

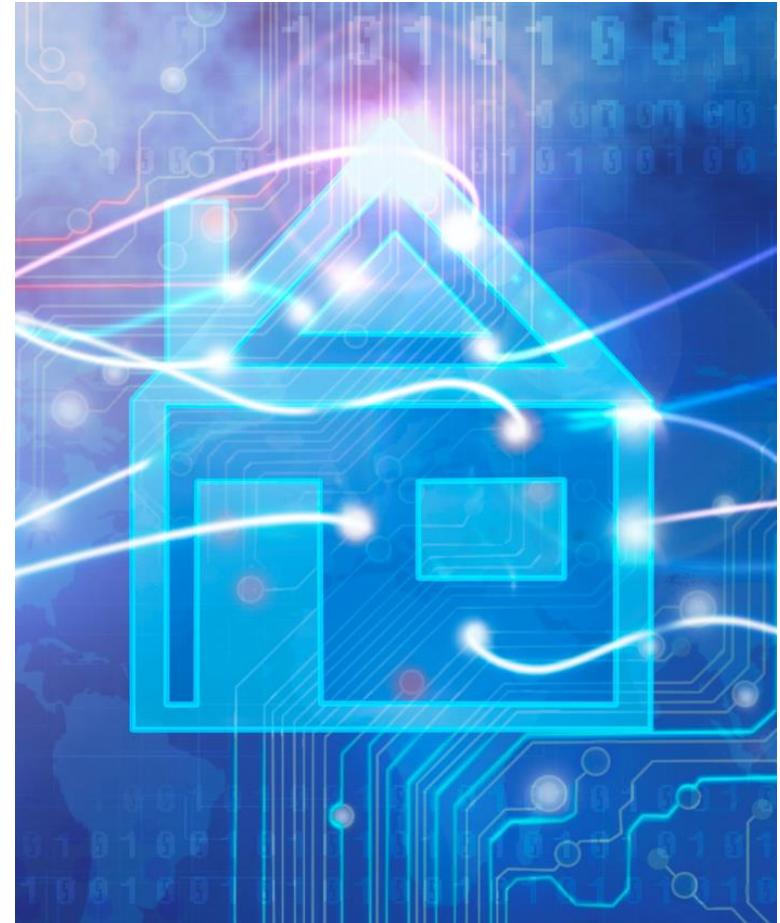


# Course Introduction

## Ambient intelligence

Fulvio Corno

Politecnico di Torino, 2017/2018



# Basic information

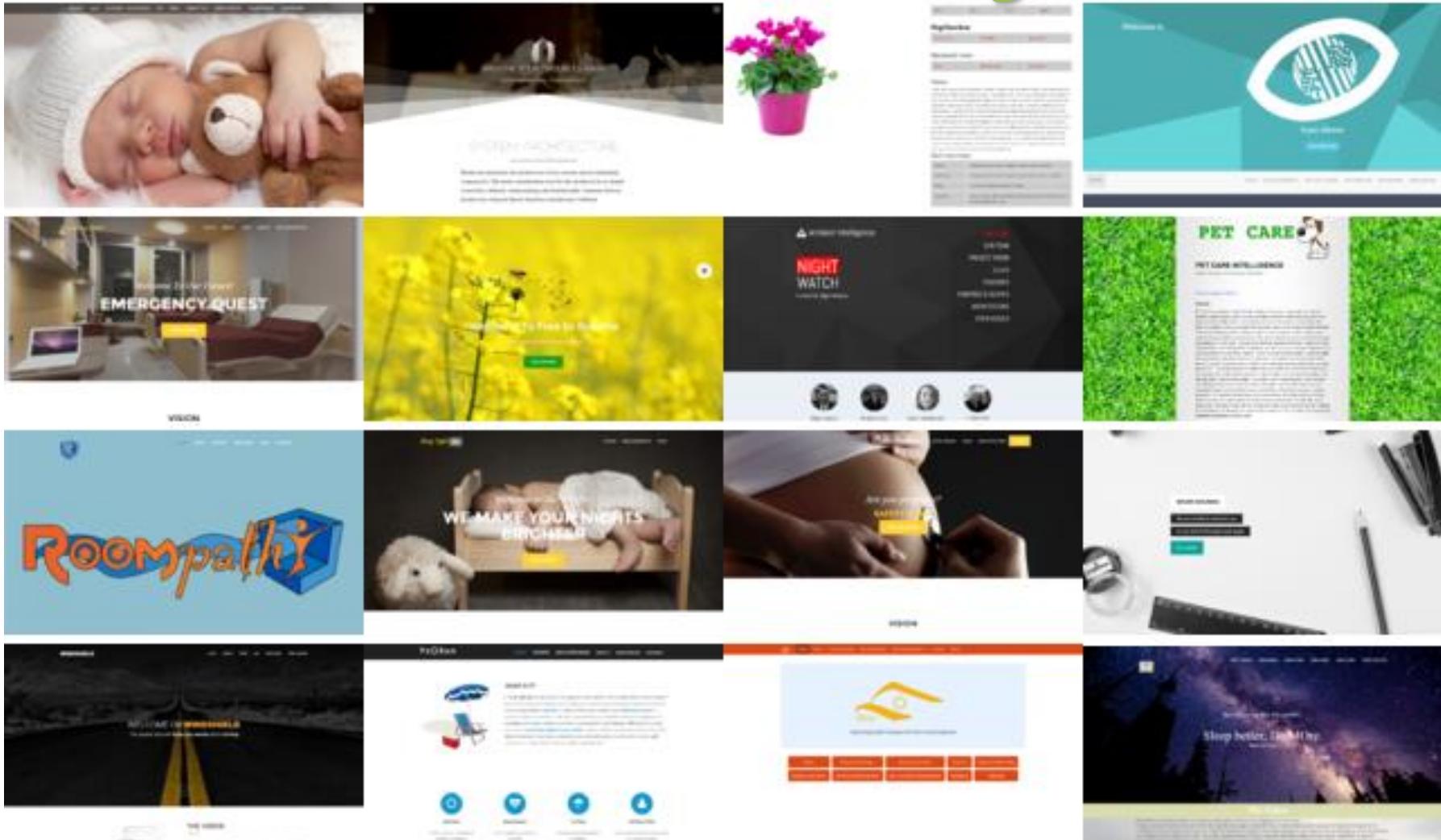
- Title: **Ambient Intelligence**
- Code: 01QZPxx
- Year: 3, Semester: 2
- Credits: 6
- Language: English (almost...)

