# mallenom
## SYSTEMS

Machine vision
and machine learning

# Machine Vision and Machine Learning

Today, the level of intelligence of **machine vision systems** is so high that it enables to solve a wide range of production control and management tasks simply and quickly. Only a few years ago it was considered an exclusively human prerogative.

Machine vision systems based on smart cameras and sensors, as well as on special image processing algorithms, can significantly improve any manufacturing process – increase production rate, reduce the number of defects and production costs.

The use of **machine learning technologies** increases the intelligence of machine vision systems to the level of a human being. Taught on an initial dataset, a system can continue learning, i.e. enhance its efficiency without reprogramming its basic algorithms.

# Why use machine vision?

**Product safety guarantee**

- Anomaly detection
- Package quality control
- Decrease in the volume of low-quality products

**Quality and brand protection**

- Guarantee of product and package quality
- Product tracking
- Prevention of "package confusion"
- Net weight guarantee

**Performance improvement**

- Faster production lines
- Reduction of manual labour costs
- Quick changeover while manufacturing a wide range of products

# Why Mallenom Systems?

## Highly competent team

Mature team with knowledge of cutting-edge technology and extensive experience in implementing high-tech projects in different industries.

## Technological capabilities

Deep expertise in the field of machine vision and machine learning, technological capabilities of rapid development of new smart products.

## Artificial intelligence-based products

The systems developed by the company are based on both proprietary solutions built on neural networks and deterministic image analysis algorithms, as well as algorithms from the world leader in machine vision - Cognex.

## Qualified customer support

At the initial stage of the project, we conduct its technical evaluation and assist with equipment selection. Software and hardware training, and technical support are also available.

# Detection and identification

**27.000**
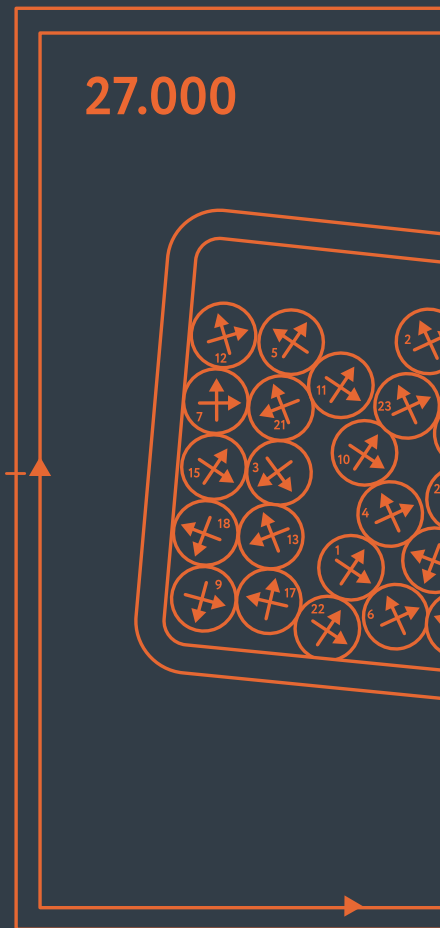
## Search for articles and their parts

- Object localisation
- Automatic devices and robots positioning

## Classification and grading

- Object classification by size, shape, colour, and surface texture
- Classification into groups, defined by an expert

## Object counting

- Counting finished products on a conveyor
- Counting articles in a package
- Presence verification

## Color-based identification

- Detecting colour deviations
- Detecting missing or excessive components by color
- Color identification for detection, measurement and counting

# Projects implemented

### Classification of rough diamonds by colour and shape

Machine vision cameras shoot a diamond as it free-falls. Classification is performed based on models, that apply proprietary machine learning methods and video analysis algorithms. Sorting rate is up to 20 diamonds per second.

