

FIG WORKING WEEK 2019

22-26 April, Hanoi, Vietnam

Presented by the FIG Working Week 2019,
April 22-26, 2019 in Hanoi, Vietnam

"Geospatial Information for a Smarter Life
and Environmental Resilience"



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2D and 3D Crowdsourced Cadastral Surveys Looking Ahead

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Where we were

- Comprehensive LAS exist in only 50 countries and only for the 25-30% of the world's 6 billion land parcels
- The rest of the world: reduced security of tenure; poverty
Registration improves:
security of tenure, establishes property rights over the investment, minimizes lending risks and provides easy access to credit and funding mechanisms; enables the poor to unlock the value of their land; improves legal protection, as well as legal empowerment of occupants

A country without a formal system for registering property rights limits its own economic development and prevents its citizens from realizing their full potential

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Our plan in FIG Com3

1. test the available tools and infrastructure
2. test the citizens attitude
3. investigate the methods/ procedures / FFP
4. identify the type of information that should be collected 2D / 3D?
5. test the results in urban and rural areas
6. cooperate with the local authorities / cadastral agencies / professionals
7. *activate community leaders and citizens*
8. ***Plan for basic training / assessment of results***
9. communicate the benefits / publication

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Test the available tools and infrastructure

LADM in the Cloud

On your phone, on your desktop, on the web....

LADM WFS– feature service
Editable worldwide
Publically available



- GIS is key to good land administration
- Rapid change of platforms
- Cloud created a new environment
- ESRI's Collector for ArcGIS online application:
LADM in the cloud (available in IOS and Android)
- Various base maps

Implementation requires a server-side and a client-side functionality

Authoritative and Contributed Content

Using all data available, appropriately.....



Created our own applications:

1. Hellenic Cadaster
2. NTUA

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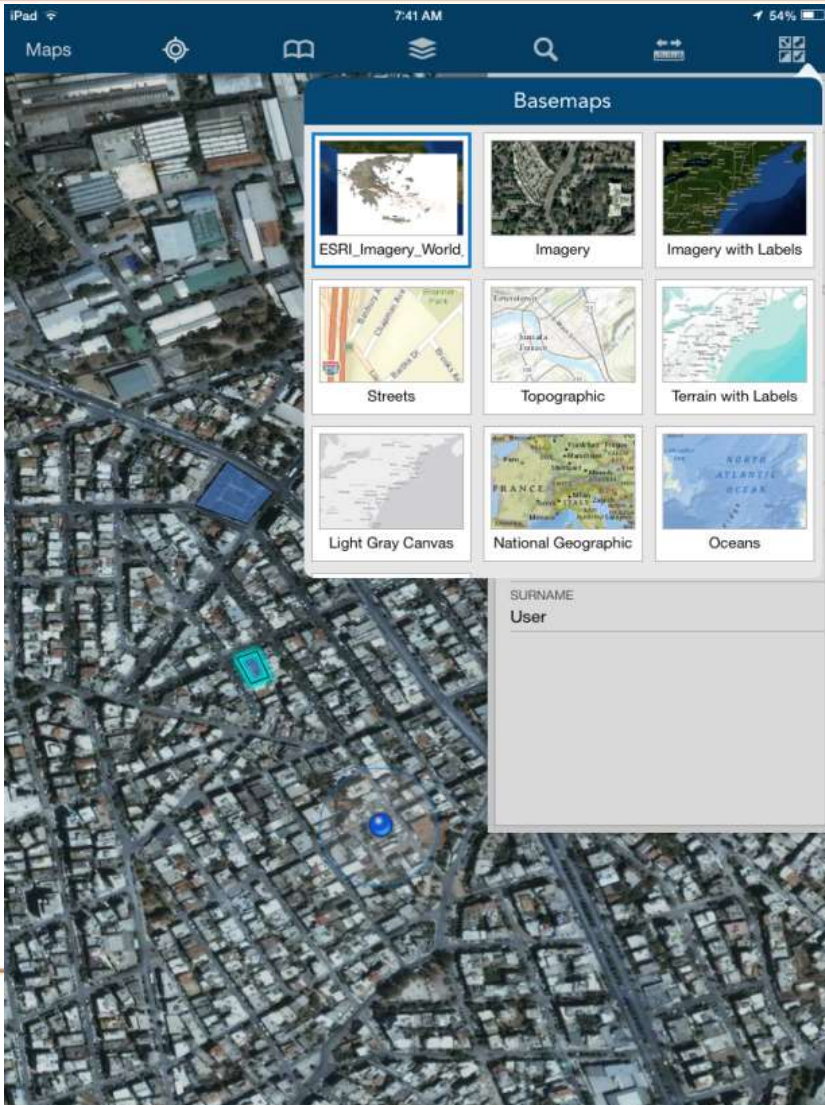


