

Making sense of the wild

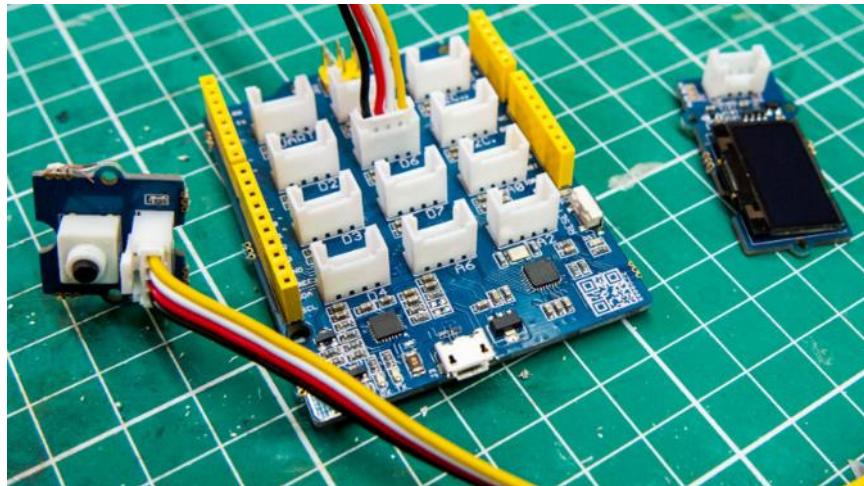
Eric Pan

CEO

seeed studio

seeed studio

seeed studio



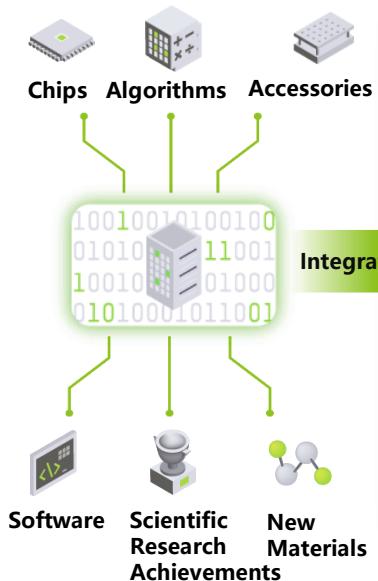
How it started since 2008

From possibilities to productivities



How it's going 2022

Community driven, Industry oriented

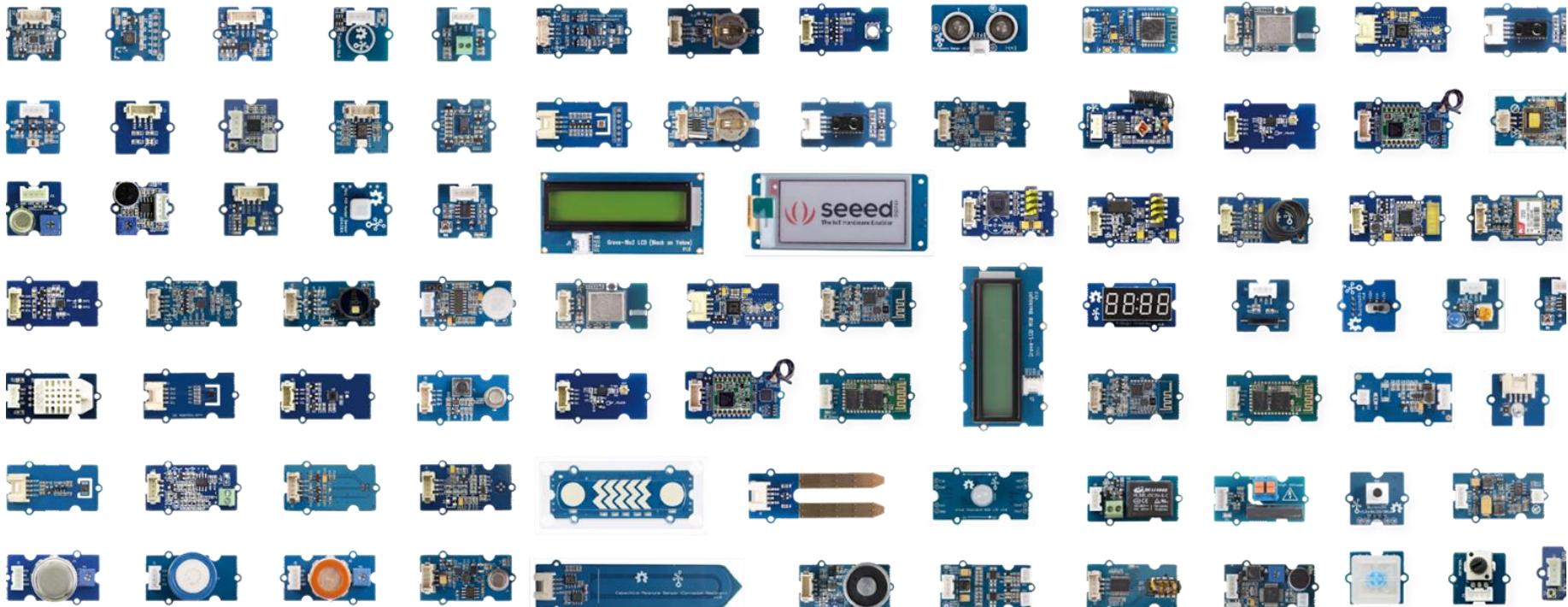


seeed studio Open technology for the rest of us.

**Emerging
Technologies**

Making Sense

Open Hardware Sensor system



Sensor + TinyML

Multi Gas Sensor + Embedded AI = Smart Nose



Make:
MACHINE LEARNING
Swear Bear... Trash Sorter... Easy AI Trainers
Teach your project to think for itself

BENJAMIN CABÉ'S "NOSE" KNOWS!
Build this smell-identifying AI sniffer

23 PROJECTS!

- Raspberry Pi Meteor Camera
- Digital String Art Portraits
- Animated LED Skirt
- Arduino Borealis Lights

SKILL BUILDERS

- Digital Mobile Radio
- Hack a Knitting Machine

makezine.com | makercampus.com | makerfaire.com

VOLUME 77

Hardware Assembly

Data Acquisition

Model Training

Deploy & Infence

Alcohol classification using the Artificial Nose

Smart Nose for Real Problems

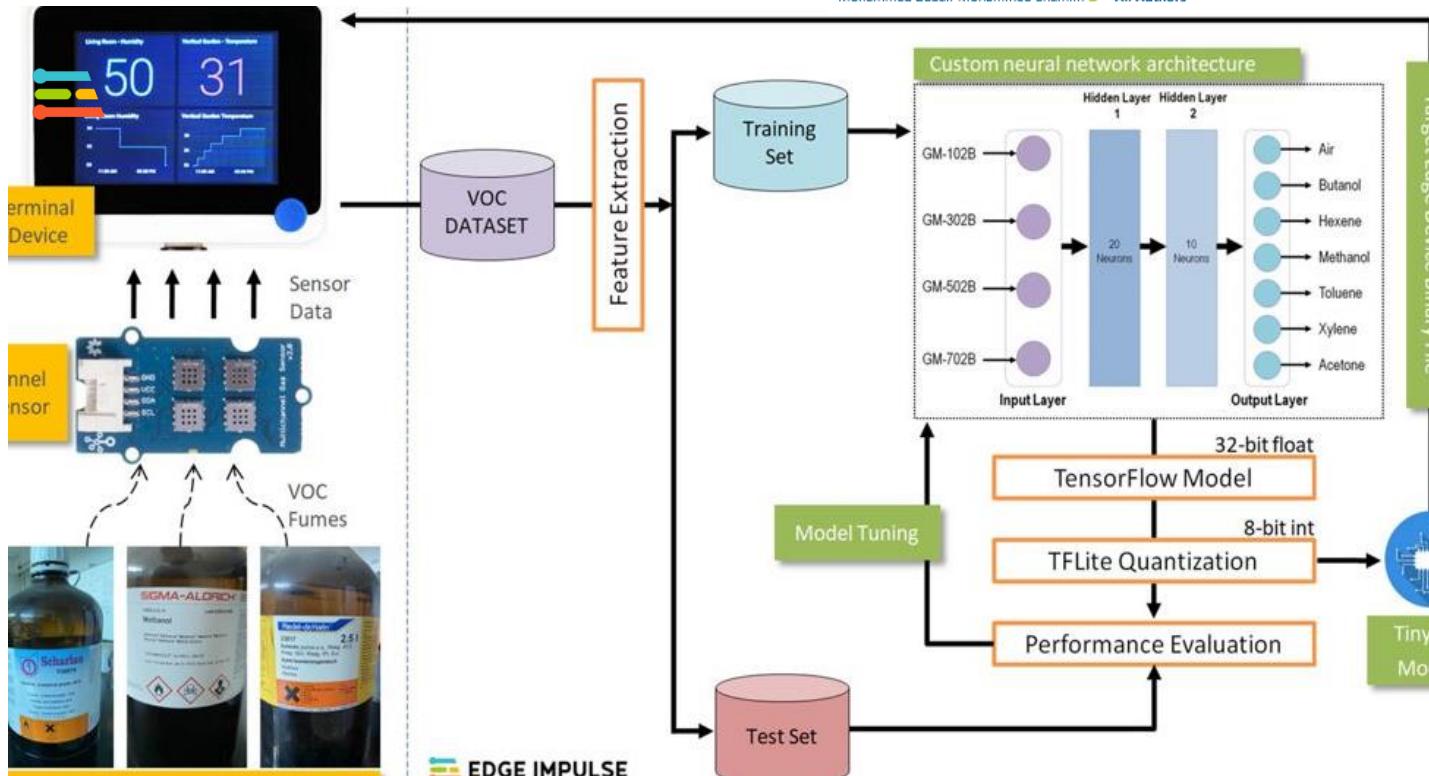
TinyML Model for Classifying Hazardous Volatile Organic Compounds Using Low-Power Embedded Edge Sensors: Perfecting Factory 5.0 Using Edge AI

Publisher: IEEE

Cite This

PDF

Mohammed Zubair Mohammed Shamim All Authors



Liquid Classification with TinyML



TDS(Total Dissolved Solids) sensor + Turbidity Sensor + Wio Terminal + Embedded AI = Smart Tongue



