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Databases and computerisation of the property registration process in the Real Estate Register

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Databases, computerisation, cadastre

'It is time to consider that the digital plays the same role that water, sewerage or energy play in the home'.[1]

'Digitalisation means a new way of collaborating, of creating. It also means that you get almost instant feedback on what you do.That is why the way you build must be collaborative both inside and outside. (...) In fact, to be or not to be digital means to have the ability to make decisions quickly.'[2]

1. Geographic information systems

In this era of digitalisation, respectively in the economy based on the knowledge of the competitive companies information systems for data creation and organisation, respectively tools for extracting new information become essential elements in the decision-making process for choosing the best development strategies.

In addition to the classic types of data used in information systems, geospatial data has seen a considerable development in recent years. This geospatial data involves storing more information about the shape, size and location of various objects around the globe.[3]

The information systems that store, process, visualize the classic economic data together with the geospatial data are called geographical information systems, GIS. These information systems are becoming a fad, a necessity for a number of companies or institutions working with geographic data. For example, utility companies can monitor local water, gas or electricity networks more efficiently with a GIS. Regional development agencies can use the spatial analyses provided by geographic information systems to develop documented and consistent development strategies based on the economic and geographical data of the region. Due to the complexity of geographic information systems, and their interdisciplinarity, GIS specialists are reduced in number. In recent years, the international community of open source software developers has made available a number of open source GIS components almost as robust and powerful as the proprietary ones. The open source web GIS community adopts OGC standards, including WMS, WFS, to ensure interoperability.[4]

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[1] *Tatian Diaconu, CEO al Immochan România, https://www.zf.ro/eveniment/zf-digital-leadership-fii-lider-era-digitala-digitalul-intr-companie-acelasi-rol-apa-canalizarea-energia-il-au-intr-casa-romania-nevoie-digitalizare-aceeasi-masura-nevoie-autostrazi-16779714*, 2017;
[2] *Sergiu Manea, CEO al BCR, https://www.zf.ro/eveniment/zf-digital-leadership-fii-lider-era-digitala-digitalul-intr-companie-acelasi-rol-apa-canalizarea-energia-il-au-intr-casa-romania-nevoie-digitalizare-aceeasi-masura-nevoie-autostrazi-16779714*, 2017;
[3] Ion Lungu, Gheorghe Sabau, ManoleVelicanu, Mihaela Muntean, Simona Ionescu, Elena Posdarie, Daniela Sandu, SistemeInformatice, Ed. Economica, Bucuresti, 2003
[4] Patrick Weber, Dave Chapman, Investing in geography: A GIS to support inward investment, Computers, Environment and Urban Systems, nr. 33, 2009

1.1. Defining a GIS

GIS is defined by OGC as an information system used to capture, store, verify, integrate, manipulate, analyse, and visualize georeferenced or geospatial data[5]. Geospatial data are data related to geographical location, the characteristics of natural or built objects, their limits on the Earth's surface. OGC is a consortium of 369 companies, government agencies and universities that work together to create standards, specifications, known as OpenGIS® Standards and Specifications. These standards ensure the interoperability or smooth operation of the 'plug-and-play' concept at the software level.

1.2. GIS architecture and database models

According to OGC standards[6], the composition of a GIS is shown in Figure 1.1.

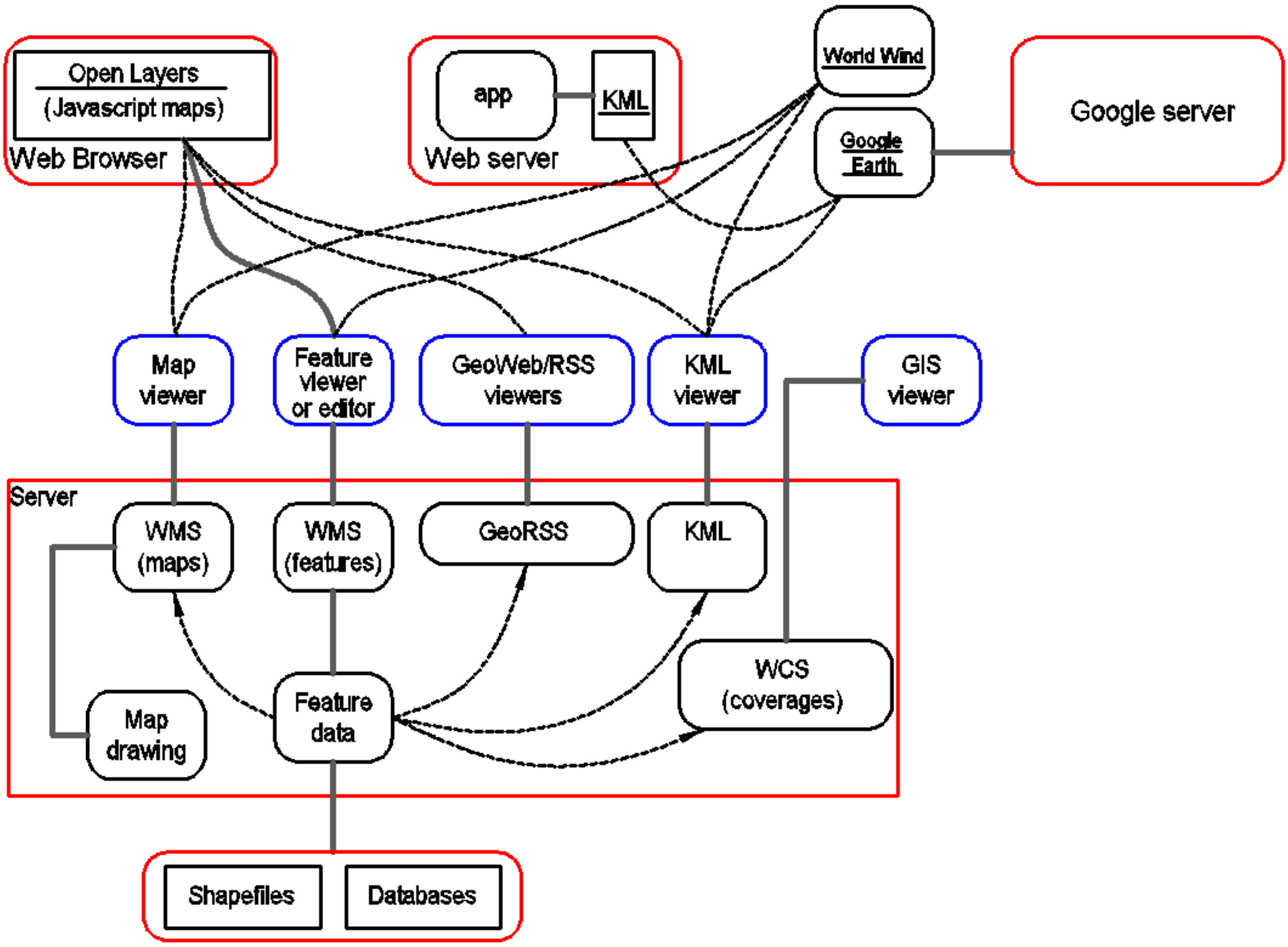

Image 1.1. GIS architecture

According to image 1.1., 3 levels can be identified: the level of geospatial data storage, the level of the web-server for map generation and the level of web or desktop GIS applications in which those maps are viewed. The first level of the presented architecture refers to the methods of storing geographical data, methods that know different degrees of evolution such as:

[5]OpenGIS Consortium Homepage, http://www.opengis.org
[6] Open GIS Consortium Inc., OGC Web Map Service Interface, Editor: Jeff de la Beaujardiere, 2004

CAD model, used since the 60s and 70s, a model that stores geographic data in binary files with various representations for lines, points and areas. Very little descriptive information is included in these files.

The coverage or georelational **model**, which assumes that spatial data are combined with descriptive data.Spatial data is stored in files and descriptive data is stored in tables in relational databases.

The geodatabase model is a model that introduces a new way of storing, respectively of object-oriented data, both geographical and descriptive data are stored in the same place, the same database. These databases are also called spatial databases. Examples of open source spatial databases: PostGIS/PostgreSQL, MySQL Spatially Enabled. Oracle Spatial, SQL Server Spatialy Enabled stand out as proprietary solutions. As a spatial data storage solution used in the world, the *.shp files, shapefiles, a solution developed by ESRI, stand out. This type of file stores both geographic, spatial and descriptive information.

To ensure interoperability, spatial database manufacturers such as Oracle provide tools, such as shp2sdo, that generate, starting from .shp files, control (.ctl) files used to upload those spatial data to the database. The next level of architecture refers to the servers for generating maps, WMS (Web Mapping Service) that produce maps (.jpg, .png files) based on georeferenced data, in digital format.

Examples of open source WMS servers: GeoServer, MapGuide Open Source; proprietary: Oracle MapViewer. WFS (Web Feature Service) is a service that returns georeferenced data in vector format, without information about how that data will be viewed, and WCS (Web Coverage Service) does the same thing but for data in raster format. KML - Keyhole Markup Language is an XML language used to view geographic information, a language used by Google Earth. The latest level of architecture refers to 2D or 3D visualization of maps through web or desktop GIS applications.