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Either with on-site visit using mobile phone, or through the desktop/laptop



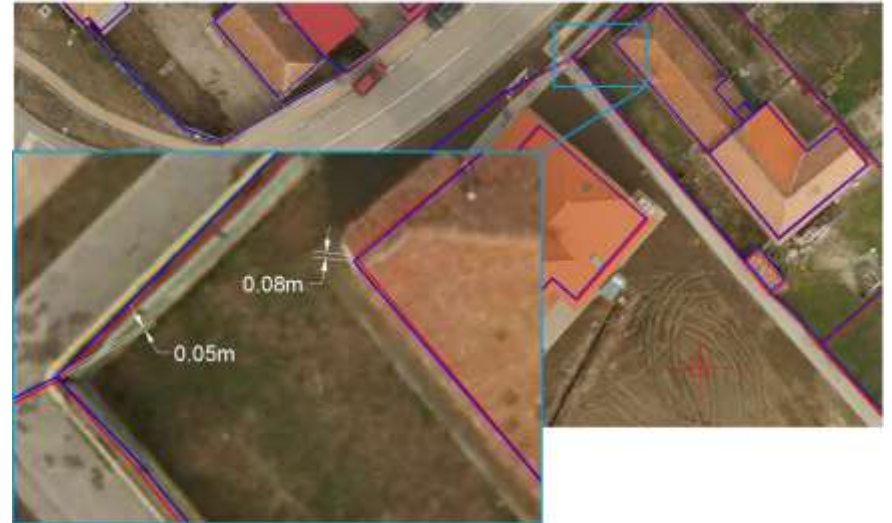
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b. Pilot Case study in a Urban area

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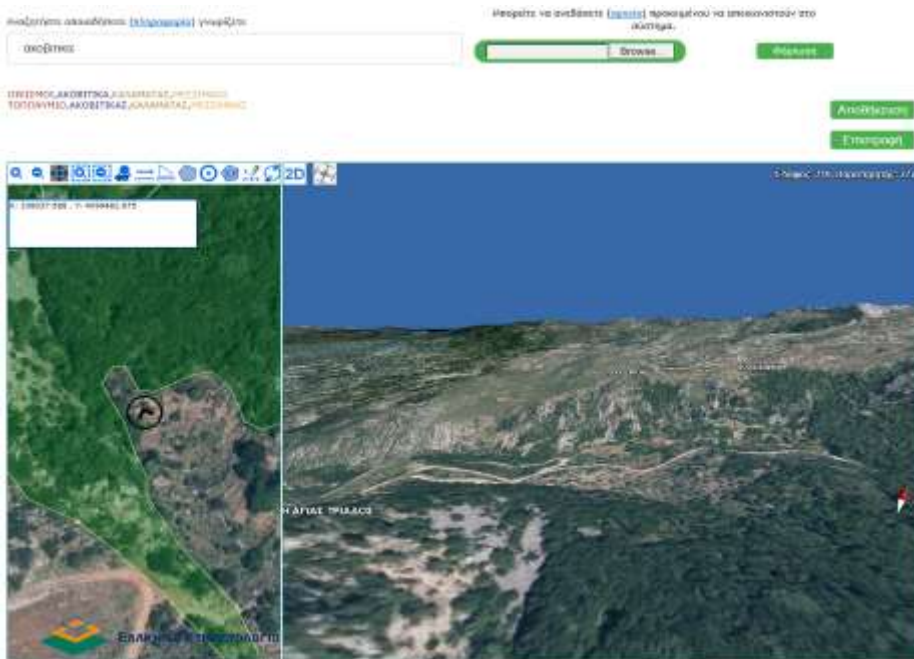
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Both 2d and 3d representations of the area are provided to help the user locate the parcel



