



LOGIPIX

# TRAFFIC VIOLATION DETECTION SOLUTION

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





# TRAFFIC VIOLATION DETECTION SOLUTION

The Logipix Traffic Violation Detection Solution provides a complete, custom size system that automatically detects all the common types of traffic

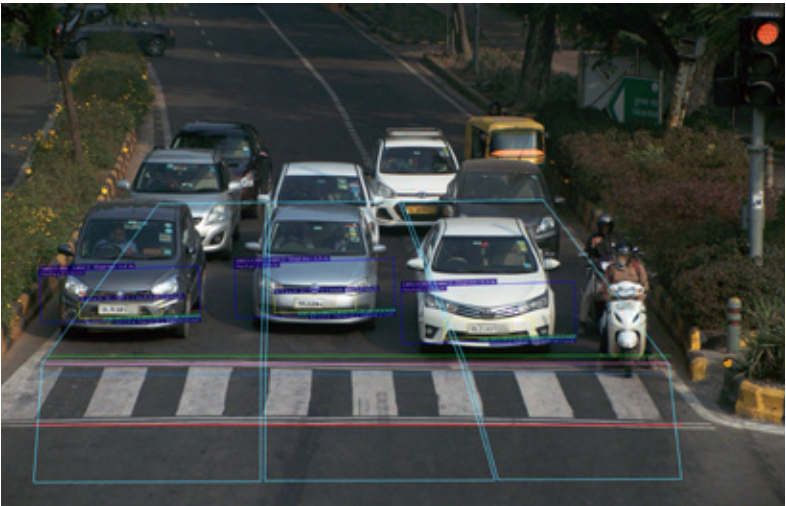
violations in cities, on highways and at other traffic areas. It can be sized to city-wide scale projects and also for smaller range plans that involves less surveillance sites.

The solution operates with high accuracy even in the densest traffic environments and it is able to detect various traffic violation types simultaneously. The system covers the entire workflow and performs its tasks automatically from violation detection and vehicle data collection to compiling detailed violation reports, which can be used by local authorities.



## Automatic traffic functions

- Red light violation detection
- Stop line violation detection
- Overspeed violation detection
- Wrong-way violation detection
- Turn violation detection
- Lane violation detection
- Parking violation detection
- Traffic counting







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

- equip urban areas or other traffic areas with a complete, automatic traffic violation detection system that is able to detect various types of traffic violations
- deploy a well grounded solution that was developed with many years of experience in the industry
- have a system with an automated workflow, wherein only violation verification requires human resources
- have high detection accuracy even in chaotic traffic environments
- process even hundred thousands of violations daily with minimal manpower
- accurately detect violations day and night, regardless of the lighting conditions
- have clear and detailed images of license plates 24/7, regardless of whether they are reflective or non-reflective types
- cover the maximum number of lanes with the minimum number of traffic cameras
- implement a system that operates reliably even in extreme hot or cold environments
- have a time resistant system with high-end hardware and easy function extension possibilities
- easily increase the number of surveillance sites in case of future expansions







## FINANCIAL BENEFITS

- **Valuable investment** – Minimized payback period of a city-wide traffic violation detection system.
- **Reduced operating costs** – Violation detection and violation package compilation is automatic in the system, only violation verification task is performed by operators.
- **Decreased installation costs** – It is possible to install surveillance sites without financing road or intersection closures for long periods.
- **Preliminary plan for installation** – Logipix always consider the specific tasks of each project and design the most efficient camera arrangement possible.
- **Avoid physical obsolescence** – Logipix hardware components are designed with rugged enclosures and built-in heating and cooling systems. This way they can withstand intense weather conditions and avoid malfunctions.
- **Long-term reliability** – Logipix develops future-proof technologies that ensure long system life-time.
- **High MTBF** – All hardware components of the Logipix system are created carefully to function without failures for long periods.
- **Advanced remote maintenance** – The system constantly gives feedback of its condition in the form of detailed health reports and SNMP traps. This way local maintenance can be more efficient and less time-consuming.
- **Easy system expansion** – Logipix solution is designed to be flexible for future developments. Both the number of surveillance sites and system functions can be extended easily on demand.





