



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

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UGM



ATR/BPN



PETAIN



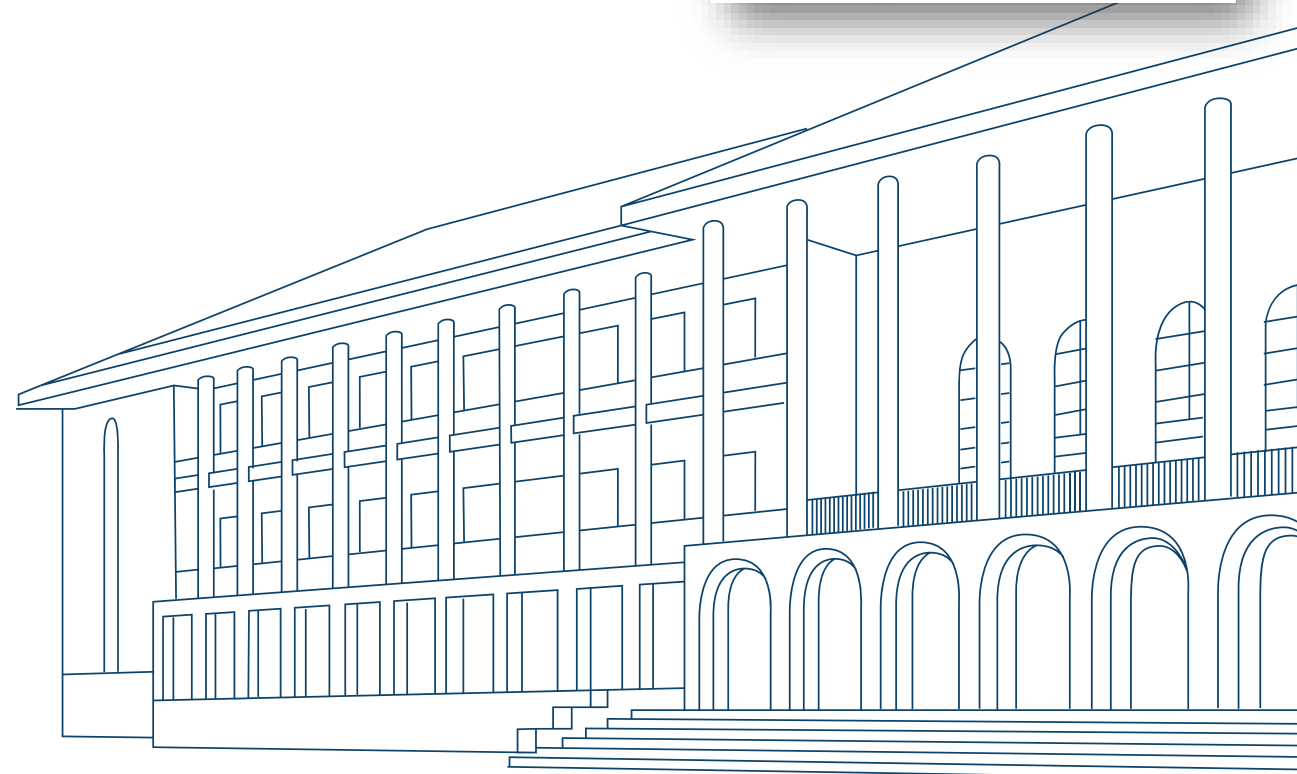
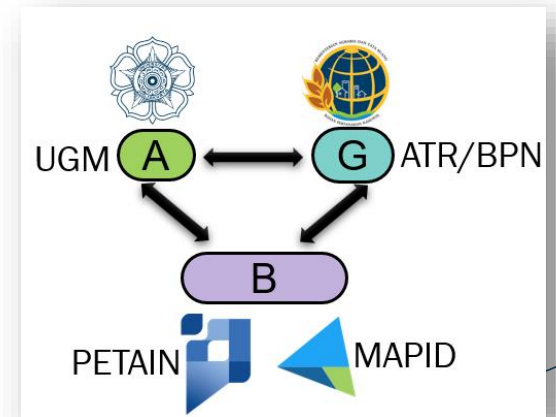
MAPID

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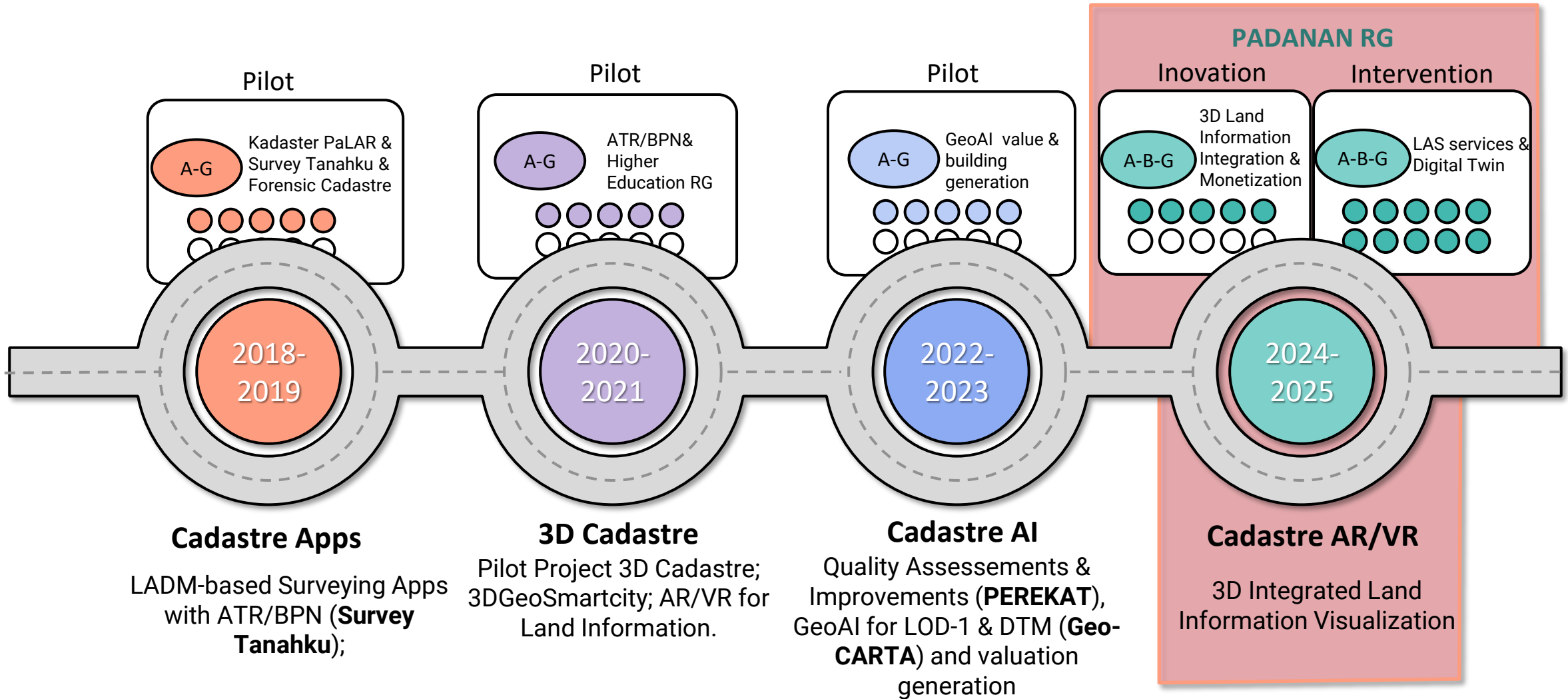
- Research Roadmap & Motivation
- LADM & Research Methods
- 3D Land Information Services
- AR/VR Development
- Work in Progress & Concluding Remarks

