6-4: Topics

The topics web pages for each topic are divided into 3 parts:

1. Preparations
 - a. Software
 - b. Resources
 - c. Textbooks
2. Activities in Class
 - a. Week assignment
 - b. Resources
3. Complementary work
 - a. Resources
 - b. Questions

Part 1: Preparations are activities the students need to do at home to prepare for class. These activities are, e.g., installing necessary software, get an overview of the specific topic watching introduction videos, read selected chapters in the recommended textbooks, etc.

Part 2: Activities in Class gives an overview of the activities that shall be done in the classroom, including short introduction lectures, exercises and week assignments, etc.

Part 3: Complementary work are activities and resources that the students should complete after class, including resources for deeper understanding (web links, videos, etc.) and questions/quizzes and additional exercises.

The course uses a practical approach with focus on practical implementations and less theory. In many cases the students will need to find answers and solutions outside the classroom, using other sources, like, internet, books, etc. The course is also based on “Flipped Classroom”, i.e., the students need to read the theory, watch videos, etc. in advance at home (in general be prepared) so we can focus more on interactive teaching and guidance (discussions, group work and practical exercises) in the class.

Figure 6-5 shows the main teaching activities in the Software Engineering course.

Teaching Activities

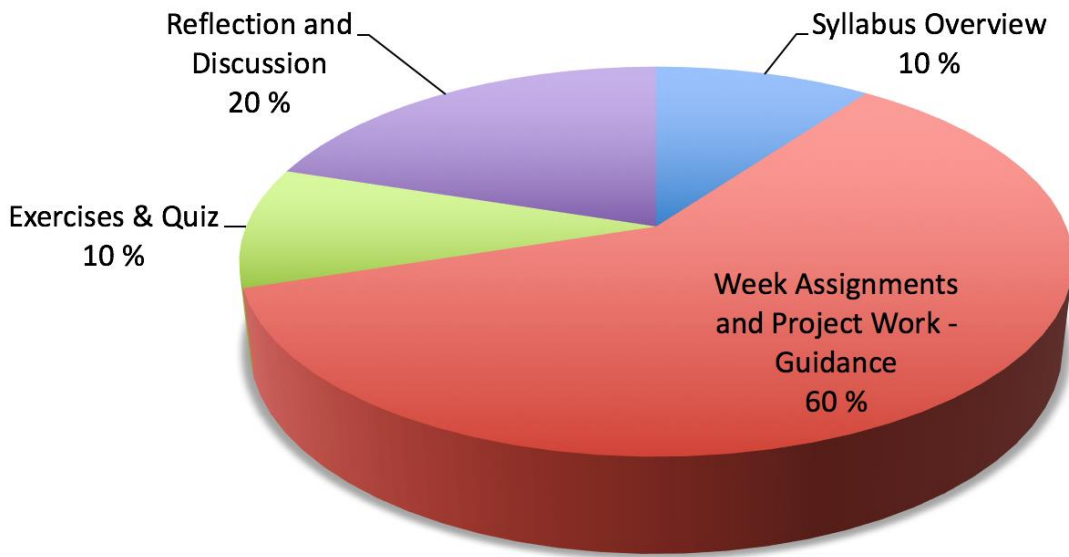


Figure 6-5: Teaching Activities in Software Engineering Course

The project counts 70% of the grade, while an individual written final test (30%) tests the knowledge accumulated through the project and the course as a whole.

6.1.1 Videos

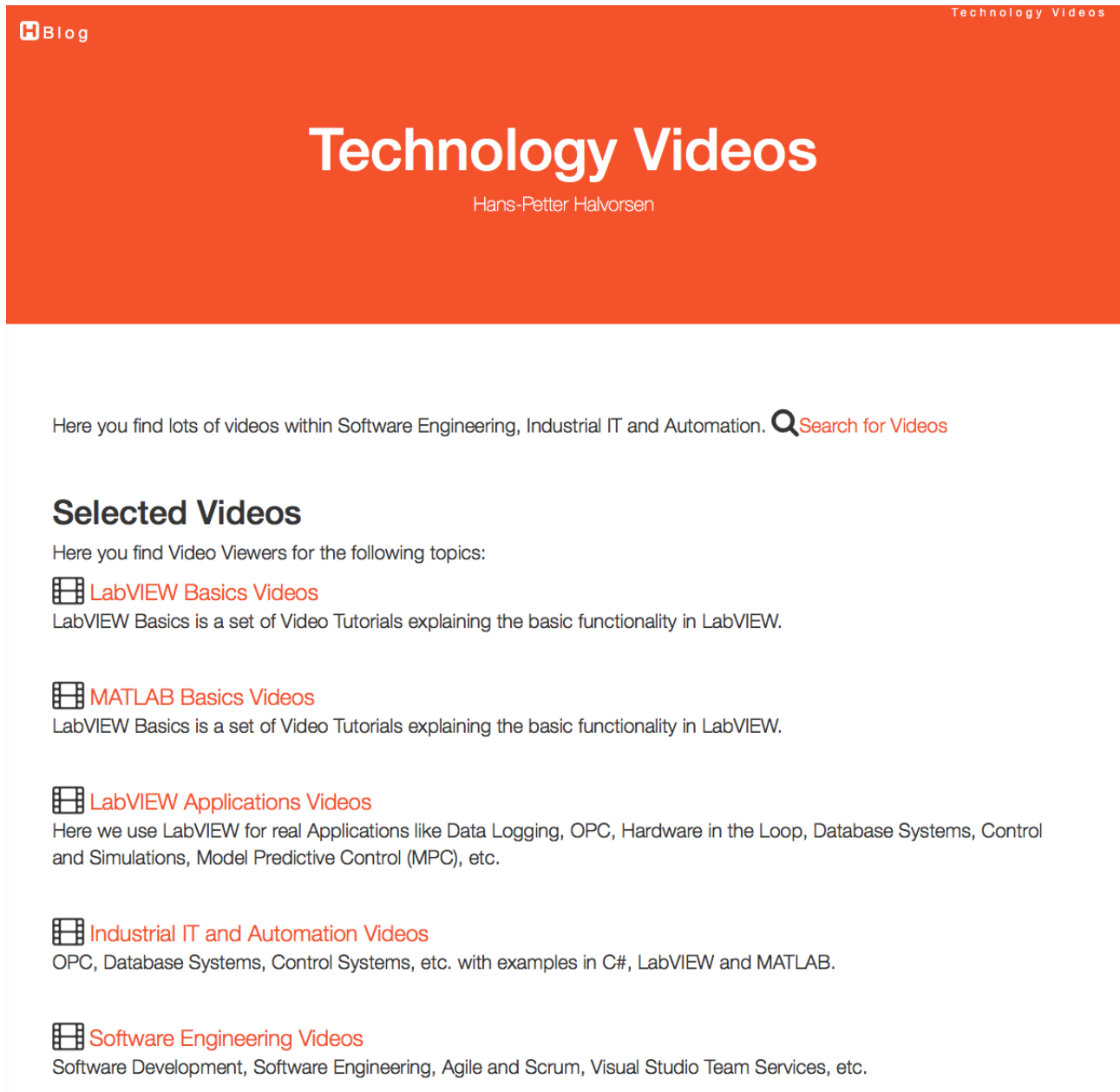
I think videos are an excellent resource when it comes to learning the syllabus, both the theoretical parts as well as the practical parts, such as programming and learning practical software tools needed to practice Software Engineering.

A “Video Viewer” (see Figure 6-6) has been made for this purpose. Here you will find a selection of recommended Videos within “Software Development”. Many of the videos are self-produced, while others are carefully selected from other sources.

There are directly links to the videos in the course schedule web page, in addition they have easy access to all the videos in one place using the “Video Viewer”. For each topic in the syllabus there is some videos explaining the topic, both the theory and many practical studies of tools and programming techniques regarding the specific topic.

The videos are used by the students to prepare themselves for new topics, practice on skills in different software tools, but they are also ideal for repetition, prepare for

final exam, etc. Based on the videos, a set of exercises has been made, so that they need to pay attention and work with the contents of the videos.



Blog Technology Videos

Technology Videos

Hans-Petter Halvorsen

Here you find lots of videos within Software Engineering, Industrial IT and Automation. [Search for Videos](#)

Selected Videos

Here you find Video Viewers for the following topics:






-  [LabVIEW Basics Videos](#)
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
-  [MATLAB Basics Videos](#)
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
-  [LabVIEW Applications Videos](#)
Here we use LabVIEW for real Applications like Data Logging, OPC, Hardware in the Loop, Database Systems, Control and Simulations, Model Predictive Control (MPC), etc.
-  [Industrial IT and Automation Videos](#)
OPC, Database Systems, Control Systems, etc. with examples in C#, LabVIEW and MATLAB.
-  [Software Engineering Videos](#)
Software Development, Software Engineering, Agile and Scrum, Visual Studio Team Services, etc.

Figure 6-6: System/Software Engineering Videos

For more information about this course, please see the web page for the course:

https://www.halvorsen.blog/documents/teaching/courses/software_engineering.php

Part 2 : Teaching

In this part, an overview of my teaching activities will be given, an overview of e-learning principles, overview of my teaching activity at Bachelor and Master level and the teaching principles used there.

7 Teaching Activities

7.1 Introduction

I am involved in different teaching activities at the university, both at Bachelor level and at Master level. The Master programs we have are taught in English.

Here I will present my teaching principles, give an overview of the courses I have and the different areas of teaching I am involved in.

Based on the teaching, several research papers have been published.

7.2 Teaching Principles

Here are some teaching principles or key concepts within my teaching presented:

- Science, Technology, Engineering, Art and Mathematics (STEAM)
- Constructive Alignment (CA)
- Students in Centre and Front (SCF)
- Problem-based Learning (PBL)

I will present how these key concepts can and has been be applied in teaching and learning and assessments to improve the learning outcome.

Basically, it is important to have a student centric approach when planning and preparing:

- Teaching and Learning
- Learning Outcome
- Assessments

This is illustrated in Figure 7-1 and Figure 7-2. In Figure 7-1 we see the foundation of Constructive Alignment (CA), while in Figure 7-2 we see the Students in Centre and Front (SCF) concept.

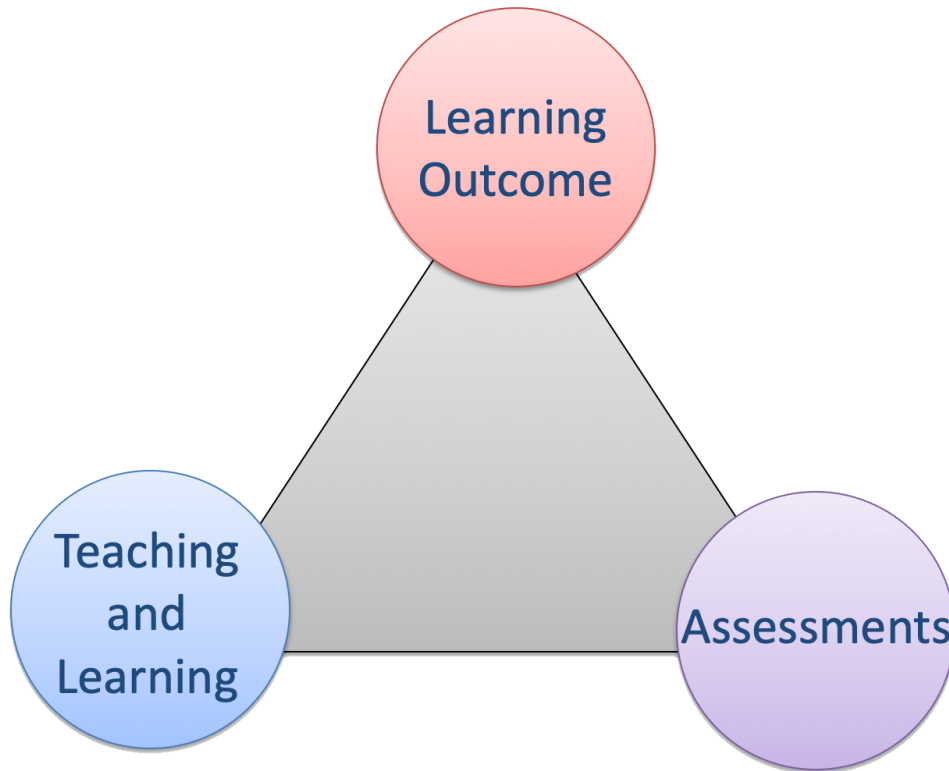


Figure 7-1: Constructive Alignment (CA)

The Students in Centre and Front (SCF)

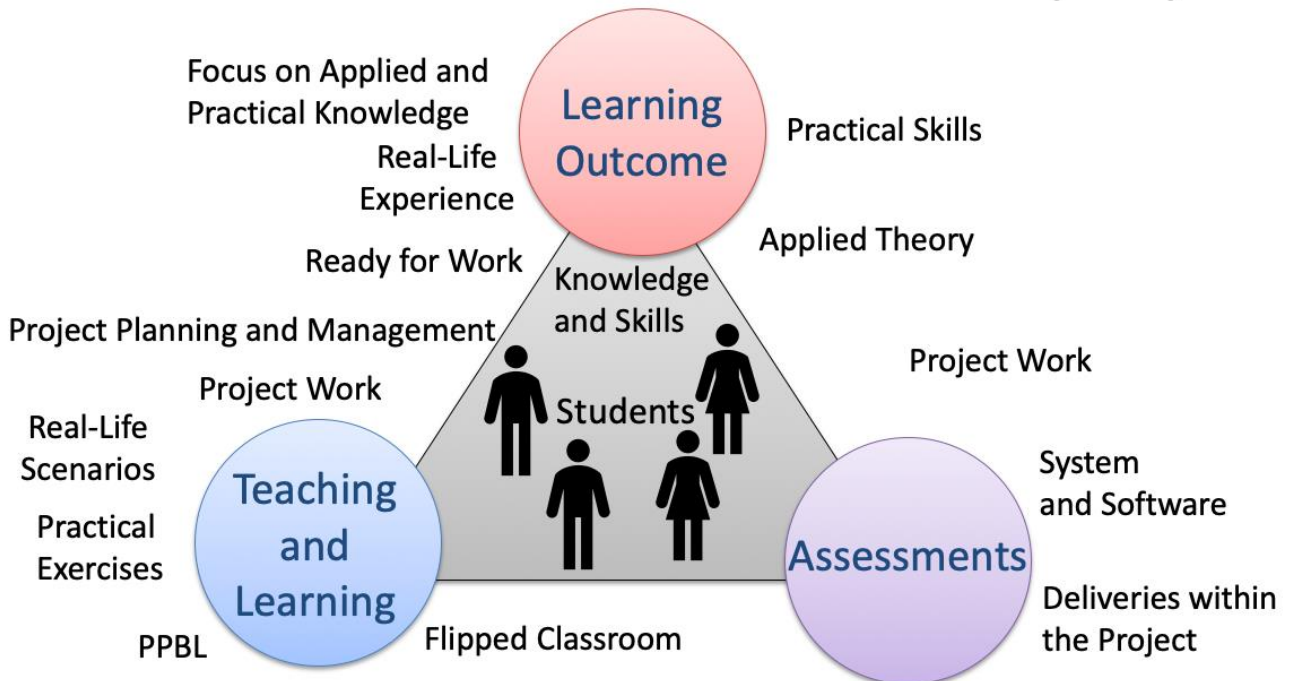


Figure 7-2: The Students in Centre and Front (SCF)

An important key concept I am using is based on problem-based learning (PBL) or problem and project-based learning (PPBL). See Figure 7-3.

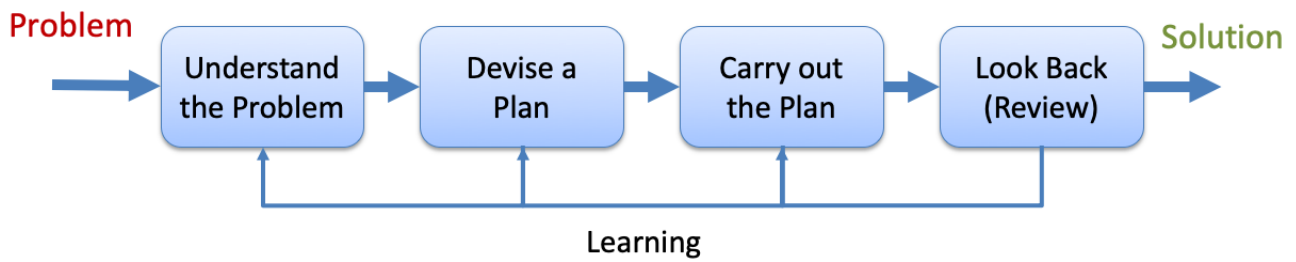


Figure 7-3: Problem-based Learning (PBL)

Typically, the PBL students score higher than the students in traditional courses because of their learning competencies, problem solving, self-assessment techniques, data gathering, behavioral science, etc.

In Figure 7-4 we see some examples of applied PBL in some of my courses at the University.



Figure 7-4: Practical Implementation of CA, SCF and PBL

Key Concepts in PBL addressing CA, SCF:

- Focus on applying knowledge
- Learning through solving problems
- Active participation - not passive!

- Find out things on your own or in groups
- Be prepared as much as possible for working life

You can read more about problem and project-based learning in chapter 15.

7.3 Publications

Some of the results from these teaching activities have been published:

- Constructive Alignment with Student in Centre and Front - Experience from Case-projects and Intensive Summer Courses - Hans-Petter Halvorsen, Josef Timmerberg, Saba Mylvaganam - MNT Conference, March 28-29, 2019, Tromsø, Norway.
- Project/Problem Based Learning in Electrical Engineering, IT and Automation - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam. ITEN2015 Conference, Łódź, Poland, September 2015.
- Experience with Case-projects in Bachelor and Master Studies in Electrical, IT and Systems & Control Engineering - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam - EAEEIE 2013, 24th EAEEIE (European Association for Education in Electrical and Information Engineering) Annual Conference, Chania, Greece 30 - 31 of May, 2013.

7.4 Courses

I am/have been involved in the following Courses at University of South-Eastern Norway (previously Telemark University College and University College of Southeast Norway):

7.4.1 Bachelor Level

I am/have been involved in the following Bachelor courses at University College of Southeast Norway (previously Telemark University College).

Current Courses:

- IA4412 - Software Engineering (“Systemutvikling”) (Course coordinator)
- IA3112 - Automation Systems (“Automatiseringsteknikk”) (Lab Work, LabVIEW Training)
- IA4212 - Instrumentation (“Instrumenteringsteknikk”)
- PRH606 - Main Project (Supervisor)

Previous Courses:

- EE4007 - Cybernetics Foundation (Lab Work)
- EE4107 - Cybernetics Advanced (Course coordinator, Lab Work + Project)
- EE3107 - Cybernetics Project (Course Coordinator)
- PRG106 - 1. Semester Project (F1 project) (Supervisor)
- IA6209 - Industrial Communication and Computer Network (Lab Work/Project)
- IA5106 – “Automatiseringsteknikk og praktisk modellering” (Lab Work/Project)
- EE4209 – Model-based Control (Course coordinator, Teaching, Lab Work)

Most of these previous courses no longer exist at University College of Southeast Norway due to changes in the curricula and the study programs.

7.4.2 Master Level

The Master courses are taught in English. I am involved in the following Master courses at University of South-Eastern Norway:

- MATLAB Course (course coordinator and instructor)
- SCE1213 - Hard/Soft Sensors in Process Measurements
- SCE4206 - Systems and Control Laboratory (course coordinator)
- SCE2006 - Industrial Information Technology (Lab Work/Projects)
- SCE4006 - Project (Supervisor)
- FMH606 - Master's Thesis (Supervisor)

For more details about these courses, see my Web site

<https://www.halvorsen.blog/documents/teaching/teaching.php>

7.5 Areas

My main teaching areas are within Industrial IT and Automation and System/Software Engineering.

7.5.1 Industrial IT and Automation

I am teaching several courses within the area Industrial IT and Automation, both at Bachelor and Master levels. We have a 5-year study program within the field Industrial IT and Automation, i.e., a 3-year Bachelor program and 2 3-year Master program.

I have developed lots of teaching resources, including eBooks, lecture notes, tutorials and other resources.

Here are links to some important resources:

Web Site:

Main page for Industrial IT and Automation resources:

http://www.halvorsen.blog/documents/technology/industrial_it_automation.php

Textbook:

“Industrial IT and Automation – A practical Approach!”:

<https://www.halvorsen.blog/documents/technology/resources/Industrial%20IT%20and%20Automation.pdf>

Lecture Notes:

http://www.halvorsen.blog/documents/teaching/teaching_material.php

Tutorials:

<http://www.halvorsen.blog/documents/tutorials/tutorials.php>

Videos:

<https://www.halvorsen.blog/documents/video/videos.php>

YouTube Channel:

<https://www.youtube.com/IndustrialITandAutomation>

7.5.2 System Engineering

At Bachelor level I have a course within system engineering, IA4412 - Software Engineering (in Norwegian: "Systemutvikling").

All teaching material and course contents are located on my Blog.

Web Site:

The web page for this course is located here:

https://www.halvorsen.blog/documents/teaching/courses/software_engineering.php

Textbook:

"Software Development – A Practical Approach!":

https://www.halvorsen.blog/documents/programming/software_engineering/resources/Software%20Development.pdf

Videos:

<https://www.halvorsen.blog/documents/video/videos.php>

YouTube Channel:

<https://www.youtube.com/IndustrialITandAutomation>

System Engineering principles are also import in other aspects the students are working with, like student projects that are integrated in many of our courses at the university as well as the final bachelor project and master thesis.

8 E-learning

I have high focus on using modern e-learning principles in my teaching. Since I have a background in IT/Industrial IT and my teaching area is the same, I (and my students) have a huge advantage taking these tools and principles in use.

I also include digital tools, blog, videos, and interactive boards (Smart Board, ActivBoard, iPad), etc. within the teaching.

I have also started to use Agile methods and Scrum methodology known from System/Software Engineering within my teaching. Here I use Visual Studio Team Services (VSTS) as the software platform. This is a tool I use in different courses as well in student projects, like the final Bachelor project, the Master Thesis project, etc. VSTS has lots of features that help increase collaboration in (student) projects at different levels. More about Agile methods and Scrum methodology in chapter 8.6 Agile methods and Scrum methodology.

I use Educational Software such as MS Office, MS Word, Excel, PowerPoint, Visio, Skype for Business (Lync), Camtasia Studio, Screencast-O-Matic, ActiveInspire, NoteBook for SmartBoard, EndNote, EverNote, OneNote, OneDrive, DropBox, Fronter, OmniJoin, Radix (Video Server), etc.

I use Educational Software such as MS Office, MS Word, Excel, PowerPoint, Visio, Skype for Business (Lync), Camtasia Studio, ActiveInspire, NoteBook for SmartBoard, EndNote, Evernote, OneNote, OneDrive, DropBox, Fronter, OmniJoin, Radix (Video Server), YouTube, Kahoot, etc.

On regular basis, I test out new software to see if they are suited to use in teaching or to create teaching material of different kinds, e.g. videos, web pages, eBooks, etc.

8.1 Web

My Blog/Web site is deeply and tightly integrated in all aspects of my teaching.

Here I have teaching material, the course schedule, additional resources, such as videos, etc. At the university, we use Fronter, but using web you can create more

flexible solutions. Since I create the web solutions from scratch, the contents can be created anyway I want. For easy access, I always create a link in Fronter.

Since the course schedules in the different courses I teach are on web, I can easily integrate syllabus, videos, and other teaching material as part of an integrated and interactive solution. This makes it so much easier for the students to see the whole picture compared to, e.g. upload lots of documents in Fronter (the teaching platform in our university) in an unstructured way.

Blog Teaching and Education

- Training Resources and Tutorials
- Learn Technology and Programming with Arduino

PC & Software

PC and Software Recommendations

Courses and Teaching Resources

Below you will find more interesting Teaching resources









 Software Engineering Learn Software Engineering	 Industrial IT Learn Industrial IT
 Systems and Control Laboratory Learn different aspects within Systems and Control	 MATLAB Course Learn MATLAB Programming
 Master Thesis Master Thesis Projects	 Bachelor Thesis Bachelor Projects
 Master Projects 3. Semester Master Projects	 Educational Videos Lots of Videos within different Applications and Areas

Figure 8-1: The main Portal to the different Courses I Teach.

A web page that has link to all these courses is located here:

<https://www.halvorsen.blog/documents/teaching/teaching.php>

Figure 8-2 shows an example of the web page for the Course IA4412 Software Engineering.

The course description, course contents, course material, course schedule, videos, different documents, such as previous exams, etc. are tightly integrated.

Blog Software Engineering

Software Engineering

Hans-Petter Halvorsen

Project Q&A Start

Course Overview

Today, modern teaching principles goes from being lecture based to becoming more student active. At the same time, new forms of education means more collaboration and problem solving. This course is organized as a project, so-called PPBL, **Project and Problem Based Learning**, ie, learning occurs through a large group project and there are minimal traditional lectures. The focus is on project and problem-based learning, so-called active learning, as opposed to passive and one-way learning methods as traditional lectures are. ...

Textbooks

The following textbooks will be used in this course:

- [Software Development - A Practical Approach](#) (Free PDF download)
- [Software Engineering](#) (I. Sommerville). You can, e.g., buy it here: [Adlibris](#) (and many other places). You can also buy or rent it as an [ebook](#).

Additional Textbooks and Resources:

Online Textbooks from [Safari Books Online](#) (the university has a subscription, so you can use it for free!):

- [Essentials of Software Engineering](#) (Frank Tsu et al.)
- [Software Engineering](#) (Saikat Dutt, et al.)

Blog
Software Engineering

Course Schedule

[Course Registration](#) (first time only!) [Quiz System](#)

Office Hours: Tuesdays 10:15-14:00 and Fridays 10:15-14:00 @ Room C-139a

[Software Engineering Topics - Week by Week](#)

Time	Topics	Work
● Part I - Planning		
Week 2	1. Project Kick-off and Planning	Week Assignment
Tue 9.1	Project Start & Project List	
Fri 12.1		Quiz
Time	Topics	Work
● Part II - Requirements Engineering		
Week 3	2. Requirements Engineering	Week Assignment
Tue 16.1	Planning Review	
Fri 19.1		Quiz
Time	Topics	Work
● Part III - Software Design		
Week 4	3. Database Systems	Week Assignment
Tue 23.1	Requirements Engineering Review	
Fri 26.1		Quiz
Week 5	4. Unified Modeling Language (UML)	Week Assignment
Tue 30.1	Database Review	
Fri 2.2		Quiz
Week 6	5. Software Development Processes and Scrum	Week Assignment

Figure 8-2: Example of the Web page for the Course IA4412 Software Engineering

For more information about this example, please see the web page for the course in the example:

<http://home.hit.no/~hansha/documents/subjects/IA4412.htm>

8.2 Interactive Boards

I have been developed (both planned and implemented at the university) new, modern and flexible teaching facilities (see chapter 16) where interactive boards (see Figure 8-3) are an integrated part of the solution. One of the rooms have a SMART Board and another room has ActivBoard.



Figure 8-3: Interactive Board [ActivBoard from Promethean]

I have been involved in applying for funds for some of these interactive boards in the teaching facilities I am using (chap. 16 Flexible Teaching Facilities).

These interactive boards make it easier to have a more interactive teaching session.

More about the flexible teaching facilities in another chapter (chap. 16 Flexible Teaching Facilities).

8.3 Skype for Business

Skype for Business is a platform for audio and video calls, instant messaging, share desktop, etc. used at business level, while ordinary Skype is for more personal use. See Figure 8-4.

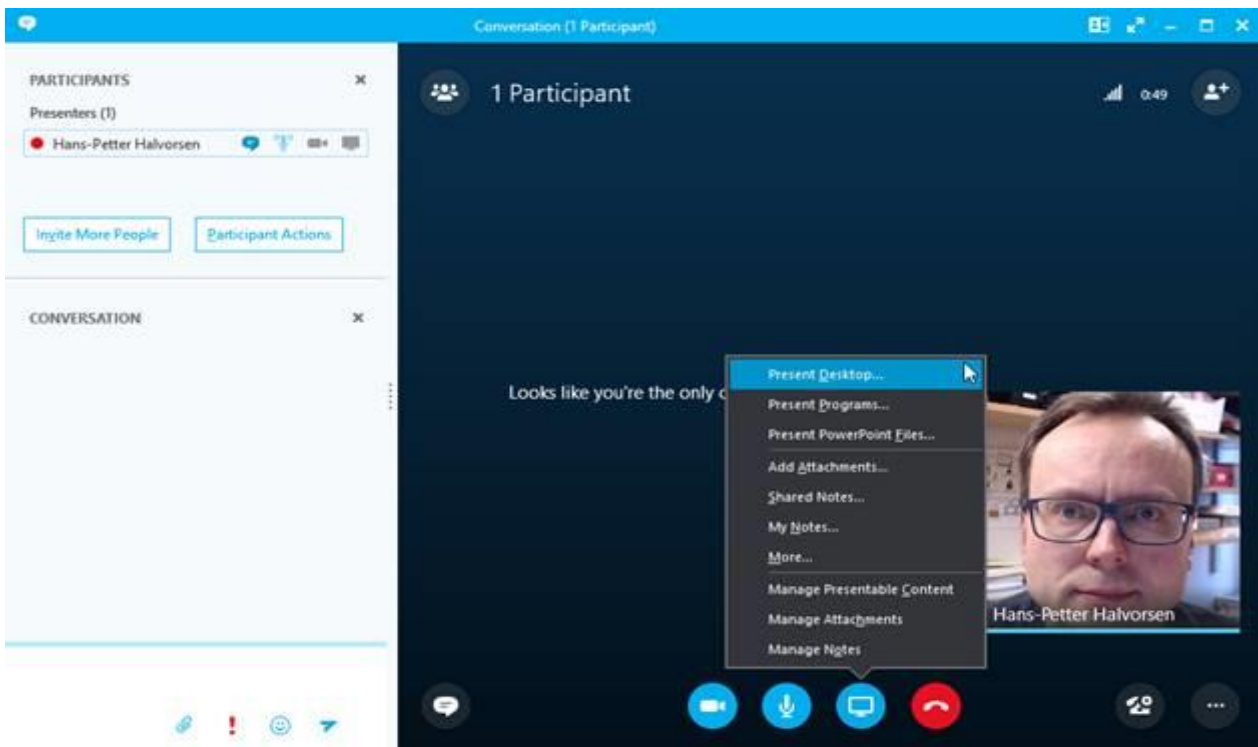


Figure 8-4: Skype for Business

We use Skype for Business internally in the university (among the employees). In addition, I use it teaching, both for teaching online students and campus students.

For online students, I use Skype for Business when students need help with exercises, laboratory work, project work, etc. For campus students, I use it when students need to present their work for me and the rest of the class. In that way, we don't need to spend lots of work connection student PCs to the projector, etc., they just share their desktop which I show on the video projector in front so everybody can see their desktop. In this way, also the limits to speak up in class and present work that they have done becomes smaller.

Skype for Business can also be used among the students for group work, project work and collaboration outside campus, which makes it a good tool for online students, but also for campus students.

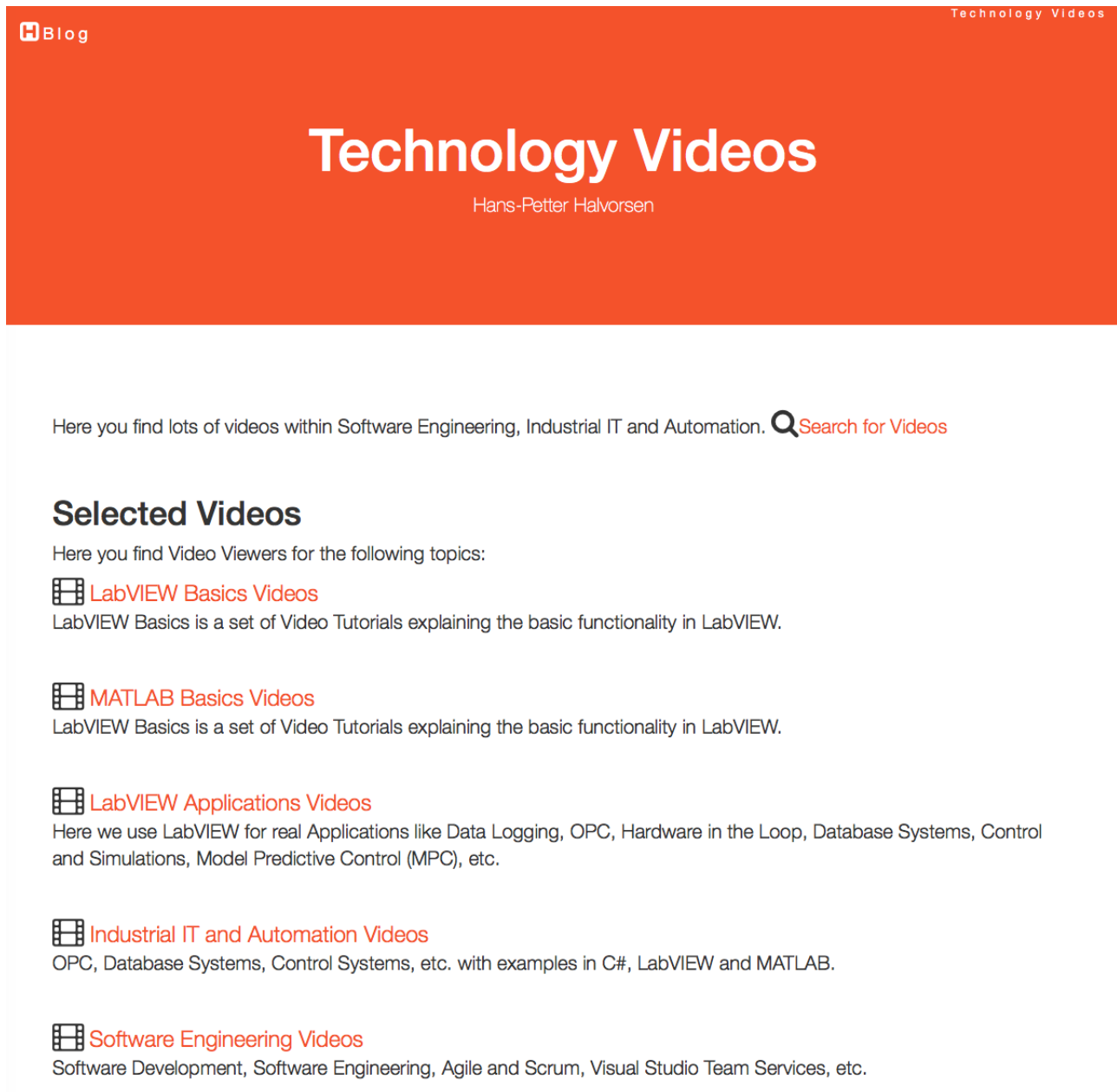
8.4 Videos


Videos are an important addition to other teaching resources. I use videos a lot as a supplement to written materials, such as eBooks, tutorials, web pages and web resources.

Figure 8-5 shows an overview of my main video web site. The videos are divided into different categories, such Industrial IT and Automation, Software Engineering, etc.

The web site can be found here:

<http://www.halvorsen.blog/documents/video/videos.php>



Here you find lots of videos within Software Engineering, Industrial IT and Automation.  [Search for Videos](#)

Selected Videos

Here you find Video Viewers for the following topics:






-  [LabVIEW Basics Videos](#)
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
-  [MATLAB Basics Videos](#)
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
-  [LabVIEW Applications Videos](#)
Here we use LabVIEW for real Applications like Data Logging, OPC, Hardware in the Loop, Database Systems, Control and Simulations, Model Predictive Control (MPC), etc.
-  [Industrial IT and Automation Videos](#)
OPC, Database Systems, Control Systems, etc. with examples in C#, LabVIEW and MATLAB.
-  [Software Engineering Videos](#)
Software Development, Software Engineering, Agile and Scrum, Visual Studio Team Services, etc.

Figure 8-5: Videos

Videos can be an important tool for preparation, during practical exercises, summarizing, etc.

I integrate videos in as part of my web site and web resources, so it becomes an integrated part of a total package of teaching resources, and not separate part you find somewhere else.

Videos are also an important part of the Flipped classroom principle which I am a user of.

I think videos are an excellent resource when it comes to learning the syllabus, both the theoretical parts as well as the practical parts, such as programming and learning practical software tools needed to practice the different disciplines.

A lot of videos have been made for specific topics and courses. The videos (see Figure 8-6) are available from Fronter (the teaching platform at the university) or from the web sites for the different courses, both as links or embedded in the web pages itself (see Figure 8-7).

The screenshot displays a web interface for video playlists. At the top, there is a 'Playlists' header with a count of '10', a 'New playlist' button, and a search bar for playlists. Below this, the playlists are listed in a table-like format, each with a video thumbnail, a title, a video count, and an 'Edit' button. The playlists include:

- SCADA** (Supervisory Control and Data Acquisition) - 4 videos
- HIL** (Hardware In the Loop Simulation and Testing) - 2 videos
- LabVIEW Basic** - 17 videos
- DAQ** - 1 video
- Visual Studio** - 2 videos
- Programming** - 1 video
- IT** - 1 video
- Database** (Database Modelling with ERwin, Database implementatio) - 5 videos
- LabVIEW** - 8 videos
- OPC** (Practical Videos about OPC) - 6 videos

Figure 8-6: Examples of Video Playlists

The videos are used by the students to prepare themselves for new topics, practice on skills in different software tools, but they are also ideal for repetition, prepare for

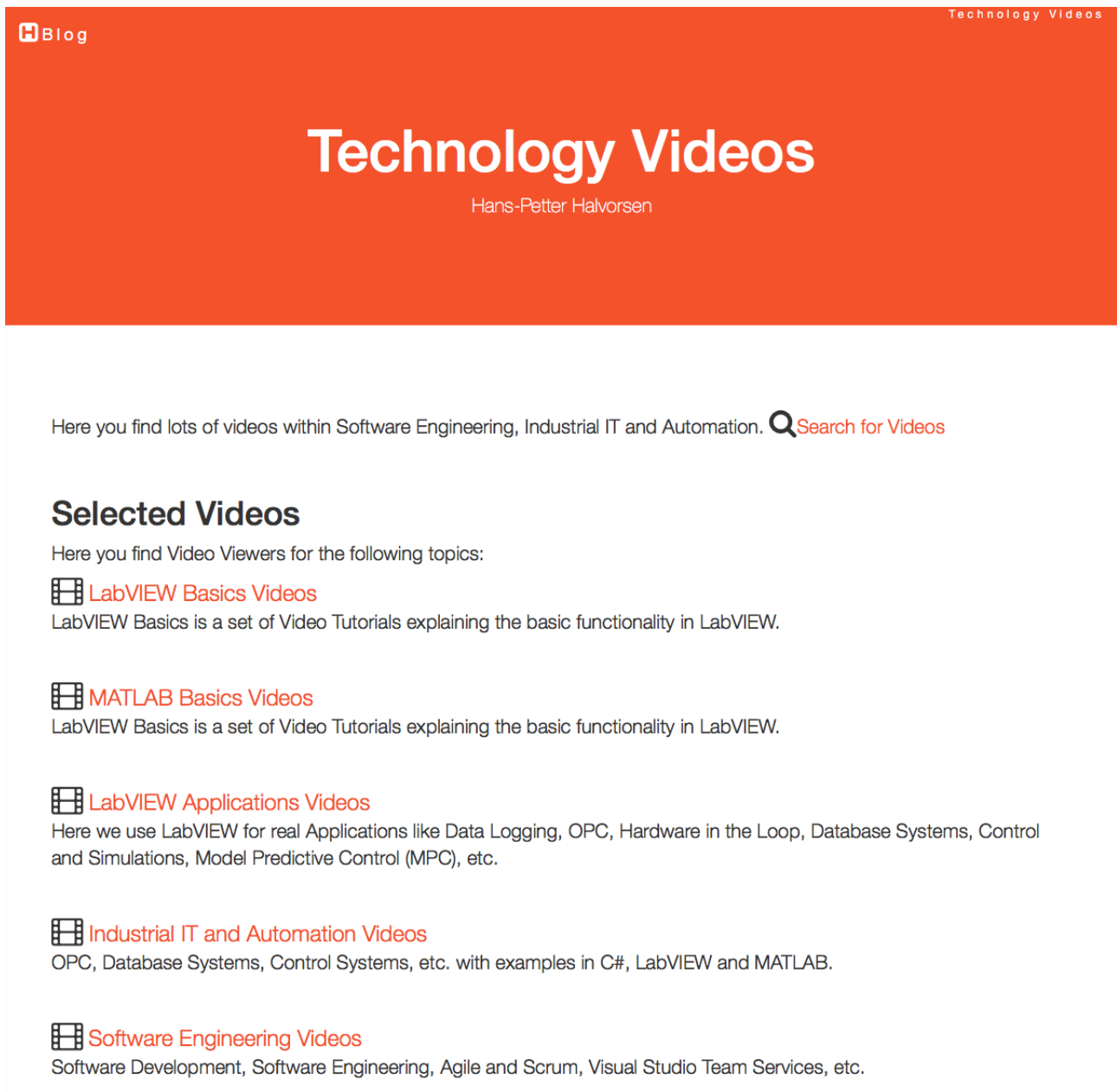
final exam, etc. Based on the videos, a set of exercises has been made, so that they need to pay attention and work with the contents of the videos.



The screenshot shows a web page with an orange header bar containing a 'Blog' icon and the text 'LabVIEW'. Below the header, the URL 'https://www.halvorsen.blog' is visible. The main content area is titled 'Getting Started with LabVIEW:' and features a video player. The video player has a large red title 'Getting Started with LabVIEW' and a play button icon. To the right of the video player is a circular profile picture of a man with glasses. Below the video player, the name 'Hans-Petter Halvorsen, M.Sc.' is displayed. At the bottom of the page, there is a paragraph of text explaining that LabVIEW is a full-blood programming language and listing various applications like Datalogging and Monitoring, DAQ, Control Systems, etc. It also includes a link to 'LabVIEW Basics'.

Figure 8-7: Example of Videos Embedded on the Web Site.

Different “Video Viewers” (see example in Figure 8-8) has also been made. Here you will find a selection of recommended Videos within the specific topic. Many of the videos are self-produced, while others are carefully selected from other sources.



Blog Technology Videos

Technology Videos

Hans-Petter Halvorsen

Here you find lots of videos within Software Engineering, Industrial IT and Automation. [Search for Videos](#)

Selected Videos

Here you find Video Viewers for the following topics:






-  [LabVIEW Basics Videos](#)
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
-  [MATLAB Basics Videos](#)
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
-  [LabVIEW Applications Videos](#)
Here we use LabVIEW for real Applications like Data Logging, OPC, Hardware in the Loop, Database Systems, Control and Simulations, Model Predictive Control (MPC), etc.
-  [Industrial IT and Automation Videos](#)
OPC, Database Systems, Control Systems, etc. with examples in C#, LabVIEW and MATLAB.
-  [Software Engineering Videos](#)
Software Development, Software Engineering, Agile and Scrum, Visual Studio Team Services, etc.

Figure 8-8: Video Viewer with Videos for a specific Topic or Course

In the Video Viewers, which are integrated in my web site, you have easy access to all videos within a specific topic in one place.

The videos are also available here (some examples), sorted by topics:

OPC Videos:

<https://www.youtube.com/playlist?list=PLdb-TcK6Aqj2OVrI5hRWSCZkCZParNnq7>

Database Videos:

<https://www.youtube.com/playlist?list=PLdb-TcK6Aqj0PedGwO7CUI6WBRyia7EQh>

Hardware in the Loop Simulation and Testing:

https://www.youtube.com/playlist?list=PLdb-TcK6Aqj3ti-q-V5cGudHltvcn_Aqk

DAQ (Data Acquisition):

<https://www.youtube.com/playlist?list=PLdb-TcK6Aqj14pdOo1Hx12fcpsloyutTY>

Visual Studio:

<https://www.youtube.com/playlist?list=PLdb-TcK6Aqj3pVNwegVKUGoHN3mi6IXjk>

Industrial IT:

https://www.youtube.com/playlist?list=PLdb-TcK6Aqj0ITAHPH6cTacNO31X94X_g

SCADA (Supervisory Control and Data Acquisition):

https://www.youtube.com/playlist?list=PLdb-TcK6Aqj3kVsLYLS_Fr_I87Ylqmbz

LabVIEW:

<https://www.youtube.com/playlist?list=PLdb-TcK6Aqj1xrRePtZy5FW-fCyFg5seb>

Automation:

<https://www.youtube.com/playlist?list=PLdb-TcK6Aqj3ERaDYI5azTAavCzFBzSLP>

Scrum:

<https://www.youtube.com/playlist?list=PLdb-TcK6Aqj2CBhgByR9v67BcZwExwsdd>

More videos and playlists (videos organized in groups or topics) are added continuously.

An updated web page with all videos can be found here:

<http://www.halvorsen.blog/documents/video/videos.php>

YouTube Channel:

<https://www.youtube.com/IndustrialITandAutomation>

8.5 Flipped Classroom

Figure 8-9 shows the basic idea of the basic principles of Flipped Classroom.

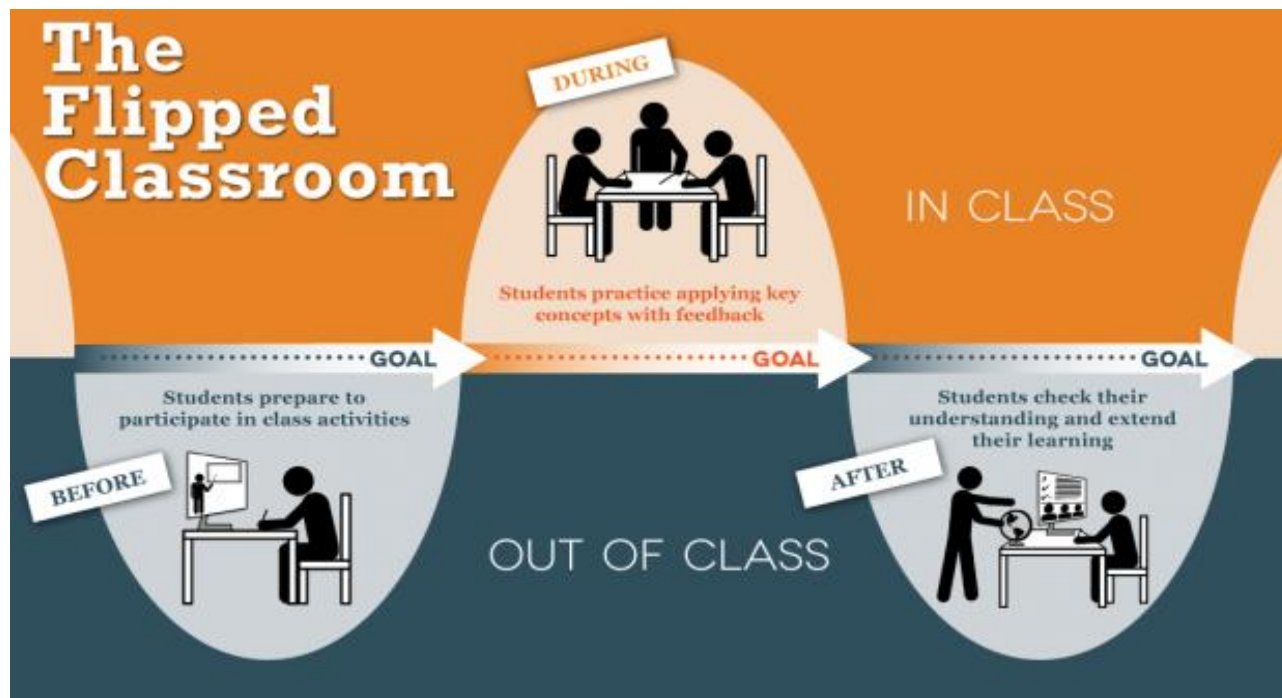


Figure 8-9: The Flipped Classroom Principles [Source:

<https://learningsciences.utexas.edu/teaching/flipping-a-class>]

Flipped Classroom is based on established teaching methods such as problem-based learning and student-centered approaches, which my focus.

Flipped Classroom reverse the more traditional teaching principles where the educator uses most of time on ordinary lectures, then the students go home a do exercises linked to what was presented in the lecture. With Flipped Classroom, the students are forced to be prepared (watching videos, reading other resources, etc.) for class activities, and instead of lectures the students do exercises, etc. either individually or in groups in class. In that way, the educator can focus more on helping the students with things they struggle with and follow up the students individually.

The main advantage is that the students become more active participants in the learning process. Instead of being a passive passenger on during lectures they get more involved in their own learning. Figure 8-10 shows the teaching outcome based on different types of teaching principles.

