Introduction to the Internet of Things

MCIoT Session 9

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Outline Today

• Introduction
• Syllabus + Course Logistics
• What is the Internet of Things
• Story Driven Modeling
• Hardware presentation
• Quick lab outline
Course Content

- Definition: Internet of Things
- Sensors
- Actors
- Connected systems
- Frameworks
- Designing and Building IoT Systems
- Data collection and Visualization
- Industrial Opportunities
- Scenarios, Stories, and Pitches
Learning Objectives

- Define and critically reflect on the term “Internet of Things” as well as align and position Internet Of Things technology in comparison to cloud and mobile computing
- Equip most physical objects with networked sensors
- Equip and interact with most physical objects with actors
- Write code to set-up systems to collect, visualize, analyze, and act on data from the physical world
- Design and implement various IoT systems made up of sensors, wireless network connection, and actuators
- Build and test a complete working IoT system as well as design and implement respective simulator components to speed up testing
- Present and defend the design and implementation of several Internet Of Things Systems in a portfolio and public presentations
Class Logistic and Assessment

- IoT part 40% (pass with 70%) - portfolio style
- You explore now/ no dedicated homework but portfolio (finish what you started)
- All work in lab (and some in lecture too) in pairs
- Checkpoint every 2 weeks – pushing portfolios into right direction and checking deadlines (lab challenges have to be fulfilled in max 1 week – notify if problems)
- 10% Extra activities (must be documented in portfolio and provable for me → need to be part of that chat/forum)
  - Dedicated tasks
  - Helping others
  - Chat activity
  - Documentation effort
  - Extraordinary solutions
  - Support and fixes for related open source projects
  - Filing/fixing issues (i.e. IoTempower on github)
Reporting in Repository

- Use our teams chat for discussing problems in and outside of class!
- Pick one repository of pair to report lab work (give mutual acess and link) – link from both personal repos (these are still your portfolios)
  - Everything goes in there
    - Lecture exercises
    - All from lab challenges (and also content that spills into homework)
  - Text and documentation only as Restructured Text or Markdown.
  - Reasonable git ettiquette (no binaries but pictures you took or drew)
A word on lectures

- Lecture and labs → flipped class room
- Self study, video material, online classes
- Teacher(s): more guide and coach than subject matter expert
- Interdisciplinary focus
- Team and social skills

IoT Trendy?

IoT - Google Webtrends:


Personal statistic: >20 talks: IoT and Making since 2015, > 10 classes, several small workshops since 2014
IoT

• What does the Internet of Things entail?
• Use laptop to google about IoT, find and note down including small description (add to portfolio):
  – 3 domains (included areas)
  – 2 commonly used (data) protocols
  – 2 typical devices (appliance or controller)
• 7 minutes time – merge next task – start comparing after 7 minutes
• 3 minutes: compare notes with peer and combine results
The Internet of Things Presents…
#LikeABosch

- **Watch:** [https://www.youtube.com/watch?v=v2kV6pgJxuo](https://www.youtube.com/watch?v=v2kV6pgJxuo)

- **While watching:**
  - Extend your domain and appliance/devices list, by 2 you didn’t have yet
  - What are the benefits of IoT? (add one)
  - What are the challenges? (add one)
  - Add to your personal lecture exercise record for portfolio
TIA IoT Introduction

- Extend your domain and appliance/devices list, by 2 you didn’t have yet
- What are the benefits of IoT? (record at least 4)
- What are the challenges? (record at least 4)
- Add to your personal lecture exercise record
- Extend further at home and transfer to portfolio
- Also worth watching:
  - https://www.youtube.com/watch?v=6mBO2vqLv38
  - Other LikeABosch commercials (especially on manufacturing)
Result Collection

- Domains
- Appliances/Devices
- Benefits
- Challenges

Extend this document:
https://docs.google.com/document/d/1kXoPtad1lhF3WYSd9oeBRSC6LV92ciSGRpu5dBlDmrw
https://tinyurl.com/mciot2021-9
Internet of Things (IoT)

