BORDER SURVEILLANCE SOLUTION

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Today there is an emerging need for more protected borders, therefore a superior defense technology must be implemented at every high risk border area. This is the reason for the creation of the Logipix Border Surveillance Solution.

The Logipix solution is an intelligent video surveillance-based system that is also able to integrate various external sensors and this way ensure the most comprehensive coverage and monitoring of a border area. Leveraging the extreme high resolution Logipix cameras and advanced Computer Vision Technologies, thermal cameras and possible third-party surveillance radars, the solution is able to realize a complex system that minimizes monitoring gaps and produces the lowest false alarm rate possible.

The structure of the solution is flexible and adapts to different open-air areas. It can act as a much more effective alternative to fences or walls and also strengthens existing ones. Potential threats are detected automatically within an immense area regardless of lighting and environmental conditions as alarm verification happens involving several different sensors. The system components are able to withstand even severe weather conditions on the field.
• monitor entire vast areas, whether they are lands or water with only a few Panorama cameras and automatically detect potential threats like smuggling, terrorism and illegal immigration
• have accurate, automatic object classification even 3 kilometers away based on Video Content Analysis (VCA)
• minimize false alarms and have Real-time Decision Making Support to display potential threats only
• automatically track even the slowest moving targets on 200-960 MP panoramic images through kilometers in any direction
• have high-resolution visual feedback on targets, and the geographic conditions in their surroundings
• monitor the area with Multi-sensor Thermal Cameras and get efficient visual information even in pitch darkness
• merge external sensor data with VCA detected objects and visualize information on 200-960 MP panoramic images
• know the real-time GPS coordinates of targets
• have a comprehensive system with full functionality, but you have only a low-bandwidth network environment
• guide patrol units or squads as fast as possible to target location
• have high-resolution footage of patrol unit or squad actions
• complete existing border surveillance systems with an intelligent video surveillance solution that provides the most effective video surveillance
SECURITY AND FINANCIAL 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 border area in order to choose the most appropriate technologies and coverage structure on the field.

• **Extended vision**
  Logipix provides 200-960 MP panoramic video streams with 20 fps. This extreme resolution creates a solid visual base for Video Content Analysis, where even humans can be detected and classified automatically at a range of up to 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 can get early alarms and alerts automatically.

• **Undoubted visual evidence**
  The 200-960 MP panoramic video footage contains high-resolution details of all squad and patrol unit actions. These images can serve as evidence during investigation on demand.

• **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 can get early alarms and alerts automatically.

• **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.

• **No need to deploy costly fiber optic network between cameras and Command and Control Centers**
  The Logipix Border Surveillance Solution ensures on-site recording with weather and vandal-proof, outdoor Network Video Recorders.

• **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 other surveillance systems**
  Each border surveillance technology has its own bottleneck. Logipix solution is designed to strengthen these technologies and leverage them. It provides AI-assisted video surveillance with unparalleled quality, moreover it brings all third-party sensor information together and eliminates monitoring gaps.
WHAT DIFFERS US FROM OTHERS

- Developing and manufacturing the full component group and technologies that are needed for extreme high resolution visible-light imagery, namely panorama and single cameras, NVRs, VCA and Command and Control Software
- 200-960 MP panoramic images ensure better spatial awareness for operators, as large areas are displayed simultaneously and the relative positions of landscape formations help visual orientation
- Providing Computer Vision Technologies specially developed to detect, classify and track targets automatically even kilometers away
- Logipix Panorama and VCA makes it possible to track multiple targets at the same time in numerous individual zoom windows
- Large area coverage by Multi-sensor Thermal Cameras for more efficient monitoring in pitch darkness and degraded visibility conditions
- Logipix can automatically control third-party thermal PTZ cameras to track targets
- 20 fps panoramic video stream with hundreds of megapixels
- Intelligent Video Content Analysis on full resolution JPEG2000 image streams
- Specially developed technology to handle large visual data and utilize the full resolution during monitoring
- 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

3D MODEL OF VISUAL COVERAGE

An accurate design of camera arrangement is essential in every border area to achieve the required resolution that is necessary for the desired Logipix functions. Logipix therefore creates 3D models that precisely visualize final installation points, field of view (FOV), and exact resolution and distance values.
The Logipix Command and Control Center makes it possible for operators to successfully surveil immense areas leveraging different surveillance sensors. The solution displays panoramic images, PTZ and thermal PTZ images, interactive map and also radar information. The entire monitored area is displayed continuously in high-resolution panoramic images and both radar and VCA detection results are visualized on the video stream. When objects are clear, the Logipix VCA classifies them automatically. Potential threats are highlighted on the front end interface. Real-time Decision Making Support and high-resolution visual verification help decide between non-threatening objects and alerts that require fast respond.

