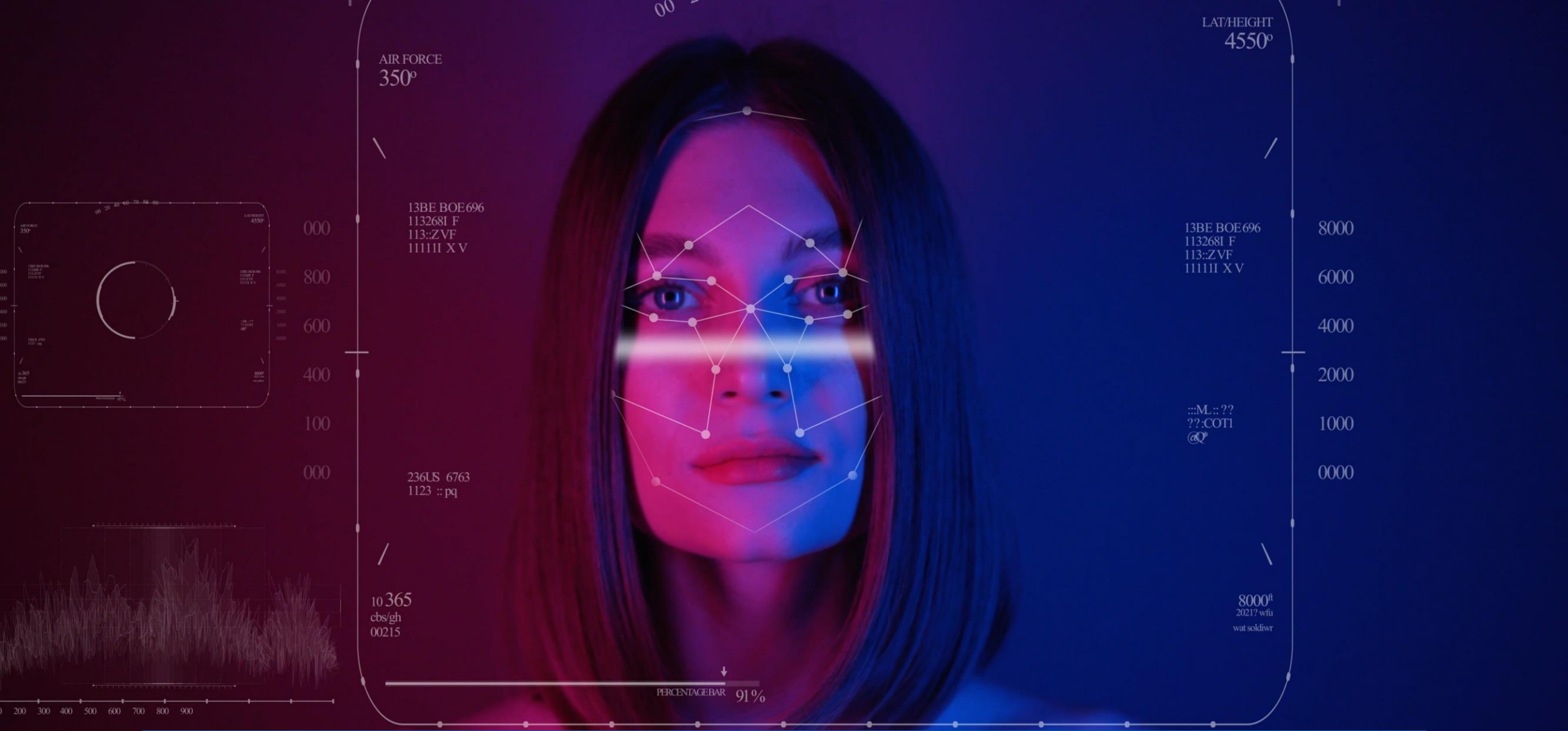


Reco 3.26
Smart Recognition System

www.reco326.com

RECO SOLUTIONS, PLATFORMS AND ALGORITHMS

Lecce, May 2023

Reco 3.26

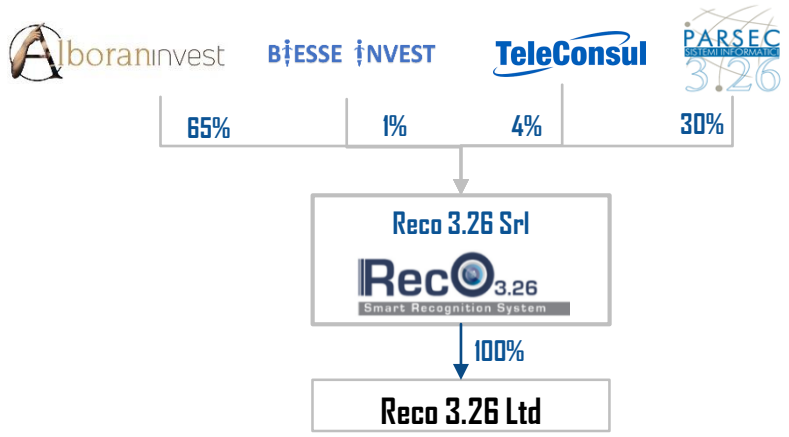
Company and Offices

Reco 3.26 srl was born in 2018 and it's based in Italy and UK. To date, it's an **innovative SME**, one of the **top Italian players** in the field of **Artificial Intelligence** applied to **Computer Vision**.
Reco 3.26 offers innovative, sustainable and customized solutions to companies and public/government entities around the world. It acts with a sense of environmental and social responsibility.
In 2018 the company developed its first product, the **S.A.R.I.,** for the Ministry of the Interior and the State Police, based on **Intelligent Recognition** (Facial Recognition) and **patented in Italy** and **in USA**.
The company is able to respond to customer needs in terms of: Security and Access Control; Intelligent Passenger Flows Management and Border Control; Logistics & Supply Chain Services; Quality control; Recognition of faces, behaviors and emotions; Object recognition; Training and Exams; Health; Smart Cities.
The main customers who use the 4.0 technologies offered by Reco 3.26 operate in the following sectors: Public Administration and Public Services; Commerce and Transportation; Industrial Production and Manufacturing; Finance; Telecommunications; Tertiary.

Corporate Structure

The control of Reco 3.26 (65%) is held by Alboran, a company attributable to Simone Pratesi (CEO). A further 1% stake is held by Biesse invest (Vieri Spadoni - CFO). The 4% is instead held by Teleconsul Editore S.p.A..

The remaining 30% is controlled by the industrial partner Parsec 3.26 Srl, an ICT company, founded and controlled by Bruno Scalpello, which has been on the market for over 20 years with a wide range of services for the management of public administration IT systems



MARKETS AND SOLUTIONS

Safety and Security

Solutions that allow you to certify the identity of subjects, monitor and control specific video surveillance areas and detect the presence of suspicious subjects.

The Automatic Image Recognition System (S.A.R.I) is a Video Analysis software capable of processing images/videos by identifying faces and comparing them in real time (<1.5 sec) with the reference image

Passenger flow management & Border Control

Solutions for the intelligent management of passenger flows and border control, which can be integrated into airports, ports and stations.
The solutions, through the use of a biometric recognition system and in a completely automated and seamless way, allow you to manage the stages of registration, identification, check-in, embarkation and disembarkation.

Access control

Solutions for managing entrances and exits, to control the access of people and / or vehicles to restricted areas of companies, fairs, ports, etc. (also equipped with turnstiles or motorized gates).
It's also possible to customize the solutions by integrating the system for checking the presence, body temperature, possession of the mask and the Green Pass

Health and Smart City

- Innovative solutions as a concrete response to the crisis caused by the Covid-19 pandemic, transforming the provisions of the Italian Government in the various DPCM into technological products useful for Private Companies and Public Bodies.
- Solutions to monitor urban areas and traffic and pollution levels and to provide support for operational and management decisions

Industry and Logistics 4.0

- Solutions to automate the quality control of materials in the aerostructures and fashion sectors and for the measurement of clothing.
- Solutions to ensure high levels of safety in the production and distribution phases of Green Hydrogen and for predictive maintenance
- Solutions to make logistics services more efficient, applying the paradigms of Industry 4.0 in the storage, handling and transport phases.