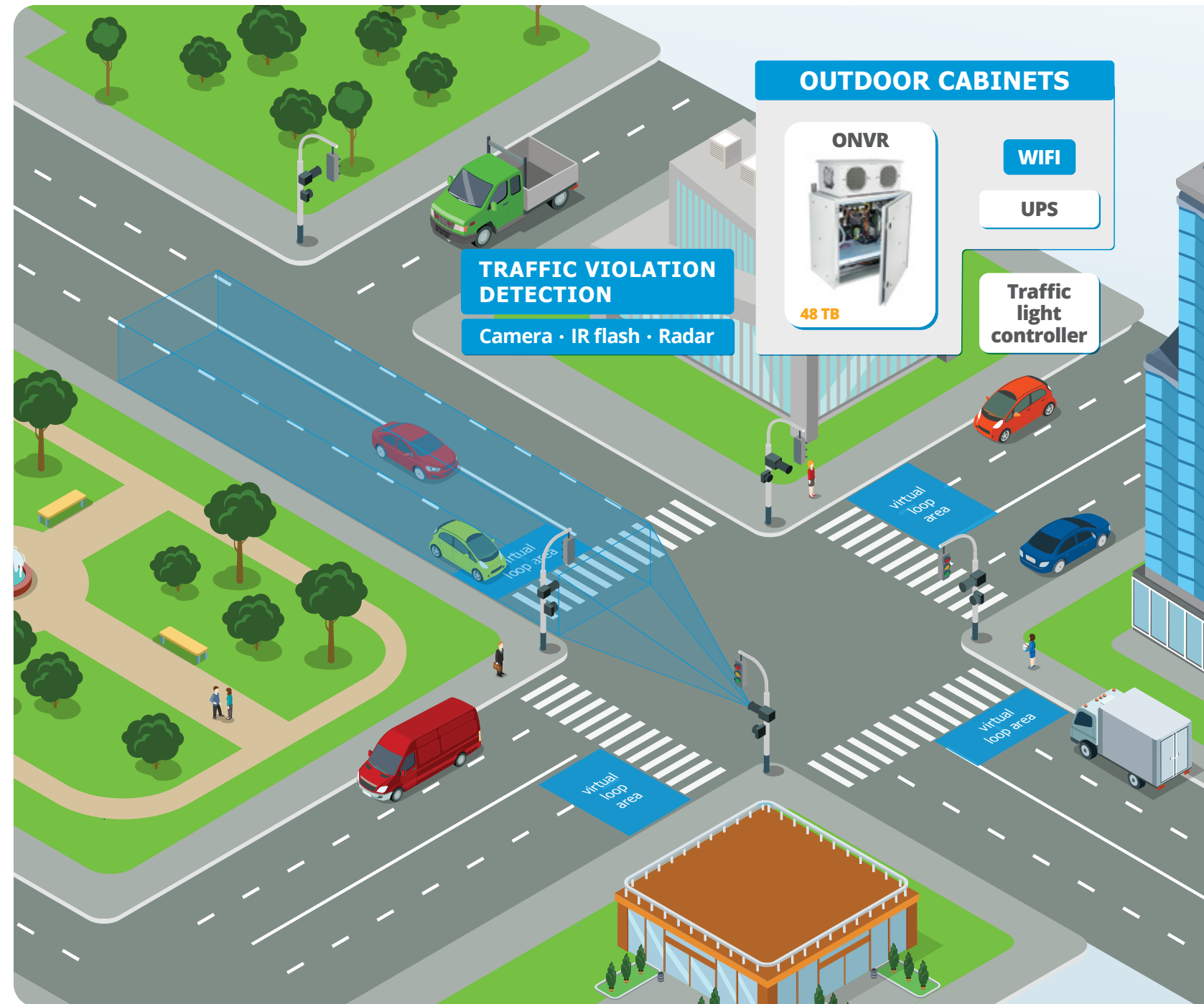
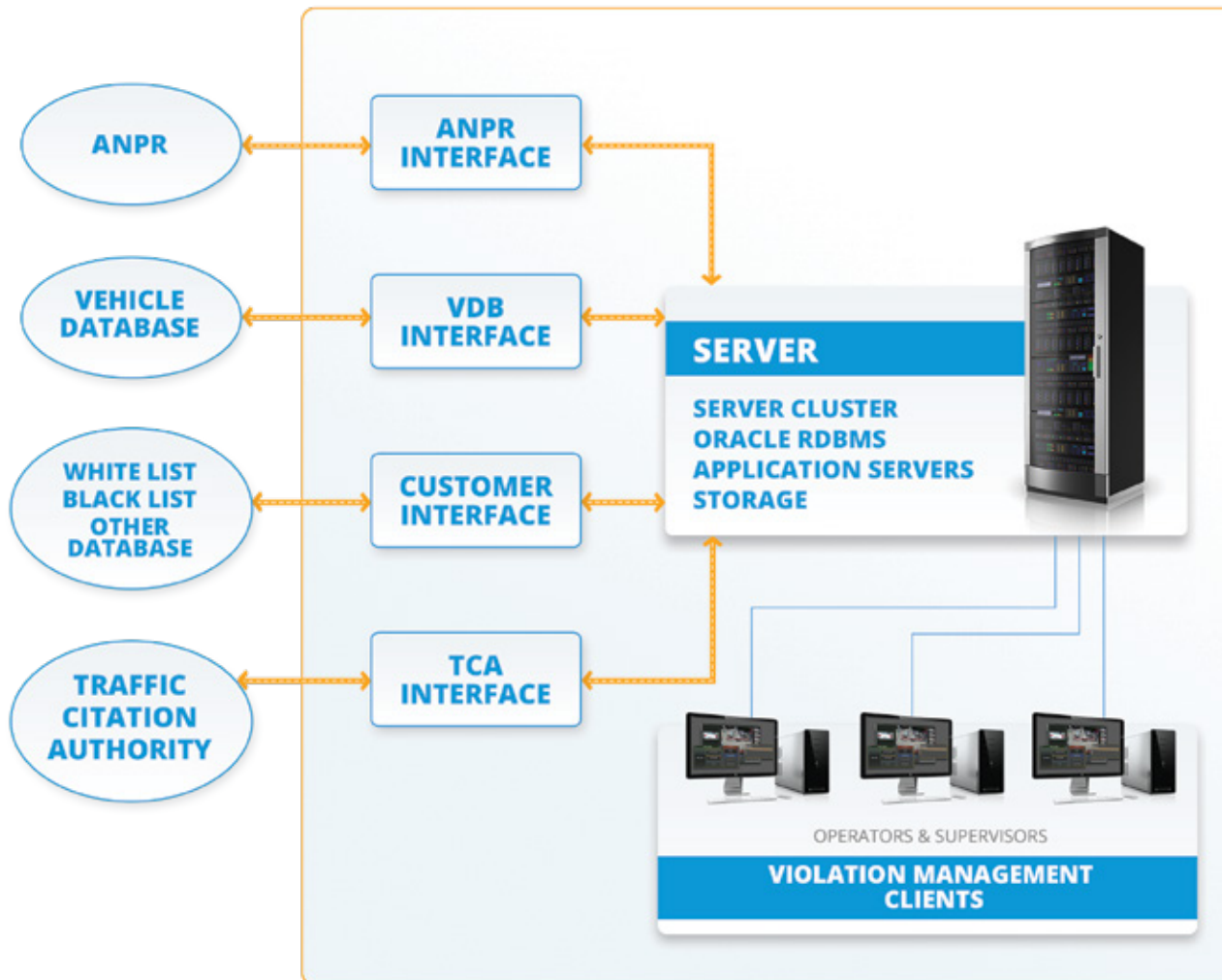


## WHAT DIFFERS US FROM OTHERS

- Logipix provides a complete solution. We develop and manufacture all the critical components of the system, namely high-end traffic cameras, lenses, 3D radars, IR laser flashes, NVRs, Video Content Analysis and server and client components.
- The Logipix Traffic Violation Detection Solution can be applied to detect various types of traffic violations at the same time without any additional hardware improvement.
- Our traffic cameras deliver 20 MP resolution and provide multi-lane coverage. This way our system detects traffic violations even in dense traffic, where people drive in-between lanes.
- Our specially designed IR Laser Flash is able to operate with alternating illumination intensity. This way both reflective and non-reflective license plates are illuminated properly in the very same video.
- We developed a special Sensor Fusion Technology, in which radar and visible light sensor data are fused and processed together, resulting in the highest detection accuracy rate possible.
- Logipix Video Content Analysis is not just a software application, it is embedded in the hardware and processes the full resolution images with strong calculation capacity.
- Logipix traffic cameras deliver JPEG2000 image streams, wherein all images are individual frames without inter-frame compression.
- Logipix NVRs store the full resolution JPEG2000 videos on-site. The traffic system does not transmit real-time data. Only previously compiled violation packages are queried by the servers for further automatic tasks and for centralized violation data storage.
- The system is able to operate on low-bandwidth networks as wireless communication is sufficient between surveillance sites and central servers.
- Logipix Violation Management Servers operate automatically querying all data for each violation from integrated ANPRs and various vehicle databases.
- The only role of operators in the Logipix Traffic Violation Detection Solution is to check the violation packages in a dedicated software that was designed to maximize the number of daily processed violations.