<http://bit.ly/polito-ami>

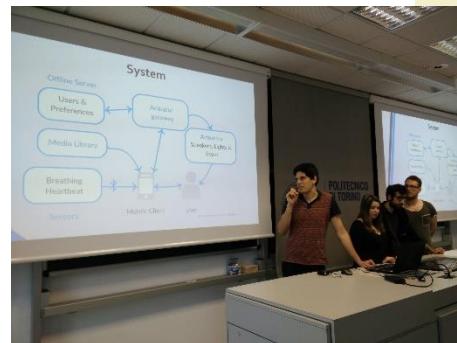
*Tattoo this!*

This is the  
Ambient  
Intelligence  
course

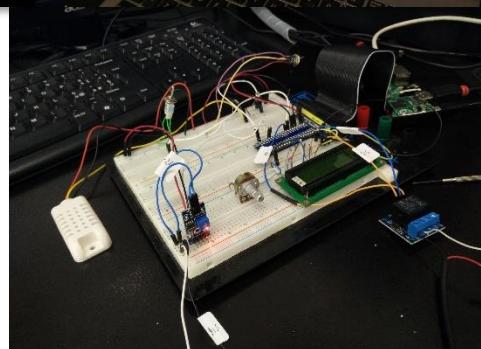
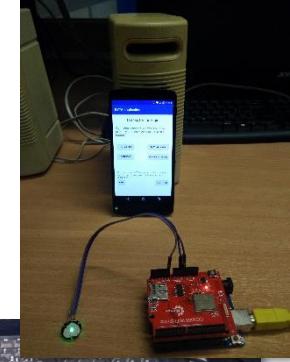
# Aml is... Projects



# Aml is... Teams



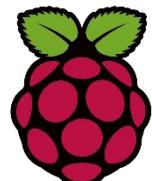
# Aml is...Technology



# Aml is... Tools

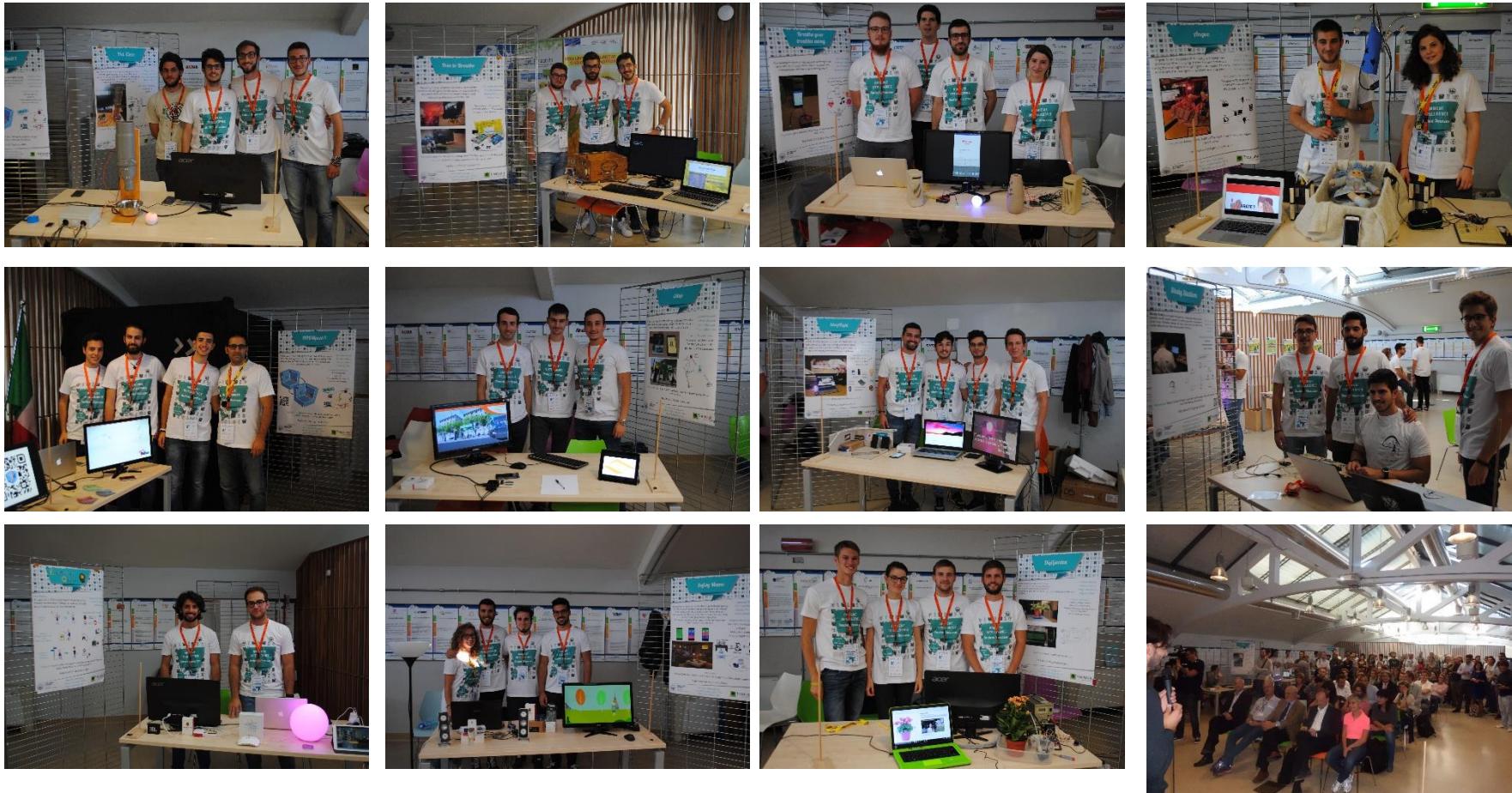


{ JSON }



{ REST }

# Aml is... Showcase



# Aml is... Startups



Ambient intelligence

# AmI is... Outreach



# Summary

- Goals and contents
- Organization
- Resources
- Exam
- Previous projects and Showcase



Course Introduction

# GOALS AND CONTENTS

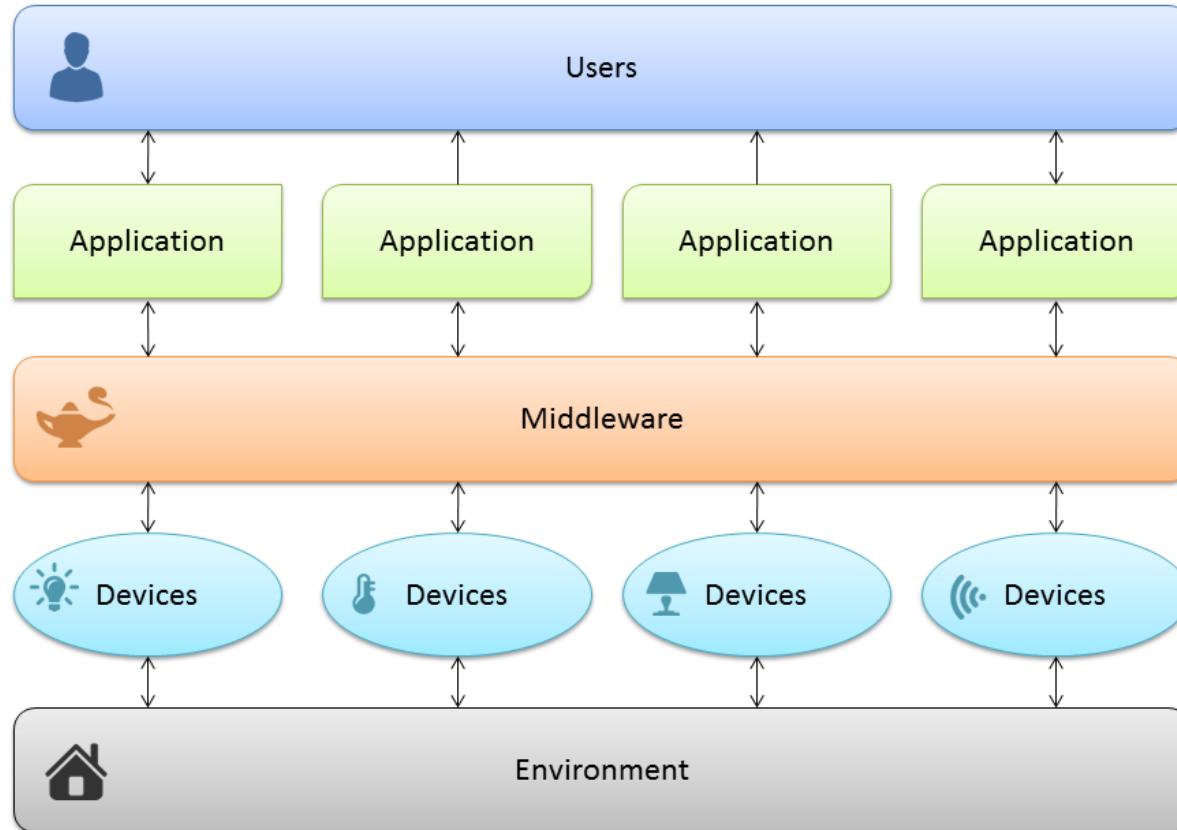
# Goals

- Designing and realizing environments that enrich the user experience and help householders in their activity
- Adopting a feature-driven design methodology, targeting open and reusable solutions
- Integrating existing devices and existing home- and building- automation systems (don't reinvent the wheel)
- Really building a (simple) working Aml system, in a multi-disciplinary team

