

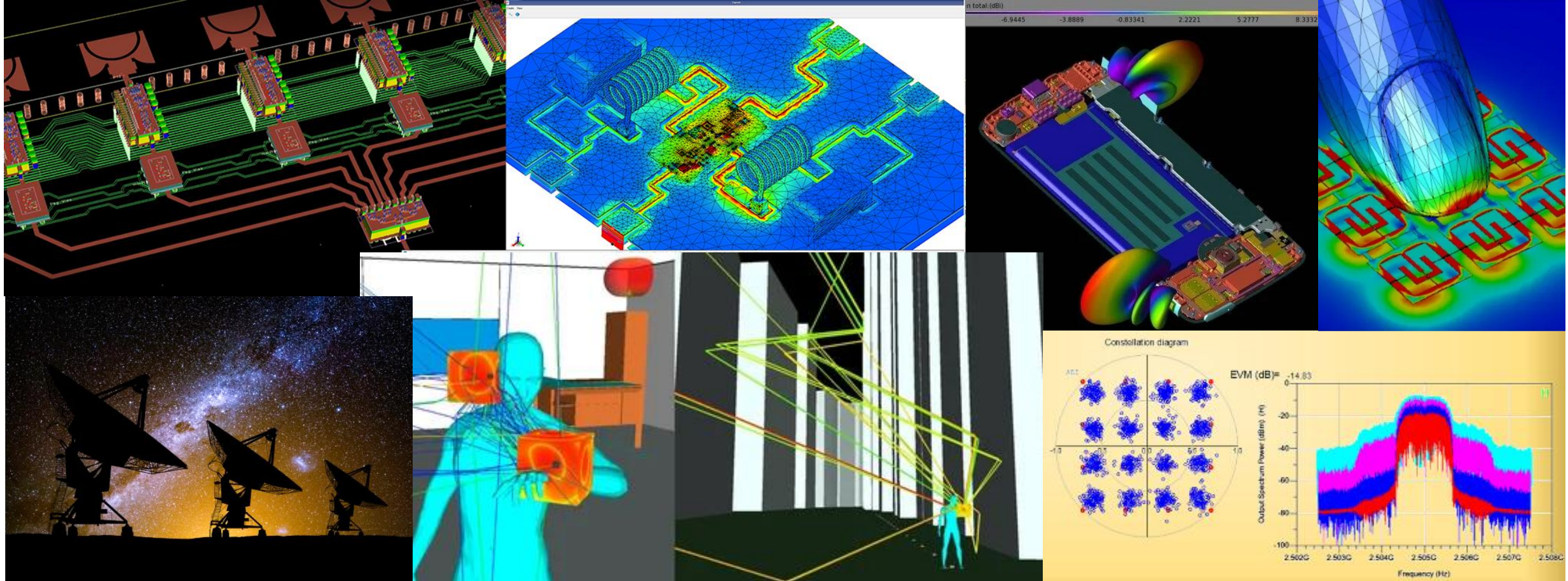
Inseguendo le Onde Radio

Valentina Palazzi | Università degli Studi di Perugia

Giornata Internazionale ONU delle Donne e delle Studentesse nella Scienza



Ingegneria Elettronica delle Alte Frequenze

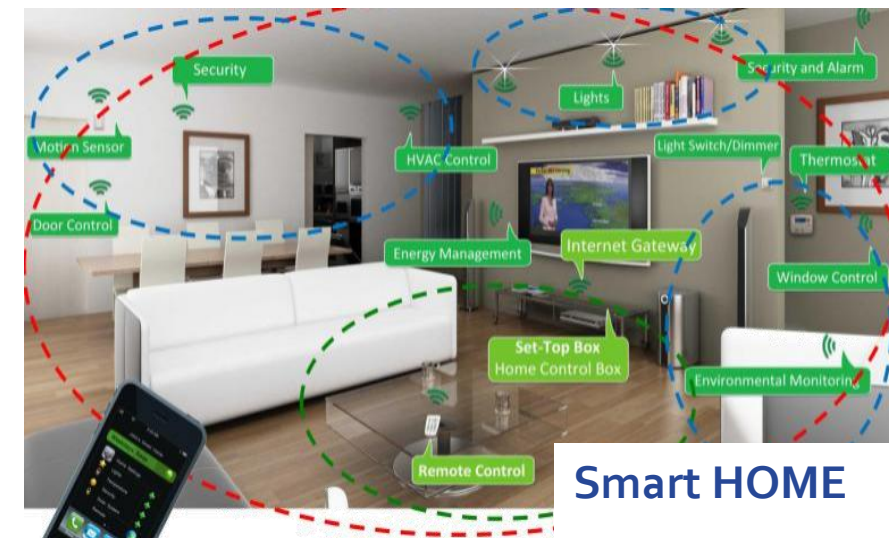
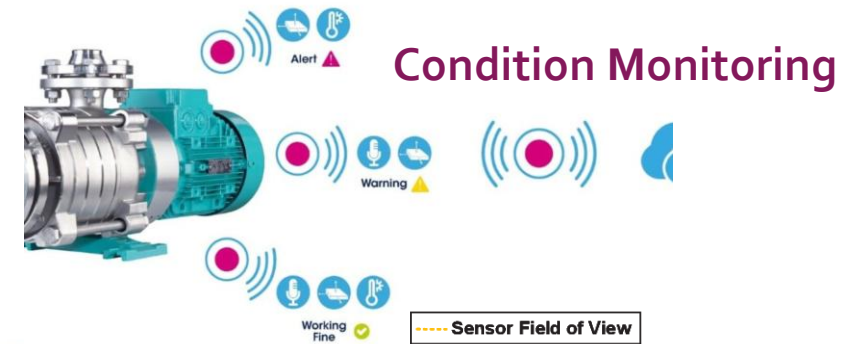
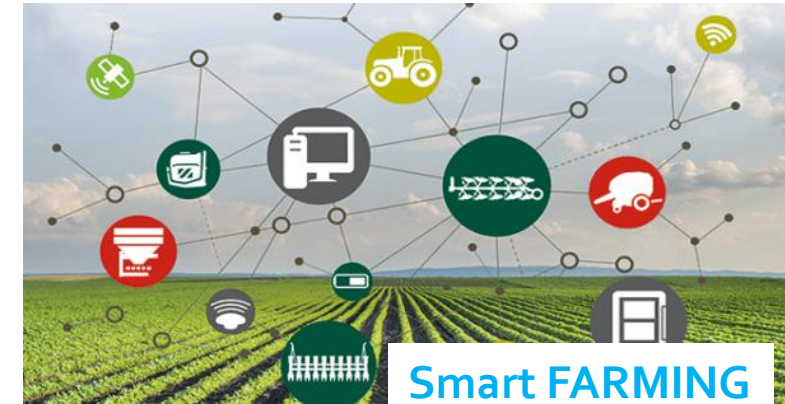
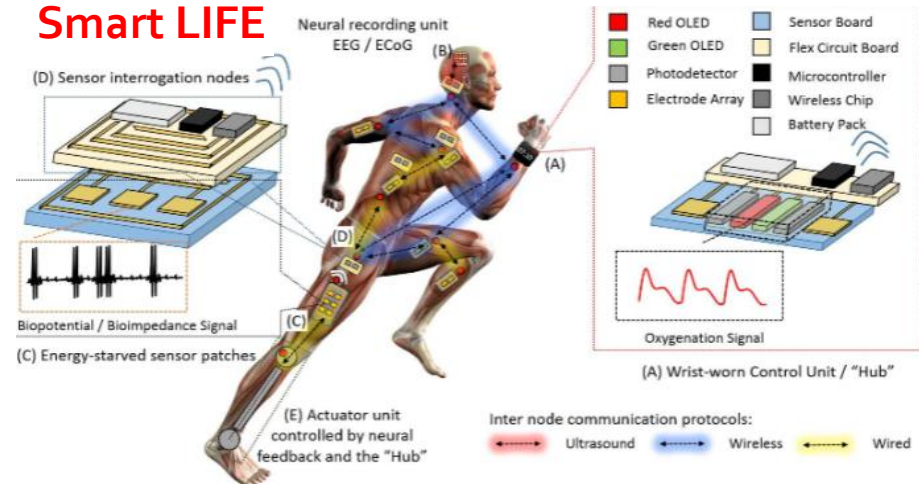


