Exercises

VITMMA09 – Smart City, MSc specialization

Bemutatkozás

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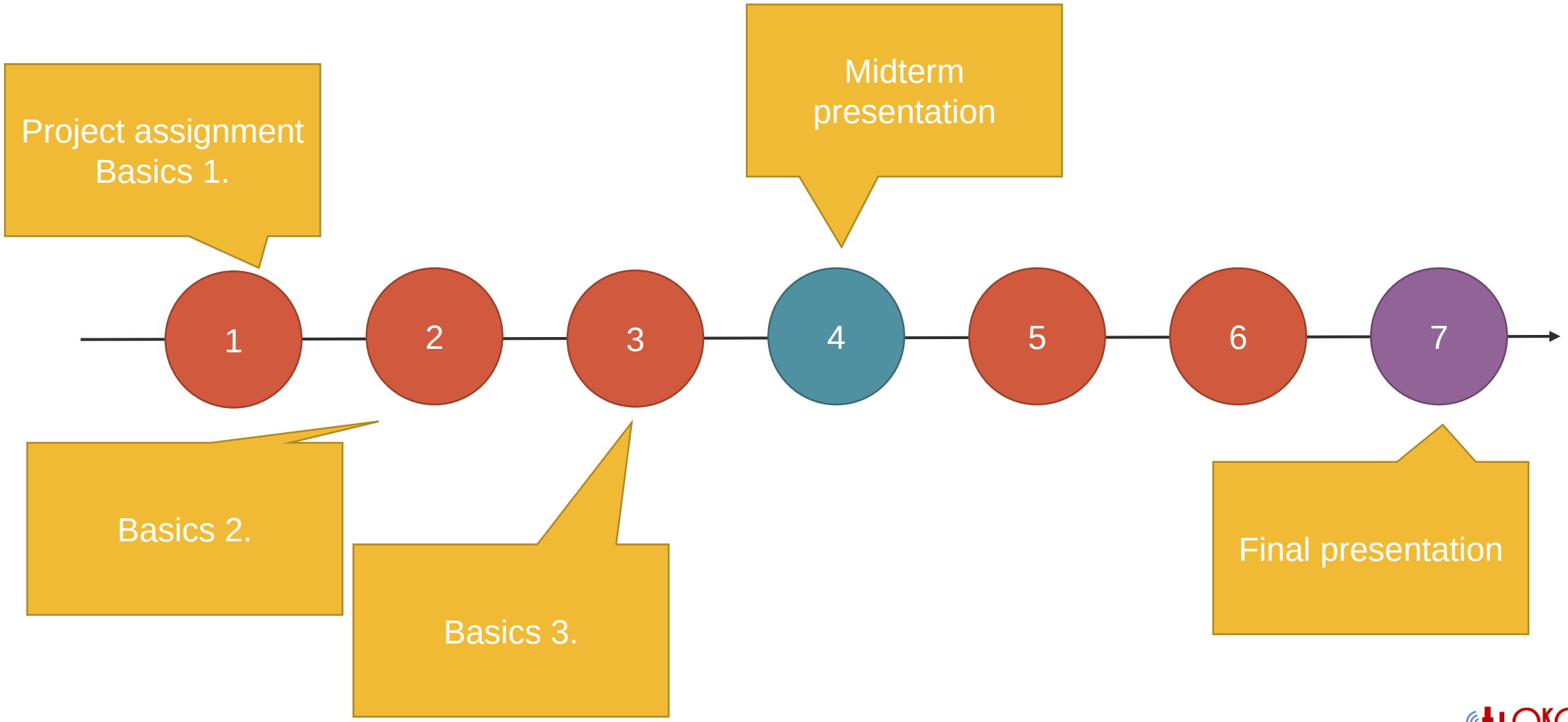
Smart City - Sensor Networks and Applications - Exercises

- Goals
  - Practice what you have learnt on the lectures. Hands on experience
  - Get to know a real sensor network
    - Plan, implement, test
  - Could be useful in real life as well

- Methodology
  - Project work, work in small groups (3/4 students)
  - Realize the project during the semester, present in the class
    - Project assignment (now!)
    - Midterm and final presentation
  - Workshop like exercises

