Last updated: December 2022

Interreg
North-West Europe
REAMIT

EUROPEAN UNION

European Regional Development Fund

Resource and materials efficiency

Improving **R**esource **E**fficiency of **A**gribusiness supply chains by **M**inimizing waste using big data and **IoT** sensors **(REAMIT)**

Introduction

REAMIT is a transnational territorial cooperation project for reducing food waste. It is funded by the Interreg North - West Europe Programme and implemented jointly by partners from universities, business development organisations and technology firms. Reducing food waste is of highest priority for the EU (88Mt or € 143B wasted per year). The EU has committed to halving food waste by 2030 by focusing on all stages in the supply chain. 35% of food waste in EU-28 occurs in supply chains.

REAMIT will focus on fruits, vegetables, meat and fish as these are wasted in large quantities. The supply chain includes farms, packaging sites, food processors, distribution, logistics, wholesalers and retailers. The project will be carried out in five countries in NWE (Ireland, Germany, France, UK and the Netherlands) due to the amount of interconnected food supply chains and huge food waste in these countries.

REAMIT will adapt existing Internet of Things and Big Data technologies to best fit the needs of the food supply chain management system in NWE. Through testing and adaptation, these technologies will be enabled to continuously monitor and record food quality and signal potential food quality issues.

Welcome from the Project Lead

Professor Ram Ramanathan
The University of Essex, UK

The REAMIT Project will help reduce food waste in NWE by innovative application of digital technologies (big data, internet of things sensors, analytics, articifical intelligence, etc.). We show the power of these technologies with at least five demonstrations, one in each of the five countries. While commercial organisations have successfully employed digital technologies for improving their financial bottomline, the REAMIT project is unique in that it demonstrates the power of these technologies for achieving a social cause and the triple botttom line. We are excited to be a part of this innovative venture and welcome others to join.

Project Aims

This project will focus on fresh food (fruits/vegetables/meat and fish) and aims to reduce waste of these foods in the following ways:

- Tracking the quality of fresh food using sensors. Both traditional sensors (temperature, humidity, light, vibrations, etc.) and newer sensors (e.g., Raman spectroscopy and 3D Fluorescence spectroscopy) will be used.
- Collecting data from sensors in the cloud and continuously monitoring the data using automated big data technologies.
- Contacting food owners (using smart phone Apps) as early as possible in the case of any potential loss of food quality, providing suggestions for saving the food before it becomes waste, including rerouting to nearby destinations before the food becomes waste.
- Conducting big data analytics on the sensor data to bring out long-term strategies for reducing food waste in NWE.

Summary of REAMIT's long term ambition:

REAMIT has the ambition to create long term and lasting impacts benefiting not only actors in food supply chains and food consumers, but also businesses operating around food supply chains and in other sectors (i.e. pharmaceutics, cosmetics) where REAMIT technologies may add value. REAMIT's long-term objectives will be achieved through the following actions:

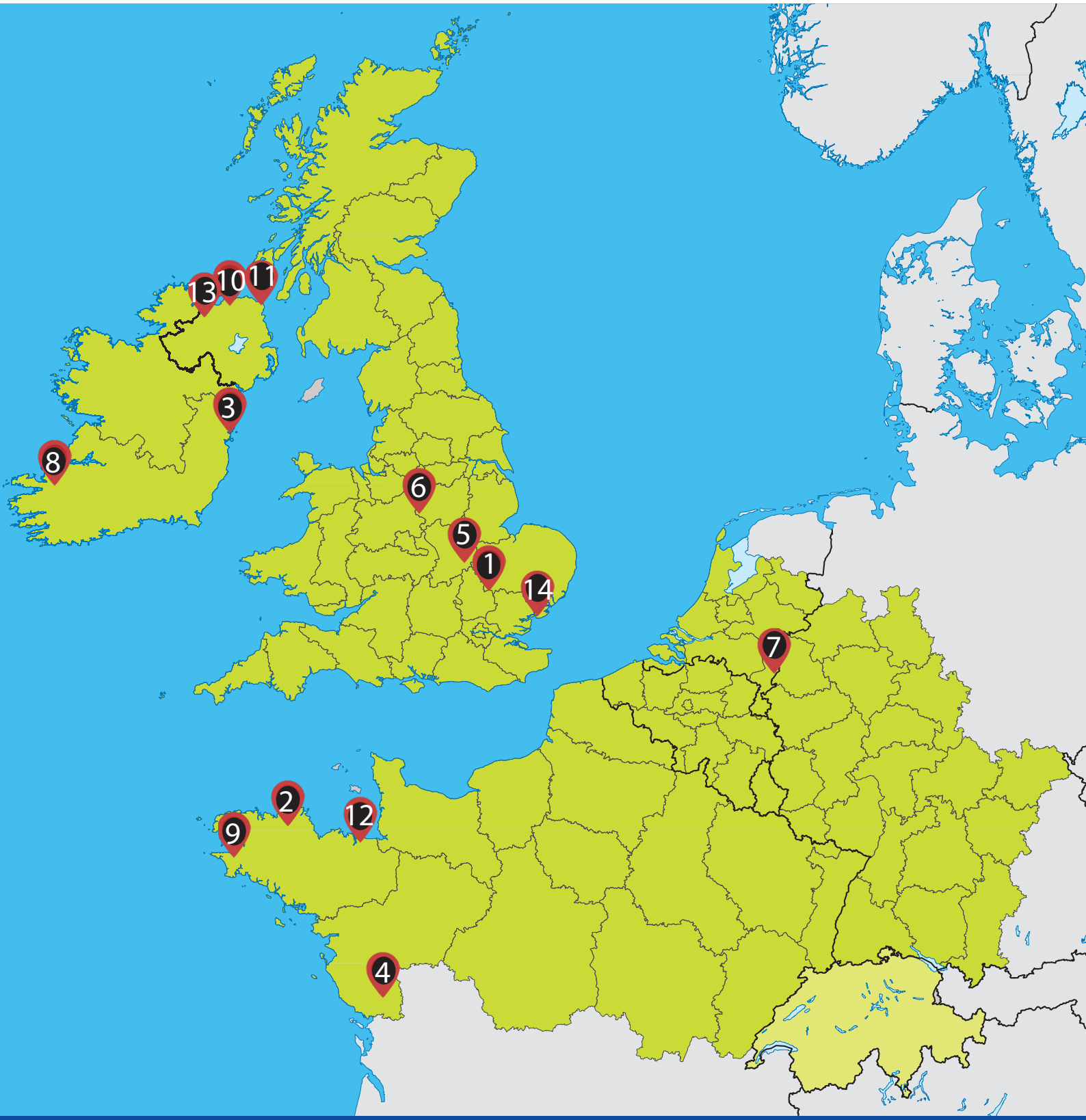
o Collecting data in Big Data Hub and conducting analytics to develop algorithms supporting decision making on rerouting 'food soon-to-become waste' to the nearest rather than planned consumer.

o Animating a Pan-European network of stakeholders involved in agri-food supply chains, technology companies and policy makers to promote saving food from becoming waste.

o Developing methodology for measuring food waste reduction with the application of REAMIT technologies.

Project Partners

Our partners span across North-West Europe, namely Ireland, Netherlands, France and United Kingdom. REAMIT is a transnational territorial cooperation project implemented jointly by partners from universities, business development organisations and technology firms.



Pin	Name	Contact	Location
1	University of Bedfordshire (Lead Partner)	Yanqing Duan	United Kingdom
2	Images & Réseaux	Gaël MAUGIS	France
3	University College Dublin	Fionnuala Murphy	Ireland
4	University of Nantes	Gérald THOUAND	France
5	Levstone Ltd	Simon McGraw	United Kingdom
6	Nottingham Trent University	Usha Ramanathan	United Kingdom
7	Whysor	Imke Hermens	The Netherlands
8	Munster Technological University	Gerard Corkery	Ireland
9	SenX	Hervé Rannou	France
10	Ulster University	Joan Condell	United Kingdom
11	WD Meats	Marc Logan	United Kingdom
12	Valorial	Adrienne GENTIL	France
13	ActionSense	Joan Condell	United Kingdom
14	University of Essex	Ram Ramanathan	United Kingdom

Updates on technology demonstrations

Ulster University, UK – Trials with WD Meats, BPS prevention trial

The occurrence of 'blown pack spoilage' (BPS) is caused by several strains of the Clostridium bacteria, most notably Clostridium Estertheticum. Presence of this anaerobic bacteria within typical vacuum sealed packaging can result in notably reduced shelf life and an inevitable increase in wasted beef. Rapid detection of this bacteria could not only prevent the spread, but also, as it is a non-toxic bacteria, it could stop infected meat from being wasted by not giving the bacteria chance to reproduce. REAMIT sensor technology will be used to rapidly identify samples containing the virus and allow for the product removal and immediate sanitisation of exposed areas.

