Ubiquitous & Context-Aware Computing

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&

Possibly, Lorenzo Bellini

Foreword

- Feel free to interrupt me anytime to ask a question
- Whatever doubts you may have are right
- **It doesn’t exist a dumb question!**

  … possibly, there are questions:

  – Out of the scope of this course

  – Asked too early

  – …

1 or 2 lessons

INTRODUCTION TO THIS COURSE

What We Will Do Today?

- Today we will answer to simple but important questions on the course

Who, what

When

How

Why

Where

Table of Contents (1/2)

- Who am I?
- Who are you?
  - Why do you choose to attend this course? Etc.
- What is this course about?
  - Educational goals
  - Motivation
  - Content

Table of Contents (2/2)

- Practical & organizational information (exam, where to find the material of the course, etc.)
- Introduction to the research area (various lessons)

Who am I? (1/4)

- From 1982 till 1989:
  - Programmer, teacher of courses for companies (as a student)
  - Bachelor's degree in "Scienze dell'Informazione" @ Unimi (1989)
- From 1989 till April 2002 @ Unimi & Unimib as "assegnista, borse di studio, etc."
  - CSCW, Context-awareness, HCI, WMS, KM (see next slide)
  - CoP, community-ware (Project manager in the European founded project Campiello, '97-2000) (…continue)

Who am I? (2/4)

- KM, HCI, User-Centred Design (we will see in this course), Seductive Design
  - Possibly in this course see next slides with related courses, Participatory Design
- Klee, European founded projects (1997-2000) we will see in this course
- Milk, European founded project (???)

April 2002: I became researcher and moved to Unimi!!! ☺

Who am I? (3/4)

- From April 2002 till September 2006 at Unimi:
  - Mobile & adaptive computing, Adaptive & context-aware Web services, modeling context (by using formal languages & ontologies), design & development of CARE (a middleware to support adaptive applications)

Who am I? (4/4)

- October 2006 - till now: I became Associate Professor!!! ☺ and moved back to Unimib again
- September 2006 I have had a baby ☺ and my participation in international and national projects became more difficult ☹. Anyway:
  - Ubiquitous Computing, Social networks (blogs, …), HCI
  - Educational projects using Large Interactive Displays (possibly, we will see in this course)

Who are you & Why are you here today?

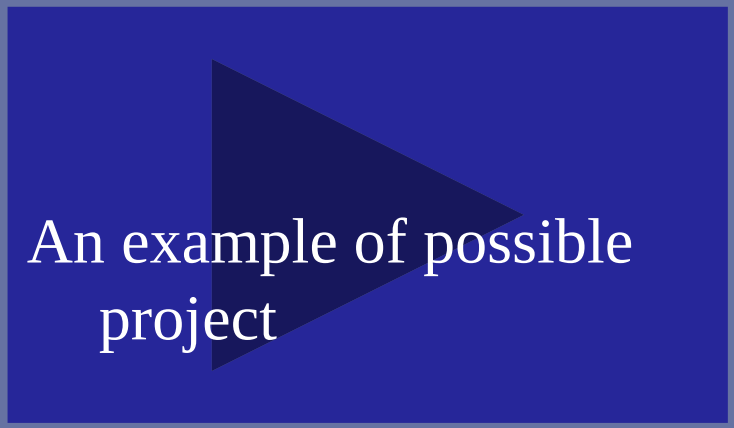
- How many students of Informatics?
- How many students of TTC?
- Why you are here today?
- Do you already have my course in your curricula?
- Which are your motivations to follow this course?
- Which kind of content do you aspect to find in this course?

WHAT THIS COURSE IS ABOUT?

