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ICT Innovation – Spring 2018

MSc in Computer Science and MEng Telecom. Engineering
MA in Innovation Management
EIT Masters ITA, S&P, VCC

Lecture 00 – Administrative Details
Prof. Fabio Massacci

https://securitylab.disi.unitn.it/doku.php?id=ict_innovation

Key People of the Course

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- **Main Lecturer**
  - Fabio Massacci, Prof. In Security and Risk Economics
- **Core Reviewers**
  - Massimo Donelli, Prof in Wireless Communication
  - Stefano Tranquillini, PhD in Service Engineering, CTO of Chino
  - Bernardo Villalbafrias, PhD in Embedded Systems
- **Feedback from**
  - EIT Digital Business Developers

Course Objective

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- **Myth:**
  - Product design and development is essentialy creative so it cannot be structured
  - It requires a talented individual (e.g. Steve Jobs)
  - The first inventor of a good-enough technology conquers the market
- **Reality (concise version)**
  - "Genius is 1% inspiration and 99% perspiration". T.A. Edison (Quoted in the Harper's Magazine)
- **Reality (extended version)**
  - Product development includes many steps that can be documented and analyzed. They can therefore be learned and, possibly, improved.
  - Product development requires a wide range of skills ranging from software engineers to marketers, from industrial designers to manufacturing engineers
  - The first-comer has an advantage ONLY if it keeps innovating its original product
- **Course Objectives**
  - Illustrate (some) steps of product design and developement and guide students, forming multi-disciplinary teams, into the development of a "product" as opposed to just a "project".
- **Which steps we don't do**
  - Complex Market, financial analysis etc. etc. → Business Development Lab Course

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Overarching Learning Objectives

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- **Course should develop and evaluate your abilities in**
  - Creativity
    - How to solve problems when not all steps are completely specified (this what you should try to do with your design/architectural result)
  - Intellectual Transformation
    - How to transform an idea into a product (the first "brainstorming" step is your research canvas, the last one is the final product)
  - Leadership
    - Organize yourselves into a team and arrive to make a final product (you should try to leverage on each other's competences)
  - Making value judgement
    - Decide which parts are important and which are not so important based on ethical and social considerations

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Course Structures

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- **Lectures on Product Design and Development**
  - Introduction
  - Product specifications
  - Concept (Mostly selection and testing)
  - Product architecture
  - Prototyping and robust design
  - Patents and intellectual property
  - Basic finances: net present value
- **The rest is team work**

Course Grading – PDD Part

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- **Creation: Research Canvas (up to 10/30 grade points)**
  - Each team will produce a research canvas to clarify the ideas on how to make it a product
- **Design: Product design and architecture (up to 10/30)**
  - Each team will produce a poster explaining how their product will work
- **Production: Product demonstration (up to 15/30)**
  - Each team will have a small budget for hardware/software and will have to actually present a working product. As you have also MAIN students you will need evidence that you have talked to some customers.
- **Advertising: Video and Documentation (Up to 4/30)**
  - Video and 4 A4 pages product sheet describing key characteristics of the product, target customers, main usage model, tentative cost/pricing structure
- **Participation to feedback sessions is mandatory**

Course Grading – Up to your ECTS

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- **Baseline – Product Design and Developement (PDD)**
- **EIT Students (9ECTS)**
  - PDD + EIT Summer School Grades
  - These normally arrives end of August please be patient
- **DISI "ICT Innovation Students" (9ECTS)**
  - PDD + Write a technical report on the product architecture and implementation
- **DEM MAIN Students (8ECTS)**
  - PDD + Write a business report on the product customers and markets

