

LOGIPIX



# CRITICAL INFRASTRUCTURE SURVEILLANCE SOLUTION

[www.logipix.com](http://www.logipix.com)



## ESSENTIAL NEED, EVIDENT SOLUTION

*Systems, networks and assets of critical infrastructure sectors are of such a vital importance that their disruption or destruction would cause serious issues to a country's safety and economy. It is therefore necessary to protect these critical infrastructures and other important industrial objects from potential threats.*

Immediate and effective reaction to external and internal threats can only be triggered by a complex sensor system. Intelligent analytics and visual verification can greatly contribute to prevent or handle incidents and keep the environment under control.

Logipix was intended to create a multi-sensor solution, which provides the best-in-class visible-light and thermal video surveillance with built-in intelligence, have a fused radar system, and is also able to integrate various third-party sensors.





## YOU NEED OUR SYSTEM, IF YOU WOULD LIKE TO...

- facilitate decision making by effectively monitoring critical areas day and night, automatically analyzing movements and have high-resolution visual verification on situations
- have high-resolution perimeter surveillance with large area coverage, also outside the perimeter line, using only a few panorama cameras
- monitor internal areas in high-resolution with minimized number of cameras
- get extended vision for all lighting conditions using visible-light and thermal sensors
- have accurate, automatic object tracking and classification within the entire monitored area
- based on fused Video Content Analysis (VCA) and Radar Data Analysis (RDA)
- minimize false alarm rate and highlight potential threats only
- decrease incident response times and increase threat evaluation efficiency by applying immediate, automatic zoom on alert spots
- accelerate patrol unit guidance by accurate intruder geopositioning, tracking and permanent visual feedback
- have high-resolution footage for investigating incidents and get irrefutable visual evidence



## SECURITY BENEFITS

- **Maximized system uptime**  
Logipix provides uninterrupted system availability as all their components are developed to operate with high MTBF.
- **Adaptable system structure**  
Logipix always consider the specific purpose of monitoring and also the characteristics of the critical infrastructure area in order to choose the most appropriate technologies and coverage structure.
- **Extended vision**  
Logipix provides dual vision Panorama cameras that covers vast areas with high-resolution panoramic images in the spectrum of visible light and thermal radiation. 960 MP visible and 6.6 MP thermal image resolutions create a solid base for Video Content Analysis. Humans can be detected and classified automatically at a range of 3 km.
- **Increased surveillance efficiency**  
Logipix fuses and visualizes the information of several sensors in order to highlight potential threats and guide the attention of operators, who get early alerts automatically.
- **Undoubted visual evidence**  
The 200-960 MP panoramic video footage contains high-resolution details of all incidents, intrusions and patrol unit actions. These images can serve as evidence during investigation on demand.



## FINANCIAL BENEFITS

- **No need for frequent maintenance using human resources**  
Logipix hardware components are capable of self-maintenance, thanks to their built-in self-cleaning and deicing systems.
- **Designed to overcome severe environmental conditions**  
Logipix hardware components are full metal constructions with built-in heating and cooling systems, and they are also available made of marine grade materials. They can withstand intense weather conditions.
- **Designed for long-term**  
Our engineers developed leading-edge technologies that ensure the system avoids both physical and technological obsolescence for a long time.
- **Interoperating with external surveillance sensors**  
Each surveillance technology has its own benefit, but it also has its own limitation. Logipix solution is designed to strengthen these technologies and leverage them together. It provides fused video and radar based surveillance with unparalleled quality, moreover it can collect various third-party sensor information together and eliminate monitoring gaps.