- [AR app](http://ugm.id/arpadanan) <http://ugm.id/arpadanan>

- [VR app](http://ugm.id/vrpadanan) <http://ugm.id/vrpadanan>



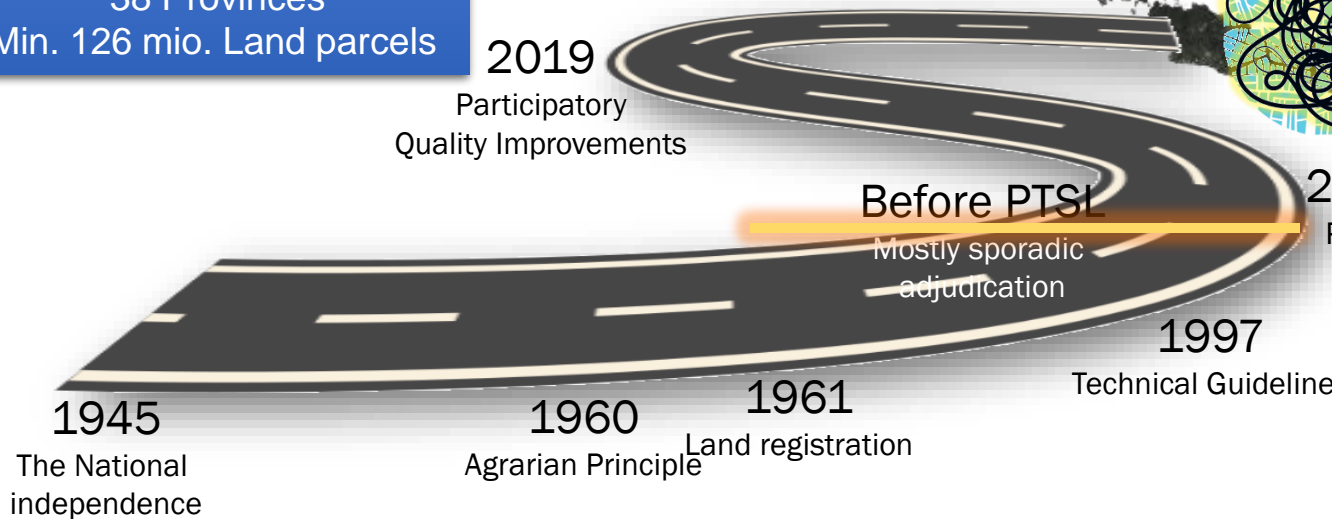
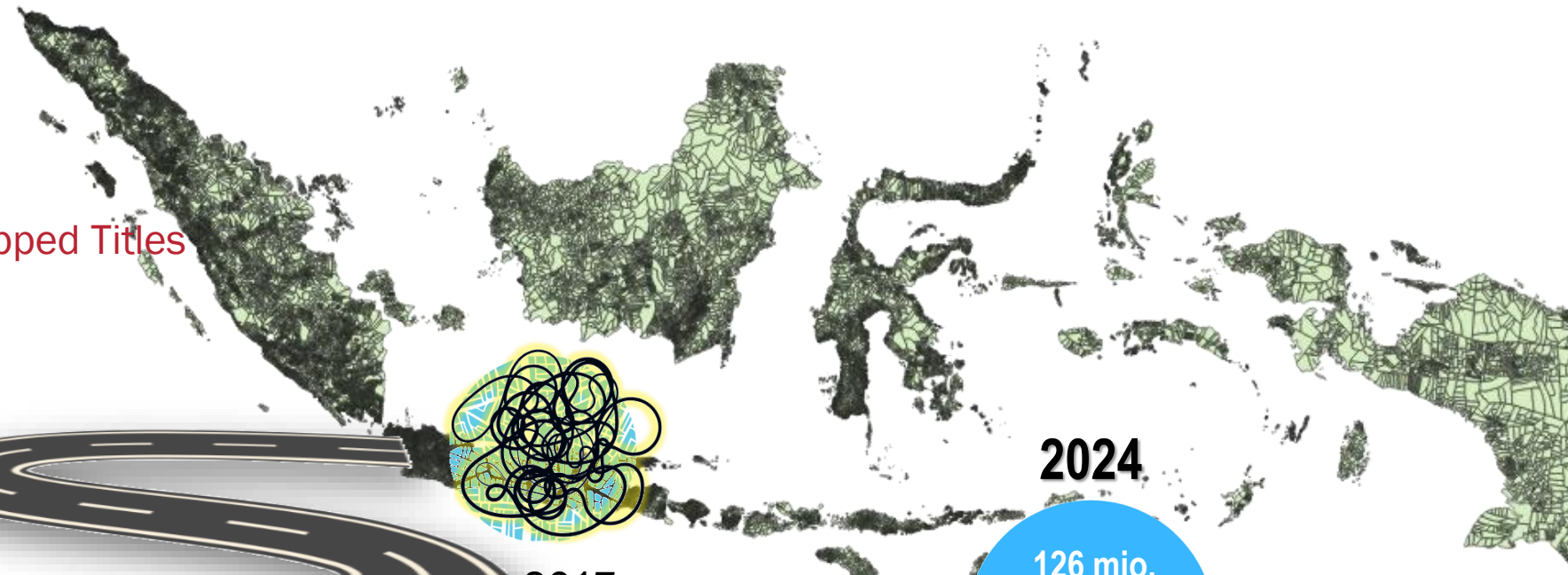
Research Roadmap on Cadastre & Land Information 2018-2025