# SYSTEM ARCHITECTURE

## VIOLATION MANAGEMENT CENTER

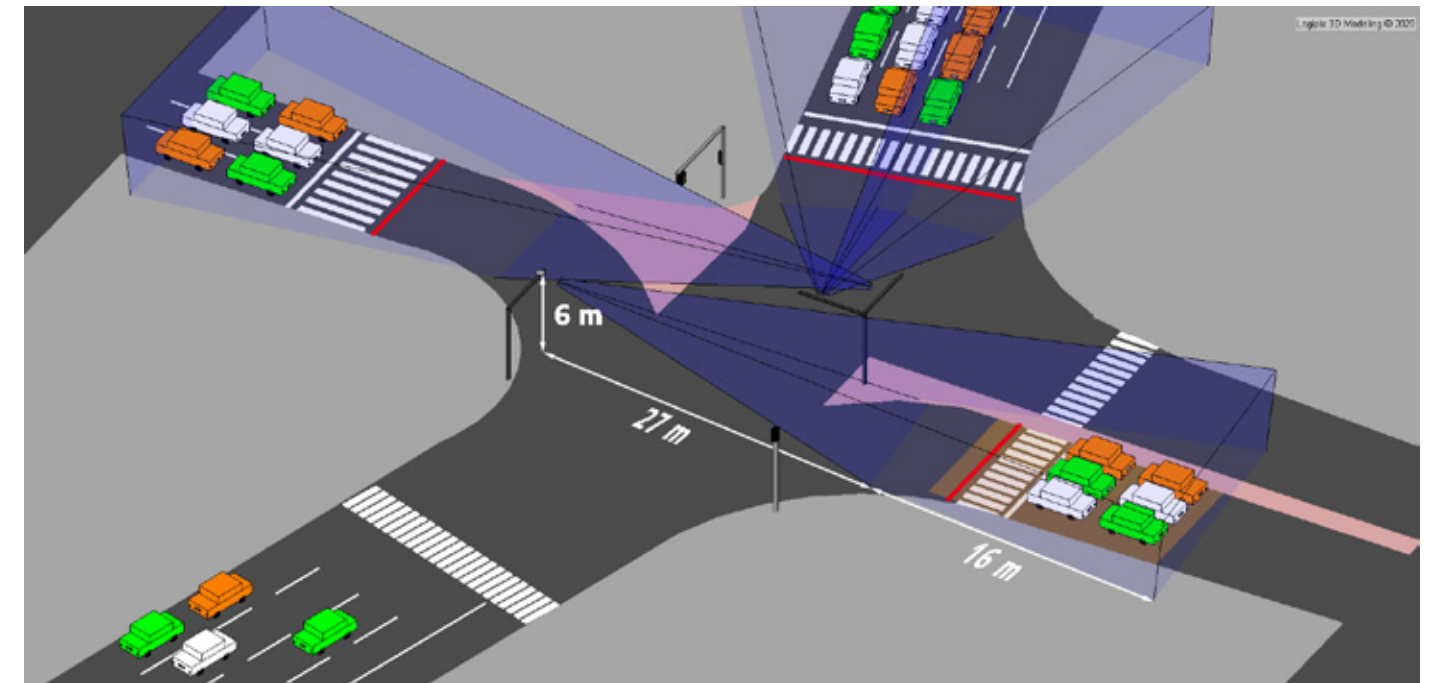
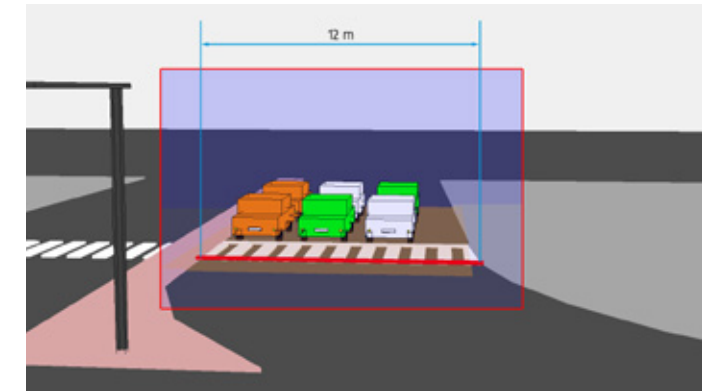




# DESIGNING YOUR PROJECT



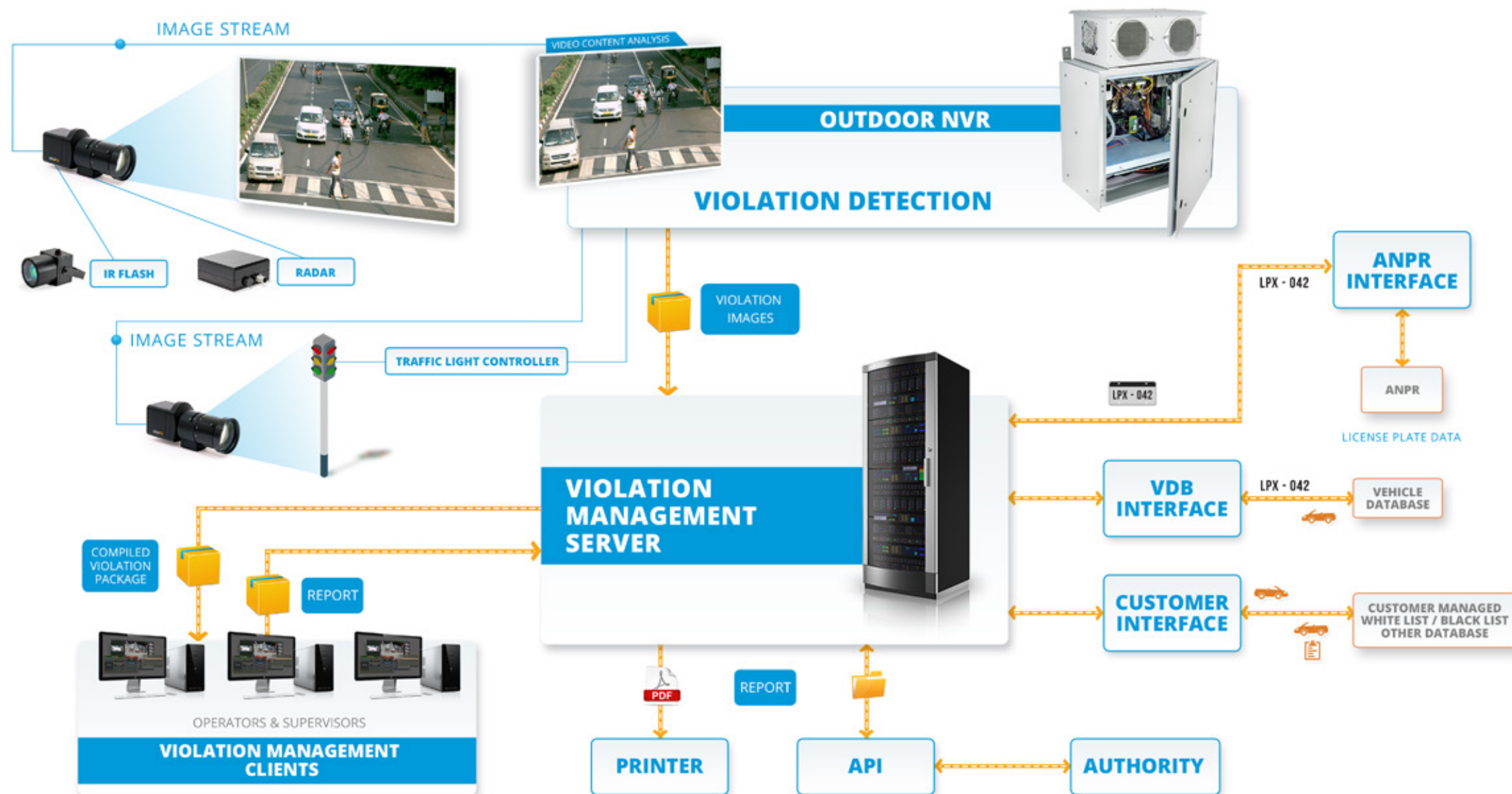
Logipix starts each project creating 3D plans for all individual intersections or other surveillance sites near by roads. We take into consideration the location of available poles that may suitable for the Logipix traffic cameras to be installed in the proper height and distance from the desired detection zone.