Customer: ALROSA

### Determination of bumper type and its correlation with the value of the skid RFID tag

The system based on In-Sight smart cameras checks for bumper presence and type. The system is integrated with a line controller via ProfiNet protocol. A special large-size, high-power and bright background illuminator (700 W and 64,000 lm) was developed for this task.

Customer: Manufacturer of bumpers for Volkswagen, Skoda, etc.

### Recognition and counting of metal tubes in a box

3 counting systems based on Cognex cameras, specialized illumination, and Cognex VisionPro software have been successfully implemented at the enterprise. The task was a challenge because of the glistening surface of the object under control and customer requirement for 100% accuracy.

Customer: Machine builder

## Advantages:

- High accuracy and reliability
- Size and positioning independence
- High-performance algorithms
- Illumination and line speed independence

# Quality control

## Integrity control

- Detecting holes, ruptures, and other integrity violations

## Defect detection

- Detecting visible defects on the surface of manufactured products and packages
- Deffect classifications

## Printing quality control

- Detecting resist spots, blurs, and gaps in printed images or texts

# Projects implemented

### Quality control of sugar beets in a truck

At the time of the truck registration, a signal is taken from the recording system to capture the truck body. Images are analysed using neural networks: beet contamination, amount of chips and grass, and presence of snow are determined. According to the data obtained, the sugar beets are classified into quality categories.

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Customer: Rusagro

### Quality control of plastic bottles on a line

The Cognex smart camera searches for foreign plastic objects and any deviations in the brightness of the bottom, such as plastic beads or holes more than 3 mm in diameter. Task complexity resides in the determination of inclusions both of the same material and colour as the bottle. Specialized background illumination is used in the system.

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Customer: ALPLA Chekhov

### Quality control of tablets and capsules

The Cognex smart camera performs automatic, non-contact presence verification and quality control of tablets and capsules in open blisters as they are moving along the line. Task complexity lies in the variety of sizes of the objects under control, variable product orientation, presence of a break line, high speed of control.
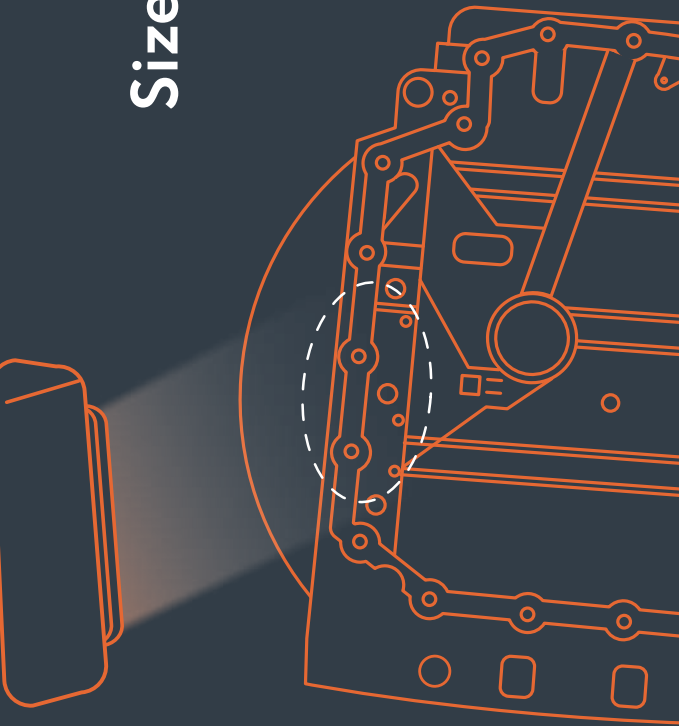
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Customer: Several pharmaceutical enterprises

## Advantages:

- High accuracy
- Illumination and line speed independence
- Repeatable results

- Improved analysis of pattern matching
- Size and positioning independence

# Size and shape control

## Edge inspection

- Searching boundary and contour deviations

## Critical dimension measurement

- Measuring geometrical dimensions of articles, angles
- Pattern matching and tolerance checking
- Checking conformity to specified characteristics

## Shape inspection

- Verifing presence of holes and other 2D shapes
- Matching 2D shape of the article with a pattern
- Recognizing 3D shape and its deviations from the pattern

# Projects implemented

### Control of hot rolled steel cutting

A linear smart camera in a water-cooled housing captures the mill in real time at a speed of 5000 lines per second. When the rolled steel reaches the required width, a control signal is supplied to cut steel with flying shears. The control point is located in severe conditions: in the area of high temperatures.

