



Introduction

Hardware 2 Course

The Project

School of ICT

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Hardware 2 (15 ECTS) - Outcomes

Students are able to apply learned skills to **measure physiological signals**. Students learn the basics of electronics. On completion of the course students are able to **use cloud services for data collection**.

Students learn basic concepts of mathematical and natural science as the foundation of engineering education. Students learn to use tools and applications to evaluate mathematical and natural science problems. They understand the connection of these concepts to ICT and are **apply learned methods for practical problems**.

Students learn to work as **active members of a project group** and understand the principles of **oral and written communication**. They are able to **communicate effectively** to support and improve their professional competence. Students are also able to **write a formal project report in English** as well as give a **presentation in a professional manner**.

Hardware 2 (15 ECTS) - Contents

Developing an embedded application for measuring physiological signals

Basics of electronics

Basics of IoT systems

Functions and their differentials

Basics of magnetism

Project communication and documentation in English

Orientation to the professional field and studies

Objectives – The hardware project

After completion of the project the student

Knows how to

- program microcontroller with MicroPython
- establish a wireless link between microcontroller and server

Is familiar with

- sensors and other accessories in connection with microcontroller
- how to read and interpret specifications for hardware devices
- microcontroller prototyping in health technology application field

Understands how to

- write an algorithm to detect heart rate and its variability

Schedule and contents

Week	Content
1	Introduction, Tools, Pins and LEDs
2	Buttons, Basics of OLED
3	ADC, Timers, Pulse Detection
4	Rotary encoder, Dynamic updates in OLED Return of the 1st draft of the report
5	Wireless connection, HRV analysis, MicroPython installation package (MIP)
6	RESTful API, KubiosCloud Return of the 2nd draft of the report
7	Development and testing
8	Project demos Return of the final version of the report

Assignments

Programming exercises

Weekly learning reports

Project documentation

Team peer evaluation

Programming exercises

- ☐ Personal assignments
- ☐ Total six (6) assignments related to the weekly contents
 - Tools, Blink a LED, Buttons, ...
- ☐ Show working demo in class room
- ☐ Return code to OMA
- ☐ Evaluated in scale
 - Approved / Redo / Failed

Weekly learning reports

- ☐ Personal assignments
- ☐ Total eight (8) short weekly learning summaries, including
 - Tools and concepts learned
 - Personal experimentation of new ideas
 - Questions and concerns about week's topics and/or the course part
 - Estimation of working hours
- ☐ Returned to OMA
 - A simple text (without attachments) is sufficient
- ☐ Evaluated in scale
 - Approved / Redo / Failed

Project documentation

- ☐ Group assignments
- ☐ Two (2) draft revisions and one (1) final version
- ☐ Returned to OMA
 - A link to Teams, where the master documents can be found
- ☐ Draft revisions evaluated in scale
 - ☐ Approved / Redo / Failed
- ☐ Final version evaluated in scale
 - (5) Excellent, (4) Very good, (3) Good, (2) Very sufficient, (1) Sufficient, (0) Failed

Teamwork evaluation

- ☐ Personal assignment
- ☐ Once at the end of the project
- ☐ Link to Google Sheet
- ☐ Signed in OMA: Done
- ☐ Evaluated in scale
 - Approved / Redo / Failed

Assessment and grading

Grade	Requirements
1 (Satisfactory)	Programming exercises: The first three (3) weeks: Approved Learning reports: First three (3) weeks: Approved Project: <ul style="list-style-type: none">• Heart rate (BPM) displayed on OLED• Project documentation in Satisfactory level Team peer evaluation: Approved
3 (Good)	Programming exercises: The first five (5) weeks: Approved Learning reports: First five (5) weeks: Approved Project: <ul style="list-style-type: none">• Basic HRV analysis included• Project documentation in Good level Team peer evaluation: Approved
5 (Excellent)	Programming exercises: All approved Learning reports: All approved Project: <ul style="list-style-type: none">• Full system with Wireless connection• Uses KubiosCloud HRV analysis• Displays recovery (PNS) and stress (SNS) indexes on OLED• Project documentation in Excellent level Team peer evaluation: Approved

Materials

Lecture notes, Assignments, documents, templates, and links to other material can be found in OMA

Hardware Project Protokit (Laitepaketti):

- Loanable from Metropolia's Karaportti Library
- [Laitepaketti | MetCat Finna](#)



THANKS!

QUESTIONS?