TinyML Case Studies

- Seeed Studio Wio Terminal
- Seeed Studio Grove-Vision AI Module
- Seeed Studio XIAO ESP32S3
- Seeed Studio XIAO ESP32S3 Sense
- Seeed Studio XIAO nRF52840 Sense
- Seeed Studio SenseCAP A1101 - LoRaWAN® Vision AI Sensor
- Seeed Studio SenseCAP K1100 – The Sensor Prototype Kit with LoRa® and AI

seeed studio



More TinyML
Case study:



The true frontier of IoT

%1 of planetary surface

Civilized

Center of digital world
Crowded

[Cloud]
Established
Omnipotent

Air Temp&Humidity: 24.80 °C
Air Humidity: 34.38 %RH
Light Intensity: 3230.0 Lux
Barometric : 101390.0 Pa
Wind Speed: 1.1 m/s
Wind Direction: 30° (N)
Rain: 0.6 mm/hour
PM2.5: 12.0 µg/m³
PM10: 17.0 µg/m³

[Prototype]
Grove system
TinyML ready

Lab

[Coverage]
Easy deployment
Long range
Ultra low power

[Edge]
On premise
Interdependent

[Air]
Temperature
Humidity
CO2e
weather

[Objects]
Vision
Sound
Vibration

[Soil]
Lightness
Temperature
EC

%99 of planetary surface

The wild

Off grid
Far away
Reckless

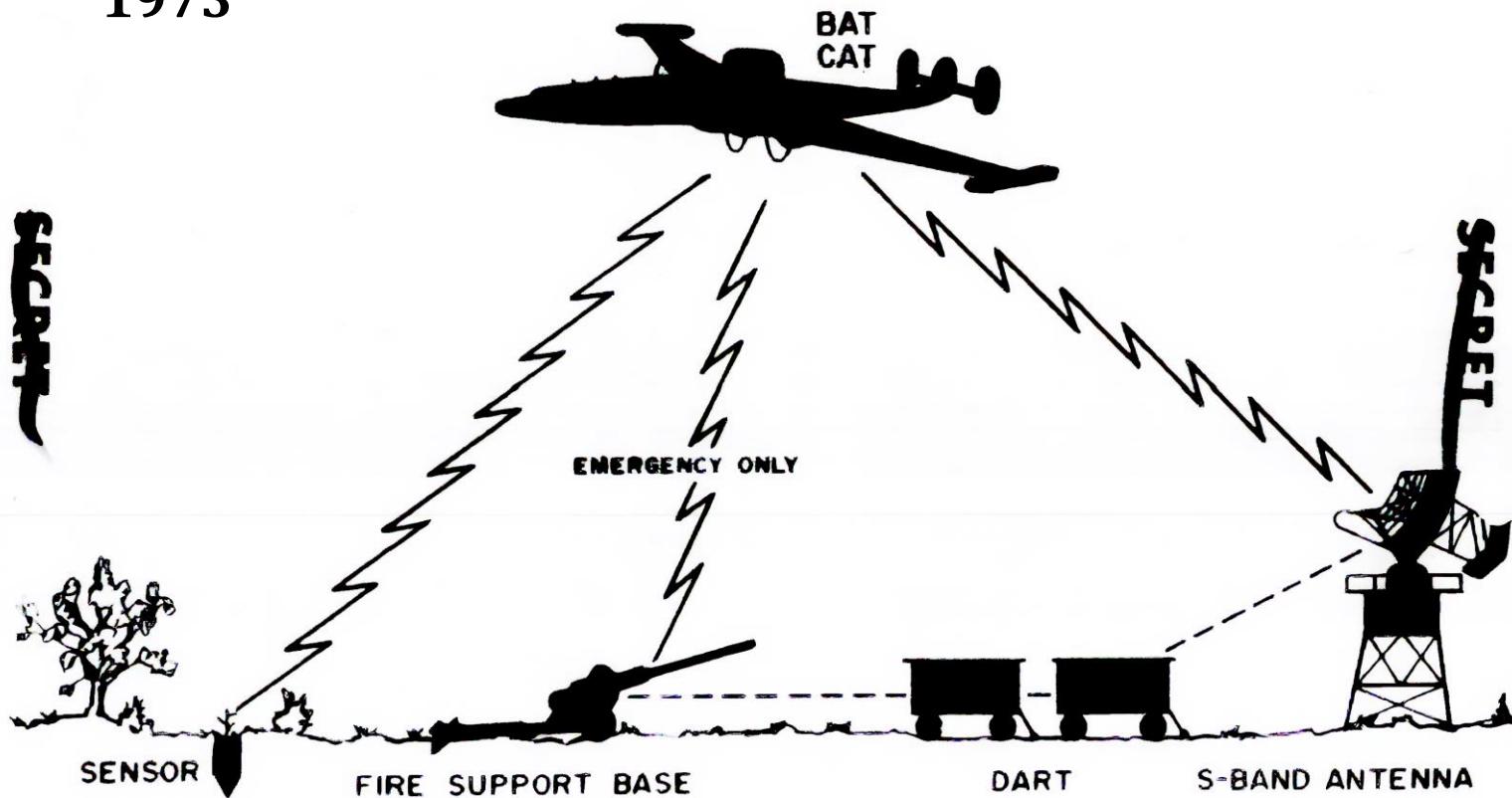
Air Temp&Humidity: 4.80 °C
Air Humidity: 14.38 %RH
Light Intensity: 5230.0 Lux
Barometric : 61390.0 Pa
Wind Speed: 12.5 m/s
Wind Direction: 20° (N)
Rain: 1.6 mm/hour
PM2.5: 3.0 µg/m³
PM10: 5.0 µg/m³

www.seeed.cc

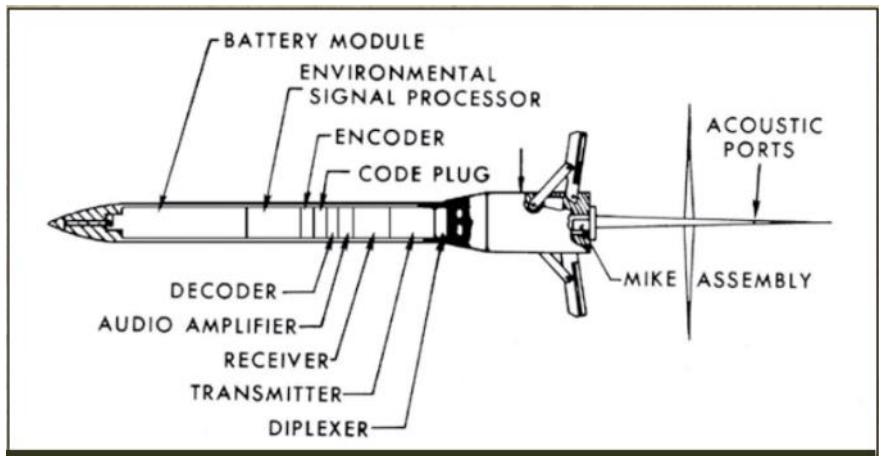
Making Sense Of the Wild

Operation Igloo White

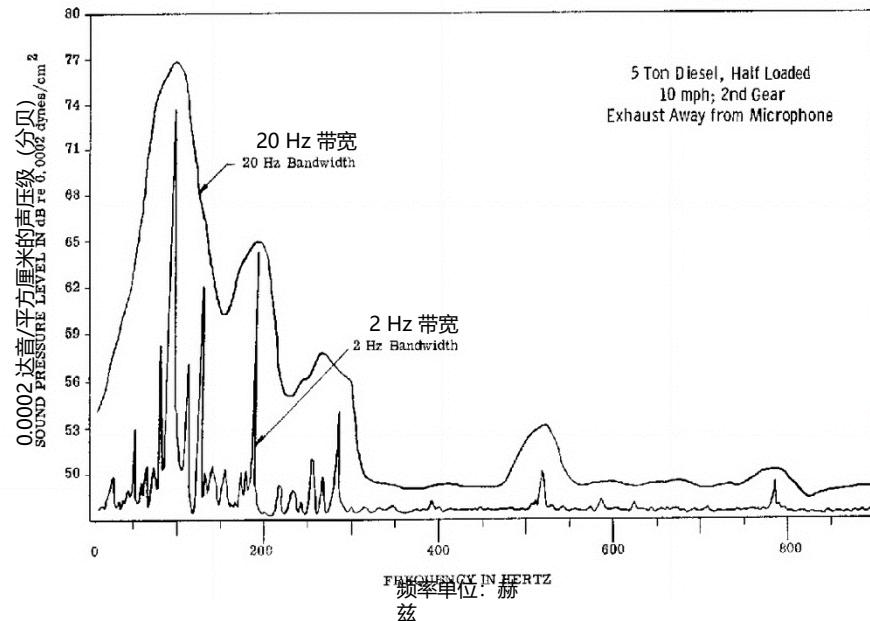
1973



Acoustic Seismic Intrusion Detector



'T-1151' Dog Doo Transmitter



A huge failed IoT piloting project:

Investment:

1 billion dollars annually

- **\$30 million** orbit reconnaissance aircraft for signal transmission.
- **\$20 million** command post
- Deploying four **\$10 million** worth of fighter jets
- **\$40 million** worth of sensors
- Huge system and personnel maintenance costs

Results:

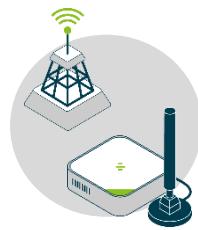
5000\$ and

- Elimination of **\$5000** worth of trucks and several combat units
- Significant collateral damage to civilians

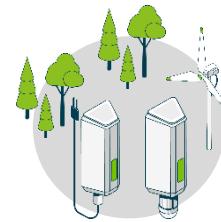
50 years later...

What's different today?