LOGIPIX IMAGE

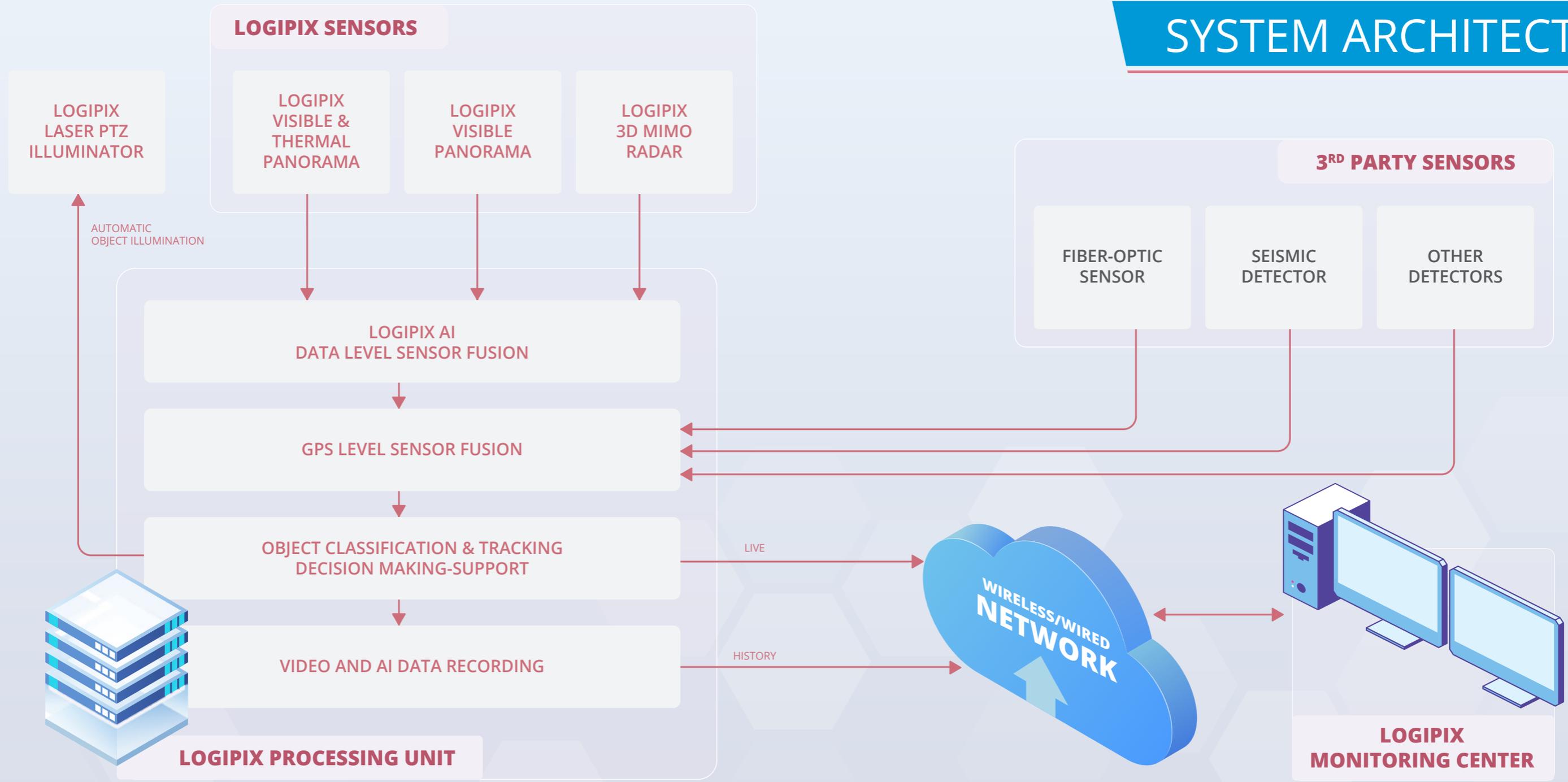
## WHAT DIFFERS US FROM OTHERS

- We are developing and manufacturing the full component group and technologies of a complex surveillance solution. This system consists of a high-end sensor cluster, intelligent video and data processing units with embedded AI and Computer Vision, and a complex monitoring software with server-client architecture.
- Our Panorama cameras provide 200-960 MP image streams at 20 fps (max). They ensure better spatial awareness for operators, as large areas are displayed simultaneously. Thanks to the extreme resolution, operators receive detailed images of even distant situations.
- The Logipix intelligent zoom functions provide immediate visual information on alerting events and lock automatic tracking on intruders.
- Our technology allows to track objects within the entire covered area, even if they move between different camera images.
- We are cross-mapping visible-light and thermal sensor data to ensure the most informative visual information in all visibility conditions.
- Our specially developed Sensor Fusion Technology realizes aggregated raw data analysis where data sources are different types of surveillance sensors
- Logipix Panorama and VCA makes it possible to track as much as 2500 objects at the same time.
- Logipix can automatically control specifically developed Laser PTZ illuminators on intruders and track their motion based on VCA and radar information.



