SUPERVISORY CONTROL SYSTEM FOR THE COLLECTION, PROCESSING AND ANALYSIS OF DATA

*eNvision* system is a high-end software platform for the collection, processing, and analysis of data and remote control which enables integration of various software and hardware components (for example - weather stations, automatic traffic counters, PTZ cameras, marine radars, traffic radars, PLCs, lighting) into a single supervisory control system.

The system is based on client-server architecture. In addition to the SCADA server subsystem, the system includes the subsystems for data analysis and visualization, which are implemented as a Web application. The system has a configurable analytical and presentation modules that allow easier interpretation and better understanding of the data and the system status.

The eNvision platform has a modular design where various components communicate via the TCP/IP network using only standardized network protocols, which enables high scalability of the system.

**MAIN COMPONENTS OF THE SYSTEM:**

- The core of the system (services for the collection, storage, processing and analysis of data)
- Database and archive (dataLogger)
- User interface (modules for visualization and graphical representation of the data)
- Interfaces to the other systems ("drivers")
- Components for the automatization of monitoring and control of the system (virtual operator, estimator and predictor of the system states)
The system is based on modern Web technologies and standards that enable easy access via Internet browsers regardless of the client platforms. Special attention has been paid to the user interface by applying widgets and enabling management of different levels of access and appearance of user profiles (configuration of appearance, language and functionality) which all gives a special user-friendly atmosphere. Furthermore, this approach allows the SCADA system a centralized and parallel multi-user operation and monitoring and prompt management of critical system resources.

**The platform currently contains the following drivers:**

- MeteoDrive
- IDrive
- PLCDrive
- TCDrive
- AISDrive
- GPSDrive
- RadarDrive
- SpeedDrive
- CamDrive
- SPZDrive
- StatDrive
- GISDrive
- LogDrive

Program components called “drivers” or driver modules are interfaces with the various systems from other manufacturers and convert various protocols and logic into a universal eNvision™ protocol. This enables easy implementation of additional protocols. The eNvision platform has a modular design where different components communicate via the TCP / IP network. Using only standardized network protocols facilitates system upgrading and scaling.

**Supported protocols:**

- Industry standard MODBUS
- Specific manufactured (“TG”) protocols to the traffic system and telephone (TPS) system
- ISS Autoscope™ interface for automatic detection of incidents via cameras and video-wall protocols (Barco™, Eyevis™)
- Simple Network Management Protocol (SNMP), OPC standard
- various video matrix, etc.
MeteoDrive module enables integration of weather stations in the system. A road weather station provides continuous collection of data on weather conditions important for the traffic. These data indicate potentially hazardous weather conditions on the road and are used to issue warnings through variable signs (VMS) or via other devices for informing the traffic participants. Also, the collected data helps road maintenance and management services, especially in the winter conditions.

**CURRENTLY SUPPORTED PROTOCOLS:**
- Vaisala
- LEDel MS v.1 (LED Elektronika d.o.o.)
- LEDel MS v.2 (LED Elektronika d.o.o.)
- NMEA 0183

**KEY MODULE FUNCTIONS:**
- Collecting of meteorological data
- Remote device configuration
- Monitoring device status (failures, anomalies in operations)

IODrive module enables integration of devices for remote control through digital inputs and outputs and relays in the system. Remote relay control enables the deployment of relay logic for remote devices or remote turning on/off of the devices. In addition to management, listening to digital inputs that are most commonly used as alarm triggers is also enabled.

**CURRENTLY SUPPORTED PROTOCOLS:**
- Advantech ADAM 6*** serija

**KEY MODULE FUNCTIONS:**
- Setting the digital outputs
- Reading digital outputs and inputs
- Monitoring device status (failures, anomalies in operations)
PLC DRIVE

KEY MODULE FUNCTIONS:
- Monitoring device status (failures, anomalies in operations)
- Localized management and unified access to the PLC device
- Independence of a subsystem in relation to the rest of the system

PLC drive module enables integration of PLC devices into the system. PLCs from the world’s most renowned manufacturers are supported, such as Rockwell Automation (Allen-Bradley), Schneider Electric, Siemens, etc.

CURRENTLY SUPPORTED PROTOCOLS:
- Modbus (serial, IP)

TCDrive module enables integration of automatic traffic counters in the traffic system on the roads. Traffic counters provide information about the number and type of vehicles at selected cross sections of road (counting points) at specified times. Average annual daily traffic (AADT) and average summer daily traffic (ASDT) are two basic and most widely used indicators of the size of the traffic resulted from the processing of these data.

TCDrive module supports:
- Collection of traffic data
- Configuration of traffic counter remotely
- Traffic counter state detection (inactivity/failure)

CURRENTLY SUPPORTED PROTOCOLS:
- LEDel TC v.1 (LED Elektronika d.o.o.)
- TLS2002
AIS Drive allows the integration of multi-channel AIS receivers in the system. Automatic Identification System or AIS is a system for short-range coastal tracking of ships and maritime traffic. In this way, the ships exchange numerous data on the current state, location and other relevant indicators related to the trajectory of the ship.