Sources:

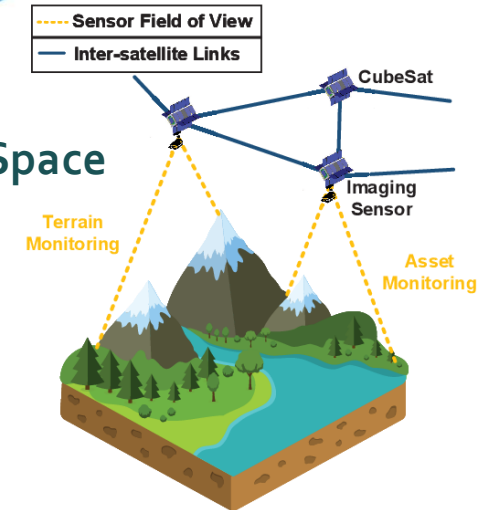
- <https://www.remcom.com/wireless-insite-propagation-software>
- <https://www.3ds.com/products/simulia/cst-studio-suite>
- <https://www.keysight.com/us/en/products/software/pathwave-design-software/pathwave-advanced-design-system/pathwave-ads-rf-microwave-circuit-design.html>
- <https://www.popularmechanics.com/space/telescopes/a43604571/worlds-most-sensitive-radio-telescope-got-better/>