- Our VCA runs on full resolution JPEG2000 image streams.
- We developed a special technology to handle large visual data and utilize the full resolution during monitoring.
- Logipix provides long storage periods, thanks to intelligent frame reducing technology.
- Beside providing intelligent video surveillance, Logipix gathers several sensor data and merges them together, making the most out of different surveillance technologies.

# SYSTEM ARCHITECTURE





# TECHNOLOGICAL DESCRIPTION

## SURVEILLANCE WITH A HIGH-END SENSOR CLUSTER

The Logipix Critical Infrastructure Video Surveillance Solution comprises a cross-mapped sensor cluster that operates in fusion to provide the most efficient computer vision-based surveillance possible. The sensor cluster consists of extreme high-resolution visible-light panorama cameras with thermal panorama modules, advanced PTZ cameras, single sensor cameras, laser PTZ illuminators and 3D MIMO Radars.

Logipix is able to integrate various third-party surveillance sensors as well and fuse their data with Logipix sensors. The system can process external sensor alerts to trigger automatic functions and therefore fill those monitoring gaps that by their nature remain blind for Logipix sensors.

### Covering critical areas

The structure of Logipix sensors is flexible and it can be easily adapted to the current environment. The largest contiguous areas can be covered visually by the Logipix Dual Vision Panorama Cameras. A single Panorama provides 320 MP resolution for visible-light surveillance and 6.6 MP for thermal vision in low visibility conditions. The Panorama provides 40° FOV and effectively monitors an area of 3.2 km<sup>2</sup> from a single viewpoint. Internal wide areas and long fence sections can be monitored by 200-300 MP Logipix Panoramas, smaller areas and areas that are obscured for the Panoramas can be covered by Logipix 20 MP cameras. Additionally

6 MP PTZs can be installed at strategical spots.

The Logipix 3D MIMO Radars work in fusion with the image sensors. The effective human detection range of these devices is 5 km.

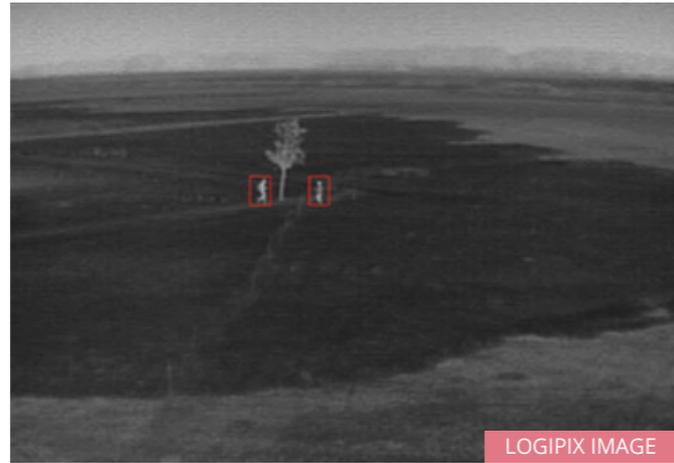
Various external sensors, for instance fiber-optic sensors or seismic detectors can be connected to the Logipix system. Their alerts are useful signals for Logipix sensors, as the system can utilize them to automatically display relevant monitor profiles and trigger automatic zoom functions on both the Logipix Panoramas and the PTZ cameras.

## Night vision performance

The solution offers various features for night vision. The Thermal Panorama module provides an informative video stream of a large area continuously. Relatively, the thermal sensors provide lower resolution than the visible-light cameras, yet they provide a solid visual base for automatic detection and classification functions even in longer distances. One of the biggest advantages of the Thermal Panoramas that they are able to track even 2500 targets at the same time.

Logipix also developed a Laser PTZ Illuminator to complete the visible-light Panorama Cameras. The PTZ Illuminators are cross-mapped with the Panorama Cameras and they are able to automatically track selected targets. Visible-light sensors provide much higher resolution on targets, but a Laser PTZ Illuminator can track only a single target or a target group at one time.

The third option for night vision is the use of the Logipix 6 MP PTZ cameras, which have their own built-in laser il-



luminators. These cameras are also cross-mapped with the Panorama Cameras and their automatic tracking function is also based on the VCA that runs on the panoramic images.