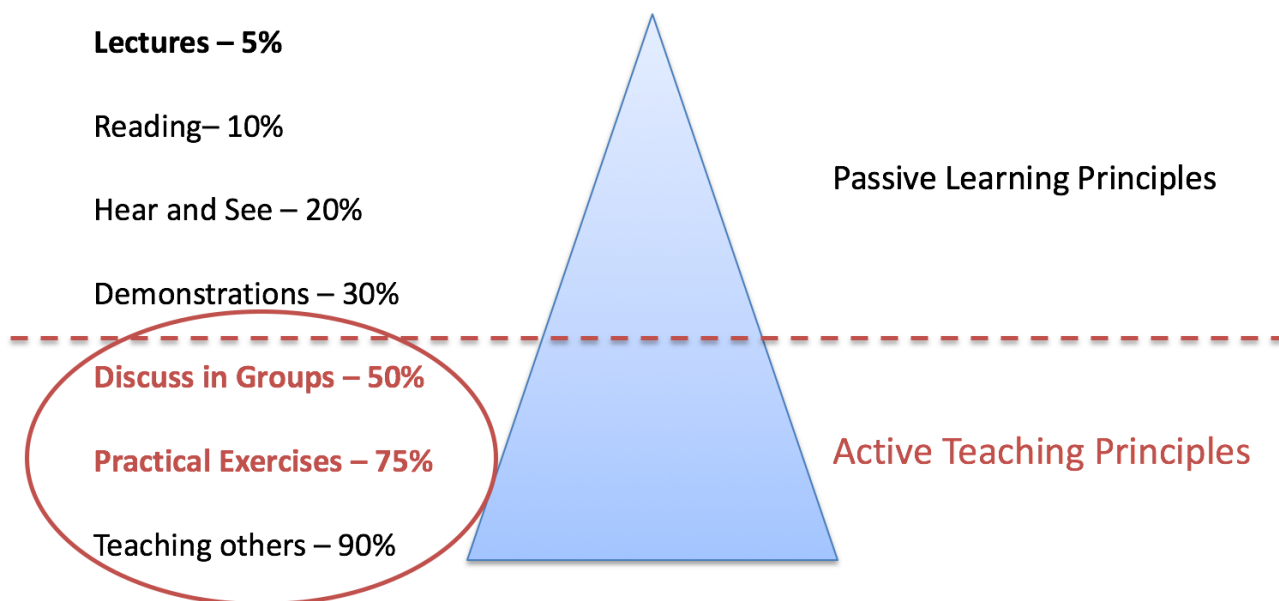


Figure 8-10: The Teaching Outcome from different Teaching Principles

It's important to notice that flipping the classroom doesn't make it easier for the educators, but rather the opposite. The main goal is to increase the learning outcome for the students and make them take responsibility for their own teaching.

For the first it's a lot of hard work preparing all the material, either it is videos, written material or other resources. But you don't necessarily need to create all the material from scratch, because lots of material do already exist out there. So, in my teaching material which I make available on web pages on my Blog I integrate lots of material from others in addition to my own material in a comprehensive manner.

The educator also needs to very well prepared for class, probably much more than for ordinary lectures.

A "problem" with more interactive teaching principles like Flipped Classroom, is that the student not necessary love the concept in a short-term view, because student tend to love ordinary lectures. Because with ordinary lectures they can just drop in without any kind of preparations, so ordinary lectures are an easy and convenient solution many students like. The students feel comfortable and it requires little effort from them, but as Figure 8-10 tells they don't necessary learn so much from ordinary lectures (just 5% as stated in Figure 8-10). The learning process is hard and the educators should not necessary choose what's most convenient for the students in a short term, but rather think what's best for them in the long term, and the goal is to make them useful in an upcoming work situation.

8.6 Agile methods and Scrum methodology

I use Agile methods and Scrum methodology known from System/Software Engineering within my teaching. This is especially relevant in PPBL (Problem/Project Based Learning) methods such as student projects, which are integrated in many of the courses at our university. In Scrum a simplified project model is used together with numerous iterations. This makes it easier to have close interaction with the students during small case projects and larger projects.

Figure 8-11 shows an example of a digital Scrum/Task Board used in a student project.

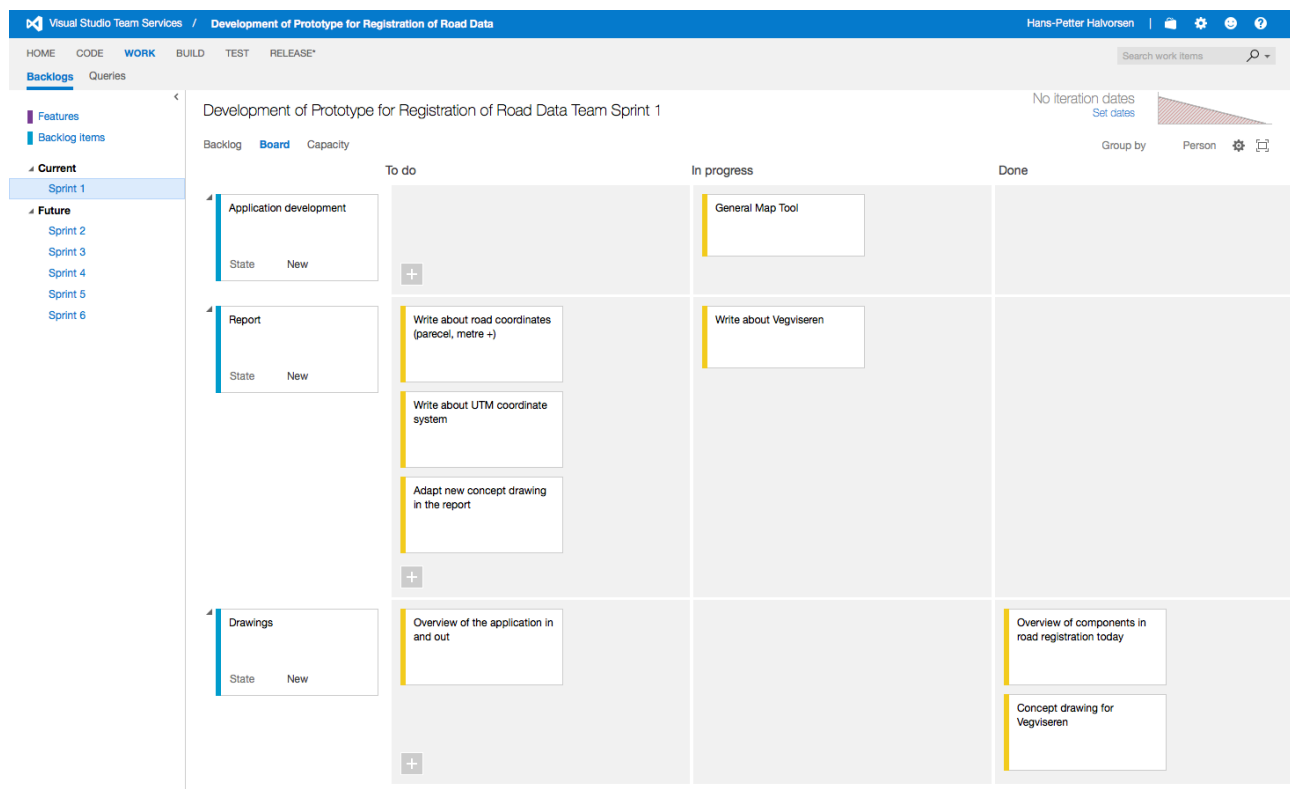


Figure 8-11: Example of Digital Scrum/Task Board used in a Student Project

Azure DevOps has been used as the software tool to handle the Scrum process. In addition, my own Project Management tool is used in different student projects, see Chapter 28 and Chapter 32 for more information about the Project Management System.

For more information about Azure DevOps, please see some of my videos on this topic:

- Scrum with Examples (<https://www.youtube.com/watch?v=h3RVZv3NGWk>)
- Introduction to Azure DevOps (<https://www.youtube.com/watch?v=cWdHuFetOIA>)

More about Agile methods and Scrum methodology in chapter 17.

8.6.1 Publications

Publications within this area:

- **Experience with Case-projects in Bachelor and Master Studies in Electrical, IT and Systems & Control Engineering** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam - EAEEIE 2013, 24th EAEEIE (European Association for Education in Electrical and Information Engineering) Annual Conference, Chania, Greece 30 - 31 of May, 2013.

8.7 Quiz and Questionnaire System

Several existing systems for testing the skills of the students have been used and testing during the years, such as Kahoot, Google Forms similar tools.

Kahoot is a game-based learning platform used to ask questions to students in real-time.

These kinds of tools make the teaching more interactive and it's a nice way to summarize what's done. To make it even better, not only the educator should be in charge of making questions and answers, the students should also be responsible for making questions in turns. A group of students can then, e.g., make 10 questions and answers for one topic in the syllabus which they present for the rest of the class, etc.

While Kahoot is for reviewing the student knowledge as part of the class activities, Google Forms or other tools are better for off-classroom reviews and testing.

With Google Forms or similar tools, the students can take the question form and review or rehearse their knowledge when it suits them, typically after a teaching session or before the final exam.

Based on the experiences using these tools, a new Quiz and Questionnaire System has been developed from scratch fitting all my needs. See Figure 8-12.

Quiz Management System
Hans-Petter Halvorsen

Logout

Quizzes

Group:
Industrial IT

Below you find available Quizzes for the selected Group:

QuizId	Quiz Name	Action	Questions
12	Database Systems	View Quiz Edit Quiz Delete Quiz	Questions
42	TI Database Systems - Lab Summary	View Quiz Edit Quiz Delete Quiz	Questions
13	HIL	View Quiz Edit Quiz Delete Quiz	Questions
43	TI HIL - Lab Summary	View Quiz Edit Quiz Delete Quiz	Questions
11	OPC	View Quiz Edit Quiz Delete Quiz	Questions
41	TI OPC - Lab Summary	View Quiz Edit Quiz Delete Quiz	Questions

New Quiz

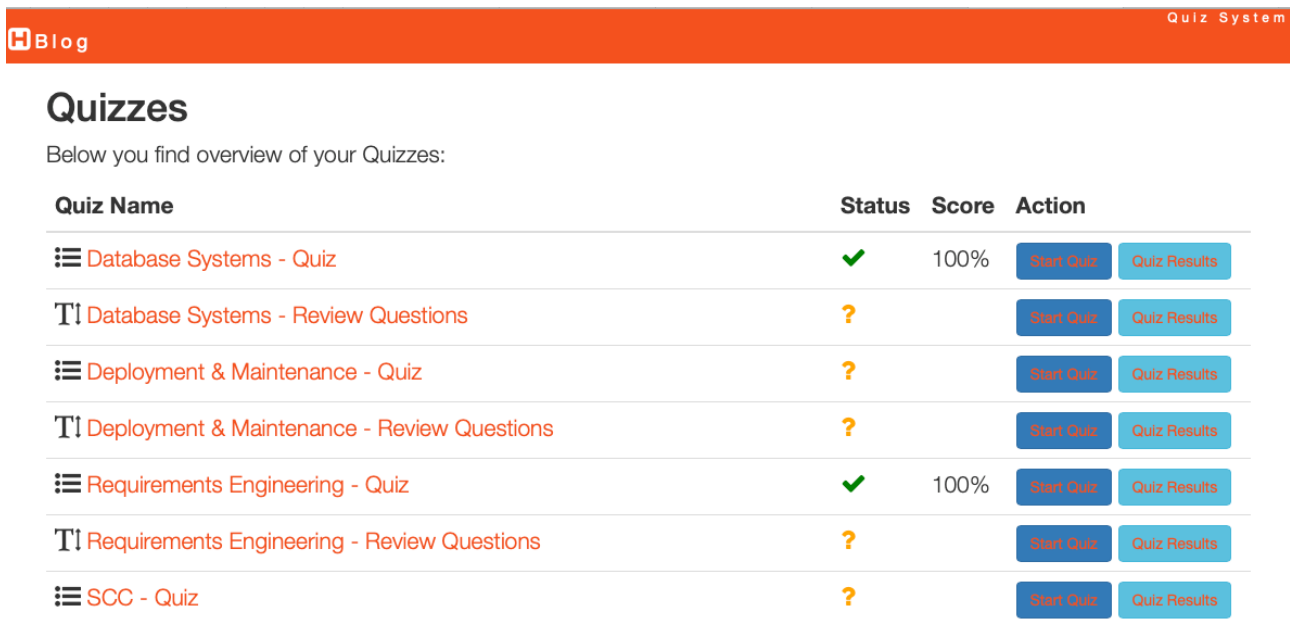
Figure 8-12: Quiz Management System

This new tool is in weekly use within all my courses such as Software Engineering, Industrial IT, Systems and Control Laboratory.

The Quiz and Questionnaire System has the following features:

- Create and change existing quizzes and questionnaires
- Create multiple choice and text answers
- An attendance key is necessary when taking the quizzes and questionnaires
- See results and statistics from quizzes and questionnaires for a single quiz or Questionnaire or groups, e.g., a specific course, etc. See Figure 8-13

- The administrator sees the results for a specific class, either a single quiz or a collection of quizzes. The end user sees only the results from the quizzes he or she has taken.



The screenshot shows a web interface for a Quiz System. At the top, there is a red header bar with a 'Blog' icon on the left and 'Quiz System' text on the right. Below the header, the word 'Quizzes' is displayed in a large, bold font. Underneath, a subtitle reads 'Below you find overview of your Quizzes:'. The main content is a table with the following columns: 'Quiz Name', 'Status', 'Score', and 'Action'. The table lists seven quizzes, each with a 'Start Quiz' and 'Quiz Results' button. The status of each quiz is indicated by a green checkmark or a yellow question mark.

Quiz Name	Status	Score	Action
☰ Database Systems - Quiz	✓	100%	Start Quiz Quiz Results
TI Database Systems - Review Questions	?		Start Quiz Quiz Results
☰ Deployment & Maintenance - Quiz	?		Start Quiz Quiz Results
TI Deployment & Maintenance - Review Questions	?		Start Quiz Quiz Results
☰ Requirements Engineering - Quiz	✓	100%	Start Quiz Quiz Results
TI Requirements Engineering - Review Questions	?		Start Quiz Quiz Results
☰ SCC - Quiz	?		Start Quiz Quiz Results

Figure 8-13: Quiz Overview for a specific Course

In the course Software Engineering a question form for each session or topic covered in the course (about 13 questions forms) has been made. Here are some examples:

- Software Engineering
- Requirements Engineering
- Scrum and Agile Development
- Software Architecture
- Database Systems
- Source Code Control
- Software Testing
- Software Deployment and Maintenance
- etc.

In the courses, Industrial IT and Systems and Control Laboratory I have made a question form the students need to take after a laboratory work session to get

approved. Then I can use the built-in tools to see the results and statistics for individual students or the whole class.

Industrial IT:

- OPC
- Hardware in the Loop
- Database Systems
- SCADA

Systems and Control Laboratory:

- Internet of Things Control Systems
- Machine Learning in Automation Systems
- Industry 4.0 and Automation

9 YouTube

As mention in the previous chapter, videos are an important addition to other teaching resources. I use videos a lot as a supplement to written materials, such as eBooks, tutorials, web pages and web resources.

In addition to include these videos in my blog/web site, I have a separate YouTube channel called “Industrial IT and Automation”:

<https://www.youtube.com/IndustrialITandAutomation>

In my YouTube channel (Industrial IT and Automation) you find 100+ videos within Programming, Software Development, Software Engineering, Data Science, Industrial IT and Automation.

My YouTube Channel (Industrial IT and Automation) has more than 1200 Subscribers.

Each month my YouTube channel has almost 10.000 views. The last 365 days people spent more than 400.000 minutes watching my videos and the total numbers of views per year is close to 100.000.

My most popular video is Introduction to OPC with Examples with 16.000+ views.

Other popular videos are:

- Datalogging and Monitoring LabVIEW Project (13.000+ views)
- Database Communication using LabVIEW (12.000+ views)
- Simulation in LabVIEW (8.000+ views)
- USB-6008 in Visual Studio and C# (7.000+ views)
- etc.

Figure 9-1 shows some of the highlight regarding the activities in my YouTube channel.

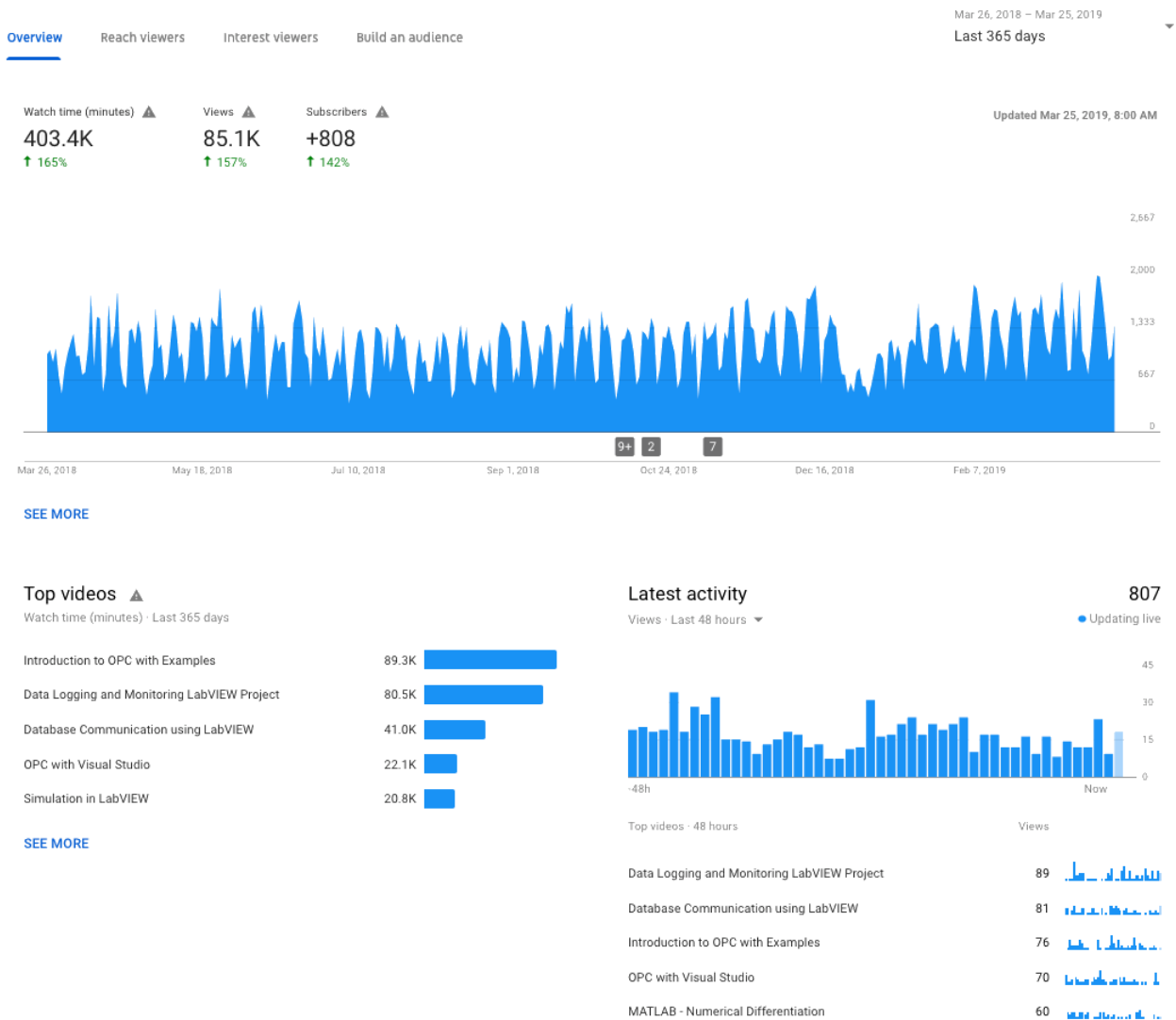


Figure 9-1: YouTube Channel Statistics [2019.03.27]

Figure 9-2 shows a list of countries where the people watching the videos are located.

We see that most of the viewers are from outside Norway, where large countries like USA, India and Germany are the most frequent viewers.

This means that the videos are used by far more than my own students in Norway.

Channel
Industrial IT and Automation ▾

Filter

Video Traffic source **Geography** Viewer age Viewer gender Subscription status

Geography	Watch time (minutes) ▲	Views ▲
<input type="checkbox"/> Total	625,600 100.0%	131,711 100.0%
<input type="checkbox"/> United States	69,308 11.1%	12,265 9.3%
<input type="checkbox"/> India	58,044 9.3%	13,064 9.9%
<input type="checkbox"/> Germany	26,989 4.3%	4,929 3.7%
<input type="checkbox"/> Mexico	7,442 1.2%	1,783 1.4%
<input type="checkbox"/> United Kingdom	5,613 0.9%	986 0.7%
<input type="checkbox"/> Norway	5,517 0.9%	889 0.7%
<input type="checkbox"/> South Korea	2,858 0.5%	434 0.3%
<input type="checkbox"/> Taiwan	2,111 0.3%	377 0.3%
<input type="checkbox"/> Vietnam	1,791 0.3%	554 0.4%
<input type="checkbox"/> France	1,687 0.3%	366 0.3%
<input type="checkbox"/> Canada	1,492 0.2%	396 0.3%
<input type="checkbox"/> Italy	1,391 0.2%	266 0.2%
<input type="checkbox"/> Turkey	1,103 0.2%	457 0.3%
<input type="checkbox"/> Brazil	1,087 0.2%	228 0.2%
<input type="checkbox"/> Indonesia	1,084 0.2%	298 0.2%
<input type="checkbox"/> Spain	1,055 0.2%	245 0.2%

Figure 9-2: Geographic/Country Location

YouTube has lots of built-in statistics, which is handy to use when you want to analyze your data.

From Figure 9-3 we see that most of the users are between 18-34 years, and the largest group are between 25-34 years that have close to 60% of the viewers.

This means besides students which are typically in the group 18-24 years, the channel has lots of viewers that are in work (25-34 years).

Viewer age ▲	Views ▲
13–17 years	–
18–24 years	37.2%
25–34 years	59.8%
35–44 years	2.8%
45–54 years	0.3%
55–64 years	–
65+ years	–

Figure 9-3: Age of the Viewers

10 Textbooks

As part of my teaching, research and development activities several textbooks have been written within different fields and areas:

- Python Programming
- Arduino
- Software Engineering
- Industrial IT
- Automation

Below you find an overview of the different textbooks.

10.1 Python

Software are an important part of our digital lives, and our way of living has dramatically changed with computers and software applications. We are totally dependent on people who have knowledge of this in today's modern society.

We have today several thousand different Programming Languages, so why should we learn Python? I guess you will need to learn more than one Programming Language to survive in today's software market. Python is easy to learn, so it is a good starting point for new programmers. In addition, Python is highly extendible, so Python is also used by professions.

Textbook:

Python Programming - Hans-Petter Halvorsen. ISBN: 978-82-691106-4-7. 2019.

In addition to the textbook "Python Programming", several other Python books are under construction (see Figure 10-1). Altogether, eventually, the following Python textbooks will be available:

- Python Programming
- Python for Science and Engineering
- Python for Control Engineering

- Python for Software Development

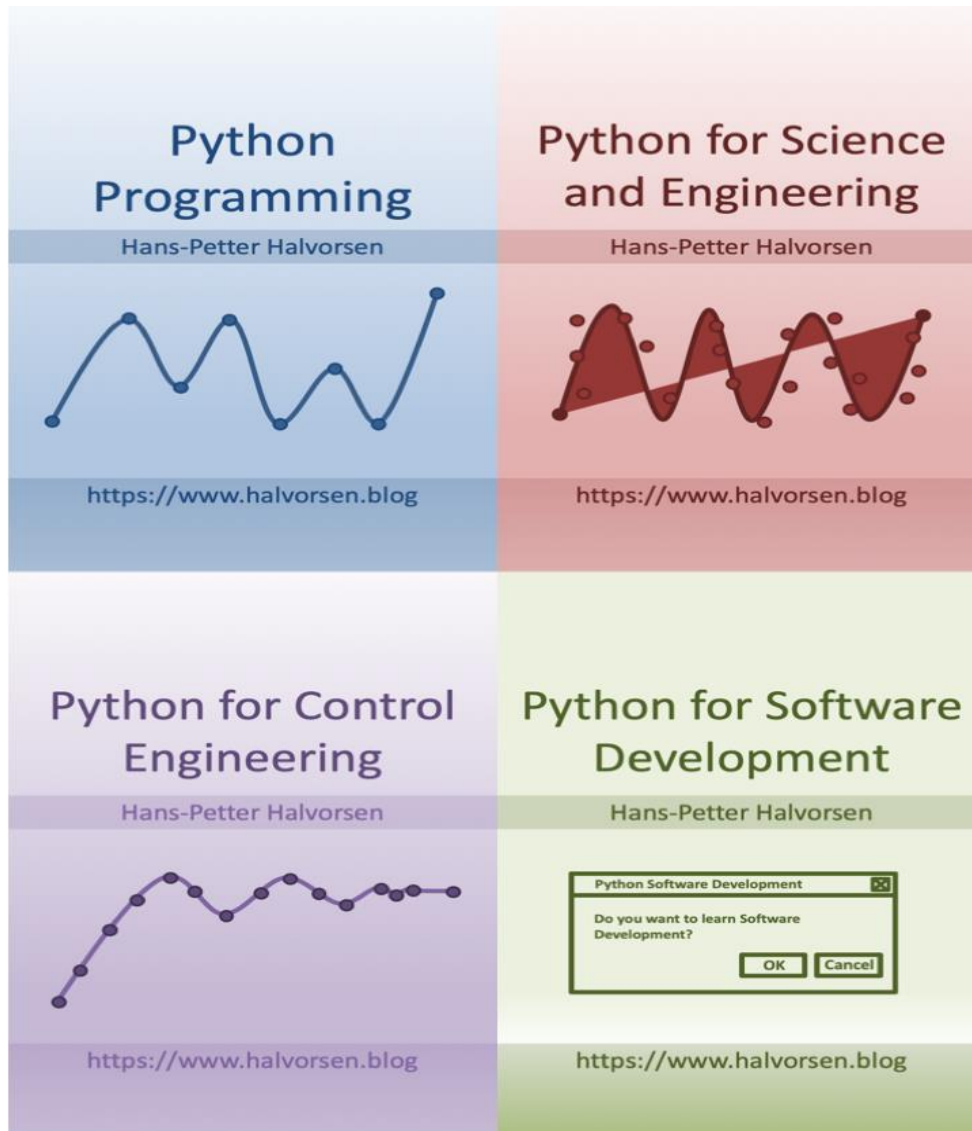


Figure 10-1: Textbooks within Python Programming

Web resources:

<https://www.halvorsen.blog/documents/programming/python/>

10.2 Arduino

Using the Arduino platform, you will learn the basics about computers, basic electronics, sensor and measurement technology and programming.

Arduino is also ideal for combining software and hardware and see how we can communicate with the outside world using computer programs and create simple prototypes.

Textbooks:

Programming with Arduino - Hans-Petter Halvorsen. ISBN: 978-82-691106-3-0. 2018.

Arduino Programmering (In Norwegian) - Hans-Petter Halvorsen. ISBN: 978-82-691106-2-3. 2018.

Web resources:

<https://www.halvorsen.blog/documents/technology/iot/arduino.php>

The target audience for these Arduino textbooks are everybody that wants to learn more about technology and programming where they with lots of practical examples can see how technology and programming can be applied in real life scenarios.

The approach where the students can make small prototypes and programs and instantly see some results are a very educational and pedagogical method to learn new students technology and programming.

In addition, this approach can be extended and be used related to more advanced topics. The concept can be used beginning with high school and up to Master level.

10.3 Software Engineering

Software Engineering is the foundation for making professional software which are important in the digital world we live in.

Textbook:

Software Development - A Practical Approach! - Hans-Petter Halvorsen. ISBN: 978-82-691106-0-9. 2017.

Web resources:

https://www.halvorsen.blog/documents/programming/software_engineering/

10.4 Industrial IT and Automation

Industrial IT and automation are foundation for our modern lives and in our high standards of living.

Textbook:

Industrial IT and Automation - A Practical Approach! - Hans-Petter Halvorsen. ISBN: 978-82-691106-1-6. 2017.

Web resources:

https://www.halvorsen.blog/documents/technology/industrial_it_automation.php

11 Teaching at Bachelor Level

I am/have been involved in the following Bachelor courses at University of South-Eastern Norway (previously Telemark University College and University College of Southeast Norway).

Current Courses:

- IA4412 – Software Engineering (Course coordinator)
- IA3112 – Automation Systems (“Automatiseringsteknikk”) (Lab Work, LabVIEW Training)
- PRH606 – Main Project (Supervisor)

Previous Courses:

- EE4007 – Cybernetics Foundation (Lab Work)
- EE4107 – Cybernetics Advanced (Course coordinator, Lab Work + Project)
- EE3107 – Cybernetics Project (Course Coordinator)
- PRG106 – 1. Semester Project (F1 project) (Supervisor)
- IA6209 – Industrial Communication and Computer Network (Lab Work/Project)
- IA5106 – “Automatiseringsteknikk og praktisk modellering” (Lab Work/Project)
- EE4209 – Model-based Control (Course coordinator, Teaching, Lab Work)
- IA4212 – Instrumentation (“Instrumenteringsteknikk”)

Most of these previous courses no longer exist at University of South-Eastern Norway due to changes in the curricula and the study programs.

Below I will go through the educational contents of some of my current courses.

Web Site:

<https://www.halvorsen.blog/documents/teaching/teaching.php>

11.1 Software Engineering

At Bachelor level, I teach the following course:

IA4412 – Software Engineering (Norwegian: “Systemutvikling og dokumentasjon”)

I am teaching system engineering/software engineering at Bachelor level. Figure 11-1 shows the web page (a small part of it) for this course.

Course Schedule

[Course Registration](#) (first time only!) [Quiz System](#)
 Office Hours: Tuesdays 10:15-14:00 and Fridays 10:15-14:00 @ Room C-139a
[Software Engineering Topics - Week by Week](#)

Time	Topics	Work
Part I - Planning		
Week 2	1. Project Kick-off and Planning	Week Assignment
Tue 9.1	Project Start & Project List	
Fri 12.1		Quiz
Part II - Requirements Engineering		
Week 3	2. Requirements Engineering	Week Assignment
Tue 16.1	Planning Review	
Fri 19.1		Quiz
Part III - Software Design		
Week 4	3. Database Systems	Week Assignment
Tue 23.1	Requirements Engineering Review	
Fri 26.1		Quiz
Week 5	4. Unified Modeling Language (UML)	Week Assignment
Tue 30.1	Database Review	
Fri 2.2		Quiz
Week 6	5. Software Development Processes and Scrum	Week Assignment

Figure 11-1: An Excerpt from the Web Site for the Software Engineering Course

The course is organized as a project, i.e., the learning occurs through a large team project and there are few traditional lectures! This requires active participation from the students from start to finish. Learning is ensured by so-called “week

assignments” that defines the focus, goals, tasks and work effort from week to week.

The course has a mix of short introduction lectures, project work, team work, Scrum meetings, project meetings, problem solving, exercises, reviews, discussions, quizzes, independent work, etc. The course is based on Project and Problem based learning methods (PPBL). In addition, the course is highly research-based with focus on the latest technology (this also means that the teachers don’t have all the answers!). The course uses a practical approach with focus on practical implementations and less theory. In many cases the students will need to find answers and solutions outside the classroom, using other sources, like, internet, books, etc. The course is also based on “Flipped Classroom”, i.e., the students need to read the theory, watch videos, etc. in advance at home (in general be prepared) so we can focus more on interactive teaching and guidance (discussions, group work and practical exercises) in the class.

Figure 11-2 shows the main teaching activities in the Software Engineering course.

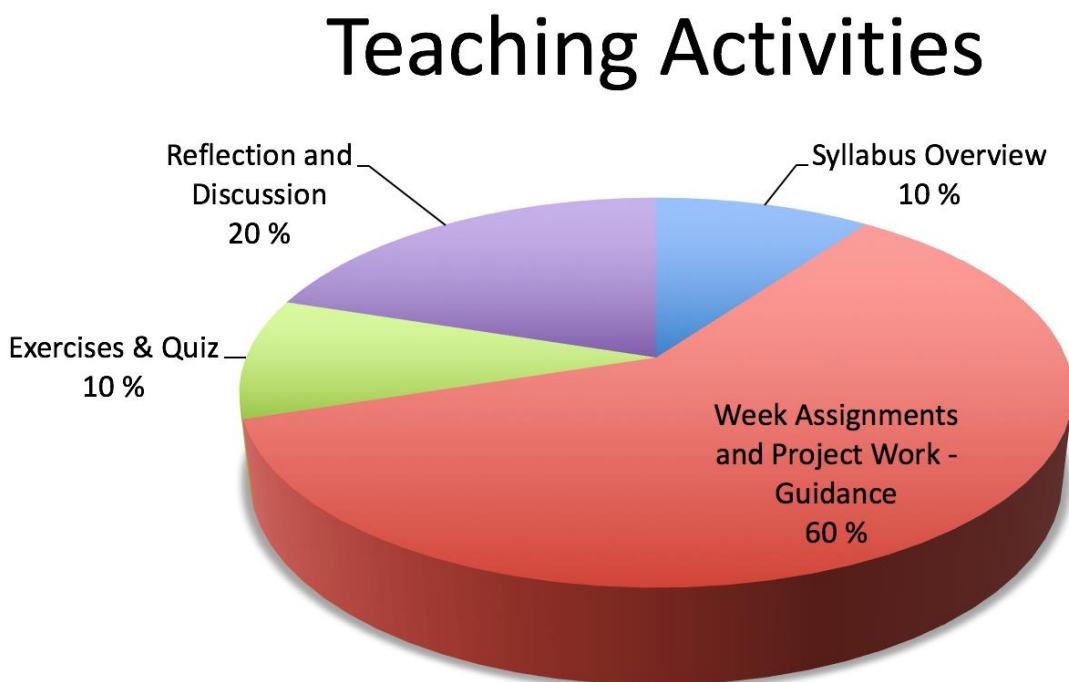


Figure 11-2: Teaching Activities in Software Engineering Course

The project counts 70% of the grade, while an individual written final test (30%) tests the knowledge accumulated through the project and the course as a whole. See Figure 11-3 for details.

Assessment Methods

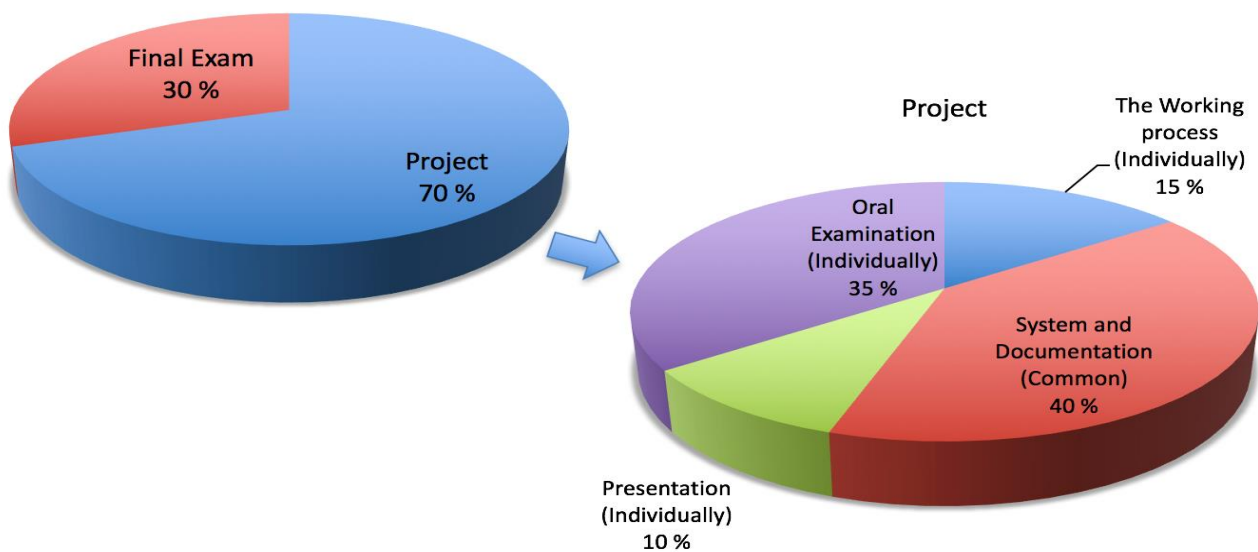


Figure 11-3: Assessment Methods in Software Engineering Course

For detailed information about the course, please see:

https://www.halvorsen.blog/documents/teaching/courses/software_engineering.php

11.2 Control Engineering

As mentioned, I have previously been involved in different courses at Bachelor level within control theory and engineering.

In that connection, a lot of teaching material, compendiums, etc. have been developed.

Some examples are:

- Control Theory with MathScript Examples
- Reguleringssteknikk vha MathScript (In Norwegian)
- Kalmanfilter, Compendium and Exercises (In Norwegian)
- Observers, Compendium and Exercises (In Norwegian)
- Systemidentifikasjon, Compendium and Exercises (In Norwegian)

For more information, see the following web site:

http://www.halvorsen.blog/documents/teaching/teaching_material.php

11.3 Main Project (Norwegian: Hovedoppgave)

Below we see some examples of Bachelor projects that have been carried the last 5 years. Local industry has been heavily involved in these projects.

- Environmental Public Health Information Management System (Partner Tel-Tek, Porsgrunn Kommune, Sykehuset i Telemark, m.fl.)
- Drilling Simulator (Partner: Kelda Drilling Control)
- DeltaV (Partners: Yara, Emerson Process Management)
- DeltaV Prosessautomasjonssystem (Partners: Emerson Process Management)
- Sensor datafusjon med DeltaV – Integring av trådløse og trådbaserte sensorer for fjern- overvåkning og styring (Partners: Yara, Emerson Process Management)
- Utvikling og prosjektering av laboratorium med prosessmodell (Partners: Yara)
- Ombygging av mobil flerfaserigg til stasjonær flerfaserigg (Partners: Porsgrunn Videregående/TAF, Emerson Process Management)

See chapter 24 for more details about some of these projects.

As part of the assessment and grading, I have created an Assessment Form in Excel (Figure 11-4) which is used in cooperation with the external sensor.

With this Assessment Form, it is easy to fill out and share information regarding the assessment with the external sensor.

Vurderingsskjema Bacheloroppgaven (PRH612) - Rapport

Prosjektruppe:
 Prosjekttittel:
 Veileder:
 Sensor:

Karakter:
 Overordnet tilbakemelding:

#	Kriterium	Vekt (%)	Kommentar	V (0-10)	S (0-10)	AVG	Weighted (%)
1	Helhetsinntrykk. Oppgavens originalitet, Helhetlig forståelse, Rapportens ryddighet og fremstilling, faglig nivå, fulgt rapportmalen, Helhetlig forståelse,	20				0	0
2	Rapportstruktur. Rapportens ryddighet og fremstilling. Fokus på introduksjon, metoder, resultat og diskusjon	10				0	0
3	Problembeskrivelse. I hvilken grad problemet er klart beskrevet, metoder er begrunnet og anvendt. Oppgavens originalitet (om kandidaten evner å skille eget bidrag fra andres	5				0	0
4	Faglig og språklig presisjon	10				0	0
5	Faglig nivå og presisjon. Integreere ervervede kunnskaper, evner og tilegne seg ny kunnskap	10				0	0
6	Resultatomtale. Hvordan resultatet er analysert og dokumentert (Evne til analyse, diskusjon og refleksjon).	10				0	0
7	Diskusjon og konklusjon. Konklusjonens kobling til problemstillingen.	10				0	0
8	Kildebruk/Referanser. At alle kilder er referert. Kandidatens evne til å vurdere kildens relevans og kvalitet på en kritisk måte.	5				0	0
9	Selvstendighet, initiativ, forståelse, modenhet. I hvilken grad kandidaten selv har generert viktige elementer/problemstillinger/ideer i oppgaven.	20				0	0
	Sum	100					0

Eventuelle utfyllende kommentarer til rapporten/System som er laget:

#	Kommentar/Merknad
1	
2	
3	
4	
5	
6	

Figure 11-4: Extraction from Assessment Form for Bachelor Project (In Norwegian)

12 Teaching at Master Level

I am involved in the following Master courses at University of South-Eastern Norway:

- SCE4206 - Systems and Control Laboratory (Course Coordinator)
- SCE2006 - Industrial Information Technology (Lab Work/Case Projects)
- MATLAB Course (course coordinator and instructor)
- SCE1213 - Hard/Soft Sensors in Process Measurements
- SCE4006 - Project (Supervisor)
- FMH606 - Master's Thesis (Supervisor)

All the Master courses are taught in English.

Web Site:

<https://www.halvorsen.blog/documents/teaching/teaching.php>

PPBL is heavily used throughout the “Industrial IT and Automation” Master program at University of South-Eastern Norway. PPBL is integrated in all courses at different levels from laboratory work, case projects, ordinary project courses, and final Master project, both individually and group based.

With PPBL the students get practical industrial experience both within programming and use of relevant hardware. They need to develop and integrate software and hardware into a unified solution using known software engineering principles.

When the students are finished, they will have knowledge of data acquisition, database systems, data communication and networks, automation and control, etc.

Below I will go through the educational contents of some of these courses.

12.1 MATLAB Course

For some years, I have been teaching MATLAB to new Master students, totally about 75 students per year. The course is for all 3 Master programs at the Faculty of

Technology, namely Process Technology (PT), Energy and Environmental Technology (EET) and Industrial IT and Automation (IA).

MATLAB is a numerical computing environment developed by The MathWorks, MATLAB allows matrix manipulation, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs in other languages. MATLAB is an abbreviation for MATrix LABoratory, so it well suited for matrix operations. MATLAB is widely used in research and education.

The MATLAB Course consists of 3 parts:

- Part I: Introduction to MATLAB
- Part II: Modelling, Simulation and Control
- Part III: Advanced Topics and Simulink

Each part has a separate document with detailed solutions.

Since MATLAB is a computer software used for simulations, etc. it is crucial that the students get experienced using the software (and not only learn about it on the blackboard). The course is a foundation for the different MATLAB activities in other courses.

Figure 12-1 we see the web page for the MATLAB course.



[Course Overview](#) [Questions](#)

Introduction

[Course Overview](#)

In this MATLAB Training for Master Students at University College of Southeast Norway you will learn basic MATLAB and how to use MATLAB in Mathematics, Modelling, Simulation and Control applications. An introduction to Simulink and other Tools will also be given. MATLAB is a tool for technical computing, computation and visualization in an integrated environment. MATLAB is an abbreviation for MATrix LABoratory, so it is well suited for matrix manipulation and problem solving related to Linear Algebra, Modelling, Simulation and Control applications, etc.

The Video below gives an introduction to this course:



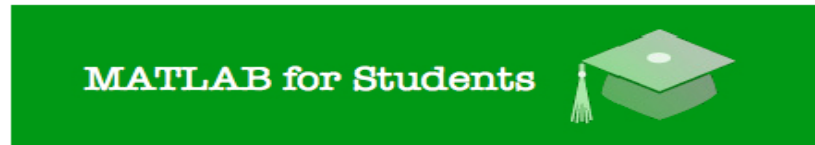
Figure 12-1: Web Page for the MATLAB Course

An important focus in the course is to do hands-on exercises based on real-life scenarios and applications.

An extensive course material has been specifically made for this course. The course material includes a set of written course manuals and a web page with lots of resources, such as videos, etc.

The course manuals (Figure 12-2) contain lots of Examples and self-paced Exercises that the users will go through and solve on their own. The user should go through the Exercises in the Course Manuals in their own pace depending on their background. The instructors (previous students) will be available for guidance and questions throughout the course.

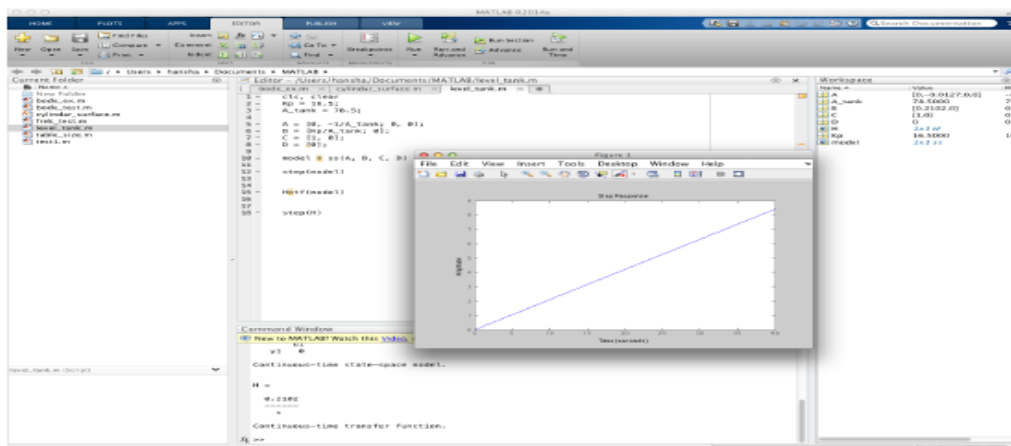
University College of Southeast Norway



MATLAB

Part I: Introduction to MATLAB

Hans-Petter Halvorsen, 2016.10.4



<http://home.hit.no/~hansha>

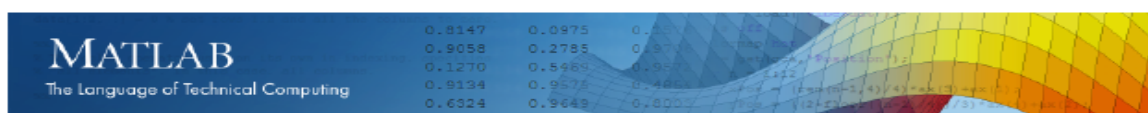


Figure 12-2: MATLAB Training Manual (Part 1 of 3)

The home page for the course is located on my blog/web site:

<http://www.halvorsen.blog/documents/teaching/courses/matlab.php>

The MATLAB course is a voluntary course that the students take in addition to compulsory courses.

What is the purpose with this voluntary course?

1. To give a Practical Introduction to basic Programming and Simulation.
2. Learn to apply basic Math and Physics knowledge (theory learned at Bachelor level) required in these Master programs.
3. To learn to use the MATLAB software within these Applications. When you have learned MATLAB, you may easily switch to similar programs.

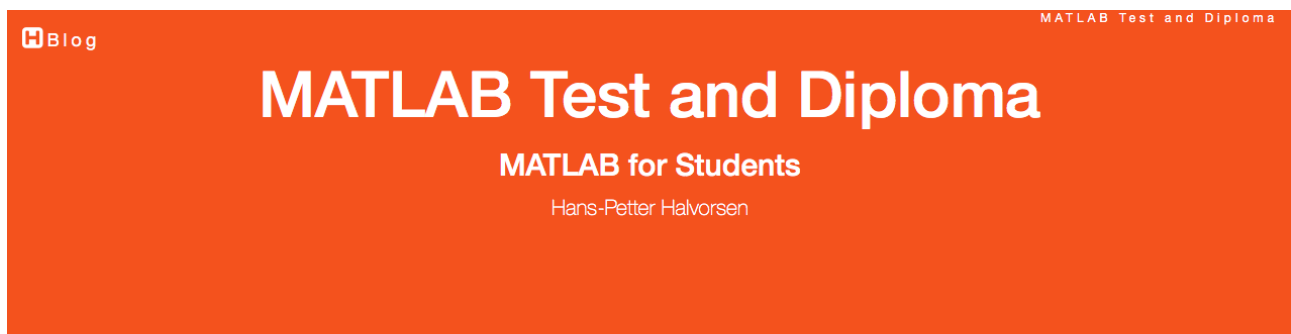
The students in these Master programs are from all over the world, so it is important that everyone have the same basic skills. Some of the students are inexperienced in programming and many have only been learning it from the blackboard only - with no practical implementations and experimentation.

MATLAB is very easy to use compared to similar tools, so it is a good tool to start with for inexperienced users. At the same time, it is very powerful, and it can be used for advanced simulations, so you will never grow away from it - neither in university or work context.

Teaching assistants (second year students) are used to help me with the teaching, supervision and guidance, because they know best where the shoe pinches.

Since there are no grades or credits in this course, I provide, as an extra service, a diploma. You will get this valuable diploma (handy when applying for jobs, etc.) only if you pass some following criteria, such as submitting exercises from the different parts.

Figure 12-3 shows parts of the multiple-choice test that finalize the course and makes it possible to print out the diploma.

A banner with an orange background. In the top left corner, there is a small white icon of a document with a plus sign followed by the word "Blog". In the top right corner, the text "MATLAB Test and Diploma" is written in a small, white, sans-serif font. The main title "MATLAB Test and Diploma" is centered in a large, white, bold, sans-serif font. Below the title, the subtitle "MATLAB for Students" is centered in a smaller, white, sans-serif font. At the bottom of the banner, the name "Hans-Petter Halvorsen" is centered in a very small, white, sans-serif font.

Blog

MATLAB Test and Diploma

MATLAB Test and Diploma

MATLAB for Students

Hans-Petter Halvorsen

MATLAB Test

Test your MATLAB skills with this MATLAB Test. The test contains **35 questions**. Each question have 3 alternatives where only one of the alternative is correct.

