AI & Smart Vision For Housing Management

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01

Overview

Problems, Opportunities, Objectives, and Working Plan

Our Client

NTT e-MOI JSC, a subsidiary of NTT East Japan, drives business development and digital transformation with Managed Service Provider (MSP), IT Outsourcing (ITO), and low-code software development, emphasizing long-term partnerships and aligning with customer goals.

NTT e-MOI

The Problems

Manual Inspection Inefficiencies

Time-consuming and prone to human error. delays and increased operational costs.

Low Scalability & Slow Response

Lack of automated system limits scalability and the ability to respond quickly to changes.

Competitive Disadvantages

High risk of falling behind competitors who adopt advanced technologies.

Opportunities

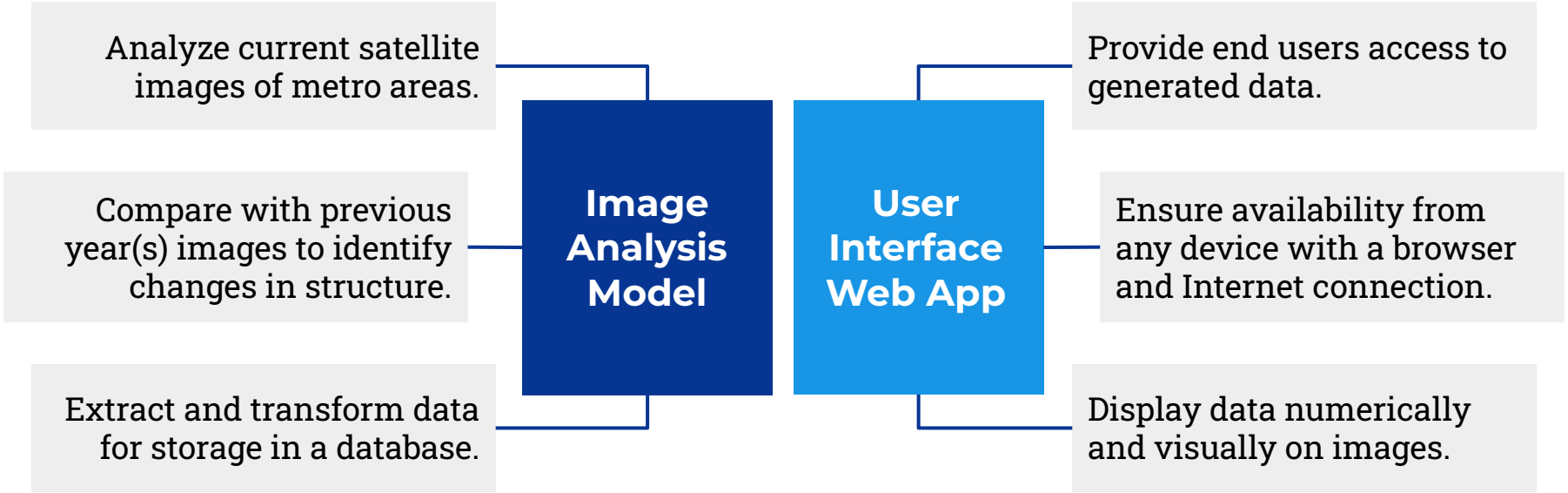
Short-Term

- Reduce inspection time and increase accuracy.
- Streamlining operations, improving the reliability.
- Immediate cost savings and operational efficiency.

Long-Term

- Leading position in property management.
- Enhanced satisfaction via data-driven decisions.
- More opportunities for service offerings.

Project Objectives



Project Scope

Analysing Housing Images

- Data Acquisition
- Preprocessing
- Object Detection and Segmentation
- Change Detection

Implementing Smart Vision Algorithms

- Machine Learning Models
- Deep Learning Frameworks
- Continuous Learning

User Interface with 2D Map

- Interactive 2D Map
- Property Information
- Search and Filter Options
- Data Export

Out-Of-Scope

2D Mapping Instead of 3D

Performance: Ensures fast load times & smooth interaction.

Simplicity: Provides a clear, user-friendly interface without the complexity of 3D.

Compatibility: Works well on a wide range of devices.

Features: Allows annotation, zooming, and viewing property details easily.

