空間數據共享平台
Common Spatial Data Infrastructure

地理空間實驗室
Geospatial Lab

CSDI Awards 2025

MetroSense

Sharing, Sustainable, Smart

Special thanks to
GeoLab Team
and our mentor
Dr Elton Chan, LandsD


Ir Dr Joey Pong


Ir Dr Keynes Chan


Mr Eric Tse, GISP

AI Sense

Background

Urban explorer

Name: Lee

Age: 40

Gender: Male

Status: Married with kids

Job: System Analyst

Hobbies: Tech-savvy, YouTuber, hiking, coffee, photography, **interested in urban development, visits construction sites in spare time, records and makes content**

YouTube channel: @sitevisit

LandsD GeoInfo Map

TPB OZP dev area

CEDD site formation data

In Search of WIP

Google satellite image construction sites

CSDI - DevB new dev data

Other urban explorers' social media

Northern Metropolis challenges	Our approaches	Our solutions
Rapid changing urban landscape and the need to capture	**Data with high temporal and spatial resolutions** needs the participation of community, crowdsourcing with an incentive mechanism	**Community Fly Program** supported by **Uber-like Sharing Drone Platform** sharing data and resources i.e. **Sharing Low-Altitude Economy (共享低空經濟)**
Raid development brings environmental impact	**Hyperlocal** environmental sensing data, monitor construction emission, allow citizen to manage their exposure	**Citizen Sensing Program** let citizens to co-create sensing data and promote **community engagement**
Adjacent to Shenzhen, potential cross-border logistics	Route planning needs to address multiple issues. NM is at **strategic location** to interface neighborhood cities and systems	AI route planning based on **3D Flying Network with composite cost**, allows further **interconnections** with nearby similar applications
Fragmented communities in the North district	Needs **transparency** on data and policies about NM development, need to improve stakeholders' engagement and awareness	**Citizen app MetroUp** data accessible to the everyone, **promoting data accessibility and community engagement, connecting nature with people**

