![ITEA3 logo]

Project Results

PS-CRIMSON

Ensuring safety in tomorrow's smart cities

EXECUTIVE SUMMARY

PS-CRIMSON's platform offers geo-localisation, human re-identification, sensor integration, multi-layer analysis and 2D/3D smart digital model data integration for smart city concepts, allowing municipalities to offer more effective services for tracking and maintaining safety and security in cities.

PROJECT ORIGINS

By 2022, the smart city market will be worth USD 1,201 billion. By 2025, cities will contribute 70% of economic activity worldwide. To make them an attractive place to work and live, authorities need to tackle information fragmentation caused by a lack of common platforms, data repositories and toolsets. Through the removal of vertically-oriented closed systems and siloed organisation models, the power of IoT infrastructure, mobile devices and data-driven digital service models can be fully unleashed.

The ITEA project PS-CRIMSON (Public Safety and Crisis Management Service Orchestration) assists municipalities in monitoring the state of infrastructure and citizens. A 3D smart digital model and information platform facilitates data collection, sharing, management, analysis and dissemination from public and private urban infrastructures and resources via interoperable ICT backends. By combining Geographic Information Systems (GIS) with real-time data streams, demonstrators in Eindhoven and Vancouver have been realised for various public safety and disaster management use-cases.

TECHNOLOGY APPLIED

Alongside the Esri platform, PS-CRIMSON uses the open-source FIWARE architecture as its basic framework. This is extended with a subsystem capable of managing huge amounts of GIS data representing a digital twin of entire cities, enabling the platform to manage high data volumes with 3D
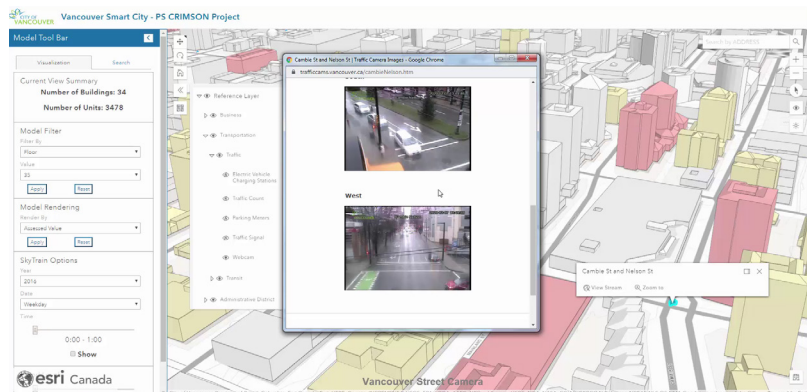
Situation awareness from dynamic smart-city data within a 3D visualisation of the city.

visualisation and streaming data from sensors that comply with various standards. Partners are able to offer their components separately or as part of the platform as a whole. Esri Canada, for instance, covers 3D data on geo-accurate infrastructure locations while Atos deals with real-time data and audio/video streams. The I3S Format from Esri has been adopted by the Open Geospatial Consortium (OGC) as a standard for streaming 3D content. Esri Canada thus offers Atos 3D city information as a data source extension and Atos extends the GIS application with dynamic data. CycloMedia can offer 3D city models to Atos for similar purposes, having developed a process for generating visually correct 3D textured meshes. Alternatively, the Esri platform can be used as a standalone integrated platform for all market partners. Developed models may target different market sectors but are strengthened by collaboration.

Within PS-CRIMSON, advanced sensor information was collected and utilised in a public safety use-case. The possibilities are endless, but examples include:

- ViNotion's AI technology for collecting the position and behaviour of individuals and vehicles to signal threatening situations.
- Sorama's sound cameras for recognising unsafe situations (such as aggression) and their exact location. Visual and audible events have been added to standardised FIWARE data models.
- TU Eindhoven's re-identification of people using cameras distributed across the city. This can periodically recognise people and reconstruct their trajectories. Peoples' locations can also be determined when they take photos with their mobile phones by comparing those to CycloMedia's image database.