Ubiquitus Intelligence

Smart LIFE



Internet of Space



Progresso tecnologico

Visore per realtà virtuale, European Space Agency

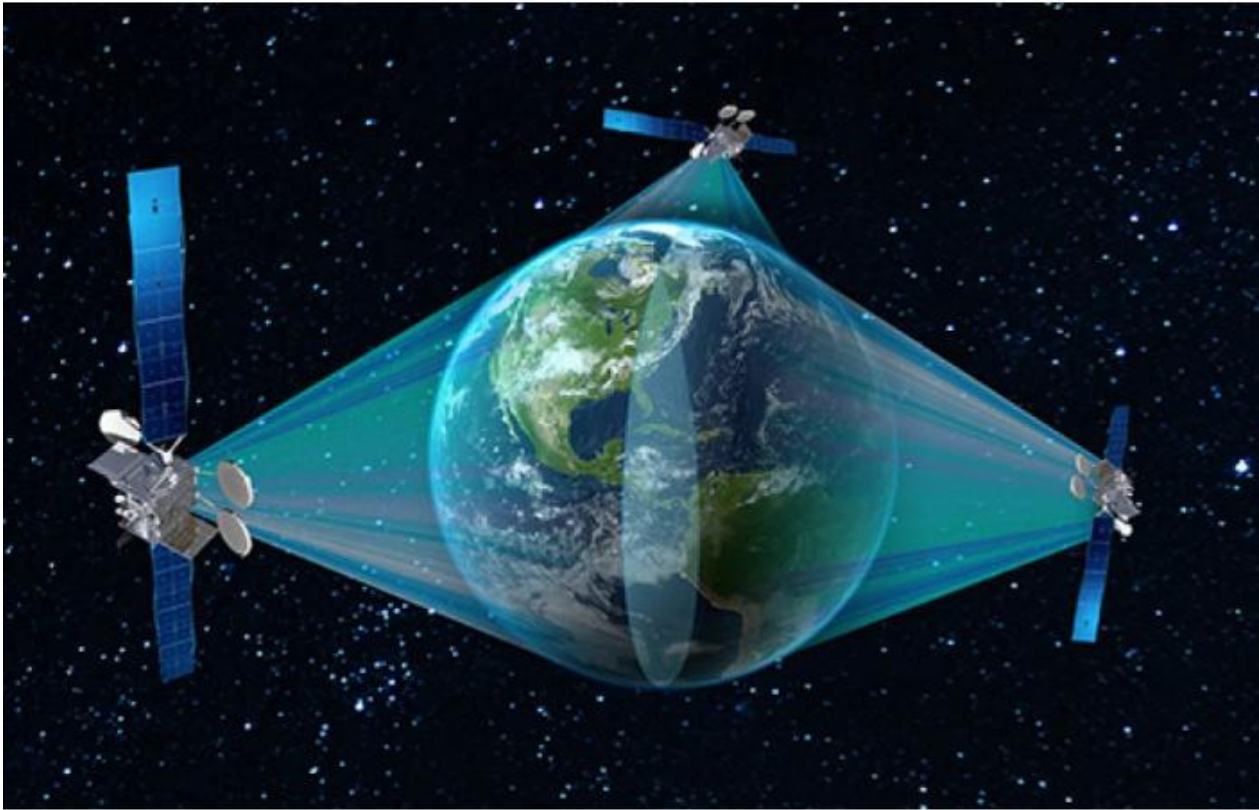


Intervento chirurgico da remoto, Fizhou Evening News

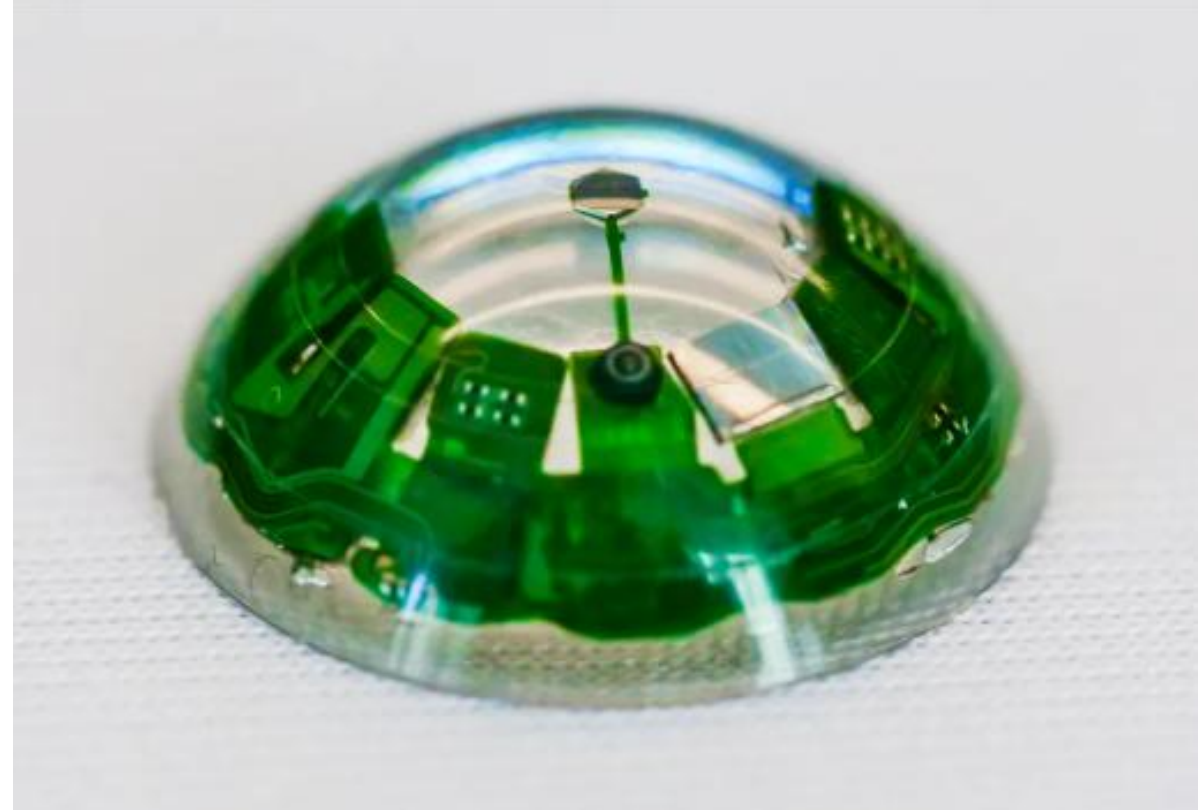


Progresso tecnologico

Internet a banda larga satellitare, Viasat



Lenti a contatto intelligenti con display a microLED, CNET



Progresso tecnologico

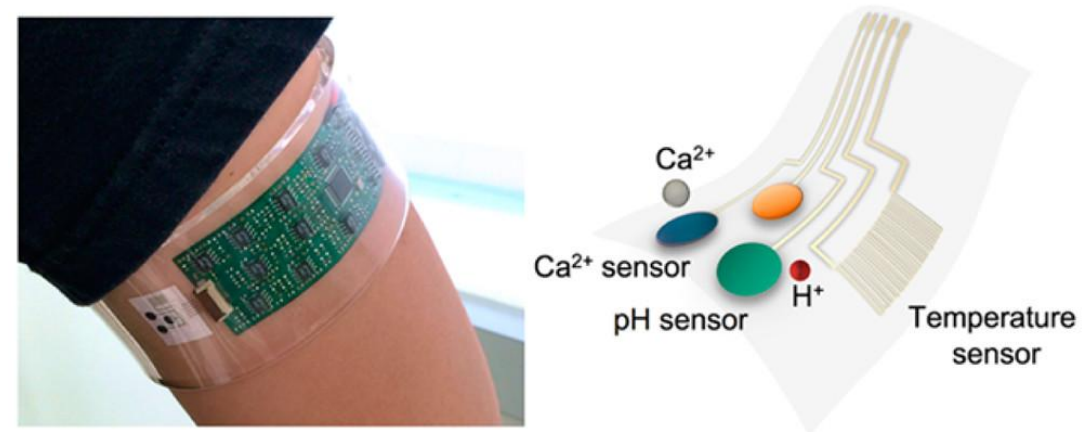
Braccio robotico controllato con la mente, UPMC



Braccio bionico, DEKA

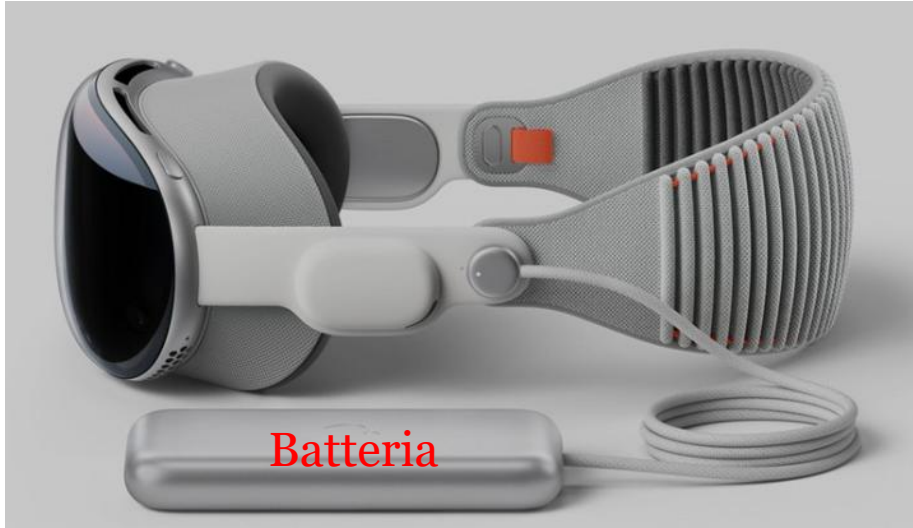


Sensore di temperature e PH, Nyein et al., 2018

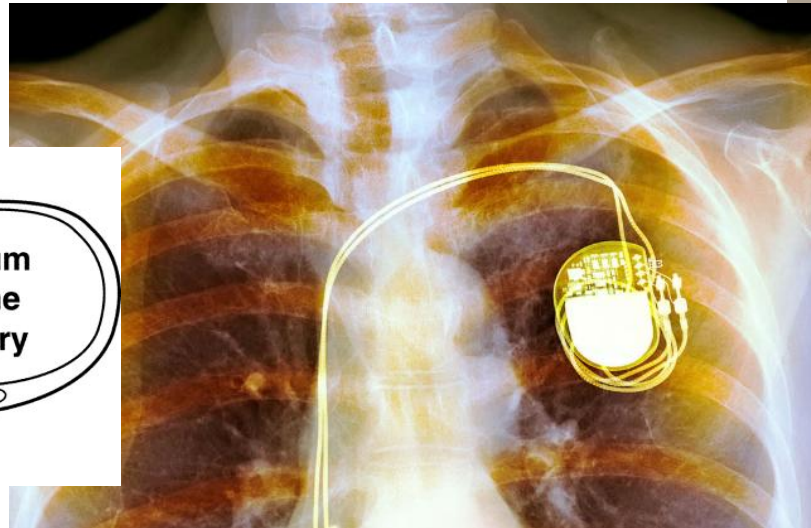
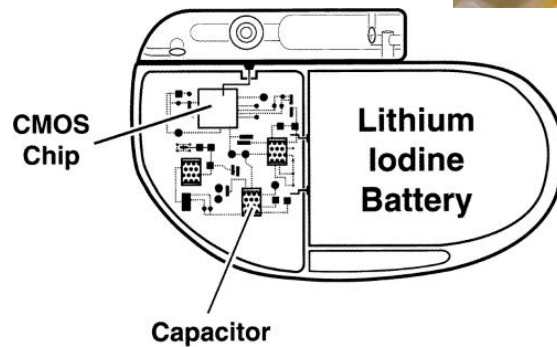
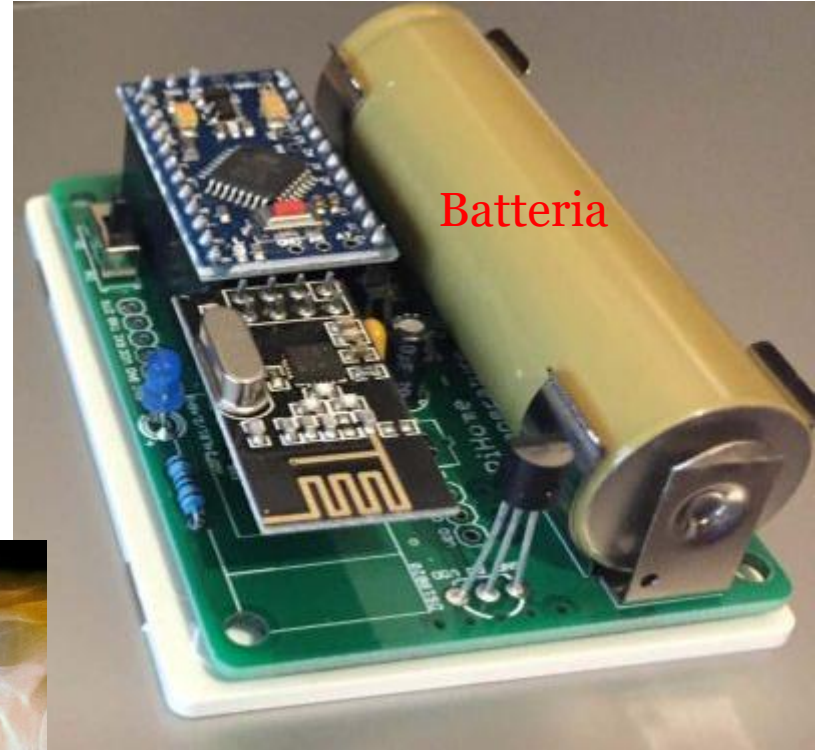


