EYYES
we make machines see

Easy-to-configure ADAS SW platform powered by high-level camera-based perception

Hans Pfluegl
EYYES GmbH
June 27th 2024

MAGNA MAGNA MIRRORS LIEBHERR TRSC STADLER Clevere Lösungen auf der Schiene VOLVO TRUCKS AMD MAN ALSTOM

Artificial intelligence for safe vision, recognition and understanding

EYYES – We make machines see

Technology leader for Safe Artificial Intelligence

PROTECT TOMORROWS WORLD WITH AI

- … make our world safer with artificial intelligence
- … experts in computer vision, machine learning, Deep Learning and embedded systems
- … camera and sensing technology
- … soft- and hardware development made in Europe
- … tailor-made solutions with leading edge technology
- … strong relationship to leading Europe machine learning research organizations

ADAC ALEXANDER DENNIS LIEBHERR MAN VOLVO BPW MAGNA MAGNA MIRRORS

VECTOR at a glance

Employees:
> 4,000
Vectorians

Turnover:
1.06 bn €
in 2023

Associations:
participation in
16 committees

Customers:
> 9,000 companies
in 76 countries

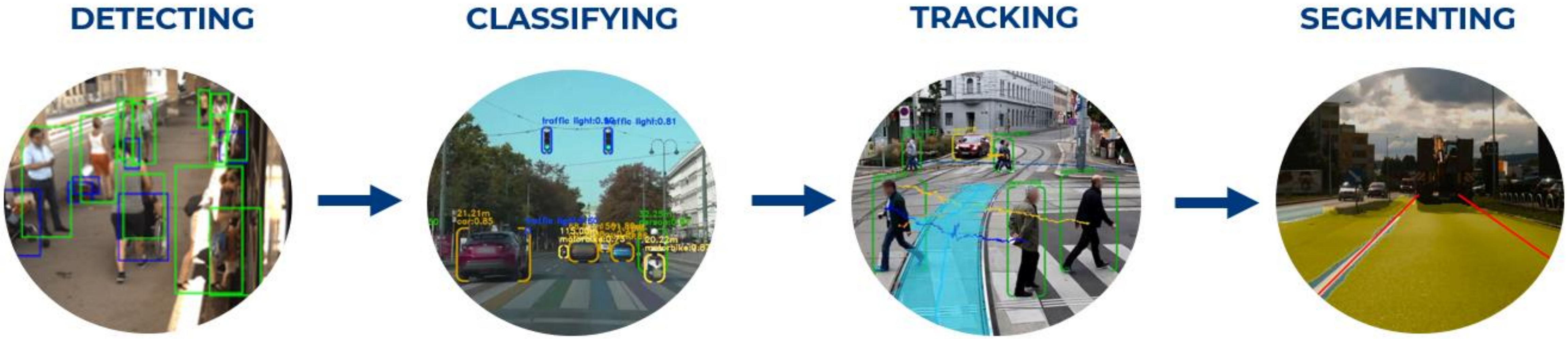
Subsidiaries:
33 locations in
14 countries

