Humans vs. the Internet of Things

Fulvio Corno – Politecnico di Torino
Outline

- IoT and Humans
  - Motivation

- Ambient Intelligence
  - Architectural framework

- Looking forward
  - Defining Missing Features
IoT and Humans

Humans vs. the Internet of Things
The **Internet of Things (IoT)** refers to the ever-growing network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other Internet-enabled devices and systems.

What Is Internet of Things (IoT)? Webopedia Definition

Definizione di IoT
Definizione di IoT

Towards a Definition of the Internet of Things (IoT)

Contribute to the ever-changing definition of the Internet of Things

IEEE Internet Initiative | iot.ieee.org

Download Document
Towards a Definition of the Internet of Things (IoT) (IEEE, 2.03 MB)
Revision 1 – Published 27 May 2015
Downloaded: 3,000+
Technologies, we have a lot of them.
What kinds of applications?

Microsoft
Azure IoT
Oracle Cloud Service
Bosch IoT Suite
Google Cloud IoT
Amazon AWS IoT
Currently…
IoT ≈ Sensor-To-Dashboard pipeline

Where are the users?
Where is interaction?
Where is intelligence?
Where are smart spaces?
What about users?


http://radar.oreilly.com/2014/05/most-of-what-we-need-for-smart-cities-already-exists.html
Conquering the user

Controlling the consumer IoT market is appealing to producers of…

May we talk?
Intranets of Silos of Things
Intranets of Silos of Things

Systems, we want

Things, not
Ambient Intelligence

Humans vs. the Internet of Things
An Ambient Intelligence system is a digital environment that proactively, but sensibly, supports people in their daily lives.

(Cook et al, Ambient Intelligence: technologies, applications and opportunities, 2009)
AmI Features

- Sensitive
- Responsive
- Adaptive
- Transparent
- Ubiquitous

AmI Lunch Seminar - Humans vs IoT
AmI Features

Incorporates Artificial Intelligence:
- Machine learning, agent-based software, robotics
- Hearing, vision, language, knowledge processing
- Semantic web, reasoning

Sensitive
- Able to sense the environments and its inhabitants.
- Able to process sensor data.

Responsive
- Able to respond to user needs.
- Able to act on the environment.

Adaptive
- Able to adapt to the context, by means of the interpretation of sensing and the generated response

Intelligent
- Able to infer a situational context:
  - from environment data
  - from user data (identity, presence, actions, ...)
  - from statistics and preferences
  - from external information sources

Ubiquitous
- Present, appearing, found everywhere.
- Able to be distributed over the ambient and over different people.

Transparent

"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

Humans vs IoT

DAQIN Lunch Seminar
Smart Environment
Smart Environment
What Would You Ask to Your home?

What would you ask – Comfort

![Bar chart showing comfort preferences]

- Lighting
- Temperature
- Shutters
- Windows
- Others

Female
Male
What would you ask – Housekeeping

- Cleaning
- Washing
- Ironing
- Gardening
- Food management
- Cooking
- Shopping
- Others

Female
Male
Meanwhile, researchers...
Meanwhile, researchers...
Smart Environment: User expectations
Quiz

- What is the difference between an enchanted house (or castle) and a haunted one?
Quiz

- What is the difference between an enchanted house (or castle) and a haunted one?

  - Both are **autonomous** in performing some **actions** (playing music, controlling doors and windows, providing food and entertainment, etc.)
  - Both could be powered by similar **intelligent systems**
Quiz

- What is the difference between an enchanted house (or castle) and a haunted one?

- Difference lies in user perception

  actions of an enchanted house are **expected**, **desired** and **welcomed** by the user, in a proactively friendly environment

  the haunted space will execute actions **contrary** to the will of the user, who will feel **trapped** by an **hostile** entity
Smart Environment: User expectations
Smart Environment
Main Steps for an AmI System

Sensing

Interacting

Acting

Reasoning
Looking forward

Humans vs. the Internet of Things

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The IoT we all want...

I wish IoT were...
The IoT we all want...

I wish IoT were...

- Useful
- Easy
- Safe
- Durable
Useful?

*Shoot a selfie, control your own music and all your phone alerts from your smart scarf!*

Dear Sir/ Madam, Dear Business Insider,

**Traced Goods** proudly announces its 1st launch on Kickstarter with wearable tech: the 1st **SMART SCARF**

"**SMART SCARF** is the 1st scarf that connects with your phone, customize your personalized notifications, has a remote selfie feature up to 8m, and a music remote control."