Base maps used for testing:

- Orthophotos available by the Hellenic Cadaster, for reliable 2D and 3D cadastral surveys

Mourafetis, Apostolopoulos, Potsiou, Ioannidis (2015)
Apostolopoulos, Geli, Petrelli, Potsiou, Ioannidis, (2018)
Gkeli, Potsiou, Ioannidis, (2019)

- OpenStreetMap, for tests compiled by NTUA Basiouka, Potsiou, Bakogiannis, (2015)

- Satellite imagery, for FFP cadastral surveys Jones, Lemmen, Molendijk, Gorton, (2017)

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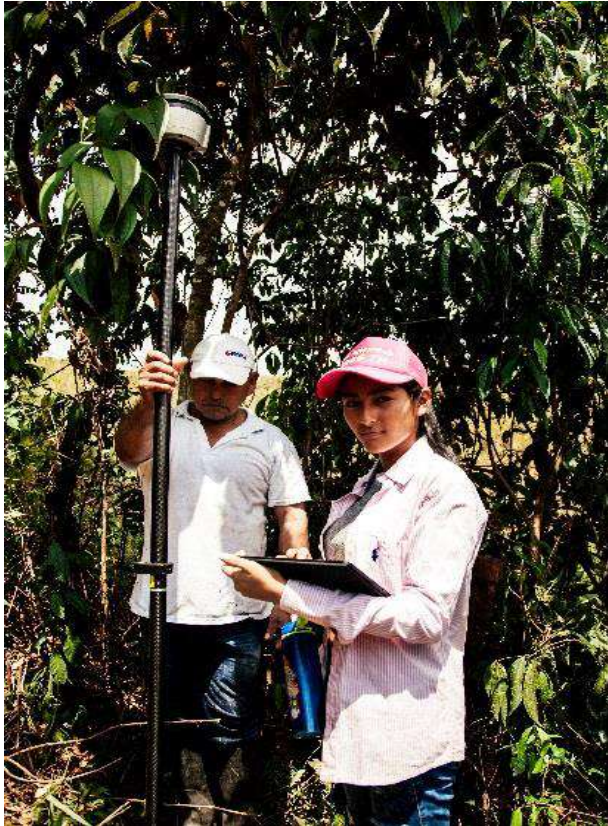




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- The App uses a Bluetooth connection of the mobile to connect with the Trimble R2GPS device
- R2 has a “quality antenna” for the reception of weak GPS signals and the reception of the required correction signals
- provides theoretically sub-meter accuracy for the observed points
- The interface between the R2 and the Collector App can be managed from Android smartphones
- observations made be recorded with an App installed on a mobile device or tablet
- Training of volunteers requires several hours

Photo of the Kadaster – ITC – ANT project “Land in Peace”
Jones et al., 2017

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Test the citizens attitude to actively participate in the data collection process



- The cost of the formal cadastral survey process is extremely high. The owners are led to pay to private lawyers and surveyors more than 2,000 € to prepare the request for correction of their declared ownership any time they submit an objection (for each parcel), on top of the fixed cadastral survey fee
- The long duration time of the process has led to great discomfort for the owners
- For more than 12 years the owners are unable to transfer their properties as the region is still under cadastral survey and the boundaries or the location of their parcels are not fixed although they are obliged to pay all property taxes for it

1. Questionnaire
2. Pilot project at an area under formal cadastral survey
3. In various African projects by Kadaster Basiouka, Potsiou, (2012a, b)
Jones, Lemmen, Molendijk, Gorton, (2017)

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Investigate the methods/ procedures / FFP

