

Practice Enterprise 2 (PE2)

tips and guidelines

Agenda for today

- Purpose of PE2
- Requirements
- Evaluation
- Composition of the teams
- Brainstorm about the project topic

Purpose of PE2

- Practice Enterprise is a multidisciplinary project assignment
Integration of knowledge and skills from different subjects and searching, finding, applying, lifelong learning, ...
- "Soft skills" collaborate / communicate / present
 - Progress reporting / report and presentation, ...
- Projectmanagement: planning !!!
- "Learning trajectory" PE1 → PE2 → Bachelor jury exam
 - Degree of finish and/or complexity ↗↗↗
 - Proof of concept → Prototype → Near product
 - Preparing for Bachelor jury exam / Job



PE2 requirements

- Minimum
 - PCB design
 - Software development
 - Preferably C on a μ Controller
 - The project does something useful.
- Important
 - Safety
 - Cost
- Preferably not based on:
 - Arduino
 - RPI
 - (Arduino) ESP32, ...









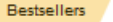





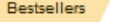










} Little learning value
- Maximum freedom of choice!
- But your subject needs to be approved.

Tip 1:



Keep in mind delivery times of PCB and Components.

Try (if possible) to order key components during the first semester.

Artikelnr. fabrikant	Ordercode	Beschrijving / Fabrikant	Beschikbaarheid
STM32F733ZEI6 	2758801  Data Sheet 	ARM MCU, STM32 Family STM32F7 Series Microcontrollers, ARM Cortex-M7, 32bit, 216 MHz, 512 KB STMICROELECTRONICS	 Niet langer op voorraad
STM32F723ZC16 	2758795  Data Sheet   Date/Lot Code	ARM MCU, STM32 Family STM32F7 Series Microcontrollers, ARM Cortex-M7, 32bit, 216 MHz, 256 KB STMICROELECTRONICS 	 Beschikbaar voor nabestelling. We hebben meer op voorraad in de week vanaf 17/10/22
STM32F730R8T6 	2980932  Data Sheet   Date/Lot Code	ARM MCU, STM32 Family STM32F7 Series Microcontrollers, ARM Cortex-M7, 32bit, 216 MHz, 64 KB STMICROELECTRONICS 	 Beschikbaar voor nabestelling. Wachten op levering door 22/04/22
STM32F765IGK6 	3365385  Data Sheet   Date/Lot Code	ARM MCU, STM32 Family STM32F7 Series Microcontrollers, ARM Cortex-M7F, 32bit, 216 MHz, 1 MB STMICROELECTRONICS	 Beschikbaar voor nabestelling. Wachten op levering door 22/04/22
STM32F722RET7 	3365373  Data Sheet 	ARM MCU, STM32 Family STM32F7 Series Microcontrollers, ARM Cortex-M7F, 32bit, 216 MHz, 512 KB STMICROELECTRONICS	 Niet langer op voorraad

