

Multi-modal, configurable optical lab-on-chip platform for low-cost multipurpose diagnostics & monitoring



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Project overview

Overall challenge

Developing a miniaturized sensing platform that integrates different detection techniques for various applications, balancing contradictory specifications from the applications

Overall solution

MultiLab addresses this challenge, by developing a modular multi-sensing platform compatible with wafer scale manufacturing that will integrate multiple sensing modalities to simultaneously detect biological and chemical targets for medical diagnostics and environmental monitoring



Objectives



- **Develop ECL bio-sensors for Biomarker Detection**

Fabricate enzyme-based ElectroChemiLuminescence (ECL) sensors on low-cost, all-graphite inkjet-printed 3-electrode cells for detecting biomarkers like lactate, uric acids, O_2 and H_2S .

- **Develop Machine Learning approaches**

Use ML to analyze multiplexed sensor data, implementing advanced techniques.

- **Develop mid-IR Photothermal Spectroscopy (PTS)**

Develop PTS sensors for label-free multi-component analysis in the mid-IR range, initially using Mach-Zender Interferometer (MZI) and exploring AWG integration for enhanced performance.

- **Optical bio-sensing modules**

Integrate an AI plasmonic waveguide in a Plasmonic augmented Arrayed Waveguide Grating (PA-AWG) module to enable simultaneous detection of proteins, miRNA and microorganisms with high scalability and cost-efficiency.

- **Integrate and validate Multi-modality optical sensing platform**

Create modular PICs with CMOS-compatible Si_3N_4 photonics and interchangeable bio-sensing modules, combining them with customized microfluidics to improve sensitivity and reduce measurement time.

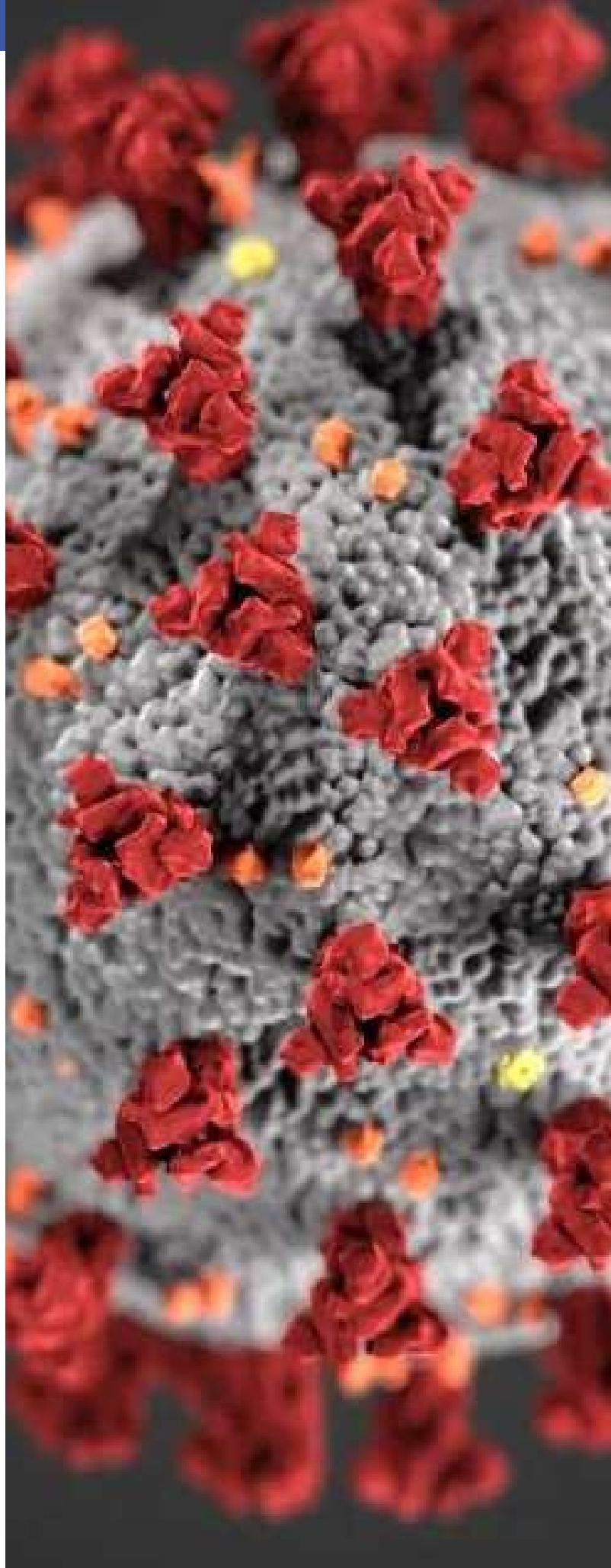


Healthcare case study

Fever is a common symptom, but accurately distinguishing between viral and bacterial infection is challenging. Conventional methods are time-consuming and unsuitable for rapid point-of-care diagnosis, potentially leading to unnecessary antibiotic use and antibiotic resistance.

MultiLab using the PA-AWG module simultaneously detects host and pathogen biomarkers, including protein markers, RNA transcripts, severity biomarkers and specific pathogens. Additionally the ECL module detects lactic and uric acid, key indicators of acute infection.