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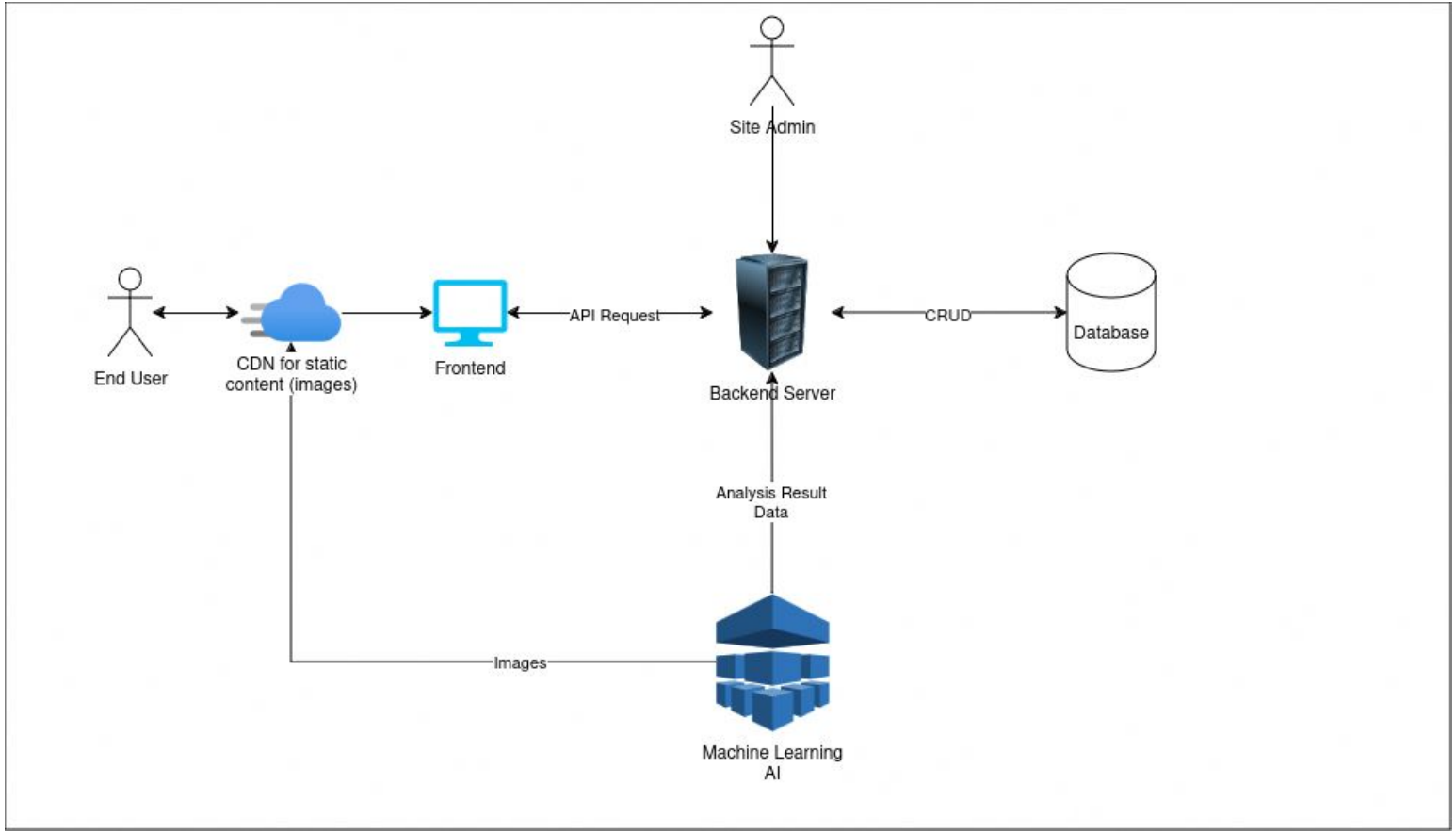
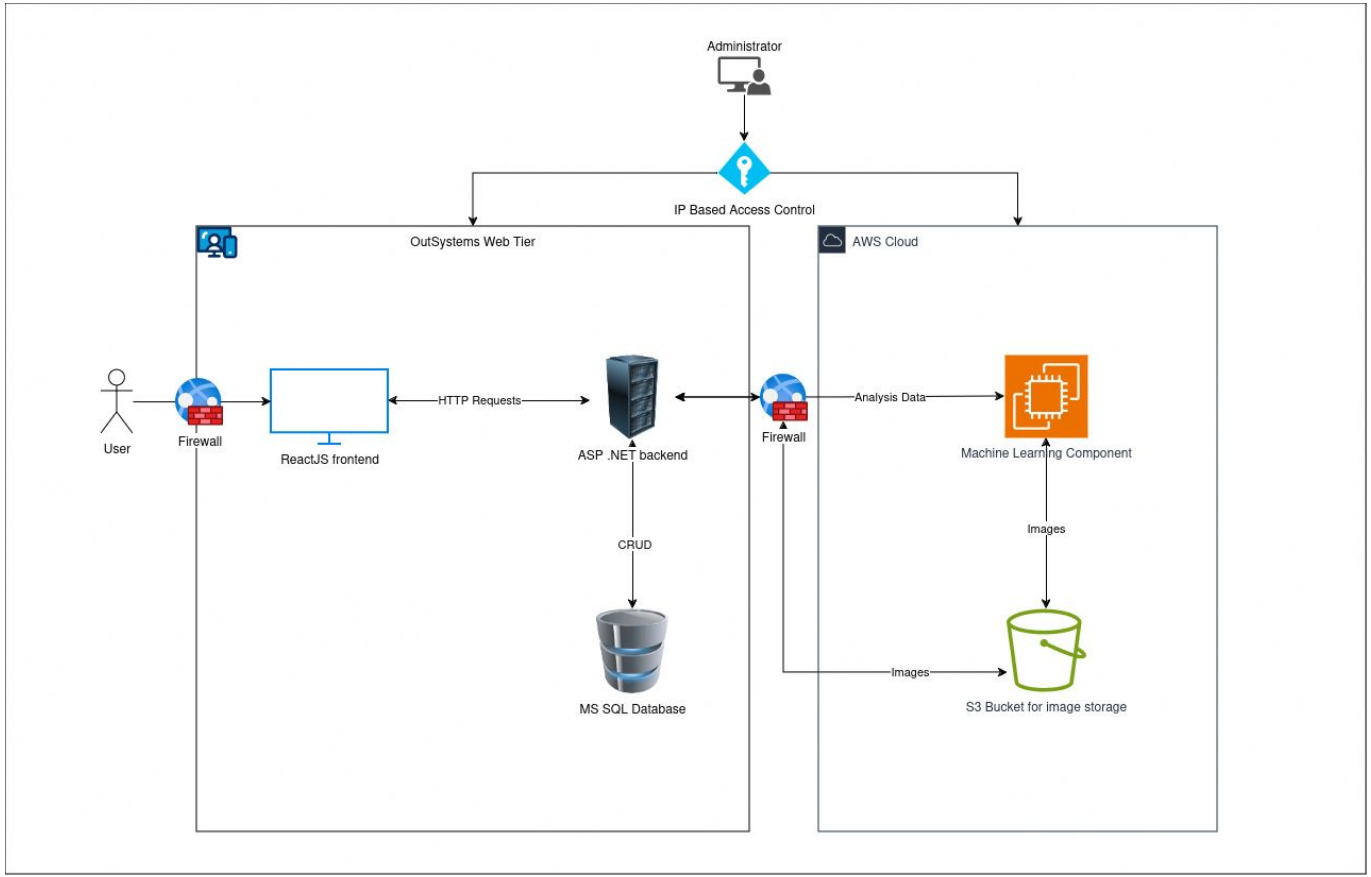
The Solution