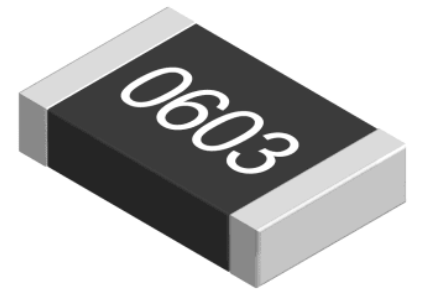
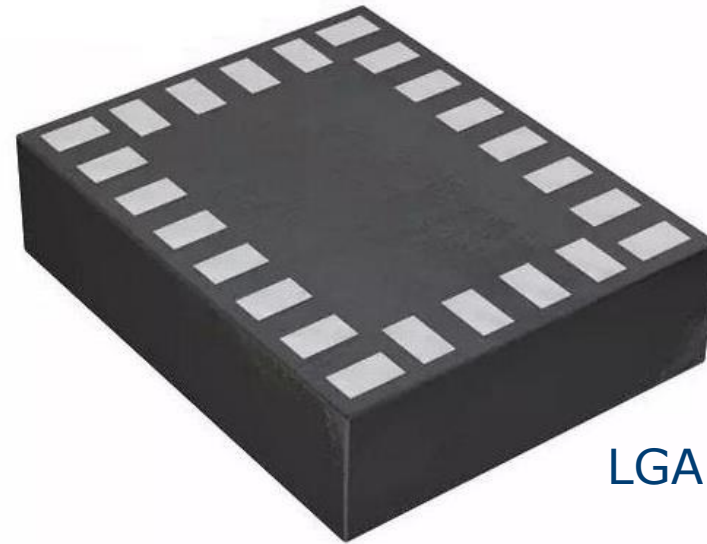
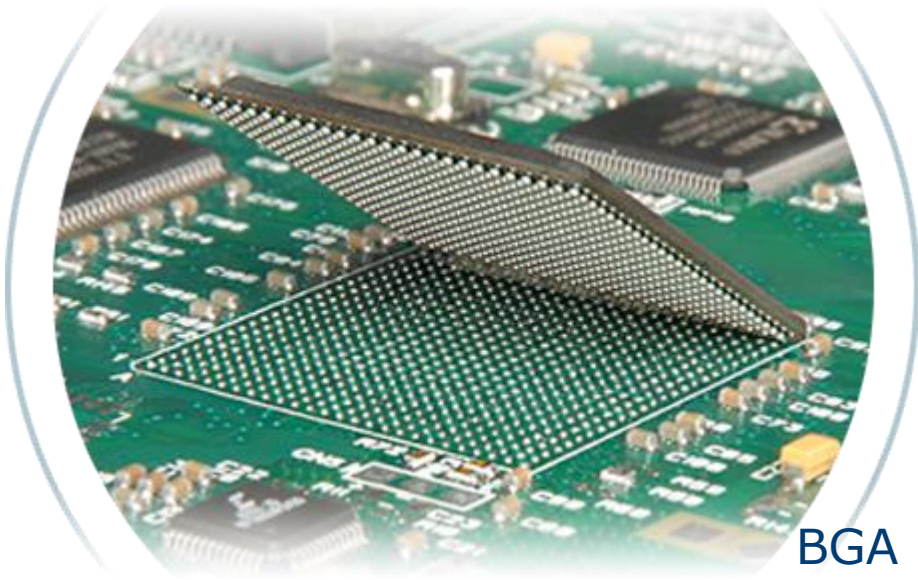
Tip 2:

- Bear in mind additional costs for online orders :
 - Import costs
 - Transport costs
 - VAT (some sites show prices ex. VAT)
 - VAT = BTW in Belgium



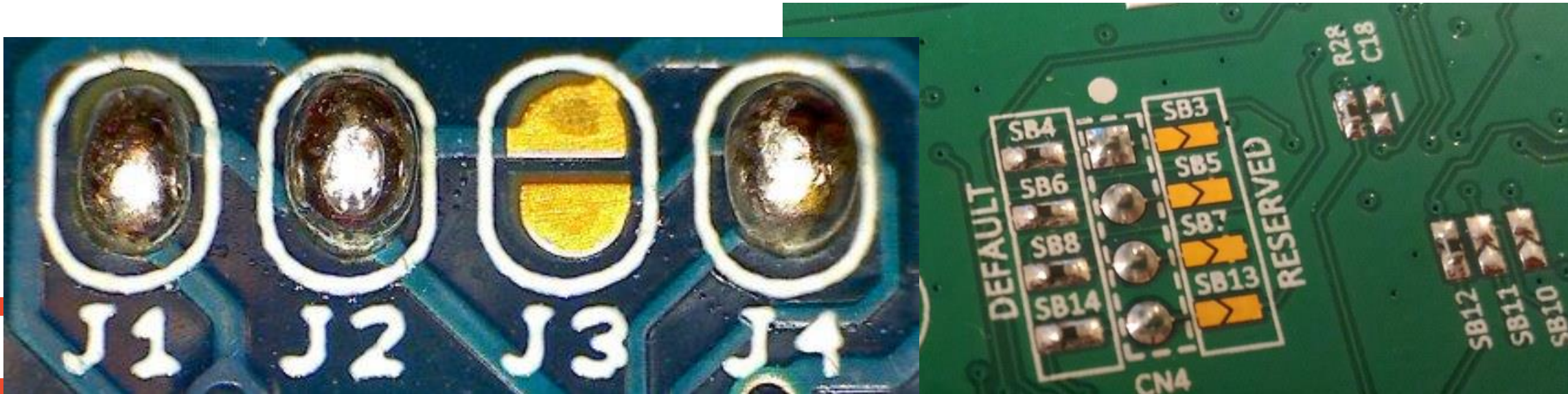
Tip 3:

- Don't be afraid of SMD (hand) soldering.
 - But do look at what is possible. BGA/LGA is a bit more difficult.
 - We are standardized on 0603 imperial for decoupling capacitors and resistors.