After calculating the required resolution for the desired surveillance task, we create the accurate 3D model of each site with exact camera installation spots and generated camera views.



# TECHNOLOGICAL DESCRIPTION



## AUTOMATIC WORKFLOW

### On-site tasks

1. Violation detection based on fused Video Content Analysis and Radar Data Analysis
2. Saving a log file that contains image ID, VCA and Radar data for each violation frames

### Server tasks

3. Querying violation images based on the saved log file
  4. Cropping license plate from the violation image and sending it to the ANPR
  5. Querying vehicle data from the connected vehicle database
  6. Querying special vehicle information from customer managed lists
  7. Compiling violation packages
  8. Sending already processed violations to proper authorities
- + Creating printable violation pdf documents based on a customizable template

### Client tasks

9. Verifying violations by operators or supervisors



# LOCAL VIOLATION QUERY

Sometimes, reasons beyond the system’s control may cause wireless network issues. In such cases, violations can be exported into a database directly from the NVRs on-site using a certified hardware key. After that, the Violation Management Server can import the violations from this device.

# AUTOMATIC TRAFFIC FUNCTIONS

Logipix developed front detection methods for automatic traffic violation detection as this way higher resolution and lower vertical angle can be achieved on license plates in the detection zone. This method also results in higher detection rate and accuracy, besides it is more reliable in dense traffic. Faces of drivers may also be captured if windscreen reflections do not hinder visibility.



# Red Light Violation Detection



## Method

### Monitoring traffic light states

- connected traffic light system
- evidence camera with moderate performance (optional)

### Video Content Analysis & Radar (optional)

- vehicle position tracking
- violation »» vehicle crosses virtual red light violation line when traffic light state is red

## Typical installation spots

- Intersections with traffic light system
- Pedestrian crossings with traffic light system

## Required Logipix components

- 20 MP Traffic Camera
- IR Laser Flash
- 4<sup>th</sup> Generation Outdoor NVR with traffic light system interface
- Violation Management Server
- Violation Management Client

## Recommended Logipix components

- Evidence camera to capture traffic light states
- 3D Multi-lane Radar



# Stop Line Violation Detection



## Method I

### Environment

- Intersection with traffic light

### Monitoring traffic light states

- connected traffic light system
- evidence camera with moderate performance (optional)

### Video Content Analysis & Radar (optional)

- vehicle position tracking
- violation »» vehicle crosses virtual stop line but stops before crossing red light violation line

## Method II

### Environment

- Intersection with stop sign

### Video Content Analysis & Radar (optional)

- vehicle position tracking and speed measurement
- violation »» vehicle crosses virtual stop line without stopping by

## Typical installation spots

- Intersections with traffic light system
- Intersections with stop sign

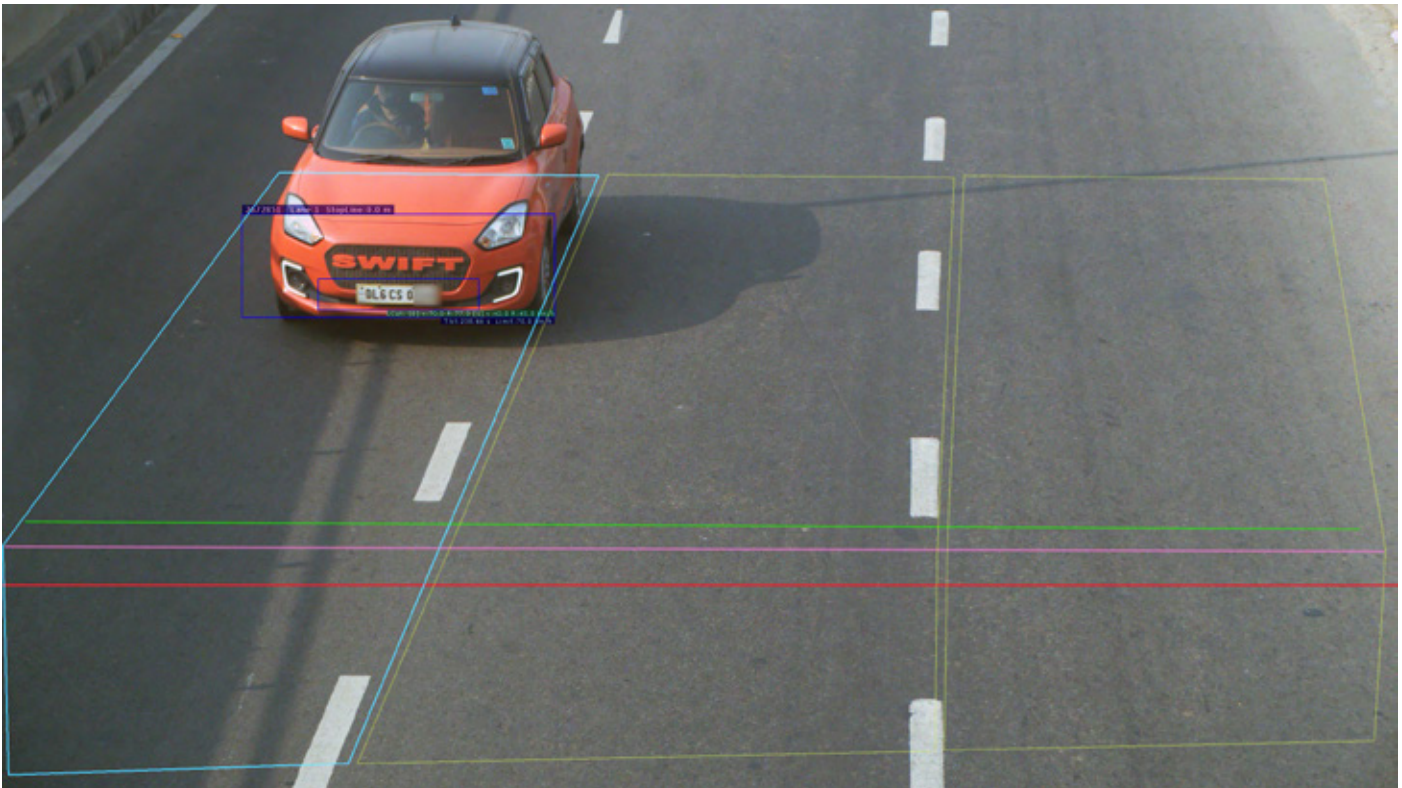
## Required Logipix components

- 20 MP Traffic Camera
- IR Laser Flash
- 4<sup>th</sup> Generation Outdoor NVR with traffic light system interface
- Violation Management Server
- Violation Management Client