On the Mathematics of ECTS

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- **Some preliminary observation**
  - 1 ECTS = 25hours of student works per student
  - 2-3 ECTS = 2-3weeks of full time work per student
  - 5-6ECTS (the PDD part) = 1.5 Month of full time work per student
- **Group Work Arithmetics:**
  - Multiplication of roles and division of effort → Ahi, ahi
    - Since are in five 1.5Month/5=1 week, so we work 1 week each, how come we don't get a brilliant grade?
    - Well in five you worked for one and produced the correspondingly poor outcome that one person could have produced alone. But 30/5 = 6 which is not enough…
  - Division of roles and multiplication of effort → Good
    - If you work in group the outcome should be proportionally multipiedy by the number of group members each one working on a different part depending on his/her capacity.
- **Example**
  - Alice don't know what a program is and Bob only talks to PCs and not humans
    - Good → Alice makes a deep customer analysis with interviews and Bob focus on coding
    - Bad → The customer analysis done by both in their spare time and the coding as well → both sucks and unsurprisingly they group got a very bad grade

The Hardest Part

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- **You chose your own customers but then…**
  - The hardest part is not having the idea of the product and having the idea of the market
- **The hardest part is connecting**
  - What can be technically done with
  - What the customers expect and
  - How the customer can actually use it
- **Something can be**
  - Technically cool but impossible to use
    - This is the typical "project" of Engineering courses
  - Cool to use but impossible to realize
    - This is the typical "product idea" of Business courses
- **Most grade points are lost on these two weaknesses**
  - That's why we have the feedback sessions, to avoid suprises at grading time and giving you time to come up with fixes. Use them!

The "Research Idea" 1

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- **2015 Starting Idea: "Keysweeper"**
  - KeySweeper is a stealthy Arduino-based device that wirelessly and passively sniffs, decrypts, logs and reports back (over GSM) all keystrokes from any Microsoft wireless keyboard in the vicinity.
    - http://samy.pl/keysweeper
- **Objections:**
  - This is illegal, how can it be a product?
    - Well, not if you are a law enforcement officer, authorized penetration tester, etc. etc. This is a big market.
  - The idea is already described what else to do?
    - It is NOT a product. You can't "search on Google to find the specs". You need a Web Server. Equally you need a reliable way to sniff the band cannot just "try the various alternatives"
  - It is a lot of work to make it a product, how can we do it?
    - You are a team of 4+ people. You need to divide the work. If somebody really doesn't work you come to see me and we discuss the issue F2F

The Spy Keyboard Sniffers

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- We have invented a wireless keyboard sniffer that we want to sell to the NSA and other law enforcement agencies doing legal wiretapping.
- It listen to the people typing on the keyboard, hacks the keyboard code, recognize selected keywords in real time and sends data in real time via a GSM card.
- Everything fits into a 35cm side cube that is connected to the main power with a separate adapter to provide longest duration and sniffing time.

What Can Go Wrong?

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- Maybe a bit too big
- Person might realize you are listening and type different things
- Could be good if components are cheap
- If I am the NSA maybe I don't want a product that everybody can replicate
- Software is harder to patent but in this case youàll patent the device

The Spy Keyboard Sniffer II

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- **We have invented a wireless keyboard sniffer that we want to sell to the NSA… It listen to the people typing on the keyboard, hacks the keyboard code and**
- **Useless**
  - "recognize selected keywords in real time and sends data in real time via a GSM card. Everything fits into a 35cm side cube that is connected to the main power with a separate adapter to provide longest duration and sniffing time."
  - You need power and space for a listening card, processing and a separate GSM card → you build something so conspicuous that the NSA could send them a letter saying "hey lady, don't you mind us spying on you?"
- **Useful**
  - "It looks like a small USB charger (and can work as such) but is also battery operated. Everything is stored into an EEPROM and if you try to open it without care it shunts and erase the memory."

The "Research Idea" 2

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- **2016 Starting Idea: "SkyJack"**
  - SkyJack is a drone engineered to autonomously seek out, hack, and wirelessly take over other drones within wifi distance, creating an army of zombie drones under your control.
    - http://samy.pl/skyjack/
- **Objections:**
  - This looks illegal, how can it be a product?
    - Well, not if you are a law enforcement officer, authorized penetration tester, etc. etc. This is a big market.
    - For example it could be a DogDrone fending off drones from your own land or finding and reconnecting out drones that lost control for whatever reason (eg stolen drones…)
  - The idea is already described what else to do?
    - It is NOT a product. You can't "search on Google to find the specs" of Parrot MACs each time a drone enter your property and hack it on demand. You need a proper Web Server addressing the alternatives. Equally you need a reliable way to hack cannot just "try the various alternatives" people who will buy your thing aren't hacker.
  - It is a lot of work to make it a product, how can we do it?
    - You are a team of 4+ people. You need to divide the work!

