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Republik Indonesia

3D Land Administration

FIG

12th International FIG Workshop on LADM & 3D LA
24-26 September 2024, Kuching, Malaysia

Design of Mixed Reality Applications for Visualizing Integrated 3D Land Information Services

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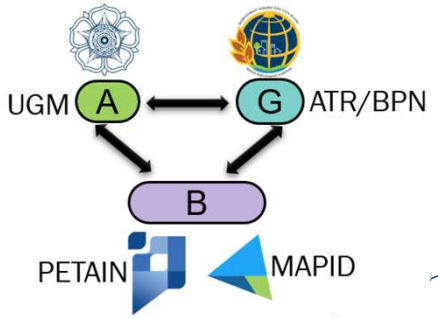
UGM ATR/BPN PETAIN MAPID

Contents

- Research Roadmap & Motivation
- LADM & Research Methods
- 3D Land Information Services
- AR/VR Development
- Work in Progress & Concluding Remarks

- AR app http://ugm.id/arpadanan
- VR app http://ugm.id/vrpadanan



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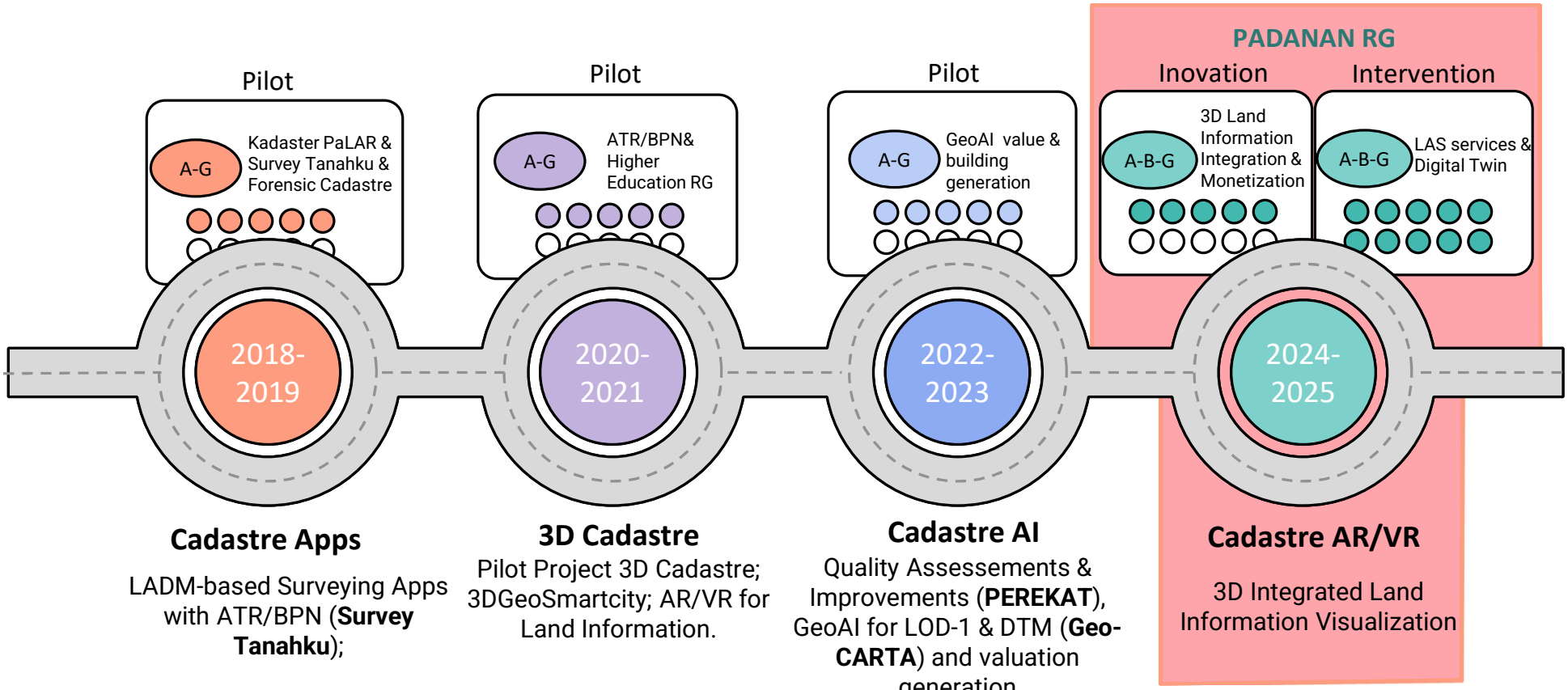
Research Roadmap on Cadastre & Land Information 2018-2025



Cadastre Apps

LADM-based Surveying Apps with ATR/BPN (**Survey Tanahku**);

3D Cadastre

Pilot Project 3D Cadastre; 3DGeoSmartcity; AR/VR for Land Information.

