Trabajo Teórico/Práctico

IPO1

Curso 2020-21

Objetivo y enunciado

- Esta actividad consiste en la realización de un trabajo teórico sobre **interacción avanzada y nuevos paradigmas de interacción.**
- El alumno deberá investigar sobre las nuevas formas de Interacción Persona-Ordenador que están apareciendo en los últimos años, y **elaborar un informe sobre dicha temática**, indicando **un posible dominio de aplicación**, proponiendo y describiendo **un escenario de uso**.

Normas e Indicaciones

- Podrá realizarse en **grupos de un máximo de 3 personas.**
- Tiene un peso de **1,5 puntos en la nota final de la asignatura:**
  - **entrega del documento o informe (1 punto)**
    - A lo largo del curso se realizará el **seguimiento de los trabajos** (tutorías presenciales en clase, de asistencia voluntaria).
    - Deberán incluir una sección de **conclusiones** (que incluya una **valoración personal** sobre el tema tratado), así como una sección que incluya la **bibliografía** consultada para la elaboración del documento.
  - **la defensa oral (0,5 puntos)**
    - En la defensa oral se recomienda el uso de imágenes, videos, demostraciones y otros recursos que hagan más **amena y clara** la presentación.
- **Fecha de entrega del trabajo teórico: 7 de Diciembre de 2020**
- **Fecha de entrega de la presentación:** Se acordará con el profesor del grupo de teoría correspondiente (**últimas semanas lectivas en Diciembre**).

Temas a elegir...

1. Internet of Things (IoT)
2. Smart Cities
3. Smart Buildings & Homes
4. Smat Classrooms, Labs & Campuses
5. m-Health
6. Ambient Intelligence (AmI)
7. Ambient Assisted Living (AAL)
8. Realidad Virtual
9. Realidad Aumentada
10. Cloud & Fog Computing
11. Big Data Analytics
12. Affective Computing
13. Dispositivos avanzados de interacción

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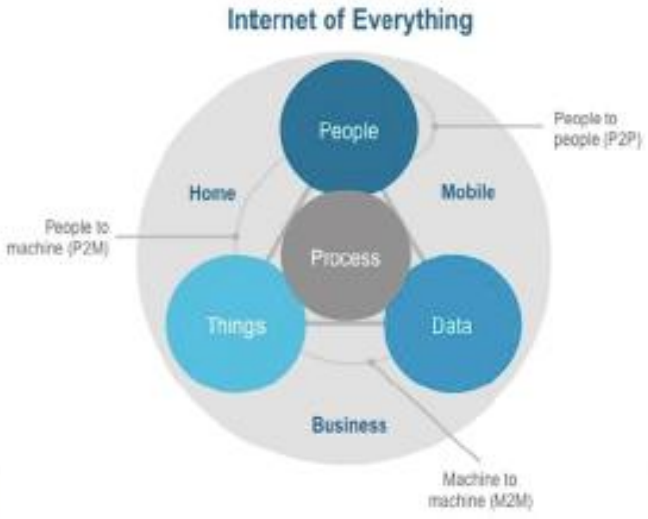
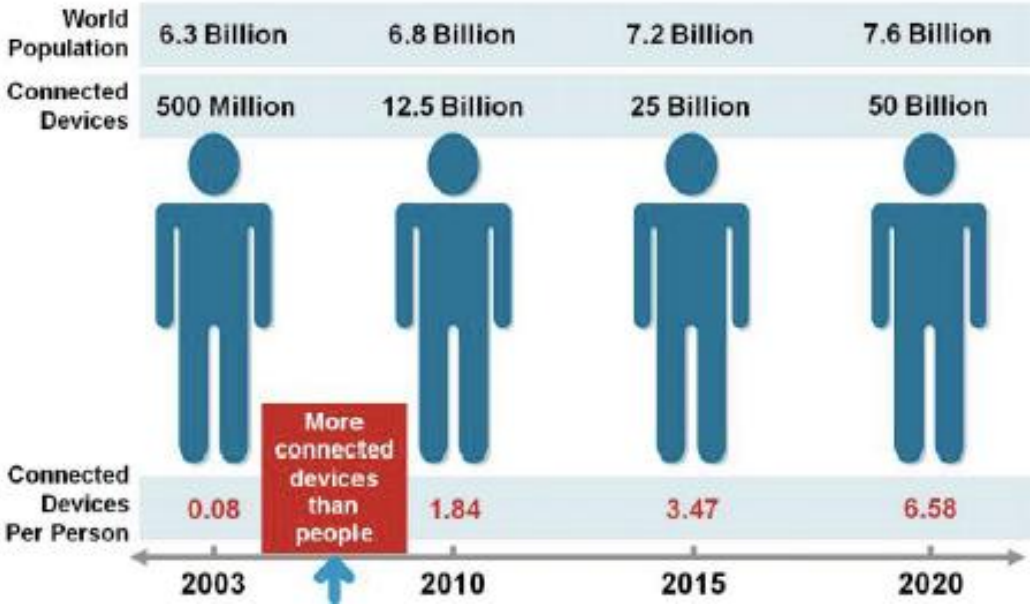
Internet of Things (IoT) Promise

- **Around 25 billion devices connected to the Internet** by **2015**, **50 billion** by **2020**
- A dynamic and universal network where billions of **identifiable "things" (e.g. devices, people, applications, etc.)** communicate with one another **anytime anywhere**; things become **context-aware**, are able to configure themselves and exchange information, and show **"intelligence/cognitive" behaviour**





IoT Definitions

- *“By embedding short-range mobile transceivers into a wide array of additional **gadgets and everyday items**, enabling **new forms of communication between people and things**, and between things themselves”.*

------WSIS 2005

- *“The term "Internet of Things" has come to describe a number of technologies and research disciplines that **enable the Internet to reach out into the real world of physical objects**”.*

------IoT 2008

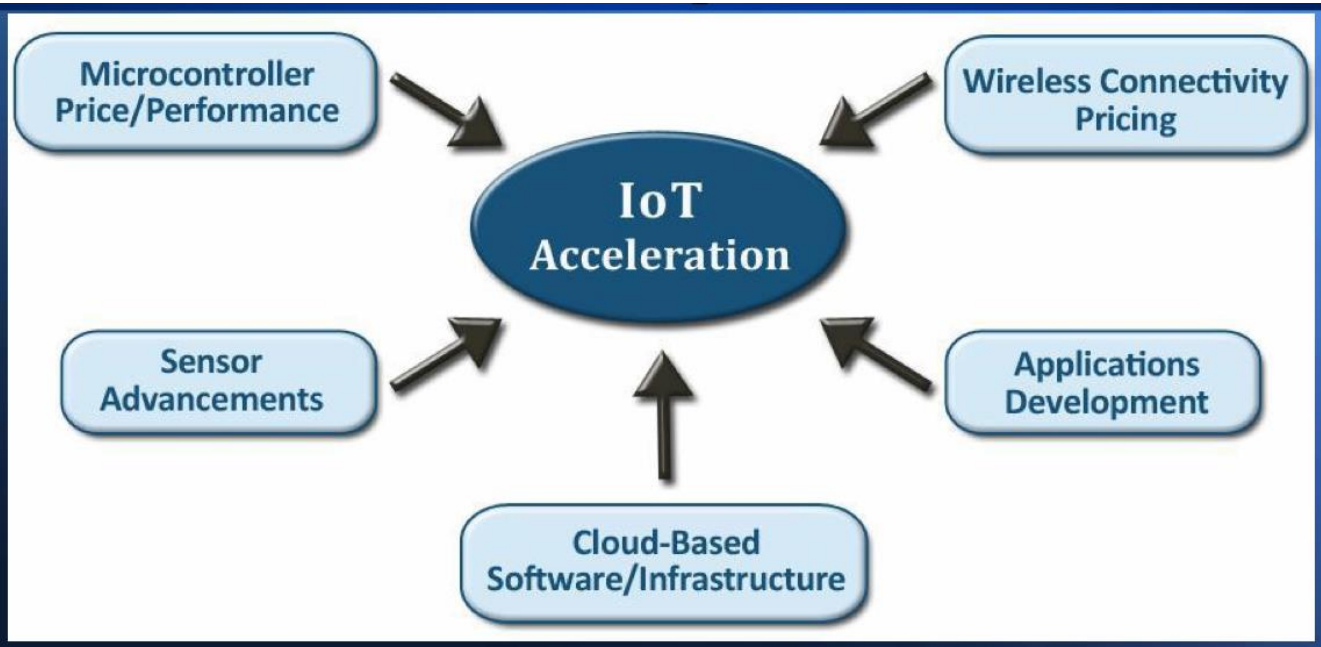
- *“Things having identities and virtual personalities operating in **smart spaces** using **intelligent interfaces** to connect and communicate within social, environmental, and user contexts”.*

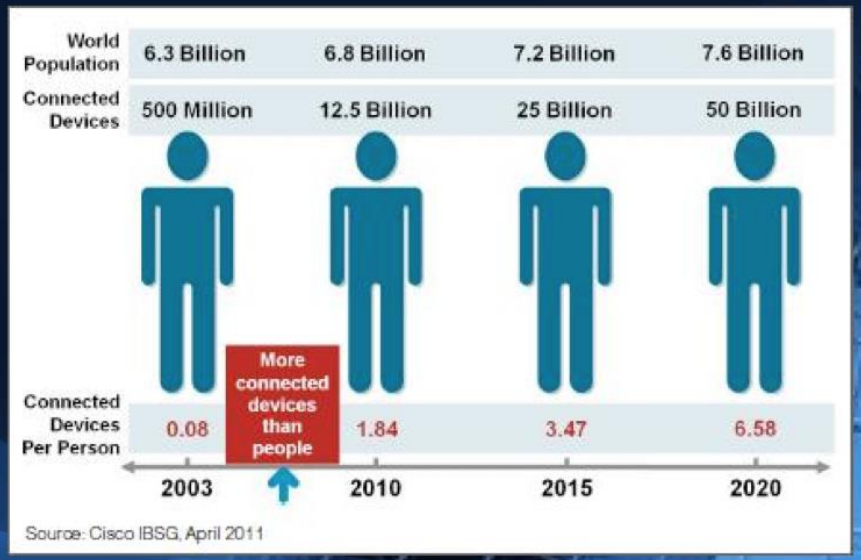
-------IoT in 2020

Smart objects (or things)

- Have a physical embodiment and a set of associated physical features (e.g., size, shape, etc.).
- Have a **minimal set of communication functionalities**
- Possess a **unique identifier**.
- Are associated to at least one **name**
- Possess some **basic computing capabilities** (Ex.- ability to match an incoming message to a given footprint (as in passive RFIDs)
- May possess means to **sense physical phenomena** (e.g., temperature, light, electromagnetic radiation level) **or to trigger actions having an effect on the physical reality** (actuators).

IoT Perspective





	2003	2011	2020
Humans	6,3B	7B	7,6B
Devices	500M	12,5B	50B

IoT impulse: Smart Cities, consumer objects, mobile sensing, smart metering

Application Areas

- Smart Cities
- Smart Environments
- Home Automation
- Health
- Adaptive Integrated Driver-vehicle Interface (AIDE)
- Shopping
- …

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What is smart city?

