SoFiN Project

Software enabled Fiber optic multisensing Network

PROJECT INTRODUCTION

The goal of SoFiN project is the development of a flexible, modular, software-defined platform for fiber optical sensing that can be implemented in existing communication fiber networks.
The final system will be tested in near-to-operational environment for three different case studies, respectively focusing on the supervision of a telecommunication infrastructure, a water supply network and a powerline grid.

KEY OBJECTIVES

- Develop an Adaptive, Modular & Highly integrated photonic multi-sensing platform
- Exploit new types of digital signal processing and cloud connection approaches
- Validation & Demonstration under the context of end-user needs

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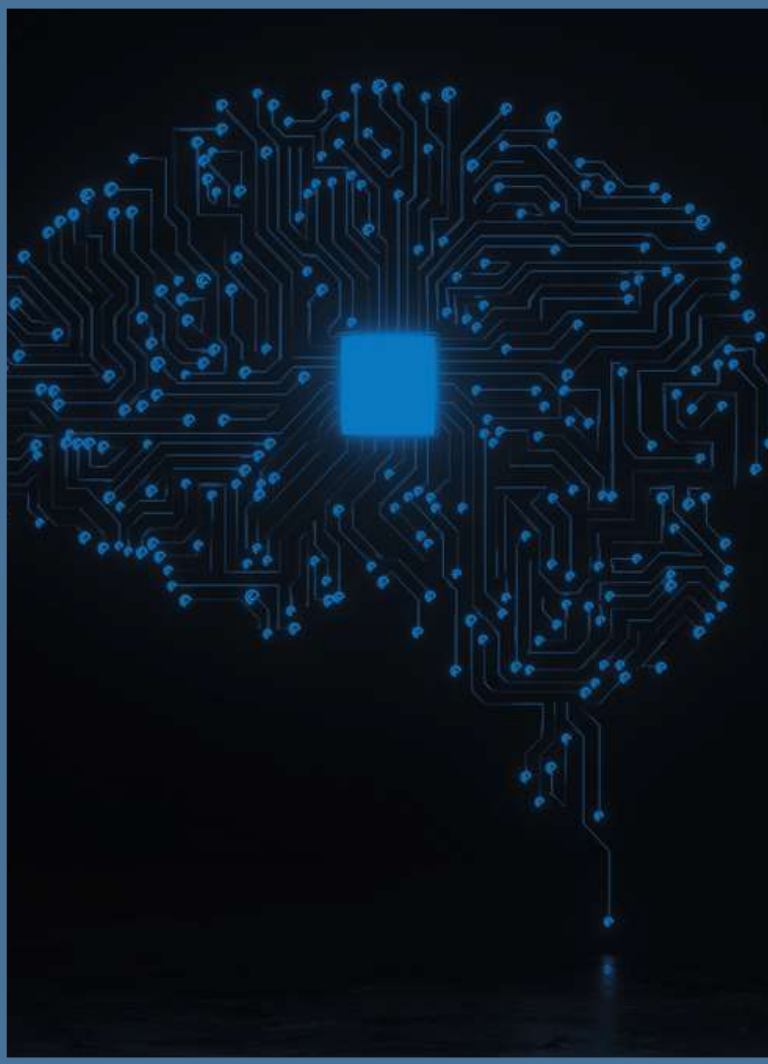
PROJECT OUTCOMES

- Ability to monitor complex industrial plants and critical infrastructure through fiber optic sensors
- Increased efficiency, lower processing time and complexity via a single, flexible, software-controlled interrogator platform for multiple sensing applications
- Enhanced sensing, early stage event detections and advanced data monitoring with machine learning, digital twin and cloud-computing technologies