You get **+5** points for each correct answer and **-2** points for each wrong answer/answers you are not answering. The Top score is **100%**.

The student have **90 minutes** available for this test. When you are finished, please print out the diploma and give it to one of the instructors for signing. The instructor will check if you have the recorded attendance needed and check if you have submitted the necessary code. If you have passed all the criteria, the instructors will sign the diploma.

Note! For some of the questions you need to use MATLAB - but you cannot use the Course Manuals or collaborate with other students during the test! Any attempt of cheating will mean that you will be deprived of the opportunity to get diploma!

You dont need MATLAB for Questions 1-30, but you may use it if you want to. For Questions 31-35 you will need to use MATLAB in order to find correct answers.

Please fill in your Name:

Student Name:

I have completed the following parts (code is submitted and approved): Part I Part II Part III

Questions 1 - 10

(MATLAB not needed for these questions)

1. What does the letters in MATLAB mean?

- Math Laboratory
- MATrix LABoratory

Figure 12-3: Multiple-choice Test

When the students are finished with the multiple-choice test, they get online access to the diploma (see Figure 12-4) which they need to print out and get signed.

The total score (0-10%), the name of the student, which parts the students have fulfilled are automatically filled out.





2016.09.26

MATLAB Training

The following student has completed the MATLAB Training at University College of Southeast Norway:

Hans-Petter Halvorsen

Score: 100.0%

In the MATLAB Training the student has reviewed the following topics:

Part I: Introduction - MATLAB Basics

The MATLAB Environment, Using the Help System in MATLAB, MATLAB Basics, Linear Algebra; Vectors and Matrices, M files; Scripts and User-defined functions, Plotting, Flow Control; For and While Loops, If and Case statements, Mathematics.

Part II: Modelling, Simulation and Control

Differential Equations and ODE Solvers. Numerical Techniques such as Interpolation, Curve Fitting, Numerical Differentiation, Numerical Integration, Other topics are: Optimization, Control System Toolbox, Transfer functions, State-space models, Frequency Response, Discrete Systems.

Part III: Simulink and Advanced Topics

Advanced Topics in MATLAB, such as: Debugging in MATLAB, More about functions, More about Plots, Using Cells in the MATLAB Editor, Importing Data, Structures and Cell Arrays. This part also covers an Introduction to Simulink and an introduction to other Tools.

For more information about the contents of the course, please visit: <http://home.hit.no/~hansha/?training=matlab>

Course Instructor



Hans-Petter Halvorsen, Course Coordinator

<http://home.hit.no/~hansha>

MATLAB

The Language of Technical Computing

0.8147	0.0975	0.4551
0.9058	0.2785	0.8912
0.1270	0.5489	0.8912
0.9134	0.9575	0.3821
0.6324	0.9649	0.5061

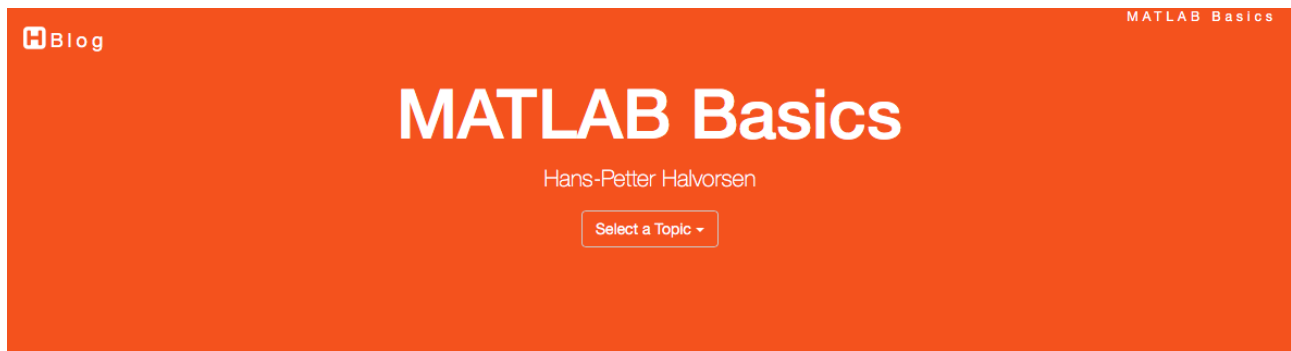
Figure 12-4: Final Diploma

I use this kind of testing in many situations where the students have approved/not approved requirements. It's easy for me because I don't need to go through all the answers (the system does it for me!), I get to test the skills of the students, and the student make an extra effort because they feel they get something with extra value for them.

For those who not follow the course on campus, anybody can get access to the same teaching material online:

http://www.halvorsen.blog/documents/programming/matlab/matlab_basics.php

Figure 12-5 shows the online MATLAB Training available for online students (or anybody else who are interested in learning about MATLAB).



MATLAB Basics

MATLAB is a tool for technical computing, computation and visualization in an integrated environment. MATLAB is an abbreviation for MATrix LABoratory, so it is well suited for matrix manipulation and problem solving related to Linear Algebra, Modelling, Simulation and Control applications, etc.

MATLAB Software:

If you dont have MATLAB, you can buy a **MATLAB student version** (350-699 NOK), which you can install on your personal computer. The MATLAB student version includes the most used Toolboxes as well, like Simulink, Control System Toolbox, Optimization Toolbox, Statistics Toolbox, etc.

Students and staff at **University College of Southeast Norway** can freely install the **MATLAB Software** on their own computers, since the university has a Total Academic Headcount (TAH) License. The Activation Key is located in Fronter, where only students and staff at the university have access.

See also the main **MATLAB** page.

1. Introduction to MATLAB

Watch the Video below in order to get an idea of what MATLAB is:

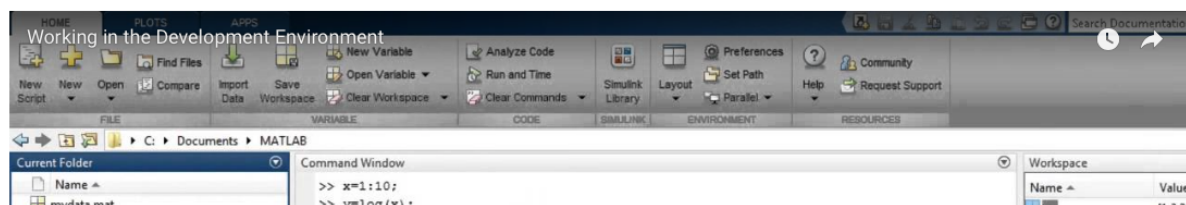


Figure 12-5: MATLAB Online Training

This is ideal for our new online study programs (where the students are not on campus, just online) and for all others that need to learn MATLAB, either it is

students or colleagues. The course material includes lots of videos explaining the different topics.

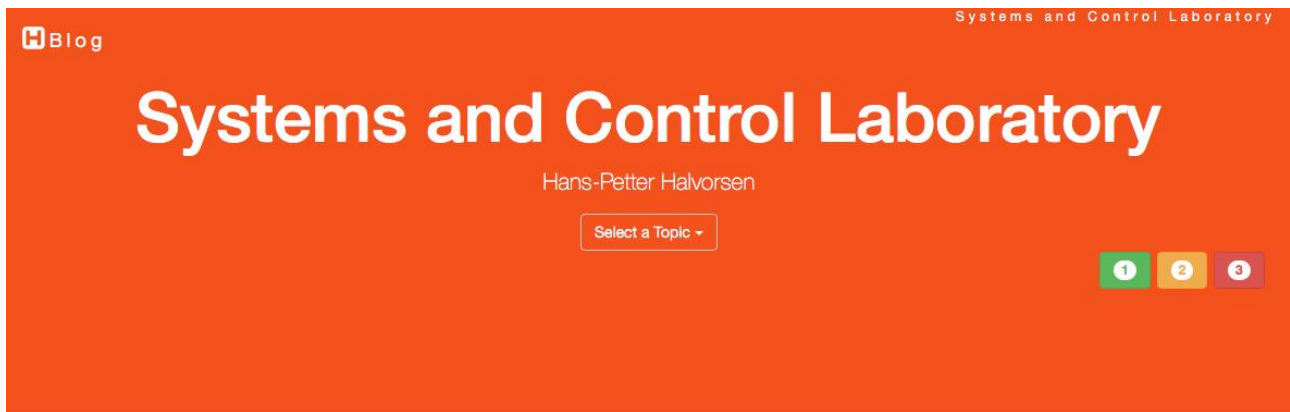
12.2 Systems and Control Laboratory

The course contains practical lab work about modeling, simulation, programming and control of industrial processes. The course consists of 3 different labs/small case-projects (4 weeks for each). The students may choose between 5 different labs/case-projects.

There will be no ordinary lectures, only practical lab work. The theory needed in this course is based on the theory the students have already learned in other courses.

The main purpose with the course is to get experience with practical problem-solving using theory, software, etc. you have learned in previous courses. The learning will be through small practical projects.

Figure 12-6 shows the web page for the course SCE4206 Systems and Control Laboratory.



Introduction

We will work with traditional topics within Industrial IT and Automation (Database Systems, DAQ, OPC, Sensors, Control Systems and Theory, PID, Modelling, System Identification, State Estimation, MPC, etc.), but in addition we will put these topics in a wider concept and see how these traditional topics can be applied to and used within concepts like Industry 4.0, Internet of Things (IoT), Cloud Computing, Machine Learning, Smart Technology, Web Technology, etc.

 **Course Registration** (first time only)

Below we see an overview of the course contents:

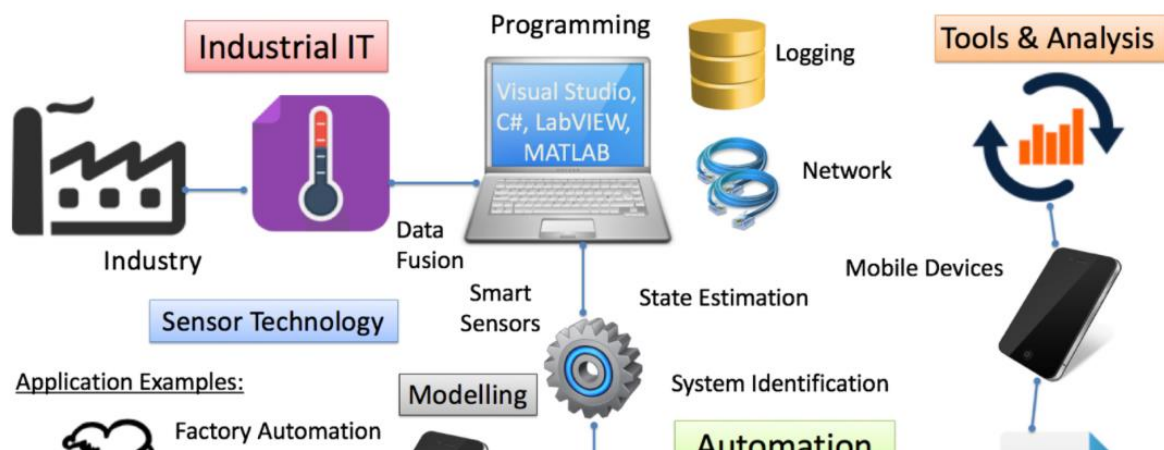


Figure 12-6: Web Page for the Course SCE4206 Systems and Control Laboratory

In the course, we use existing theory and practical knowledge, existing tutorials, Internet, etc. to solve the challenges. The small projects are real-life scenarios that the students can expect to work with when getting a job in a few months. It's crucial that they get practical experience with the theoretical topics learned in many of the other courses at the university.

The course is based on Project and Problem based learning methods (PPBL). In addition, the course is research-based, i.e., we use state of the art software and tools. This also means that the educator doesn't necessarily have all the answers

and solutions regarding the lab work. So in many cases the students will need to find answers and solutions outside the classroom, using other sources, internet, books, etc. The topics and contents in the lab assignments may vary from year to year.

The lab assignments are a bit loosely defined. The main idea with the different labs are to see the big picture and not focus on tiny details. The assignments may be seen as a practical summary of the Master program they are taken. The assignments are closely tied to the theory learned in other courses. I challenge the students to think outside the box.

The following assignment was, for example, performed in 2015:

- Sensors and Actuators with Arduino
- Home Automation with Raspberry Pi
- Weather System with myRIO
- Industrial DAQ Systems for Measurements and Monitoring
- System Identification and Estimation

The students can work in small groups (2 students) to increase collaboration, discussion and reflection among the students.

The web page for the course is located here:

http://www.halvorsen.blog/documents/teaching/courses/systems_control_lab.php

12.3 Industrial IT

This course is taught both for campus students and for our new online students.

Topics within Industrial It can be taught in a theoretical way or, in this case, in a practical way with lots of problem-based learning cases and case projects.

I guess the student spend about 10% of their time following theoretical lectures, while the rest of the time is spent on practical challenges and problem solving in relevant assignments, laboratory work and case projects. The student work both individually and in groups.

I am responsible for the following practical topics:

- OPC

- Hardware-in-the-loop Simulation and Testing (HIL)
- Database Systems and Structured Query Language (SQL)
- Supervisory Control and Data Acquisition (SCADA)

OPC, HIL, Database/SQL are approved/not approved assignments, while the final SCADA case project counts 30% of the final grade in this course. In this case project they will need “everything” they have learned in lectures and previous lab assignments.

Supervisory Control and Data Acquisition (SCADA) is a type of Industrial Control System (ICS). Industrial Control Systems (ICS) are computer-controlled systems that monitor and control industrial processes that exist in the physical world. Industrial control systems, like PLC (Programmable Logic Controller), DCS (Distributed Control System) and SCADA share many of the same features (Figure 12-7).

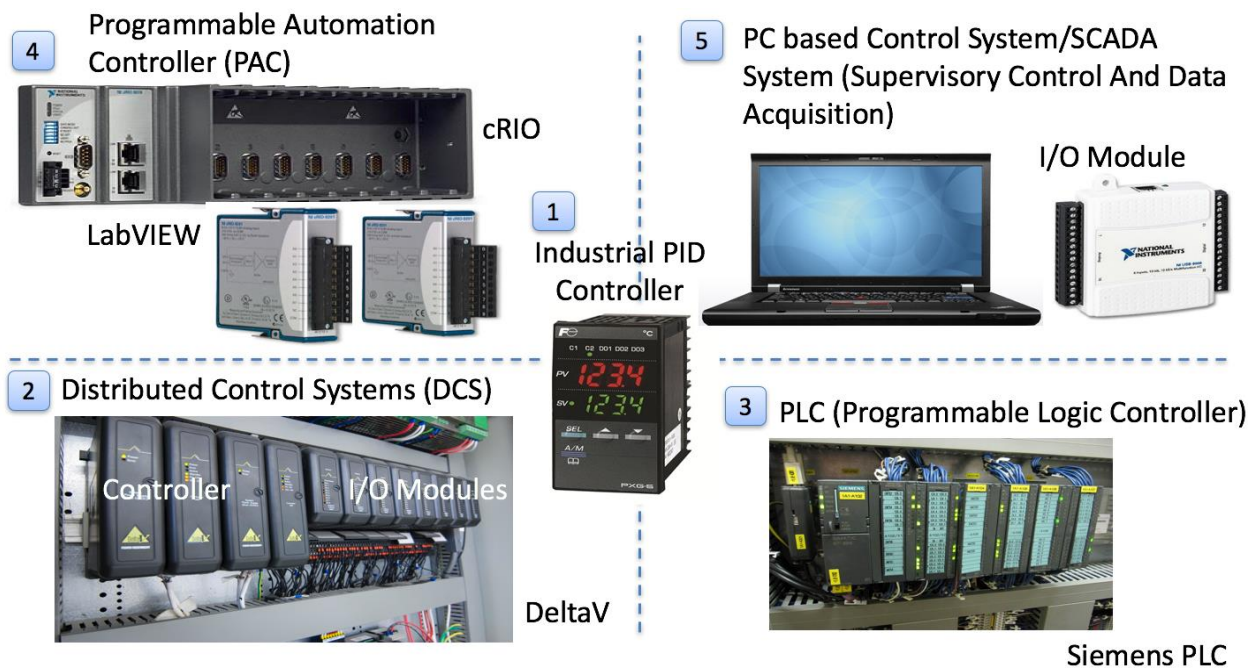


Figure 12-7: Industrial Control Systems (ICS)

Typically, the different Modules that the SCADA system consists of are distributed physically in a network (local network or over Internet), see Figure 12-8.

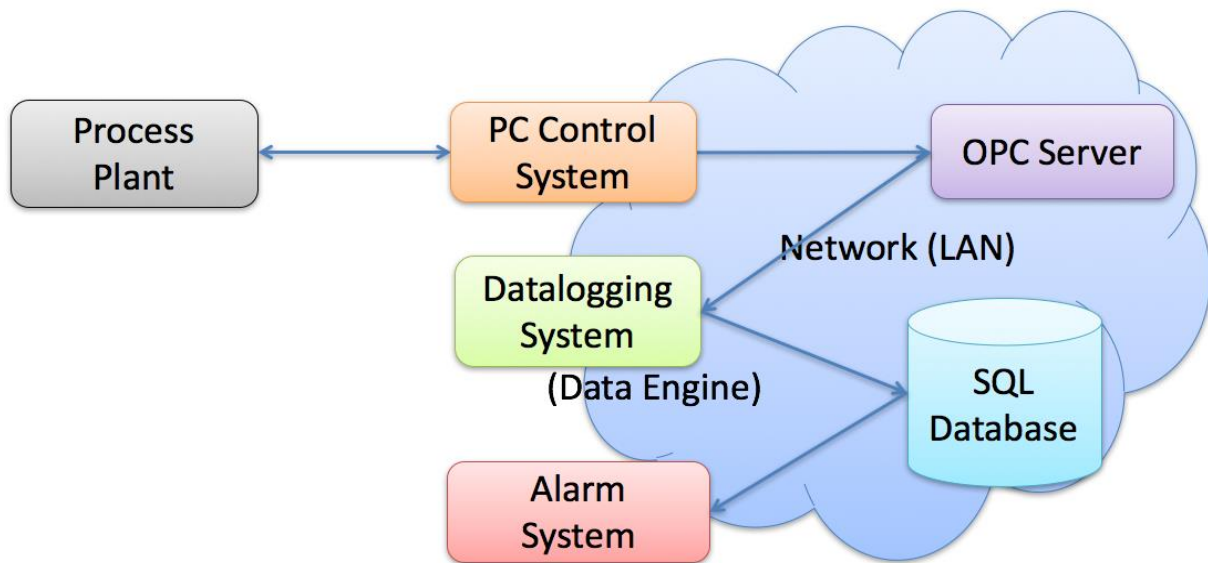


Figure 12-8: Supervisory Control and Data Acquisition (SCADA)

A SCADA system typically contains of different modules, such as:

- OPC Server
- A SQL Server Database that stores all the necessary data
- Control System
- Datalogging System
- Alarm System

These modules should be implemented as separate applications because they should be able to run on different computers in a network (distributed). The different applications can also be implemented in different programming languages, since the system is modularized and the interfaces between the different modules use open standards like OPC and SQL.

In this project the students are developing such a system from scratch. They also need to use everything they have learned in lectures and previous lab assignments, etc.

The project should follow the suggested steps and best practice guidelines:

1. Design the Database using Erwin, which is a software tool for modelling databases
2. Implement the Database using SQL Server
3. Create a Control System and send data to OPC Server.
 - a. Start with a model of the system. When the Simulations works, try with the real system

- b. You should create and use your own PI(D) controller and Lowpass Filter from Scratch (there is no built-in PID in C#)
4. Control the System with a Fuji PXG5 PID Controller. The Fuji Controller should first be tested using HIL Simulation. Send Data to OPC
5. Datalogging System: Read Data from OPC Server and Log the Data to a SQL Server Database
6. Alarm System: Create an Alarm Generation and Monitoring System
7. Distributed System/Network (OPC Server, Database Server, OPC Clients should be distributed on different computers in a network)

The suggested steps are loosely defined and more like guidelines, so the students need to interpret the tasks in their own way. They are encouraged to explore and add more value to the suggested steps.

They also need to develop the system according to proper software engineering principles, which they have learned in other courses.

In this project they need to develop med different modules in software using relevant programming languages such as Visual Studio/C# and LabVIEW and integrate with hardware available in the laboratory, see Figure 12-9.

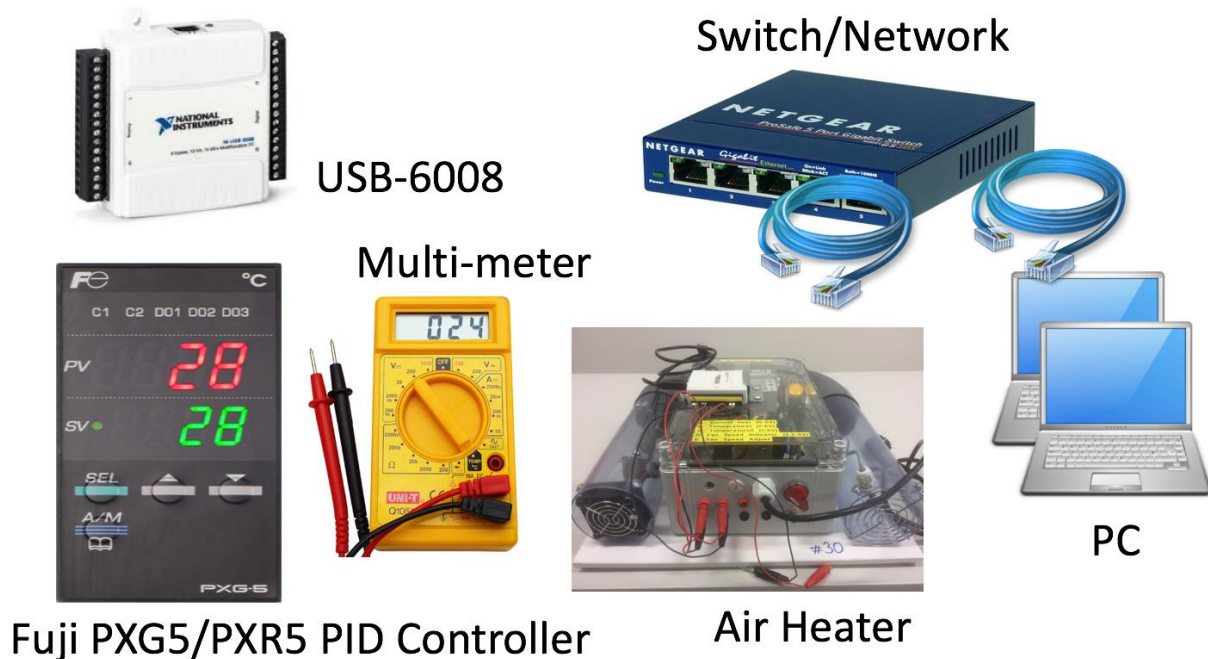


Figure 12-9: Hardware Integration

It's important that the student learn to use and operate relevant hardware and can integrate different industrial hardware devices with software.

Testing is an important part of system engineering projects. In this case, the focus is on so-called hardware in the loop simulation and testing. This means that they need to develop a mathematical model of the process plant which they need to test the hardware on before applying it on the real plant.

Figure 12-10 shows the basic principles of Hardware in the loop (HIL) Simulation and Testing.

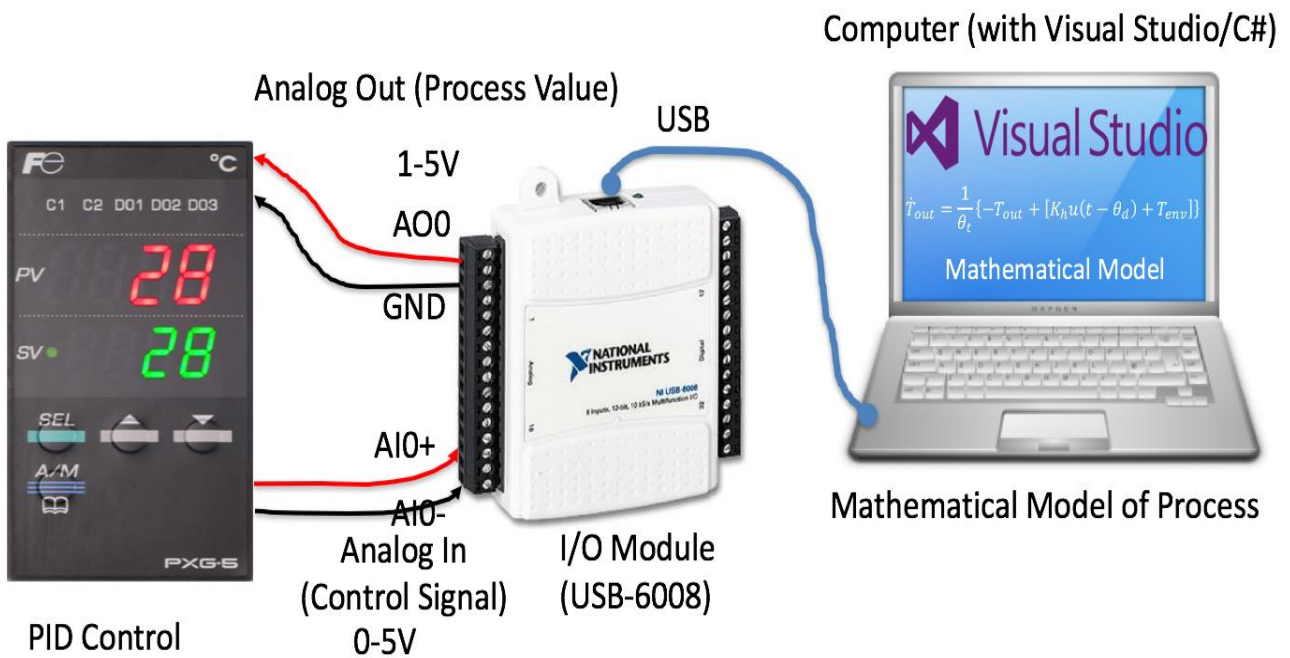


Figure 12-10: Hardware in the Loop Simulation and Testing

Overall, in this case project they get a deep understanding of many aspects of the topics learned in different courses at the Industrial IT and Automation Master program, both theoretical and practical.

The following topics are covered in this case project:

- Data Communication and network
- Control theory and industrial automation systems
- OPC, both OPC servers and OPC clients
- Database systems and Structured Query Language (SQL)
- Practical programming with Visual Studio/C# and LabVIEW
- Instrumentation and sensors
- Hardware in the loop simulation and testing
- etc.

Web page for the course can be found here:

https://www.halvorsen.blog/documents/teaching/courses/industrial_it.php

12.4 Master Thesis

Through the last 5 years many Master Thesis projects have been carried out within some selected fields.

Master students have been an important part of these projects. Working on realistic and research-based projects the students gets highly motivated and enthusiastic.

The Master study program “Industrial IT and Automation” is an international program with students from all over the world.

Many of these projects have been part of the research work at the university, in addition many of the projects have been carried out in collaboration with local industry and companies.

An example of a successful project is the Weather System we have developed and are using at the university for teaching and research.

One of the projects within that area was awarded as “Best Windows Store App” by an independently international institution. The Weather System will be described in more details later.

At my blog/web page you will find a detailed overview of many of these projects:

<http://www.halvorsen.blog/documents/projects/projects.php>

The industry has been heavily involved in many of these projects, such as companies like Yara, Emerson Process Management, National Instruments, Kongsberg Maritime, Baze Technology, Statens Vegvesen, Tel-Tek, Porsgrunn Kommune, Sykehuset i Telemark, etc.

See a detailed project list in chapter 25 Projects at Master Level.

As part of the assessment and grading, I have created an “Assessment Form” in Excel (Figure 12-11) which is used in cooperation with the external sensor.

With this Assessment Form, it is easy to fill out and share information regarding the assessment with the external sensor.

Sensurskjema Master Thesis2

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2								
3	Kandidat:							
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15	1	Faglig forankring	25				0	0
16	2	Teoretisk innsikt	25				0	0
17	3	Målbeskrivelse	25				0	0
18	4	Eget bidrag	25				0	0
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21	Del 2:	Metoder og Arbeidsform					30 %	
22	#	Kriterium	Vekt (%)	Kommentar	V	S	AVG	Vektet (%)
23	1	Ferdighetsnivå	30				0	0
24	2	Arbeidsform	20				0	0
25	3	Arbeidsinnsats	20				0	0
26	4	Selvstendighet	30				0	0
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29	Del 3:	Resultater og Diskusjon					35 %	
30	#	Kriterium	Vekt (%)	Kommentar	V	S	AVG	Vektet (%)
31	1	Arbeidet	40				0	0
32	2	Analyse og diskusjon	30				0	0
33	3	Kritisk refleksjon	10				0	0
34	4	Eget bidrag/måloppnåelse	20				0	0
35	Delsum (100%)		100					0%
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37	Del 4:	Fremstilling					15 %	
38	#	Kriterium	Vekt (%)	Kommentar	V	S	AVG	Vektet (%)
39	1	Struktur	40				0	0
40	2	Språk	30				0	0
41	3	Form	30				0	0
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Figure 12-11: Assessment Form used in Master Theses

13 Online Teaching

Online teaching has increased in popularity, and in the autumn 2015 we started with online teaching for one of our Master study programs “Industrial IT and Automation (IIA)”.

Since the online students cannot join classes at campus, we offer additional online resources to these students. These resources could be online lecture notes, PowerPoint slides, videos, tutorials, etc.

Since I already have taught this way also for the ordinary campus students, the transition to this new online study are very small. The Blog/web site of mine is already there with lots of resources for the online students, including tutorials, videos, etc. All teaching material are gathered on my Blog for easy access and collaboration across the different courses. The reuse of the teaching material across the different courses are in high focus.

Guidance and discussions with these students are done either in Skype for Business (Video Conferencing System from Microsoft) or in the discussion forum on my Blog/Web site (I am integrating the “Disqus” platform on my Blog/Web site).

I am involved in the following courses in our online teaching program:

- Systems and Control Laboratory (100%)
- Industrial IT (+50%, the practical aspects of the course)
- Hard/Soft Sensors in Process Measurements (~10%, Case-projects)

In addition, I am responsible for

- MATLAB Training, including the MATLAB course for new Master students
- LabVIEW Training

MATLAB and LabVIEW are the main tools used at the university when it comes to practical exercises, implementation and simulation, etc. These tools are used in most of the courses in the Industrial IT and Automation program, both the program for campus students and the program for online students.

All the theoretical and practical resources they need has been included in a new site I am developing for handling the online teaching in these topics. See Figure 13-1:

https://www.halvorsen.blog/documents/technology/industrial_it_automation.php



Industrial IT and Automation

Industrial IT is the integration of Automation and Information Systems across the business. You could say Industrial IT is use of IT in industrial applications, everything from Process Control Systems, Sensor Technology, Data Acquiring, Data Logging and Monitoring and Software and Systems Engineering. You need to have knowledge of Data Acquisition, Database Systems, Data Communication and Networks, Automation and Control, etc. Terms such as Internet of Things (IoT), Smart Technology, Cloud Computing and Industry 4.0 are very popular these days.

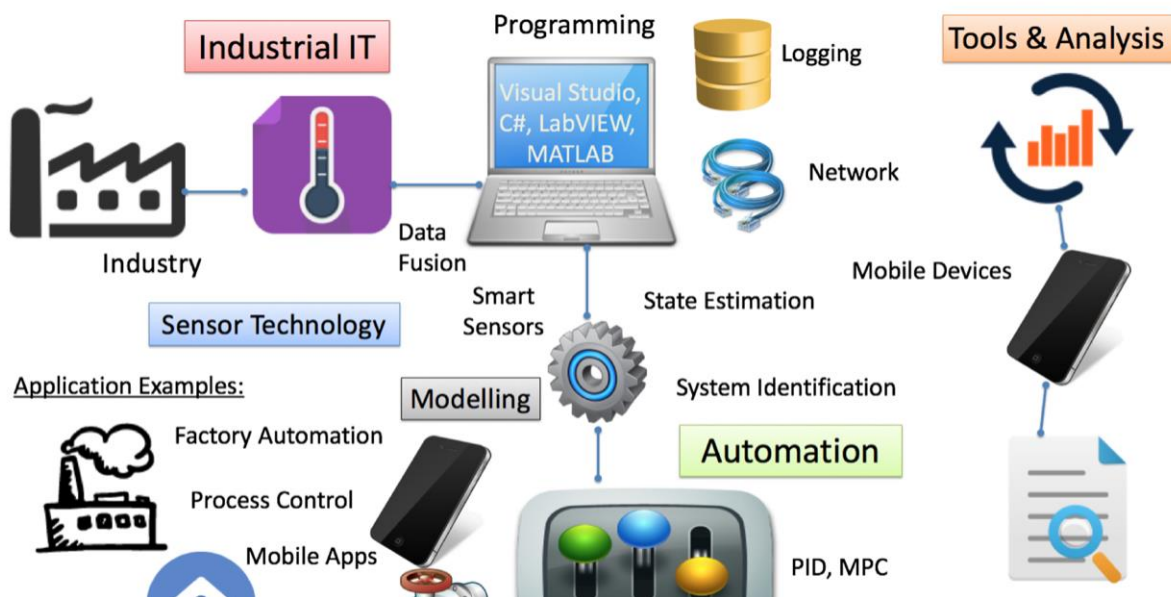


Figure 13-1: Industrial IT and Automation Web Site

This new web site will be the portal for the theoretical and practical aspects of my parts of the courses listed.

On the web site you also find the textbook “Industrial IT and Automation – A Practical Approach!” (see Figure 13-2), in addition lots of online recourses like PowerPoints, videos, tutorials, links to relevant web recourses, etc.

The textbook and the online material cover topics like project management, systems engineering, data communication, web technology like web services, virtualization technology, wireless systems, Modbus and OPC, vision systems, control systems, sensors, SCADA systems, simulations within Automation, Internet of Things (IoT) and home automation. All these topics are important pieces in modern industrial IT and automation systems.

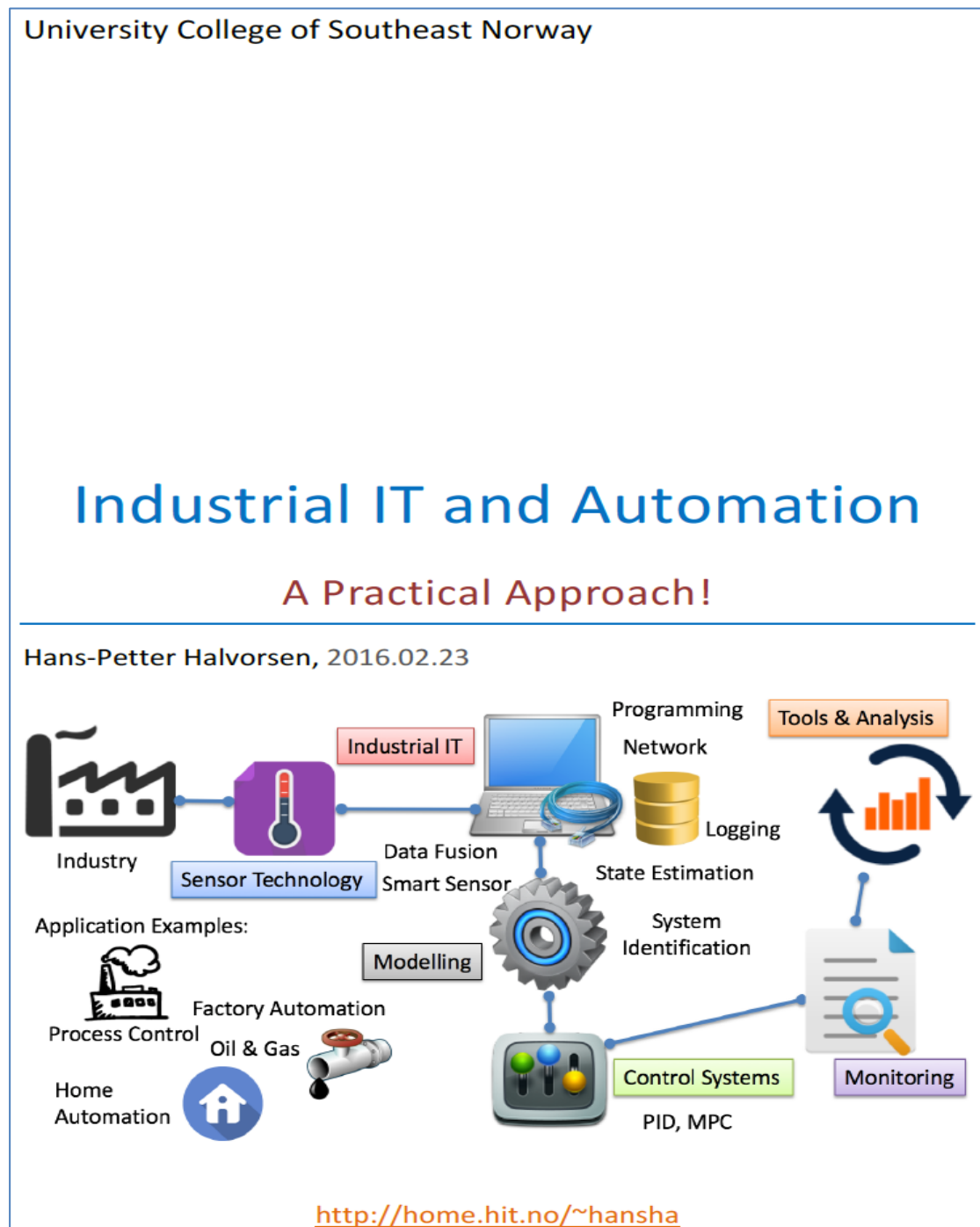
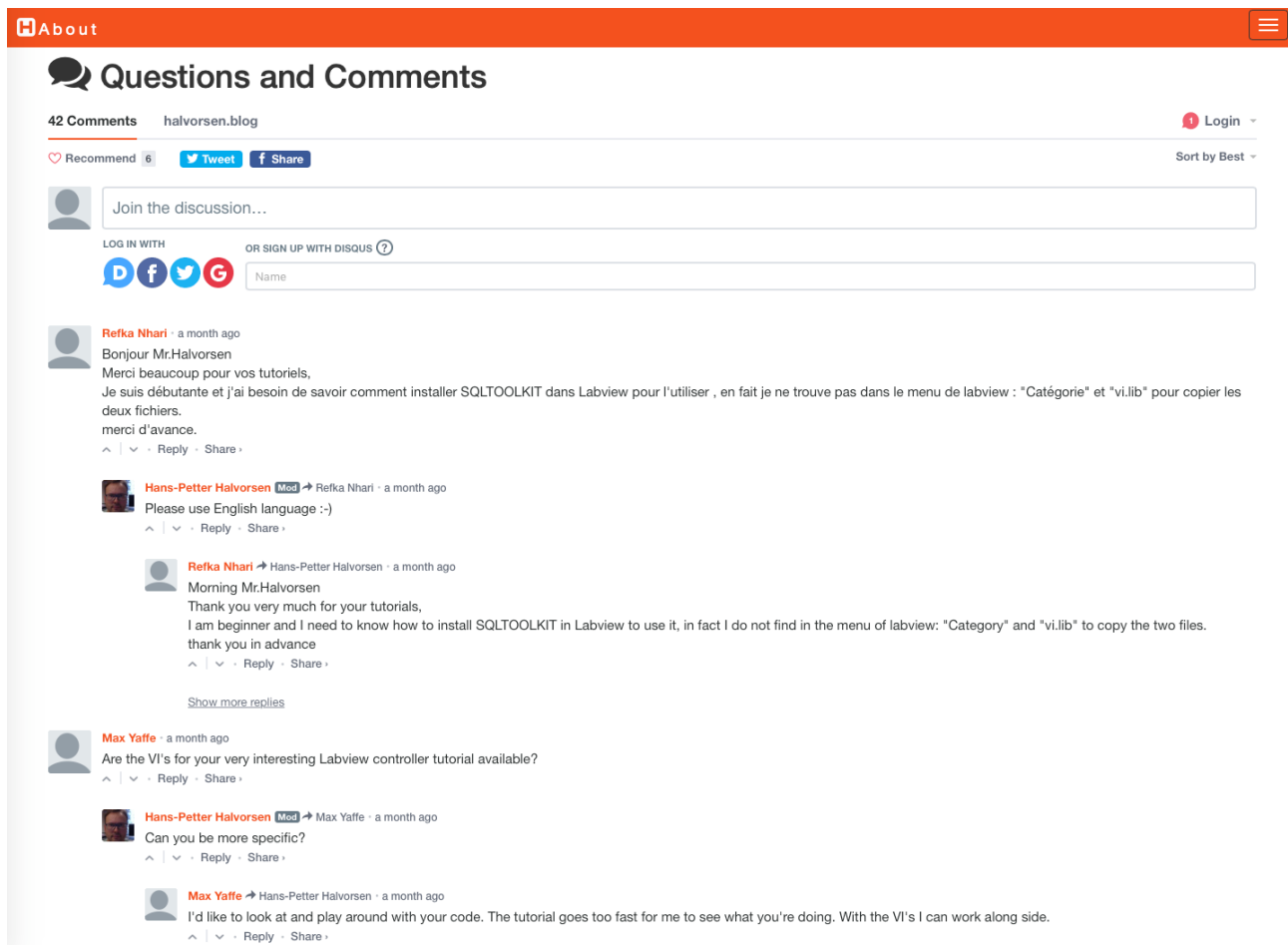


Figure 13-2: eBook: Industrial IT and Automation – A Practical Approach!

A discussion forum is also included on the web site for getting feedback from students (or others that use the resources available). The students can also ask questions and get answers, either by other students, or from me.



The screenshot shows a forum interface with an orange header bar containing 'About' and a menu icon. The main title is 'Questions and Comments' with a speech bubble icon. Below the title, it indicates '42 Comments' and the blog name 'halvorsen.blog'. There are social media sharing buttons for 'Recommend', 'Tweet', and 'Share', and a 'Login' button. A search bar with the placeholder 'Join the discussion...' is present. Below the search bar, there are options to 'LOG IN WITH' (Dribbble, Facebook, Twitter, Google) and 'OR SIGN UP WITH DISQUS'. The main content area displays a list of comments:

- Refka Nhari** · a month ago: Bonjour Mr.Halvorsen. Merci beaucoup pour vos tutoriels. Je suis débutante et j'ai besoin de savoir comment installer SQLTOOLKIT dans Labview pour l'utiliser, en fait je ne trouve pas dans le menu de labview : "Catégorie" et "vi.lib" pour copier les deux fichiers. merci d'avance.
- Hans-Petter Halvorsen** (Mod) → Refka Nhari · a month ago: Please use English language :-)
- Refka Nhari** → Hans-Petter Halvorsen · a month ago: Morning Mr.Halvorsen. Thank you very much for your tutorials. I am beginner and I need to know how to install SQLTOOLKIT in Labview to use it, in fact I do not find in the menu of labview: "Category" and "vi.lib" to copy the two files. thank you in advance.
- Max Yaffe** · a month ago: Are the VI's for your very interesting Labview controller tutorial available?
- Hans-Petter Halvorsen** (Mod) → Max Yaffe · a month ago: Can you be more specific?
- Max Yaffe** → Hans-Petter Halvorsen · a month ago: I'd like to look at and play around with your code. The tutorial goes too fast for me to see what you're doing. With the VI's I can work along side.

Figure 13-3: Forum for Discussions and Questions and Answers

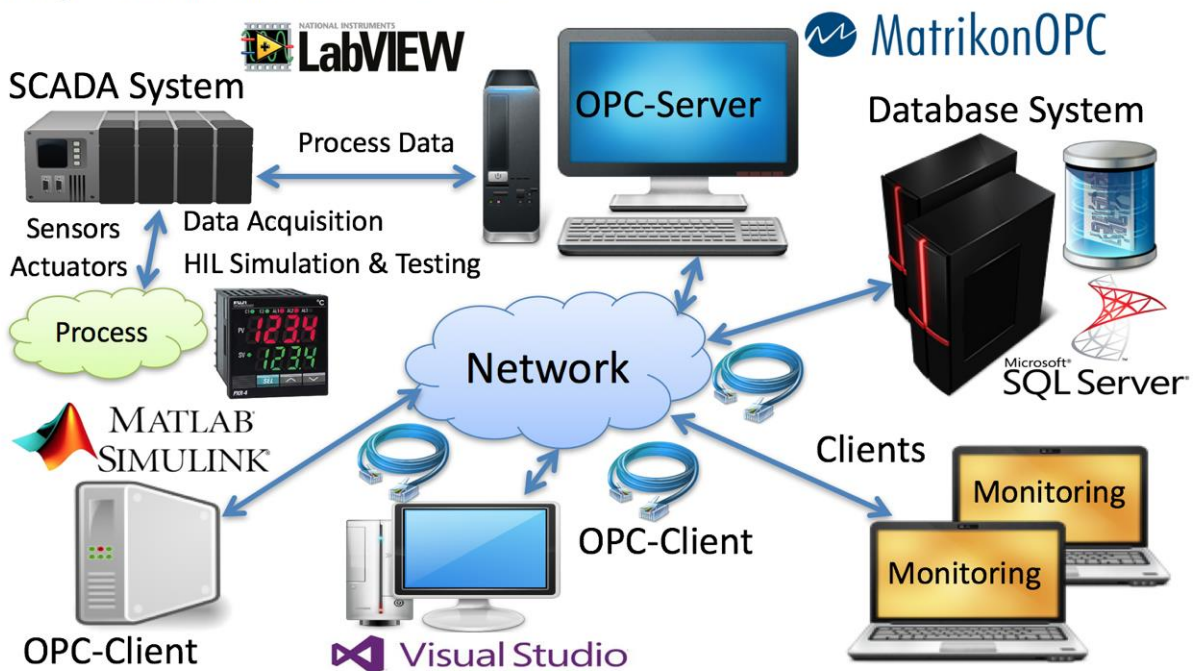
For the Industrial IT course, the following web page has been established (see Figure 13-4):

https://www.halvorsen.blog/documents/teaching/courses/industrial_it.php

Topics

Lab Topics: Programming, LabVIEW, Visual Studio/C#, MATLAB, OPC, Hardware in the Loop Simulation and Testing, Database Systems, Structured Query Language (SQL), Supervisory Control and Data Acquisition (SCADA). If you are not familiar with LabVIEW, Visual Studio/C# and MATLAB, you need to learn basic skills in these tools by yourself. See resources for self-paced teaching material below. In the Lab Work you will implement and apply most of the topics introduced in the lectures in real-life scenarios. Finally, you will end up with a complete Industrial IT and Automation System - which you will make from Scratch.

The Figure below illustrates the contents of the Lab Work:



The Video below gives an introduction to the Lab Work in this course:

<https://www.halvorsen.blog>



Figure 13-4: Industrial IT Web Page

Here you find lab assignments, etc. that are specific for this course.

A similar web page for the course Systems and Control laboratory is available.

For online students, it is important that they easily can find all available recourses online, since they cannot get the same help from the educators or other students.

14 Using Videos in Teaching

Videos are an important addition to other teaching resources. I use videos a lot as a supplement to written materials, such as eBooks, tutorials, web pages and web resources. So far more than 100 videos within Industrial IT, Automation and Software Engineering have been made.

Figure 14-1 shows an overview of my main video web site. The videos are divided into different categories, such Industrial IT and Automation, Software Engineering, etc.

Blog Technology Videos

Technology Videos

Hans-Petter Halvorsen

Here you find lots of videos within Software Engineering, Industrial IT and Automation. Search for Videos

Selected Videos

Here you find Video Viewers for the following topics:

- LabVIEW Basics Videos**
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
- MATLAB Basics Videos**
LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.
- LabVIEW Applications Videos**
Here we use LabVIEW for real Applications like Data Logging, OPC, Hardware in the Loop, Database Systems, Control and Simulations, Model Predictive Control (MPC), etc.
- Industrial IT and Automation Videos**
OPC, Database Systems, Control Systems, etc. with examples in C#, LabVIEW and MATLAB.
- Software Engineering Videos**
Software Development, Software Engineering, Agile and Scrum, Visual Studio Team Services, etc.
- All available YouTube Videos sorted by Popularity**

I also have a official YouTube Channel: <https://www.youtube.com/IndustrialITandAutomation>

Figure 14-1: Videos in Teaching

The main video web site can be found here:

<http://www.halvorsen.blog/documents/video/videos.php>

On this page, you find videos within topics like:

- Hardware - How to use hardware within different Programming languages
 - TC-01
 - USB-6008
- Programming - Videos within different Programming Languages
 - LabVIEW
 - MATLAB
 - Visual Studio
 - Web Programming
- LabVIEW Videos
 - LabVIEW
 - LabVIEW Features
 - LabVIEW DAQ
- Industrial IT - Videos explaining different topics within Industrial IT
 - Database Systems
 - OPC
 - DAQ
 - SCADA
 - IoT
 - IT
- Automation - Videos explaining different topics within Automation
 - DAQ
 - OPC
 - SCADA
 - Simulation
 - Hardware in the Loop Simulation and Testing
- Software Engineering - Videos within Software Development and Software Engineering
 - Visual Studio Team Services (VSTS)
 - Scrum
 - Testing

The list of topics and the number of videos within each topic are growing as we speak.

