

seeed studio

the AI hardware partner

Beyond Computing new trends in networked sensors

Violet Su

BOINC Workshop at CERN

May 2024

violet@seeed.cc

About us **seeed studio** the AI hardware partner

Seeed Studio has been a leading Open Hardware company **since 2008**, empowering half a million direct users to create real-world digital solutions. Through relentless efforts and earned trust, our ever-growing product lines now form around emerging AI scenarios:

- **Sensor networks to fetch extensive real-time data**
- **Edge computing to push intelligence to new frontiers**



Smart Sensors
- Collect data -



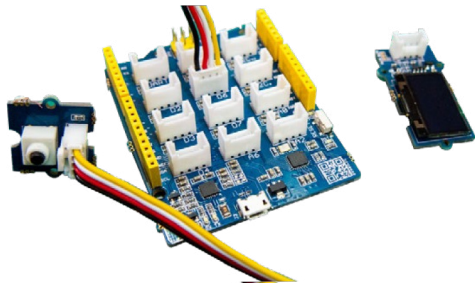
Long-range Network
- Move data -



Edge computing
- Process data -

We provide **industrial-ready modules and devices**, and open up the capability of **prototype, produce, and promote** as Fusion service. Innovators from different vertical domains co-create with us to make their creations widely available for diversified markets.

By embracing open source, community building and integrated software suites like SenseCraft, we are proactively lowering the tech barriers and including users with diverse expertise for globalized matters.



How it started in 2008

From possibilities to productivities



How it's going in 2024

From Technology to Industry

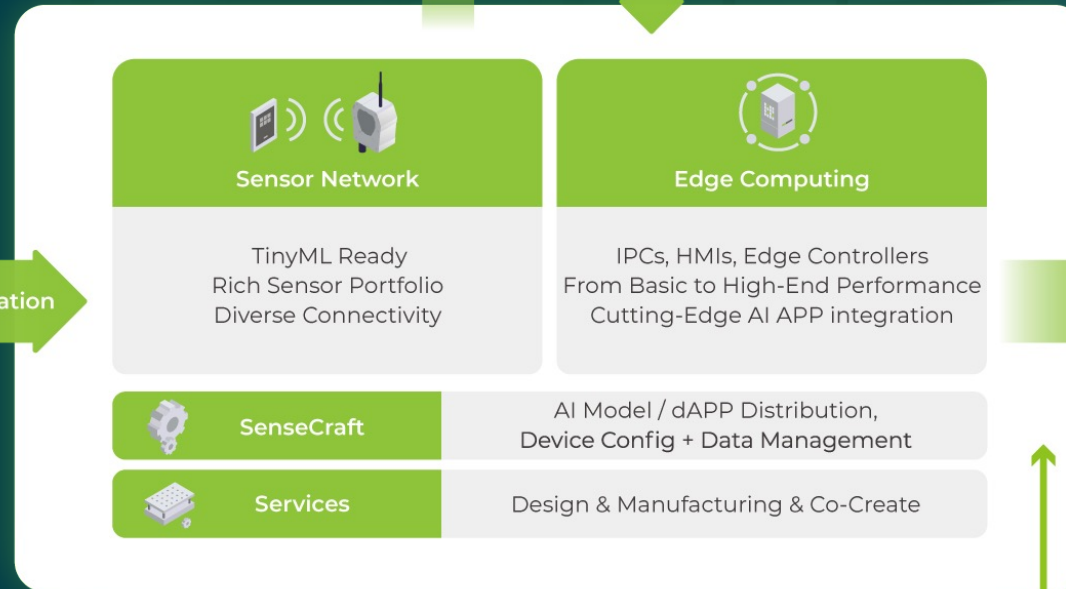
Technologies

- Open Source Hardware
- Machine Learning
- Advanced Sensors
- Home Assistant
- Wireless. DePIN
- LLM

Emerging Technologies



Collaborative Innovation



Applications

- Asset Tracking
- Smart Building
- Industrial space
- Smart City
- Smart Agriculture
- Smart Energy
- Tech for good
- Open Science

Digital Economy



Traditional Industries

- Digital Infrastructure
- Smart Environment
- Smart Agriculture
- Smart Energy



Arduino



Beaglebone



Home Assistant



NVIDIA@ Jetson



Raspberry Pi



SenseCAP



TinyML

Sensor Network fetch extensive real-time data from physical world

Seed Studio provides customers with smart sensing and network coverage capabilities.

- Low-power + efficient + intelligent
- Ready to use devices + easy to develop open source modules

Devices

AI Sensors

Smarter sensors, to see, to hear, to understand



LoRaWAN Devices

Low power, long range
Low connectivity cost



LoRaWAN Sensors

Gateways

Weather Sensors

All-in-one with multi parameter
Easy to integrate



Modules

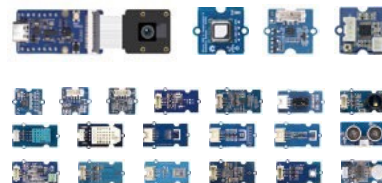
XIAO tinyML MCUs



10+

Arduino, ESP32, tinyML,
Diverse connectivities

Grove Open Source Plug & Play Modules



400+

Vision, environmental sensors, actuators,
Various kits with rich tutorials

Wio Communication Modules

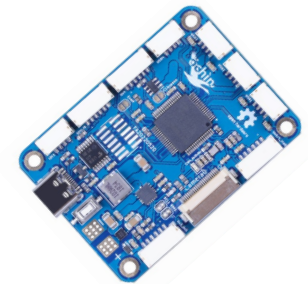
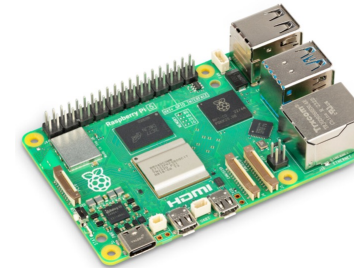
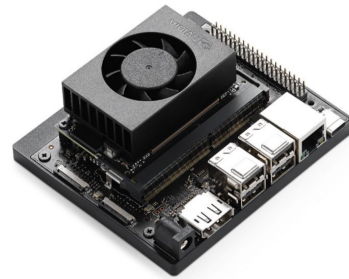
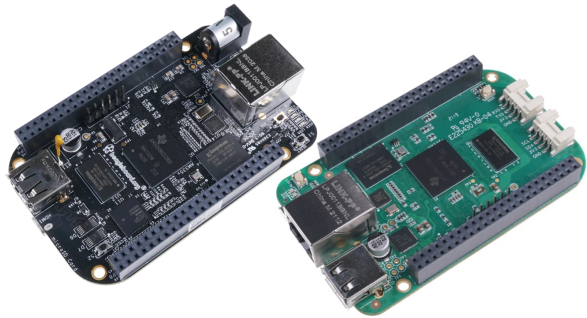


Low-cost LoRa modules for sensor & gateway

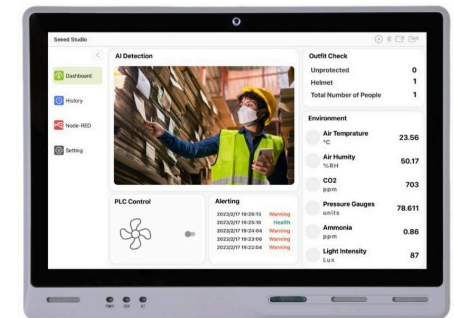
Edge Computing push intelligence to new frontiers

Seed Studio offers a wide range of edge computing options, from development boards to industrial-grade devices.

- **SBCs & accessories for developers**



- **Robust devices for industries**



SenseCraft Automate device deployment and MLops in the field

SenseCraft Edge Builder



LoRaWAN | 2G / 4G |
Bluetooth | Wi-Fi4G

SenseCraft Node Builder



Firmware Payloads

Edge AI



DePIN



Open Source Projects



SenseCraft

Mobile App / Web toolkit

- Enable 3 steps quick configuration and easy deployment. No code, No touch, No complexity.
- Fleet management.
- Secure device up to date, not just on the cloud, but also at edge locations.
- Flexible API.
- On-premise deployment support. Remote data access, visualization.

SenseCraft Model Assistant

- 3 steps to deploy AI models to devices.
- Build active community and model sharing mechanisms to maximize the value of models.
- Offline available, ensuring data privacy and security.