Challenges – Racing Against Time

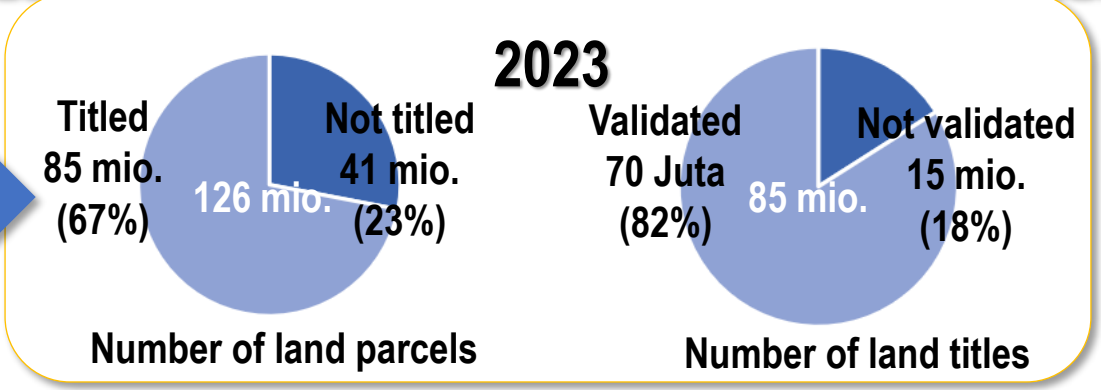
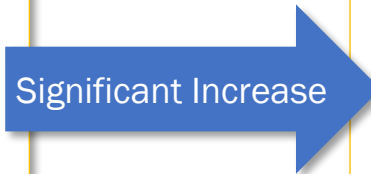
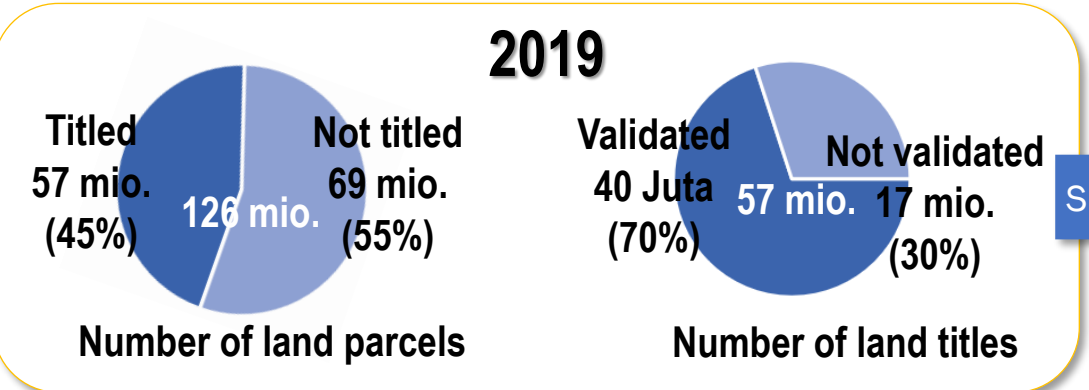
Significant increases of Land Titles
 Significant Threats of Massive Unmapped Titles

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



2024
 126 mio.
 Titled & Validated
 100%?

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



Remedy to the Challenges?



participation



Smart data collection

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



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kedaireka

3D



Land
Administration



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

LADM-compliant Field Data Collector

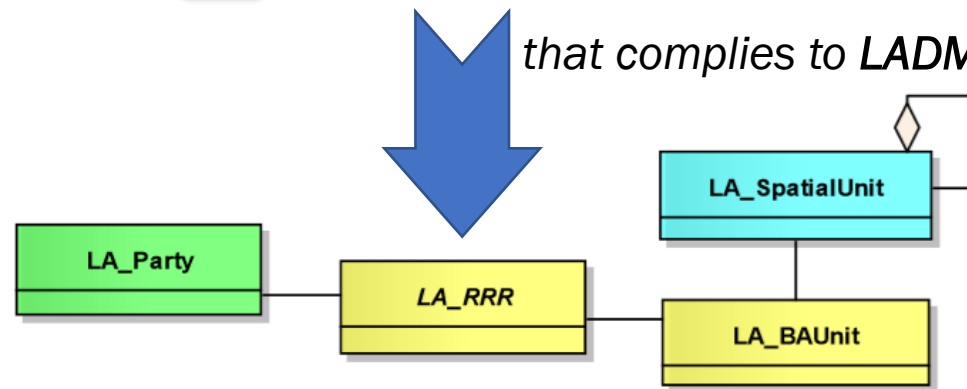
(Same Time – Same Place Interaction)