Ulster University, UK – Trials with WD Meats, Dry-Aging trial

Due to the configuration of dry-aging chambers, the proximity of beef products to heat sources, such as doors and distance from refrigerators can affect the moisture content of the beef. These changes in beef moisture content can affect both business value and the overall quality of the beef. REAMIT has added a number of Ursalink UC-11 IoT-connected LoRaWAN temperature and humidity sensors to these chambers and provide real-time monitoring and analysis of the dry-aging process to help identify the ideal temperature and humidity parameters which maximise beef quality while reducing beef waste.

Ulster University, UK - Trials with Musgrave, Cold Chain Anomaly Detection

While performing deliveries to their business customers, Musgrave, Irelands largest grocery distributor, noticed that the refrigeration units in their last-mile delivery vans operating in the greater Belfast area would occasionally malfunction, without any indication to either the driver or the logistics staff at the warehouse. The temperature of the chilled and frozen food products inside the van would increase, surpassing the food storage temperature safety threshold, resulting in a van load of spoiled stock. In April 2022, REAMIT added a number of Digital Matter Eagle IoT- connected GSM temperature and humidity sensors to these vans and have monitored 3000+ journeys since installation. Real-time monitoring and alerting is available from the Whysor platform if problems are detected.

Updates on technology demonstrations

The University of Nantes, FR - Raman Spectroscopy trials

REAMIT team in the University of Nantes use the Raman spectrometer to measure the characteristics of the object under observation and expressing the chemical composition at its current state which is a great advancement of the REAMIT technology to reduce food waste and save food. This smaller version of Raman spectrometer has a huge potential to be used to detect food waste in moving trucks.

The University College Dublin, UK - Burns Farm Meats trial

The University College Dublin is working with Burns Farm Meats Ltd., a long-established family-owned company located in north Sligo, Ireland. Their main activities include farming, operation of an abattoir, processing of organic meats, and delivery of retail orders to the public. As part of these activities, being firmly committed to animal welfare and providing meat of the highest quality, Burns Farm Meats runs a dry ageing process to deliver tender cut meat of their own locally raised, fed and cared for animals. The dry ageing of the obtained beef is stored into refrigeration chambers at around 2°C for a duration from 2 to 3 weeks. During that time, tenderness and flavour are improved by aging, which induces physical changes in the muscle tissue that enhance the quality of the meat.

Burns Farm Meats are especially interested in the monitoring of the dry-aging process. In fact, despite increasing quality properties of the meat, it is still a costly process for abattoirs because of shrinkage of the meat, trim loss, and risk of contamination.

Whysor, NL - Trials with Picnic

The Dutch pilot partner, Picnic is the largest online supermarket in the Netherlands. Picnic has more than 1,000 electrical vans delivering groceries free to their customers' home. It has an end-to-end business and a just-in-time supply chain. Technology, smart planning, and a fleet of electric vehicles lead to less food waste and fewer food miles.

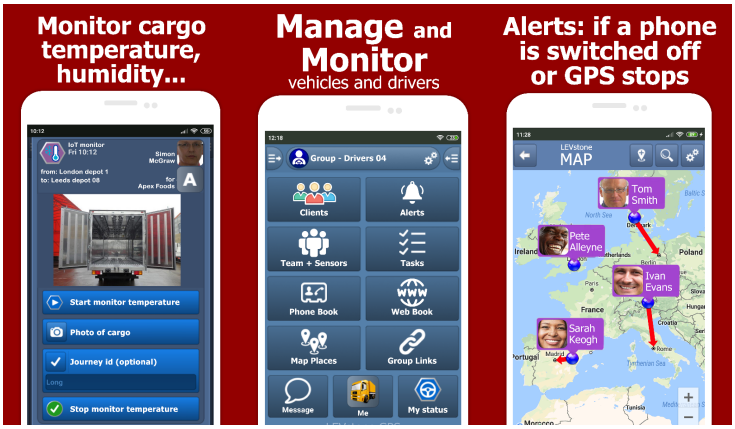
The aim of this REAMIT technology demonstration pilot test is to prepare a personalised cooling profile per coolbox, goods are transported in. This is done by using data from a.o. the Picnic weather regime, the outside weather conditions and the duration of travel.

Updates on technology demonstrations

Whysor, Luxembourg – Trials with Biogros
The Luxembourg pilot partner, Biogros is a wholesaler for high quality organic and biodynamic foods. For more than 25 years, Biogros has been supplying high quality organic food six days a week to their Luxembourg customers.