Operators can easily track multiple targets simultaneously in individual zoom windows. Both PTZ cameras and Panorama cameras track targets automatically based on Video Content Analysis that runs on the panoramic images. To control the PTZs manually, operators use the panoramic images. They select the area of interest and the PTZ zooms in on the required area. The interactive map also provides reference for better orientation as targets are displayed on it as moving icons. The Command and Control Software displays real-time GPS coordinates of each targets, which allows operators to effectively guide patrol units or squads to the exact spot, where they can take efficient actions to stop illegal activities.

FROM THE PERSPECTIVE OF OPERATORS
Logipix Border Surveillance Solution realizes a complex system that leverages different surveillance technologies in order to overcome monitoring bottlenecks. Basically the solution provides intelligent video surveillance with 200-920 MP resolution cameras for visual coverage, computer vision technologies for automatic threat detection, on-site recorders for storage and data transmission and Command and Control Center software for monitoring.

In order to see beyond IR and visible-light the solution is able to integrate third-party detection and surveillance sensors, namely mid-range and long-range radars, intrusion detection sensors and thermal PTZ cameras.

**Covering vast areas**

Logipix solution was designed to fully cover immense border areas even on challenging terrains using high-end imagery sensors.

The main line of visual coverage consists of Logipix Panorama cameras. A single 320 MP Panorama camera has 40° FOV and effectively monitors an area of 3.2 km² from a single viewpoint. Its resolution allows to detect humans within a range of up to 3 km. Three of these cameras can be installed at a single spot, providing 120° FOV and 9.6 km² area coverage.

In case a narrower area should be monitored near a defense line, Logipix 20 MP cameras can be used in a desired structure.

**Logipix cameras at night**

Logipix Panoramas have excellent low-light performance. When it comes to night monitoring, the image sensors efficiently utilize IR light, and unless the covered area is not in pitch darkness, the camera still delivers images wherein humans can be detected kilometers away.

In addition to this high-resolution surveillance, Logipix Multi-sensor Thermal Cameras ensure efficient night monitoring and delivers useful visual information, specially when the monitored area is not illuminated by natural or artificial lighting.
Automatic object detection
Logipix VCA delivers exceptionally accurate object detection. Video Content Analysis recognizes any suspicious moving object in the distance that could be a potential threat. Geofencing function allows specific detection configurations within the visually covered area. Zones can be virtually designated which for various detection rules can be assigned.

False alarm reduction
Accurately detecting an object within the defense area is just the first step. Fast decision between real threats and non-threatening objects is essential. Logipix VCA-based object classification and the configured geofence rules ensure to filter animals and other hazardous objects to avoid numerous false alarms. Logipix Real-time Decision Making Support boosts operators’ efficiency, as using this embedded intelligence, the system displays only potential threats. Visual target verification is fast and effective as Logipix provides automatic zoom functions on detected objects. Complementing each other, Panoramas, thermal and PTZ cameras deliver informative details even under degraded visibility conditions.

Automatic target tracking
Once operators identifies objects as targets, the system automatically tracks their motion. Even they moves between Panorama Cameras, the VCA accurately follow their path in the images. The VCA is able to track unlimited targets and display many of them at the same time in automatically tracking zoom windows. Based on GPS coordinates that are calculated by interpolation on the panoramic images, the system automatically controls PTZ and thermal PTZ cameras. During night monitoring or in low-bandwidth network environments an aligned reference image and moving position indicators help operators to find targets’ real-time spatial positions in the images.

Target localization
In order to respond threats effectively, the exact positions of targets must be known beside tracking them. Logipix delivers the precise GPS coordinates, speed and heading information of all detected objects from the moment of detection. The system may use both radar information and VCA-calculated coordinates for localization. It is able to match radar data with the VCA-detected objects and display the information together with the targets.

Interactive map
Logipix also provides an interactive map that visualize objects as moving icons. It shows camera FOVs and real-time GPS coordinates of targets as well. Operators can select targets on the map to show immediate zoom images of them.