In addition, all my web pages that is part of my blog have relevant videos embedded into the different pages focusing on different topics like “Software Engineering”, “Industrial IT and Automation”, “Programming”, etc.

Videos can be an important tool for preparation, during practical exercises, summarizing, etc.

I integrate videos in as part of my web site and web resources, so it becomes an integrated part of a total package of teaching resources, and not separate part you find somewhere else.

I use some videos from external sources like YouTube, but many of those don't have the proper quality or the right angle needed. Thus, I have started to make more and more vides from scratch.

In addition to teaching online classes, where videos are especially useful, I use elements from so-called “flipped classroom”. In the flipped classroom, students prepare for classes by studying the learning material (e.g., videos) with the classroom discussions focused on problem solving, application of the learning material, exercises, case-projects, discussion of examples and challenges and so on.

The benefits of the flipped classroom approach are that students can more easily absorb knowledge at their own pace rather than at a pace set by the teacher. Then the time in class can be spent more effectively on problem solving, individual support and challenges, etc. I problem though, is that not all students are motivated to work independently and to meet well prepared for more active class activities. At Master level, the students are more mature, so then this is not a problem.

Many of my teaching activities is about practical work and implementation, such as laboratory work, programming and case projects, and the student may then also work with different things at the same time. In this way, ordinary lectures or no good, but videos that the students can watch individually is a great approach to this.

Videos are of course also very relevant for repetition.

As a summary, videos are very useful in the following cases:

1. As part of a flipped classroom approach.
2. A substitute for ordinary lectures, especially for online students that are not available on campus.

3. To learn practical implementation and programming working with laboratory work, exercises, assignments case projects, etc. (“How-To” Videos)
4. Mixing Theory and Practical issues in on unified package.
5. Explanations and going through solutions to laboratory work, programming exercises, etc.
6. Repletion and processing of undergone material, both theoretical and practical.
7. Easy access and repetition to topics and methods learned in previous courses. That’s way I also provide the video material on the web with open access at any time.

Videos are useful in many contexts, but you need to have in mind that they are time-consuming to make. Typically, you may need to spend several weeks to make a video that last 30 minutes. Of course, this depends on several factors, what kind of video you make, if you need to create all the material in the video from scratch, etc. Practical “How-To” videos where you mix theory and practical examples are typically very time consuming.

Is it possible to reuse the Videos? Creating and publishing videos are time consuming. Can you reuse videos for several years? Well, it depends on the theme I guess. Within computers, data and information technology the technology continuously changes. What appears to yesterday does not work today. Videos may need to be re-created each year, but PowerPoints/script used as base for the video production can be updated and thus reused. More traditional topics like Math, etc. can certainly be reused for many years.

It is also important to think generally (but not too general), avoiding version number in software (LabVIEW 2016, Visual Studio 2015, Office 2013), logos that need to be replaced next year, etc.

14.1 Using Videos in Online Teaching

Online teaching has increased in popularity, and in the autumn 2015 we started with online teaching for one of our Master study program Industrial IT and Automation (IIA). Since the online students cannot join classes at campus, we offer additional

online resources to these students. These resources could be online lecture notes, PowerPoint slides, videos, tutorials, etc.

Since I already have taught this way also for the ordinary campus students, the transition to this new online study are very small. The Blog/web site of mine is already there with lots of resources for the online students, including tutorials, videos, etc. All teaching material are gathered on my Blog for easy access and collaboration across the different courses. The reuse of the teaching material across the different courses are in high focus.

Guidance and discussions with these students are done either in Skype for Business (Video Conferencing System from Microsoft) or in the discussion forum on my Blog/Web site (I am integrating the "Disqus" platform on my Blog/Web site). In addition, there are a 3 days' lab gathering at the end of the semester.

14.2 Statistics

The videos are both integrated (embedded) in my web page and many are public available on YouTube.

Here you find a link to the YouTube Channel:

<https://www.youtube.com/IndustrialITandAutomation>

With YouTube, you also get access to Google Analytics, which gives you lots of statistics data regarding your videos, such as number of views, watch time, average view duration, country, most viewed videos, what kind of device they are using, gender, playback locations, etc.

Figure 14-2 shows the YouTube video statistics.

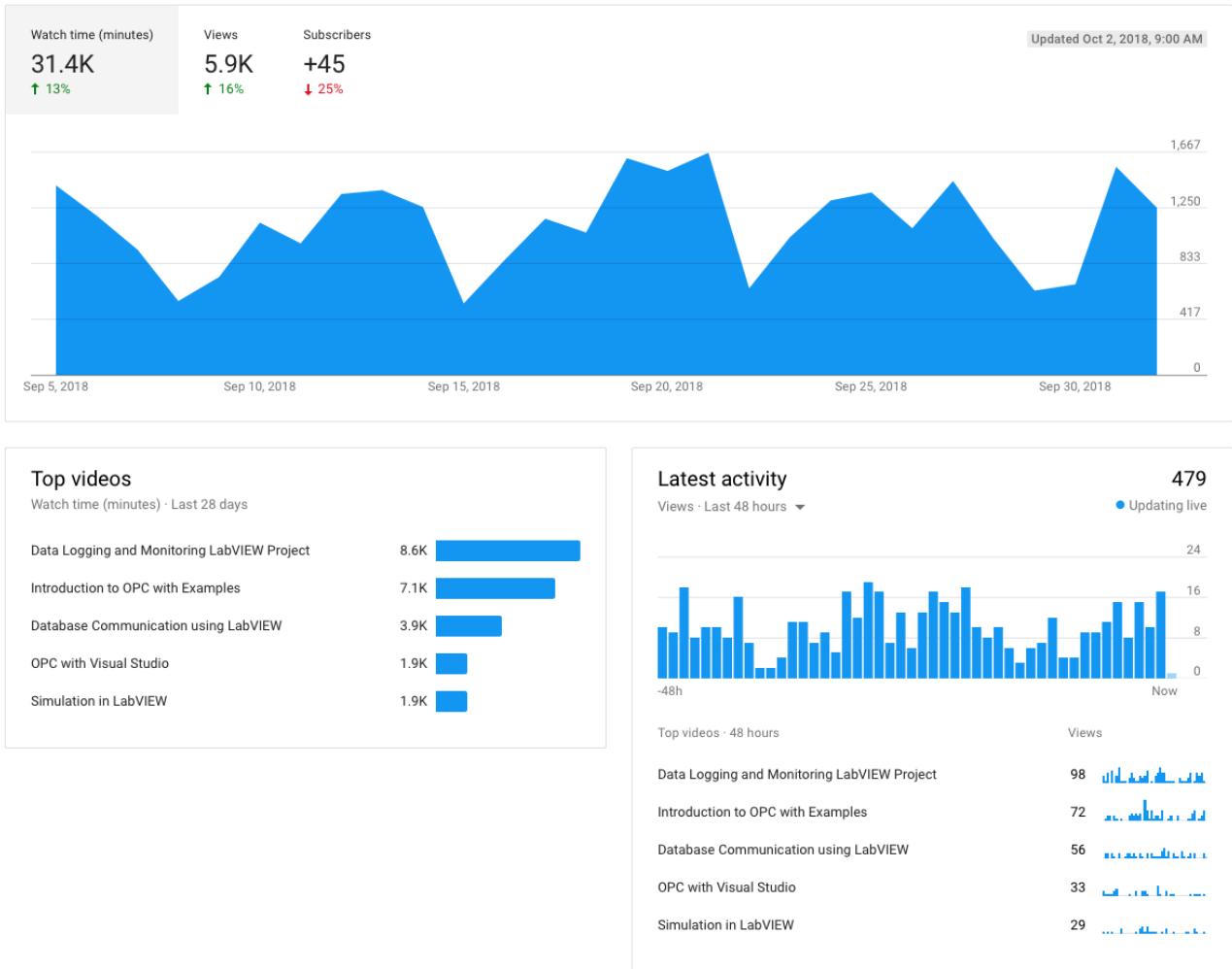


Figure 14-2: YouTube Video Statistics [October 2018]

The YouTube channel has more 1200 followers and about 10.000 views per month.

From Figure 14-3 we see that most of the viewers are from outside Norway.

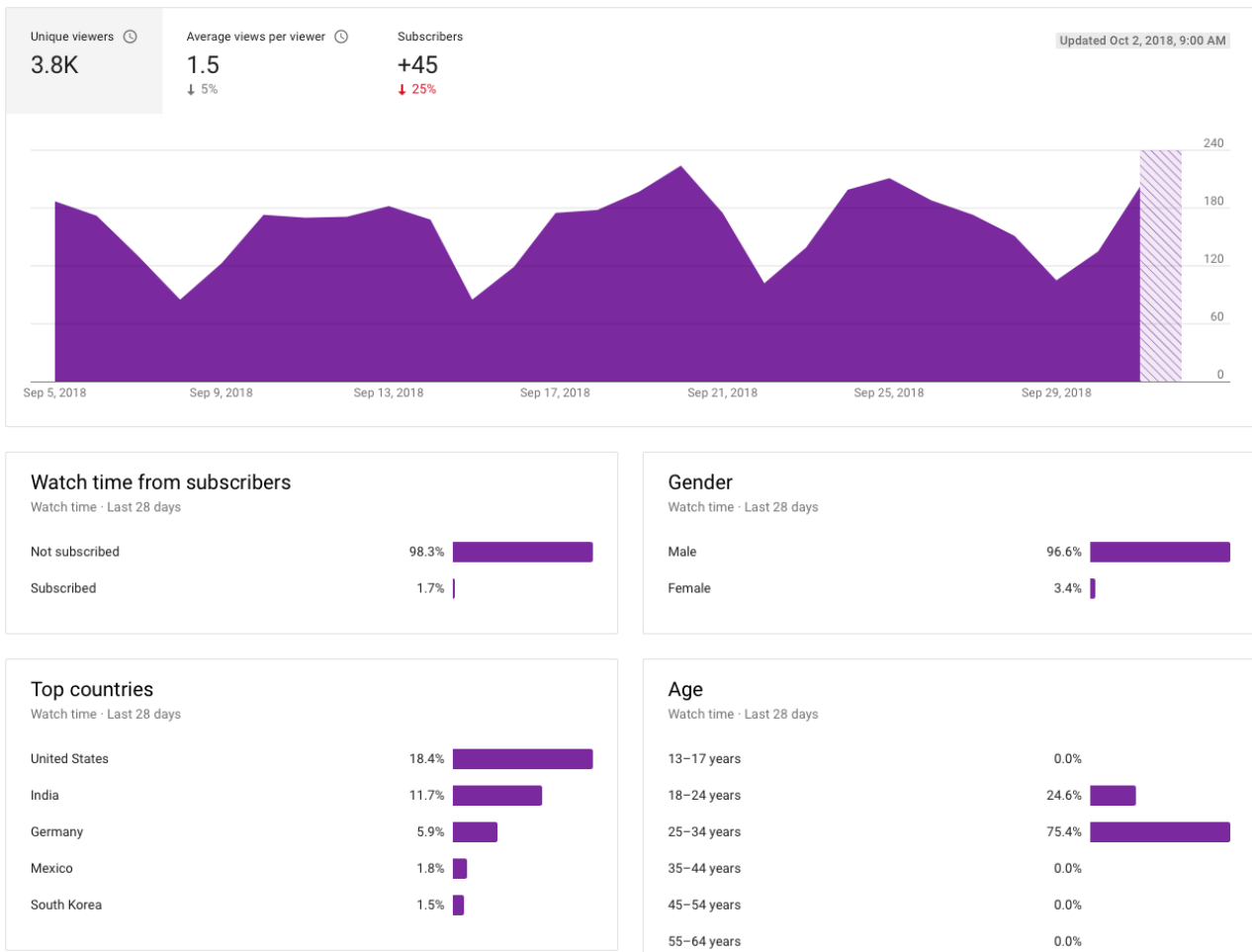


Figure 14-3: YouTube Audience Statistics [October 2018]

15 Problem- and Project-based Learning

My main teaching principles is all about practical teaching methods with focus on practical exercises, lab work and project work. These PPBL (Problem/Project Based Learning) methods such as student projects, which are integrated in many of the courses at our university.

With PPBL the students get practical industrial experience both within programming and use of relevant hardware. They need to develop and integrate software and hardware into a unified solution using known software engineering principles.

PPBL is heavily used throughout the “Industrial IT and Automation” Master program at University of South-Eastern Norway. PPBL is integrated in all courses at different levels from laboratory work, case projects, ordinary project courses, and final Master project, both individually and group based.

When the students are finished, they will have knowledge of data acquisition, database systems, data communication and networks, automation and control, etc.

Flipped Classroom principles is highly relevant within these practical teaching methods. Flipped Classroom is based on established teaching methods such as problem-based learning and student-centered approaches, which is my main focus.

Flipped Classroom reverse the more traditional teaching principles where the educator uses most of time on ordinary lectures, then the students go home and do exercises linked to what was presented in the lecture. With Flipped Classroom, the students are forced to be prepared (watching videos, reading other resources, etc.) for class activities, and instead of lectures the students do exercises, etc. either individually or in groups in class. In that way the educator can focus more on helping the students with things they struggle with and follow up the students individually.

More about Flipped Classroom in chapter 8.5.

15.1 Publications

Below you find publications related to Problem/Project Based Learning (PPBL):

- **Constructive Alignment with Student in Centre and Front - Experience from Case-projects and Intensive Summer Courses** - Hans-Petter Halvorsen, Josef Timmerberg, Saba Mylvaganam - MNT Conference, March 28-29, 2019, Tromsø, Norway.
- **Project/Problem Based Learning in Electrical Engineering, IT and Automation** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam. ITEN2015 Conference, Łódź, Poland, September 2015.
- **Experience with Case-projects in Bachelor and Master Studies in Electrical, IT and Systems & Control Engineering** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam - EAEEIE 2013, 24th EAEEIE (European Association for Education in Electrical and Information Engineering) Annual Conference, Chania, Greece 30 - 31 of May, 2013

15.2 PC

I think using the PC as an integrated part of the teaching is crucial today, especially when dealing with engineering students within Industrial IT and Automation.

Lots of students struggle with their PCs, installing software, etc. That's way I have made an online resource where they can get help regarding these things. See Figure 15-1. This page focusing on all the aspects of PC and software that is not handled by our IT department. The IT department oversees the general IT structure and software that everybody uses, like MS Word, etc., while this web site deals with specialized tools and software used at the Faculty of Technology.

PC

All students need their own PC. The PC will be used in all courses at the university.

Many computer stores (online or physical stores) advertise with "cheap" (<8K NOK) computers when schools start, but these computers normally have only 128GB SSD disks (or an old type of harddrive), 4GB RAM, i3 CPU (or an old version of i5/i7). Make sure not to buy these computers! For many computers these things cannot be upgraded later.

Remember a typical PC should last 5 years, so if it's good enough today it may not be good enough for tomorrow.

This is the recommended Technical Specifications for your own PC within Bachelor and Master Engineering education:














-  Operating System: **Windows 10** (Pro) 64bit. Some the software needed at the university only exists for Windows (Examples: Visual Studio, LabVIEW, SQL Server, ERwin, Visio, Project, OPC Software). Good alternatives for Linux or Mac OS may exists, but then you need to figure out things by yourself.
-  Processor (CPU): Intel **Core i5/i7** or similar (make sure it is one of the latest version!) 6th generation Core processor ("Skylake") or preferably 7th generation Core processor ("Kaby Lake")
-  Storage: **256 GB** (absolute minimum!). SSD recommended! You need to install lots of software, so a 128GB (SSD) disk is not enough!! If you need to choose due to economics, choose a larger HDD (ordinary Hard Drive) instead of a small SDD.
-  Memory: **8 GB RAM** or more
-  Wi-Fi: **802.11ac**
-  Battery and Power: **7+** hours recommended (should last an entire school day without charging)
-  Screen Size: **15.6"** or 13.3" with screen resolution 1920x1080 (minimum)
-  Ports: 2-4 USB ports, HDMI or Mini DisplayPort, VGA or HDMI/DisplayPort Adapter, Ethernet connection (RJ45) or adapter
-  External Mouse. If you want help from supervisors, etc. during lab and exercises, you need to have an external mouse!
-  Built-in (or external) Web Camera (for Skype)
-  Headphones with microphone (for Skype)

Figure 15-1: PC, Software and Hardware Resources

For more details about PC, Software and Hardware resources, please refer to the following web page:

https://www.halvorsen.blog/documents/software/pc_software.php

15.3 Laboratory Work and Case Projects

I believe strongly that practical work, laboratory work or similar should be an important part of all courses, that's why my teaching is heavily based on these principles.

Figure 15-2 shows the teaching outcome using different teaching principles. With ordinary lectures, 95% of the knowledge you need to learn has disappeared! This is because students passively trying to receive knowledge. You have to work actively to prepare and process the knowledge.

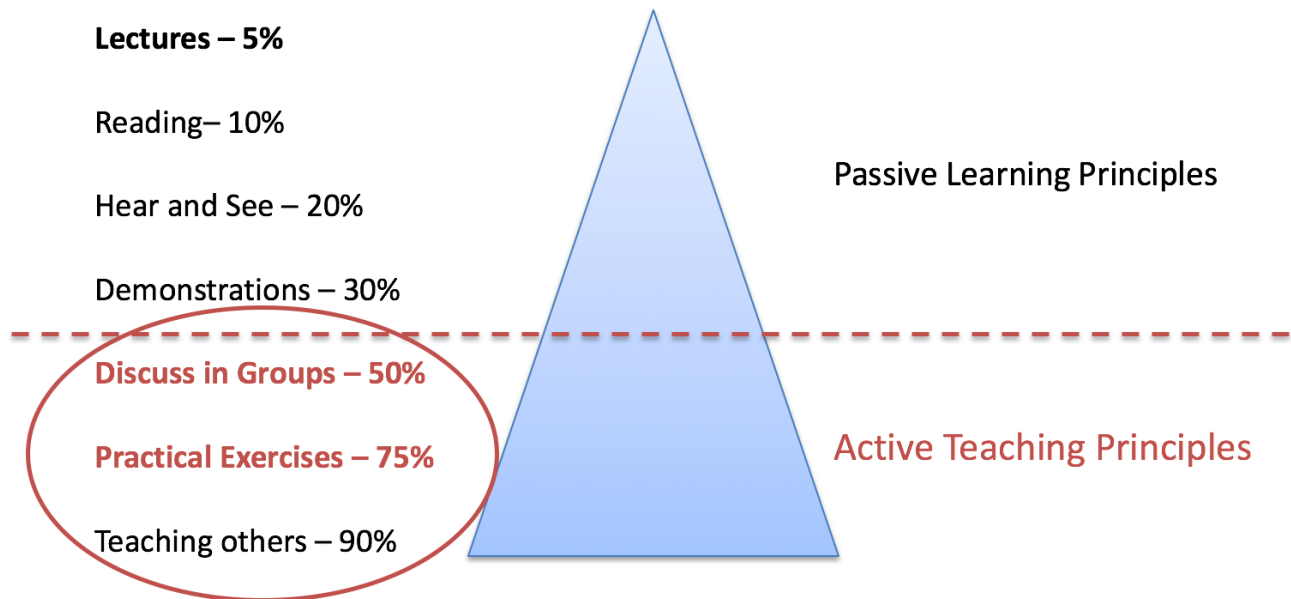


Figure 15-2: Teaching outcome using different Teaching Principles

15.4 Project Work

At our university, we have lots of project work, both as separate project courses and as integrated part of many courses.

See Part 3: Research and Development for more details about these projects.

16 Flexible Teaching Facilities

16.1 Introduction

Since I use a practical teaching approach, with few ordinary lectures, I thought the existing classroom was not suited for me. So, I decided to do something about it. I then started to collect and analyze the requirements (this was natural since I work with System Engineering and Requirements Engineering), what did I need?

I think the ordinary classrooms we have today (at least those we have at our university) is not suited for modern teaching principles with a mix of different teaching methods, use of e-learning, etc.

Today the students work with practical exercises using their PC, they work with lab assignment that has special needs, they work in groups and they work with projects.

Since there are short of electricity in the classrooms, many rely on these things, see Figure 16-1.



Figure 16-1: Many are dependent on these things in today's Classrooms

Here are some challenges with the existing classrooms:

- They have not changed the last hundred years. What was good 100 years ago is probably not good today.
- Today's classrooms have no facilities for modern teaching methods, such as practical lab work, working with projects and group work, use of computer where easy access to electricity, etc. missing.
- Chairs and desk are all over the room and you stumbling in PC cables, etc. It is not easy to walk around in the classroom and help the students
- The Smart Boards are placed in front of the existing blackboards/whiteboards, i.e., “modern” devices have been "thrown" into existing classrooms without comprehensive planning.
- “Room A... is useless” says the educators
- Special rooms (such as computer rooms, laboratories, etc.) require lots of maintenance, e.g. hardware and software upgrades, etc. It is difficult to get IT to update software as this is a comprehensive job.
- “There are not enough group rooms” says the students
- “Existing rooms are not flexible”
- A lot of different teaching methods do exist, such as ordinary lectures, group work, PC exercises, pen and paper exercises, project work, etc. Many of these activities are also present at the same time (or at least they should be). Can one room fit all these needs? Not the classrooms we have today!

Figure 16-2 shows some different types of classrooms that do exists today.

We have ordinary classrooms, we have computer rooms, conference rooms, etc., but none of these rooms are suited for students using their own PCs. All these different rooms are very traditional and very little flexible for more modern teaching principles where the student work with the PC, work in groups to solve problems, etc.



Figure 16-2: Different types of Classrooms

Teaching outcome using different teaching principles (Figure 16-3):

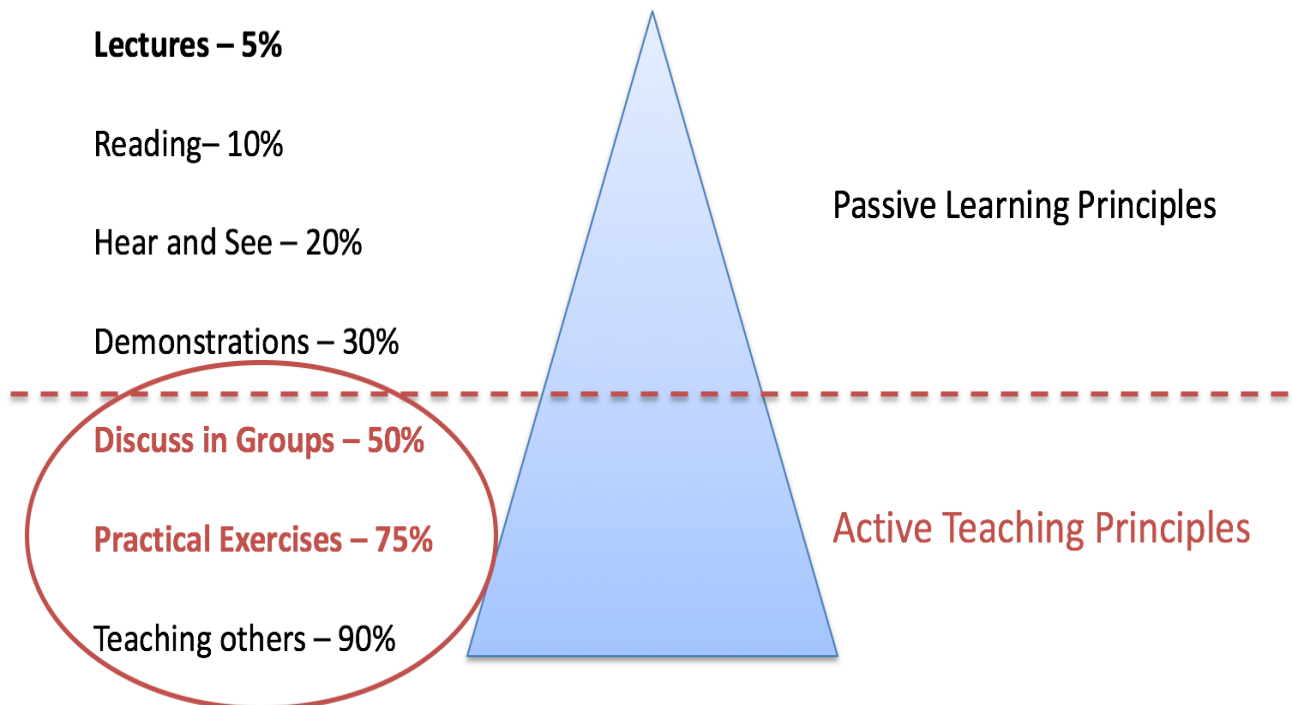


Figure 16-3: Teaching outcome using different Teaching Principles

16.2 Lab and Project-based Teaching

New guidelines from the government involves changes in the way the different courses should be organized, with increased focus on lab and practical applications.

In general, practical teaching principles leads to big challenges in today's classrooms, i.e. practical teaching principles where you use PCs, lab equipment, etc. There is a need for tables with plenty of room for PC, lab equipment as well as access to electricity, etc.

Figure 16-4 shows some examples of equipment used in teaching at the university, they all require space and electricity.



Figure 16-4: Examples of Lab Equipment

It is important that the classrooms are designed for these forms of teaching. The best, of course, would be if the classroom is suited for all kind of teaching. See Figure 16-5.

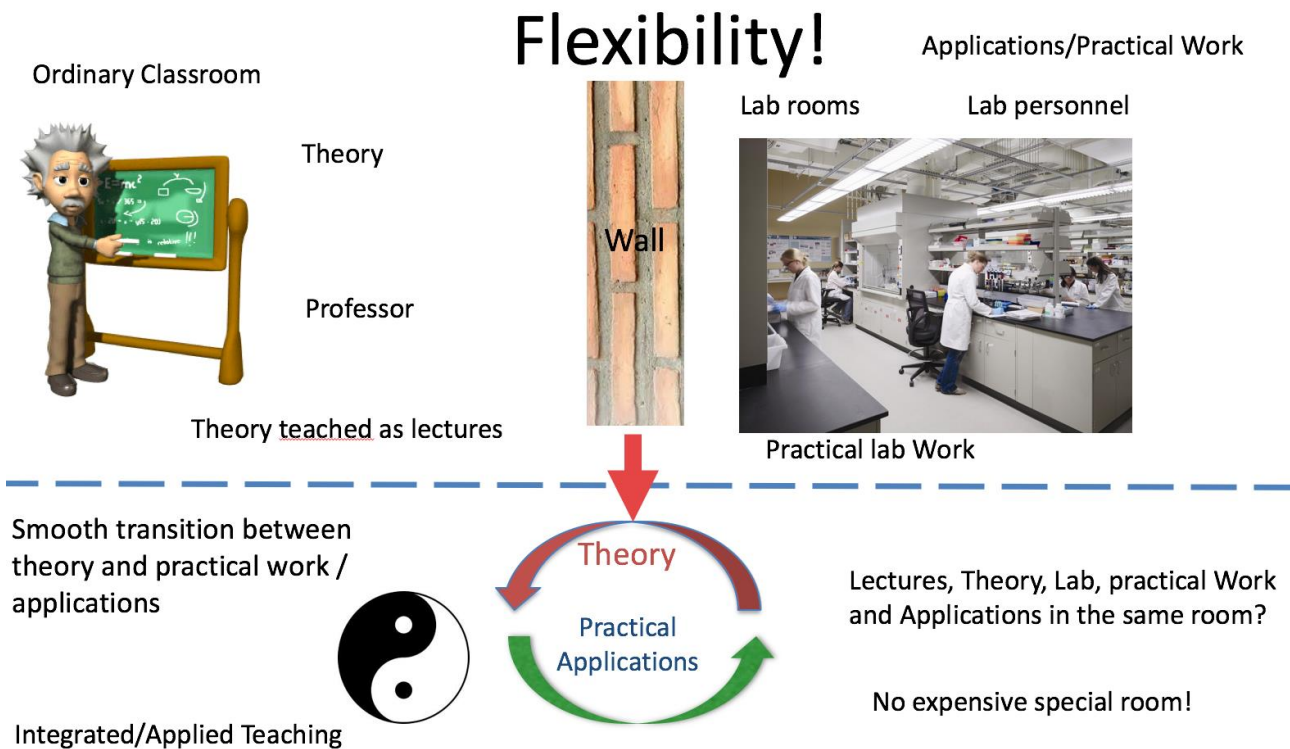


Figure 16-5: Flexibility is important in Teaching

Room that are specifically designed for one type of teaching are very expensive and they have few applications. By making the rooms more flexible and that they can facilitate different types of teaching is important. This will lead to a better and cheaper solution in the long term.

16.3 Needs

New classrooms need to be able to handle:

- Modern teaching principles and use of PCs
- Flexible regarding use of different teaching methods, such as lectures, project and group work, laboratory work, etc. in the same room and at the same time.
- Module-based, the same solution should fit for small rooms as well as larger rooms.
- Electricity for all the student PCs.

- Different types of boards, such as ordinary blackboards, whiteboards, interactive boards, PC and PowerPoints, etc.

The goal should be that these rooms can handle the primary needs regarding ordinary lectures, but also the need for practical work, lab work, project and group work, etc. See Figure 16-6.

	Existing Rooms	New Flexible Rooms?
Teaching	70%	100%
PPBL Principles	30%	100%

Figure 16-6: Goal for new Classrooms

16.4 The Solution

Is it possible to make flexible teaching facilities that covers all these different needs and requirements? Well, I found the answer in the nature, the Hexagon!

The Hexagon (see Figure 16-7) shape is everywhere in the nature, honeycombs, water crystals, diamond crystals, basalt columns, epithelial cells in the eye, Saturn's north pole, etc.

Hexagon

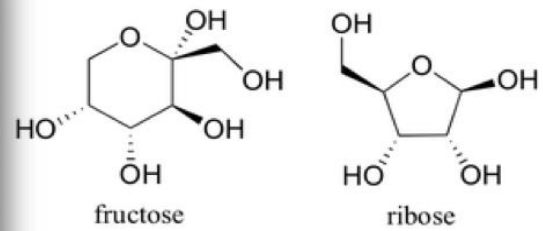


Figure 16-7: The Hexagon – The perfect Shape in all parts of the Nature

This made me look for similar structures in a classroom, since the hexagon shape take less space compared to e.g., round shapes. The hexagon shape has also better ergonomics than round shapes.

The plan was to establish group-based and flexible modules where 6 and 6 students could sit together working. See Figure 16-8.

Using the hexagon shape you get most of the room, within a quite small room you can easily have 6 such modules with seats for 6 students in each group, totally 36 students.

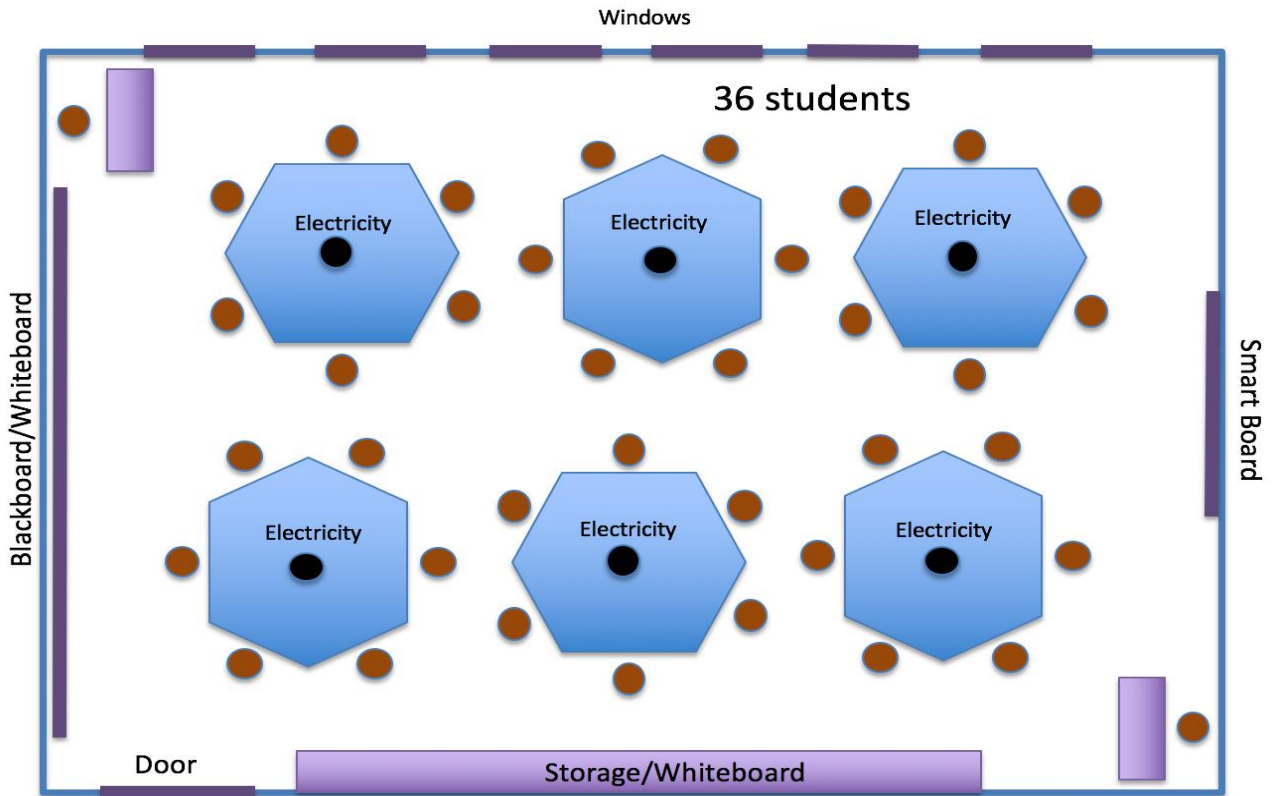
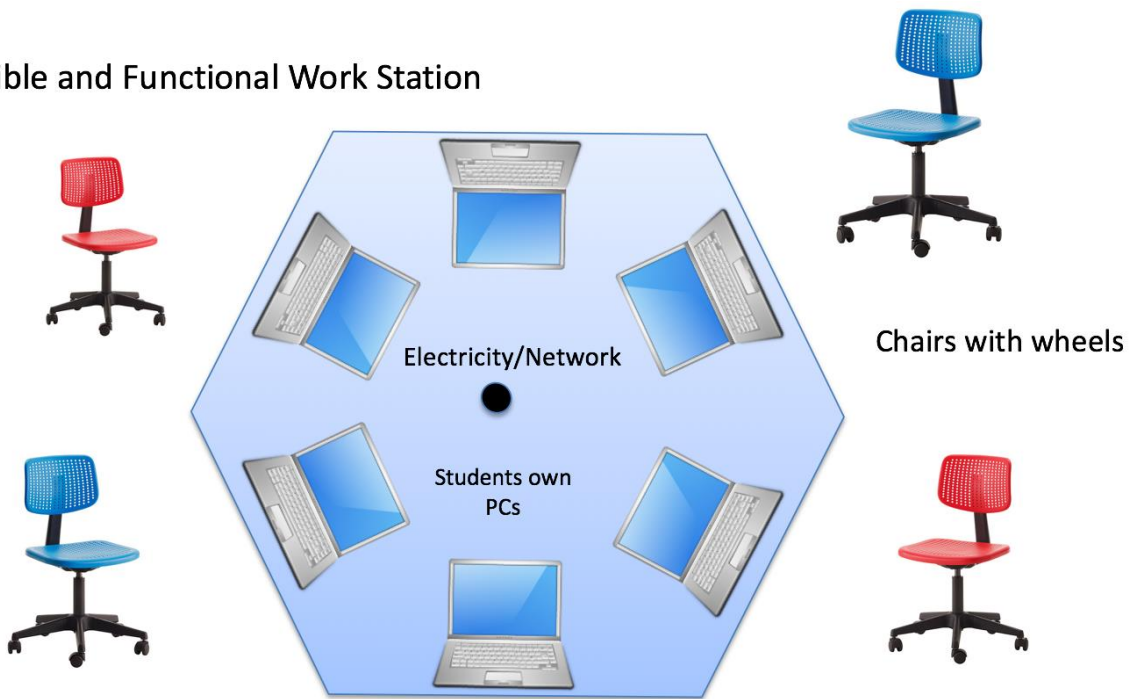


Figure 16-8: A sketch of a Flexible Classroom

Figure 16-9 shows one of the “workstations” in such as solution.

Flexible and Functional Work Station



Hexagon Table with 6 Seats

The key is to use the students own PC for minimum maintenance

Figure 16-9: Sketch of Workstations

This solution will be very flexible, it can be used for many purposes and for many different teaching principles. This solution can be used for small rooms, large rooms, group rooms, etc. See Figure 16-10.

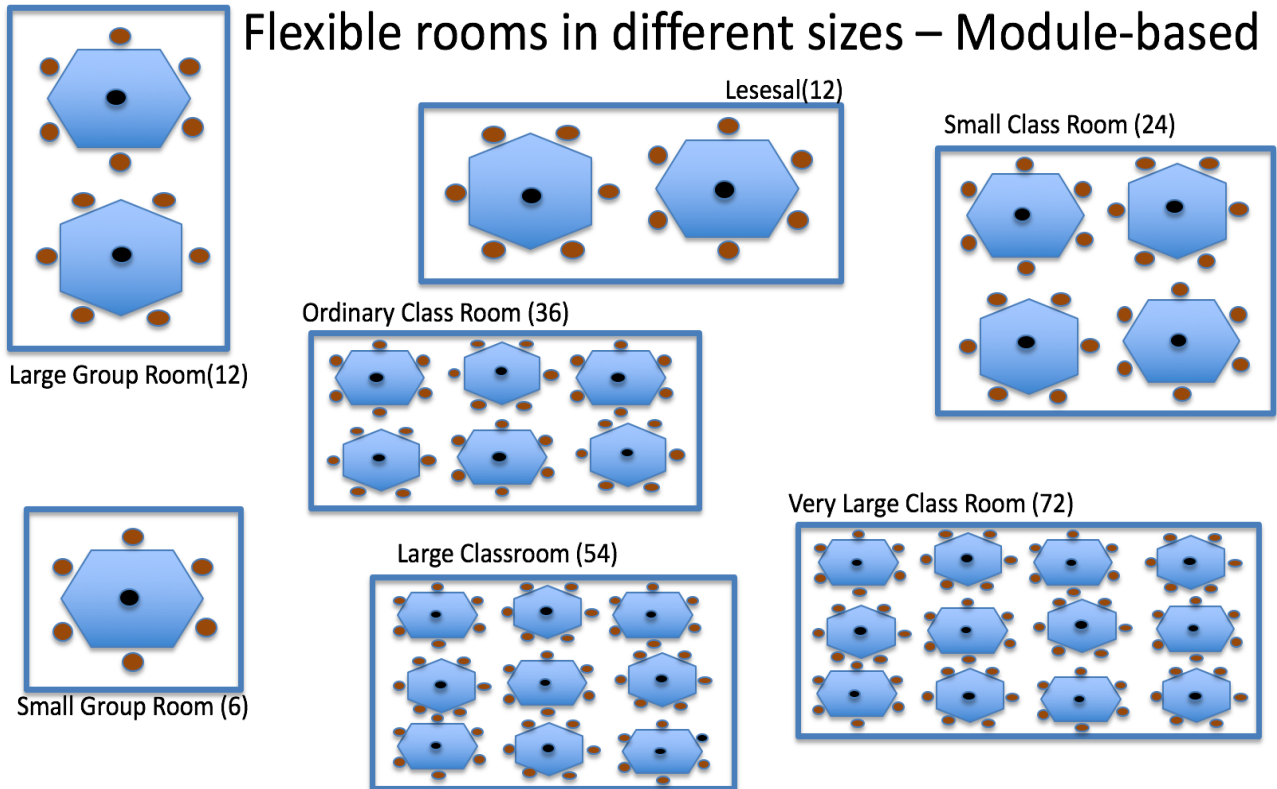


Figure 16-10: Module-based

16.4.1 Advantages

Here is a summary of some of the advantages with these rooms:

- Module-based. One or many modules with seats for 6 students in each.
- Electricity is available from the center of the table, enough for their personal computers, lab equipment, etc. Even network may be available in the same manner.
- Number of modules can vary depending of the size of the room.
- Different types of boards (interactive boards, blackboards, whiteboards, etc.), projectors, etc. can be used at the same time since this solution can use all the 4 (or at least 3, since we need some windows) walls in the room without they getting in way of each other.

- It is very flexible where the educator can be located, he could be in front, in back, etc. since there are no in front or in the back of the room. Student that always intend to sit in back can risk to suddenly sit in front.
- In that way, the educator gets much closer to the students.
- Flexible: The educator can vary the teaching in a much broader sense. He could be showing something on the projector, while writing something on the blackboard at the other end of the room, etc.
- It is ideal for group work and project work
- It is ideal for laboratory work
- Nice rooms make nice students, makes it easier to get new students, and makes the students want to be there, increased creativity, etc.
- Not to mention better ergonomics
- Different educators can collaborate on the teaching, e.g., one educator have a short lecture on the blackboard, while another prepare for a demonstration in the other end of the room.
- When there are not teaching in the room, the student can use it for group rooms

16.5 Final Solution

Based on the ideas and principles explained above, the following has been fulfilled at the university:

- Room C-139a
- Room C-222
- Room A-289
- 12 Group rooms in C-building

These new facilities have been built based on internal assets.

These new rooms are explained in detail below.

16.5.1 Room C-139a

Figure 16-11 and Figure 16-12 shows the final solution implemented in room C-139a. The room consists of 5 modules, totally 30 students can be present the room. The room has an interactive board and some storage cabinets on one wall, a blackboard on another wall, and a projector and a whiteboard on the third wall. It has speakers, camera for e-teaching/online teaching, etc.



Figure 16-11: Room C139a - Final Solution with Flexible Teaching Facilities

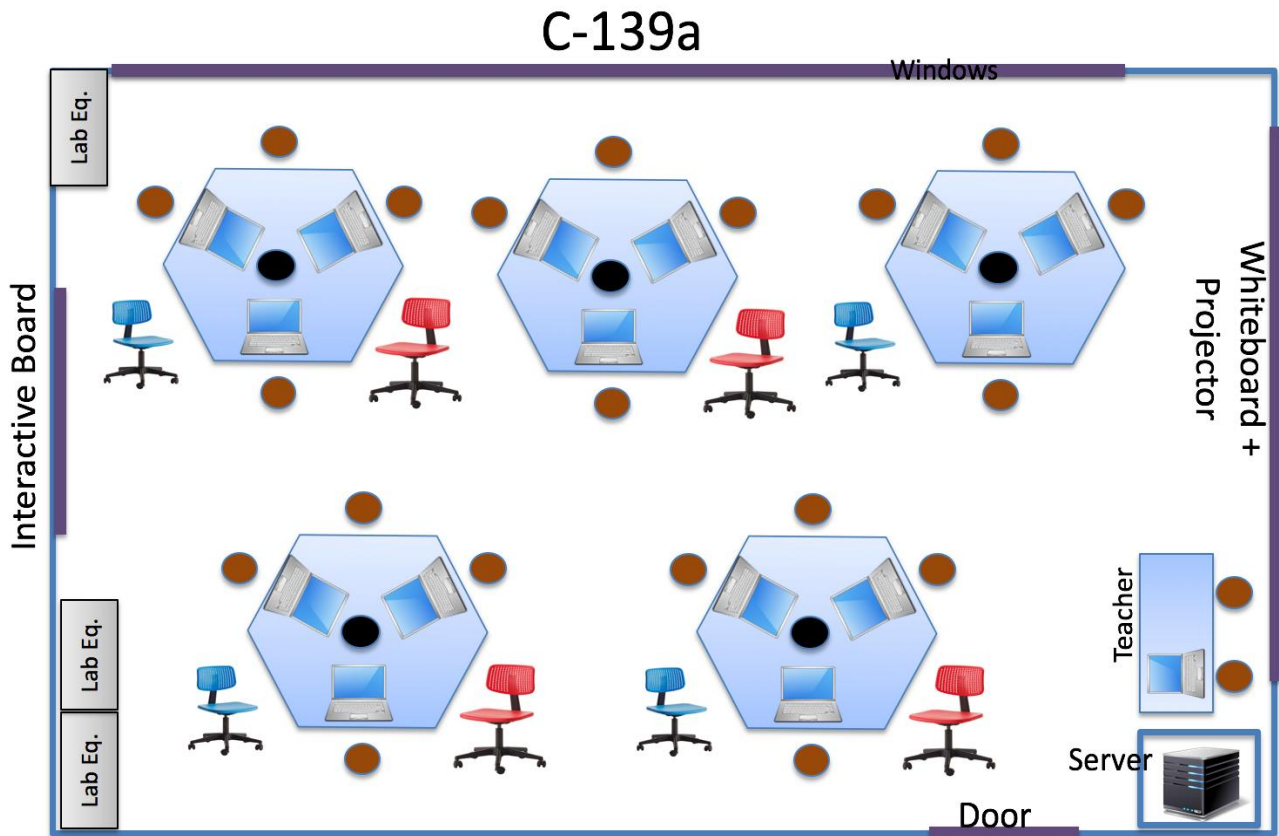


Figure 16-12: C-139a Room Drawings

The room has also an internal network with servers, etc. for use in the Industrial IT and Automation courses we have we have at the university.

16.5.2 Room C-222

A similar room, C-222, in the same building has almost an identical structure. See Figure 16-13.

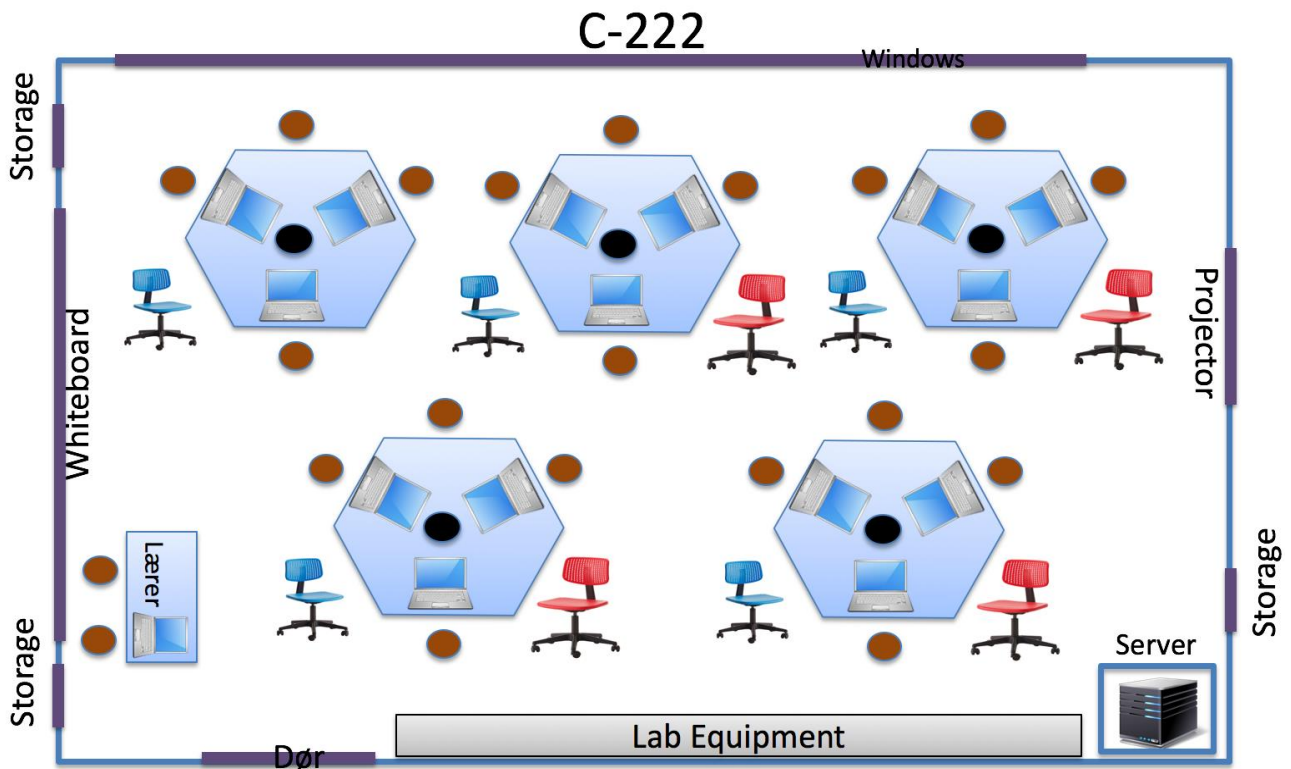


Figure 16-13: C-222 – Flexible Teaching Facilities

Figure 16-14 shows the final solution implemented in room C-222.