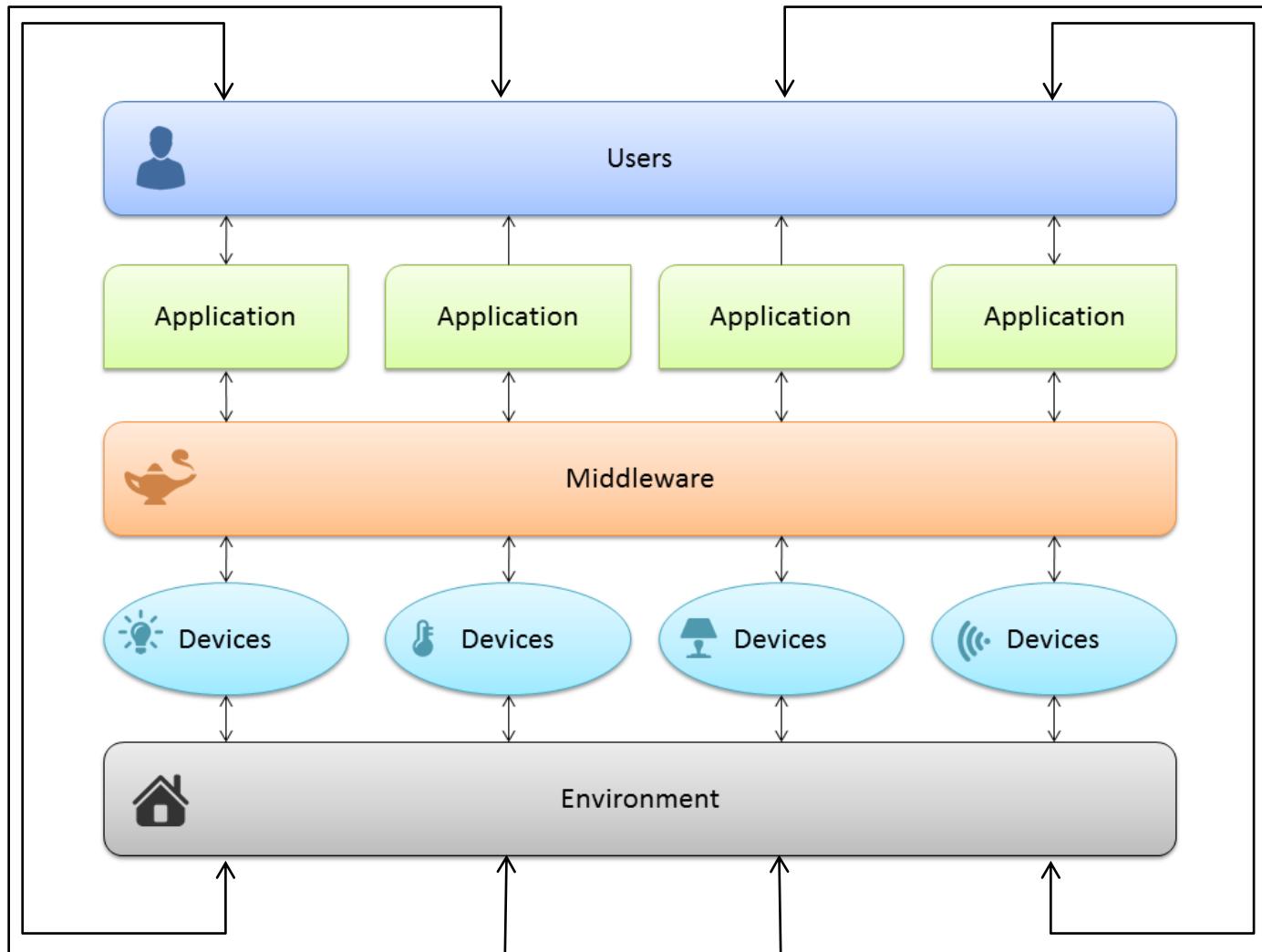
# Definitions

- “An **Ambient Intelligence** system is a digital environment that proactively, but sensibly, supports people in their daily lives”
- “An **Intelligent Environment** is one in which the actions of numerous networked controllers (controlling different aspects of an environment) is orchestrated by self-programming pre-emptive processes (e.g., intelligent software agents) in such a way to create an interactive holistic functionality that **enhances occupants experiences.**”

