# Expression of Interest

**Contact details**

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## Short description of the organisation

Signalton is a research and development company established in 2017, bringing together decades of academic/industry experience and expertise of its founders, team members and associates in a vast spectrum of areas within electrical and electronics engineering, especially digital signal processing (DSP) and signal analysis including artificial intelligence (AI), pattern recognition, machine learning, deep learning, image processing, computer vision (CV), statistical array signal processing, sensor data fusion, and acoustic/audio signal processing.

As Signalton, we are capable of end-to-end system design and development including electronic hardware design, algorithm development, embedded programming, and application software development including sophisticated user applications and interactive interfaces.

The current focus of the R&D efforts span fields such as sensors, wireless sensor networks (WSN), sensor arrays, sensor based information processing, sensor data fusion, acoustic/audio signal analysis, IoT (Internet of Things), smart city, smart home/building/environment, manufacturing (Industry 4.0, 5.0) and intelligent transportation (ITS, V2X) and micro-mobility.

We have developed systems and applications through collaborative or B2B partnerships with the global and national industrial partners, and also established international collaboration with a large number of partners throughout Europe and the world for Horizon Europe project proposals.

## Specific skills related to the project

Targeted topic: HORIZON-CL5-2024-D6-01-06, Optimising multimodal network and traffic management, harnessing data from infrastructures, mobility of passengers and freight transport.

For the advanced analysis of sensor signals from IoT networks by using artificial intelligence (AI) and big data algorithms, we developed SigMote and DataMote platforms. SigMote is a versatile sensor/actuation hardware with embedded software and wireless/cellular cloud connectivity specifically developed for high-end, real-time, low-latency, edge-computing (on-premises) applications. DataMote, on the other hand, is suitable for IoT sensor data collection and actuation supporting signal analysis within a cloud-computing IoT network.

Our platforms developed fully in house address the fast customization needs of digital transformation for smart industry, city, environment and transportation with real-life implementations for various use cases that require precision sensing, low-latency processing and high-speed wireless connectivity.

We developed software for various on-board sensors (sound, vibration, image/video), hardware peripherals and off-board sensor interfaces of our platforms supporting full multitasking real-time operation for data collection and connectivity. We also developed embedded AI algorithms of machine learning, signal processing, pattern recognition and signal classification, and executed in real time on the SigMote hardware platform.

The adaptable, extensible and configurable capabilities of our platforms and our extensive industrial R&D experience provide critical expertise, technologies and systems for the projects targeting more intelligent solutions that are better adapted to real-world use cases than the current conventional implementations.

## Proposed activities for the project

1. System specification, design and development: Starting from the use case requirements analysis, we can design/develop a multi-sensor multi-modal heterogeneous network in hardware and software including a data centre and communication infrastructure according to the specifications. Such a network can be used for data collection, on-premises analysis through edge units/gateways, and communication of the data to a centre for further analysis.
2. Research, implementation and beyond-the-state-of-the-art development of signal/data analysis algorithms.
3. Software development using state-of-the-art technologies for data analysis, presentation and end-user applications with web/mobile interfaces.
4. Use case development, integration and system-level testing in laboratory and in the actual operational environment.
5. Dissemination of results through scientific publications.
6. IPR management and developing patents.
7. Exploitation of the results through our own industrial networks.
8. Proposal development: We also work intensively on the proposals of the Horizon Europe projects that we participate in.

# References

## A. Previous research projects

We have completed several national projects supported by grants from the Scientific and Technological Research Council of Turkey (TUBITAK) and the SME Development Organisation of Turkey (KOSGEB).

1. **Development of the SigMote platform [2017-2019]**
   Electronic hardware and embedded software design/development/testing of the platform as well as real-time execution of the developed machine-learning classification algorithms for audio scene analysis and speech detection on SigMote.

2. **DSAR: A disaster search and rescue system as part of smart/resilient cities [2020-2021]**
   Based on SigMote platform and AI-based algorithms on acoustic, vibration and image/video signals, a working digital sensing system was developed together with the cloud-side software for analysis, data presentation and mobile user interfaces for citizens and first responders. The main aim was to detect survivors under rubble after an earthquake or a landslide.

3. **AQNS: Air quality and noise sensing system [2020-2021]**
   Design and development of an air quality and noise sensing system as a mobile sensor network for smart city pollution monitoring for use on shared micro-mobility vehicles (e.g. scooters, bicycles) or other modes of transportation in general.

4. **DataMote/Locomopt: IoT device and informatics platform for smart transportation [2021-2022]**
   Design and development of DataMote embedded platform as the micro-mobility and general purpose IoT device, and GIS based informatics system Locomopt as a green electric vehicle sharing, micro-mobility data analysis and optimisation platform.

## B. Publications relevant to the above projects

1. N. Cadalli, R. Ergün, and G. Malcı, "Smart city disaster search and rescue system for enhanced detection of victims", Proc. of 2nd Int. Disaster and Resilience Congress (idRc), pp. 269-273, Oct. 13-15, 2020.
2. N. Cadalli and R. Ergün, "SigMote: A Digital Signal Processing Sensor Platform for Smart Applications", Proc. of 2nd Int. Conf. and Exhibition on Digital Transformation and Smart Systems (DTSS), pp. 51-54, Oct. 23-25, 2019.

## C. Recent Horizon Europe applications

1. An Intelligent Multi-Hazard Platform for Urban Risk Assessment, Disaster Early Warning and Mitigation with a Major Application to Structural Health Monitoring of Buildings.
   Topic: HORIZON-CL3-2022-DRS-01-05. Submitted in November 2022.
   From an idea we initiated as Signalton, we formed a 21-partner consortium from 7 countries. We will develop the wireless multi-sensor network, analysis algorithms and multi-hazard platform software as well as performing the technical project coordination.
2. Multi-Hazard Early Warning and Situational Awareness Platform.
   Topic: HORIZON-CL3-2022-DRS-01-05. Submitted in November 2022.

We will develop the wireless sensor network and the low-power communication infrastructure as well as working on data analysis algorithms within a 25-partner consortium from 10 countries.

3. Trustworthy Artificial Intelligence and Cognition-as-a-Service framework for value chain optimisation, worker safety and end-user digital rights protection in a sustainable Service Industry 5.0.

   Topic: HORIZON-CL4-2022-DIGITAL-EMERGING-02-05. Submitted in November 2022. We will work on trustworthy AI algorithms, federated learning on edge-computing device networks and implement a use case in preventive maintenance as a service for manufacturing industry, within a consortium of 21 partners from 10 countries.