

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 WORK COMPLETED

TECHNICAL UPDATES FROM LAST 6 MONTHS

>> SOFIN MACHINE LEARNING & CLOUD PLATFORM

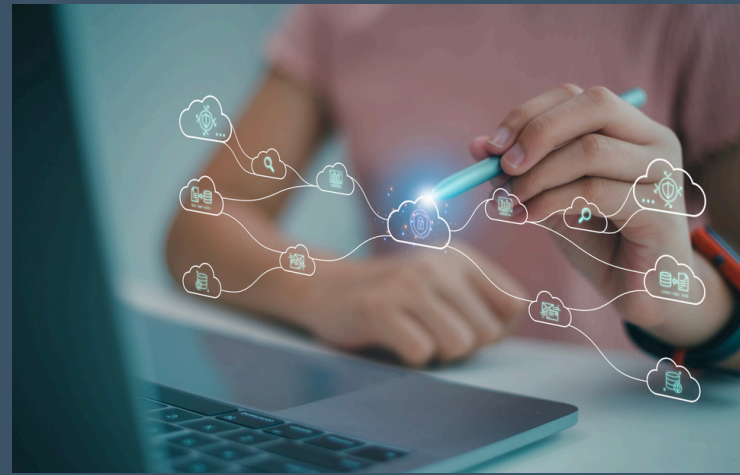
The last 6 months, a main focus was the progress on Machine Learning and cloud platform development. The challenges of long-range sensitivity to strain, vibration, and temperature, are addressed with a specialized interrogator developed upon Rayleigh backscattering as a method to detect temperature events.

A theoretical model was created to simulate Rayleigh backscattering under temperature effects, which led to the development of two key algorithms: one for detecting temperature events and identifying their location, and another for recovering temperature changes.

Experimental validation showed a strong correlation achieved between recovered and measured temperatures. This model is being integrated into a Digital Twin (DT) for real-time system monitoring.

Additionally, data reduction methods were investigated, and algorithms proposed to minimize the data volume without losing critical information.

This deliverable also presents the current state of the cloud platform, and details the interactions between the interrogator, DT, user interface, and cloud services.



PROJECT USE CASES

The 3 use cases of the project are:

- 1) Powerlines supervision
- 2) Telecommunications supervision
- 3) Water Supply Network supervision

Featured in Newsletter Vol. 01

>> TECHNICAL MEETING AT FAU LABS

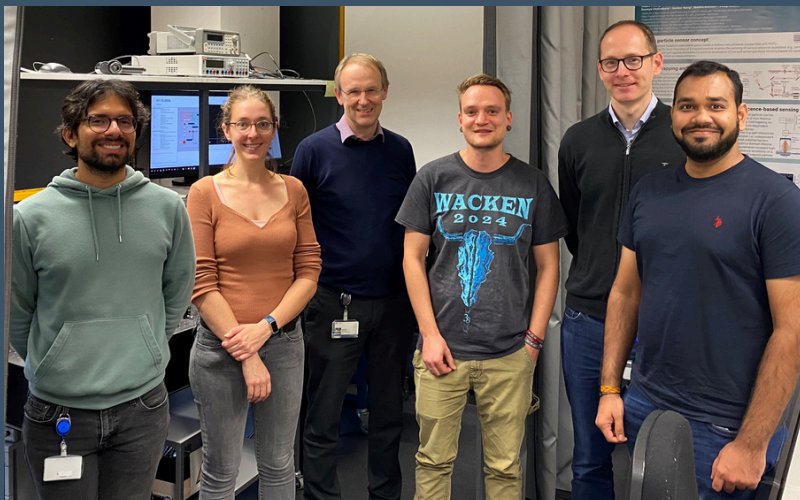


Photo taken at the FAU laboratory.

Technical partners FAU and ADTRAN met at FAU labs to exchange updates on the overall technical progress and alignment of work progress in fiber sensing and interrogator development.

