POLITECNICO DI TORINO

e-Lite

Course Introduction

Ambient intelligence: technology and design

Fulvio Corno

Politecnico di Torino, 2014/2015

http://bit.ly/polito-ami

Basic information

- Title: Ambient Intelligence: Technology and Design
- Code: 01PRDxx
- Year: 3, Semester: 2
- Credits: 6
- Language: English (almost…)

http://bit.ly/polito-ami

Tattoo this!

Summary

- Goals and contents
- Organization
- Resources
- Exam
- 2014’s projects and Showcase
- 2015’s Project Theme

Course Introduction

GOALS AND CONTENTS

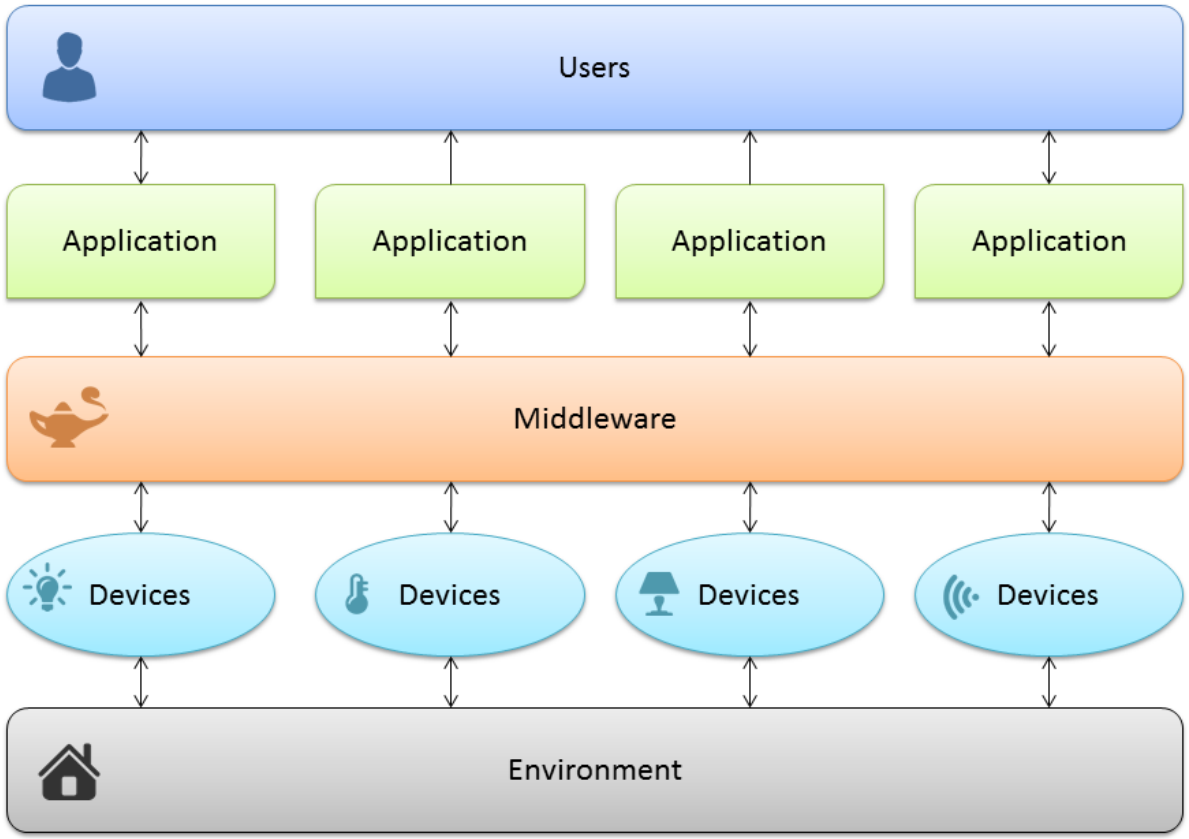
Goals

- 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 AmI 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."