Problema: energia

Apple Vision Pro

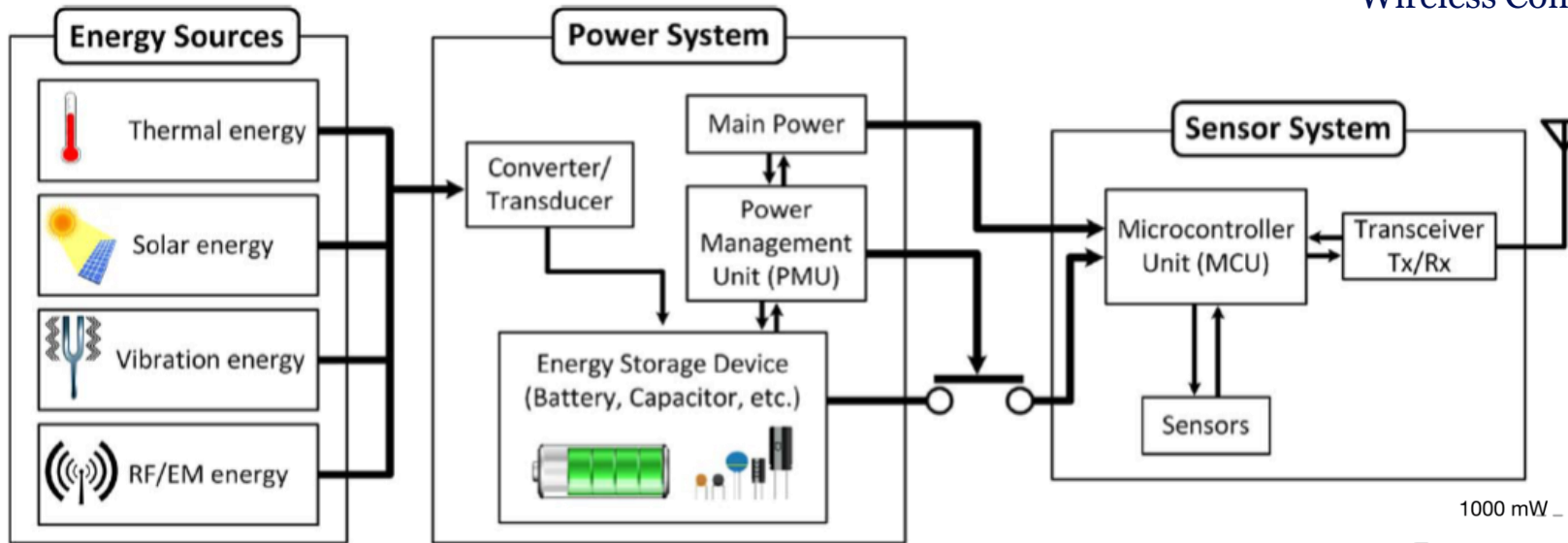


18650 Battery-powered DS18B20
Temperature Sensor

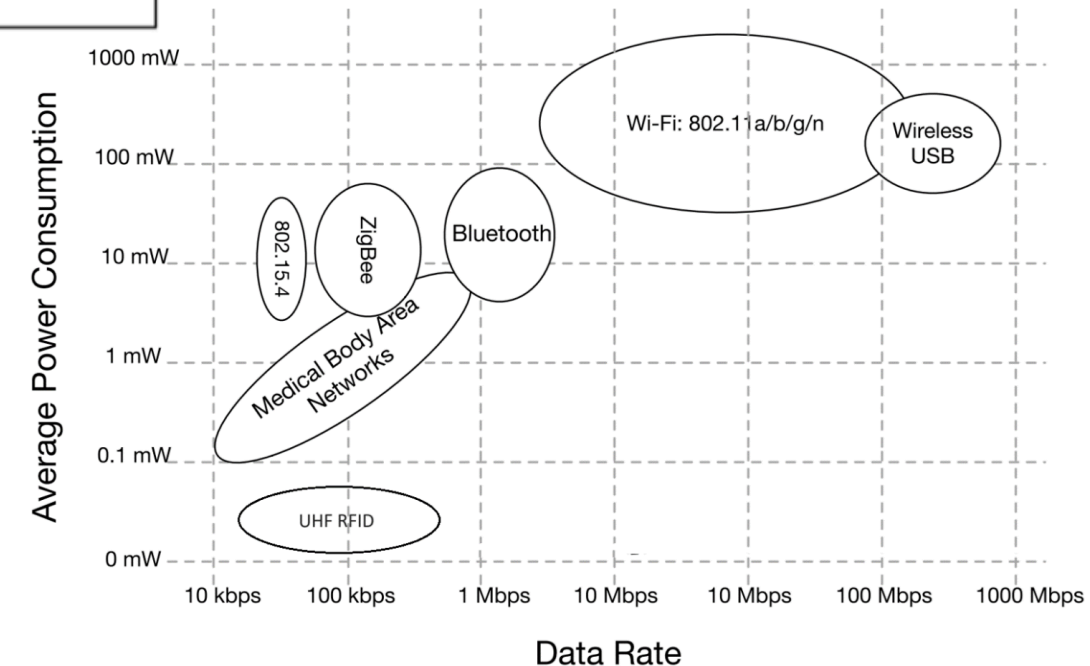


Energy Harvesting

S. Kim et al., Proceedings of the IEEE, Nov. 2014
 De Mil, et al. J Wireless Com Network 2010
 R. Correia and N. B. Carvalho, in IEEE Microwave and
 Wireless Components Letters, Dec. 2017



Energy source	Characteristics	Efficiency	Power density
Light	Outdoor	10–25%	100 mW/cm ²
	Indoor		100 μW/cm ²
Thermal	Human	0.1%	60 μW/cm ²
	Industrial	3%	10 mW/cm ²
Vibration	Hz-Human	25–50%	4 μW/cm ²
	kHz-Machines		800 μW/cm ²
Radio frequency	GSM 900 MHz	50%	0.1 μW/cm ²
	WiFi 2.4 GHz		0.001 μW/cm ²