PROJECT WORK COMPLETED

TECHNICAL UPDATES FROM LAST 6 MONTHS

>> FIRST VERSION OF THE INTERROGATOR

In SoFiN a flexible sensor platform is developed that can be used for various fiber-based sensing applications. This platform consists of the fiber sensor, interrogator and cloud infrastructure. The early version of the SoFiN interrogator was delivered as part of this work. As an early version, it is at current stage connected with all core components for testing and debugging. Initial tests were performed with the individual core components and the operation of all components together, and the detection of a vibration applied to a short fiber section has been demonstrated.




Optical Fiber Technology

Volume 88, December 2024, 104000



Single-channel distributed Raman temperature sensing based on a 1-dimensional convolutional neural network

Esther Renner^a  , John S. Mampilli^a, Nadia Amer^a, Bernhard Schmauss^{a, b}

The scientific publication presents the latest research advancements and results stemming from the significant project work exploring temperature prediction with a convolutional neural network performed by colleagues Esther Renner et al. from Prof. Dr.-Ing. Bernhard Schmauss team at FAU – Friedrich-Alexander-Universität, Erlangen-Nürnberg, Institute of Microwaves and Photonics.

The full publication titled “Single-channel distributed Raman temperature sensing based on a 1-dimensional convolutional neural network” can be accessed here: <https://www.sciencedirect.com/science/article/pii/S1068520024003456>

DISSEMINATION & COMMUNICATION

UPDATES FROM EVENTS ATTENDED

>> EUROPEAN CONFERENCE ON OPTICAL COMMUNICATION (ECOC) 2024

— 22.-26. SEPTEMBER 2024 —

ECOC 2024

50th European Conference on Optical Communication

50th ECOC

SoFiN progress from the joint work of partners DTU and ADTRAN was presented at the European Conference on Optical Communication (ECOC) held in Sep. 2024. This year marked a significant milestone of 50 years ECOC, an EU leading conference on optical communications.

At the conference, SoFiN work was presented by colleague Dr. Roman Ermakov from DTU with a keynote presentation of the joint work titled “Distributed Sensing of Temperature Variations via Coherent Correlation OTDR”.

DTU

SoFiN

50th Anniversary
ECOC2024
FRANKFURT

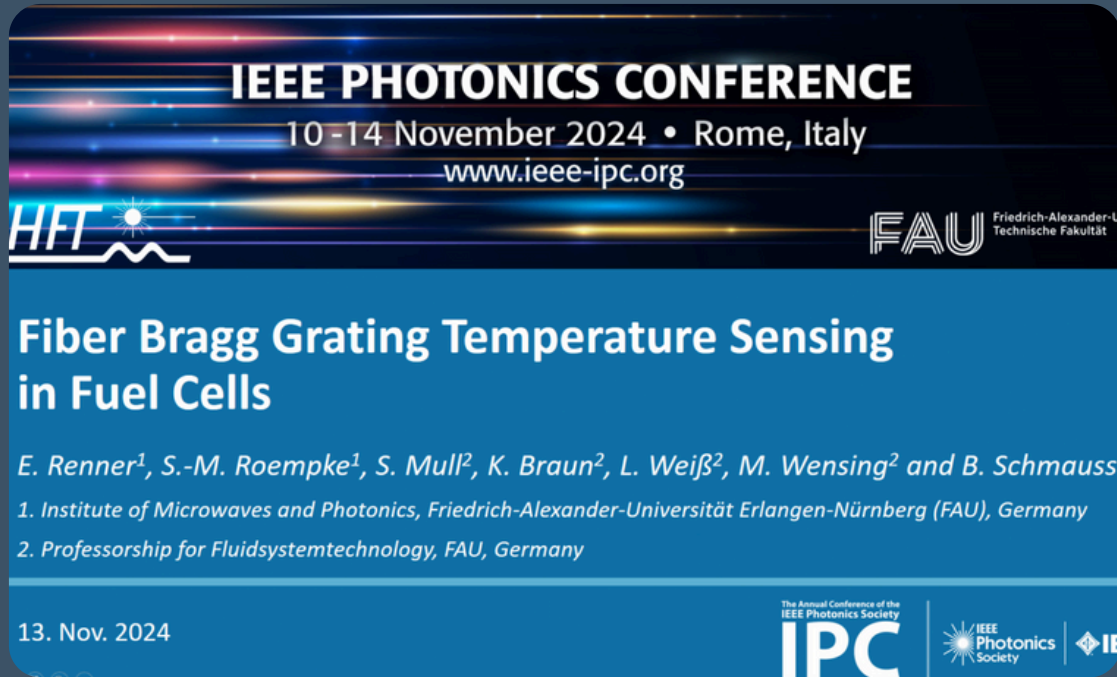
Distributed Sensing of Temperature Variations via Coherent Correlation OTDR