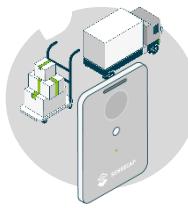
- Millions of Long range communication infrastructure
- Millions of Cheap sensor with embedded AI
- Millions of makers all over the world



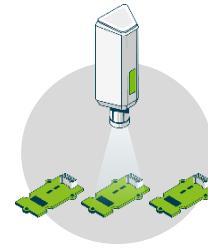
LoRaWAN®
Network



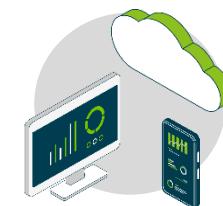
Multi modal Sensing



Location based
sensing



Edge Inference



Distributed
Cloud



Low power long range networks



老人看护



Water



Cameras



Air



Location



Temperature & Humidity



Meteorology



Alarm



Others

Thing centric infra

Coverage>10KM

People centric infra

Coverage<1KM

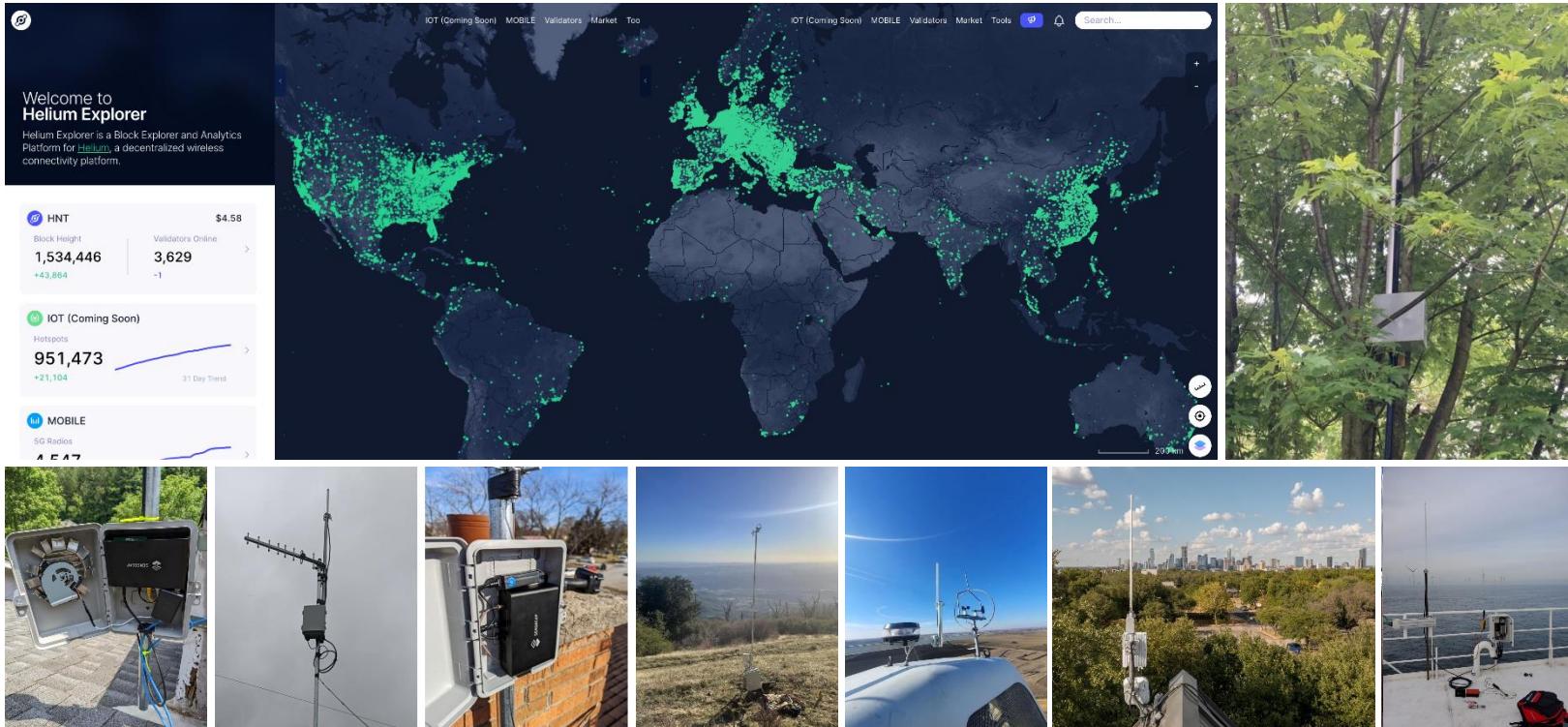


Gateway



lets ready for long range IoT

LoRaWAN Network rapid growing (Helium & TTN)



pervasive LoRaWAN infrastructure

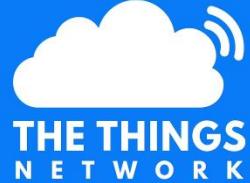
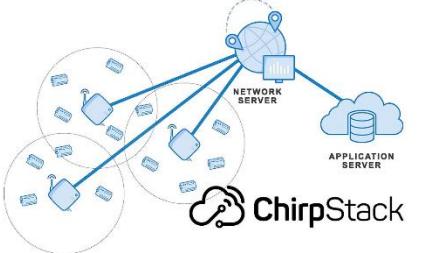


hijack consumers > 10,000,000 hotspots

private

by operators

web3 infra >1,000,000 hotspots



SenseCAP S210x Sensors

SenseCAP S210x series' sensors offer long-distance data acquisition via LoRaWAN®. With IP66 enclosure rating, the sensors can operate in extremely low and high temperature zones (-40°C to +85°C). Their built-in, 19AH high capacity battery, S210x series can operate in harsh, outdoor environments up to 10 years with a range of up to 10km. To add, the built-in Bluetooth made them easy to be configured and deployed, that together reduces field deployment costs. Moreover, users can get data in just a few steps, and with open Cloud API, they are easy to be integrated.

10 years, 10KM, 10\$(not yet)



SenseCAP S2100 LoRaWAN® DTU

NEW

LoRaWAN Data Logger

SKU

[114992872](#)

Overview

SenseCAP S2100 Data Logger can connect to Modbus-RTU RS485/Analog Input/GPIO sensors and transmit data from sensors to the LoRaWAN® network. It is specifically optimized for OTA with built-in Bluetooth, which enables quick setup and update. It can be battery-powered or connected to a 12V external power supply. With the help of S2110 sensor builder, S2100 Data Logger is able to connect to Seeed Studio's wide range of Grove Sensors, which will make it the ideal solution for developing, fast prototyping, and small deployment for DIY Industrial level LoRaWAN® Sensors.

Physical World



Agriculture



Industrial Control



Energy

Expanding to 400+ Grove Sensors



S2110 Sensor Builder



Increased to 100+ Industrial Sensor Probes



Water

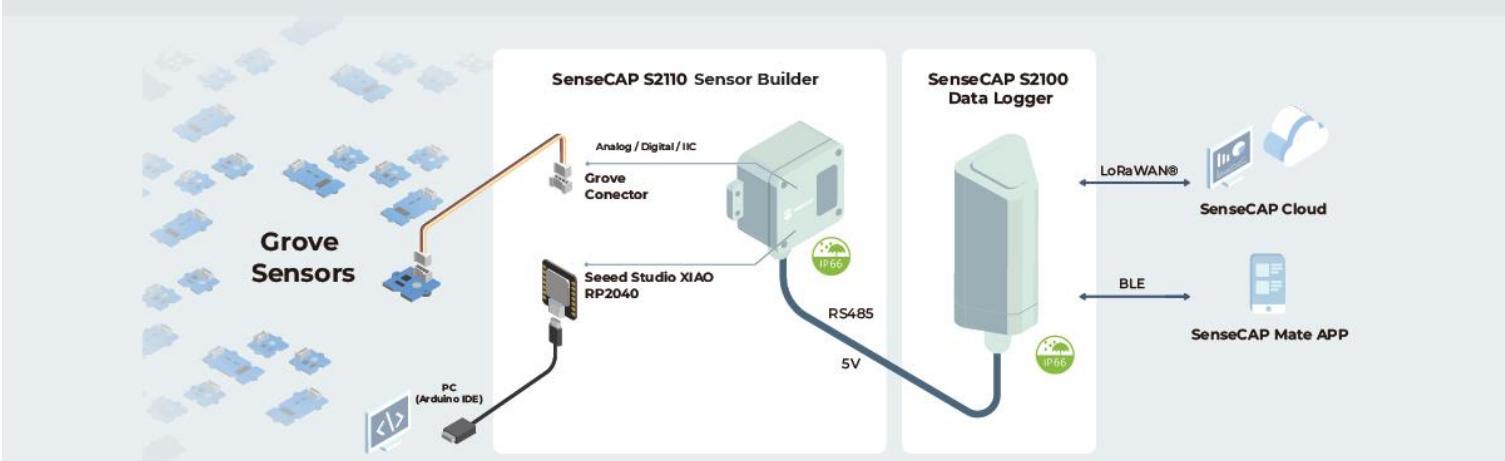


Air



More...