This innovative approach promises to enhance diagnostic accuracy, reduce inappropriate antibiotic use, and lower healthcare costs. With validation using clinical samples, MultiLab aims to transform the management of febrile patients and combat antibiotic resistance.





Environmental case study

Surface water eutrophication can lead to Harmful Algal Blooms (HABs), affecting water quality and posing risks to human health and aquatic life. Conventional monitoring methods are often slow and unable to provide early warnings, leaving a significant gap in protecting water resources.

MultiLab steps in to bridge the gap with groundbreaking innovation offering an IoT-enabled, affordable and reliable monitoring tool for early HAB detection. By analyzing water samples for nutrients (Nitrate, Ammonium, Phosphate), dissolved oxygen and hydrogen sulphide, Multilab enables predictive models for confident early warnings, crucial for safeguarding drinking water sources.

By quantifying nutrients with precision and validating against standard methods, aims to enhance current monitoring practices and advance understanding of nutrient-bloom relationships.





Life Cycle Assessment (LCA)

LCA, or Life Cycle Assessment, is a comprehensive method used to evaluate the environmental impact of a product or system throughout its entire life cycle, from raw material extraction to disposal.

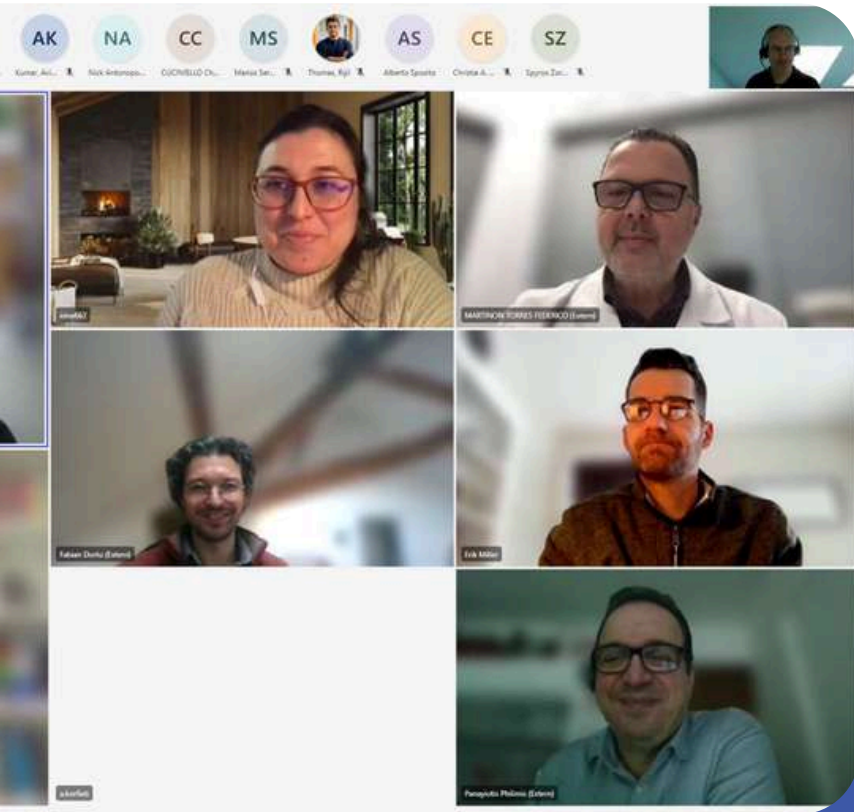
By undergoing LCA, MultiLab aims to analyze various environmental factors such as resource consumption, energy usage, emissions, and waste generation associated with its fabrication, operation, and application in case studies.

Through this assessment, MultiLab can identify opportunities to minimize its environmental footprint, optimize processes, and enhance sustainability. By aligning with green deal objectives and adopting eco-friendly practices, MultiLab contributes to the broader goal of promoting environmental responsibility and mitigating adverse ecological effects across different sectors and applications.

Dissemination & Communication

Kick-Off Meeting

The Kick-Off meeting was held online, on January 9th, 2024, hosted by CyRIC. Partners gathered online to discuss our mission to revolutionize medical diagnostics and environmental monitoring.



4M Meeting

The 4M Meeting in Nicosia, Cyprus, hosted by CyRIC, was a success.

Consortium partners gathered to discuss project progress, challenges and solutions.



Dissemination & Communication

Events / Conferences

MultiLab was presented in several prestigious events and conferences over the past six months. These engagements have provided valuable opportunities to present our groundbreaking work and gain insights into the latest innovations in our field.

Press Release

“The key innovation of MultiLab is a modular sensor chip that can detect biological, chemical, and molecular targets simultaneously... Two important applications of the MultiLab platform include early warning systems for harmful algae blooms and improved diagnosis of fevers without an apparent cause.”

CyprusMail, 25 April 2024



analytica
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Contact

Wrapping up our first newsletter edition, we're thrilled by the progress within our MultiLab project.

With gratitude to our partners, we stride into the future, eager to pioneer advancements in medical diagnostics and environmental monitoring.

Stay tuned for updates as we revolutionize the field through technology and commitment.

CONTACT US



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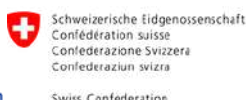
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