**IoT Domains**
- Ubiquitous Computing (Pervasive Computing)
- Home automation
- Urban Computing/Smart Cities
- Embedded Computing
- Actor/Sensor Networks
- M2M Communication/Manufacturing
- Mobile Computing, Wearable Computing
- (Hacking/Making)
- Big/Actionable Data

→ **Systems, Connectivity, Data**

**Devices and controllers**
Example IoT System
Smart Door Bell

Story Driven Modeling

• Scenarios (user stories) first, very concrete, example based
• Scenarios are base for tests (similar to tests first)
• (First diagrams usually on object level to show relations between concrete instances)
• Very agile, iterative development process
• Allows and embraces problems and their solutions (XP style → embrace change)

Story/Scenario?

- From Home and Building Automation lecture this spring
- Students’ final scenario: “Big house, airbnb, smart lock and more automation.”
- Great idea, but enough to design, implement, and test software?
Story v2

- A landlord has a house with multiple bedrooms and offers these rooms on airbnb.
- Each room is supposed to have a smartlock, hvac, temperature sensor, and an automated media system.
- This should all be controllable via phone.

Taken from: http://www.houseplans.com/plan/3584-square-feet-4-bedrooms-2-5-bathroom-modern-house-plan-2-garage-37341
Story v3+

Airbnb-Homeautomation Smartlock/Noise/Temperature Scenario

Landlord: Karli, Tenants: Bob, Eddy

Karli has a house in Linz, Austria with four bedrooms and rents out three on AirBNB. He is currently on a small hiking trip in the forests nearby Linz. It is summer and the outside temperature is around 30 degrees Celsius. Eddy stays already in his room and is binge-watching Game of Thrones.

Karli’s cell phone rings. It’s his new tenant Bob, who just arrived to his house and wants to enter, however the main door is locked. Karli opens his House-Management App and activates Bob’s profile. Bob logs into Karlis public airbnb wifi as he doesn’t have a data plan in Austria using previously exchanged credentials.

He opens the karlis-house-app, Karli made him download earlier, and presses the open main-entrance-door button which unlocks it.

Bob can now enter.

Bob finds his private bedroom (which has the number 3 written on it). It is also locked.

He presses the unlock-room button in the application.

The bedroom door opens and Bob can enter the room.

Bob presses the media button, which starts the TV, and displays the kodi media-center main screen. Using a built-in remote, Bob selects a youtube documentation on home automation. When the movie starts, the light in the room is dimmed.

An hour later, Bob feels tired and goes to bed. Using the app he switches of the TV and all lights. There are buttons for single lights or one for interacting with all lights. Bob is very tired from traveling and falls asleep.

As it is hot outside Bob’s room temperature reaches 22 degrees triggering the air conditioning unit to switch on to bring the room down to 21.

Later, Karli comes back home, enters his house and goes to his private rooms (unlocking main entrance and private quarters with his app).

On one wall he has led-strips showing the temperature and noise levels in each of his tenant’s rooms. 2 leds are green, the led of Eddy’s room is red.

Karli goes to Eddy’s room, knocks at the door and asks Eddy to lower the volume as it is after midnight. Eddy complies (using the app) and Karli goes back to his quarters.

All status led’s are green now.
Airbnb-Homeautomation
Smartlock/Noise/Temperature Scenario

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Image from: http://www.iaacblog.com/blog/2011/arduino-workshoprs3-session/
Hardware

• We are going hands-on
• With ESP8266 (and later ESP32)
• Watch: https://youtu.be/wOEDaFRlhLo
• While watching: (save for portfolio)
  - Why esp8266?
  - What is personally inspiring for you?
  - What is the connection to coffee?
Mini Demo

- Arduino Hello World (switch a light)
- Steps
  - Install Arduino IDE
  - Add esp8266 repository
  - Install ch340 driver (if on windows or mac)
  - Select example (Blink)
  - Compile and flash -> enjoy