Protopaja / Proto camp

ELEC-D0301 – Introductions

Aalto University
School of Electrical
Engineering

Salu Ylirisku

1.6.2023

Today’s agenda

10:15 - Lecture (Salu)

Introductions & Teaming up

Lab Safety + Tour

Who are we?

Teaching staff

Teacher: Dr. Salu Ylirisku

Assistants:

Emil Fihlman

Aleksi Zubkovski

Shahram Barai

Pekka Parkkonen

You

Aalto University
School of Electrical
Engineering

Projects and Teams

GIM Robotics

Aleksi Saajakari

Elias Lindberg

Roni Vallius

Verneri Turkki

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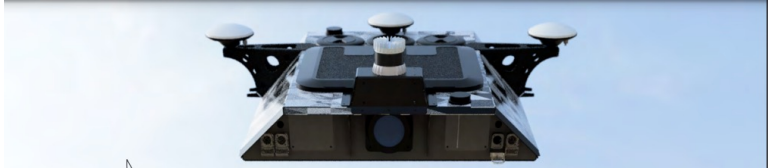
TA: Aleksi

Aalto University
School of Electrical
Engineering



GIM ROBOTICS

PROTOPAJA 2023 PROJECT IDEA

Sensor calibration platform

In this project students will design a computer-controlled 3-DOF kinematic platform for calibrating IMU, LiDAR and camera sensors. GIM will provide guidance through the project, and there is a possibility to use industry-standard hardware and software or design your own.

Specifications:

- 3 degrees of freedom
- Computer interface for commands and feedback
- Absolute position feedback during movement
- ±45 degrees per axis (roll, pitch yaw)
- Minimum 5 kg payload
- Good dynamic performance, low jitter and backlash

Tips:

- ROS interface?
- Possible use of hardware and software common 3D printers

Contact:

Aleksi Turunen
Senior Robotics Engineer, M.Sc.(Tech)
tel +358 451247027
email: aleksi.turunen@gimrobotics.fi

Granlund

Aws Al Izzawi

Mimi Määttä

Beatriz Glaser

Akbar Urlenbayev

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TA: Aleksi & Emil

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Protocamp course

Device and sensor for infrastructure measurement

The goal of the project is to develop a IoT device that can measure as much information as possible from infrastructures, such as elongation (stress-strain curve) and motion (e.g. deflection, torsion). The environment where the device would be used is mobile network base station. The device can be situated in each structural parts (e.g. prestressing Steel or wire) of different kinds of mobile network base towers. The measurement should be done taking privacy issues into consideration, for example, all the calculations are done in the device and only metadata (stress, strain etc.) is sent to a cloud service.

In addition to the device development, new possibilities for sensors in structural health monitoring (SHM) should be considered. For instance, durability of sensors and devices is in focus because those should be in the structures more than twenty years. One example for discussions is so called energy harvesting.

Contact persons:
Esko Sistonen, Esko.Sistonen@granlund.fi
Markku Vuori, Markku.Vuori@granlund.fi

Company info:
Granlund specialises in software services, consultancy, and design. We focus strongly on innovation and development and our aim is to create wellbeing in the built environment. Granlund was established in 1960. Today we have customers in over 30 countries and employ over 1,500 experts in Finland, Scandinavia, China, the UAE, and UK.

Murata

Johannes Oittinen

Tomi Tiainen

Sonja Hyvönen

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TA: Shahram

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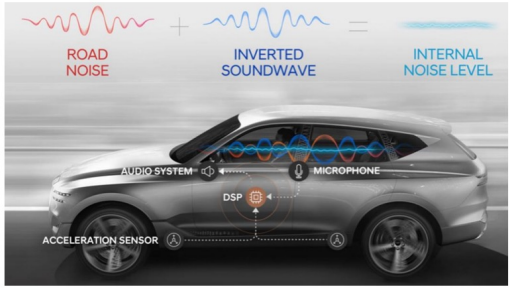
muRata
INNOVATOR IN ELECTRONICS

Road noise cancellation demo

In an electric driven vehicle, the road noise is considered to be especially disturbing for driver and passengers. The main source of noise is the wheel contact to road, and this can be measured with an accelerometer close to the source of the noise. Compared to traditional use of microphones the advantage is that the measurement is earlier in the signal chain and enables more processing and generation time for the cancelling signal.