Training and Exams

Innovative solutions to certify the identity of participants in training courses, exams and public competitions both remotely and in presence. These solutions allow to verify anomalous behaviors and to improve the training experience. It's also possible to customize the solutions by integrating the Green Pass verification system

MAIN CUSTOMERS:

MINISTERO DELL'INTERNO
Polizia di Stato
Posteitaliane
SPORT E SALUTE
MILAN BERGAMO AIRPORT BGY
aeroporto di catania
AEROPORTI DI PUGLIA
ATM AZIENDA TRASPORTI MILANESI S.p.A.
LEONARDO
OVS
TeleConsul
sirfin

Reco 3.26
Smart Recognition System

SOLUTIONS

- PUBLIC SECURITY
- STADIUM SECURITY
- FACE2FLY
- ENTRY EXIT SYSTEM
- FACE CAPTURE TOTEM
- FACE2SAIL
- PEOPLE ACCESS CONTROL
- COVID-19
- REMOTE CERTIFIED TRAINING (FOCE)
- CERTIFIED TRAINING IN PRESENCE (ECM)
- EXAMS AND PUBLIC COMPETITIONS
- RECO SMART PARKING
- FAIR ACCESS MANAGEMENT
- SECURE AUTHENTICATION AND PAYMENTS
- SMART CITY, URBAN SECURITY SYSTEM

PLATFORMS

- NDI CHECKS
- RECO WRINKLEMETER
- AUTOMATIC ALUMINUM INSPECTION
- AUTOMATIC INSPECTION OF MATERIALS AND PRODUCTS
- RECO DIGITAL METER
- DIGITAL INFRASTRUCTURE FOR GREEN HYDROGEN PLANTS
- DRONE SCANNER
- CRITICAL INFRASTRUCTURE

ALGORITHMS

- FACE RECOGNITION
- IDENTITIY VERIFICATION
- ANTI-SPOOFING
- OBJECT RECOGNITION
- PLATE RECOGNITION
- EMOTION RECOGNITION
- ABNORMAL BEHAVIOUR
- PEOPLE CROWD DETECTION
- PEOPLE COUNTING
- SOCIAL DISTANCING
- VEHICLE COUNTING
- VEHICLE SPEED DETECTION
- ROAD SPACE ANALYZER
- CARRIAGEWAY CROSSING DETECTION
- DETECTION OF A VEHICLE IN THE WRONG DIRECTION

SOLUTIONS > SAFETY & SECURITY

PUBLIC SECURITY

Main Customers: MINISTERO DELL'INTERNO Polizia di Stato

The solution developed by Reco, for which a patent has been granted in Italy and the USA, makes it possible to make the management of public safety more efficient

Face Finder

The solution allows you to compare a face in a video stream, with thousands of faces in a database

- Less than 1 second to search through 20 MILLION faces
- The system is designed to search for an identity by combining different recognition algorithms (also in parallel)
- The solution is able to integrate facial recognition and face tracking algorithms, even from different providers

Face Real Time

The solution is capable of analyze real-time video streaming from IP cameras by detecting faces in unconstrained environments and with non-collaborative subjects, identifying individuals against a predefined list of suspects

- 50 milliseconds to search 100K faces
- Able to identify all faces in each frame
- Real-time alert functionality
- Recognizes faces in different poses (neural network estimation)
- The system is designed to search for an identity by combining different recognition algorithms (also in parallel)
- The solution is able to integrate facial recognition and face tracking algorithms even from different providers
- Police officers can use a mobile app integrated into the same scenario, in order to easily verify each specific subject in real time

Markets: State police and government agencies around the world

Main Clients: Ministry of the Interior and State Police, National Central Anti-Crime and Scientific Police Department

STADIUM SECURITY

The solution makes it possible to detect and identify the presence of attentive subjects at the entrance or inside the locations and protected and sensitive areas of the stadium.

The solution allows you to **analyze in real time the faces captured by the cameras** and is used by law enforcement agencies for the **management of activities to protect public order.**

It allows the identification of **subjects with suspicious behavior positioned in the stadium bleachers** (e.g. handling smoke bombs and firecrackers) as well as reporting to the inspectors any **unauthorized persons to access the stadium.**

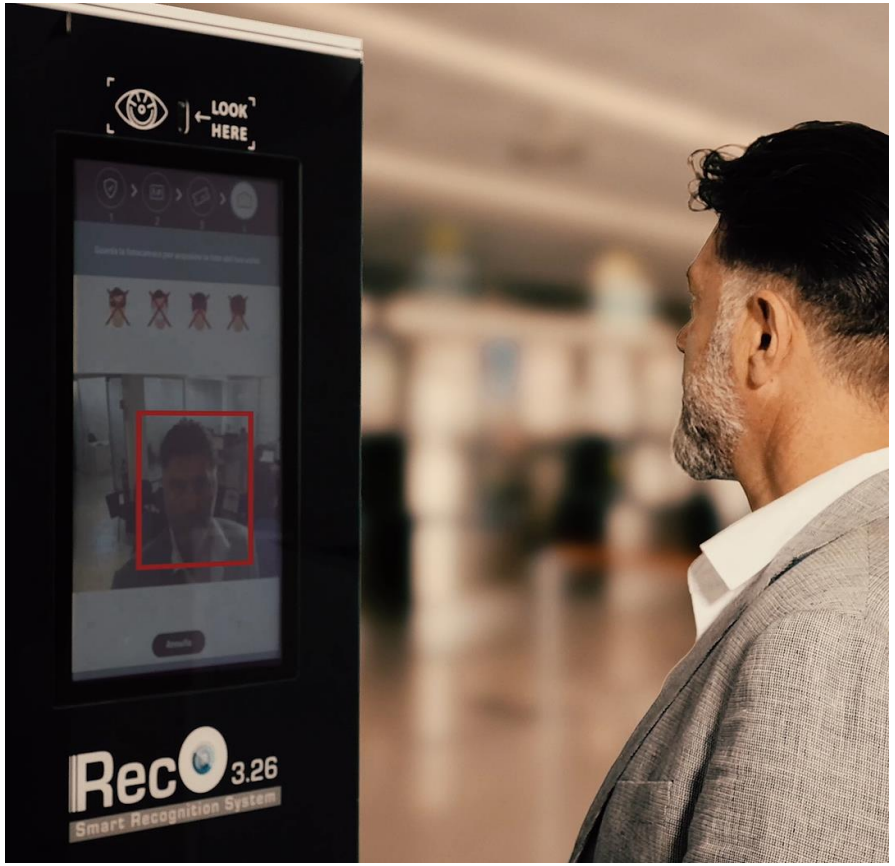
All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure.

Markets: Stadiums from all over the world, including 143 Italian stadiums

Main Customers: SPORT E SALUTE

SOLUTIONS > PASSENGER FLOW MANAGEMENT & BORDER CONTROL

FACE2FLY



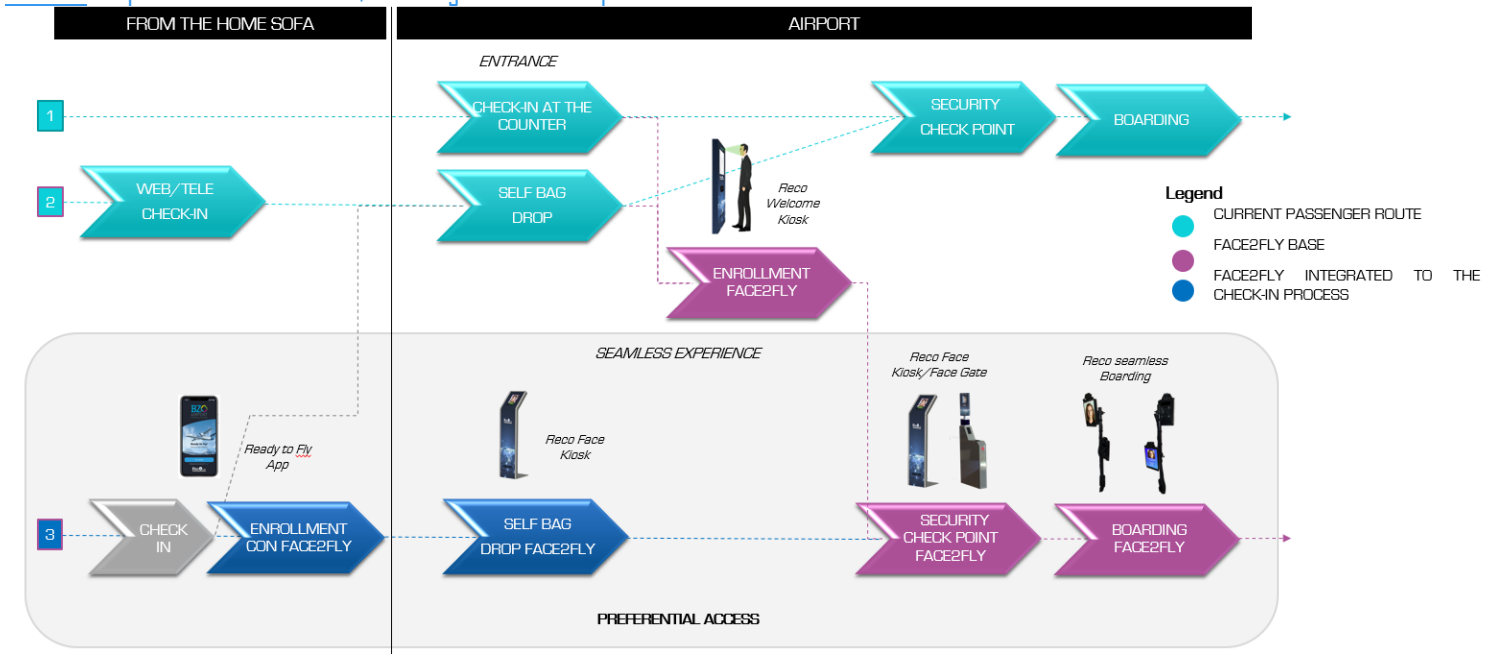
Main Customers: Orio al Serio international airport – S.A.C.B.O. S.p.A. · aeroporto di catania

Reco 3.26 offers a solution, called Face2Fly, for the management of passenger flow, through a biometric identification system, from check-in to the boarding gate, in a fully automated and seamless way.