## Recommended Logipix components

- 3D Multi-lane Radar

# Overspeed Violation Detection



## Method

### Video Content Analysis & Radar

- Vehicle position tracking and speed measurement by sensor fusion technology
- violation »» vehicle exceeds the speed limit with more than the configured speed tolerance

## Typical installation spots

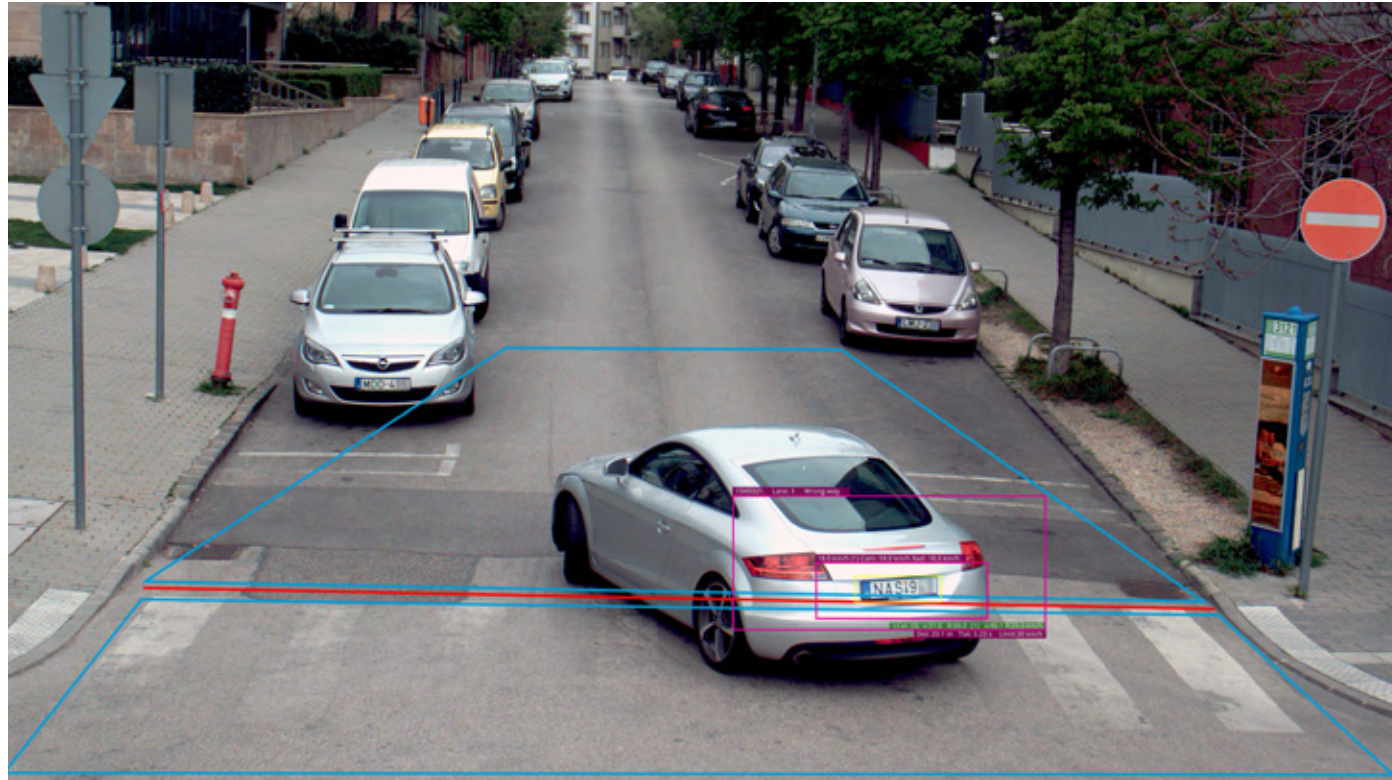
- Intersections (all types)
- Streets
- Highways

## Required Logipix components

- 20 MP Traffic Camera
- IR Laser Flash
- 3D Multi-lane Radar
- 4<sup>th</sup> Generation Outdoor NVR with traffic light system interface
- Violation Management Server
- Violation Management Client



## Wrong Way Violation Detection



### Method

#### Video Content Analysis & Radar (optional)

- vehicle position tracking
- violation »» vehicle turns into the designated detection zone from the wrong way
- violation »» three point turn in the intersection from the wrong way

