Organic Visible Light Communication

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ISCOM @ Glance

Istituto Superiore delle Comunicazioni e delle Tecnologie dell'Informazione (aka ISCOM), DG of the "Ministero dello Sviluppo Economico" (MISE) is a technical scientific body. Its main activities are developed for the central PAs, the end users and the private companies.
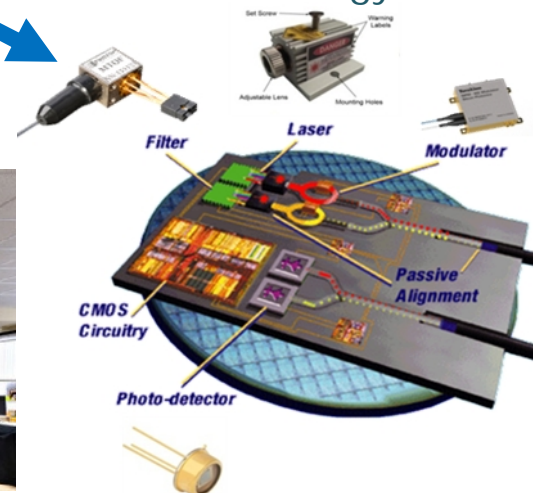
ISCOM – Research Topics in NGN

Optical Wireless Communication

Università di Roma
Tor Gata

OPTICWISE

WEATHER STATION

MEDIACONVERTER

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SETUP FSO

Data Center

Optical Tx/Rx

Tx Rx

INDOOR →

← OUTDOOR

Activities

Silicon Organic Hybrid Technology

Filter Laser Modulator

CMOS Circuitry Passive Alignment

Photo-detector

Test Plant Laboratory

Cavo Roma-Pomezia:
MAN (50km)

Visible Light Communication

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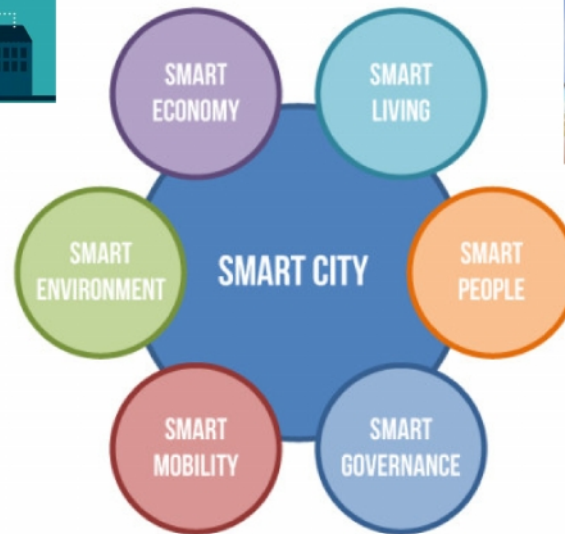Tor Vergata

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Partnerships e collaborazioni

- CNR – Ist. Fotonica e Nanotecnologie, Rome & Trento, Italy
- University of Rome Tor Vergata, Italy
- University of Rome Roma Tre, Italy
- University of Rome Sapienza, Italy
- University of L'Aquila, Italy
- Politecnico of Milano, Italy
- University of Cagliari, Italy
- University of Padova, Italy
- Istituto Superiore Mario Boella, Turin Italy
- University of Palermo, Italy
- S.S. Sant'Anna - CNIT, Pisa Italy
- NICT (National Inst. ICT), Tokyo, Japan
- University of Newcastle upon Tyne, UK
- Instituto de Telecomunicacoes, Aveiro, Portugal
- National Insitute of Communications, Warsaw, Poland
- Academy of Science, Prague, Czech Republic
- Athens Information Technology Center, Athens, Greece
- Universidad Politecnica de Cataluna, Barcelona, Spain
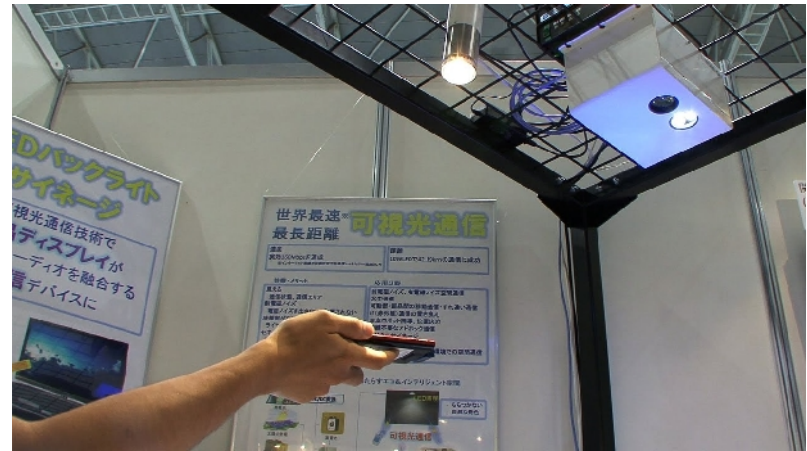- University Politecnick, Yerevan, Armenia