The most used desktop applications for 3D map viewing are: Google Earth and the NASA World Wind open source application. The above architecture only presents the software component of the geographic information system. A more comprehensive architecture is presented by authors Mike Worboys and Matt Duckham, according to image 1.2.[7]

[7] Mike Worboys, Matt Duckham, GIS: A Computing Perpective, CRC Press, 2004

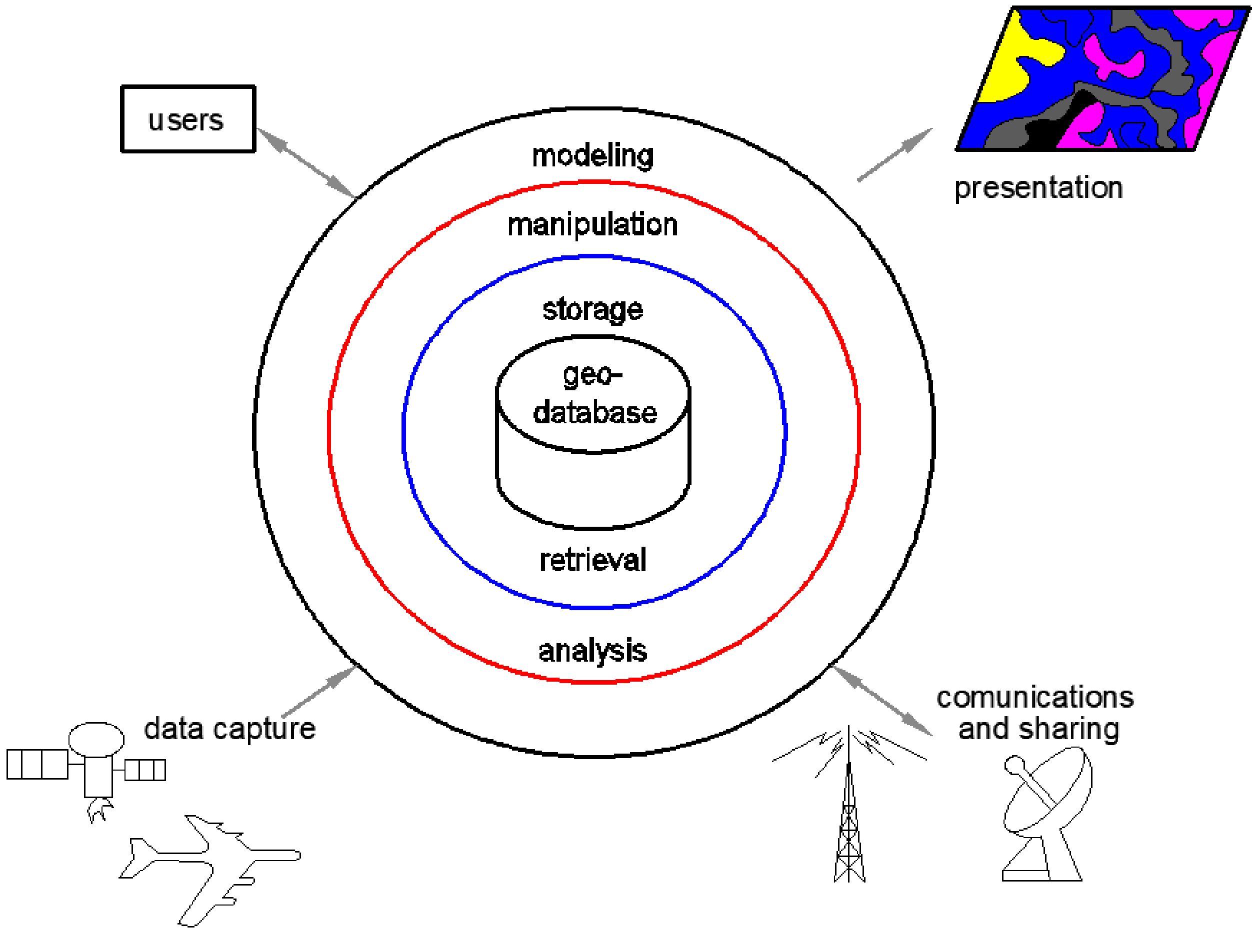

Image 1.2. GIS architecture according to Mike Worboys and Matt Duckham

1.3. Types of geospatial data

The main types of data used in geographic information systems are divided into two classes, namely:

1. **Raster data**. It is obtained by established remote sensing or photogrammetric methods, data taken either by satellite or by aircraft, or currently using Drone (UAV). These are files that store information organised in discrete cells arranged in rows and columns. Each cell (pixel) stores a certain value, which can be: in the case of the digital elevation model (DEM) the quota, in the case of orthophotoplans the RGB code, and in the case of different thematic data, the characteristic significance (e.g. slope orientation, slope map, etc.)
2. **Vector data.** This vector data consists of points, lines, polygons, being suitable for storing the outline of objects, in contrast to raster data that stores mainly their contents.

In image 1.3. both vector data and raster data can be identified. The plots identified with the colour yellow represent vector data, and in the background you can see the orthophotoplan, represented in raster.

The main feature of raster data is the resolution. This is expressed as units of distance per pixel, and the lower the values, the more accurate the raster data, but at the same time a very good resolution automatically implies an increase in storage capacity and in the case of webservers an increase in data loading and viewing time. In order to reduce the time required to display raster data in the online environment, the concept of TileCache was adopted. TileCache involves displaying raster data in portions and at resolutions adapted to the degree of zoom.

In order to set the resolution of a raster image, it is implicitly necessary that it be georeferenced. Georeferencing is the operation by which a raster image is brought by translation, rotation, scaling and possibly deformation, in the coordinates of the chosen projection system. In order to perform the georeferencing, identifiable points are used on it, which have the known coordinates in the chosen projection system[8]. Following the georeferencing, the source points, located on the image are brought as close as possible to the destination points, the discrepancy between the two representing the transformation error.

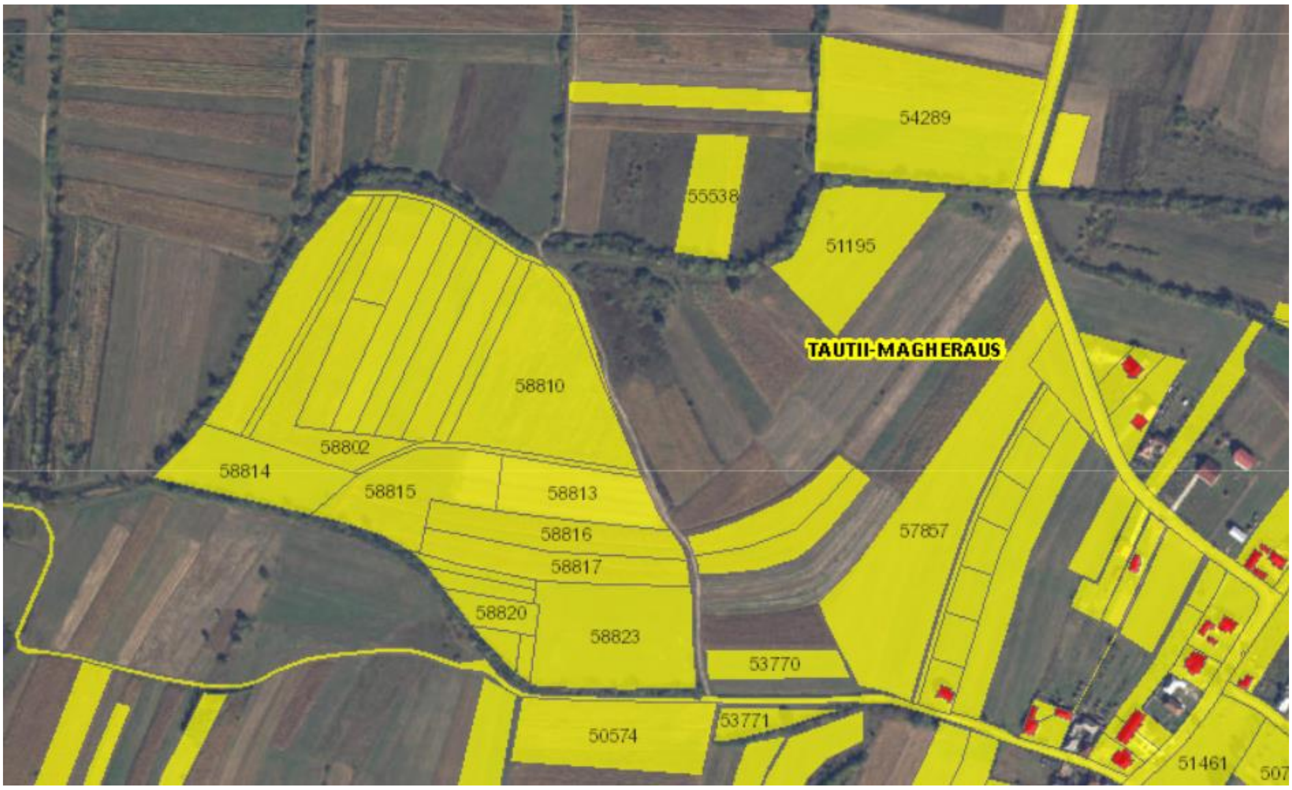

Image 1.3. Raster data and vector data

Unlike traditional methods of recording data on various activities on files (written documents) or even on files on disk, database systems offer many advantages, which justifies their increasing use. The main advantages conferred are:

- High compactness: the volume occupied by database systems is much smaller than the volume occupied by written documents or uncorrelated files.
- High speed of retrieving and updating information.
- Low redundancy of stored data, which is achieved by sharing data between multiple users and applications. When storing data in tabs or files, each application contained its own data sets. In database systems, multiple applications can use shared data, stored only once. For

[8]Gheorghe Badea, Ana Cornelia Badea, Aplicații Sisteme Informaționale specificedomeniilor de activitate – îndrumător, editura conspress, București 2013

example, a staff application and an examination results application from a university operating a single database can use the same information regarding the structuring of faculties and departments.

- Possibility to introduce standards on how to store data, which allows the exchange of information between different organisations.
- Maintaining data integrity through security policy (access rights differentiated according to the role of users), by managing transactions and by restoring data in case of malfunction of various hardware or software components.
- Database management systems provide an external view of the data, which does not change when the physical storage medium is changed, which ensures immunity to the database structure and applications to changes in the hardware system used.[9]

2. Databases

A spatial database is a database optimised to store and query geospatial data. With regard to cadastral works and not only, a GIS must meet at least the functionalities specified in image 2.1.

