European project aims to create a step-change in chemical detection

The European research and innovation project EU-SENSE, which has a timespan of 36 months (from May 2018 to May 2021), is conducted by a consortium of end users, academic and applied research communities and industry SMEs with flexible and lean procedures, under the advice of the EC Community of Users. It is based on two large interactive communities: practitioners and customers, and industrial and technological providers.

Words: *Inspector Phil Menary, Police Service of Northern Ireland.*

EU-SENSE consortium consolidates nine organisations, namely: ITTI Sp z oo – the leader of the project (Poland); Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek Tno (Netherlands); Totalforsvarets Forskningsinstitut (Sweden); Forsvarets Forskninginstitutt (Norway); Technisch-Mathematische Studiengesellschaft mbh (Germany); The Main School Of Fire Service (Poland); Airsense Analytics (Germany); University of Warsaw (Poland); and the Police Service of Northern Ireland (United Kingdom). Their work focuses on improving tools and procedures in the area of global threats in the field of chemical attacks.

Innovative solution

The EU-SENSE project will provide an innovative technical solution to deal with selected shortcomings in CBRNe protection, indicated in the ENCIRCLE Catalogue of Technologies. The created system will be a step-forward in chemical detection, which exploits advanced machine-learning and modelling algorithms for improved performance.

The crucial innovation of the EU-SENSE project is the development of a novel network of chemical sensors consisting of heterogeneous sensor nodes supported by cutting-edge machine-learning and dispersion modelling. Further innovation will be the use of machine learning algorithms in order to improve the detection capabilities and reduce the impact of environmental noise, which is defined here as any signal arising from pollutants in the environment that can cause either false positive (danger indicated with no danger present) or false negative (dangers not indicated when danger present) detection results.

Within the scope of conceptual design, EU-SENSE comprises three key components: a chemical detection system; a situational awareness tool; and a training and simulation module.

Chemical detection system

The chemical detection system will comprise a network of stationary and person-worn sensors supported with novel data fusion algorithms. Fused data from the network of sensors will feed into the situational awareness tool that will give end-users the ability to simulate the hazard dispersion over the area of interest. The hazard prediction will apply inverse modelling that will allow for quick and precise threat source location. The algorithm will estimate potential threat source locations as soon as the system raises an alarm and the network collects the first positive readouts. Subsequently, the estimation will be improved based on the incoming sensors' measurements. Lastly, the EU-SENSE system will comprise a training and simulation module that enables end-users to train on the use of the system and rehearse specific use cases.

Describing the characteristics of the EU-SENSE system and its components, it is important to emphasise that the phase of chemical threat detection will provide novel data fusion algorithms, which are going to accomplish the objective of fast and robust detection of a defined chemical agents spectrum. Including heterogeneous sensor nodes in the network, it will give the opportunity to apply several types of sensors within a node. Furthermore, the development of the network, considering as adaptable and multi-purpose detection system, will also offer research on standardisation, which contains the definition of a unified data model prepared by the project partners.

Situational awareness tool

The next component of the EU-SENSE project, the situational awareness tool, aims to increase the situational awareness of the CBRN practitioners.

The EU-SENSE system will include a situation recognition tool that integrates the results from the sensor network and data fusion results, and displays them to CBRN practitioners on a dedicated user interface. As a result, the tool will efficiently support the decision-making process.

Training and simulation module

The training and simulation module, the third part of the EU-SENSE project, will contain functionalities of the operating system, with the exception of elements responsible for collecting data from actual data sources, for example sensors and sensor networks. The system will be delivered with artificial data, previously prepared, as training scenarios.

Nowadays, chemical agents could be the source of danger for European societies. The European Union predicts that it becomes more and more important to support initiatives taken by, among others, industry SMEs as well as academic and applied researchers to provide an innovative technical solution to deal with chemical detection. The answer for work programme topic SEC-05-DRS-2016-2017: Chemical, biological, radiological and nuclear (CBRN), which was given by the EU-SENSE consortium, has offered a chance to create a step-change in chemical detection as well as to implement a dedicated mode covering CBRNe practitioners' training needs.

http://eu-sense.eu