Co-Create with Seeed Fusion Fast Track from Idea to Market

Seeed Fusion: One-stop services catering to your needs:

Design & customization => production => promotion.

Open Source + AI + Hardware



Produce



Prototype



Promote



Prototype - Design and Customization for Diverse Needs

- Full spectrum services - from light to deep customization
- Open reference design - lower threshold for rapid prototyping
- Professional expertise - proven product design experience



Produce - From Small-batch to Mass Production

- Instant online quotation & lead time for PCB & PCBA
- Professional experts - guaranteed services for scale-up
- Designated engineers & professional project management



Promote - Rich Resources for Marketing and Promotion

- Online store serving half a million direct customers worldwide
- 200+ global and local distributors via online/ offline channels
- Dedicated resources to create contents with active communities

Fusion Co-Create Success Cases



Demo Badge for AWS IoT

IoT educational platform



ESPressoscope

Platform for in situ microscopy



Ochin CM4

Carrier board for RPI CM4



Smart Citizen

Environmental monitoring



Crazyflie

Micro palm-size quadcopter



Loko GPS Tracker

Tiny LoRaWAN GPS Tracker

Co-create and launch your ideas with Seeed Studio

The easiest way to amplify on your ideas and talents



Growing Partnerships

       **Chip providers**
30+

      **Embedded SW**
15+

      **ML / CV**
20+

      **Cloud & Network**
40+

     **Community**



“Leave No One Behind”

- Motto of the UN 2030 Agenda for Sustainable Development

“Empower Everyone to Achieve Their Digital Transformation Goals”

- Mission Statement of Seed Studio

Tech for SDG

Smart Citizen

Deployed in: USA, Mexico, Brazil, Argentina, Chile, Puerto Rico, Colombia and more.

An open source hardware and software platform that enables local citizens to collect data in urban areas. This project contributes to SDG 3, 4, 5, 6, 9, 10, 11, 12, 13, 16, and 17.

FarmBeats for Student Program

Deployed in: Global
This program is to facilitate technological empowerment of young people to learn about AI, Machine learning, and IoT in agriculture. This project contributes to SDG 2, 10, 4, 1, 5, 9, 8, 6, 7, 12, 11, 13 and 17.

Smart Black Soldier Fly Farming

Deployed in: Tanzania
A resource-efficient and low-cost protein production method by monitoring and optimizing BSFs' living environment. This project contributes to SDG 1, 2, 9, 11, 12, 13, 15, and 17.

Marine Litter Detective

Deployed in: Hong Kong
A GPS-tracking device for monitoring marine pollutants, such as plastics and oil spills. This project contributes to SDG 3, 4, 6, 9, 11, 12, 13, 14, 16, and 17.

Animal Behavior Analysis & Habit Pattern Tracking

Deployed in: US, Australia
Leverages computer vision AI models to optimize zoo management, identify and tracks animals within their enclosures. This project contributes to SDG 9, 11, 13, 15, and 17.

Carbon Sequestration Monitoring

Deployed in: Liberia
Monitor climate and greenhouse gas data in rainforests for climate research. This project contributes to SDG 4, 9, 11, 13, 15, and 17.

Protei - Open Source Ocean Cleaning Robot

Deployed in: Global
This is a wind-powered and automated sailing fleet robot designed to resolve the world's oil spill issues caused by the Deepwater Horizon Disaster in the Gulf of Mexico. This project contributes to SDG 6, 14, 11, 15, 3, 1, 7, 9, 8, 12, 13 and 17.

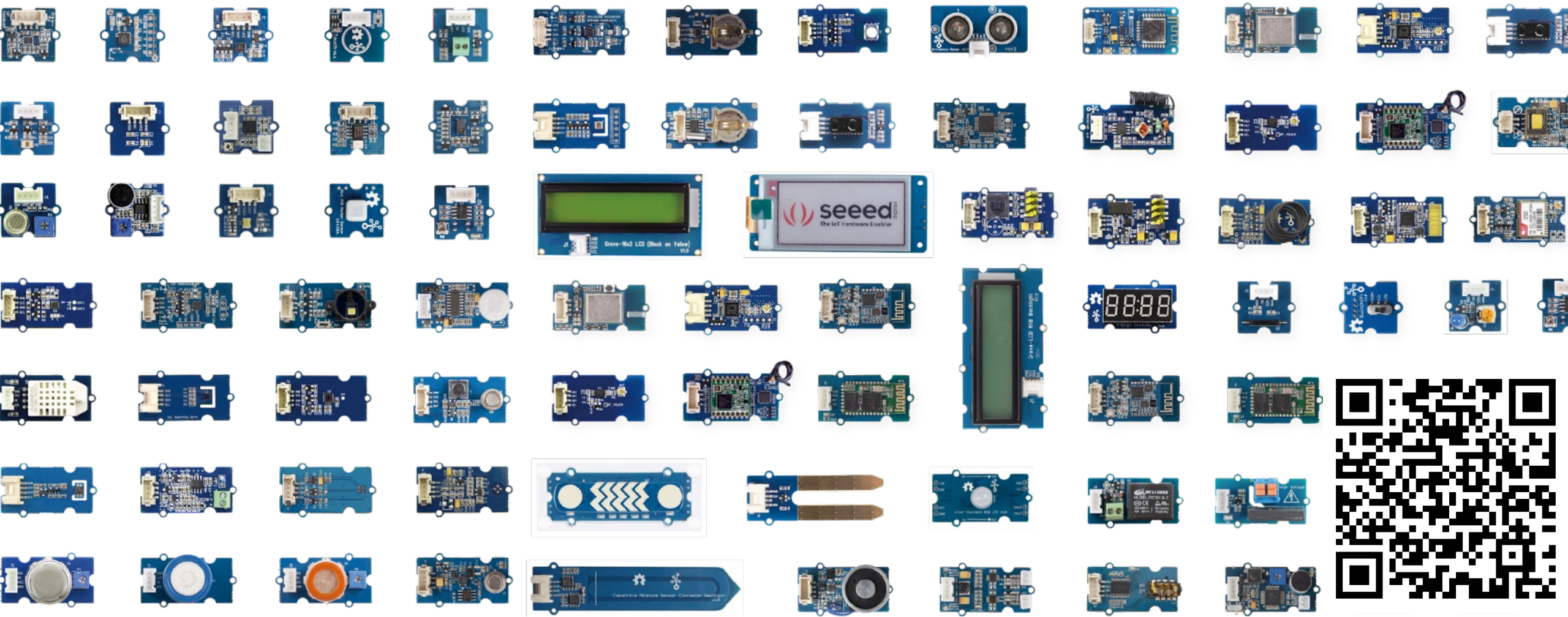
Code Jumper Kit

Deployed in: USA, Canada, Australia, UK, India
Innovative educational tool designed for students with visual difficulties to enhance their computer coding and programming skills. This project contributes to SDG 1, 4, 5, 8, 9, 10, 16, and 17.



Atlas of Sensors

Nerve endings of the digital world



Scan code to download

SenseCAP ONE Weather Sensors

Compact all-in-one weather sensors measure multiple parameters



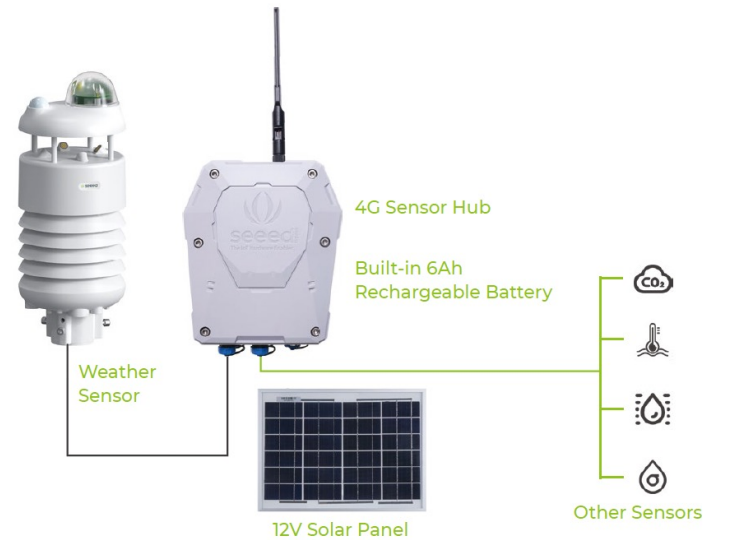
	SKU	Air Temperature	Humidity	Air Pressure	Light Intensity	Wind Speed	Wind Direction	Rainfall	PM2.5	PM10	CO ₂	Noise	Radiation
S1000	101991024	●	●	●	●	●	●	●	●	●	●	/	/
S800	101991023	●	●	●	/	●	●	/	●	●	/	●	/
S700/ S700-A	101991022	●	●	●	●	●	●	●	/	/	/	/	/
S700-B	101991102	●	●	●	/	●	●	●	/	/	/	/	●
S500	101991021	●	●	●	/	●	●	/	/	/	/	/	/
S200	101991044	/	/	/	/	●	●	/	/	/	/	/	/