"With **SMART SCARF** you walk and cycle even more safe in traffic, you watch less on your phone and the **SMART SCARF** is fun too with its selfie remote and music control!"

Mandatory reading: [https://twitter.com/internetofshit](https://twitter.com/internetofshit)
Useful?

Huggies Tweet Pee
The first diaper that tells mommy when it's time to change.

**Situations**
- Mommy is new at being a mom and she doesn't always know when I need a change.
- When I squeeze, it's hard to tell her when I need one.

**Idea**
TweetPee: A diaper gadget that tweets when a "diaper condition" is detected, saves money by preventing unnecessary changes, and allows money to buy diapers on sale.

**Results**
- Huggies created a whole cute and functional device. It's small enough to use on my diapers and is impossible for me to take it off and play with it. Believe me, I tried. Inside the little device, they were able to combine a humidity sensor, an accelerometer, and small batteries that last 3 days and their own technology.
- The Huggies are proving that diaper innovation can go beyond just comfort and absorption for babies; they are excited at the possibility that one day, every diaper will be able to speak for itself. And Babies like me are dry and happy.
Useful?
Easy?

🌟🌟🌟🌟🌟 Scdragon • 8 days ago

Wifi does not connect

Wifi connectivity does not work. Stuck in setup mode.
End the frustration of losing keys and forgetting combinations forever. Noke is the world's first bluetooth padlock you can share.
Easy?
OMG... user interfaces
Safe?

Blame the Internet of Things for Destroying the Internet Today

An army of hacked Internet of Things devices could be one of the reasons why your internet sucks today.

motherboard.vice.com
Aiuto, la mia casa smart è stata posseduta via radio

Qualcuno, probabilmente un autore di fantascienza, una volta ha detto che nelle case “smart” del futuro sarà impossibile distinguere un attacco informatico da una possessione demoniaca.

Ma non c’è bisogno di aspettare il futuro, secondo quanto riferisce la catena di emittenti radiofoniche pubbliche statunitensi NPR. Chi ha comprato l’assistente di domotica Echo di Amazon ha già questo bizzarro problema.

Echo è un dispositivo che riceve comandi vocali dal padrone di casa e manda comandi digitali ai vari dispositivi interconnessi dell’abitazione: antifurto, luci, cucina elettrica, riscaldamento. Basta dire “Alexa, spegni l’antifurto”, eccetera (“Alexa” è la parola chiave e anche il nome della assistente virtuale integrata in Echo).

Tutto molto bello, molto cool, molto futuribile. Fino al momento in cui nella casa “smart” c’è la radio accesa su un programma come quello presentato un paio di settimane fa dalla NPR, che parlava proprio di Amazon Echo citando fra l’altro alcuni esempi di comandi. Avete indovinato: i microfoni sensibili di Echo hanno captato i comandi annunciati alla radio e li hanno eseguiti. Gli ascoltatori si sono trovati con il riscaldamento reimpostato, l’impianto audio impazzito, e altro ancora.

Un altro esempio di come l’Internet delle Cose ci viene proposta senza alcuna riflessione sulle conseguenze e senza includere una minima sicurezza predefinita, come per esempio una parola chiave di autorizzazione personalizzata o un riconoscimento della voce delle persone abili a dare comandi.

Etichette: Amazon, domotica, Internet delle cose
Safe?
Safe?
Safe?
Durable?
Durable?

The Spooky Cyber @charlesv · 1d
@tweethue hi! I have a 2.0 hub and am attempting to pair cree bulbs that have previously worked. Has firmware removed support?

Meet hue @tweethue · 21h
@charlesv ...Have you tried a ZigBee channel change? Scroll down in the Bridge menu to change it. Hope this helps. 2/2

The Spooky Cyber @charlesv · 18m
@tweethue Thanks - tried every zigbee channel with no luck. These bulbs (Cree) worked with a firmware from mid 15 - just updated and no dice
Conclusion

Humans vs. the Internet of Things
Internet of Things and Humans

- IoT systems should include *acting* on the *user-perceivable* part of the environment
  - Otherwise it’s not a «smart» home/building/car/city/…
- Users should *close the loop* of the intelligent algorithms
  - They must feel connected and feel in control
- Consider *user needs* and requirements
- More technology is not always the answer

- Research is not going in the ‘right’ direction
- Industry is not going in the ‘right’ direction
Contact information

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- e-Lite Research Group
  https://elite.polito.it/

- Ambient Intelligence course
  https://ami-2018.github.io (student projects)
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