Research, Design, Development and Outcome

Systems Architecture



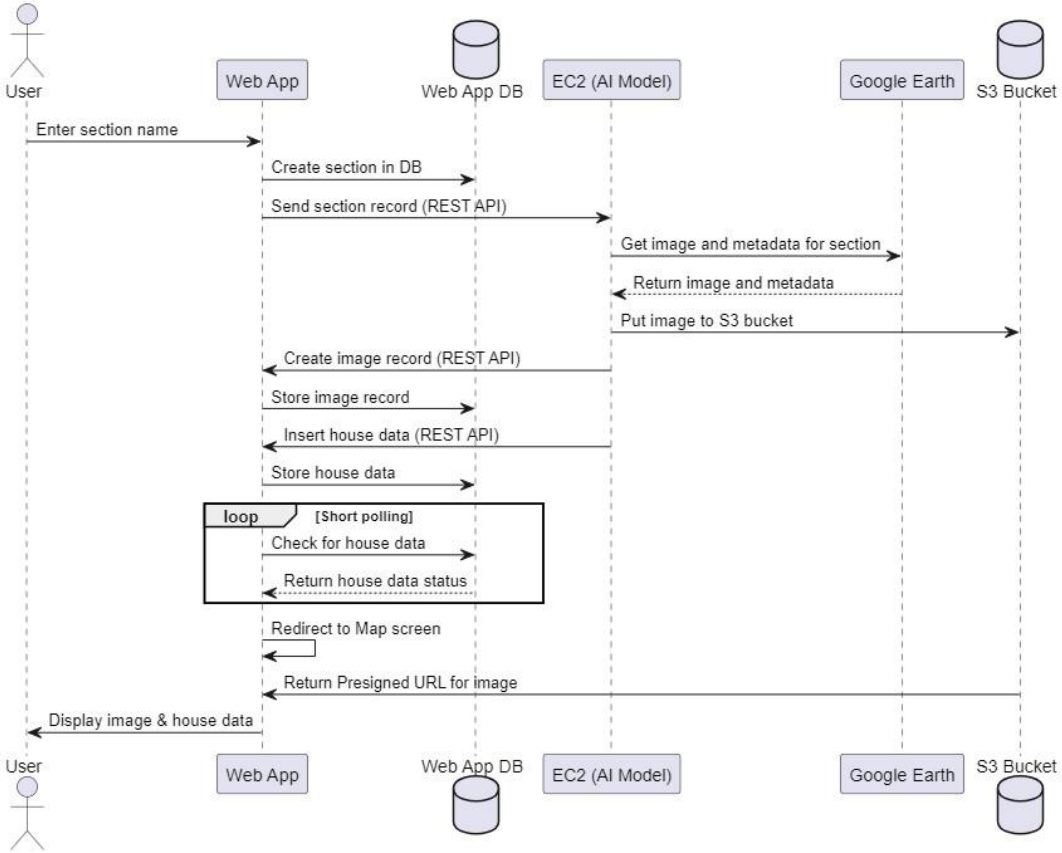
Systems Architecture



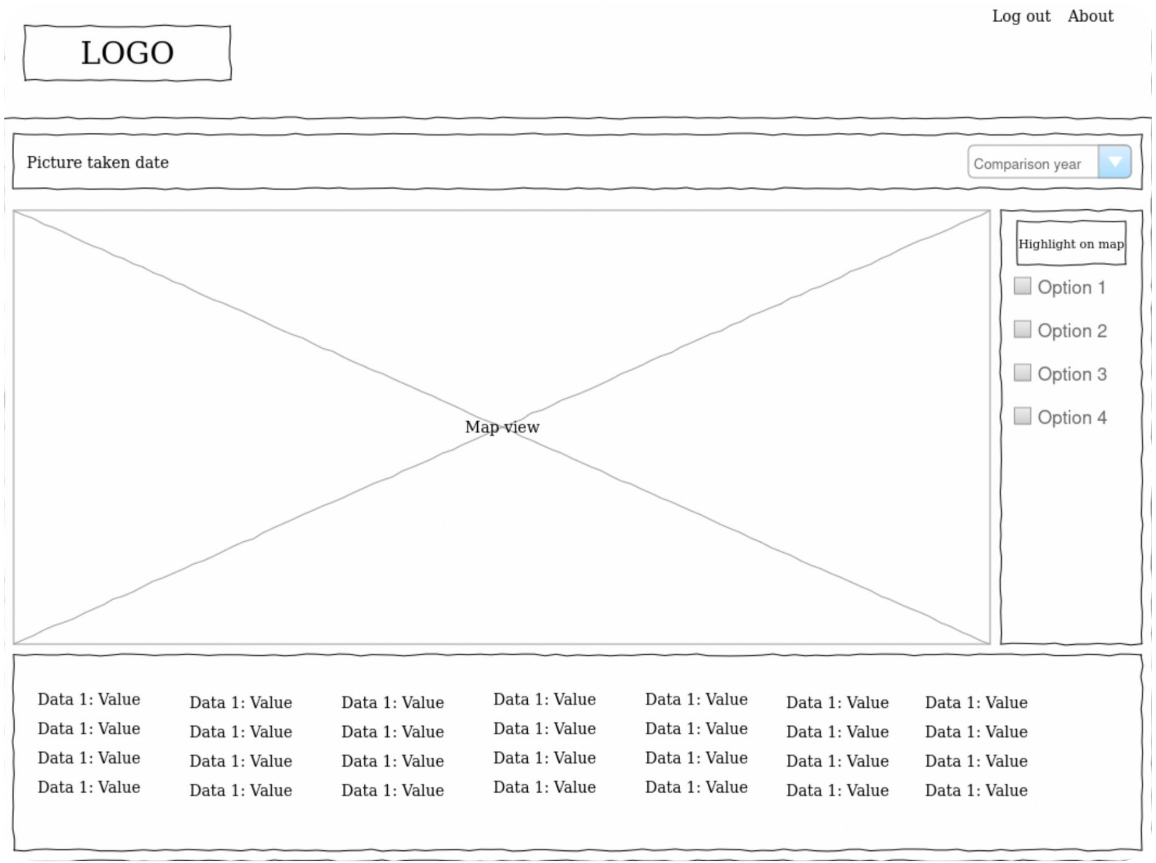
Development Tools

Web App	Machine Learning