- A developed **urban area** that create **sustainable economic development & high quality of life** by excelling in multiple key areas: Economic, Mobility, enviourment, people, living & Govt. excelling in these key areas can be done so through strong human capital, social capital and/or ICT infrastructure
- Smart Cities **improve the efficiency and quality of the services provided** by governing entities and business and (are supposed to) increase **citizens' quality of life** within a city
  - This view can be achieved by leveraging:
- Available infrastructure such as Open Government Data and **deployed sensor networks in cities**
- **Citizens' participation** through apps in their smartphones

The need for Smart Cities

- Challenges cities face today:
  - **Growing population**
    - Traffic congestion
    - Space – homes and public space
  - **Resource management** (water and energy use)
  - **Global warming** (carbon emissions)
  - **Tighter city budgets**
  - **Aging infrastructure** and population

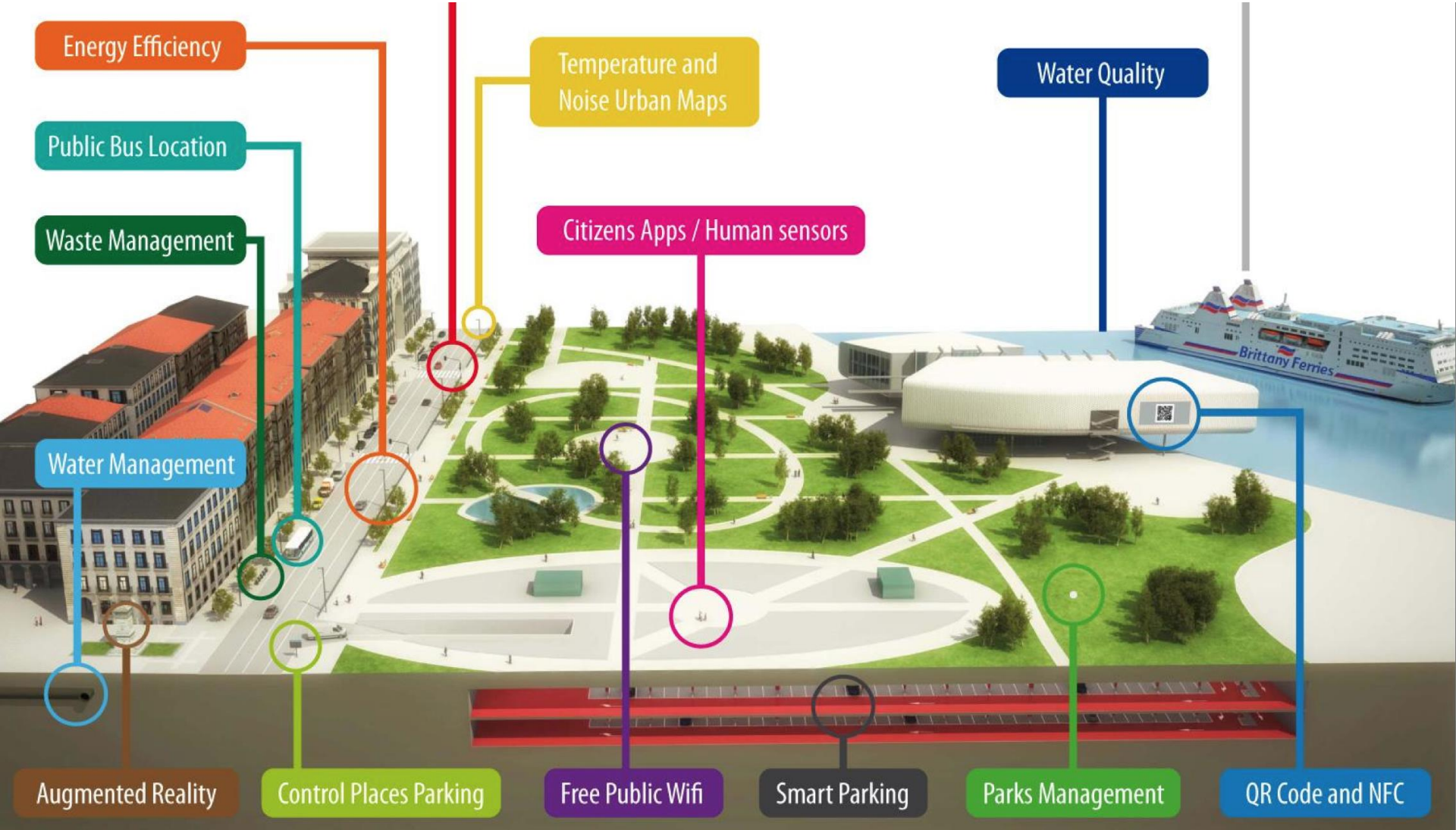
SMART CITY


Traffic Management
Education
Air Pollution
Open Data
Internet of Things
Smart Health
Intelligent Shopping
Smart Environment
Electromagnetic Emissions
Smart Buildings
Public Safety
Smart Home
Gas & Water Leak Detection
Smart Street Lights
Smart Energy
Water Quality
Smart Parking
Electric Vehicle Charging
Waste Management

Top 10 Smart Cities in world

- Vienna
- Toronto
- Paris
- New York
- London
- Tokyo
- Berlin
- Copenhagen
- Hong Kong
- Barcelona

Santander Smart City



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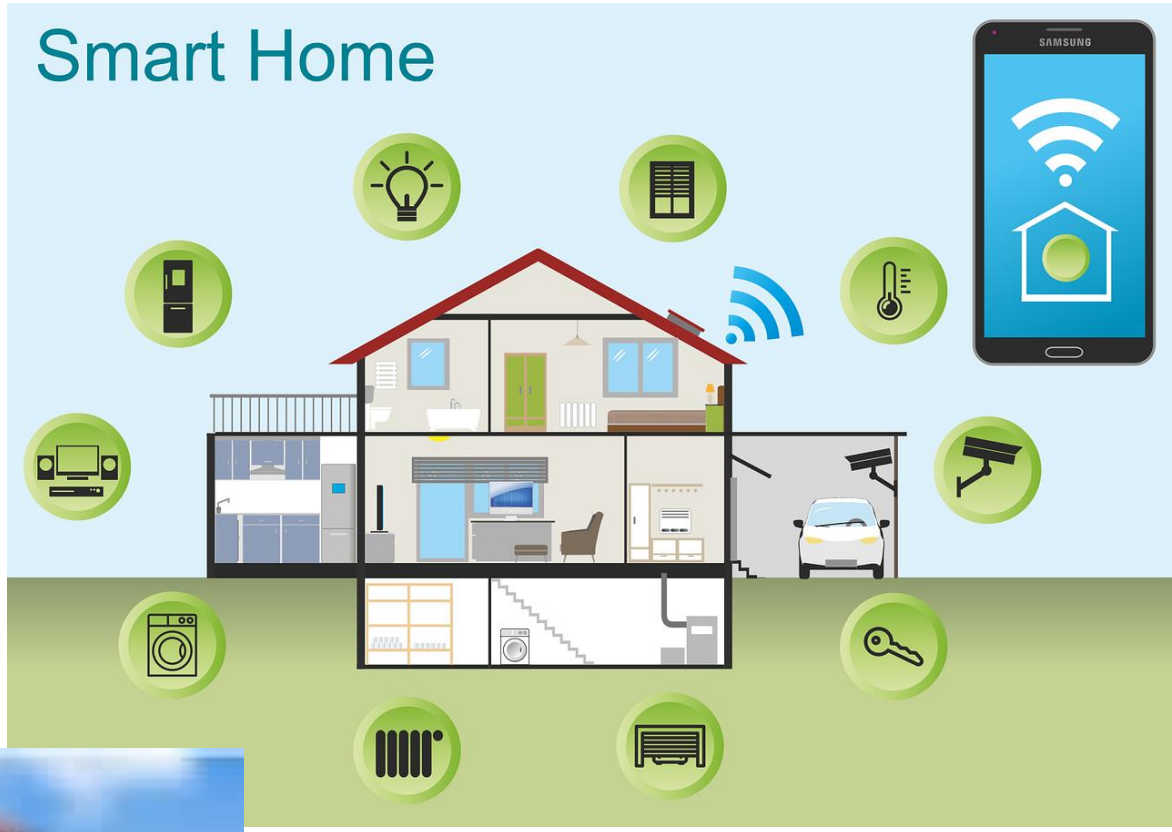
Smart Buildings

- **Edificios con sistemas automatizados** para la gestión de las funciones principales de la vivienda:
  - Luminosidad, Confort, Seguridad, etc.
  - Optimización energética y natural
- Otras denominaciones:
  - **Home Automation, Imnótica, Domótica**

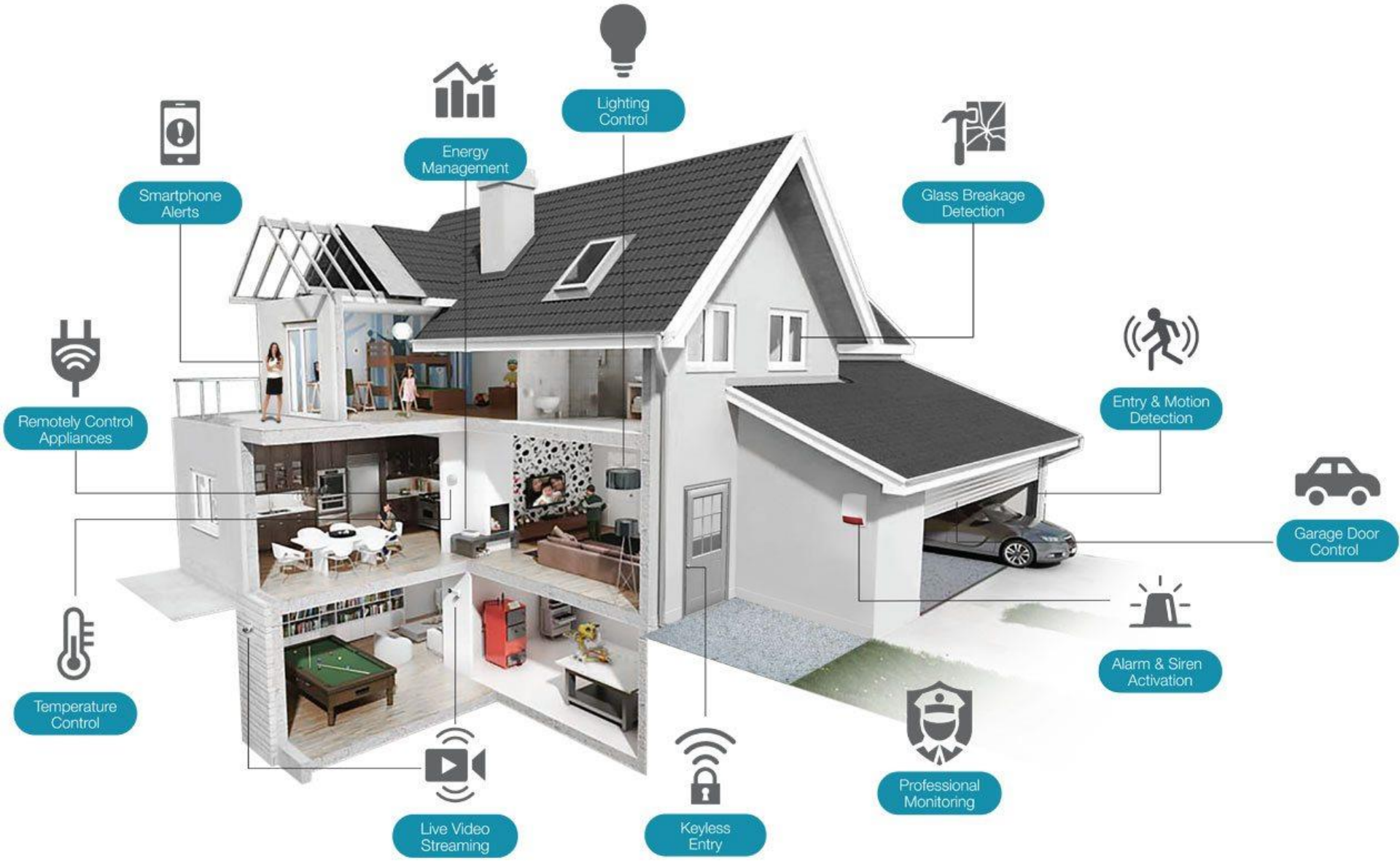
Smart Buildings

- **Consumo eficiente** para el ahorro de energía y agua.
- **Domótica integrada**.
- Debe ser **flexibles y escalable**.
- Debe tener en cuenta el **medio ambiente** y el entorno que le rodea promoviendo el uso de **energías alternativas**.
- **Ahorro Energético** mediante la inclusión de **materiales** más **resistentes**.

Home Automation



Smart House


Lighting Control
Energy Management
Smartphone Alerts
Glass Breakage Detection
Remotely Control Appliances
Entry & Motion Detection
Garage Door Control
Temperature Control
Alarm & Siren Activation
Professional Monitoring
Live Video Streaming
Keyless Entry