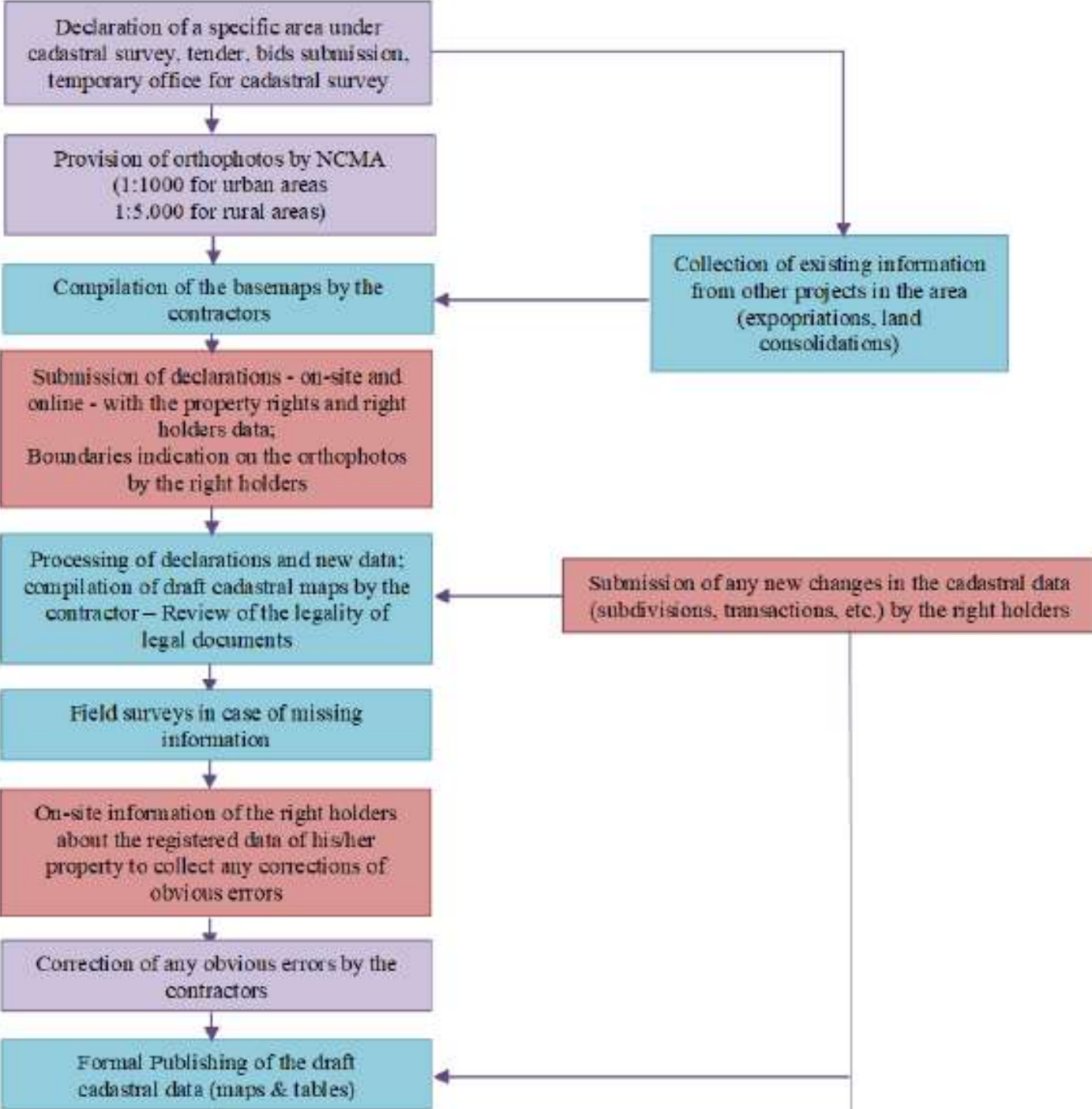
- Develop a FFP strategy
- Decision on the required accuracy
- Decision on the level of involvement of professionals (preparation of the base maps to be used, training the volunteers, controls/editing of the collected data, additional field work-if needed)
- Decision on the type of information to be collected (rights, rights holders, geometric data) parcel centroid or parcel boundaries, building outline, building characteristics, floors, property rights, property rights holders' data, photos of the property, photos of supporting documents
- Pilot projects are needed; Case studies are available
- For complex urban situations (2D) volunteers with technical / digital skills may be needed
- Local volunteers are preferable

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1. Pilot Case study in a Rural area
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Comparison with NCMA'S Cadastral Map