**Currently Supported Protocols:**
- NMEA 0183

GPS Drive module enables integration of GPS receivers in the system. GPS receivers allow effective monitoring of mobile objects through geographic areas. The collected data are commonly used in statistical and spatial analysis in surveillance and security purposes.

**Currently Supported Protocols:**
- NMEA 0183
The RadarDrive module enables integration of maritime radars into the system. Strategically deployed radar devices may cover / monitor a large area, regardless of the climatic conditions and provide high level of protection for monitored locations. In addition to applications in marine and coastal areas, this solution can also be used on land if the protected area configuration enables such application.

**CURRENTLY SUPPORTED PROTOCOLS:**

- Broadband 3G/4G™ Radar, Navico Holding AS.

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The SpeedDrive module enables integration of radar speed sensors in the system. The radar speed sensors measure the speed of vehicles and indirectly enable traffic counting. In addition to the basic purpose - current preventive traffic control, connecting these devices to a central system also allows the monitoring of traffic and complex analysis of the efficiency of the traffic management model in order to conduct preventive actions regarding the safety of traffic.

**CURRENTLY SUPPORTED PROTOCOLS:**

- LEvmsSD (LED Elektronika d.o.o.)
CAMDRIVE

The CamDrive module allows the integration of optical cameras in the system. Optical PTZ camera allows automated video surveillance and tracking of detected object within a defined protected area.

CURRENTLY SUPPORTED PROTOCOLS:

- AUX commands, Bosch Security Systems B.V.
- HTTP API, MOBOTIX AG
- RTSP, MJPEG, JPEG

KEY MODULE FUNCTIONS:

- Remote device configuration
- The retrieval of images
- Absolute and relative management
- PTZ device
- Monitoring device status (failures, anomalies in operations)
- Special features:
  - Thermal imaging
  - Windscreen
  - Module for washing
  - Relays

SPZDRIVE

The SPZDrive module enables integration of light variable signs in the system. Depending on the assessment of the state of the location where the device was installed, the goal is to promptly inform the traffic participants via dynamic traffic signs. Variable signaling system and measuring stations are placed at locations of possible rapid status changes that may lead or have already led to difficulties in relation to process operation within the domain of application. In such situations, the automatic forwarding of information in the form of warnings or restrictions via the light variable signals greatly contributes to the reduction of harmful effects on people.

CURRENTLY SUPPORTED PROTOCOLS:

- Futurit VMS (SWARCO Group)
- LEvms (LED Elektronika d.o.o.)

KEY MODULE FUNCTIONS:

- Remote device configuration
- Set / retrieve the current display
- Monitoring device status (failures, anomalies in operations)
The StatDrive module enables statistical analysis and presentation of the data collected in the system.

Statistical reports include the data of all physical and logical measurements at the local or global level. Reports are dynamically generated via a Web application depending on the specific requirements of the user or pre-defined templates. The system enables the creation of standard statistical reports (e.g., minimum and maximum deviation and average values in a given time interval) for all measurements and specific for certain measuring units (e.g., relative / absolute number of occurrences in intervals).

Statistically processed data facilitate a high-quality decision making process within a specific domain of application of the system and allow the identification of interdependencies between individual measured values of the system.

The GISDrive module enables spatial analysis and review of spatial data collected in the system.

The map enables real-time viewing of geo-referenced data. It is used for visualization of all spatial measurements, display of objects (devices, zones, markers) and the interaction/management of these objects.

**CURRENTLY SUPPORTED PROTOCOLS:**
- WFS, WMS, WPS, LEsockets (LED Elektronika d.o.o.)
MIS-METEOROLOGICAL INFORMATION SYSTEM

The system includes automatic weather stations, variable light signals, communication subsystem for data transmission and the central subsystem for data collection and processing. In many processes, an underlying requirement is fast adjustment to the current hydrometeorological conditions so special attention should be paid to two determinants: the exact amount (JIQ-Just in Quantity) and the right time (JIT-Just in Time) of action.

Possible models of integration with meteorological systems:

- Publicly available systems
  - Meteorological and Hydrological Service

- Private Systems
  - Hrvatske ceste d.o.o.
  - Autocesta Rijeka – Zagreb d.d.

- Private weather stations

General hydrological systems can serve as general indicators of trends and the current state in the larger areas. This means that the simulations allow modeling of the real situations in the field.

