EnerHarv 2024

PSMA International Workshop | 26-28 June, 2024 | Perugia, Italy

COMMERCIAL SPONSORS

EnerHarv 2024 Workshop:

Plant Microbial Fuel Cells for Sustainable Electronics

Presented By –

Davide Brunellli, Prof

University of Trento

davide.brunelli@unitn.it

Wednesday, June 26, 2024

ORGANIZER PSMA

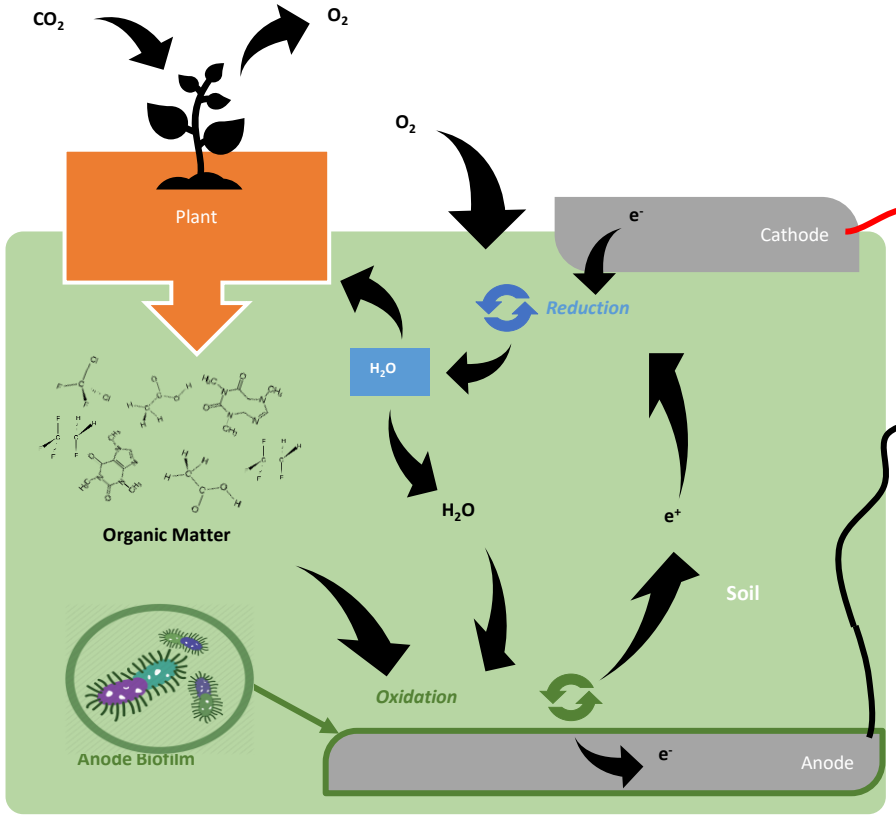
HOST A.D. 1308 unipg

MEDIA SPONSORS

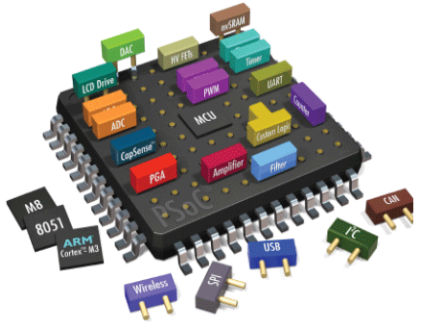
TECHNICAL SPONSORS

Good News: Free energy form in Bacteria!

Use **Microbial Fuel Cells (MFCs)** to produce power boosted by the presence of *living* **Plants**