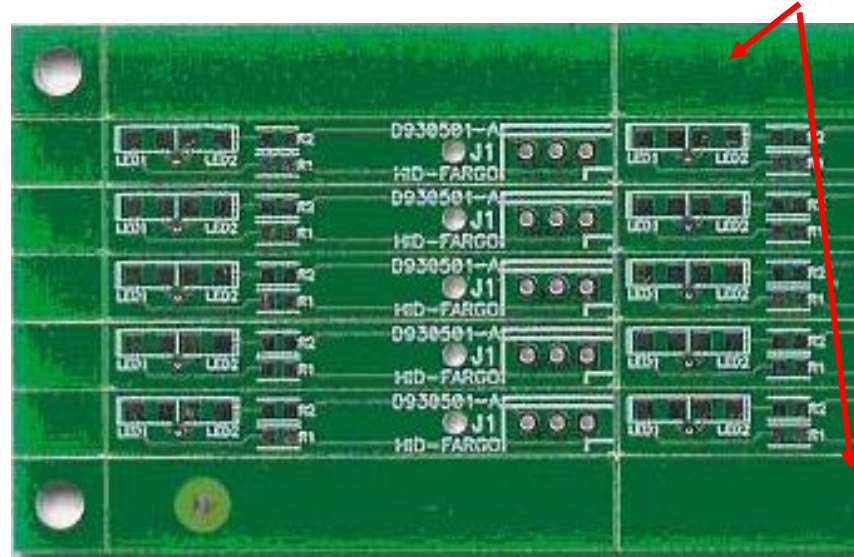
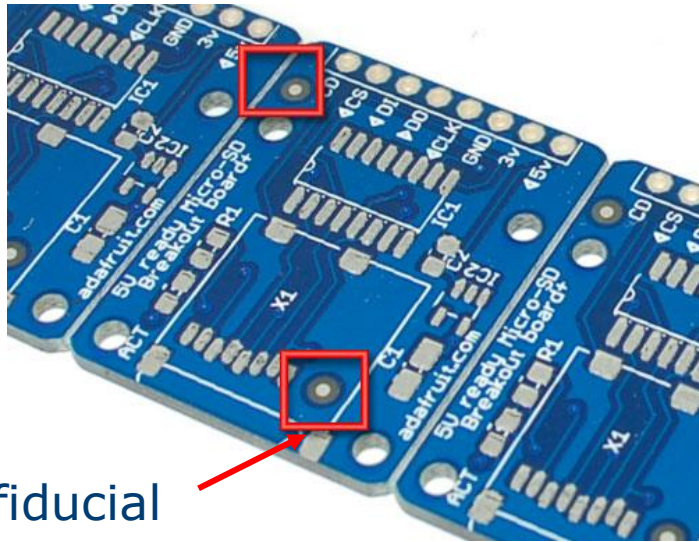
Tip 4:

- Manual assembly :
 - Don't solder everything on the PCB and then power it up.
 - Instead, assemble selectively and then test it with a power supply that has a configurable current limit.
 - If not possible to assemble selectively: provide a solder bridge jumper in line with the power supply.



Tip 5:

- If you want to assemble with our pick-and-place machine.
 - Come and have a chat. Before drawing the PCB!
 - Only if necessary (e.g. many components)
 - On your PCB, provide 3 fiducials and a 10 mm break edge (at the top and bottom)
 - Supply your components on rolls



Tip 6:

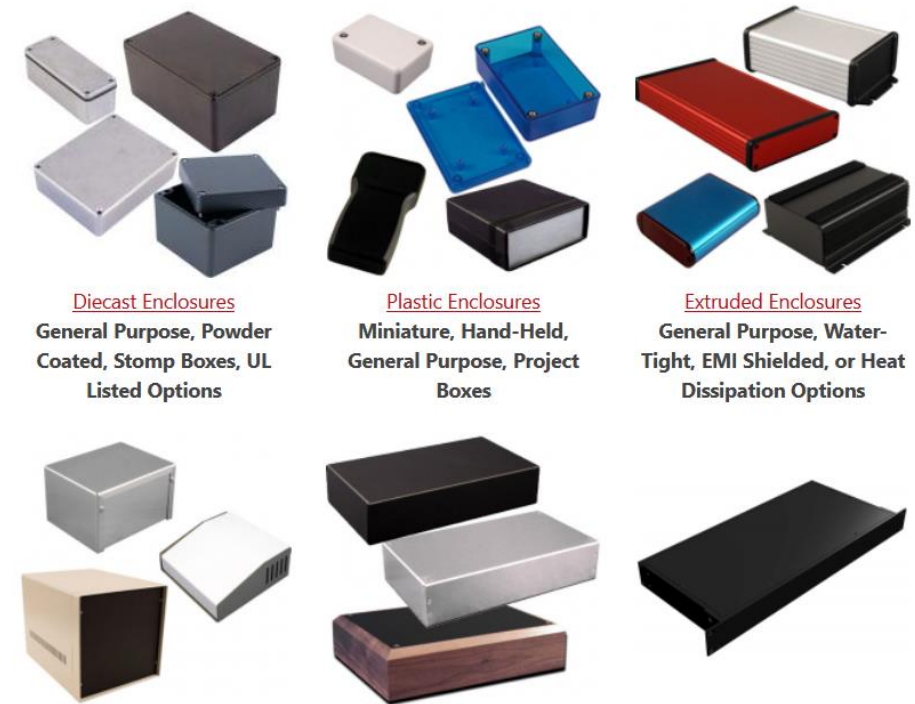
- Consider your enclosure before you start drawing your PCB.

Buy existing enclosures:

- <https://www.hammfg.com/>
- <https://www.fischerelektronik.de/en/>
- <https://www.camdenboss.com/>
- <https://www.polycase.com/>
- <https://www.newageenclosures.com/>
- <https://www.takachi-enclosure.com/>
- <https://www.budind.com/>

- Consider how you will attach your PCB.
(mounting holes, click system, glue...)

Small Enclosures



Tip 7:

- Usually, it is a good idea to develop code on PC or evaluation platform while “waiting for” or “creating the” PCB.
(even if you are working alone)
- Also provide a debug UART on your PCB.
- Make sure you can debug your code (breakpoints, view variables, ...) See what programmer's dongle you need and how to connect it:
Pickit 3 (Microchip), MKII (AVR), **STLINK-V3MINIE**(STM32)



STLINK-V3MINIE(STM32)

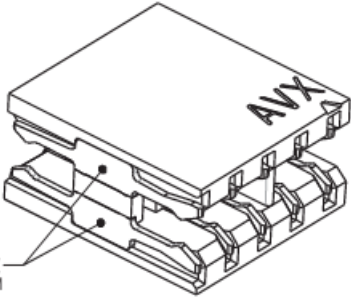
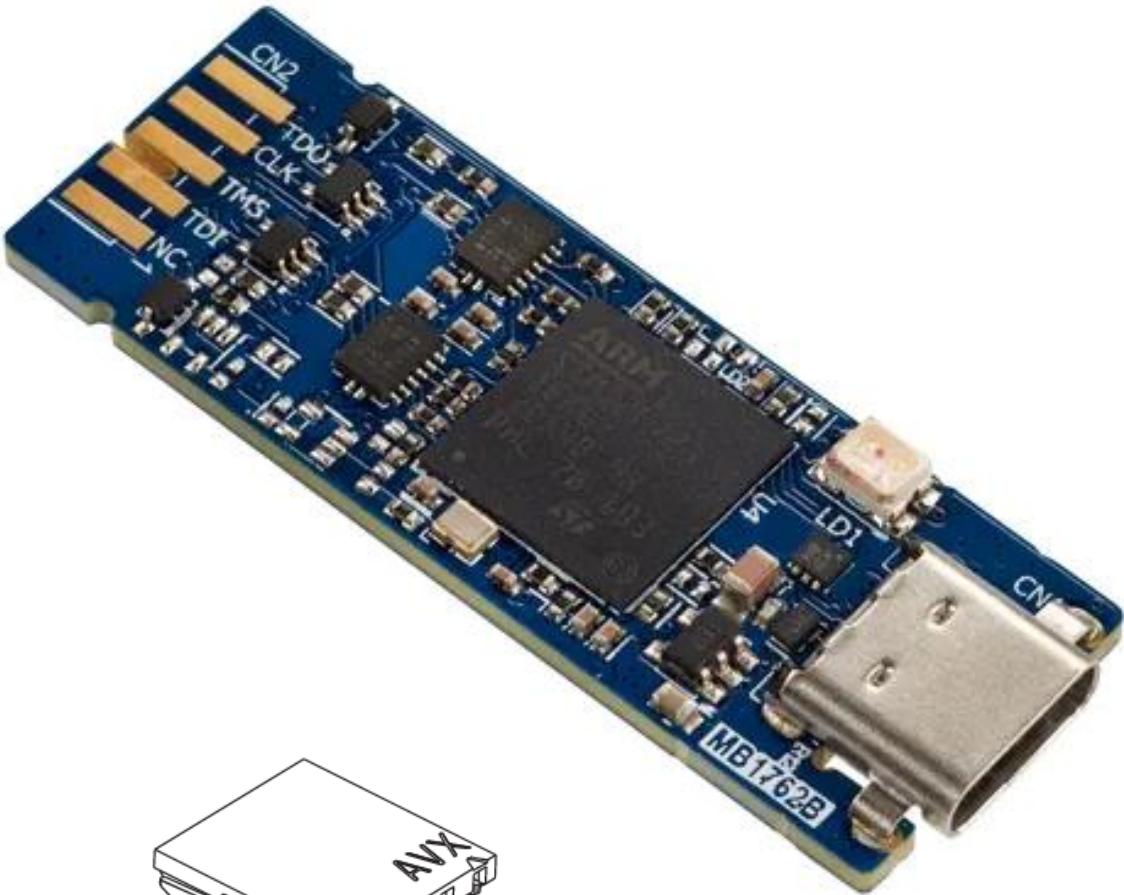
Pads on board to CN2 BTB card edge connector