- Exercise schedule
  - **Monday on all even weeks**
  - Required to show up at least 70% of the exercises (we have a catalog)

Project assignment, presentation



Project work and presentations

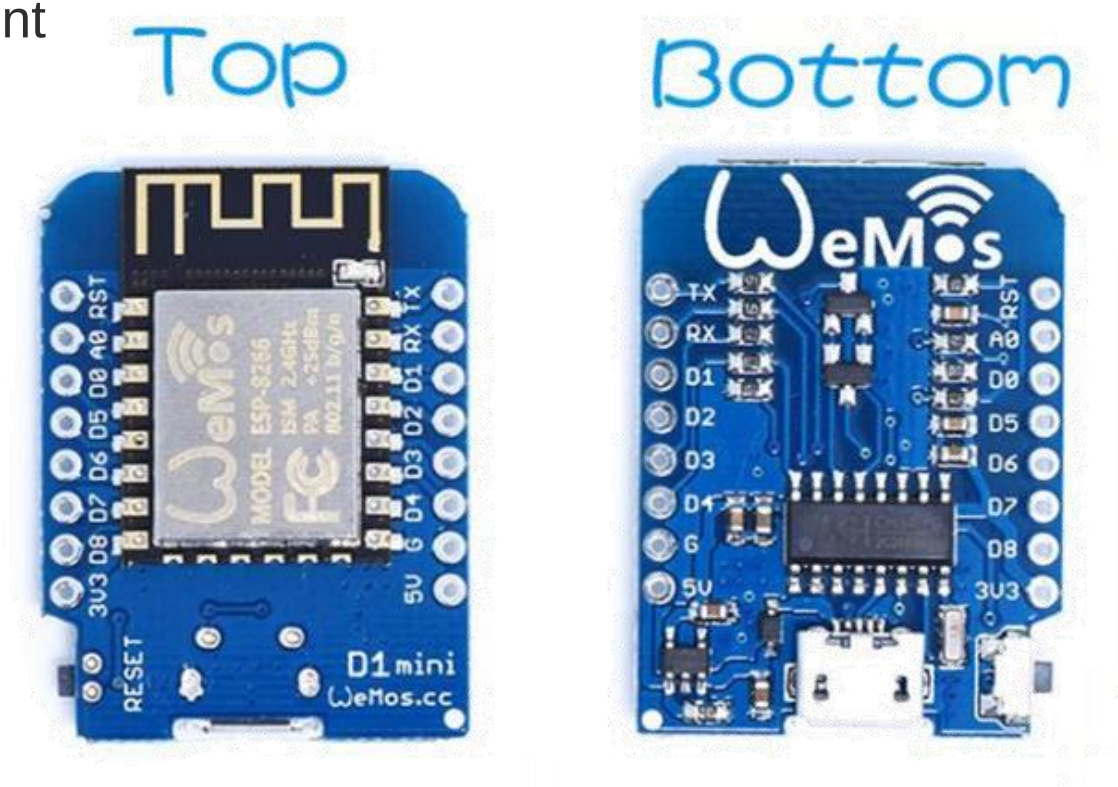
- Smart City laboratory, IE.326b
  - „Working zone” for work and presentations
  - Could be built up at home as well
- Consultations
  - Should be arranged in email
  - Forum for the students?
- Tutorials on the Internet as well
- Presentations
  - Midterm presentation
    - Idea, plan should be ready
    - All modules are available
    - Presentation with a video
      - “Trailer for the application”
    - 5 minutes discussions
  - Final presentation
    - Presentation with a video
      - More like a marketing movie
      - Presented on YouTube
    - 5 minutes discussions
  - Voting

Project environment

- Same sensor and communication for all projects
  - Make connections between the projects, help each other

- HW/SW elements provided by the department
  - Mote
    - Microcontroller + communication
  - Sensor/Actuator