While receiving deliveries from BIOG organic growers in Luxembourg, Biogros noticed that the quality of fragile produce, such as mushrooms, unions, potatoes and celery roots, would occasionally not be up to standard. The aim of this REAMIT technology demonstration pilot test is to gain insight in the climatic conditions (temperature and humidity) in the full supply chain, from grower to supermarket.

Levstone, UK - REAMIT's Solution
The latest cutting-edge technology evolution has small sensors that use wireless low-power Bluetooth for communication. Previously, IoT sensors still required a relatively expensive gateway device in the truck requiring additional maintenance.



LEVstone have developed a solution that does not require a gateway device. The idea is to simply use a regular mobile phone to act as the gateway – it means low-cost IoT sensors wirelessly communicate via low-power Bluetooth to a regular mobile phone. To receive continual live sensor alerts and updates whilst a truck is in motion, the mobile phone in the truck or cab in order for it to transparently and seamlessly route the sensor data up to the internet.

REAMIT partners have jointly researched the market to identify a suitable low-cost IoT sensor. One commonly encountered problem was that the sensor manufacturers used closed proprietary communication protocols. This allowed LEVstone to design and develop a compatible software interface. This interface is complete and is presently being embedded into the "LEVstone GPS Vehicle Tracker" app.

Updates on technology demonstrations

The University of Bedfordshire, UK - Trials with the Human Milk Foundation

The University of Bedfordshire has been working closely with the Human Milk Foundation (HMF) and have installed sensors to monitor the temperature of donor human milk during transportation to and from the milk banks to their customers. It is key for HMF to maintain temperatures during transportation at less than -18°C, according to the national NICE guideline for Human Milk Bank Operations. Therefore, with the help of REAMIT's monitoring system in place, the milk will be kept at the optimal temperature and will send alerts if the temperature fluctuates beyond the threshold.

The main factor related to human milk wastage is microbiological contamination, currently this means around 10% of donated milk must be discarded. Fluctuating or high temperature and humidity levels can impact quality. Although REAMIT is about reducing food waste, the most important objective for HMF is providing donor human milk at its highest quality. This pilot test with HMF has been successful so far and REAMIT will continue to support HMF with their cause to safely store and transport donor human milk to babies and mothers in need.

The University of Bedfordshire, UK - Trials with Yumchop Foods

The University of Bedfordshire is leading on a technology demonstration pilot test with Yumchop Foods. The REAMIT technology is integrated into the Yumchop operations starting from storing the raw materials and prepared foods in the internal storage until the 'ready-to-eat' meal packages are stored in the vending machines/outlets. In each stage of the operations namely sourcing, preparing, storing, logistics and delivering to customers, the REAMIT sensors monitor the temperature and transmit data to Yumchop team with an alerting system that helps the team know when there is a problem during storage, to avoid the food going to waste. Using REAMIT technology, the company prevents nearly 10% of food from being waste.

Meet the Partners

University of Bedfordshire

University of Bedfordshire is the lead partner of the REAMIT project. It is a leading centre for Higher Education and Research in the UK. The business school works extensively with local and global businesses. The school has been recognised for its start- up and business growth advice with the award of a Small Business Charter Bronze Award and BSIS certification.

The University has handled a number of UK, European and international projects involving robotics, big data and IoT, and the business school specialises in bringing out business perspectives these innovative applications and in demonstrating the use of these technologies for SMEs and for social causes.

Professor Yanqing Duan
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Images & Reseaux

Images & Réseaux (I&R) cluster is a non-profit association of technology companies and research institutions based in the Brittany and Pays de la Loire regions of France.Images et Reseaux operates Digiwest (DIH from Brittany Region).

The main objectives of I&R are:

- To initiate and facilitate cooperation and other technology exchanges between enterprises and academic institutions with the goal in creating a world recognized ecosystem of innovation and research.
- To provide expertise and set-up projects on 6 cores digital technologies (5G & next generation infrastructures, big data and AI, immersive & interactive content, cyber physical system, software and IoT, and photonics).
- To initiate and facilitate the valorization and realization of the economic, technological and communication impacts as a result of the projects and from the cluster members as a whole (products / services / revenue / employment).