### Typical installation spots

- Intersections with one way street

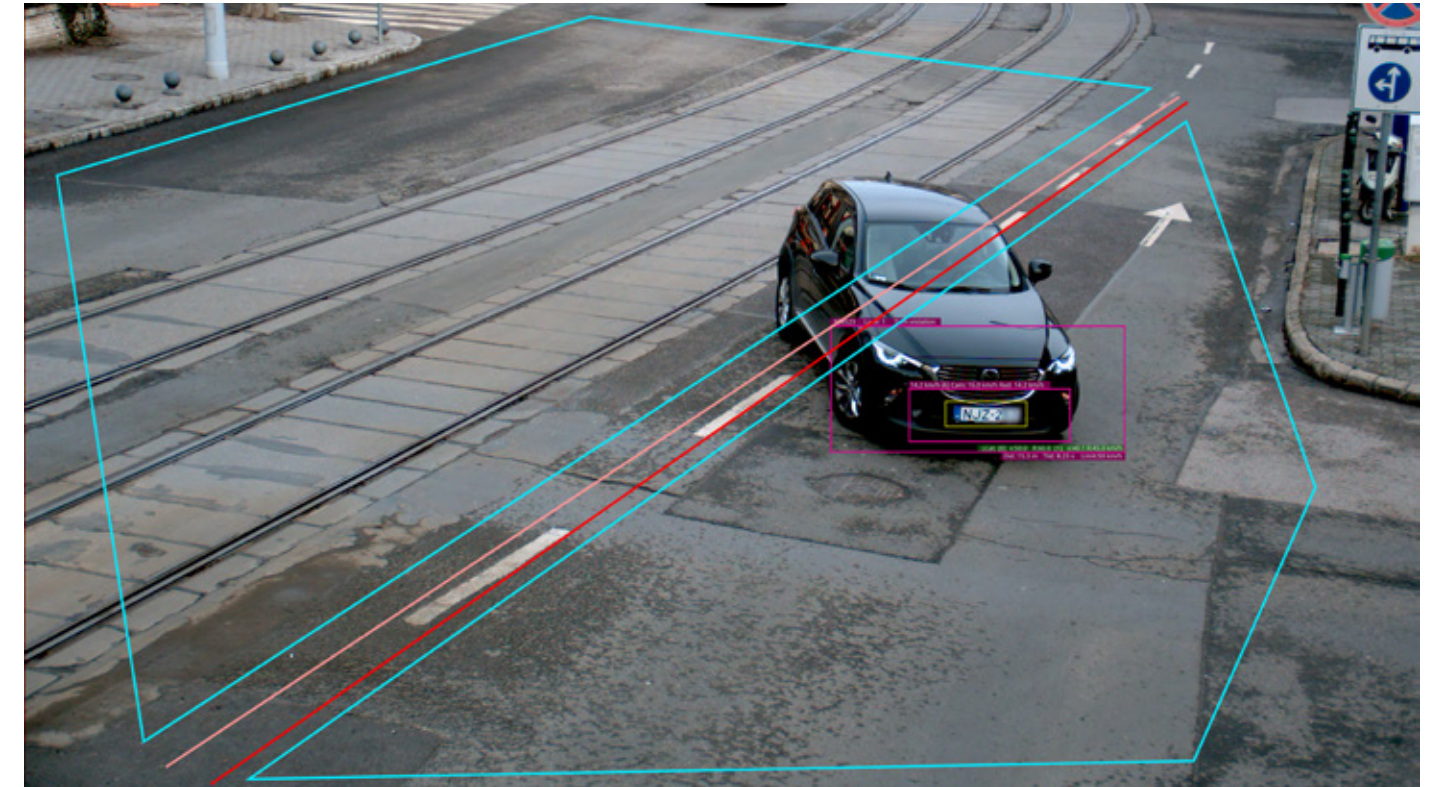
### Required Logipix components

- 20 MP Traffic Camera
- IR Laser Flash
- 4<sup>th</sup> Generation Outdoor NVR
- Violation Management Server
- Violation Management Client

### Recommended Logipix components

- 3D Multi-lane Radar

## Turn Violation Detection



### Method

#### Video Content Analysis & Radar (optional)

- vehicle position tracking
- violation »» vehicle enters the virtual detection zone from the forbidden direction

### Typical installation spots

- Intersections (left turn, U-turn)

### Required Logipix components

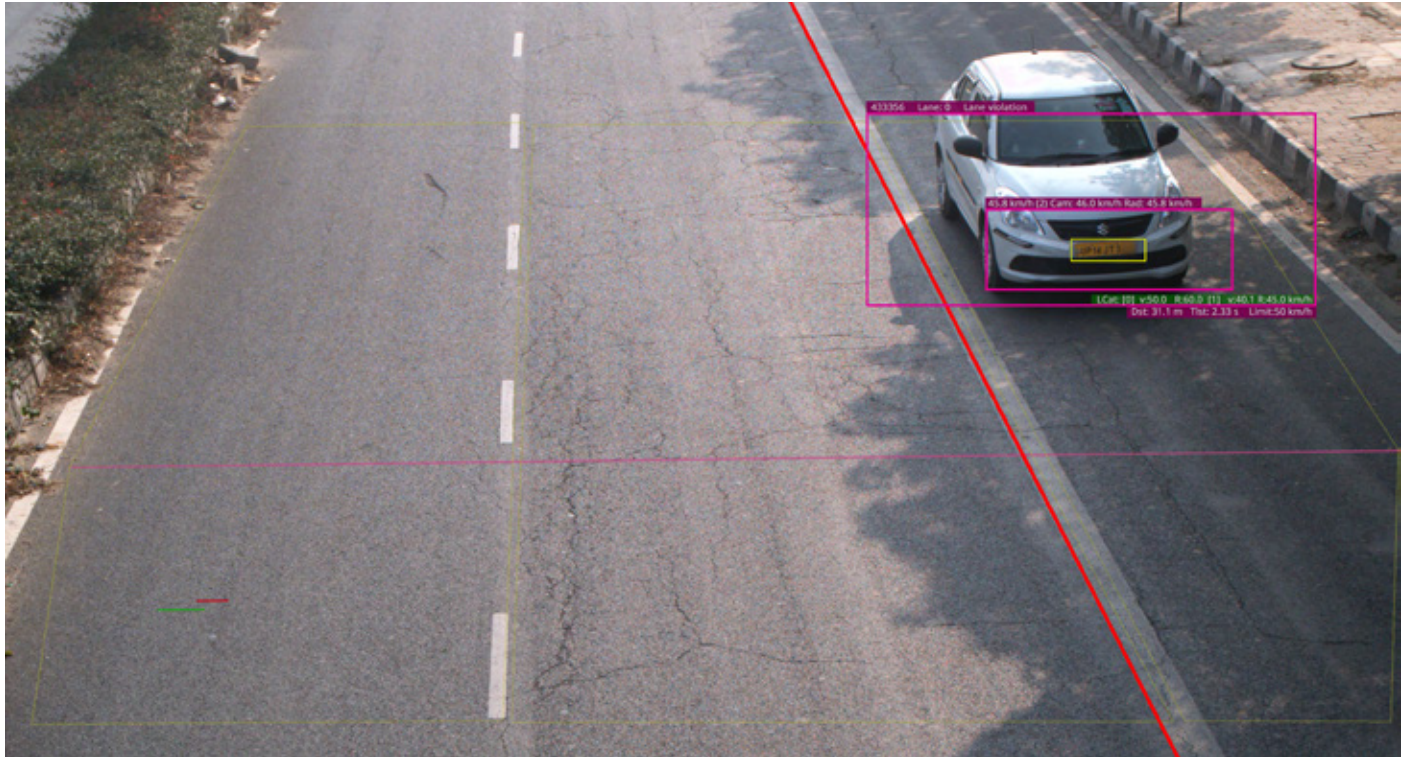
- 20 MP Traffic Camera
- IR Laser Flash
- 4<sup>th</sup> Generation Outdoor NVR
- Violation Management Server
- Violation Management Client

### Recommended Logipix components

- 3D Multi-lane Radar



# Lane Violation Detection



## Method

### Video Content Analysis & Radar (optional)

- vehicle position tracking
- violation »» vehicle moves into or stays in the restricted lane
- drop violation »» detecting authorized vehicle based on configured license plate exceptions (white list)