Key Results

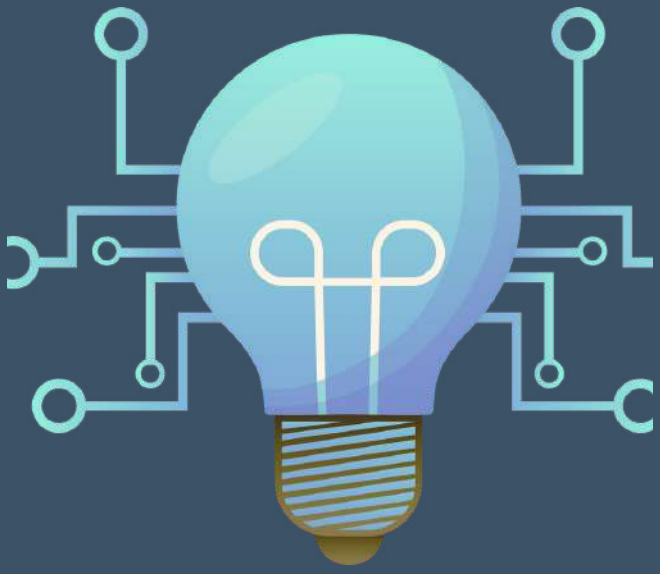
- Adaptive, modular and highly integrated photonic multi-sensing system; a flexible interrogator capable for various sensing applications in a sensor network based on new laser types, sensor elements & sensing approaches compatible with fiber sensing.
- Novel monitoring system based on machine learning algorithms for enhanced sensing, digital twin modelling for detections at very early stage and cloud-based control of the system.

PROJECT WORK COMPLETED

TECHNICAL UPDATES FROM FIRST 12 MONTHS

>> LASER SOURCES

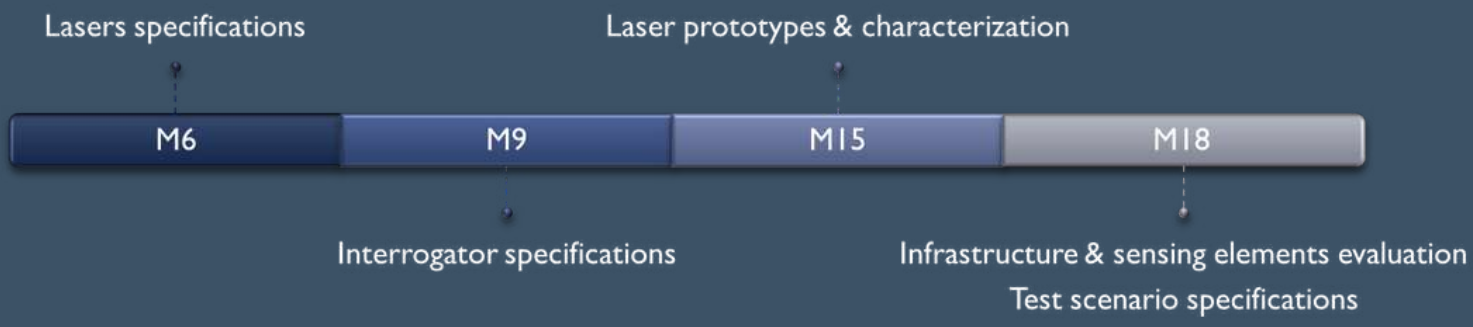
Specifications of laser sources have been defined and the appropriate options selected for implementation within the development envisioned as part of the project. This work was completed upon submission of the corresponding report detailing the research performed, decisions made and approach to be followed with next steps towards further progress of the relevant work package.



>> INTERROGATOR PLATFORM

SoFiN involves the development of a flexible sensor platform that can be used for various fiber-based sensing applications. This platform consists of the fiber sensor, interrogator and cloud infrastructure. As part of this work package, the interrogator specifications were defined. Therefore, several environmental effects have been evaluated and how these impact fiber parameters. The particular specifications of the interrogator architecture and its individual components, have been determined.
This work overall defined the electrical, optical and electro-optical components, as well as other required peripherals to be implemented. The design is focused on maintaining a high flexibility and modularity of the overall system by controlling the system parameters via software. By using integrated components, an energy-efficient design is targeted.