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University College Dublin

University College Dublin (UCD) is Ireland's premier university, with over 24,000 students and a research budget in excess of €100 million per annum. The UCD REAMIT work is being led the UCD School of Biosystems and Food Engineering which is one of the leading research groups within the university, with an exemplary track record in national and international research project participation and leadership. The School's REAMIT project members have expertise in food engineering, IoT based sensors (e.g., the CyberBar system) and life cycle assessment modelling for the analysis of environmental impacts of a range of production systems.

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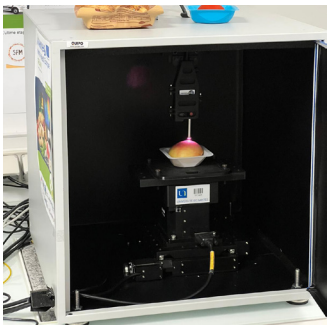
University of Nantes



The University of Nantes is a public higher education institution currently with 45,200 students and 4047 staff. The Nantes University laboratory, GEPEA (Chemical Engineering for Environment- Food), is located in the Pays de la Loire region. The GEPEA team at La Roche sur Yon includes multi-disciplinary researchers that works on the development of biosensors and bioassays applied to environment and food. The group also works in the food sector having developed detection of bacteria and food freshness with Raman spectroscopy and CARS imaging (Coherent anti-Stokes Raman spectroscopy). The group has over 20 years of research and experience on the design and technology transfer and has established a large collaboration network with many main groups and companies in the field.

Professor Gérald Thouand
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Levstone

Levstone's primary objectives for the REAMIT project are to utilise our Mobile framework and our knowledge to facilitate Live operations status that include logistics transport, energy, security, asset tracking, status of the goods, provide internet and mobile phone solution to manage jobs and provide customers with
on-line tracking and updates in real time. Connection and Data from sensors instrumentation and transmission up to the cloud, secure, resilient, Big Data for analytical purpose to our partners and clients.

Together with their partners, Levstone will use various sensors [oiT, Food ioT] to capture valuable data in order to link the data to cloud and use complex data analytics algorithms to automatically detect anomalies. In case we detect potential quality loss, we will contact owners of the food via smartphone APPs about this and suggest best strategies to save the food, including giving details of locally available demand points.

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Nottingham Trent University

Nottingham Trent University (NTU) is a leading Higher Education Institution in the East Midlands, UK. NTU has a diverse working group liaising with local businesses for research and enterprises. NTU has obtained several awards including Guardian University awards 2019, Outstanding Support for Students 2020 (Times Higher Education Awards) and the Queens Anniversary Prize for Higher and Further Education in 2021. Most recently, NTU have been named Modern University of the Year in The Times and Sunday Times Good University Guide 2023.

NTU is committed to contribute towards achieving the 17 United Nations Sustainable Development Goals (SDGs), which collectively aim to maintain sustainability, empower local society to end poverty, protect the planet and ensure prosperity for all. In this line, the REAMIT project is helping us to achieve our sustainable goals by involving food SMEs, agri-food businesses and IoT companies. Reducing food waste is one of our ongoing activities helping to create sustainability within the society. UN75+2 International Workshop on Future Mobility is conducted by NTU in 2022. This attracted several projects running around the globe, having sustainability objectives.

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WHYSOR

Software development for ambitious, innovative pioneers

Extremely motivated, we bring impact to our customers, affected by agile development from idea to prototype, not only from our standard technologies, but combining what we know and what we don't know, adapting future technologies as a second nature.

Our main activities in REAMIT are in the Internet of Things and Big Data area. We connect your devices to the cloud, by providing a long-range, low-power infrastructure for the Internet of Things. We collect machine and enterprise data in order to create a structured Big Data Architecture. This is the basis for real-time and historical data analytics, extracting knowledge and wisdom, using disruptive technologies.

Team Whysor
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Munster Technological University

The IMaR (Intelligent Mechatronics and RFID) Research Centre at Munster Technological University is an applied research centre delivering expertise in the areas of data analytics, intelligent systems, hardware (mechatronics, robotics, control systems), IoT (RFID, Sensors, Wireless Comms) and mechanical systems for increased productivity in the manufacturing, agriculture and process sectors.

IMaR delivers technology solutions for industry under the direction of an industrial steering committee, with a proven track record of delivering technology solutions to industry. Leveraging nationwide expertise in the Enterprise Ireland Technology Gateway Network and SFI Lero: The Irish Software Research Centre, IMaR exploits the use of sensor technology, data capture, data analytics and artificial intelligence to tackle some of industry's most difficult problems.