Road weather systems measure following values:

- Air temperature and humidity
- Air pressure
- Visibility
- Precipitation
- Freezing point
- Wind speed and direction

Legend:
- Temperature zraka [°C]
- Temperature rinita [°C]
Weather stations for special purposes may include the following:

- The temperature of the soil freezing
- Soil temperature at multiple depths
- Soil moisture at multiple depths
- Soil condition at multiple depths
  - Dry
  - Moist
  - Frozen
- Light intensity
- Salt concentration on the road
- Energy consumption

Such stations allow the owner the automation and compliance with both before mentioned determinants (JIQ, JIT).

The developed system is based on the eNvision application platform which includes the following modules:

- MeteoDrive
- SPZDrive
- StatDrive
- GISDrive
- LogDrive

The purpose of the system is continuously collecting and tracking data from the weather stations, centralized processing, automatic control of variable message signs (VMS) on the basis of collected data, and distribution and presentation of current and archived information to system users.

Via the integration of the above modules the system provides the following functions:

- Reporting failures and states of emergency
- Analysis and development of statistical calculations specific for meteorological data
- Viewing geo-referenced data in real time
- Automatic preventive action by informing the driver
- The analysis of the interdependence of physical units
- Spatial data analysis
- Development of high-quality strategies on the basis of years of archiving data
- Manual control of VMS
- Configuration and remote control depending on user rights
TDAAS—TRAFFIC DATA ACQUISITION and ANALYSIS SYSTEM

Counting traffic enables a systematic collection of data on traffic load and the structure of traffic flow (the structure of traffic flow by type of vehicle) and the traffic fluctuations in space and time on the road network. Basic information about traffic on the roads are the result of analysis by counting the collected and subsequently processed data. These findings are a necessary condition for the development and implementation of an effective traffic policy. Without accurate data on the traffic flows in the road network, it is impossible to imagine an economic and technically rational management of the road traffic system.

In the past three decades, a rich fund of information has been created about the traffic load of the road network in the Republic of Croatia, especially on the basis of automatic counters, which allows variety of research in the area of the methodology and development of forecasting models, traffic trends and other fields. Since the beginning of a systematic counting of traffic in our country, it is being constantly developed. The development of the road and the entire traffic system requires high-quality traffic information, which imposes the need for a continuous expansion and improvement of the traffic counting system.

The developed system is based on the eNnvision application platform which includes the following modules:

- TCDrive
- StatDrive
- GISDrive
- LogDrive
The purpose of the system is continuously collecting data from automatic traffic counters, central processing and distribution and presentation of current and archived information to the system users.

The system provides via the integration of the above modules the following functions:

- Reporting failures and states of emergency
- Analysis and development of statistical calculations specific for traffic flows
- Viewing geo-referenced data in real time
- Spatial data analysis
- The analysis of the interdependence among traffic flows
- Configuration and remote control depending on user rights

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Count Day average
The operators of critical infrastructure encounter a difficulty of covering larger surfaces within the perimeter area. The perimeter area on land is often protected by perimeter fencing, video surveillance systems, and microphone, optical fiber and other systems of detecting intrusions, which require great costs in the implementation of security requirements. The difficulties also often occur in protecting the marine perimeter or the coastal zone as a perimeter of the critical infrastructure.

The system of detection and tracking of objects in the coastal area is based on the integration of a set of sensors whose role is to detect and track objects and inform the command, communication and control headquarters of the critical infrastructure.

The network of interconnected radar base stations and mobile video surveillance cameras (optical and thermal), forms the perimeter surveillance area. Based on the detection and classification of objects into valid targets, whose trajectory is directed towards, or is located within the perimeter surveillance area, emergency procedures are initiated which are determined in accordance with the degree of threat to the critical infrastructure. The relevant data regarding the target (the time of detection, target position, speed and direction of motion, radar and video display of the target) are recorded, and enable the operator to estimate the possible aims of the attack, and to plan counter-measures with the aim of reducing the potential consequences of the attack.

The developed system is based on the eNvision application platform which includes the following modules:

- IODrive
- MeteoDrive
- AIDrive
- RadarDrive
- CamDrive
- StatDrive
- GISDrive
- LogDrive
The purpose of the system is continuously collecting data from radars and AIS receivers, central processing, automatic control of PTZ cameras and relays and distribution and presentation of current and archived information to the system users.

Via integration of the above modules the system provides the following functions:

- Reporting failures and states of emergency
- The analysis and statistical calculations specific in relation to monitoring the marine and coastal area
  - The number of emergency occurrences
  - Localization of critical areas
- Viewing geo-referenced data in real time
- Spatial data analysis
- Automated detection and tracking of suspicious objects
- Advanced methods of analysis of the radar signal and object extraction
- Integration of multiple different radar devices
- Automated reconstruction of scenarios by linking events and data into reports
- Automated reporting and handling emergency situations
- The automated system configuration depending on the local weather conditions
  - Radar configuration
  - Thermal imaging
- Manual and automatic control of devices
  - PTZ cameras
  - Relays
- Configuration and remote control of system depending on user rights
- Control of events (alarms, emergencies)