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



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



ICS > 35 > 35.240 > 35.240.70

ISO 19152:2012

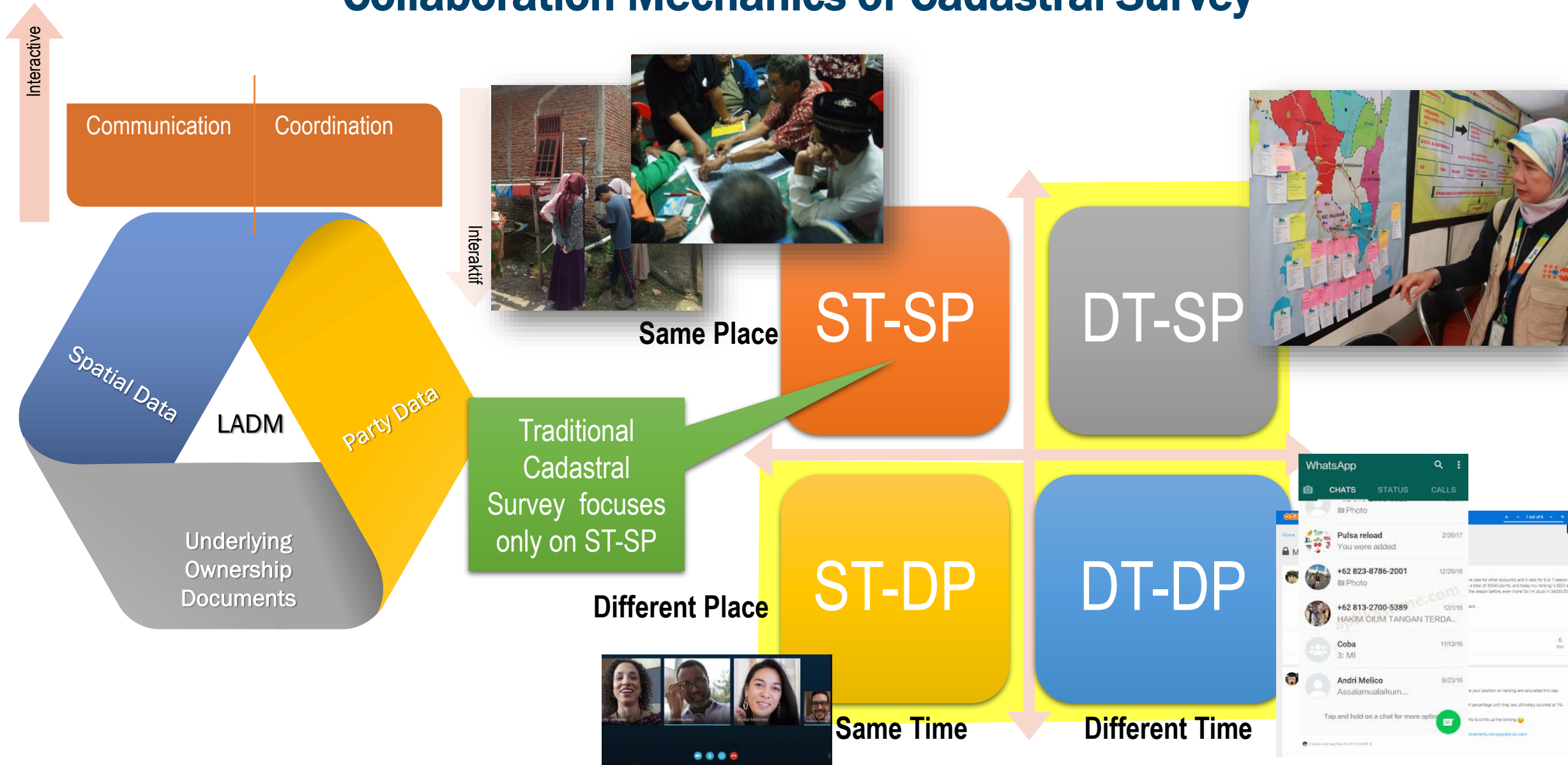
Geographic information – Land Administration Domain Model (LADM)

SUSTAINABLE DEVELOPMENT GOALS

This standard contributes to the following Sustainable Development Goals:

1 2 11 14 15

Collaboration Mechanics of Cadastral Survey

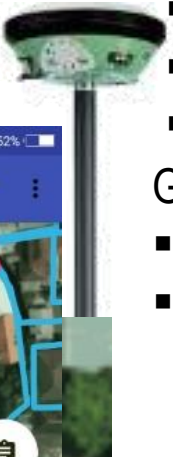


Modern Survey + Collaboration with AR/VR (MR)

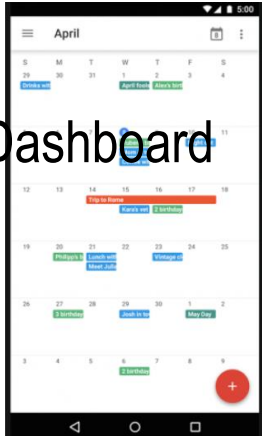
- Cadastral Databases
- Sensors (GNSS+Finger print+Camera+...)
- Web Communication
- Realtime Capture (2D + 3D)

Goal:

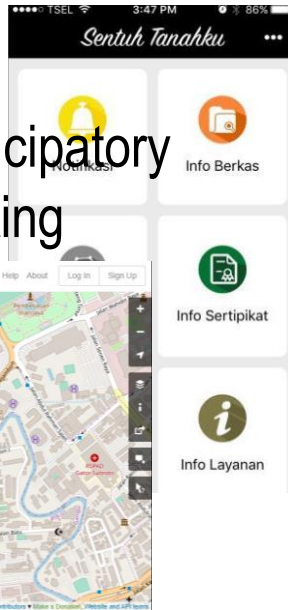
- Developing AR app for Field Officers
- Developing VR app for Owners & Mediators