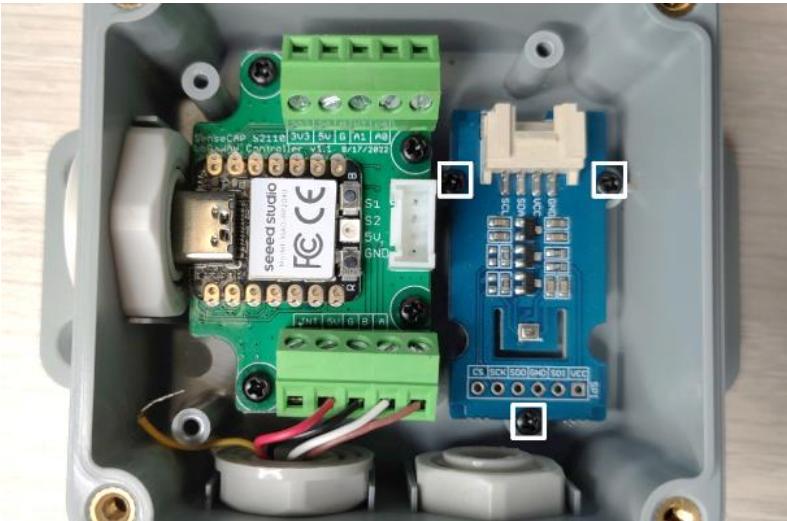




Modbus Register Table

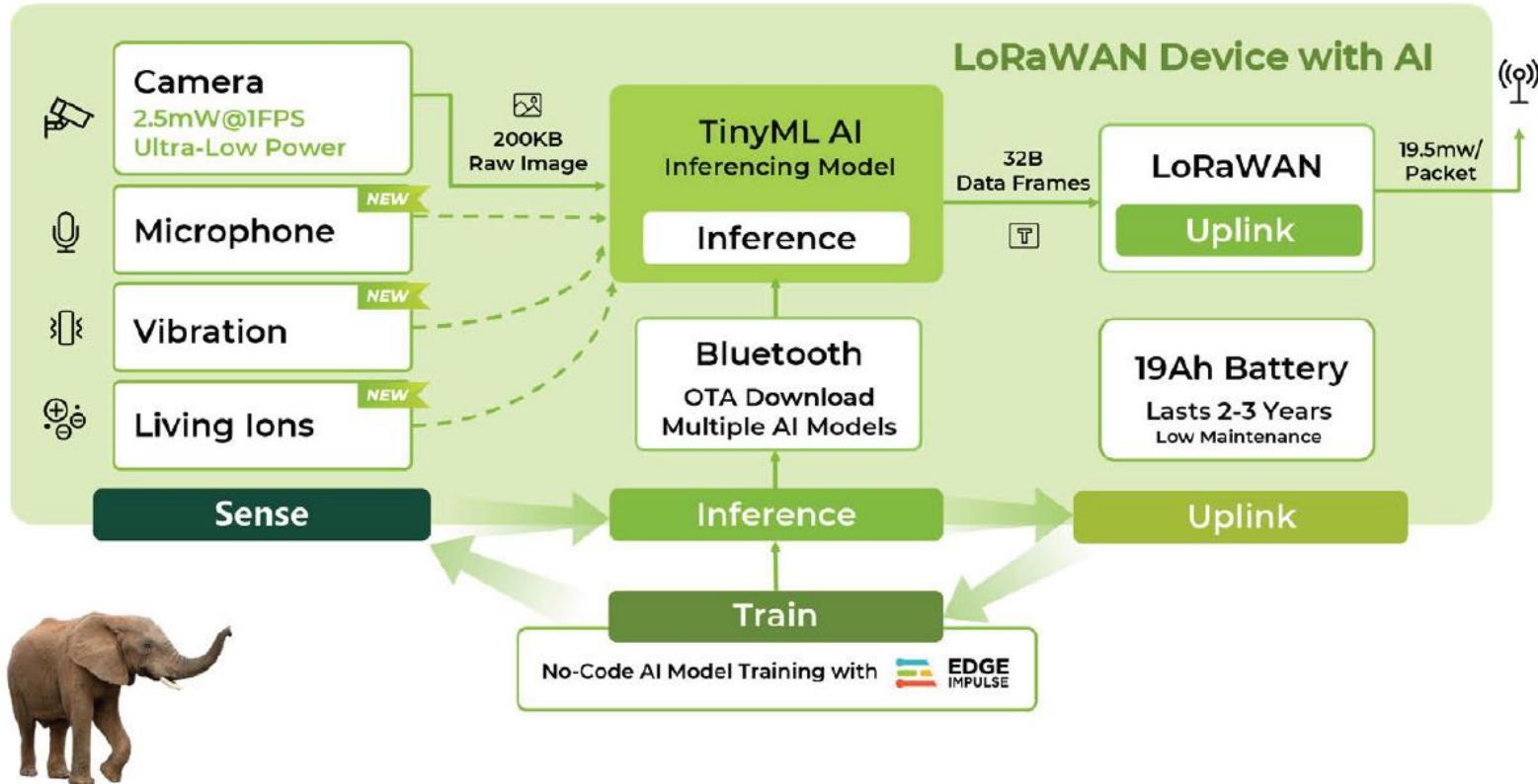
Grove Sensor Name	Register Name	Register Address (Hexadecimal)	Register Address (Decimal)
Grove - CO2 & Temperature & Humidity Sensor (SCD41)	Temperature	0x0004	04
	Humidity	0x0006	06
	CO2	0x0008	08
Grove - Light Sensor v1.2	Light	0x000A	10
Grove - Flame Sensor	Flame	0x000C	12
Grove - Oxygen Sensor (MIX8410)	Oxygen	0x000E	14
	Light Intensity	0x0010	16
Grove - Sunlight sensor (SI1151)	Visible Light	0x0012	18
	UV	0x0014	20
Grove Temperature and Barometer Sensor (BMP280)	Barometric Temperature	0x0016	22
	Atmospheric Pressure	0x0018	24
	Height	0x001A	26
Grove - Temperature Humidity Pressure Gas Sensor(BME680)	Temperature	0x001C	28
	Atmospheric Pressure	0x001E	30
	Humidity	0x0020	32
	Air Quality(VOC)	0x0022	34
	N02	0x0024	36
Grove - Gas Sensor V2(Multichannel)	C2H5OH	0x0026	38
	VOC	0x0028	40
	CO	0x002A	42
Grove - UV Sensor	UV Intensity	0x002C	44
Grove - Turbidity Sensor Meter V1.0	Turbidity	0x002E	46
Grove - TDS Sensor	TDS	0x0030	48
Grove - Ultrasonic Ranger	Distance	0x0032	50

Build your own sensors
Or use light sensor by default



https://github.com/Seeed-Studio/Seeed_Arduino_S2110

Perfect combination between TinyML and LoRaWAN



Panda Sensor: Detection and Tracking in Sichuan, China

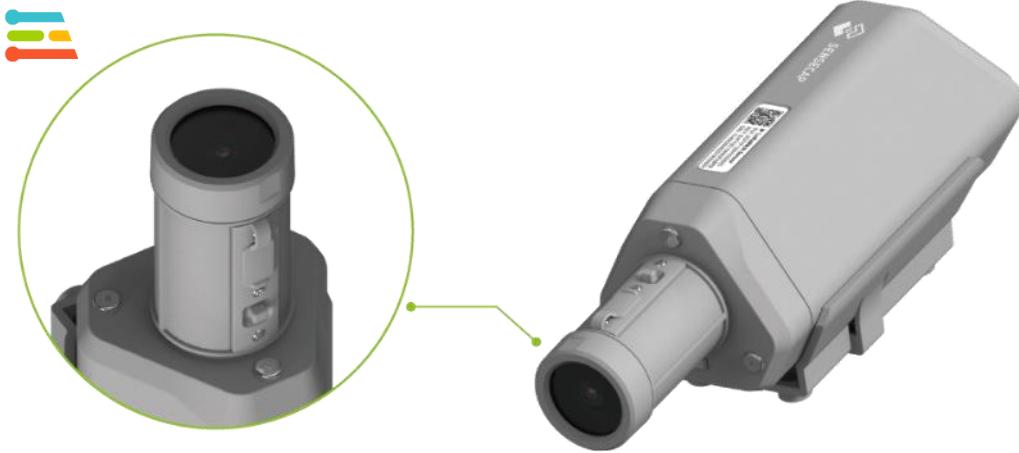
It is a vision-based tracking system deployed in "Laohegou Nature Reserve", so as to monitor wild pandas in Sichuan Province, China. Through combining Computer Vision AI and LoRaWAN technology, the system alerts when it detects and tracks pandas in the wild to help the conservation of the beloved creatures.

Wild panda monitoring has been traditionally done manually by rangers, which was difficult, time-consuming, and inefficient. Through this digitalized system, the rangers can monitor illegal activities (such as poaching and invasion), that can help protect animals from various risks in wildlife habitats. The application of real-time monitoring and intelligent identification technology can not only reduce human interference to the conservation areas, but also shorten the distance between pandas and the outside world.



SenseCAP A1101

LoRaWAN Vision AI Sensor



- Ultra-low power AI chipsets
 - Built-in AI inference
 - Long Range transmission
 - Up to 10 years battery life
 - IP66 protection
 - Designed for wild deployments

The screenshot shows the DataQube web application interface. At the top, there's a navigation bar with links for 'Dashboard', 'Data feeds', 'Your alerts', and 'Report bugs'. Below the navigation is a search bar with placeholder text 'Search for data'. The main area features a video player-like interface with a play button, a progress bar showing '79% / 271 s', and a volume icon. To the right of the video player is a green circular button with a plus sign. Further down, there's a section titled 'Recent live data' with a 'Delete' button. On the left, there's a sidebar with 'Collected data' and a table listing data for 'Week 1' through 'Week 12'. The row for 'Week 12' is highlighted with a blue background. The table has columns for 'Week', 'Name', 'Status', 'Last update', and 'Actions'. On the right side, there's a 'Manage alert' section with a 'Create alert' button, a 'Graph' section with a 'Graphing' dropdown menu, and a 'Data viewer' section with a 'View raw data' button.

Train at Edge Impulse

The screenshot shows the SenseCAP Vision AI application interface. At the top left is the 'seed studio' logo. In the center is a camera feed showing a circular dial with numbers 0.00, 0.04, 0.08, 0.12, and 0.16. Below the camera feed are several configuration buttons: 'Disconnect' (greyed out), 'Set Center Point' (with X and Y inputs), 'Set Start Point' (with X and Y inputs), 'Set End Point' (with X and Y inputs), 'Measuring Range' (From 0 To 0), and 'Decimal Places' (set to 1). At the bottom are 'Configure' and 'Reset All' buttons, and a 'Result' field containing the value '0.120851231'.

Deploy and verify

The screenshot displays the SenseCAP mobile application interface. It features three main cards:

- SenseCAP**: Shows a summary of connected devices: S11Bn Sensor (online), Vision AI Sensor (online), S11B Weather Station (online), and a small image of a person (offline).
- Text #15 people**: A card showing the status of 15 people. One person is online (S11Bn Sensor), while the others are offline.
- Text #15 people**: Another card showing the status of 15 people, with all individuals listed as offline.

Below these cards, there are sections for **Records** (with a blue button for "Week" and "Month" filters) and **Time** (with a blue button for "Device" and "Sensor" filters). The bottom section shows a timeline of events from 2022-09-08 15:57:48, listing various sensor readings and device statuses.

