Introduction to the Internet of Things

Session 06

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Project 1 – Liquid Challenge

- Remotely monitor different liquids with different sensors
- Liquids (moving)
  - Fuel
  - Waste water
  - Fresh water
  - Water of AC/Heating
- Sensors: weight, distance (laser+acoustic), rain-water, switches (reed, hall, flip, light bar)

Project 1

- In teams of 2 (exceptions 3)
  - Measuring liquid (water and oil) challenge (acoustic distance, optical distance, weight, conductive sensing, physical switches)
    - Bring props: 3 bottles/containers (one for clear water, one with vegetable oil, one with dirty water), something to block lights in bottle, magnet, swimmer (cork?), scissors, glue, cardboard
  - For different liquid types (clear water, dirty, oil) and each measuring challenge build systems to measure series of data over time
  - Rate quality for that sensor for the specific liquid
  - Produce dashboard and software prototype in Node-RED, showing all tanks
  - Produce table and recommendation for use case
  - Produce recommended installation manual with rational (why you chose what)
  - Produce scenario/story of one case how your system is used in practice

IoT Nice to Have

- (5min) write down features you would like to see in an IoT Framework → research report
- Demo(s)
- Open discussion
- Adjust personal notes

IoT Nice to Have (examples)

- Usable (ease of use, documentation)
- Teachable (works in class setting)
- Affordable (hard- and software)
- Open and extendable
- Scalable
- Testable
- Secure
- Private
- MQTT supported
- Works offline
- Debug guide
- System maintenance overview