Get the Weather Data via SenseCAP Data Logger

- Data transmit via LoRa Network



- Data transmit via Cellular(4G/3G/2G) Network



seeed studio

Adding AI to almost anything

① multi-modal

vision
sound
speech
sensors

② faster
new architecture
(Cortex-M55)

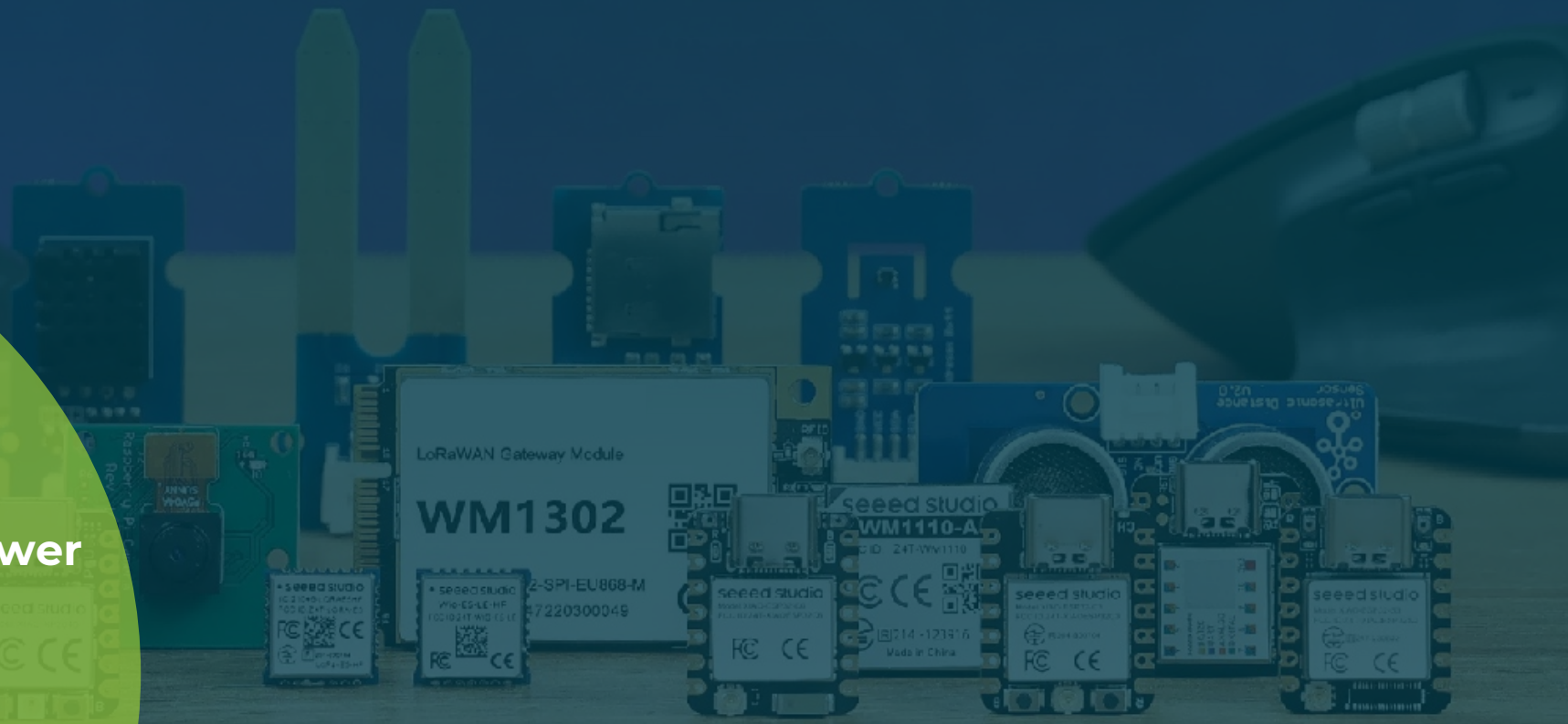
③ low power
<1 w

④ easier

few shot
training
no-code
web server

TinyML

⑤ cheaper
<10 \$



Smaller and cheaper

seed studio

XIAO - tinyML MCUs Add AI to Almost Everything

The Seeed Studio XIAO Series is a collection of thumb-sized, powerful microcontroller units (MCUs) tailor-made for space-conscious projects requiring high performance and wireless connectivity.

Supporting ESP32, RP2040, nRF52840, and SAMD21, the Arduino compatible XIAO series is the perfect toolset for you to embrace tiny machine learning (tinyML) on the Edge. Trusted by 500,000 developers globally!