Passengers, after checking in on the web or at the airport, can go to the 'land side' of the departures area and use the ***Reco Welcome Kiosk*** to register, by associating their face with the electronic identity document. and the boarding pass provided by the same. You will then be able to pass the subsequent security checks via ***Reco Face Gate*** and go to the boarding gate, where access authorization will be verified via ***Reco Face Boarding***. All without having to use an identity document or travel document.

It's also possible to provide a system dedicated to frequent flyers to allow them to save their digital identity in the system for a predefined period of time. In this case, it will be sufficient to match the boarding pass to the stored identity to be able to seamlessly access the airport.

Markets: Airports around the world, including 126 Italian airports



SOLUTIONS > PASSENGER FLOW MANAGEMENT & BORDER CONTROL

ENTRY EXIT SYSTEM

Self Service Kiosk

Reco 3.26 offers a solution for managing the Schengen external borders through a biometric identification system, which can be installed at airports and ports.

The entry / exit system (EES) will allow the registration of travelers from third countries, both short-stay visa holders and visa-free travelers, whenever they cross an external EU border.

The system will record the name of the person, the type of travel document, the biometric data (fingerprints and facial images acquired) and the date and place of entry and exit, in full compliance with fundamental rights and data protection.

The traveler, in the first instance, carries out **the Pre-Enrollment** through **Self service kiosk**.

The system:

1. Verifies **the authenticity of the travel document and acquires passenger data**;
2. Check **"self-service station" eligibility**;
3. Check the **EES relevance**;
4. Acquires the **biometric image of the face** and verifies the **identity**;
5. Acquires **fingerprints** in the case of the first file;
6. Record the answers to the completed **multiple choice questionnaire**,

for incoming passengers only;

7. Register/Update **EES data**

Subsequently, at **E-gate**, the system:

8. Verify the **authenticity and integrity of the travel document**;
9. Verify the **legitimate ownership of the travel document by the passenger**;
10. Record the necessary **passenger data**;
11. Checks the **eligibility of the border crossing by the passenger**, in accordance with predetermined rules

Markets: Airports and ports

Reco E-Gate*

**you must have an e-passport and be at least 14 years old*

Main Customer: Orio al Serio international airport S.A.C.B.O. S.p.A. · aeroporto di catania · AEROPORTI DI PUGLIA

SOLUTIONS > PASSENGER FLOW MANAGEMENT & BORDER CONTROL

FACE CAPTURE TOTEM

Main Customer:

The “Face Capture Totem" solution, designed and developed by Reco 3.26, is the result of a valuable research and experimentation work.

The following are the benefits for the client of using the solution:

- Guarantee of compliance with safety standards and with current legislation on data processing;
- Enhanced border control;
- Reduction of manual control operations and evaluation of the related results;
- User-friendly and intuitive devices. Modern, fast and safe process;
- Reduction of queues and waiting times;
- Greater protection from dangerous situations;
- Fully Automated Process.

The "Facial Image Capture Totem" is made of steel and aluminum with a painted glass front and it’s equipped with: display 10.1; antispoofing camera (3D camera); face capture camera (2D camera); automated vertical sliding system of the camera-monitor block; led lighting system; "intercom" system; bumb rails.

The use of various construction solutions affects not only some purely aesthetic aspects but also production and functional aspects: on the one hand, by optimizing production times, on the other by allowing a high degree of customization of the components, particularly useful for supporting the required services, reducing the overall dimensions. From the design point of view, the vertical movement mechanism of the camera for the acquisition of facial biometrics and the perfect "usability" of the solution in full compliance with the ADA regulations are highlighted.

The ISO9001 certification of the manufacturer ensures compliance with the quality procedures necessary for the treatment and processing of materials.

All the steps that make up the process are completely automatic: from the start and adjustment of the movement of the camera, to the acquisition of the best front face, up to the return of the face image to the calling application.

Markets: Airports, Station, Ports

SOLUTIONS > PASSENGER FLOW MANAGEMENT & BORDER CONTROL

FACE2SAIL

Reco 3.26 offers a solution for the passenger flow management, through a biometric identification system, from check-in to the boarding gate, up to landing gate, in a fully automated and seamless way.

The solution developed by Reco allows you to:

1. Carry out the enrollment at the Welcome Kiosk: once the passenger has given his consent to the processing of personal data, he will first insert his "electronic identity document" and then the "boarding pass" in the appropriate scanner for validity check. Subsequently, the kiosk will invite the passenger to lend his face to the webcam to take a photo of him in order to carry out the biometric verification and for a subsequent biometric identification near the security checkpoints. The passenger will be given a barcode. If necessary, the personal information (including the fingerprint) can be transferred to the authorities for an additional control via S.A.R.I.
2. Identify the passenger, by facial recognition, at the Face Kiosk: the passenger will be recognized by means of the facial biometrics, the barcode will be verified, the tracking of the passage from the check point will be carried out and will be notified to video.
3. Carry out the e-boarding/landing: the passenger arriving at the gate will be invited by an operator to lend his face to the "mirror" of a kiosk, for identification, through facial recognition. Subsequently, the passenger will scan their barcode, so that the system can verify the boarding authorization and trace the passage from the check-point. Biometric recognition can be used in both directions, boarding and landing, by placing the devices in both directions.

All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure.

Markets: Ports from all over the world, including 57 Italian ports

COVID-19

Main Customers:

ATM AZIENDA TRASPORTI MILANESI S.p.A.

Reco 3.26 has developed some innovative algorithms as a concrete response to the crisis caused by the Covid-19 pandemic, transforming the provisions of the Italian Government in the various DPCMs into technological products useful for Private Companies and Public Bodies.

The solution proposed by Reco 3.26 allows you to:

- detect the density of aggregation of people and report the presence of a crowd in real time using the Crowd Detection algorithm;
- carry out an accurate and real-time count of people accessing or passing through a video surveillance area using the People Counting algorithm.
- automatically and in real time, calculate the distance between each person framed by the camera and all the others in the area, using the Social Distancing algorithm

Markets: Public and Government Entities; Private companies

PEOPLE ACCESS CONTROL

The biometric **access control solution**, based on facial recognition, can be used to authorize a person to enter restricted areas and detect their presence.

It's also able to:

- Take **body temperature**
- Check the **validity of the Green Pass**
- Check the **presence of the mask** (personal protective equipment)

The control types are optional and can all be turned on/off as needed.

The solution:

- ✓ is compatible with all personnel management systems;
- ✓ can control the opening of a turnstile or a motorized gate using a supplied Bluetooth relay;
- ✓ is a quick access system;
- ✓ protects the health of users;
- ✓ is accurate and timely

The biometric model can be saved in the user's mobile device (decentralized storage) or, alternatively, in the centralized database.

In this context, the solution can be used for the access control of:

- ➢ Employees
- ➢ Providers
- ➢ Supervisory staff
- ➢ Police
- ➢ Other authorized parties

Markets: Public and governmental bodies; Private companies

Main Customers:

REMOTE CERTIFIED TRAINING (FOCE)

Main Customers: TeleConsul

The following are the main applications of the FOCE system in the 'distance learning' area:

A. REGISTRATION TO E-LEARNING PLATFORM

To allow access to the e-learning platform, there is a user registration phase through which the system:

- acquires **consent for data processing;**
- acquires the information and the photo from the **identity document**;
- requires a **selfie** type photo;
- makes the **match between the biometric model of the selfie and the one previously acquired**;
- if successful, it returns the **login credentials** to the platform.

It's possible to customize the solution by integrating the Green Pass verification and validation system.

B. SERVICE ROLLING

The system, throughout the period of use of the service, verifies, through the application of face recognition techniques, that the identity of the learner always coincides with that of the authorized user in the enrollment phase. In addition, it notifies any anomalies to the service provider (eg. Unauthorized person in the enrollment phase)

C. DETECTION OF ABNORMAL BEHAVIORS

The system allows to identify any anomalous behaviors that the learner might have during the course. The definition of abnormal behaviors is established together with the course provider, according to the specific objectives to be achieved. Here are some examples of abnormal behavior:

- Subject absent;
- Subject who looks away from the screen for a time longer than a set parameter and who is distracted and bored (low level of attention);
- Subject who looks away from the screen by turning his head for a time longer than a set parameter (in an alleged attempt to "copy" during an exam);
- Presence of multiple subjects within the range of the webcam (someone is helping during an exam);
- Presence of a person other than the person being examined (someone else performs the task during the exam).