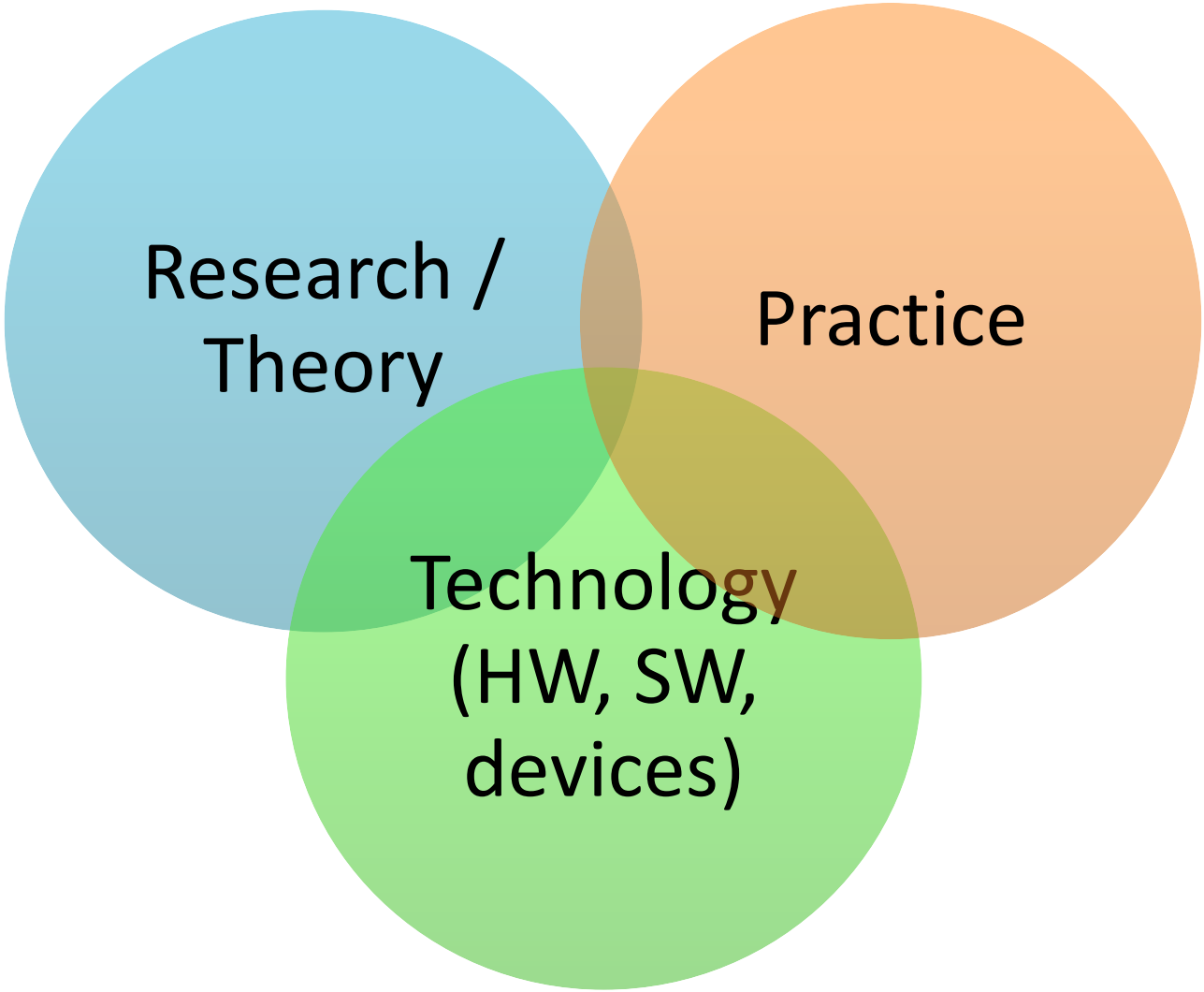
Reference architecture



Main contents

- AmI definitions, applications, systems: taxonomy and market overview
- Feature-driven design methodology
- Enabling technologies: Linux, hardware boards, python, Web, Dog3.0
- 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) AmI solution*

Course Introduction

ORGANIZATION

Teachers

- Fulvio Corno <fulvio.corno@polito.it>
- Luigi De Russis <luigi.derussis@polito.it>
  - Politecnico di Torino, Dipartimento di Automatica e Informatica
- Dario Bonino <bonino@ismb.it>
  - Istituto Superiore Mario Boella
- ~20 hours each, mixed Lecture / Exercise / Lab