Slight Variations in shape & orientation

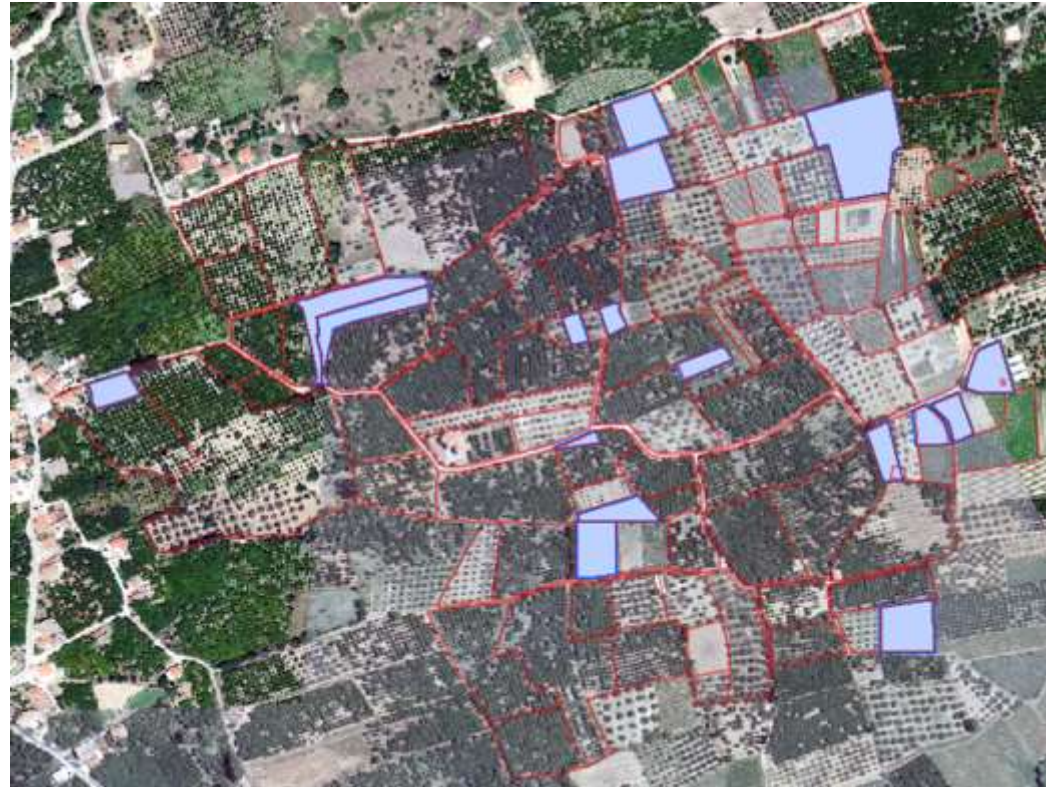
NCMA'S technical specifications:

Rms_{xy} for rural areas is 1.41m

Only 17/114 land parcels exceed these specifications (14.9% of the digitized crowdsourced land parcels)

Average deviation → 0.55 m

Max deviation → 1.8 m



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Test the results of the method in urban and rural areas

- Some of the collected information may be available to the users and some of that may be kept private; this is very encouraging in terms of privacy considerations
- Achieved geometric accuracy depends on the used base map
Orthophotos are excellent for reliable AAA Cadastral surveys
For the missing information:
 - the GPS of the phone may be used for location only, accuracy depends on the type of mobile phone used and on the existing network of antennas; within the city areas, due to the dense network, accuracy is quite acceptable for a AAA cadaster
 - if the Trimble R2GPS device is used depends on the land cover (theoretically <math>< m</math>), for rural areas may be acceptable considering that boundaries are usually "general"
- In the field one may work connected to internet or independently, which is preferable when there is no good internet connection
- Training may require several hours, depending on the digital skills and the understanding of "space"; accuracy may vary according to the volunteer
- Activating volunteers is not always easy; need for incentives