## Typical installation spots

- Intersections (all types)
- Streets
- Highways

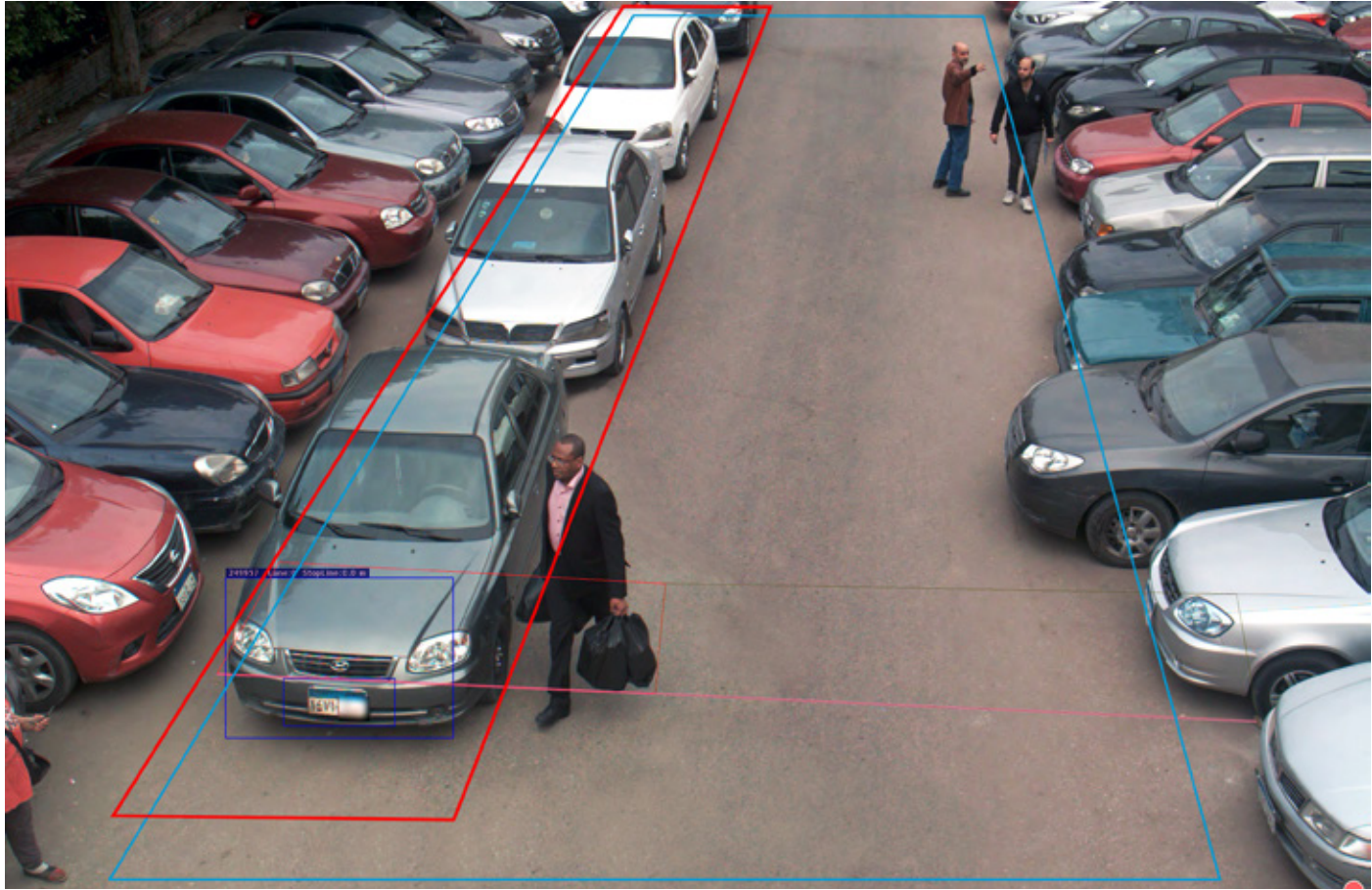
## Required Logipix components

- 20 MP Traffic Camera
- IR Laser Flash
- 4<sup>th</sup> Generation Outdoor NVR
- Violation Management Server
- Violation Management Client

## Recommended Logipix components

- 3D Multi-lane Radar

# Parking Violation Detection



## Method

### Video Content Analysis

- vehicle detection
- violation »» vehicle stays in the configured illegal parking zone
- drop violation »» detecting authorized vehicle based on configured license plate exceptions (white list)

## Typical installation spots

- Streets

## Required Logipix components

- 20 MP Traffic Camera
- IR Laser Flash
- 4<sup>th</sup> Generation Outdoor NVR
- Violation Management Server
- Violation Management Client



## Traffic Counting



### Method

#### Video Content Analysis & Radar

- image-based traffic counting without the use of physical inductive loop detector system
- vehicle detection and object feature extraction
- recognizing vehicle classes

### Typical installation spots

- Intersections (all types)
- Streets
- Highways

### Required Logipix components

- 20 MP Traffic Camera
- IR Laser Flash
- 3D Multi-lane Radar
- 4<sup>th</sup> Generation Outdoor NVR
- Violation Management Server
- Violation Management Client

## VIOLATION MANAGEMENT CLIENT

The Logipix Violation Management Client (VMC) is an intuitive software, wherewith operators and supervisors can process the automatically created violation packages. It allows for a quick and easy violation verification method. The software was designed with an easy-to-use interface that can be learned within minutes.

### Violation verification

The VMC displays the automatically prepared violation packages one by one from the violation queue. Operators only have to check the displayed violation key frame, ANPR and vehicle data and decide whether the captured situation was a real violation or not. Thanks to the transparent software interface they can perform this process in seconds.

The visual data content of the violation package is customizable, it only depends on customer needs. It can contain several violation frames and even a short video of the violation.

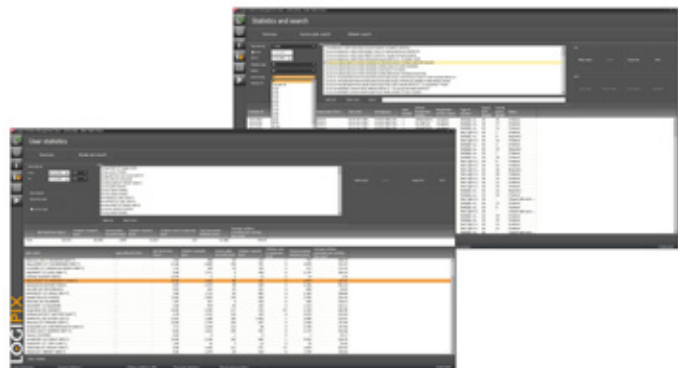




## User's hierarchy

VMC software usage is built on operator-supervisor operation. Operators only see distributed and queued violations during their work, which they can verify, reject or send to supervisors for further inspection.

Basically, supervisors see only those violations that have been sent to them by operators. However, they are allowed to revisit any violation and override operator decisions. Supervisors access special configuration functions and they are also able to query various operation statistics. They can oversee detailed user activity and analyze overall violation processing efficacy.