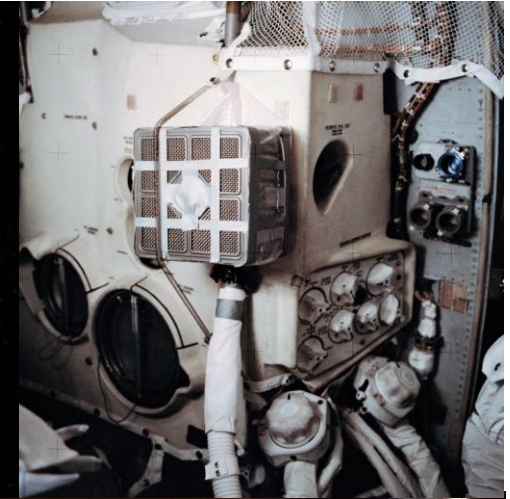


Una vita sull'Apollo XIII

Filtro dell'aria costruito
con materiali di fortuna

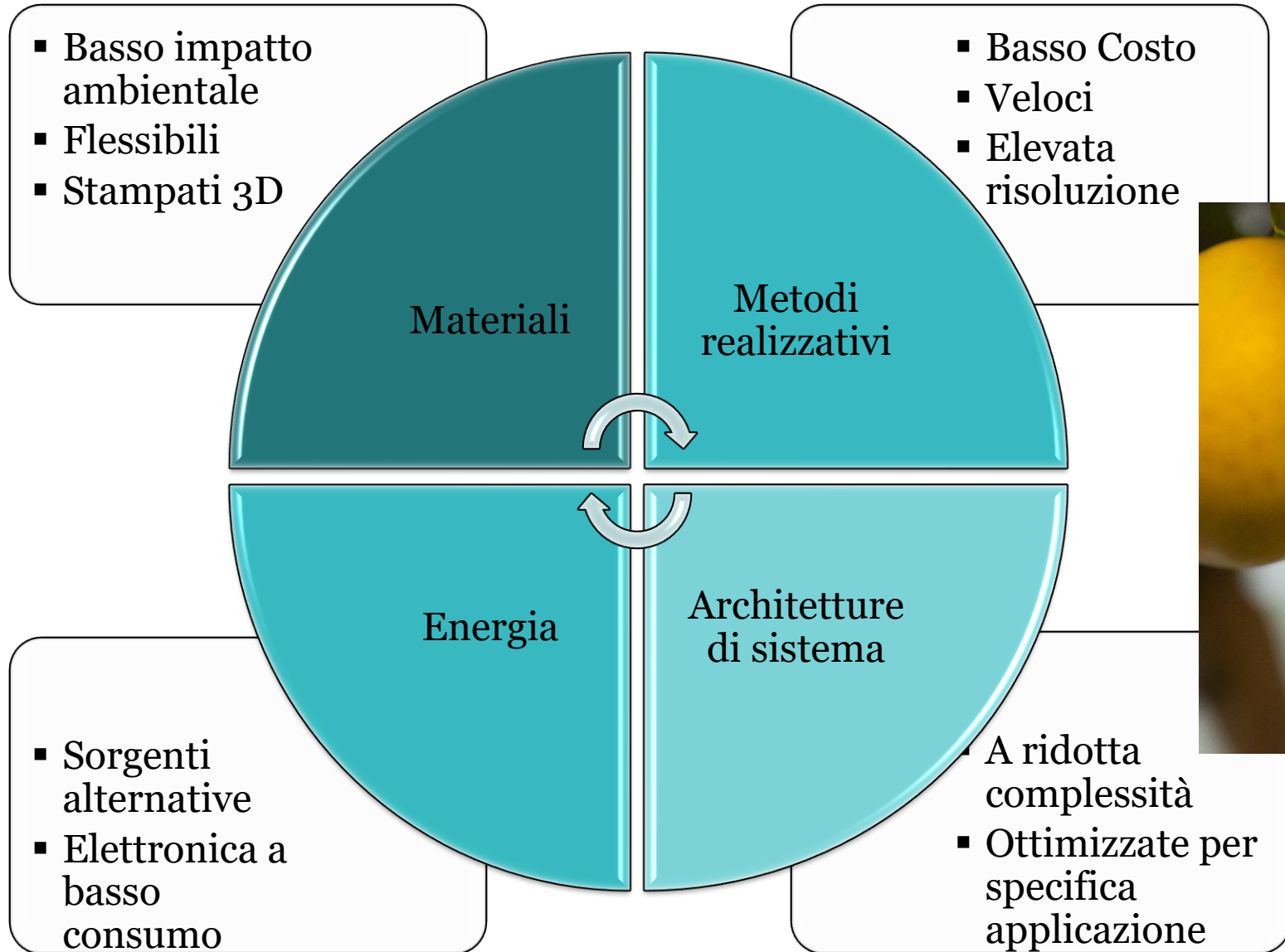


Modulo di servizio danneggiato

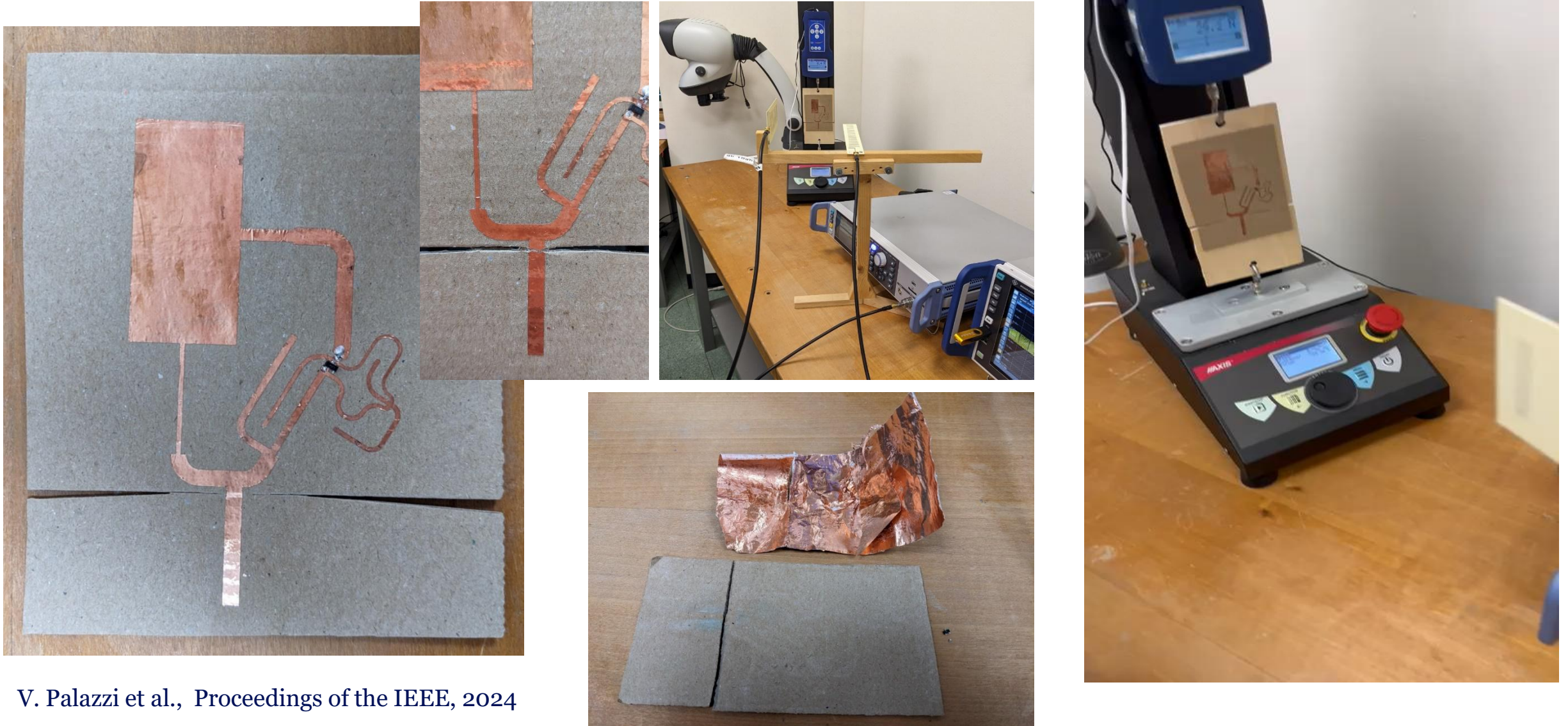


Kennedy Space Center, Cape Canaveral,
Florida, mio 30esimo compleanno

Elettronica verde: approccio multidisciplinare



Sensore monitoraggio integrità strutturale

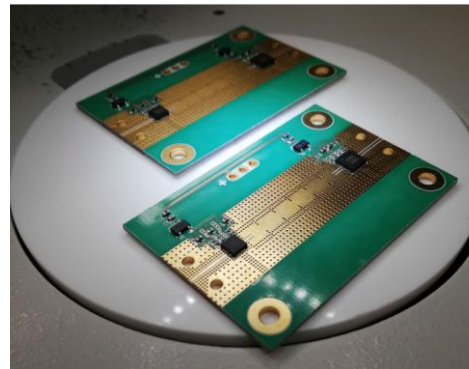
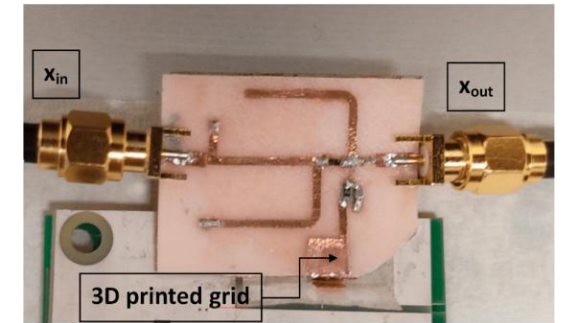
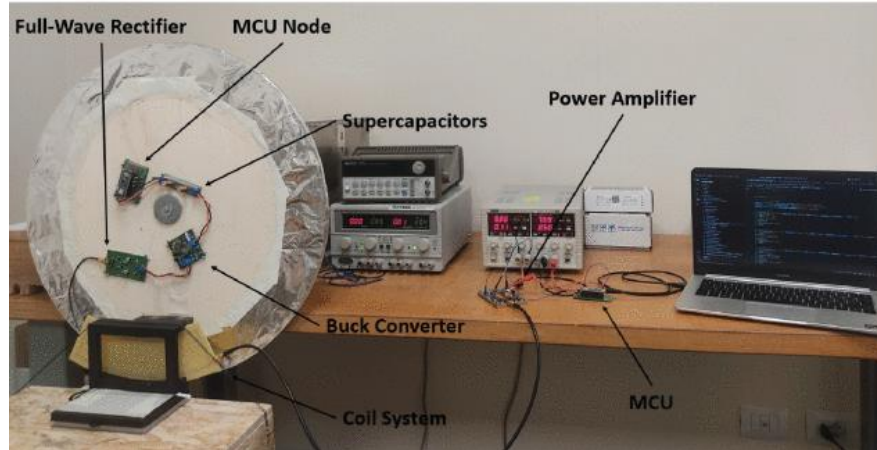