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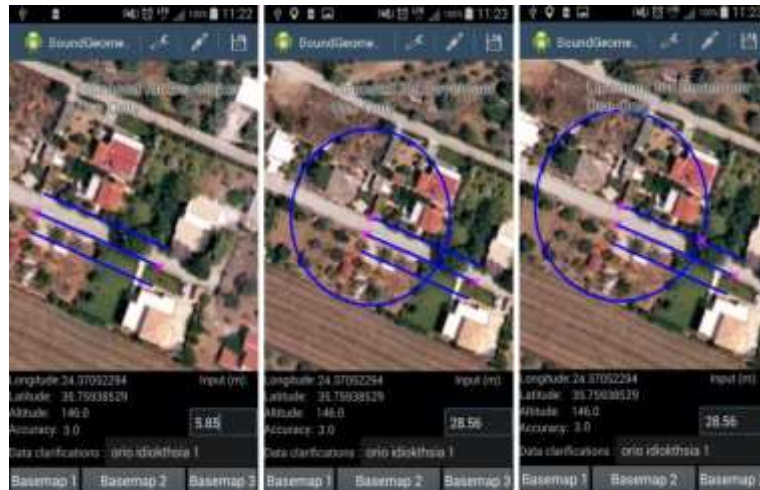
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- Remaining challenges for reliable 2d cadastral surveys: the collection of the missing information on the base maps, citizen involvement, training, control of collected data
- Development of software may be helpful



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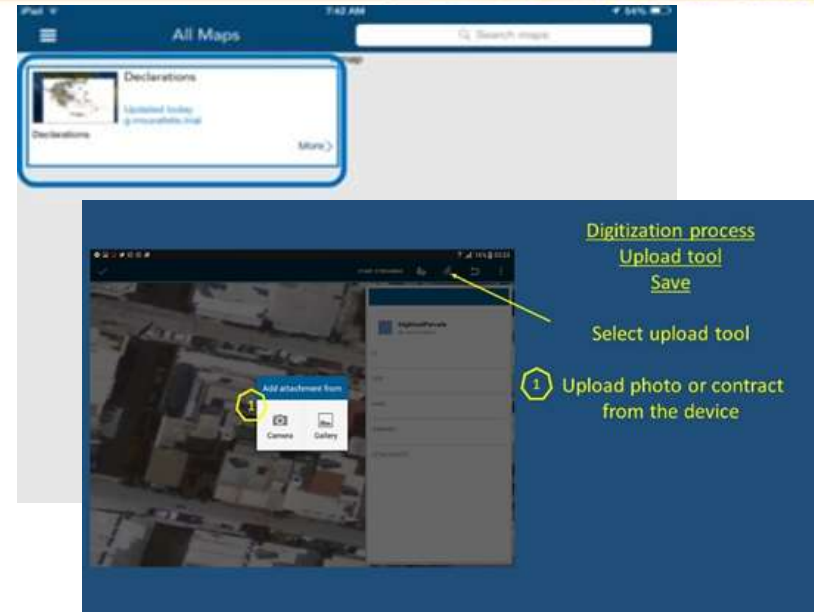
Video guide by NTUA

This video guide aims to raise citizen awareness for the Cadastral Surveys and how to participate with their mobile devices.

It is a **simple, step-by-step** guide of:

- **Applications**
(Esri's Collector for ArcGIS and MapIT GIS)
- **Their features and their tools**

Any Citizen can be informed and trained how to identify a parcel on the orthophotos and digitize it properly



**For all age groups,
regardless of educational
background and digital skills**

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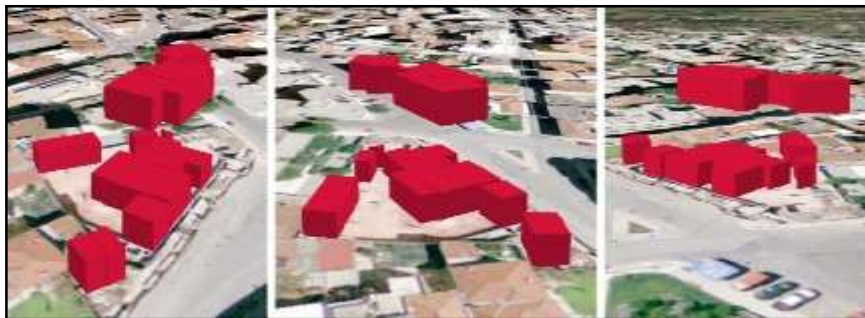
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Looking ahead



Further research on
3D crowdsourced
cadastral surveys by
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