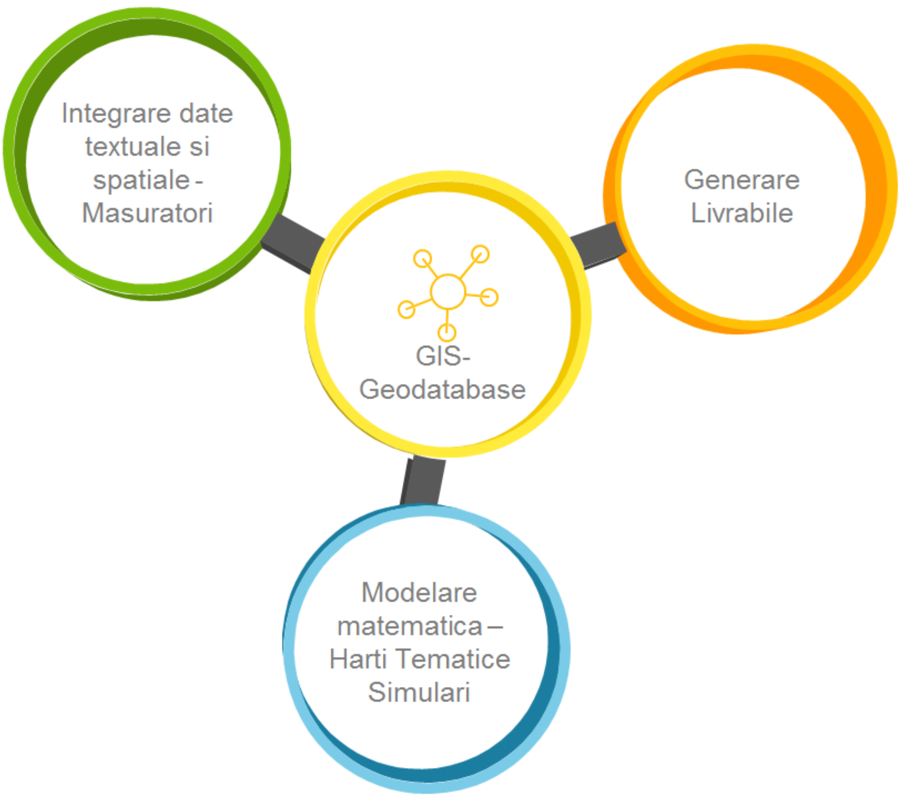

Image 2.1. The structure of a GIS

[9]http://webbut.unitbv.ro/carti%20on-line/Ratiu/BD/Cap.1.pdf

2.1. Databases specific to cadastral works

Within the cadastral works, the structure and composition of this database is legally regulated according to order 700/2014 and order 533/2016 with subsequent amendments and supplements.

In order to ensure a standardisation in the works of registration of properties in the real estate register, both the content of the cadastral plan and the shape and size of its main components were legally regulated. In table 2.1. the main component parts of the cadastral plan can be visualized.

Table 2.1. The content of the Cadastral Plan[10]

The content of the Cadastral Plan	**Content/Features**
Title	Cadastral plan
Scale of the plan	For plots within built-up areas, the denominator of the scale must not exceed 1000 For plots outside built-up areas, the denominator of the scale must not exceed 2000
Projection system	STEREO 70
Legend	-
Northbound	-
Administrative-territorial unit boundary and neighbouring territories	The county to which one of the neighbours belong is from another county; if all the neighbours are from the same county, only the name of the administrative-territorial unit is written
Name of the contractor	(4 cm x 2 cm), stamp, signature, date of preparation
Limits of the plots within/outside the built-up areas	Number / Name
Limits and numbers of cadastral sectors	-
Limits and property ID	-
Postal numbers of properties within the built-up areas	
Limits of final constructions	-
Toponymy	Names: hydrography, main forms of relief, forests, roads and streets, names of industrial, sociocultural objectives, etc.
Sketch with the layout of the cadastral sectors	-
Number of drawing	if there are more
Squares features 10 cm x 10 cm	line thickness 0.18 mm, with coordinate dimensions of 2 mm

In order to print the cadastral plan, it will be drawn up in A3 - A0 format, at an appropriate scale. The printing must be done in colour, and the main characteristics of the respective component lines of the texts are presented in table 2.2.

Table 2.2. Features of the linear and textual details that make up the cadastral plan[11]

[10]http://www.ocpi-cs.ro/uploads/Ordin_533_2016.pdf

The content of the Cadastral Plan	Features
Linear details	
Drawing frame	Black line thickness 1 mm
County boundaries	Red line with a thickness of 1 mm
Administrative-territorial unit boundary	Red line with a thickness of 1 mm
Cadastral sector boundary	Green line with a thickness of 1 mm
Limit of the plots within the built-up areas	Blue line with a thickness of 1 mm
The boundary of permanent constructions	Black line with a thickness of 0,2 mm
Crosses of squares	Black line with a thickness of 0,2 mm
Textual data	
County	8 mm, Uppercase, Vertical, Black
Administrative-territorial unit	8 mm, Uppercase, Vertical, Black
Cities	8 mm, Uppercase and lowercase, Vertical, Black
Hydrography	2 mm, Uppercase and lowercase, Italic, Blue
Title	10 mm, Uppercase, Vertical, Black
Subtitle, Cad. sect.	8 mm, Uppercase and lowercase, Vertical, Black
Scale	6mm, Uppercase and lowercase, Vertical, Black
ID	4, Vertical, Black

In order to complete the graphical database, but also to describe certain elements within the graphical database, a textual database is also drawn up. This textual database contains all the elements necessary to complete the real estate registers. These details are recorded in a *cgxml file, but which can also be edited with a text editor. This file has the composition set according to ANCPI specifications.

[11]http://www.ocpi-cs.ro/uploads/Ordin_533_2016.pdf

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The registration of properties in the Real Estate Register is a challenge at present, especially due to the confusing legal regulations over time and the lack of a unitary direction in the process of restitution of properties. The works for registering the properties in the Real Estate Register, according to the current regulations are divided into: sporadic cadastre works and systematic cadastre works.

The systematic cadastre works, unlike sporadic cadastre, are works of greater complexity, involving the identification and cadastre of many real estates. One of the most complex tasks in these works is the correlation of the old database with the new one. The correlation of these two databases is a challenge for several reasons, such as: the existence of databases in various projection systems, the degree of deterioration of drawings (without scale or coordination system) etc. Also, an impediment is the lack of plot plans in certain areas subject to systematic cadastre works, or their inconsistency with the reality on the ground.

This subchapter highlights various methods of integrating the old topo-geodetic database, respectively the creation of new databases, through innovative methods in order to further integrate them into a GIS system to streamline the works.

In order to computerise the cadastral works, here are some own contributions, in terms of creating a GIS database containing both old raster data and the application of UAV photogrammetric methods to create new cadastral support, orthophotoplans, elevation digital model etc.

According to image 2.1, a geographic information system involves both the retrieval of raw data and their integration into the created databases.

3. Case study

The case study included an area outside the Tăuții Măgherăuș administrative-territorial unit, Bozânta Mare, subject to systematic registration works, according to the National Cadastre and Real Estate Register Program carried out by the A.N.C.P.I. The studied area can be viewed in image 3.1.

Image 3.1. The studied area

3.1 Execution of the Orthophotoplan, support for cadastral works

In order to streamline the systematic recording works, a UAV photogrammetric flight was performed, according to the principles listed in the scientific research report no. 2 entitled 'Modern concepts regarding the computerisation of real estate registrations in the Real Estate Register'. The main steps for obtaining the orthophotoplan consisted of:

- recognising the terrain and assessment of the elevations in order to carry out the flight plan,
- flight planning,
- making the pre-marking and taking over the coordinates of these points,
- performing the flight and taking the photocopies,

- processing photocopies and obtaining deliverables.

The pre-marking of the checkpoints on the ground was performed either by painting, where possible, or by installing an artificial banner cloth marking, as can be seen in image 3.2.

Image 3.3. Examples of Pre-marking (banner, and painting)

A number of 12 flights were performed (image 3.4), ensuring a sufficient overlap between them to be able to join them later.

The position of the checkpoints on the ground was set so as to ensure a homogeneous layout. It was considered that each individual flight contained sufficient checkpoints on the ground to be properly modelled. The location of the checkpoints on the ground can be seen in Figure 3.5. 105 checkpoints on the ground were taken over.

Table 3.1. Details for taking photogrammetric data

Parameter	**Value**	**Parameter**	**Value**
Number of photocopies	5148	Usable photocopies	5131
Flight altitude	105 m	Connection points	5,428,043
Average ground resolution	2.52 cm/pix	Projections	19,226,572
Covered area	6.48 km^2	Projection error	0.55 pix