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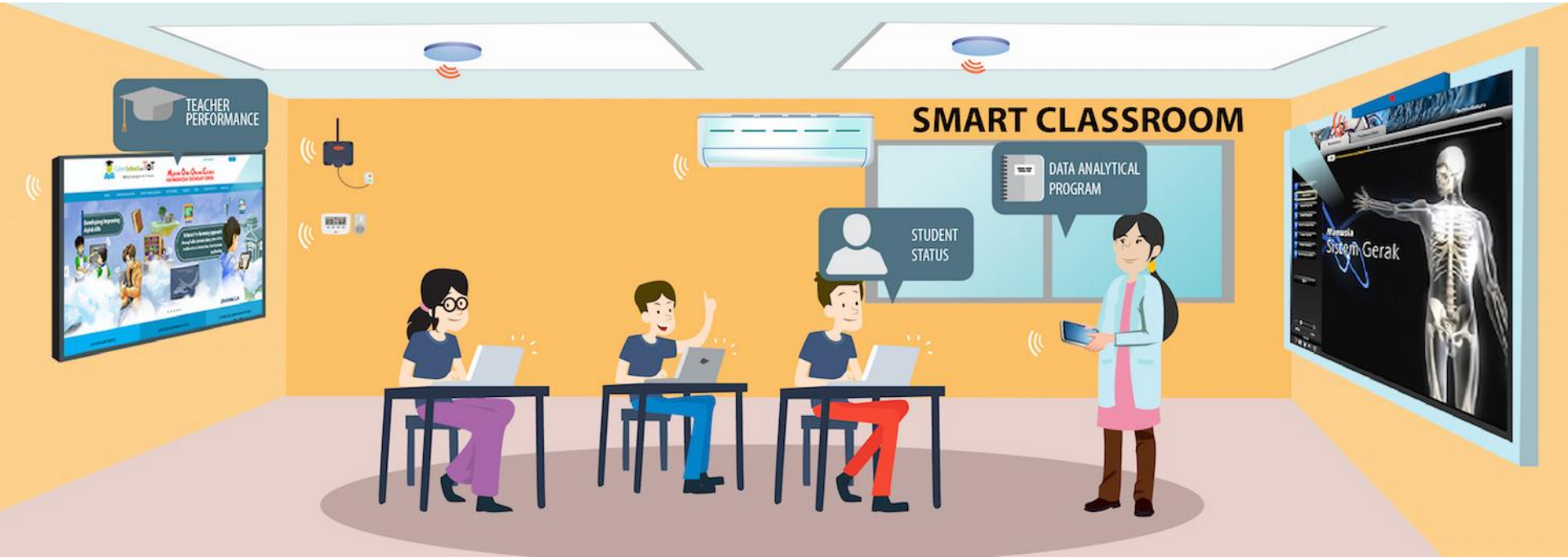
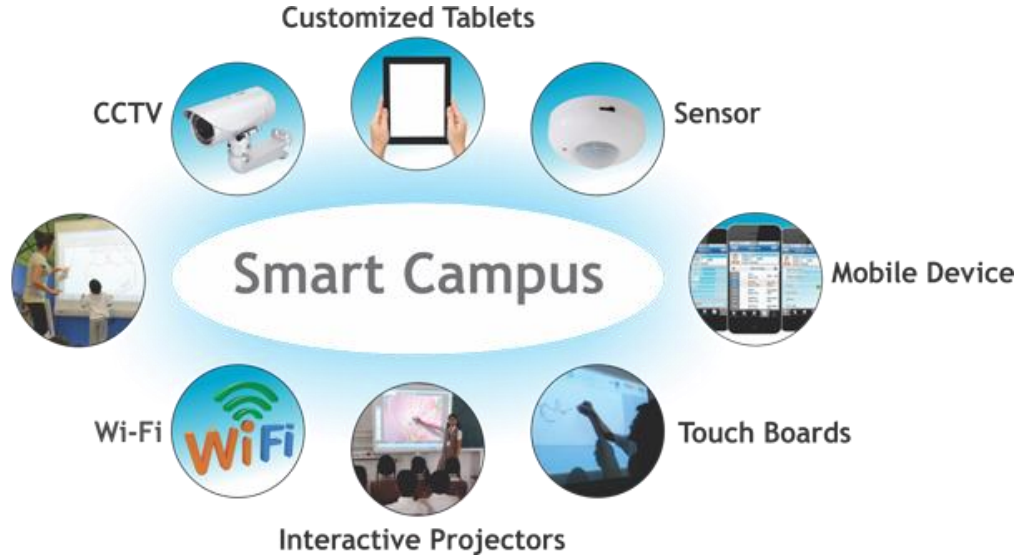
Smart Classrooms

- El diseño arquitectónico del aula, centrado en la **ergonomía**.
- Las **tecnologías que se integran** en el espacio físico, de una **manera fluida**, y con **plena conectividad.**
- **Metodologías pedagógicas innovadoras**, que sean capaces de hacer un **uso eficaz** tanto del **espacio** como de las **tecnologías** empleadas en el **nuevo modelo de aula**.



Smart Campuses

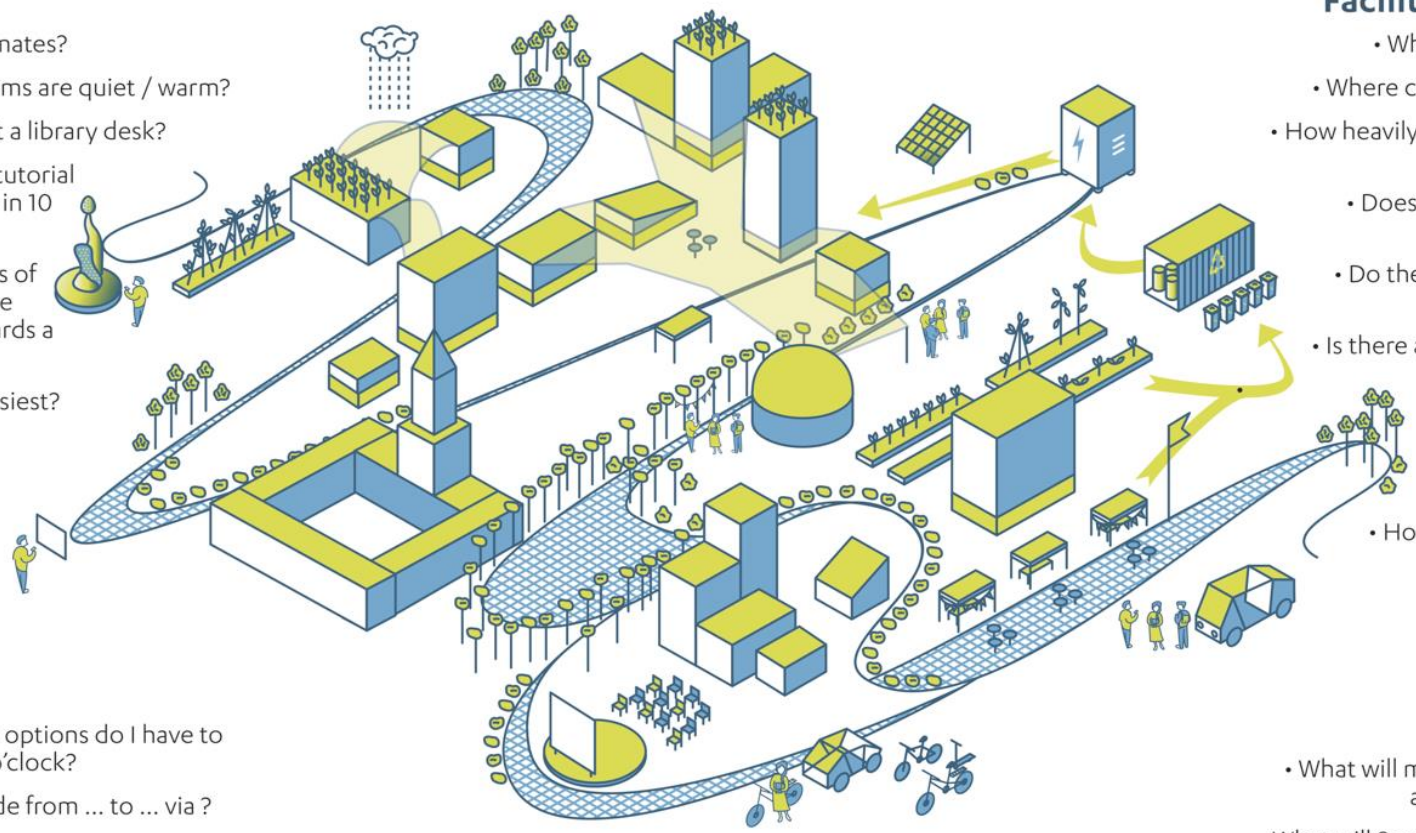
- **IoT** Spreading Across the **Institution**
- **Always-On Experiences** (not only anytime, anywhere' connectivity but also, teaching and learning anytime, anyplace and anywhere)
- **Intelligent Spaces** (Context-Aware adding intelligence)
- **Wearables** and **Location-Awareness Solutions**



Smart Campuses

Personal

- Where are my mates?
- What study rooms are quiet / warm?
- Where can I get a library desk?
- Where can my tutorial group meet up in 10 minutes' time?
- Are my patterns of work and leisure taking me towards a good degree?
- Which bar is busiest?



Facilities Management

- Which bins need emptying?
- Where can I find a parking space?
- How heavily are rooms in a building / school utilised?
- Does the lecture theatre need more ventilation?
- Do the lights still need to be on here and now?
- Is there a pollution event / noise?
- Can the heating be turned off?
- Is this building staying dry / damp free?
- How much beer is left in the bar cellar kegs?

MaaS

- What transport options do I have to get to ... by ... o'clock?
- Who wants a ride from ... to ... via ?
- How do I get to ... by foot / bike / wheelchair ...?
- What 'active travel' approach would fit with me and what I do?

Weather

- Is it windy / raining / sunny / snowy?
- Is this path at risk of icing?
- Is the salt bin full?

Engagement

- What's around me that's of interest (to me!)?
- What's that thing over there?

Privacy

- What will my activity patterns reveal about me? And to whom?
- What will Smart Campus reveal, and to whom, about:

Students | Staff | Visitors
The infrastructure | Services

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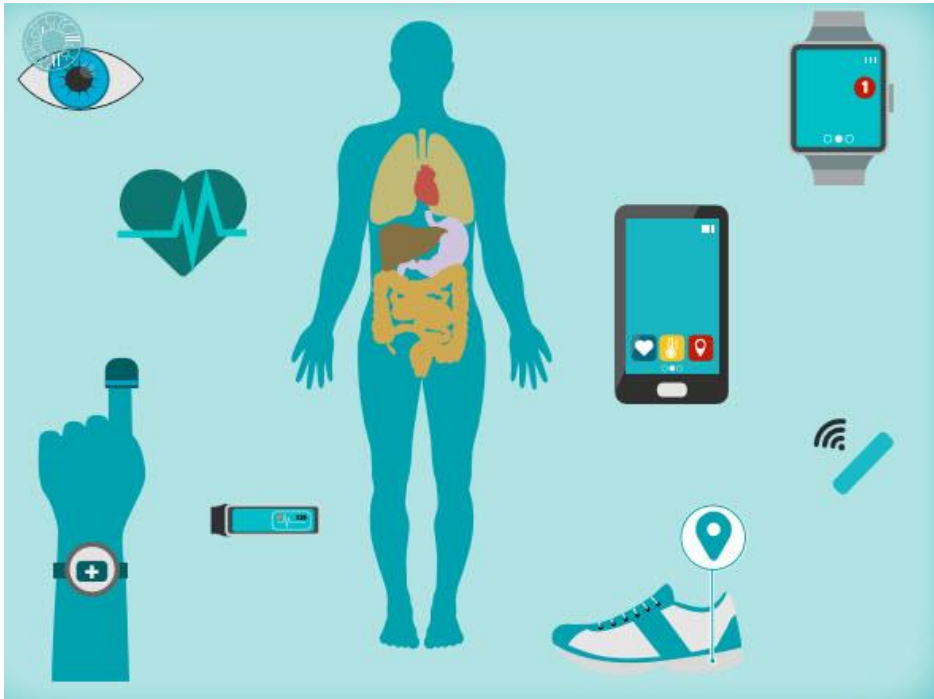
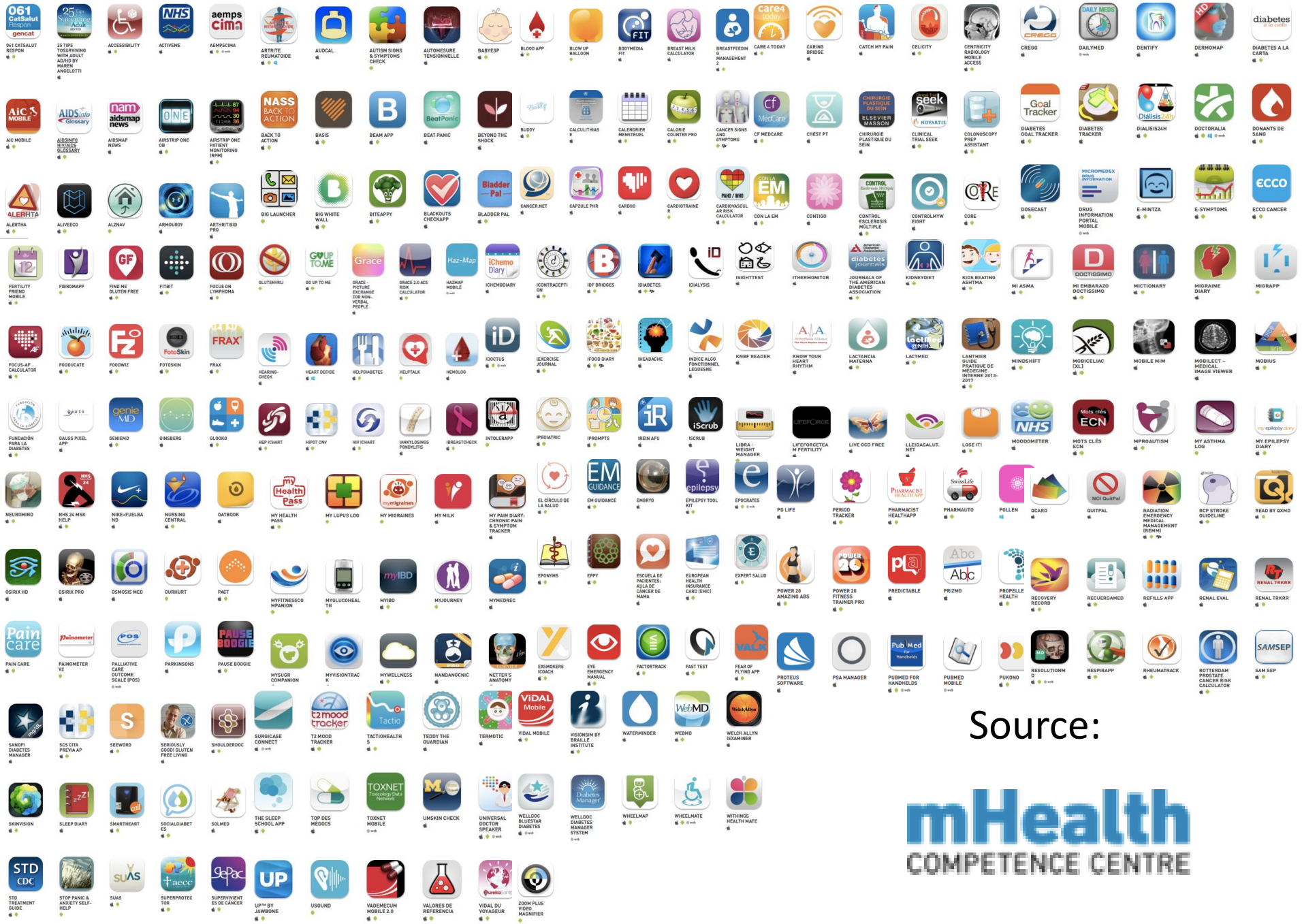
Motivation: New horizons for health through mobile technologies

What is mHealth?

