preliminary

Visual Inertial Navigation System

Accurate Positioning. Anywhere. Anytime.

A foundational building block for autonomy is understanding the exact position of the moving agent. Artisense Visual Inertial Navigation System (VINS) fuels moving agents with an accurate and robust positioning solution.

Your road to autonomy is now powered by VINS positioning solution.

Building blocks for VINS / VINS PRO

ArtiSLAM
Simultaneous Localization and Mapping (SLAM) is a geometrical approach to calculate ego pose (positioning) and map surrounding objects at the same time. Because ArtiSLAM is based on a direct-SLAM method (as opposed to feature-based, indirect methods), accurate and robust pose estimation in real-time is possible.

ArtiSensor
Being able to produce quality data is essential for computer vision applications. Artisense has put together years of know-how in sensor synchronization and calibration into a single sensor that enables state-of-the-art performance.

ArtiUI
Standardized interfaces and user-friendly web-dashboard optimized for easy use of the system.

ArtiMap-based Re-localization
Based on deep learning, map-based localization identifies the position of the current image in the database along with an accurate 6 DoF camera pose. VINS PRO is specifically designed to compute the exact pose by identifying common features between the current image and the map database even when their appearance differs due to different weather conditions, lighting or scene changes.

ArtiFusion
Stereo camera, IMU and GNSS work together in a tightly-coupled manner, using the Artisense proprietary fusion algorithm. As a result, VINS outputs the highest quality position data for moving agents.

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Included

	VINS	VINS PRO
Hardware	Sensor head, compute module, GNSS receiver and antenna, cable accessories and secure case	Sensor head, compute module, GNSS receiver and antenna, cable accessories and secure case
Software	VINS software, web-based dashboard	VINS PRO software, web-based dashboard
Documentation	Manual, factory calibration and quality reports	Manual, factory calibration and quality reports

Output

	VINS	VINS PRO
ArtiMap-based Re-localization	-	Vision-based 6DoF re-localization in local or geo-referenced coordinates
	-	ArtiMap size ca. 30 MB/km
ArtiSLAM	6 DoF pose in ECEF / WGS84 and/or 6 DoF pose in local coordinate	Same as VINS
	Point cloud	
ArtiFusion	Confidence (covariance) output	Same as VINS
	Velocity [m/s]	
ArtiSensor	Sensor synchronization < 100 ns	Same as VINS
	960x600 or 1920x1200 px @ 30 FPS in RAW10	
	Support for synchronization with other sensors	
	GNSS receiver output[1)]	

Interfaces

ArtiUI

	VINS / VINS PRO
Output Interface	ROS, gRPC
Hardware Interface	M12 Ethernet
User Interface	Web-based dashboard

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Accuracy

ArtiSLAM (visual-inertial only)

Scenario	Horizontal[2)]	Vertical[2)]	Heading	Roll and Pitch
Urban (Day)	0.6 %	0.1 %	0.001 deg/m	0.0001 deg/m
Urban (Night)	1.2 %	0.3 %	0.002 deg/m	0.0002 deg/m

ArtiMap-based Re-localization

Scenario	< 0.1m accuracy	< 0.3m accuracy	< 0.5m accuracy
Overcast	>50%	>80%	>85%
Rain	>30%	>65%	>70%
Snow	>25%	>70%	>80%

Performance

	VINS	VINS PRO
Initialization time	10s - 3min.[3)]	1 - 10s[4)]
Re-initialization time	10s - 3min.[3)]	1 - 3s[4)]
Latency	Configurable down to 0 ms latency	Configurable down to 0 ms latency
Output frequency	Up to 100 Hz	Up to 100 Hz

Hardware[5)]

ArtiSensor Components

Parameter			Value
Output	Image		Monochrome RAW8 or RAW10
	IMU data		3 axis gyroscope and 3 axis accelerometer
Sensor Components	Sensor head	Camera	Two (2) automotive-grade grayscale HDR global shutter cameras
		IMU	MEMS IMU
	Compute module[6)]		NVIDIA Jetson AGX Xavier[7)]
	Storage[8)]		512GB M.2 SSD
	GNSS Receiver[8)]		Septentrio mosaic-X5 as a default receiver
	GNSS Antenna[8)]		Supports L1, L2 and L5
Dimensions [H x W x D]	Sensor head		30 x 180 x 37.4 mm (stereo camera and IMU, including FAKRA plug)
			150 mm baseline
	Compute module		103 x 140 x 53 mm (contains NVIDIA Jetson AGX Xavier by default)
Environment	Operating Temperature	Sensor head	0 - 40 Degrees C
		Compute module	0 - 60 Degrees C
	Weatherproof		Not available
	Illumination		External light source is required for VINS / VINS PRO

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Weight	Sensor head		160g
	Compute module		900g
Power	Sensor head		5 W
	Compute module		13 W
	Input voltage		9 - 20 V
Recording	Image resolution		Up to 1920x1200 px
	Image field of view		Up to H: 90 degrees V: 60 degrees
	Rate	Cameras	Max. 140 FPS
		IMU	Max. ca. 6.7 kHz
		GNSS	10 Hz (RTK)[1)]
Interface	Sensor head to compute		FPD-Link III
	Compute module output		M12 Ethernet and micro-B USB2.0 SMA plug for GNSS antenna connection Phoenix Contact PC5/2-GU-7,62 (mating connector included) Sync in/out for synchronization with other clock source
Mounting	Default[8)]		Two (2) ¼-20 UNC threads with 8.5 mm thread depth

Optional Components

ArtiSensor Custom Components

Components		Default	Customization
GNSS	Receiver	Septentrio mosaic-X5	Please enquire for exclusion or different unit
	Antenna	Supports L1, L2 and L5	Please enquire for exclusion or different unit
Mounting	Windshield mount	Not included	Variable angle 30 to 80 deg from the horizontal in 5 deg intervals
	Custom mount	Custom mount available upon request	
Storage	Internal	512 GB M.2 SSD	Upgradable up to 2 TB
	External	None	External storage via USB2.0
Cables	Compute module to client	3m M12-RJ45	Variable length
	Sensor to compute module	6m FAKRA	Variable length

1) Please refer to datasheet for Septentrio mosaic-X5
2) Position error as drift in % of travelled distance
3) Initialization in global coordinate (ECEF / WGS84) requires RTK signal and movement
4) Initialization with respect to re-localization map layer
5) Custom configuration / porting to customer HW possible within scope of Non-Recurring Engineering project
6) Images are accessible on the included compute. Please enquire about further customization
7) Please refer to datasheet for NVIDIA Jetson AGX Xavier
8) Please see section “Optional Components” for customization

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