Schedule

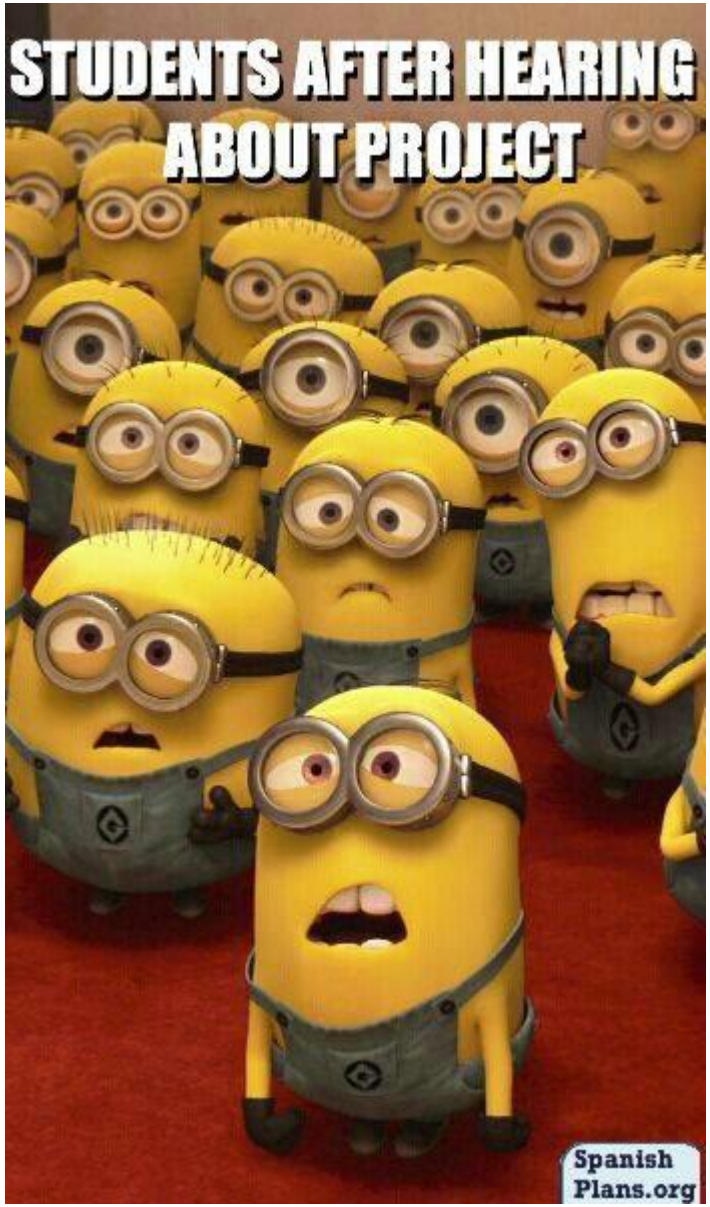
- Monday
  - 16:00-17:30
    - Room 4D (sometimes)
    - LADISPE (most of the times)
  - 17:30-19:00 (sometimes)
    - Room 4D / LADISPE
    - Free LADISPE access
- Thursday
  - 16:00-17:30
    - Room 3I
  - 17:30-19:00 (sometimes)
    - Room 3I

Updated week-by-week schedule on the course website (“Log” 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