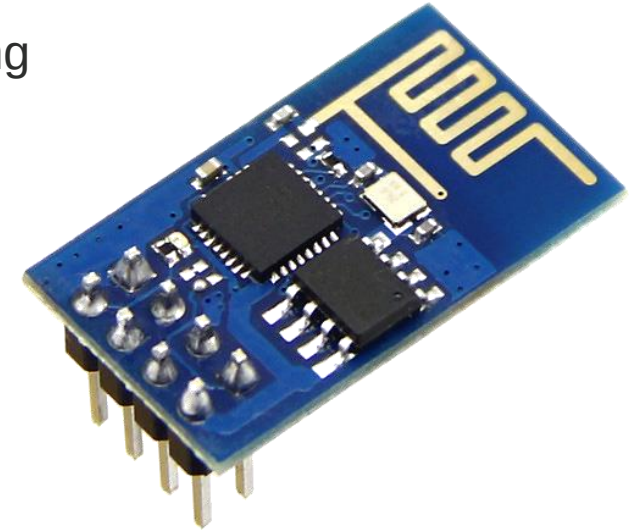
  - ~~Gateway~~
    - ~~Connection to the Internet~~
  - ~~Application~~
    - ~~Backend (Server side / cloud)~~
    - ~~Frontend (web / app)~~



- You will get the thing on the second exercise

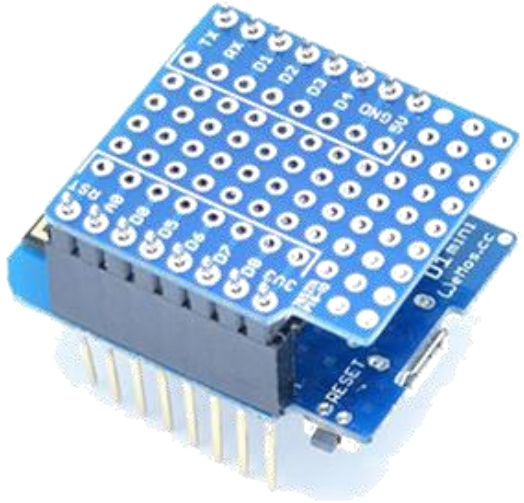
HW/SW components 1.

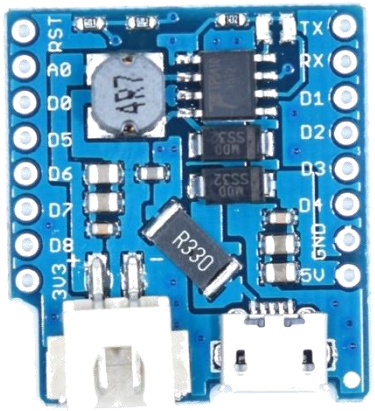
- Wemos D1 mini
  - ESP8266 based WiFi
    - 32 bit architecture
      - Tensilica L106
    - 80 (160) MHZ CPU
    - 4MB FLASH
    - ~ 36 KB RAM
  - Serial communication and programming
    - CH340G USB to UART
- WiFi communications
  - WiFi 802.11 b/g/n
  - STA/AP/STA+AP
  - WEP/WPA/WPA2
  - TCP/IP stack