Operators can freely change between these options depending on which feature provide the most relevant information in the current situation.

## Perimeter protection

The fence is the first physical defense line of critical areas with a fixed layout. However, Logipix allows to surveil immense areas outside the fence, and thus detect potential threats way before intruders reach the perimeter line.

The Logipix Dual Vision Panoramas and the embedded VCA are developed to effectively detect, classify and track humans from 3 kilometers away. Using this technology together with the Logipix 3D MIMO Radars, operators get early warnings on any suspicious objects that approach the defended area.

In case intruders try to enter the protected area, numerous sensors can detect their actions. The Logipix VCA is able to detect fence climbing and it is able to virtually designate an alert area nearby the fence.

Our system is also able to work in smart fusion with various types of Perimeter Intrusion Detection Systems. In case the PIDS generate one or more alarm signals, the Logipix image sensors, both the Panoramas and the rel-



evant PTZs immediately zoom in on the alarming areas. They can spot even multiple intruders and track their motions, which are displayed in individual zoom windows on the front end interface.

## Area based intrusion alert (geofencing)

Area based intrusion alert is a Video Content Analysis based function, which allows to virtually assign various object and/or time-based rules to designated zones on the camera images. These rules can be applied to both external and internal areas.

The function makes it possible to realize complex access control within the monitored field. The set of rules defines, which object types may enter into which zones in certain time intervals.





LOGIPIX IMAGE

### Multi-level alert areas

Automatic multi-level proximity detection can also be implemented within the monitored area. The detection zones can be divided into warning and alert sections. These sections may protect large areas outside the fence, but they can be configured around buildings and differ-

ent industrial constructions as well in the internal zones. Object distance from the protected area and object classification also affect the outcome of the detection. The Logipix VCA accurately detect animal, human and vehicle presence where it is not allowed.



### Multiple object tracking

The system tracks all detected objects, whether they are intruders or authorized people or vehicles within the monitored area. Even if they move between camera images, the fused VCA and the RDA accurately follow and record their paths in the images. The algorithm is able to track 2500 objects at the same time. Operators can lock selected objects

on and display their tracking in individual zoom windows.

Both the Panorama cameras and the PTZs can track the objects automatically. Beside accurate tracking, the system also provides exact GPS coordinates on objects. This way operators can effectively guide patrol or emergency units to spots of incidents.

### Internal traffic enforcement

In order to increase overall safety and protect critical objects, assets and employees the system is able to detect and register traffic violations on the internal roads. The solution is developed to accurately detect stop line violations, over-speeding vehicles and wrong-way driving. There is also the possibility of automatically detecting the leaving of designated paths that can make reaction to unusual movement much faster.