Energy-Neutral Computing

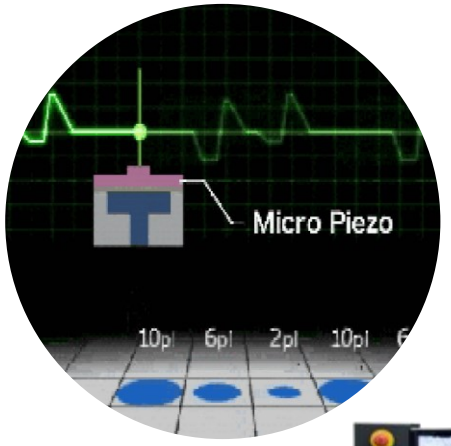


Enabling technologies

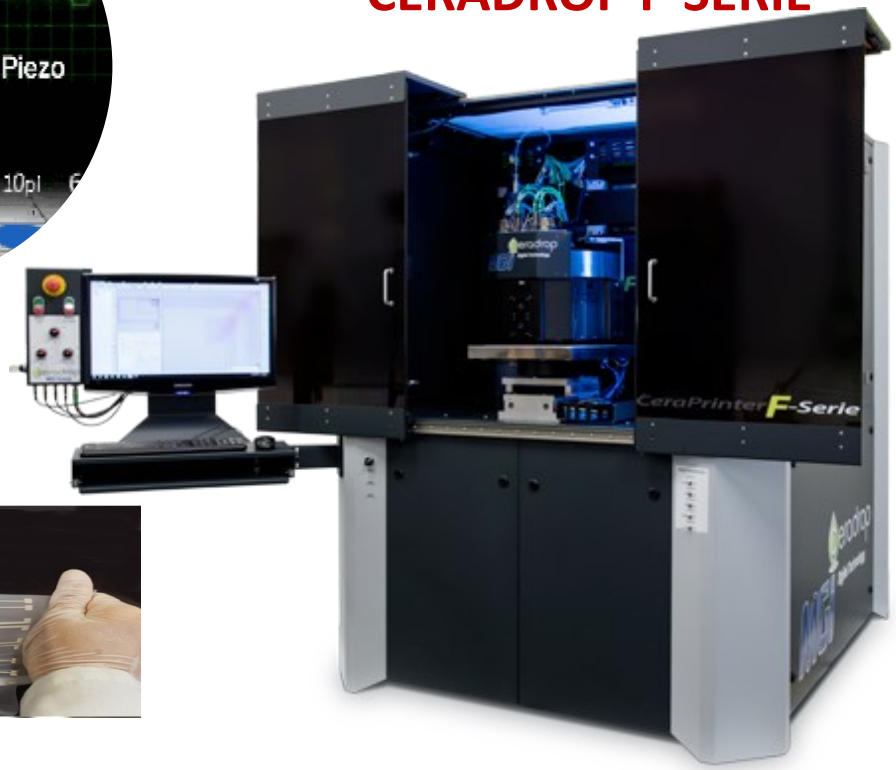
- *Non conventional DC conversion*
- *Intermittent/Burst Computing*
- *Near-threshold*
- *"Energy-coins" based scheduling*
- *Adaptive power management*

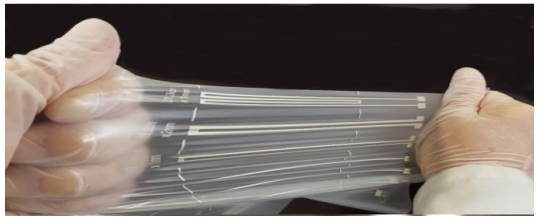
Next steps: 3D Printed degradable electronics

Printed electronics refers to the application of printing techniques, both conventional and digital, to fabricate electronic structures, devices and circuits, no matter which functional materials (ink) and substrates are used.



CERADROP F-SERIE





ELECTRONICS	
Conventional	**Printed**
Rigid	Flexible
High Cost	Low Cost
Complex Multistep Fab. Process	Easy Fabrication Process
Wasteful	Minimal Wastage
Bulky	Easily Integrable
Feasible only on large scale	Cost effective also for prototyping
Not eco-friendly	Environmentally friendly