Roman Ermakov¹, Florian Azendorff², Huwei Wang¹, André Sandmann², Francesco Da Ros¹, and Darko Zibar¹


DISSEMINATION & COMMUNICATION

UPDATES FROM EVENTS ATTENDED

>> IEEE PHOTONICS CONFERENCE (IPC) 2024



IEEE PHOTONICS CONFERENCE
10-14 November 2024 • Rome, Italy
www.ieee-ipc.org

HFT  **FAU** Friedrich-Alexander-Universität Erlangen-Nürnberg Technische Fakultät

Fiber Bragg Grating Temperature Sensing in Fuel Cells

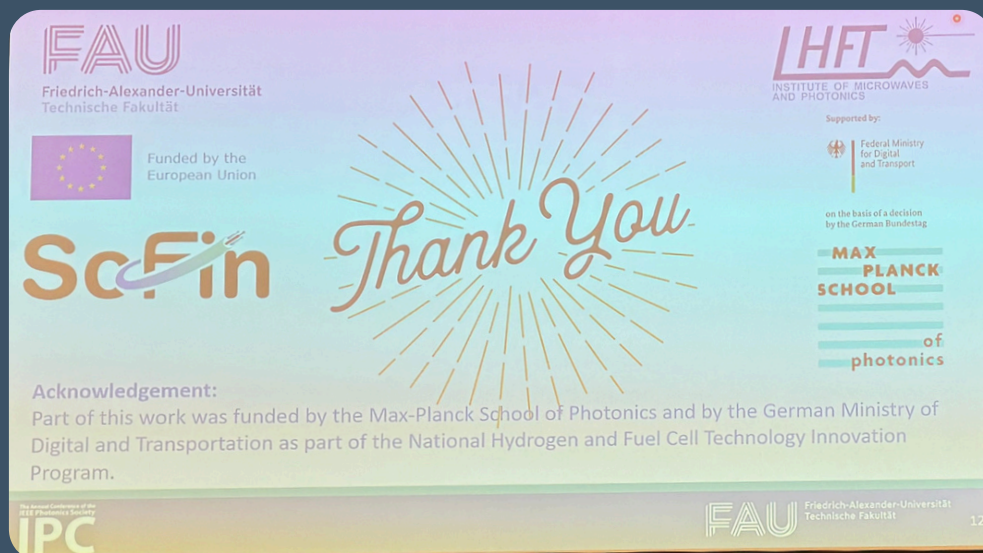
E. Renner¹, S.-M. Roempke¹, S. Mull², K. Braun², L. Weiß², M. Wensing² and B. Schmauss²

1. Institute of Microwaves and Photonics, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany
2. Professorship for Fluidsystemtechnology, FAU, Germany

13. Nov. 2024

The Annual Conference of the IEEE Photonics Society
IPC | IEEE Photonics Society | IE

Results from the research performed by partner FAU were presented on 10-14th Nov. at IEEE Photonics Conference (IPC) 2024, which is considered the flagship meeting of the IEEE Photonics Society.