Remote sensing with APP

79\$ MSRP

All in one TinyML sensor



Seeed Studio XIAO ESP32S3 Sense

Ultra-small ESP32-S3 development board with OV2640 camera

HIGH-PERFORMANCE

240MHz Xtensa 32-bit LX7 dual-core processor

MEMORY

8MB PSRAM + 8MB FLASH

MULTI-FUNCTIONAL

Microphone/SD card slot/Detachable OV2640

WIRELESS

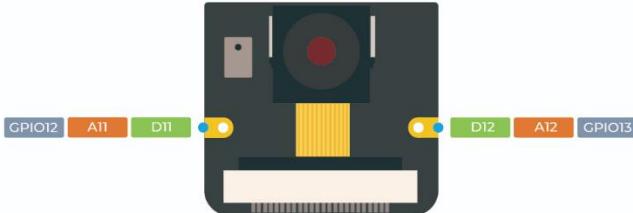
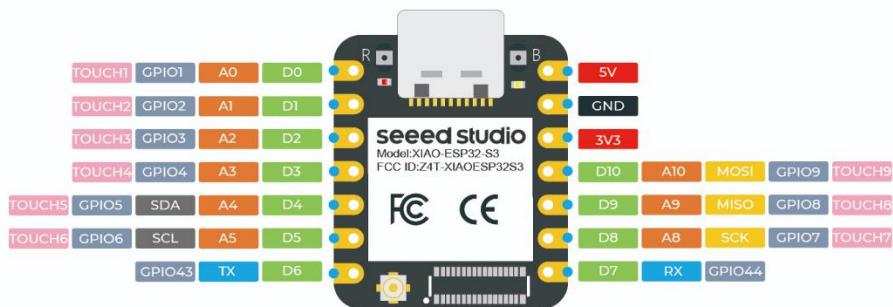
2.4GHz WiFi and BLE 5

TINYML-SUPPORTED

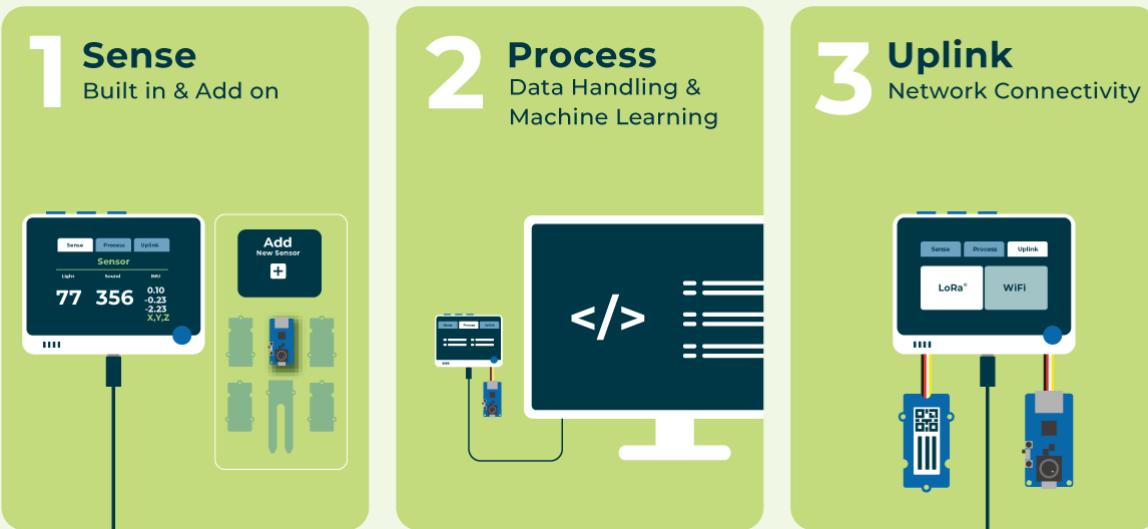
Image Processing/Speech Recognition

Xiao
= 小 (xiǎo)
= Tiny

FRONT



SenseCraft: No Code & No IoT



* The LoRa® Mark is a trademark of Semtech Corporation or its subsidiaries.



Open Source on GitHub: <https://github.com/Seeed-Studio/SenseCraft>

Perception system for real world data

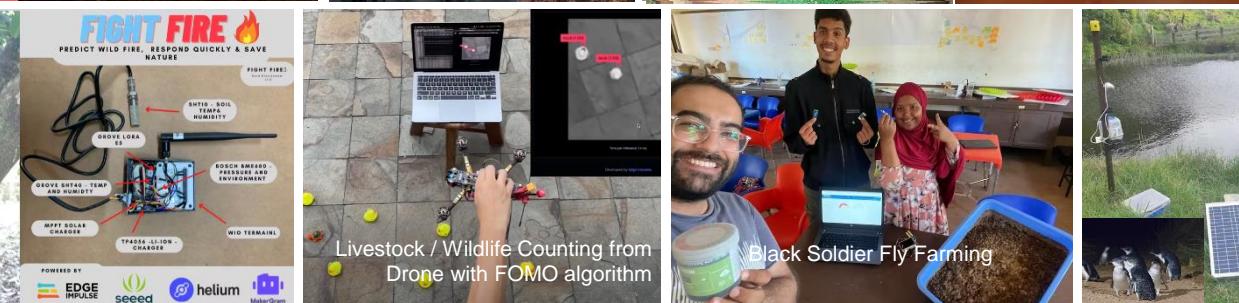


**Making Sense
Of the Wild
With the community**

IoT2wild Contest

Website: <https://www.hackster.io/contests/iotinthewild>

Winner announced at Hackster Impact Summit on October 11, 2022



Smart Lake - Early Detection of Algae Bloom

By, Sashrika Das & Mithun Das

Project Description

Using data from different sensors and ML on the edge, this device can detect early sign of algae bloom and notify authorities or citizens.

Highlights

- Multi-model sensing
- Edge AI for inference
- Long-range, low-power monitoring
- Full stack open source

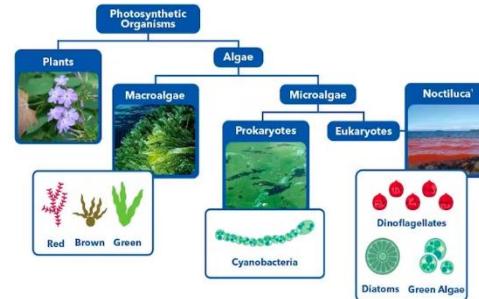


Scan to Know More

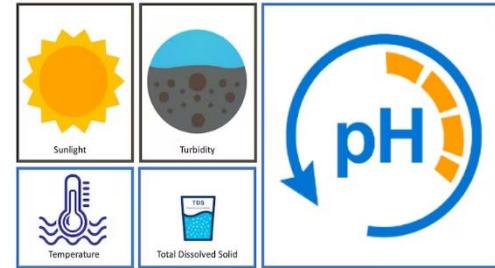
Make Sense of the Wild

Keywords: Climate Crisis Prevention/Mitigation, LoRaWAN, Blockchain, AWS

Sustainability Topic



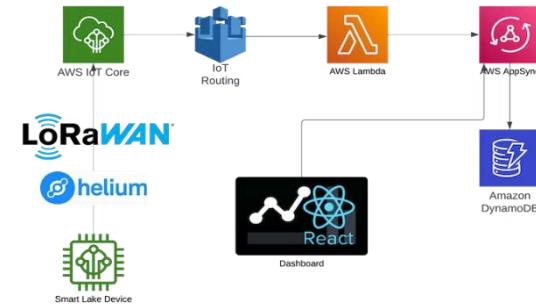
Key Info to Monitor



Prototype



System Diagram



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AgroLoRa

By, EdOliver & Victor Altamirano

Project Description

Automated irrigation and crop health monitoring device for local and urban farming, developed on the basis of SenseCAP K1100 Kit, while performing predictive agriculture analytics via Helium network.

Highlights

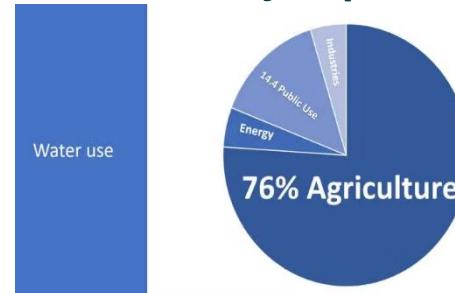
- All-in-one, inexpensive precision farming solution
- Predictive analysis
- Long-range, low-power monitoring
- Full stack open source



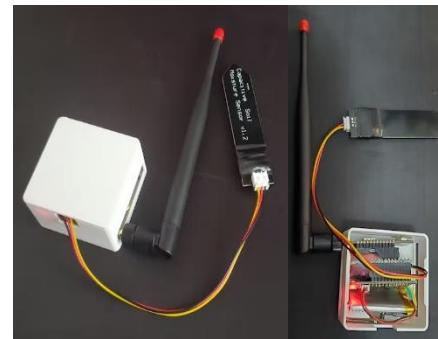
Scan to Know More

Keywords: Precision Farming, LoRaWAN, Helium, AWS

Sustainability Topic



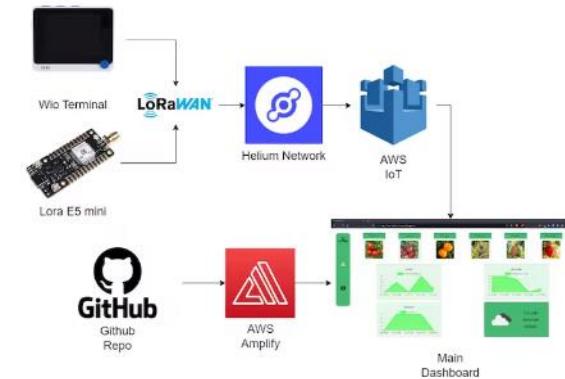
Prototype



Key Info to Monitor



System Diagram



IoT AI-Driven Tree Disease Identifier w/ Edge Impulse & MMS

By, Kutluhan Aktar

Keywords: Tree Disease, Edge Impulse, MMS

Project Description

Tree disease identifier using SenseCAP K1100 Kit, Wio Terminal, and Grove sensors (CO₂, temperature, humidity sensors) to collect data from trees infected with different types of plant diseases, and then uses Edge Impulse to train the object detection model with machine learning, and finally, receives the detection results and early warning notifications through MMS.

Highlights

- Web application in PHP to save the transferred detection results (images)
- Long-range, low-power monitoring
- Full stack open source



[Scan to Know More](#)

Sustainability Topic



Prototype



Key Info to Monitor



System Diagram



Weather Balloon "Mining" Using Blockchain and IoT

By, Nicolas Lopez

Keywords: Climate Crisis Prevention, LoRaWAN, TTN, Node-RED

Project Description

Floating balloon to measure meteorological data 32,000 feet above West Africa, using a Grove sensor (air temperature, humidity, barometer sensor). Helium's LoRaWAN network was used to transfer the collected environmental data, after which Node-RED (no-coding platform) was used to process weather observations and authentication checks.