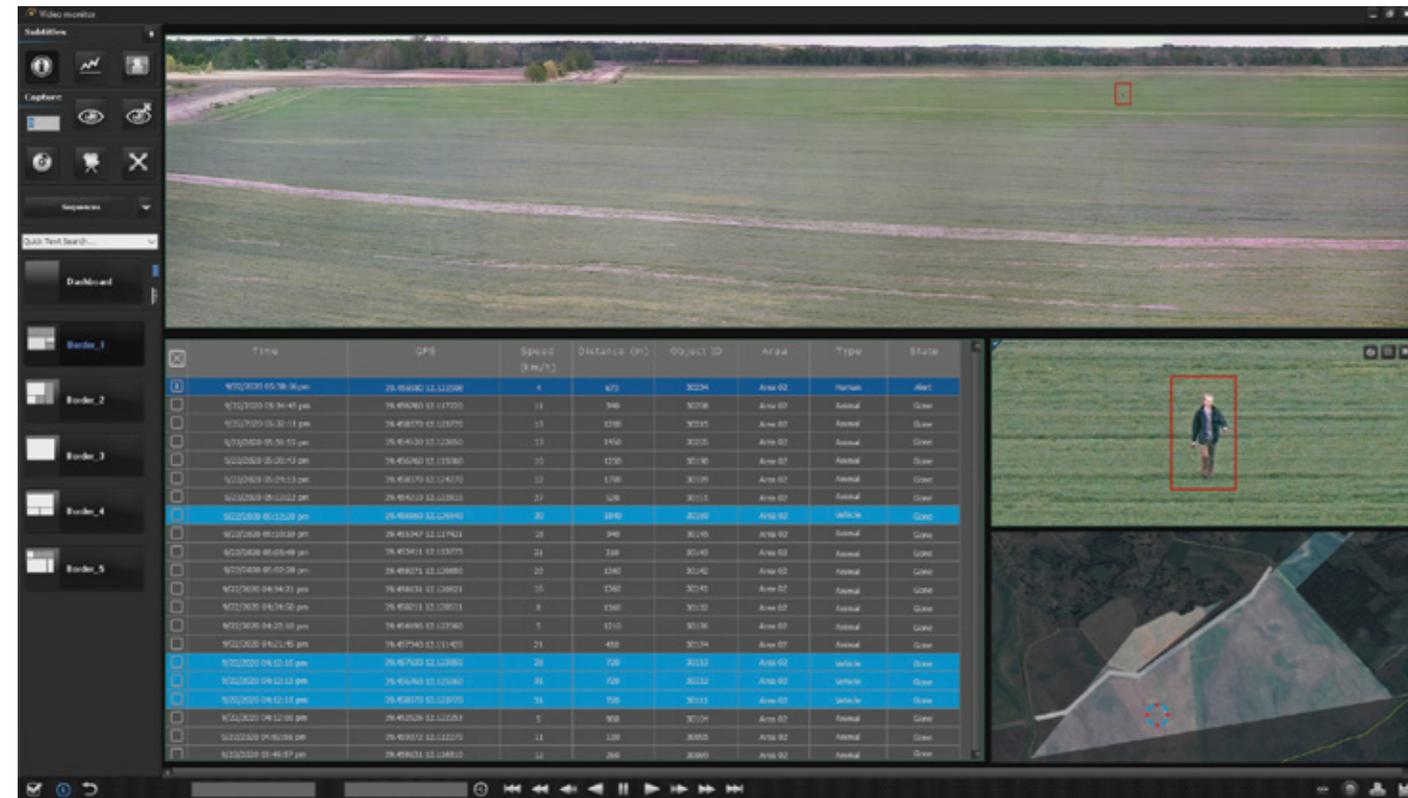
# THE FRONT END INTERFACE

The Logipix Critical Infrastructure Video Surveillance Solution comprises a versatile monitoring software that is responsible to display and structure all information generated in the system.

Operators use multiple monitor profiles, which always adapt to the current surveillance area. Automatic hierarchical alerts trigger to display the most relevant

monitor profile, with the most relevant camera images.

A main monitor profile generally consists of an overview panoramic image, zoom windows for the Panorama and the PTZ cameras, an interactive map with moving object icons and an object list with detailed object information.



The entire monitored area is displayed continuously in high-resolution and both radar and VCA detection results are visualized on the video stream. Operators can freely change between the visible-light and thermal images depending on the time of the day and the current visibility conditions.

The entire interface and its functions were developed to guide the focus of operators permanently on the

most urgent situations. Both the panoramic views and the interactive map provide references for better orientation within the vast monitored area. As the Control Center displays real-time GPS coordinates on each object, it allows operators to effectively guide patrol or emergency units to exact spots of intruders or incidents, where they can take the necessary measures.