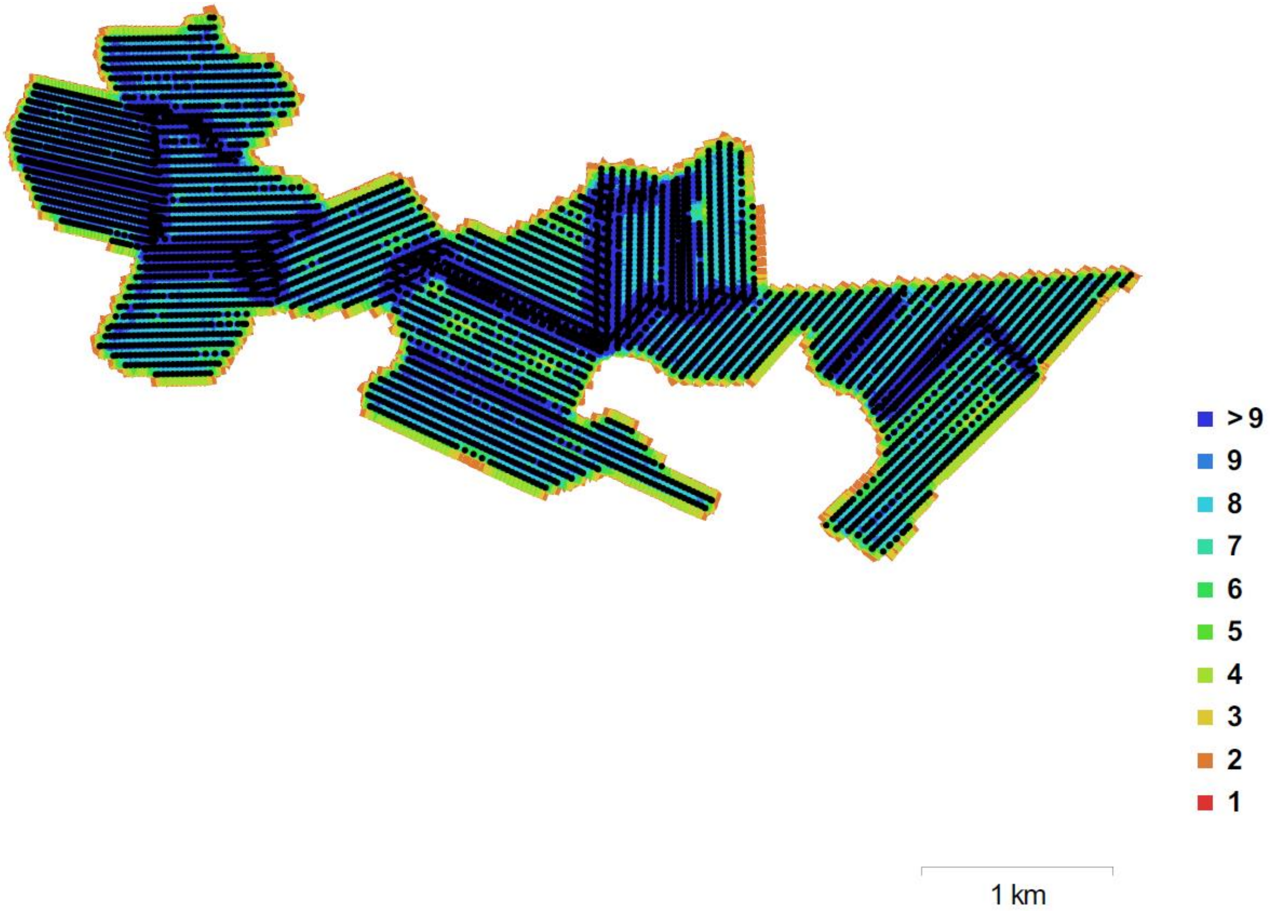

Image 3.4. Position of cameras and overlap

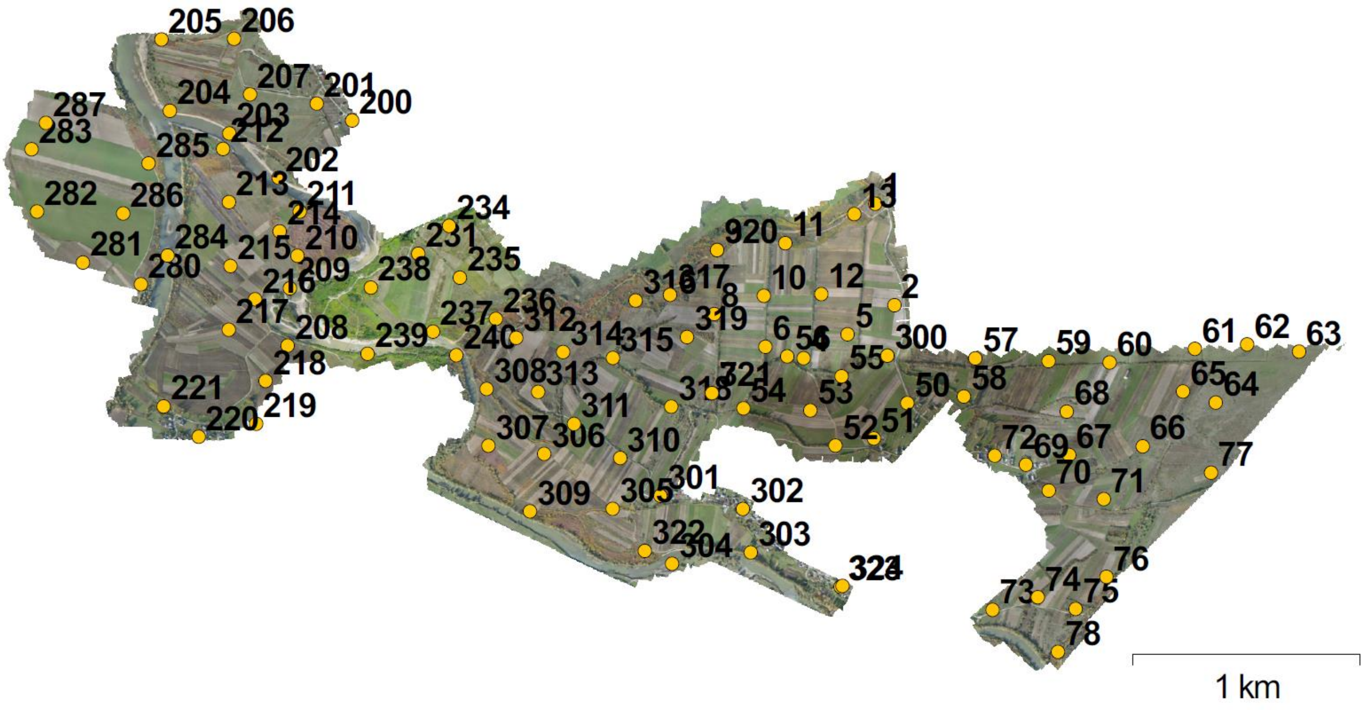

Image 3.5. Position of the checkpoints on the ground

The main data specific to the area flown over, as well as the raw data taken over are presented in table 3.1. A DJI Phantom4 Pro drone was used to take the data, with a built-in camera with a 1-inch sensor and a resolution of 20 megapixels. Following the photogrammetric processing and the block compensation of the aerotriangulation, its accuracy was also assessed, with a mean square error (RMSE) on X, Y, of 0.0152 m, and at elevations of 0.0122 m.

3.2. Vectorisation of plots and their integration in the database

The vectorisation of the plots was done after obtaining the orthophotoplan. In order to establish the boundaries of the plots, it was used both the automation of the determination of contours, improving the images by applying convolution filters (Sobel filter, Roberts filter) in arcgis, according to those presented in detail in research report 2, and where not it was possible to automate the detection of contours, by manually vectorising them. Also, in the hardly visible areas, mainly covered with vegetation, classical measurements were taken. In order to obtain more conclusive results, the orthophotoplan was converted to black and white format, then applying convolution filters. Image 3.6 shows the result of applying the Roberts filter.

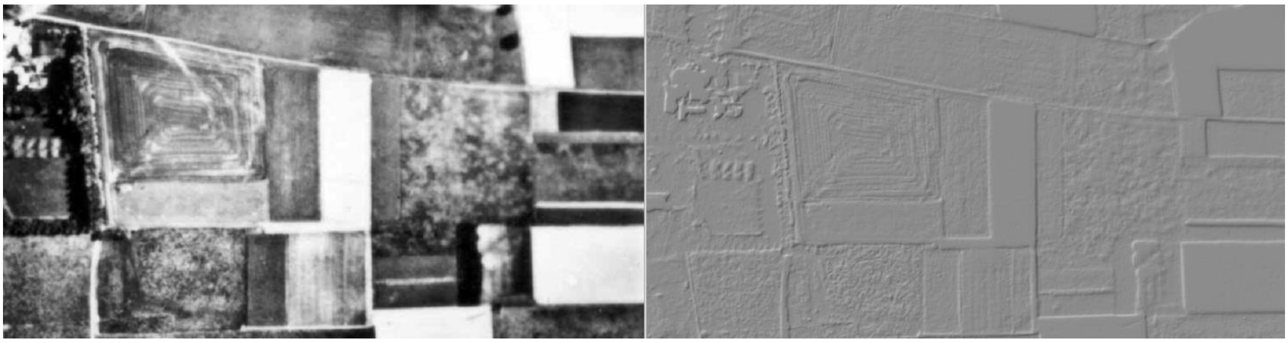

Image 3.6.Roberts filter for contour determination

After vectorising the linear details, a polygon file was created, to which serial numbers were attached, related to the CadGen ID. This polygon file can be seen in image 3.7.

