V-ROX

The enhancement of the A-ROX system with computer vision sensors including AI algorithms

Advanced Navigation Solutions

Application

The V-ROX system is based on the A-ROX system and extended with a powerful 128-channel LiDAR and a stereo camera, enabling SLAM-based localization for GNSS-denied environments or fully/ partially indoor environments for example. It can be used for ADAS and autonomous vehicle testing, survey and mapping, georeferencing of cameras, and LiDAR sensors, logging of parameters during vehicle tests and machine automation.

Technology

The patented **tightly coupled** sensor fusion algorithms integrate **survey-grade GNSS** raw measurement data (multi-constellation, multi-frequency), **RTK and PPP** (HAS and terrestrial) correction data, **inertial sensor** data (FOG-grade MEMS IMU) , **odometry** data, **LiDAR** data and **camera** data for a highly accurate position, velocity and attitude solution, even in challenging GNSS environments. AI based algorithm supports the localization solution for a unique positioning performance.

A powerful forward-backward post-processing engine is available to further enhance the accuracy of the position, velocity and attitude solution with all recorded sensor raw data.

System configuration

The V-ROX system is built on a new modular hardware platform, delivering improved processing capabilities and upgraded interfaces. The system is configured with three GNSS antennas. The processing units, including two embedded GPU units, are part of the V-ROX system. A powerful configuration and visualization software is implemented as a **web app**, easily accessible from different kinds of devices, including laptops and tablets. It is directly hosted on the system with no need for installation of software on your device. On top of the local app, a cloud-based fleet management feature is available for controlling all your V-ROX devices and accessing all sensor data from anywhere.

Interfaces

The V-ROX system comes with an integrated **5G** module, providing access to RTK and PPP correction data and enabling remote view and system configuration very user-friendly. Further interfaces are Wi-Fi, Gigabit Ethernet, USB-C and up to 4 CAN -FD channels. Trigger events, like wheel ticks, can be fed through the GPIOs into the sensor fusion framework.

There are several output formats available with a maximum rate of 200 Hz (1000 Hz optional): ROS 2, NMEA, ACOM and CAN.

Why choose the V-ROX system?

1 cm	0.01 km/h	0.05°	0.02°
Position	Velocity	Heading	Roll and Pitch

Highly Accurate Navigation

Highly accurate position, velocity and attitude information for ground truth data generation.

AI Inside

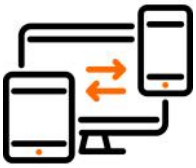
Extended accuracy with AI-based algorithms using computer vision sensors to support the localization in GNSS-denied environments.

RTK-PPP Handover

Seamless handover between both technologies depending on available correction source.

HAS + OSNMA Technology

Uses Galileo High Accuracy Service (HAS) + OSNMA for Precise Point Positioning (PPP) and Integrity.



Web App

Web-based user interface for configuration, test-control, fleet management and post-processing.

Easy System Integration

Out-of-the-box working, without measuering lever arms of the system and without the need for additional hardware thanks to integrated 5G modem and NTRIP client v2.

ROS 2

Solution output and interfaces to all GNSS receivers, IMU, vehicle, LiDAR and camera data with ROS 2.

ACOM Data Stream

Compatible with NCOM, fits directly to the OxTS toolchain. Your toolchain does not need to be changed.

Minimal Warm-up Time

1-2 min, no dynamic run-in procedure required.

Made in Germany

Development, production, support and repair service in Germany.

Technical Specifications

SENSOR FUSION PERFORMANCE

Accurate RTK Positioning* (1σ)	
Horizontal accuracy	0.006 m ± 1 ppm
Vertical accuracy	0.010 m ± 1 ppm
Accurate PPP Positioning* (1σ)	
Horizontal accuracy	0.20 m ± 1 ppm
Vertical accuracy	0.40 m ± 1 ppm
Accurate Attitude* (1σ)	
Without dynamic pre-calibration (2m antenna spacing)	
Roll and Pitch	0.100°
True Heading	0.100°
With dynamic pre-calibration	
Roll and Pitch	0.020°
True Heading	0.050°
Velocity Accuracy	0.03 m/s RMS
Time-Stamp Accuracy	1 µs RMS
Solution Output-Rate	up to 200 Hz (1000 Hz optional)
RTK Initialization*	
Initialization Time	< 7 s
PPP Initialization*	
Initialization Time	< 4 min
Slip angle accuracy*	0.15°