- Diverse application of **wireless and mobile technologies** designed to improve health research, health care services and health outcomes
- **NOT JUST CELL PHONES**





Source:

mHealth COMPETENCE CENTRE

mHealth Goals

- Develop **patient-centered healthcare** delivery
- Increased **self-management of illness**
- **Alleviate** the systemic **pressures** on the **healthcare industry**
- Reduced **number of hospital beds** occupied
- **Remote monitoring** and **smart diagnosis**
- Improved **disease management**
- Improved **compliance with treatment regimes**

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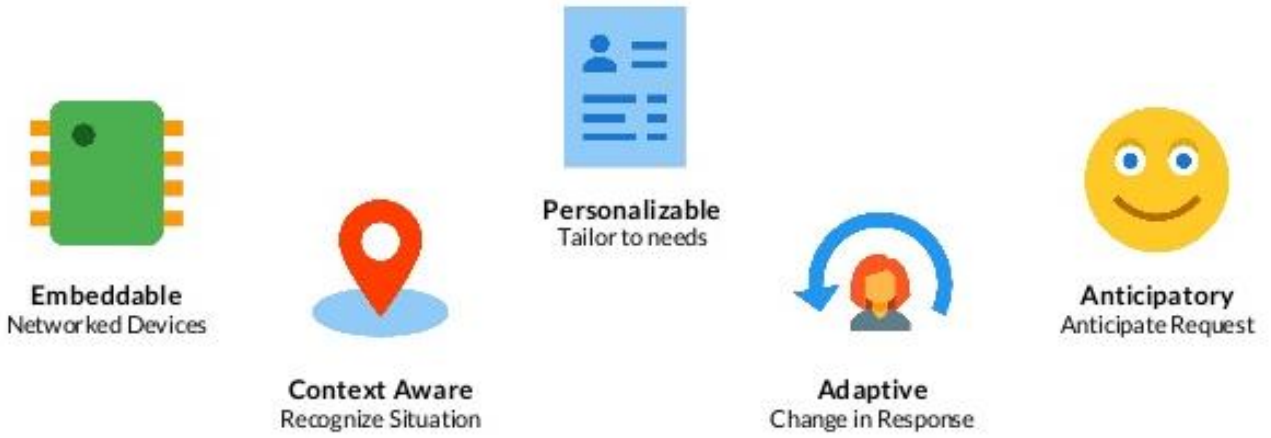
Ambient Intelligence (AmI)

- Six Framework Program of the European Community (ISTAG).
  - Visions in which **technology becomes invisible**, **embedded**, present whenever we need it, enabled by **simple interactions**, attuned to all our senses and **adaptive** to users and contexts.
  - In AmI, people are empowered through a **digital environment** that is **aware** of their presence and **context sensitive**, **adaptive** and **responsive** to their needs, habits, gestures and emotions.

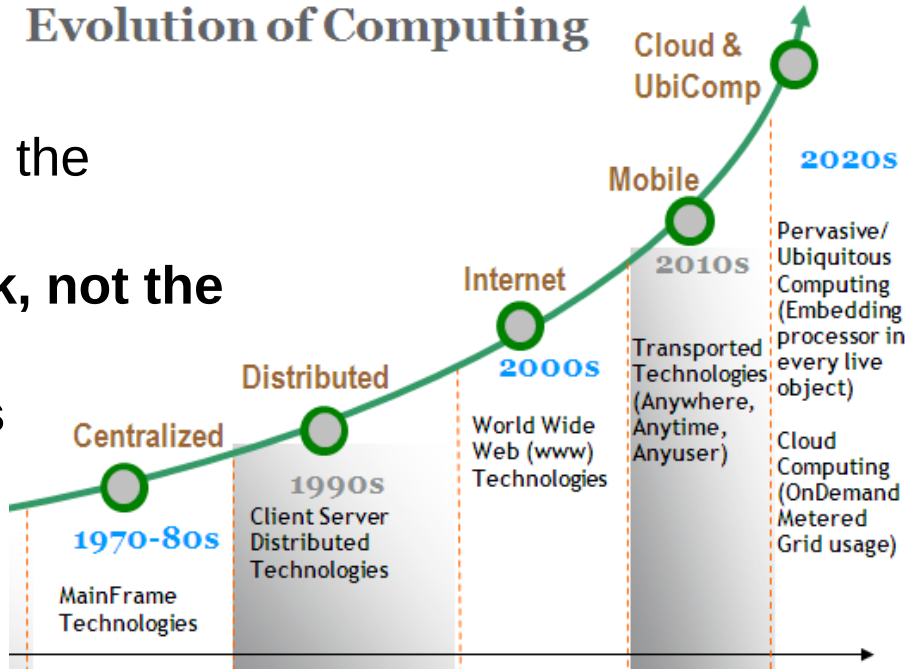


Ubiquitous Computing

Mark Weiser (1952 – 1999)

"*In the 21st century the technology revolution will move into the everyday, the small and the invisible…*"

- **Disappearing Computer**
  - "*The most profound Technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.*"
- **Invisible Computing**
  - Information processing moves to the background
  - Human **concentrate on the task, not the tool**
  - **Computing without computers**

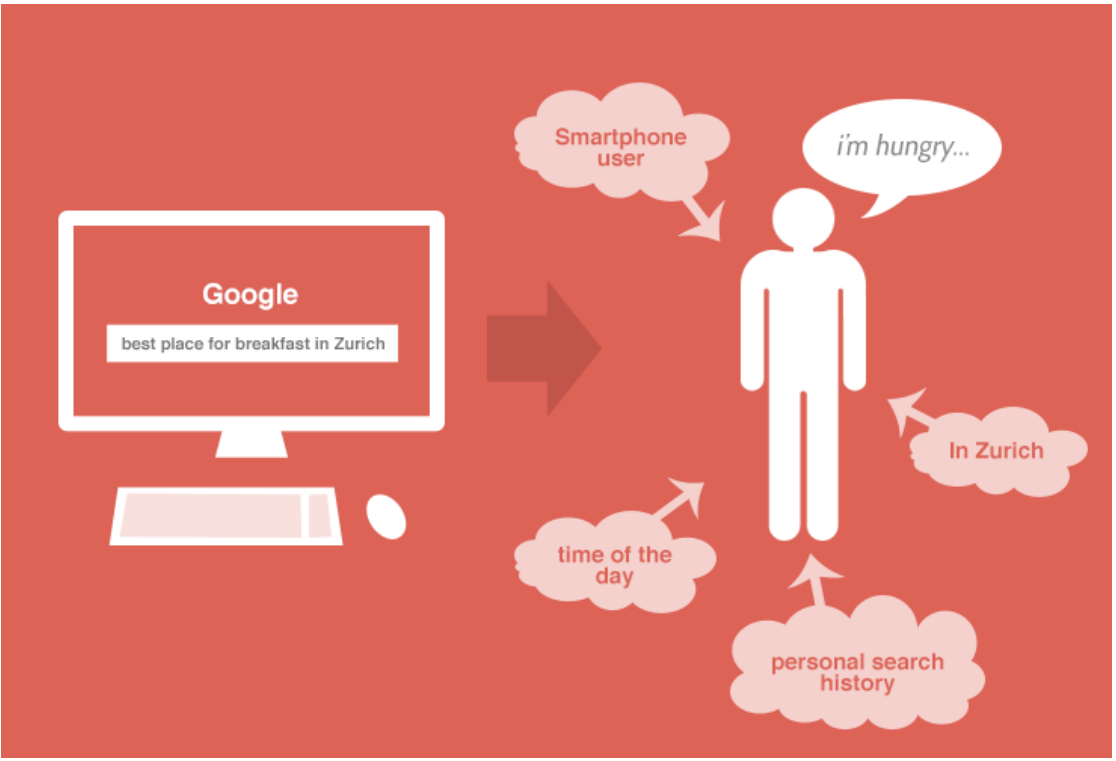


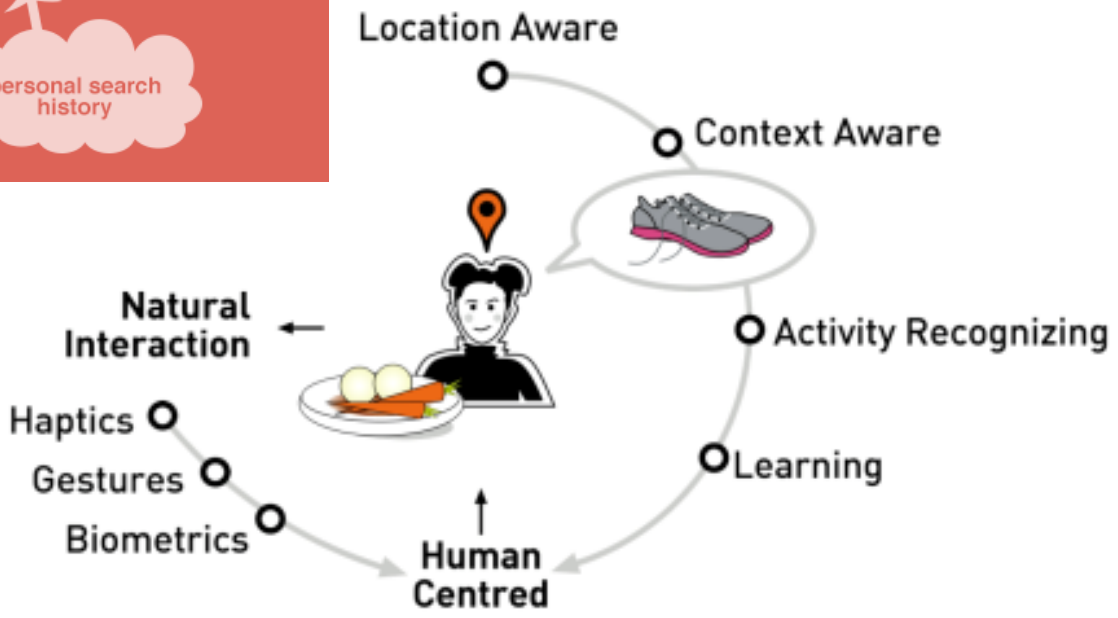
Ubiquitous Communications

Environment-friendly

- Access desired information
  - any time
  - anywhere
  - easily
  - immediately
  - ultra-low energy consumption
  - without causing any serious environmental problems.