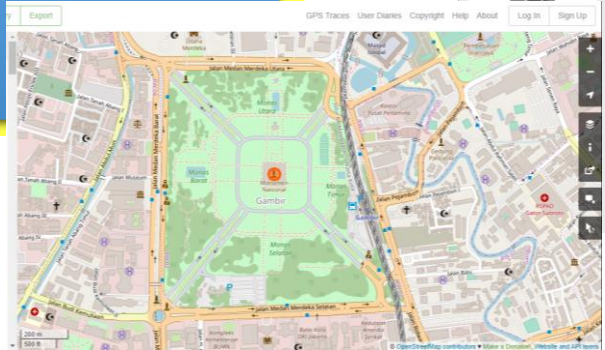
✓ Live Dashboard



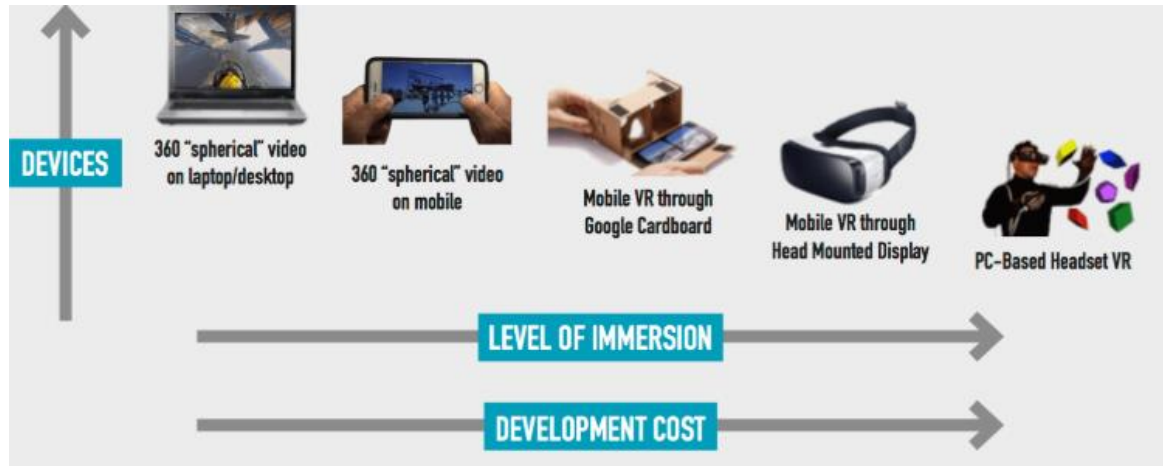
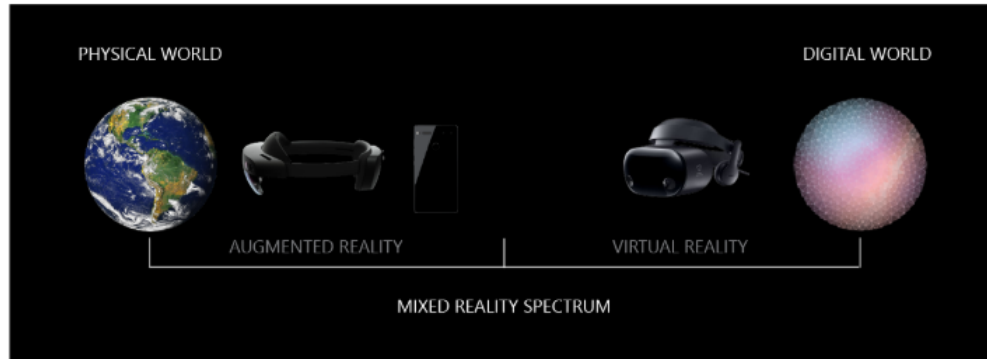
✓ Participatory Plotting



✓ AR/VR Collaboration



Collaboration Mechanics in Cadastral Survey with AR/VR



Immersive Technology with AR/VR (martechtoday.com)



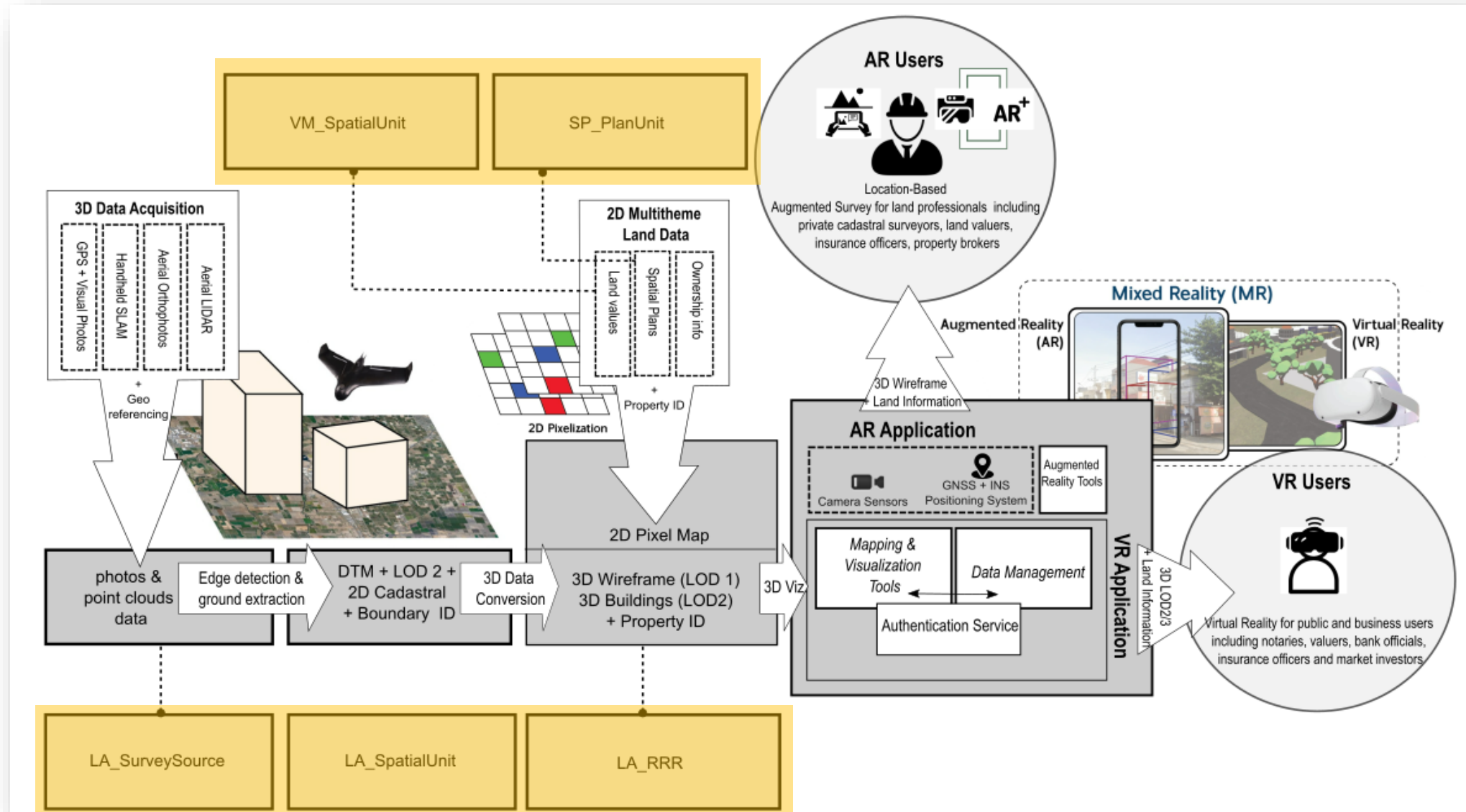
Surveyor/Valuer



Land Information Requester
(Notary/Bank/Insurance)