The pads on the board have the same function as the STDC14 connector. The user can select a BTB card edge connector to connect STLINK-V3MINIE and the target board. The board-to-board card edge connector reference is 009159010061911 from AVX.

Table 3. Pads on board to CN2 BTB card edge connector

Side	Pin number	Pin description	Type
TOP	1	Reserved ⁽¹⁾	-
	2	T_JTDI/NC ⁽²⁾	O
	3	T_JTMS/T_SWDIO	I/O
	4	T_JCLK/T_SWCLK	O
	5	T_JTDO/T_SWO ⁽³⁾	I
BOTTOM	6	GND	S
	7	T_VCP_RX	O
	8	T_VCP_TX	I
	9	T_NRST	O
	10	T_VCC	I

- 1. Do not connect on target.
- 2. NC means not required for SWD (Serial Wire Debug) connection.
- 3. SWO (Serial Wire Output) is optional, and only required for SWV (Serial Wire Viewer) trace.



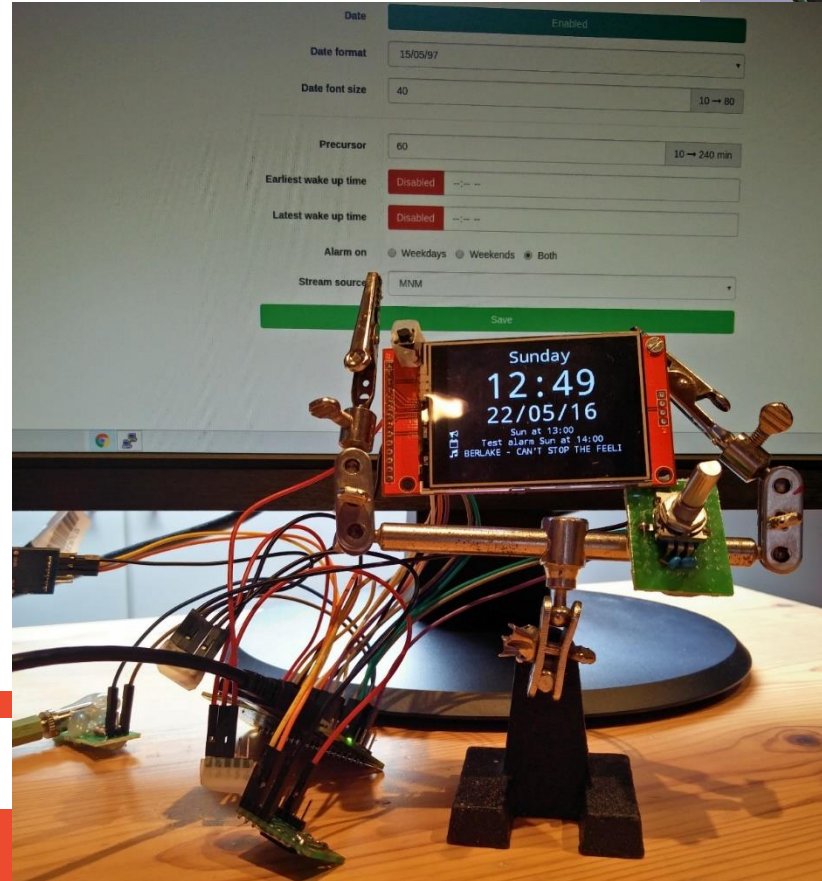
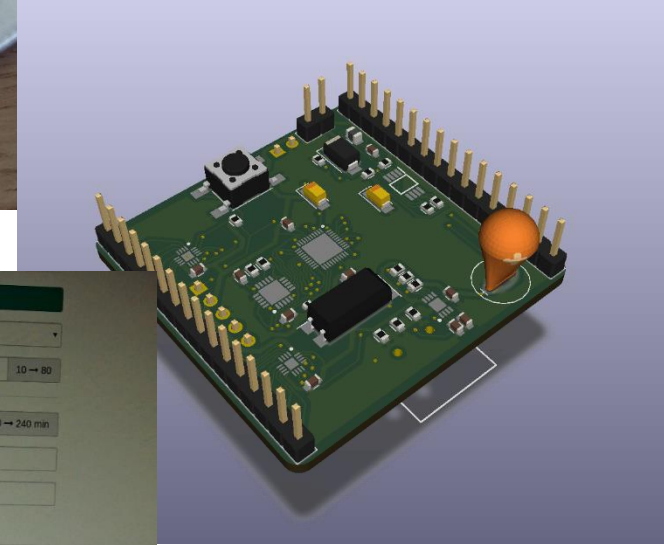
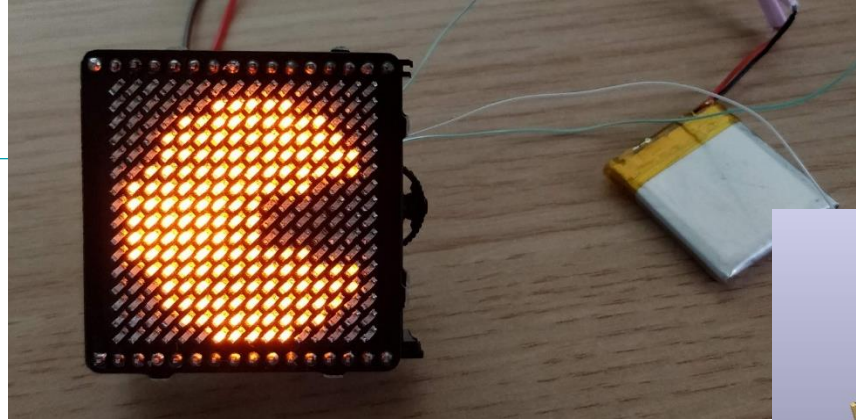
Tip 7:

- Makerspace on campus
 - 3D printen
 - Laser Cutting
 - CNC
 - Handtools
- Useful for the enclosure or mechanics