- **Module and Development Board Hybrid**

Perfect for rapid prototyping



- **Unified form factor**

Easy integration for product design



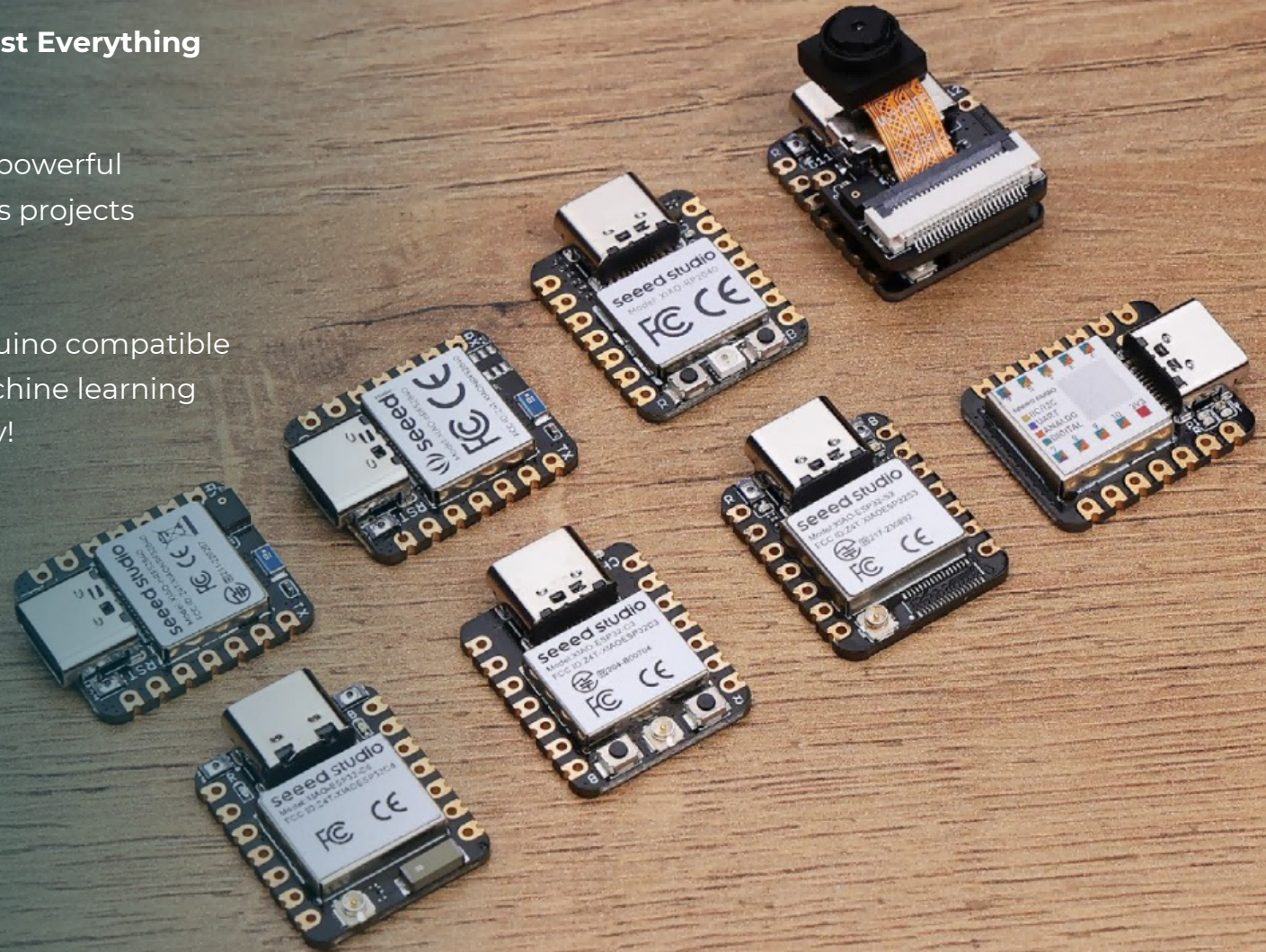
- **Single-Sided Surface Mount Design**

Streamline production process



- **Strong Ecosystem Support**

Extendable for iteration of your projects



SenseCraft Model Assistant

It is an AI platform dedicated to simplifying the training, distribution, and deployment of AI models.

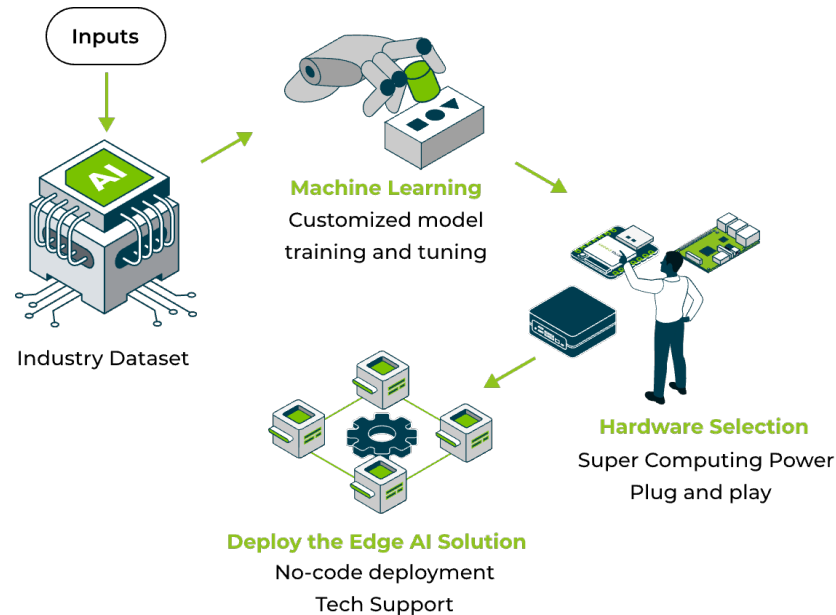
Enable high-speed and accurate inference on low-cost hardware, unlocking the powerful potential of AI in edge devices.

Just a few clicks => deploy models (~~configuration and coding~~).

✔ Current computer vision algorithms: target detection, image classification, image segmentation, and pose) & LLMs

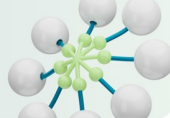
Support users to

- ✔ upload and share self-trained models,
- ✔ build a shared model library,
- ✔ promote collaboration and innovation among AI enthusiasts.



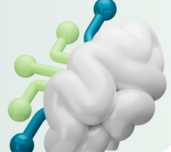
Explore AI Solution Public AI Models

Ready-to-use public AI models are powered by SenseCraft and Model Maker to solve your problems.




Share your own AI Model Custom Model

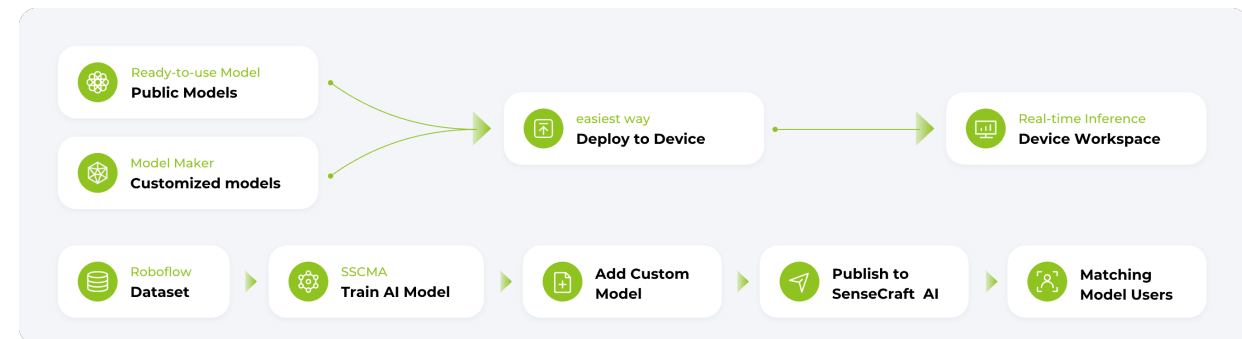
You can add your own AI models and can publish them to SenseCraft!