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Customer: Severstal PJSC

### Dimensioning of nanofiltration membrane pores

In membrane production, it is critical that the pores are distributed evenly, and large openings (holes) do not occur. The developed software allows to localize pores on membrane images obtained by using an electronic microscope, to calculate their dimensions and to detect holes that are inadmissible in size.

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Customer: Joint Institute for Nuclear Research, Dubna

### Control of sealant applied to the engine cylinder block

Two systems based on the Cognex high-resolution vision cameras and a recognition server have been successfully implemented to determine deviations of sealant thickness, its position, sealant breaks. Communication with external devices is provided via the OPC protocol. A separate camera monitors sealing ring defects.

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Customer: ThyssenKrupp System Engineering LLC for a large car manufacturer

## Advantages:

- High accuracy of measurement
- Size and positioning independence
- Illumination and line speed independence
- Efficient contour detection
- High rate

# Assembly verification

## Completeness verification

- Verifying completeness in the process or upon completion of article assembly
- Cheching article presence in the package
- Verifying presence of design elements

## Positioning verification

- Verifying correct positioning of article components
- Checking correct positioning of articles in the package

## Verification of presence and positioning of packaging elements

- Controlling seal integrity, cap and label presence, as well as presence of any visible element of the package

# Projects implemented

### Verification of bottle cap presence

The Cognex vision sensor checks for the presence and proper position of a cap on the bottle. Control is carried out on a high-speed bottling line. When a defect is detected, a control signal is issued to reject low-quality products.

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Customer: Large effervescent drink manufacturer

### Verification of label presence on oil cans

The Cognex vision sensor checks for the presence of labels on engine oil cans. If necessary, search for print defects and label matching with a pattern can be carried out. In case defect is detected, a control signal is issued to stop the line.

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Customer: Large manufacturer of oils and process liquids

### Verification of washing machine legs presence

The Cognex vision sensor checks for the presence of washing machine legs. In case defective products are detected, a control signal is issued to stop the line. Defective product statistics is gathered. The system can process 4 types of washing machines on the line.
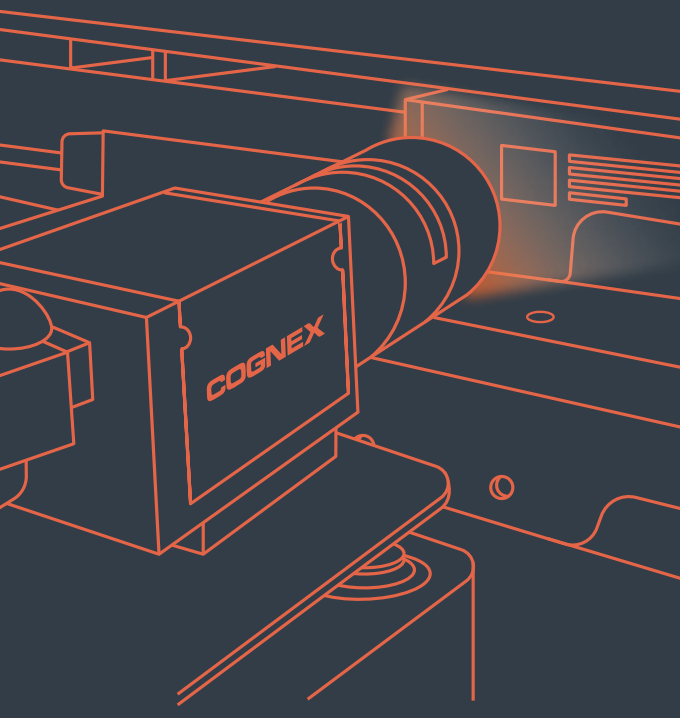
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Customer: Large manufacturer of household appliances