# Reference architecture



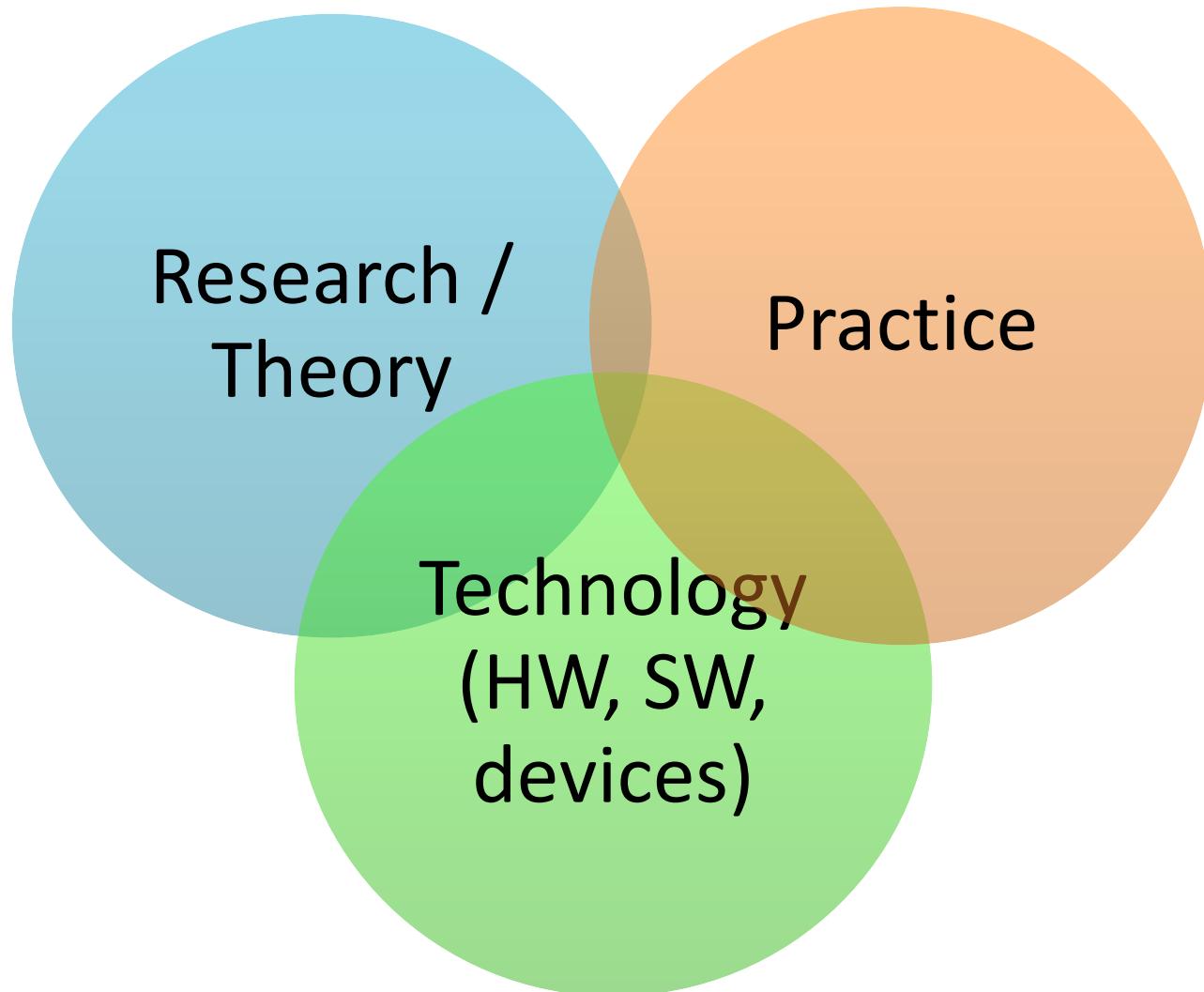
# Reference architecture



# Main contents

- Aml definitions, applications, systems: taxonomy and market overview
- Feature-driven design methodology
- Enabling technologies: Linux, hardware boards, Python, Web
- Some off-the-shelf automation technologies
- Rapid prototyping and development
- Group work (supervised and free)

# Approach



# Approach

- Mix of
  - Theory
  - Technology overview
  - Practical information
  - Hands-on experience
  - Group work
  - Industry information
  - Application areas
- Main focus
  - Practical approach
  - Sound design methodology
  - Open and reusable solutions
- *Learning to design and build a (working) Aml solution*



Course Introduction

# ORGANIZATION

# Teachers

- Fulvio Corno <fulvio.corno@polito.it>
- Luigi De Russis <luigi.derussis@polito.it>
- Alberto Monge Roffarello <alberto.monge@polito.it>
- Politecnico di Torino, Dipartimento di Automatica e Informatica
- ~20 hours each, mixed Lecture / Exercise / Lab

# Schedule

- Monday
  - 14:30-16:00
    - LADISPE
    - Room 8I
  - 16:00-17:30
    - LADISPE
    - Room 8I
- Thursday
  - 17:30-19:00
    - Room 8I

Updated week-by-week schedule  
with slides, readings, ... on the course  
website (“Schedule” section)

# The Lab

- LADISPE
- Essential part of the course  
(the most important)
- Real smart home hardware  
and IoT devices
- 50% assigned exercises
- 50% supervised group work
- Group work



Spanish  
Plans.org

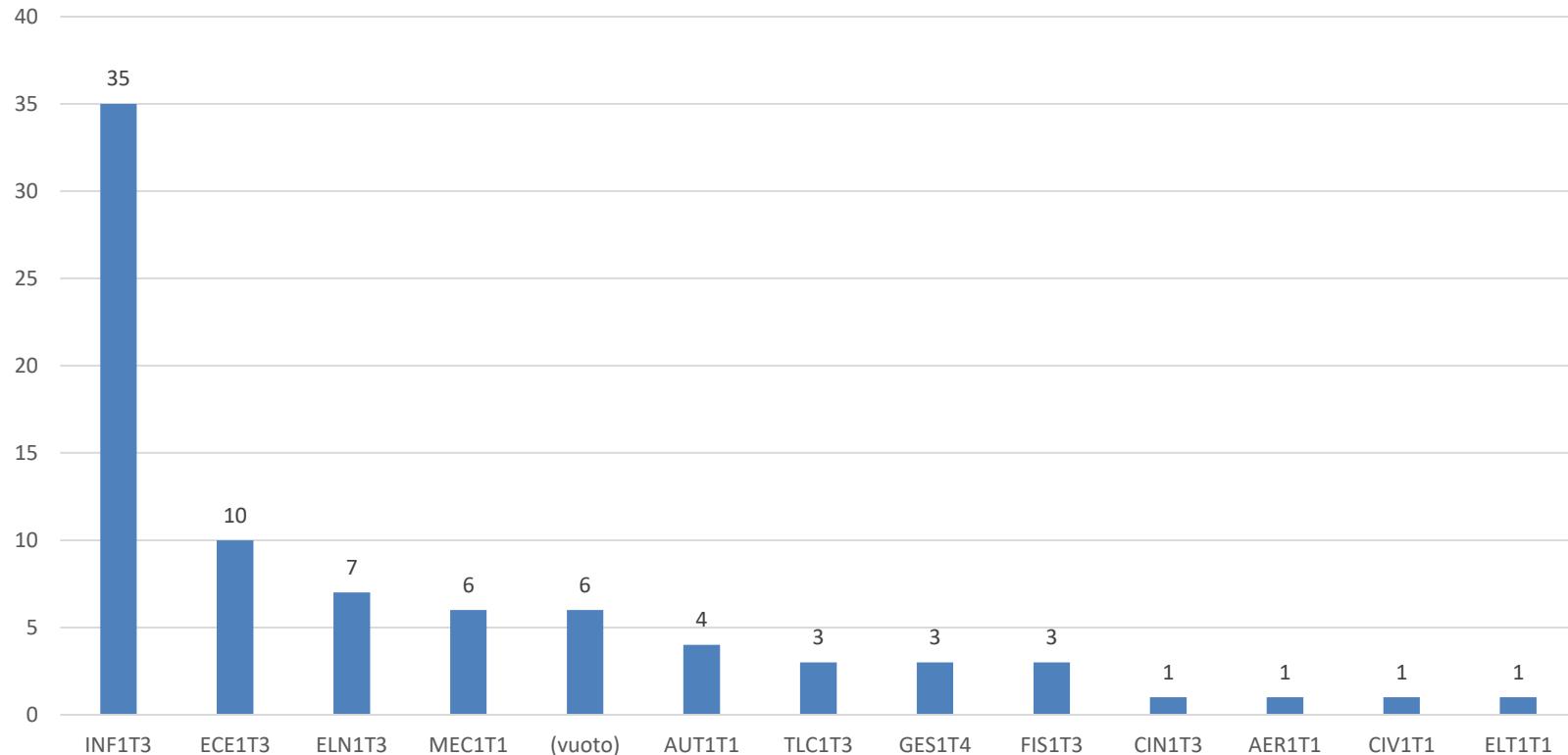
# The Skewed Schedule

Week	Classes	Exercises	Group Work
1	1		
2	3		
3	1	1	1
4	2	1	
5	2	1	
6	2	1	
7	1	2	
8	2	1	
9	2		1
10	1	1	1
11	1		2
12		1	2
13		1	2
14		1	2