Group Y: The Drone Repeller

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- We have invented a drone repeller to cover large properties and villas, for example by celebrities. If there is a drone invading your property it wirelessly hacks the drone and send it back.
- To maximize its duration and property coverage it is a completely echological product as we sell it in the form of those garden lamps with solar powered batteries.
- It is connected to a home web-server for configuration and customization, and monitoring.

What Can Go Wrong?

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- The spying drone fights back and hacks your anti'drone
- Should celebrities going to pay for this
- Drones has wrong type of software is not affected by your defense
- Is it legally to hack other people drones if they are not trespassing probably not but if they are_
- They have listen to all wifi and make sure
- Can be intereference with other devices_

How it is powered at some point there is not going to be sunlight and it going off

The Drone Repeller II

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- **The idea looks cool**
  - We have invented a drone repeller to cover large properties and villas of celebrities. If a drone invades your property it wirelessly hacks the drone's wifi connection and sends it back.
  - To maximize duration and coverage it is an echological with solar powered batteries.
  - It is connected to a home web-server for configuration and customization.
- **But is technically unworkable**
  - Solar powered batteries can at most power a dim lamp. They cannot power a WiFi card, a CPU processor, that is constantly prodding for invading drones…
  - The web based configuration (given the uncertainty of ranges, devices, maps, etc) … needed a dedicated IT technician to mantain it.
- **Workable solution (was the best product eventually)**
  - We build the product for single home owners. It is attached to the front of the house (e.g. nearby a entrance light, or the mosquito ultraviolet light) and a single knob with three modes: warn and send back, send back, land immediately.

The "Research Idea"

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- **2017 Idea: "SkyDive"**
  - A swarming fleet of inexpensive drones can be used for several purposes from crop monitoring in agriculture to surveillance of industrial facilities, etc.
- **Objections:**
  - I might need a license to fly, how can it be a product?
    - Well, small drones requires an inexpensive license, and anyhow if you do it on your own agricultural field it's fine, you are not very likely to be just near an airfield.
  - The idea is already described what else to do?
    - It is NOT a product. You can't just control the fleet manually with seven people following you each with his drone and an art director orchestrating the thing. This is a movie shooting team not a product. Equally you need a reliable way to control the swarm cannot just "show you how to do it by typing commands on the shell".
  - It is a lot of work to make it a product, how can we do it?
    - You are a team of 4+ people. You need to divide the work. If somebody really doesn't work you come to see me and we discuss the issue F2F

Group Z: The Drone Toy Alarm

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- Some people tend to doze off in the morning: when the alarm rings they turn it off and don't move from the bed. We have invented a small wake-up drone connected to your phone
- The toy drone sits on your bed table side by side with the phone and when the phone alarm rings it starts flying around in the room.
- The only way to stop the alarm ringing is to get out of the bed and catch the drone.

What Can Go Wrong?

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- What if ti flies to high and you can't catch it?
- What if you are sick and can't catch it?
- I can be too expesinve
- What about safety with no collision
- What if you have pets? Can use sensors to detect surrounding objects
- What about the energy of the drone

The Drone Toy Alarm II

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- **Some people tends to doze off. We have invented a small wake-up drone connected to your phone: when the phone alarm rings it starts flying in the room and you have to catch it to stop the alarm.**
- **Usage problem:**
  - If catching something moving in your bedroom is challenging… what about stopping rotating blades with your bare hands?
- **Technical problem:**
  - It starts flying in the dark… and how does it know that there is a ceiling up here or a wall over there (not to mention your face)?