## Advantages:

- High rate
- Illumination and line speed independence
- High accuracy
- Size and positioning independence

## Code reading and verification

- Alphanumeric code reading
- 1D and 2D barcode reading
- DPM code reading
- Embossed text tags reading
- Reading of non-standard marking

## Multiple code reading

- Reading up to several hundreds of codes in one image
- Forming an array of code coordinates in the image

## Code verification

- Quality evaluation of code applying in compliance with the international standards

# Projects implemented

### Reading of Dot-Code and text marking from cigarette packs

The specialized Cognex smart camera reads simultaneously Dot-Code and text marking. The challenge is to read marking at a high rate from 4 packs at once (customer requirement), the small size of marking and complex method of its applying.

Customer: Imperial Tobacco Volga LLC

### Reading of identification number from metal tubes

The system based on the Cognex vision cameras and recognition server reads and recognizes the identification number applied to the article and prints the label. The challenge of the task is to read from cylindrical glistening metal surfaces. Twenty control points have been successfully implemented.

Customer: Machine builder

### Identification of fuel assemblies by marking

The system based on machine vision cameras and a recognition server ensures visual recognition of fuel assembly numbers and their transmission to the server via the Ethernet. The challenge: lack of unified marking, severe conditions at the control point, and customer requirement for 100% accuracy of reading.
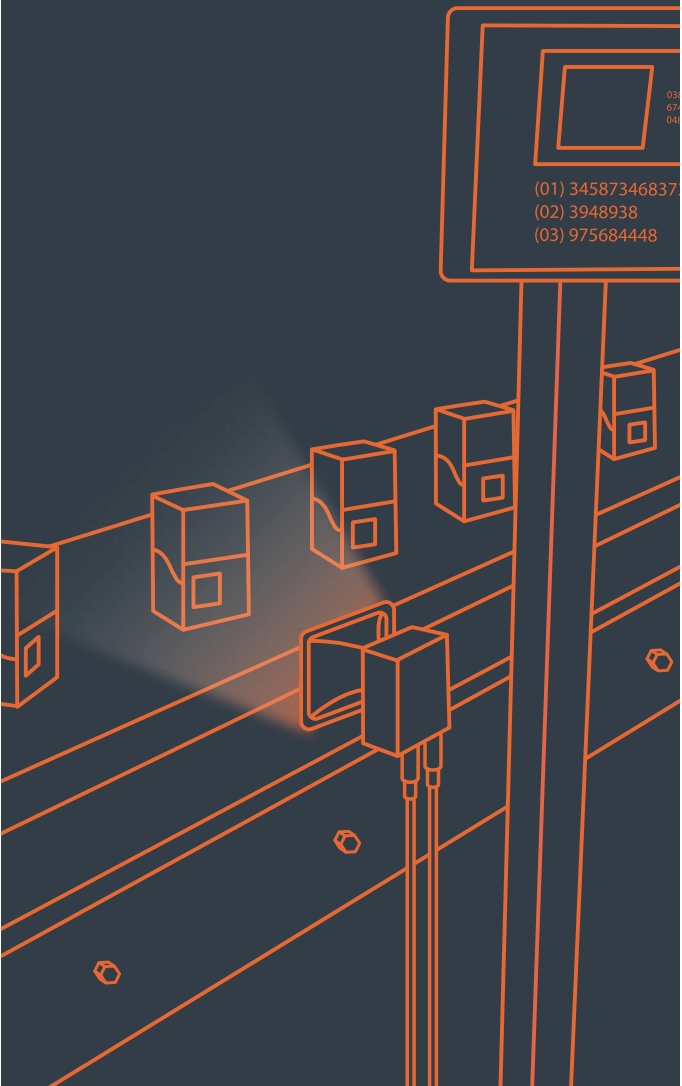
Customer: Nuclear industry enterprise