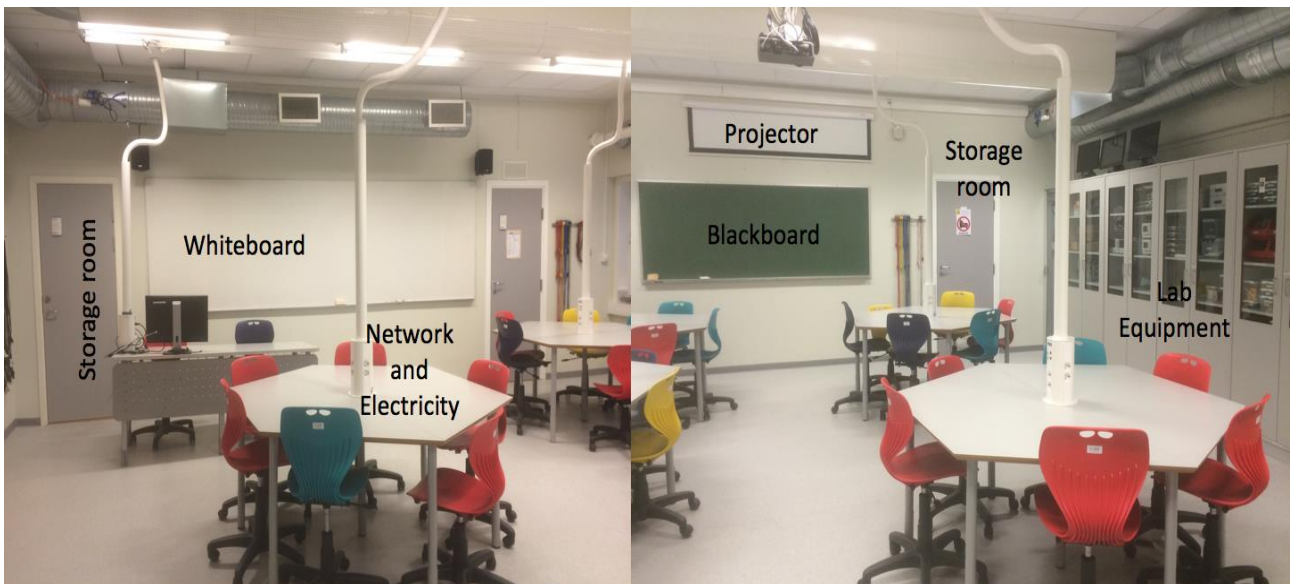


Figure 16-14: Room C-222 – Final Solution

C-222 has become a very flexible teaching room with whiteboard on one of the walls, blackboard and projector on another wall. A third wall have lots of storage for lab equipment, in addition we have 2 separate storage rooms for additional lab equipment, etc. (see Figure 16-15).

All the tables (5 tables with 6 seats in each) have electricity and local network. The local network is use for in laboratory work and project work.

The solution has lots of space for laboratory equipment, etc. (see Figure 16-15 and Figure 16-16).



Figure 16-15: Storage Room for Laboratory Equipment



Figure 16-16: Storage for Laboratory Equipment

16.5.3 Room A-289

In addition, a new room, A-289, is under construction using the same principles.

See Figure 16-17.

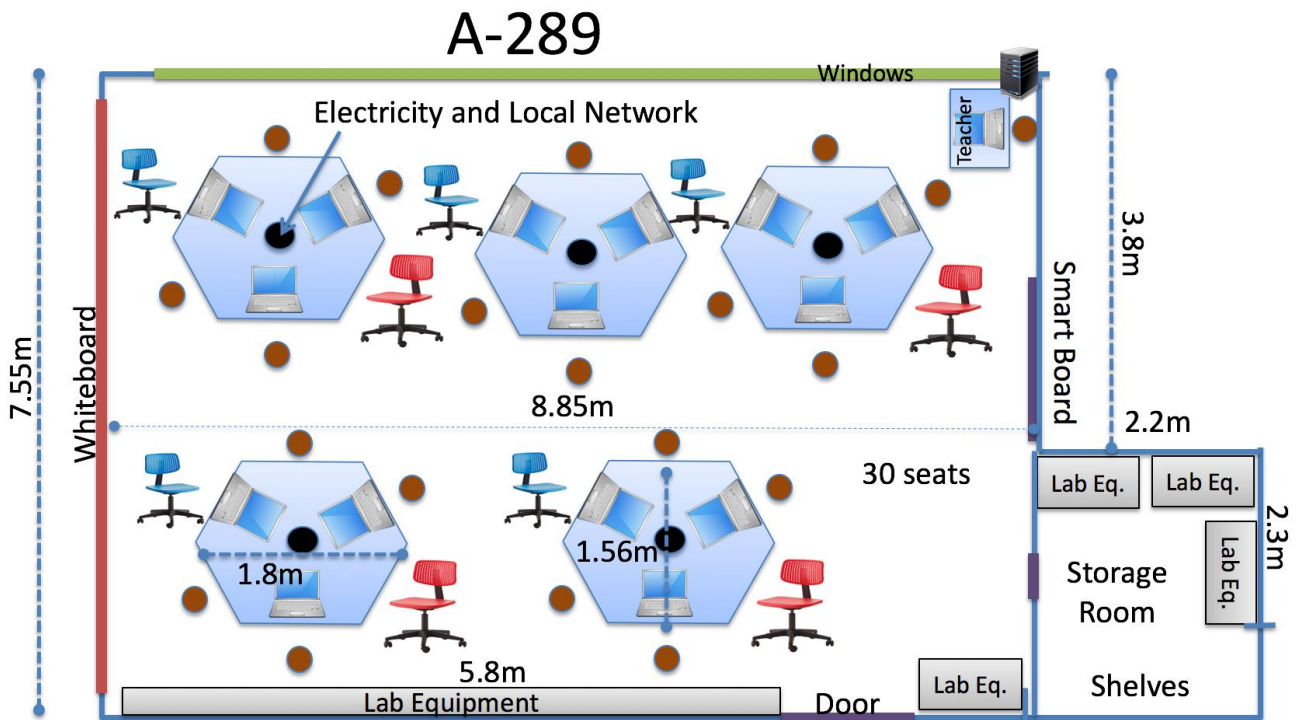


Figure 16-17: A-289 – Flexible Teaching Facilities

Figure 16-18 shows the final results for room A289 with the new flexible inventory and teaching facilities.

The room have now 5 work stations (with seats for 6 students, totally 30 students), a Smart Board, ordinary whiteboard, and also an ordinary projector. All these things can be used such that are not getting in the way for each other, which make it very flexible.

The room has lots of space for storage of laboratory equipment in the form of a small storage room, in addition to a cabinet inside the room.



Figure 16-18: Room A289 with New Flexible Inventory

16.5.4 New Group Rooms

In the C-building we had 12 outdated group rooms. They have now been upgraded using the same principles. They have new tables with built in electricity, a large TV used for collaboration and presentations, a whiteboard, etc. See Figure 16-19 and Figure 16-20. All this make these rooms very flexible when the students work with group and project related tasks, and they can easily collaborate and share information using the TV and the whiteboard.

Totally, with these 12 rooms we can have up till 72 students.

These group rooms are mainly used by Bachelor students in different project courses, and especially used for their final Bachelor Project (20 credits).

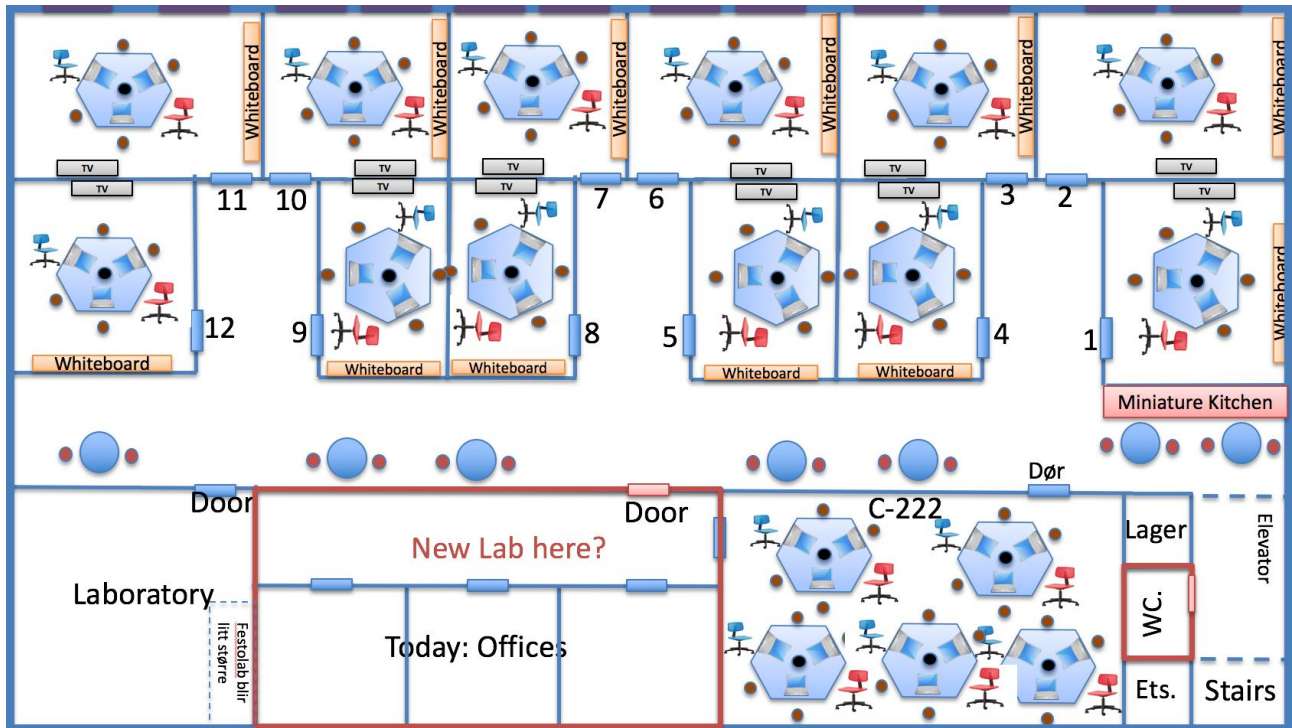


Figure 16-19: New Flexible Group Rooms

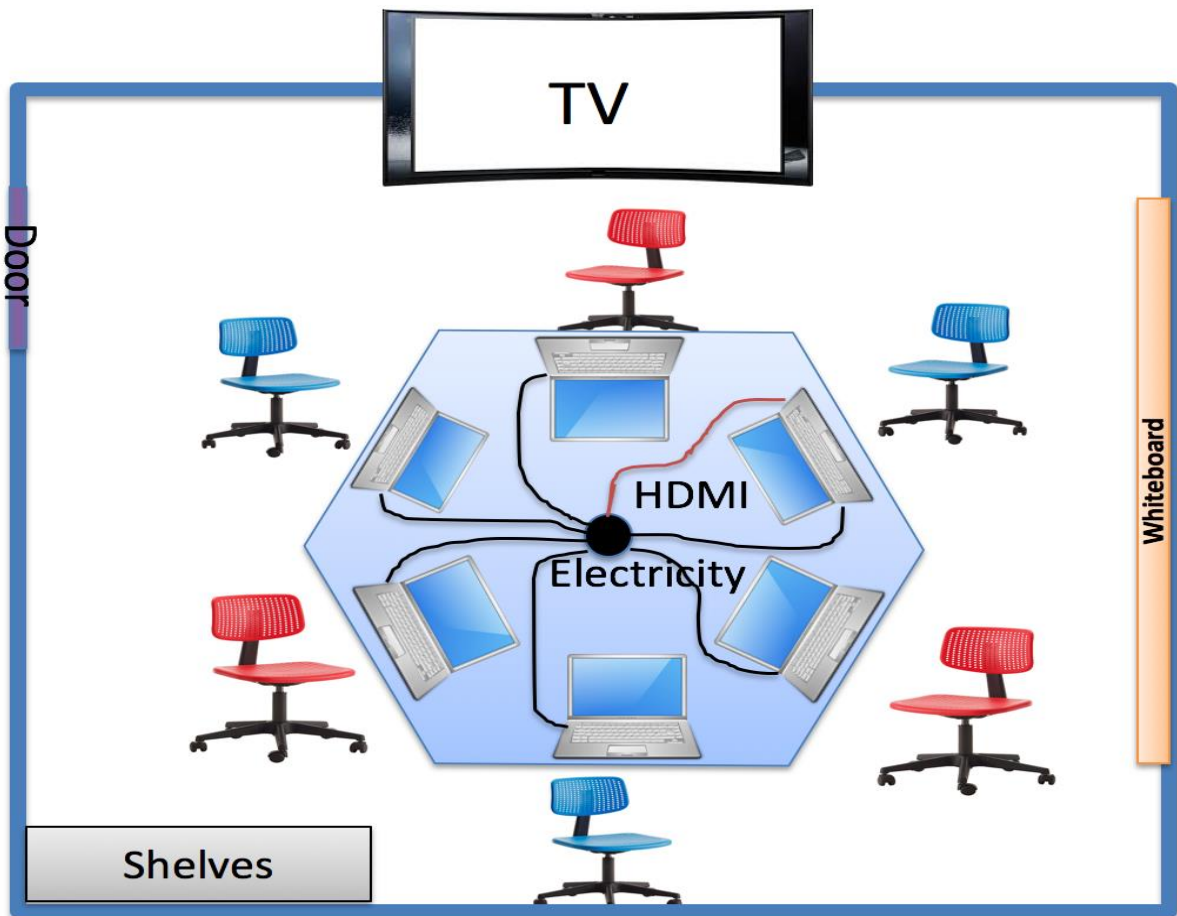


Figure 16-20: New Group Room Concept

16.5.5 Further Extensions

The next step is to increase number of simultaneous students so up till 60 students can be present. See Figure 16-21.

Multipurpose and Flexible Room for 60 students

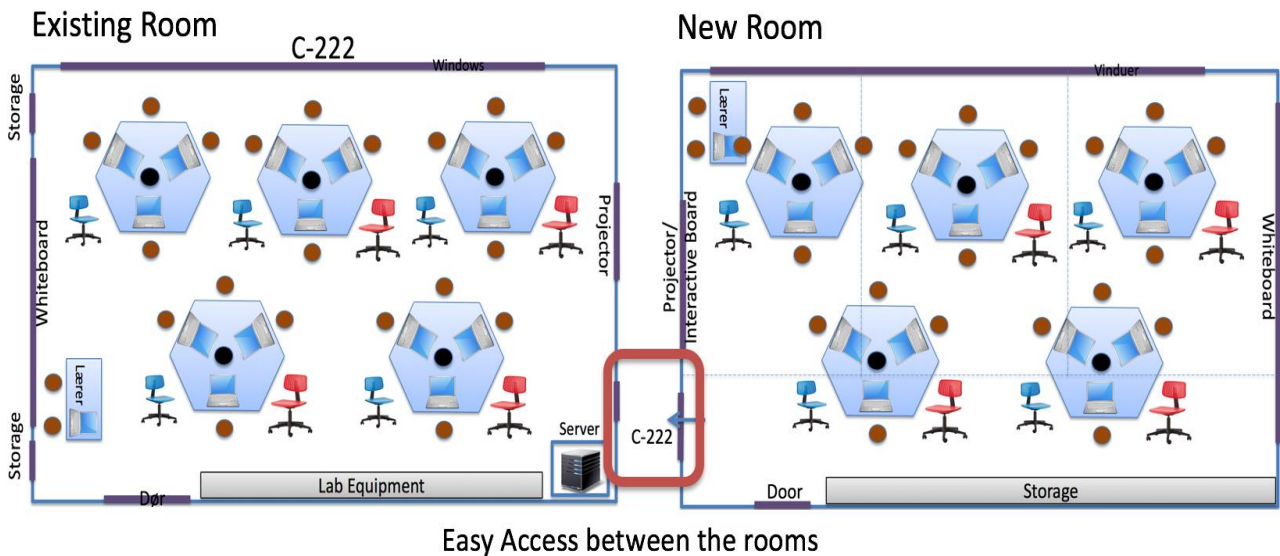


Figure 16-21: New plans for multi-purpose Teaching facilities for 60 students simultaneously

16.6 Laboratory Hardware and Equipment

As seen in Figure 16-15 and Figure 16-16 lots of laboratory hardware and equipment are in use, some of the equipment can only be used in the laboratory, while other hardware can be borrowed by student and employees. In order to handle that, we needed a Laboratory Inventory System (LIS) to keep track of the laboratory equipment, keep track of loans, etc.

What is Lab Inventory System (LIS)?

- A system that keeps track of Laboratory Equipment at our university
- Employees and Students can use it when they need to borrow Lab Equipment home, to group rooms, etc.

- When you use it for the first time you need to register information about yourself (Name, Login Name, Password, E-mail, Phone, etc.)

In combination with different student project, such a LIS system has been created from scratch and are in use today in the laboratory.

16.7 Publications

Below you find publications related to Problem/Project Based Learning (PPBL) and flexible teaching facilities:

- **Constructive Alignment with Student in Centre and Front - Experience from Case-projects and Intensive Summer Courses** - Hans-Petter Halvorsen, Josef Timmerberg, Saba Mylvaganam - MNT Conference, March 28-29, 2019, Tromsø, Norway.
- **Project/Problem Based Learning in Electrical Engineering, IT and Automation** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam. ITEN2015 Conference, Łódź, Poland, September 2015.
- **Experience with Case-projects in Bachelor and Master Studies in Electrical, IT and Systems & Control Engineering** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam - EAEEIE 2013, 24th EAEEIE (European Association for Education in Electrical and Information Engineering) Annual Conference, Chania, Greece 30 - 31 of May, 2013

17 Agile and Scrum Methodology

I have started to use Agile methods and Scrum methodology known from System/Software Engineering within my teaching. This is especially relevant in PPBL (Problem/Project Based Learning) methods such as student projects, which are integrated in many of the courses at our university.

What is Agile and Scrum methodology? One of the most popular Agile methods today is Scrum. Agile methods such as Scrum have less focus on documentation.

In Figure 17-1, we see different teaching methods. We see how this new approach differs from the more traditional methods. It is more flexible and offers larger room for more variations in scope and content for the students and staff.

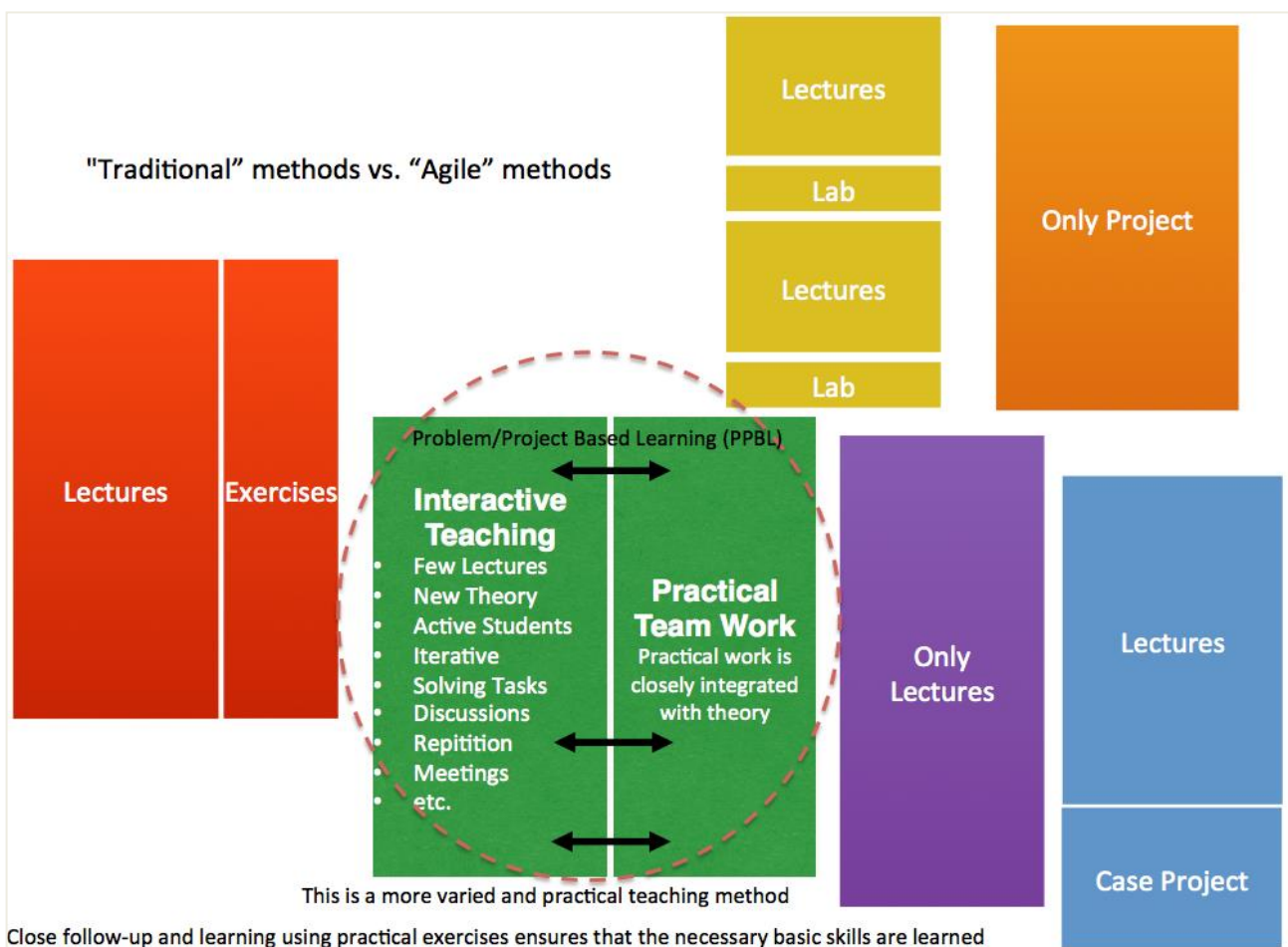


Figure 17-1: "Traditional" methods vs. "Agile methods"

In Figure 17-2, we see the Scrum approach used within a teaching environment.

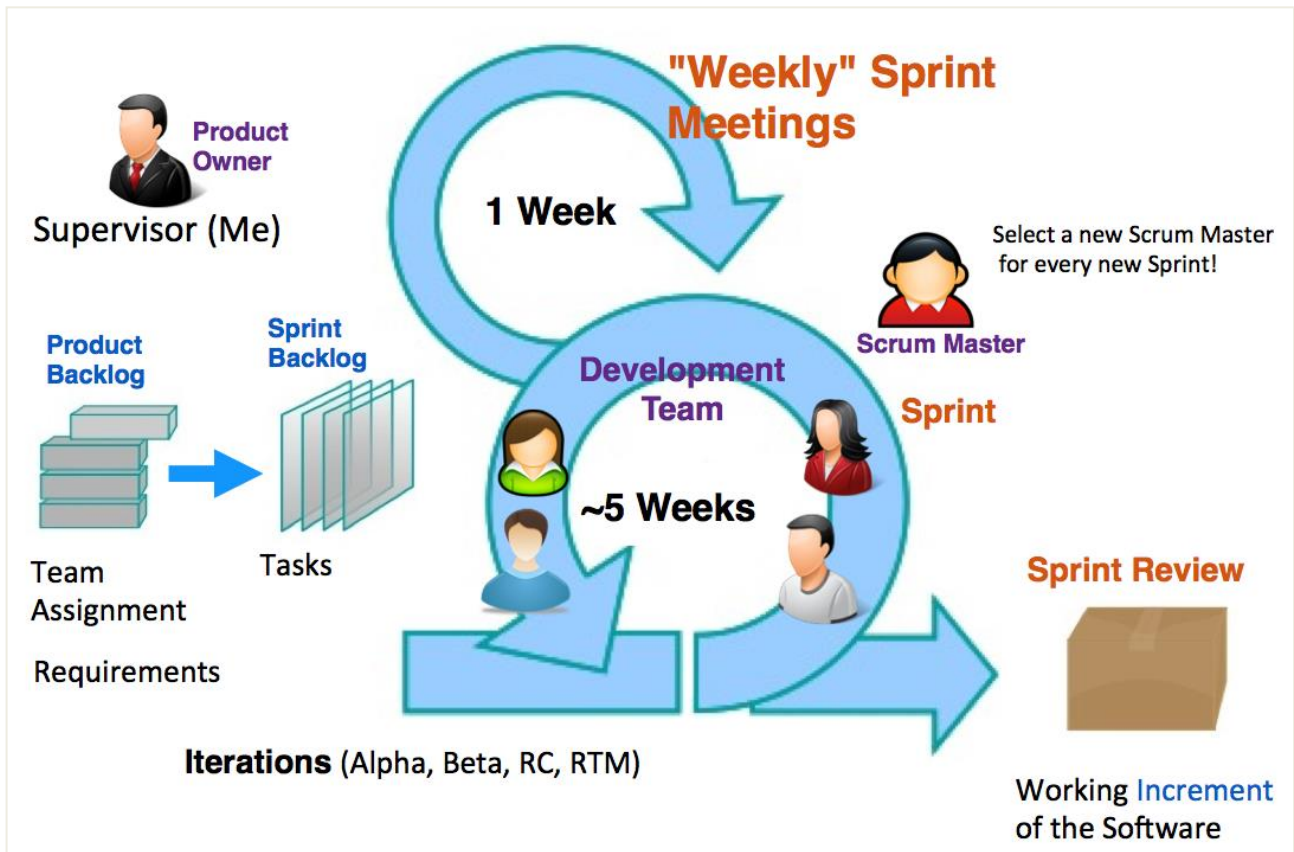


Figure 17-2: Scrum Approach within Teaching

Scrum uses a “simplified” project model with less focus on writing documents for everything. You could say it is a more practical approach to dealing with projects.

One of key principles is to have daily meetings where they go through the status of the project. These meeting are very short and each member in the project need to answer 3 simple questions:

1. What did you do yesterday?
2. What shall you do today?
3. Any Problems?

With these 3 simple questions, you get a pretty good track of what the members in the groups (actually, it does not need to be a group, it could be a Master Thesis where the students are working alone).

Another tool which is popular in Agile and Scrum methodology is the so-called “Task Board” (Figure 17-3). A Task Board is a whiteboard with sticky notes, where each sticky note contains a specific task that needs to be done. You normally divide the board in the columns, tasks that needs to be done, tasks that they have started on

(in progress) and tasks that are finished. If this Task Board is available on the wall in the project room (group room), you continuously get an overview of the work (tasks) in the project.

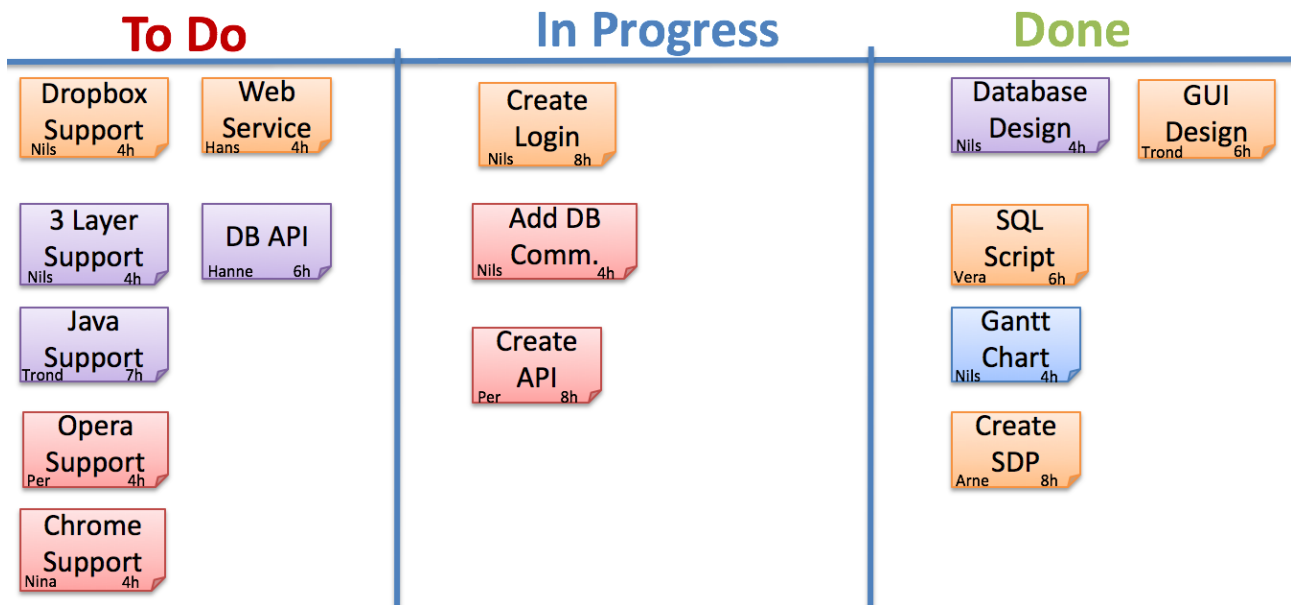


Figure 17-3: Task Board – Popular in Agile and Scrum methodology

Instead of using a physical whiteboard as the Task Board, a lot of software exists for this purpose.

Azure DevOps/Visual Studio Team Services has been used as the software tool to handle the Scrum process in different courses and student projects.

For more information about Scrum and Visual Studio Team Services, please see the following videos:

- Scrum with Examples (<https://www.youtube.com/watch?v=h3RVZv3NGWk>)
- Introduction to Azure DevOps/Visual Studio Team Services (<https://www.youtube.com/watch?v=cWdHuFetOIA>)

In addition, a software program called “Project Management System” has been created from scratch. Project Management System has been developed from scratch by me and it has agile methods such as Scrum in mind. It is also well suited for PPBL.

17.1 Publications

Some of the results regarding using this approach in teaching is also published:

- **Experience with Case-projects in Bachelor and Master Studies in Electrical, IT and Systems & Control Engineering** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam - EAEEIE 2013, 24th EAEEIE (European Association for Education in Electrical and Information Engineering) Annual Conference, Chania, Greece 30 - 31 of May, 2013.

I quote a section from the publication:

“A combination of teacher-student classes, projects and practical problems is found to be attractive to the students and can help to define appropriate learning goals and set “measurable” learning outcomes, involving all aspects of engineering related to a given case study, encompassing hardware/software, design, testing and implementing the solution in a real-life scenario, either in the industry or in the lab. This would stimulate students and make them interested in the topics and their sphere of influence/applications. This approach creates a platform for students’ independent thinking and innovativeness and leaves imprints on the students by engaging many facets of the topics covered during the studies by the students and the staff involved in the process.”

Figure 17-4 shows some PPBL courses at our university that I am teaching with high PPBL weight.

Course Code	Courses & PBL/PBBL		
	Topic	ECTS	PBL/PBBL or related weight
EE4107	Cybernetics Adadvanced	5	50%
EE4209	Model Based Control	5	50%
SCE4206	Systems and Control Laboratory	5	70%
IA4412	System/Software Engineering	10	70%

Figure 17-4: Courses at the university that I am teaching with high PPBL weight

18 Interactive Learning Platforms

With Flipped Classroom principles, teaching methods such as problem-based learning (PPBL) and student-centered approaches, online study programs, etc. it is crucial to have interactive learning platforms. During the years I have established lots of resources for this purpose, some examples are

- Self-paced training material
- Online Tests, e.g., multiple choice tests
- Tutorials
- etc.

More about some of these interactive learning tools and platforms in the following sections.

18.1 Online Multiple-choice Tests and Diplomas

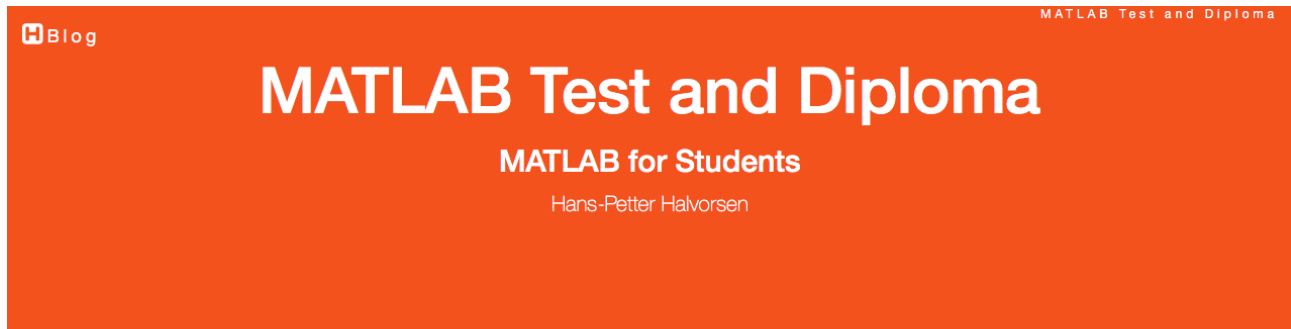
I use this kind of testing in many situations where the students have approved/not approved requirements. It's easy for me because I don't need to go through all the answers (the system does it for me), I get to test the skills of the students, and the student make an extra effort because they feel they get something with extra value for them.

18.1.1 MATLAB Training

Since there are no grades or credits in this course, I provide, as an extra service, a diploma. You will get this valuable diploma (handy when applying for jobs, etc.) only if you pass some following criteria, such as submitting exercises from the different parts.

These things make it more attractive for students to fulfill the training and work hard with exercises, etc. to be able to take the test and get the diploma.

Figure 12-3 shows parts of the multiple-choice test that finalize the course and makes it possible to print out the diploma.



MATLAB Test

Test your MATLAB skills with this MATLAB Test. The test contains **35 questions**. Each question have 3 alternatives where only one of the alternative is correct.

You get **+5** points for each correct answer and **-2** points for each wrong answer/answers you are not answering. The Top score is **100%**.

The student have **90 minutes** available for this test. When you are finished, please print out the diploma and give it to one of the instructors for signing. The instructor will check if you have the recorded attendance needed and check if you have submitted the necessary code. If you have passed all the criteria, the instructors will sign the diploma.

Note! For some of the questions you need to use MATLAB - but you cannot use the Course Manuals or collaborate with other students during the test! Any attempt of cheating will mean that you will be deprived of the opportunity to get diploma!

You dont need MATLAB for Questions 1-30, but you may use it if you want to. For Questions 31-35 you will need to use MATLAB in order to find correct answers.

Please fill in your Name:

Student Name:

I have completed the following parts (code is submitted and approved): Part I Part II Part III

Questions 1 - 10

(MATLAB not needed for these questions)


1. What does the letters in MATLAB mean?


- Math Laboratory
- MATrix LABoratory

Figure 18-1: Multiple-choice Test

When the students are finished with the multiple-choice test they get online access to the diploma (see Figure 12-4) which they need to print out and get signed.

The total score (0-10%), the name of the student, which parts the students have fulfilled are automatically filled out.





2016.09.26

MATLAB Training

The following student has completed the MATLAB Training at University College of Southeast Norway:

Hans-Petter Halvorsen

Score: 100.0%

In the MATLAB Training the student has reviewed the following topics:

Part I: Introduction - MATLAB Basics

The MATLAB Environment, Using the Help System in MATLAB, MATLAB Basics, Linear Algebra; Vectors and Matrices, M files; Scripts and User-defined functions, Plotting, Flow Control; For and While Loops, If and Case statements, Mathematics.

Part II: Modelling, Simulation and Control


Differential Equations and ODE Solvers. Numerical Techniques such as Interpolation, Curve Fitting, Numerical Differentiation, Numerical Integration, Other topics are: Optimization, Control System Toolbox, Transfer functions, State-space models, Frequency Response, Discrete Systems.

Part III: Simulink and Advanced Topics

Advanced Topics in MATLAB, such as: Debugging in MATLAB, More about functions, More about Plots, Using Cells in the MATLAB Editor, Importing Data, Structures and Cell Arrays. This part also covers an Introduction to Simulink and an introduction to other Tools.

For more information about the contents of the course, please visit: <http://home.hit.no/~hansha/?training=matlab>

Course Instructor



Hans-Petter Halvorsen, Course Coordinator

<http://home.hit.no/~hansha>

MATLAB

The Language of Technical Computing

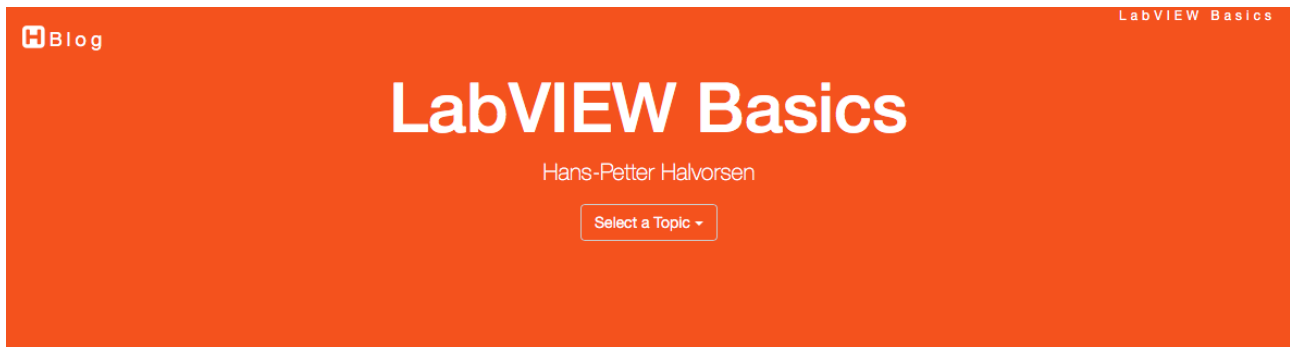
0.8147	0.0975	0.1576
0.9058	0.2785	0.9708
0.1270	0.5469	0.9573
0.9134	0.9575	0.3821
0.6324	0.9649	0.8002

Figure 18-2: Final Diploma

18.1.2 LabVIEW Training

I use the same concept when learning student LabVIEW Programming. LabVIEW is a graphical programming used in different courses and projects in our university.

We have different courses in programming, where we now use Visual Studio and the C# programming language. When it comes to LabVIEW, we don't have a separate course for that, but since the students need it and use in many courses, they need some training. That's where my LabVIEW Training resources comes handy, where the students get access to all the LabVIEW Training resources online, see Figure 18-3.



LabVIEW Basics

LabVIEW is a graphical programming language, and it has powerful features for simulation, control and DAQ applications.

LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.

After each Video you will also find small Exercises that you should do in order to practice on the topics explained in the Videos.

1. Installing LabVIEW

Installing [LabVIEW](#) is straightforward. But just to be sure, take a look at the Video below before you start downloading and installing LabVIEW. See also the main [LabVIEW](#) page.



Figure 18-3: LabVIEW Training

Here they get access to information about LabVIEW, how to install the software, self-paced exercises, videos, etc.

In addition, they have the possibility to take online, multiple-choice test and get a diploma, which they need to print out.

LabVIEW Training Web Site is available from here:

http://www.halvorsen.blog/documents/programming/labview/labview_basics.php

18.2 Training and Tutorials

As part of my blog I have published a set of extensive “Tutorials” within different fields from programming languages and programming techniques, data acquisition, database systems, etc. See Figure 18-4.

Blog Training and Tutorials

Training and Tutorials

Hans-Petter Halvorsen

Below you find many useful resources within different topics.

LabVIEW

- Introduction to LabVIEW
- Control and Simulation in LabVIEW
- Model Predictive Control in LabVIEW
- System Identification and Estimation in LabVIEW
- Linear Algebra in LabVIEW

For more information about LabVIEW, goto [LabVIEW](#).

Visual Studio/C#

- Introduction to Visual Studio and C#
- Data Acquisition in C#
- ASP.NET and Web Programming

For more information about Visual Studio/C#, goto [Visual Studio and C#](#).

Control Engineering

- Control and Simulation in LabVIEW
- Model Predictive Control in LabVIEW

Figure 18-4: Tutorial Portal

The Tutorial Portal is available here:

<https://www.halvorsen.blog/documents/tutorials/tutorials.php>

Here are some of the tutorials listed:

LabVIEW Tutorials:

- Introduction to LabVIEW
- Data Acquisition in LabVIEW
- Control and Simulation in LabVIEW
- LabVIEW MathScript
- Linear Algebra in LabVIEW
- Database Communication in LabVIEW
- Wireless Data Acquisition in LabVIEW
- Introduction to State-based Applications in LabVIEW
- OPC and Real-Time Systems in LabVIEW
- System Identification and Estimation in LabVIEW
- Model Predictive Control in LabVIEW
- Introduction to Vision Systems in LabVIEW

Data Acquisition Tutorials:

- Data Acquisition in LabVIEW
- Data Acquisition in C#
- Data Acquisition in MATLAB
- Wireless Data Acquisition in LabVIEW

MATLAB/Simulink Tutorials:

- Introduction to MATLAB
- Introduction to Simulink
- Data Acquisition in MATLAB

The .NET Platform/Visual Studio/C# Tutorials:

- Introduction to Visual Studio and C#
- Using SQL Server in C#
- Data Acquisition in C#
- ASP.NET and Web Programming
- Introduction to Web Services

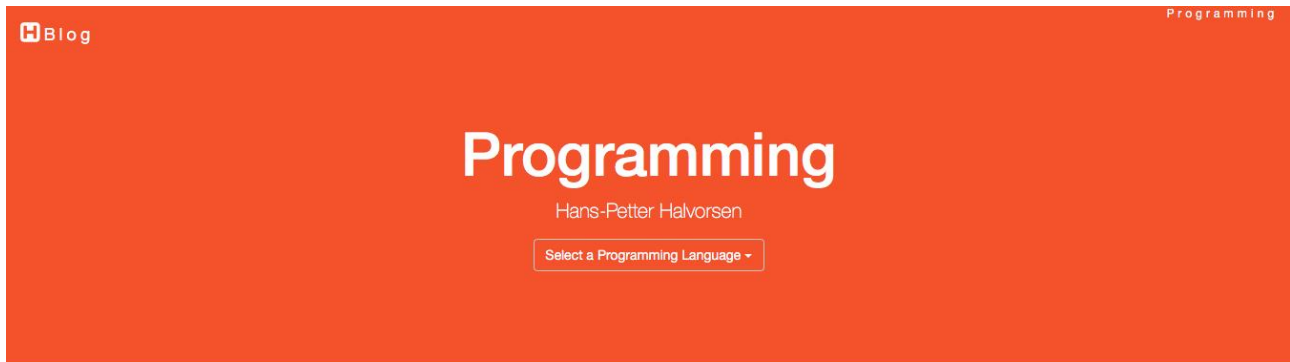
The tutorials are combinations of written material, installation instructions, videos, examples, code available for download, etc. – everything available from web sites.

On the Tutorial web pages, we have:

- Written Tutorial
- Videos
- Overview of necessary Hardware and Software
- Code Examples
- Web links for additional resources
- Question and Discussion forum

19 Teaching Programming

I am involved in lots of programming activities, so a main part of my activities is about teach programming, programming languages and software development (Figure 19-1).



Programming

Today we have hundreds of different programming languages. Here I will only focus on the programming languages and programming environment I am using, these are:

- LabVIEW
- MATLAB
- Visual Studio and C#
- Python
- Database Programming (SQL)
- Arduino Programming
- Web Programming
- PHP Web Programming

Programming Videos

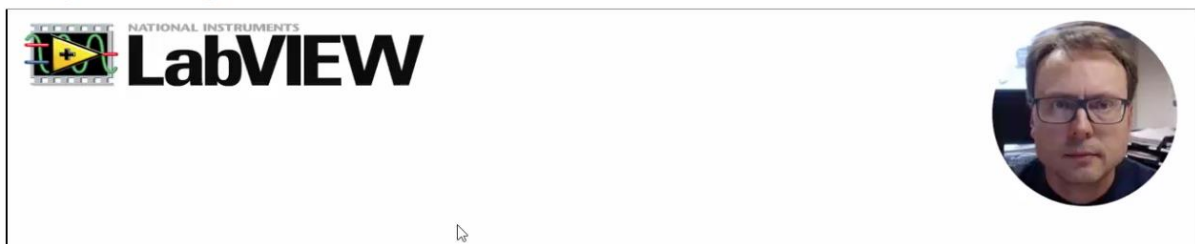


Figure 19-1: Teaching Programming

I am involved in many programming tools and programming languages, which is also explained in other parts and chapters in this document.

In this chapter I will focus on LabVIEW programming and MATLAB programming.

19.1 LabVIEW Programming

LabVIEW is a program which I use widely. LabVIEW has a graphical and intuitive way of creating applications, and it is especially useful when creating data acquisition and control and simulation applications.

Figure 19-2 gives an overview of some of the LabVIEW contents on my web site.

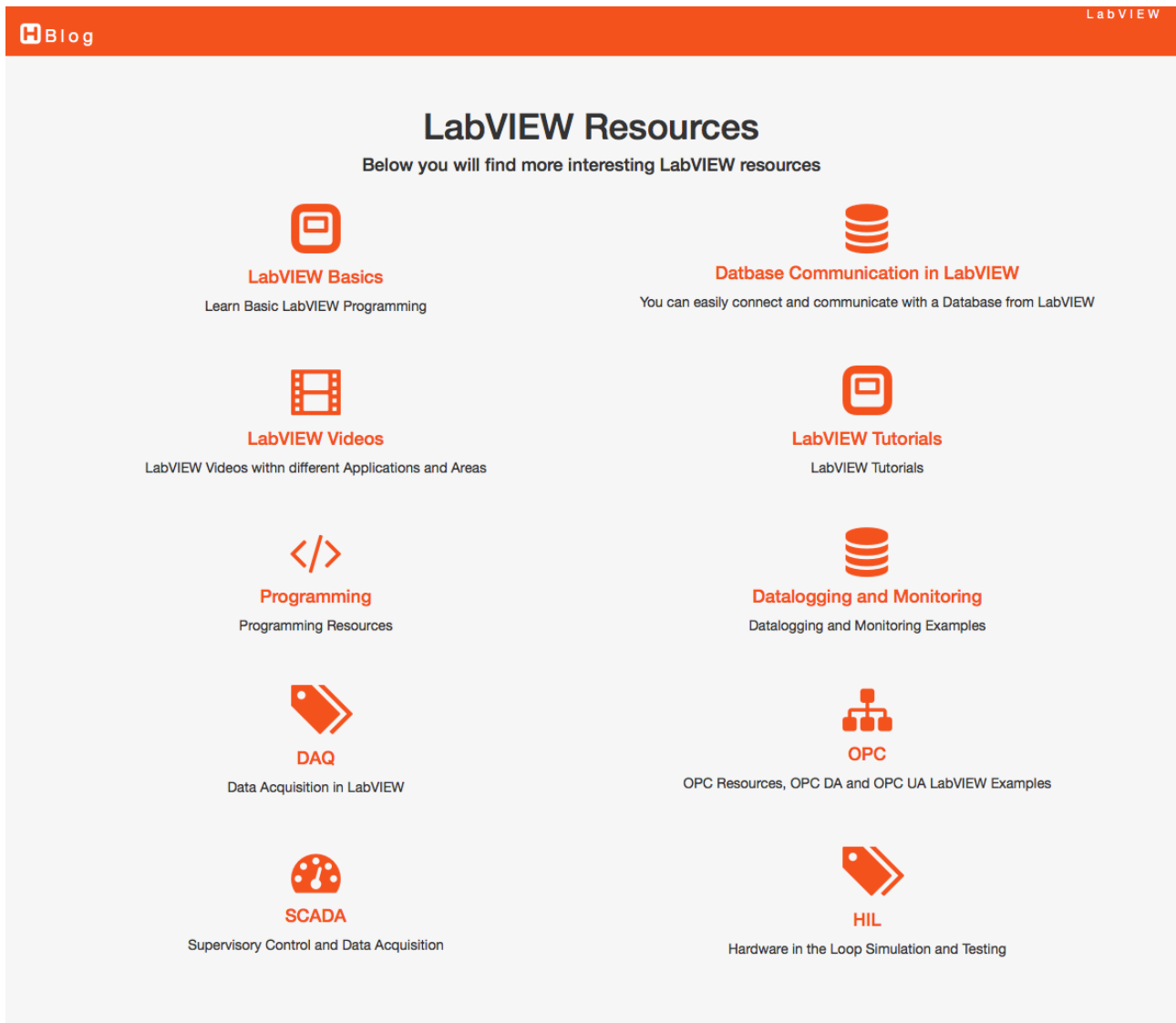
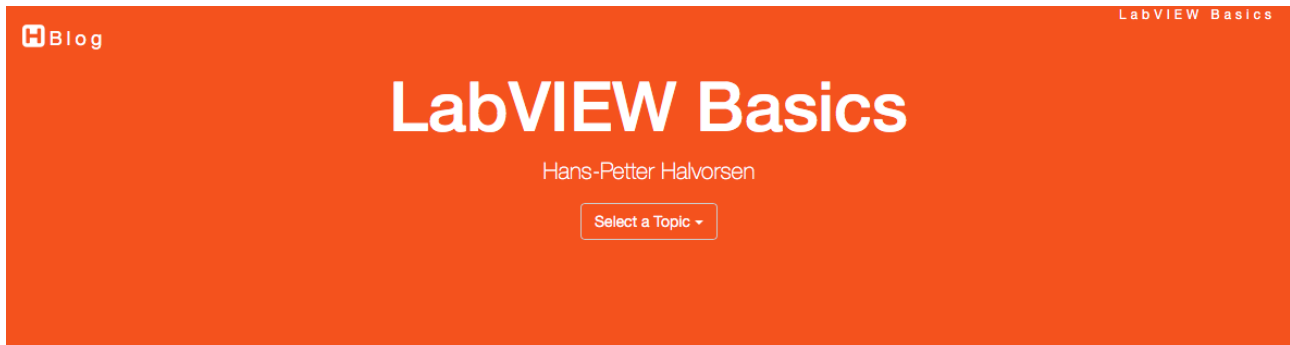


Figure 19-2: Teaching LabVIEW Programming

LabVIEW Basics (see Figure 19-3) includes a set of LabVIEW videos explaining the basic principles in LabVIEW with small step by step examples.