Markets: Private companies and public bodies

CERTIFIED TRAINING IN PRESENCE (ECM)

Main Customers: TeleConsul

The following are the main applications of the ECM system in 'face-to-face training' area:

A. REGISTRATION TO THE COURSE

To allow access, there is a user registration phase via web*. The system:

- acquires consent for **data processing**;
- acquires the information and the photo from the **identity document**;
- requires a **selfie** type photo;
- makes the **match between the biometric model of the selfie and the one previously acquired**;
- if successful, it returns a **pass** for access in person.

For preferential and quick access to the facility where the learner will use the course, he will have to carry out biometric identification using facial recognition. It's possible to customize the solution by integrating the Green Pass verification and validation system.

** As an alternative to online registration, enrollment can be done via Welcome Kiosk located at the entrance to the facility where the course will be held.*

B. SERVICE ROLLING

The system, throughout the period of use of the service, verifies, through the application of face recognition techniques, that the identity of the learner always coincides with that of the authorized user in the enrollment phase. In addition, it notifies any anomalies to the service provider (eg. Unauthorized person in the enrollment phase)

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- Presence of multiple subjects within the range of the webcam (someone is helping during an exam);
- Presence of a person other than the person being examined (someone else performs the task during the exam).

Markets: Private companies and public bodies

EXAMS AND PUBLIC COMPETITIONS

The following are the main applications of the system in the 'public exams and competitions' area:

A1. REGISTRATION TO THE COMPETITION CARRIED OUT VIA WEB (step mutually exclusive with A2)

To allow access to the e-learning platform, there is a user registration phase through which the system:

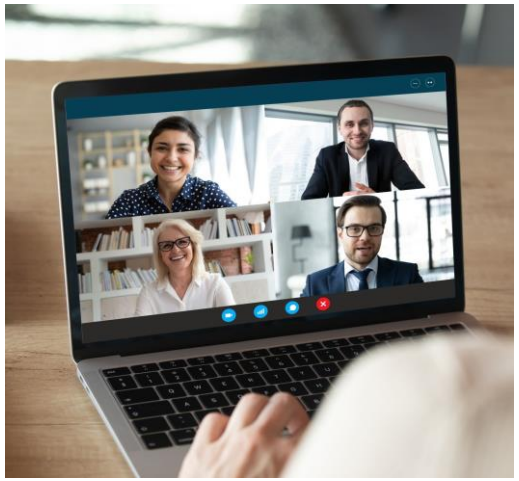
- acquires consent for **data processing**;
- acquires the information and photo from the **identity document**;
- requires a selfie type photo
- makes the **match between the biometric model of the selfie and the one previously acquired**;
- if successful, it returns the **login credentials** to the platform.

It's possible to customize the solution by integrating the Green Pass verification and validation system.

A2. REGISTRATION TO THE COMPETITION CARRIED OUT IN PRESENCE (step mutually exclusive with A1)

To allow access, there is a user registration phase via web*. The system:

- acquires consent for **data processing;**
- acquires the information and the photo from the **identity document**;
- requires a **selfie** type photo;
- makes the **match between the biometric model of the selfie and the one previously acquired;**
- if successful, it returns a **pass** for access in person.



For preferential and quick access to the facility in which to carry out the exam, the participant must carry out biometric identification by facial recognition. It's possible to customize the solution by integrating the Green Pass verification and validation system.

** As an alternative to registration via web, enrollment can be done via Welcome Kiosk located at the entrance to the facility where the competition is held.*

B. DETECTION OF ABNORMAL BEHAVIORS

The system allows you to identify any abnormal behaviors that the participant in the competition may have during the exam. The definition of anomalous behaviors is established together with the client, according to the specific objectives to be achieved. Here are some examples of abnormal behavior:

- Subject absent;
- Subject who looks away from the screen by turning his head for a time longer than a set parameter (in an alleged attempt to "copy" during an exam);
- Presence of multiple subjects within the range of the webcam (someone is helping during an exam);
- Presence of a person other than the person being examined (someone else performs the task during the examination)

Markets: Private companies and public bodies

RECO SMART PARKING

Reco Smart Parking is the solution developed by Reco 3.26 for the control of vehicle access, through automatic recognition of number plates (ALPR).

The solution is suitable for managing the access of vehicles in public, residential, corporate car parks or restricted areas.

Through special graphic interfaces, the system allows you to configure: Areas; Gates; White list of Vehicles (and their owners); Access allowed time slots.

All transits occurred (transit history) can be consulted using a powerful and intuitive graphic interface for "research".

Applications: Monitoring of parking lots and reserved areas to intelligently manage the entrances and exits of cars from unattended car parks, combined with Automated License Plate Recognition

Markets: Private companies and public bodies

FAIR ACCESS MANAGEMENT

Reco has developed a solution for managing accreditation at trade fairs and other events.

Reco 3.26 uses innovative technologies, which include the integration of computer vision and video analysis techniques, for the management of "accreditation", "hands free access to the fair" and "real-time biometric identification" activities, based on the "face recognition".

In the area of the fair used for accreditation procedures, a 'Welcome Kiosk' is positioned, used by the visitor for the acquisition of consent and the enrollment of their biometric data. Alternatively, the event registration operation can be carried out via web, from Reco platform or via customer's pre-existing portal suitably integrated.

For preferential and quick access to the reserved areas of the fair, a 'Face Kiosk' will be positioned for biometric identification by facial recognition of the visitor.

All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure.

It's possible to customize the solution by integrating the Green Pass verification and validation system.

Markets: Private companies and public bodies

SECURE AUTHENTICATION AND PAYMENTS

The solution offered by Reco allows you to carry out online banking transactions with maximum security

- Enrollment of new account holders: when opening a new bank account, the process involves the acquisition, via an integrated camera, of the customer's identification documents, to verify their validity, and of the face, in order to carry out the biometric verification.
- Double payment authentication: to confirm the execution of a payment, the process involves the use of the camera for the biometric verification of the customer through one's face

Biometric verification is carried out directly on the Bank's servers

Benefits:

- PSD2 Compliance
- Automated verification of the validity of identity documents (electronic ID card, passports etc.)
- Adaptative Multi-Factor Authentication

Reco solutions integrate anti-spoofing algorithms.

All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure.

Applications:

- private companies in banking/insurance/TELCO sector and public bodies
- e-commerce

Markets: Fintech, Banche ed Assicurazioni, TELCO, Aziende private; E-commerce

URBAN SECURITY SYSTEM

The 'Urban Security' system designed by Reco 3.26 receives, stores and organizes geo-referenced information from different sources (video / image streams from video surveillance cameras, sensors, GPS, metadata, etc.) **and uses them to provide operators a tool for monitoring and controlling urban areas and supporting decisions.**

The system, through **Computer Vision and Video Analysis mechanisms**, is able to:

- **Carry out the counting of people and/or vehicles** from both directions of travel, verifying whether a pre-set parametric threshold is exceeded;
- **Detect the density of aggregation of people and/or vehicles** in a video surveillance area;
- **Classify the vehicles, check the speed, the positioning and the color and detect the license plate** for traffic monitoring and control of compliance with the highway code;
- **Detect the license plate** of a vehicle for access control in restricted traffic areas;
- **Detect the presence of abandoned objects and/or waste and fires;**
- **Evaluate the pollution levels**, verifying the possible exceeding of a pre-set parametric threshold;
- **Notify events in real-time**.

The control types are optional and can all be turned on/off as needed.

The collected data are analyzed, consolidated, transformed into useful information and displayed on a platform developed by Reco, which:

- offers real-time **statistics, risk maps and analyzes, including predictive ones**, which allow local administrations and police to **make more informed, rapid and effective decisions;**
- allows **direct management of citizens alert**, allowing local administrations and police to intervene promptly, and to **update them on the measures implemented**.

The solution can be an effective tool for:

- ✓ improve mobility and viability;
- ✓ intelligently manage traffic lights and road signs;
- ✓ intelligently manage parking areas;
- ✓ make transport management more efficient;
- ✓ increase the level of public safety;
- ✓ ensure compliance with the highway code;
- ✓ reduce accidents and traffic congestion levels;
- ✓ reduce the concentrations of atmospheric pollutants;
- ✓ reduce public spending;
- ✓ protect the environment, tracing the causes of pollution in congested areas;
- ✓ promptly implement corrective / preventive measures;
- ✓ identify new business opportunities.