>> TECHNICAL OUTCOMES TIMELINE UP TO M18

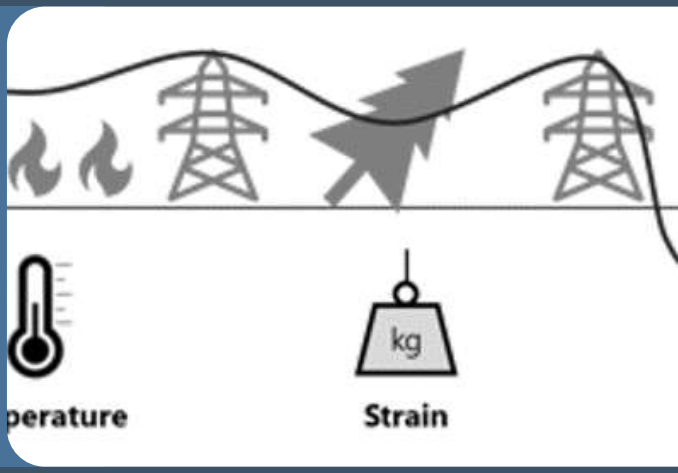


04.

SoFiN Use Cases Explained

>>> Powerlines Supervision

Distributed temperature and acoustic sensing will be used to collect information on the status of powerlines. FBG (Fiber Bragg Grating) arrays will be interrogated to further demonstrate and validate the flexibility of the system.



>>> Telecommunications Supervision

Monitor via data collection on external impacts threatening the fiber infrastructure, e.g. fire, stress, heavy machinery within proximity of fiber cables that could risk fiber integrity.

>>> Water Supply Network Supervision

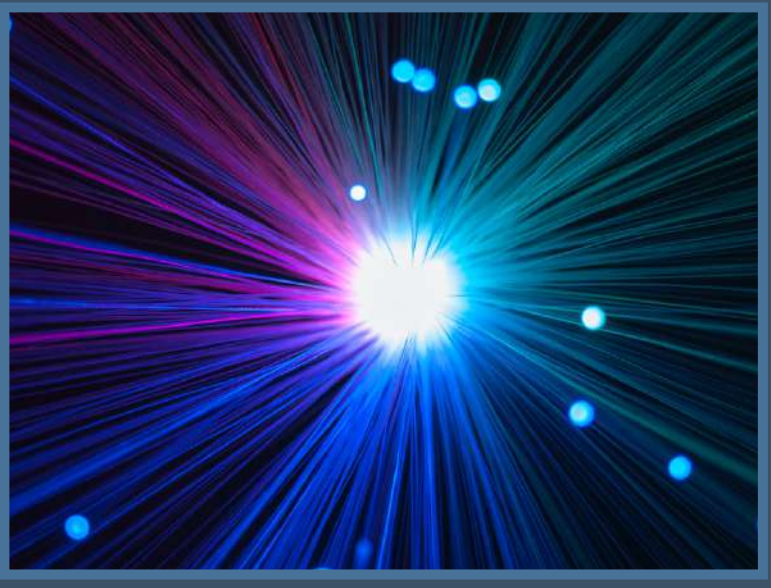
Distributed acoustic sensing to detect leaks and FBG array-based supervision to detect temperature and strain variation caused by lost water combined with methods of machine learning to detect water loss at an early stage.

DISSEMINATION & COMMUNICATION

UPDATES ON ACTIVITIES PERFORMED

>> FIRST PROJECT PRESS RELEASES

"Pause for a minute and think what life would be without things like electricity in buildings, direct water supply to every house or internet connection in every corner." *SoFiN Press Release, CyprusMail, March 17, 2023, Cyprus.*

