PROJECT PERIODIC REPORT

Grant Agreement number: SCP7-GA-2009-218513

Project acronym: ASPIS

Project title: Autonomous Surveillance in Public transport Infrastructure Systems

Funding Scheme: Collaborative project

Date of latest version of Annex I against which the assessment will be made: 06 May 2011

- **Periodic report: 1st ☐ 2nd ☐ 3rd ■**

Period covered: from 01 June 2011 to 31 March 2012

Name, title and organisation of the scientific representative of the project's coordinator[1]:

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[1] Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.

[2] The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

Declaration by the scientific representative of the project coordinator

I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate) [3]:

  ■ has fully achieved its objectives and technical goals for the period;

  ☐ has achieved most of its objectives and technical goals for the period with relatively minor deviations;

  ☐ has failed to achieve critical objectives and/or is not at all on schedule.

- The public website, if applicable

  ■ is up to date

- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 3.4) and if applicable with the certificate on financial statement.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 3.2.3 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of scientific representative of the Coordinator: M. Serge PORTAL

Date: 15/05/2012

For most of the projects, the signature of this declaration could be done directly via the IT reporting tool through an adapted IT mechanism.

[3] If either of these boxes below is ticked, the report should reflect these and any remedial actions taken.

3.1 Publishable summary

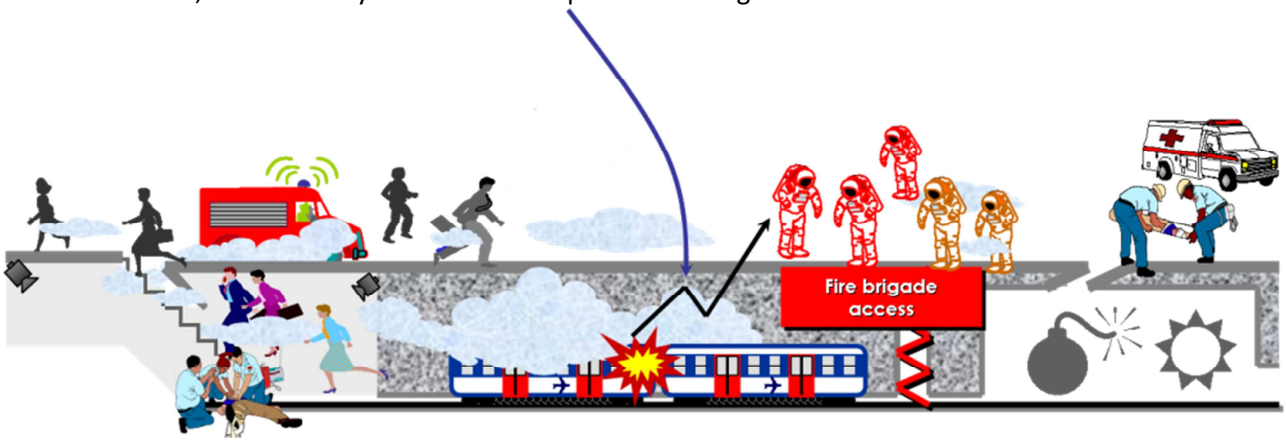
Introduction

The prompt availability of relevant information to the right people is the critical factor for the management of any emergency situation, in particular during the critical, early post-incident stages.
In case of a catastrophic event such as a bombing in a subway or the wreck of a ship, a quick assessment of the situation and the awareness of the number of potential victims could improve drastically the rescue operations and help to save lives.
The ASPIS project has the ambition to fill this gap by developing a video "black-box" able to send video sequences recorded just before the event to the rescue teams to help them in their tasks.

The ASPIS project started the 1st of June 2008 and consists of 8 participating companies, organizations or End-users, all presented on the ASPIS web site: www.aspis-project.eu.

Project Objectives

The project aims to develop and test a scalable, unattended surveillance/alarm system for public spaces, in particular for public transportation systems. Having a highly modular architecture, this innovative system is meant for the unattended surveillance of public transport, maritime transport and other public spaces. It serves primarily for the prompt and reliable situation awareness during the early, most critical emergency phase, thus greatly facilitating the overall crisis response. It is an innovative application enabling civil protection authorities to take advantage of the most recent developments in the fields of ad-hoc networking, multi-modal communications, embedded systems and microprocessor integration.



A system concept will be developed, validated and demonstrated through the design and implementation of a complete prototype aimed specifically to public surface transport means (i.e. trains, metro, buses, ferries or passenger vessels) in particular in the event of an explosion or a fire, accidental or intentional. I will be based on autonomous, smart monitoring devices that capture and retain data only upon the occurrence of an incident, potentially dangerous for the passengers (like an explosion blast or the triggering of the fire detector). When triggered, these devices propagate the triggering to their neighbouring devices and send an alarm. Successively, they upload the captured data to the central station providing a wide (space and time-wise) coverage of the potentially hazardous incident. Finally, they provide a dedicated bi-directional communication channel between the emergency centre and the affected areas. If, for any reason, they don't succeed to establish communication, they serve as "black boxes", preserving the data until they are physically recuperated by the authorities.