Cadastre AI

Quality Assessements & Improvements (**PEREKAT**), GeoAI for LOD-1 & DTM (**Geo-CARTA**) and valuation generation

Cadastre AR/VR

3D Integrated Land Information Visualization

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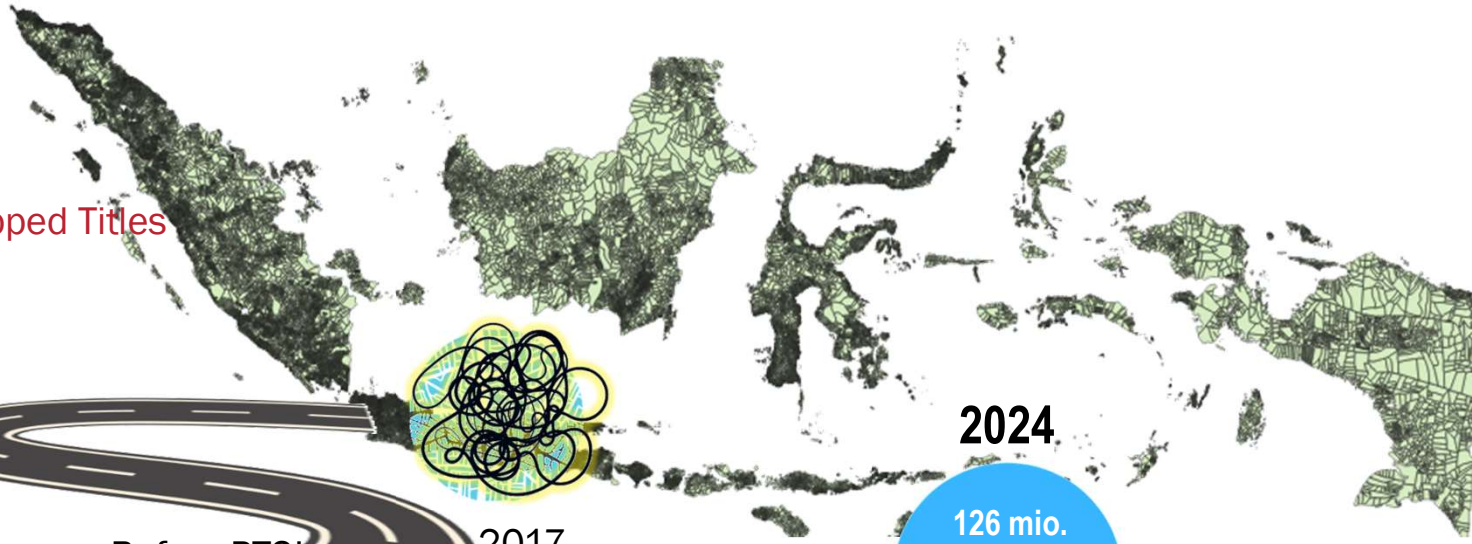
Challenges – Racing Against Time

Significant increases of Land Titles

Significant Threats of Massive Unmapped Titles

191.2 mio ha
74,957 villages
513 districts/cities
38 Provinces
Min. 126 mio. Land parcels



1945
The National independence

1960
Agrarian Principle

1961
Land registration

1997
Technical Guidelines

2017
PTSL

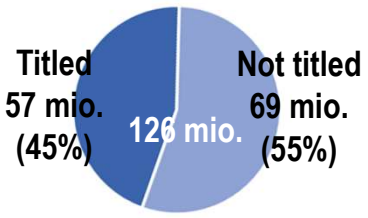
Before PTSL
Mostly sporadic adjudication

2019
Participatory Quality Improvements

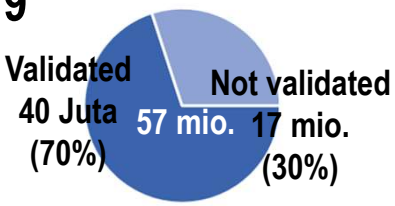
2024
126 mio.
Titled & Validated
100%?

Big Challenges:
K4 (Unmapped titles: Unknown Boundaries, subject registered)
K3 (Unfinished registration: Mapped Boundaries, subject not registered)

