MATRICS-eNOBU

ENHANCED AI ON BOARD UNIT FOR THE TRANSPORT OF THE FUTURE

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New communication technologies, advanced artificial intelligence and advanced integration and management features are integrated into a single on-board platform to make complexity manageable, service reliable and the public transport a choice, not a need.

Electric vehicles, self-driving technology, High-Speed Rail, Integrated multimodality, enhanced customer experience, operation optimization, security inside are the reference elements to win the challenge of increasingly efficient public transport in sustainable and smart environment.

The first step towards this goal is to have intelligent and technologically advanced vehicles at the service of operators, passengers and mobility.

> We are leader in the transport sector and we want to take a step into the near future by evolving one of its flagship products and proposing the new eNOBU on-board unit for buses, metro, trains and other public transport systems (light, rail, people mover, etc.).
> The challenge is to combine the qualities of the previous version with new features that make the solution unique and at the forefront of the market.

MAIN FEATURES

The enhanced new generation of On-Board Unit is not just a localization and communication system between the control room and the vehicle, but an on-board intelligent control unit that integrates the following features in a single hardware device:

- A cutting-edge chipset with high computing power and high storage capacity (Raid 0 or Raid 1 support)
- A complete set of I/O ports to interconnect all on-board systems
- Integrated air-to-ground communications that also include latest generation technologies (5G)
- Geolocation through different satellite systems (GPS, GALILEO, GLONASS)
- Embedded network switch capabilities for managing a high-speed on-board network (Gbit LAN)
- Processing unit dedicated to AI algorithms onboard
- Video surveillance management:
  - acquisition (up to 60 channels),
  - recording,
  - data encryption,
  - standard encoding and live transmission of video streams
- The one-touch driver console for authentication, interaction with the system, communication with the control unit, view of the situation on board.

- **Railway Environment:** characteristics and compliance with the standards required for electronic equipment used on rolling stock in railway applications. Cab Radio integration and train control systems.

- **Public Transport:** characteristics and compliance with standards for automotive applications and complete data interface to the CAN-bus for assessing the state of the vehicle and to identify in advance maintenance interventions

Our modular, intelligent and secure-by-design AVM software integrated into the eNOBU allows to:
- Manage the entire on-board ecosystem (displays, loudspeakers, ticket validators, cctv, emergency call, diagnostics, network, driver console)
- Supply geolocation, travel information, board-to ground communications, audio announcement, passengers counting, infotainment, driver services, and video surveillance
- Interact with external systems (V2X, ITxPT, GTFS, etc.)
- Use AI algorithms for video and data analysis

MORE EFFICIENT MONITORING AND MANAGEMENT FROM THE CONTROL CENTER
- Updated and accurate vehicle position
- Immediate communication (voice and data) with drivers.
- Real-time data collection for assessing the status of the service, measuring performance, estimating vehicle occupancy, planning also at short-term.
- Live video streaming of internal and external cameras.
- Management and a posteriori analysis of all the data acquired to improve the final accounting and the planning and regulation of the service.
- Interaction for the management of the vehicle and the activities in the depots areas.

DRIVERS ALWAYS INFORMED AND CONNECTED WITH THE CENTRAL
- Reliable authentication on the vehicle and identification of shifts and runs.
- All information available at a glance in a console specifically designed for drivers (run data, modifications and diversions, vehicle diagnostic, messages).

- One-click mode to communicate with the control center.
- Native speech synthesis engine for on board announcements.
- Live video from cameras on a dedicated monitor to watch the situation indoor, outdoor and on the doors.
- Innovative features based on Artificial Intelligence and 5G to improve safety and quality of service (remote obstacle detection, anomalous situations on board).
- Security functions to send alarms and live video streams from vehicle to control center.

RELIABLE SERVICE AND BETTER EXPERIENCE FOR PASSENGERS
- Timetables, arrival times, occupancy status, travel times, warnings and alerts already available before getting on the vehicle, at the stops or on the smart device APP.
- All travel information visible on the displays inside and outside the vehicle and via audio alerts on board (travel data, next stop, vehicle occupancy, etc.).
- Timely announcements and information (video, audio, smart device APP) in case of critical event with suggestions of alternatives based on the position of the vehicle.
- Integration of emergency systems for any inconvenience
- 5G at the service of passenger safety and entertainment.

5G AND AI NATIVELY EMBEDDED
eNOBU AI is a cutting-edge solution natively providing an integrated 5G modem and a chipset with a Neural processing unit capable of supporting algorithms based on AI.
These unique features allow the device to have onboard solutions for smart mobility (i.e.: green light priority) and AI algorithms applied to video and data analysis to improve safety & security, predictive diagnostics, smart maintenance, service optimization.

TECHNICAL DATA

Hardware

Cooling system	Fan less
Case material	Aluminum
Operative temperature	-40°C ÷ +70°C (80°C for 10 minutes) [-40°F to 158°F / 176°F for 10 min.]
Operative humidity	up to a 95% not condensing
Input Voltage	9-36 V DC
Power	<160 W
Dimensions (HxWxD)	100x250x200 mm [3,94x9,84x7,87 in]
Weight	4.5 Kg (max) [9,92 lb]
Connector type	M12, DBx, SMA

Processor/Memory

CPU	Imx8 QuadCore 1.6 GHz (automotive range) with Neural processing unit
RAM	2GB RAM
Flash	8GB eMMC
Hard Disk	2x M.2 SSD disk slots
Operating System	Linux 5.4.47 to enable real-time application

Communications

Wi-Fi	802.11 ac/a/b/g/n, AP/Client mode
3G/4G/5G	up to 2 modules UMTS/HSPAx/LTE (only 1 5G enabled)
Ethernet	• 8 x Interfacce Ethernet 10/100Mb/s Standard POE 802.3af • 2 x Interfacce Ethernet 10/100/1000Mb/s
Satellite	• GPS signal accuracy ± 10m, typical ± 1.5m, better with EGNOS support • GALILEO Positioning Service (option) • GLONASS Positioning Service (option)

I/O Interfaces

I/O Ports	• 1 ports USB 2.0 • 1 x CAN ports • 8 x digital inputs + 3 x digital outputs • 2x configurable ports (RS-232/RS-485/RS-422)
Video	HDMI connections to external display
Audio	• 2x analog input • 2x analog output • 3x analog output class D a 20W/linea • Audio Matrix

MVR (Mobile Video Recorder)

Video surveillance capture	• Up to 8 POE camera directly connected to eNOBU (up to 60 or more cameras with external networking devices) at various resolutions and frame rates • Dynamic text insertion (date, time GPS position)
Codec	supported recording formats: MPEG4/H264/H265/MJPEG, H264 encryption on disk
Video Streaming	• Unicast and multicast over RTP recording and extracting • Circular buffers for permanent recording • Streaming of recorded videos • Extraction of sequences (standard container)
Configurability	Onvif 2.2 compliancy
Remote control and maintenance	Built in web server and upgradeable firmware via network
Security	• AES Data encryption with a 128/256 bit key • Login with user name and password via secure protocol (HTTPS) • Portable HDD protection with double password

Certification Compliance

CE marking	• Compliant with RED Directive 2014/53/EU • Compliant with ROHS Directive 2011/65/UE
Automotive	Compliant with UNECE R10, UNECE R118
Railway	Compliant with CENELEC EN 50155/EN45545
Vibrations	Compliant with CENELEC EN 61373
IP Protection	IP 65

Additional features

Software suite	AVM, OBC, PIS, MVR, PCS, CAN, SDK

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