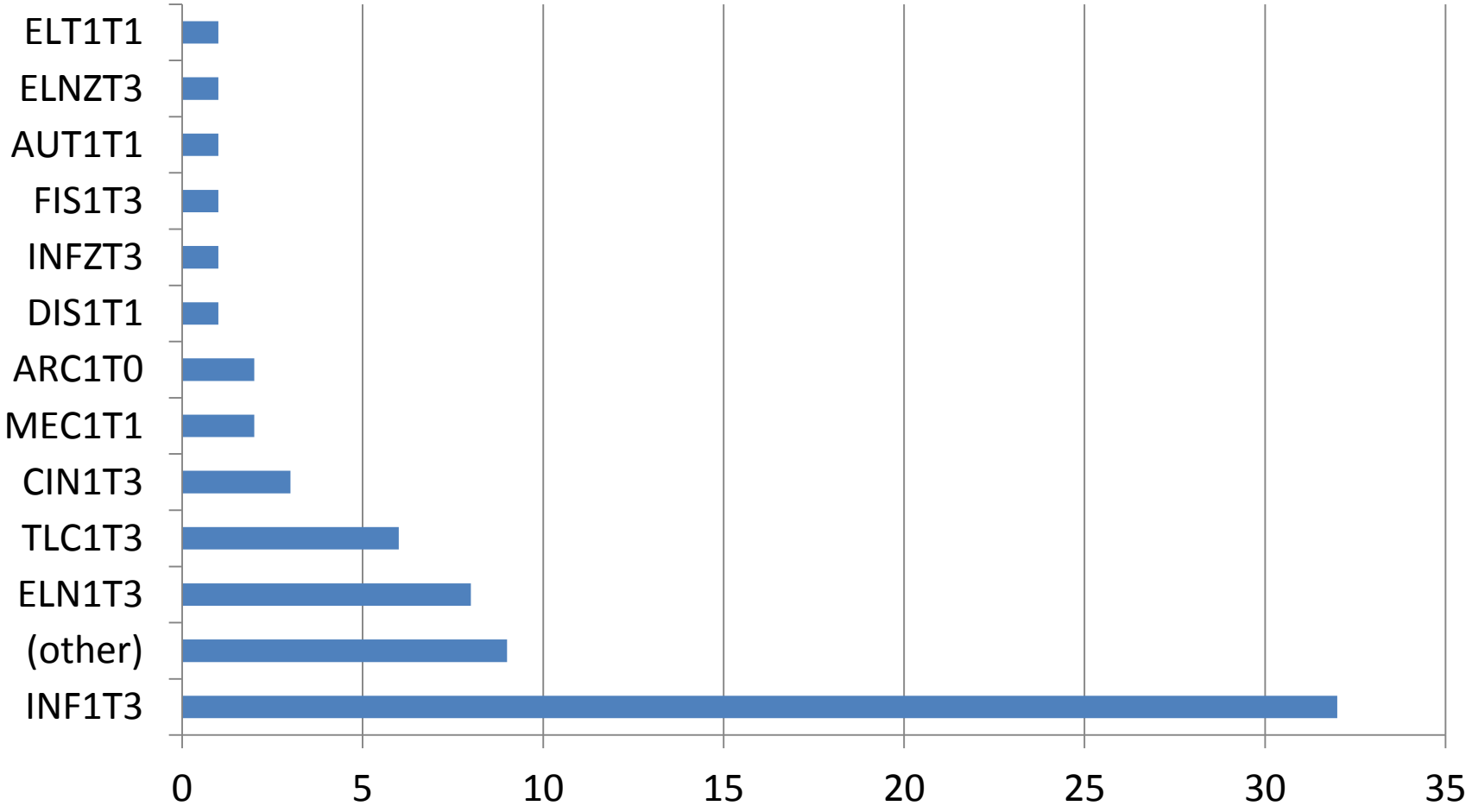
The Skewed Schedule

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

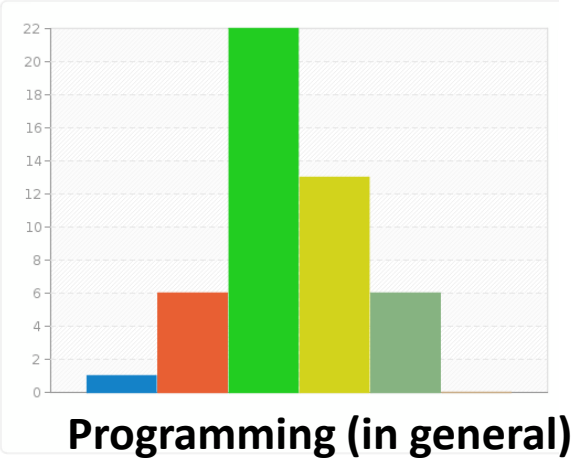
BETA

- Non-uniform distribution of hours
- Decreasing impact of classes
- Increasing time for supervised GW
- Increasing free time for developing the project

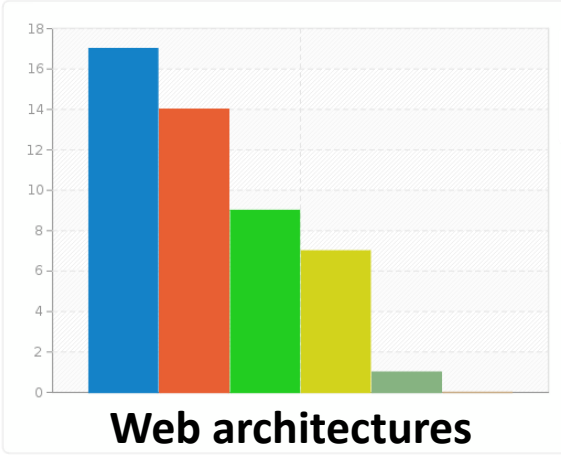
Students (about you…)



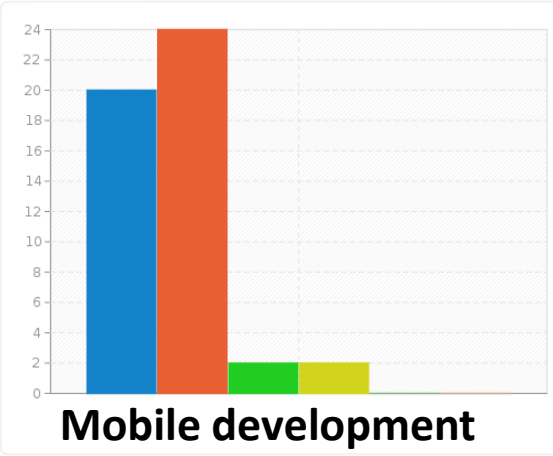
Skills



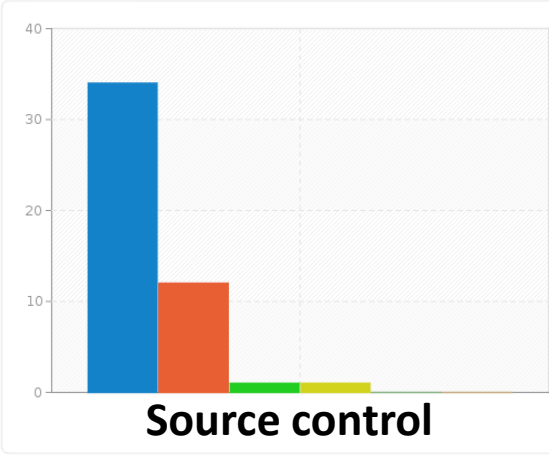
Programming (in general)