outsystems	Amazon S3 Amazon EC2 MINICONDA FastAPI

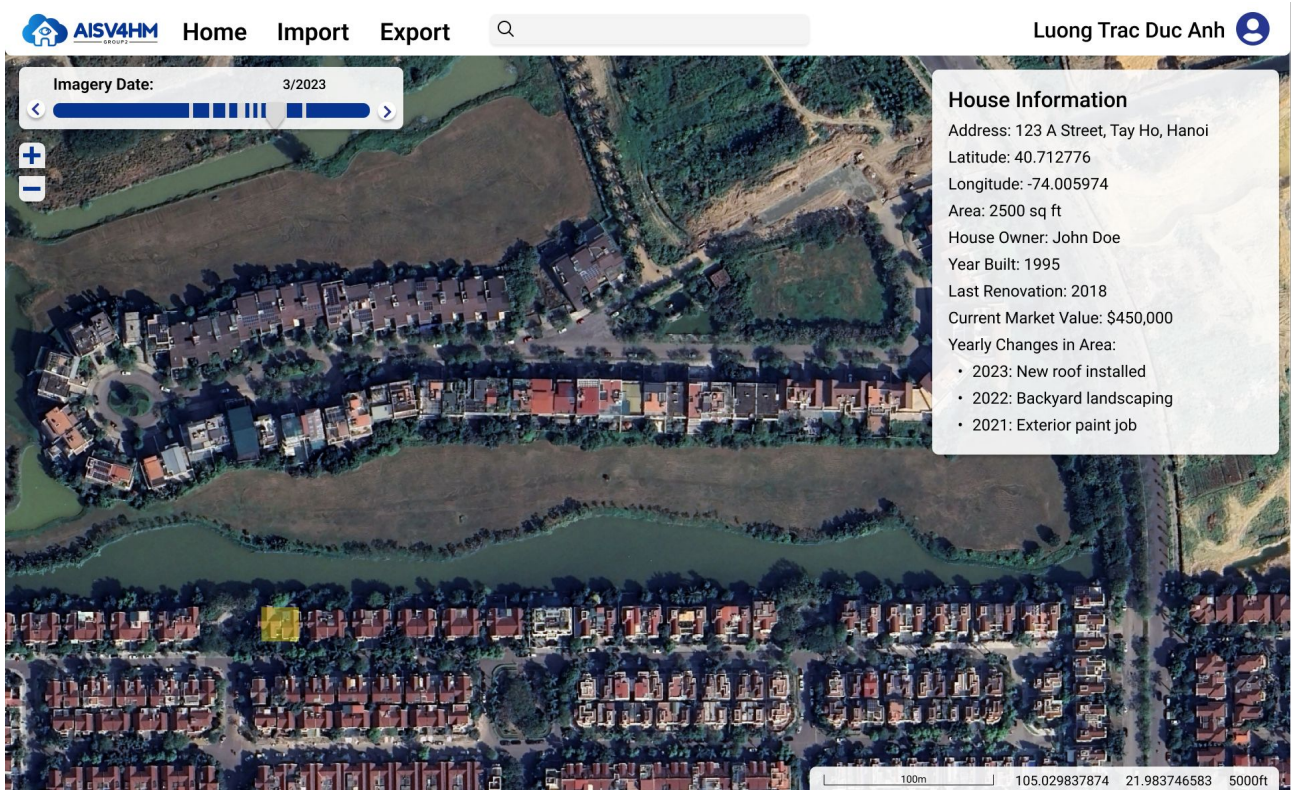
Systems Workflow



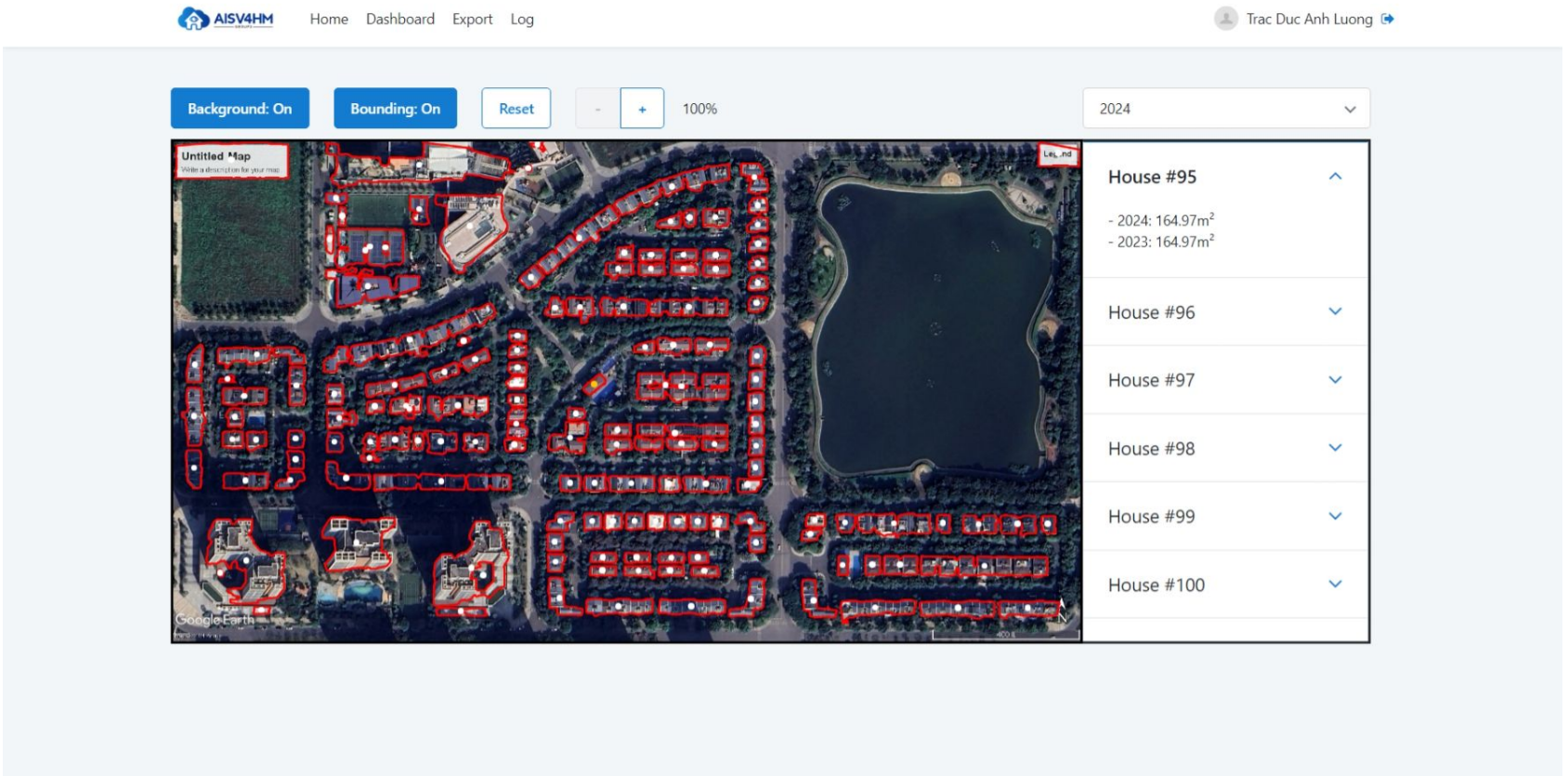
Web App: Wireframe



Web App: Prototype



Web App: Outcome



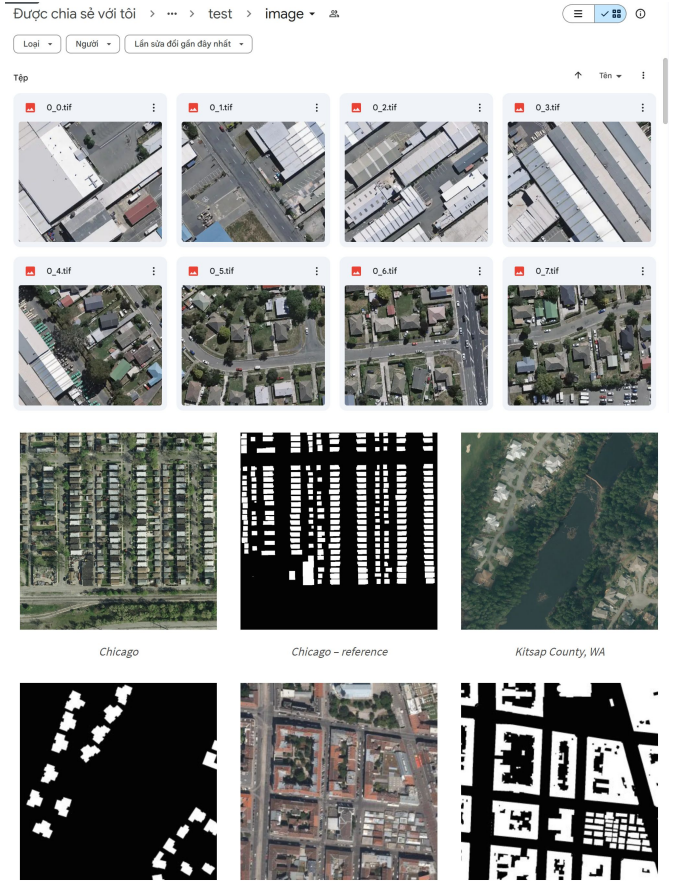