Affiliated Companies:
GiN | CSM | EYYES

Development partner
for over 35 years

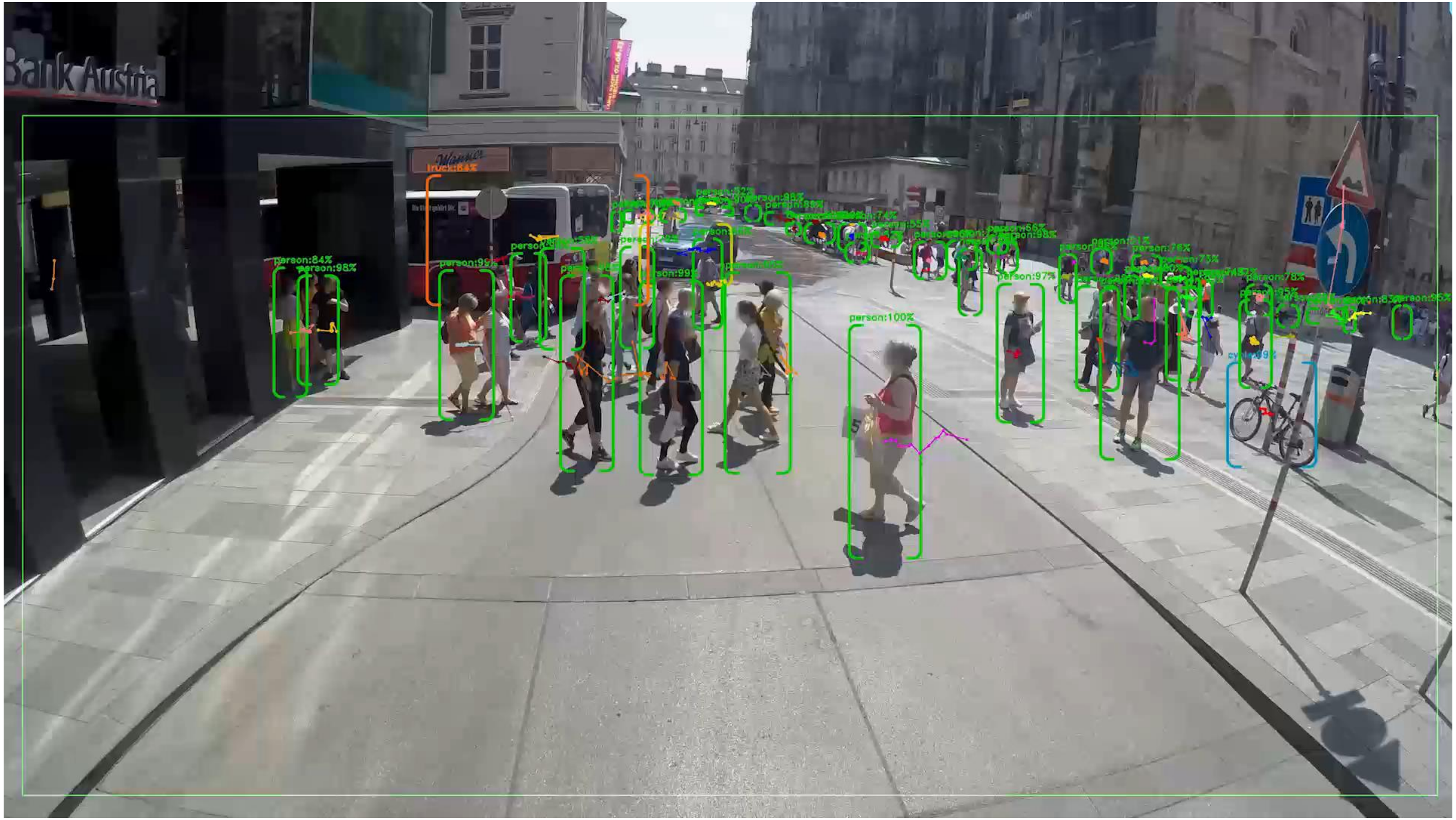
EYYES Perception

is providing a “description” of the image/video content in real time for a wide range of use cases



DETECTING → CLASSIFYING → TRACKING → SEGMENTING

EYYES AI - Image processing for ADAS


Bank Austria
truck:86%
person:84%
person:98%
person:99%
person:97%
person:100%

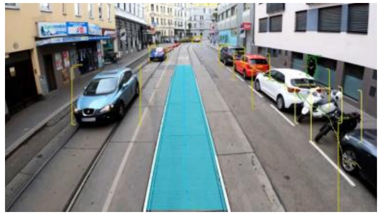
Artificial intelligence for safe vision, recognition and understanding

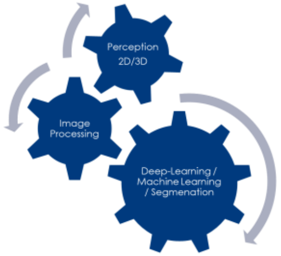
Offering overview vehicle industry

EYYES **CarEye® solutions for Driving assistance** help our customers to reduce “time to market” by using our flexible Software framework and the EYYES Deep learning CNNs.

CarEye® Perception Software ADAS & AD

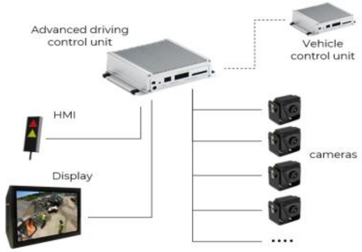
- ✓ Software-framework for developing camera-based ADAS-Solutions
- ✓ Different pretrained specialized EYYESNETs available for serial and parallel use
- ✓ Ready to install, easy to configure via graphical user interface
- ✓ Object-list streaming for sensor fusion




