

# FMH606 Master's Thesis

**Title:** Development of Open Source Datalogging and Monitoring Resources for IoT Platform

**USN supervisor:** Hans-Petter Halvorsen

**External partner:** Dimension Four

## **Task background:**

USN uses different IoT platforms today in within the IT and Automation Bachelor program and the Industrial IT and Automation Master program, both for educational and research purposes.

Dimension Four (<https://dimensionfour.io>), a local company in Grenland Norway has developed a new IoT platform, which may be relevant to use by USN in the future. The IoT platform uses MQTT and GraphQL.

To use this platform at USN, both in education and research, APIs and practical examples need to be developed for different devices (PCs with DAQ devices from National Instruments, Arduino, and Raspberry Pi) and programming platforms. The main programming environments and programming languages at USN within the Bachelor/Master programs mentioned above are Visual Studio/C#, Python, LabVIEW, and MATLAB.

## **Task description:**

In this project the following activities should be performed:

- Give an overview of existing IoT solutions for Datalogging and Monitoring. Azure and ThingSpeak are platforms used by USN today, but there exist many others that may be relevant to use in the future.
- Give an overview of different standards and protocols within IoT and compare and discuss advantages and disadvantages, some examples are REST, MQTT, and GraphQL. Industrial protocols like OPC UA are also relevant to use.
- Discuss especially Data Security issues within the different platforms and protocols
- Give an overview of the Dimension Four IoT platform and their existing API. Make a detailed list of pros and cons and suggest a list of improvements and give examples how these can be implemented.
- Development of APIs and practical examples that communicates with the Dimension Four IoT platform, both datalogging (publishing data) and monitoring/visualization (retrieving data) of data for the programming platforms Visual Studio/C#, Python, LabVIEW, and MATLAB. Julia may also be an alternative, as well as ASP.NET Web Applications for presentation of data.
- The APIs and the practical examples should be tested out on different devices such as standard Windows PC with different DAQ devices from National Instruments, Arduino, and Raspberry Pi.

- Arduino: An open-source (GitHub) Arduino Library should be part of the solution
- Raspberry Pi: An open-source (GitHub) Python Library should be part of the solution
- Visual Studio/C#: An open-source (GitHub) Nuget package should be part of the solution
- LabVIEW: Open-source (GitHub) distribution via VI package Manager (VIPM)
- The APIs and the practical examples need to be investigated, tested, and explored thorough on practical applications within Home Automation and Industrial Applications. Here should also data analysis and presentation be in focus, e.g., Machine Learning.
- Compare and discuss the different IoT platforms and their features, advantages and disadvantages and suitable applications for the different IoT platforms.
- The APIs and the practical examples should be open source and should be available at GitHub.
- The different APIs and the practical examples need to be documented properly both as written documents (e.g., in GitHub), but also in form of videos available on YouTube.

**Student category:** IIA, both campus and online, but also for industry master students that want to take a project outside their own company.

**The task is suitable for online students (not present at the campus):** Yes. All work can be done online.

**Practical arrangements:**

Necessary resources and help will be provided by Dimension Four.

External partner (Dimension Four) will be responsible for providing a sensor for the project that will grade the work in collaboration with the supervisor from USN.

The resulting report should be public available.

**Supervision:**

As a general rule, the student is entitled to 15-20 hours of supervision. This includes necessary time for the supervisor to prepare for supervision meetings (reading material to be discussed, etc).

**Signatures:**

Supervisor (date and signature):

Student (write clearly in all capitalized letters):

Student (date and signature):