FOG-GRADE MEMS IMU FEATURES

Accelerometer	
Dynamic range	±10 G
Misalignment	0.01°
Bias Initial Error	2 mG
Bias Repeatability	2 mG
Bias Instability	12 µG
Bias Velocity Random Walk	0.023 (m/s)/√hr
Bais Noise Density (RMS)	60 µG/√Hz
Gyroscope	
Dynamic range	±450 °/s
Misalignment	0.01 °
Bias Initial Error	0.1 °/s
Bias Repeatability	0.01 °
Bias Instability	0.8 °/h
Bias Angular Random Walk	0.06 °/√hr
Bias Linear Acceleration Eff.	0.005 (°/s)/G
Bias Noise Density (RMS)	0.0013 (°/s)/√Hz

GNSS FEATURES

Constellations
Galileo, GPS, Beidou, Glonass
SBAS (EGNOS, WAAS, GAGAN)

Concurrently used Constellations All

Bands
GPS: L1C/A, L1C, L1PY, L2C, L2P, L5
GAL: E1, E5a, E5b, E5 AltBoc, E6
BDS: B1I, B1C, B2a, B2I, B3
GLO: L1CA, L2CA, L2P, L3
QZSS: L1C/A, L1C, L2C, L5, L6

Channels	448
GNSS data rate	up to 100 Hz
Jamming detection	Yes
Dual/Triple Antenna	Yes

LIDAR FEATURES

Type: Ouster LiDAR
Model: Ouster (OS1-128, REV7)

Measurement Range:	Mid-range (max. 200 m)
Vertical Resolution:	128 channels
Horizontal Resolution:	512, 1024, or 2048
Rotation rate:	10 or 20 Hz
Field of View (Vertical):	45° (+22.5° to –22.5°)
Field of View (Horizontal):	360°
Angular Sampling Accuracy:	Vertical: ±0.01° / Horizontal: ±0.01°
Range Resolution:	0.1 cm
Operating Temperature:	-40°C to 60°C
Ingress Protection:	IP68 & IP69K

* Depends on environment and used GNSS-Antenna

Technical Specifications

CAMERA FEATURES

Type: Stereolabs ZED GMSL2
Model: ZEDX

Description: A GMSL2 global shutter wideangle stereo -camera with high-performance IMU, external synchro-nization and integrated depth estimation, localization and object detection features.

Output Resolution:	2x (1920x1200) @60fps, 2x (960x600) @120fps, etc.
Baseline:	120mm
Image Sensor:	Size 1/2.6“, Global Shutter
IMU:	400Hz 16-bits Acc. and Gyro
Ingress Protection:	IP67
Operting Temp.:	-20°C to 55°C

GPU UNIT PERFORMANCE

CPU:	12-core Arm Cortex-A78AE v8.2 64bit CPU 3MB L2 + 6MB L3
GPU:	2048-core NVIDIA Ampere arch. GPU with 64 Tensor Cores
Memory:	64GB 256bit LPDDR5 204.8GB/s
Storage:	64GB eMMC 5.1 + M.2 SSD- Storage with 2 TByte
OS:	Linux / NVIDIA JetPack SDK

Description: Used to interface camera and LiDAR sen-sors and as high-throughput data storage. Enables real-time processing, for object detection, semantic segmentation, and SLAM for example.

INTERFACES

Output Format

Standardized	NMEA format, ROS 2
Proprietary	ANavS binary format, ACOM

Storage 32 for A-ROX,
2x 2TB for GPU units

Communication

- Gigabit Ethernet
- Wi-Fi
- 4G or 5G 2x2 MIMO cellular network
- Up to 4 CAN-FD channels
- USB 3.1
- 4 GPIO, PPS and Sync-in

Powering

- Variable input voltage

PHYSICAL & ENVIRONMENTAL

Dimension	784x858x323 mm
Weight	8.5 kg
Input voltage	
Nominal	12 - 24 V
Power Consumption	
Peak	60 W
Average	30 W
Operating Temperature	-20 to 65°C
IP-Rating	IP65

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DS-VROX-2024-05-21

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