Perception 2D/3D
Image Processing
Deep-Learning / Machine Learning / Segmenation

CarEye® ADAS Solution tailormade solution

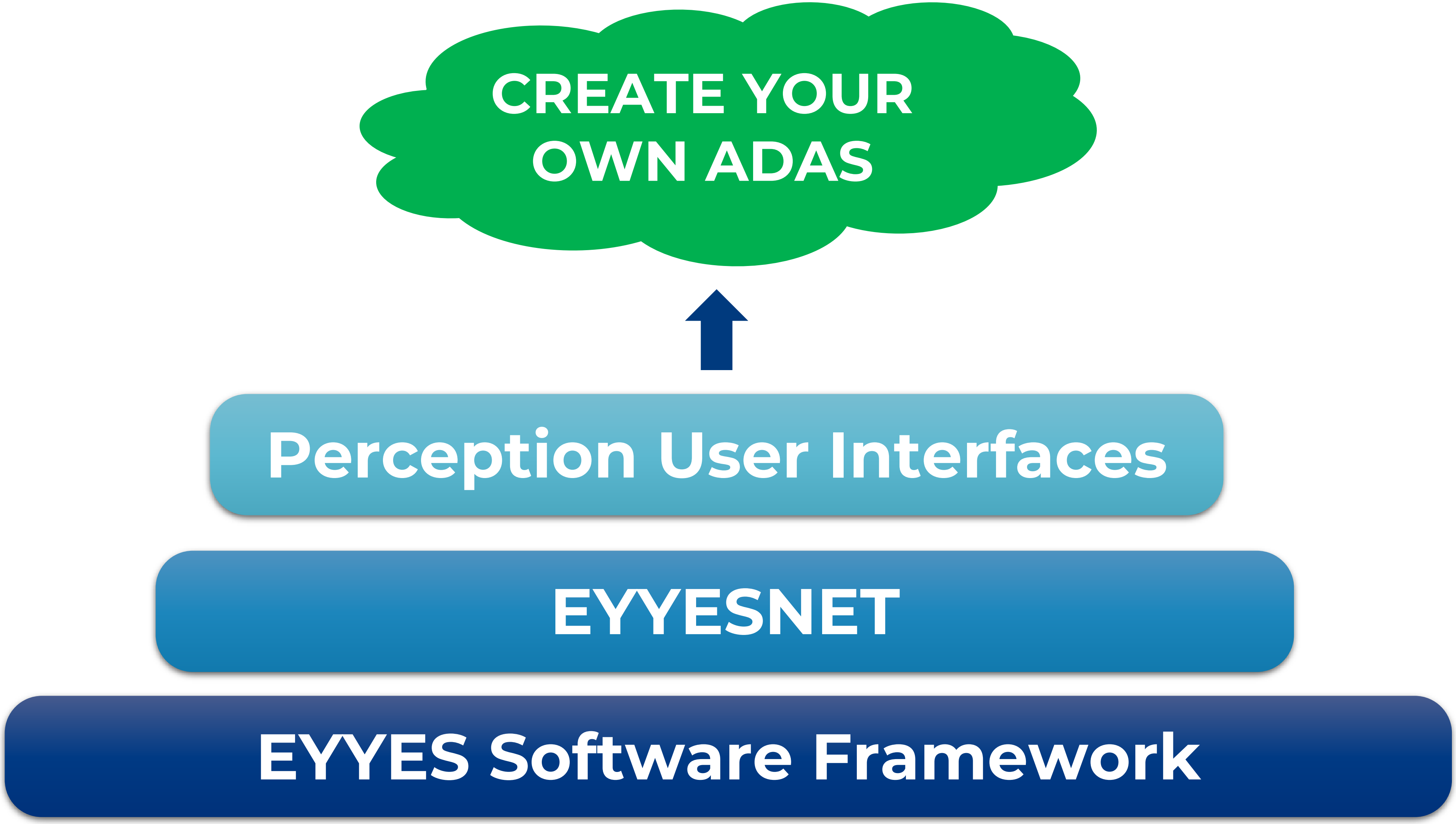
- ✓ Complete ADAS Solution including components, hardware and software
- ✓ One integrated solution for all camera applications on the vehicle
- ✓ Person detection & Collision Warning
- ✓ GSR II –Assistant Systems
- ✓ 360° Bird-view with detection


Advanced driving control unit
Vehicle control unit
HMI
Display
cameras
....

CarEye® Retrofit ADAS for aftermarket

- ✓ Off the shelf products for BSIS, MOIS, Rear view assistant; 180°, 270° and 360°person detection
- ✓ Trucks and buses
- ✓ Construction machinery
- ✓ Commercial vehicles
- ✓ Agricultural machinery

EYYES Perception Software



CREATE YOUR OWN ADAS

Perception User Interfaces

EYYESNET

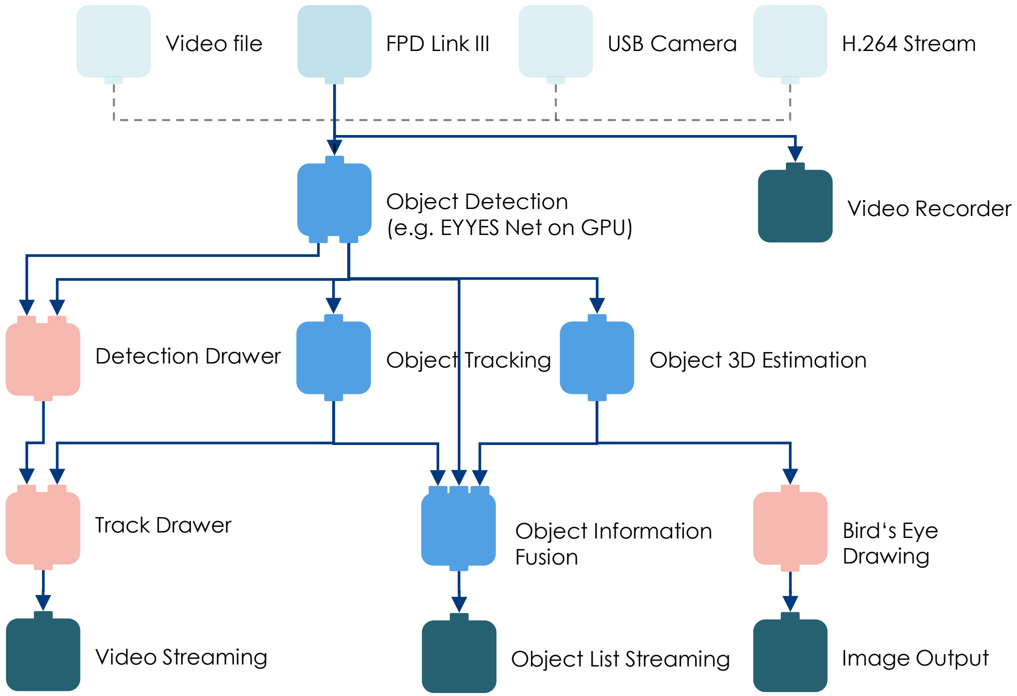
EYYES Software Framework

EYYES Perception Software Framework

for all video-based AI use-cases for 2D/3D Perception, Image processing, AI processing

A proven software architecture framework for **direct customer** use with more than 200 C++ modules – multithreaded - high performance.