Another typical feature is that the source of the experienced noise is in the wheel well of passenger area and the source of cancelling signal would be located in the A-pillar of the vehicle. That is, the distance to the human head (and direction) are different for the main signal and cancellation signal.

The purpose of the demo is to show the feasibility of using MEMS accelerometer instead of microphone (microphone can be used verify the feedback loop) and to show that the required latency times for the sensing, processing and generation of the cancelling signal can be reached. Ideally, "a quiet bubble" is created instead of a well-defined single location.



Picture: Hyundai Motor company

Contact information:

Lasse Aaltonen	lasse.aaltonen@murata.com
Tommi Vilenius	tommi.vilenius@murata.com
Altti Torkkeli	altti.torkkeli@murata.com

Murata Electronics is global market leading manufacturer and supplier of MEMS (micro-electromechanical) accelerometers, inclinometers, and gyro sensors. We have R&D, mass-manufacturing, and business operations in Vantaa, Finland with 1000 employees and we are part of global Murata Manufacturing Company.

Helvar

Tuomas Maijala

Ilmari Oivanen

Iiro Naulapää

Nadeem Qaisar

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TA: Emil & Shahram

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MpW sensor (Multipurpose wireless Sensor)

Backround

Every so often we run into sensing problem of getting reliable information on particular activities, such as whether the coffee pot is on or is there anyone sitting on a desk – and we do number of other trivial-sounding various sensing tasks, that lack suitable sensor tooling. As of such tool the mpw sensor will be usable component for instrumenting the sensing on various tasks.

On top of this, we have larger goal: We want to train multi-parameter environment sensor networks to do a level of recognition on activities in space, for this we need "ground truth" data – that is, reliable data on actual events to act as labels for neural network training.

What is ready

We got an infrastructure

- Designed for receiving BT adverts
- Cloud tool for reporting, visualization etc

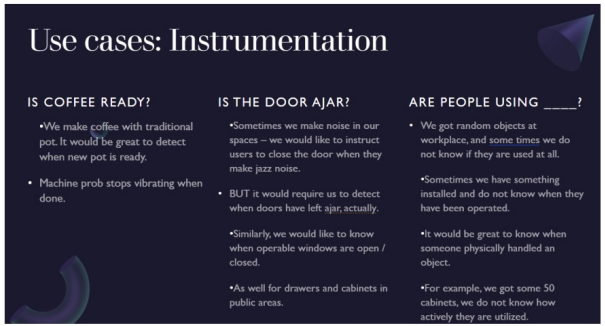
Your task

We want to know what is happening in offices and public places

Make us a sensor that is

- Battery operated and/or energy harvesting
- Sends events through Bluetooth adverts (we have light spec for this)
- Compact (approx. size of match box)
- Actual sensor palette (gyro, accelometer .....– use what you like depending on your application.
- May have a display, speaker etc. as an extra

Some **non-limiting examples of the sensor use cases**:



SAAB

Ville Hirvonen

Quang Ngo

Venla Tiainen

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TAs: Pekka & Emil

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SAAB

Protopaja challenge

In our project students will design a system for alerting of overhead unmanned aerial vehicles (UAV).

By employing commercial building blocks, the system should be able to:

1) Detect drone flying overhead
2) Trigger an alarm mode (ie. notification to mobile)
3) Be as portable as possible

Savox

Iiro Karppanen

Henrik Toikka

Hanno Lehtiniemi

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TA: Emil & Pekka

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Protocamp summer 2023

Wearable thermal camera

You will explore the concept of a wearable thermal camera, which can be used for a variety of applications such as security monitoring, search and rescue operations, and environmental monitoring.

This prototype will have a resolution that is enough to show a human clearly in the video feed. Prototype will also include additional normal camera with a wide field of view to capture extra visual information. We propose that the prototype may also have gesture recognition, allowing the user to control the camera with hand gestures if required.

Additionally, prototype could provide warnings based on the thermal camera video feed to alert the user of any potential issues. To make the device more versatile, we will aim to include video streaming to a network.

The wearable thermal camera prototype could be a wireless device with battery power or a wired device with external powering.