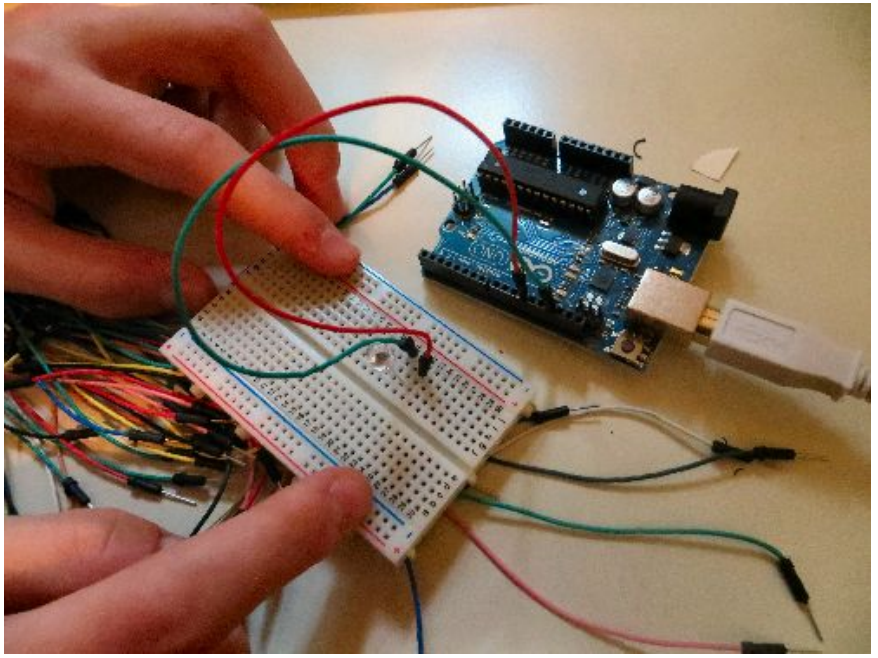
Coffee and IoT

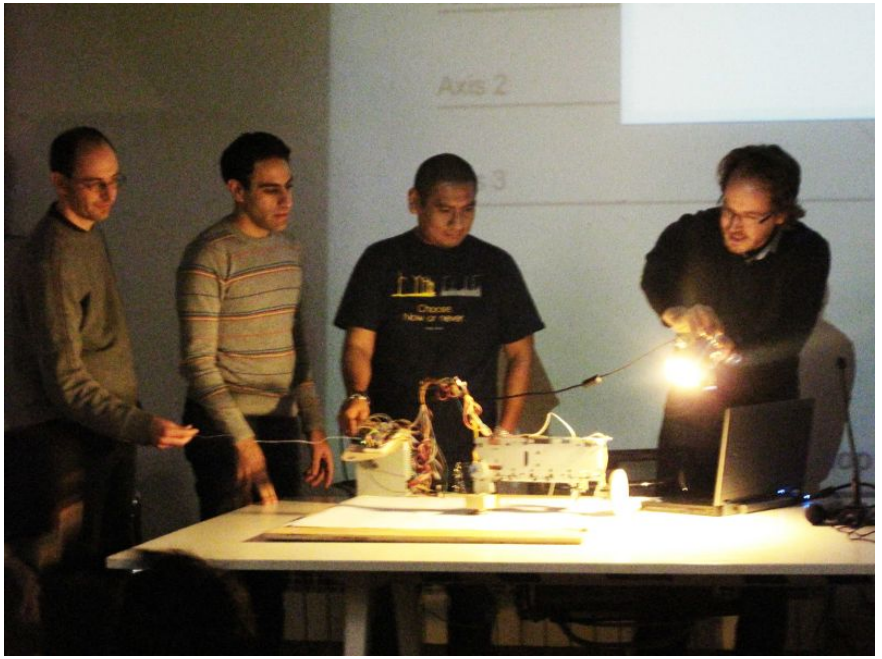
Once Upon A Time in Indonesia

- William Hooi
- Espresso Lite
- Democratization of hardware development

Students With Their First IoT Projects

- Discovery during “Home and Building Automation” classes
- Different type of motivation than “Hello World”
- Change something in the real/physical World

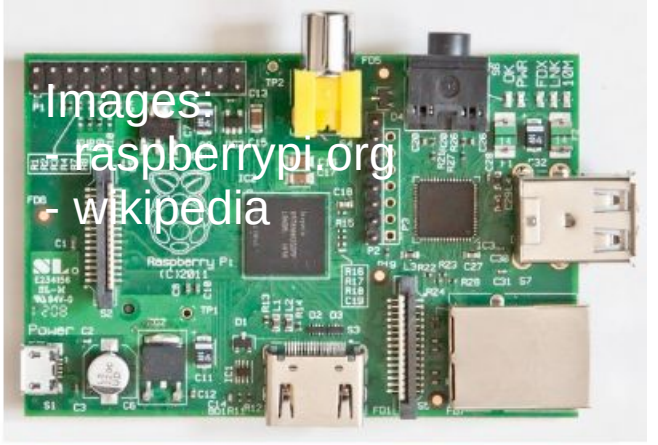




Images from:
- http://www.trycomputing.org/lesson-plans/arduino-blink-challenge-lesson
- http://www.iaacblog.com/blog/2011/arduino-workshoprs3-session/

Raspberry Pi
> 25 000 000 sold

- Pi 1
  - The first, slowish (better server)
  - 1 core, 512MB, 700MHz, now $20 (used)
- Pi 3 (Pi 2 similar, no WiFi)
  - Current, fast (also Desktop), available
  - 4 cores, 1GB, 1GHz, WiFi, now $35
- Pi Zero
  - Slowish (better server), not very available
  - 1 Core, 512MB, 1GHz, $5 if available
- Pi Zero W
  - Slowish (better server), not very available
  - 1 Core, 512MB, 1GHz, WiFi, $10 if available



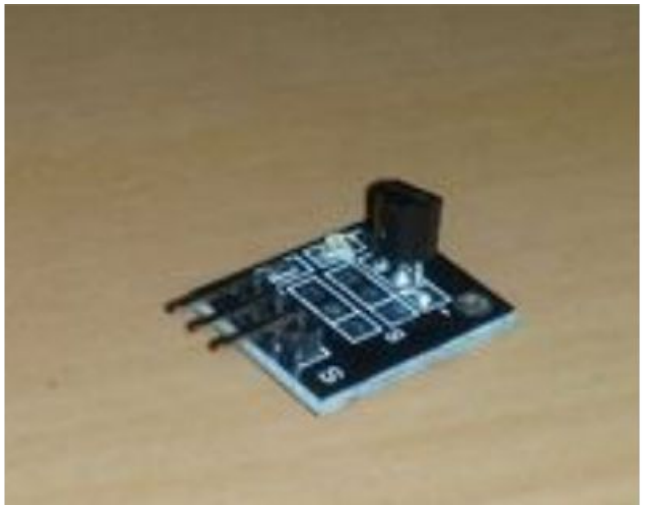
ESP8266 (ESP32)