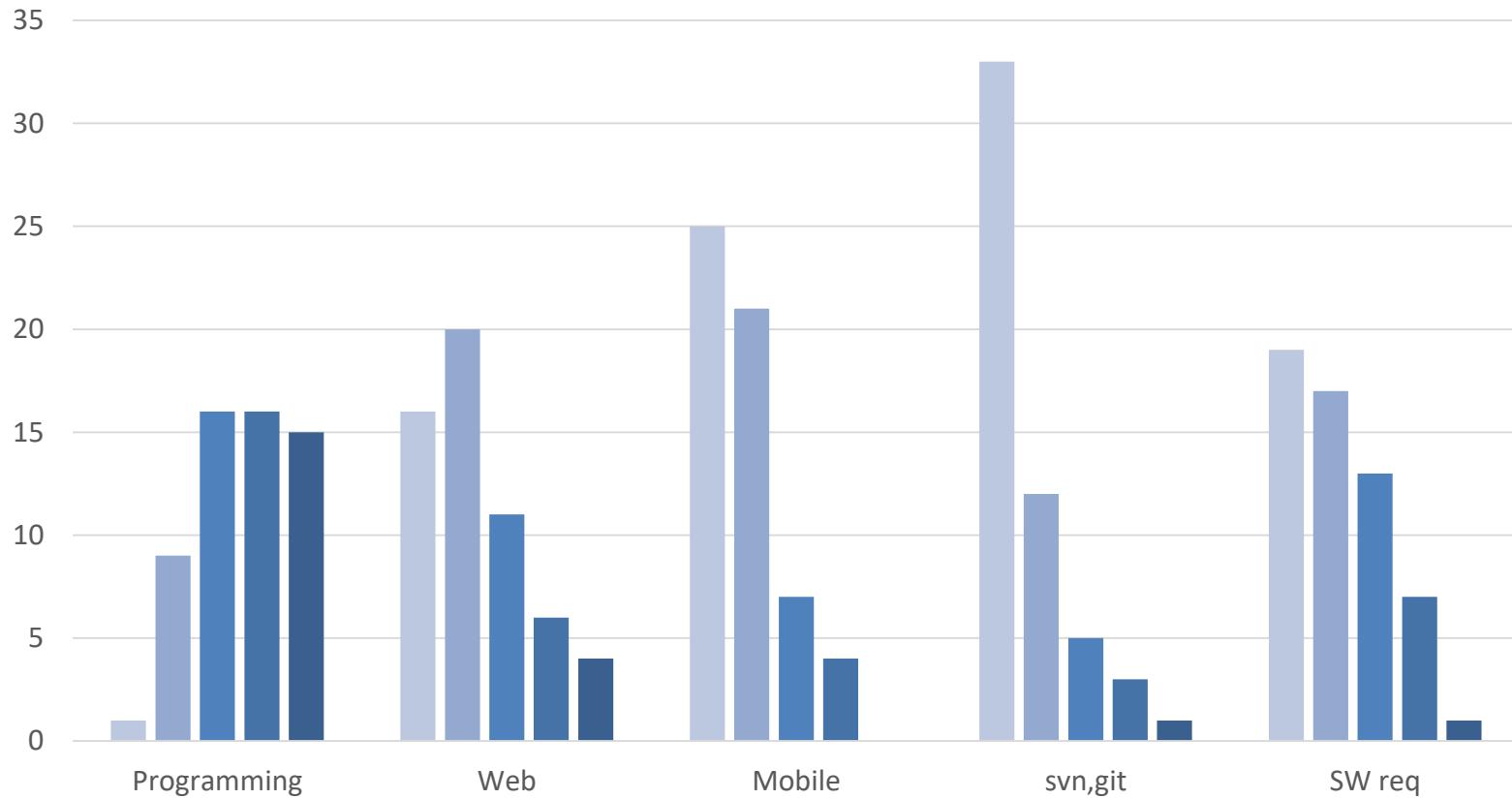
BETA

- Non-uniform distribution of hours
- Decreasing impact of classes
- Moving from Classes to Exercises (in class, in lab)
- Increasing time for supervised GW