## Advantages:

- Reading of marking from different surfaces and on flexible packages
- Reading of low-contrast, indistinct, and damaged marking
- Reading of small marking
- High rate
- Multidirectional reading

# Tracking

## Marking

- Printing of check information on the article or package
- Verification of print quality in compliance with quality standards

## Serialization

- Assignment of unique identification code to each article or each consumer package

## Aggregation

- Generation of transport package code in relation to codes of serialized articles or secondary packages contained within

## Product tracking

- Identification of articles by marking and/or appearance
- Product control and accounting at technological conversions
- Photo/video recording of all articles in the database

(01) 345873468373
(02) 3948938
(03) 975684448

# Projects implemented

### Tracking of alcoholic beverages

The systems based on the Cognex cameras or readers detect DataMatrix codes on federal or excise stamps and caps on positioned and non-positioned bottles. Aggregation is provided. Obtained data are transmitted to the state information system.

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Customer: Several liquor manufacturers in Russia and Armenia

### Tracking of pharmaceuticals

The system generates and prints codes on the secondary package, checks correctness and quality of code application, rejects package with poor-quality code, controls packaging when stowing in a box, labels tertiary package, registers data in the top-level system.

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Customer: Several pharmaceutical manufacturers

### Tracking of pipes by marking

The system based on the Cognex machine vision cameras and identification server reads digital markings from pipes. Recognition is performed in motion: while the pipes are rotating around their axis. The challenge: low quality of marking, large control area, glistening surface, and a wide variety of pipe products.
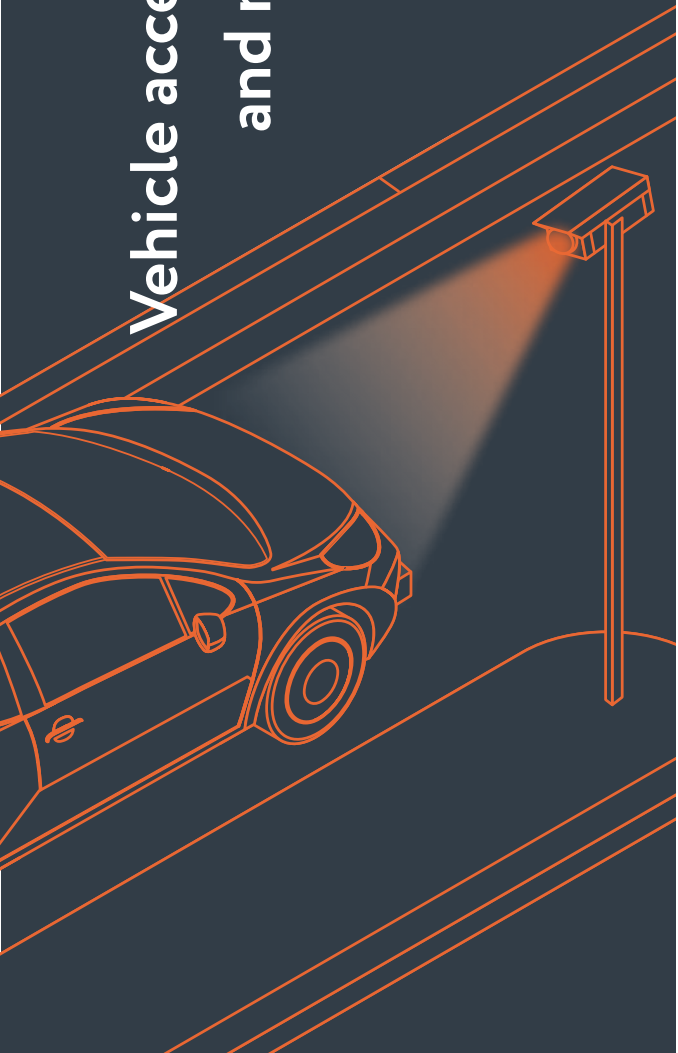
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Customer: Large iron and steel enterprise