Designed for AI and image processing.


Video file
FPD Link III
USB Camera
H.264 Stream
Object Detection
(e.g. EYYES Net on GPU)
Video Recorder
Detection Drawer
Object Tracking
Object 3D Estimation
Track Drawer
Object Information Fusion
Bird's Eye Drawing
Video Streaming
Object List Streaming
Image Output

Factory-based

Applications can be **designed** to the **exact needs of the client** and by a configuration file:

- No programming
- No compiling
- Easy Use

Cross-platform

- **Operating system independent** – Windows/Linux
- Usable on most hardware platforms
- Framework core with **low dependencies**

Modular

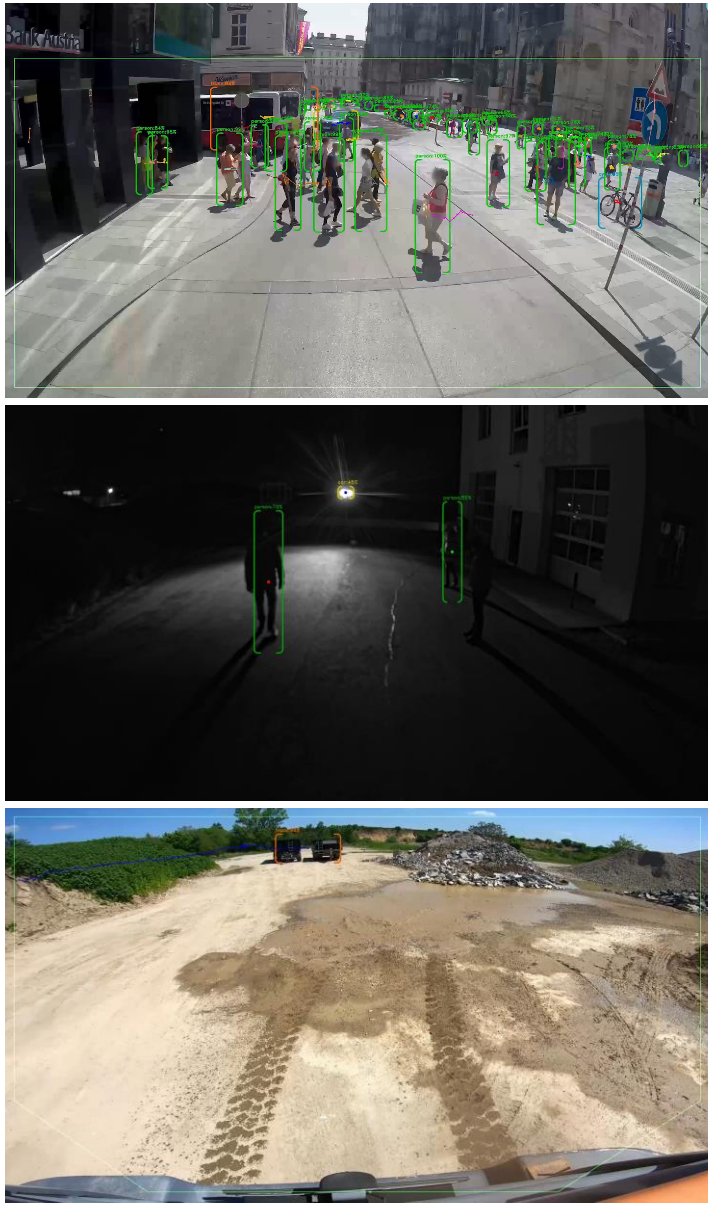
- Application pipeline consists of **modules, connections and parameters**
- **Reusable and exchangeable** modules
- **Extendable** applications
- **Add and exclude** modules according to your needs

Fast & efficient

- C++ with an object-oriented design
- **No data copy for transport** between modules
- **No memory allocations** needed
- **Sequential or parallel** computation