Educational Goals (1/4)

- Ability to design ubiquitous/pervasive applications which are adaptive to the context of interaction of the users:
  - Focused on (group of) **users**
  - **Adaptive** to the context & personalizable with respect to the user
  - Allowing an **aware** and **contextualized** action of the users
  - Able to stimulate and support the creation of **knowledge**

Educational Goals (2/4)



Vedere video Mozilla SeaBird (in Video Vari)

Educational Goals: two students' examples 3/4

Vergilius

Cimitero Monumentale di Milano

(Vedere video in Video Vari)

Visual Message System

Educational Goals: some examples 4/4

- You can find more examples within the “forum per studenti” of Moodle of the previous academic years

Motivations

The wide variety of interaction devices (fixed and mobile) together with the multiplicity of user's contexts of the applications ask for designing and developing systems which are **aware** of the information characterizing each single & unique human-machine interaction, in other words **context-aware**

Only context-aware applications can be really **useful** to people

Contents [1/2]

- Main principles of Ubiquitous Computing
  - **Ubiquitous** vs Pervasive vs Mobile vs Internet of Things (IoT) vs …
- Context & Context-Awareness
  - Definitions, techniques for modeling & using the contextual information (in the field of ubiquitous/pervasive systems supporting **group** of users)
- Seminars
  - Mobile Computing, modeling of context-awareness, the problem of privacy in mobile computing, ITSME, CARE, app supporting blind people, …

Contents: the focus [2/2]

- The course focus on:
  - The information of the context denoted as «social» and, in general, that information which are more difficult to «collect, model, calculate, use»
    - E.g., Group, community, circles (google?), venue (ITSME)
  - The design process:
    - User-centered, Interaction Design, Participatory Design

      Versus

    - Artificial Intelligence (NO automate), Traditional Software Engineering (e.g., NO cascade process without user's involvemnt), …

Some Related Courses

- Strumenti e applicazioni del Web (Giuseppe Vizzari) – TTC - I anno
- Gestione della Conoscenza (KM) (A. Agostini)- TTC & INFO – I anno
- Laboratorio di Interaction Design o Laboratorio di Progettazione (G. De Michelis) – INF e TTC – II anno: various commonalities (Participatory Design, Interaction Design, Seductive Design) You will tell me the differences!!! I already know that the relationships between the students and the Professor are totally different

PRACTICAL & ORGANIZATIONAL INFORMATION

Organization of the Course

Tuesday: 16:30 – 18:30 Room **T023**

Friday: 15:30 -18:30 – Room **T024**

There are 2 CFU of practice & 2 of laboratory therefore:

- Many time we will discuss the progress of your group-work (see next)
- Sometimes you will work alone and we will skip the lesson

Organization of the Course: Exam

The English/American method: part of the exam is carried out during the lessons

Composition of the exam:

- Preparing a presentation deepening a topic*
- Classroom participation and posting on the forum
- Designing and possibly developing a simple pervasive & context-aware application* which **doesn't exist (innovative)**
- Oral: concepts + 3 lessons of the colleagues

* Related in order to create synergy

Exam: the vote

The vote is calculated by using the following criteria:

- 30% presentation on a topic (group)
- 30% project (group)
- 10% participation during the course (in the classroom and on-line) qualitative evaluation (individual)
- 30% oral evaluation (individual)

Presentation [1/3]

- Some material is provided by the teacher:
  - Ex. Material collected by a group of students in a.a. 2012-2013
- The group must be composed of 3 students:
  - It must be 1 student of Informatic & 2 students of TTC

Presentation [2/3]

- Calendar
  - Beginning of work on presentation
    - **End of October**
    - First In First Served policy in choosing :
      - The topic
      - The date of the presentation
    - NO overlapping on the topic, yes synergy among groups
    - The vote is given to the group
  - Beginning of work on the project
    - **Beginning of December**

Presentation: some hints

- Where to search
  - Some useful sites:
    - Google Scholar, Research Gate
    - ACM DL, IEEE DL, *Springer*, DBLP
- Which material to select
  - Both academic/scientific and on the market (e.g. apps on Google store, Videos on YouTube, …)
- You must mention the source

Evaluation of the presentation & of the project (1/3)

- Criteria to evaluate the in-depth analysis & its presentation:
  1. Quality of the found material
     - The material MUST include innovative researches both in the market place and in international conferences, workshops, and journals
  2. All students (TTC/INFO) have to understand the complete presentation
  3. The presentation have not to be boring