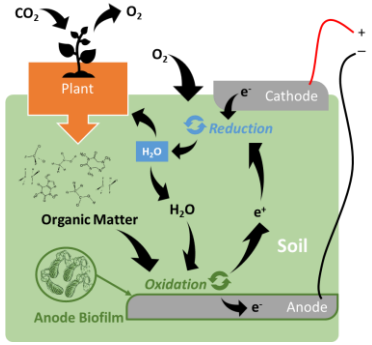
EnerHarv 2024

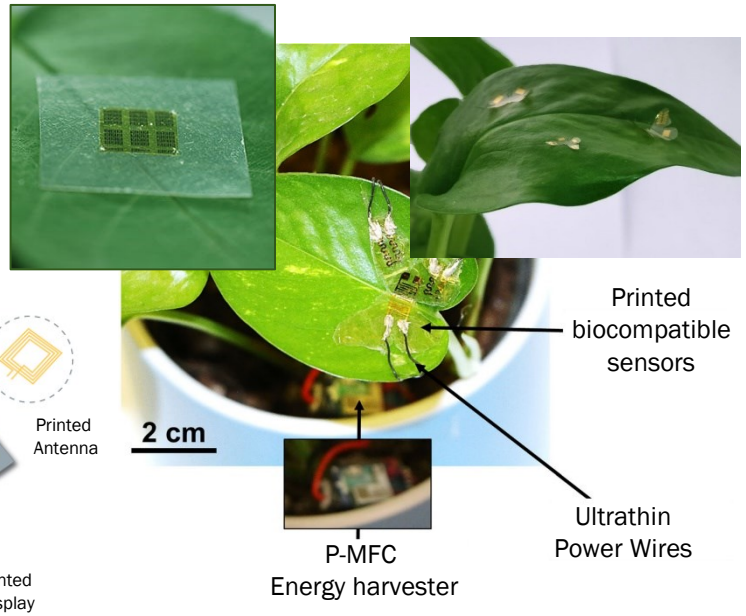
PSMA

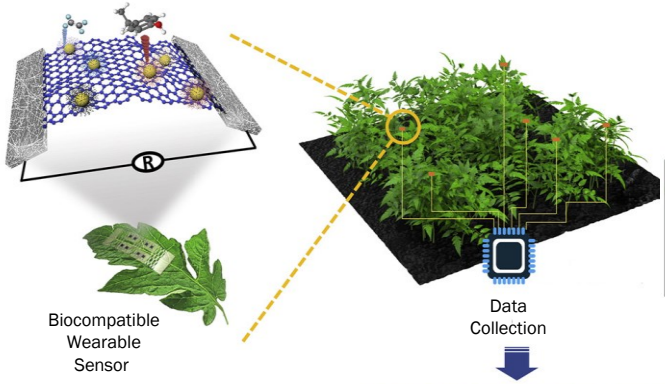
UNIVERSITY OF TRENTO

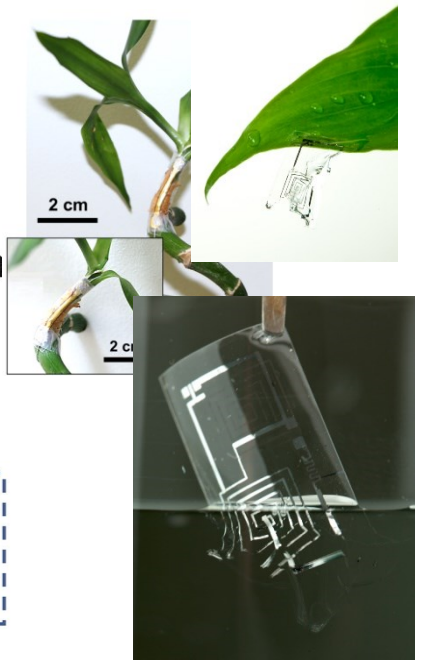
INNOITALY

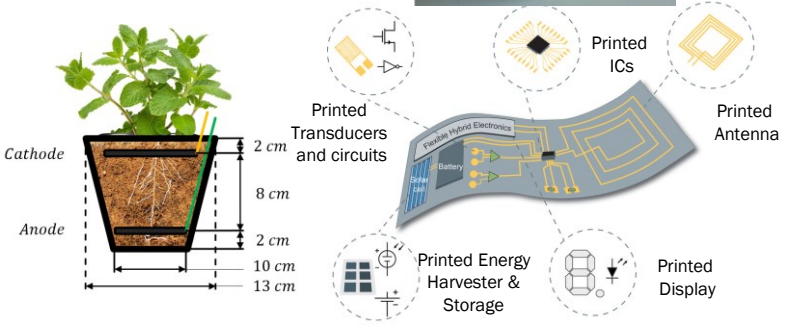
Sustainable and degradable electronics











Battery-Less 3D printed biocompatible electronics → Deploy → Sense & Compute → Dispose & Recycle

Costless sensors massively distributed is the innovation frontier!!

EnerHarv 2024

PSMA

UNIVERSITY OF TRENTO

INNOITALY

Q & A

EnerHarv 2024

PSMA International Workshop | 26-28 June, 2024 | Perugia, Italy

Thanks very much for your time and attention!

Questions/comments???

TECHNICAL SPONSORS

ORGANIZER

HOST

COMMERCIAL SPONSORS

MEDIA SPONSORS

References

- Brunelli D. et al. Long range wireless sensing powered by plant-microbial fuel cell doi: 10.23919/DATE.2021.7927258.
- Brunelli D. et al. Batteryless Soil EIS Sensor Powered by Microbial Fuel Cell doi: 10.1007/978-3-031-26066-7_43
- D. Balsamo, D. Brunelli et al., Hibernus++: A Self-Calibrating and Adaptive System for Transiently-Powered Embedded Devices, doi: 10.1109/TCAD.2016.2547919
- D. Brunelli et al. NORM: An FPGA-based Non-volatile Memory Emulation Framework for Intermittent Computing, ACM JTECS doi: 10.1145/3517812
- A. Torrisi, D. Brunelli, *et al.* Reliable Transiently-Powered Communication," 2022, doi: 10.1109/JSEN.2022.3158736.
- A. Torrisi, D. Brunelli et al. Zero Power Energy-Aware Communication for Transiently-Powered Sensing Systems. 2020 doi:10.1145/3417308.3430269
- PATENT: D. Brunelli, K. S. Yildrim . ARCHITECTURE AND PROCESS FOR EMULATING A NON-VOLATILE INTERMITTENT PROCESSING SYSTEM…