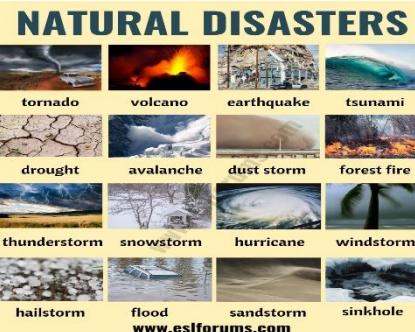
Highlights

- 25 launches of weather balloons with students in Africa and the USA
- Long-range, low-power monitoring
- Full stack open source



Scan to Know More

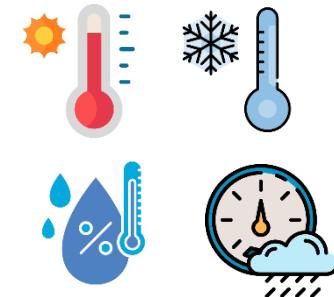
Sustainability Topic



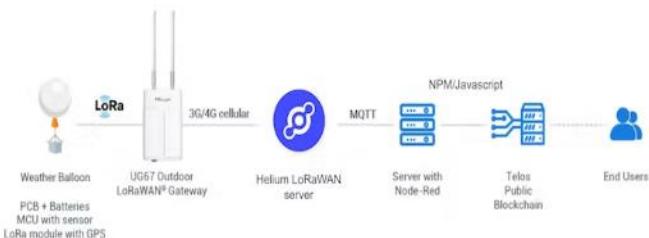
Prototype



Key Info to Monitor



System Diagram



Study of Animal Movement: Equipment Design and Development

By, Laila Kazimierski et al.

Project Description

Wildlife movement and behavior tracking device for endangered species to research about their biology, using Wio Terminal, Grove - Long Range 868MHz, and Arduino IDE. Used for field monitoring in mapping out and monitoring the animal's movement patterns, trajectories, nests, and natural environmental habitats in real-time.

Highlights

- Latest status quo of the wildlife and their natural habitats
- Long-range, low-power monitoring
- Full stack open source



Scan to Know More

Keywords: Wildlife Conservation, Biodiversity, LoRaWAN, Arduino IDE

Sustainability Topic



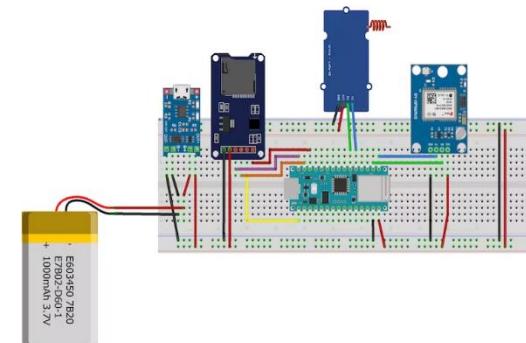
Prototype



Key Info to Monitor



Hardware Diagram



MonSand: Monitoring Illegal Sand Mining

By, Raunak Singh

Project Description

A device that detects illegal sand mining activities in the oceans and river banks, by using Wio Terminal, SenseCAP K1100 Kit, Grove Lora E5, after which the collected data is sent to Helium Console, and then the monitoring outcome analysis will be directly shown on Google Sheets to send SNS to relevant authorities, either government agencies or NGOs.

Highlights

- Embedded system to map out illegal sand mining sites
- Long-range, low-power monitoring
- Full stack open source



Scan to Know More

Keywords: Illegal Sand Mining, Marine Conservation, LoRaWAN, Helium

Sustainability Topic



Prototype



Key Info to Monitor



System Diagram



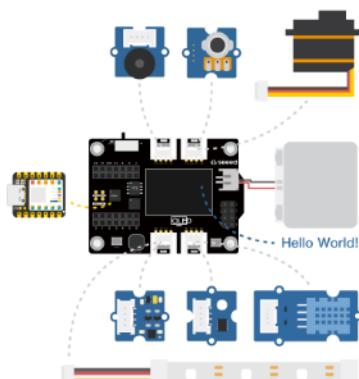
XIAO Empowers TinyML in Academy

Ready-To-Use XIAO Course: Big Power, Small Board - Mastering Arduino and TinyML



This course uses a project-based approach and hands-on practice to teach students how to create projects with Seeed Studio XIAO, from simple LED lighting to TinyML projects. Community-made project cases are also included to inspire students to explore the technological possibilities of XIAO.

	XIAO for this kind of	NPU (Neural Network Processor)	MPU (Microprocessor)	GPU (Graphics Processor)
Low-End MCU	High-End MCU	Audio Classification	Complex Images or Sound	Video Classification
Sensor Fusion Classification				
Memory	18KB	50KB	256KB	1MB+
Sensors				
Audio				
Images				
Videos				



Rich TinyML Projects from Community as Open Source TinyML Teaching Materials ...

Community Project

1. Exploring Machine Learning with the New XIAO ESP32S3

Marcelo Rovai showcased his latest project, delving further into the world of machine learning, by introducing the newest member of the XIAO family, the XIAO ESP32S3. In this project, he utilized a low-cost IMU and harnessed the power of edge impulse to detect anomalies and classify motion.

Seeed Studio XIAO ESP32S3 leverages 240MHz Xtensa 32-bit LX7 dual-core processor, supporting both WiFi and BLE 5.0 wireless connectivities, along with a built-in WiFi antenna and a LiPo battery slot up to 14.8V, supporting lithium battery charging management. Ideal for the Internet of Things, Smart Home, Wireless wearable devices, Robotics, etc.



Seeed's hardware used in this project:
Seeed Studio XIAO ESP32S3

Softwares used in this project:
 ARDUINO EDGE IMPULSE

[Read the full project on Hackster](#)

XIAO ESP32S3

Community Project 1

2. TinyML Made Easy: Image Classification

Marcelo Rovai shared a comprehensive tutorial covering an introduction to TinyML and how to get started with an XIAO board. In this project, where Marcelo demonstrates how to collect data from sensor Vespa datasets from Kaggle and train a model using Edge Impulse. The trained model is then deployed as an Arduino library in a zip format and uploaded to the XIAO ESP32S3 Sense, enabling users to classify fruits and vegetables with ease.

Seeed Studio XIAO ESP32S3 Sense integrates a camera sensor, digital microphone, and SD card support. Combining embedded ML computing power and photography capability, this development board can be your power tool to get started with intelligent voice and visual AI.



Seeed's hardware used in this project:
Seeed Studio XIAO ESP32S3

Softwares used in this project:
 ARDUINO EDGE IMPULSE

[Read the full project on Hackster](#)

XIAO ESP32S3



Community Project 2

XIAO in TinyML4D

tinyML® Talks

Enabling Ultra-low Power Machine Learning at the Edge

"Unleashing the Power of the New XIAO ESP32S3 Sense:
Tackling Anomaly Detection, Image Classification, and
Keyword Spotting with TinyML"

Marcelo Rovai – Co-Chair, TinyML4D group

June 13, 2023



www.tinyML.org

"The new XIAO ESP32S3 development board is an ideal fit for TinyML education and projects in developing countries due to its affordability, high quality, and ease of setup and use."

--- Quote from Prof. Marcelo Rovai



Student Project: A "Personal Trainer" Built on XIAO nRF52840 Sense using TinyML



Professor Stalin Arcienega from the University of Ecuador (PUCIESE), which streamed the Talk with his engineering students:

TinyML Case Studies



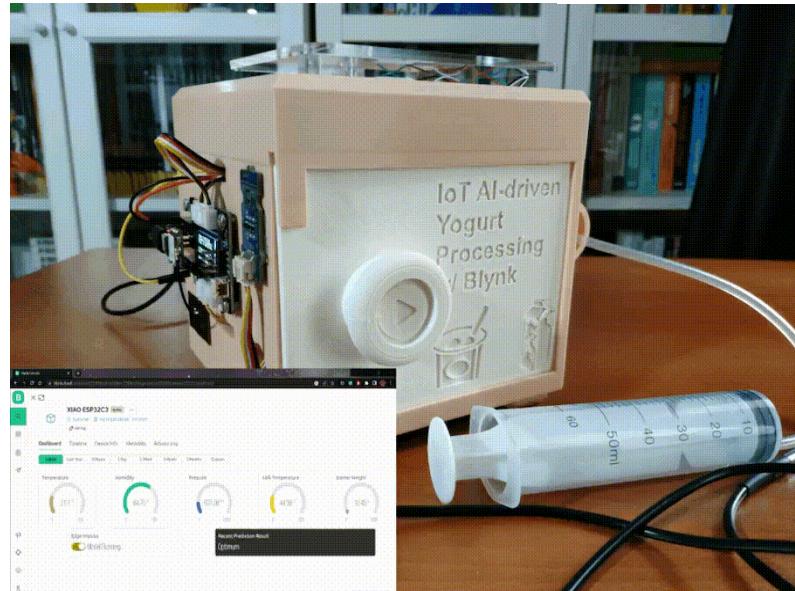
IoT AI-driven Yogurt Processing & Texture Prediction by Kutluhan Aktar

Background

Yogurt's quality is affected by factors like temperature, humidity, pressure, milk temperature, and the presence of yogurt bacteria. Chemical additives are commonly used, but there's a growing demand for additive-free yogurt.

Solution

This project measures key data points using temperature and humidity sensors, as well as pressure sensors, to estimate the consistency level of yogurt. It uses XIAO ESP32C3 to build and train an artificial neural network model, which analyzes the collected data to determine the most suitable environmental conditions for yogurt fermentation.



Softwares used in this project:



AUTODESK®
FUSION 360™

B Blynk

EDGE
IMPULSE

A Pet Activity Tracker using XIAO BLE Sense & Edge Impulse

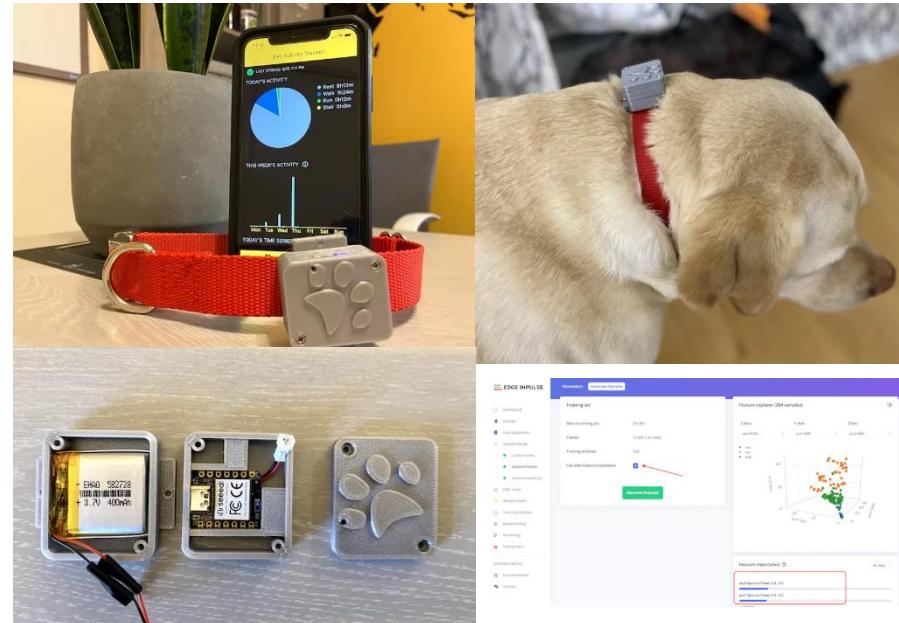


Background

Why should humans have all fitness trackers? Our pets deserve more to stay active. We love our pets and we want the best for our pets: good health, deep sleep, nutritious food—essentially, all the things that ensure a long, happy life together.