EYYESNET

Pretrained Neural Network for visual object detection

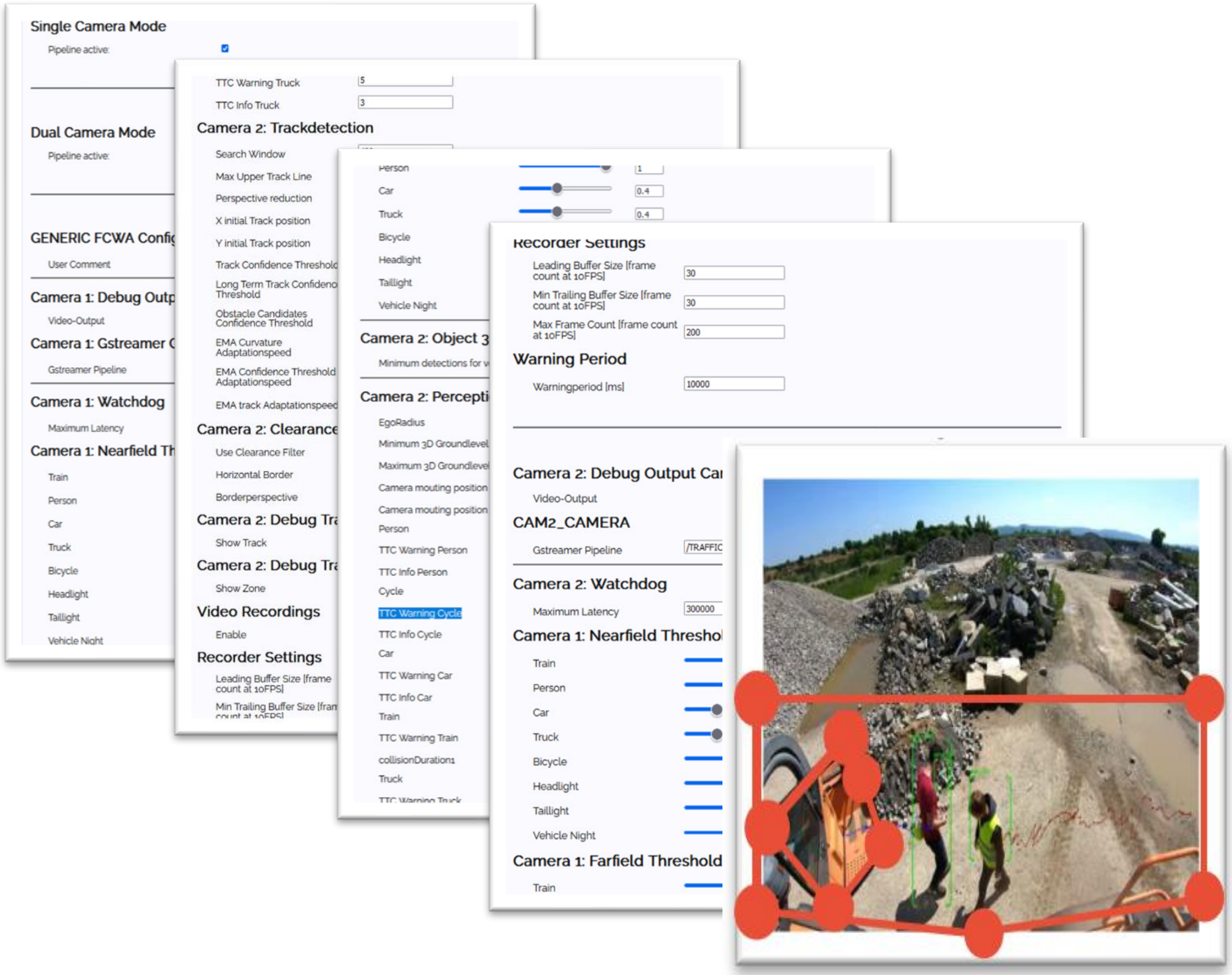


- Developed in an iterative training process over 5 years based on ourselves collected training data
- Different versions available for specific use cases, camera positions and viewing angles.
- Ongoing training for corner cases and different Operational Design Domains (ODDs)
- Customer specific CNNs using EYYES training data and available customer training data possible

EYYES Perception Software User Interface

Graphical user interface

- ➢ Easy to configure, no coding, just click and type
- ➢ Custom polygonal zones by mouse click
- ➢ Easy safe and restore different versions
- ➢ Customizable user rights
- ➢ Pre-configured use cases available



Single Camera Mode
Pipeline active: ☑

Dual Camera Mode
Pipeline active:

GENERIC FCWA Confi
User Comment

Camera 1: Debug Outp
Video-Output

Camera 1: Gstreamer C
Gstreamer Pipeline

Camera 1: Watchdog
Maximum Latency

Camera 1: Nearfield Th
Train
Person
Car
Truck
Bicycle
Headlight
Taillight
Vehicle Night

TTC Warning Truck: 5
TTC Info Truck: 3

Camera 2: Trackdetection
Search Window
Max Upper Track Line
Perspective reduction
X initial Track position
Y initial Track position
Track Confidence Threshold
Long Term Track Confidenc Threshold
Obstacle Candidates Confidence Threshold
EMA Curvature Adaptationspeed
EMA Confidence Threshold Adaptationspeed
EMA track Adaptationspeed

Camera 2: Clearance
Use Clearance Filter
Horizontal Border
Borderperspective

Camera 2: Debug Tra
Show Track

Camera 2: Debug Tra
Show Zone

Video Recordings
Enable

Recorder Settings
Leading Buffer Size [frame count at 10FPS]
Min Trailing Buffer Size [fram

Person: 1
Car: 0.4
Truck: 0.4
Bicycle
Headlight
Taillight
Vehicle Night

Camera 2: Object 3
Minimum detections for v

Camera 2: Percepti
EgoRadius
Minimum 3D Groundlevel
Maximum 3D Groundlevel
Camera mouting position
Camera mouting position
Person
TTC Warning Person
TTC Info Person
Cycle
TTC Warning Cycle
TTC Info Cycle
Car
TTC Warning Car
TTC Info Car
Train
TTC Warning Train
collisionDuration1
Truck
TTC Warning Truck