Time	GPS	Speed (km/h)	Distance (m)	Object ID	Area	Type	State
9/22/2020 05:38:23 pm	39.456955 12.122375	4	653	30234	Area 02	Human	Alert
9/22/2020 05:34:45 pm	39.456760 12.117220	11	340	30208	Area 02	Animal	Gone
9/22/2020 05:32:11 pm	39.458370 12.123770	13	1200	30215	Area 02	Animal	Gone
9/22/2020 05:31:55 pm	39.454830 12.123850	13	1450	30205	Area 02	Animal	Gone
9/22/2020 05:31:43 pm	39.456760 12.115060	10	1250	30190	Area 02	Animal	Gone
9/22/2020 05:24:13 pm	39.458370 12.124270	12	1700	30189	Area 02	Animal	Gone
9/22/2020 05:12:22 pm	39.454210 12.122810	27	520	30151	Area 02	Animal	Gone
9/22/2020 05:12:20 pm	39.458160 12.128540	30	1840	30150	Area 02	Vehicle	Gone
9/22/2020 05:10:10 pm	39.455347 12.117421	18	340	30145	Area 02	Animal	Gone
9/22/2020 05:05:49 pm	39.453411 12.113773	21	210	30143	Area 02	Animal	Gone
9/22/2020 05:02:28 pm	39.458271 12.120650	20	1360	30142	Area 02	Animal	Gone
9/22/2020 04:34:21 pm	39.458131 12.120621	16	1360	30141	Area 02	Animal	Gone
9/22/2020 04:34:50 pm	39.458211 12.120511	8	1360	30132	Area 02	Animal	Gone
9/22/2020 04:22:10 pm	39.454196 12.122560	5	1210	30126	Area 02	Animal	Gone
9/22/2020 04:21:45 pm	39.457340 12.111420	21	410	30124	Area 02	Animal	Gone
9/22/2020 04:12:16 pm	39.457530 12.123850	28	720	30113	Area 02	Vehicle	Gone
9/22/2020 04:12:13 pm	39.456760 12.125080	31	720	30112	Area 02	Vehicle	Gone
9/22/2020 04:12:11 pm	39.458370 12.123770	31	720	30111	Area 02	Vehicle	Gone
9/22/2020 04:12:01 pm	39.452526 12.122253	5	980	30104	Area 02	Animal	Gone
9/22/2020 04:02:56 pm	39.459372 12.112270	11	110	30095	Area 02	Animal	Gone
9/22/2020 03:49:57 pm	39.458131 12.116810	12	260	30089	Area 02	Animal	Gone



LOGIPIX IMAGE

## TECHNOLOGIES BEHIND LOGIPIX FUNCTIONS

### Logipix Panoramic Technology

Logipix panoramic technology makes it possible to geometrically stitch together images of individual Logipix sensors. The images are taken in a synchronized fashion which precludes the possibility of duplicated or hidden objects at the stitching borders. White balance and tone corrections smoothen the gradient between images.

### PTZ Auto-tracking

Logipix is able to automatically control PTZ cameras based on Video Content Analysis that runs on panoramic images. As Panorama cameras and PTZ cameras are cross-mapped, once the VCA detects and tracks an object, the system can transmit its real-time coordinates towards the PTZ. This way PTZ cameras can automatically track the selected targets.

### PTZ control

A special Logipix function allows the Panoramas and PTZ cameras to be assigned by registering common spatial points that are visible to both cameras. This function allows operators to control the PTZ cameras by selecting the area of interest in the panoramic image.

### Sensor Fusion Technology

Logipix developed a specific data level sensor fusion technology, wherewith it provides raw data analysis involving different types of surveillance sensors. Raw data analysis means, the algorithms work with uncompressed data. This technique provides data fusion at the lowest level of abstraction, therefore it provides the highest level of accuracy.



## Logipix Video Content Analysis

The Logipix VCA relies on several advanced methods. One of them is the Multidimensional Gaussian Background Model that always adapts to the background and differentiates every moving object from the learnt environment. The VCA also applies Object Feature Extraction, Motion Behavior Analysis and Motion Path Estimation algorithms in order to realize an intelligent, self-learning virtual environment.



## Monitoring in Full Resolution

Displaying 200-960 MP panoramic images during live monitoring or archive playback is not an easy task. This amount of data can impose excessive burdens on the network infrastructure and also on client computers.

Logipix developed a special technology to overcome this issue. The system stores the panoramic images in

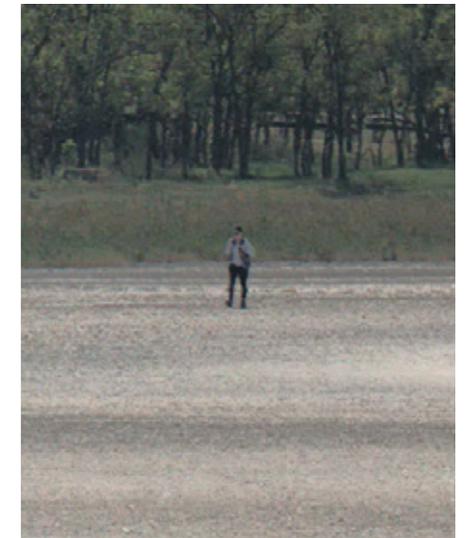
full resolution on the NVR, but always transmits and displays only relevant pixels. When a panoramic overview is on screen, its horizontal resolution is equal to the screen resolution. When an operator zooms in, the system sends the cropped image in higher resolution. As the zoom value increases, so does the transmitted image resolution.