Smart City – A 'broad' concept

A Smart City is an urban development vision to integrate multiple information and communication technology (ICT) and Internet of Things (IoTs) solutions to improve quality of life.
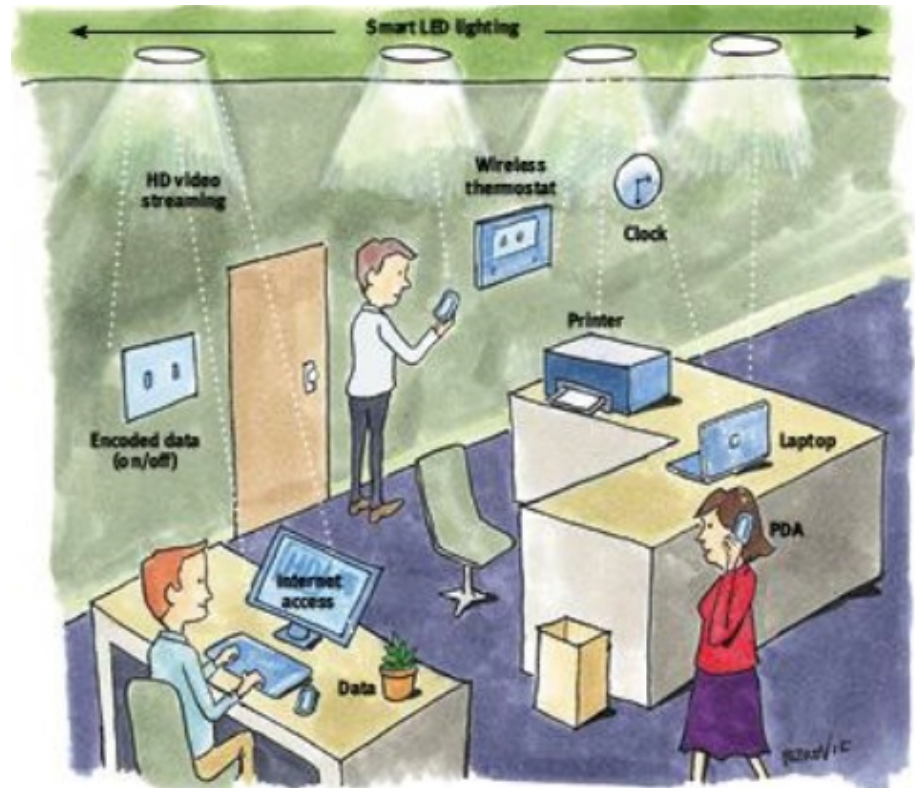
Visible Light Communication (VLC)

The use of the environmental light as source of an optical wireless data communication system.

LED Light Fixture

Send

Light On/Off Color Info, etc.

Receive

LED Backlight for LCD TV

On

Off

Data is transmitted by rapidly switching a light source On and Off. Communication can be implemented using standard lighting, but LED sources are ideal. Switching is too fast to be seen.