2019



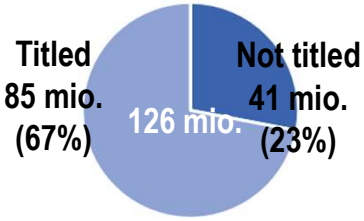
Number of land parcels



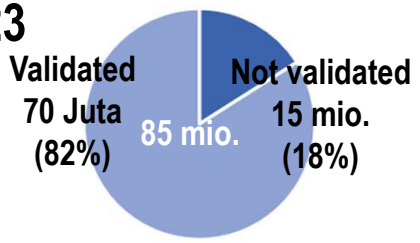
Number of land titles

Significant Increase

2023



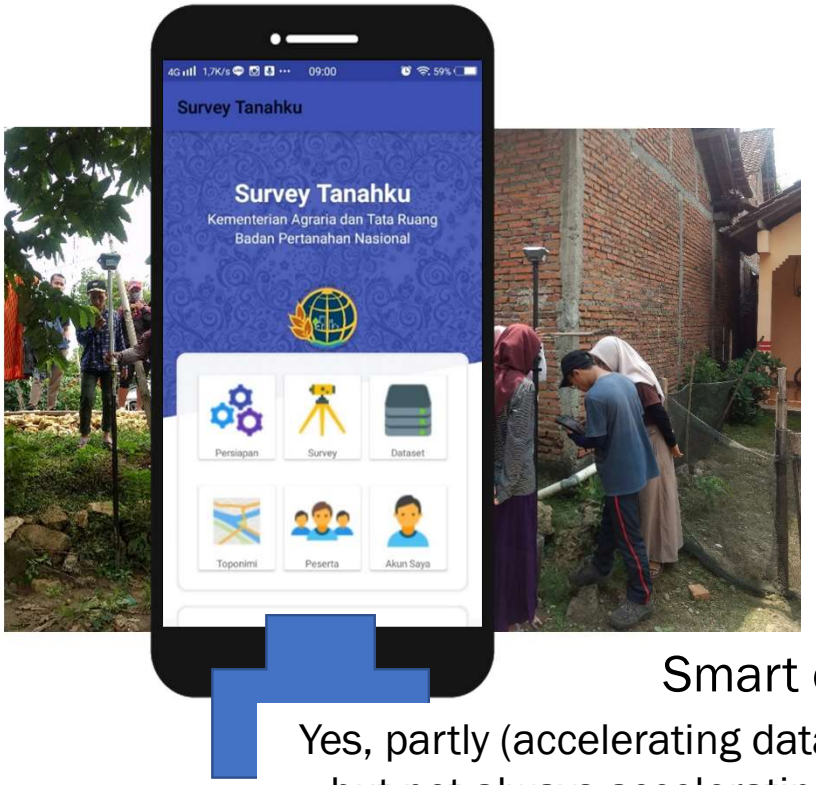
Number of land parcels



Number of land titles

Remedy to the Challenges?

participation



Smart data collection

Yes, partly (accelerating data collection)
but not always accelerating job done
(agreements and validation)

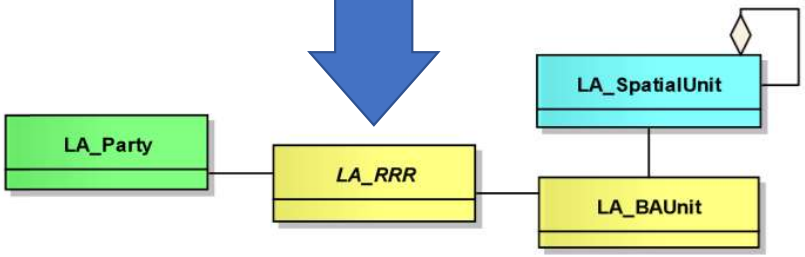
LADM-compliant Field Data Collector

(Same Time – Same Place Interaction)