AI Model: Data Gathering

The WHU building dataset include:

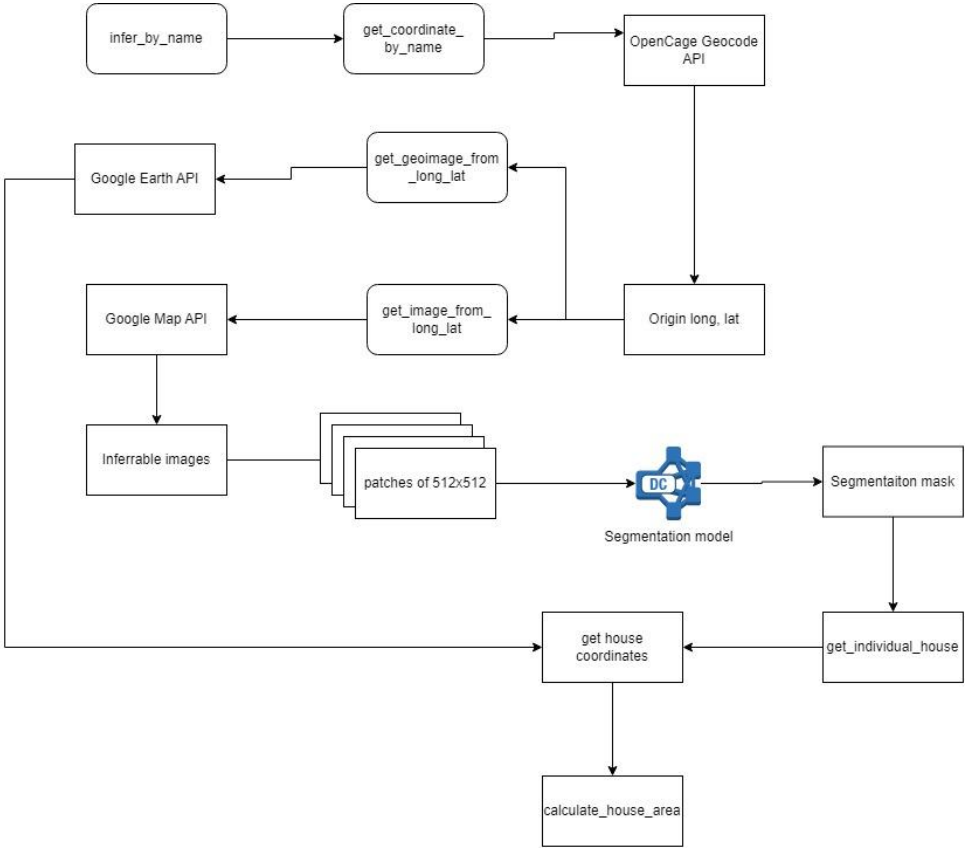
- ~12,000 satellite images
- Image size: 512x512
- Image format: GEO TIF
- Labeled carefully
- 2012 with 12,796 buildings/20.5 km²
- 2016 with 16,077 buildings/20.5 km²

The Inria Aerial Image Labeling dataset include:

- Coverage of 810 km²
- Aerial orthorectified color imagery, spatial resolution of 0.3 m
- Ground truth data for two semantic classes: building and not building