These combined technologies enable the platform's users to detect suspicious situations, localise them, follow the subjects involved and intervene before escalation takes place. Regarding security, edge processing is used to only extract data related to public behaviour, so no privacy-sensitive data is sent to the general platforms. Atos also embeds a number of standardised technologies to prevent unauthorised access, offering greater clarity on the stakeholders involved.

MAKING THE DIFFERENCE

PS-CRIMSON has achieved world-class technological results while providing competitive advantages for market players. By combining dynamic data from sensors with static GIS information, Atos has built FIWARE architecture extensions two to three years ahead of market, enabling use-cases such as smart surveillance. For human re-identification, for example, the theoretical state-of-the-art was 91% for database images and the project has managed a comparable performance for never-before-seen images. Similarly, real-time pedestrian and vehicle sensing has reached 95% accuracy with a 1% False Positive Rate (a two-factor improvement).

Most smart city platforms cannot handle high-velocity data streams as cloud management and continuous monitoring cause the amount of data to grow exponentially. Nonetheless, 95% of all outdoor surfaces have photorealistic texturing for flythrough capabilities. Going even further, Esri has demonstrated their GIS software for 3D data visualisation in a project for the Vancouver region, a jurisdiction of over 2.5 million people. The entire city has been modelled, including building interiors – a 100% success rate. PS-CRIMSON's first commercial project, a tender for Smart City Hilversum, is now being deployed and similar projects are being implemented in Canada, America and China.

Crucially, these involve citizens on themes like property assessment, planning, community development, transportation and safety. After all, PS-CRIMSON is about making cities liveable. By modelling city interiors and infrastructure, evacuations can be easily organised during natural disasters and damages can quickly be forecasted. On a smaller scale, traffic monitoring and aggression detection support individuals in their daily routines and make them feel safe on the streets. Ultimately, PS-CRIMSON will allow heterogenous, legacy systems to connect to the platform. In doing so, citizens worldwide will be given the chance to reap the benefits of effective municipal services and attractive cities for all.

PS-CRIMSON
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Partners

Canada
Esri Canada

The Netherlands
Atos Nederland
Cyclomedia Technology
Eindhoven University of Technology
Signify
Sorama
ViNotion

Project start
September 2016

Project end
March 2020

Project leader
Egbert Jaspers, ViNotion

Project email
egbert.jaspers@vinotion.nl

Project website
http://www.ps-crimson.com/

MAJOR PROJECT OUTCOMES

Dissemination
- 15 scientific publications and presentations in international journals and conferences (e.g. SPIE, VISAPP, ICIP), 12 project press releases
- 18 presentations at industrial conferences, such as IAOO, WSACA, PAAF, FLIAAO
- Project results presentations and demonstrations to 25+ municipalities

Exploitation (so far)
- Full-fledged PS-Crimson platform in FieldLab, Eindhoven
- Exploiting PS-Crimson platform for Vancouver City and TransLink, CA
- PS-CRIMSON architecture is now to be used in Smart City Platform Hilversum project with a consortium of Atos, Esri, ViNotion, Sorama (and others)
- 3D reconstruction contracts are signed with: Pinellas, Palm Beach and Hillsborough County Property Appraiser (FL USA), Maui County (HW USA), Tridel Group (ON Canada), Urban Renewal Authority (Hong Kong)
- Project on interactive 3D models is developed with City of Tilburg
- Pilot with Hong Kong Lands Department and Urban Renewal Authority in 2019
- Pilot with National Dutch Police and Utrecht for Vuelta 2020
- Pilot with Rotterdam to supply public safety for Eurovisie 2020
- Developing the Inbraakvrije Wijk project in Rotterdam

Standardisation
- Participation in OGC (Open Geospatial Consortium) standardisation body resulted in approved Standards for streaming 3D Content: OGC Indexed 3D Scene Layer (I3S) 2017, Scene Layer Package Format Specification, Advancing open 3D: New layer types and capability in I3S 2019