Your "Physical" Product

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- **You can invent "your product" BUT it must be a physical product**
- **Why a physical product?**
  - The product lives or dies on the spot
  - There is no disagreement on whether it satisfied the requirements or not: if you say the robot should follow the customer, and it doesn't, well it doesn't and both you and us can see it.
- **Why not a service?**
  - A service typically requires an underlying infrastructure of people and computers that do "stuff" and this "stuff" is all magically imaginated and powerful and flawless
    - Actual integration is always extremely complicated and well beyond the course work
  - As a result, every group who "invented" services as a part of their product came out with something like the discussion below
    - "Yes, we invented this system for the rescue of people in car accidents but we cannot demo the rescue part as it requires a call center that receives alert calls and decides what to do"
    - "We can only show you that our GSM simcard sends the position to our server which tracks if you have been moving and detect whether you have suddendly stopped and are not restarting"
    - "The difference between parking, stopping at a traffic jam, or crashing is solved by the call center"
  - Then grading becomes a very very unpleasant discussion on whether we should believe that your imagined, superpowerful infrastructure is at all credible
    - Should we believe into the viability of a company that each time you brake at a traffic jam in Rome or Los Angeles will call your phone to ask whether you are all right? According to this group we should have…

Tentative Timing of Classes

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- **Lectures on Thursday-Friday**
- **Key Milestones**
  - Fri. 16/Mar → Feedback Sessions
  - Fri. 23/Mar → Concept Canvas Show at CLC
  - April (20, 27) → Feedback Sessions
  - Fri. 4/May → Design Poster Show at CLC
  - May (18, 25, 1) → Feedback Sessions
  - Fri 15/Jun → Product ShowRoom at TDB
- **(Grades are "won" at the ShowRoom)**
- **Show Room final date and place to be confirmed (may be any day of week 13-15/June)**
  - Ehi if you have drones flying I need to find a place, last year we went to Italfly's main Hangar at the Caproni Airport.

What's a ShowRoom at CLC?

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- **CLC=Co-Location Center at EIT Digital - Italy**
  - This is the main lobby
- **Each group will have a stand and we will pass around giving you a vote for your set up**
  - Concept Canvas → basically a poster with some key ideas
  - Design Poster → more details, clear architecture, how to solve steps, started to talk to some customers etc.
  - Product → you'll have the product and should be able to do some demonstrations eg with a laptop, the keyboard etc,

It's a product…

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- **You must have a complete walk through for the "customer experience".**
  - You buy one, you set up the network, how do you register the drone/how do you set-up the web service (eg is it "a install on your machine", or it is "use a remote service")
  - It cannot be
    - "it works but only on our laptop pasting these commands from the shell".
    - "It worked perfecly this morning at 6am"
    - "It assumes a call center with 1000 people to fix this problem"
- **You have a budget for the actual hardware, or if you need Amazon WS etc.**
  - We have bought some devices (drones, rapsberry pi and antennas) but you might have your own set-up.

Multi-disciplinary Teams

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- **See the excel file on Google Drive**
- **Normally I do by Master Course but groups over 5 are hard to manage.**

More Information

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- **The Course Webpage**
  - Security
- **Google Classroom Page**

Textbook

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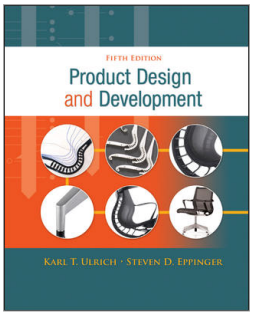
Product Design and Development
Karl T. Ulrich and Steven D. Eppinger
5th edition, Irwin McGraw-Hill, 2012.

1. Introduction
2. Development Processes and Organizations
3. Opportunity Identification
4. Product Planning
5. Identifying Customer Needs
6. Product Specifications
7. Concept Generation
8. Concept Selection
9. Concept Testing
10. Product Architecture
11. Industrial Design
12. Design for Environment
13. Design for Manufacturing
14. Prototyping
15. Robust Design
16. Patents and Intellectual Property
17. Product Development Economics
18. Managing Projects



Also as eBook with most chapters and far cheaper