LabVIEW Application Videos (see Figure 19-4) contain lots of LabVIEW videos for different applications and domains, such as data acquisition applications, simulation and control applications, OPC applications, database applications, etc.

LabVIEW Tutorials are in-depth tutorials containing different resources within different areas.



LabVIEW Basics

LabVIEW is a graphical programming language, and it has powerful features for simulation, control and DAQ applications.

LabVIEW Basics is a set of Video Tutorials explaining the basic functionality in LabVIEW.

After each Video you will also find small Exercises that you should do in order to practice on the topics explained in the Videos.

1. Installing LabVIEW

Installing [LabVIEW](#) is straightforward. But just to be sure, take a look at the Video below before you start downloading and installing LabVIEW. See also the main [LabVIEW](#) page.



Figure 19-3: LabVIEW Basics Training

Here is feedback from some of the users:

“I have watched almost all of your tutorial videos about LabVIEW which helps me to build my knowledge. It was amazing. your video is well prepared which is clear and easily understandable.

“It is not easy to get such a quality free educational videos and also a person like you who is willing to share his knowledge without cupidity.”

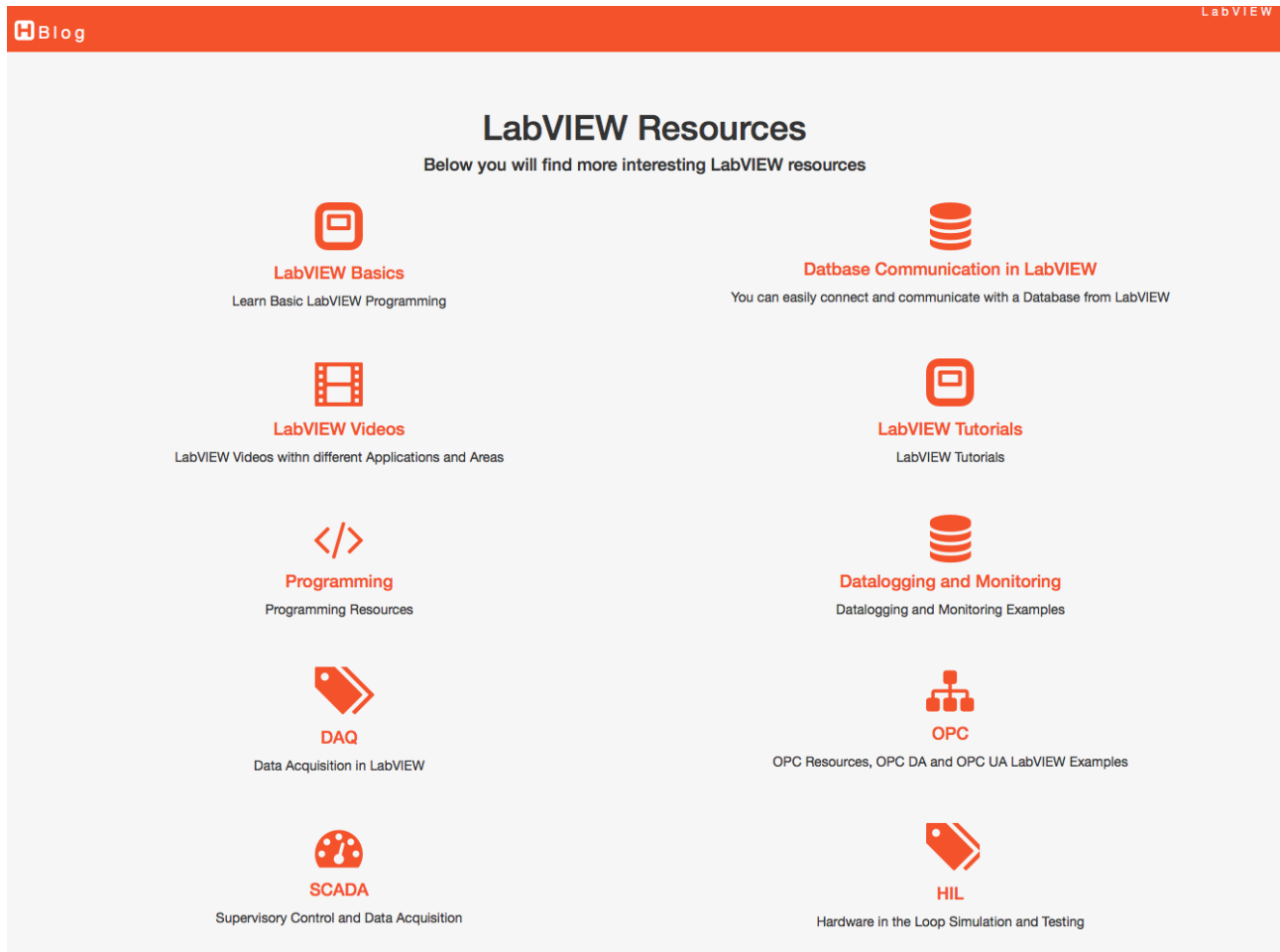


Figure 19-4: LabVIEW Applications Videos

19.2 MATLAB Programming

Another widely use programming tool and language is MATLAB. In addition to the MATLAB course for the Master students, I use and include MATLAB in different teaching activities, including laboratory work, different student projects, etc.

Figure 19-5 gives an overview of some of the MATLAB contents on my web site.

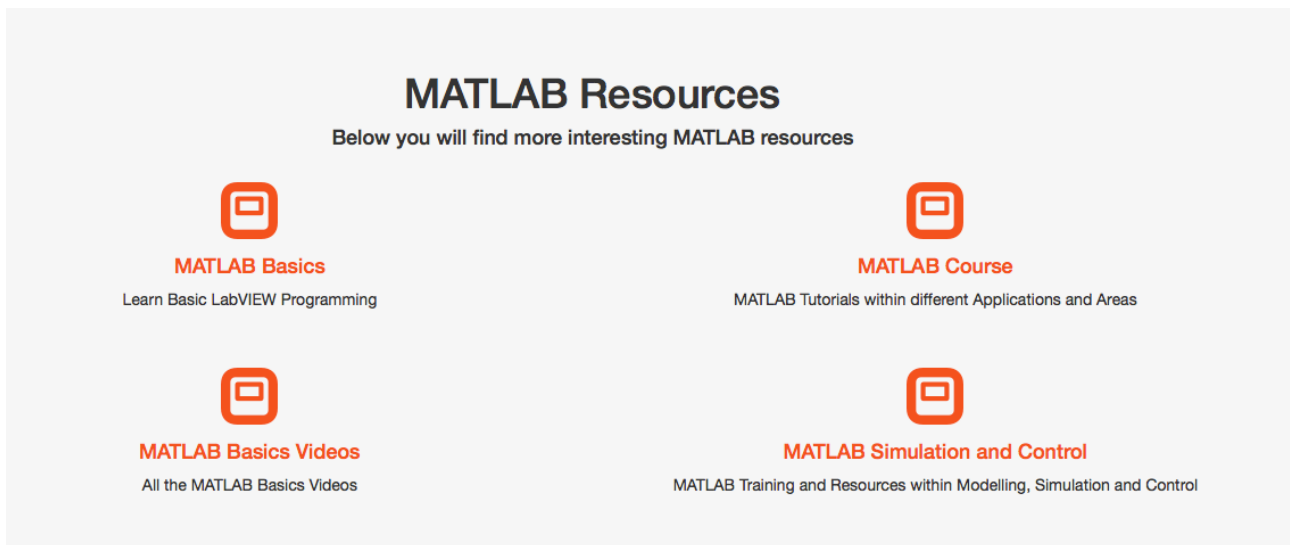


Figure 19-5: Teaching MATLAB Programming

MATLAB Basics (see Figure 19-6) includes a set of MATLAB videos explaining the basic principles in MATLAB with small step by step examples.



MATLAB Basics

MATLAB is a tool for technical computing, computation and visualization in an integrated environment. MATLAB is an abbreviation for MATrix LABoratory, so it is well suited for matrix manipulation and problem solving related to Linear Algebra, Modelling, Simulation and Control applications, etc.

MATLAB Software:

If you don't have MATLAB, you can buy a [MATLAB student version](#) (350-699 NOK), which you can install on your personal computer. The MATLAB student version includes the most used Toolboxes as well, like Simulink, Control System Toolbox, Optimization Toolbox, Statistics Toolbox, etc.

Students and staff at [University College of Southeast Norway](#) can freely install the [MATLAB Software](#) on their own computers, since the university has a Total Academic Headcount (TAH) License. The Activation Key is located in Fronter, where only students and staff at the university have access.

See also the main [MATLAB](#) page.

1. Introduction to MATLAB

Watch the Video below in order to get an idea of what MATLAB is:

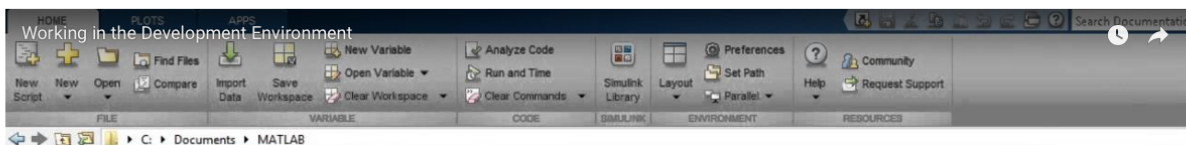


Figure 19-6: MATLAB Basics

MATLAB Modelling, Simulation and Control is more specifically directed to applications within these topics and include more in-depth videos, exercises and other resources.



1. What is MATLAB?

MATLAB is a tool for technical computing, computation and visualization in an integrated environment. MATLAB is an abbreviation for MATrix LABoratory, so it is well suited for matrix manipulation and problem solving related to Linear Algebra, Modelling, Simulation and Control applications, etc.

New to MATLAB? - See [MATLAB Basics](#).

2. Modelling, Simulation and Control

Contents: Solving Differential Equations (ODEs), Discrete Systems, Interpolation/Curve Fitting, Numerical Differentiation/Integration, Optimization, Transfer Functions/State-space Models, Frequency Response.

Open the Course Manual (PDF document) below and start doing the Exercises/Tasks inside.

2.1 Quick Start Guide with Examples

Below you find a Quick Introduction to MATLAB with Examples:

 [MATLAB Modelling and Simulation Quick Start Guide with Examples](#)

Figure 19-7: Modelling, Simulation and Control with MATLAB

19.3 Python Programming

Python has become a popular programming language, and it is one of the most used programming languages today.

The way we create software today has changed dramatically the last 30 years, from the childhood of personal computers in the early 80s to today's powerful devices such as Smartphones, Tablets and PCs.

The Internet has also changed the way we use devices and software. We still have traditional desktop applications, but Web Sites, Web Applications and so-called Apps for Smartphones, etc. are dominating the software market today.

We need to find and learn Programming Languages that are suitable for this New Age of Programming.

We have today several thousand different Programming Languages, so why should we learn Python? I guess you will need to learn more than one Programming Language to survive in today's software market, but Python is easy to learn, so it is a good starting point both for new programmers and for more experienced programmers.

At University of South-Eastern Norway (USN) we use Python in many different courses, in addition to different Projects, etc. Especially in the Industrial IT and Automation Master program and in the "Informatikk og Automatisering" Bachelor program (In English: "Computer Science and Industrial Automation") we use Python (and many others like C#, LabVIEW, etc.).

I am writing different textbooks that deal with the Python programming language within different areas. See Figure 19-8.

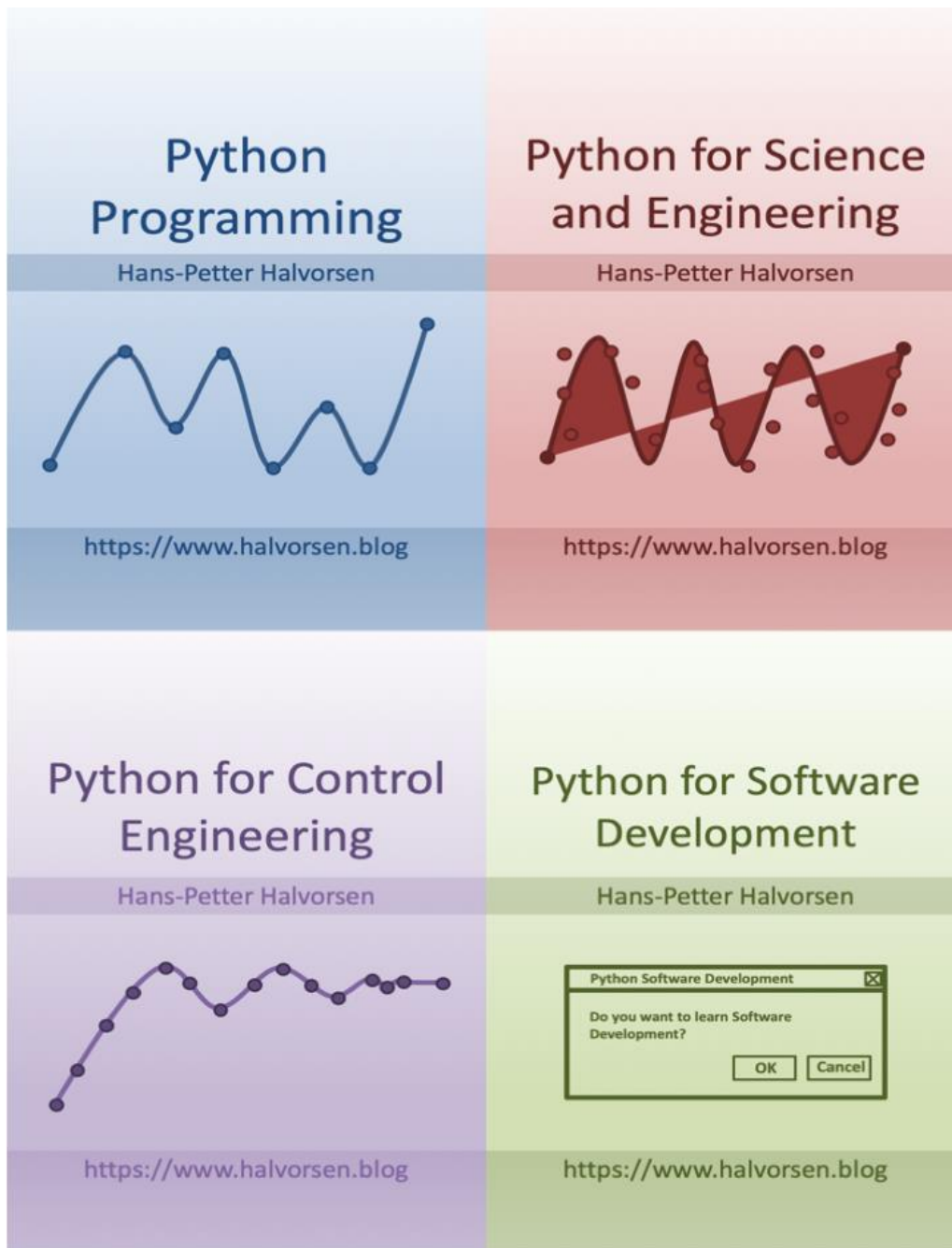


Figure 19-8: Python Textbooks

19.4 Publications

Textbooks within programming:

- **Python Programming** - Hans-Petter Halvorsen. ISBN: 978-82-691106-4-7. 2019

- **Programming with Arduino** - Hans-Petter Halvorsen. ISBN: 978-82-691106-3-0. 2018.
- **Arduino Programmering** (In Norwegian)- Hans-Petter Halvorsen. ISBN: 978-82-691106-2-3. 2018.
- **Software Development - A Practical Approach!** - Hans-Petter Halvorsen. ISBN: 978-82-691106-0-9. 2017.
- **Industrial IT and Automation - A Practical Approach!** - Hans-Petter Halvorsen. ISBN: 978-82-691106-1-6. 2017.

20 Programming for Beginners

It's important to make new generations interested in technology and engineering disciplines, and especially programming.

20.1 Arduino

The Arduino platform is a good choice for this because it is easy to start with, but very flexible and challenging also for advanced used. This means the Arduino platform can be used on many different levels from primary school to universities.

Arduino (Figure 20-1) is an open source platform consisting of hardware and software where you can program and interface with the real world, such as turning on lights, read temperature, etc.

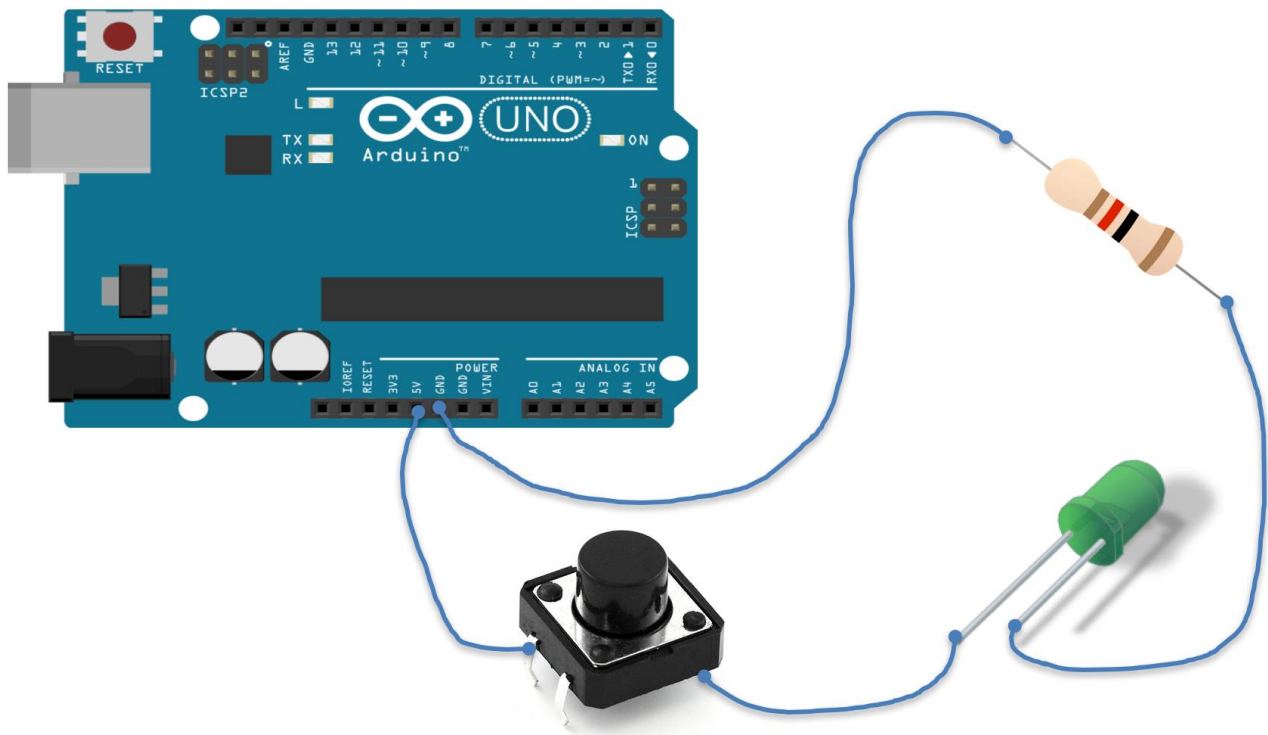


Figure 20-1: The Arduino platform

With the use of Arduino, you can learn the basics about computers, electronics, sensor and measurement technology and programming (Figure 20-2).

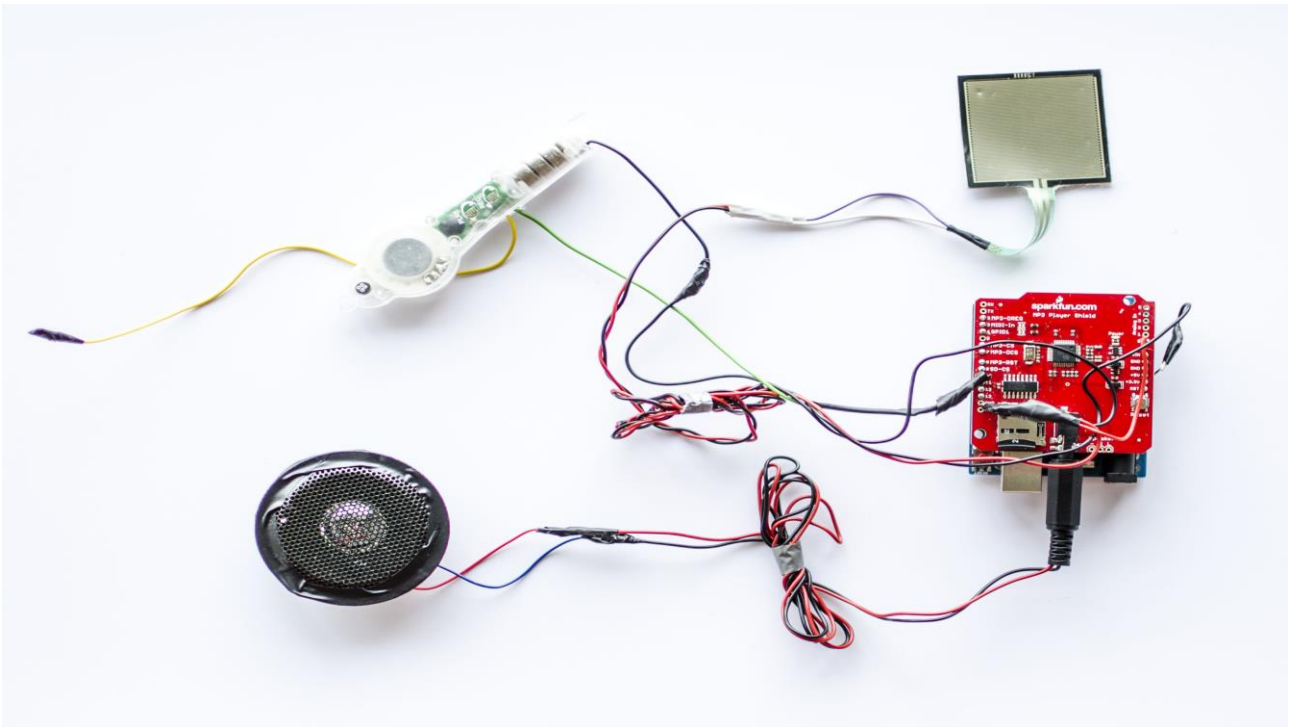


Figure 20-2: Programming with Arduino

As part of that I have developed an introduction course to programming, electronics and other technology activities called “Arduino Programming” (Figure 20-4). This concept learns pupils from secondary school and high school (or others) basic skills in programming, electronics and other concepts within technology.

The course focus on practical programming activities using the open source Arduino platform.

The Arduino programming language and environment uses an easy to learn syntax and it is very intuitive.

```
void setup()
{
    pinMode(8, OUTPUT);
}
void loop()
{
    digitalWrite(8, HIGH); // Turn on the LED
    delay(1000);           // Wait for one second

    digitalWrite(8, LOW); // Turn off the LED
    delay(1000);          // Wait for one second
```

```
}
```

The course contains lots of practical exercises where the participants can go through the exercises in their own pace.

You learn the basic concepts of:

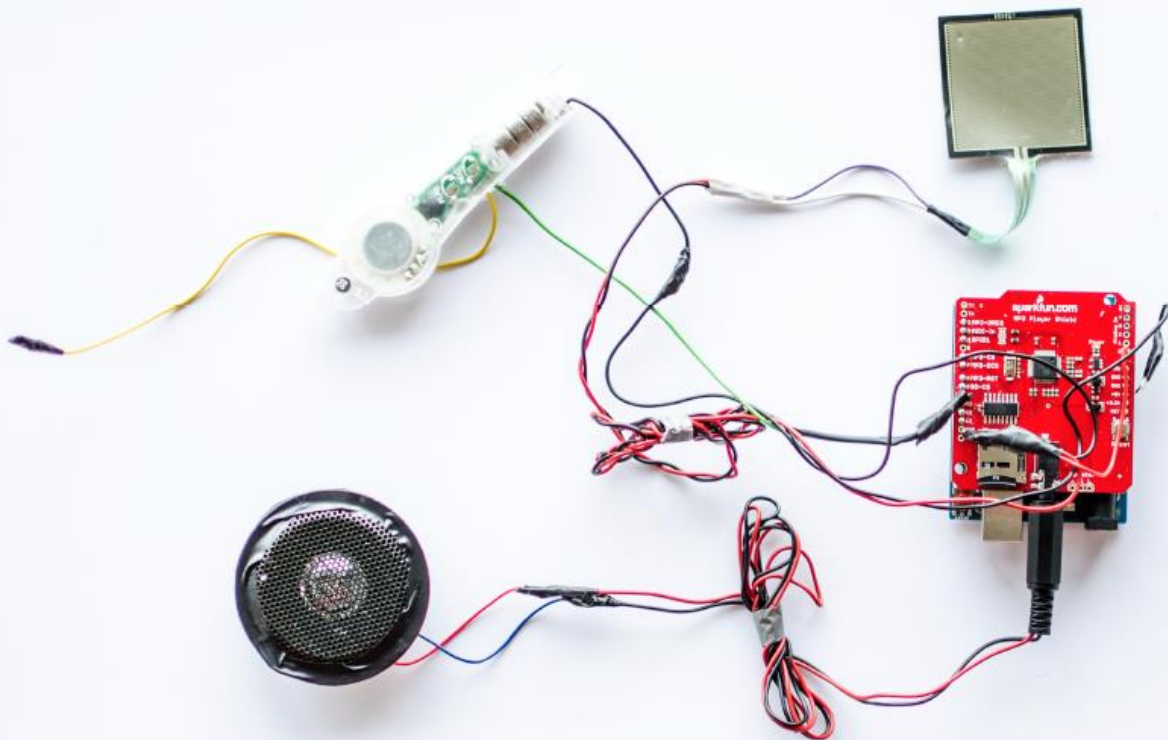
- Computers and Microcontrollers
- Analog and digital signals
- Interfacing and communication with real world objects
- Programming
- Electronics
- Sensors and measurements
- Internet of Things (IoT)

The exercises are typical engineering oriented with a combination of theory, practical wiring and programming. Since we have this combination of programming and an interface to the real world, they can instantly see the results of their programming, such as turning on a lamp, read the temperature in the room, etc.

Together with the textbook, the participants are provided with the following components (Figure 20-3):

| Arduino Programming |

Hans-Petter Halvorsen



<https://www.halvorsen.blog>

Figure 20-4: Introduction to programming and Arduino – Textbook

20.2 Python

Another programming language suited for beginners is Python.

Figure 20-5 shows the book cover for my Python textbook for beginners called “Python Programming”.



Figure 20-5: Python Programming for Beginners

20.3 Publications

Below you find a list of textbooks written within programming for beginners:

- **Python Programming** - Hans-Petter Halvorsen. ISBN: 978-82-691106-4-7. 2019
- **Programming with Arduino** - Hans-Petter Halvorsen. ISBN: 978-82-691106-3-0. 2018.

- **Arduino Programmering** (In Norwegian) - Hans-Petter Halvorsen. ISBN: 978-82-691106-2-3. 2018.

The Arduino textbooks and additional resources are located here:

<http://www.halvorsen.blog/documents/technology/iot/arduino.php>

The Python textbook and additional resources are located here:

<https://www.halvorsen.blog/documents/programming/python/>

Part 3 : Research and Development

This part gives an overview of research activities, publications, research groups, and some relevant projects at Bachelor and Master level.

21 Research Activities

My research activities are within the field “Software Engineering, Industrial IT and Automation” (see Figure 21-1).

Industrial IT and Automation

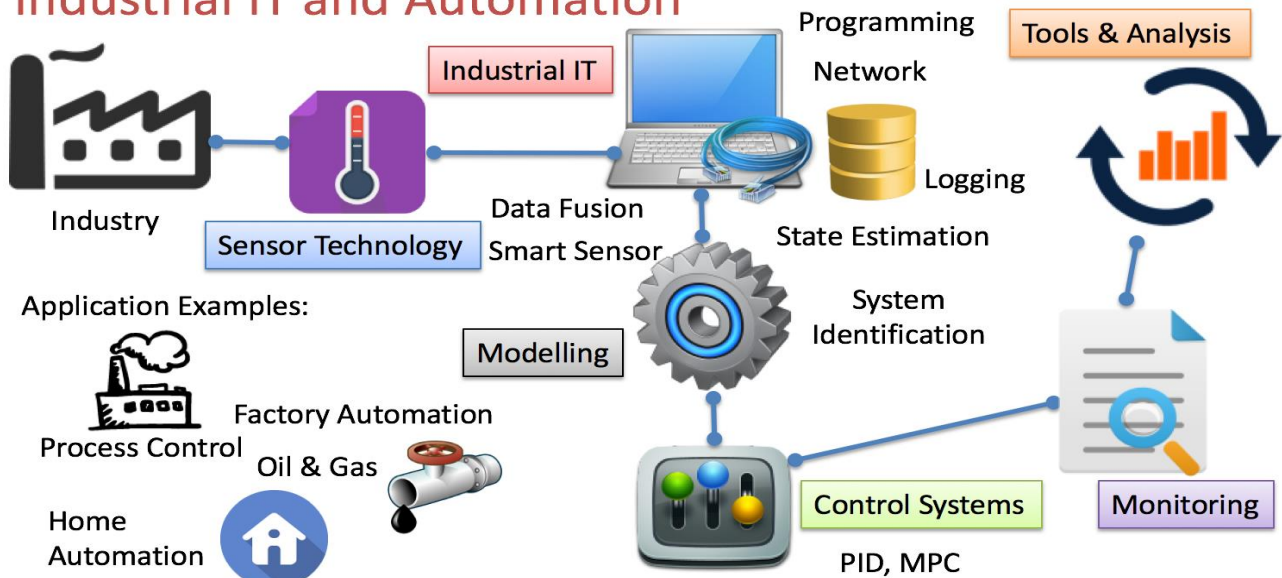


Figure 21-1: Research Activities

In the next chapters my work within the field “Industrial IT and Automation” will be discussed in detailed. These chapters include international publications, projects at Bachelor and Master levels, research groups that I am involved in, descriptions of some important Research and Development projects.

22 Academic Publications

Below you find an overview of all my international academic publications.

22.1 Scientific Articles

Below you find a complete list of all my scientific articles published in journals and conferences.

2019

- ***Monitoring of selected Numeric Water Quality Criteria (NWQC) using IoT Platform – Digitalizing Water Care System (WCS)*** - Hans-Petter Halvorsen, Colin Dubreuil, F. Hansen, R. Bakke, J. Timmerberg, J-M. Thiriet, S. Mylvaganam - 2019.
- ***Sandboxing for Cross-Platform Applications of Robots*** - Hans-Petter Halvorsen, Alexander Jonsaas, Lilly Eikehaug, Saba Mylvaganam - 2019 IEEE International Symposium on RObotic and Sensors Environments (ROSE), June 17-18, 2019, Ontario, Canada.
- ***Constructive Alignment with Student in Centre and Front - Experience from Case-projects and Intensive Summer Courses*** - Hans-Petter Halvorsen, Josef Timmerberg, Saba Mylvaganam - MNT Conference, March 28-29, 2019, Tromsø, Norway.
- ***Fusion of Body Sensors' Data and Video Images in Assistive Technology*** - Hans-Petter Halvorsen, Karina Kaspersen, Alexander Jonsaas, Saba Mylvaganam - IEEE Sensors Applications Symposium (SAS), March 11-13, 2019, Sophia Antipolis, France.

2018

- ***Environmental Monitoring with focus on Emissions using IoT Platform for Mobile Alert*** - Hans-Petter Halvorsen, Ola Anton Grytten, Martin Veel Svendsen, Saba Mylvaganam – EAEEIE, The 28th EAEEIE Annual Conference, September 26-28, 2018, Reykjavík.

2017

- **Case Studies in IoT - Smart-Home Solutions** - Hans-Petter Halvorsen, Alexander Jonsaas, Josef Timmerberg, Saba Mylvaganam - EAEEIE 2017, The 27th EAEEIE Annual Conference, June 7-9, 2017, Grenoble.
- **Industrial IT and Automation - Curricula and Experience at USN in the context of Industry 4.0** - Hans-Petter Halvorsen, Nils Olav Skeie, Saba Mylvaganam - EAEEIE 2017, The 27th EAEEIE Annual Conference, June 7-9, 2017, Grenoble.

2015

- **Project/Problem Based Learning in Electrical Engineering, IT and Automation** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam. ITEN2015 Conference, Łódź, Poland, September 2015.
- **Remote control of a robotic arm - A cross-platform study using LabVIEW and DeltaV** - Hans-Petter Halvorsen, Alexander Jonsaas, Lilly Eikehaug, Sondre Mogård, Håkon Viumdal, Rune Andersen, Saba Mylvaganam. ITEN2015 Conference, Łódź, Poland, September 2015.

2013

- **Experience with Case-projects in Bachelor and Master Studies in Electrical, IT and Systems & Control Engineering** - Hans-Petter Halvorsen, Josef Timmerberg, Carsten Helgesen, Morten Pedersen, Saba Mylvaganam - EAEEIE 2013, 24th EAEEIE (European Association for Education in Electrical and Information Engineering) Annual Conference, Chania, Greece 30 - 31 of May, 2013.
- **Intermediate Measurement Node for Extension of WSN Coverage** - Rabin Bilas Pant, Hans Petter Halvorsen, Frode Skulbru, Saba Mylvaganam - Journal of Cyber Security and Mobility, Vol. 2, 2013. Available from River Publishers.

22.2 Textbooks

Below you find a complete list of all my textbooks.

2019

- ***Python Programming*** - Hans-Petter Halvorsen. ISBN: xxx. 2018.

2018

- ***Programming with Arduino*** - Hans-Petter Halvorsen. ISBN: 978-82-691106-3-0. 2018
- ***Arduino Programming*** - Hans-Petter Halvorsen. ISBN: 978-82-691106-2-3. 2018.

2017

- ***Software Development - A Practical Approach!*** - Hans-Petter Halvorsen. ISBN: 978-82-691106-0-9. 2017.
- ***Industrial IT and Automation - A Practical Approach!*** - Hans-Petter Halvorsen. ISBN: 978-82-691106-1-6. 2017.

List of Publications (online):

<http://www.halvorsen.blog/documents/research/publications.php>

In addition, here you find more R&D material that have been published:

<https://www.halvorsen.blog>

23 Research Groups

I'm involved in the following research groups available University of South-Eastern Norway:

- SMART Technology
<https://www.usn.no/research/our-research/technology/smart/>
- Telemark Modeling and Control Centre (TMCC)
<https://www.usn.no/english/research/our-research/technology/telemark-modeling-and-control-center/>

Below an overview of these research groups are given.

23.1 SMART Technology Research Group

The focus is to find good technical solutions for welfare technology and automatic assistance system for people who lives alone at home.

Development of Home Automation and SMART House solutions is an important part of this work.

Several projects have been completed to develop a platform for these scenarios. See chapter 25 “Projects at Master Level” for more details about these projects.

For more information about the SMART Technology research group, please visit the home page of the group:

<https://www.usn.no/research/our-research/technology/smart/>

23.2 Telemark Modeling and Control Centre

Telemark Modeling and Control Centre (MCC) is doing research within sensor technology, industrial IT, modelling and control.

Figure 23-1 shows the main working areas for the TMCC research group.

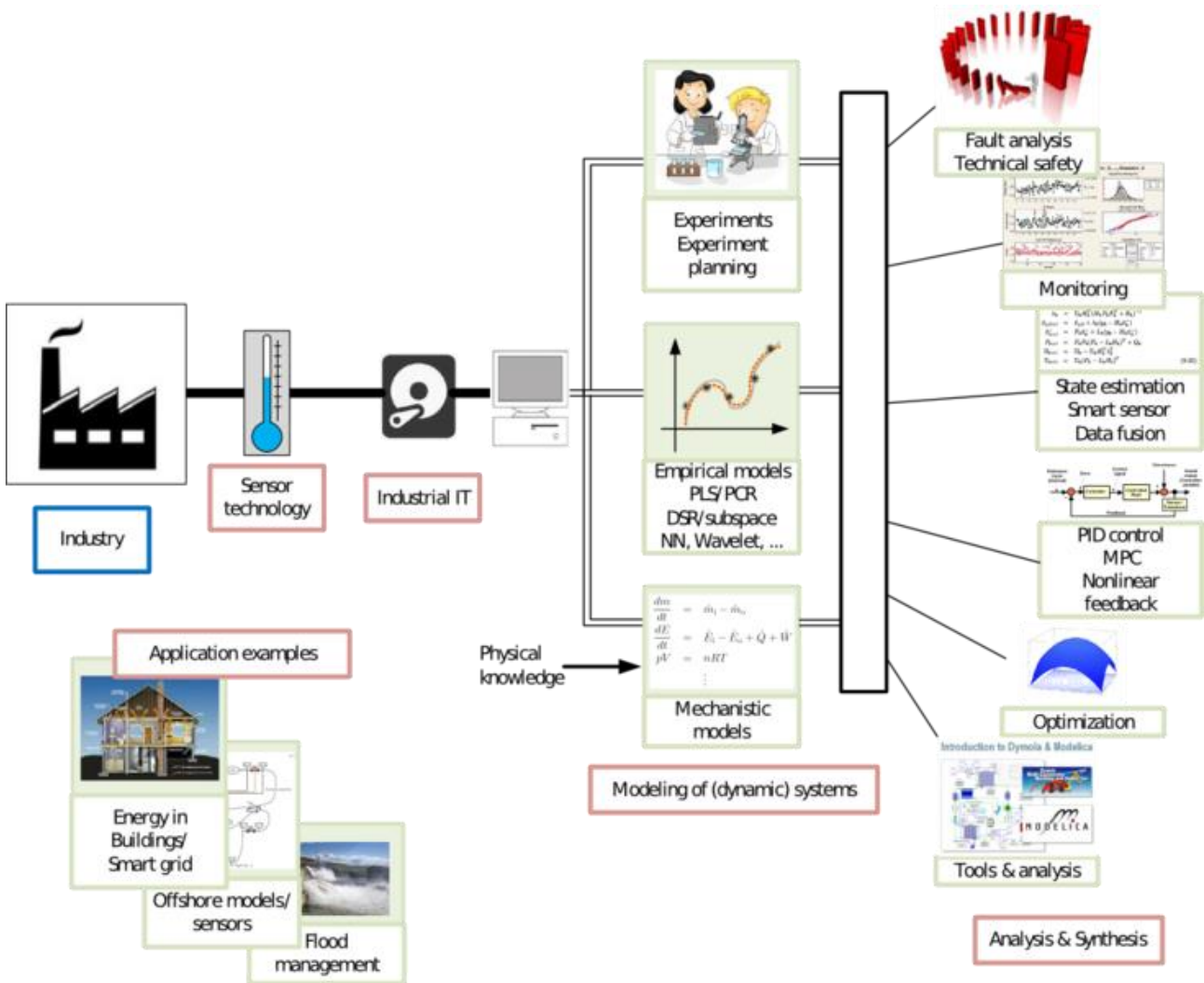


Figure 23-1: Working Areas for the TMCC Research Group [TMCC Web Page]

Several projects have been accomplished within these areas. See chapter 24 “Projects at Bachelor Level”, chapter 25 “Projects at Master Level for more details about these projects.

For more information about the TMCC research group, please visit the home page of the group:

<https://www.usn.no/english/research/our-research/technology/telemark-modeling-and-control-center/>

23.3 Publications

See previous chapter.

24 Projects at Bachelor Level

Through the last 5 years many projects have been carried out within some selected fields.

Bachelor students have been an important part of these projects. Working on realistic and research-based projects the students gets highly motivated and enthusiastic.

Many of these projects have been part of the research work at the university, in addition many of the projects have been carried out in collaboration with local industry and companies.

The industry has been heavily involved in these projects, such as companies like Kelda Drilling Control, Yara, Emerson Process Management, National Instruments, Statens vegvesen, Tel-Tek, Telemark Hospital, Porsgrunn municipality, etc.

The projects are also closely connected to the research groups within the university, both the SMART Technology research group and Telemark Modeling and Control Centre (TMCC) research group.

At my blog/web page you will find a detailed overview of many of these projects:

<http://www.halvorsen.blog/documents/projects/projects.php>

See also the detailed project list below.

24.1 Project List

Below we see a list of Bachelor projects that have been carried the last years. Local industry has been heavily involved in many of these projects.

2019

Automation and Process Systems

- Scanjet (Partner: Scanjet Arison)
- Inline-Test (Partner: OIW Process)

Cyber Security

- Software Testing, Data Security and GDPR (Partner: Cevia Solutions)

Environmental Public Health

- Development of Web-based Infrastructure for Environmental Services in Grenland (Partners: Tel-Tek, Telemark Hospital - Department of Occupational Medicine/Sykehuset Telemark, and Porsgrunn municipality/Porsgrunn Kommune)

2018

- Development of Service System for Electrical Installations (Partners: Skagerak Energy)

2017

Environmental Public Health

- Information Management System for Environmental and Public Health Information (Partners: Tel-Tek, Telemark Hospital - Department of Occupational Medicine/Sykehuset Telemark, and Porsgrunn municipality/Porsgrunn Kommune)

2016

System Engineering

- Development of App for Road Data Registration (Partner: Statens vegvesen)

2015

Oil & Gas, Simulation

- Drilling Simulator (Partner: Kelda Drilling Control)

2014

Process Control Systems

- DeltaV (Partners: Yara, Emerson Process Management)

2012

Process Control Systems

- DeltaV Prosessautomasjonssystem (Partners: Emerson Process Management)
- Sensor datafusjon med DeltaV – Integrering av trådløse og trådbaserte sensorer for fjern- overvåkning og styring (Partners: Yara, Emerson Process Management)
- Utvikling og prosjektering av laboratorium med prosessmodell (Partners: Yara)

2011

Process Control Systems, Multiphase

- Ombygging av mobil flerfaserigg til stasjonær flerfaserigg (Partners: Porsgrunn Vidergående/TAF, Emerson Process Management)

25 Projects at Master Level

Through the last 8 years many projects have been carried out within some selected fields.

Master students have been an important part of these projects. Working on realistic and research-based projects the students gets highly motivated and enthusiastic.

The Master study program “Industrial IT and Automation” is an international program with students from all over the world.

Many of these projects have been part of the research work at the university, in addition many of the projects have been carried out in collaboration with local industry and companies.

An example of a successful project is the Weather System we have developed and are using at the university for teaching and research.

One of the projects within that area was awarded as “Best Windows Store App” by an independently international institution. The Weather System will be described in more details later.

At my blog/web page you will find a detailed overview of many of these projects:

<http://www.halvorsen.blog/documents/projects/projects.php>

The industry has been heavily involved in many of these projects, such as companies like Yara, Emerson Process Management, National Instruments, Kongsberg Maritime, Baze Technology, Statens Vegvesen, Tel-Tek, Telemark Hospital, Porsgrunn municipality, etc.

Scientific Articles: The results from many of these Research and Development projects have also been published.

See also the detailed project list below.

25.1 Project List

Below we see a list of Master projects that have been carried the last years.

2019

Cyber Security

- Software Testing, Data and Cyber Security and GDPR (Partner: Cevia Solutions)

Software Engineering

- Cloud solution for vessel fuel consumption monitoring (Partner: KROHNE Marine)

2018

Environmental Public Health

- Monitoring of Environmental and Health related Data in Grenland from a Historical perspective (Partners: Tel-Tek, Telemark Hospital - Department of Occupational Medicine/Sykehuset Telemark, and Porsgrunn municipality/Porsgrunn Kommune)
- Environmental Public Health Information Management System (Partners: Tel-Tek, Telemark Hospital - Department of Occupational Medicine/Sykehuset Telemark, and Porsgrunn municipality/Porsgrunn Kommune)

Process Control/Automation

- Beer Production on a Pilot Plant using the Emerson DeltaV Control System (Partners: Emerson)
- Implementation of Accurate Temperature Controller for Pressure and Gravity Sensors (Compact Temperature Regulator for Subsea Sensor). Partner: Octio

2017

Environmental Public Health

- Environmental Public Health Information Management System (Partners: Tel-Tek, Telemark Hospital - Department of Occupational Medicine/Sykehuset Telemark, and Porsgrunn municipality/Porsgrunn Kommune)

2016

Environmental Public Health

- Environmental Public Health Information Management System (Partners: Tel-Tek, Telemark Hospital - Department of Occupational Medicine/Sykehuset Telemark, and Porsgrunn municipality/Porsgrunn Kommune)

System Engineering

- Development of App for Road Data Registration (Partner: Statens vegvesen)

Industrial IT and Automation

- Data Logging and Monitoring Platform

2015

Home Automation & Smart House Solutions

- Home Automation Platform using Windows 10 IoT
- Home Automation (Partner: National Instruments)

Process Control

- Process Control and Monitoring using Arduino and Raspberry Pi (Partner: National Instruments)

2014

Web Programming (C#, ASP.NET, SQL Server)

- Lab Inventory System. The Lab Inventory System is today in use at our university.

2013

Measurements, Control & Monitoring

- Measurement, Monitoring and Control System using Arduino (Partner: National Instruments)
- Mobile and Wireless Technology for Measurement, Monitoring and Control (Partner: National Instruments)

Programming (Windows Store App)

- Design and Development of Windows 8 Metro Application for Measurement and Monitoring (Partner: National Instruments). The App has been tested and rated by the BestWindows8Apps.net. The App is awarded as "Editor's pick award".

2012

Oil & Gas, Black Team Testing

- Black Team testing methods and Design Full Picture Test Lab (The Final Report is Classified Information) (Partner: Kongsberg Maritime)

Industrial IT and Sensor Technology

- Weather Station - Wireless sensor networking using AADI Sensors with WSN Coverage (Partner: National Instruments)

2011

Wireless Sensors, WSN

- Wireless Sensor Networking with lab-scale intermediate measurement node for extension of WSN Coverage (Partner: National Instruments)

Wireless Technology, Process Control Systems

- System Integration of Wireless Technology in a DeltaV system (Partners: Yara, Emerson Process Management)

2010

Oil & Gas

- Use of semantic models in Integrated Operations for Oil & Gas and New Energy (Partner: Baze Technology)

Advanced Process Control, Modelling, MPC

- Develop Advanced Control strategies for a 4-Tank Laboratory Process

Part 4 : R&D Projects

In this part, some important R&D projects that I have been involved in the last years will be discussed. These projects are parts of the research groups I'm involved in at the university: SMART Technology and Telemark Modeling and Control Centre (TMCC).

Here are some of the R&D projects that will be described: “Environmental Public Health Information Management System”, “Smart Houses and Buildings” and “Automation Systems and Industry 4.0”.

26 Environmental Public Health

The Environmental Public Health R&D project is a collaboration with local companies and industry. The project is about development and maintenance of infrastructure and data system for gathering, acquiring and analysis of environmental and public health information data for Porsgrunn and Grenland.

Typical data for acquiring and analyzing are air pollution and air quality, emissions from industry, emissions from cars, number of cars, etc. Design and development of stations for data acquitting and monitoring, or integration with existing stations are important part of the project.

So far 3 student projects have been carried out, 2 Master projects and 1 Bachelor project.

The system will be important in the development of new industries, research and development areas.

The project includes among other things the following key elements:

- Get an overview of data for acquiring and analysis
- Planning and System Design
- Database modeling, design and implementation
- Web design and web development, ASP.NET Core/ASP.NET MVC 6 and C# Programming
- Big data - acquiring and analysis of large amounts of data
- Data acquiring and management. Development of modules with flexible import and export options, including REST APIs system, etc.
- Analysis, statistics, and presentation of data. Generation of reports about analysis and reporting of data to authorities and other contracting authorities.
- Design and development of monitoring stations in connection therewith, or integration with existing monitoring stations.
- Infrastructure, servers and network infrastructure
- Development of relevant decision support tools
- Get information of the various forms of data storage, such as SQL databases and NoSQL databases, etc.

- Hosting of the data, either locally or in the cloud.
- Safety aspects (data security, backup, load balancing, redundancy, etc.)

Figure 26-1 shows an announcement about the project in the local newspaper.