# Students (about you...)

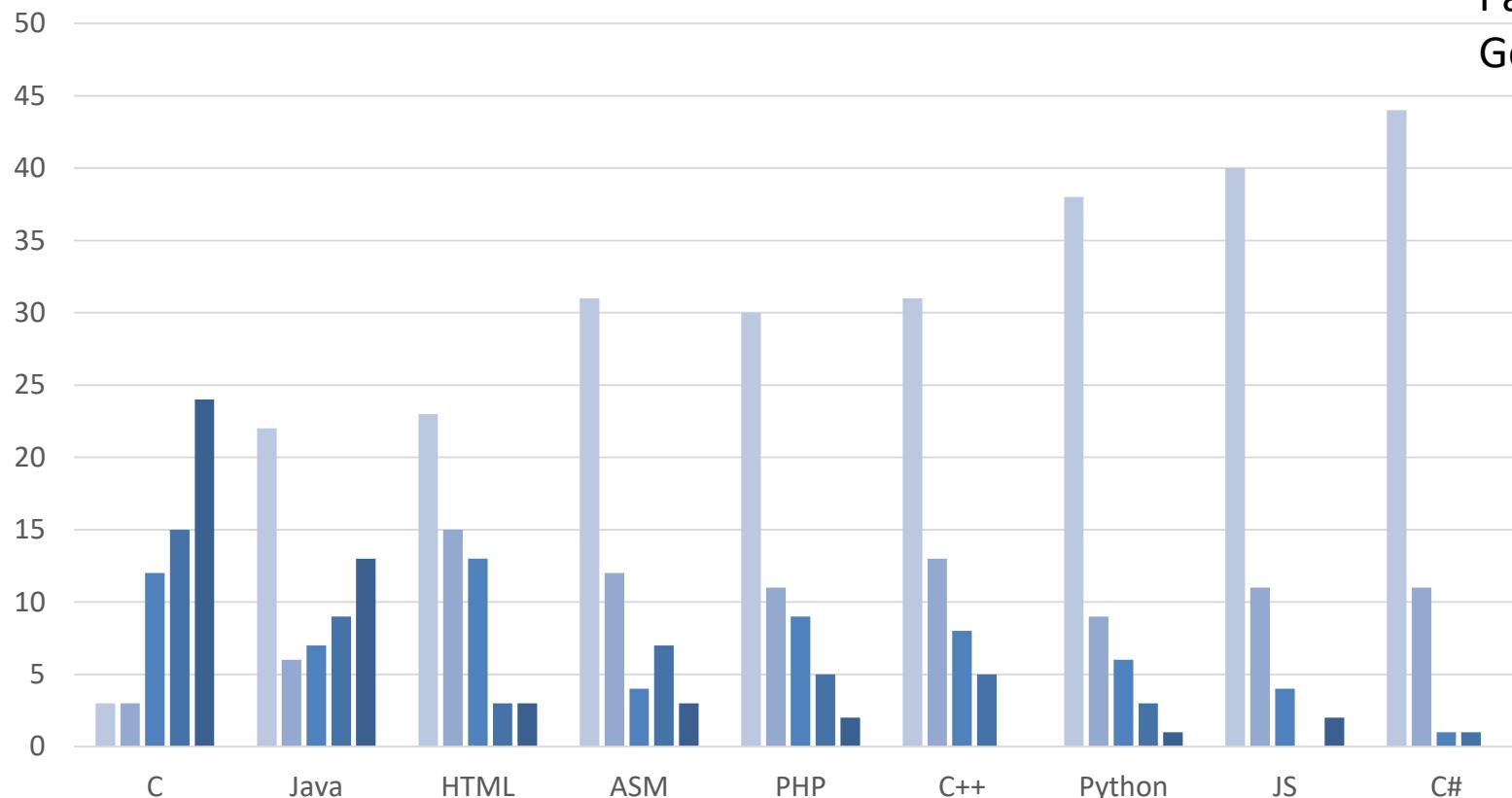


# Skills



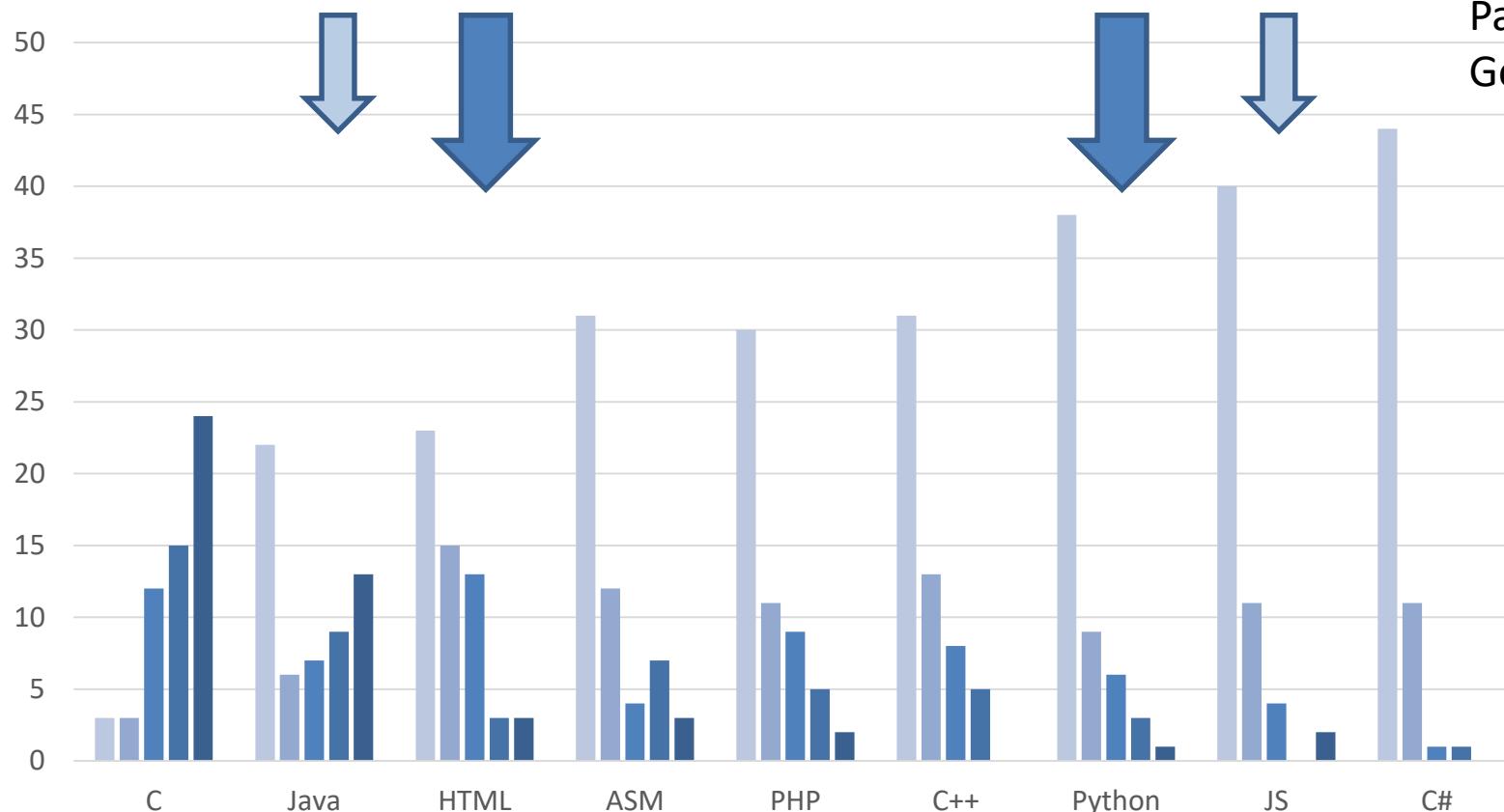
# Languages

*Others:*  
SQL, Bash,  
Matlab, Awk,  
Kotlin, VB,  
Pascal, Ruby,  
Go, Perl



# Languages

*Others:*  
**SQL, Bash,**  
Matlab, Awk,  
Kotlin, VB,  
Pascal, Ruby,  
Go, Perl



# Don't worry... we'll get there

From initial survey

Topic	Low (1-2)	Average (3)	High (4-5)	Projects
Programming (in general)	13.21%	<b>41.51%</b>	35.85%	14/14
Web Architectures	<b>58.49%</b>	16.98%	15.09%	13/14
Mobile development	<b>83.02%</b>	3.77%	3.77%	8/14
Source Control management	<b>86.79%</b>	1.89%	1.89%	14/14
Software requirements specification	<b>75.47%</b>	11.32%	3.77%	14/14
Python	<b>86.79%</b>	0.00%	3.77%	14/14
HTML/CSS	<b>67.92%</b>	13.21%	9.43%	14/14
JavaScript	<b>81.13%</b>	5.66%	3.77%	12/14
Java	<b>73.58%</b>	11.32%	5.66%	8/14
C	13.21%	18.87%	<b>58.49%</b>	3/14

At exam-time



Course Introduction

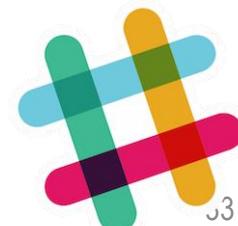
# RESOURCES

# Course website

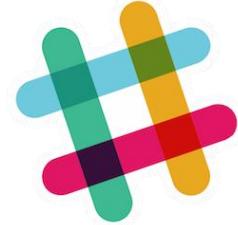
- <http://bit.ly/polito-ami>
- All lecture slides
- All exercise material (texts, solutions, examples, ...)
- Required readings and deadlines
- Exams
- News and notices (official)
- Detailed (tentative) schedule
- Lecture video recordings
- Reference papers, links, ...

# Additional on-line resources

- Facebook group, for open discussion and information exchange: <https://www.facebook.com/groups/polito.ami/>
- Video Lectures on YouTube  
<https://www.youtube.com/playlist?list=PLqRTLlwsxDL8fUcY2Y54sITILyJcTySpC>
- Collaboration on Google Drive
- Projects on GitHub:  
<https://github.com/Aml-2018>
- Communication with teachers and among groups via Slack App at <https://polito-ami-2018.slack.com>



# Internal Communication



- All contacts with teachers **must** take place on **Slack**
  - e-mail messages will not be considered
- The **#general** channel is reserved to official communications by the teachers.
- The **#discussion** channel is for questions, requests, ideas, etc. by any student. Teachers will read and respond.
- The **#random** channel is for free discussion among students.
- Groups of students may create *private channels* for collaborating on their project

# Development



- All development (labs, projects, websites) on GitHub
  - Use it! Really! Continuously!
- Create a GitHub account
  - Choose a nickname that may last forever (don't use the "matricola" number)
  - Register with a @studenti.polito.it address, you may get free private repositories (request on <https://education.github.com>)
- Per-project repositories will be created in Aml-2018
  - If you need further repositories, please ask
- Always commit your intermediate work
- Will give a “reading” about git/GitHub

# Study material

- No suitable textbook for the whole course
- Teachers' slides
- Required readings
- Lecture videos
- Suggested books for some of the topics
- Suggested papers
- On-line technical documents

# Required software (cross-platform!)

- Python 3.6+ - <https://www.python.org/downloads/>
  - Pycharm Professional -  
<https://www.jetbrains.com/pycharm/>
    - Register with your student e-mail for a free license
  - Git - <https://git-scm.com/>
  - MariaDB - <http://mariadb.org/>
- Bring your laptop to the classes!