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Why VLC?

➢ **Fast**
1÷3.5Gb/s (recently 10Gb/s demonstrated!)

➢ **Secure**
receive data only inside the room

➢ **Cheap**
use of environmental light

➢ **Safe**
light instead radio

➢ **Omnipresent**
light is everywhere!

VLC isn't "the one" wireless communication technology, but more a valid alternative and complementary to other technology
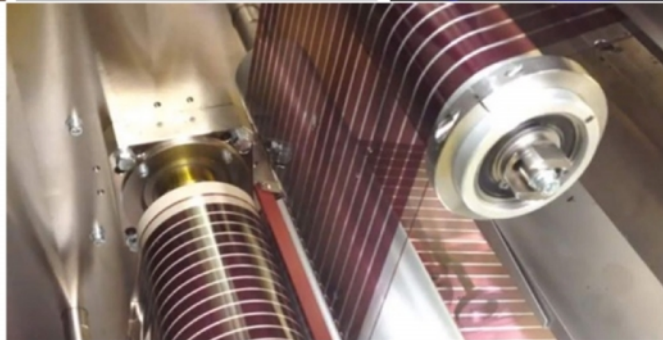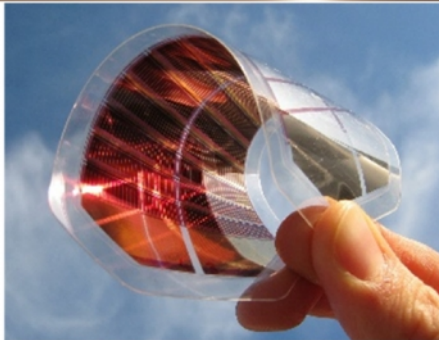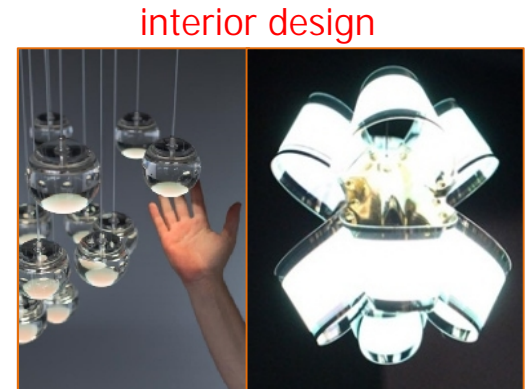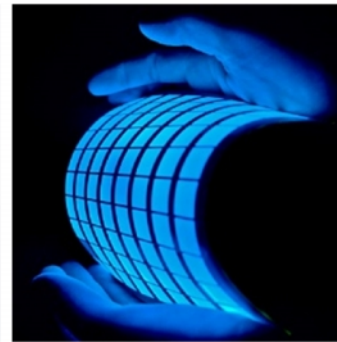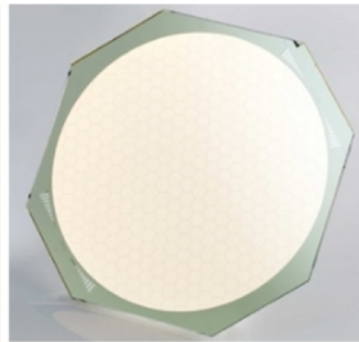
Organic Visible
Light Communication

Organic devices: printed, cheap, large-area, flexible

✓ OLED (organic light-emitting diode)

✓ OPD (organic photo-detector)

interior design

Organic devices are incorporable on many different other products!

