

Broadband MEMS-based InfraRed spectrometers: The core of a multipurpose spectral sensing photonic platform

BROMEDIR Introduction

The project aims to innovate by developing a new generation of miniaturized FTIR (Fourier Transform Infrared) and PTS (Photothermal) spectrometers for liquid and gas sensing applications respectively. In addition, a new cloud-based platform will be developed for enabling advanced data analytics. Therefore, the overall system approach intends also to achieve a faster analysis of data, with results easily accessed from anywhere by the end-user.

Project Objectives

- Develop the novel FTIR and PTS spectrometers
- Develop the new integrated and flexible platforms
- Tests and validations of the innovations developed
- Wide-scale but also audience-specific communications to demonstrate the results and overall value to all stakeholders



OUTCOMES

Price and size reduction of spectrometers with uniform performance and improved ruggedness:

- New generation of miniaturized MEMS-FTIR spectrometer for detection of larger pool of chemicals and biochemicals
- New ultra-miniature & sensitive photothermal spectrometer for trace gas sensing
- Faster data analytics aiming at less than 10 sec of total time of analysis, for lower detection limits aiming at concentration level down to 50 ppm for liquids and 5 ppb for gases

PROTOTYPES

PROTOTYPE 1: new generation of miniaturised MEMS FTIR spectrometers with extended range from NIR to MIR regions above 9000 nm.

PROTOTYPE 2: completely new approach for miniaturised MEMS PTS spectrometers, for ultra-sensitive detection of trace level markers in small gas volumes.

PROTOTYPE 3: integrated system platforms for each application to be tested.

PROJECT WORK COMPLETED

NEWS & UPDATES FROM THE FIRST SIX MONTHS

USER & STAKEHOLDERS REQUIREMENTS REPORT

The end users and stakeholders relevant to the BROMEDIR project case studies were identified and approached to collect valuable information regarding the requirements, current practices and applied standards. Core needs/demands and challenges in each field were also collected. The data was received as a market research performed in terms of customised surveys, disseminated to the relevant end users and stakeholders. The responses were analyzed and presented within D2.1. Standards were indicated and where applicable, additional information as recorded in published literature was determined to further supplement the overall research performed.

BROMEDIR USE CASES

The three case studies included in the project are:

- 1) sustainable farming
- 2) hydrogen supply chain and
- 3) fuel quality control

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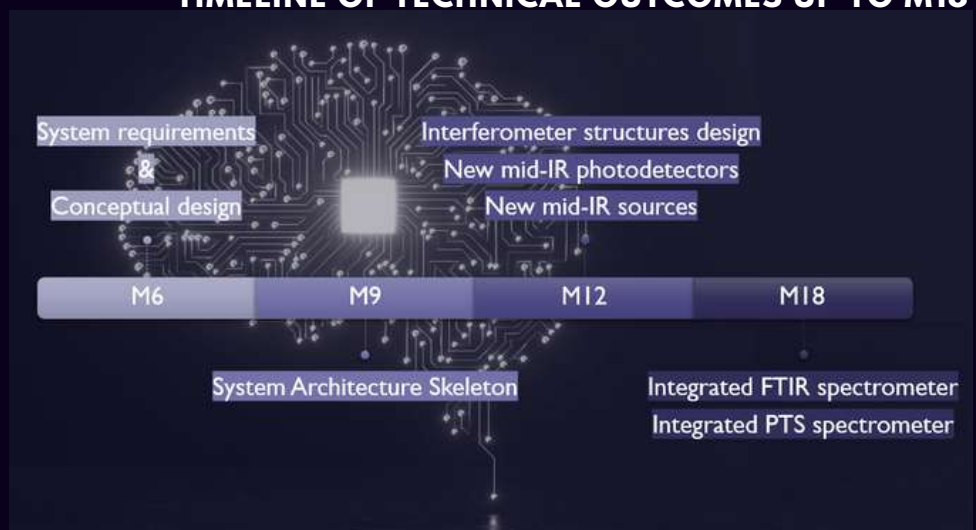
VALIDATION SCENARIOS

The types of samples to be collected for testing were identified and where applicable, the pre-processing and special needs in terms of sample storage and use as well as gold standard techniques used for comparisons were all defined and documented within the validation scenarios deliverable. The work was specifically focused on aspects that may affect the technical developments. The overall protocols to be followed in each use case were clearly determined as part of this deliverable.