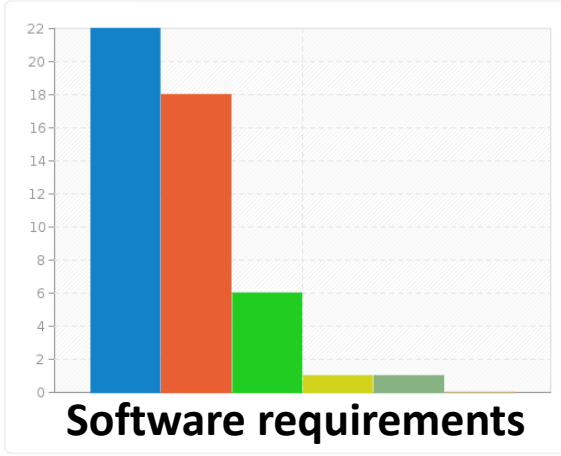
Web architectures



Mobile development

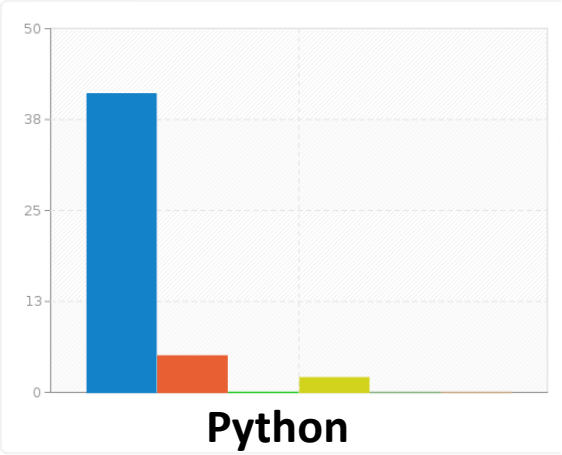


Source control

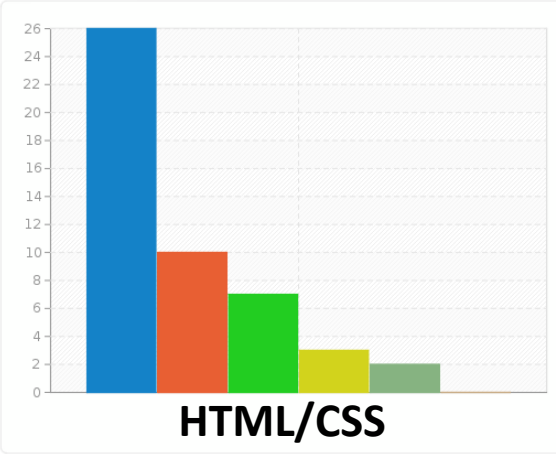


Software requirements

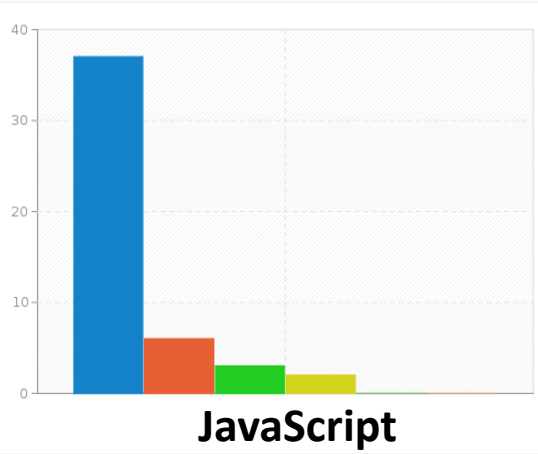
Programming languages



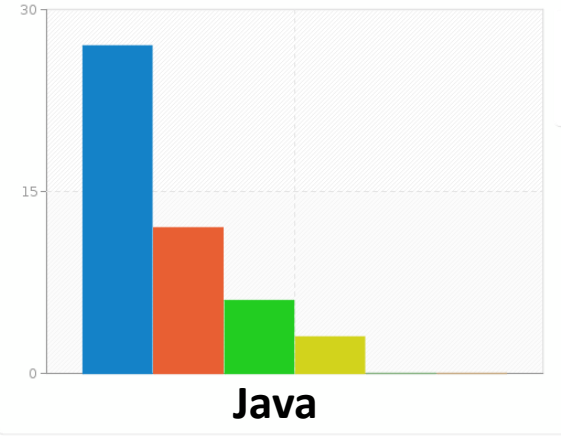
Python



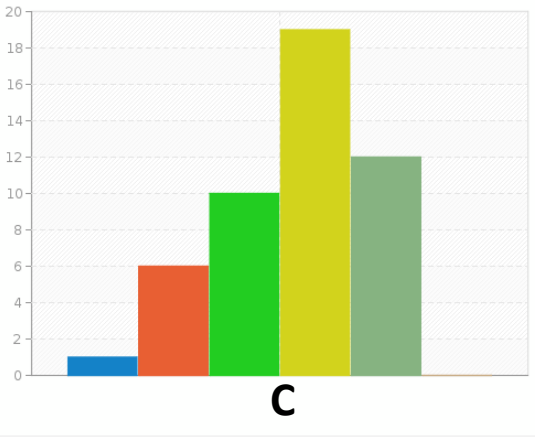
HTML/CSS



JavaScript



Java

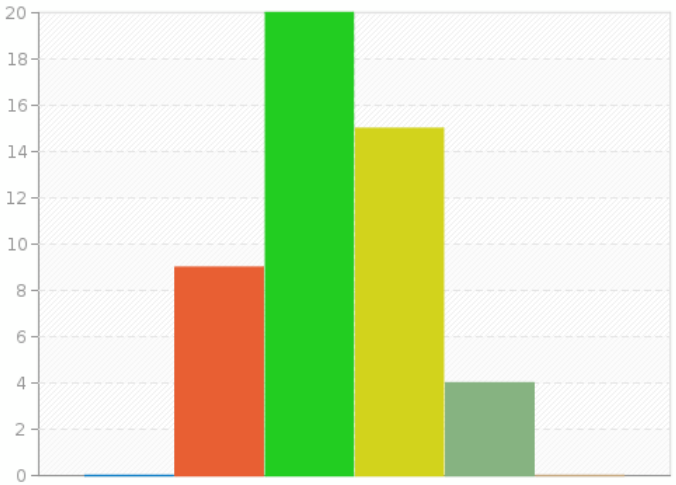


C

Others…

C++, Assembler, gawk, C#, PHP, Pascal, Matlab

Team working



Experience

Standard deviation	0.64
Average	3.58
Minimum	2.0000000000
1st quartile (Q1)	3
2nd quartile (Median)	4
3rd quartile (Q3)	4
Maximum	5.0000000000

Best group size

Course Introduction

RESOURCES

Course website

- http://bit.ly/polito-ami
  - Long version: http://elite.polito.it/index.php/teaching/current-courses/196-01prd-ami
- All lecture slides
- All exercise material (texts, solutions, examples, …)
- Reference papers, links, …
- Exams
- News and notices (official)
- Detailed (tentative) schedule
- Lecture video recordings
  - On your page on the Portale della Didattica

Additional on-line resources

- Facebook group, for open discussion and information exchange: https://www.facebook.com/groups/**polito.ami/**

- Slides will also be posted on slideshare (delayed w.r.t. the course website)

- Lectures will also be uploaded on youtube (at the end of the course)

Study material

- No suitable textbook for the whole course

- Teachers' slides
- Lecture videos