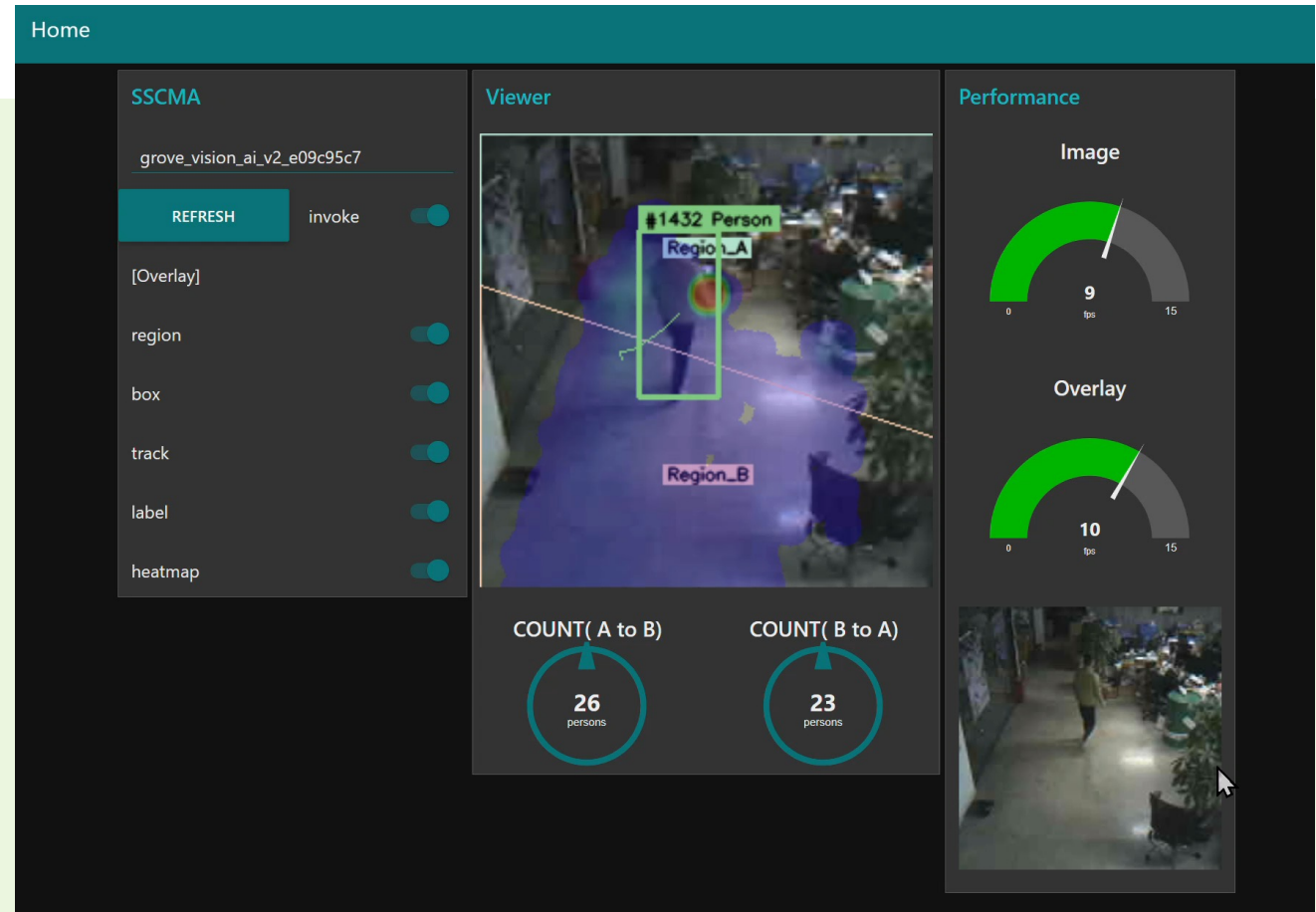
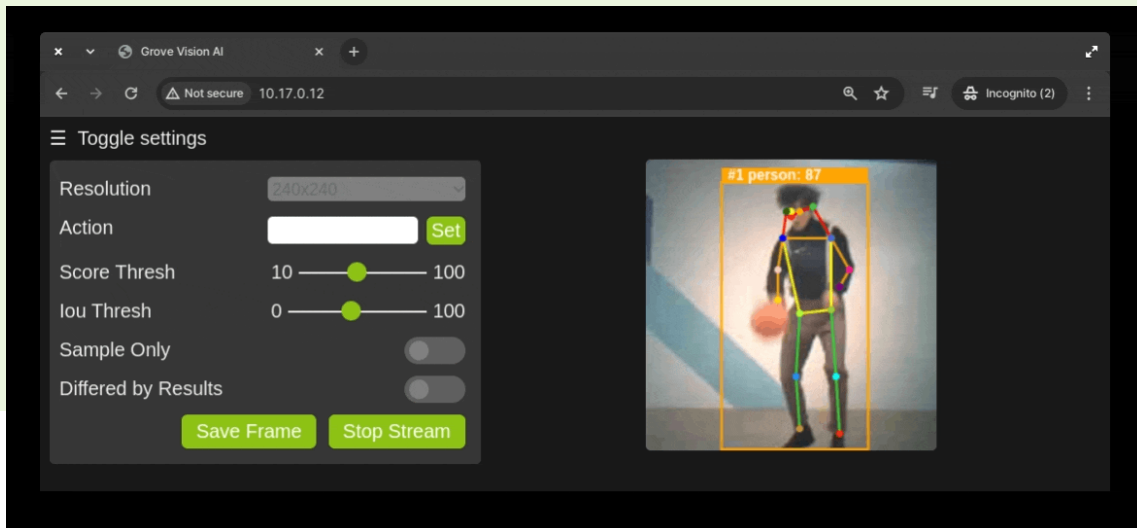
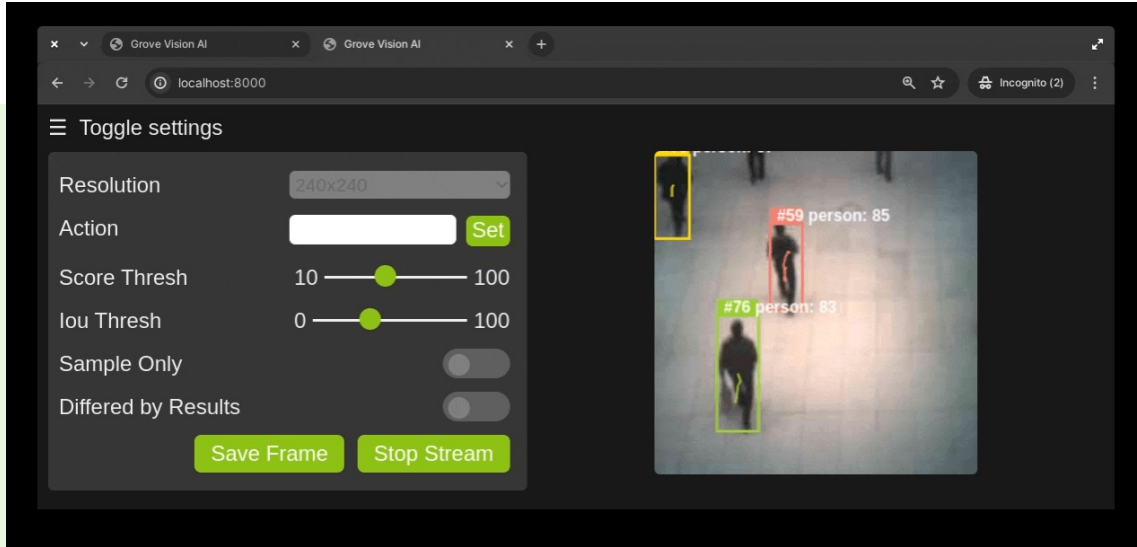
Real-time Inference Device Workspace

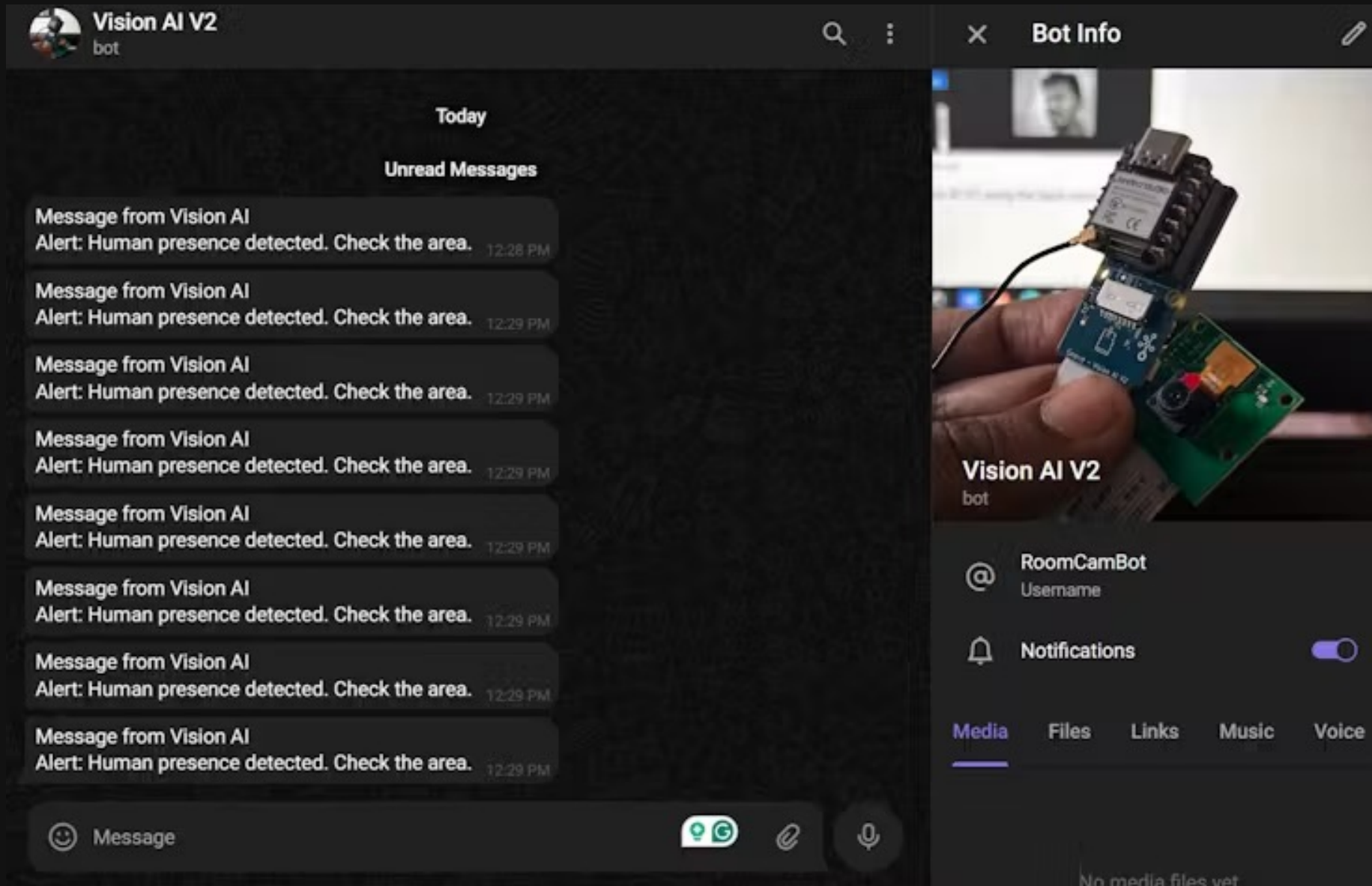
Remotely managing devices for edge AI analytics, accessing inference video streams