V. Palazzi et al., Proceedings of the IEEE, 2024

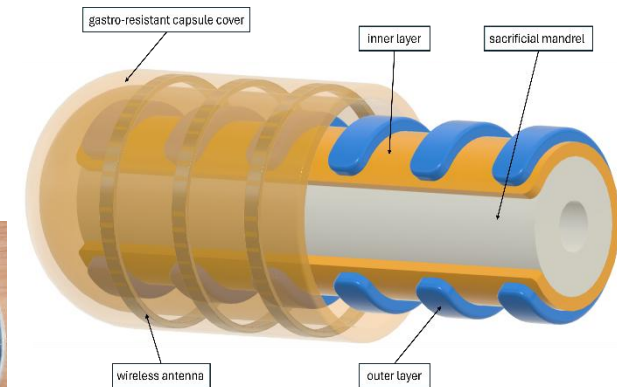
Partecipazione a progetti europei e nazionali

CHARM

OP-EVA

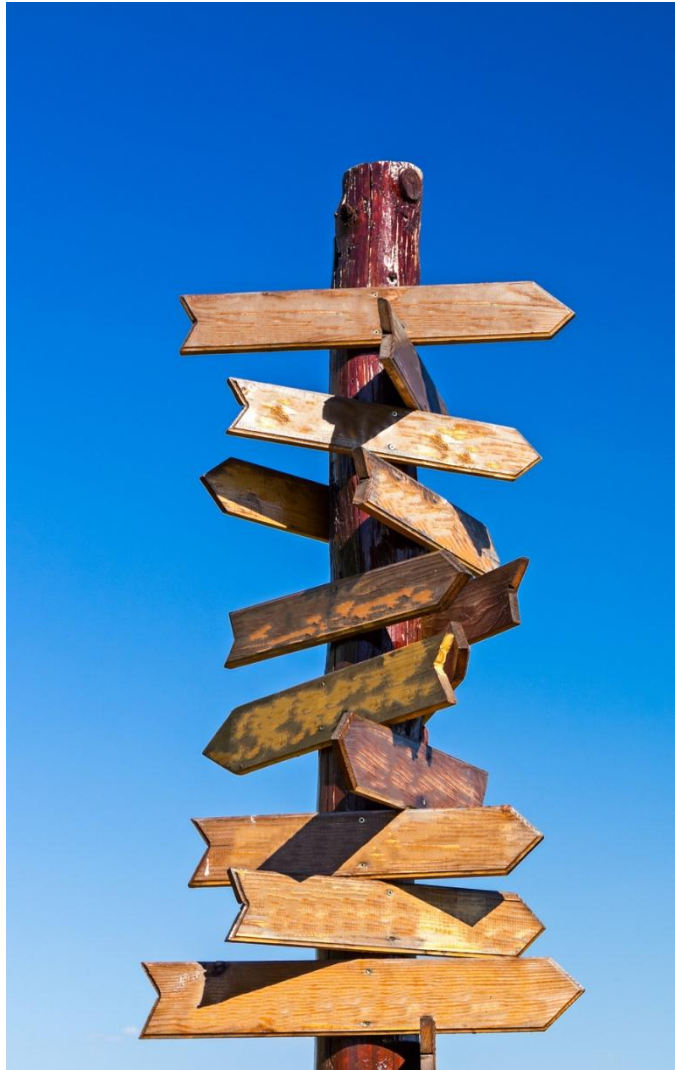


PICOSATS
SPACE TECHNOLOGIES SOLUTIONS



rometheus

Percorso universitario



Visita al CERN,
Ginevra, 2008

International Summer School and Conference
on Sustainable Strategies and Operations,
Columbia University, NY, 2010



Laurea triennale, 2012



Matematica: panico!

The band structure of a crystalline solid, that is, the energy-momentum (E - k) relationship, is usually obtained by solving the Schrödinger equation of an approximate one-electron problem. The Bloch theorem, one of the most-important theorems basic to band structure, states that if a potential energy $V(\mathbf{r})$ is periodic in the direct lattice space, then the solutions for the wavefunction $\psi(\mathbf{r}, \mathbf{k})$ of the Schrödinger equation^{14,16}

$$\left[-\frac{\hbar^2}{2m^*} \nabla^2 + V(\mathbf{r}) \right] \psi(\mathbf{r}, \mathbf{k}) = E(\mathbf{k}) \psi(\mathbf{r}, \mathbf{k}) \quad (5)$$

are of the form of a Bloch function

$$\psi(\mathbf{r}, \mathbf{k}) = \exp(j\mathbf{k} \cdot \mathbf{r}) U_b(\mathbf{r}, \mathbf{k}). \quad (6)$$

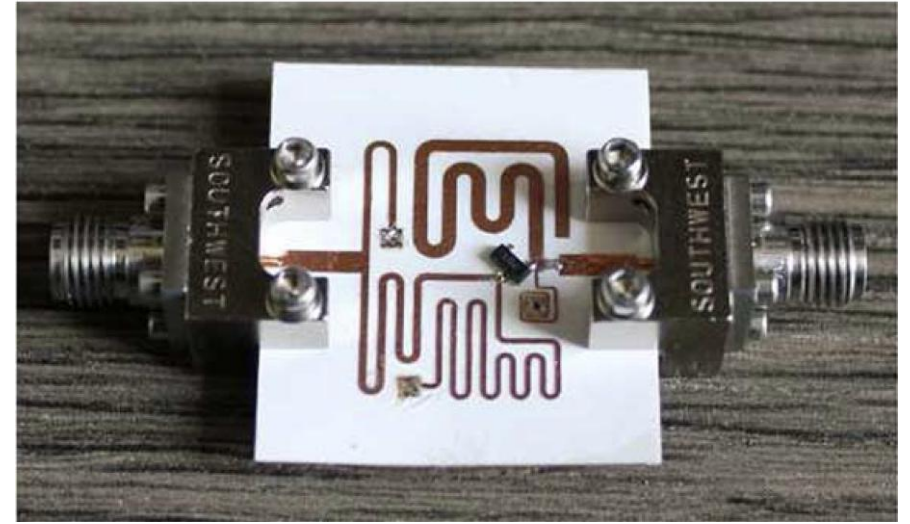
Here b is the band index, $\psi(\mathbf{r}, \mathbf{k})$ and $U_b(\mathbf{r}, \mathbf{k})$ are periodic in $\mathbf{R}$ of the direct lattice. Since

$$\begin{aligned} \psi(\mathbf{r} + \mathbf{R}, \mathbf{k}) &= \exp[j\mathbf{k} \cdot (\mathbf{r} + \mathbf{R})] U_b(\mathbf{r} + \mathbf{R}, \mathbf{k}) \\ &= \exp(j\mathbf{k} \cdot \mathbf{r}) \exp(j\mathbf{k} \cdot \mathbf{R}) U_b(\mathbf{r}, \mathbf{k}), \end{aligned} \quad (7)$$

and is equal to $\psi(\mathbf{r}, \mathbf{k})$, it is necessary that $\mathbf{k} \cdot \mathbf{R}$ is a multiple of 2π . It is the property of Eq. 4 that the reciprocal lattice can be used when $\mathbf{G}$ is replaced with $\mathbf{k}$ for visualizing the E - k relationship.