- Suggested books for some of the topics
- Suggested papers
- On-line technical documents

Course Introduction

EXAM

Goal and rationale

- The exam should assess the capability to design and develop some AmI 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

02/03-05/03: Project Theme Definition

19/03: Discussion on groups and project ideas

20/03: Submit group composition, repository creation

26/03: Submit Website + Vision [D1]

30/03: Project check, and Feedback on D1

13/04: Submit Requirements [D2]

27/04: Feedback on D2

05/04: Submit Architecture [D3]

11/05: Feedback on D3

14/05: Final Project Review

27/04—08/06: Supervised work group

Always: Free access to Ladispe

Always: Assistance and consultancy

EXAM
30/06, 21/07, 01/09

Public showcase
(optional, Sept.'15)

The exam (or, how to get 30+)

- Evaluation of documents (submitted in advance)
  - Project web site
    - Deliverable D1 (vision)
    - Deliverable D2 (requirements)
    - Deliverable D3 (architecture)
    - Presentation video
  - Project sources on github
- Oral exam
  - Presentation (15 minutes)
  - Demo (5 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

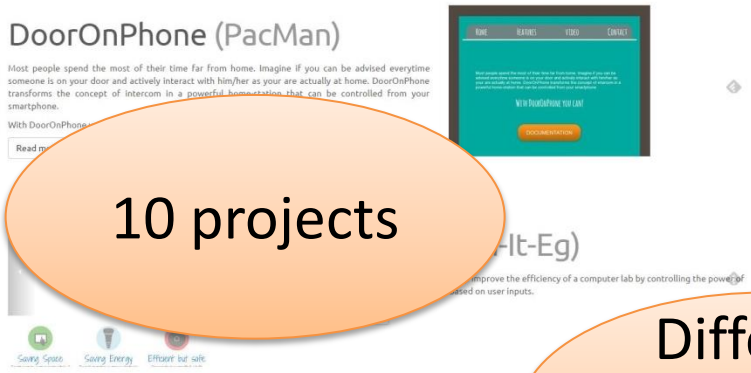
Tips and suggestions

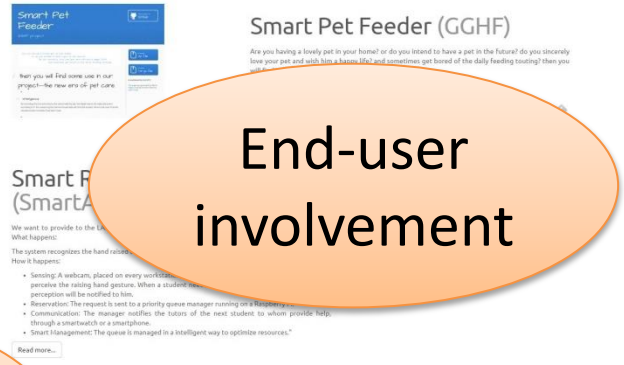
- Start sooner than later
  - Really
- Don’t aim too high
  - Modular features
- Seek interaction
  - Ask for feedback and suggestion
  - …and listen to them
- Exploit the LAB hours
  - Proposed labs, Supervised WG, Free hours, …