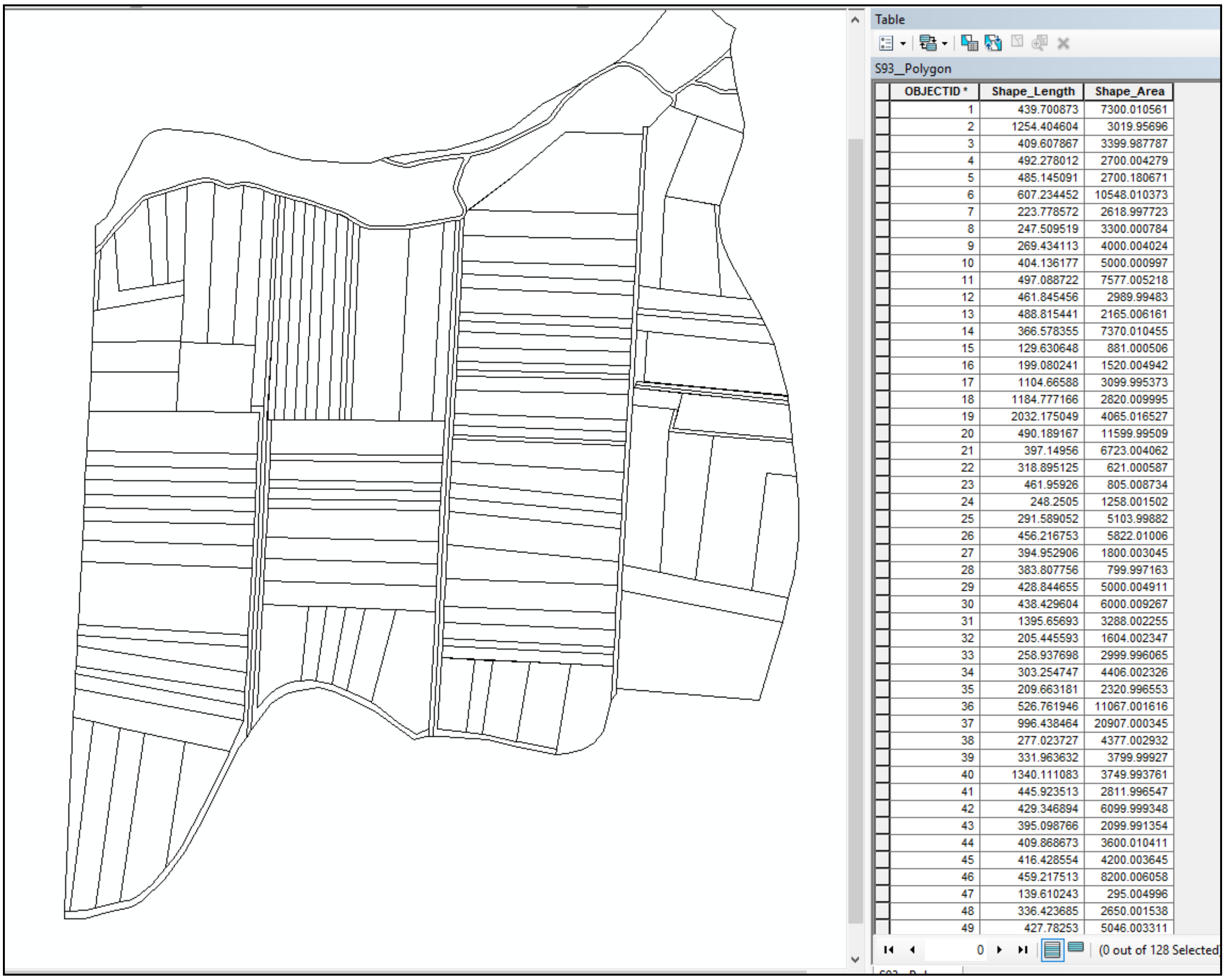

Image 3.7. Vector data obtained by vectorisation from Orthophotoplan

3.3. Creating the database and integrating the measurements

For the optimisation of the works, the option of creating a GIS database was chosen, which will later allow updating it with the new data collected, but also publishing it online - ArcGisOnline. Image 3.8 shows the database created.

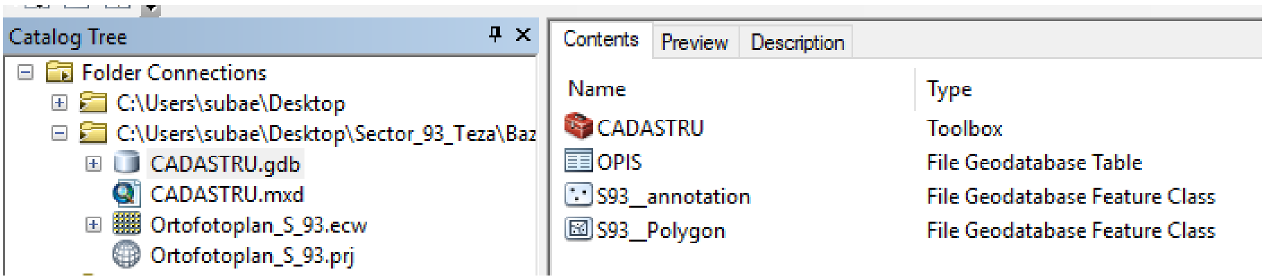

Image 3.8. Database created

After the creation of the database, it imported both graphic and textual data. To unify the data, a toolbox has been created that allows the union of textual data with graphic data. This toolbox is shown in figure 3.9.

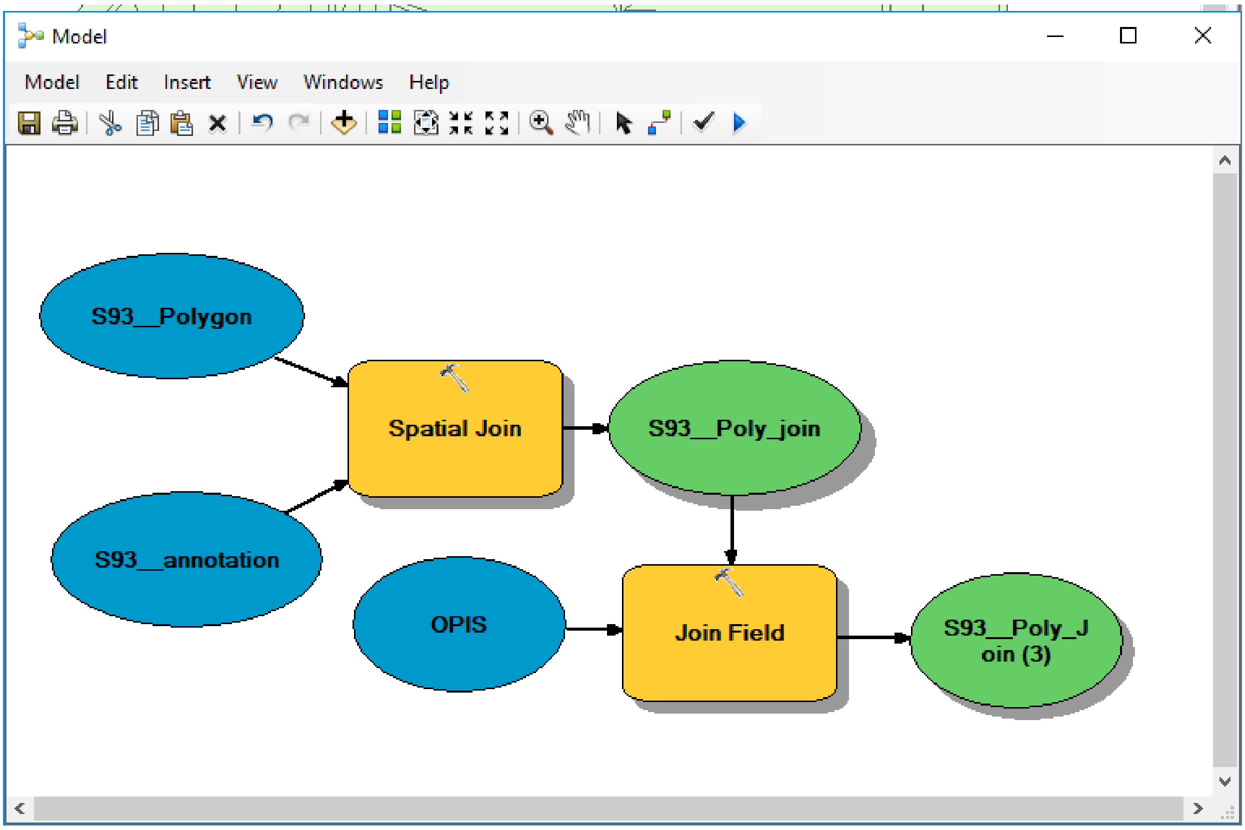

Image 3.9. Toolbox

The main purpose of this toolbox is to unify the graphic data with textual data, so as to generate a complex database that provides all the information needed to complete the process of registering properties in the real estate register. Image 3.10 shows the data from the textual database that has been unified with the graphical ones.

Table

S93__Poly_Join

TxtMemo	Shape_Length	Shape_Area	Identificator	Nume_denumire_deţinător	Data_naşterii_CUI	Planşa	Sector_cadastral	Adresa_imob
275	434.277349	5399.998626	275	Nistor Găvrilă	05.02.1937	1	93	judet MARAMURES, UAT Tautii-Magheraus,
265	441.064855	1480.002634	265	Gaie Pavel	11.01.1930	1	93	judet MARAMURES, UAT Tautii-Magheraus,
264	448.592424	1479.99381	264	Gaie Ecaterina	18.10.1956	1	93	judet MARAMURES, UAT Tautii-Magheraus,
263	466.978387	2500.013189	263	Ghise Ioan Dumitru	22.10.1937	1	93	judet MARAMURES, UAT Tautii-Magheraus,
262	480.052494	2999.99925	262	Chira Ioan	15.12.1932	1	93	judet MARAMURES, UAT Tautii-Magheraus,
259	497.529167	2600.004536	259	Gaie Pavel	11.01.1930	1	93	judet MARAMURES, UAT Tautii-Magheraus,
258	503.099973	2599.997706	258	Marina Anica	05.01.1953	1	93	judet MARAMURES, UAT Tautii-Magheraus,
257	498.667858	1699.964639	257	Breban Ilie	<Null>	1	93	judet MARAMURES, UAT Tautii-Magheraus,
254	417.920504	3999.990181	254	Ster Gheorghe	04.03.1945	1	93	judet MARAMURES, UAT Tautii-Magheraus,
253	394.111995	1800.008103	253	Mihut Aurel-Florinel	07.10.1968	1	93	judet MARAMURES, UAT Tautii-Magheraus,
252	396.107871	1999.999521	252	Ster Gheorghe	04.03.1945	1	93	judet MARAMURES, UAT Tautii-Magheraus,
250	438.727652	5999.999699	250	Gaie Gheorghe	08.09.1939	1	93	judet MARAMURES, UAT Tautii-Magheraus,
249	422.727498	4499.996911	249	Ster Gheorghe	04.03.1945	1	93	judet MARAMURES, UAT Tautii-Magheraus,
247	428.513808	5000.001257	247	Mihut Aurel-Florinel	07.10.1968	1	93	judet MARAMURES, UAT Tautii-Magheraus,
246	350.000659	6700.001995	246	Mihut Ioan	19.11.1922	1	93	judet MARAMURES, UAT Tautii-Magheraus,
242	199.635629	1444.999925	242	Tămaş Ioan	<Null>	1	93	judet MARAMURES, UAT Tautii-Magheraus,

1 (0 out of 128 Selected)

S93__Poly_Join

Image 3.10. Real estate attribute table

A next step in the process of computerisation of cadastral works was the publication of the map in ArcGisOnline. For this purpose, a new map was created, as shown in image 3.11.