Figure 26-1: Newspaper Announcement [Telemarksvisa 2017-04-19]

An important part of the project is the web site that displays and present the environmental data. Below you find the web site that has been developed as part of this R&D project:

<http://luftforurensing.azurewebsites.net>

Here you see some of companies that are involved in these R&D projects:

- Tel-Tek - <http://www.tel-tek.no/eng/>
- Telemark Hospital - Department of Occupational Medicine (In Norwegian: Sykehuset Telemark - <https://www.sthf.no>)
- Porsgrunn municipality (In Norwegian: Porsgrunn Kommune) - <https://www.porsgrunn.kommune.no/eng/>

- University of South-Eastern Norway – www.usn.no

This system has been developed in cooperation with and part of different student projects.

The technical foundation for this project is the following topics:

- Industrial IT
- Automation and Control
- Software Engineering
- Programming with Visual Studio/C#
- Internet of Things (IoT)
- Cloud Hosting and Computing
- Industry 4.0
- Database Systems
- Data Acquisition (DAQ)
- Datalogging and Monitoring
- Arduino
- Raspberry Pi
- etc.

You find more information about the project here:

<http://www.halvorsen.blog/documents/projects/projects/eph.php>

26.1 Publications

Some of the results from these projects have been published:

- ***Monitoring of selected Numeric Water Quality Criteria (NWQC) using IoT Platform – Digitalizing Water Care System (WCS)*** - Hans-Petter Halvorsen, Colin Dubreuil, F. Hansen, R. Bakke, J. Timmerberg, J-M. Thiriet, S. Mylvaganam - 2019.
- ***Environmental Monitoring with focus on Emissions using IoT Platform for Mobile Alert*** - Hans-Petter Halvorsen, Ola Anton Grytten, Martin Veel

Svendsen, Saba Mylvaganam – EAEIE, The 28th EAEIE Annual Conference, September 26-28, 2018, Reykjavík.

27 Smart Houses and Buildings

Home automation, Smart houses and buildings solutions 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.

Some of the results from these projects has been published in a scientific article:

- *Case Studies in IoT - Smart-Home Solutions* - Hans-Petter Halvorsen, Alexander Jonsaas, Josef Timmerberg, Saba Mylvaganam - EAEEIE 2017, The 27th EAEEIE Annual Conference, June 7-9, 2017, Grenoble.

In this document, a brief introduction will be given, for more details, see the following web page:

http://www.halvorsen.blog/documents/projects/projects/smart_buildings.php

Such a platform has many applications, such as:

- Logging, Monitoring
- Industrial IT
- Automation/Control Systems
- Home Automation/Smart Home Solutions
- IoT, IIoT
- Cloud Computing and Storage
- Weather systems
- Acquiring public health data, such as air pollution, etc.
- etc.

Home Automation Examples

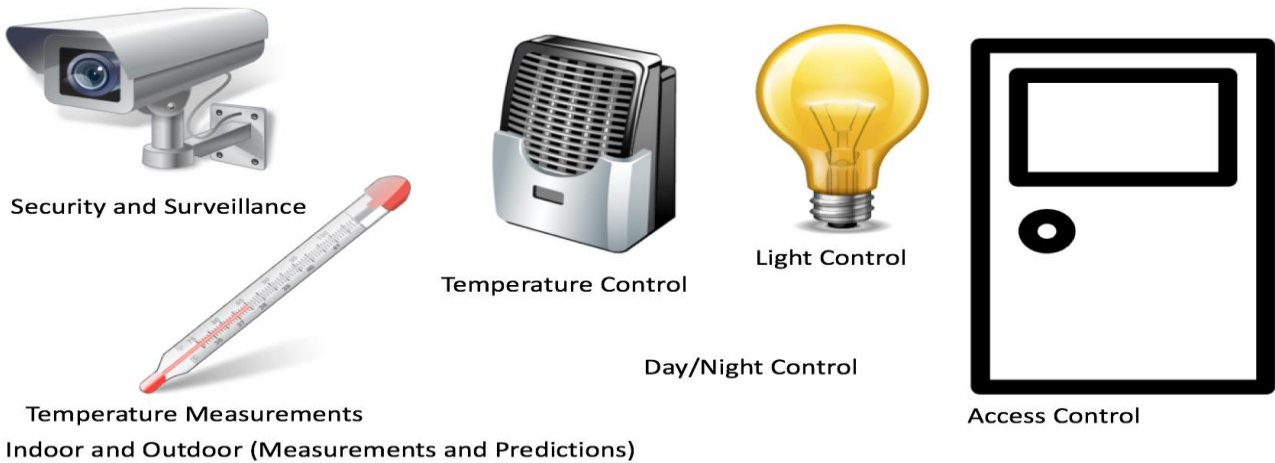


Figure 27-1: Home Automation Examples

In Figure 27-2 we see an overview of a Home Automation System developed at the university.

The system has been developed through several students projects the last years.

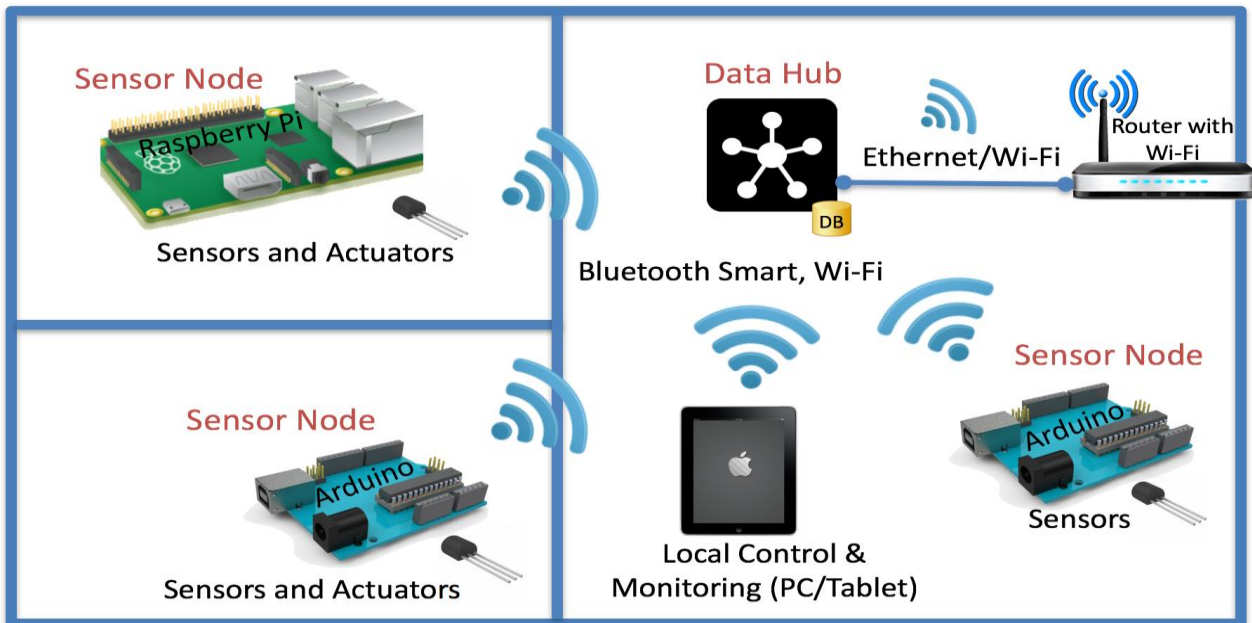


Figure 27-2: Home Automation Overview

Terms such as Internet of Things (IoT), Smart Technology, Cloud Computing and Industry 4.0 are very popular these days, and these concepts are some of the fundamentals for Home Automation systems (Figure 27-3).

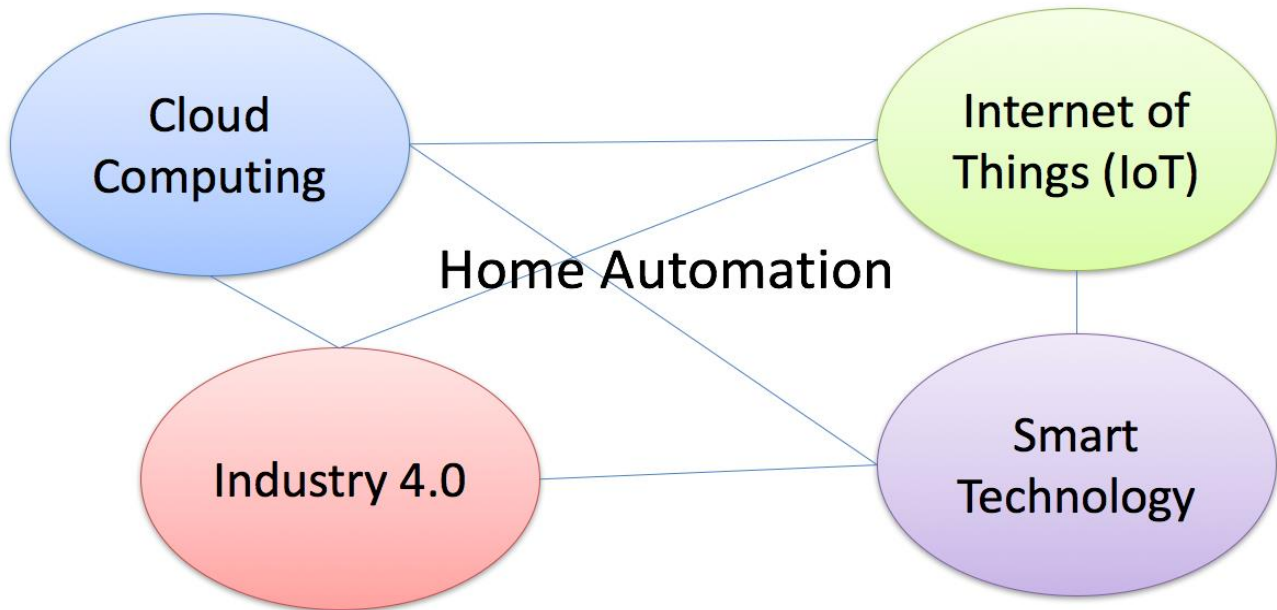


Figure 27-3: Home Automation Fundamentals

Figure 27-1 shows some typical Home Automation examples.

The technical foundations for these projects are:

- Industrial IT
- Automation and Control
- Software Engineering
- Programming with Visual Studio/C#, LabVIEW and MATLAB
- Internet of Things (IoT)
- Cloud Hosting and Computing
- Industry 4.0
- Database Systems
- Data Acquisition (DAQ)
- SCADA
- OPC
- Datalogging and Monitoring
- Arduino
- Raspberry Pi

27.1 Internet of Things

Home Automations is part of the wider concept “Internet of Things (IoT)” where “everything” is monitored and controlled. See Figure 27-4.

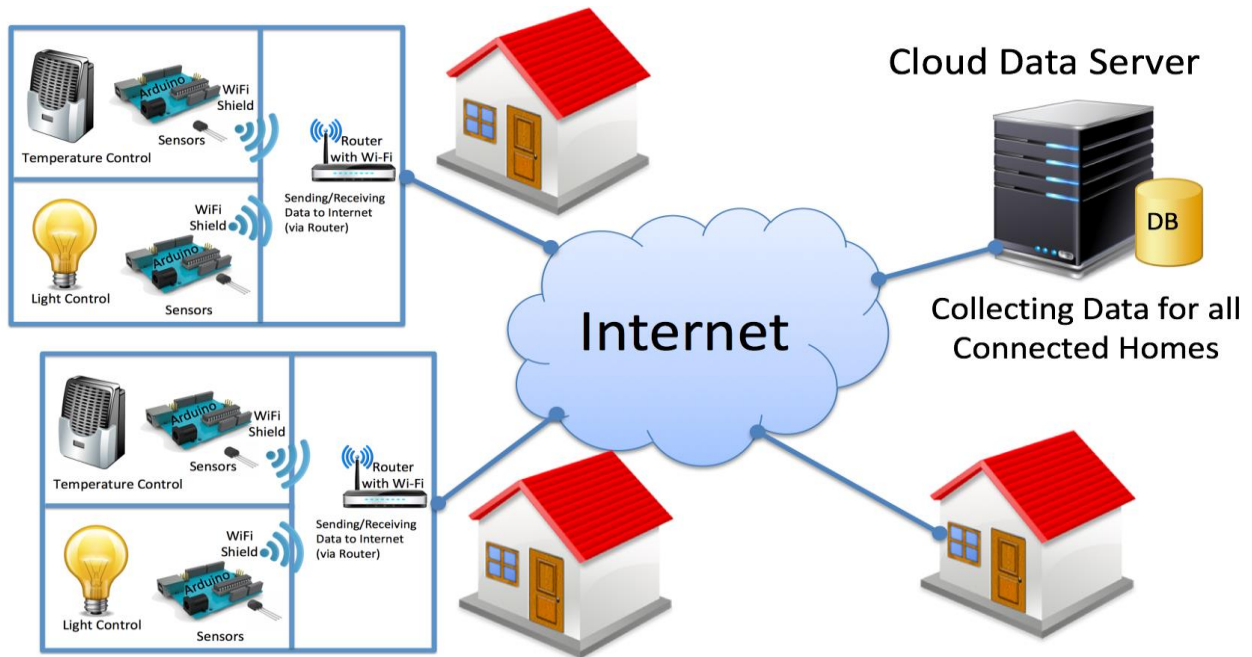


Figure 27-4: Home Automation and Internet of Things (IoT)

Home Automation, Smart Houses and buildings solutions is an important focus area within research and development at the university. The focus is to find good technical solutions for welfare technology and automatic assistance system for people who lives alone at home. The “SMART Technology” research group is important in this context.

For more information about the “SMART Technology” research group, please refer to the following web page:

<http://www.tuc.no/Research/Research-Groups/SMART>

27.2 DMM Platform

This subchapter will give a more technical overview of the DMM platform that have been developed. DMM is short for Data Management and Monitoring Platform (DMM), which consists of the software and services that makes everything works.

A detailed overview is given here:

<http://www.halvorsen.blog/documents/projects/projects/dmm.php>

In Figure 27-5 we see an overview of the platform developed at the university.

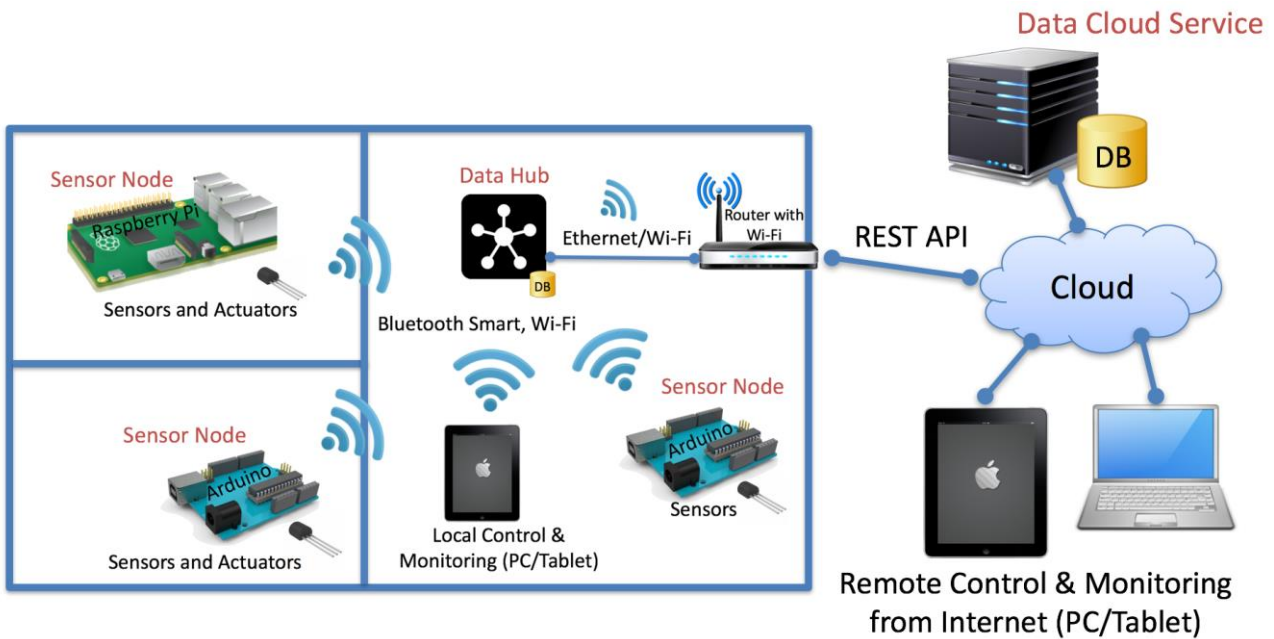


Figure 27-5: Home Automation Example

The DMM platform consists of the following parts:

Devices and Components:

- Sensor Nodes/Devices: Acquires data. The Sensor Node can be Arduino, Raspberry Pi, etc.
- Data Hubs: Collects data from the sensor nodes in one location or area, typically a house, part of a factory plant, etc.

Software and Services:

- Database: Repository for the sensor data
- Data Cloud Service: Service for acquiring data from multiple areas in the cloud. The communication is based on HTTP and REST APIs
- Data Management Software: Configuration of Data Points, Logging Rates, Events and Actions, etc.
- Data Logging Software: The software that handles the data acquiring from the sensors within a sensor node
- Data Monitoring Software: Monitoring and Alarm Handling from multiple Sensor Nodes

27.2.1 Datalogging Applications

Figure 27-6 shows the Datalogging (and Monitoring) software.

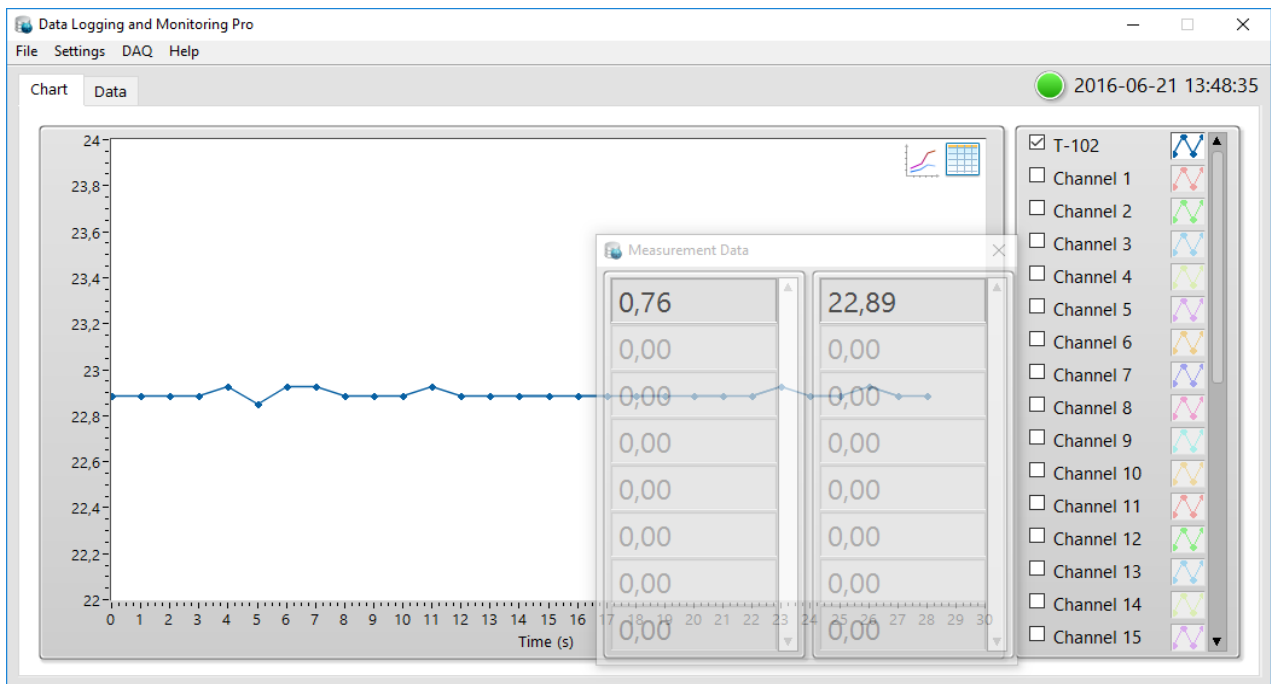


Figure 27-6: Datalogging Software (Developed by H-P. Halvorsen)

Different datalogging applications have been made for different purposes. You find more information here:

<https://www.halvorsen.blog/documents/projects/projects/dmm.php>

27.2.2 Data Management

A web-based system has been developed for configuration, management and monitoring of the devices and data (see Figure 27-7,

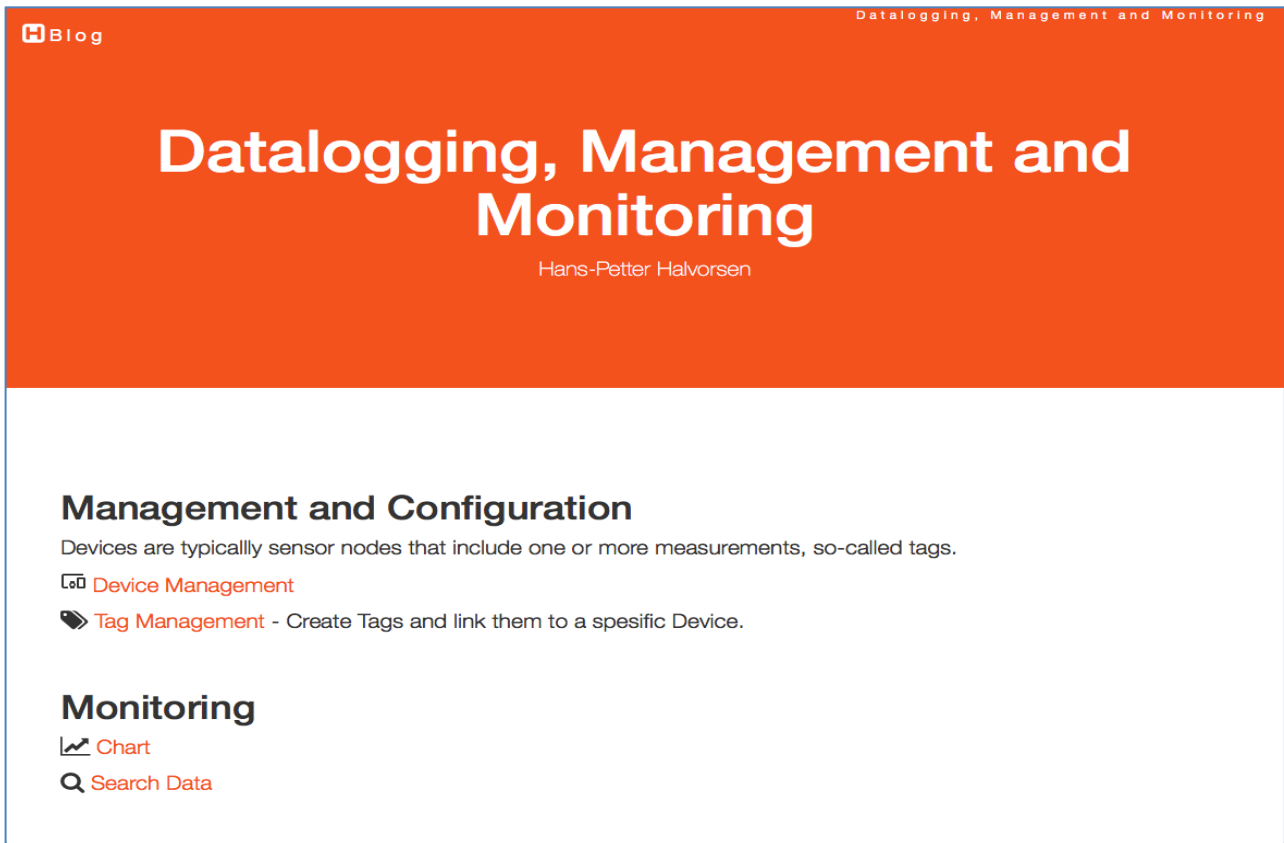


Figure 27-7: Data Management Example (Developed by H-P. Halvorsen)

Here you can manage devices and measurements, so-called tags, see Figure 27-8.

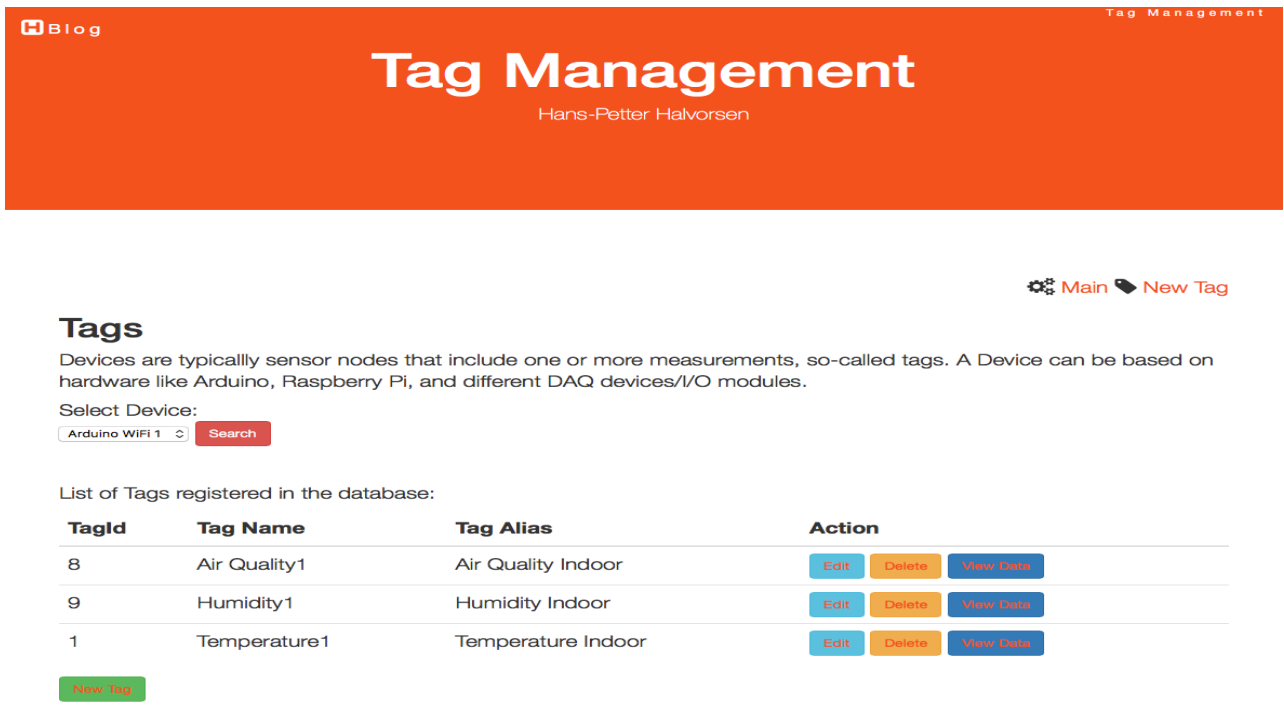


Figure 27-8: Configuration of Devices and Logging (Developed by H-P. Halvorsen)

27.2.3 Data Monitoring

For each measurement, we can see charts for the logged data, see Figure 27-9.

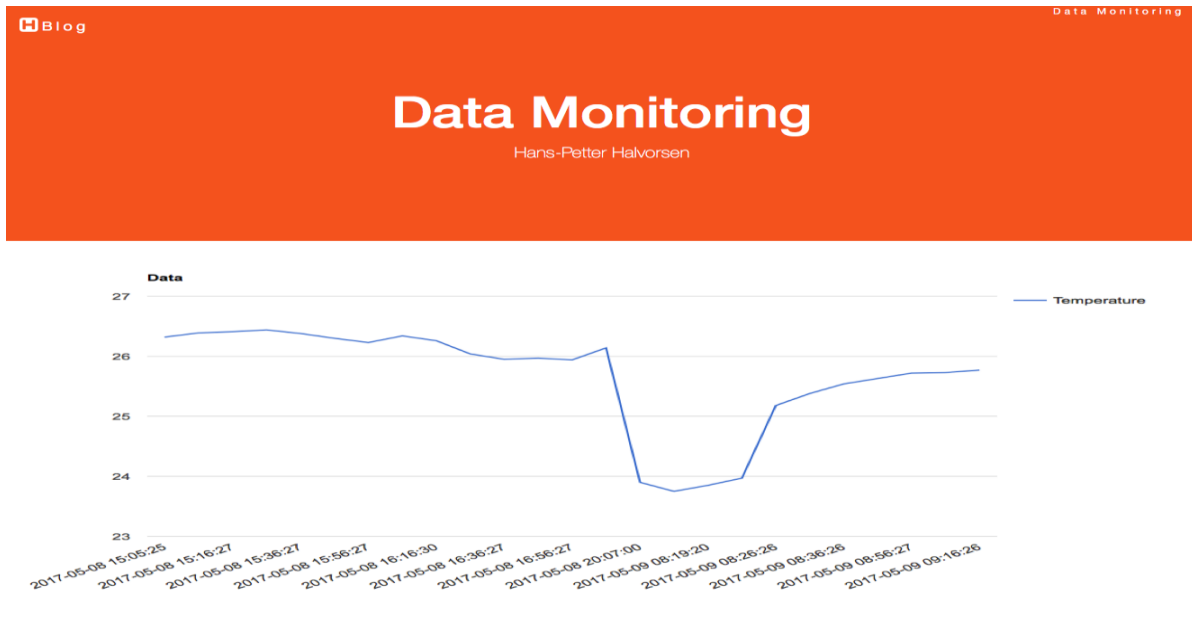


Figure 27-9: Presentation and Monitoring of Data (Developed by H-P. Halvorsen)

27.3 Research Group

At the University of South-Eastern Norway there is a research group named “SMART Research Group” that has focus on Home Automation and Smart House solutions.

Link to the SMART Research Group web site:

<https://www.usn.no/research/our-research/technology/smart/>

The SMART research group cooperates with other research groups at the university like “Telemark Modeling and Control Center (TMCC)” and “Kommunale helsetjenester til eldre”.

Some of the external partners are Western Norway University of Applied Sciences (HVL), UiT / The Arctic University of Norway (Campus Narvik), Tiny-Mesh, and Larvik, Bamble and Skien municipalities.

The SMART research group also collaborate internally with the Health and Social Work Studies at University of South-Eastern Norway (Faculty of Health and Social Studies (HS)) to find both good technical and practical solutions.

27.4 Research and Development Projects

Several student projects at Master level have been carried out the last years:

The following projects have been implemented in recent years:

3.semester project:

- Home Automation Platform using Windows 10 IoT

Master theses:

- Data Cloud Platform for Data Management, Logging, Control and Monitoring
- Home Automation (Partner: National Instruments)
- Process Control and Monitoring using Arduino and Raspberry Pi (Partner: National Instruments)

27.5 Publications

Publications within Smart houses and buildings:

- *Case Studies in IoT - Smart-Home Solutions* - Hans-Petter Halvorsen, Alexander Jonsaas, Josef Timmerberg, Saba Mylvaganam - EAEIE 2017, The 27th EAEIE Annual Conference, June 7-9, 2017, Grenoble, France.

28 Project Management

I am involved in many R&D projects, many of them in connection to the industry in Grenland, Norway and other areas. In these projects, project management is important parts of the projects.

In context of this, I have made a Project Management System (PMS) from scratch that I am using in many of these projects.

In Figure 28-1 we see some of the features included in the Project Management System.

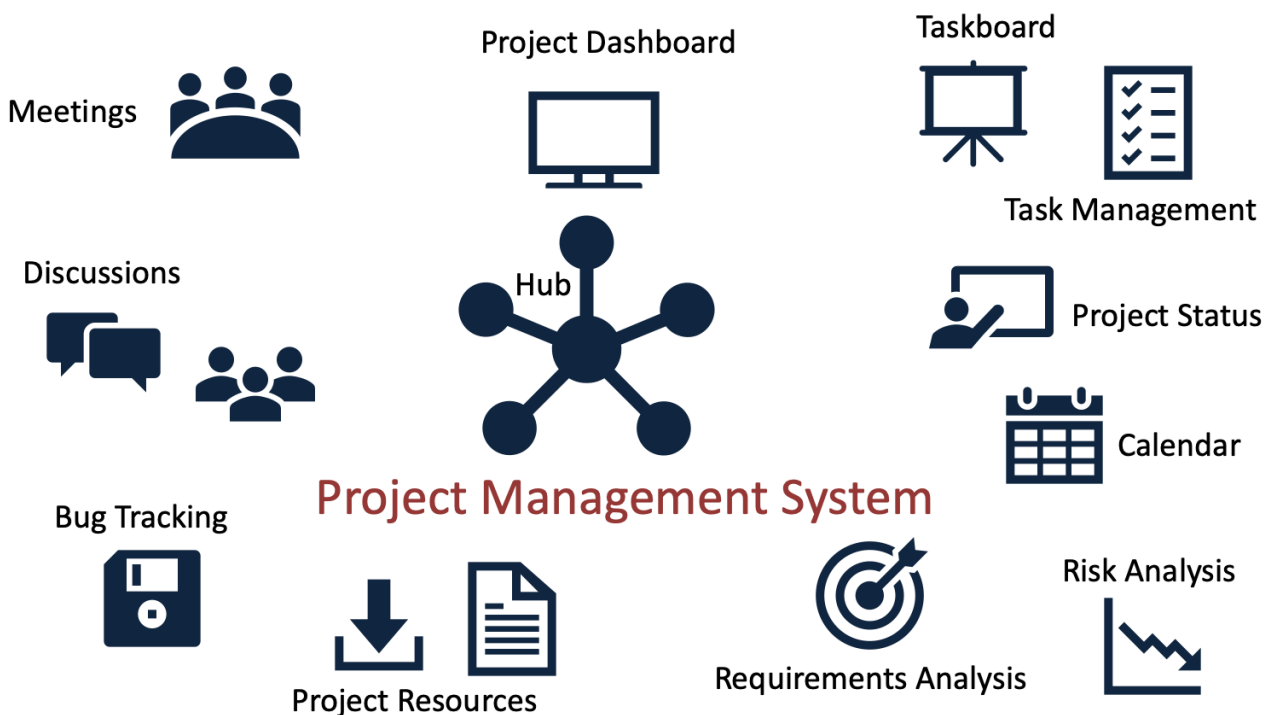


Figure 28-1: Project Management System Features

Here you find an overview and can get access to the system:

https://www.halvorsen.blog/documents/projects/projects/project_management_system.php

PMS is made from scratch using HTML, JavaScript, CSS, Bootstrap, PHP and MariaDB (MySQL). See my page about Web Programming for more information about these technologies.

<https://www.halvorsen.blog/documents/programming/web/>

PHP is used to create dynamic web pages where data is typically stored in a database, like MariaDB (MySQL) or SQL Server.

The system is hosted on an Apache HTTP Server, but other Cloud Hosting Services could have been used as well.

With Project Management System (PMS) the project members can keep track of the development of the project, from the early beginning to the end of the project. PMS is a modern and flexible web application that handles all aspects of the project, from requirements analysis, task management including Taskboard, meetings (notice of meetings, minutes of meetings, etc.), discussions, status reporting, issue tracking and management, etc. In general, PMS can be used to handle all aspects of the project planning and management.



Figure 28-2: Project Management System (PMS)

PMS is well suited for projects developing some kind of software, but it can be used for other projects as well. PMS follows modern Software Engineering principles

using features from Agile and Scrum. See my page about Software Engineering for more resources.

https://www.halvorsen.blog/documents/programming/software_engineering/

Below, some examples of features in PMS:

- Project Dashboard
- Project Resources
- Project Status and Reporting
- Risk Management
- Requirements Analysis
- Task Management
- Taskboard
- Bugs and Issue Tracking
- Meetings (Notice of Meetings, Minutes of Meetings, Notifications, etc.)
- Calendar
- Discussions
- Notifications

28.1 Features and Functionality

28.1.1 Project Dashboard

In the Project Dashboard you get a quick overview of "everything" in your project.

In Figure 28-3 you see a Dashboard example (a small part of it).

The screenshot shows a web application interface for a project dashboard. At the top, there is a red header with a 'Blog' link on the left and a menu icon on the right. The main title 'Project Dashboard' is centered, with a subtitle 'Project: Monitoring of Environmental and Health related Data in Grenland' below it. A navigation bar contains icons and labels for Risk, Requirements, Task Management, Taskboard, Tissue, Meetings, Discussions, and Home. Below the navigation bar, the user 'Hans-Petter Halvorsen' is identified. The main content area features a title 'Monitoring of Environmental and Health related Data in Grenland' followed by a project description, start/end dates, and workload. Two alert boxes are present: a yellow 'Warning!' box indicating that work hours in the Taskboard are below the required minimum, and a pink 'Important!' box listing 11 new bugs, 9 new feature requests, and 2 new impediments, with buttons to report a new bug or feature request.

Figure 28-3: Project Dashboard

28.1.2 Taskboard

The Taskboard is a tool used in Agile/scrum to keep track of the work that shall be executed in a software development project.

In Figure 28-4 you see an example of the Taskboard.

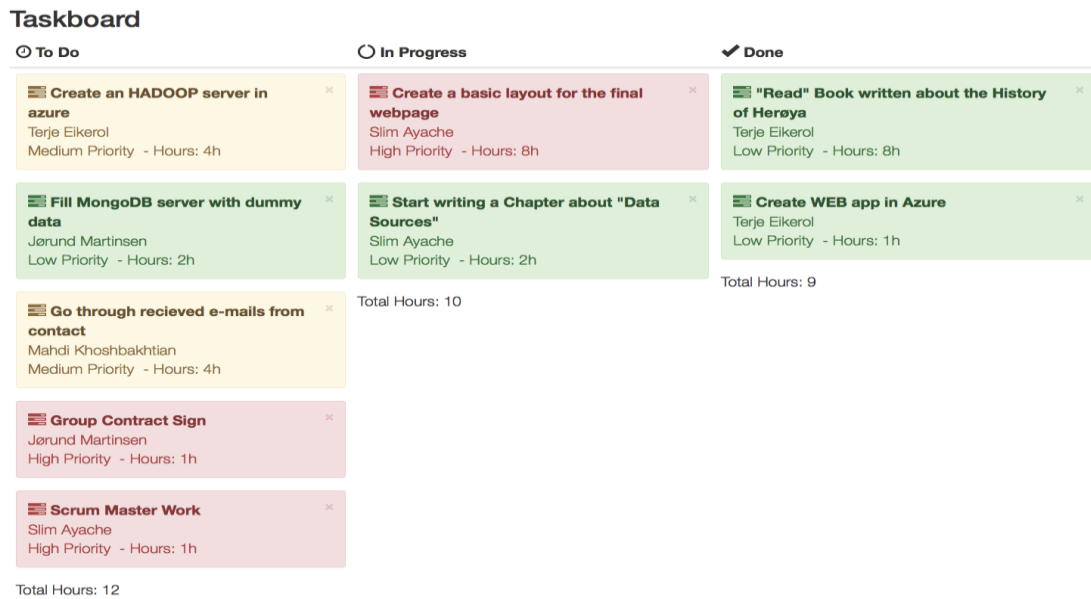


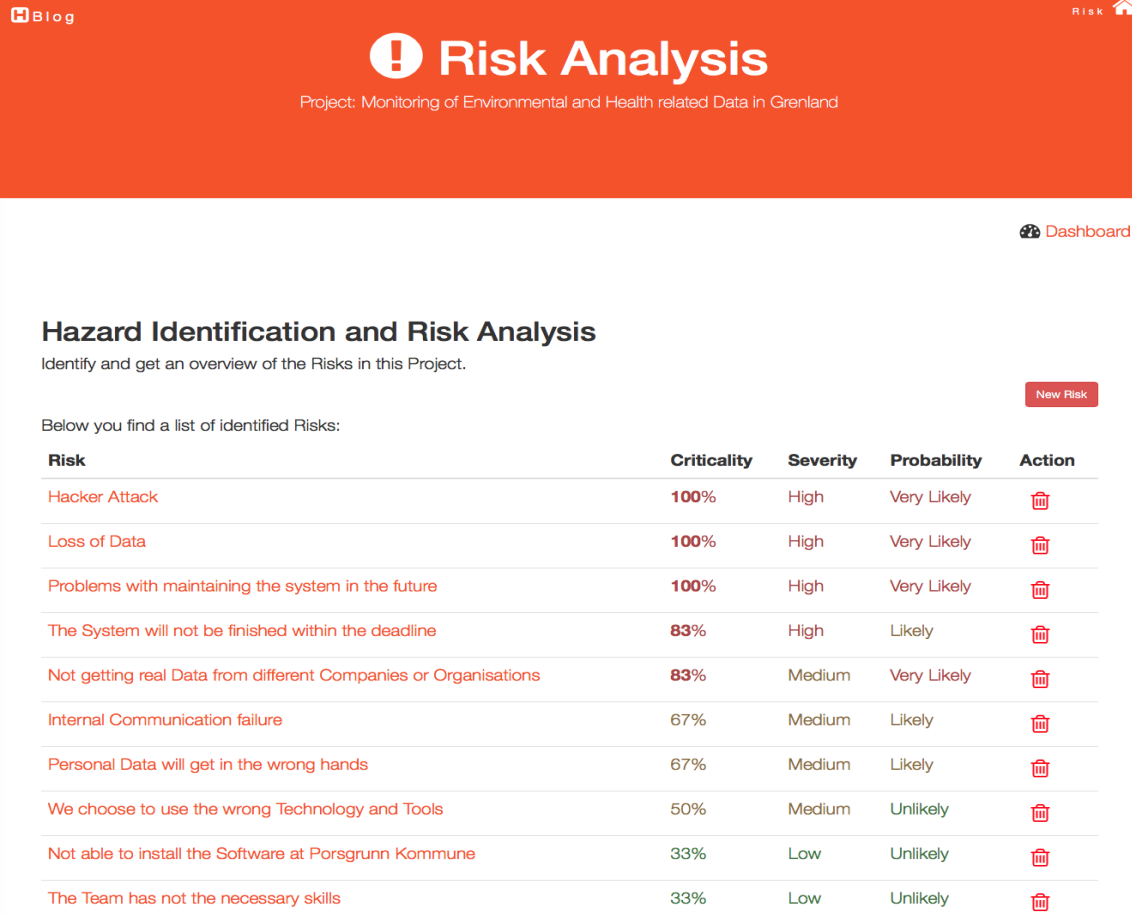
Figure 28-4: Taskboard

28.1.3 Risk Analysis

Hazard Identification and Risk Analysis is an important part of any project in the planning and start-up phase. It is important to identify what can go wrong and find good treatments to solve these issues.

Risk Analysis and Management is the identification, evaluation, and prioritization of risks.

In Figure 28-5 you see an example of Risk Analysis.



Hazard Identification and Risk Analysis
Identify and get an overview of the Risks in this Project.

Below you find a list of identified Risks:

Risk	Criticality	Severity	Probability	Action
Hacker Attack	100%	High	Very Likely	
Loss of Data	100%	High	Very Likely	
Problems with maintaining the system in the future	100%	High	Very Likely	
The System will not be finished within the deadline	83%	High	Likely	
Not getting real Data from different Companies or Organisations	83%	Medium	Very Likely	
Internal Communication failure	67%	Medium	Likely	
Personal Data will get in the wrong hands	67%	Medium	Likely	
We choose to use the wrong Technology and Tools	50%	Medium	Unlikely	
Not able to install the Software at Porsgrunn Kommune	33%	Low	Unlikely	
The Team has not the necessary skills	33%	Low	Unlikely	

Figure 28-5: Risk Analysis

28.1.4 Bugs and Issue Tracking

With the Bugs and Issue Tracking feature you can report and track Bugs and other Issues within your project. See Figure 28-6.

Bugs and Issues in your Project
Search for existing Issues or create new Issues.

[New Issue](#) [Multiple Bugs](#) [Multiple Feature Requests](#)

Search
Select proper search criteria:

Software: Report

Issue Type: Feature Request

Status: <All>

Assigned Person: <All>

Registration Person: <All>

List of Issues
Below you find Issues that fulfills the search criteria above:

Issued	Issue Title	Priority	Status	Action
126	Add some text about ISO in context of your project and the system you are creating	Medium	New	+ -

Figure 28-6: Bugs and Issue Tracking

28.1.5 Meetings

The system keep track of all the meetings carried out in a project, including Notice of Meetings, Minutes of Meetings, Notifications, etc.

In Figure 28-7 you see an example of this feature.

Meetings

Below you find a list of upcoming and some of the previous meetings. You can schedule Meetings, write or see Meeting Requests and Minutes of Meetings.

Meeting	Location	Date & Time	Action
Meeting with the supervisor #4	C-139a	2018-10-05 10:30	Send Meeting Add to Calendar
Meeting with Supervisor #3	C-139a	2018-09-28 10:30	Send Meeting
Demo and Presentation #1	B-1007 Library	2018-09-26 14:00	Send Meeting
Internal meeting #3	B-1008 Library	2018-09-26 08:00	Send Meeting
Internal meeting #2	Cafe Henrikke	2018-09-24 16:00	Send Meeting

Goto the [Meeting Manager](#) to see all previous Meetings and see previous Minutes of Meetings.

[New Meeting](#)

Figure 28-7: Meetings

In Figure 28-8 you see an example of a Notice of Meeting/Minutes of Meeting.

Meeting

Project: Monitoring of Environmental and Health related Data in Grenland

[Dashboard](#) [Meeting Manager](#)

Meeting Information

Below you find detailed information about the Meeting:

Meeting Title*:

Meeting Content:

Agenda:

- Individual Status Reports (3 Questions). Make sure to shortly answer (keywords) these 3 questions in advance using PMS. Create the necessary Tasks using the Task Manager (some of these may be added to the Taskboard in #7)
- Project Status.
 - The Project Manager/Scrum Master should write a short (keywords) Status Report in advance using PMS.
 - In the Meeting the Project Manager gives a short Overview of the Project Status, Progress, etc. Is the Project on Track? Why/Why Not?
 - Open the Task Management to get an overview of Tasks. We have the following Tasks: Not Started, To Do, In Progress, Done, Approved.
- Make an overview of what has been discussed with Martin and Tone and find out what should be done in relation to that.
- Finishing Previous Iteration. See the Taskboard. Go through and Approve Done Tasks. Why have To Do and In Progress Tasks not finished?
- Follow up the previous Status Meeting. Read the Minutes of Meeting and see if there are some things that we agreed on but have not done. Make new Tasks if necessary.
- Bugs and Features. Go through registered Issues, make Priorities and Approve fixed Issues. Use the Fire Fighting feature in PMS.
- Prepare Next Meeting. What should we focus on in the Next Meeting? Create necessary Tasks and update the Taskboard.

Meeting Location:

Meeting Date: Start Time: End Time:

Summary:

Teknisk ukeblad. Articles
- Oslo får fleksibel IKT platform

Figure 28-8: Notice of Meeting and Minutes of Meeting

28.1.6 Project Status

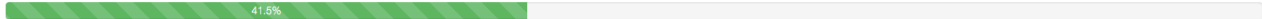
The system keep track of all the individual status for each member of the development team as well as the overall status of the project.

In Figure 28-9 you see an example of this feature.

i Project Status

Project Status. What is the current status for your project? Is your Project on track? (What is on track, What is not on Track?), etc. Please update the overall Project Status on a regular basis (e.g., weekly updates). This should be done by the Project Manager before the Weekly Status Meetings. Just a small reality check: According the Project Schedule, you should now be finished with **41.5%** of the Project $\{(\#DaysToday/\#DaysTotal)*100\}$. Are you on track? See **Tasks Overview** below.

Project Time Schedule:



Status Reports:

Date	Status Information	Action
2018-09-26	No response from contacts. Decided to use mock data for development. Database solution has been selected (MongoDB and HADOOP). Report has been updated. Several tasks have been created, more to come. Website GUI design is in progress. Requirements have been evaluated and risks identified. Next iteration should create mock data, begin coding, revisit contacts, start analysis process.	Edit
2018-09-21	The Structure of the project report is being formed. Initial contacts with external parties have been made. We have a good knowledge what has been done before and we know the history of the scope of the project (Herø	Edit
2018-09-14	Report Template created, Dropbox folder created etc	Edit
2018-09-04	Project Kick-off and Start-up (Week 36) Initial Meeting with Supervisor Initial Meeting with Customer Get Overview, create Requirements, etc.	Edit

[Add Project Status](#)

Figure 28-9: Project Status

The Project Manager or the Scrum Master, etc. can report the overall Project Status as shown above. In addition, each project member (in the Development Team) can add Individual Status Reports.

In Figure 28-10 you see an example of this feature.

Blog
☰

Individual Status Reports

Each Project Member needs to answer 3 Questions. Make sure to shortly answer (keywords) these 3 questions before the Status Meeting. Then make sure to also create the necessary Tasks using the [Task Management](#) (some of these Tasks may then be added to the Taskboard later).


For more details, see the [Individual Status Reports](#) page.

3 Questions:


Q1. What have you done Last Week?
Q2. What shall you do this Week?
Q3. Any Problems or Impediments?


Latest Status Reports:


Week 44

 (2018-11-02 11:07)


Q1. Created machine learning chapter. Read up on ML techniques, how they work, what can be applied to this project. Written into chapter, along with suggestions for the system.
Q2. Continue on ML chapter, continue with the request regarding ML.
Q3. Difficult to find out which ML applications that would be best. Maybe best with ML on the data, not meta-data, but most difficult to implement(when we have no data).