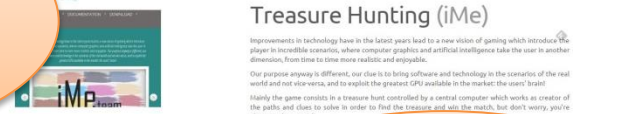
Course Introduction

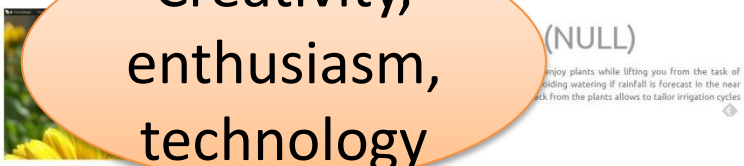
2014’S PROJECTS AND SHOWCASE

Successful projects









10 projects

End-user involvement

Different application domains

Creativity, enthusiasm, technology

Multi disciplinary approach

From the idea to a working prototype

Successful projects

DoorOnPhone (PacMan)

Most people spend the most of their time far from home. Imagine if you can be advised everytime someone is on your door and actively interact with him/her as your are actually at home. DoorOnPhone transforms the concept of intercom in a powerful home-station that can be controlled from your smartphone.

With DoorOnPhone you can!

Read more...

Smart Pet Feeder (GGHF)

Are you having a lovely pet in your home? or do you intend to have a pet in the future? do you sincerely love your pet and wish him a happy life? and sometimes get bored of the daily feeding touting? then you will find some use in our project—the new era of pet care

Read more...

Set App (Ten-It-Eg)

The purpose of this project is to help improve the efficiency of a computer lab by controlling the power of the workstations and the lights based on user inputs.

Read more...

Smart Raise Your Hand (SmartAttack)

We want to provide to the LADISPE a smart system able to manage the help requests of the students.
What happens:

The system recognizes the hand raised and assures the reservation for getting help from the tutor.
How it happens:

- Sensing: A webcam, placed on every workstation, sends continuously images to a program able to perceive the raising hand gesture. When a student needs help he rises his hand, until the gesture perception will be notified to him.
- Reservation: The request is sent to a priority queue manager running on a Raspberry Pi.
- Communication: The manager notifies the tutors of the next student to whom provide help, through a smartwatch or a smartphone.
- Smart Management: The queue is managed in a intelligent way to optimize resources."

Read more...

Smart Butler (Sm

The Smart Butler project aims to create a system able
environment.

Read more...

http://ami-2014.github.io/

Smart Gardener (NULL)

Smart Gardener is a project that would allow you to enjoy plants while lifting you from the task of watering them. It would also optimize resources by avoiding watering if rainfall is forecast in the near future or if the day will not be particularly hot. Feedback from the plants allows to tailor irrigation cycles to their specific needs without manual input.

Read more...

Smart Routine Optimizer (PiSquared)

What if you could come home to a comfortable and warm environment?
What if you could forget about controlling your home's heating system?
What if you cut down your energy bill without doing anything?
What if you never run into a cold shower again?
What if could wake up to a hot cup of coffee?
What if you could buy a product that did all this and more for you?

At PiSquared© we have worked hard to ensure our customers find more than what they are looking for.
SRO knows what and when
SRO controls desired appliances when you need them without you having to move a finger. Yes, it's that simple. You can sit back, relax and enjoy life while SRO does the tedious things you would rather not do. Lowering the temperature at night to save energy, turning on the shower's heating system in the morning, the coffee machine, the TV, the alarm when you're gone... are all things of the past.

Read more...

Smart Notifications (TAP)

Smart notifications are reminders for the users of the system to help them keep track of several activities to do, places to go to and events to attend. It can sometimes be difficult to remember all of these duties due to the fact that many of these notifications reside on different platforms that are not integrated with each other. Our Smart Notifications system aims at providing an efficient way to solve this issue!

Read more...

Never be locked outside your apartment again! (YAAIG)

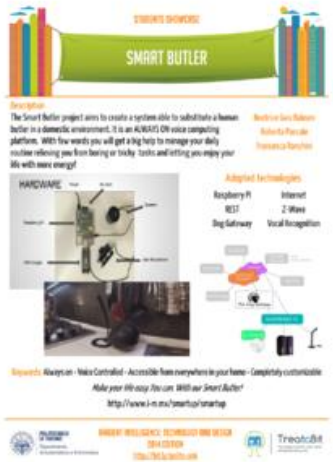
The idea of the project consists in preventing the user from leaving the room forgetting important objects such as wallet, phone, keys and similar objects. Everyone can benefit of the system because it exploits low cost hardware and doesn't require any direct interaction.