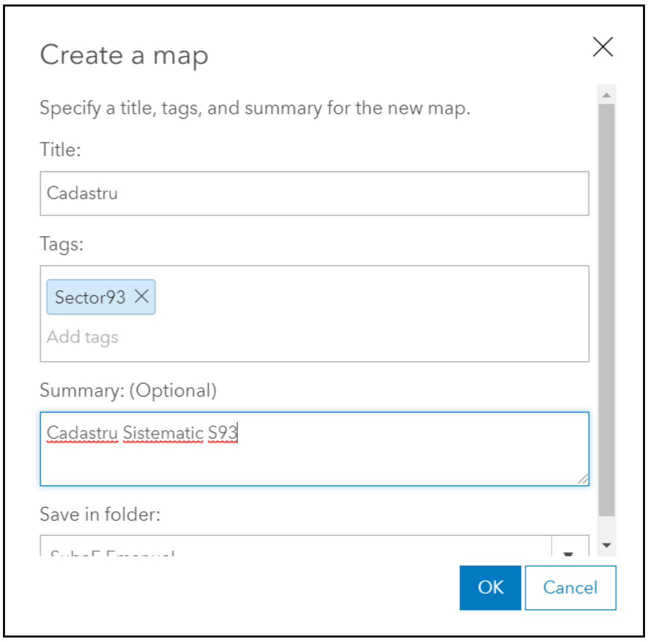

Image 3.11. Creation of ArcGisOnline map

After the creation of the ArcGisOnline map, it was completed with the previously created polygons, respectively with the orthophotoplan related to the cadastral sector studied. Image 3.12 shows the cadastral sector, as the ArcGisOnline map. Old maps, scale 1: 2880, cadastral maps, scale 1:5000 1:2000, etc. can also be integrated in the database, which will facilitate the identification of buildings.

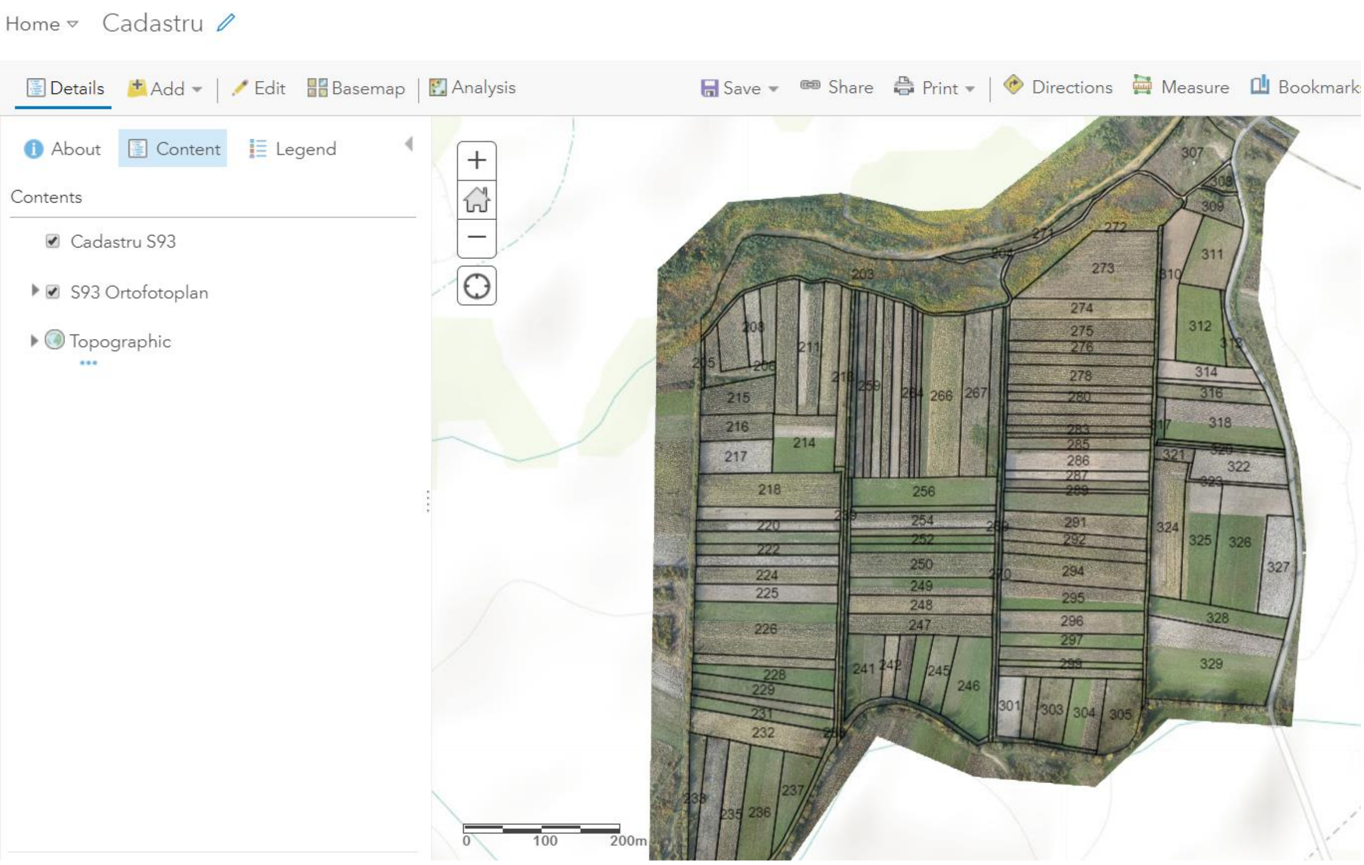

Image 3.12. Creation of ArcGisOnline map

Image 3.13 shows an overlap of the current database (orthophotoplan) with the cadastral plan 1:5000 which allows easy identification of the lands, if the property titles were issued in this way, but on the studied area, they were not released on the land, but only the topical name of the area was identified.

Image 3.13. Orthophotoplan overlap with the cadastral map

In order to identify the toponymic name, respectively the topographic numbers, topographic drawings can be integrated in the database, if they are drawn up at scale, if they are not at scale, being concrete, as well as the situation of the studied perimeter, their integration into the database is practically impossible.

3.4. Editing data collection and updating using mobile devices

A great advantage of the online database is that it can be updated in real time, using simple mobile devices, such as a tablet or a smartphone. In order to automate the process of collecting the owners' documents, during the meetings organised in the field, we proposed the use of two applications dedicated to data collection, both spatial and textual data. To update the previously created polygons, or to add additional data, we proposed to use the dedicated GIS Collector application, which allows editing, or completing an online map with new data. The main advantage of this application is the fact that the database is updated instantly, the office team being constantly connected to the team on the field. The collector application can be installed on a smartphone or tablet. Logging in the application, viewing the data, but also editing the elements of the map, as well as adding new records is done as can be seen in images 3.14 and 3.15.