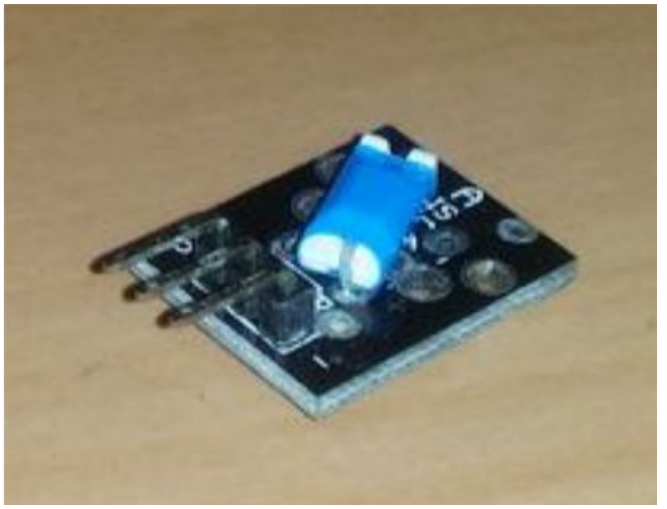
- ESP8266 ($1-$3)
- Arduino on steroids
  - Wifi on board
  - Python, Lua, C, C++, Java-Script
- Popular versions
  - Wemos D1 Mini ($ 2.1)
  - NodeMCU ($ 2.3)
- Several billions sold

Personal favorite: Wemos D1 Mini ($2)

Paradigm Shift Through Affordability

- Since using ESP8266
  → students go out and buy to explore themselves
- Sensors for both, often <$2 per piece





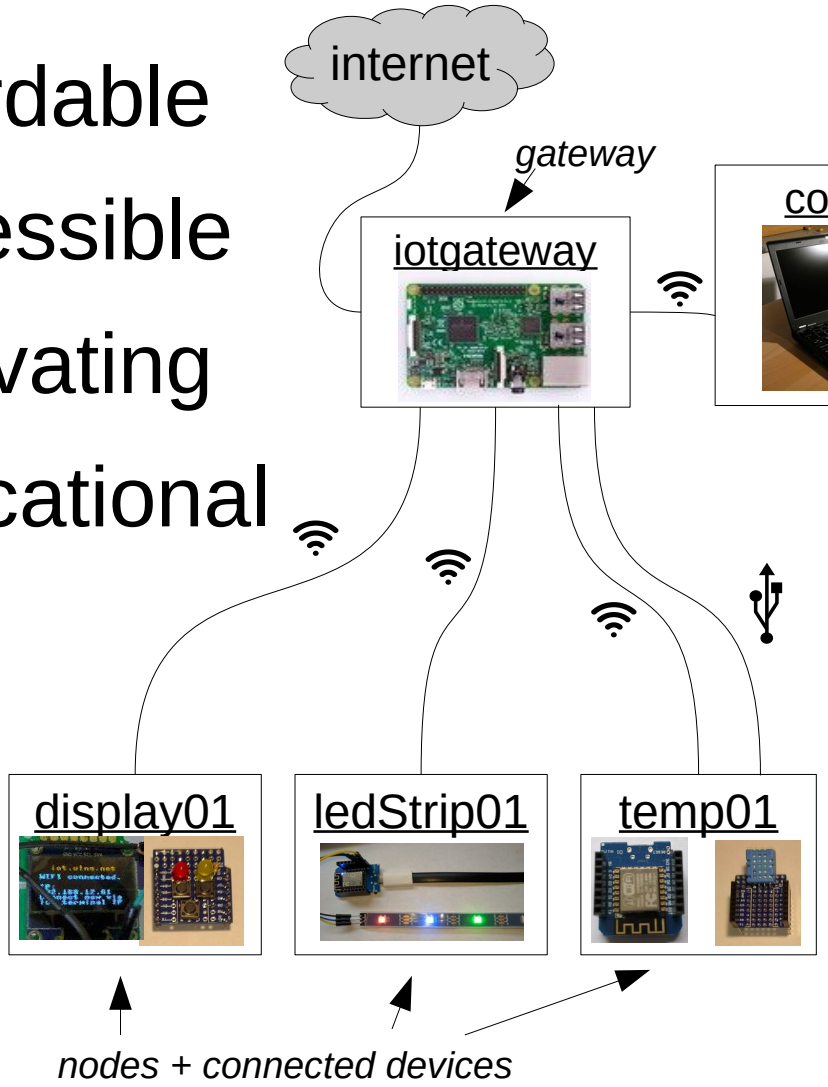
last two pictures from http://www.instructables.com/id/Arduino-37-in-1-Sensors-Kit-Explained/