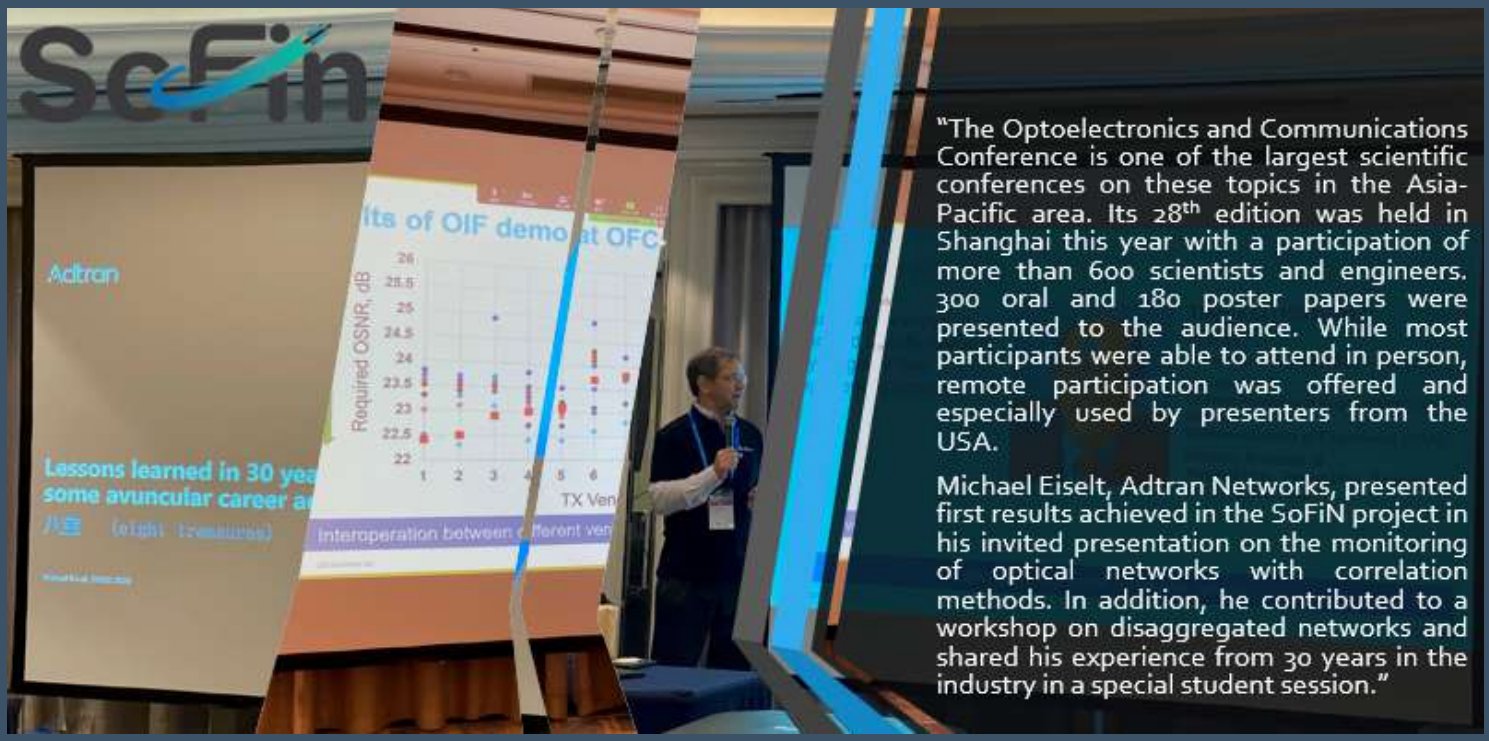


"Remember that day or even that one hour with a power cut, water supply cut or internet outage?" *SoFiN Press Release, Economy Today, Cyprus.*

Initial SoFiN Press Releases published at national CY media to introduce the project and the intention to eliminate outages by proposing an innovative and intelligent system for more accurate and continuous monitoring and early detection of potential issues.

>> OPTOELECTRONICS AND COMMUNICATIONS CONFERENCE 2023

An initial scientific outreach of the SoFiN project was performed by project partner Adtran Networks, at the OptoElectronics and Communications Conference (OECC), with an invited presentation on the monitoring of optical networks with correlation methods, which included up-to-date project results.