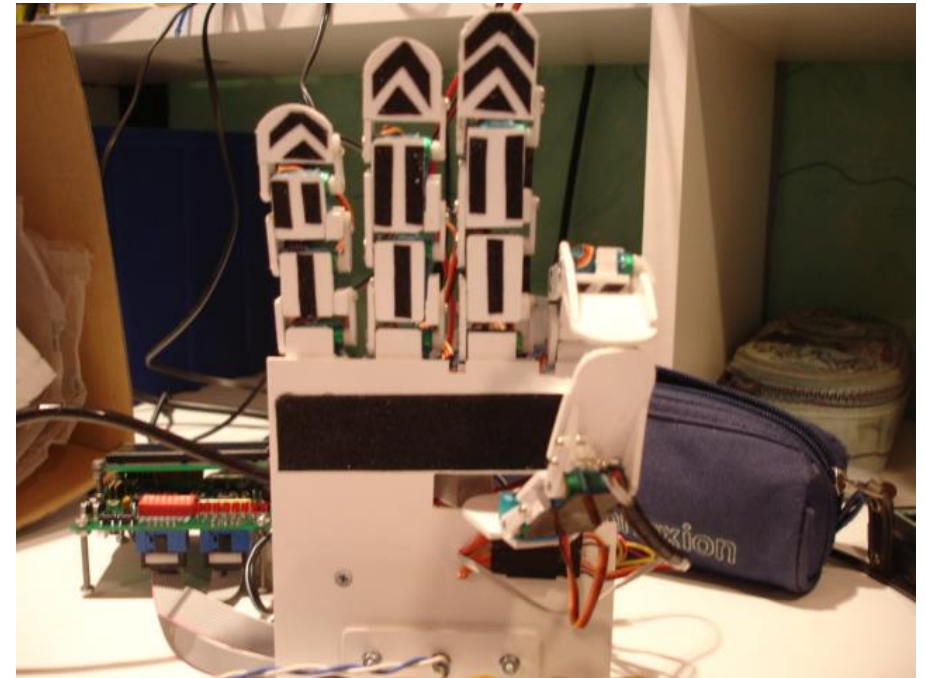
Examples

- DMX ledbar (2020) movie
- UniTune (2019) movie
- Led watch (2018) photo
- RobuCup (2017) movie
- SmartAlarmClock (2016) photo



Choosing your project

- Best done based on:
 - Interests (subject)
 - (Still to acquire/improving) Knowledge
 - Future job (Helps with your job interview)



Evaluation

- Practice Enterprise (theory) 30%
 - Project Proposal (including completeness of specification and requirements)
 - How you used GIT
 - Presentation
- Practice Enterprise (lab) 70%
 - Proper operation according to specification and requirements
 - Documentation
 - Demonstration (final presentation)
 - Oral Defence

Teams

- Groups per 2
- Alone is possible but only if you have a good reason
- Good communication = important
- Task allocation = important



What is expected (in total)

- Working project (preferably up to and including housing)
- Project proposal / Plan of action (deadline)
- Logbook (calculations, sketches, measurements, problems, ...)
 - GIT -> markdown file in doc folder
 - Time accounting (who, hours, item, ...)
- Final report (PDF)
- Project documentation on Github
- Pictures and a demo movie (youtube link)
- Presentation, demo and defence in front of a jury
- Demo during at least one open doors day/infoday

What is expected by Deadline

- Project proposal / Plan of action
 - Team members (Names)
 - Title
 - Brief description
 - Block diagram
 - In detail description of the blocks
 - Component / tool choice
 - Results of market research
 - What already exists?
 - Results of technology exploration
 - Budget estimate

Lots of work !

Discuss it with your teacher up front!

Use drawings, sketches, wire frames where necessary

Submit via Canvas

What is expected by first Lab class (2nd semester)

- Ordered components have arrived
- Planning (preferably in the form of Gantt-chart)

Think of: number of weeks, vacations, delivery time PCB, open day

- Idea what you are going to do in the first lesson.

Preferably not:

- Which components are we going to use?
- Look up ...

} Should already have happened

But do:

- Component testing / concept testing
- Code writing
- ...

Only for 2023-2024: STM32F301C8T6TR

- You can get a microcontroller for free from the school (only for a.y. 2023-2024): STM32F301C8T6TR (3 pieces)

Core: Arm® 32-bit Cortex®-M4 CPU with FPU (72 MHz max.), single-cycle multiplication and HW division, DSP instruction

Memories

- 32 to 64 Kbytes of Flash memory
- 16 Kbytes of SRAM on data bus

CRC calculation unit

Reset and power management

- V_{DD} , V_{DDA} voltage range: 2.0 to 3.6 V
- Power-on/Power down reset (POR/PDR)
- Programmable voltage detector (PVD)
- Low-power: Sleep, Stop, and Standby
- V_{BAT} supply for RTC and backup registers

Clock management

- 4 to 32 MHz crystal oscillator
- 32 kHz oscillator for RTC with calibration
- Internal 8 MHz RC with x 16 PLL option
- Internal 40 kHz oscillator

Up to 51 fast I/O ports, all mappable on external interrupt vectors, several 5 V-tolerant

Interconnect matrix

7-channel DMA controller supporting timers, ADCs, SPIs, I²Cs, USARTs and DAC

1 × ADC 0.20 μ s (up to 15 channels) with selectable resolution of 12/10/8/6 bits, 0 to 3.6 V conversion range, single ended/differential mode, separate analog supply from 2.0 to 3.6 V

Temperature sensor

1 x 12-bit DAC channel with analog supply from 2.4 to 3.6 V

Three fast rail-to-rail analog comparators with analog supply from 2.0 to 3.6 V

1 x operational amplifier that can be used in PGA mode, all terminal accessible with analog supply from 2.4 to 3.6 V