SYSTEM REQUIREMENTS & CONCEPTUAL DESIGN

The users' and stakeholders' requirements and case studies definitions were used to identify the system requirements, the conceptual design of the system and the technical requirements of the various technological components proposed in BROMEDIR.

TIMELINE OF TECHNICAL OUTCOMES UP TO M18



BROMEDIR USE CASES EXPLAINED

BRIEF REMINDER OF THE PROJECT CASE STUDIES



»»» SUSTAINABLE FARMING

Focus will be on cows farming. An essential element for precision livestock farming is the possibility of providing continuous (daily) monitoring. In this pilot, BROMEDIR, will be used for on-farm, fast analysis of individual cow milk samples focusing on the nutritional value of milk (measurement of total fat, total protein, carbohydrates-lactose content) and cow's health traits (fatty acids profiling that can indicate physiological imbalance).

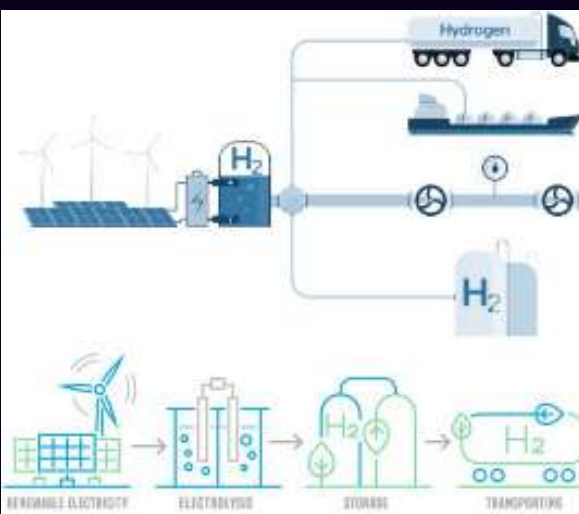


»»» FUEL QUALITY

Monitoring of jet fuel quality and control of biodiesel percentage present in car and marine diesel are included as BROMEDIR case studies. Contamination of these fuels with fatty acid methyl ester (FAME) will be tested.

EXTRA NOTE

The end-users' and stakeholders' requirements were further considered for implementation where possible within the final BROMEDIR instruments to be validated in the three use cases shown here...



»»» HYDROGEN QUALITY

Continuous hydrogen measurement is required a) in feed gas, b) after pre-enrichment, and c) in product gas after electrochemical compression-separation for dynamic process control, since pipeline compositions and supply situations may vary significantly. For all three positions along the hydrogen refining, we target the use of the new H₂ PTS sensor developed in BROMEDIR.

For the Green Deal, a successful technical implementation and a reliable 24/7 operation of the hydrogen supply chain is a key success factor.



DISSEMINATION & COMMUNICATION

UPDATES ON ACTIVITIES PERFORMED IN THE FIRST SIX MONTHS

»»» PHOTONICS PARTNERSHIP ANNUAL MEETING 2023

CyRIC (Cyprus Research and Innovation Centre) represented the project and introduced BROMEDIR with an overall project presentation to leading scientists at the Photonics Partnership Annual Meeting 2023 which took place in Brussels on 26 and 27 April. This Annual Meeting is one of the most important events for the European photonics industry.



»»» HANNOVER MESSE 2023

TU Wien represented the project and introduced the BROMEDIR hydrogen supply chain use case at Hannover Messe 2023, a leading trade fair for industry and experts from mechanical and electrical engineering, digital industries and the energy sector, joined together at the event to showcase technologies and solutions from the digitalization and automation of complex production processes and the use of hydrogen.