## Advantages:

- Integration with operating equipment
- Integration with external systems
- High performance
- Scalability

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**Vehicle access control and monitoring**

## AUTOMARSHAL

system to control vehicle access to the territory of an enterprise

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### Tasks in the focus:

- Security automation

- Reduction of time required to make decision on access of each given vehicle to the enterprise territory

- Theft prevention due to vehicle and cargo recording

- Saving information on all entering and exiting vehicles, statistics, and reports

- Integration with information systems installed at the enterprise and automation of business processes due to the use of vehicle traffic information

# Projects implemented

Automation  of vehicle access
to the territory of manufacturing
enterprise

The Automarshal system controls
vehicle access to the territory of
two Fazer plants in Saint
Petersburg and Moscow ( 8
checkpoints), with data transfer
to a single centralized database.
Record of drivers and passengers
is kept. Vehicle location and
availability of free parking spaces
in the enterprise parking lots are
tracked.

Customer: Fazer

Control of tenants' vehicles access
to the logistics center with
account for allocated
parking spaces

The Automarshal system
automates access of tenants'
vehicles to the territory of a
logistics center in accordance
with the number of parking
spaces allocated for each of
them. Access is controlled by
means of a barrier and magnet-
ic induction loops, which
allows to avoid tailgating.

Customer: Prime Logistic

Automation of oil product
loading/unloading accounting
at the container gas station
of the enterprise

Automarshal is a part of an
integrated system for oil
products accounting. It recogniz-
es vehicle number plates and
transfers information to the
automated workstation "Oil
depot". Obtained data are used
by the system to maintain the
log, generate reports and bills for
loading/unloading operations.