Natural Interfaces





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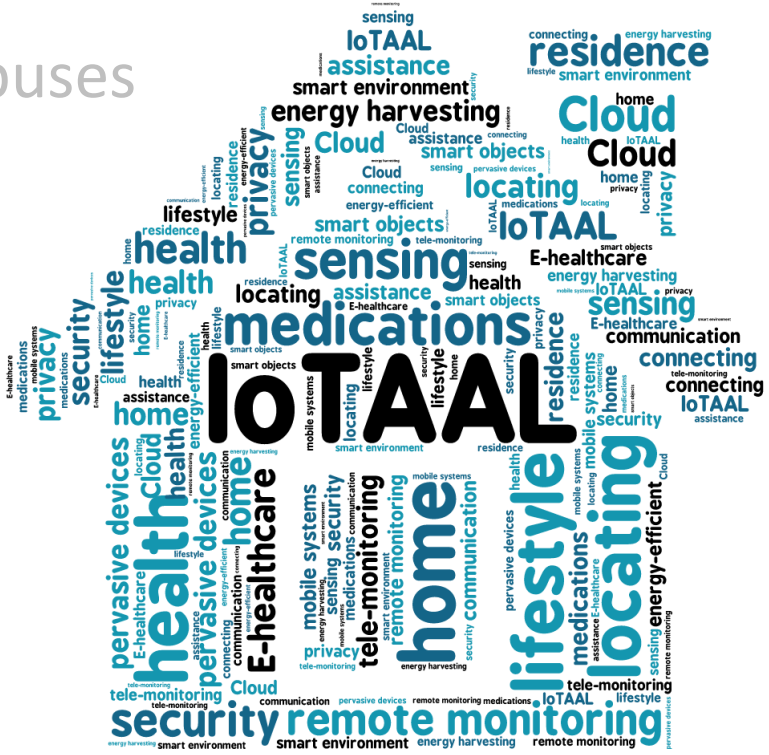
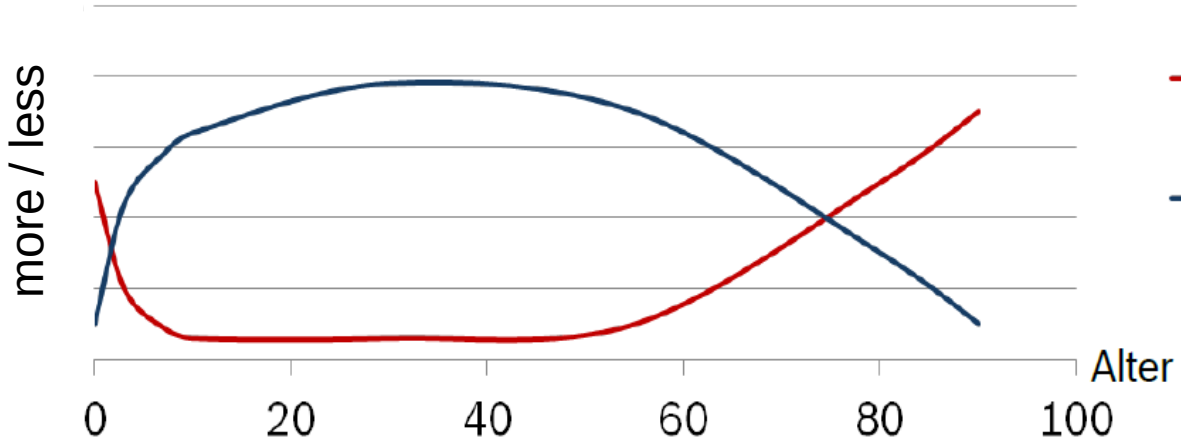


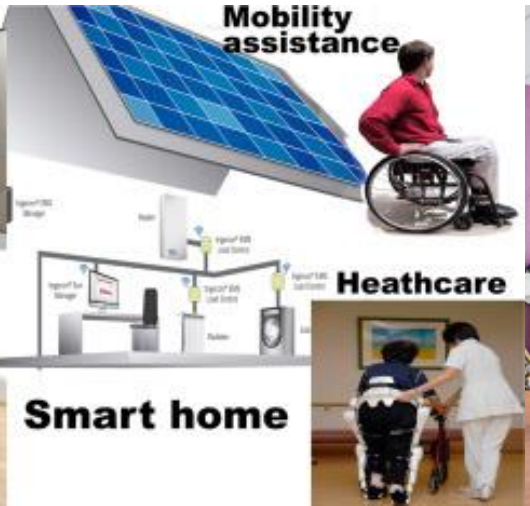
Ambient Assisted Living (AAL)

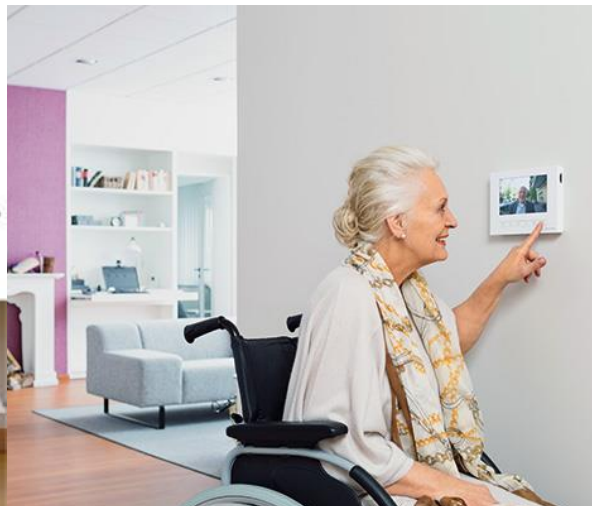
“Ambient Assisted Living” (AAL) comprises concepts, products and **services** which **connect** and improve new **technologies** and social life in order to **improve quality of life <u>in all periods of life</u>.**



Selected Topics

- **Health care / prevention**
- **Social participation**
- **Mobility**
- **Security**
- Improving **quality of life** by good maintenance processes
- General questions about a **society of longer lifes**

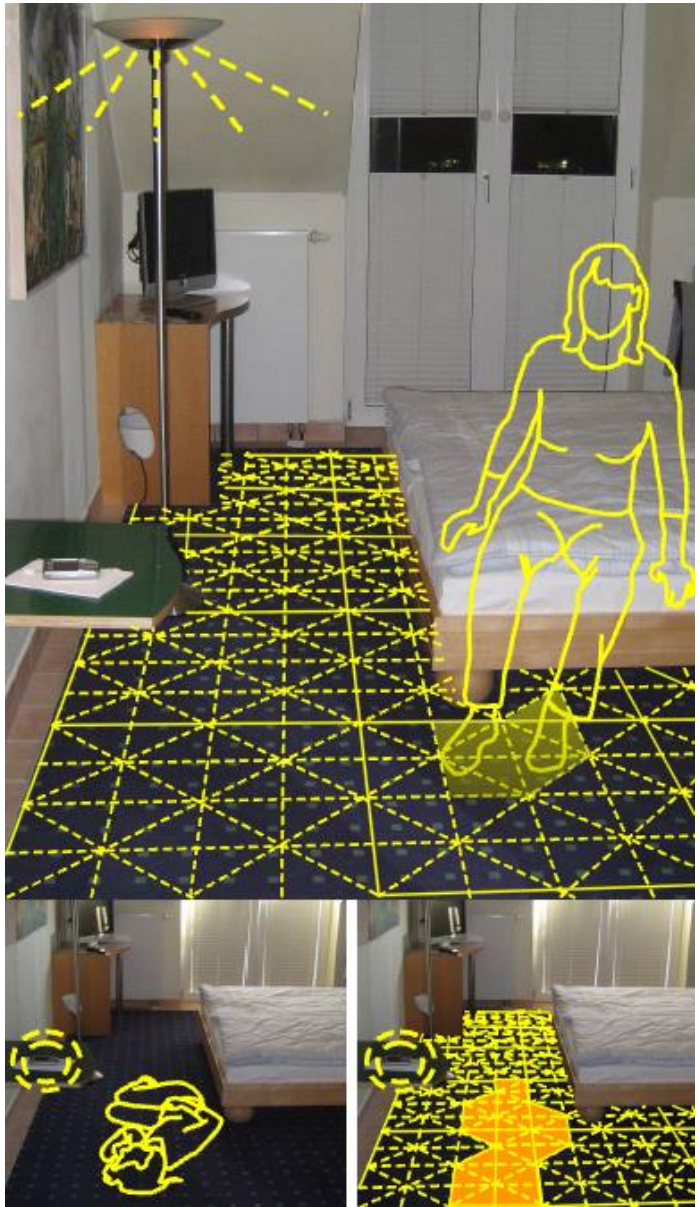




Social communication

Security

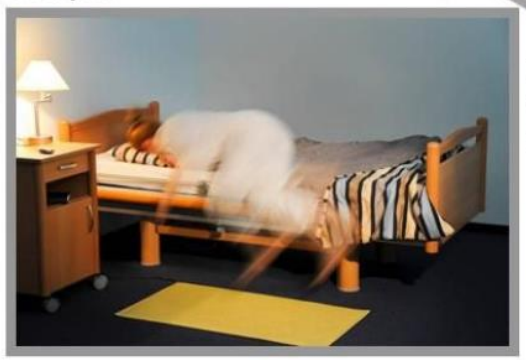
Sensfloor



SensFloor receiver 868MHz RS232 interface, easy wave interface, buzzer alarm, orientation light, interconntect to indoor call systems

Y adapter

Plug-in radio bell



Necklace and wristband transmitter, battery-operated

Fixed network phone

GSM dialer for sending SMS

Plug-in receiver

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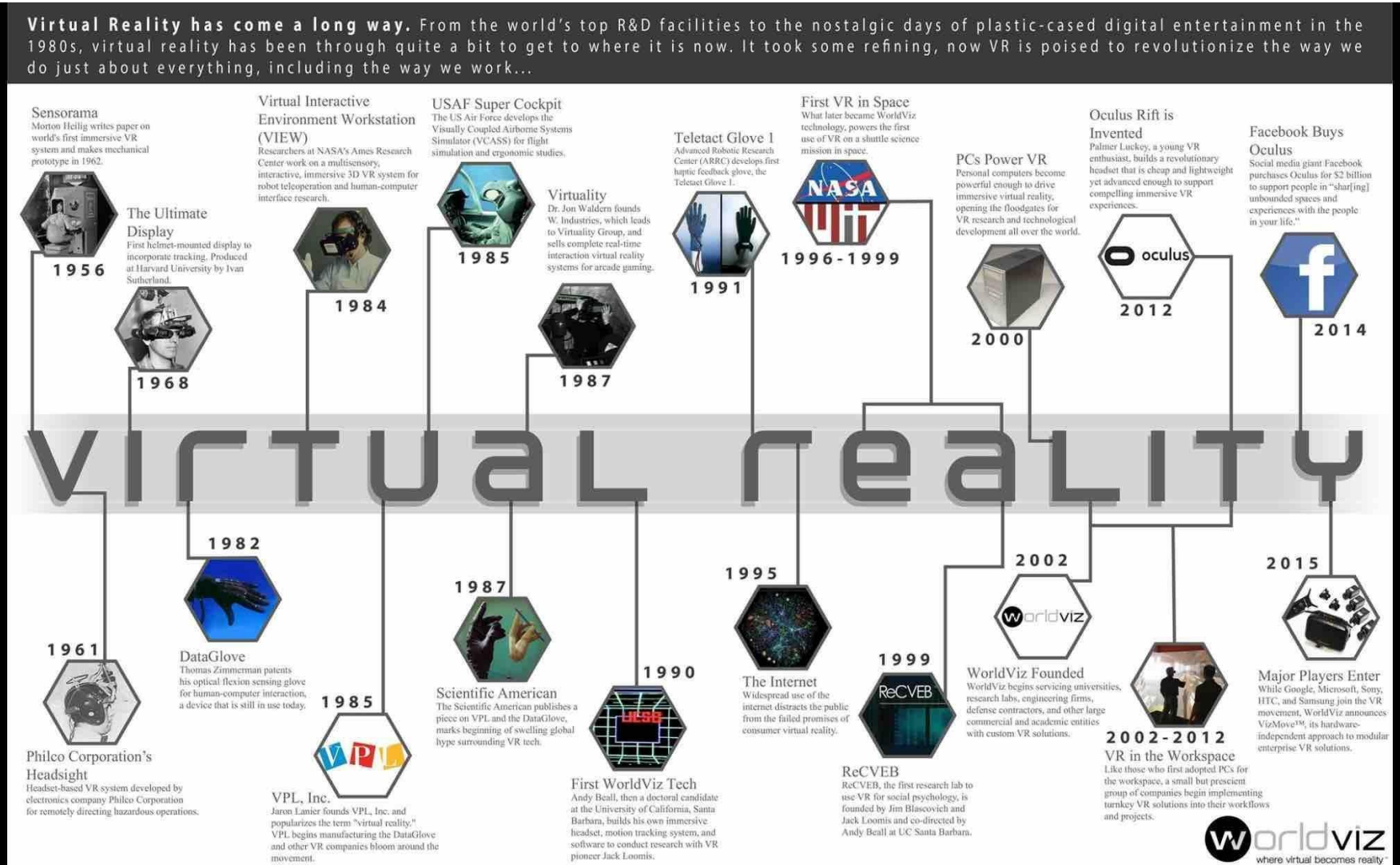
Virtual Reality

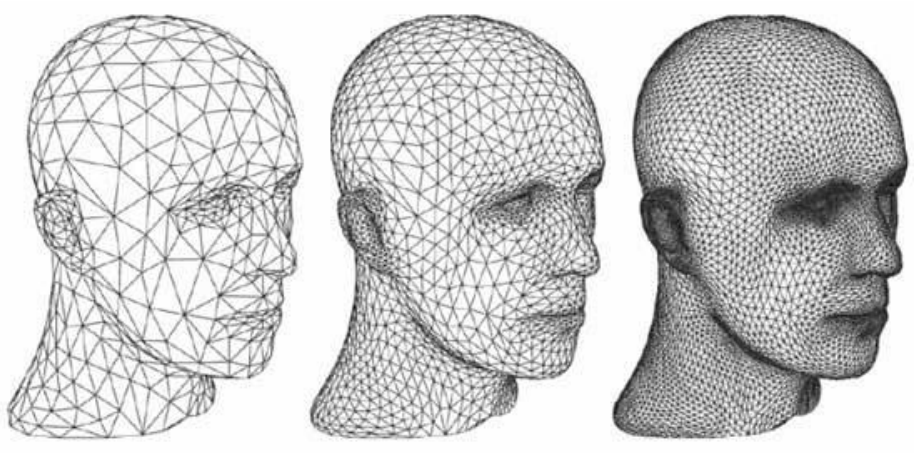
Virtual Reality: a paradigm of interaction with a long history

