SOS Report Summary

Project reference: 286105
Funded under: FP7-PEOPLE

Periodic Report Summary 1 - SOS (Sensors system for detection and tracking Of dangerous materials in order to increase the airport Security in the indoor landside area)

1.1 Summary description of the Project Objectives

The SOS project aims at establishing a reinforced industry – academia research partnership to face the research challenges related to the development of non-intrusive and pervasive surveillance systems for airport and air transport security, based on an completely new combination of passive radar technology, detection and tracking sensors combining various frequency range, and sensitive data processing.

The SOS project will use a concrete R&D project as a basis to develop synergies and implement the transfer of knowledge programme. The four tangible objectives of the underlying R&D project are:

1) to design and develop new imaging sensors for detection of dangerous materials and tools based on X-band, exploring different range of frequencies , without interfering neither with the normal passengers flows, nor with the standard airport operations. The system will be able to discover hazard items concealed (under clothes or inside bags) by people circulating inside airports.
2) to design and develop prototype devices based on new indoor-passive radar sensors and on 8 ÷ 18 GHz sensors, able to track suspicious people (e.g. concealing forbidden items), so that they can easily be localized by security operators. The overall sensors network will survey wide airport areas without requiring the passengers cooperation
3) to design and develop new data fusion algorithms to improve data management and distribution for a reliable combination of the information provided by the all SOS subsystems.
4) Integrate and test the prototype tools of the innovative security system. Virtual simulations and real case studies will be provided by SESM and META in two main locations within the indoor airport area.

1.2 Work performed since the beginning of the project

During the first two years of the project, the partners have fruitfully collaborated to achieve the foreseen results of the SOS project. The defined objectives have been reached and the planned secondments of the researchers have been realized so that to bring their know-how and to share their competences in a more effective way among the five partners. From the beginning od the project the main activities that involved the researchers are:
• Definition users and operational requirements on the basis of the needs of the future airport system, extending the analysis at the area external the airport building like the airport perimeter and the taxi area;
• Experiment exploiting X-band radar sensors to observe vehicles in a real environment, exploiting also polarimetric sensors for the data acquisition;
• Analysis and test if the algorithm for the active detection and tracking based on sensors at 15 ÷ 35 GHz and 8-18 GHz, both in a simulated environment and in a real environment with the setup of sensors for the data acquisition;
• Detection and localization system based on passive radar technology for the localization of people and/or vehicles in indoor and outdoor environment, both in a simulated environment and in a real environment with the set-up of a use low/medium complexity and affordable equipment.

1.3 Main results achieved so far

During the time project, the different researchers achieved the following results:
• A report including the main operational requirement for the airport environment in order to identify the better solution for the airport security. During this activity the main advantage and drawback of the different solution was highlighted and analysed with the aim to select the best solution;
• Methodologies for the localization and identification of moving target were performed, exploiting SAR and ISAR approach. Particularly, the signal processing methods using a near field Synthetic Aperture Radar (SAR) approach were studied in an aspect to deliver high resolution data and the principle of SAR Tomography and ISAR processing of a moving target echo was applied at the radar operating the frequency range 8-18 GHz and the achievable performance is evaluated. The results was analysed exploiting simulations of a simple target and a complex model of a truck as the

object of ISAR imaging at X-band.
• Moreover the preliminary processing algorithms for FMCW radar and the processing algorithms for FMCW radar were developed were developed.
• A surveillance radar system for the detection and tracking of suspect vehicles moving around airport perimeters was developed. The features extracted from the targets have been used to perform a tracking stage based on Kalman filter. The problem of the target localization and the performance analysis of radar network by using the Cramer Rao Lower Bound (CRLB) was investigated.
• A simulator able to perform all the main features of the system has been developed and preliminary results, on tracking and data fusion has been created. Using the simulator multiple scenarios with single or multiple targets can be analysed and performance of different algorithms can be compared.
• As a first demonstration of the tracking capabilities, a measurement campaign was performed with the aim of detecting and tracking moving vehicles on a street and also pedestrians walking. A single FMCW sensor has been used
• First of all, an evaluation of emerging digital communication systems as potential sources of opportunity for short-range indoor passive radar operation and , a comparative analysis of the expected performance was carried out, in particular GSM and UMTS telephony, WiMAX transmissions and WiFi links. At the end of such analysis, WiFi signals as specified by IEEE 802.11 Standards were chosen
• A Multistatic Passive Radar, the 2D target localization has been addressed. Different strategies have been investigated based on different sets of measurements provided by multiple PBR receivers. The performance of the considered strategies has been evaluated and compared against real data collected for a vehicular target localization experiment and it has been shown that a reasonable target localization capability is obtained.
It was investigated the possibility of applying ISAR processing in Passive Radar. The purpose is to obtain high resolution cross-rang profiling of moving targets that could provide important information for their discrimination and automatic recognition. The test was performed exploiting two identical cars move along the same path, orthogonally to the antenna beam steering direction (assuming that the receiver was co-located with the transmitter). This provides a preliminary demonstration of the effectiveness of the proposed technique that allows us both to separate the two vehicles in the cross-range direction and to identify their main scattering points making it possible to measure their size.