Proposed solution

共創北部空間，共享都會數據

Air quality

Noise

Co-create(共創) data

Capture the changes of urban

Air quality

Share(共享) data

3D models

Check completeness of dataset

AI

Post microtasks

Building images

Citizens

Distribute sensors

Incentive

Share(共享) resources

Incentive

Drones/pilots

paid tasks request

External companies

3D models

Crowdsourcing issues
OSM as example

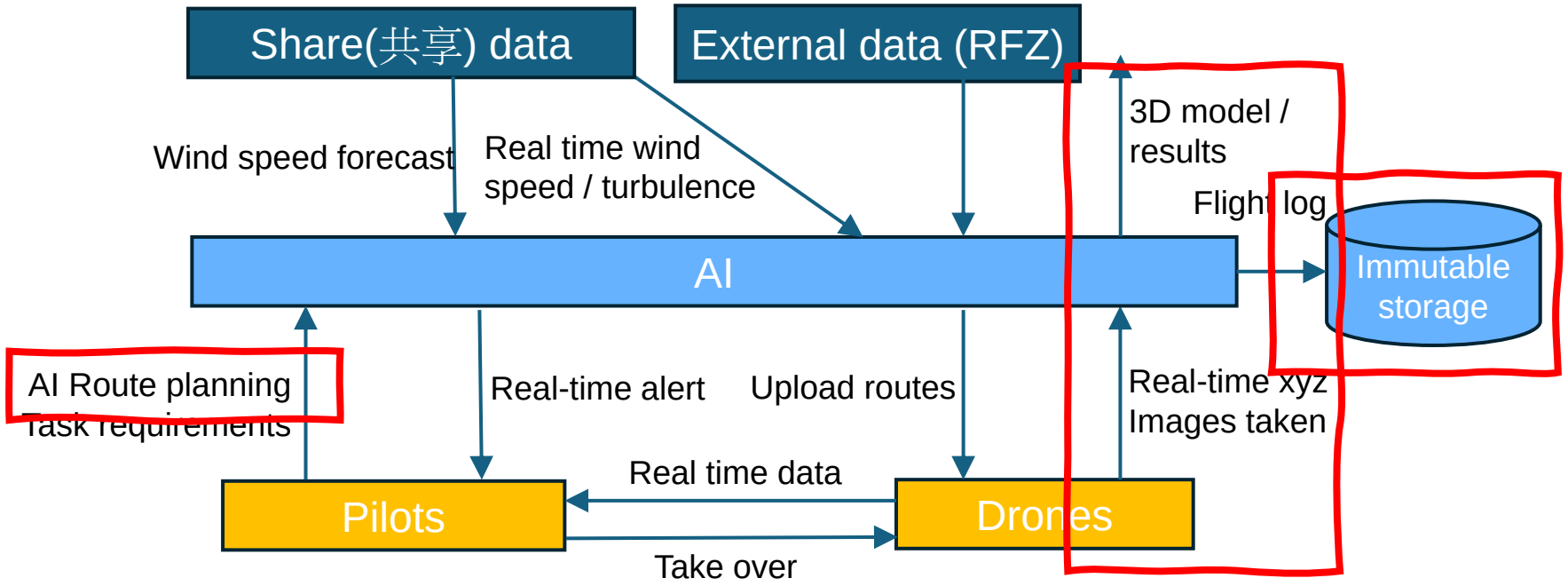
1. No incentive

2. No validation

Our solution : NFT
only after validated

Key feature – One-stop AI platform

共創北部空間，共享都會數據



Potential applications:

Surveying and 3D reconstruction

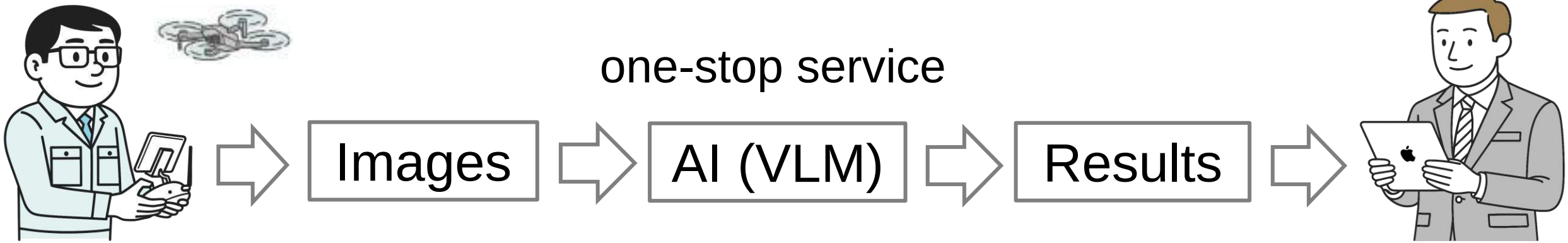
Building inspection

Detection of road crack

Counting pedestrian and traffic flow

Ecological monitoring

etc



Key feature – AI Route Planning

Common drone related pain points

安全 Safety

私隱 Privacy

誤闖 Enter by mistake

噪音 Noise

Our **3D Flying Network (三維空中路網) with Composite Cost** is addressing these pain points

Compliance

- **Restricted Flying Zone (RFZ)**
- License
- Has application?
- flying time, distance, height, speed

Privacy

- Avoid flying close to window if drone has camera?
- Co-design flight path with building **window's direction**?

Safety

- Factor in **people density on ground, weight of drone and flying height**
- Consider hyperlocal **wind forecast**
- Coordination protocol among drones when they fly in the same path
- Avoid bird strike by providing real-time birds count and location data
- Redundant infrastructure on **GNSS/5G signals**

Efficiency

- Job requirement
- Optimal path with multiple objectives
- Based on a **3D flying network (空中路網)**

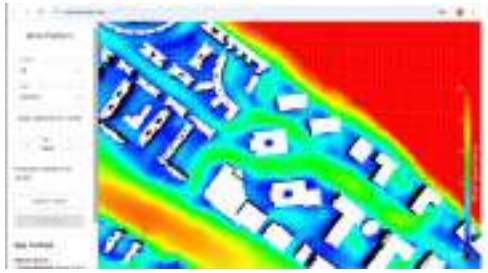
Noise

- **Distance to residents** or habitats in wetland and conservation circle
- Factor in drone model's propellers (high pitch) noise?
- Factor in **flying time** of the day?