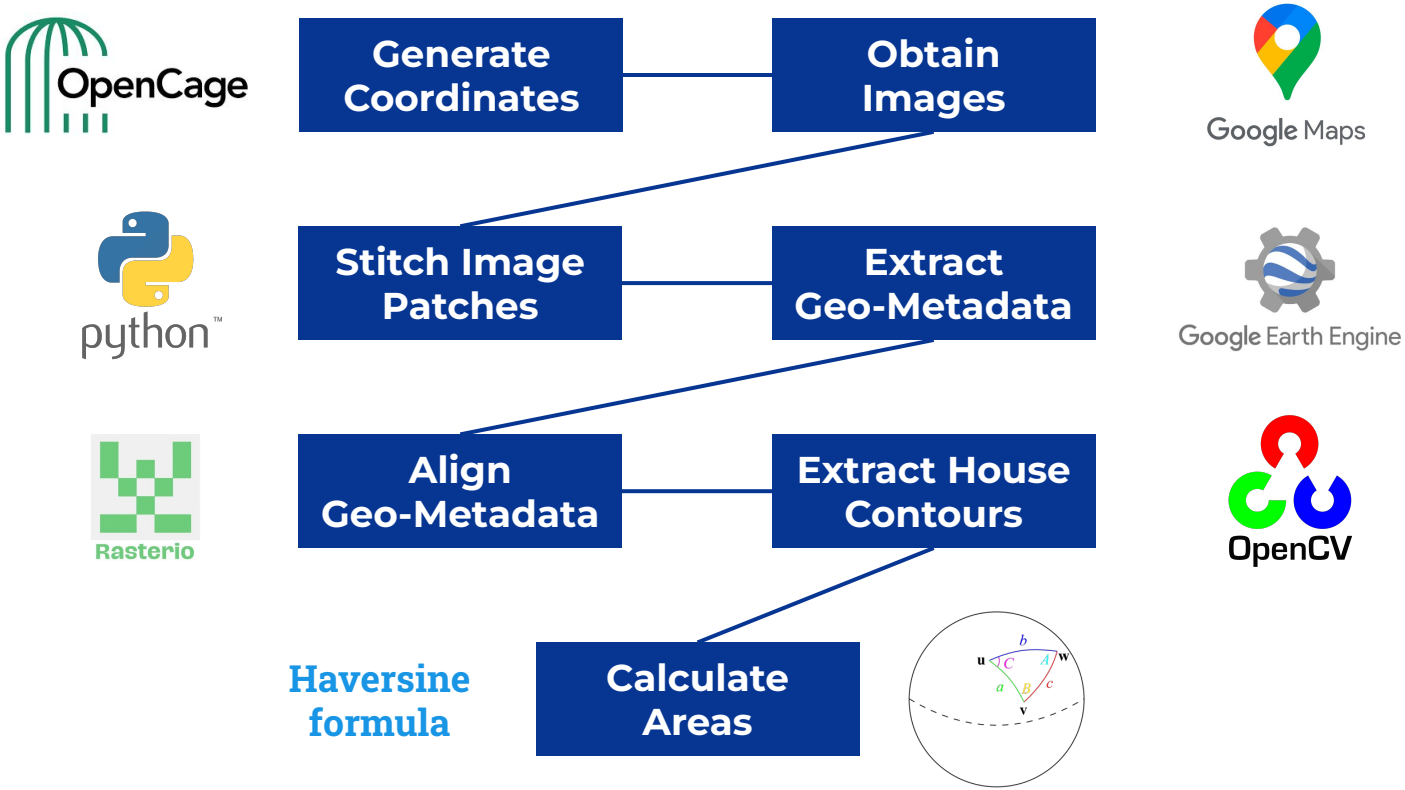
AI Model: Pipeline Design



AI Model: Model Training

Encoder	Decoder	Average Val dataset IOU (higher is better)
ResNet	Unet	0.52
ResNet	FPN	0.61
ResNet	MANet	0.74
EfficientNet	Unet	0.66
EfficientNet	FPN	0.67
EfficientNet	MANet	0.77
Mix Vision Transformer	Unet	0.67
Mix Vision Transformer	FPN	0.73
Mix Vision Transformer	**MANet**	**0.81**