Contact: Veli-Matti Anttila <veli-matti.anttila(a)savox.com>
Head of Center of Excellence
Savox Communications Oy Ab

Project Agreement

Agreement signing is required

- **Enables you to publish and use the results openly**
- **Explicates and limits your responsibility**

Responsibilities (students)

The Students shall perform their work carefully. The Students shall not copy any third party's work when producing materials in connection with the Project in any manner, which infringes copyright. Students may neither consciously include any other third party's material, which is protected by other intellectual property rights, in the Result.

The Students must complete the Project within the Schedule. A student who decides not to complete the course or the Project is obliged to inform the Partner and Aalto immediately.

Students participating in the course will publish the results of the course in open source either via the MIT license that will be applied to program code, or the Creative Commons license, model CC BY 4.0 that will be applied to other results.

Learning goals

Learning goals

- Planning and execution of an industrial project
- Apply knowledge of your own domain to practical problems
- Combine technical skills with practical project skills, such as teamwork, meeting practices, and documentation.

Lectures

Lectures (required sessions are underlined)

Thu 1.6. 10-13	Intro / Teaming up (AS2) / Lab Tour (safety) – Emil
Fri 2.6. 10-13	Project planning / Agreement signing (AS2) – Salu
Wed 7.6. 10-13	Resources (what is available and where to order) - Emil, Microcontrollers – Emil, Git / Gitlab – Shahram
Thu 8.6. 10-13	Software architecture C vs. JavaScript - Emil, power optimization – Emil
Fri 9.6. 10-13	Project planning II – planning session – Salu
Mon 12.6. 10-13	Sensors, and buses (UART, I2C, SPI, RS485) – Aleksi
Tue 13.6. 10-13	Modelling, 3D printing and laser cutting – Pekka
Wed 14.6. 10-13	Basics of KiCAD, electronics, and circuit design – Aleksi & Shahram (pajalla)
Thu 15.6. 10-13	Circuit manufacturing, soldering, measurement – Shahram (pajoilla)
Fri 16.6. 10-13	(Wireless) data transfer and security – Emil

Project Course

Project Phases

Teaming Up – Today

Contacting the company – Today/Tomorrow

Project planning – Tomorrow -> 9.6. -> 21.6

Building and testing (+documenting)

Presenting

Documenting

Deliverables

1. Prototype
2. Presentation
3. Poster
4. Documentation (Wiki)

Teamwork

Weekly meetings with your Team’s assistant (required)

Meetings documented on a wiki page

Deadlines

Thu 25.5. Projects announced

Wed 8.6. Project plan draft (will be edited on the 9th)

Wed 21.6. Project plans

Wed 26.7. Mid-project report

Fri 25.8. Final Presentations (incl. poster, prototype demo)

Thu 31.8. Final Report (online + codes + models + licences)

Resources

Resources

Sähköpaja (electronics workshop)

- Coding, modelling, 3D printing, laser cutting, PCB carving

Piiripaja (circuit shop)

- Etching, soldering, testing

Design Factory

- Metal processing, wood working, painting, bigger structures

Purchases

We shall use the following shops to make purchases:

- **Farnell, Mouser, DigiKey, TME**
- **Claes Ohlson, Exptech, Amazon.de, and many others**
- **Ebay, Aliexpress, Banggood, etc. may need weeks to deliver**

Manufactured PCBs:

- **Aisler (Germany)**

Handling the orders:

- **Shahram Barai (firstname.lastname@aalto.fi)**
  - Purchases bundled on Friday mornings
  - Personal purchases are not re-funded

Project budget

Up to 1200 € + VAT for the components

Sähköpaja – how to find

Join the tour after the lecture!

Sähköpaja – when/how to access

Always open – but the building is not..

Storage room open only when assistants available

Circuit shop – you can have personal access when you know that to do properly

Weekly schedules

- **Lectures 10-13 on given days**
- **Team meetings with assistant, 1 meeting/week**
  - Documentation to the wiki
  - Salu will open your wiki pages today
    - log in to create your access account into the wiki system, if you have not used aalto wiki account before

Grading

0-5 / 5 **Active participation, active learning attitude, delivering the required results in time = 5**

10 ECTS = 270h

This is a significant amount of work!
-> Avoid other major obligations during the summer

Contacting the company

Sketch an e-mail

Dear …,

…

Kind regards,

NN, NN, ..

Team x / Protopaja

Tervehdys …,

…

Terveisin,

NN, NN, …

Team x / Protopaja