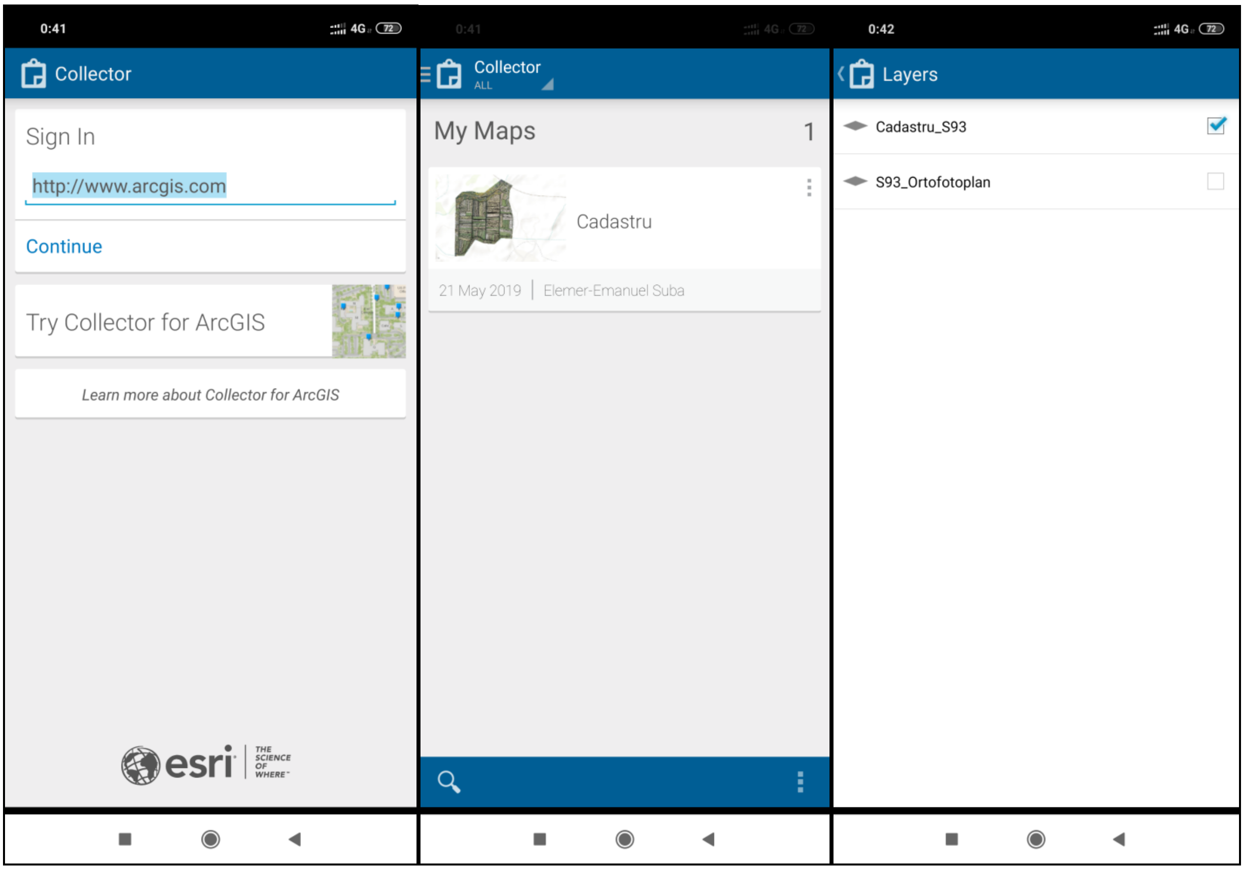

Image 3.14. Viewing the map on the mobile collector application

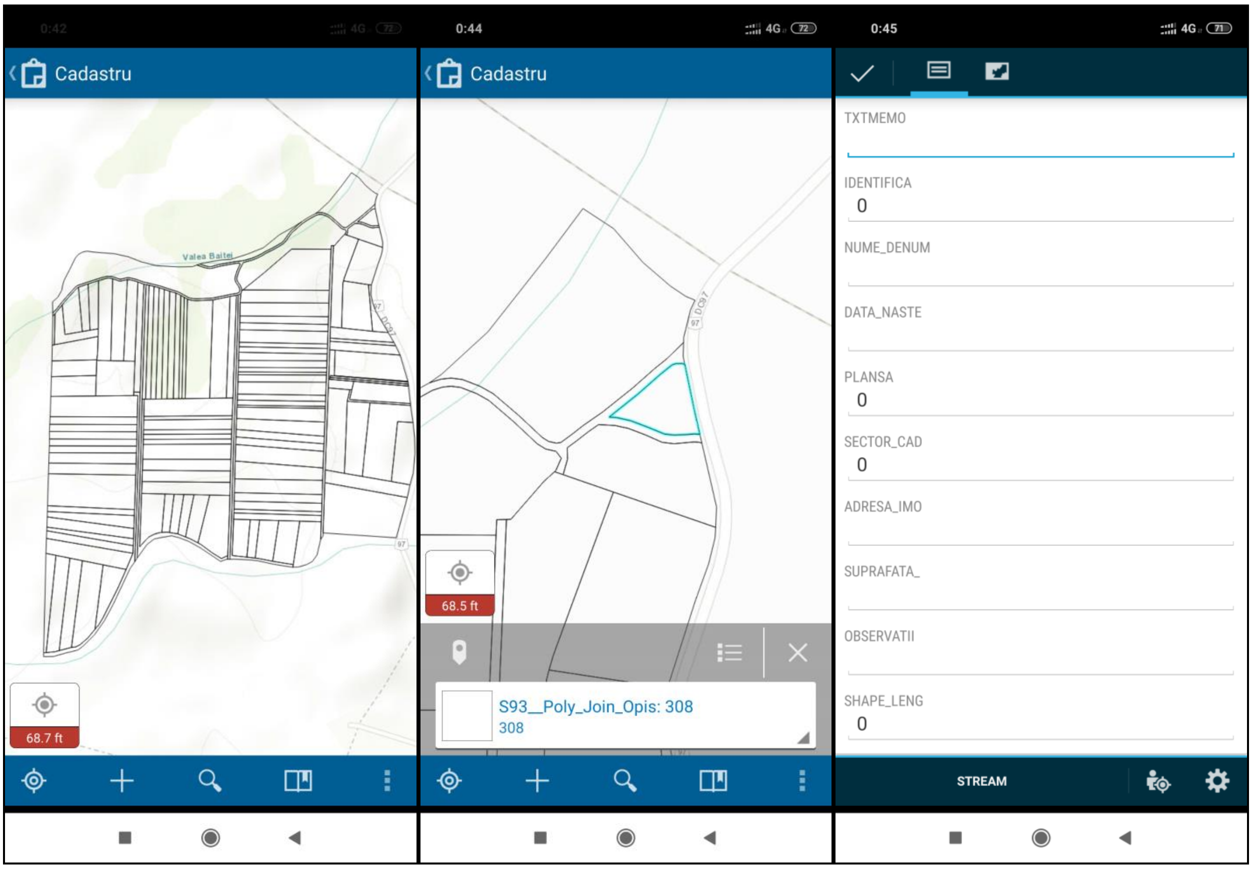

Image 3.15. Viewing graphic data and editing textual data

The Esri survey123 mobile application can be used to purchase new data, but also to complete the field interview form. This application involves the prior creation of a questionnaire template, as can be seen in image 3.16.

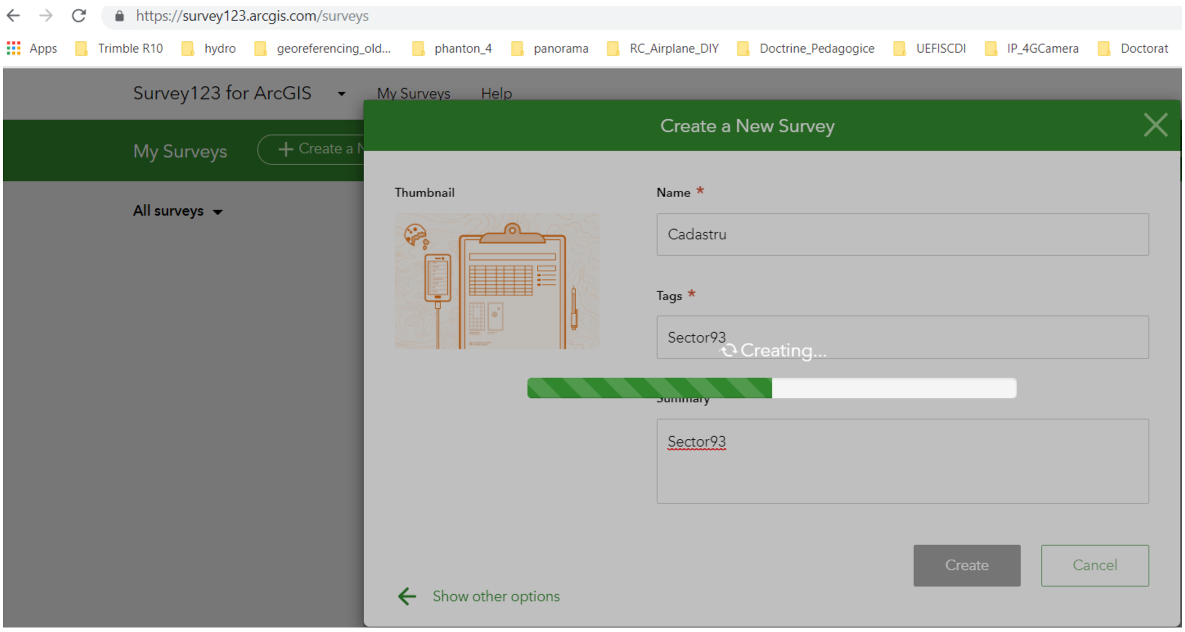

Image 3.16. Creating a questionnaire template

The application allows the addition of several items characteristic of cadastral and real estate register works, such as last name, first name of the owner, an image with the title deed, GPS position of the place where the interview was taken, but also the signature of the owner. These items are added to the questionnaire, as can be seen in image 3.17.

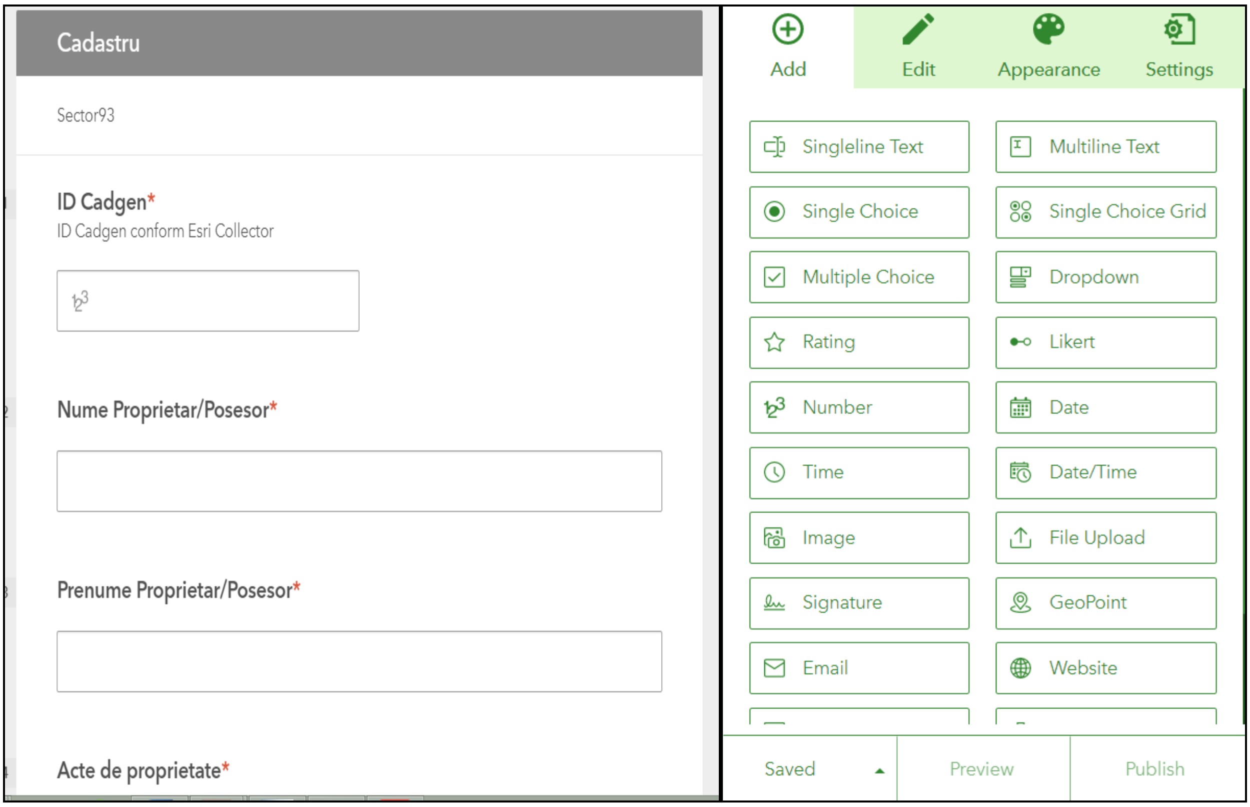

Image 3.17. Adding items to the questionnaire

Once the questionnaire has been completed, it can be accessed from mobile devices in order to collect data during the interviews on the plot. The functionalities of the survey123 mobile application can be seen in image 3.18. respectively 3.19.