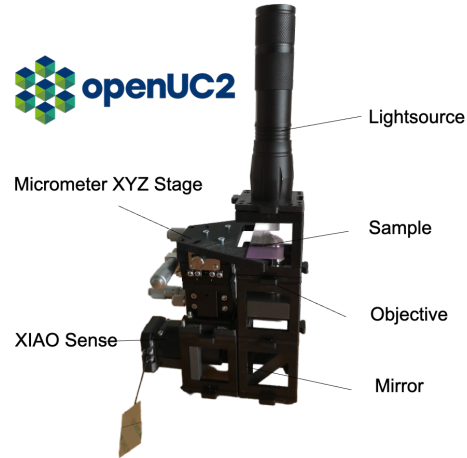
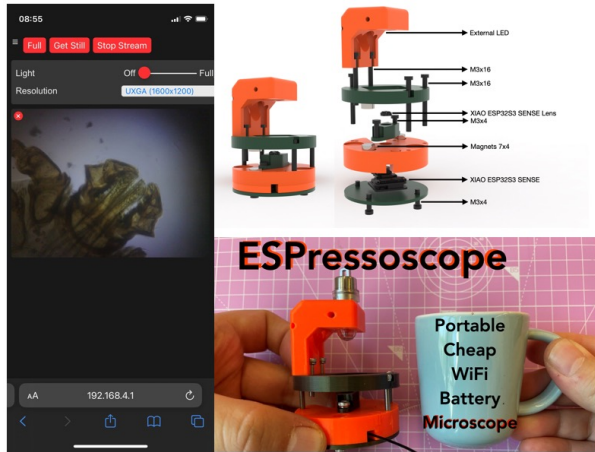


Easier - No code model MLops



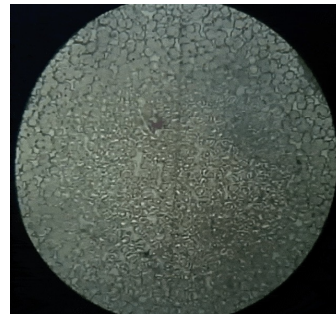


OpenUC2 – Open-source, modular optical platform



OpenUC2 provides open source modular microscopy toolboxes for biology, chemistry, physics etc. for education and researches.

- Decentralized data collection for citizen science
- Edge AI processing the data
- High resolution
- Low-cost
- Open source



Available soon!

Urban Heat Island Mitigation in Cagliari, Italy

Location: Cagliari, Italy (300+ sites in 30+ zones)

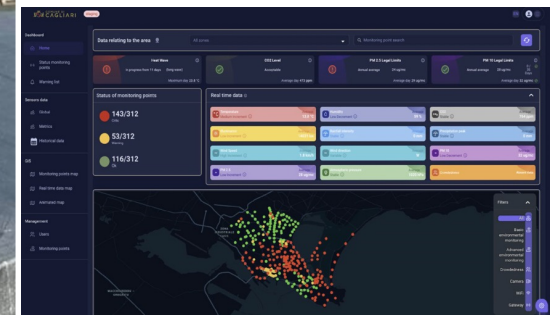
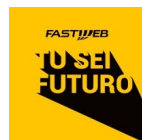
Specific Scenario: Smart City Heat Island Monitoring

• **Parameters:**

- **Crowdness via WiFi sniffers**
- **Micro-climate data via weather stations:** air temperature, air humidity, wind speed, wind direction, rain fall, PM2.5, PM10, CO2, barometric pressure, light intensity

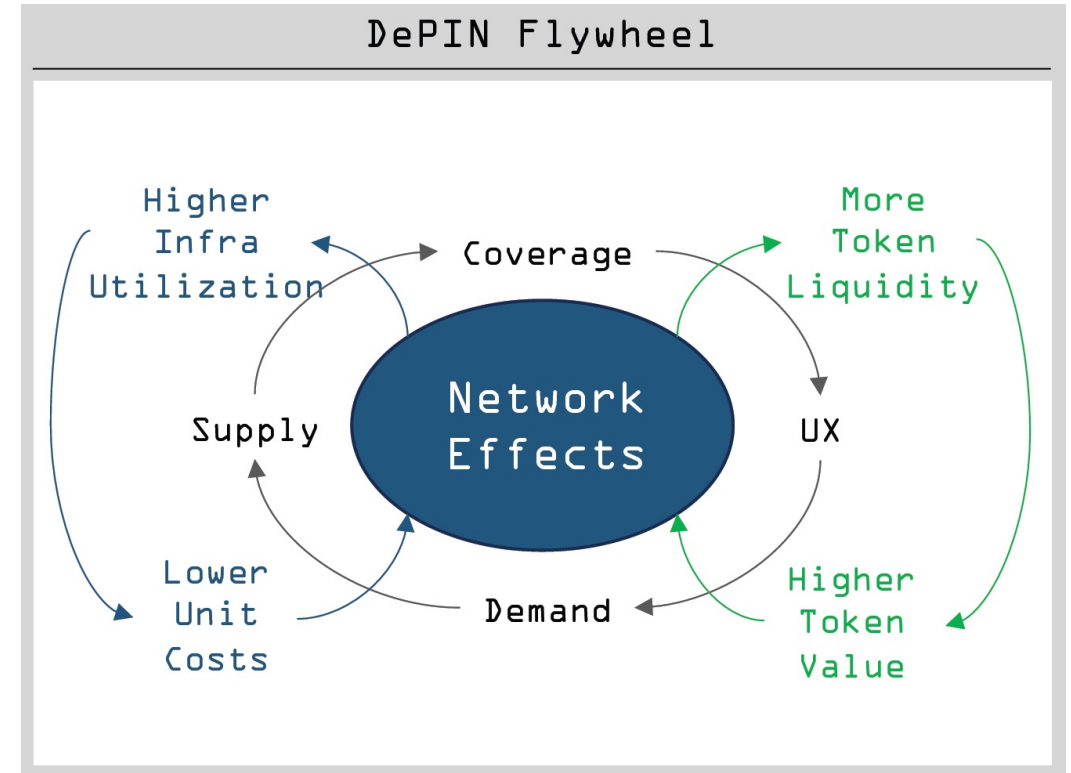
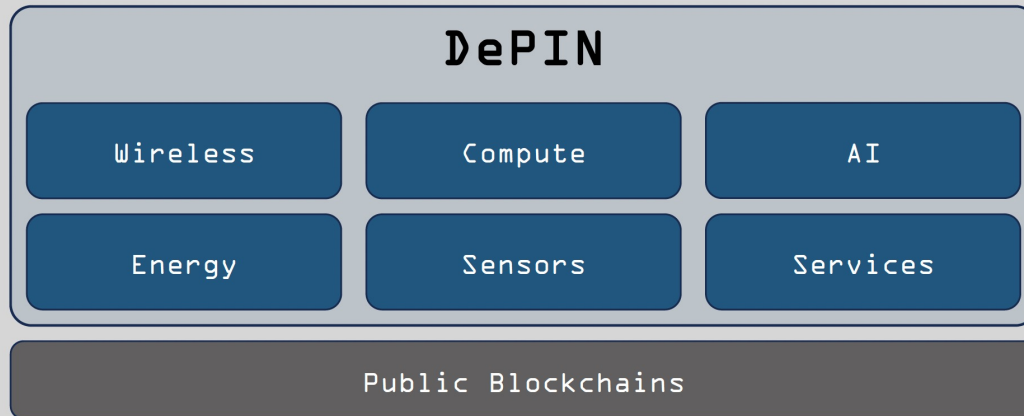
Values/Results created

- ✓ Identify & monitor urban heat islands
- ✓ Create more green areas
- ✓ Enforce light color of building facades
- ✓ Study and build urban heat island mitigation systems
- ✓ Build AI models to predict future heat waves and air quality
- ✓ Optimize services for smart cities



DePIN = decentralized physical infrastructure networks.