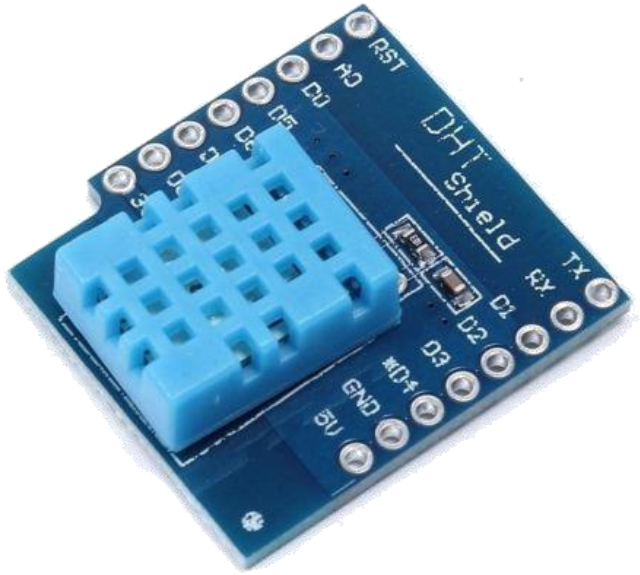


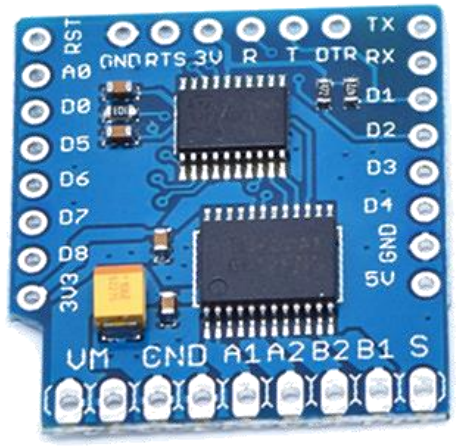
HW/SW components 2.

- Wemos D1 mini shields
  - Relay Shiled
  - Proto Board
  - Motor Shield
  - Battery Shield
  - Digital Temperature Humidity







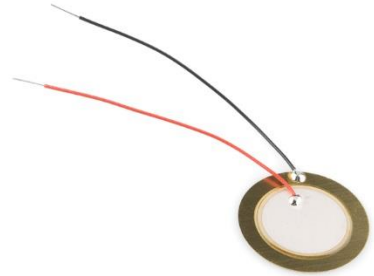


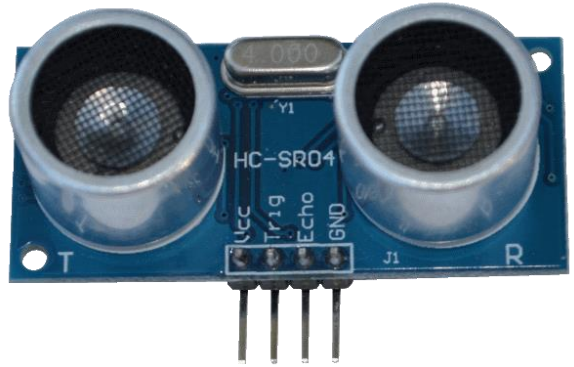
HW/SW components 3.

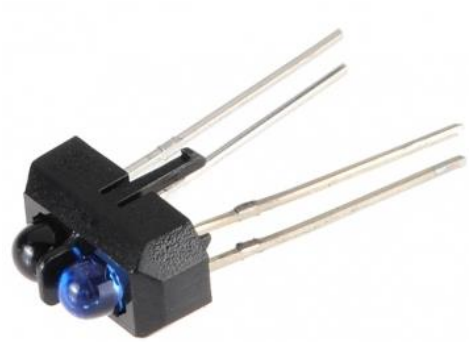
- Sensors and actuators
  - Fitting with breadboard or probe panel
  - Analog/SPI/I2C connection
    - Drivers are available on the internet

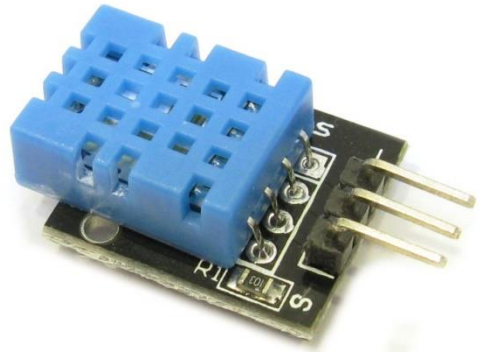
- Accelerometer
- Gyroscope
- Compass
- Barometer
- Photoresistor
- Microphone
- Temperature
- Humidity
- Distance
- Proximity
- Piezo