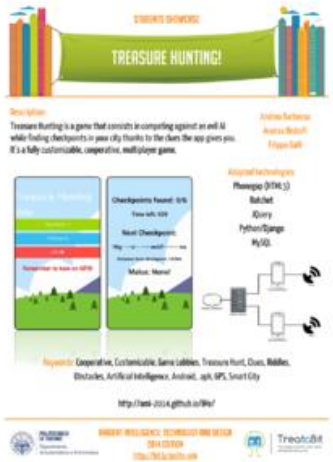
When the user is leaving the room, the system can detect if he's not carrying some important object and warns him in multiple ways. It can also check presence of the objects when the user gets back in the room.

The system can warn the user on ad-hoc devices or on smart devices such as smartphone or smart watches.

Read more...

Student's showcase @ I3P





Student's showcase @ I3P

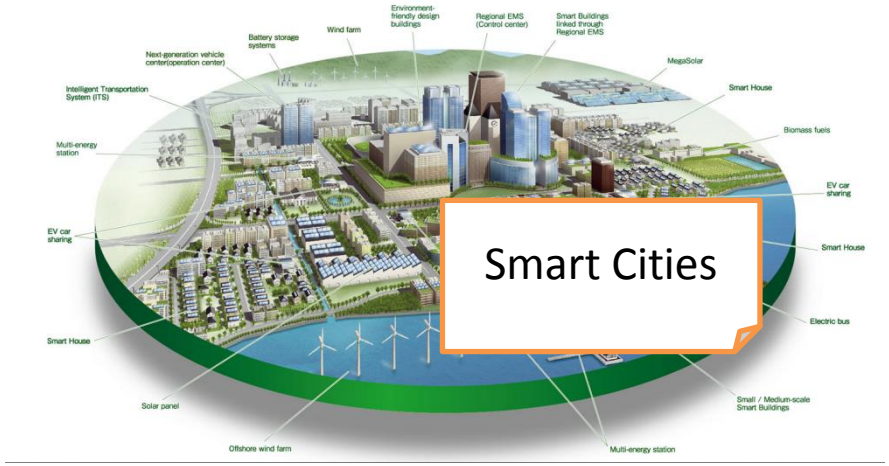
Ambient Intelligence?

	Sensitive	Responsive	Adaptive	Transparent	Ubiquitous	Intelligent
Smart Pet Feeder	★	★				★
Door On Phone	★★	★★	★	★★★	★★★	★★
SétApp	★★	★★		★	★★	★
Smart Butler	★	★★		★★	★★	★★
Smart Gardener	★★★	★★	★★	★★	★	★★
Smart Raise Your Hand	★★	★	★	★★★	★★★	★★
Smart Notifications	★★	★★★	★★★	★★★	★★	★★
Treasure Hunting	★	★★	★	★	★★★	★

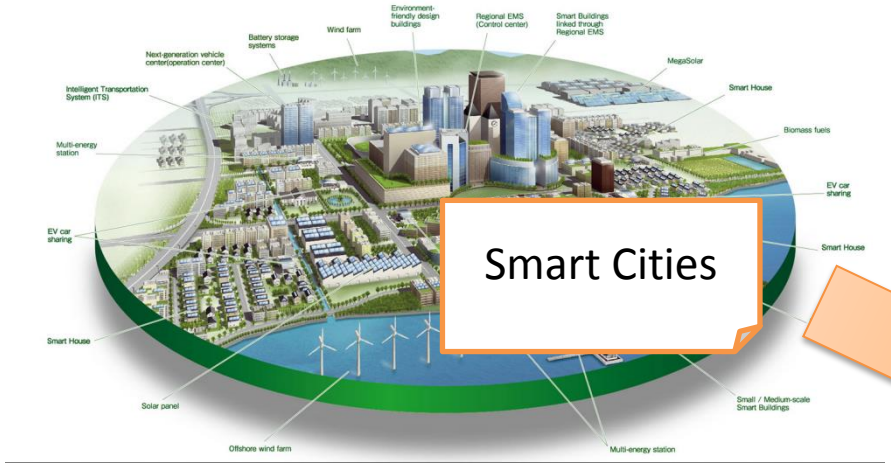
Course Introduction

2015’S PROJECTS THEME

Project Theme for 2015



Project Theme for 2015



Smart Cities

Politecnico di Torino

Smart "Cittadella Politecnica"

Smart “Cittadella Politecnica”

- How can the campus be “smarter”?
- For end-users
  - Students (enrolled & visiting)
  - Teachers & staff
- What services, which information, how to interact, …
- Must be feasible within the exam constraints

- Some ideas in the student survey, keep brainstorming!
- More hints in Thursday’s class
- Deadline: 19/03 (group + project title)

Questions?

01PRD AMBIENT INTELLIGENCE: TECHNOLOGY AND DESIGN

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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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