Markets: Public and governmental bodies

PLATFORMS > INDUSTRY 4.0

NDI CHECKS

Main Customers: LEONARDO

The solution allows to automatically detect defects with ultrasonic inspection on composite parts.

Any non-visible defects, generated during the manufacturing process and present within the composite material package, can only be detected by **non-destructive inspection with the ultrasonic method**. The main advantages of the ultrasound method range from high control sensitivity to the ability to identify the location of the defect. Defects detectable by ultrasound can be divided into 3 main types: delaminations, inclusions, porosity.

With regard to ultrasound scans for the identification of defects in the aircraft fuselage, complex surfaces are scanned using maps which, joined together using scanning paths, inspect 100% of the fuselage. The method used by the scanning system is the pulse-echo technique (or echo-pulse, in reflection): the ultrasonic waves invest the piece to be tested, penetrate it and are reflected and refracted by the surfaces that delimit the component itself. It's precisely the internal reflections (echoes) that are examined and provide information on the presence of any defects in the piece. The inspector in charge of NDI checks is the person authorized to carry out visual analyzes of the scanned maps in order to identify or not the potential defects and then proceed with the acceptance or rejection of the defective parts.

With a view to building a flexible tool capable of automatically **detecting and classifying defects in different production cycles**, Reco 3.26 is developing an industrial research project and experimental development of artificial intelligence techniques for the improvement and automation of non-destructive testing and for the detection of imperfections resulting from ultrasonic testing in carbon fiber fuselage sections. The goal is to provide NDI inspectors with a tool capable of automatically detecting potential defects without the need for the inspector to analyze all of the scan maps.

All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure.

Applications: Solution applied in the field of aeronautics/aerostructures

Markets: Private Companies / Government Entities

RECO WRINKLEMETER

Main Customers: LEONARDO

The solution offered by Reco allows to automatically detect imperfections in sections of fuselage parts composed of carbon fibers.

Due to the uneven distribution of the resin between the layers or due to uneven temperature and/or pressure, imperfections are created on the fiber layers, which have the appearance of a crease. Such imperfections are called 'wrinkles'.

In this specific context, the visual inspection is carried out with the aid of optical microscopy in order to acquire the photos on which the qualification operators will perform the measurements for the assessment of the severity of any wrinkles detected.

As part of the structural analysis for the identification of these specific anomalies, Reco has developed a prototype machine vision system, for the detection and measurement of wrinkles, in fuselage sections composed of carbon fibers.

Reco WrinkleMeter is a software for processing images acquired by microscope by quality control operators, to identify and measure the information characterizing any wrinkled ply inside the package.

Applications: Solution applied for the inspection of carbon material in the field of aeronautics/aerostructures

All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure.

Markets: Private companies, particularly in the Aerospace and Transportation sector

AUTOMATIC ALUMINUM INSPECTION

Main Customers: LEONARDO

The solution offered by Reco 3.26 allows for an automated analysis of fuselage defects.

As part of the structural analysis for the identification of anomalies in the fuselage assembly process, Reco 3.26 is developing an experimental computer vision system which, using suitably trained convolutional neural networks (CNN Convolutional Neural Network), is able to detect, locate and classify possible defects on aluminum surfaces caused by improper use of assembly tools or abrasive means and/or incorrect rework operations.

The computer vision subsystem developed by Reco 3.26 and enhanced with artificial intelligence techniques and algorithms, receives in input the images and/or information retrieved from the acquisition subsystem, and returns the defect classification, if present, with its location on the image.

All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure.

Applications: Solution applied for the inspection of aluminum material in the aeronautical/aerostructures field

Markets: Private Companies / Government Entities

AUTOMATIC INSPECTION OF MATERIALS AND PRODUCTS

The proposed solution allows to carry out an automated analysis of defects present on **materials** (raw materials and semi-finished products) and **products** (prototypes and final products) through Computer Vision and Video Analysis mechanisms.

❖ Defect detection, such as holes/scratches/trims and non-conforming seams

During the production of the prototype or final product, the manufacturing and packaging process can lead to results that differ from those of the starting model.
Computer vision systems based on machine learning will be used to detect the defects.
The Reco solution includes:

1. The development of the **lighting system** and the **acquisition set up**;
2. The creation of the **training dataset**;
3. The implementation of the **defect detection subsystem**;
4. The implementation of the **defect classification subsystem**

❖ Color defect detection

The color of the material used for production (leather, fabric, rubber, etc.) may appear different from that of the example model.
The Reco solution includes:

1. The development of a **lighting system** and the **acquisition set up**;
2. The analysis of the **appropriate color space** and **chromatic distance**;
3. The implementation of an **artificial vision system** for the matching / detection of chromatic anomalies (handcrafted computer vision technology).

RECO DIGITAL METER

Main Customer: OVS

The solution designed by Reco allows for a **highly reliable and automatic measurement** of a product, with an **error of the order of a millimeter**, **minimum compared to the reference context**.

The technology is designed for operators in **the industrial and manufacturing production area**, in particular in the **Textile and Fashion sector** for the **measurement of clothing and accessories**.

In fact, the use of the solution allows to increase the **quality of the product**, **reducing manual operations and times**, making the **measurement repeatable and certified** and **increasing the level of customer satisfaction and profits**.

This technology can be used:

- in the **prototyping phase**, to verify that the sample produced complies with the model designed;
- **post-production**, on a sample of products, to verify that its are compliant with the prototype;
- **in e-commerce**, to make a comparison between products (eg. the item photographed by the customer and the product in the store).

The system uses, for the automatic measurement of the product and for the standardization of the measurements, Computer Vision and Video Analysis mechanisms combined with neural networks suitably trained and specific to each type of product (for example for the measurement of clothing there is a specific neural network for t-shirts, one for blazers, etc.).

The results of the measurements are subsequently used by the system to re-train the same neural networks.

It's possible to certify the measurement process and the historical archive using tools such as **Blockchain**.

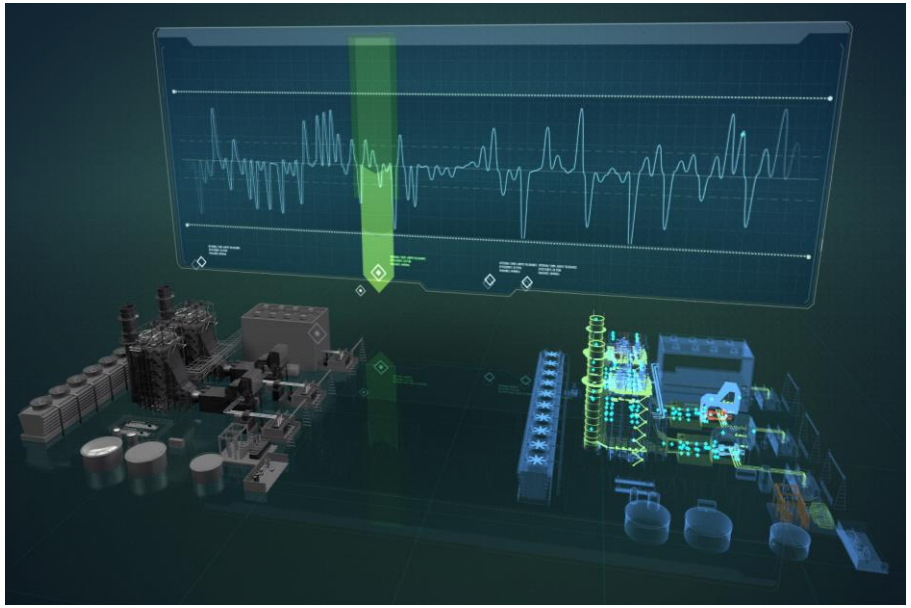
Markets: Private companies, in particular in the Textile and Fashion sector

PLATFORMS > INDUSTRY 4.0

DIGITAL INFRASTRUCTURE FOR GREEN HYDROGEN PLANTS

EFFICIENCY AND SAFETY/SECURITY IMPROVEMENT

Reco 3.26 has designed, together with some partners in Energy sector, a **Digital Infrastructure for the management of the integrated ecosystem for the production and distribution of Green Hydrogen.**



EDISON EDF GROUP · Alboran HYDROGEN · snam · SAIPEM · LEONARDO · RINA

MAIN TECHNICAL FEATURES OF THE SYSTEM

- **Digital Twin implementation for critical components and Electrical Network**
  - Artificial Intelligence
  - Simulation
  - Vertical Know-How on Processes and Materials
- **Blockchain and Smart Contracts**
  - Certification of Equipment and Production Process
  - Tracking of Lots
- **Cyber Security Management**
  - Artificial Intelligence for Malware Detection
  - Machine Learning applied to Cyber Attack Pattern Recognitions
  - HOLOS, SPlunk, Mobile Iron, Tenable, Digital Shadows
- **Safety & Security**
  - Audio/Video analysis based on Artificial Intelligence
  - Wearable Devices for robust anticollision systems and PPE monitoring. Work Force Digital Management
  - Autonomous Systems
  - Control Room
- **Cyber Risk Analysis in Industrial Process**
  - Endpoint and Secure SCADA (Security for Supervisory Control and Data Acquisition)
- **Wireless sensor network and AI based analytics architecture**
  - WSN
  - Artificial Intelligence
  - Data Lake
- **Infrastructure & Communication**
  - 4G/5G
  - AI
- **Vertical Know-How on Materials and its H2 interaction**
  - Development of Materials DB in relation to performance in H2 environment.
  - Technology scouting on most promising sensoring techniques to be applied on H2 plant components devoted to detect: material soaking, local damage, H2 leakage and permeation.
  - Corrosion modeling to drive inspections and maintenance with AI algorithms
  - Corrosion prediction module to be integrated in the Digital Twin Maintenance Module
  - Development of most suitable and reliable H2 embrittlement models (physical or phenomenological)

DRONE SCANNER

Main Customers: OVS

The Solution offered by Reco allows to improve warehouse management, applying the paradigms of Industry 4.0.