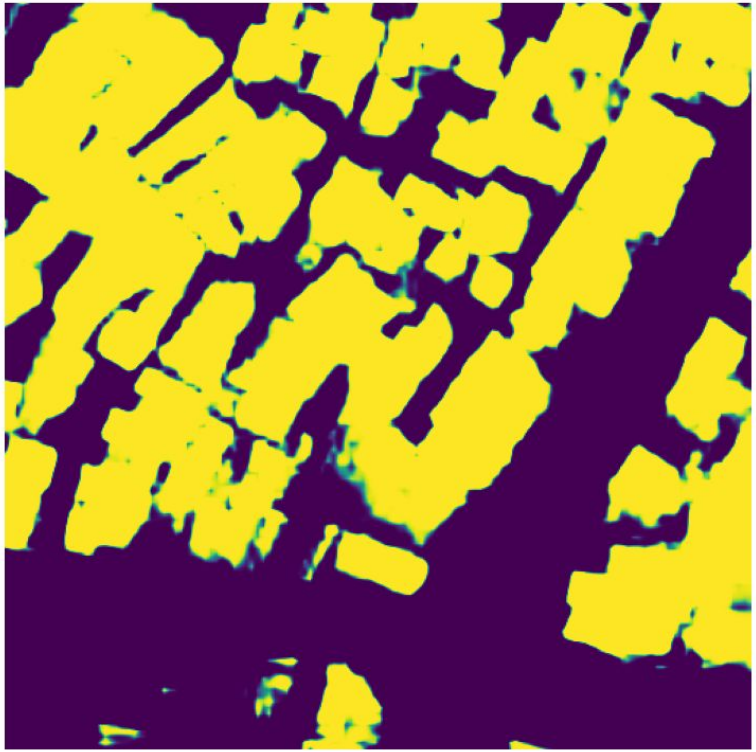
AI Model: Image extract pipeline



AI Model: Training Outcome

Image

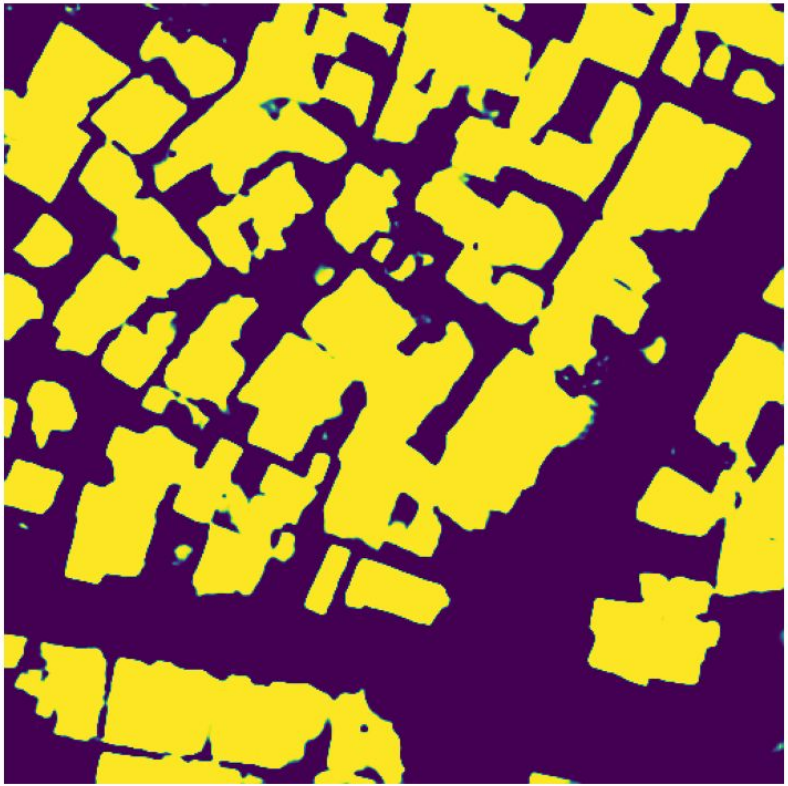
Prediction



AI Model: Training Outcome

Image

Prediction



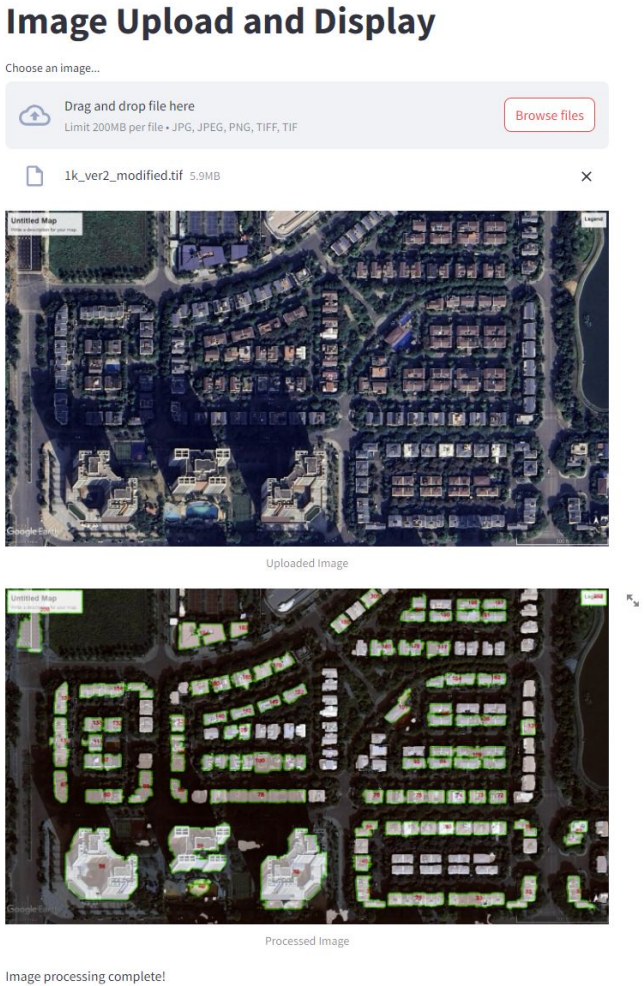
AI Model: Final Outcome

Use mathematical model to calculate areas based on geometric coordinates

Segmentation => Contours => Polygon in format of (x, y) => Convert to geometric coordinates => Calculate areas

Image processing complete!


```
[
  0 : {
    "area" : 643.715269156804
    "shape" :
      [ 0 - 100 ]
      [ 100 - 103 ]
    "center" : {
      "x" : 1500
      "y" : 993
    }
    "building_id" : 23
    "coord" : {
      "lat" : 21.052102562116673
      "lon" : 105.79422842381483
    }
  }
```

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Product Demo

The most interesting part of this presentation

References

[1] Aerial Images dataset: https://project.inria.fr/aerialimagelabeling/

[2] WHU building dataset: http://gpcv.whu.edu.cn/data/building_dataset.html

[3] OpenCage Geocoder API: https://opencagedata.com/

[4] Google Maps API: https://mapsplatform.google.com/

[5] Google Earth Engine API: https://developers.google.com/earth-engine

Thanks!

Do you have any questions?
If Yes we will assume it is No.

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