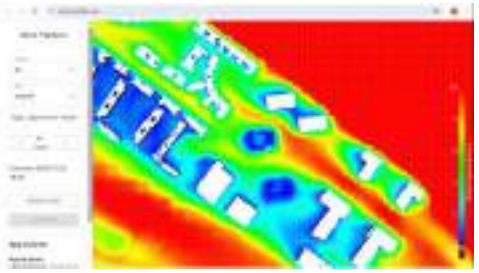
Key feature – AI Route Planning

Professional Wind Data Source

- Potential data sources / integration
- Smart Wind Technologies provides 5 hours forecast of wind speed and direction at 20, 50, 100, 150 and 200m altitude in a 10m resolution at any location in Hong Kong
- They are advancing their urban turbulence prediction model



20m



50m

3D Flying Network (三維空中路網) - Path Cost Calculation

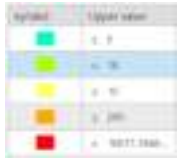
$$safety\ index = \begin{bmatrix} ppl\ density\ high & 3 \\ ppl\ density\ medium & 2 \\ ppl\ density\ low & 1 \\ no\ ppl\ below & 0 \end{bmatrix} x \begin{bmatrix} holiday & 10 \\ 9{:}00-18{:}00 & 5 \\ else & 2 \end{bmatrix} x \begin{bmatrix} A1 & 1 \\ A2 & 2 \\ B & 5 \\ C & 1000 \end{bmatrix} x \begin{bmatrix} \leq 20m & 1 \\ \leq 50m & 2 \\ \leq 100m & 5 \\ else & 10 \end{bmatrix} x \frac{1}{sky\ view\ factor}$$

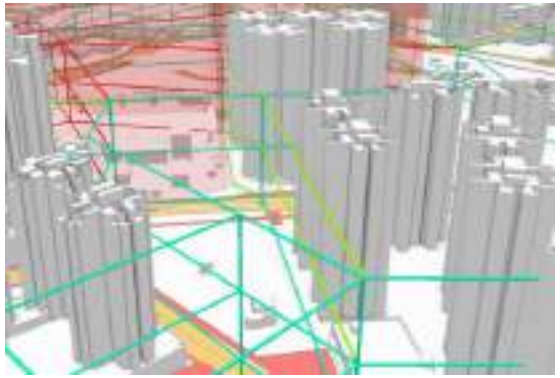
$$privacy\ index = \sum \left(\frac{1}{dist\ to\ closest\ window}\ x\ \#residents\ in\ that\ flat \right) x \begin{bmatrix} has\ cam & 1 \\ no\ cam & 0 \end{bmatrix}$$

$$noise\ index = \sum \left(\frac{1}{dist\ to\ closest\ window}\ x\ \#residents\ in\ that\ flat \right) x \begin{bmatrix} A1 & 1 \\ A2 & 2 \\ B & 5 \\ C & 10 \end{bmatrix} x \begin{bmatrix} 23{:}00-7{:}00 & 3 \\ else & 1 \end{bmatrix}$$

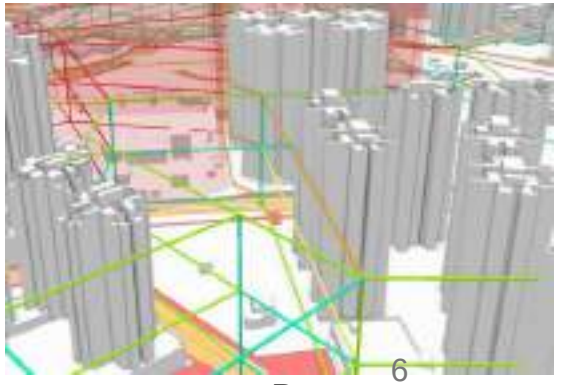
$$compliance\ index = \begin{bmatrix} intersect(path, RFZ) & \infty \\ else & 0 \end{bmatrix} x \begin{bmatrix} has\ permit & 0 \\ else & 1 \end{bmatrix}$$

$$efficiency\ index = length$$





A1



B

Data sources

空間數據共享平台
Common Spatial Data Infrastructure
CSDI

- 3D Visualization Map API
- 3D Spatial Data 3D-BIT00
- Building
- Digital Terrain Model
- District boundary
- Tertiary Planning Unit
- 2021 Population Census (Small Subunit Groups)
- Pavement polygon