Integration
A great advantage of the Logipix Border Surveillance Solution is that it is able to integrate third-party surveillance components in order to fill monitoring gaps. In addition to the Logipix sensors the system can integrate third-party surveillance radars, long-range and thermal PTZ cameras and PIDS. Logipix ensures the full manual and automatic control of the integrated PTZ cameras. Although, in contrast with the Panoramas, a single PTZ can not track multiple targets at the same time, but installing them on strategic spots they can perform as effective surveillance sensors. Surveillance radars are important components of border security, especially on challenging terrains. Logipix is able to integrate mid-range and long-range radars and merge their data with the visual information of Logipix cameras. In case a Perimeter Intrusion Detection System operates on the field, Logipix can receive its signals and use them to trigger automatic zoom functions on cameras.
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 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.

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.

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 measured together, 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 desired targets.
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 panoramic video stream with 20 fps
- Thermal images
- Real-time monitoring in full resolution
- PTZ control on panoramic images
- Automatic zoom tour
- Archive video

**VCA functions**
- Object 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
- Geo-fencing

**Integration**
- Long-range, mid-range surveillance radars
- Air and ground drone surveillance radars
- Long-range PTZ cameras (2000 mm or higher focal length)
- Thermal PTZ cameras
- Long-range IR Laser Illuminators
- Perimeter Intrusion Detection System
TECHNOLOGIES FOR AN OPEN-AIR SOLUTION

Resistant hardware design
All Logipix cameras and NVRs are ruggedized, full metal constructions and are designed for long-term use. They can be equipped with passive and also active thermal constructions. This makes them resistant even to extreme weather and environmental conditions. Heat pipes, heat sinks with fans and Thermoelectric Peltier modules ensure the appropriate operating temperature within the devices.

On-site recording
4th generation Logipix Network Video Recorders are available with a special, outdoor design. They are weather- and vandal-proof constructions with integrated thermal management to operate on-site. This feature significantly reduces installation costs, as there is no need to deploy fiber optic infrastructure over hundreds of kilometers between the cameras and the Command and Control Centers.

KEY SYSTEM COMPONENTS

- Logipix 960 MP Panorama Camera
- Logipix 320 MP Panorama Camera
- Logipix 200 MP Panorama Camera
- Logipix Multi-sensor Thermal Camera
- Logipix ONE 20 MP Camera
- Logipix Outdoor Network Video Camera 4th gen
- Logipix Command & Control Center
Logipix provides immense area coverage with visible/IR-light and thermal imagery cameras. A single 960 MP Panorama construction can monitor an area up to 24 km².

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 Network Video Recorders. It works with full resolution JPEG2000 images.

Logipix Video Content Analysis provides accurate object detection and classification at long range. The system can differentiate animals, humans, heavy and light vehicles. Humans can be classified automatically at a range of up to 3 km.

Logipix automatically filters false alarms based on Logipix VCA, which works with extreme high resolution images.

Logipix provides automatic multiple target tracking based on Logipix VCA and if possible other integrated surveillance sensors. Targets are highlighted on the interactive map and also on the panoramic images.

TECHNOLOGICAL STRENGTHS OF THE SOLUTION

- Logipix Video Content Analysis provides accurate object detection and classification at long range. The system can differentiate animals, humans, heavy and light vehicles. Humans can be classified automatically at a range of up to 3 km.
- Logipix automatically filters false alarms based on Logipix VCA, which works with extreme high resolution images.
- Logipix provides automatic multiple target tracking based on Logipix VCA and if possible other integrated surveillance sensors. Targets are highlighted on the interactive map and also on the panoramic images.
- VCA-based target tracking makes it possible to display multiple targets in individual, automatically tracking zoom windows.
- Logipix Border Surveillance Solution provides real-time GPS coordinates on moving targets.
- Logipix enables to integrate third-party border surveillance sensors into the Logipix Border Surveillance Solution.
- The system is able to intelligently process all received third-party sensor data and merges them with VCA detected objects.
- The system can automatically control integrated PTZ cameras to zoom in on targets and track their motion based on VCA information.
Logipix brings a new era in border surveillance. The most secure walls are not built from concrete and steel, but from thousands of megapixels, advanced computer vision technologies and intelligent data processing. Logipix created an intelligent surveillance solution with which illegal activities can be detected automatically, while most of the false alarms are filtered. The end result is safer borders and, ultimately, more secured nations.
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.

CONTACT US

H-1158 Budapest, Késmárk u. 11-13.   sales@logipix.com   +36 20 480 5933   +36 1 410 0556

www.logipix.com