## TECHNOLOGIES BEHIND LOGIPIX FEATURES AND FUNCTIONS

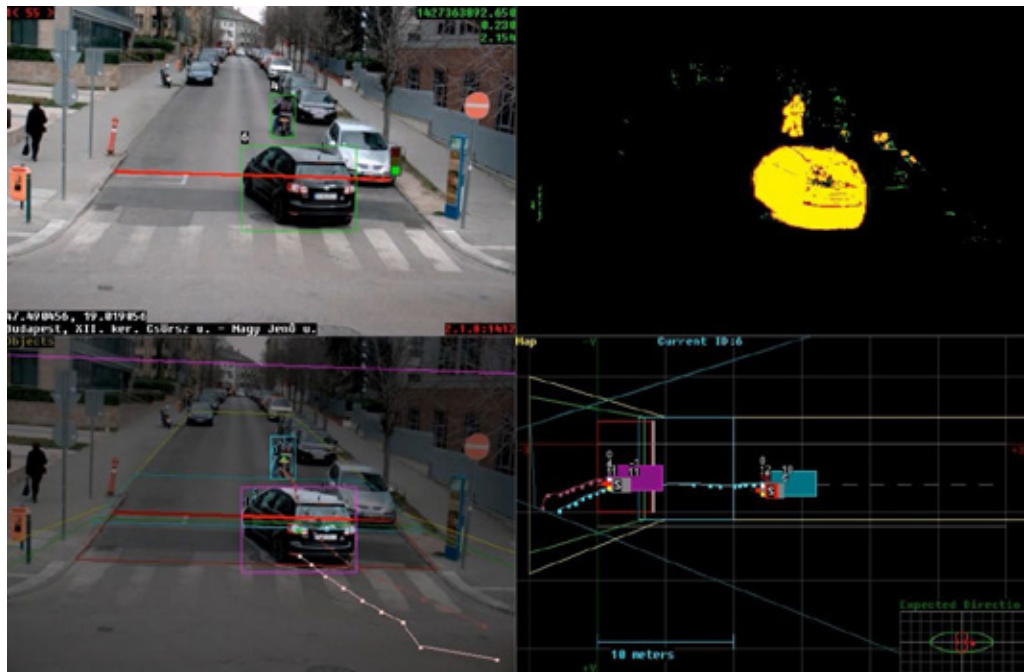
### Alternating flash intensity for night monitoring

Logipix created a special IR Laser Flash that is able to illuminate the desired area with alternating intensity. This technology is extremely useful when different types of license plates must be illuminated within the same traffic flow. The device is synchronized to the camera frame rate and it makes both reflective and non-reflective license plates visible even in complete darkness.



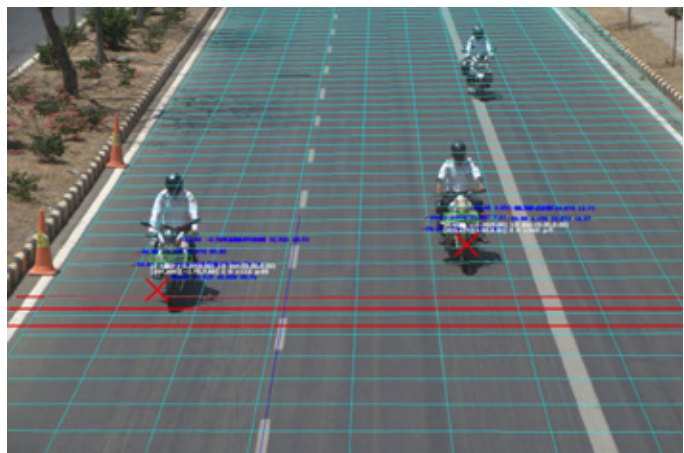
## Video Content Analysis

Logipix engineers developed specific Video Content Analysis functions for automatic traffic violation detection. The VCA relies on object feature extraction and advanced positioning and tracking algorithms that accurately recognize and analyse the motion of objects in the images.



### Sensor Fusion

Logipix created a special technology whereby the information of the image sensor and the radar are fused, resulting in a more accurate speed and position analysis. The technology ensures a high-performance environment for calculation as data processing happens in the hardware, as close to the sensors as possible. That means raw radar data is transmitted into the traffic cameras that performs a fused object position and speed analysis based on video content and radar data.







## On-site recording

Logipix NVRs are vandal-proof constructions with metal outfitted enclosures and security locks that ensure they remain intact during on-site operation. Their integrated thermal system, which consists of heat pipes, heat sinks with fans and Thermoelectric Peltier modules makes them resistant to even extreme weather and environmental conditions.



## KEY SYSTEM COMPONENTS

- **Logipix ONE 20 MP Camera**
- **Logipix 3D Multi-lane Radar**
- **Logipix IR Laser Flash**
- **Logipix 15 MP evidence camera**
- **Logipix Outdoor Network Video Recorder 4<sup>th</sup> gen**
- **Logipix Violation Management Server**
- **Logipix Violation Management Client**





## TECHNOLOGICAL STRENGTHS OF THE SOLUTION



- Logipix developed a wide dynamic range, 20 MP traffic camera that delivers 20 fps videos. It covers multiple lanes, therefore it remains effective in chaotic traffic situations. Thanks to its enormous resolution it takes recognizable images of even 3-wheeler or 2-wheeler license plates.
- Logipix is able to capture both reflective and non-reflective license plates in complete darkness. The IR Laser Flash illuminates the surroundings with an adjustable Field of Beam. It works synchronized to the camera and flashes with alternating intensity in order to illuminate both type of license plates.
- The specially designed Logipix 3D Radar covers multiple lanes and provides accurate position and speed information on moving objects.
- Logipix developed advanced Video Content Analysis functions to automatically detect all the common types of traffic violations. The VCA is able to detect different types of violations simultaneously.
- The Logipix Radar and the VCA can work together effectively. We developed a special Sensor Fusion Technology that uses both radar and image sensor data for analysis. The result is the most accurate vehicle speed measurement and object tracking possible.
- The Violation Management Server is built of task-specified server modules. Multiple server modules can be installed on multiple servers, therefore capacity allocation is more controlled. The size of the server park can be tailored to the size of the system itself.
- The whole system operation is automatic. Only the violation verification is performed by operators, who can easily process a large number of violations daily.
- The Logipix system ensures data integrity, which means all data remain intact and unchanged during their entire life-cycle in the system.



## CONCLUSION

With many years of experience in computer vision technology and traffic surveillance, Logipix created a versatile traffic violation detection solution that operates reliably even in the most challenging, dense traffic conditions with the highest accuracy possible. The system works 24/7 automatically, maximizing the number of the daily detected and also processed violations.

The Logipix Traffic Violation Detection Solution has already been installed within city-wide scale projects in some of the world's densest metropolises. These successful projects proved our concept that a state-of-the-art violation detection solution can operate reliably under difficult traffic conditions and may also result in more organized, smarter cities.



## 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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