Data from other departments

CEDD

- Restricted flying zone
- Site formation
- Statutory plans
- TPB Outline zoning plans

Internet maps

GEOINFO MAP 地理資訊地圖

Google Maps

- WIP sites
- Satellite images

Platform partners

wind

- API for real-time and 5 hour forecast wind data

Community

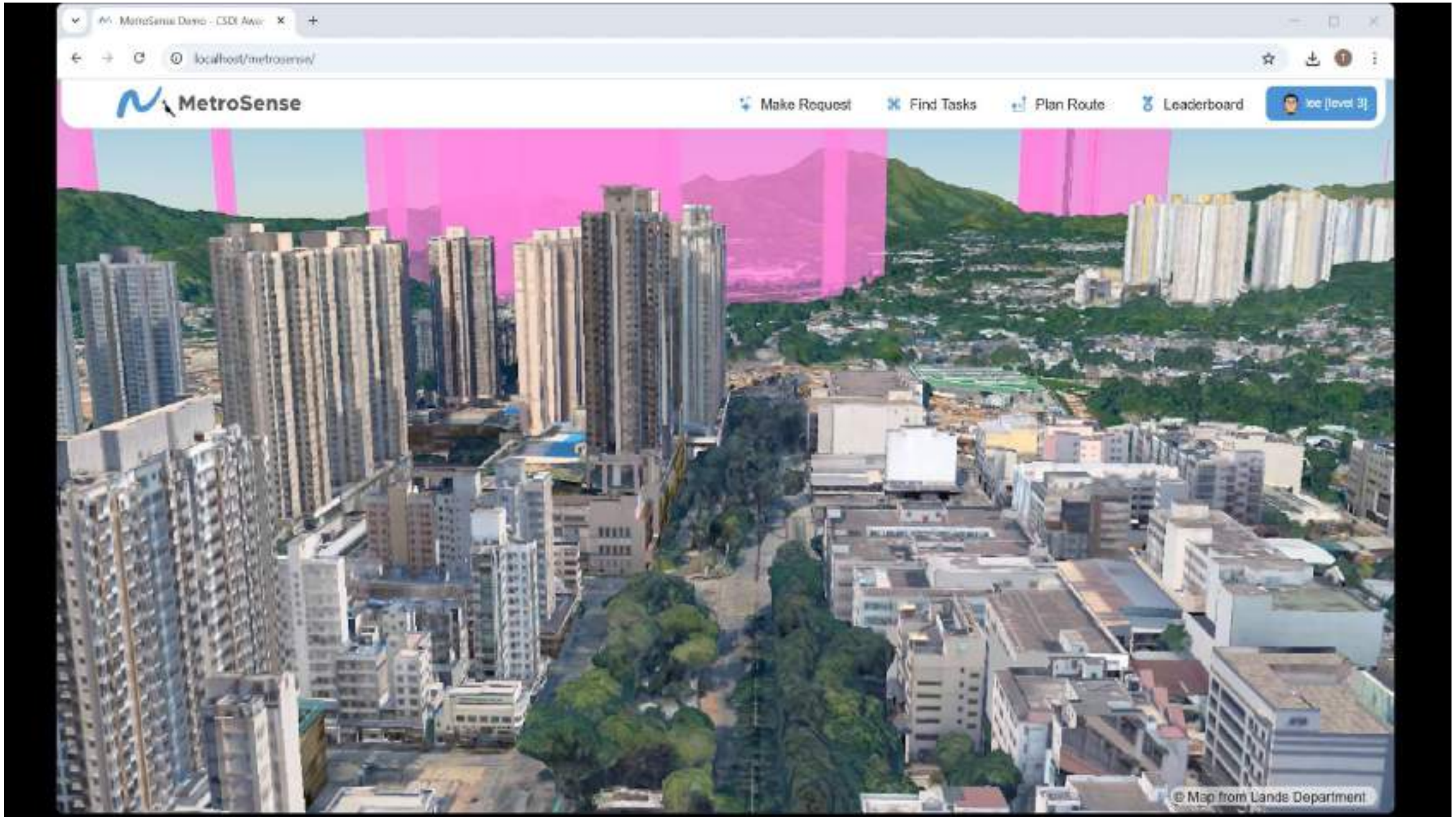
Pilots

- Surveying images
- 3D building model
- Air quality data

Citizen

- Env sensing data
- Bird count data
- Forum

MetroSense platform



Citizen sensing program thinking process

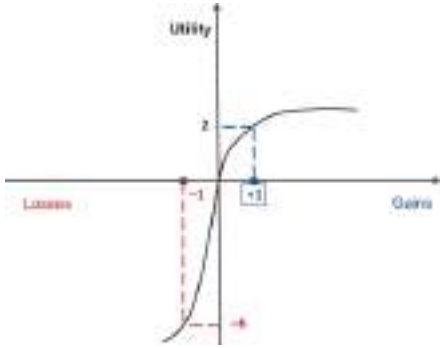
We started by buying a similar all-in-one sensor from SeeedStudio at $1200HKD and study

Start from the end result: we want a final product a 200m resolution air quality map

We estimate min. sensors required by spatial analysis, 200m grid index intersects with NM district polygons = 3969 grids, 5m HKD!!!

If using Fanling as pilot testing area = 275 Grids, 330k HKD!!

We research similar sensors product in Mainland market, can make one at $500 HKD i.e. Fanling pilot = 137.5k HKD!