Networks that use crypto-incentives to efficiently coordinate the buildout & operation of critical infrastructure.



Decentralized Sensors



weather network



LoRaWAN WXM Weather Station



IoT Platform



DePIN Dev Kit

Decentralized Networks



LoRaWAN Network



SenseCAP M1

SenseCAP M2

SenseCAP M4



VPN Network



SenseCAP M1

SenseCAP M4

Decentralized Compute



Cloud Network



SenseCAP M4

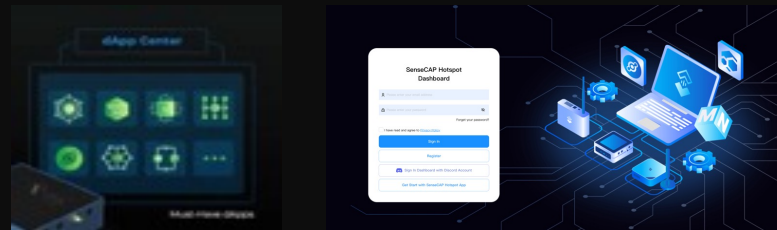


More to come!

Hardware & Software Suite

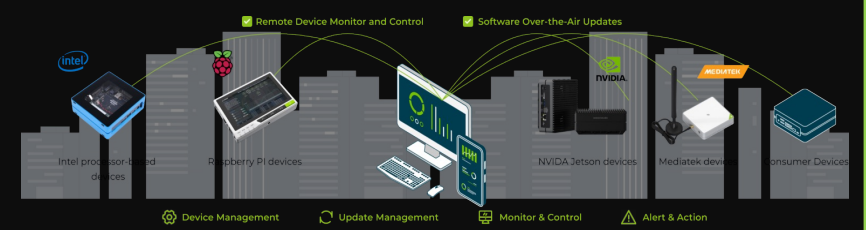
- Reliable
- Robust
- Plug & play
- Easy-to-use
- Scalable
- Multiple-in-one

Powered By SenseCAP Software Suite



Web3 dApps Center

SenseCAP Hotspot App/Dashboard



SenseCraft Device Management



By deploying a Helium Hotspot in your home, office, or elsewhere in the wild, you can provide your town with wireless network coverage and earn Helium tokens.

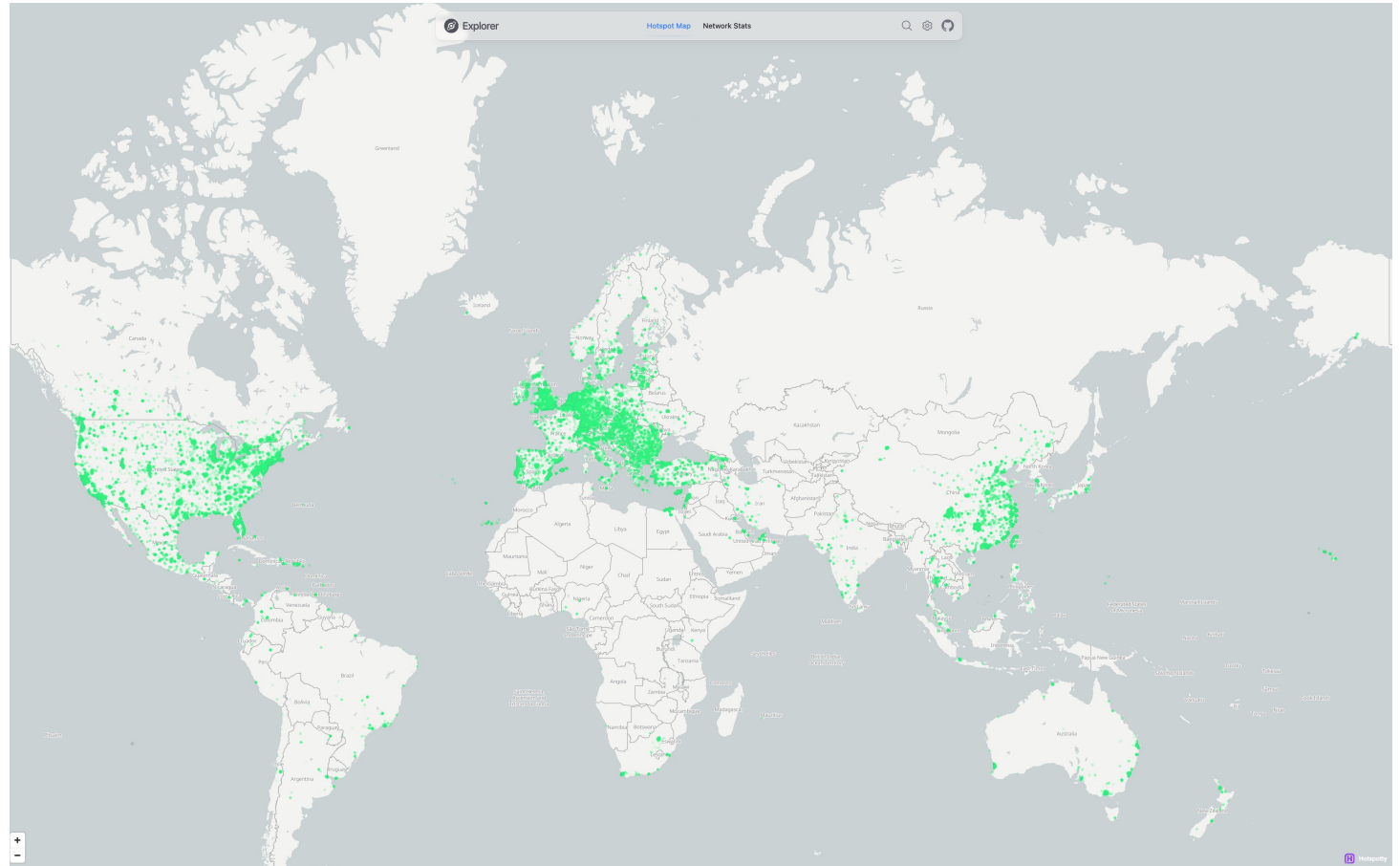
Rewards

- PoC – proof of coverage
- Package forwarding

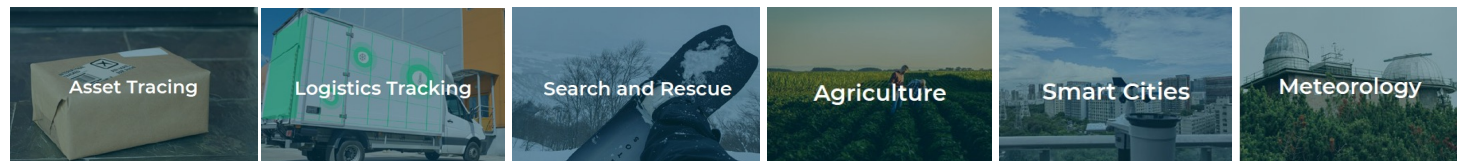
SenseCAP loRaWAN hotspots & end nodes



Credits & learn more: <https://www.helium.com>



Applications



Sensor - Decentralized Weather Network



WeatherXM is a community powered weather network, that rewards weather station owners and provides accurate weather services to individuals, businesses and research organizations.



Parameters

temperature, humidity, precipitation, wind speed, wind direction, barometric pressure, light, UV index, and more!