IoTempower

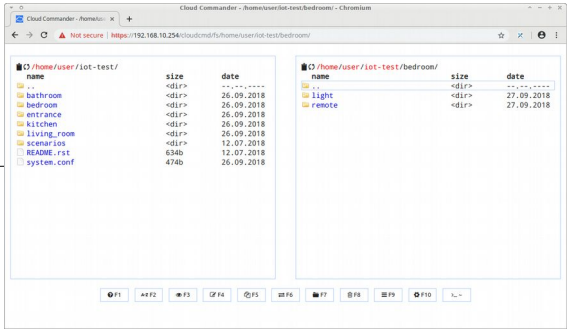
- Finally
- Why was IoTempower created
  - Focus on teaching
  - Affordability (price → focus on potentially supporting disadvantaged communities)
  - Openness (you and I can change it)
  - Extensibility
  - ESP8266 → game changer
  - Serial flashing in class not feasible (as too error prone)
  - Should work with or without internet

IoTempower
Framework and Ecosystem for IoT

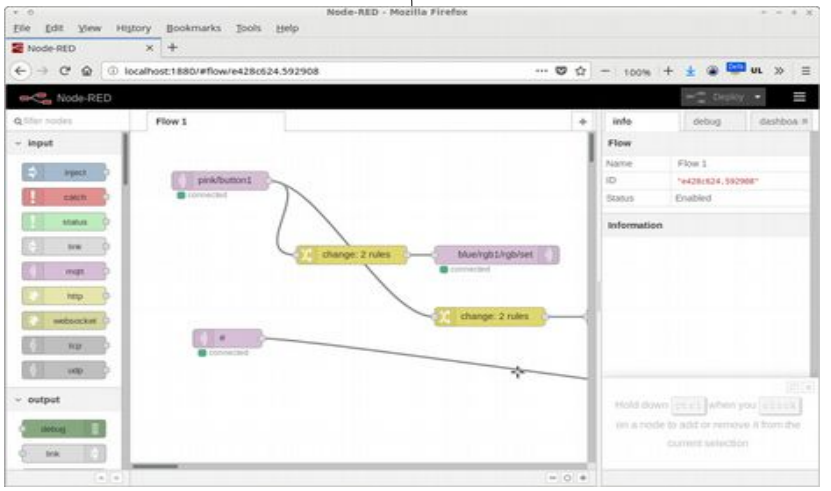
- Affordable
- Accessible
- Motivating
- Educational



node management



device integration



For more info:

- http://iot.ulno.net
- http://github.com/iotempire/iotempower

Thinkpad image: Robert Kloosterhuis - http://www.flickr.com/photos/jemimus/6461569529/
Raspberry: https://www.raspberrypi.org/

IoTempower Live Demo

- Research task during demo
  - Check covered features (and check off the personal covered features).
  - Write down and ask questions (related to realization of own project)
    → research report (3 questions, recommendations, feature requests each)
  - Any special requests to show?
- Content:
  - Flash device via serial (dongle and pre_flash)
  - Adopt device via dongle / directly on pi via serial
  - OTA update (deploy)
  - Different devices (led, button, relay, trigger, display, analog, rgb-led, rgb-led-strip, ultrasonic distance)
  - Integration in Node-RED → graph and charts

Lab 6

- Continue Flogo initial examples, integrator replacement
- IoTempower
  - Flash the dongle
  - Flash all other esp's with pre_flash_wemos
  - Do adoption for all
  - Rebuild switch/actor example with IoTempower (and re-use Node-RED)
  - Add RGB-Led
  - Add acoustic distance sensor, use as motion detector
  - Add buzzer alarm
  - optional: install IoTempower on your PC and configure/deploy your devices from there (you can also try to install it in termux under android, but currently untested)
- optional: Checkout PJON or Mongoose OS