- Moror
- LED
- RGB LED
- Buzzer
- Heater







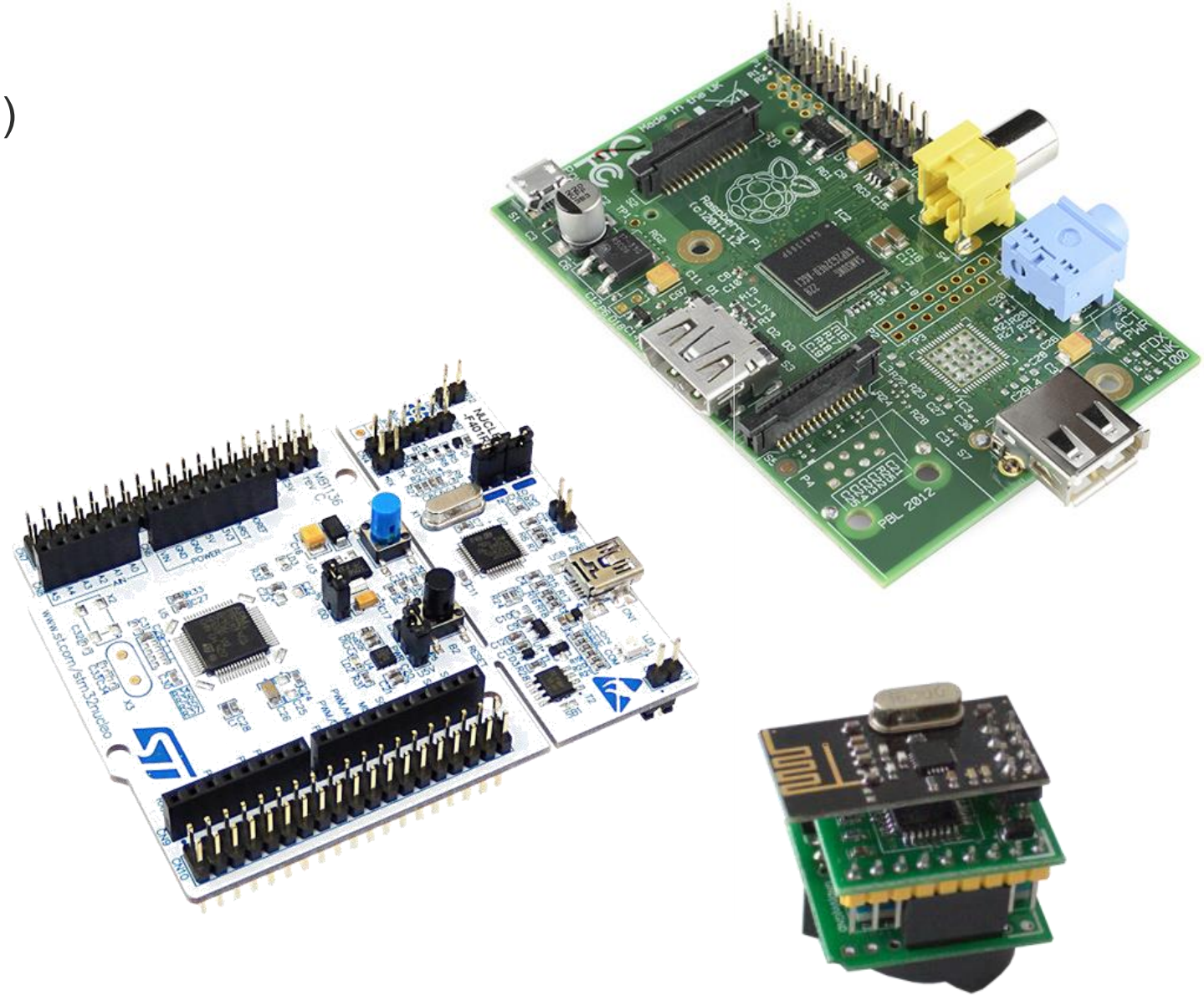


HW/SW components 4.

- Wemos D1 mini
  - LUA scripts
  - Micropython
  - C or C++
- Application side
  - Android apps
  - Cloud backend
  - Web frontend

For advanced students

- Arduino (ATMEGA328p alapú MCU)
- STM32 based microcontrollers
- Raspberry Pi 1-2-3
  - Ethernet (WiFi) connection
- nRF24L01+ radio
- Cameras and computer vision
- Support, help width
  - PCB design, manufacture
  - 3D printing
  - Assembly



Projects

Project A. – Smart City lights

- Smart lighting
  - Switching/dimming the lamps based on local measurements
  - Control lamps based on events
    - Passing people
    - Passing vehicles
    - According to needs