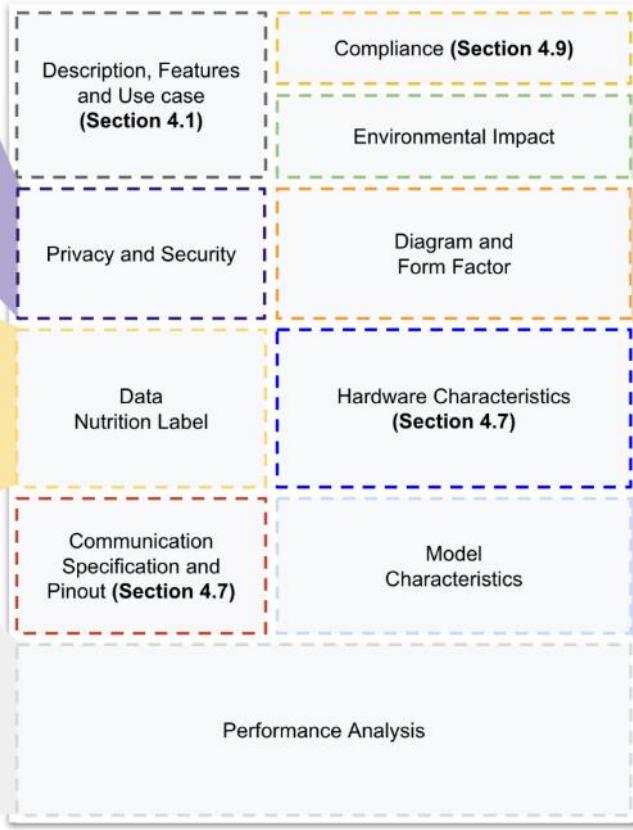
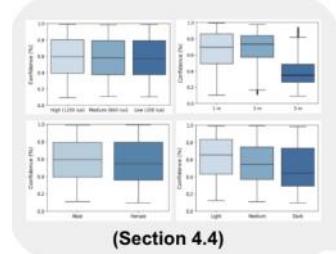
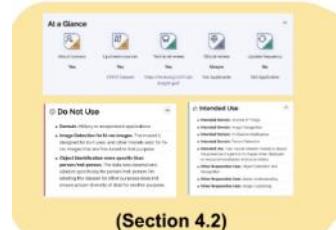
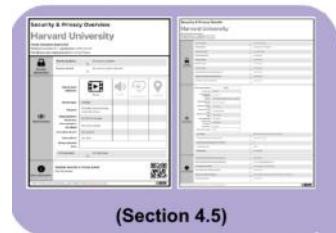
Solution: A Low-Cost and Flexible Fitness Tracker Especially for Pets

This tracker only includes an XIAO nRF52840 Sense, a rechargeable battery, and a case on the hardware side. Mithun Das trained a TinyML model to make the pet's activity recognizable and identifiable and designed an accompanying mobile app connected to the device over Bluetooth and a microcontroller sends prediction data every minute. Data is stored on mobile local storage and plotted on graphs to provide meaningful insight.



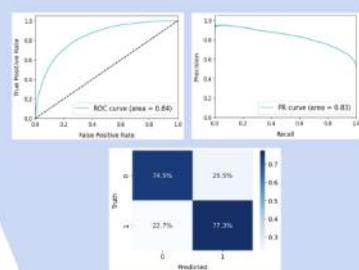
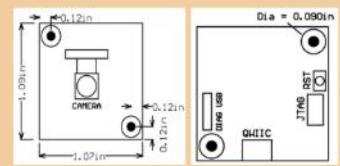
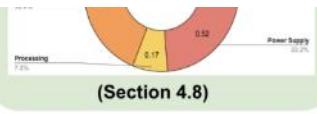
Next?

Unify the AI sensor standards and create more



Matthew Stewart^{1*} Pete Warden^{2,5} Yasmine Omri¹ Shvetank Prakash¹ Joao Santos¹
Shawn Hymel¹ Benjamin Brown¹ Jim MacArthur¹ Nat Jeffries⁵ Brian Plancher³
Vijay Janapa Reddi¹

¹Harvard University ²Stanford University ³Barnard College, Columbia University
⁴Edge Impulse ⁵Useful Sensors



Co-Invent Solutions with vertical-specific models

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.

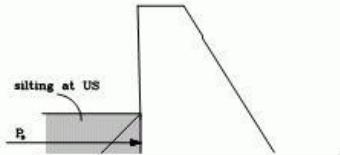


bridge between science and practice

(4) Silt Pressure

$$P_{silt} = \frac{1}{2} * \gamma_{silt} * h_{silt}^2 * k_a$$

neglected, if considered after time a part of the dam



(5) Wave Pressure

$$\begin{aligned} P_{wave} &= \frac{1}{2} \left(\frac{5}{3} h_w * 2.4 \gamma_w h_w \right) \\ &= 2000 h_w^2 \text{ kg/m}^2 \\ &= 2h_w^2 t / \text{m}^2 \end{aligned}$$

P_w = wave force

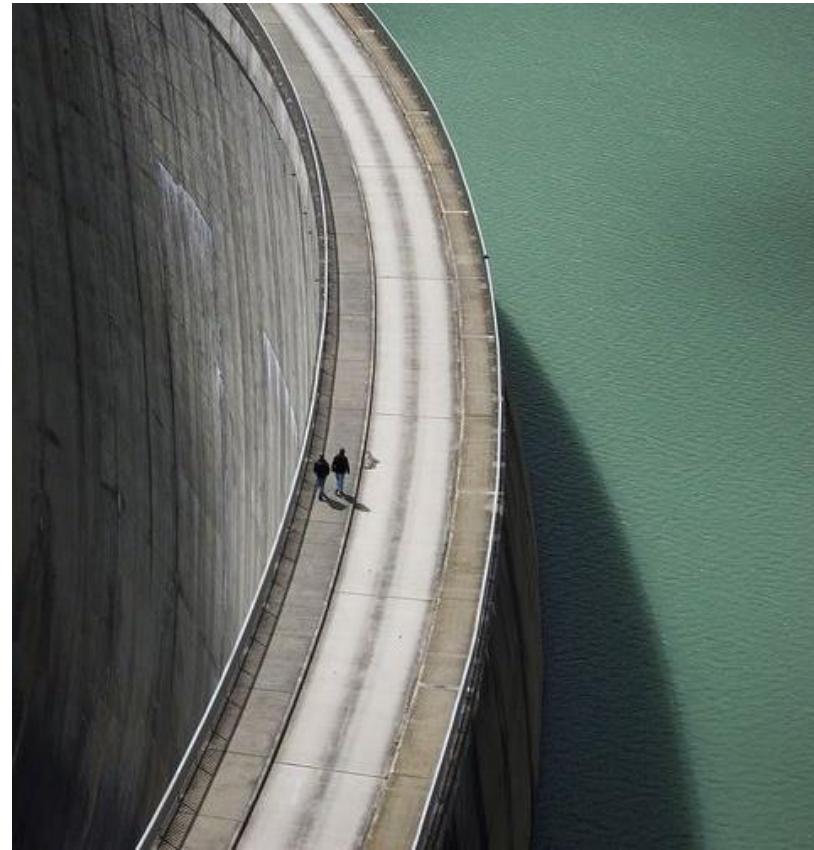
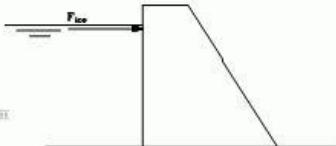
h_w = wave height

$$\begin{aligned} &= 0.032 \sqrt{VF} + 0.763 - 0.271 F^{\frac{1}{4}} \quad (F < 32 \text{ km}) \\ &= 0.032 \sqrt{VF} \quad (F \geq 32 \text{ km}) \\ V &= \text{wind speed (km / hr)} , F = \text{straight length (km)} \end{aligned}$$

(6) Ice Pressure

$$F_{ice} = 50 * h_{ice} * \gamma_w t / \text{m}^2$$

$$\approx 25 - 150 \text{ t / m}^2$$



From data to GPT insights

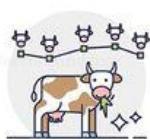
SUSTAINABLE AGRICULTURE



SOIL SALINITY MANAGEMENT



POST HARVEST LOSSES MANAGEMENT



LIVESTOCK MANAGEMENT



WATER AND IRRIGATION MANAGEMENT



ENERGY MANAGEMENT



EROSION MANAGEMENT



INTEGRATED PESTS MANAGEMENT



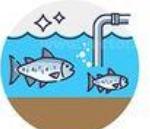
PASTURELANDS MANAGEMENT



NUTRIENTS AND SOIL FERTILITY MANAGEMENT



WETLANDS MANAGEMENT



FISHERY AND AQUACULTURE MANAGEMENT

14:52

AI answers are provided for reference only. Please use them with caution as SenseCAP cannot be held responsible for any consequences resulting from the use of AI services.

Crop or Animal *

Input the crop or animal

Location *

Input Location

Time *

1 Month 6 Months (selected) 1 Year

Measurements(up to 5) *

+

Send

Copy Message

Try Again

SenseCAP AI

these are the data of Soil Temperature, Soil Moisture, Electrical Conductivity for the last Month , Based on these data, please give some suggestions.

Environmental Data analysis:
The average soil temperature of 26.49°C in Sichuan is suitable for strawberry cultivation. However, further analysis is needed to provide more specific advice.