Developing a Mobile Data Collector to Enable
Government Surveyor & **Para Surveyors**
To Collect & Upload Party, Underlying Right &
Spatial Data for Land Registration Purposes

Party + RRR + Spatial Unit

*that complies to **LADM** standard (ISO 19152:2012)*



ICS › 35 › 35.240 › 35.240.70

ISO 19152:2012

Geographic information — Land Administration Domain Model (LADM)

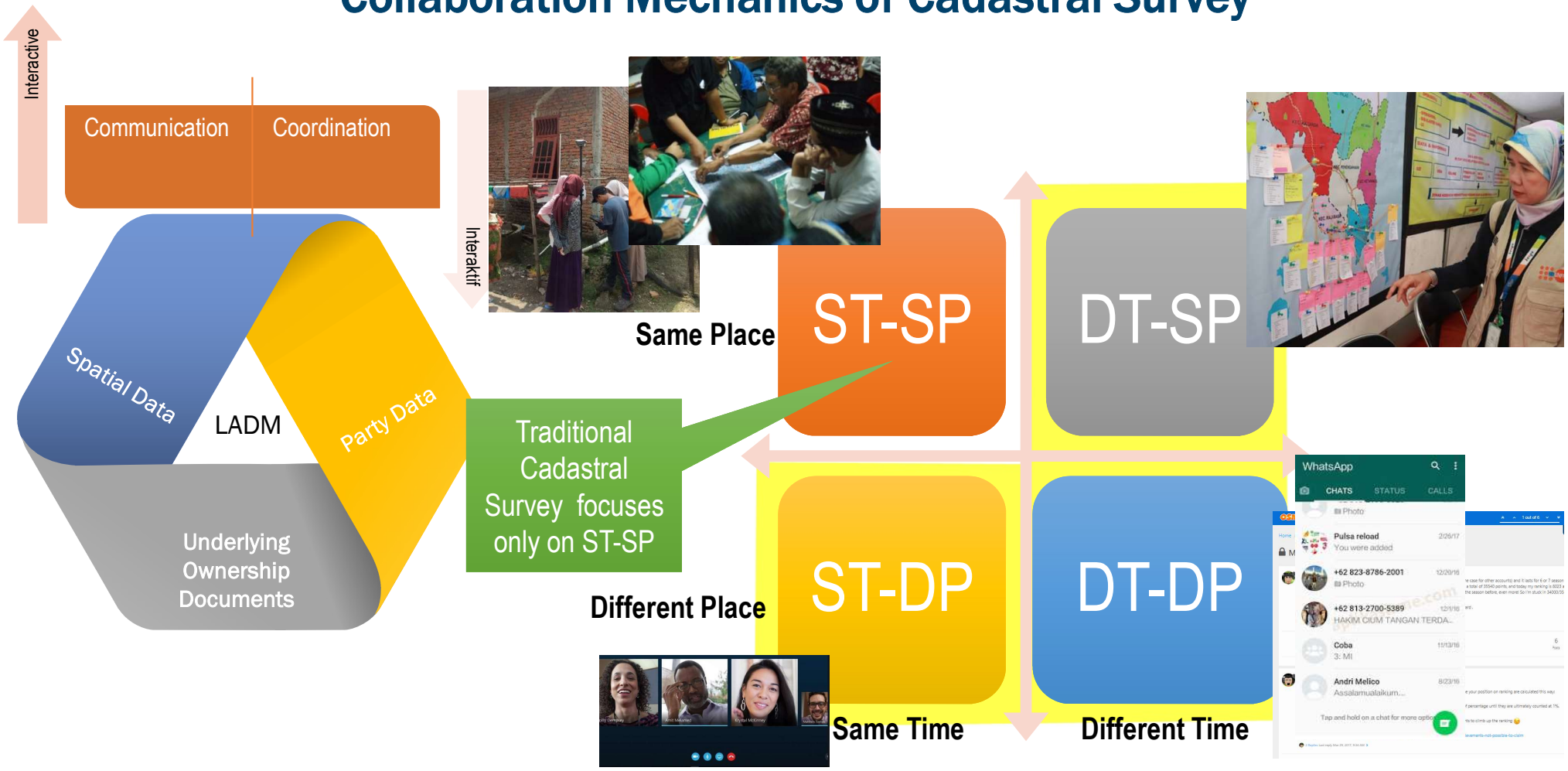
SUSTAINABLE DEVELOPMENT GOALS

This standard contributes to the following Sustainable Development Goals:

1 2 11 14 15

Aditya, Ary Sucaya, Adi (2021). LADM-compliant field data collector for cadastral surveyors, Land Use Policy, Vol 104 (May).

Collaboration Mechanics of Cadastral Survey

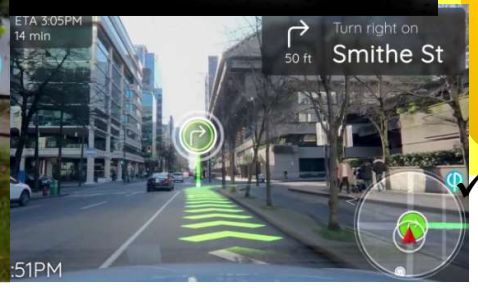


Modern Survey + Collaboration with AR/VR (MR)

- Cadastral Databases
- Sensors (GNSS+Finger print+Camera+…)
- Web Communication
- Realtime Capture (2D + 3D)

Goal:

- Developing AR app for Field Officers
- Developing VR app for Owners & Mediators



STSP

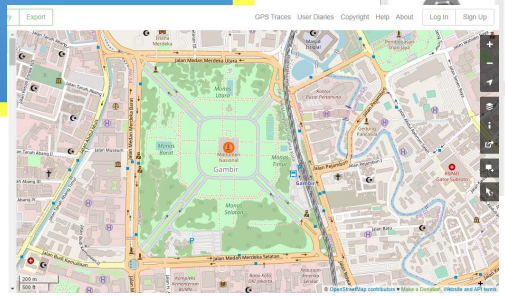
DTSP

STDP

DTDP

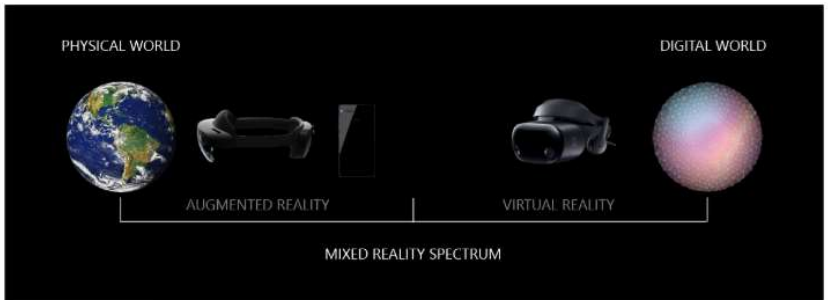
✓ Live Dashboard

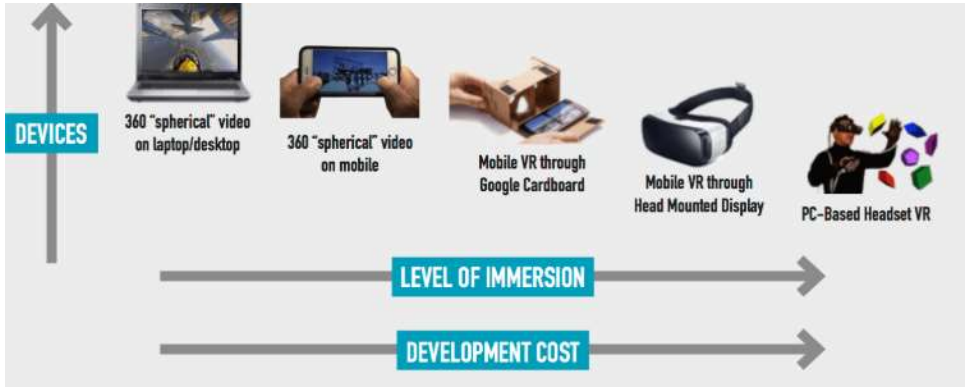
✓ Participatory Plotting



✓ AR/VR Collaboration

Collaboration Mechanics in Cadastral Survey with AR/VR





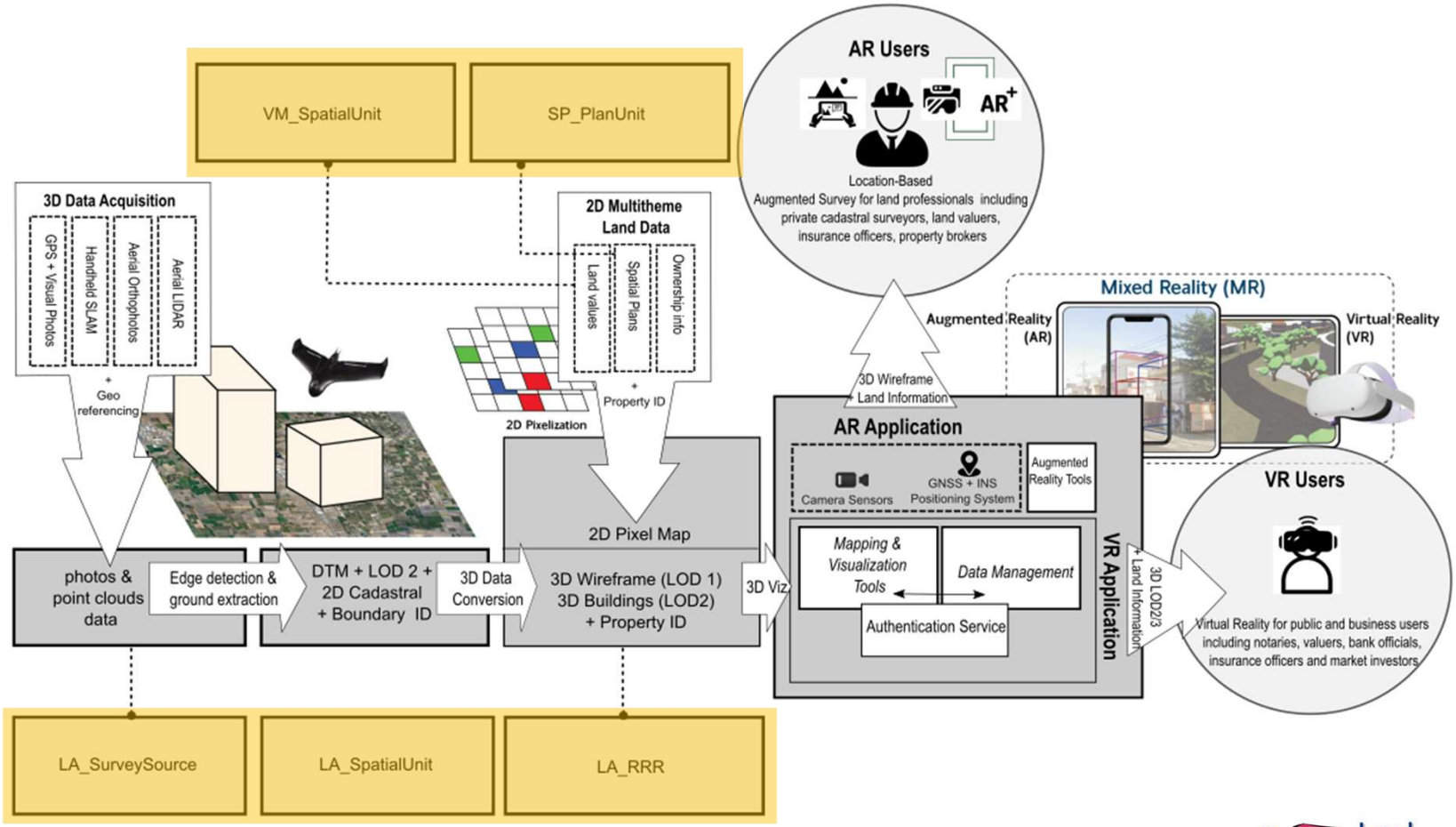
Immersive Technology with AR/VR (martechtoday.com)

veyor/Valuer

Land Information Requester
(Notary/Bank/Insurance)

2025?

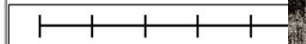
Research Framework & LADM Implementations?