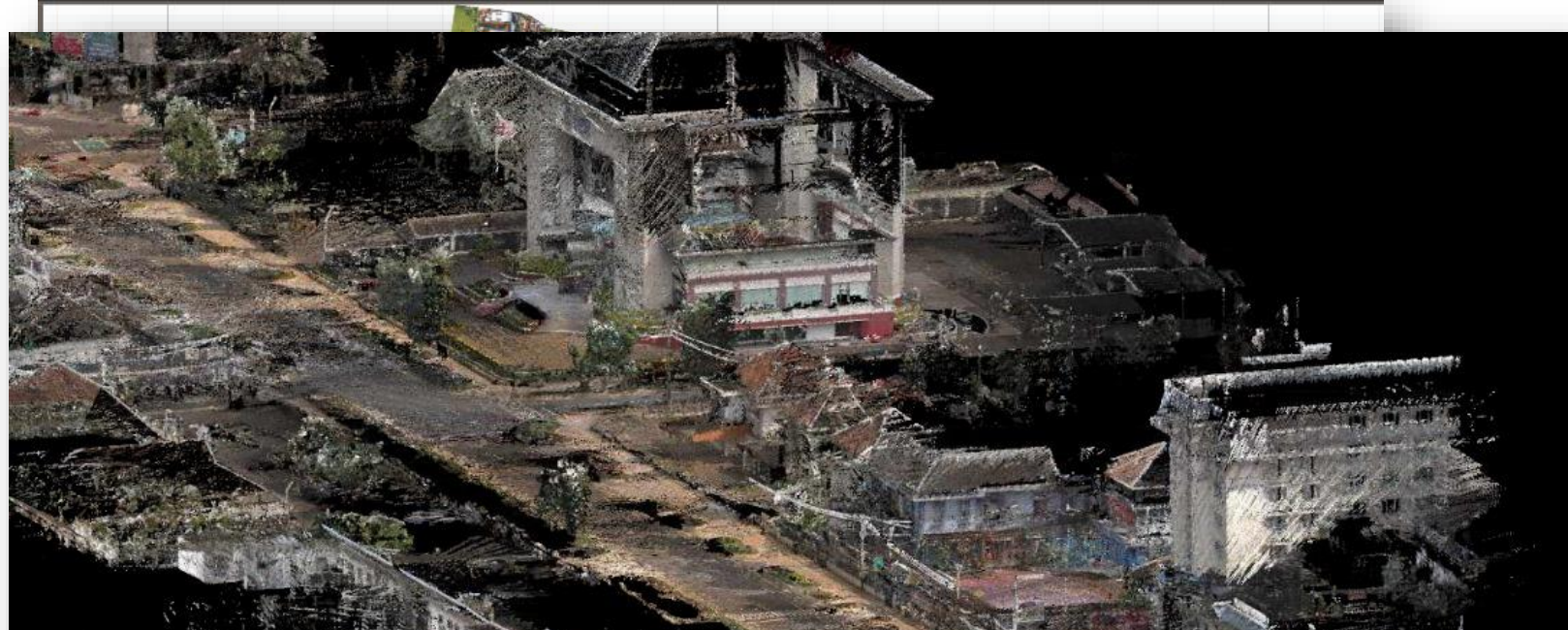
2025?

Research Framework & LADM Implementations?