Tratto da S. M. Sze, Physics of Semiconductor Devices

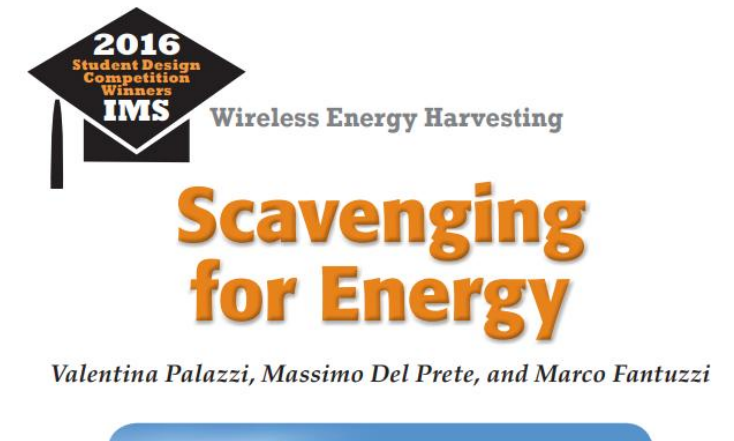
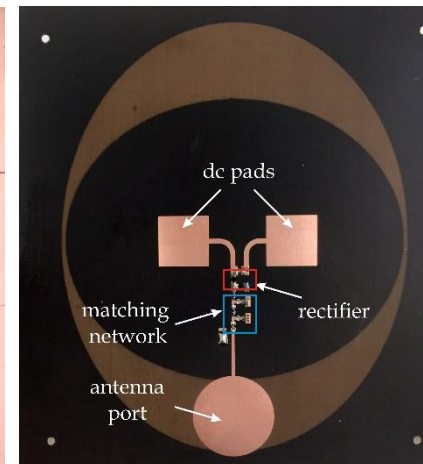
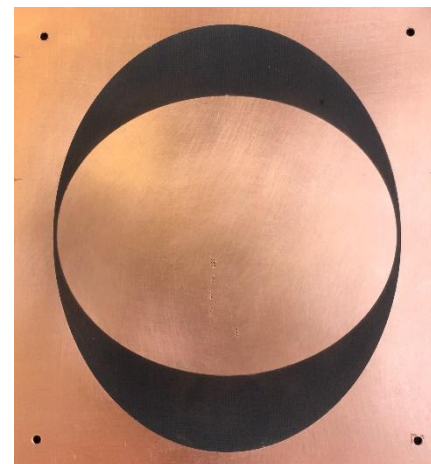
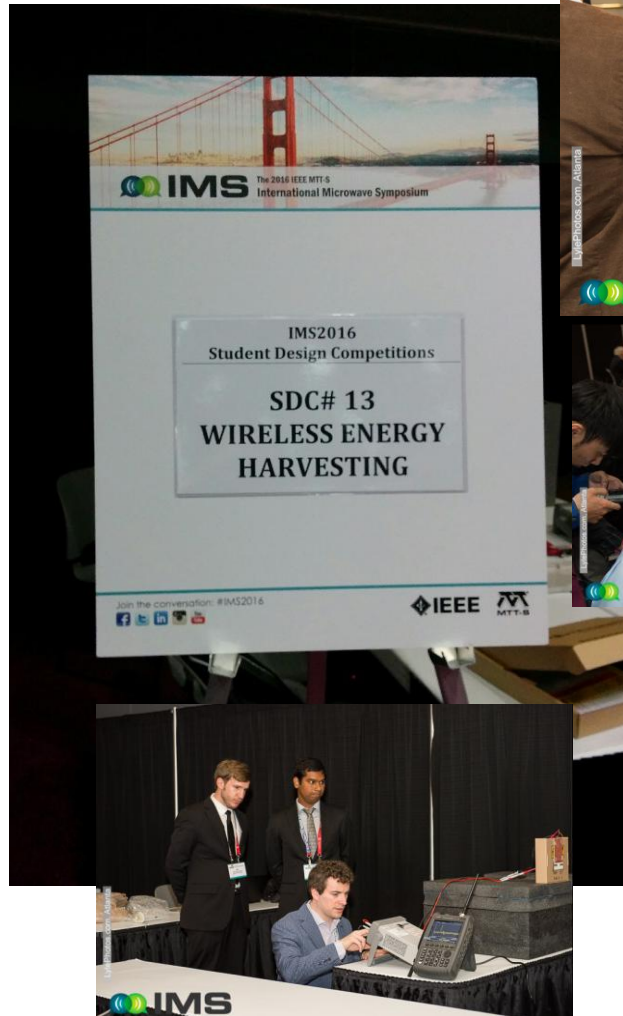
Laurea magistrale



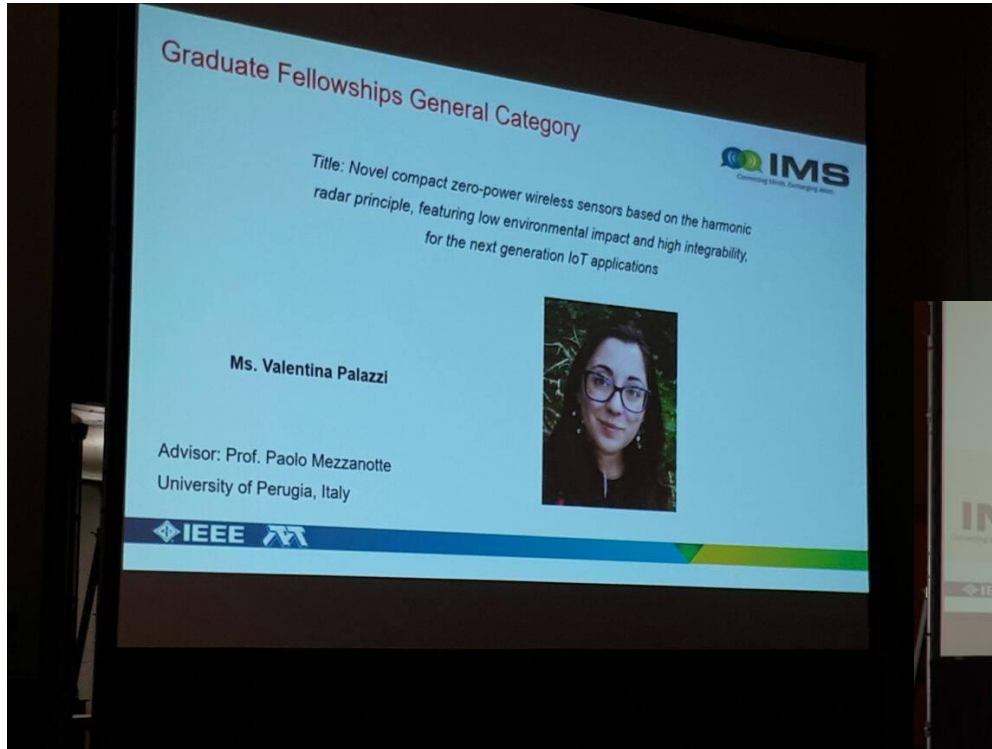
Prima presentazione a congresso internazionale



Student Design Competition



IEEE MTT-S Graduate Fellowship

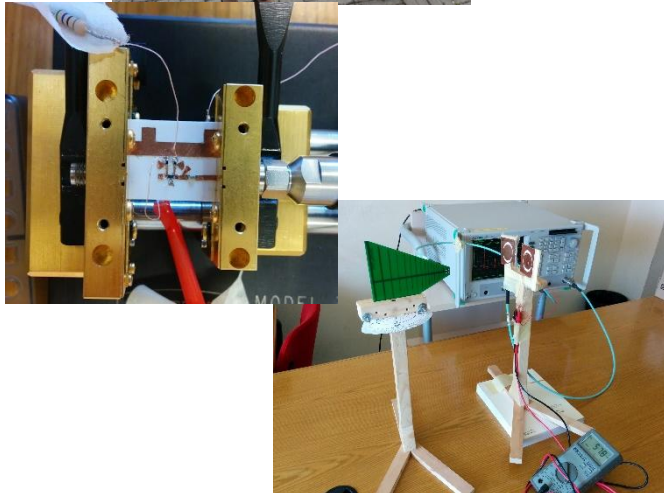


Dottorato

Università degli Studi di Perugia, Italia
Tyndall National Institute, Cork, Irlanda

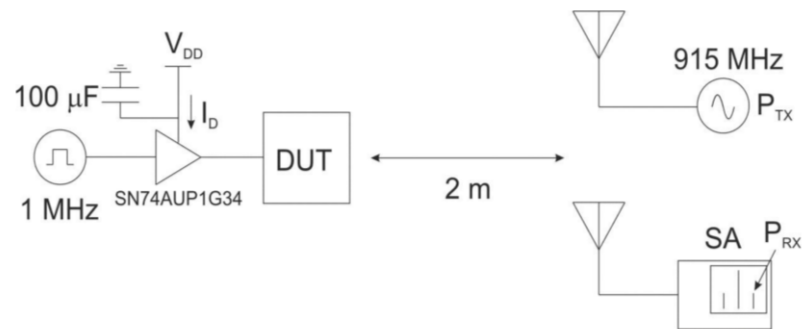


Georgia Institute of Technology,
Atlanta, Georgia, USA



Dall'altra parte della barricata

- Student Design Competition su Backscatter Radio



$$FOM = \frac{P_{RX1}(nW) + P_{RX2}(nW)}{P_{C1}(\mu W) + P_{C2}(\mu W)} \times \frac{100}{D1(cm) \times D2(cm)} \times \frac{100}{weight(g)}$$