Customer: GC Agrosy

**Automation of vehicle weighing**
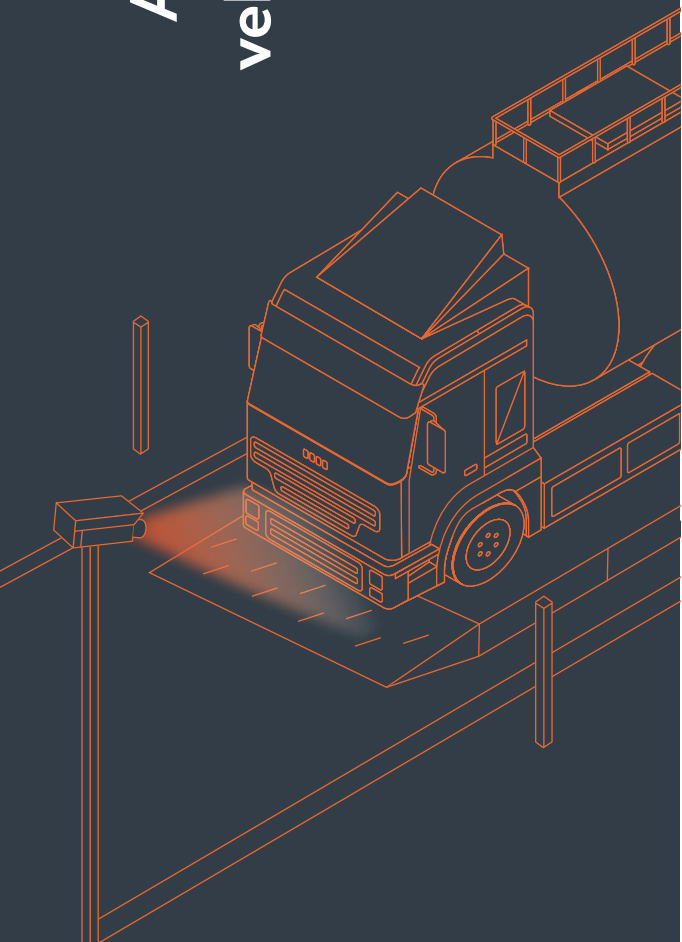
## AUTOMARSHAL.WEIGHBRIDGE

hardware-software complex for automation of weighbridges

The functions include recognition of vehicle number plates, automatic calculation of net weight, weighing without operator, control of traffic lights, barriers and illumination, automatic generation of documents, video surveillance, etc.

### Tasks in the focus:

- Reduction of human factor in the weighing process

- Labor saving and weighing process acceleration

- Increasing transparency of weighbridge operation

- Workflow automation

- Generation of data for complaint work

- Vehicle overload control (avoiding overweight fines)

- Photo/video recording of each vehicle on the weighbridge

# Projects implemented

**Automation of the weighing station at gas producing enterprise**

Automarshal.Weighbridge ensures control of product shipment, with data being transfered to the information system of the enterprise. At customer's request, a feature was added: when recognizing rear number plates, the truck number plate is skipped and only the trailer number plate is read.

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Customer: Air Liquide Kstovo LLC

**Automation of weighing, prevention of misconduct during product shipment/acceptance**

Automarshal.Weighbridge includes 2 video cameras for number plate recognition and a surveillance camera to record cargo body contents. For this project, the possibility of blocking data changes "retroactively" has been implemented, which helps to prevent fraudulent activities of operators.

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Customer: Ammoni JSC

**Automation of vehicle weighing at mining and processing plants using RFID system**

Vehicle identification is performed by reading RFID tags. After that Automarshal.Weighbridge receives data on the vehicle (type, make, number plate, garage number), it associates them with the vehicle weight, determines the weighing type, and displays net weight data.

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Customer: MMC Norilsk Nickel PJSC

**Video control and accounting of railcars, containers, and tanks**

## ARSCIS

hardware-software complex for railcar identification and inspection, railway scales automation

A family of solutions for railcar identification, management of product shipment by rail, commercial inspection of railcars, control of railcar movement and location, based on the railcar number recognition system and solving metrology, logistics, and security tasks.

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### Tasks in the focus:

- Human factor exclusion
- Total control over railcar movement
- Transparent shipment using railcar scales
- Reduction of expenses and irretrievable losses
- Faster execution of documents for railcars

# Projects implemented

## Acceleration of product shipment/acceptance by rail

The ARSCIS system automates railway scales, calculates net weight of each railcar. Photo/video recording and documentation of weighing are provided. The system automatically controls illumination to ensure best recognition of railcar numbers. Integration with enterprise information system is provided.

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Customer: Rosneft Oil Company PJSC

## Control of railcar location in the enterprise territory, workflow workflow automation

The ARSCIS system compares numbers of the railcar and the transported cargo with data specified in the documents, performs an external inspection of each railcar and controls the filling level using thermal imaging cameras. Automatic generation of customized reports is provided.

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Customer: Transneft PJSC

## Commercial accounting and control of logistics operations on the railway lines of the enterprise

The ARSCIS system provides recognition of railcar numbers and their automatic weighing, keeps record of shipped/accepted products, automates workflow. The complexes are implemented at 21 sections of railway lines at 4 enterprises.

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Customer: Bashneft JSC

# Partner System Integrator of Cognex

**COGNEX**

Mallenom Systems is the only official partner system integrator (PSI) in Russia and the CIS of **Cognex** – the worldwide leader in industrial machine vision.

Cognex PSI status means that we are trained, experienced, and acknowledged experts in the Cognex brand. Cognex trusts our company and confidently recommends us to the customers seeking system integration solutions.

