

PROJECT ERRATA:

A UAS and Satellite Empowered Sensing Platform Operating in Hazardous Areas



This project has received funding from



SECURIT



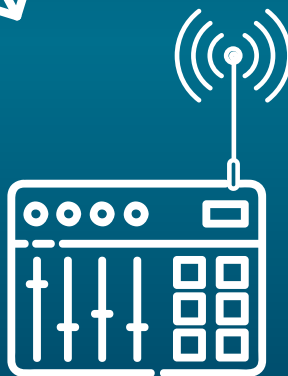
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101005292".

SYSTEM ARCHITECTURE



**A satellite constellation
of 1/3U cubesats.**

**Low-frequency
technology for low-data
long-range/deep indoor
penetration.**



**Fully modular embedded
hardware and software
technology stack.**



**Autonomously navigated
UAV, integrated with an IoT
connectivity node.**



USE CASE

1

GPS RESTRICTION

A GPS restricted location experiences an unexpected catastrophic event inducing hazardous conditions and thus making the area inaccessible to ground personnel



2

STATIONED UAS

The autonomous UAS is activated, transmitting environmental data through the communications node



3

COMMS NODE

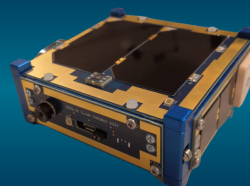
The pair of nodes enables the bidirectional data transmission between the UAS and the control station at the surface by a custom low frequency technology



4

PICOSATELLITE

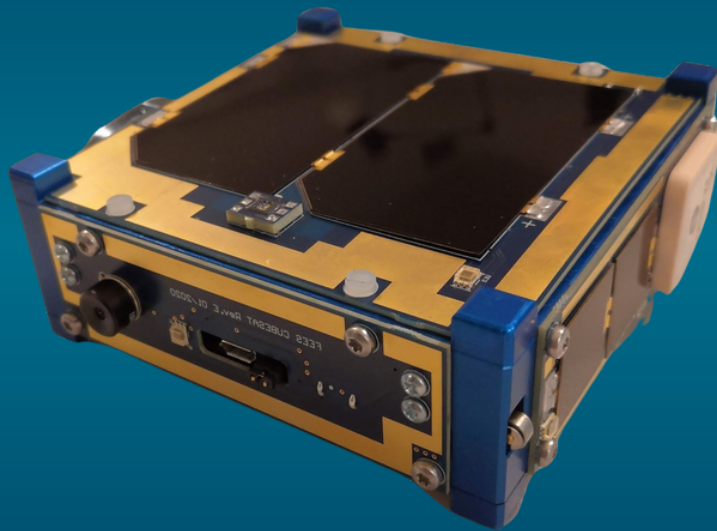
The surface control station communicates the data to an orbital picosatellite making them accessible globally



An abstract graphic featuring a large, light blue gear-like shape in the upper half and a circuit-like shape in the lower half, both centered. A dashed line forms a circle around the gear. The background is dark blue with a pattern of small, light blue dots.

HARDWARE

PICOSATELLITE CONSTELLATION



**Secure
Transmission**



**Low
Consumption**



**Long Life
Battery**

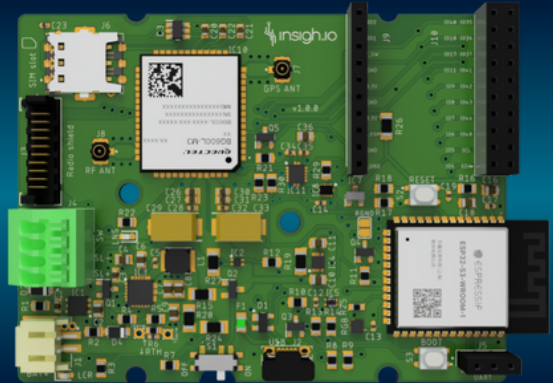


**Remote
Operations**

PICOSATELLITE SPECIFICATIONS

Constellation	9 picosatellites (10x10x3 cm) launching in November 2023, 96 operating by 2027
Orbit	LEO (Low Earth Orbit) 550km, Sun Synchronous Orbit
Average communication time	Around 6 minutes for each passage
Transmission direction	Earth-to-Space. Space-to-Earth to be introduced mid 2024
Modulation	LoRa
Protocol	Proprietary
Encryption	AES 256
Frequency	169 Mhz
Modem	Existing modules on the market, embeddable in the device itself
Message size	10 bytes

Insigh.io board is a generic and affordable board for accelerating IoT adoption by companies, makers and non-experts.



Out Of The Box Features:

- Programmable microprocessor
- Multiple power supply options
- USB/solar charging
- On-board temp/hum sensor
- Embedded GPS
- Device access via USB/Serial port
- Configurable via WiFi and Web UI
- Ready to fit in IP-rated enclosure

Build To Last For Years:

- Ultra-low power design
- Energy consumption profiling
- Automatic power management

One Product - Infinite Applications:

- Exposed IOs for breadboard tests
- Tailor-made sensor shields
- Additional connectivity shields
- Open-source firmware
- Cloud-platform ready