Planting/Breeding advice:
For strawberry cultivation, it is recommended to select suitable cultivars that can tolerate high temperatures and have good heat resistance. Proper irrigation management is also crucial to maintain soil moisture and temperature. It is suggested to use mulching to conserve soil moisture and reduce soil temperature. Additionally, providing partial shade to the plants during the hottest part of the day can help to mitigate heat stress.

Pest control:
The specific environmental data provided does not give enough information to provide specific pest control recommendations. However, it is recommended to monitor for common pests that affect strawberries, such as spider mites, aphids, and thrips, and use appropriate control measures if necessary.

Device AI GC Mail User

Commercialized Research Project: Carbon Monitoring System with Institute of Atmospheric Physics, Chinese Academy of Science



Monitoring

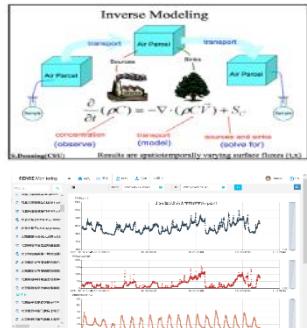


Simulation

- Ground: Network of ground compact weather stations
 - Air: Drones, Aircraft
 - Space: Carbon Satellite:TanSat、GOSAT2、OCO3
-
- Atmospheric Transport: WRF-CO₂
 - Ground Carbon Sources and Sinks: VEGAS/TRENDY
 - Model Assimilation: LETKF-C, CarbonTracker



Data Collection with reliable and high-precision monitoring weather station from Seeed (CO₂ monitoring with the accuracy of 1% in ppm)



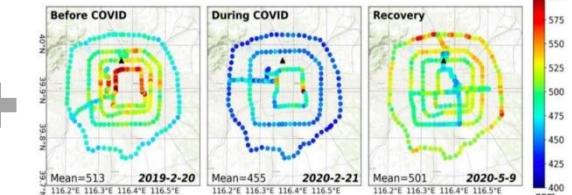
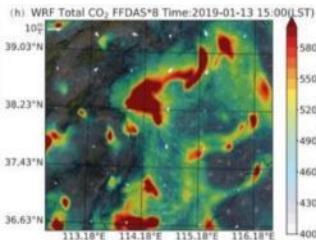
Modeling Assimilation System: Data Processing and Analysis

Simulator Model: Data Analysis

Dashboard: Data Visualization



Industry



High Resolution Simulation of Carbon Sources and Sinks in Beijing-Tianjin-Hebei City Cluster

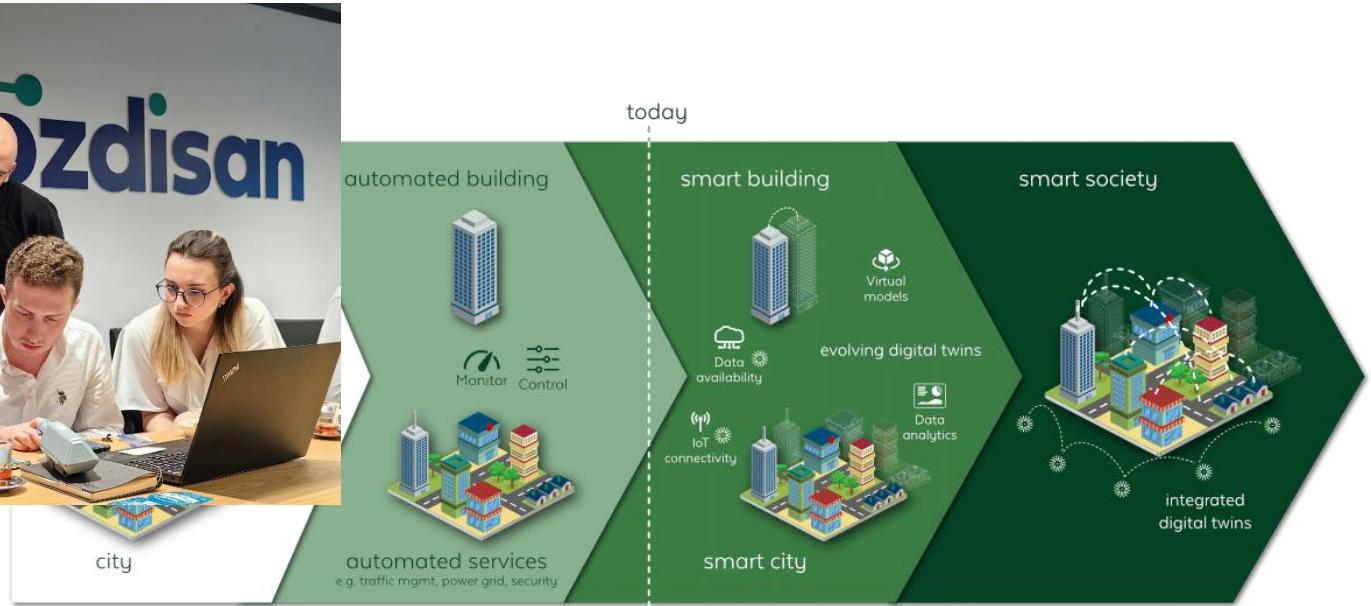
According to the system, the average CO₂ concentration of Beijing's roads decreased by 40~60ppm

Train local solution makers with confidence

seeed studio

Digital Transformation 101

Build your first perception system in 8 hours



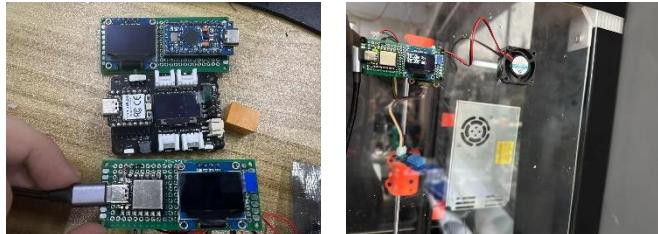
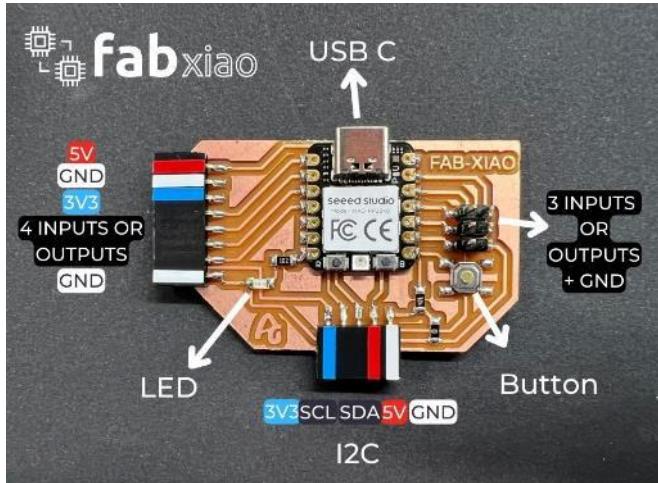
XIAO in Fab Academy & Fab Labs



The Fab Lab Network is a global community of makers, located in 90+ countries with 1,500+ Fab Labs. They share tools and knowledge to democratize technical invention and foster innovation.

FabXIAO

XIAO is the Designated Official Teaching Tool Recommended by Prof. Neil Gershenfeld, the Founder of the Global Network of Fab Labs.



A screenshot of the FabLab Kannai - Fab Academy 2022 website. The page title is "Basics of XIAO Series". It includes a "Table of contents" sidebar with links to "XIAO series", "Seesu Studio XIAO RP2040", "Arduino Board", "Raspberry Pi Board", "Seeed Studio XIAO ESP32C3", "About", "Pinout/Board", and "Arduino Board". The main content area contains a "Seeed Studio XIAO Series Comparison Table" which compares four models: RP2040, RP2040, ESP32C3, and SAMD21. The table lists various technical specifications for each model.

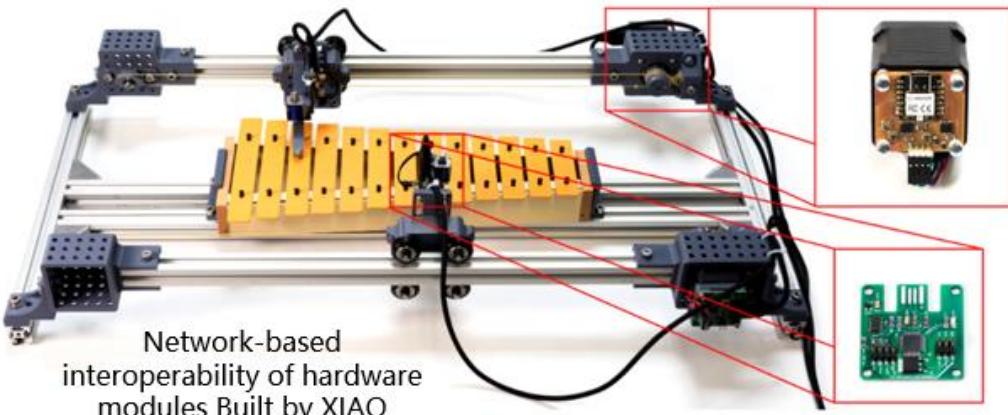
Week 4 group assignment Embedded programming
Introduction to the platforms



Picture 1: Different platforms RP2040, ESP32C3, SAMD21

Introduction

During the Instructor Bootcamp in Amsterdam, we recommended starting with the **Seeed Studio XIAO**. Specifically the version model or the ESP32C3. In my case, the first I had was the **Seeed Studio XIAO RP2040**. The Fab-XIAO can also use the **Seeed Studio XIAO ESP32C3**.



seeed studio

Make Sense of the Wild



Discord
discord.seeed.cc



Project Hub
hackster.io/seeed



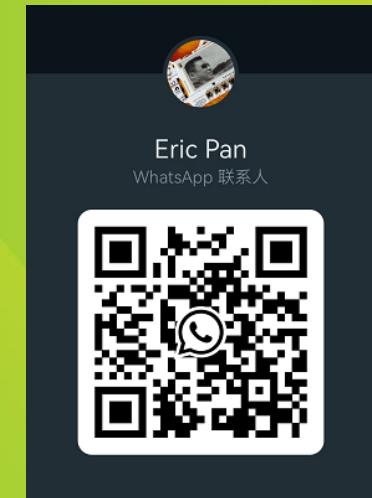
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Let's talk!
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