Two demonstrations will be done, one in the Paris Metro and one on a Ferry-boat in Athens in order to evaluate and demonstrate the performances of the system.

Work performed during the project

The work performed can be divided into four main parts: operational and functional requirements analysis, technical analysis of the state of the art and available solutions, system design and development, demonstration

- **Operational and Functional Analysis**

  The objectives of the operational and functional analysis were to identify the operational requirements and the functional specifications of the ASPIS system with the End-users, in the scope of improving crisis management in case of a bombing blast in a subway or the wreck of a ferryboat.

  The results of this phase are input to the continued work with the systems and sub-systems design and development. They are also used for the definition of the acceptance criteria necessary for the testing and validation procedures. During this phase, the ASPIS end-users involved all the actors who interface directly with the ASPIS system in case of an emergency, like transport police, fire brigades, the ship's captain or any other entities involved directly in metro or ferry vessel SAR operations.

- **Technical analysis**

  In the technical analysis phase, state-of-the-art studies and feasibility testing of particular components for the ASPIS devices were performed. Three areas were mainly analysed: networking and communications, modularity and system integration and finally mechanical packaging and cost of the future solution. Technologies available and able to fulfil the functional requirements were identified and compared to the subway of ferry environment constrains allowing finally to give the inputs to design and development of the ASPIS component.

- **System design and development**

  The systems design and development started in June 2009. The outcomes from the operational and functional analysis and from the technical analysis phases have been developed into specifications for the ASPIS sub-systems and full system. Availability and maturity of the technologies as well as environmental constrains proved to be strong factor for the selected solutions.

  The architecture of the AMD (ASPIS Mobile Device) has been designed in order to be able to interface either with analogue cameras (legacy cameras) or IP cameras. The mechanical design of the AMD was achieved taking mainly into account the RATP requirements which were the most severe concerning available space (volume) and thermal requirements (heat draining without using a fan). The PC 104 form factor was selected for the processor board and frame grabber. An Ethernet switch available of the shelf has been selected for its environmental specifications and PoE capabilities meeting RATP requirements. It has been integrated in the AMD so as to provide connections for IP cameras directly powered by Ethernet (PoE). IP cameras with H.264 compression have been developed as well as a 4 channel video encoder able to compress in H.264 the videos streams provided by 4 analogue cameras and convert them into an IP stream.

  The AMD communication, management and recording software has been developed in order to interface with its various peripherals (IP cameras, compression board, power management module, Wimax unit, Wifi modules) as well as with other AMDs (for redundancy and alarm spreading) and with the ASC (ASPIS Central Station). AMD power supply needed some particular attention for the selection of the battery and development of the power supply management system in order to meet the operational requirement.

  Different communication paths have been developed to allow the AMDs to communicate inside the train as well as with the ACS located in the central control room. They can communicate using either a wired Ethernet link, a Wifi connection or even an ad-hoc Wifi connection. The AMD communicate with the ACS through Wimax and the Wimax unit. The Wimax unit communicates with the AMDs using either a wired Ethernet link or a Wifi connection.

This allows redundant communication paths and the ability to send data even if one communication mean is destroyed during the catastrophic event (probably the wired connection).
The ACS software has been developed in order to work either on a fixed platform (a laptop) for control room operation, or on a mobile platform (a tablet PC) for rescuers.

- **Subway Demonstration**
  For the subway application, three AMDs were installed in a subway train and each recorded the video streams of six cameras. The triggering device composed of a microphone sensor and a pressure sensor was activated to send an alarm which froze the video buffers. The alarm as well as snapshots grabbed at the time of the alarm were transmitted to the ACS located in the Control room via the Wimax link and FO network. After alarm validation by the ACS, the AMDs transferred their video buffers, giving to the operators a clear view of the situation as it was just before the event and just after the event. The demonstration also showed the capacity to transfer a live video and audio stream from the train to the control room from anywhere in the tunnel between two stations.

- **Maritime Demonstration**
  Two maritime scenarios were created to respond to IMO (International Maritime Organisation) requirements. The first scenario demonstrated the ability of the ASPIS system to detect an intrusion in a restricted zone using video analytics. The intrusion alarm was detected by the AMD and transferred to the ACS on the bridge with a video sequence showing the intrusion. The second scenario consisted in detecting people re-entering a zone that had been evacuated following an "Abandon Ship" order. In this scenario, cameras were installed in the passageways of the ship. The AMD and cameras are disabled in normal conditions for privacy preserving reasons. However, in case of fire or wreckage, the passengers are evacuated zone by zone by the crewmembers and when a zone had been fully evacuated, the AMD covering the zone is activated in order to detect by video analysis people trying to re-enter the zone and sent an alarm to the Captain.
  Both demonstrations worked very satisfactory and demonstrated the ASPIS concept as fulfilling the requirements.