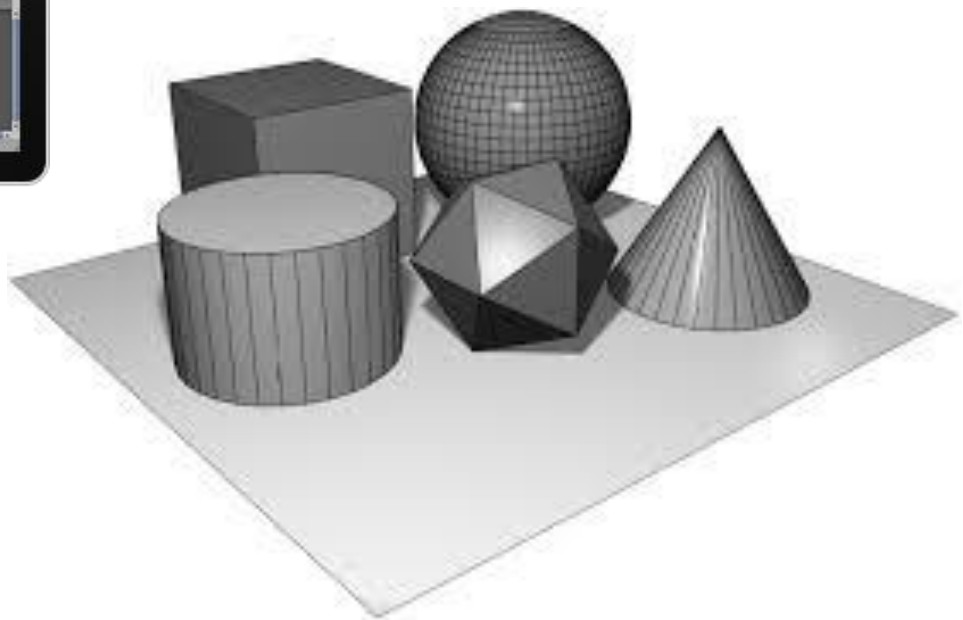


Complexity


CUSTOM
2D & 3D MODELS
PERSONALIZED
CONTENT
IMMERSIVE APPS
3D ANIMATION AND VIDEOS
VR GAME
DEVELOPMENT
360°
VR EXPERIENCE
CUSTOM
AUGMENTED
REALITY

Software





Hardware: Equipment

SAMSUNG GEAR VR

TOP VR EQUIPMENT IN THE MARKET

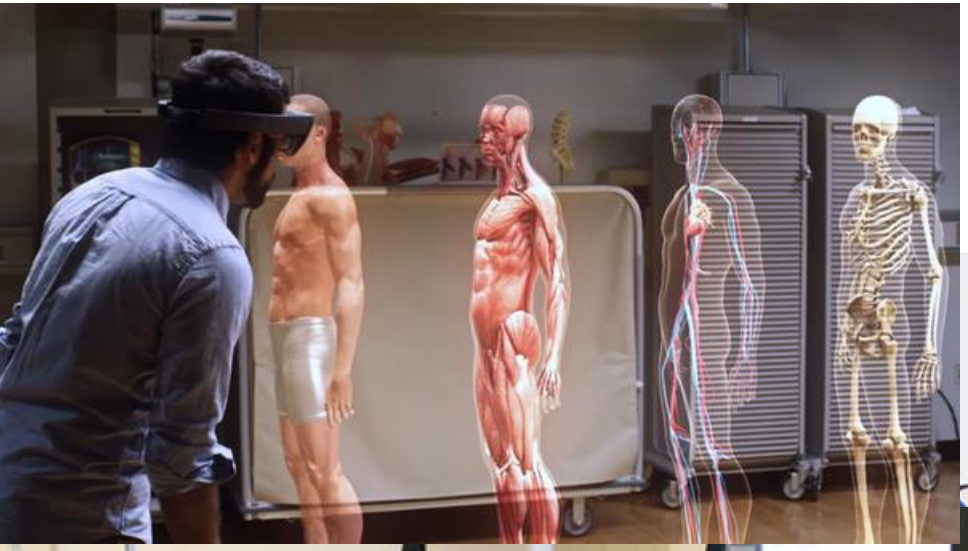
HTC VIVE

OCULUS RIFT

MICROSOFT HOLOLENS

Virtual Reality
(Industrial Design/Architecture)

Virtual Reality (Medicine)



Virtual Reality (Phobias)

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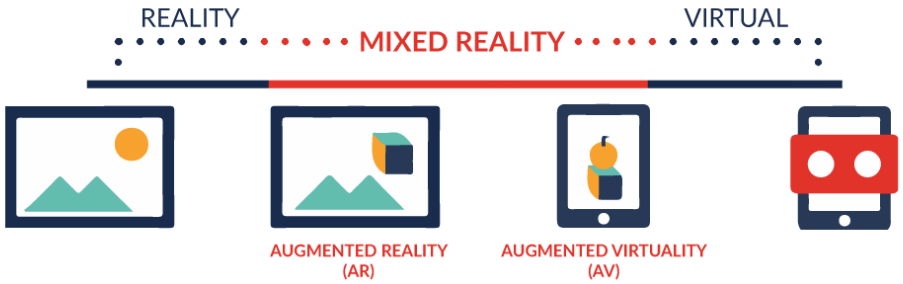


What is Augmented Reality ?

Computer/mobile Generated Data **(Augment)**

+

Physical, Real-world environment **(Reality)**

=

Augment Reality

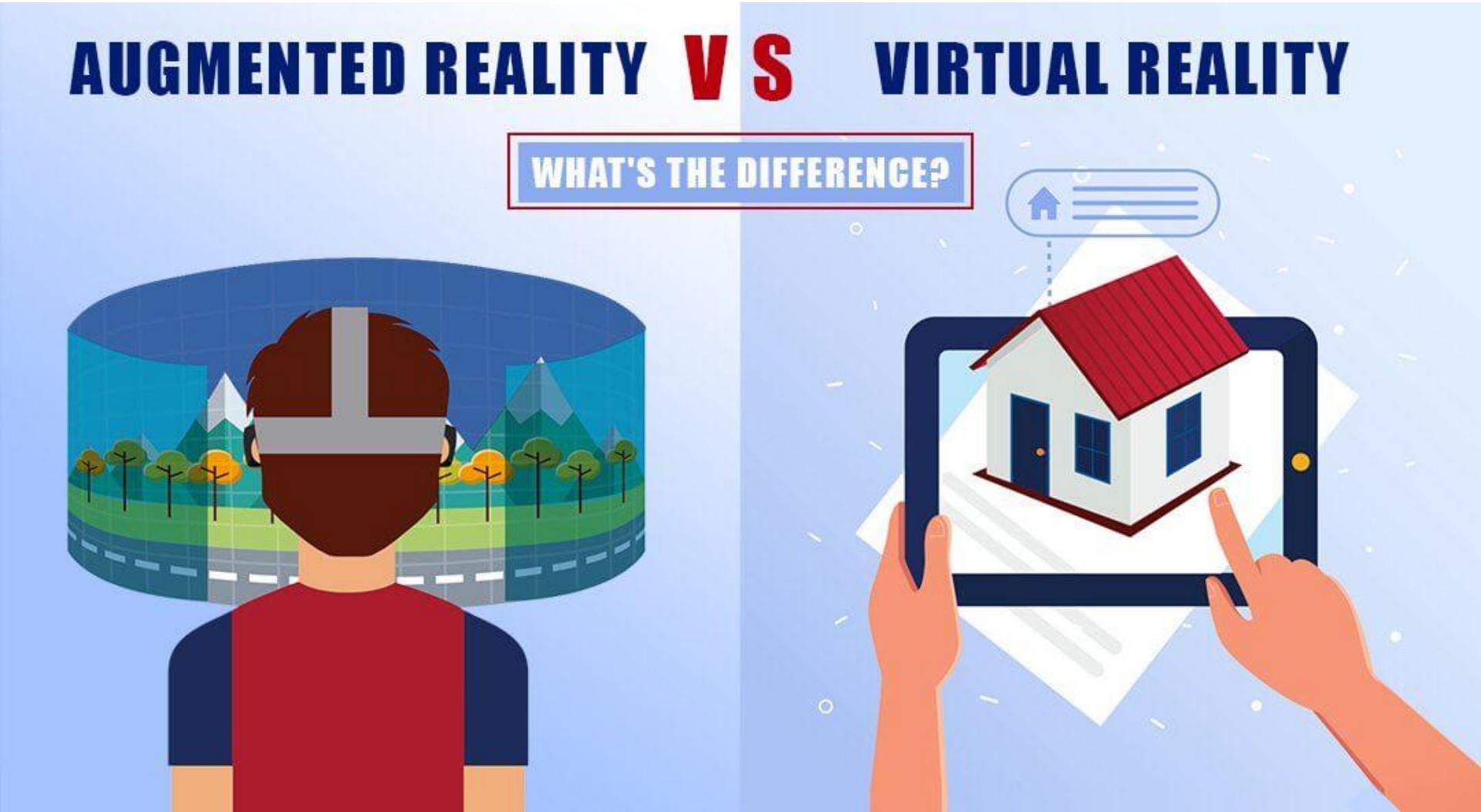
How does it work?

Pick a real world scene

Virtual object added in it

Visualizes the digital as if it's real

Virtual Reality vs. Augmented Reality

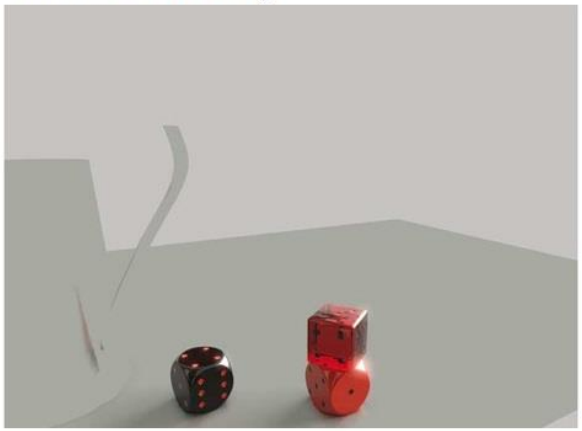


Augmented Reality

Augmented Reality

Reality

Virtual Reality

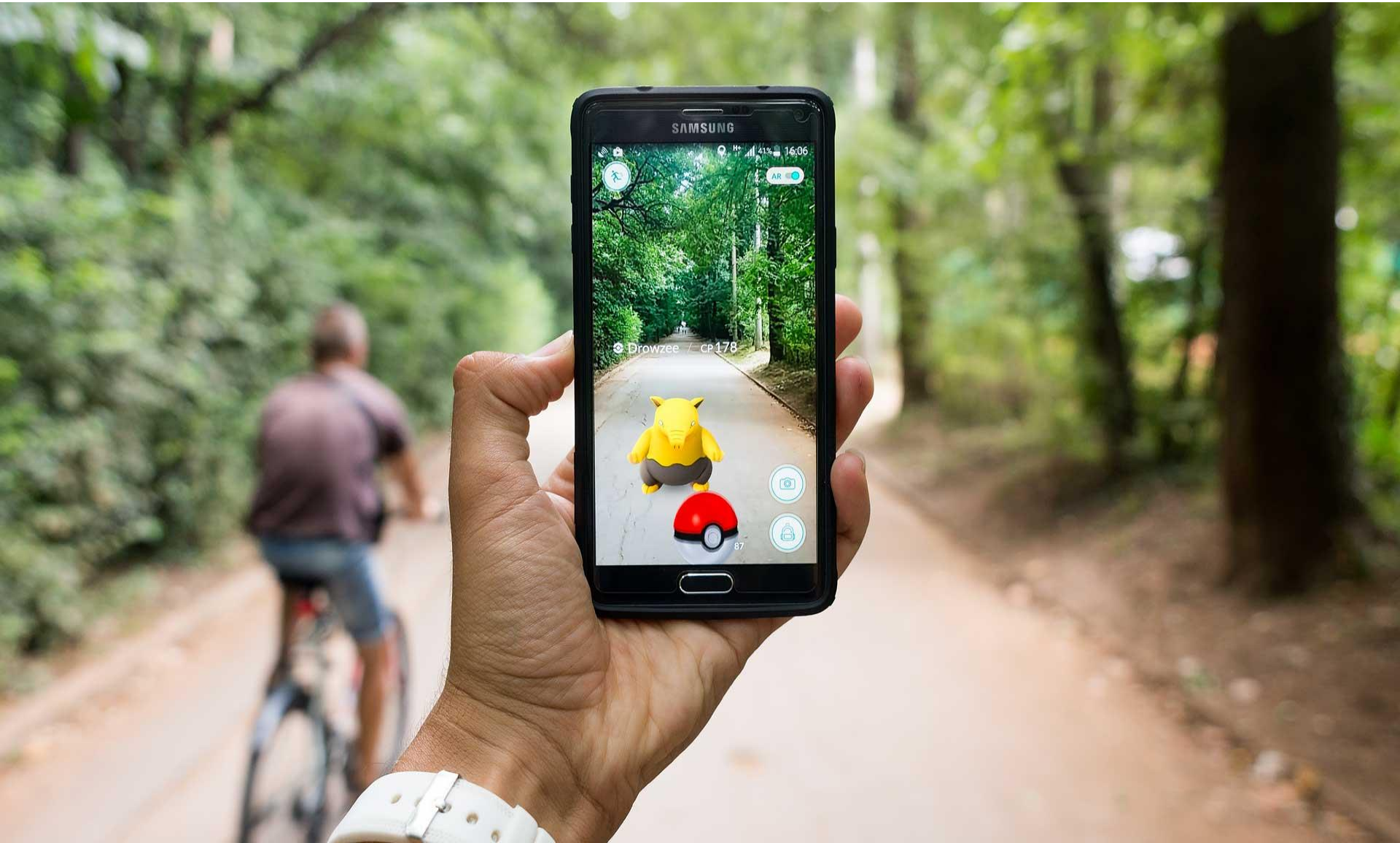


VISUALISATION

TRACKING

INTERACTION

Augmented Reality (Games)



Augmented Reality (Tourism)

Augmented Reality (Phobias)

Augmented Reality vs Mixed Reality

THINGS YOU NEED TO KNOW ABOUT MIXED REALITY VS. AUGMENTED REALITY

WHAT IS AUGMENTED REALITY?