Dall'altra parte della barricata

Comitato di revisione articoli per International Microwave Symposium (IMS) 2019



URSI Young Scientist Best Paper Award, Pisa, 2019



Workshop @ European Microwave Week, Londra 2021



Workshop @ IMS, San Diego 2023



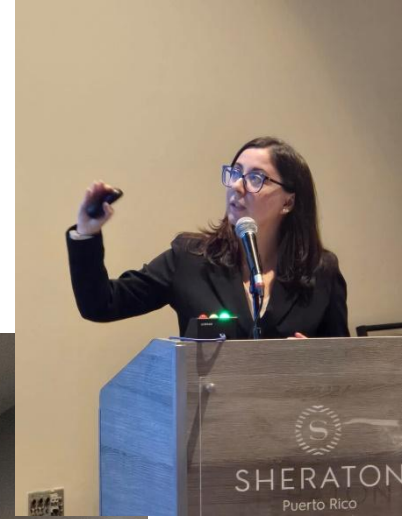
Panel Session, Radio Wireless Week, San Antonio 2024



Workshop @ IMS, Washington 2024



Consiglio di amministrazione di MTT-S



Presidente del comitato Young Professionals



Presidente del comitato Young Professionals

Tour dell'India



Attività Scientifica, Didattica ed Editoriale

Final Review meeting di
CHARM, Praga, 2024



Meeting progetto OPEVA,
Perugia, 2024



Corso di Elettronica di
Potenza, 2024



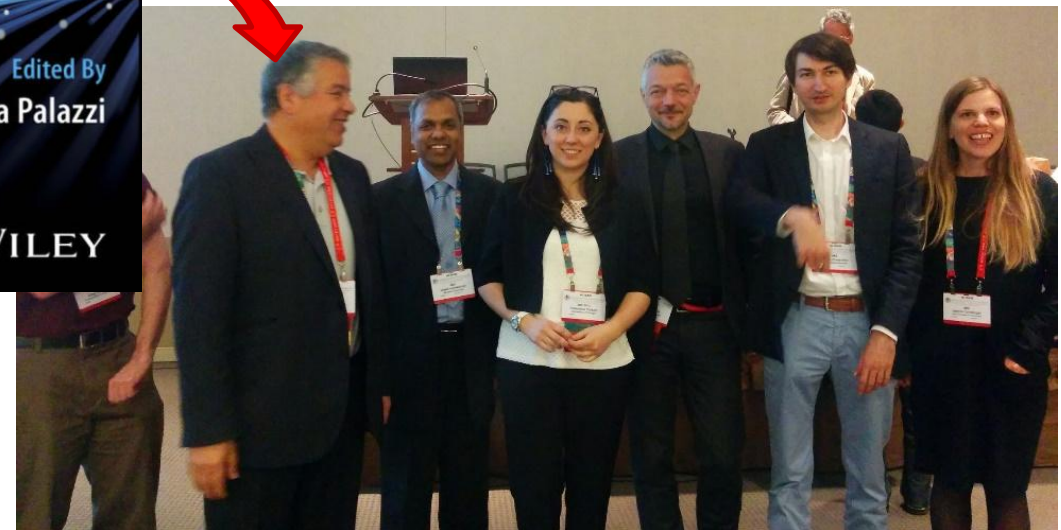
Wireless Identification and Sensing Systems for Harsh and Severe Environments

Edited By
Smail Tedjini • Valentina Palazzi

IEEE Press

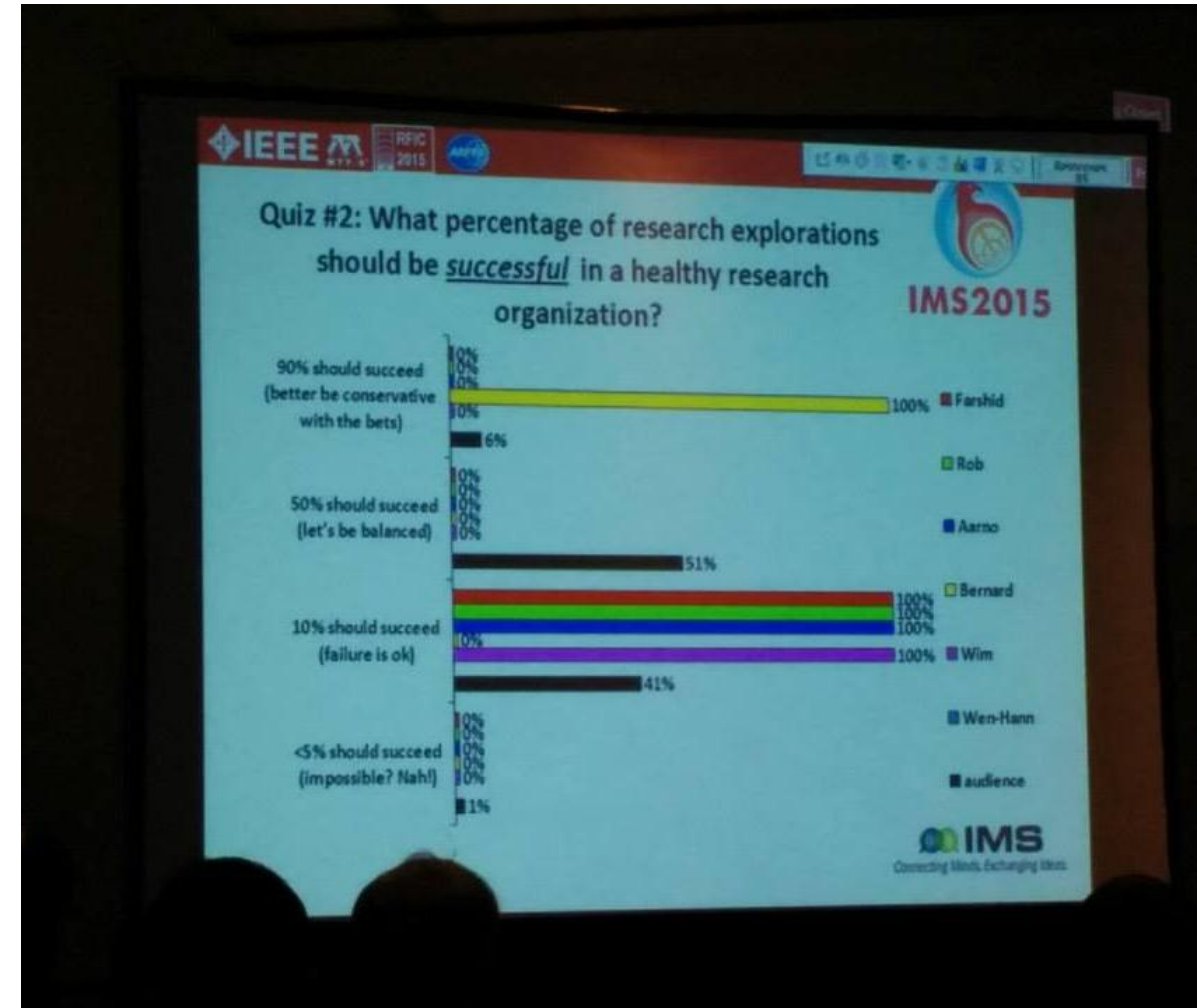
WILEY

Intellectual Property Award, EXPO Dubai, 2022



Conclusioni

- La ricerca scientifica è una **meraviglia**.
- Il **fallimento** è necessario per progredire.
- Studiare materie scientifiche è un'**opportunità**.



Vi ringrazio per l'attenzione!

**Giornata Internazionale ONU delle Donne e delle
Studentesse nella Scienza**