It involves the use of drones in order to improve efficiency and productivity in inventory management by automatic scanning of barcode/Qrcode.

The inventory check, carried out using a drone, returns, for each location (box), all the pallet codes (pallet) and all the related package codes, giving a visual / sound feedback to each acquisition. successful. At the end of the verification, the development system sends the result of the acquisitions.

All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure. In particular, integration with the customer's digital backbone is envisaged starting from the WMS (warehouse management system).

Markets: Private companies or companies operating in the Logistics and Distribution sector

CRITICAL INFRASTRUCTURE

The solutions offered by Reco allow you to carry out inspections on structures located in critical areas in safety.

All Reco 3.26 systems can be easily integrated into the customer's pre-existing infrastructure.

❖ Non-destructive inspections

The Reco technology is suitable for determining the areas with homogeneous mechanical characteristics and therefore obtaining a mapping of the materials (carbon, concrete, etc.).

Variations in ultrasound propagation speed inform us about the mechanical-elastic characteristics of the material, the level of homogeneity, the quality, any deterioration and the presence of any gaps or inclusions. The presence of imperfections or inhomogeneities in the body in fact causes the onset of scattering phenomena that occur with the presence of spurious echoes, reverberations and, in general, attenuation of the sound wave.

Reco 3.26 transforms ultrasonic data into images by applying their skills in computer vision to these. This survey methodology is particularly useful for monitoring the structures, the effectiveness of remediation interventions over time and the improvement of the mechanical characteristics of the vehicle. This technological approach allows to accurately estimate the mechanical characteristics of the investigated structure.

❖ Inspections with drones

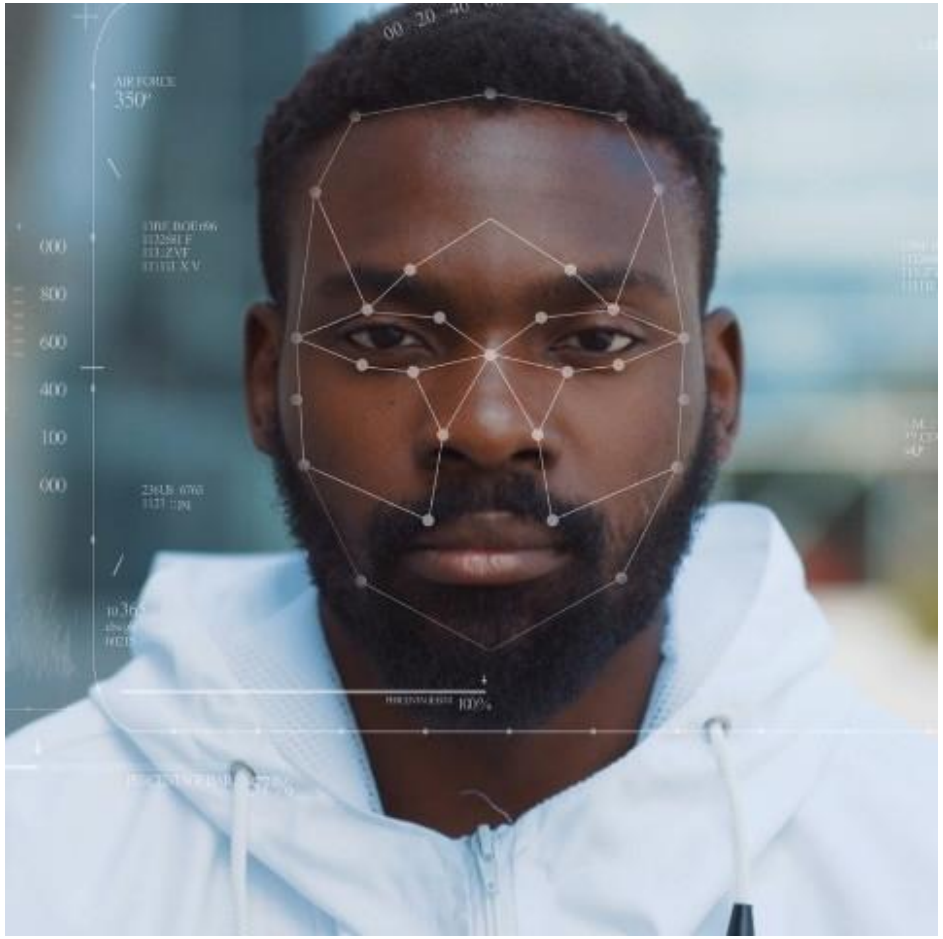
Critical infrastructures (such as bridges, viaducts) are large and complex structures: monitoring and control operations require time and expensive specialized equipment; inspections pose significant risks to the safety of operators due to the very nature of conventional operations. Consequently, in order to provide safe access to the facility, it's necessary for operators to carry out training courses.

Reco technology allows, through the use of drones equipped with video cameras, to generate 3D models of the investigated structure. These are used for the identification of defects, through the use of computer vision techniques, in order to accurately recognize a variety of types of defects with precision of less than a millimeter.

Applications: Public and private infrastructures

ALGORITHMS

FACE RECOGNITION



The algorithm is able to identify or recognize a person in real time by comparing the face captured by the camera and the reference watch-list.

Function able to **analyze in real time the faces of the subjects filmed by the associated camera, comparing them with a database,** owned by the customer, restricted and predefined, called "**watch-list**", whose size can be of the order of hundreds of thousands of subjects.

The face recognition node sends an **alert to the platform**, i.e. to the command and control system, **when a correspondence is found between the biometric model of the face imaged and the biometric model of the watch-list.** The system operator receives a notification generated following the comparison match (for example for an interested person who cannot access a place deemed sensitive or forbidden to it).

Benefits:

- **real time analysis** of subjects in a non-cooperative context
- **offline analysis** of faces in previously captured video streams
- **comparison watch-list** from any desired source
- **identification of all faces** in the scene at the same time
- **face recognition in different poses** (even extreme ones)

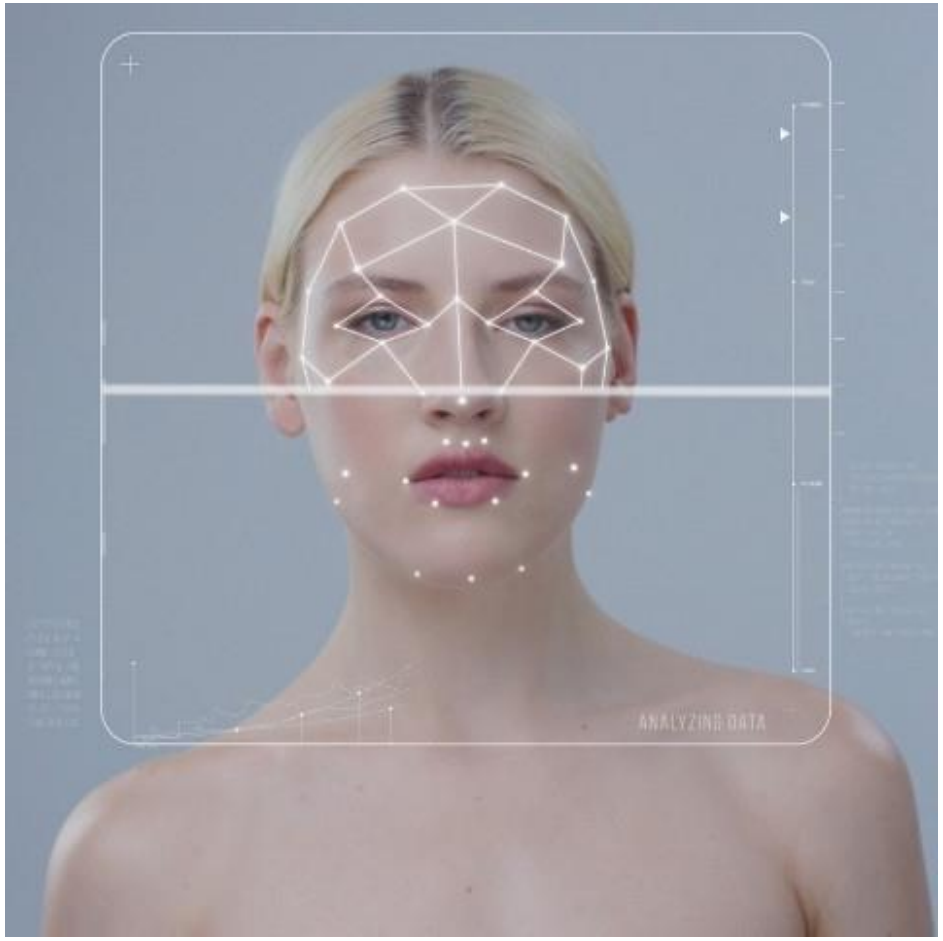
Applications:

- **Public and private security** management
- **Access control** management for public and private entities
- **E-commerce**
- **Authentication and online payments**

Markets:: Private Companies / Public Bodies / State Police and Government

ALGORITHMS

IDENTITY VERIFICATION



The algorithm is able to identify a person through a 1 to 1 comparison.

To allow biometric recognition it's necessary to acquire the "biometric characteristic" (face) and from this extract the "biometric model" with a procedure that guarantees the correctness of accreditation in the biometric system (biometric enrollment), the link with the subject undergoing enrollment and the quality of the resulting "biometric model".

The biometric verification process is described below:

1. The system extracts the **biometric model** from an identity document or a badge or image provided by the person;
2. The subject declares his **identity** by lending his face to a camera;
3. The system performs a compatibility check between the **biometric model detected by the camera** and **the one previously acquired from the photo** of the identity document and corresponding to the declared identity.

Applications:

- **Public and private security** management
- **Access control** management for public and private entities
- **E-commerce**
- **Authentication and online payments**

Markets: Private Companies / Public Bodies / State Police and Government

ANTI-SPOOFING

Reco solutions are resilient to impersonation (spoofing) attacks, where the impostor directly uses a user's biometric data to attack or to create spoofs or fakes.

The Reco biometric systems based on Face Recognition have been successfully tested against the most common methods of Presentation Attacks and against Attacks using photos / videos:

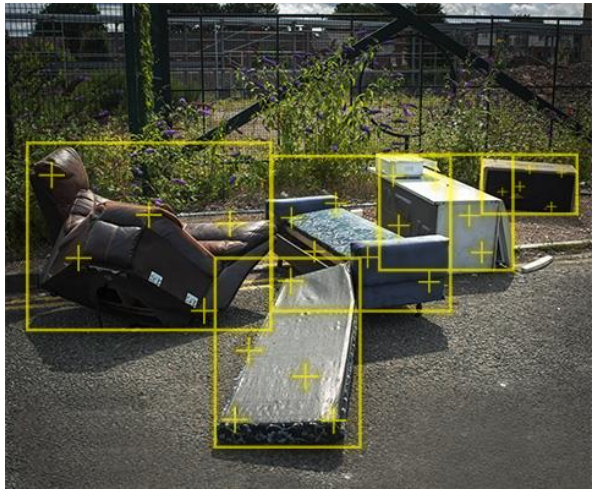
- printed photo attack (photographic paper or on A3/A4 sheets)
- warped photo attack (both vertical and horizontal)
- photo display attack (playback on screen)

In addition, they have been successfully tested against attacks by video playback (either on smartphone displays; tablets or on laptop screens).

Markets: Prevention and security measure in Banking/Insurance/TELCO/Private Companies / Public Bodies sectors

ALGORITHMS

OBJECT RECOGNITION



The algorithm is able to detect and report in real time the presence of objects within a specific video surveillance area. Similarly, it allows the detection of an object removed from a video surveillance area.

The algorithm can be integrated into a system that allows you to:

- **detect the presence of the object** by providing information about its position and size in an automated manner and in real time;
- **classify the object**;
- **send a notification** to report the presence / absence of the object;
- proceed with the necessary **follow-up** operations.

The solution is plug & play and easily integrates with the pre-existing infrastructure.

In the Public Administration area, the algorithm can be integrated into a system that allows the citizen to take a photo of the abandoned object detected in a specific place and send a report to the platform. The system analyzes all the acquired images offline and classifies the abandoned objects starting from a previously defined priority list. The Reco systems are able to recognize the following abandoned waste, classified into macro-categories: Building Material (Bricks); Abandoned vehicles (car, bicycle, scooter, etc.); Bulky items (shopping cart, sofa, chair, bench, etc.); Household appliances (washing machine, TV, refrigerator, etc.); Bathroom (Faucet, Sink, Toilet, etc.); Tires; Sacks.

Benefits:

- detect abandoned objects avoiding the risk of accidents;
- prevent the formation of illegal landfills and fires;
- detect unattended objects and prevent the risk of theft or vandalism.

Applications:

- Monitoring public/private spaces as a control and security measure
- Monitoring and control of road sections in the city and highways
- Workplaces as a prevention and safety measure
- E-commerce and User Genereted Content solutions

Markets: Aziende Private; Enti pubblici e governativi; E-commerce

ALGORITHMS

PLATE RECOGNITION

The automatic license plate recognition algorithm (ALPR) is able to identify the number plates of vehicles entering or passing through a video surveillance area.

It can be integrated into a system that allows you to:

- **detect the license plate of a vehicle**;
- **authorize access** to a reserved area;
- **send a notification** in real time if the detected plate is present in a black list;
- proceed with the necessary **follow-up** operations.

The operator of the command and control system can also search for a vehicle starting from the following characteristics: license plate; type (car, truck, motorcycle, etc.); template; color; time range (Date from - Date to; From Hours - To Hours).

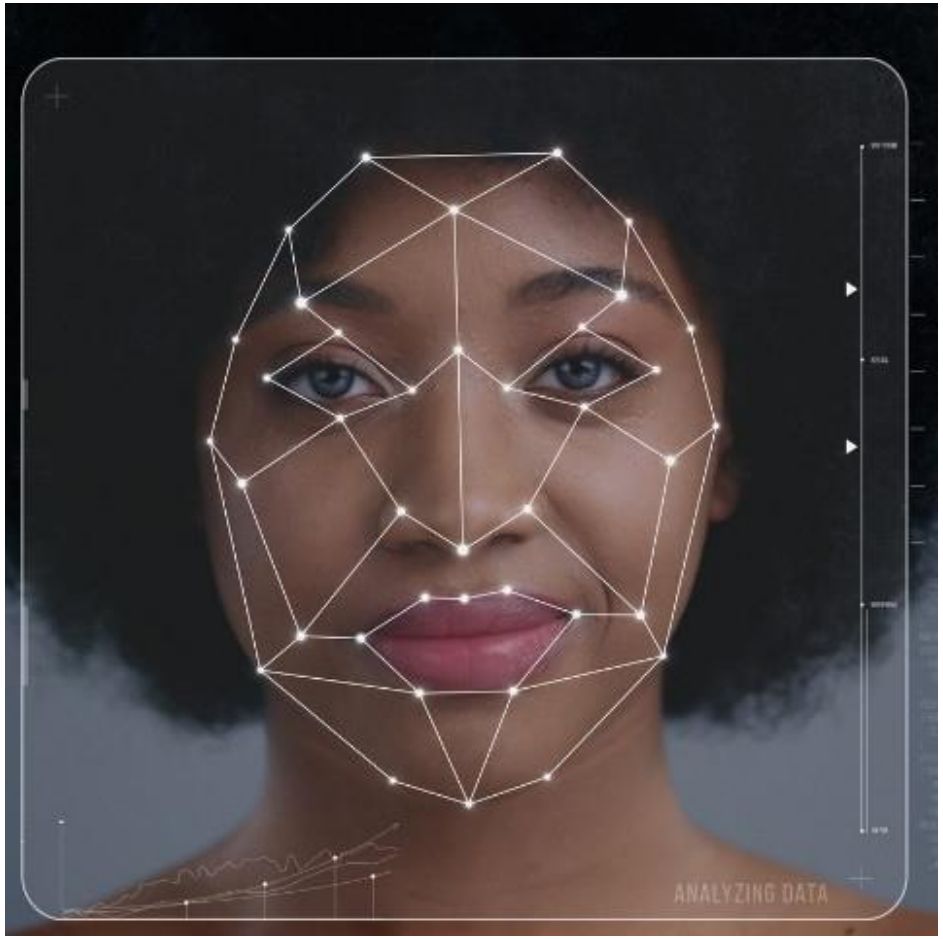
The solution is plug & play and easily integrates with the customer's pre-existing infrastructure.