1.4 Expected final results and their potential impact and use (including the socio-economic impact and the wider societal implications of the project so far)

In that context combined detection and tracking in public spaces using new multiple sensor systems is expected to become a key enabler. Combined and integrated radar, signal processing and data fusion technologies as proposed by SOS will therefore establish an important step ahead in the state of the art towards realizing actual impact on the safety of citizens and critical infrastructures such as airports, ports, train stations and other public spaces. Such new monitoring concepts based on combined and advanced sensing techniques, such as investigated in the SOS project, are emerging, but require knowledge on multiple sensor technologies (passive radar, X Band and 8 -18 GHz imaging technologies), data fusion and integration, which is currently fragmented over different industrial and academic organisation in different countries.
Only through mutual understanding about these technologies and the fostering of a culture of collaboration towards the integration of these technologies, significant progress can be achieved towards next generation security systems that:
• aim at a wider coverage in terms of space, being able to monitor the airport access area and the gate area;
• target to detect a wide possible array of threats, from handguns to explosives to knives, which may or may not be detected by metal detector;
• should be almost “invisible”, and therefore difficult to be detected, localised and jammed;
• are more robust to faults and false positives (or false negatives) because made up by several and distributed sub-systems that cannot turn out of order simultaneously;
• should not require the passengers co-operation and therefore will be perceived as non-intrusive by passengers;
• should not interfere with the normal airport operations;
• aims not represent a bottleneck for the normal passengers movements in the airport areas;
• should allow airport security operator to be aware of the threat they’ll have to face well in advance with respect to their intervention (which can, therefore, be more effective, while implying a lower risk).

The SOS project final results will provide substantial social impacts at European level:
 Enhance security in the Air Transport Management (ATM), reducing the possibility that hazards of dangerous materials and hostile actions, by allowing both the detection of hidden hazardous materials/tools and the tracking of suspicious people. This will, of course, enhance security in air transport.
 Provide improvements in the normal security procedures addressed to passengers in airports, because of its intrinsic characteristics, the SOS system will be complementary to other security systems already in-use in airports.
 Promote research on of scientific concepts, innovative solutions and technologies addressed to security of citizens: The SOS project will exploit several solutions and technologies for security system. Passive radars, imaging sensors based on different range of frequency (X band and/or in the 8 ÷ 35 GHz) will be studied and developed. They are new generations of high tech systems that could be applied in the future in different sectors (and not only in airports) related to the security of citizens: e.g railway stations, ferries and vessels, underground stations, etc. It also will contribute to reduce the current European dependence on US industry and technology in the security sector.
Develop the competitiveness of the European industries related to security in the global market and comply with general purposes of European institutions. The SOS project will increase the competitiveness of EU industry in security-related technologies/applications. In fact the final results can bring the industrial participants to an increased productivity and an increased turnover

1.5 Communication materials
Communication activities and material have been realised to increase the impact of the project. In particular:
a. A project logo was realised
b. the project Web Site was published at http://www.sos-project.eu/
c. The consortium created brochure and leaflet describing project objectives, expected results and consortium involved
d. A general power point presentation have been prepared with the main description of the project, to be used by project consortium and researchers involved in dissemination opportunities

1.6 Contact
Project Coordinator: Roberta Cardinali
Leading Partner: SESM
email: rcardinali@sesm.it
tel: +39 06 41504847
fax: +39 06 41504989

Partner Name
Project Primary contact person Primary contat person email

SESM Roberta Cardinali rcardinali@sems.it
DIET Francesco Lombardo lombardo@infocom.uniroma1.it
META Adriano Meta adriano.meta@metasensing.com
WUT Krzysztof KULPA kulpa@ise.pw.edu.pl
TUD Alexander YAROVYI o.yarovyi@tudelft.nl

Related information

Result In Brief	Radar for airport security

Contact

Cardinali, Roberta (Radar and system researcher - Project Manager)
Tel.: +39 06 41504847
Fax: +39 06 41504989
E-mail

Subjects

Industrial Manufacture

Information source: SESAM

Last updated on 2014-09-17
Retrieved on 2016-07-26

Permalink: http://cordis.europa.eu/result/rcn/148188_en.html