Innovation Report – ITEA 04005 SERKET « SEcuRity KEeps Threats away »

Author: François-Xavier Josset (francois-xavier.josset@thalesgroup.com)

The European R&D project "SERKET" led to the prototyping of technologies for preventive security of public places and large events: mass transportation, sporting and cultural events, demonstrations, etc. Through the analysis of information supplied by the sensors, SERKET aims at detecting automatically the risk-prone situations. Henceforth supervising operators can focus on their mission since the system reports alarms to them in case of latent threats. The interest of this approach simply consists in improving the operators' knowledge on the field situation that is potentially complex, by avoiding them the tedious and unfeasible analysis of all images supplied to the control room.

Challenges of public "homeland" security

❖ *Public safety / security*

The main security missions of the forces of law and order, who constitute a majority of police resources in most of occidental countries, focus on the following events:

- Large demonstrations of protest,
- Strikes in public transports with outbursts,
- Damages and violence in sensible districts,
- Visits of high-level representatives (heads of state, diplomatic delegations, religious personalities…),
- Organisation of international sporting events,
- Violence inside and outside stadiums.

The action of such forces is becoming both complex because some form of delinquency gets ordinary and the society brutal, and sensible given that order keeping must be errorless to avoid situations getting more critical.

❖ *Urban surveillance*

Whatever their nature, the complexity of the missions presented to forces of order often implies one centralized coordination from a command and control room, where information of very different types are transmitted for decision making. Indeed these missions are complex since they result of they depend on several key factors: presence of crowd or of small violent groups, variety and severity of latent threats, typology of the site in question, control level of surveillance hardware means, availability and ease of coordination of forces of order, interferences among simultaneous missions…

Hence the supervision of an event and the surveillance of a public site from a command and control room is a hard task: the accumulated experience by the operators and the preparation of the event remain the best current guarantees of adaptation to unexpected situations that occur very regularly and that request quick decisions with dramatic consequences.

Limits of current means – Passive surveillance

❖ *More and more data*

Through the impulse of United Kingdom, occidental countries acknowledged the efficiency of video-protection on preventing delinquency, fighting criminality and terrorism. This trend is materialized by an accelerated equipment of territories with video-protection hardware, very often by preferring the

amount of images recorded against their quality, unfortunately. In France the law is progressively establishing a frame for these deployments by imposing technical minima to local and territorial communities that are installing new systems.

As a consequence, amounts of information are exploding, that are potentially taken at the disposal for the forces of order. Assets are straightforward for investigation activities (more recorded images = higher chance to find clues and to satisfy judiciary requests), even if numerous questions are still pending, such as solving the trade-off between the storage capacity and the clearness of recorded images, when determining the formats and compression rates.

On the other hand, concerning urban protection missions, novel usage doctrines have to be settled for an appropriate exploitation of this overload of information in the C2 room. How to cope efficiently with this new paradigm at the supervision time?

❖ *Supervision and hypervision*

The operator in C2 room is in charge of appreciating all the information related to his running mission in order to handle it until its end, by offering the contact point for relaying and coordinating the security forces deployed on the field.

It is important to note that video is not used as a visual support when searching one particular information or when one suspect situation has already been detected. Video itself exceptionally becomes a source of alarm, contrarily to the radio reports supplied by policemen. Indeed it is impossible for the operator to visualize in real time all the images related to his mission; irregularly he focuses on those that he estimates as the most informative at the each instant. It is easy to understand that the multiplication of images does not simplify the supervision task.

SERKET objective – Preventive security

The SERKET project (ITEA Call 7) enabled the development and the prototyping of technologies focusing on a more preventive security of public places and for large events: mass transportation, sports and cultural events, supervision of demonstrations… The project objective is to provide the security operators with more knowledge that are relevant regarding their mission, in order to optimize their decisions.

By analyzing automatically the information supplied by the different types of sensors (video surveillance cameras, intrusion detectors, access control barriers, microphones…), SERKET aims at detecting the risk-prone situations. Since then the operators can focus on the supervision of their mission, and are alerted by the system as soon as any threat is detected and identified. Their knowledge on the situation is enriched, that is of prime interest when such situation is particularly sensible (violence), complex (risk of interference with other events) and infected with concealed threats. The idealist and inapplicable visual analysis of all in interesting images transferred to the control room is then avoided.

From low-level processing up to situation display

The major federated result of SERKET is the specification and the prototyping of a novel software platform especially dedicated to the security of public places and large events, presenting several assets like openness, integration and deployment facilities that are very innovative in the business of security systems. To build this platform, the SERKET consortium focused first in adapting existing hardware and software material as much as possible: video surveillance cameras and other sensors, mediation middleware COTS, robust video analysis algorithms for intrusion detection, standards for dynamic 3D display. Besides, some innovative functions have been especially designed in order to meet the SERKET goals, such as the generalized concept of heterogeneous smart sensor, the

mediation principle applied to the security platform, advanced signal processing algorithms and the fusion of their results for an automatic detection of abnormal situations.

The SERKET platform includes the up-to-date technologies and standards – SOA, mediation middleware, Complex Event Processing for information fusion… – enabling this innovative software layer to fit the requirements of low-level processing algorithms (signal and data processing, e.g., images, sounds, interruptions) as well as upper-level applications (information filtering, correlation and combination for threat assessment and situation picture display). The proposed event-oriented architecture is seen by SERKET industrial partners as the base of a new generation for integrated security systems.

Project results – SW components, services and products

The SERKET project led to numerous results in terms of software products and services:
- 5 new products, 6 existing products improved,
- 6 new services, 3 existing services improved,
- 5 integrated prototype demonstrators: Demonstration supervision and illicit intrusion, private infrastructure protection, coastal surveillance, and single location surveillance point.