Course Introduction

# **EXAM**

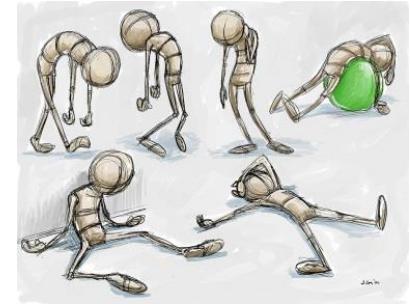
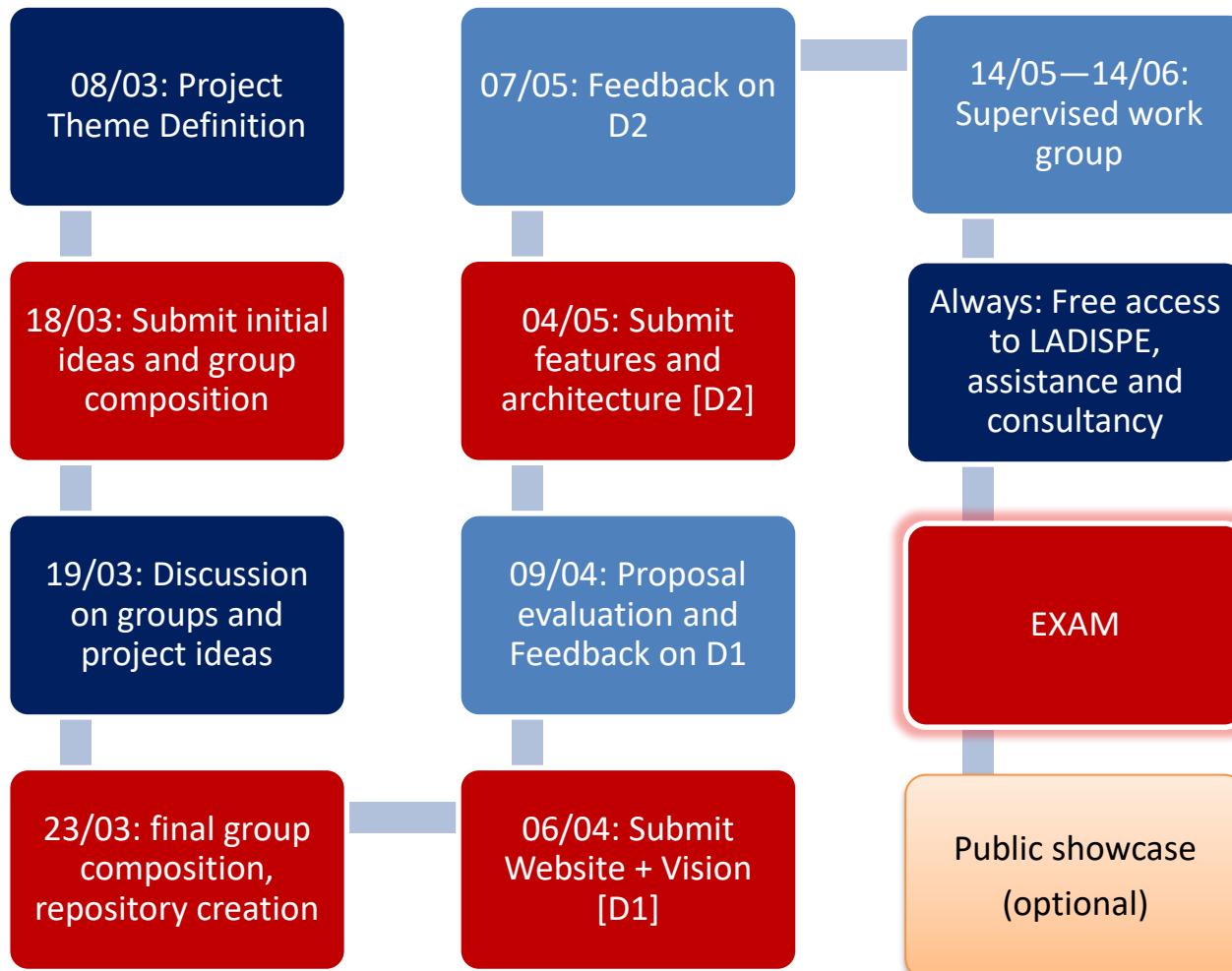
# Goal and rationale

- The exam should assess the capability to design and develop some Aml functionality
- Multiple skills and disciplines are needed in the process
- The course is highly lab-intensive
- A sound design process must be coupled with the capacity to deliver a working system
- You are close to graduation
- Some of you need to return to their home universities

# Exam rules

- The **exam** consists in **the evaluation of the Group Work** that is assigned during the course
  - Documents uploaded on-line
  - Presentation given at the exam date
- Work groups must be formed at the beginning of the course
- Topics are proposed by the group and approved by the teachers
- Many lab hours are devoted to group work development
  - LADISPE may be used in additional hours
- Ideally, developed **during** the course

# Work Group Development Process



# The exam (or, how to get 30+)

- Evaluation of documents (submitted in advance)
  - Project web site
    - Deliverable D1 (vision)
    - Deliverable D2 (features and architecture)
    - Presentation video
  - Project sources on GitHub
- Oral exam
  - Presentation + Demo (20 minutes)
  - Discussion (5 minutes)
- Individual contribution must emerge from the presentation

# First steps

- Identify a Working Group (WG)
  - 3 or 4 students
  - Possibly, with mixed skills
  - Avoid all-non-programmers groups
- Start developing ideas
  - The first two weeks' classes will give you suggestions, seeds, pointers, ...
  - Interact with the teachers

# Tips and suggestions

- Start sooner than later
  - Really!
- Don't aim too high
  - Modular features
- Seek interaction
  - Ask for feedback and suggestion
  - ...and listen to them
- Exploit the LAB hours
  - Proposed labs, Supervised WG, Free hours, ...



Course Introduction

# PROJECT EXAMPLES

# Past projects

Year	Theme	URL
2015	Smart “Cittadella Politecnica” (smart university campus)	<a href="https://ami-2015.github.io/">https://ami-2015.github.io/</a>
2016	Health and Well-Being	<a href="https://ami-2016.github.io/">https://ami-2016.github.io/</a>
2017	Sustainability	<a href="https://ami-2017.github.io/">https://ami-2017.github.io/</a>

# 2017 showcase

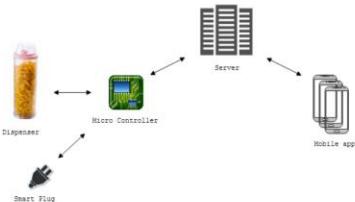
## AmIcook

Whenever you are hungry, with AmIcook you can easily organize a meal or join one. It will count how many participants will attend the meal, furthermore it will decide and dispense the optimal amount of ingredients needed for the pasta.

Then, it controls the stove and notifies the users when the meal is ready.



Implemented with:  
Arduino Uno, sensors, a stepper motor, a smart plug, a server and an Android App



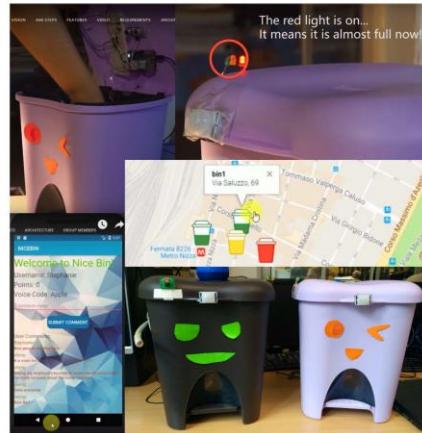
Cook automatically pasta, shared meals, save food, save time

<https://ami-2017.github.io/Amlcook/>

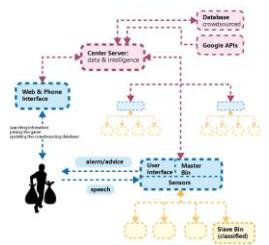
**Authors:**  
Samuele Battaglino  
Davide Cota  
Roberto Monelli  
Arian Nowbahari

## NICE Bins

Waste production is constantly increasing in urban areas, leading to waste abandon and untidy neighborhoods. NICE Bins makes the habit of waste classification easier and fun for residents and allows faster notification of waste abandon.