Virtual overlays on top of real-world objects.

WHAT IS MIXED REALITY?

Virtual overlays and real-world objects interact with each other.

Temas

1. Internet of Things (IoT)
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7. Ambient Assisted Living (AAL)
8. Realidad Virtual
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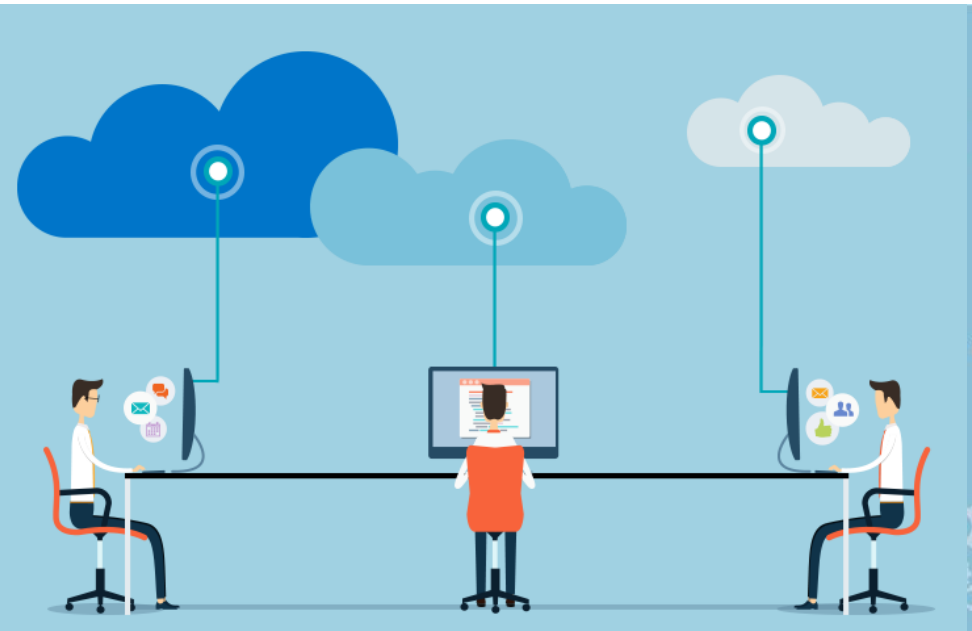
11. Big Data Analytics
12. Affective Computing
13. Dispositivos avanzados de interacción

