

PARTICIPATING INSTITUTIONS



IMDEA Networks Institute is a networking research organization whose multinational team is engaged in cutting-edge fundamental science. As a growing, English-speaking institute located in Madrid, Spain, IMDEA Networks offers a unique opportunity for pioneering scientists to develop their ideas. IMDEA Networks is establishing itself internationally at the forefront in the development of future network technologies.



Electrosense is a non-profit association whose goal is to improve the efficiency, security and reliability of the electromagnetic space usage. The main goal is to sense the entire spectrum in the world and to make the data available in real-time to stakeholders which require a deeper knowledge of the actual spectrum usage. ElectroSense is an open initiative in which everyone can contribute with spectrum measurements and access the collected data.

KU LEUVEN

KU Leuven is dedicated to education and research in nearly all fields. Its fifteen faculties offer education, while research activities are organized by the departments and research groups. These faculties and departments, in turn, are clustered into three groups: Humanities and Social Sciences, Science, Engineering and Technology (SET), and Biomedical Sciences. Each of these groups has a doctoral school for its doctoral training programmes. KU Leuven boasts fourteen campuses, spread across 10 cities in Flanders



The Emerging Security
Challenges Division

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.

 www.nato.int/science

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**Large Scale Collaborative
Detection and Location
of Threats in the
Electromagnetic Space**

SOCRATES

**THE NATO
SCIENCE FOR PEACE AND SECURITY
SPS PROGRAMME**

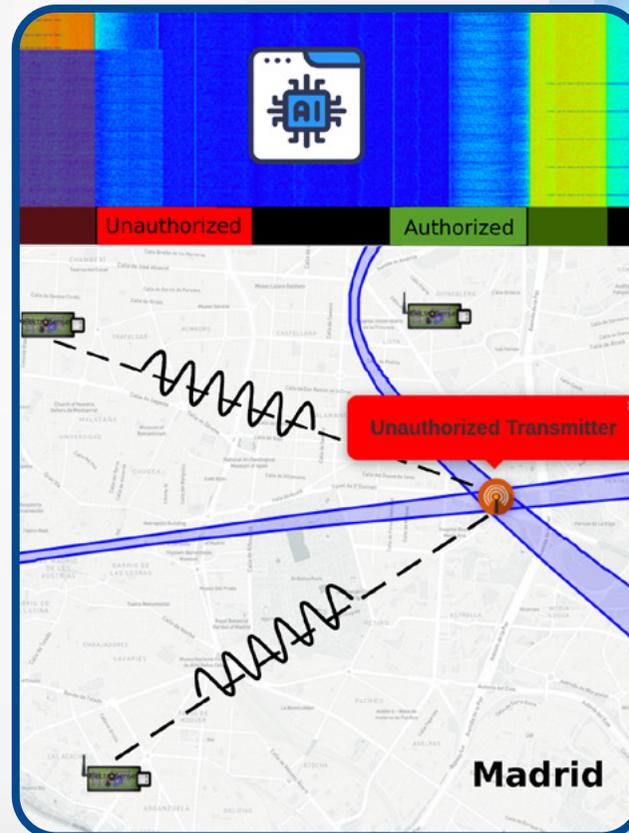
CONTEXT

Monitoring the electromagnetic space is fundamental in the 21st century: the spectrum is a strategic, essential, invisible and limited resource of modern life. But nowadays the protection of this resource has become more difficult, as radio commodity technologies are easily available, within the budget of individual attackers, and no longer restricted to governments. This results in more frequent and sophisticated threats, posing serious economic and international security challenges to our society. Protecting the spectrum means protecting critical wireless infrastructures and people from attackers and maintaining economic opportunities.

In today's society, wireless infrastructure carries critical services such as cellular networks, aerial communications, and GPS. To counteract threats in the electromagnetic space, there is the pressing need to design novel, flexible and autonomous methods to protect wireless infrastructures from cyber-attackers and develop novel architectures. SOCRATES uses a crowdsourcing network of low-cost spectrum sensors to monitor remotely and accurately the radio frequency spectrum. The objective is to test the system in controlled and realistic conditions, in real experiments, and showcase findings in demonstrators targeting different scenarios, in order to show its effectiveness, and provide a first step towards the exploitation of the system in real-life.

GOALS

- Create the foundations for an accurate, autonomous, fast and secure system that identifies intruders in the electromagnetic space.
- Prevent serious threats by detecting their properties as waveform characteristics and their geographic location.
- Deliver a security system to protect the electromagnetic environment and the services and users that depend upon it.
- Shield economic and social structures from those who would harm them.



DELIVERABLES



A prototype integrated in the Electrosense network with novel capabilities to detect anomalies in the electromagnetic spectrum, such as unknown and unauthorized transmissions, and to find their geographical location at a high accuracy.

IMPACT



An innovative Internet of Things architecture has been created to leverage emerging trends in science and technology such as crowd sourcing, big data and deep learning.



With the SOCRATES sensors, spectrum analysis became affordable. SOCRATES algorithms have the potential to create spectrum insights that can be useful for many stakeholders from the public and private sectors.