awareAI

Smart camera system with artificial intelligence to detect and track vehicles and pedestrians in flexible detection zones

Overview

The Siemens awareAI System is a smart camera system with artificial intelligence focussing on detection, classification and tracking of road users, including pedestrians, bikes, cars, trucks and busses. All detection tasks are performed within the local processing unit, guaranteeing the highest level of data protection as only fully anonymized information is processed by external systems.

For detection and classification of road users, the awareAI System can be used right away without any additional configuration. The device is easily configured for advanced features such as detection zones and tracking using its integrated graphical web interface.

Benefits

- Versatile all-in-one solution with artificial intelligence
- Support for advanced setups incorporating multiple cameras
- Highest privacy protection level due to local video processing
- Reliable classification of various vehicle and pedestrian types
- Flexible and convenient configuration of detection zones
- Ease of installation with a single PoE+ line for data and power

Key Features

Object detection and classification: Using the integrated artificial intelligence engine, the standard awareAI System detects and classifies at least eight different object types, specifically pedestrians, bikes, motorcycles, cars (incl. vans), trucks, busses, trams and trains. Object detection and classification are standard features without any required configuration.

Detection zones: After installation, so-called detection zones are simply configured through the awareAI graphical web interface. Different types of detection zones are available, e.g. for pedestrian crossings, parking applications or generic tracking areas. For detection zones, precise georeferences must be provided for the camera itself and for the detection zone polygon vertices. When detection zones are used, all detected objects are referenced to a respective detection zone.

Object tracking: The awareAI System determines movement direction and speed of detected objects, using the resulting data for applications such as crossing time predictions.

Data interface: The data interface transmits all detected objects through a secure web socket connection in the JSON format. The device connects to the configured server when starting up

and pushes its detections with each video frame. For each object, the object class, normalized boundary polygon position and classification confidence rate are transmitted. When detection zones are used, the corresponding detection zone of each object is also transmitted. When tracking is used, speed, direction and object ID are transmitted as well. Additionally, an optional evidence image can be included in each transmission.

Live view: For commissioning and maintenance purposes, the awareAI System can optionally provide a web interface with a live view of the camera image, with detection zones and detected objects highlighted.

Supplementary Features

Network configuration: The local processing unit is default-configured for DHCP. As an alternative, a static IP address and subnet mask can be configured.

Security configuration: The encrypted data interface requires the certificate of a CA as well as client certificates for authentication when establishing a connection.

Temperature monitoring: To ensure safe operation, the local processing unit continuously monitors relevant temperature values.

Time synchronization: The awareAI System can connect to an NTP time server for time synchronization.

System Architecture

awareAI Camera: Both conventional IP cameras, which can be connected to a local processing unit via Ethernet, or the awareAI Camera with its own local processing unit integrated directly into the camera unit can be used as cameras for the awareAI System.

Using infrared illumination built into IP cameras, both standing and moving road users can be detected and tracked by the awareAI System even during adverse lighting conditions. Due to the compact form factor of the IP cameras and the single Power-over-Ethernet line required to connect them, awareAI Cameras can be installed at various different mounting positions, including poles, gantries and building facades.

awareAI Core: The local processing unit awareAI Core is responsible for the processing of imagery from IP cameras. Depending on individual application requirements, awareAI Core transmits the fully anonymized object data for further processing or data analysis, such as to a server unit or a traffic control center.

Each awareAI Core can process three frames per second when connected to a single awareAI Camera. In cases where lower framerates are sufficient for the intended application (e.g. parking monitoring), a single awareAI Core is used to process the imagery of multiple awareAI Cameras. Depending on complexity and scope of the downstream business logic, further processing of anonymized object data is performed directly on the awareAI Core, or alternatively on a separate local awareAI Server.

awareAI Server: More complex business logics and data fusion tasks can be executed locally with the local server unit awareAI Server. This allows integration of data from various detectors and other sensors connected via Ethernet into the awareAI System. Furthermore, the awareAI Server allows signals to be sent over dry contacts, in order to directly communicate with conventional traffic controllers or other local devices.

The awareAI System can be used for a wide range of different fields of application; for the most common applications such as pedestrian and cyclist crossing supervision, parking space occupancy monitoring and counting applications, preconfigured business logics that can be easily adapted are available out-of-the-box.

Application Examples

Traffic counting: For applications involving counting of road users, detection zones can be used to define virtual counting cross sections. Over specified periods of time, all tracks of vehicles and pedestrians passing the cross section are counted, aggregated and classified according to their direction and vehicle or pedestrian type; further relevant attributes such as speed can be averaged. Object positions can also be processed and visualized as cumulative trajectories.
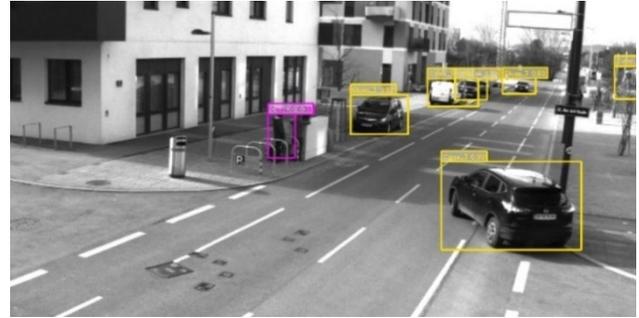
Crosswalk supervision: The awareAI System for crosswalk supervision enables traffic controllers to actively initiate green phases for waiting pedestrians and cyclists, without needing to use manual push buttons at intersections. Depending on the number of waiting pedestrians or cyclists, waiting times can be dynamically reduced; furthermore, green phases are dynamically extended to facilitate slower pedestrians and larger groups crossing safely.
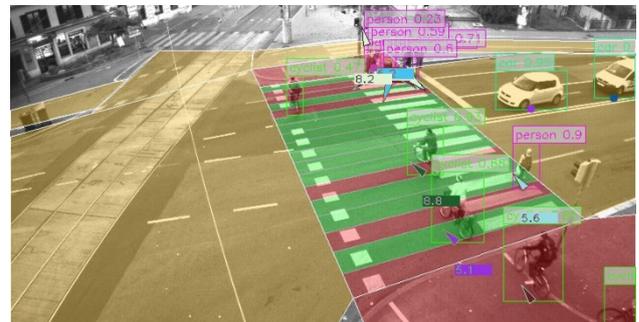
Parking space monitoring: awareAI can be used for monitoring both marked and unmarked parking spaces, detecting occupancy and parking time of individual vehicles. In case of unmarked (e.g. curbside) parking spaces, the awareAI System automatically calculates the number of available parking spaces based on the distance between parked vehicles, and can optionally differentiate between available parallel parking spaces for different vehicle lengths.