Recorder Settings
Leading Buffer Size [frame count at 10FPS]: 30
Min Trailing Buffer Size [frame count at 10FPS]: 30
Max Frame Count [frame count at 10FPS]: 200

Warning Period
Warningperiod [ms]: 10000

Camera 2: Debug Output Ca
Video-Output

CAM2_CAMERA
Gstreamer Pipeline: /TRAFFIC

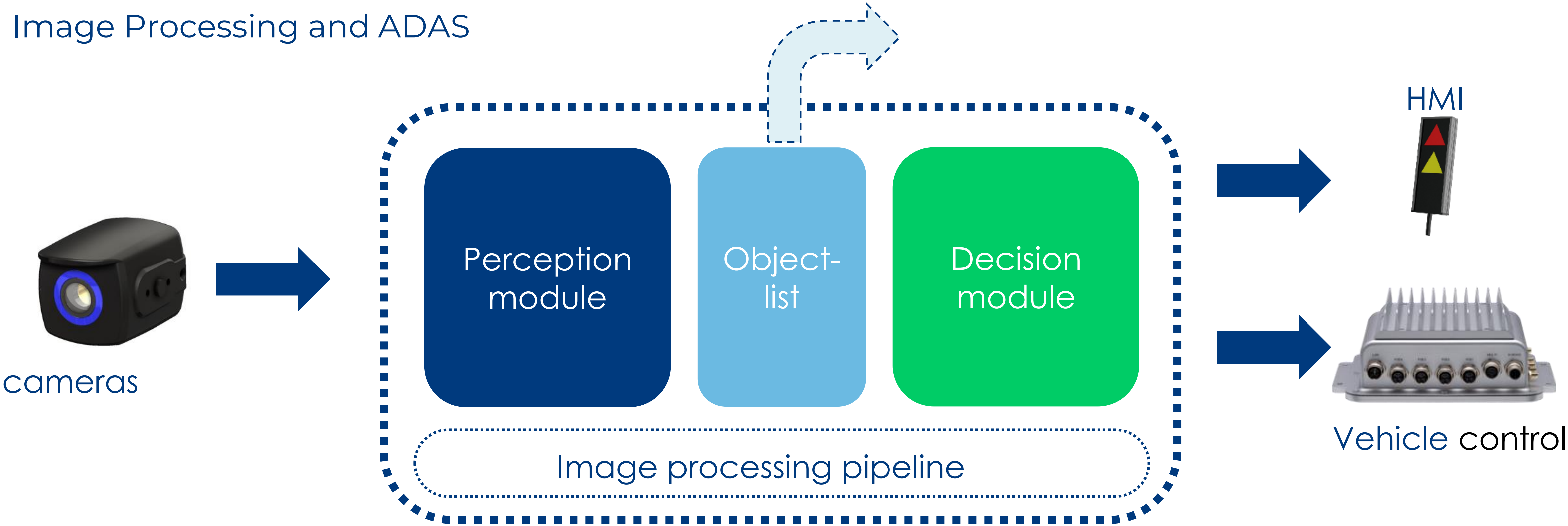
Camera 2: Watchdog
Maximum Latency: 300000

Camera 1: Nearfield Threshol
Train
Person
Car
Truck
Bicycle
Headlight
Taillight
Vehicle Night