FAU Friedrich-Alexander-Universität Technische Fakultät

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Thank You

LHFT INSTITUTE OF MICROWAVES AND PHOTONICS

Supported by:
Federal Ministry for Digital and Transport

on the basis of a decision by the German Bundestag

MAX PLANCK SCHOOL of photonics

Acknowledgement:
Part of this work was funded by the Max-Planck School of Photonics and by the German Ministry of Digital and Transportation as part of the National Hydrogen and Fuel Cell Technology Innovation Program.

The Annual Conference of the IEEE Photonics Society
IPC | **FAU** Friedrich-Alexander-Universität Technische Fakultät 12

As part of this year's conference the SoFin progress was communicated by colleague Esther Renner from FAU with a keynote presentation titled "Fiber Bragg Grating Temperature Sensing in Fuel Cells".



DISSEMINATION & COMMUNICATION

NEWS FROM CONSORTIUM MEETINGS

>> M26 PHYSICAL MEETING

The SoFiN project physical Consortium Meeting which took place on project month 26, January 2025 in Meiningen, Germany was hosted by the project partner ADTRAN. Colleagues from all partners gathered to discuss project updates, exchange ideas on several aspects of the project and align plans for the next 6 months. Following the two-day meeting, the consortium also had the opportunity to visit ADTRAN labs and get a first view at the SoFiN demonstrator.



CONSORTIUM
MEETING

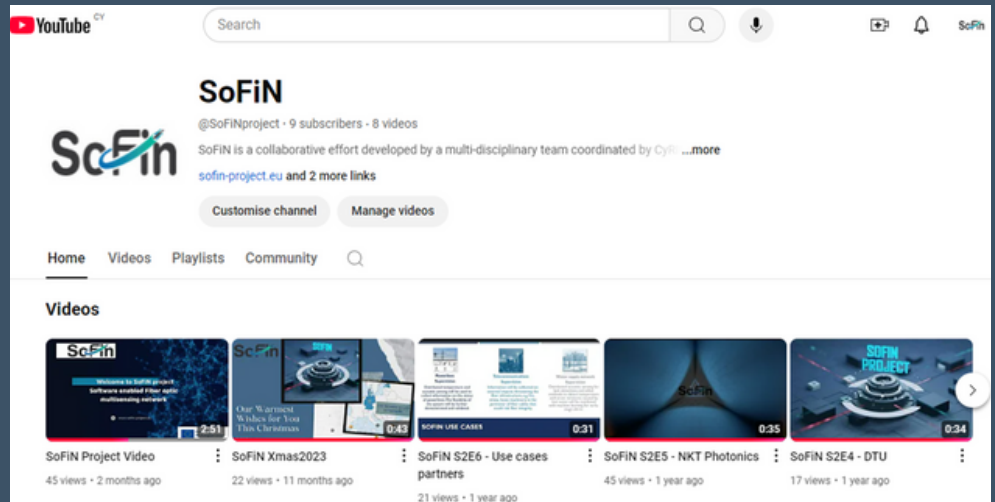
MONTH 26

SoFiN

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PROJECT VIDEO RELEASED

Short videos are regularly shared on project's YouTube page as a more interactive way to communicate updates from the project.



A first complete video to present the project and work performed by each partner was recently published on social media pages and website. The recordings were performed during the Consortium meeting at DTU in June 2024 with all partners introducing their work. The final video was released in September 2024 and also available on project's YouTube page here: https://youtu.be/Nj4_jHzTN80?si=L9uh1Zp2mJspsv6d



Welcome to SoFiN project
Software enabled Fiber optic
multisensing network

 www.sofin-project.eu



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PROJECT CONTACT DETAILS

08.

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.

»»» CONTACT DETAILS

Website: <https://sofin-project.eu/>

Email: info@sofin-project.eu

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ENERGINET



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