Due to the risk aversion human factor they might **commit more** if pay for the sensor initially vs freely distribute to them, assumed discounted 60%, cost = 82.5k HKD

According to some success cases reference from CSDI and other countries, we will **embrace open standards** and define our data format and API format as well

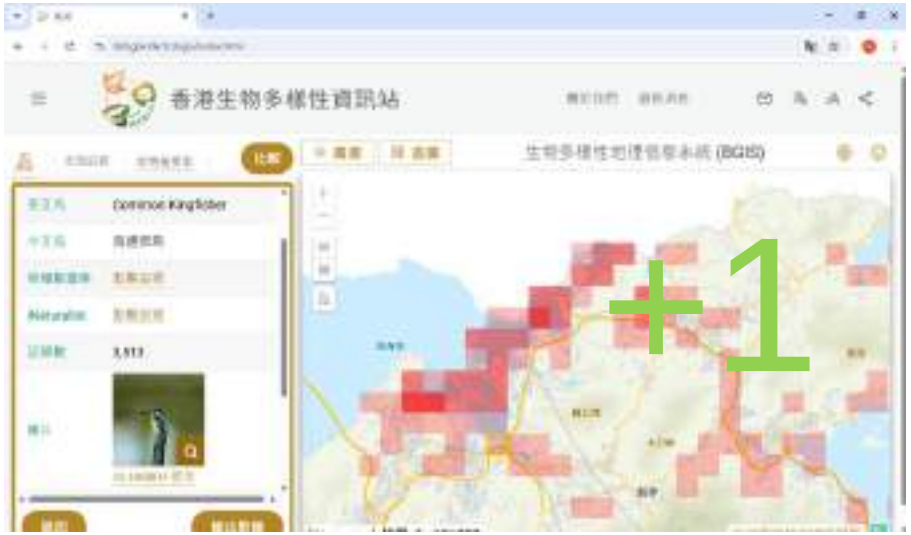
Map visualization of data

MetroUp App

App logo design concept – symbolize flying bird, drone on the sky and happy citizen on the ground

Features

- Photo AI e.g. Take a picture of bird -> AI recognize -> can optionally share to HKBIH or WWF
- Air quality map – In this demo a suspicious pollutant source is spotted in 16:05, future roadmap is AI to actively monitor such condition in case of toxic gas leakage, and alert corresponding parties
- Noise and flight path AR
- User profile showing open data contribution level and community engagement achievements



Thanks