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SENX

Time Series technologies are going to design the new future of data SenX (senx.io)) is the software publisher of Warp 10 (www.warp10.io), an open source solution to manage sensors / IoT data (Time Series, Geo Time Series™) and anykind of sequence data in an horizontal and industrial perspective. It includes:

"Warp 10 Analytics Engine" based on a powerful language WarpScript that gives access to 1000+ analytics functions, fully compatible with market framework and languages.

"Warp 10 Storage Engine" (Time Series Database) as the most trendy architecture to store and to manage sensors / IoT data, available in 3 versions: distributed, standalone and embedded.

SenX proposes to build up neutral and performant data environment and ecosystems to really take profit of data and to industrialize new services. Operational use cases: industry, energy, transport, automotive, aeronautics, defence, cybersecurity, telecommunications, insurances, smart cities, agriculture, health.

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Ulster University

Ulster University (Northern Ireland) is renowned as a responsive, dynamic vibrant centre of learning with a progressive approach to teaching, dedication to pushing research boundaries and strong commitment to economic development.

In the REAMIT project, Ulster University partner with local companies WD Meats and Musgrave. The lead investigator, Dr Joan Condell, has expertise in sourcing and developing sensors as well as developing and intelligently analysing data from sensors with applications in agriculture, health, tourism and other sectors. The Ulster University team will be involved with analysing data in the cloud coming from sensors fitted to transportation and/or warehouses to support REAMIT partners to obtain long term sustainability and reduce food waste.

Professor Joan Condell
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WD Meats

WD Meats, based in Coleraine, Northern Ireland is a Beef Manufacturer since 1979. It provides a high-quality beef with full traceability of meat and livestock. WD Meats supplies beef to a wide range of retailers and other food services across the UK and Europe, as well as to markets in Asia and Africa. WD Meats also makes regular supply to various food services outlets such as catering butchers, independent retailers and as well as wholesalers.

REAMIT - WD Meats - Ulster University collaboration Ulster University, one of the partners in the REAMIT consortium, is working closely with WD Meats on two pilot tests. One approaches the global food waste phenomenon known as “blown pack spoilage” (BPS) and the other investigates the impact temperature gradients can have on beef within dry-aging chambers. REAMIT will add a number of Ursalink UC-11 IoT-connected LoRaWAN temperature and humidity sensors.

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Valorial

Valorial is the agri-food innovation cluster based in the west of France, in the heart of Europe’s largest agri-food area. Valorial is a front door to access to industry, research and technological skills on West of France agri-food. We help to develop and fund food innovations by supporting collaborative innovation projects.

Valorial activity in REAMIT project activity

Valorial is subpartner of PP Images & Réseaux and help to find some end-users (or similar) to test technologies that will be developped. In partnership with Images & Réseaux.

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ActionSense

ActionSense (Northern Ireland) is a start-up company established as a result of a strategic collaboration between academics, specialists and product development experts.The first ActionSense measurement solution offered many benefits in terms of time-savings, speed and accuracy of diagnoses and remote monitoring and analytics. ActionSense brings to REAMIT their unique range of strategic sensor knowledge, networks with academia and business product development experts in the EU and internationally.

Professor Joan Condell
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University of Essex

The University of Essex is a leading centre for Higher Education and Research in the UK. It won the prestigious University of the Year award in 2018 and ranks in the top 25 for research quality in The Times and The Sunday Times Good University Guide 2022. It was also ranked top 20 for research in the UK's Research Excellence Framework and has broad experience in large collaborative and international research projects and has been awarded over 100 projects sponsored by the European Commission throughout EU FP7 and EU H2020 research and innovation framework programmes. University of Essex will work closely with the University of Bedfordshire in providing overall direction and guidance for the successful execution of the project.

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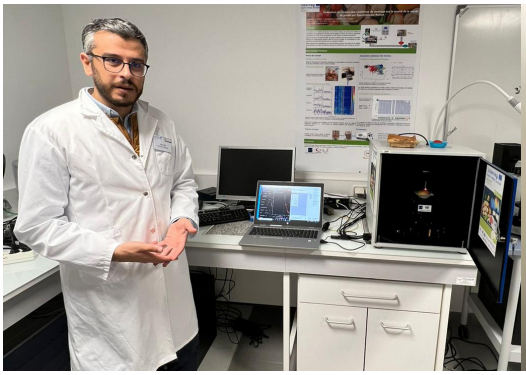

Get in touch

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Ulster University
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ActionSense
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