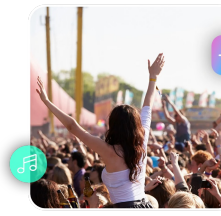
Applications



Agriculture



Energy



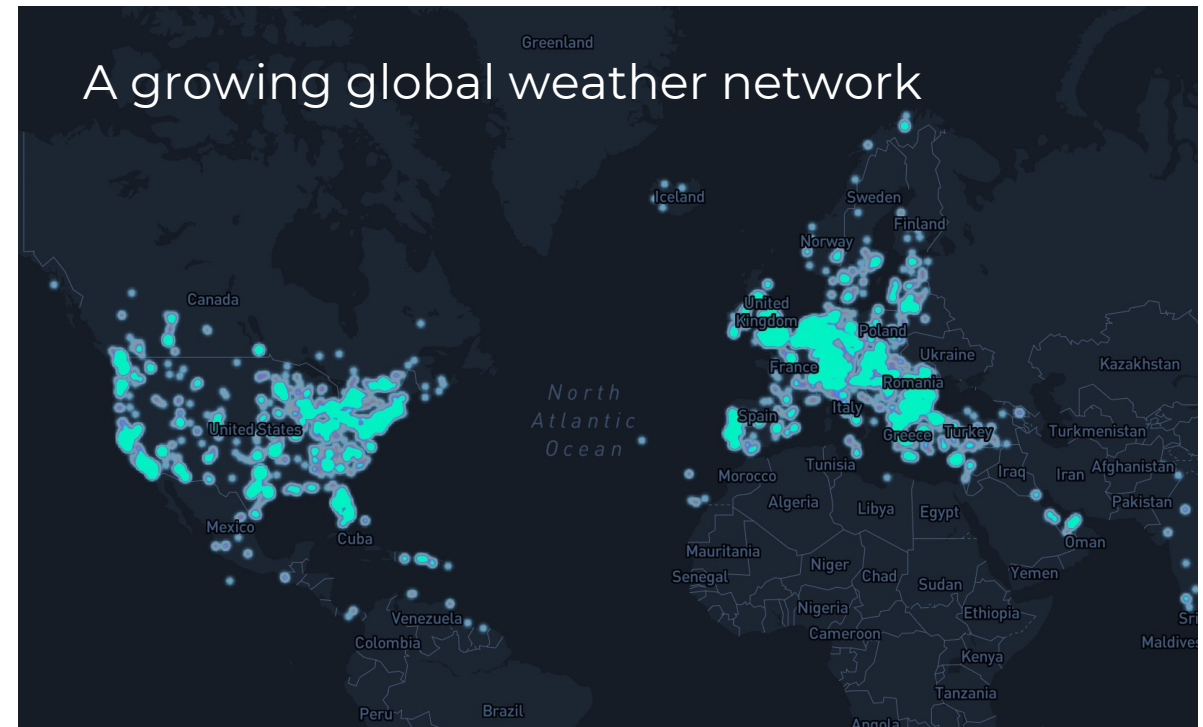
Outdoor Events



Climate Modeling



Insurance





The Flux Cloud is powered by thousands of FluxNodes connected from all around the globe, and the community is the backbone. By contributing their computational resources, individuals are incentivized accordingly.

SenseCAP M4 Square
Support Multiple Apps
Plug and Play

3.0 dBi

	4	4	489	8	512	500
	Core	Threads	EPS	GB RAM	SSD	MB/s DWS

LoRaWAN® Coverage Witness Data Transfer

LoRaWAN® is a mark used under license from the LoRa Alliance®.

Credits & learn more: <https://runonflux.io>

A Global Cloud Network

Flux Cloud is connected worldwide, across all continents. Its strongest Availability Zones are the EU and United States. South Asia and Australia are also witnessing an increase of server deployments. Flux Cloud is the most decentralized and fastest growing network in the world.

[View Dashboard](#)



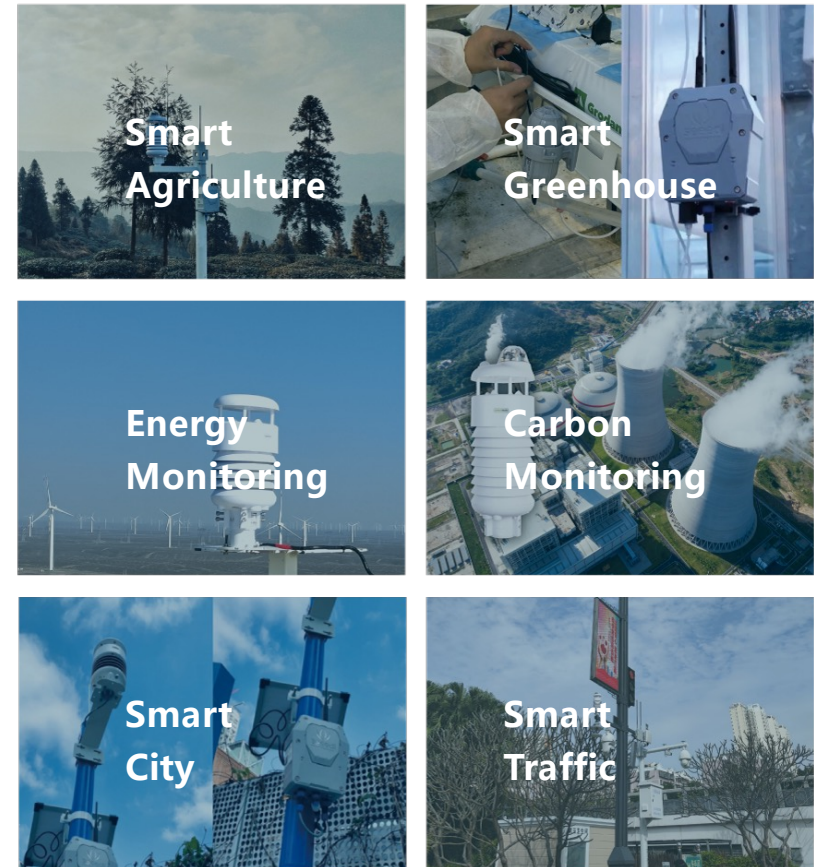
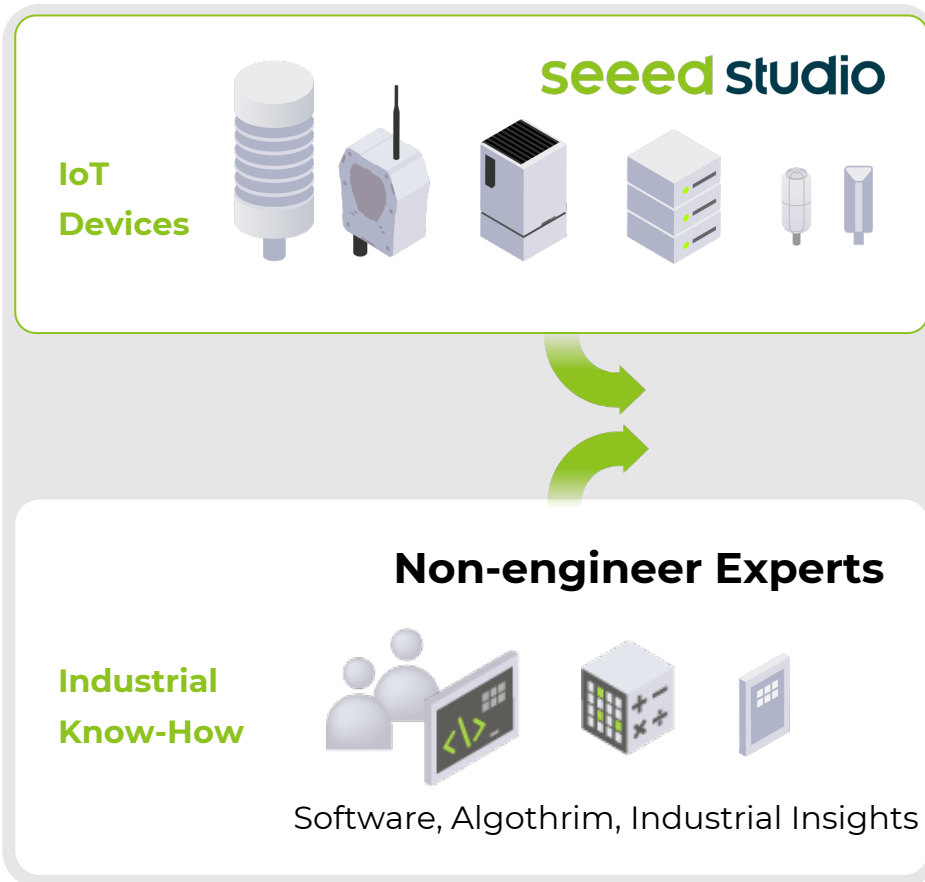
Applications running on Flux Web3



Embodied AI as a bridge between science and application

Co-Invent Solutions

Based on various digital transformation scenarios, we continue to develop smart devices that integrate the latest technologies, and work closely with developers and industry experts to provide software and hardware solutions for vertical industries at multiple levels.





seeed studio

The AI Hardware Partner

Let's talk!

violet@seeed.cc



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[hackster.io/seed](#)