Camera 1: Farfield Threshold
Train

EYYES Perception Software

Image Processing and ADAS



cameras

Perception module

Object-list

Decision module

Image processing pipeline

HMI

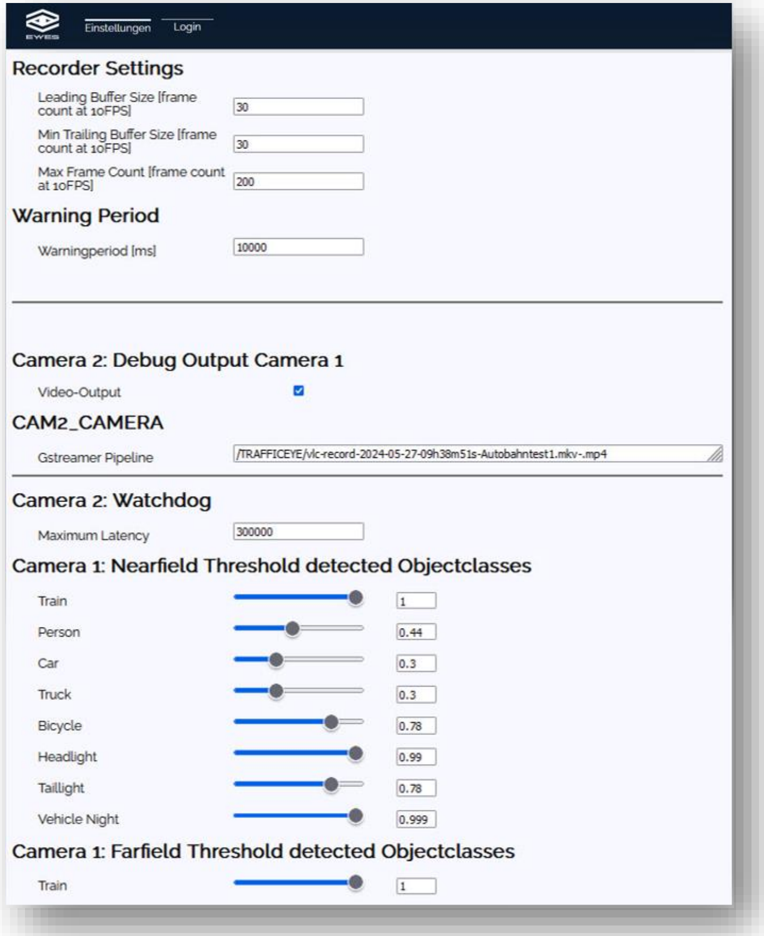
Vehicle control

One software for all camera applications in a vehicle

EYYES Perception Software

Features and functions

- ✓ System self-monitoring
- ✓ Lens contamination monitoring
- ✓ High level Logging possibilities
- ✓ Easy adaption of the processing pipeline
- ✓ Video-output H264/H265 stream or HDMI
- ✓ Overlays like bounding boxes, etc.
- ✓ Object List Streaming via UDP



Recorder Settings

Leading Buffer Size [frame count at 10FPS]	30
Min Trailing Buffer Size [frame count at 10FPS]	30
Max Frame Count [frame count at 10FPS]	200

Warning Period

Warningperiod [ms]	10000

Camera 2: Debug Output Camera 1

Video-Output ☑

CAM2_CAMERA

Gstreamer Pipeline	/TRAFFICEYE/vlc-record-2024-05-27-09h38m51s-Autobahntest1.mkv-.mp4

Camera 2: Watchdog

Maximum Latency	300000

Camera 1: Nearfield Threshold detected Objectclasses

Train	1
Person	0.44
Car	0.3
Truck	0.3
Bicycle	0.78
Headlight	0.99
Taillight	0.78
Vehicle Night	0.999

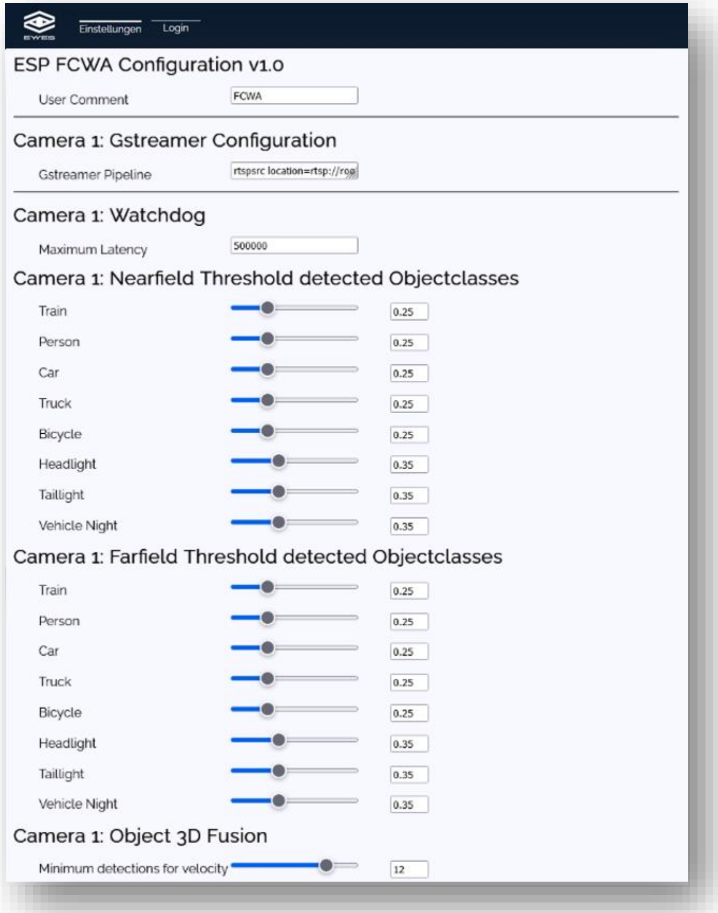
Camera 1: Farfield Threshold detected Objectclasses

Train	1

EYYES Perception Software

Features and functions

- ✓ Object detection, object classification, object tracking
- ✓ 2D/3D estimation
- ✓ Localization of objects
- ✓ Movement prediction
- ✓ EYYESNET or customer neural networks
- ✓ Parallel processing of different neural networks
- ✓ 3 different warning strategy approaches available



ESP FCWA Configuration v1.0

User Comment: FCWA

Camera 1: Gstreamer Configuration

Gstreamer Pipeline: rtspsrc location=rtsp://rog

Camera 1: Watchdog

Maximum Latency: 500000

Camera 1: Nearfield Threshold detected Objectclasses

Train	0.25
Person	0.25
Car	0.25
Truck	0.25
Bicycle	0.25
Headlight	0.35
Taillight	0.35
Vehicle Night	0.35

Camera 1: Farfield Threshold detected Objectclasses

Train	0.25
Person	0.25
Car	0.25
Truck	0.25
Bicycle	0.25
Headlight	0.35
Taillight	0.35
Vehicle Night	0.35