Main results achieved so far

The main results of the project at this point are summarized in the following points:

1. **Operational and Functional Analysis**
   - Three different scenarios under which the ASPIS systems could be used have been selected with the End-users and the operational needs to be fulfilled have been summarized into the functional specifications.
   - End-user requirements have been elaborated from the three scenarios.
   - Privacy concerns have been identified and taken into account for the definition of the use-cases.
2. **Technical analysis**
   Existing technologies potentially usable for the ASPIS system have been identified and analysed. They have been compared in terms of performance in the different situations and environments corresponding to the operational needs, regulations, cost, and maturity/availability.
3. **System design**
   The architecture of the ASPIS system has been chosen to fulfil the functional requirements. The different sub-systems have been identified and specified in terms of functions, environmental requirements, mechanical constrains and interfaces. In order to allow re-use of existing equipment such as cameras or to be able to interface with them, a modular architecture has been defined with various options to deploy according to the case.
4. **Sub-Systems development**

- The AMD platform has been developed on a PC 104 of the shelf boards. It is composed of a CPU board with H.264 compression capability, a Solid State Disk (SSD) and a PC 104 frame grabber for analogue cameras connection. This frame grabber has mainly been used during the early development phase.

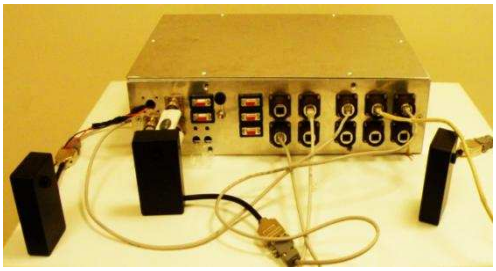


Figure 1 - AMD prototype with three ASPIS cameras

- A 4 channel H.264 compression board has been designed and developed to allow processing of 4 analogue cameras. This board is fitted inside the AMD housing and reduces the CPU load of the AMD. It is connected to the AMD core through IP and Ethernet and uses standard RTP/RTSP protocol for video streaming. Several such boards can be installed inside the AMD if more analogue cameras have to be connected.
- A PoE switch meeting subway environmental requirements has been integrated inside the AMD. It allows connection of IP cameras powered directly over Ethernet.
- An IP camera of the shelf has been selected and connected to the AMD using the manufacturer's API. It has been mainly used during the development phase.
- An IP camera has been developed (hardware and software) providing H.264 compression and standard RTP/RTSP protocol for streaming. This camera meets subway requirements and has been used for the demonstrations.
- Wi-Fi dongles of the shelf have been selected with respect to their ability to fulfil the different network modes.
- A Wimax communication set (base station and subscriber unit) has been selected with additional Wi-Fi communication. Software has been developed to manage the different communication channels.
- Different Wimax antennas have been selected and tested in order to quantify the transmission performances and validate the best choice for the subway demo.
- Power supply and battery have been selected and power management software has been developed in order to provide full performance operation on battery for at least one hour of data transfer or one day in idle state.
- ACS development has been started on a Windows platform for both desktop/laptop using a conventional keyboard/mouse or a tablet PC with a touch screen interface

5. **System integration**
   The system has been integrated with the different sub-systems: AMD, IP cameras, microphone and speaker for intercom purpose, WiFi, Wimax, subsricber units and base stations, antennas and ACS as well as mobile ACS.

The expected final results and their potential impact

The final results of the project are the design and development of a video and audio system that will enhance the situation awareness in crisis management. This system has been demonstrated in two different use-cases on end-users RATP and ANEK sites. The first use-case consisted in a simulation of a bomb attack in a subway train. This demonstration allowed demonstrating the capacity of the ASPIS system to trigger an alarm and to record video and audio sequences just before the bombing, to set-up an emergency communication channel with the central command and control station and a mobile station owned by first responders. The recorded sequences were transferred to the rescuers for optimizing SAR operations. The second use-case consisted in the simulation of the evacuation of a ship in case of wreckage for instance. The ASPIS system helped the evacuation operations by triggering and alarm upon detecting a person entering a zone of the ship that was fully evacuated.

After the positive results obtained, the ASPIS system can be the precursor to drastic changes not only of the surveillance means and methods but of the whole concept of information generation and management in case of crisis or emergencies.
At short / medium term, the proposed system is expected to have a significant impact on the safety and the security of public transport. More precisely: increased public transport safety through more efficient emergency management and search and rescue operations.

Figure 2 – ASPIS partners. Final meeting at RATP

Web site: www.aspis-project.eu

Contact information:
General questions to the project, please use the "Contact Us" section of the ASPIS web site
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