»»» BROMEDIR PRESS RELEASE

"The EU-funded BROMEDIR project goes the extra mile to develop a new generation of miniaturised spectrometers with extended range to allow detection of a large pool of chemicals and/or biochemicals, but also achieve detection at even lower limits." BROMEDIR Press Release, CyprusMail, April 16, 2023, Cyprus.



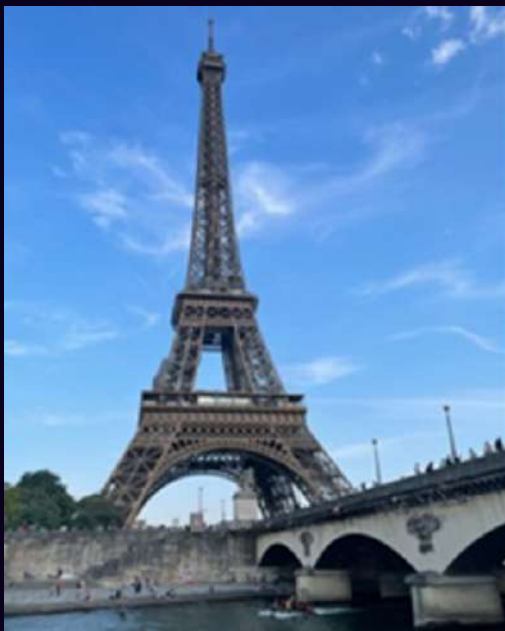
DISSEMINATION & COMMUNICATION

NEWS FROM BROMEDIR CONSORTIUM MEETINGS

The Consortium meets regularly via online meetings where partners can share updates, discuss issues, and results. In addition, BROMEDIR holds in-person meetings every six months with an opportunity for a different partner each time to host the event.

»» KICK-OFF MEETING

A successful BROMEDIR kick-off meeting was held on 18th-19th Jan. 2023 in Nicosia, Cyprus which was hosted by CyRIC | Cyprus Research and Innovation Center. The two-day meeting was a great opportunity for all partner teams involved in the BROMEDIR Consortium to meet in person and discuss in detail the project.



»» M6 MEETING

The M6 BROMEDIR meeting was hosted by the project partner UGE | Universite Gustave Eiffel, on 7th-8th June 2023 in Paris, France. The two-day meeting was a great opportunity for all partner teams involved in the BROMEDIR Consortium to discuss in-person, the up-to-date progress of the project, share presentations on all work packages and delve deeper into technical matters, issues and solutions. Actions and tasks were planned for the next 6 months of the project.



The project meeting at UGE premises, also included visits of university laboratories providing the consortium an opportunity to have a closer look at different technologies.

»»» LAB TOUR A

Members of the Consortium had the opportunity to visit the sense-city district-scale climatic chamber. Sense-City is a climate chamber that can cover two 400m² areas. On each of these areas, a portion of territory is built on, called a Mini-City, equipped with many sensors to:

- study the performance of facilities and urban materials
- monitor the city of tomorrow by sending appropriate information
- study air, water and soil pollution



»»» LAB TOUR B

The cleanroom microfabrication facilities were also visited by Consortium members. Various leading-edge electronic and micro-electronic resources are available at UGE, for educational and research activities:

- A state-of-the-art technical centre with 650m² cleanroom for manufacturing and characterizing semiconductors and Microsystems.
- Electrical engineering teaching laboratories.

BROMEDIR CONTACT DETAILS

ONLINE PRESENCE OF THE PROJECT

»»» PROJECT NEWSLETTER

The newsletter aims at presenting a quick overview of project updates, news, work performed and events attended, every 6 months throughout the project duration. Anyone interested in BROMEDIR project, may conveniently subscribe via the project website to receive an automated notification once a newsletter is released.

BROMEDIR

LET'S STAY CONNECTED

»»» CONTACT DETAILS

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