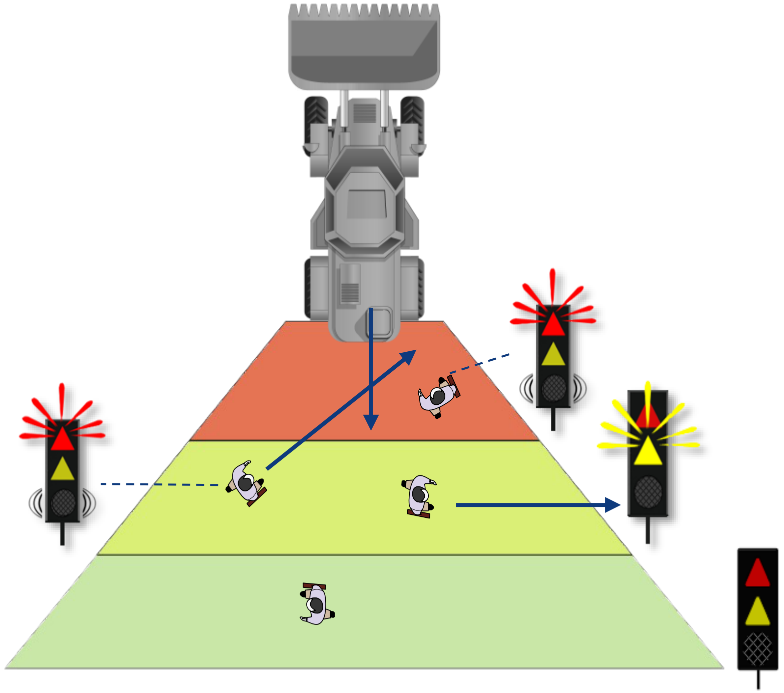
Camera 1: Object 3D Fusion

Minimum detections for velocity: 12

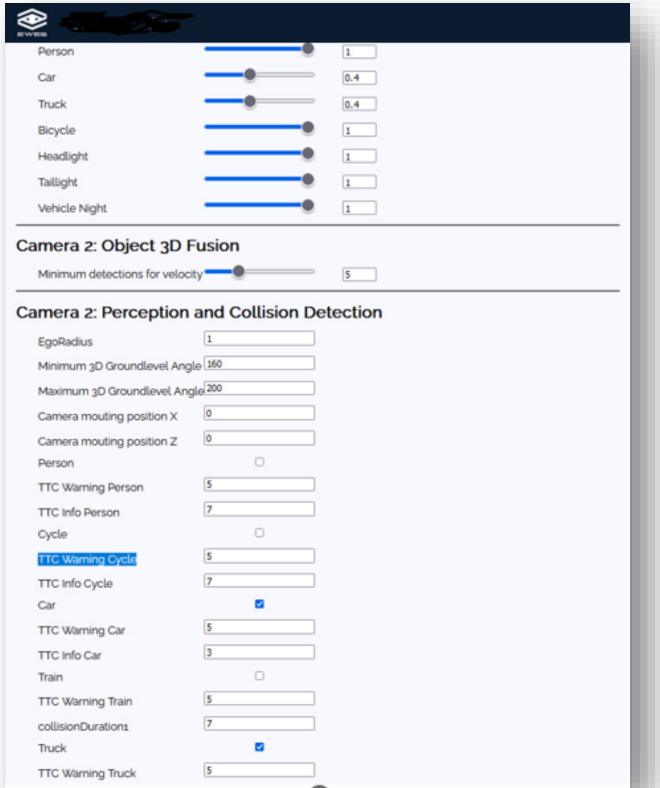
Artificial intelligence for safe vision, recognition and understanding

EYYES Perception Software

multiple warning strategies



- ✓ ***PRESENCE DETECTION***
- ✓ ***MOVEMENT PREDICTION***
- ✓ ***TTC-WARNING STRATEGY***



[redacted]

Person	1
Car	0.4
Truck	0.4
Bicycle	1
Headlight	1
Taillight	1
Vehicle Night	1

Camera 2: Object 3D Fusion

Minimum detections for velocity	5

Camera 2: Perception and Collision Detection

EgoRadius	1
Minimum 3D Groundlevel Angle	160
Maximum 3D Groundlevel Angle	200
Camera mouting position X	0
Camera mouting position Z	0
Person	☐
TTC Warning Person	5
TTC Info Person	7
Cycle	☐
TTC Warning Cycle	5
TTC Info Cycle	7
Car	☑
TTC Warning Car	5
TTC Info Car	3
Train	☐
TTC Warning Train	5
collisionDuration1	7
Truck	☑
TTC Warning Truck	5

EYYES Perception Software

Preset use cases

- ✓ BSIS
- ✓ MOIS
- ✓ Rear view monitoring
- ✓ Blindspot warning
- ✓ Nearfield person- detection 180° /270°/360°
- ✓ Swivel range monitoring
- ✓ Front collision warning

FLEXIBILITY
QUALITY
SAFETY

EYYES

YOUR LEADING EUROPEAN AI TECHNOLOGY PROVIDER

- # FLEXIBILITY
- # QUALITY
- # TIME-TO-MARKET
- # SAVE LIVES WITH AI

Thank You for Your Attention

For further information please contact

DI Hans Pflügl MBA
Head of Business Unit Manufacturing
hans.pfluegl@eyyes.com
Tel: +43 664 88155650

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