LA_SurveySource

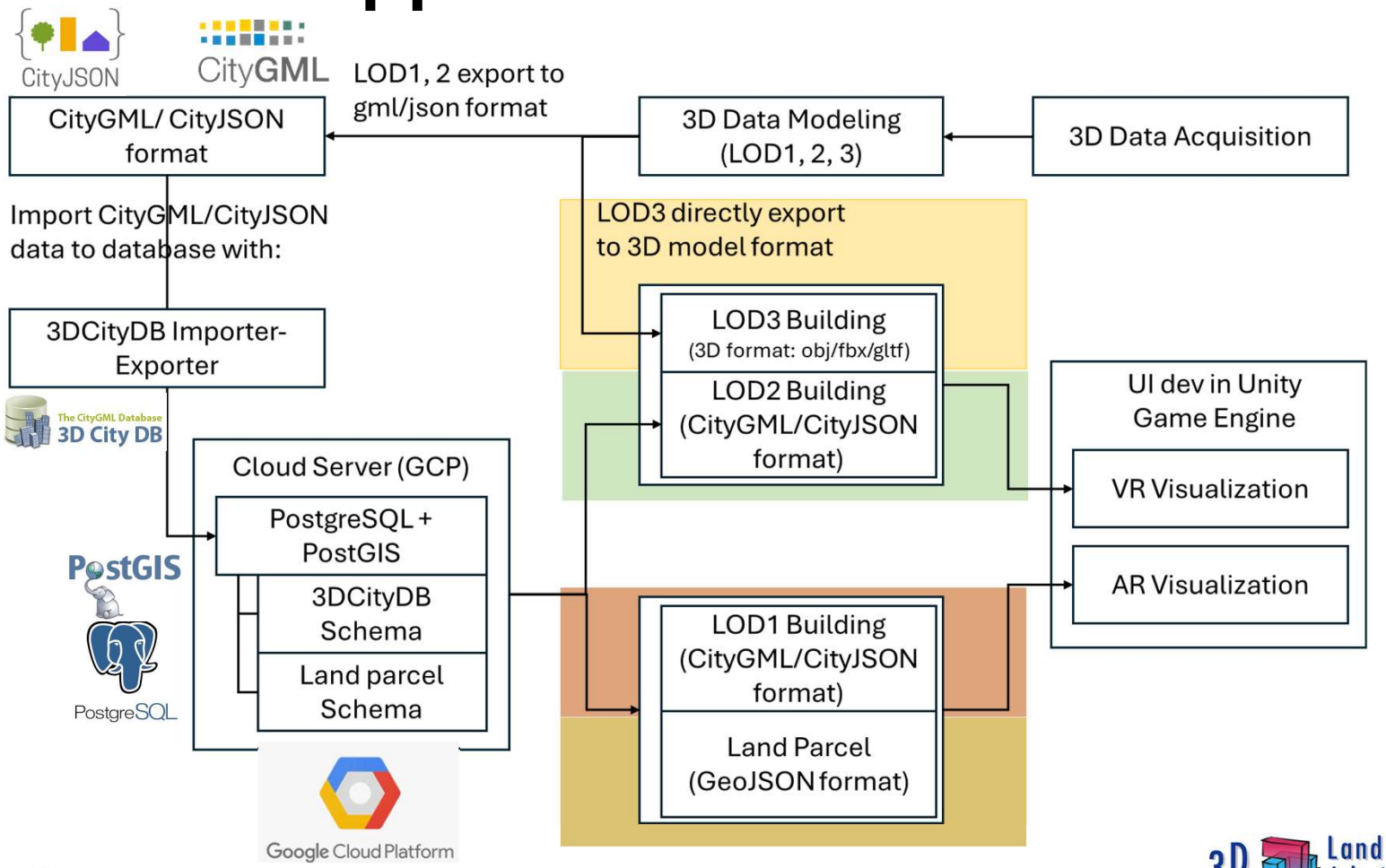
Orthopotos + LIDAR

SLAM LIDAR

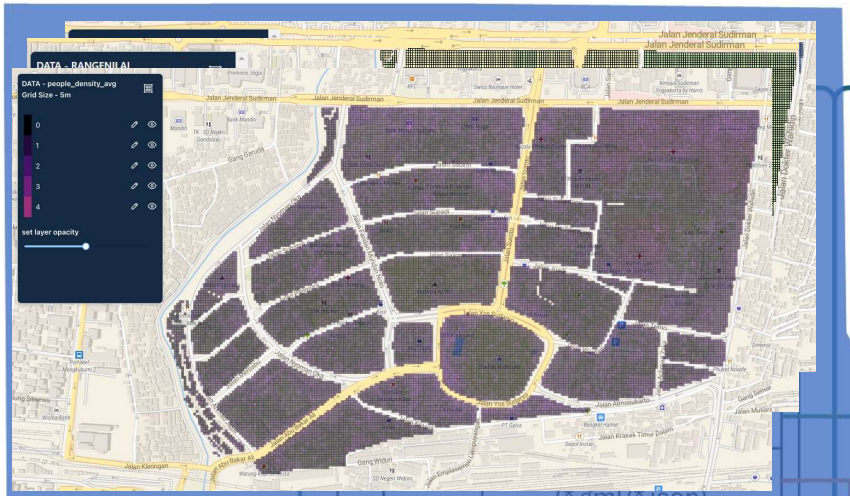


LA_SpatialUnit

Application Data Flow



Application Development



Petain

Land parcel Schema

Land parcel, spatial plan (*.GeoJSON)

Google Cloud Platform (GCP)

LOD3 Buildings (3D format: obj/fbx/gltf)

Service & UI Development

Unity Game Engine

Creation of UI, Menu, Minimap, Tools of Game

Call LOD1 buildings from DB (API, streamline from DB to Unity)

Procedural Generation of Land Parcel and Spatial Plan Zone

Call LOD2 buildings from DB (API, streamline from DB to Unity)