Connectivity

- WiFi / Bluetooth
- Cellular
- LoRa
- Satellite IoT



Energy Sources

- Battery
- Solar Power
- USB



Sensors

- Analog
- Digital
- Industrial Protocols



Scenarios

- Agriculture
- Smart Cities
- Smart Office
- Machines

MAIN BOARD SPECIFICATIONS

General Information				Operating Conditions						
Dimensions (L x W x H)		78 (83.5*) x 57.2 x 16.7 mm * including WiFi antenna		Operational Temperature		0 – 50°C				
				Charging Temperature		0 – 50°C				
Weight		28 g		Charging Current Limit		500 mA				
				Maximum Drawn Current (sensors)		500 mA				
Power Supply										
USB	Port		Input Voltage							
	Micro USB Female		Min.	Typ.	Max.	Units				
			4.5	5	5.5	V				
Battery	Port		Nominal Characteristics							
	JST PH 2.0		1 x Rechargeable LiPo/Li-Ion 1S1C 3.7-4.2 V							
Solar Panel	Port		Input Voltage							
	Fixed Terminal Block with push-in connection (no tools required)		Min.	Typ.	Max.	Units				
			5.5	6	6.5	V				
Connectivity										
Integrated Radio Modules		WiFi/Bluetooth, Cellular IoT & 2G fallback								
Extensions		LoRa, Satellite IoT (using external modules connected with Molex 92317-1012 Ribbon Cable)								
Switches										
S1		Controls power supply to the micro-controller (the battery charging process is not affected)								
S2		Tactile switch for rebooting the micro-controller								
S3		Tactile switch for activating the micro-controller's bootloader (needed only for fw upgrade)								
J4		Port for connecting external switch (S1 should be in OFF state)								
On-board diagnostics, protection & features										
On-board Sensors		1 × Temperature/Humidity Sensor (based on the SHT40 chip) 1 × GPS (using embedded modem's functionality)								
Energy Profiling		Accurate Measurement of battery voltage even at charging state								
Embedded Protection		4 x Resettable Fuses for protecting battery, solar panel and USB ports, 3.3V regulator 1 x Thermistor protecting charging								
Expansion		3 x 10 Female Headers Pin Connector								
LED Indicators				Additional Peripherals						
Usage	Type	Status	Indication							
Charging	RED	ON	Battery is charging	Battery	Cellular IoT/WiFi: At least 1200 mAh GSM: At least 2200 mAh 4000 mAh for permanent deployment * Battery Mandatory for GSM					
		OFF	Battery charged							
		FLASH	Battery not present (USB on)							
Modem	RED	OFF	Disabled by micro-controller	Solar Panel	6V/1W or 6V/2W					
		FLASH	Activity (connecting, sending)							
Scenario	RGB	BLUE	Sensor measurement							
		RED	Connecting to network							
		GREEN	Sending Data							
				Certification						
				CE, FCC, RoHS	In progress					

SENSOR AND CONNECTIVITY EXPANSION SHIELDS



Swappable



**Ready For Final
Product**



Power Management



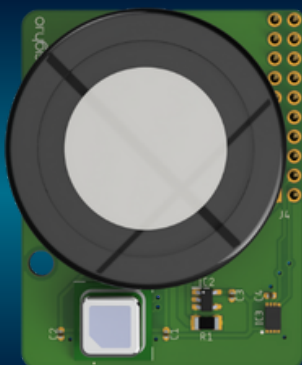
Rapid Testing



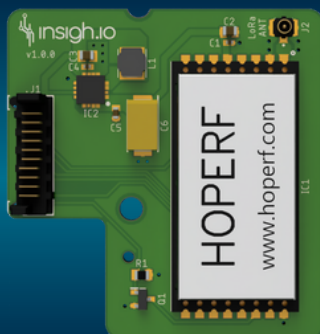
Built-In Firmware



Push-in Connectors



Number of Sensors	2 (Embedded)
Operating Voltage	3.3V
Ports	-
Embedded sensor built-in firmware	Sensirion SCD4x (CO ₂ , RH/T)
	Amphenol Sensortech SGX-70X (Oxygen)
Example applications	Smart Workspaces Monitoring, Confined Spaces (Mines, Tunnels) Inspection



Operating Voltage	3.3 V & 5V
Modem/Chipset	Based on RFM98W-16952 (HopeRF) module Chipset: Semtech's SX1276 137 MHz to 1020 MHz Low Power Long Range Transceiver
Connector/Cables	10-pin Connector (Part number: 90325-0010) Flexible 10-pin Ribbon Cable (Part: 92317-1015)
Firmware	- Basic functionality can be enabled with the open-source Micropython library u-lora available in Github - "insighio-ready" firmware support expected in Q2-24



VERTLINER™

AUTONOMOUS UAV



Autonomous
Exploration



3D Scanning &
Mapping



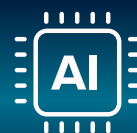
GPS-Denied
Operations



Dynamic Obstacle
Avoidance



Human Hand
Precision



AI Powered Object
Segmentation

UAV SPECIFICATIONS

Build material		Carbon Fiber, SLS
Dimensions*	(mm)	427x437x214
Weight with battery	(grams)	2200g
Weight W/O battery	(grams)	1600g
Battery type		Li-Po 4S 16.8V
Battery Capacity	(mAh)	6750mAh
Total Thrust (4 motors)	(grams)	6800gr
Payload maximum	(grams)	1000gr
Payload recommended	(grams)	400gr
Flight Time	(min)	9min
Range in reinforced concrete	(m)	40m in all directions
Flight Modes	2	Stabilize, Guided
Indoor Positioning System	YES	3D Position Hold in GPS Denied locations
Wi-Fi Connectivity	YES	4G/5G
UAV Sensors		
Camera	YES	e-CAM80_CUNX - Sony 4K Camera
Indoor Positioning System	YES	3D Position Hold in GPS denied locations using LiDAR and SLAM method.
Laser LiDAR Sensor	YES	3D LiDAR centimeter accuracy
IMU	YES	3 axis MEMS accelerometer, gyroscope and precision barometer
Inclinometer	YES	Inclinometer with 0.001 degrees accuracy for gravity alignment before the mission.

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