PROJECT PROFILE

16012

Electronic solutions for MRI scanning of patients with multiple implants drastically reduce examination time and increase accuracy

[DISPERSE]

The occurrence of three or four concurrent medical conditions by the age of 70 is now common among an ageing population leading to more and more people wearing implanted medical-treatment devices. Unfortunately, current medical practice generally excludes patients with implants from access to magnetic resonance imaging (MRI). In the case of state-of-the-art implants, only patients with a single implant may be scanned, and even then under severe restrictions. This drastically increases examination time. The DISPERSE project does away with all these limitations, while delivering additional benefits.

What is most noticeable among an ageing population is a steep increase in the incidence of diabetes, musculoskeletal, cardiovascular and neurological diseases. Many of us will develop multiple clinical conditions, either chronic or acute. Studies on the prevalence of comorbidity show that at age 70, occurrence of three or four conditions is common. Treatment of many chronic conditions involves placement of implants or use of body-worn treatment-delivery devices. These electronic devices are mainly found in the elderly population. For numerous identified medical conditions, magnetic resonance imaging (or MRI, a way of obtaining detailed images of organs and tissues throughout the body without the need for X-rays or so-called 'ionizing' radiation) is required for diagnosis and treatment monitoring. As patients develop multiple medical conditions, many of those needing an MRI scan will have one or more implants.

Crucially, current medical practice excludes patients with one or more 'standard' active implantable medical devices (AIMDs) from access to MRI treatment, because MRI scanners need to use (electro-) magnetic fields which are far stronger than those encountered in everyday situations. This causes serious health inequalities for a rapidly growing group of patients. Now, scanning patients with a single, so-called state-of-the-art implant, is permitted under strict and limiting conditions. Unfortunately, these restrictions increase the typical examination time from 20 minutes (for a patient without an implant) to one hour (for patients with a single, advanced implant).

Reducing examination times, increasing scan accuracy

DISPERSE's key objective is therefore to develop the electronic means of reducing examination times of patients with multiple implants by a factor of three, while also improving scanning accuracy. This objective will be achieved by developing electronics for spatially distributed sensor and transducer arrays exploiting synergies with other domains, which in turn will optimise the workflow for MRI-scanning these patients.

In particular, DISPERSE will develop:

- Improved MR conditional implants (safe under certain tested conditions);
- Multi-implant coexistence;
- Optimal MRI workflow for implants;
- New and improved components.

Tangible results include:

- AIMDs causing less MRI distortion;
- New methods for multi- implant testing;
- Sensor arrays with increased density;
- Miniaturised, low-power sensor and actuator electronics (ASICs);
- High-speed, low-power and low-volume (refers to their small size, not low production volume) photonic modules for data transmission.

DISPERSE will develop a technology value-chain for creating large distributed multiple sensing arrays, including low-latency, interference-free data communication. These sensing networks have a large application potential in other markets, such as smart cities and space. In particular, DISPERSE will demonstrate applications in radio telescopy and acoustic surveillance of public space.

KEY APPLICATION AREAS

- Health & Well-Being
- Digital Life

ESSENTIAL CAPABILITIES

- Systems and Components Architecture, Design & Integration
- Safety, Security & Reliability
- ECS Process Technology, Equipment, Materials & Manufacturing

PARTNERS

Cochlear
UZ Gasthuisberg (KU Leuven)
Luceda Photonics
MinDCet NV
Firecomms Limited
Tyndall National Institute
ASTRON Netherlands Institute for Radio Astronomy
GTX Medical
Philips Medical Systems
Sorama BV
Sound Intelligence
Technobis

COUNTRIES INVOLVED

- Belgium
- The Netherlands
- Ireland

PROJECT LEADER

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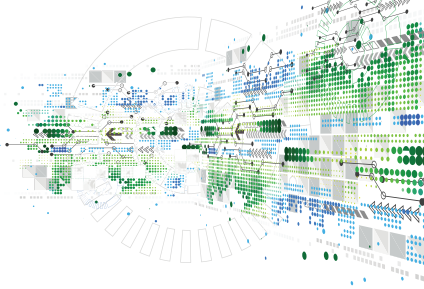
KEY PROJECT DATES

01 February 2017 - 31 January 2020



Finding the right expertise mix

In order to meet key objectives, the project consortium includes a clinical end-user, application partners, as well as technology and knowledge providers, working together on innovations in photonics, micro-electronic design and packaging. As such, DISPERSE brings together implant manufacturers, an MRI producer and a hospital, together with two acoustic specialists, to develop new acoustic monitoring solutions for detecting patient anxiety. This solution will operate in the harsh MRI acoustic environment. A research partner from the space domain will also provide the project consortium with valuable knowledge on distributed sensor networks.

Wider implications, broader applications

In addition to the strictly technical and technological benefits mentioned earlier, DISPERSE's focus on diagnosis and treatment, for example, fits perfectly in the 'Continuum of Care', a concept involving an integrated system of care that guides and tracks patient over time through a comprehensive array of health services spanning all levels of intensity of care.

On the financial side, the implant market is expected to grow by 71% in 2015-2020, according to US data, and an increasing likelihood that someone aged 70 will require an MRI within the next 10 years could drive the double-digit CAGR (compound annual growth rate) for DISPERSE AIMDs, leading to a total market size of €6.9 billion in 2020. In that same year, the MRI market is expected to expand to €6.1 billion, thanks to shorter examinations times and improved diagnostic capabilities.

Now, DISPERSE's innovative devices for the healthcare market – such as photonic transceivers, ASICs for sensor arrays, and solutions for acoustic observation – have significant potential in at least four other markets:

- **Brain monitoring:** expected to reach US$11.3 billion by 2020, from US$ 7.5 billion in 2015 at a CAGR of 7% over the forecast period. Factors – such as the increasing incidence and prevalence of neurological disorders; rising awareness about neurodegenerative diseases; technological advancements in devices; and growing incidence of traumatic brain-injuries – are driving market growth;
- **Smart cities and acoustic observation:** beyond acoustic patient observation, implementing an array of sound cameras will enable major breakthroughs in the emerging market of audio and classification for smart home (home care) and smart city applications, where there will be greater emphasis on the audio capabilities of video surveillance systems;
- **Space:** application activity focuses on the development of communication technology for a satellite-based radio telescope. Here there is interest in the communication module to be developed in DISPERSE. There is also interest in using DISPERSE as a model for EU-based companies to develop technology needed to build the future space telescope;
- **Photonic components and systems:** photonic data-transceiver technology and components developed in DISPERSE will address wide, lucrative and growing market-segments outside of the MRI application field, both within the healthcare domain, but importantly also in the industrial Internet of Things (IoT), a market which is predicted to reach $8.6 trillion by 2025.

And interestingly, DISPERSE is also expected to 'disrupt' the therapy market and break the dominance of large pharmaceutical companies by influencing factors that challenge the strong growth of AIMDs.

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