## Logipix Ageing Technology

The system continuously records the images. Thanks to the Logipix Ageing Technology, storage period of video streams can be greatly prolonged. The system intelligently drops frames from the video stream according to

a configured period. As the JPEG2000 stream consists only intra-frame images, the footage will be still available after video stream ageing, but with reduced fps.



## MAIN FEATURES AND FUNCTIONS (SUMMARY)

### Video Monitoring functions

- 200-960 MP visible-light panoramic video stream with 20 fps
- 6.6-19.8 MP thermal panoramic video stream
- Real-time monitoring in full resolution
- PTZ control on panoramic images
- Automatic zoom tour
- Remote monitoring
- Archive video

### Integration

- External Radar Systems
- Various Perimeter Intrusion Detection Systems

### AI-powered Video and Data Analysis

- Automatic intrusion detection
- Object classification (animal, human, heavy and light vehicle, boat, vessel)
- Multiple target tracking through multiple camera images
- Automatic zoom and tracking function
- PTZ control for automatic target tracking
- Geofencing
- Multi-level alerting areas



## KEY SYSTEM COMPONENTS

- 960 MP + 19.8 MP Dual Vision Panorama Camera
- 320 MP + 6.6 MP Dual Vision Panorama Camera
- 300 MP Logipix Panorama Camera
- 200 MP Logipix Panorama Camera
- 20 MP Logipix ONE Camera
- 6 MP Logipix PTZ Camera
- Logipix 3D MIMO Radar
- Logipix Network Video Recorder 4<sup>th</sup> generation
- Logipix Control Center Client & Server





## TECHNOLOGICAL STRENGTHS OF THE SOLUTION

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- Logipix uses a specifically developed data level sensor fusion technology, involving multiple surveillance sensors for the most accurate intrusion detection and tracking possible.
- Logipix enables to integrate third-party Perimeter Intrusion Detection Systems into the Logipix Critical Infrastructure Video Surveillance Solution.
- AI-powered Video Content and Radar Data Analysis provides accurate object detection and classification at long range. The system can differentiate animals, humans and vehicles. Humans can be detected automatically at a range of up to 3 km.
- Various Logipix image sensors provide clear vision in all visibility conditions.
- Logipix automatically filters false alarms out based on intelligent data analysis, which works with fused image and radar data.
- Our system allows to virtually designate different areas and assign specific detection rules to them.
- Logipix makes it possible to define multi-level alerting areas wherewith more sophisticated detection rules can be realized.
- Logipix provides automatic multiple objects tracking based on VCA and RDA. Intruders are highlighted as alerting objects on the interactive map and also on the panoramic images.
- Logipix provides full area coverage with visible-light and thermal imagery sensors. It provides multi-sensor Panorama cameras, Thermal Panoramas and also single sensor and PTZ cameras. A single 320+6.6 MP Panorama construction can monitor an area up to 3.2 km<sup>2</sup>.
- The solution uses the scalable JPEG2000 image compression, which is the only standard that allows for real-time monitoring with hundreds of megapixels in a bandwidth effective manner.
- Logipix Video Content Analysis is embedded in the Logipix cameras and in the Data Processing Units. It works with full resolution JPEG2000 images.
- Logipix Critical Infrastructure Surveillance Solution provides real-time GPS coordinates on moving objects.

# CONCLUSION



Logipix developed the best-in-class visible-light and thermal video surveillance system that is completed by an advanced radar technology and comprehensive integration possibilities. Utilizing the intelligent perimeter intrusion detection functions and the progressive VCA and Radar based analytics, no external or internal threats remain unnoticed. The Logipix image sensors provide enhanced vision for operators and AI functions guide their focus to the most prior incidents, which help realize a more controllable environment in high security areas.

## ABOUT LOGIPIX

Logipix Technical Development Ltd. is a privately held company established in 1996 in Budapest, Hungary. Since then, Logipix has grown into the international company that it is today – one of the most innovative, end-to-end video surveillance solution developers and manufacturers. Today the main profile of the company is to provide specially designed, high-end video surveillance solutions considering the various characteristics of different application areas.

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