DISSEMINATION & COMMUNICATION

UPDATES ON ACTIVITIES PERFORMED

The SoFiN project and certain results were further presented at scientific conferences by project partners Adtran Networks and NKT Photonics, with a poster presentation at ECOC 2023 and an invited talk at FreQomb Workshop.

>> EUROPEAN CONFERENCE ON OPTICAL COMMUNICATIONS 2023

SoFiN

49th European Conference on Optical Communications (ECOC 2023)

The European Conference on Optical Communications is the largest scientific conference in Europe in the field of optical communications and fiber sensing. Its 49th edition was held in Glasgow, Scotland, this year, with the participation of 1461 delegates from 40 different countries from all over the world. The number of delegates and their national variety are a testament to the importance of this conference. 743 scientific papers were submitted to the technical conference, of which 246 were accepted for oral presentations and 105 as posters. They were presented and discussed in 70 sessions over 5 days.

Florian Azendorf, Adtran Networks SE, presented first results related to the SoFiN multi-sensing platform with the paper "Acoustic Sensing after 50 km Transmission Fiber using Coherent Optical Subassembly". In a 2.5-hour poster session, Florian explained the team's achievements to many delegates and PhD students. This gave the opportunity for a variety of interesting discussions and numerous new contacts with other researchers in the field.

>> FREQOMB: OPTICAL FREQUENCY COMBS WORKSHOP 2023

Angelo Manetta, NKT Photonics, Denmark
Microcomb generation in the normal-dispersion regime

In the last decade, microresonator-based frequency combs or microcombs have come into the limelight as a compact, cost-effective alternative to mode-locked lasers. The large comb line spacing and lower power threshold offered by these on-chip devices are attractive for several applications, such as telecommunications, optical frequency synthesis and LiDAR. Until recently, the majority of studies have focused on anomalous dispersion microresonators, leaving the normal dispersion regime comparatively less explored, although the latter can lead to the generation of combs with higher power conversion efficiency.

NKT Photonics has developed a frequency-comb platform based on low frequency-noise Koheras lasers and dual-ring optical resonators, where light is coupled to a normal dispersion silicon nitride microstructure. This talk will describe the mechanism of comb generation in the current setup and present a thorough study of the resulting spectral and noise properties of the comb. Furthermore, we will discuss an experimental technique for the reduction of thermorefractive noise in microcombs based on an all-optical feedback scheme.

DISSEMINATION & COMMUNICATION

NEWS FROM CONSORTIUM MEETINGS

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

>> ONLINE KICK-OFF MEETING

The SoFiN kick-off meeting was held online in Dec. 2022. The meeting was arranged to officially initiate the project and put in action the plans for development.

>> PHYSICAL KICK-OFF MEETING

A successful SoFiN in-person and online meeting was held in Feb. 2023 and hosted by CyRIC | Cyprus Research and Innovation Center in Nicosia, Cyprus. After the online KO meeting back in Dec. 2022, this was a great opportunity for the SoFiN Consortium to meet in person and discuss in detail the project with focus on active work and upcoming tasks for the next 6 months.

DISSEMINATION & COMMUNICATION

NEWS FROM CONSORTIUM MEETINGS

>> M10 PHYSICAL MEETING

The next SoFiN project meeting took place on project month 10, Sep. 2023 in Erlangen-Nürnberg, Germany. The meeting was hosted by the project partner Friedrich-Alexander-Universität, FAU - LHFT. The two-day meeting was another great opportunity to discuss in-person, the up-to-date progress, and look further into technical matters, issues and solutions. Actions and tasks were planned for the next 6 months of the project.

SoFiN partners also had the opportunity to visit the Photonics laboratories for a closer look at different technologies and experiments.

PROJECT CONTACT DETAILS

09.

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 SoFiN project, may conveniently subscribe via the project website to receive an automated notification once a newsletter is released.

LET'S STAY CONNECTED

CONTACT DETAILS

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