

OFSETH

Optical Fibre Sensors Embedded into Textile for Healthcare

OFSETH will develop Optical Fibre based sensors to continuously assess the vital parameters of a patient. The objective is to demonstrate the validity of optical sensing solutions for healthcare and develop this technology taking into account the issues linked with textile and wearability for a future efficient and continuous care of patients.

Objectives of the project

The integration of optical sensors into textile is of high interest for monitoring the health parameters of patients with limited mobility or requiring continuous medical assistance and treatment. The majority of the sensors that were explored in previous projects are based on electrical or piezo-electric technology. Good results have been obtained by using such sensors that represent a valid option for the present but also a technology very promising for the future.

OFSETH will explore particular applications where optical sensing seems to be the only practical choice.

The main objectives of **OFSETH** are the following :

- Develop NIRS (Near Infra Red Spectrometry) and FBG (Fibre Bragg Grating) fibre based sensors integrated into textile.
- Test these sensors onto simulators and compare it with standard sensors.
- Integrate the sensors and interrogation devices into an autonomous monitoring cloth.

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- Validate the results of the project through a clinical evaluation with patients and healthy volunteers.

Project Description

Healthcare monitoring is a general concern for patients with limited mobility or requiring a continuous medical assistance and treatment. In order to enlarge the actual capabilities of such a technology, **OFSETH** targets the investigation of the application of optical sensor techniques to this field.

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To construct this project an analysis has been carried out on the possible optical techniques and on the requirements from medical end-users that are not assessed by more classical healthcare monitoring technologies.

It appeared that two main technologies can be pointed out : one based on Fibre Bragg Grating sensors and the other one based on Near Infrared Spectrometry. These technologies can permit to assess various parameters such as cardiac, respiratory

Scenario

Silica fibres are not necessarily the best candidate for an integration into textile due to their mechanical properties. Polymer Optical Fibres (POFs) might be more suitable. The main problem with POFs will be the possibility to develop Fibre Bragg Grating based sensors with this fibre (POF-FBGs).

In this project, our research will include investigations of both standard and special POF available on the market as basis for FBG sensors. Our research work will also include experimental investigations of the created POF gratings and their suitability (sensitivity, resolution, measurement range) as sensors for medical applications. To our knowledge, there are no publications on POF-FBG sensors embedded into textiles. Therefore, an important part of our work should concern the integrity of POF-FBG sensors in textiles and possible disturbances onto the sensor signals due to the integration process.

rates and oximetry that will be investigated here but also pH or glucose concentration. Actually **OFSETH** will investigate the possibility to make these kind of measures through optical devices embedded into textile in order to make these technologies wearable and these parameters assessable continuously.

Then **OFSETH** targets the validation of both applications through FBG (both on silica and polymer fibres) and NIRS fibre technology and the demonstration of the wearability of these solutions for an extension of the assessable parameters for actual and future healthcare monitoring system.

To perform this study **OFSETH** gathers competencies in the fields of textile, optics and health through eleven partners in five European countries. The full duration of the project is planned over 42 months at the end of which we will have demonstrated a solution for monitoring of patients submitted to MRI and the wearability of these techniques for SIDS (Sudden Infant Death Syndrome) purposes for instance.

Expected Results & Impacts

The preparation of this project was first driven by the need for Electro-magnetic Compatible (EMC) sensors in the case of applications such as Magnetic Resonant Imaging (MRI). Fibre optical solutions is the ideal candidate to answer to this need. And then **OFSETH** goes one step further by turning this technique wearable in order to address a larger span of mobile applications. It is important to clarify here that **OFSETH** does not intent to develop new clinical solutions or protocols but to reproduce existing ones with fibre optical technology in order to make them compliant with specific applications where convincing solutions are still awaited.

The foreseen applications of **OFSETH** are the following (list not exhaustive) :

- Short and mid-term results :
 - Monitoring of cardiac and respiratory rhythm and oximetry through FBG and fibre NIRS for patients submitted to Magnetic Resonance Imaging (MRI) procedure and needing particular care such as in the case of anaesthesia or reanimation;
 - At the end of the project we plan to demonstrate the wearability of these two technologies : FBG and fibre NIRS monitoring to enlarge their application to ambulatory healthcare monitoring and SIDS.
- Long term results - expected future consequences - of the project :
 - Wearable systems for continuous monitoring with all parameters assessable by NIRS (pH, glucose level...) and FBG (bio-chemical analysis...). This project will have obvious long-term societal impacts at the European level through applications such as diabetes regulation, with which a large ratio of the world population is concerned.

O F S E T H

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- Bundesanstalt für Materialforschung und – Prüfung (DE)
- Advanced Optics Solutions GMBH (DE)
- Fiberware Generalunternehmen für Nachrichtentechnik GmbH (DE)
- Technische Universität München (DE)
- ELASTA Ind (BE)
- TYTEX A/S (DK)

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