Project B. – Smart City parking

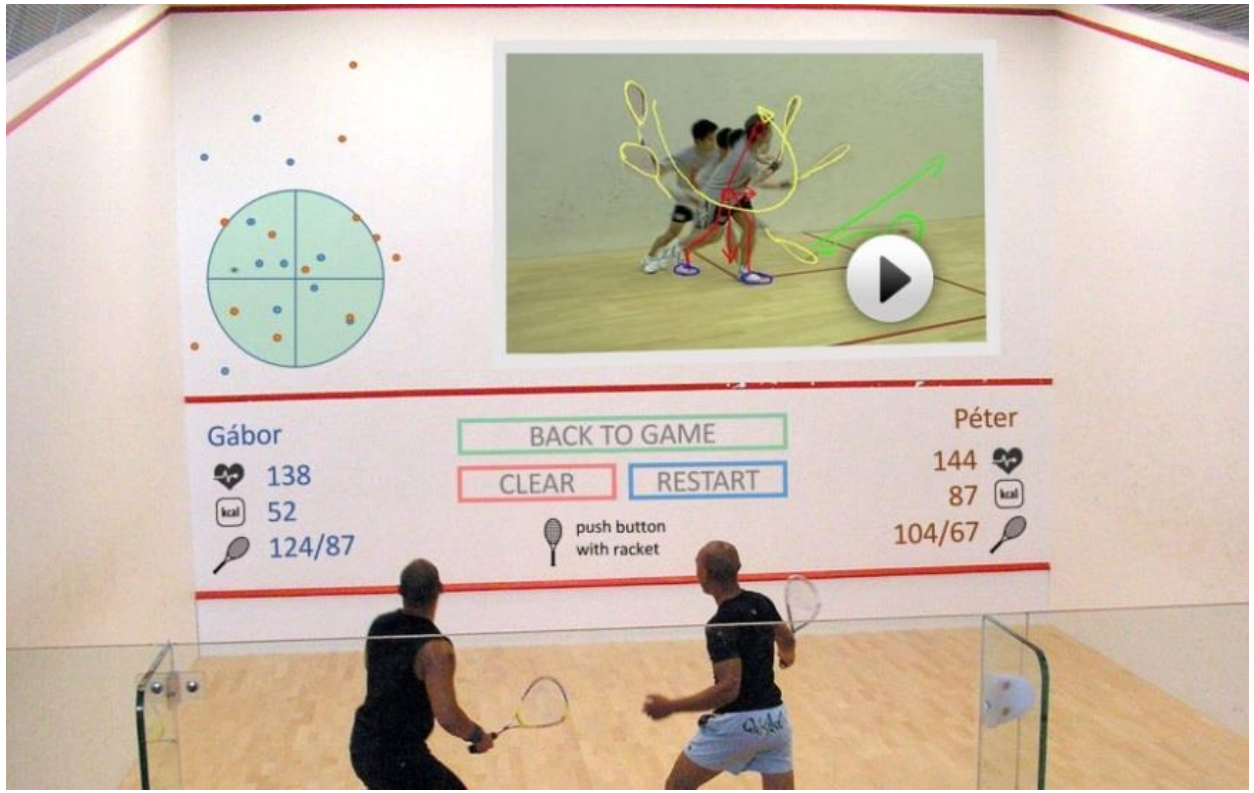
- Smart parking
  - Recognizing parking cars
  - Display free spaces, analytics
  - Navigation to empty sports
    - close areas

Projekt C. – Smart City playground

- Smart playground
  - Interaction with children
  - Analytics (usage, popularity)
  - Monitoring, repairs
  - Safety

Project D. – Smart City sport

- Smart sport
  - Support public sport and racing
  - Sport analytics
    - Performance
    - Race, tactics
  - Incentives
  - Social sharing