VLC – Commercial products

pureLiFi
Light becomes data
LiFi-X
40Mb/s full-duplex

- Touch Screen
- WYSIPS® Crystal component
- Display
- Terminal Interface Materials

integrated receiver for smartphone

VLC PRODUCTS

LED Spot Light Transmitter

Light Receiver USB Dongle

Light Receiver for smart phone and tablet PC's

Patented High Sensitive Photo Detector

VLC Transmit and Receive Development Kit

dongle

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Applications of VLC

Applications of VLC – Home & Office

Visible Light Communication is intrinsically an effective choice in an environment with many final 'users' to satisfy, and some of them are not humans!!! (IoTs scenario)

smartphone, TV, tablet and…
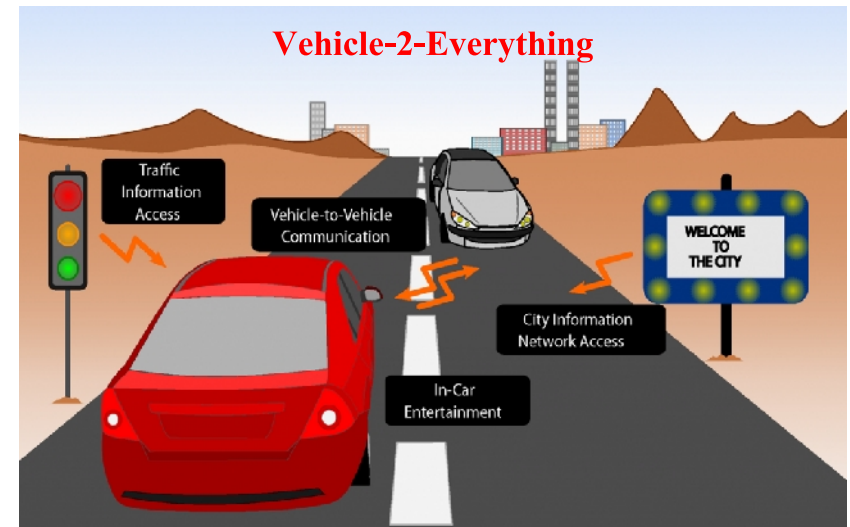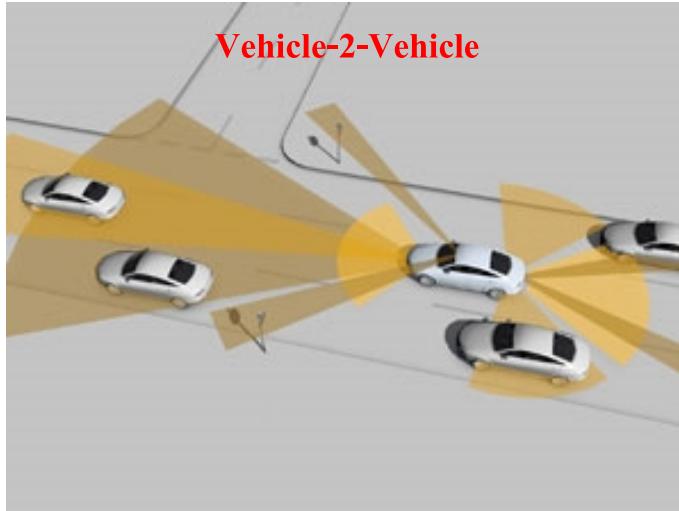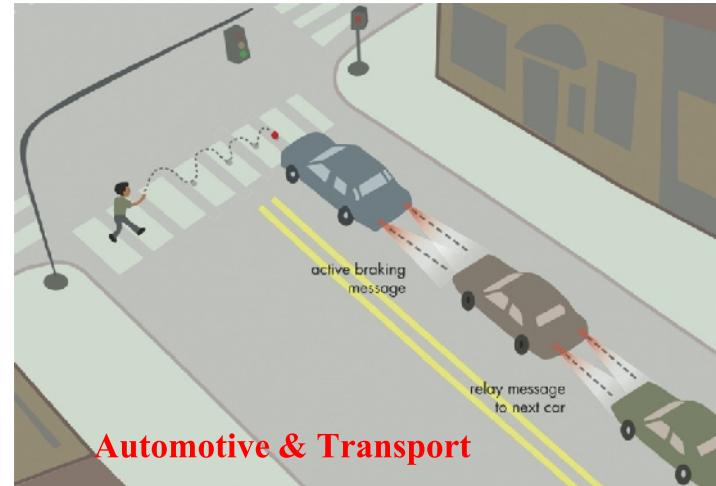my water heater?!?
(household appliances)

smartphone, laptop PC,
printer, air conditioner
(office equipment)