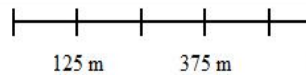


LA_SurveySource

Orthophotos +
LIDAR



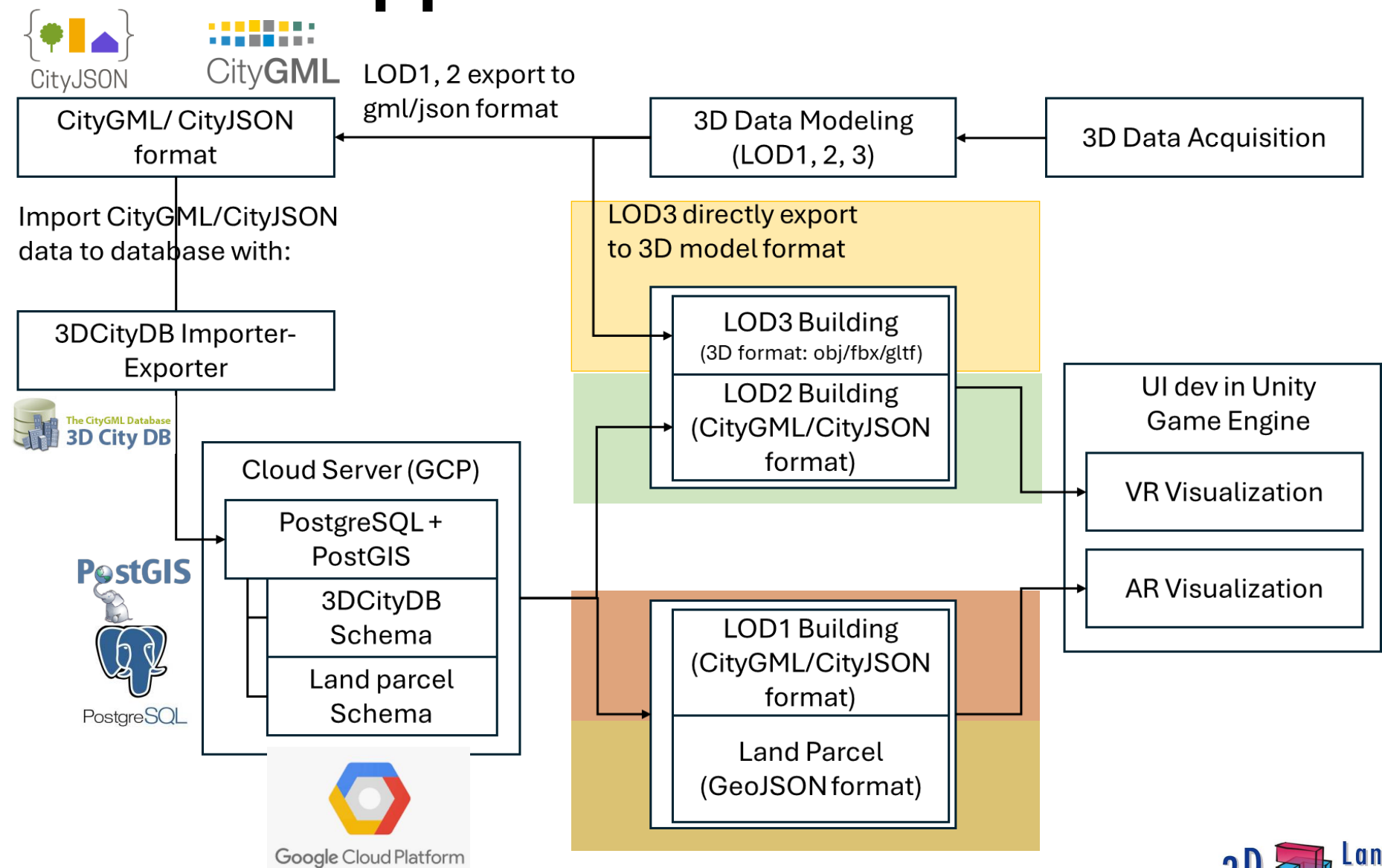
SLAM LIDAR



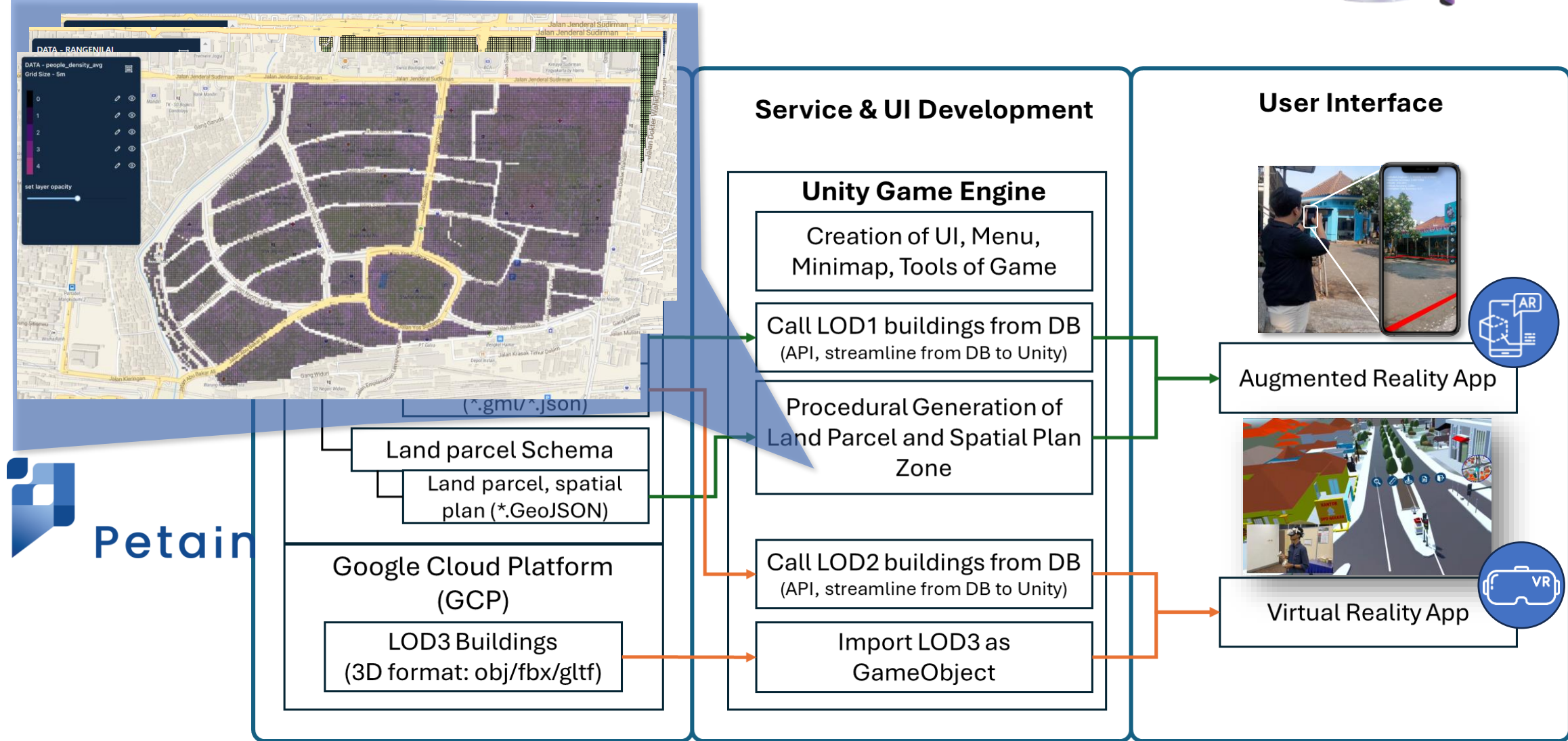
LA_SpatialUnit



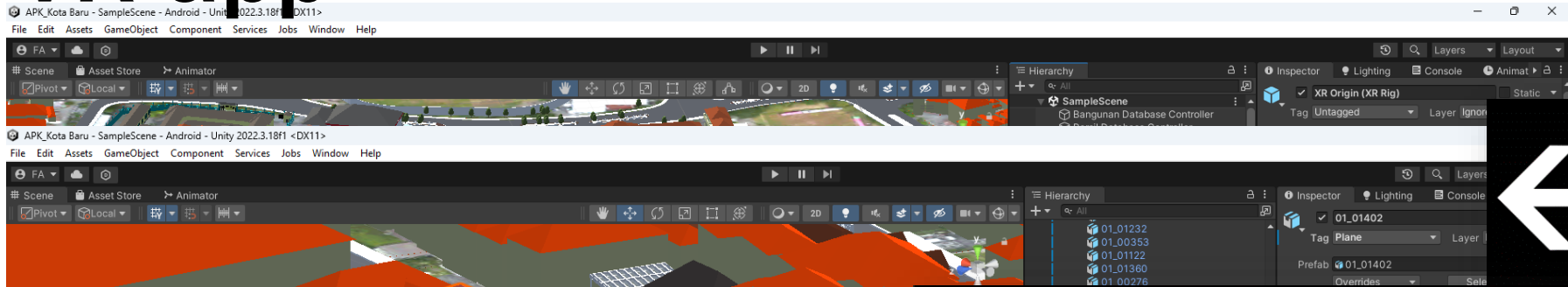
Application Data Flow



Application Development



VR app



- 1st person view
- Bird eye view

Fly Mode First Person Mode

INFORMASI BIDANG TANAH

NIB	: 00546
TIBE 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
NOP BUMI (Rp)	: 24093475000