 (2018-11-02 08:38)


 (2018-11-01 22:34)

 (2018-11-01 21:22)

Week 43

 (2018-10-25 23:55)

 (2018-10-25 22:36)

 (2018-10-25 21:01)


 (2018-10-25 20:52)

Figure 28-10: Individual Project Status

28.2 Research Groups

Many of these projects has been carried out as part of the following research groups at the university:

- Smart Technology Research Group
- Telemark Modeling and Control Centre (TMCC)

28.3 Software Engineering

The purpose with creating the Project Management System (PMS) is many:

- The system is used in many R&D projects

- The system is used in many student projects, where students learn about project management and project tracking as part of solving or implementing a technical problem, e.g., create a software system for a given customer (external industrial partners).
- The system is used in Software Engineering, both in teaching and in Software Engineering projects
- PMS is made from scratch using HTML, JavaScript, CSS, Bootstrap, PHP, MariaDB (MySQL), etc. I have created the system to illustrate how you can use web technology and combine these techniques for creating powerful and user-friendly Web Applications.
- I teach in different courses within programming, web technology and Software Engineering. The application is used to exemplify these topics.
- Open Access and Source

29 Weather Systems

Weather systems have become very popular today. Weather data is widely needed in the process industry and in automation systems like dynamic position (DP) offshore, etc. At the university, we have mounted 2 different weather systems intended to use in research, laboratory and project work. We want to add more functionality to these 2 weather stations and merge them together.

At University of South-Eastern Norway, we have several Weather stations that we use in teaching, research and development. I have been in charge for the platforms and the technical solutions for these systems, including several education projects.

The system has been developed through several students projects the last years.

The project will include topics like instrumentation, industrial IT, programming, modelling and simulation, project planning and management.

In Figure 29-1 we see an overview of the Weather System which has been developed and is maintained at University of South-Eastern Norway.

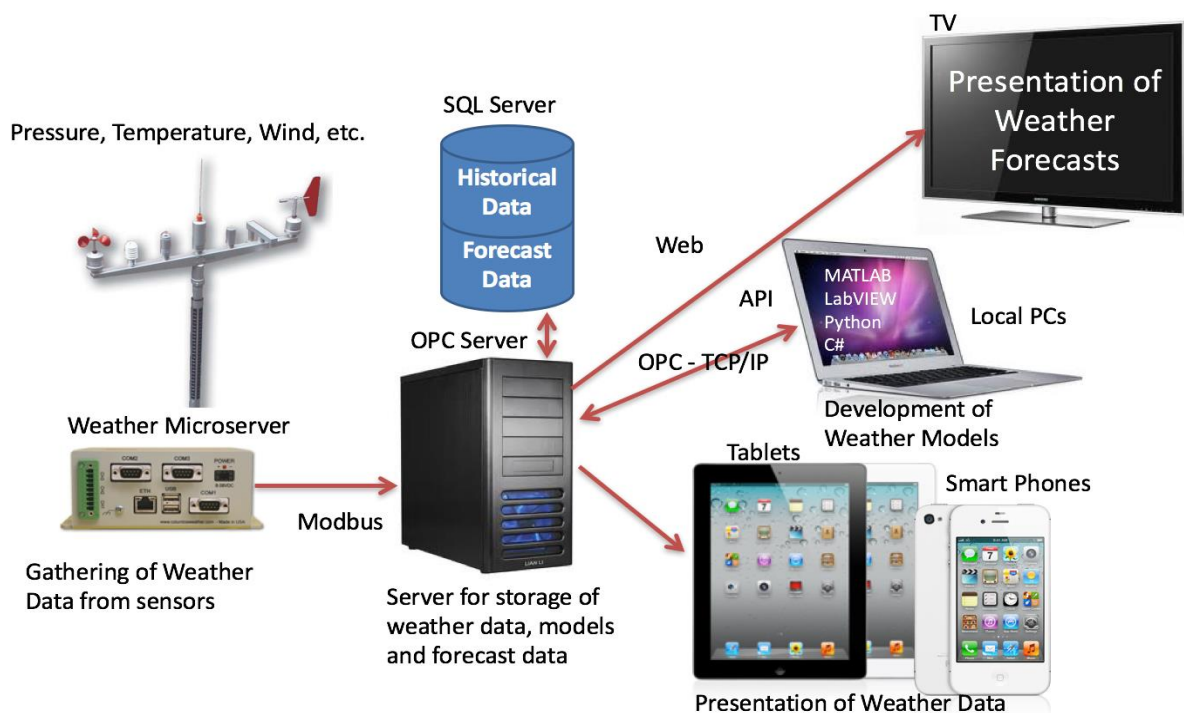


Figure 29-1: Weather System Overview

A part of the solution is a Windows App, see Figure 29-2.

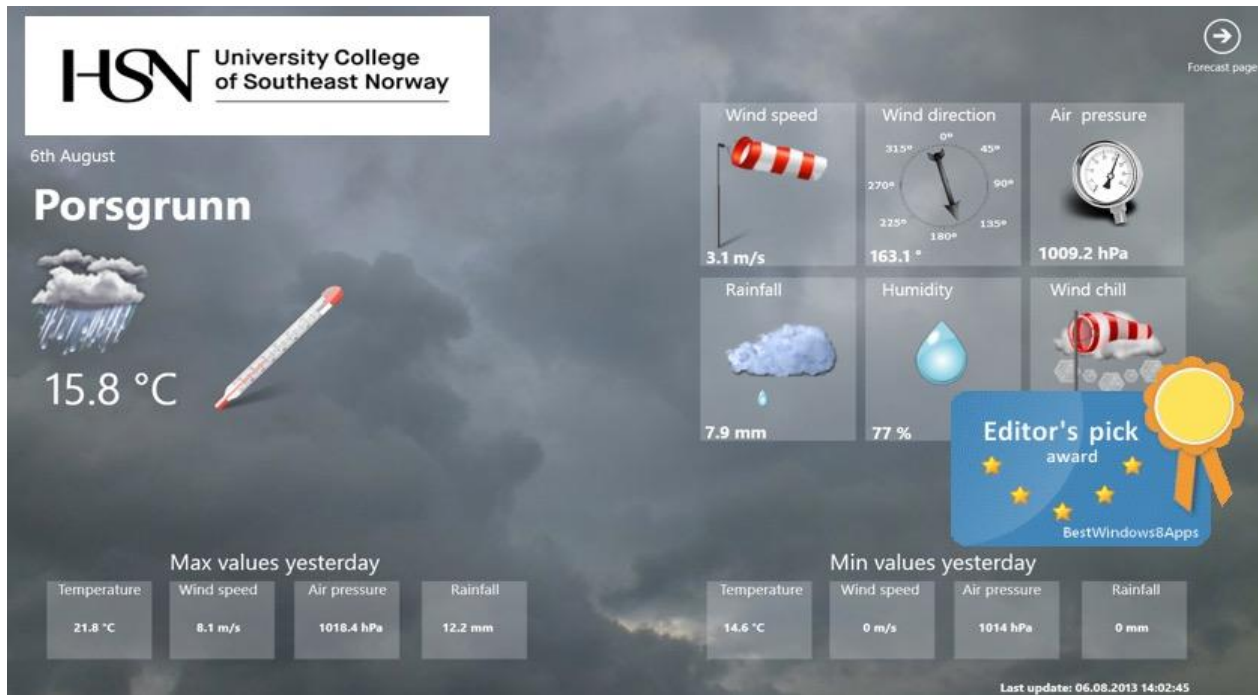


Figure 29-2: Weather System (Student Project)

The App can be downloaded from the Windows App Store:

<https://www.microsoft.com/en-us/store/apps/telemark-university-college-weather-system/9wzdnrcdccc9>

The Windows App has been tested, rated and awarded as "Editors pick award" by the BestWindows8Apps.net, see Figure 29-3.



★★★★★ (8.5/10)

Figure 29-3: Editors pick award by the BestWindows8Apps.net

More information about the award can be seen here (Figure 29-4):

<http://bestwindows8apps.net/telemark-university-college-weather-system>

Best Windows 8 Apps | What are you looking for? | Search | Apps | Games | Collections | Sign In

Enterprise File Sharing

Universal Access & Sharing of Your Files. From Any Device, Anywhere.

Home / Weather / Telemark University College Weather System

Telemark University College Weather System

Telemark University College Weather System App gives you current weather data and various weather trends from a weather station located in Telemark University College, Porsgrunn.

Features:

- Showing Current Weather and Trends
- Live Updates from Telemark University College Weather Station

5.0 (1 total review)

Category: News & Weather / Weather
Published by: Hans-Petter Halvorsen
Size: 3.4 MB
Supported processors: x64
Language: English (United States)
Learn more: Website & Support

Telemark University College

24th April
Porsgrunn
7 °C

Wind speed	Wind direction	Air pressure
4 m/s	264.4 °	1011.9 hPa
Rainfall	Humidity	Wind chill
0 mm	72 %	-1.8 °C

Max values last week				Min values last week			
Temperature	Wind speed	Air pressure	Rainfall	Temperature	Wind speed	Air pressure	Rainfall
14.3 °C	10.3 m/s	1028.9 hPa	140.2 mm	-2.3 °C	8 m/s	991.3 hPa	0 mm

Last update: 24.04.2015 22:09:44

Figure 29-4: BestWindows8Apps.net Web Site

30 Automation Systems and Industry 4.0

30.1 Introduction

Industry 4.0 is the new buzzword for the combination of industry, automation and the current Internet of Things (IoT) technology.

IIoT is industrial use of IoT technology. Industrial Internet of Things (IIoT) is another word for Industry 4.0. You could say that IoT is consumer oriented with applications like Smart Home, Home Automation, etc., while IIoT has more industrial focus and applications. The term "Industrie 4.0" was first used in 2011 in Germany.

Below you find more information about the R&D projects under the "Automation Systems and Industry 4.0" umbrella:

<http://www.halvorsen.blog/documents/projects/projects/automation.php>

30.2 Process Control Systems

Knowledge and experience with so-called Process Control Systems (PCS) are an important part of "Industrial IT and Automation" study for the students at the university.

It is important that we can offer training, laboratory work and projects on such systems. It is also an important research area.

DeltaV is such as Process Control System. DeltaV is a Process Control System from Emerson.

DeltaV is probably the PCS system that are most widely used today in the process industry. At our university, we have 2 of these systems. These systems are heavily used in laboratory work, student projects, R&D projects in conjunction with local process industry.

30.3 Collaboration with Industry

DeltaV is probably the process control system that are most widely used today in the process industry. At our university, we have 2 of these systems. These systems are heavily used in laboratory work, student projects, R&D projects in conjunction with local process industry

30.4 Projects

During the last years, I have been involved in lots of R&D projects with local industry regarding Process Control Systems (PCS).

Local industry such as Yara and Emerson has been heavily involved.

Yara: <http://www.yara.no/about-yara/yara-global/production-sites/yara-porsgrunn/>

Emerson: <http://www.emersonprocess.com>

30.5 Lab Facilities

Figure 30-1 shows some of the DeltaV equipment available at the university.

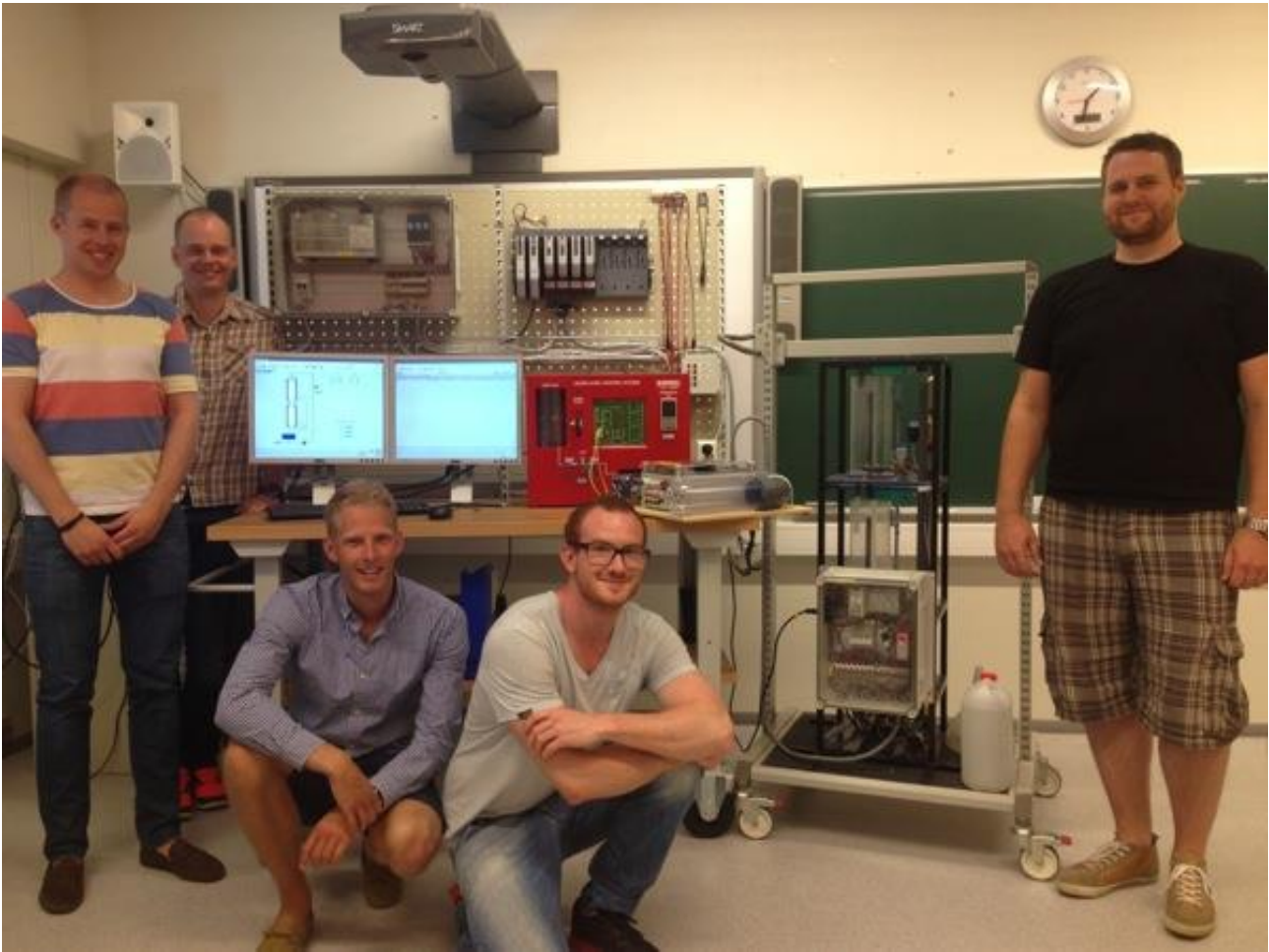


Figure 30-1: DeltaV Lab Training Equipment (Student Project)

30.5.1 DeltaV Training and Research Center

As part of these facilities, a web-based Training and Research Center has been established as part of different student projects the last couple of years. See Figure 30-2



Research Center	Training Center
	
<p>Is a information portal for HiT's DeltaV distributed control system. On this website you will find:</p>	<p>Is a training portal for HiT's DeltaV Training Station On this website you will find:</p>
<ul style="list-style-type: none"> • Basic informat ion about the DeltaV system • Basic information about the UBD Model and the Silo Model • A brief user manual • Specifications and schematics of the DeltaV system • Information about DeltaV student projects 	<ul style="list-style-type: none"> • Basic information about DeltaV • Basic information about the DeltaV Training Station • Basic information about the Air heater, level control, two-tank, pt-100 • Video tutorials and written tutorials

Figure 30-2: DeltaV Training and Research Center

Below we see the link to the DeltaV Training and Research Center:

<https://www.halvorsen.blog/documents/hardware/deltav.php>

The training material is web-base with lots of resources like videos, tutorials and exercises that the students can use when they are learning about process control systems as part of their education. The training videos and the web pages are made from previous students under my supervision.

Figure 30-3 and Figure 30-4 shows some of the facilities.

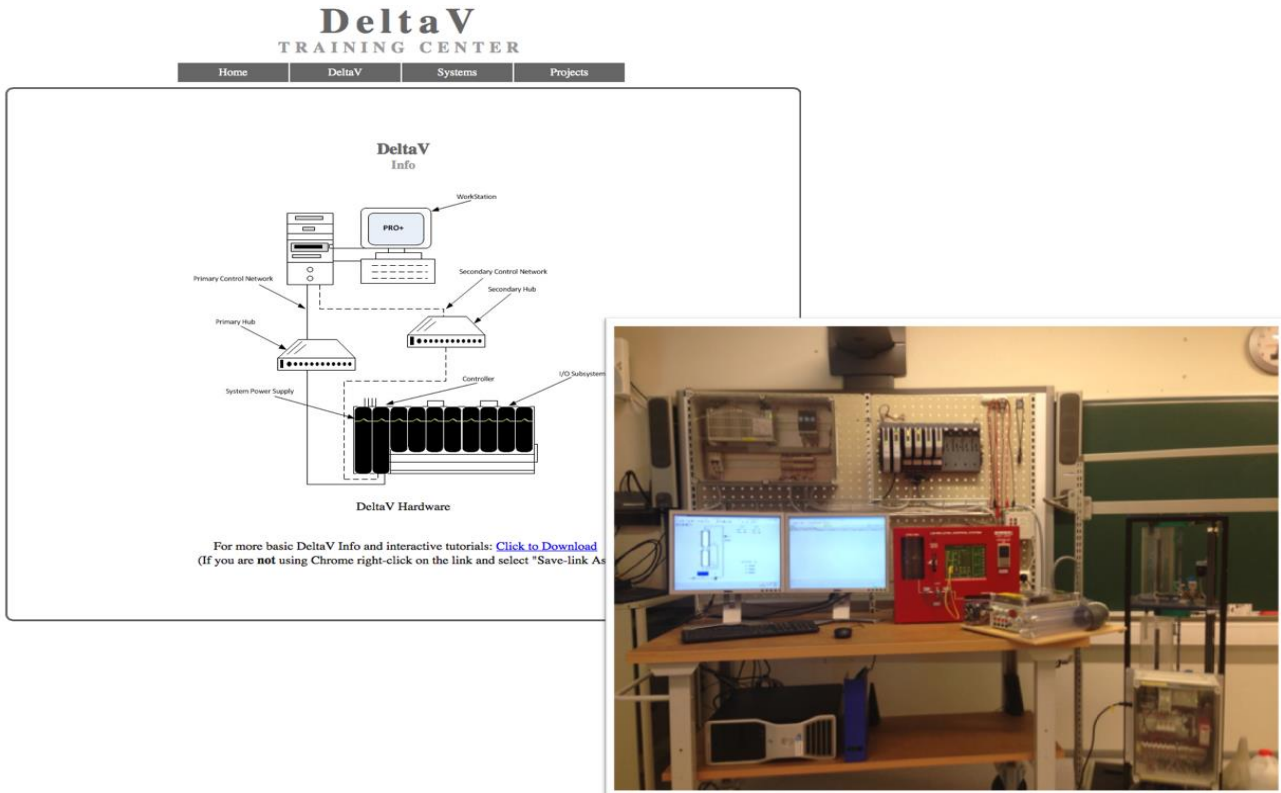


Figure 30-3: DeltaV Training facilities

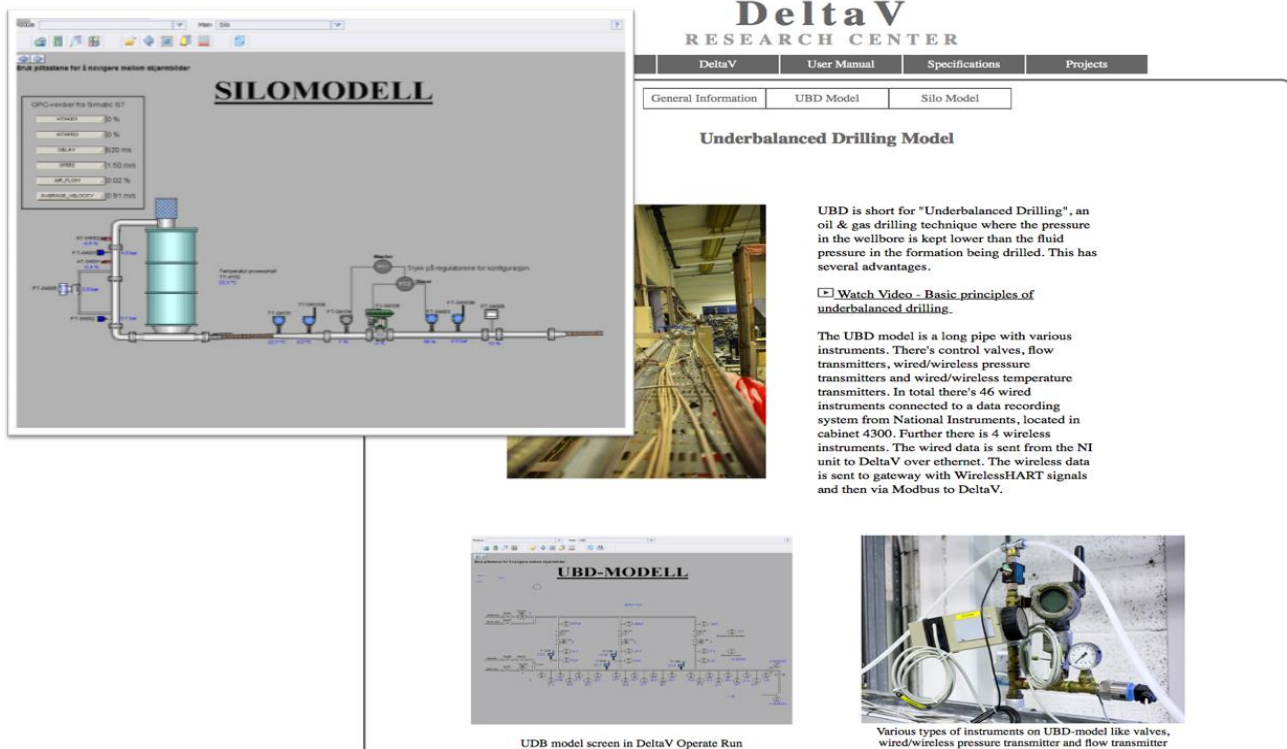


Figure 30-4: DeltaV Research facilities

30.6 Publications

Some of the results from these projects have been published within the area of Automation systems, Industry 4.0 and other industrial applications:

- Modelling of Anti-icing System for Airplanes - Maths Halstensen, Joachim Lundberg, Hans-Petter Halvorsen, 2019.
- *Sandboxing for Cross-Platform Applications of Robots* - Hans-Petter Halvorsen, Alexander Jonsaas, Lilly Eikehaug, Saba Mylvaganam - 2019 IEEE International Symposium on RObotic and Sensors Environments (ROSE), June 17-18, 2019, Ontario, Canada.
- *Industrial IT and Automation - Curricula and Experience at USN in the context of Industry 4.0* - Hans-Petter Halvorsen, Nils Olav Skeie, Saba Mylvaganam - EAEEIE 2017, The 27th EAEEIE Annual Conference, June 7-9, 2017, Grenoble.
- *Remote control of a robotic arm - A cross-platform study using LabVIEW and DeltaV* - Hans-Petter Halvorsen, Alexander Jonsaas, Lilly Eikehaug, Sondre Mogård, Håkon Viumdal, Rune Andersen, Saba Mylvaganam. ITEN2015 Conference, Łódź, Poland, September 2015.
- *Intermediate Measurement Node for Extension of WSN Coverage* - Rabin Bilas Pant, Hans Petter Halvorsen, Frode Skulbru, Saba Mylvaganam - Journal of Cyber Security and Mobility, Vol. 2, 2013. Available from River Publishers.

31 Health and Welfare Technology

31.1 Introduction

There are increasing numbers of elderly people in the society and people want to stay home even when they are sick or get old. It is also important with increased security for the users and their relatives.

Health and welfare technology also deal with e-health and digitization of the health and welfare sector, as well as work with open technical infrastructures and solutions that enable seamless information sharing between different organizations, relatives and users.

31.2 Sensors for Welfare Technology

The research area deals with monitoring of the elderly and sick people using sensor technology. Sensors are typically attached to the body and surroundings and the sensors detects if they fall, get heart attack, etc. The Sensors typically use Bluetooth or other forms of wireless communication. See Figure 31-1.

Sensors for Welfare Technology



Figure 31-1: Health and Welfare Sensor Technology

The digital age and modern technology have made it possible to combine health and welfare and technology in new ways which was not possible just a few years ago. See Figure 31-2.

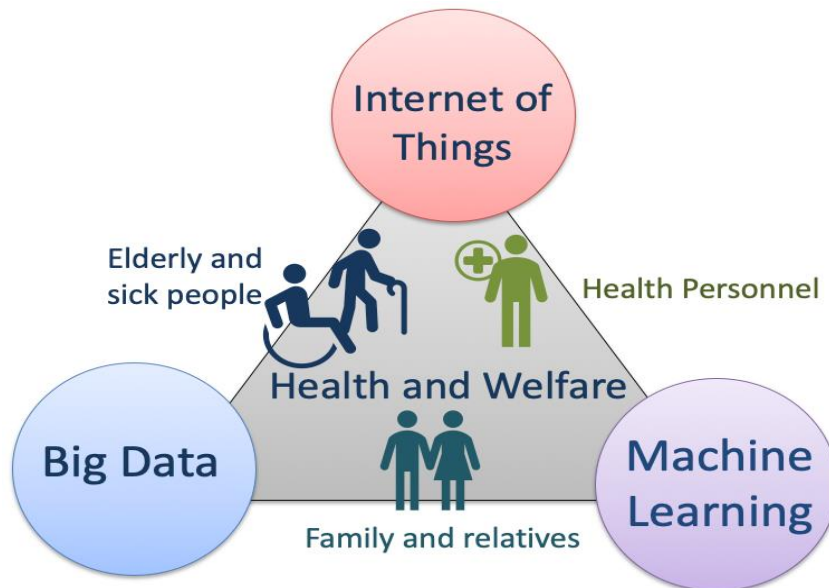


Figure 31-2: Machine Learning in Health and Welfare

By combining technologies like Internet of Things, Big Data and Machine Learning we can improve how we react on the inputs from the sensors and use the large amount of data that are collected on new and innovative ways.

31.3 Monitoring of Environmental Issues

The projects and the research and development work I am involved in this topic includes topics like:

- Development and maintenance of infrastructure and data system for gathering, acquiring and analysis of environmental and public health information data for Porsgrunn and Grenland.
- Real-time monitoring of air pollution data
- Design and development of measurements stations in connection therewith, or integration with existing measurement stations.

In addition, we have more technical aspects like:

- Digitalization
- Database Solutions
- IoT and Big Data
- Machine Learning
- User Interaction and Design
- Safety aspects (data security, backup, load balancing, redundancy, etc.)
- Etc.

In Figure 31-3 you see an Environmental Monitoring System made as part of one the projects and R&D work within this field.



Figure 31-3: Environmental Monitoring of Pollutions in the Grenland Area of Norway

For more information:

<https://www.halvorsen.blog/documents/projects/projects/eph.php>

See also chapter 26 - Environmental Public Health.

31.4 Projects

These projects are in collaboration with local companies and local industry.

Several projects have been carried out at University of South-Eastern Norway.

The projects have been a collaboration between USN, Porsgrunn municipality, Tel-Tek (SINTEF) and the hospital in Telemark.

The main goal with these projects has been to measure, collect and monitoring environmental issues in Grenland, Norway.

31.5 Research

The R&D work within Health and Welfare Technology has been carried out as part of the SMART Research Group at the University of South-Eastern Norway.

Link to the SMART Research Group web site:

<https://www.usn.no/research/our-research/technology/smart/>

31.6 Publications

Some of the results from these projects have been published within the Health and Welfare area:

- ***Monitoring of selected Numeric Water Quality Criteria (NWQC) using IoT Platform – Digitalizing Water Care System (WCS)*** - Hans-Petter Halvorsen, Colin Dubreuil, F. Hansen, R. Bakke, J. Timmerberg, J-M. Thiriet, S. Mylvaganam, 2019.
- ***Fusion of Body Sensors' Data and Video Images in Assistive Technology*** - Hans-Petter Halvorsen, Karina Kaspersen, Alexander Jonsaas, Saba Mylvaganam - IEEE Sensors Applications Symposium (SAS), March 11-13, 2019, Sophia Antipolis, France.
- ***Environmental Monitoring with focus on Emissions using IoT Platform for Mobile Alert*** - Hans-Petter Halvorsen, Ola Anton Grytten, Martin Veel Svendsen, Saba Mylvaganam – EAEEIE, The 28th EAEEIE Annual Conference, September 26-28, 2018, Reykjavík, Iceland. Available from IEEE Xplore.

32 Software Engineering

One of my main working field is software development. Here I will present some of my works within this field.

The examples presented below are professionally made applications that I have made using different development tools and programming languages.

Some of them are built using the latest web technology (HTML5, CSS, JavaScript, PHP, ASP.NET, Bootstrap, etc.), while others are developed using Visual studio/C#, LabVIEW and Python.

The purpose with the applications is twofold; one aspect is to learn and use these technologies in teaching and research and development projects, another aspect is to create professional applications that can be used by me personally and my students in different R&D projects.

Another thing is that these apps are part of my R&D work within Software Engineering, User Interface design and interaction and Cyber Security.

The applications can be freely used or downloaded from my website:

<https://www.halvorsen.blog>

32.1 Project Management System

I am involved in many R&D projects, many of them in connection to the industry in Grenland, Norway and other areas. In these projects, project management is important parts of the projects.

In context of this, I have made a Project Management System (PMS) from scratch that I am using in many of these projects. The Project Management System is also used in the student projects that I am are involved in. In that way the students and I can keep track of the projects from the beginning to the end of the projects.

See chapter 28 for more information regarding this system.

32.2 Work Management System

The Work Management System (called Workless) is a modern web application where you can manage your personal daily work.

Workless is made using HTML, JavaScript, CSS, Bootstrap, PHP and MariaDB (MySQL).

See my page about web programming for more information about these technologies:

<https://www.halvorsen.blog/documents/programming/web>

Here you can read more about database systems. PHP is used to create dynamic web pages where data is typically stored in a database, like MariaDB (MySQL) or SQL Server. Another framework for creating dynamic web pages is ASP.NET. The system is hosted on an Apache HTTP Server, but other Cloud Hosting Services could have been used as well.

I have created Workless to illustrate how you can combine these techniques for creating powerful and user-friendly web applications.

See also my pages about Programming and Software Engineering:

<https://www.halvorsen.blog/documents/programming/>

https://www.halvorsen.blog/documents/programming/software_engineering/

Figure 32-1 shows an overview of the Work Management System.

Blog

Workless | Work Today

Keep Track of your Work with Workless

[Home](#) [Work Manager](#)

Today's Work

Below you find Today's Work:

Work Group:

Software Engineering

Search

Software Engineering

[New Work Today](#)

Below you find your Work that fulfills the search criteria above:

Work	Work Group	Priority	Action
<input type="radio"/> Installere siste versjon av VMware Workstation Player	Software Engineering	Medium	<input type="checkbox"/> <input type="checkbox"/>
<input type="radio"/> Lage 3-lags arkitektur eksempler i C#	Software Engineering	Medium	<input type="checkbox"/> <input type="checkbox"/>
<input type="radio"/> Lage Web API Eksempel i C#	Software Engineering	Medium	<input type="checkbox"/> <input type="checkbox"/>

Add Work Today:

Enter the Title of the Work

Hint: Just hit the Enter key for fast entry

[Add Work Today](#)

Figure 32-1: Work Management System

With Workless you can:

- Keep track of your Daily Work
- Become more organized and be able to work more effectively
- Create “To Do” Lists and mark Work as Done
- Organize your Work into different Categories/Groups
- Set Deadlines when the work should be finished

The main features in Workless are:

- Work Today: List of Work that you should focus on at the moment
- Work Manager: List of all your Work. You can easily move work between Work Today and the Work Manager

32.3 Event and Attendance System

The Event and Attendance System are used to create no events and to register or keep track of the person joining these events. See Figure 32-2

Event Management
Hans-Petter Halvorsen

Events

EventId	Event Name	Attendance	Action	Sessions
5	Industrial IT	Attendance Overview	Edit Event Delete Event	Sessions
1	MATLAB	Attendance Overview	Edit Event Delete Event	Sessions
16	Software Engineering	Attendance Overview	Edit Event Delete Event	Sessions
2	Systems and Control Laboratory	Attendance Overview	Edit Event Delete Event	Sessions

[New Event](#)

Figure 32-2: Event Management

The applications are many. At the university I use it for registration of the activities in my courses, like keep track of attendance for compulsory activities, etc. See Figure 32-3 and Figure 32-4.

Event Registration

Hans-Petter Halvorsen

Select Event:

Event Registration List

Person	E-Mail	Additional Information

Figure 32-3: List of Registered Person for a specific Event

Session Attendance

Hans-Petter Halvorsen

Select Event:

MATLAB

Select Session:

MATLAB - Session#1

Session Attendance List

AttendanceId	Person	E-Mail	Attendance Date
665			2018-08-16 11:25:02
654			2018-08-16 09:41:25
625			2018-08-16 09:03:14
648			2018-08-16 09:37:06
650			2018-08-16 09:38:06
647			2018-08-16 09:36:50

Figure 32-4: List of Attended Persons for a specific Event Sessions

32.4 Quiz and Questionnaire System

In all my courses I use different kind of quizzes and questionnaires to test the student skills.

When the students are finished with either a specific topic or finished with a lab assignment, they need to take a quiz with multiple choice questions to verify that they got the necessary acquired skills.

The software I use for creating and executing these quizzes are made from scratch customized to suits my needs.

In Figure 32-5, Figure 32-6, Figure 32-7 and Figure 32-8 you see some of the screenshots from the software.

Blog Quiz Management

Logout

Quizzes

Group:
Industrial IT

Below you find available Quizzes for the selected Group:

QuizId	Quiz Name	Action	Questions
12	☰ Database Systems	Start Quiz Edit Quiz Delete Quiz	Questions
42	☰ Database Systems - Lab Summary	Start Quiz Edit Quiz Delete Quiz	Questions
13	☰ HIL	Start Quiz Edit Quiz Delete Quiz	Questions
43	☰ HIL - Lab Summary	Start Quiz Edit Quiz Delete Quiz	Questions
11	☰ OPC	Start Quiz Edit Quiz Delete Quiz	Questions
41	☰ OPC - Lab Summary	Start Quiz Edit Quiz Delete Quiz	Questions

[New Quiz](#)

Figure 32-5: Quiz System

Quiz: OPC

New Question

Below you find available Questions for the selected Quiz:

QuestionId	Number	Question Name	Action	Answers
90	1	What is OPC?	Edit Question Delete Question	Answers
91	2	Why do we need OPC?	Edit Question Delete Question	Answers
92	3	What is OPC DA?	Edit Question Delete Question	Answers
93	4	What is OPC UA?	Edit Question Delete Question	Answers
94	5	Which of the following is NOT a OPC protocol?	Edit Question Delete Question	Answers
95	6	What is the main difference between OPC DA and OPC UA	Edit Question Delete Question	Answers
96	7	What kind of Data format is used in OPC UA?	Edit Question Delete Question	Answers

Figure 32-6: Question Management

Quiz: OPC

Question 1: What is OPC?

[Edit Question](#)
[New Question](#)

Below you find available Answers for the selected Question:

AnswerId	Answer Name	Correct	Action
276	A communication protocol between a single Master and a single Slave	—	Edit Answer Delete Answer
277	A standard that defines the communication of data between devices from different manufactures	✓	Edit Answer Delete Answer
278	A client that can store process data in an SQL Server	—	Edit Answer Delete Answer
279	A standard protocol for storing real-time data into a SQL Server database	—	Edit Answer Delete Answer

[New Answer](#)

[← Previous Question](#)
[→ Next Question](#)

Figure 32-7: Answer Management

Quiz Results

Name	E-Mail	Score	Status	Action
		85.0%	✓	Show Diploma
		90.0%	✓	Show Diploma
		100.0%	✓	Show Diploma
		95.0%	✓	Show Diploma
		95.0%	✓	Show Diploma
		90.0%	✓	Show Diploma
		100.0%	✓	Show Diploma
		90.0%	✓	Show Diploma
		95.0%	✓	Show Diploma
		85.0%	✓	Show Diploma
		100.0%	✓	Show Diploma
		85.0%	✓	Show Diploma
		95.0%	✓	Show Diploma
		95.0%	✓	Show Diploma
		95.0%	✓	Show Diploma
		100.0%	✓	Show Diploma
		100.0%	✓	Show Diploma
		100.0%	✓	Show Diploma
		100.0%	✓	Show Diploma

Average Score: 94.5%
Counter: 19

Figure 32-8: Quiz Results and Statistics

32.5 Notes

Many different Note application do exist today, such as Evernote, OneNote, etc. All of these have their strengths and weaknesses. In order to have a Note application that are tailor-made to all my needs, I have made my own Notes application from scratch. See Figure 32-9.

With the Notes application you can organize your Notes into different Groups or Categories. With Notes you can create Text, Tables, Hyperlinks. You can format your Text using Headers, Bold, italic, you can also create Bulleted Lists and Numbered Lists.

You can also Print out your Notes or create a PDF file. In addition, you can easily share your Notes with others. You can select if a Note that is shared should be read-only or editable.

Note Group:

Projects

New Note Group Edit Note Group

Search

Note List

New Note

Note	Date Modified	Modified By	Action
Environmental System	2018-11-20 13:54	Hans-Petter Halvorsen	Edit Share Delete
Projects 2018	2018-11-20 11:17	Hans-Petter Halvorsen	Edit Share Delete

Figure 32-9: Notes

32.6 Datalogging and Monitoring Tools

Several R&D applications for Datalogging and Monitoring have been made. See Figure 32-10.

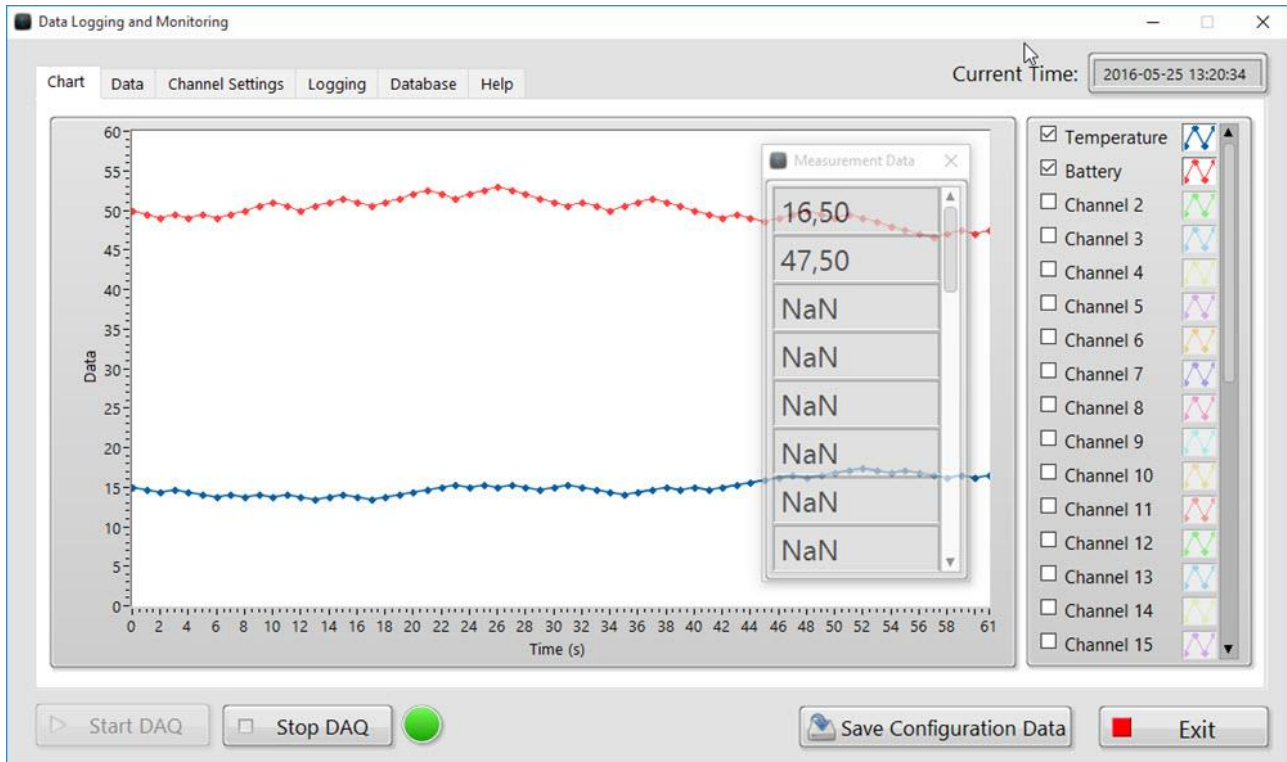


Figure 32-10: Datalogging and Monitoring Application

Some of the Features:

- With this Application you can Log measurement Data using e.g., an USB-6008, to Files, Databases, etc.
- This Examples uses programming techniques such as the State Machine principles, Event handling Local/Global variables, Property Nodes, Arrays, String Manipulation, Shift Registers, Writing and Reading to Files, Writing/Reading to/from Database, Web Services, Error Handling, SubVIs, etc.
- This Example also shows how you can create Executable Files and Installation Packages with LabVIEW.
- Feel free to download and test it out in order to get some ideas for your own applications. Just Unzip and open the File "Data Logging.lvproj" to get started.

For more details see:

<https://www.halvorsen.blog/documents/technology/datalogging/>

32.7 Control Systems

Several R&D Control Systems applications have been made. See Figure 32-11 and Figure 32-12.

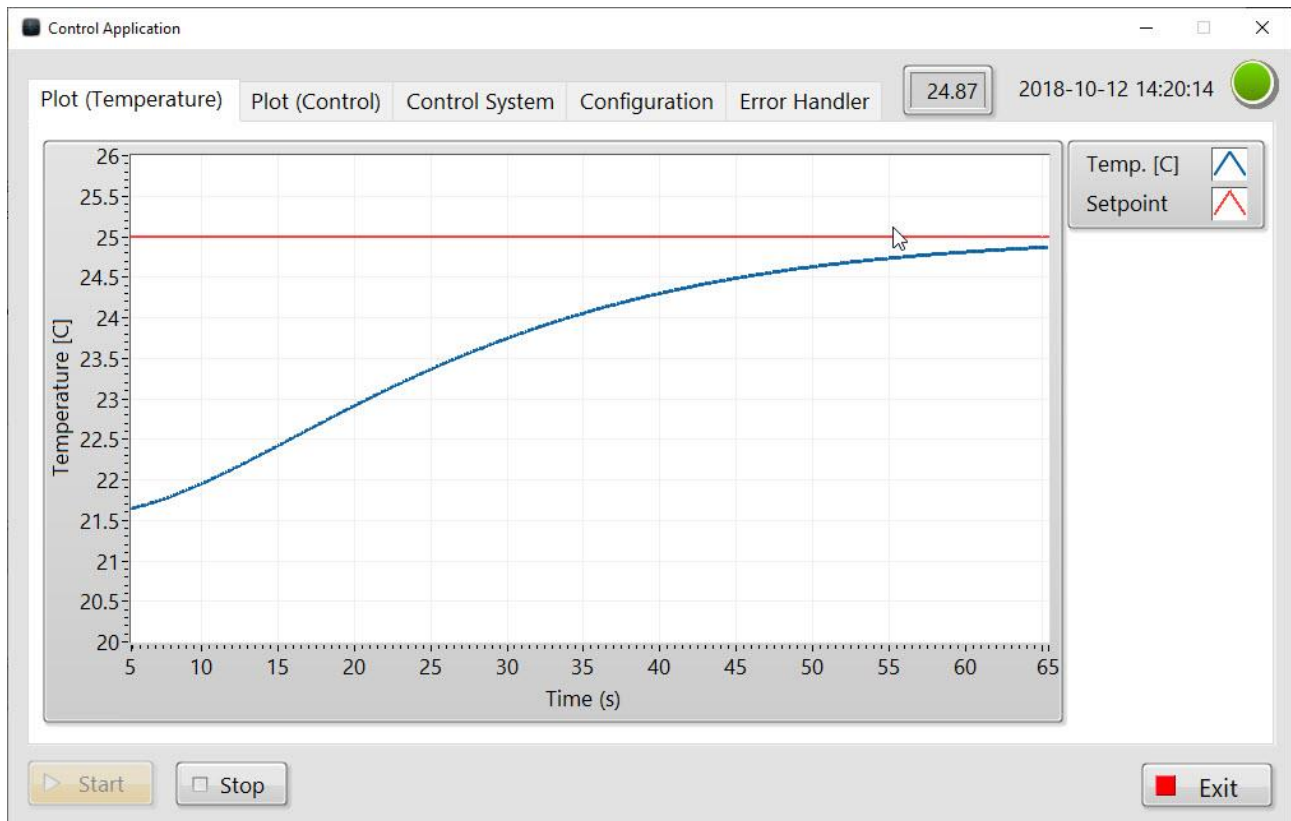
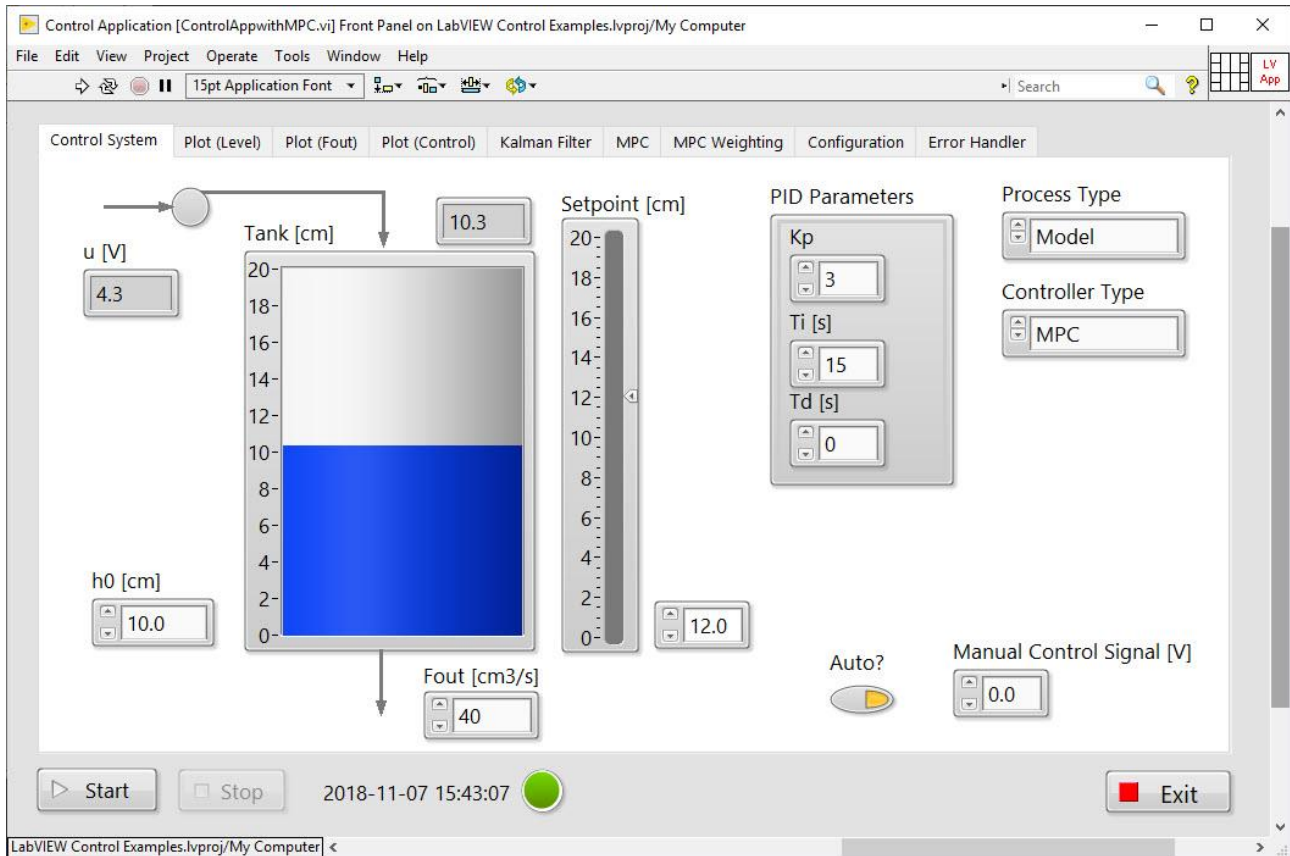


Figure 32-11: Control System



For more details see:

<https://www.youtube.com/playlist?list=PLdb-TcK6Aqj2loEYiVHmiYCGvnK2evwP0>

and

<https://www.halvorsen.blog/documents/automation/mpc/>



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