Applications of VLC – Smart Mobility

Visible Light Communication could be used to realize a diffused communication system for traffic information and to prevent and avoid accidents
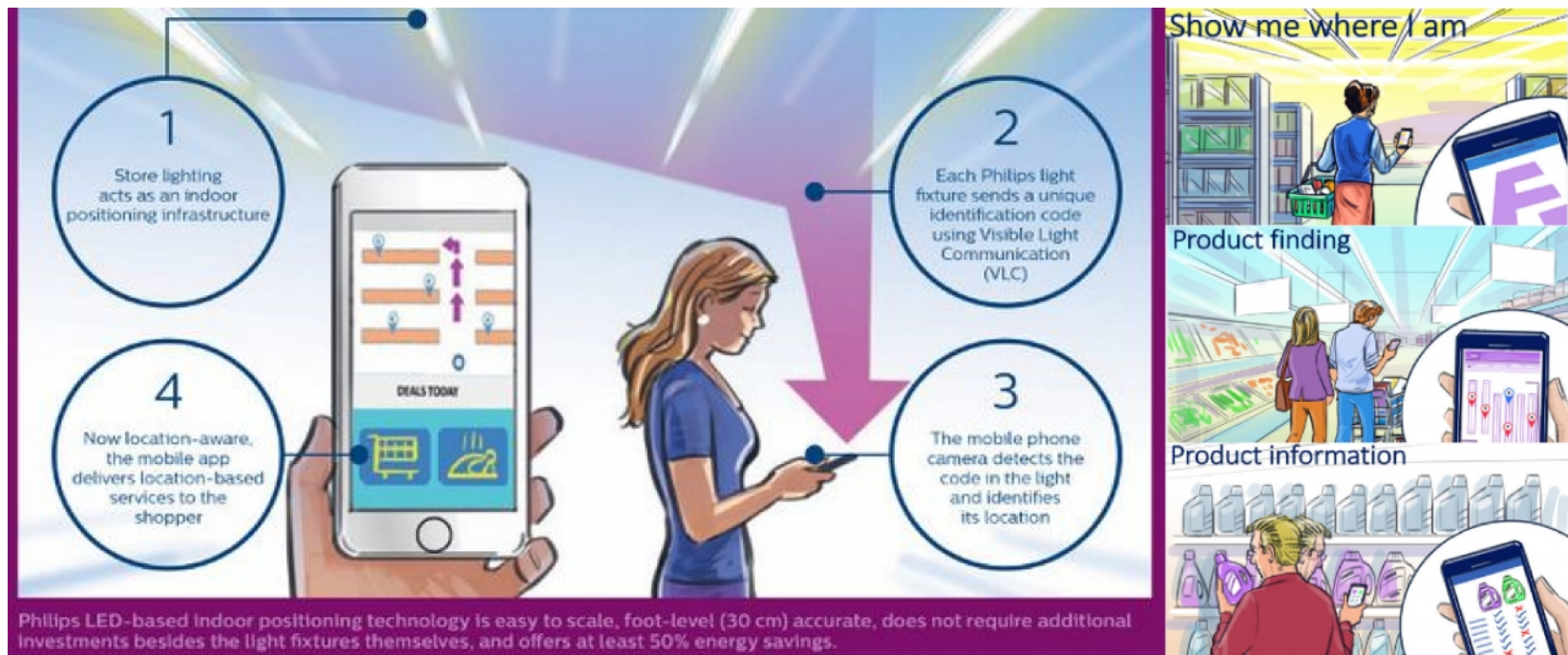

Smart Traffic Headlights

Automotive & Transport

Vehicle-2-Vehicle

Vehicle-2-Everything

Applications of VLC – Indoor Positioning System (IPS)

Visible Light Communication used for tracking something in a huge environment (with a precision up to 30cm), for example your favorite cornflakes!!! (indoor GPS)