Evaluation of the presentation & of the project (2/3)

4. Respecting the timing of the presentation (30 minutes)
5. Quality of the slides:
   - No typos
   - Overview with differences of the various analysed systems
   - Good structure
   - Presentation in English (optional)

Evaluation of the presentation & of the project (3/3)

- Criteria of evaluation of the project:
  1. Degree of innovation
  2. Quality of the relation
  3. Degree of completeness of the design
  4. Complexity of the presentation of the project: presentation by using slides, video, mock-up, demonstrator, prototype

Introduction

UBIQUITOUS COMPUTING

The Coming Age of Calm Technology

&

Open House

&

His home-page

by

Mark Weiser (1952-1999)

et al.

*Lucidi, fine anni ’80, M. Weiser liberamente rivisti da A. Agostini;
i dettagli degli articoli citati NON sono nei lucidi vedere Moodle

The Coming Age of Calm Technology

- Phase I – The Mainframe Era

- Phase II – The PC Era

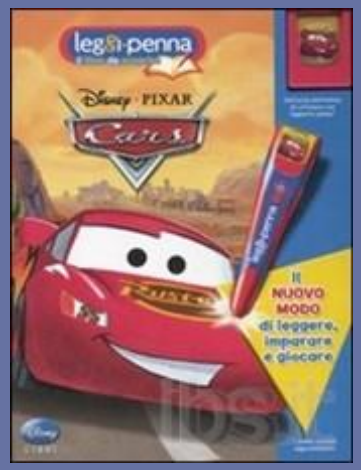
- Phase III – The UC/Ubicomp Era

The UC Era

- Lots of computers sharing each of us
  - Internet servers
  - Embedded/wearable computers
- Technology prerequisites
  - Internet
  - Microprocessors
- From thin clients to thin servers
  - Everything is adressable (over IP)

Some Examples of Technology embedded in everydays objects (1/2)

- Some examples of technology in Educational Toys
  - Leggi penna disney
  - Clementoni: Penne elettroniche (wireless) versus Sapientino con 2 penne wired



Some Examples of Technology embedded in everydays objects (2/2)

- In-depth analysis of pen & paper interaction:
  - sd-X Interactive Technology
  - Campiello project
  - livescribe smart pen 2 (vedi Video vari)

What is NOT Ubicomp?

- Virtual Reality:
  - "VR puts people inside a computer-generated world, UC forces the computer to live out here in the world with people."
- Mobile Computing
  - "UC is nor a superset nor a subset" of Mobile Computing
  - ""UC"… does not just mean computers that can be carried to the beach, jungle or airport."

M. Weiser

Ubicomp: some details (1/3)

- Various different **computers*** for doing many different tasks. Different in size & numbers:
  - inch/tab, foot/pad, yard/board
  - 100, 10, 1-2
- Computers who know where they are
- “Ubiquitous computing pushes the *user interface* away from the desktop and into our everyday environments”

*Il termine computer, nel corso, verrà usato in senso lato: dispositivi, tecnologie, ecc.

Ubicomp: some details (2/3)

- UC integrates social & human sciences, computer science, engineering, & *'design'*

UC, some details (3/3)

- Computers:
  - invisibili e discreti: “If computers are everywhere they better stay out of the way”
  - usati *inconsapevolmente*: scompaiono dal focus centrale del nostro pensiero
  - integrati *seamlessly* nell’ambiente per migliorare la nostra vita quotidiana
- Some examples & similarities:
  - 1) Writing (& reading): alphabetization versus scribe; 2) Electricity 3) Olivetti ActiveBadge

UC & Disappearing Computers & Calm Technology

The most profound technologies are those that **disappear**. They weave themselves into the fabric **of everyday life** until they are **indistinguishable** from it.