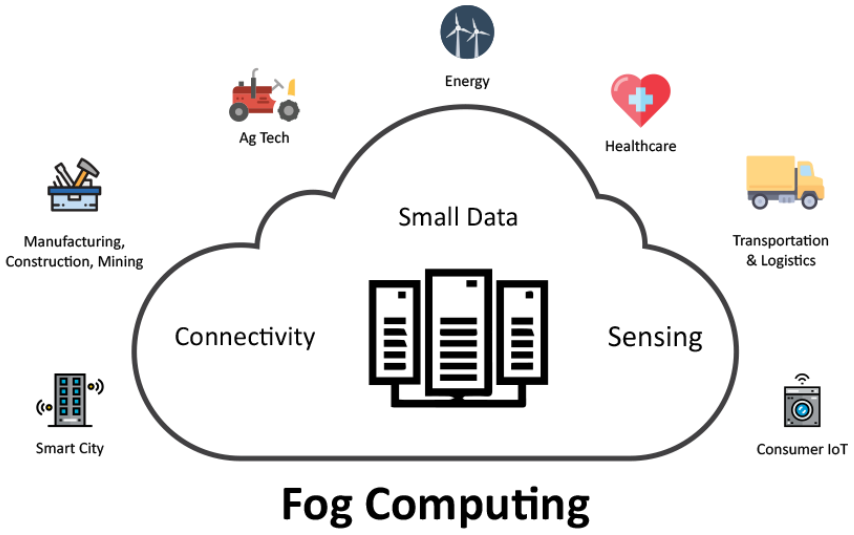
Communication Need



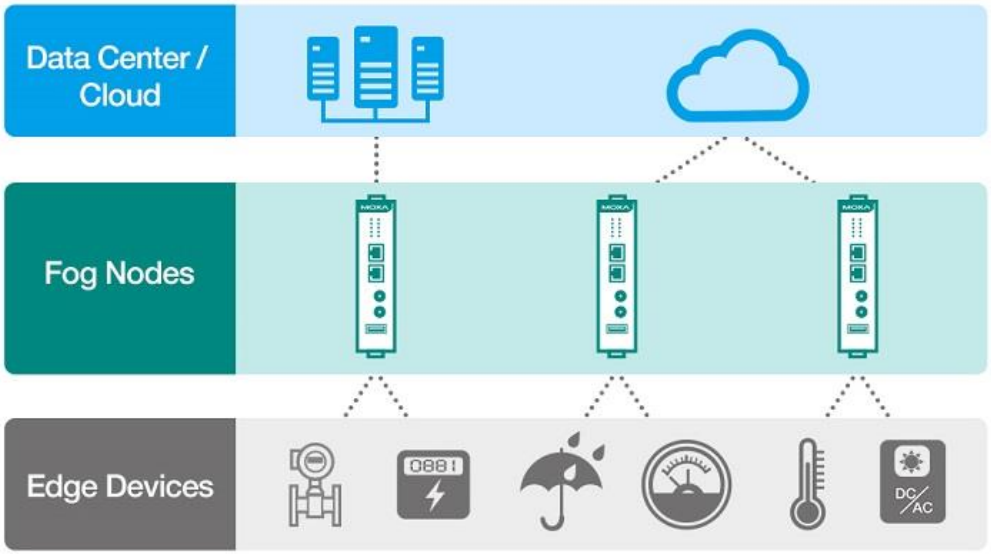
Cloud & Fog Computing

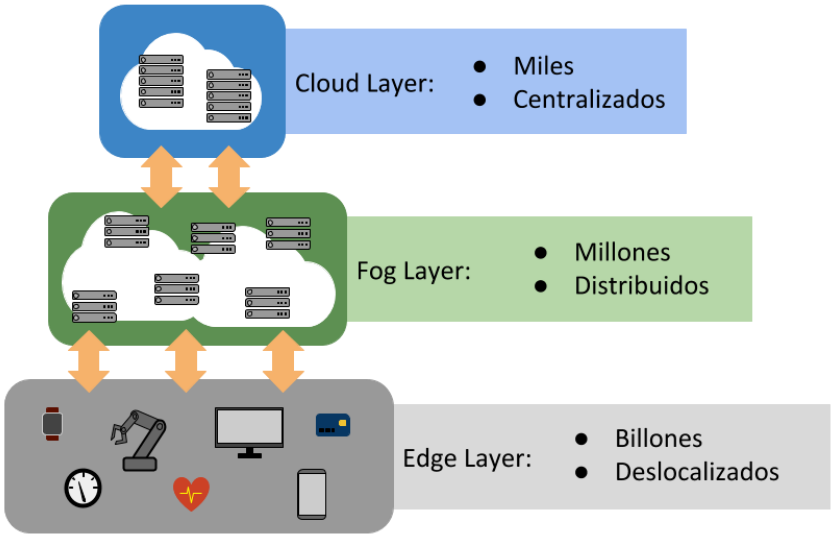
Cloud Computing

Having secure access to all your applications and data from any network device

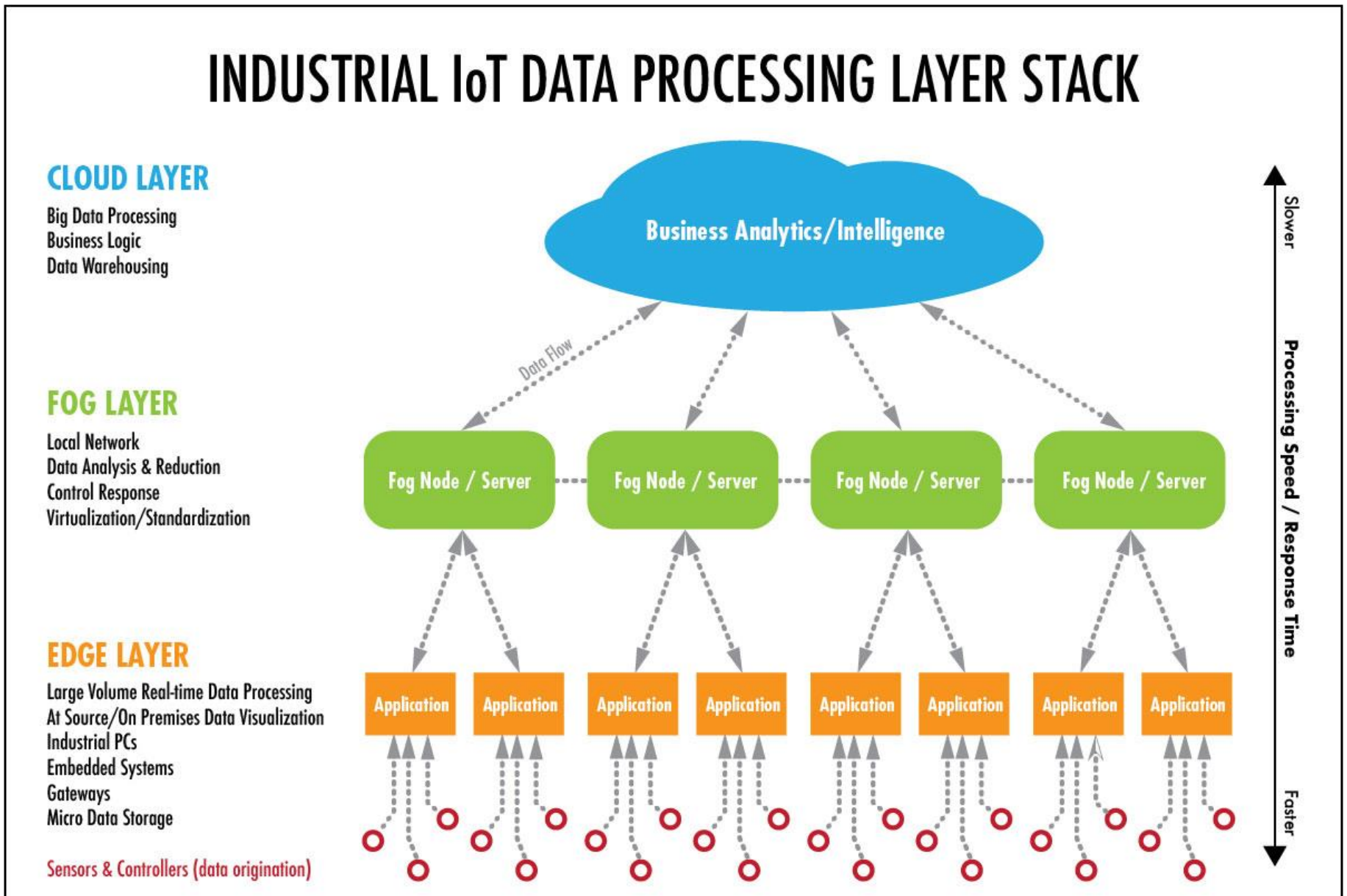


Fog Computing





Multilayer Architecture



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Need for data processing

Multiple Information Sources

Big Data & Data Analytics Services

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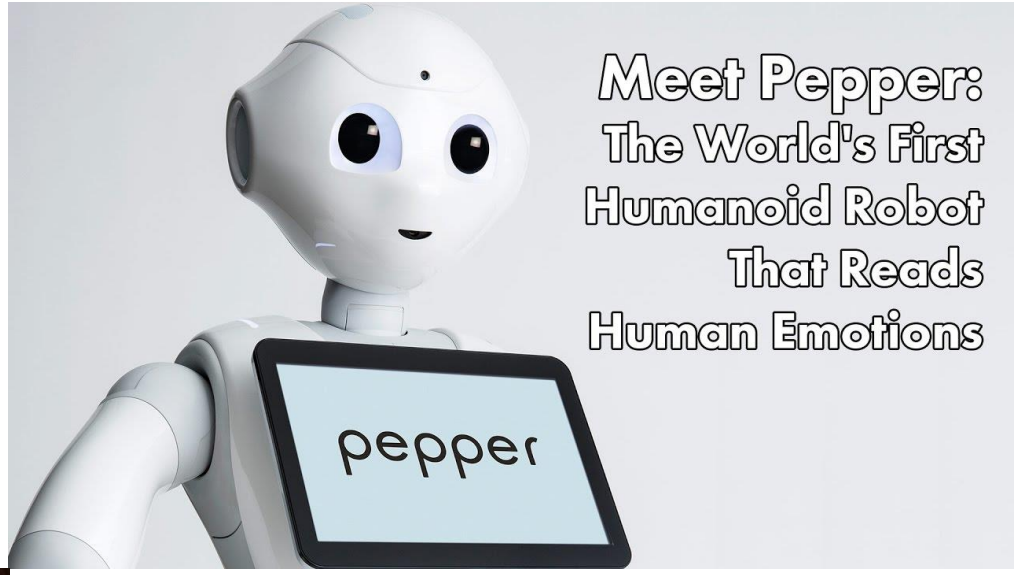
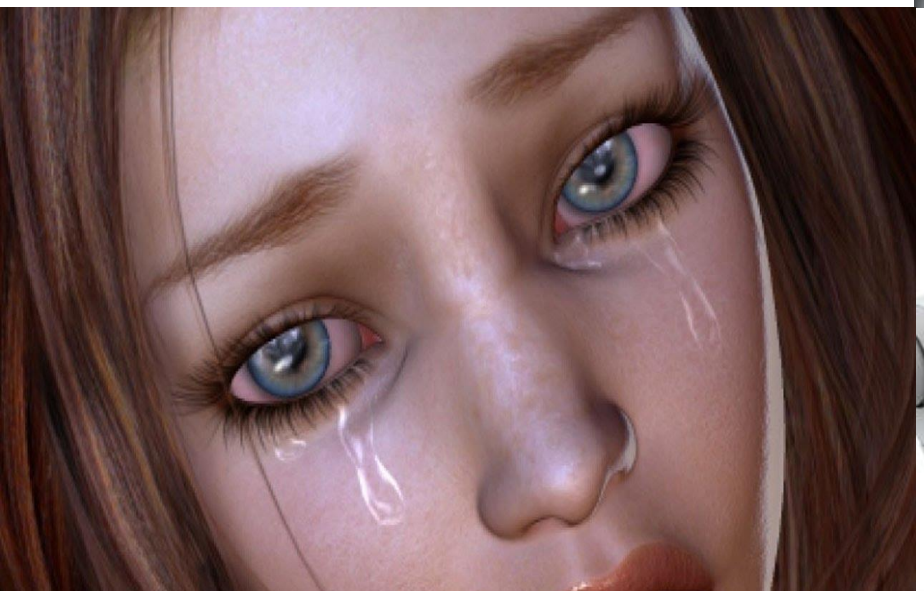
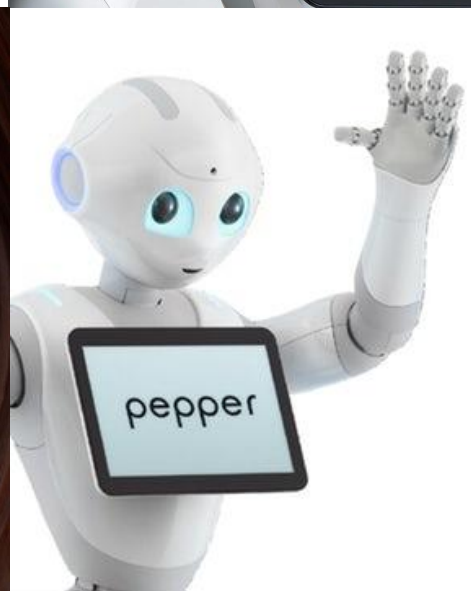
What is Affective Computing?

"**Affective Computing** is the study and development of **systems and devices** that **recognize, interpret, process and simulate** human affects"

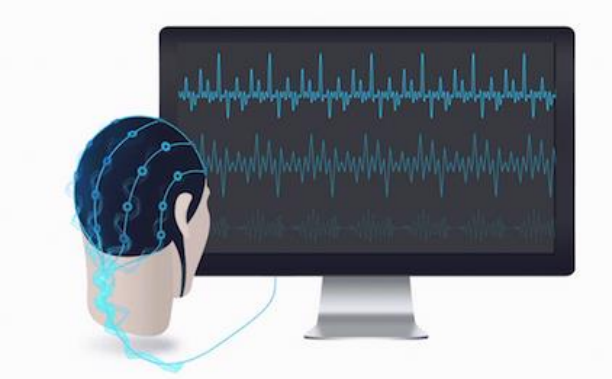
Recognize, interpret, process and simulate



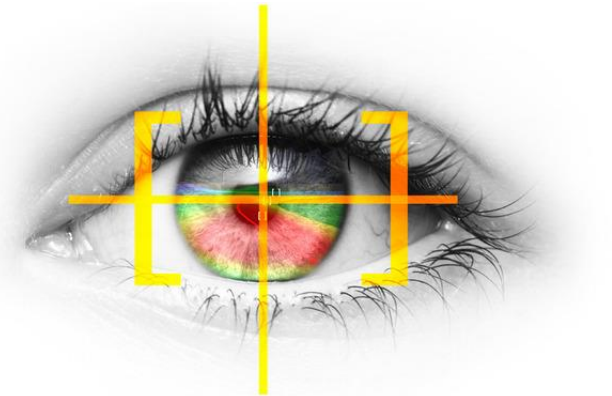




Measuring




Emotions can be measured
Visualization
Classification
Neutral
Neutral
Open
Open
Open
affectiva
HAPPY



Emotion Recognition

How?: Recognition, simulation, ...

Raw Data

Self-report, face, voice, context, brain signal, EDA signal....

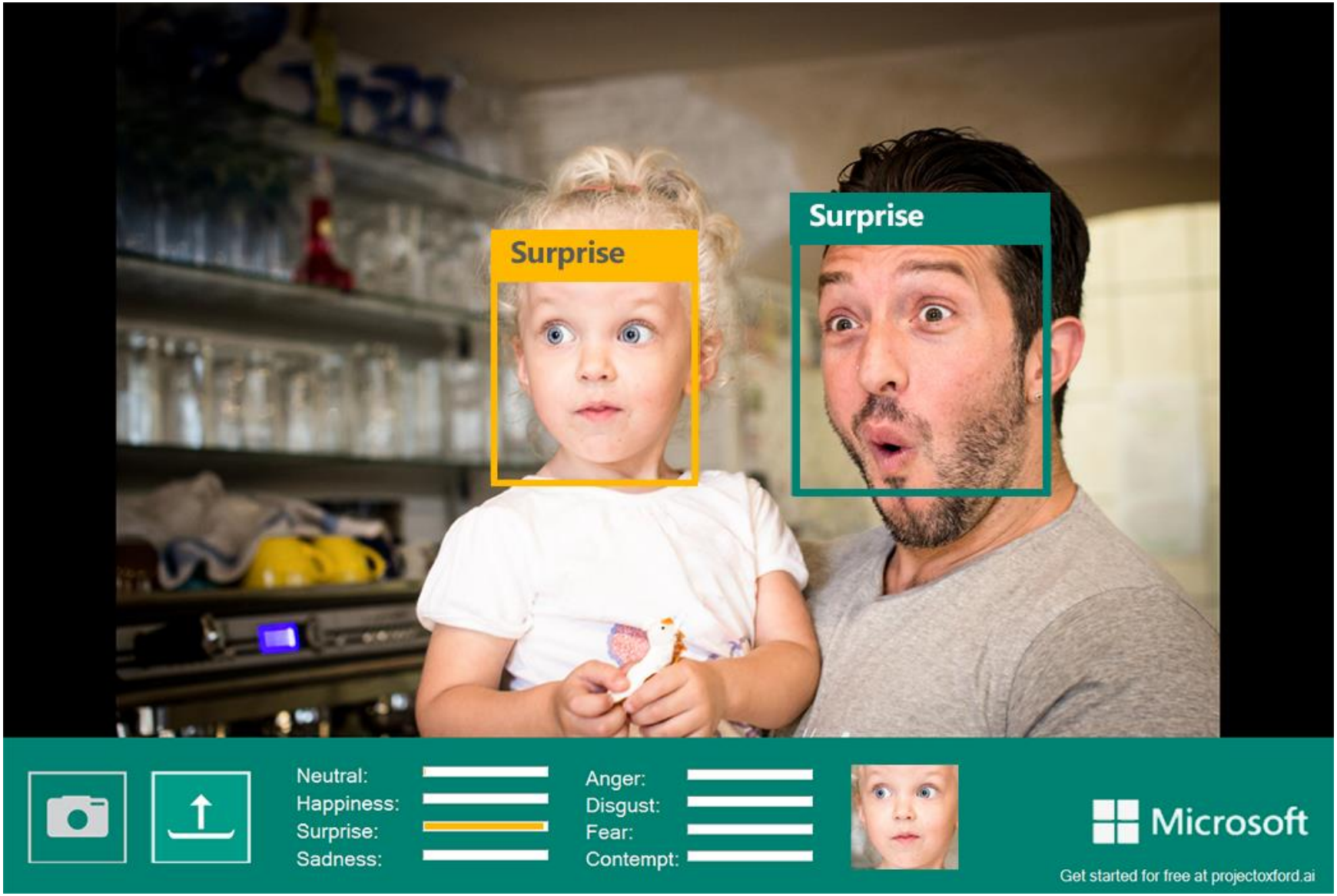
Feature Extraction

Q_1, Q_2, Q_3.....

Emotion Classification

Y_1, Y_2, Y_3...

Face analytics & Emotion Recognition



Face analytics & Emotion Recognition

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TIME
Never Offline.
The Apple Watch is just the start. How wearable tech will change your life—like it or not
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1,278
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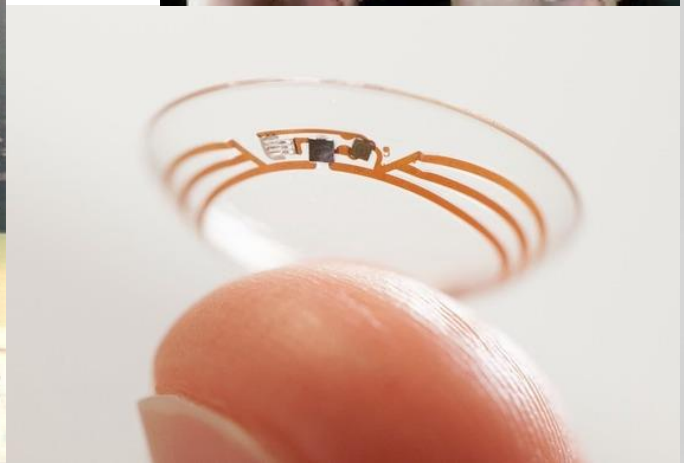
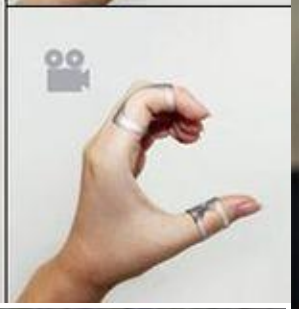
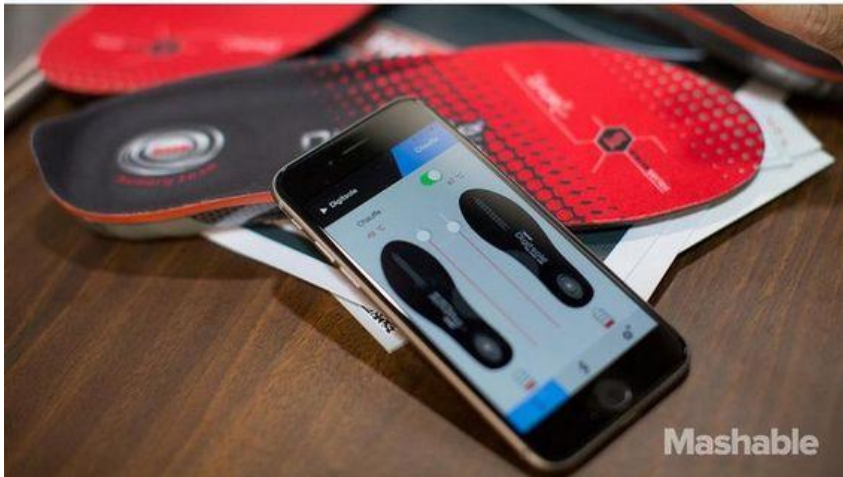
Wearable Computing

Innovative materials



New interaction styles





Scenario

Scenario

Film “Terminator 2” (1991)