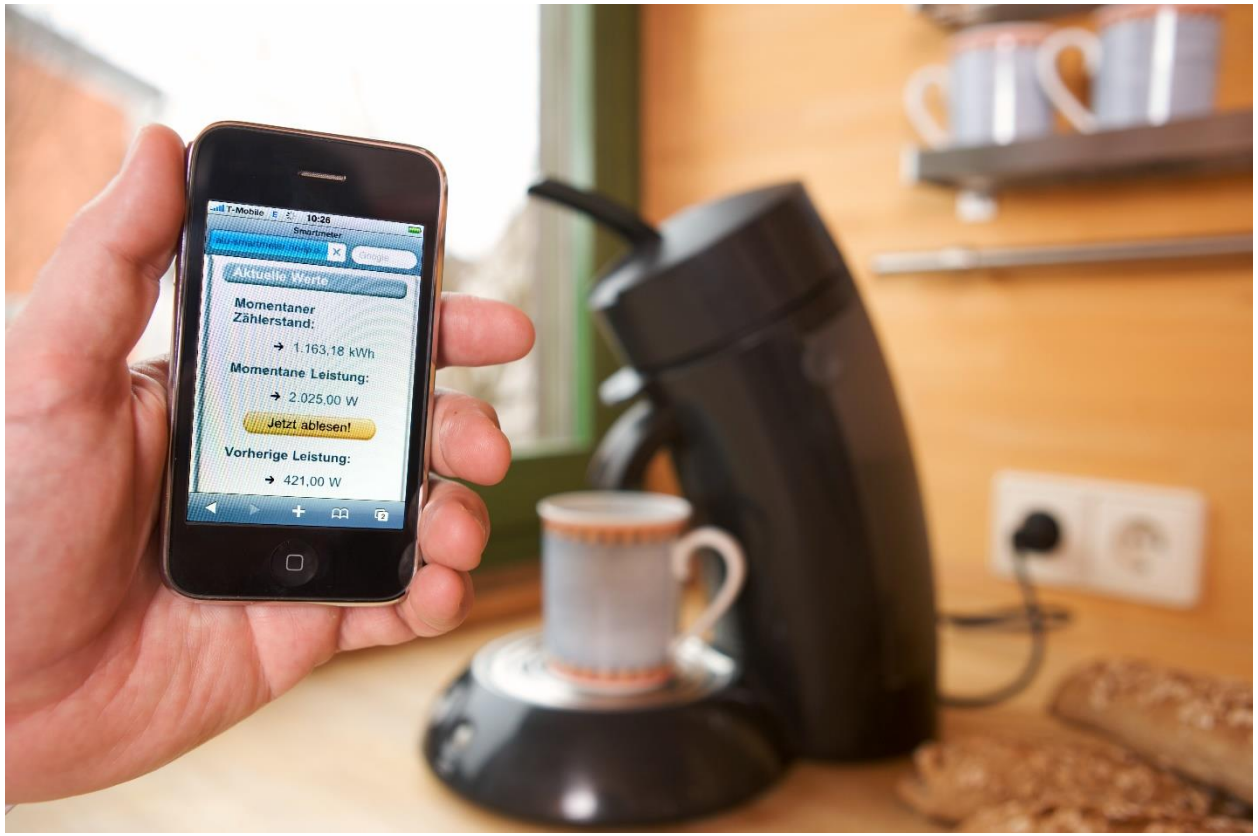


Project E. – Smart City traffic

- Smart traffic control
  - Measure vehicles passing by
  - Control traffic lights
  - Analytics
    - Traffic jams
    - Pollution

Project F. – Smart City utilities

- Smartmetering
  - Measuring consumption
    - Electricity
    - Water
    - Gas
  - Analytics
  - Incentives, social approach, gamification



Project G. – Smart City flora

- Smart parks
  - Control watering or shading
  - Analytics
    - Weather
    - Events (blooming)
    - Visitors

Project H. – Smart environment

- Smart environment measurements
  - Weather
  - Air Pollution
  - Noise, light pollution
  - Analytics
    - Combine multiple stations

Project I. – Smart City home

- Smart vacuum cleaners
  - Sensors
    - Movement
    - Proximity, distance
  - Control over the internet

Project X – Smart idea

Your OWN idea!

Connections

- Connections between projects are encouraged!
  - Knowledge sharing on same/similar HW/SW components
  - Connection between topics
    - E.g.:
      - Lighting + traffic
      - Playground + park watering
      - Parks + environment