Mark Weiser

Ubicomp & Disappearing Computers

- “Such a disappearance is a fundamental consequence NOT of technology, but of human psychology
- Whenever people learn something sufficiently well, they cease to be aware of it
- When you look at a street sign, for example, you absorb its information without consciously performing the act of reading”

Mark Weiser home-page at (Xerox) PARC

Ubicomp & Disappearing Computers

- “Computer scientist, economist, and Nobelist Herb Simon calls this phenomenon "**compiling**"
- Philosopher Michael Polanyi calls it the "**tacit dimension**“” Mark Weiser home-page at (Xerox) PARC

…,

- John Seely Brown & M. Weiser at (Xerox) PARC call it the "**periphery**" (see next slides)

Ubicomp & Disappearing Computers

- Everybody “say that only when things disappear in this way **we are freed to use them without thinking and so to focus beyond them on new goals”**

Calm Technology

- Encalms and informs
- The users remain serene and in control
- Engages our peripheral attention
  - Allows us to attune to more things
  - A large portion of our brain is devoted to peripheral processing
- Moves easily from center to periphery and back
  - Recenter to take control
  - Ex: Car engine; when not OK we notice it

Calm technology & Affordance

- Calm technology is related to the notion of affordances
- An affordance is a relationship between an object in the world and the intentions, perceptions, and capabilities of a person

Calm technology & Affordance

- Calm t d to the notion
- An affo nship betwee world and the inte s, and capabilities of a person
- A flat push plate in the side of a door that only pushes out is an example of good affordance

Vedere lavori di: Gibson, Gaver, Norman (il famoso Design of everyday things)

Examples of calm technology

- Maggiore informazione che tranquillizza:
  - **videoconferenze** versus conferenze telefoniche
- Non è solo un problema di Interfaccia Utente:
  - **Inner office windows** versus open space
    - Peripheral two way information channel
    - You can catch the other person’s attention

Examples of calm technology

- Maggiore ir nquillizza:
  - **videocon** enze telefoniche
- Non è solo rfaccia Utente:
  - **Inner offic** en space
    - Peripher nnel
    - You can tention
- I computer attuali non sono davvero multimediali, il focus è sempre sul computer:
  - **Dangling string**
    - Rotation speed connected to network traffic
    - motion(vision), sound and touch

Open House - M. Weiser, 1996

A few years ago I found myself on a stage at the MIT Media Lab, arguing with Nicholas Negroponte in front of 700 people. Nick was rhapsodizing about a world in which computerized "intelligent agents" will answer our every need.

To illustrate Nick's idea, an actor dressed as a butler introduced speakers and entertained the audience with snide remarks. The butler was fun, up to a point, but also distracting and intrusive. Fortunately, Nick was wrong about what to expect from the third wave in computing. The defining words will not be "intelligent" or "agent", but rather "invisible" and "calm" and "connection".

Open House, Mark Weiser

Many persons per computer → Many computers per person

~~Interacting~~ with computer → **Dwelling** with computers

~~Smart~~ houses/ applications/assistants →

Dwelling with computers vs Interacting with computers

- Interacting with computers
  - Computers will inhabit the most trivial things
  - Interacting with something keeps it distant and foreign
  - **We don’t want to interact with our everyday environment in the same way as we interact with computers**

Dwelling with computers vs Interacting with computers

- Dwelling with computers:
  - Co-exist comfortably
  - Provide clues about environment
  - We can ignore them most of the time
  - Like weather, street sounds
  - Suggestive but not intermediating
- Examples
  - Augmented window
  - Wake up music-chooser

Smart People versus Smart Computers

- Previous (r)evolutions in computing were about bigger, better, faster, smarter
- **Smart is a bad metaphor**
- Does all things get better if they get smarter?
  - Smart house => better house?
  - Smart Cappuccino?
- Next computing revolution must focus on **smarter people**:
  - Machines take care of unnecessary details
  - People can think (care) about less
- It is not enough to put computers everywhere. You must specify what they should do

UC: Yesterday's Tomorrows by Dourish & Bell

- M. Weiser vision dates back to al 1988, the *UC era* is now. The *UC era* is quite different:
  - There are a myriad of devices and services not orderly
  - There isn't *calm technology*, the technology is neither invisible nor intrusive
  - There are more and more smart objects