Multiple ADB server instances found, the following ADB server instance have been terminated due to being run from another SDK. Process paths:

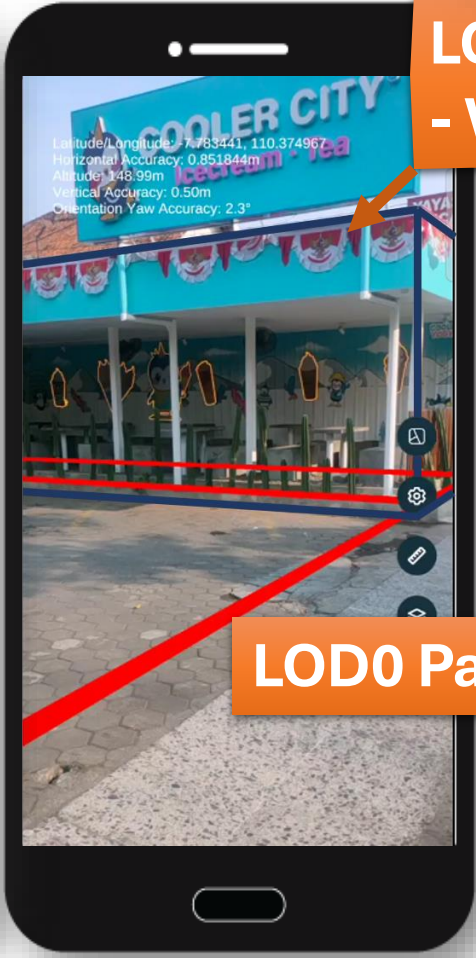
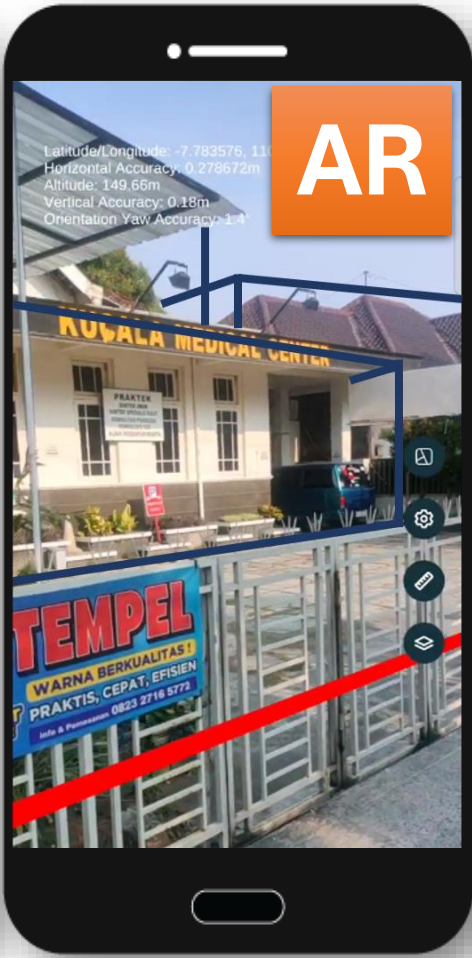
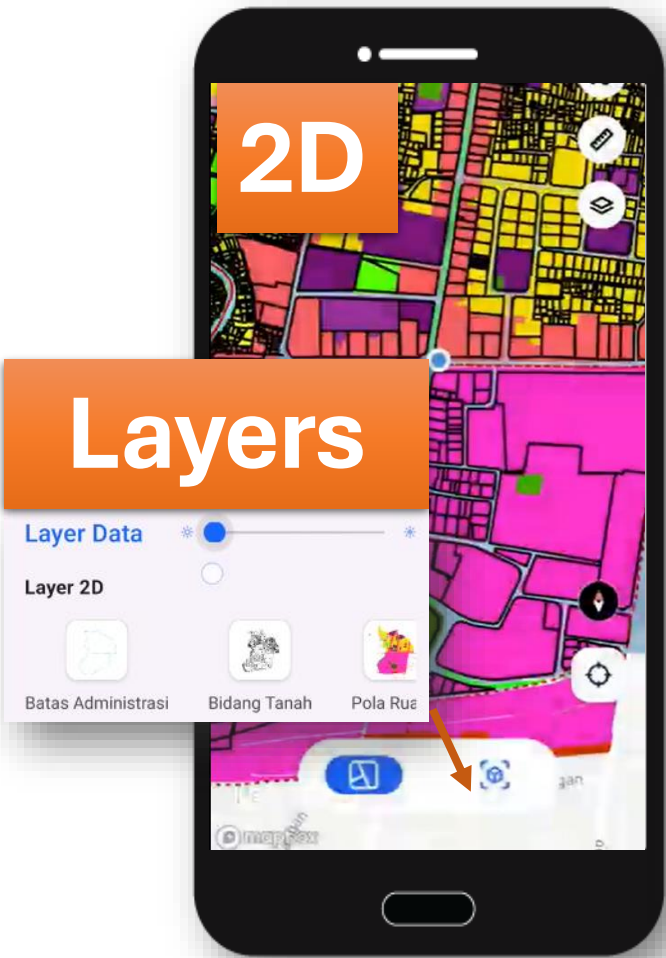


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AR app



UI/UX Features



Augmented Reality App

- 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)




Virtual Reality App

- 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 (± 5 km)
- Feedback Form

Dashboard & AR app

DASHBOARD REAL-TIME VIDEO STREAMING

Refresh 

LiveStream Kolaborasi Survei Lapangan
Diikuti oleh pemilik tanah, tetangga, petugas, dan pegawai BPN

Office

Neighbour

Owner

Petugas

Peta Interaktif

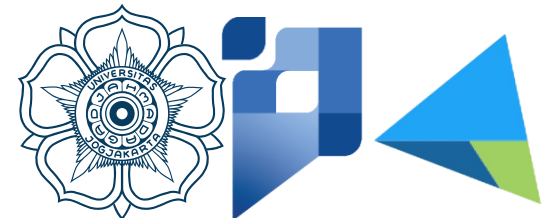
Location

LiveStream Penunjukkan Batas Bidang Tanah

Field

Measurement
Distance : 0.000 m
Area : 0.000 m²

<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).