Arduino, Raspberry Pi, Alexa API



waste, classification, speaking bins

<https://ami-2017.github.io/NICE-bins/>

**Authors:**  
Chen Yun  
Ma Qiang  
Medina Francesco  
Sejas P. Xileny  
Zafar Taha

# 2017 showcase

## The Battery Drive-in

Price limitations? Limited life? Long charging process?

Why not switching ElectricVehicles batteries up?

Adopted technologies

- Arduino
- Raspberry Pi
- Li-ion battery
- Python

Paolo Notaro  
Matteo Manfredi  
Simone Longobardi

ElectricVehicles - Sustainability - Ambient Intelligence - Batteries

<https://ami-2017.github.io/battery-in/>

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Ambient Intelligence Student Showcase 2017 <http://bit.ly/polito-ami>

Treatabit powered by I3P

## Trash-IT

Trash-IT is an intelligent waste collection system that reduces human workload and increases efficiency within an eating environment. Through sensors, it locates tables that need to be cleaned, offering the option of sending a bin directly to them.

Adopted technologies

- OpenCV
- ROS
- Android
- Arduino
- Raspberry Pi

Sirio Longo  
Marybeth Iannuzzi  
Pietro Rastelli  
Victoria Florence

Keywords: Sustainability, Recycling, Waste Disposal, Computer Vision, ROS

<https://ami-2017.github.io/Trash-IT/>

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# 2016 showcase winners

## Safety Mama

**SafetyMama** helps women to attain a peaceful pregnancy. It collects and monitors data pertaining to their physical well-being and tries to make them feel unstressed. She receives notification about her stress status and daily activity through a mobile application. If she is stressed, and at home, the Home Relaxation System starts automatically.

**Adopted technologies**

- Raspberry Pi+Raspberry Z-Wave
- Philips Hue Lamp
- Android Application




**Keywords:** Stress Detection, Automatic presence recognition, Daily steps' control

<http://ami-2016.github.io/SMa/>



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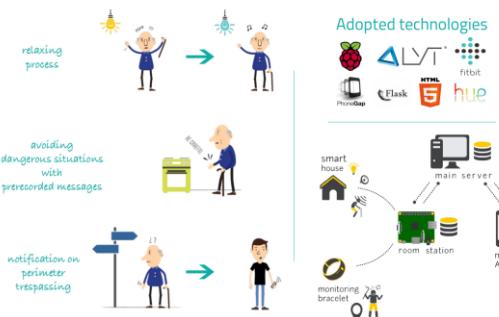
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## EMERGENCY QUEST

**Description**  
The goal of the EQ is to give support to people with a disease like dementia or Alzheimer, making them able to continue living at home by themselves

**Adopted technologies**

- PhoneGap
- Flask
- HTML 5
- hub
- fitbit



**Keywords:** room station • bracelet • caregiver • map • notifications • agitation detection • mobile application

<https://ami-2016.github.io/EQ/>



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<http://bit.ly/polito-ami>



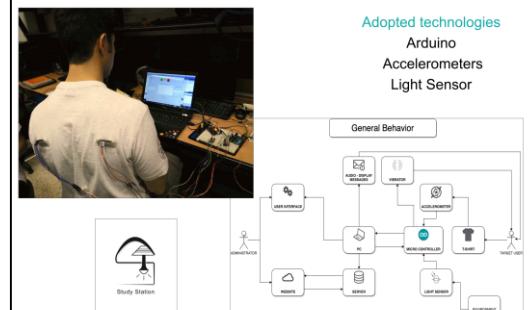
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## Study Station

**Study Station** is a system thought as a *wearable device* that avoids health issues caused by wrong postures maintained over time. Benefits interest all users that want to keep the body relaxed even after long periods of sitting.

**Adopted technologies**

- Arduino
- Accelerometers
- Light Sensor



**Keywords:** Study Station Project, wearable technology, wearable device, Health and Well-Being, Biomedical

<http://ami-2016.github.io/StSt/>



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Ambient Intelligence Student Showcase 2016  
<http://bit.ly/polito-ami>



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# 2015 showcase winners

**Student Showcase MARCOPOLI**

**Description**  
Giving everyone the opportunity to enhance their own campus experience is our mission. With MarcoPoli, students receive smart suggestions about the best places where to go. Moreover, stakeholders can monitor and gather statistics about the whole structure, or they can get sponsored on the platform. Avoid stress, avoid chaos: embrace MarcoPoli!

**Adopted technologies**  
HTML5 + jQuery + CSS3 + JavaScript  
RaspberryPi

**Keywords:** crowd detection • temperature • noise • maps • smart • responsive • place finder • expandable• adaptable

<http://ami-2015.github.io/MarcoPoli>

**Ambient Intelligence: technology and design 2015 edition**  
<http://bit.ly/polito-ami>

**Student Showcase Well Cleaned**

**Description**  
W.C. is a mobile application that allows users to check on the Politecnico map where all the bathrooms are located and to see their condition in terms of toilet paper, trash and soap.

**Adopted technologies**  
Proximity sensors  
Raspberry Pi 2  
Phonegap  
Google Maps APIs

**Keywords:** campus map, real time information, bathroom, student, cleaning staff member, notification, schedule

<http://ami-2015.github.io/well-cleaned>

**Ambient Intelligence: technology and design 2015 edition**  
<http://bit.ly/polito-ami>

**Student Showcase MyBikePlace**

**Description**  
MyBikePlace is a bike-parking managing system able to communicate with users through a dedicated mobile app. It suggests comfortable places for your bikes and protects them.

**Adopted technologies**  
Raspberry  
Android OS  
MySQL  
Pressure sensors  
GPS localization  
NFC detection

**Keywords:** efficient environment, safer bike-parking, tool-free

<http://ami-2015.github.io/MyBP>

**Ambient Intelligence: technology and design 2015 edition**  
<http://bit.ly/polito-ami>

# Ambient Intelligence?

Project	Sensitive	Responsive	Adaptive	Transparent	Ubiquitous	Intelligent
EasyPark	**	***	*	***	**	*
ItsYourTurn	***	**	**	***	*	**
MarcoPoli	***	**	***	***	***	**
MyBikePlace	**	*	*	**	**	*
NeverLate	**	**	**	***	***	**
NoNoise	**	*	*	***	**	*
Smart Make Your Bag	**	*	***	**	**	*
SmartClassSchedule	*	*	**	**	***	**
TrackDown	***	**	**	**	***	**
WC Info	**	*	*	***	*	*
Well Cleaned	***	**	**	***	*	**
Adaptive Online Radio	**	***	***	***	**	*
MyGuide	**	**	*	**	*	*
PoliRoute	*	***	***	**	***	**

# Questions?

**01QZP AMBIENT INTELLIGENCE**

Fulvio Corno

[fulvio.corno@polito.it](mailto:fulvio.corno@polito.it)



# References

- “Intelligent Environments: A manifesto”, Augusto et al., *Human-centric Computing and Information Sciences* 2013, 3:12, <http://www.hcis-journal.com/content/3/1/12>

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