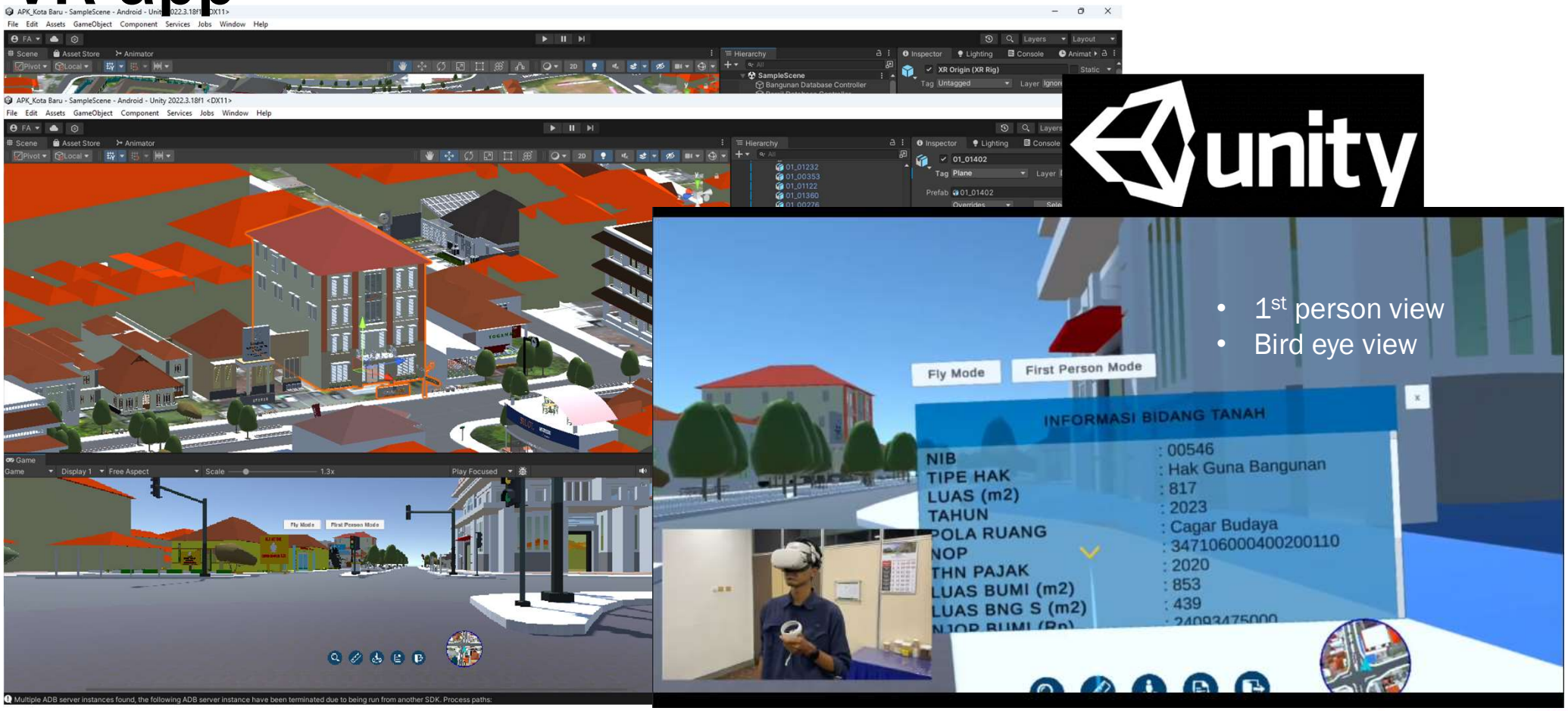
Import LOD3 as GameObject

User Interface

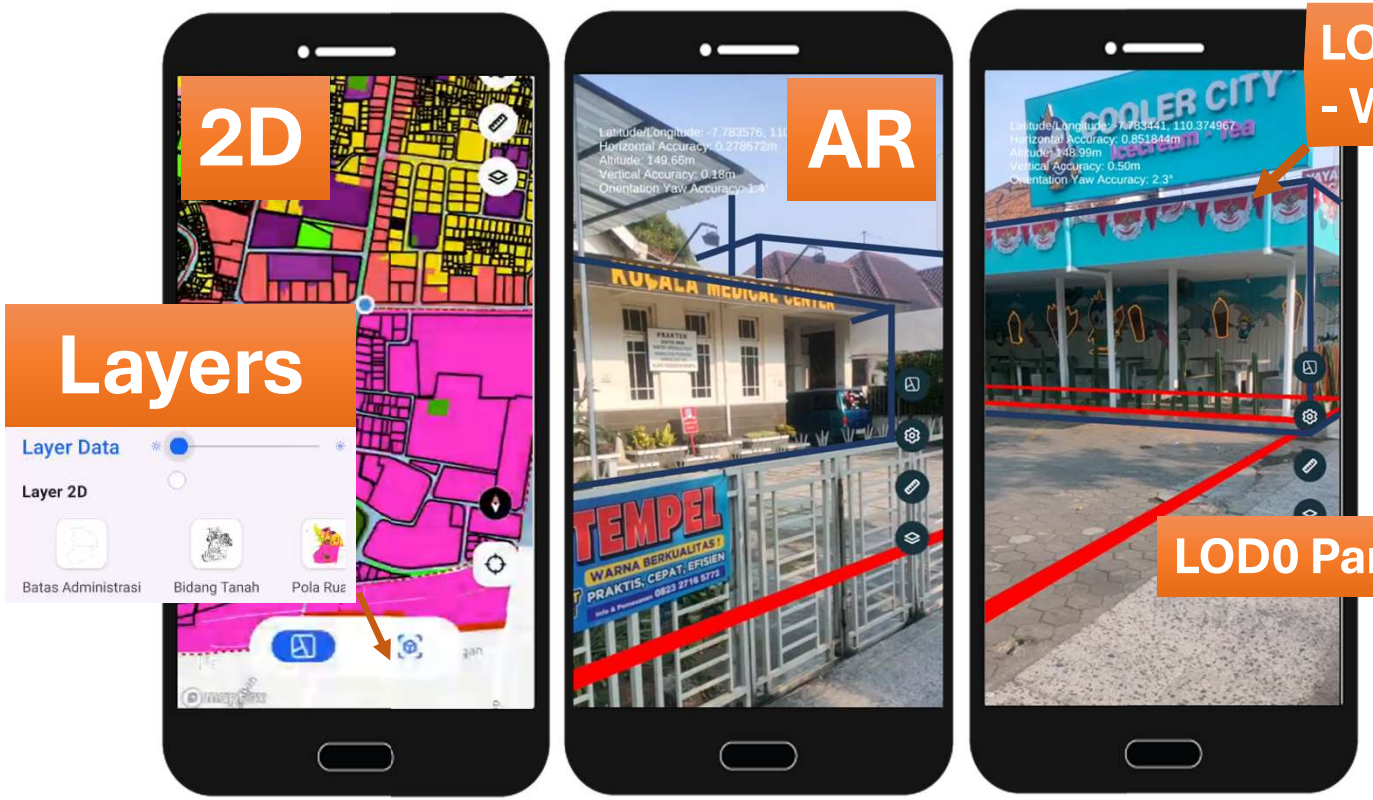
Augmented Reality App

Virtual Reality App

VR app


unity
Fly Mode
First Person Mode
INFORMASI BIDANG TANAH
NIB : 00546
TIPE HAK : Hak Guna Bangunan
LUAS (m2) : 817
TAHUN : 2023
POLA RUANG : Cagar Budaya
NOP : 347106000400200110
THN PAJAK : 2020
LUAS BUMI (m2) : 853
LUAS BNG S (m2) : 439
• 1st person view
• Bird eye view

