Participating Institutions

Institute of Measurement Science, Slovak Academy of Sciences (Bratislava, Slovakia) is dedicated to basic research in measurement science, methods for processing of measured data and development of measurement systems for biomedicine and material science. It offers advisory and expert services, publishes the journal Measurement Science Review and provides postgraduate education.

The Institute for Chemistry, Technology and Metallurgy (Belgrade, Serbia) is the oldest scientific institution in the country, established in 1859. The multidisciplinary Centre for Microelectronic Technologies addresses fundamental research and applications in the fields of sensors, microelectromechanical systems, nanotechnologies, photonics, plasmonics and semiconductor technologies.

Université Libre de Bruxelles (Brussels, Belgium) is a multidisciplinary university established in 1834. The Department of Physical-Chemistry of the Faculty of Engineering addresses a variety of scientific fields and has many collaborations in the field of physics of multi-scale, multi-phase and multi-component fluid systems.

University "Ss Cyril and Methodius", Faculty of Computer Science and Engineering (Skopje, North Macedonia) is the largest faculty in the field of computer science and technologies in North Macedonia. The Faculty is involved in many national and international projects and offers expertise in many domains, especially in data science and in building different models using machine learning and deep learning techniques.

Comenius University, Faculty of Medicine, (Bratislava, Slovakia) was established in 1919 as the first and founding faculty of the university. Its education and research is oriented on four main areas: neuroscience, cardiovascular diseases, oncological diseases, and metabolic, endocrine, and inflammatory diseases.

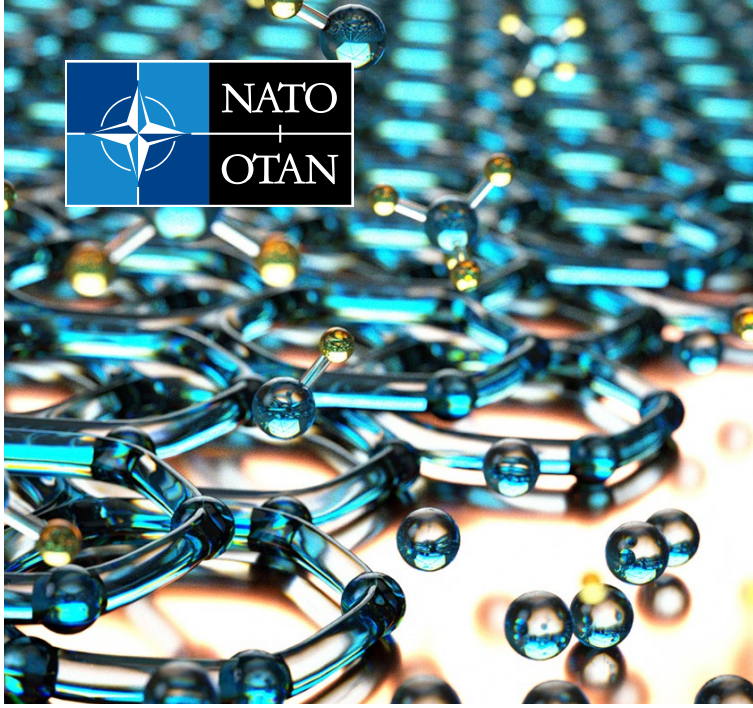
The **NATO Science for Peace and Security (SPS) Programme** is an integral part of the NATO Emerging Security Challenges (ESC) Division. The SPS Programme develops and implements practical cooperation and enhances dialogue between NATO nations and partner countries through capacity-building and security-related civil science technology and innovation. All SPS activities contribute to the Alliance's strategic objectives, have a clear link to security and respond to at least one of the SPS Key priorities.

NATO HQ – Bd. Leopold III
B-1110 Brussels – Belgium

You can find further information on our website:

www.nato.int/science
@NATO_SPS
E-mail: sps.info@hq.nato.int

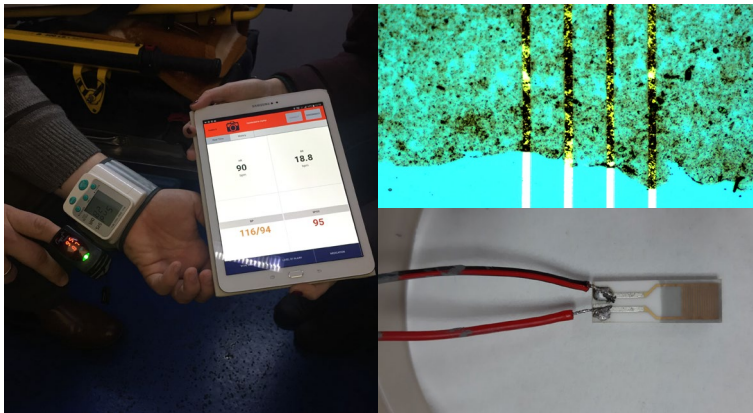
0228-21 NATO Graphics & Printing



SPS Multi-Year Project:

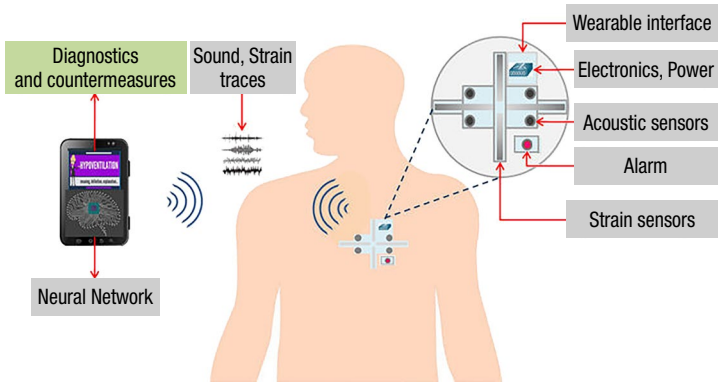
Smart Patch for Life Support Systems SP4LIFE

Science for Peace and Security (SPS) Programme
Emerging Security Challenges Division



Context

Early detection of physical threats is an effective approach to reduce casualties and increase the safety of operating personnel and civilians during mass casualty incidents resulting from terrorist attacks and chemical, biological, radiological and nuclear (CBRN) accidents. Personnel participating in emergency rescue operations and combat actions experience rapid changes in physiological parameters that could give rise to medical emergency conditions. Monitoring of vital health parameters of personnel as well as of victims would enable greater awareness and draw conclusions that could guide personnel actions in real time.



The SP4LIFE project aims to design and develop a wearable real-time monitoring system constructed as a patch-like device. It will be capable to collect and analyze information on vital parameters, such as respiration, heart rate, blood oxygen saturation, blood pressure or body temperature. The system will identify and communicate the level of stress, onset of respiratory disorders or cardiac events of personnel in action, and help team leaders improve decision-making and resource allocation in emergency situations. Moreover, the system will set alarms for wounded victims to help prioritize individuals for medical treatment and increase their chance of survival after large-scale terrorist attacks.

Goals

- Development of a wearable monitoring platform with sensitive respiration, heartbeat and auditory sensors based on graphene, containing electrocardiogram, blood oxygen saturation, blood pressure and body temperature sensor modules.
- Creation of a biocompatible wearable body-sensing interface hosting electronics, alarm, and low-power transmission for light-weight and portable applications.
- Development of a software that will alert in real time of changes in critical physiological parameters or changes of the triage medical status according to the START (Simple Triage and Rapid Treatment) algorithm.
- Use of Artificial Intelligence (AI) to create unsupervised software capable of real-time diagnostics and rapid countermeasures' selection.
- Analysis of existing processes for patient management on accident sites, and considering their redesign based on the wearable monitoring technology under development.
- Creation of a network of young scientists training in soft and hard skills in wearable electronics for biomedical applications.

Deliverables

The main scientific and technological outcomes of the project are:

- The creation of a working prototype of graphene-based sensors with a biocompatible interface complying with the mechanical requirement of stretchability, light invasiveness and robustness;
- A tested and operational wearable hardware platform for physiological data acquisition and analysis;
- Software modules for acquisition, local processing and possible transfer of physiological data;
- A software platform to analyze in real time physiological data including the cardiac and respiratory rhythm, and create mathematical models based on Big Data, AI and Deep Learning.

Impact

The patch-like device will be a novelty in integrated sensors using AI for a new generation of health monitoring solutions. It will be able to monitor heart rate, breathing, temperature and other vital health parameters of operating personnel and civilians during mass casualty incidents and generate immediate alert if the patient's health status in the triage process deteriorates.

Real-time measurement and analysis of vital health parameters allow detection of changes in critical health status after the initial triage and enable emergency crews to prioritize activities and direct resources to help those in need in a timely fashion.