## Supply of Cognex equipment:

- Machine vision cameras
- Barcode readers
- Vision sensors
- Smart cameras

- Machine vision software
- Illuminators
- Verifiers
- Accessories

# Works performed

### Front end engineering

- Pre-project inspection
- Development of technical specifications and other project documentation

### Software development

- Development of both separate modules and distributed information systems with modern user interface

### Hardware supply and configuration

- Delivery, installation, setup, and commissioning of all supplied machine vision equipment

### Service and warranty maintenance

- Consulting and engineering support
- Warranty and post-warranty service maintenance

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# About the company

**MALLENOM SYSTEMS** – one of leading developers of machine vision and machine learning systems in Russia.

The company has successfully implemented a wide rage of science-intensive IT projects in transport, engineering, oil and gas, metallurgy, food, pharmaceutical, diamond mining, nuclear and other industries.

The company's products are represented in most regions of the Russian Federation, the CIS and EU countries. The company's unique implementation experience and know-how ensure rapid development of new high-tech products and solutions.

## Our Partners:

COGNEX  iTeco  NIS GLONASS

LINE video surveillance system  MITSUBISHI ELECTRIC  TENSOFT

**50+** partners

## Our Customers:

Severstal  BOSCH  BASHNEFT

LUKOIL  GAZPROM NEFT  P&G

Pharmstandard  ALROSA  MICRODIGITAL

**80+** loyal customers
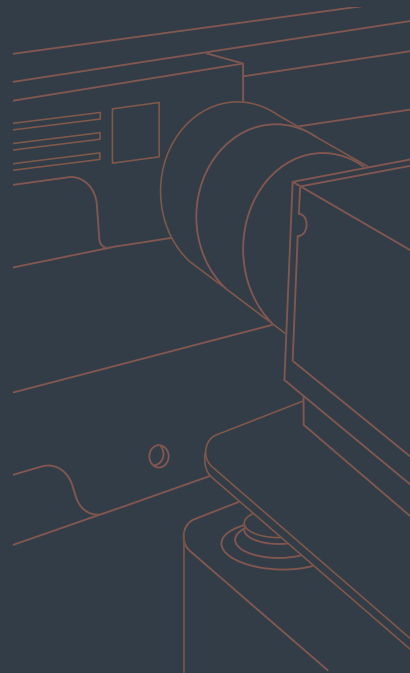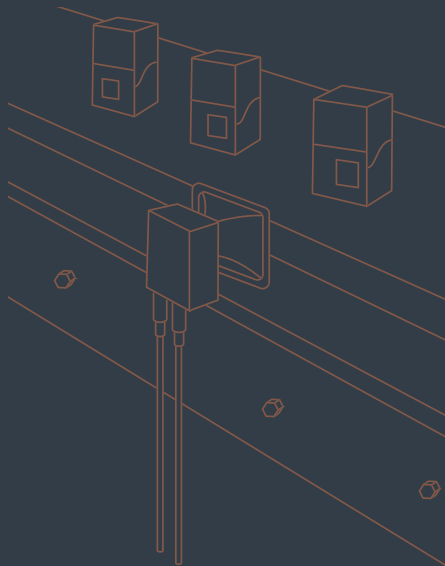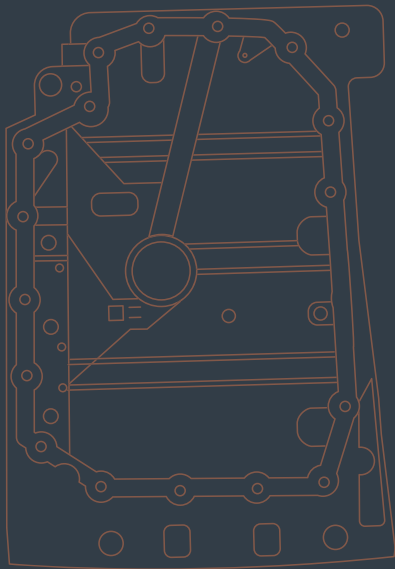
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