Applications of VLC – Merchandiser Info

Applications of VLC – Entertainment

Use for entertainment purposes (museums and exhibition halls)

LED spot lighting
(indirect lighting)

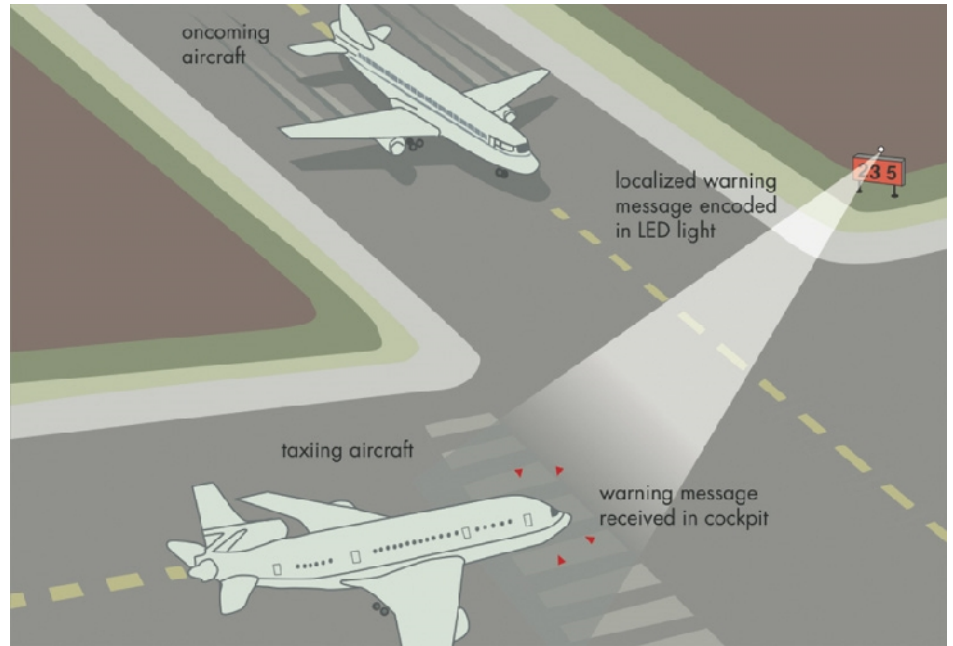LED panel-type lighting
(indirect lighting)

Transmit (receive) ID signals, which function as the basis for indicating detailed information on the displays or artists.
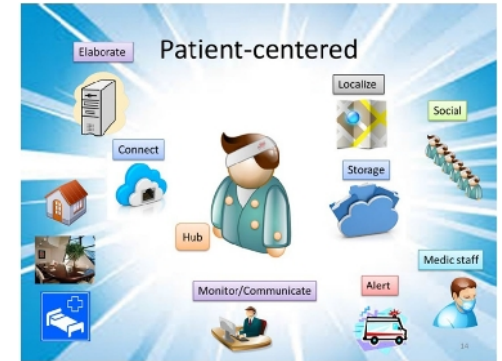
Applications of VLC – Airplane

Visible Light Communication replaces radio communication where it isn't allowed
- ❑ communication on airstrips (airplane to center of operations)
- ❑ communication inside airplanes (entertainment systems)
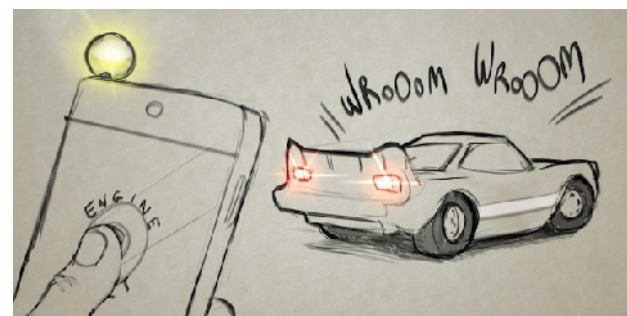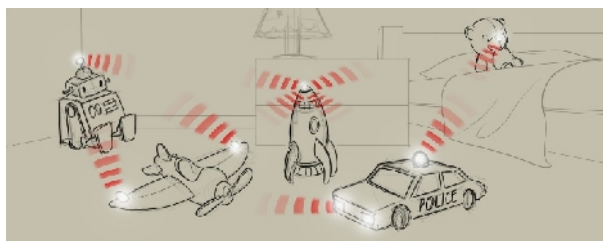- ❑ no interferences with on-board instruments