In addition, these results were widely disseminated in Europe in front of various audiences (scientific, technical, marketing, business):
- 31 communications in conferences, 7 publications in scientific journals;
- 14 communications in business workshops, 3 articles in reviews;
- Contribution to several standards in different domains: semantic web, information processing, communication between components, video meta-data encoding, alert messaging…

❖ *"System and architecture" domain*

Result	Function	Type	Owner (to remove?)
Networked Broadcast Monitoring Suite	Monitor the broadcast process efficiently and visualize real-time video content and meta-data	Product improved	Barco
Control Room Monitoring Suite	Disseminate information and facilitate co-operating in control rooms	New product	Barco
Video Server Software	Streaming engine	Product improved	Bull
Coastal Surveillance System	Guarantee security and deal with threats as quickly as possible to avoid disasters	Product improved	INDRA
SATHI	Security/Supervision System with multi-sensor alarm monitoring	Product improved	TSS
Security system middleware	Message-oriented middleware, said of mediation, especially adapted for security system architectures	Product improved	TSS
Drone system	Mission control devices and HMI for multi-sensor carrier UAV	New product	CEA
Security Testing OPtion	Security monitoring, security system testing	New product	Nethawk

❖ *"Advanced signal and data processing algorithms" domain*

Result	Function	Type	Owner
Intelligent Video Surveillance	Real-time image analysis and automatic behavior recognition	Service improved	Bull
Audio-based abnormal situation detection system	Abnormal audio events (fear-type emotions, gun-shots) detection for security in public places	New service	Thales R&T
People counting	Count automatically people entering a zone using a video surveillance camera	Product improved	ACIC
Crowd monitoring	Automatic monitoring of crowd	New service	Multitel
Computational Attention Algorithms	Assign normalized attention potentials to multimedia data, more especially audio and video	New service	Faculte Polytechnique de Mons
LAPI	License Plate Recognition	Service improved	TSS
VSIP module	Video processing component to detect crowd dynamics and to recognize crowd behaviors	New service	INRIA
MVISION	Motion detection, multi-target tracking, and behavior analysis with MPEG7 metadata storage/streaming	Service improved	Vrije Universiteit Brussels - ETRO

❖ *"Information processing for threat evaluation and situation awareness" domain*

Result	Function	Type	Owner
Threat Assessment Module	Alarms generation by combining events or CEP according to a priori knowledge of the situations of threats that can occurs	New service	EADS
µCEP	Building-block complex event processing unit related to a physical, logical or cognitive partition of the environment	New service	Universidad de Murcia
CEP service	Event rule-based engine for information processing (filtering, correlation, combination, matching…)	New product	4CT

❖ *"Graphical visualisation for global picture rendering" domain*

Result	Function	Type	Owner
3D alarm display	Allow an operator to navigate in a 3D security site map	New product	TSS

Business value of SERKET key enabling technologies

❖ *SERKET breakthroughs*

Numerous technologies have been developed or tuned throughout the SERKET project, in order to cope with the requirements specified by the end-users. Amongst this set of technologies, some of them represent a genuine breakthrough, that are sorted in 3 categories:

- o Intelligent signal and data processing:
  - ▪ Video: Robustness to challenging conditions, individual tracking, novel crowd motion algorithms;

- Audio: Security-like sounds detection (gun shots, shouts, window/pane breaking…), emotion classification in speech (fear);
- Combination of both: Uncertainty mitigation (false alarm removal);
  - Information processing and fusion for enhanced situation awareness:
    - Complex Event Processing (CEP): Filters, matching rules, spatio-temporal correlations;
    - Threat assessment: Alarm trigerring when potential threats detected;
  - Architecture: From classical surveillance equipment to a novel generation of integrated security systems
    - Event-driven architecture by coupling SOA and CEP service;
    - Heterogeneous smart sensors: (meta-)data produced in a generalised format.

❖ *Targeted markets*

SERKET addresses market segments such as mass transport security (ports, airport, train stations…), urban security and road surveillance, as well as the organisation of large cultural or sports events in stadiums, sports grounds, olympic sites, concert halls, operas, etc.

Transportation companies are very much concerned now with the threat of terrorism attacks in public places. The global improvement of the security within the buildings and the stations is important also to get people feel safer when using the train, planes, boats and thus to increase the use of public transportation. It is important in large sites to be able to intervene rapidly and so to give the central surveillance people as well as the on-site security people the information as fast as possible and also as relevant and accurate as possible.

SERKET results lead to a software platform capable of managing a complex security system. This software platform is being marketed to system security providers who will incorporate it into their systems offering advanced capabilities (threat assessment, information fusion, …).

The security market is expected to grow at about 10% per year. Nevertheless, the SERKET platform is expected to penetrate this new market rapidly and deeply, with an increase far more than 10% per year.

❖ *Innovation management*

A new methodology has been set up and applied to SERKET technologies in order to quantify their innovation level and to provide their owner with particular advice for improvements. Briefly, this methodology, called Monnier's Innovation Matrix©, relies on the representation of the market x technology maturity levels on one 2D matrix, according to measurements achieved over these two axes on the concerned technology.

This matrix can be considered as a standard measure for different products, similar to a diagnostic framework where one may identify the parameters to be focused on in order to improve the innovation level.

Innovation applies to new technologies, products and processes, as well as the adoption of best practices in industry. The Monnier's Innovation Matrix© with the associated methods revealed efficient on several cases to measure innovation and to define a strategy for increasing it. The synthesised results on each one of four categories – algorithms, software architecture, hardware architecture, and system and services – helped in identifying current technological shortcomings with respect to the growing market of global security.