Applications: It's possible to manage different scenarios of interest, by monitoring the road sections of the City and Highways. The system is usually used by the Police Forces to detect stolen vehicles or vehicles under administrative detention. The detected plates are compared with those of the vehicles reported.

Markets: The license plate detection and the reading system can be successfully used for the monitoring and safety of road arteries around the world

ALGORITHMS

EMOTION RECOGNITION



The algorithm detects human emotions and is able to work on any device equipped with an HTML 5 browser, without the need for an app or plug-in.

It's an innovative, fast and safe solution for **recognizing the user's emotional state**: sensitive data is never stored as its are processed in real-time. The solution is 100% GDPR compliant: no biometric data is saved on the servers. The application is also modular and totally scalable: it runs on local architecture without any infrastructure cost.

What does it detect:

- Position of the head along the three axes;
- Attention level from zero to 100%;
- Basic emotions (Anger, Disgust, Fear, Happiness, Sadness, Surprise, Neutral);
- Circumflex model of emotional states based on the values of arousal and valence;
- Expressions of desire;
- Demographic data (age, gender);
- Other features (+30).

The main application areas are listed below:

- Monitoring of the **maximum level of customer satisfaction** when purchasing a product
- **Customization of advertising campaigns**
- **Emotion recognition during a live event** (conferences, concerts, talks, other)

Applications:

- **Training and Exams**
- **Event Management & Marketing**
- **E-commerce**

Markets: Private Companies and Public Bodies; E-commerce

ALGORITHMS

ABNORMAL BEHAVIOUR

The algorithm is able to detect, track and interpret human movements.

The solution, created to analyze textual data and images, finds its main application in the **recognition of human behavior through the identification and interpretation of the individual's movements.**

The main application areas are listed below:

- Detection of **facial expressions and movements**, of one or more subjects, considered anomalous or suspicious
- Detection of a **fast moving crowd**
- Detection of **one or more subjects who enter prohibited areas**
- Detection of **one or more subjects attempting a theft**
- Detection of **anomalous behaviors during the exam**

  During the examination session, the system calculates in real time some parameters of the ICAO standard that allow you to identify abnormal behavior. In the specific case of an exam, the main anomalous behaviors are: absence of the examiner; examining, he diverts attention from the screen by turning his head for a time longer than a set parameter (in an attempt to "copy"); presence of several people within the range of the webcam (someone is helping); presence of a person other than the person being examined (someone else performs the task in place of the person being examined). The alerts of each candidate are monitored and the reports are sent to the person in charge of the examination session.
- Monitoring of the **attention level and facial expressions** of participants in training courses (face-to-face and remote), video conferences and live events.

Applications:

- **Public and private security** management
- **Training and Exams**
- **E-commerce**

Markets: Private Companies and Public Bodies; E-commerce

ALGORITHMS

PEOPLE CROWD DETECTION

The algorithm allows to detect the aggregation density of people in a video surveillance area.

The algorithm can be integrated into a system that allows the **formation of a crowd or the presence of groups to be reported in real time.**

The crowd detection node sends an alert to the platform, that is to the command and control system, when it detects an increase in the density of people aggregation.

The operator of the command and control system:

- receives the alert of this type coming, for example, from a camera that monitors an open area inside the park, or on the streets;
- processes the alert by viewing the images received on the platform;
- if necessary it proceeds with a follow up: it could decide to directly access the streaming of the context camera (using the video surveillance management software), to make sure that the group of people can present a real threat or not.

The solution is plug & play and easily integrates with the pre-existing infrastructure.

Applications: Ideal for monitoring the density of aggregation within means of transport (buses, trains and metro) and within a delimited space (congresses, events, squares) for the purposes of safety and prevention and in addition as a containment measure of Covid-19 infection.

Markets: Private companies and public/government entities

ALGORITHMS

PEOPLE COUNTING

The algorithm allows you to perform, through a settable threshold, an accurate and real-time count of the number of people accessing or passing through a video surveillance area in both running directions.

The algorithm allows you to perform, through the existing cameras:

- **the total count of people** accessing or passing through a video surveillance area;
- **the partial count of people** entering or passing through a video surveillance area **in the two directions of travel.**

The people counting node sends an alert to the platform, that is to the command and control system, when the meter exceeds the "safety threshold" (max number of admissible subjects) previously set by the operator. The operator of the command and control system receives the alert of this type from a camera that monitors the area and proceeds with a follow up if necessary.

Applications: Ideal for managing the influx in public areas that have capacity limits for safety reasons, in order to prevent the dangers deriving from overcrowding and as a containment measure of the Covid-19 infection. There are many applications of people counting, such as monitoring how many people enter a museum, a public office, or a stadium, a public event, a square, an historic center, stations, airports. With the data collected, it's possible to check, for example, which days or hours are when a greater presence of personnel is required, as well as to perform flow statistics.

Markets: Private companies and public/government entities

ALGORITHMS

SOCIAL DISTANCING

The algorithm allows you to automatically and in real time calculate the distance between each person framed by the camera and all the others present.

The system has been designed to use images and/or video streams from fixed cameras as well as images from drones and allows you to check promptly and in real time that the requirements relating to public safety are respected.

The solution is plug & play and easily integrates with the pre-existing infrastructure.

Applications: The solution can be used in confined spaces of public bodies or private companies (for example gyms, trade fairs, conference rooms, construction sites) for the purposes of safety and prevention and as a measure to contain the infection from Covid-19.

Markets: Private companies and public/government entities

ALGORITHMS

VEHICLE COUNTING

The algorithm allows you to perform, through a settable threshold, an accurate and real-time count of the number of vehicles entering or passing through a video surveillance area in both directions of travel.

The algorithm allows you to perform, through the existing cameras:

- **the total count of vehicles** entering or passing through a video surveillance area;
- **the partial count of vehicles** entering or passing through a video surveillance area **in the two directions of travel**.

The vehicle counting node sends an alert to the platform, that is to the command and control system, when the meter exceeds the "safety threshold" (max number of admissible vehicles) previously set by the operator. The algorithm allows you to automatically count the vehicles through the existing cameras. The operator of the command and control system receives the alert of this type from a camera that monitors the area and proceeds with a follow up if necessary.

It's also possible to automatically classify vehicles by type (two-wheeled vehicles, cars, buses, trucks ...) and obtain up-to-the-minute data to make statistics on the influx

Applications: Ideal for monitoring the flow in restricted and/or restricted traffic areas.

Markets: Private, public and government entities

VEHICLE SPEED DETECTION

The algorithm allows you to calculate the speed of a vehicle and prevent the formation of queues and traffic.

It's possible to integrate the algorithm into a system that allows you to:

- notify when the speed limits are exceeded according to the vehicle category;
- report the formation of queues;
- dynamically set the priorities of the traffic light signal.

Applications:

Ideal for monitoring traffic and preventing the risk of accidents in the city and highways

Markets: Public and governmental bodies

ALGORITHMS

ROAD SPACE ANALYZER

The algorithm allows you to analyze the road space by detecting the parking areas occupied by vehicles and those available, and calculating the time a vehicle remains in a given space.

It also allows you to:

- **identify vehicles placed in spaces where parking is prohibited or reserved for specific categories;**
- **identify vehicles in the wrong direction.**

It's possible to integrate the algorithm into a system that allows you to:

- report to the driver the nearest and available parking area;
- buy a parking ticket;
- report vehicles in non-parking areas.

Applications: Ideal for monitoring urban spaces and parking lots and preventing the risk of accidents.

Markets: Public and governmental bodies

ALGORITHMS

CARRIAGEWAY CROSSING DETECTION

The algorithm makes it possible to automatically detect the presence of a pedestrian and/or an animal crossing a road where there is a ban on transit.

It's possible to integrate the algorithm into a system that allows you to signal the presence of a danger to the driver.

Applications: Ideal for preventing the risk of accidents in cities and highways

Markets: Public and governmental bodies

ALGORITHMS

DETECTION OF A VEHICLE IN THE WRONG DIRECTION

The algorithm makes it possible to detect the presence of a vehicle traveling along a road section in the wrong direction and to send a signal to the control system.

It's possible to integrate the algorithm into a system that allows you to signal the presence of a danger to nearby drivers.

Applications: Ideal for preventing the risk of accidents in cities and highways

Markets: Public and governmental bodies

Our Partners

Reco 3.26

Smart Recognition System

www.reco326.com

PHONE: +39 0832.349295
EMAIL: INFO@RECO326.COM

HEADQUARTER:
VIA DEL PLATANO, 5
CASTROMEDIANO, CAVALLINO (LE)
ITALY

MILAN OFFICE:
VIA MARIO PAGANO, 51
MILANO, ITALY

ROME OFFICE:
VIALE LUCA GAURICO, 91/93
ROMA, ITALY