Applications of VLC – Healthcare

Visible Light Communication is the most suitable choice in closed environment like an hospital. Since the regulated and limited use of radio waves, the VLC system could connect medical equipment (cable-free), particularly in the operating rooms.
Plus, the electrical isolation on the connection between devices is possible.
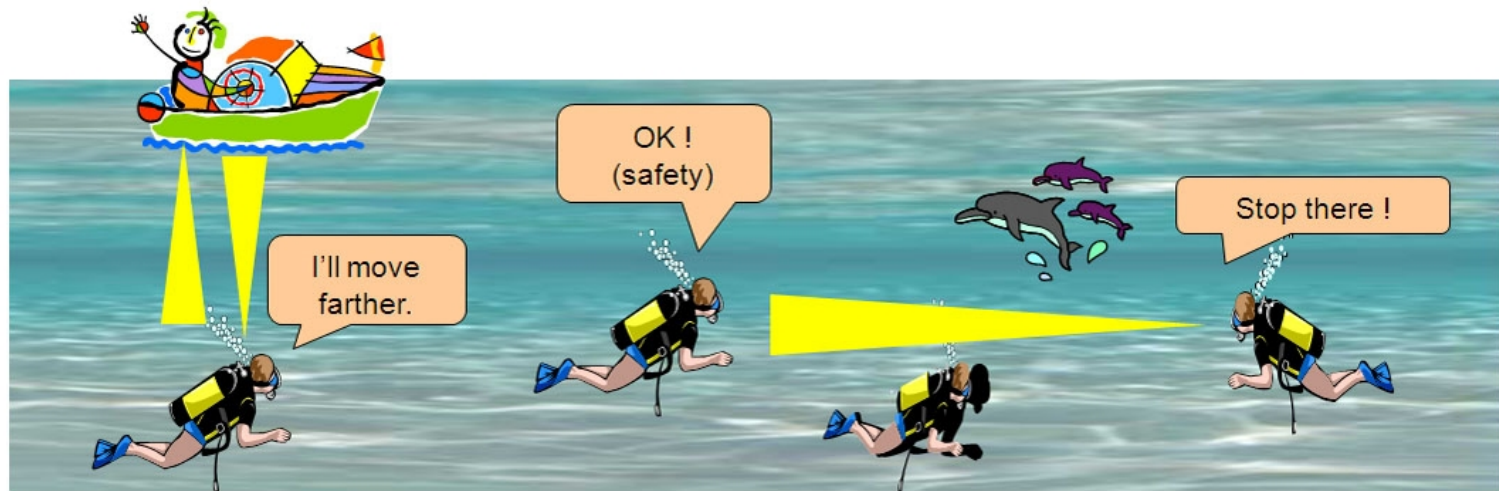
Applications of VLC – Disney Research

"Disney Research's mission is to drive value for The Walt Disney Company by delivering scientific & technological innovation Company-wide. Our world-class research talent invents and transfers the most compelling technologies enabling the Company to differentiate its content, services, and products"(from website)

Applications of VLC - Underwater

Visible Light Communication could be the unique technology available in "particular" situation!!!

Underwater... (where radio couldn't)

Conclusion

Visible Light Communication is a promising wireless technology communication system, providing fast, cheap and secure data-link using modulated environmental lights

Its fascinating characteristics make the appropriate solution to implement IoTs' scenario in a Smart City background

Furthermore, thanks to the possibility to realize organic devices (both light sources OLEDs and photo-voltaics OPDs), cheap and flexible, Organic Visible Light Communication is realizable practically on everything

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