AR app

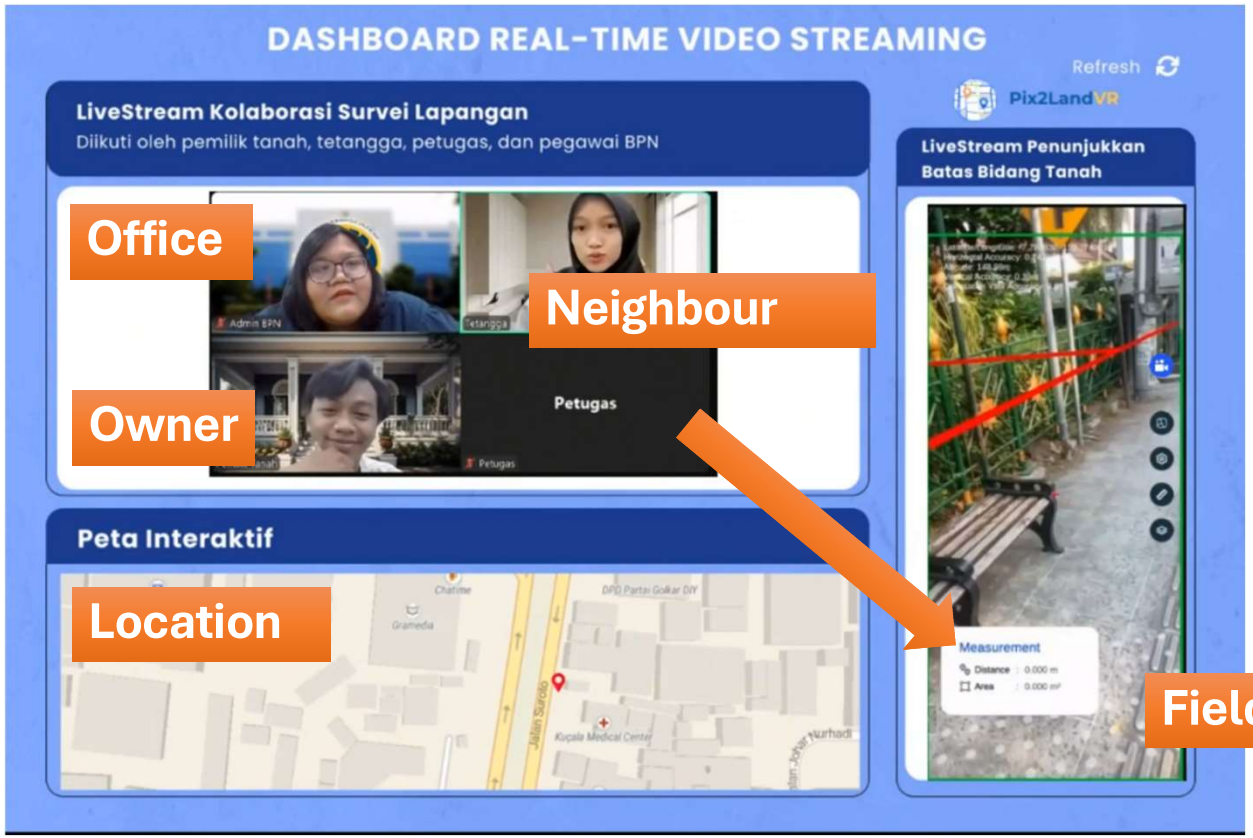

2D
AR
LOD1 Building
- Wireframe
Layers
Layer Data
Layer 2D
Batas Administrasi
Bidang Tanah
Pola Rua
TEMPEL
WARNA BERKUALITAS!
PRAKTIS, CEPAT, EFISIEN
LOD0 Parcel

UI/UX Features

- AR Camera Overlaid with LOD 0 (parcel) and LOD 1 (Building space)
- 3D Measurements (Planimetric & height)
- Attributes of Multi-theme Land Information-2D map layers: Spatial plan, cadastral map, scoring map related to land interests
- Field Observation Feedback (connected to a dashboard)

- LOD 2 and LOD 3 visualization of on-surface infrastructures & buildings
- Bird eye & First-Person View Alternatives
- Attributes of Multi-theme Land Information & Scoring
- List of nearest public facilities (±5km)
- Feedback Form

Dashboard & AR app



http://ugm.id/dashboardpadanan

Work in progress and remarks

- 3D data modeling challenges : need to consider the production cost vs. cost-benefit & monetization prospects
- Land-pixelized information for location scoring and monetization is feasible as services fed into AR app
- Representing LADM **LA_SpatialUnit** & **SP_PlanUnit & VM_SpatialUnit**
  - **LA_LegalSpaceParcel** and **LA_LegalSpacebuildingUnit** have been sufficient with LOD 1 on AR screen.
  - **LA_LegalSpaceUtilityNetwork**, **LA_LegalSpaceInfrastructure** can be more useful to be seen with VR glasses
  - **SP_PlanUnit and VM_SpatialUnit** inserted into each and every **LA_LegalSpaceParcel**
- 3D Visualization of 3D Integrated Land Services (status, tax, value, development license) can be blended into AR camera as LOD 1 & attributes; while integrated representation into VR glasses require more computing resources and more use-cases' validation (with more user tests).

TERIMA KASIH

Thank you

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