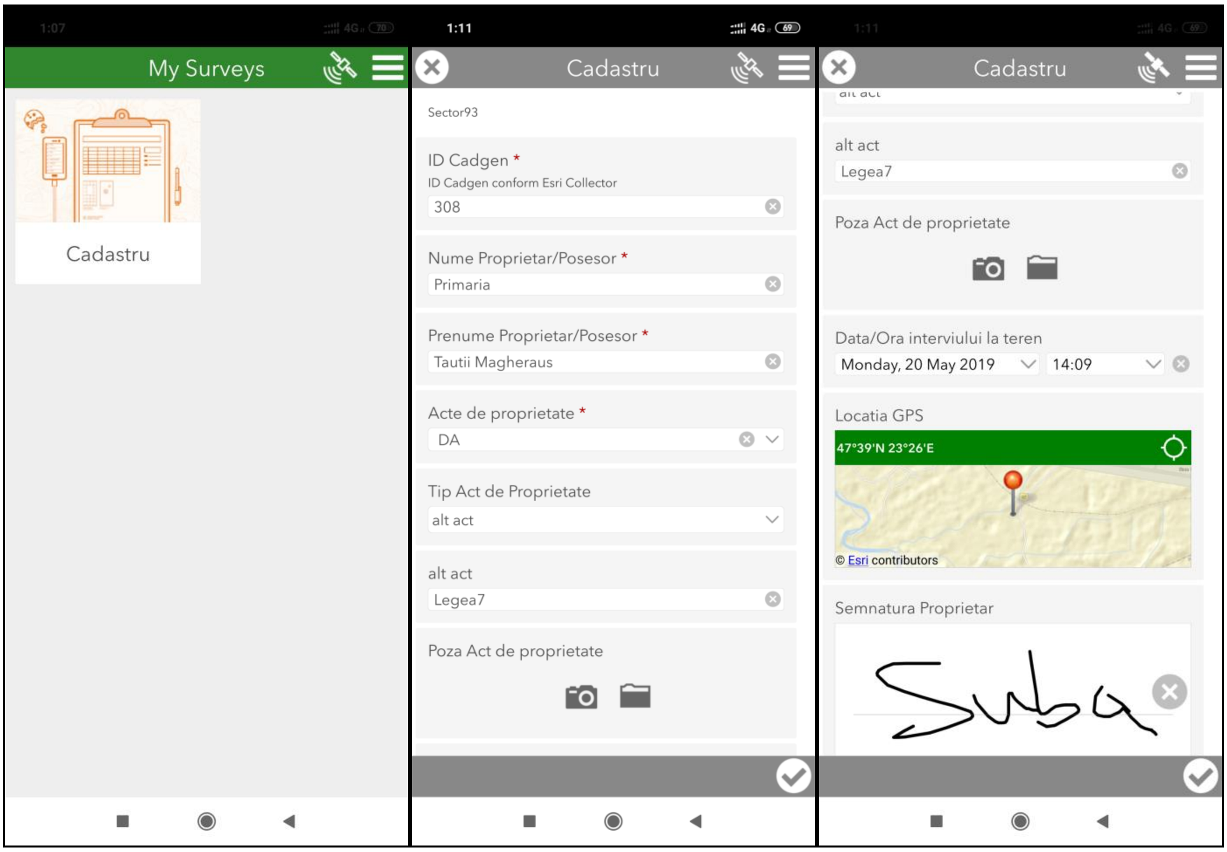

Image 3.18. Filling in the interview form in the survey123 mobile application

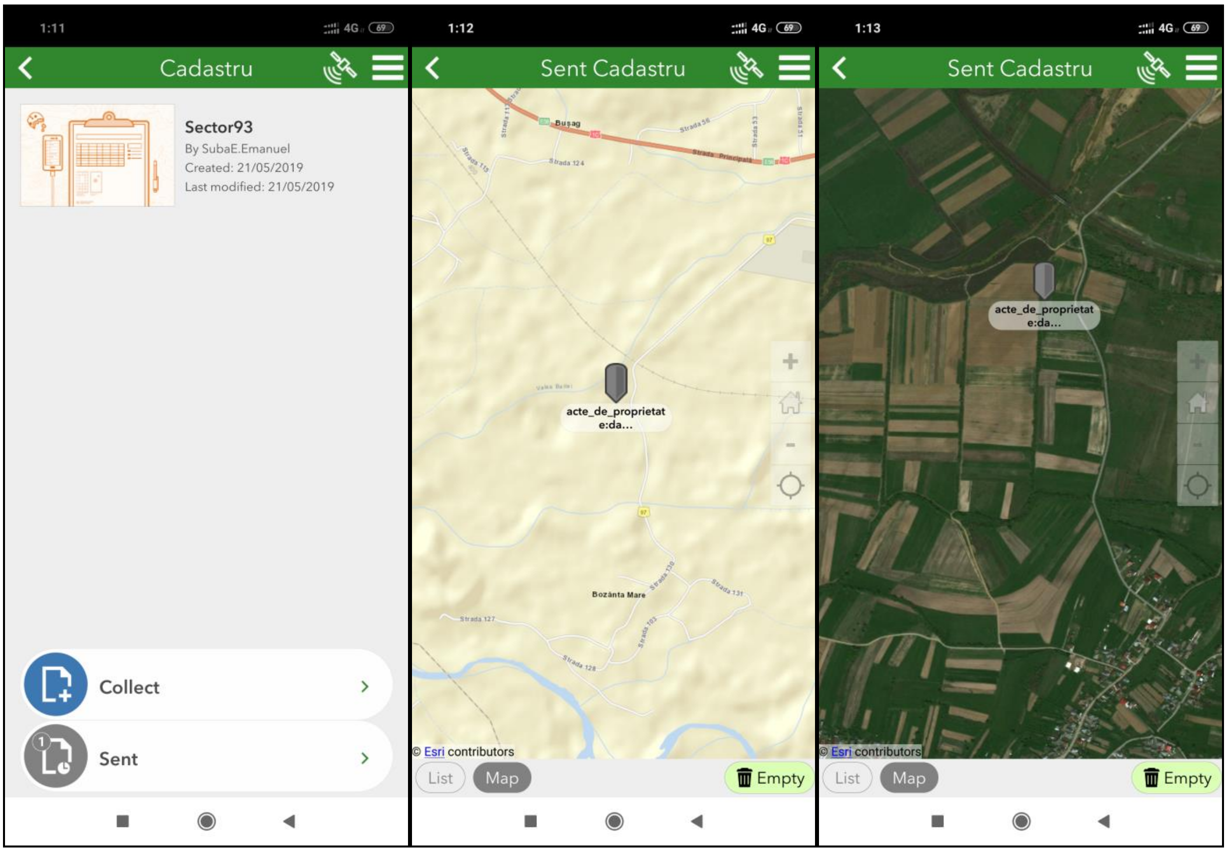

Image 3.19. Viewing the collected data and transmitting them

After collecting the field data, they can be viewed at the office, as shown in image 3.20. Also, having the data collected, the database is updated, thus generating the items necessary for the registration of properties in the real estate register.

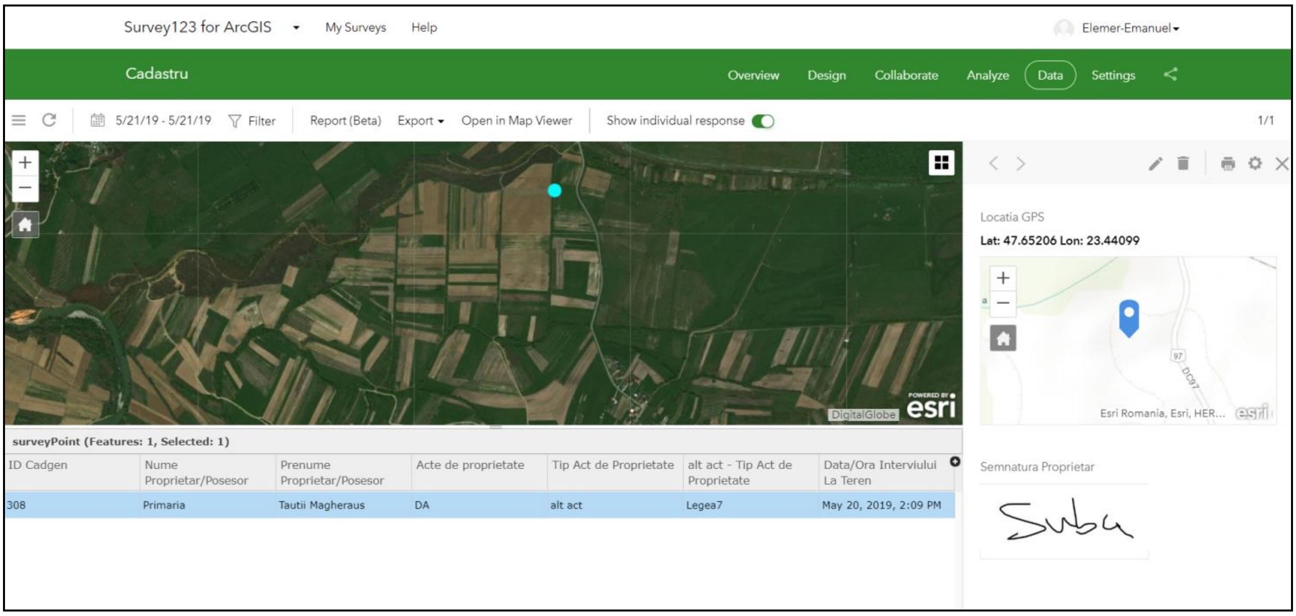

Image 3.20. Viewing the collected data

3.5. Preparing the cadastral plan and generating annexes

Having the data collected, on the occasion of the measurement campaign, respectively on the occasion of conducting the interviews on the field, it can be centralised, following to be integrated in the specific annexes of the systematic cadastre works. A specific application in this regard is CadGen, developed by the company TopoCom. This application allows the addition of textual items to vector data, and subsequently the generation of all necessary annexes deliveries to the general cadastre documentation, including *cgxml files. A first stage in the generation of annexes is the creation of polygons related to buildings, checking their surfaces and especially the elimination of possible overlaps. This is possible both in the gis environment, regarding the verification of the topology, and using the cadgen application. After the completion of the polygons, the cadastral plan is created, as can be seen in image 3.21, according to the specifications listed in the previous chapters.

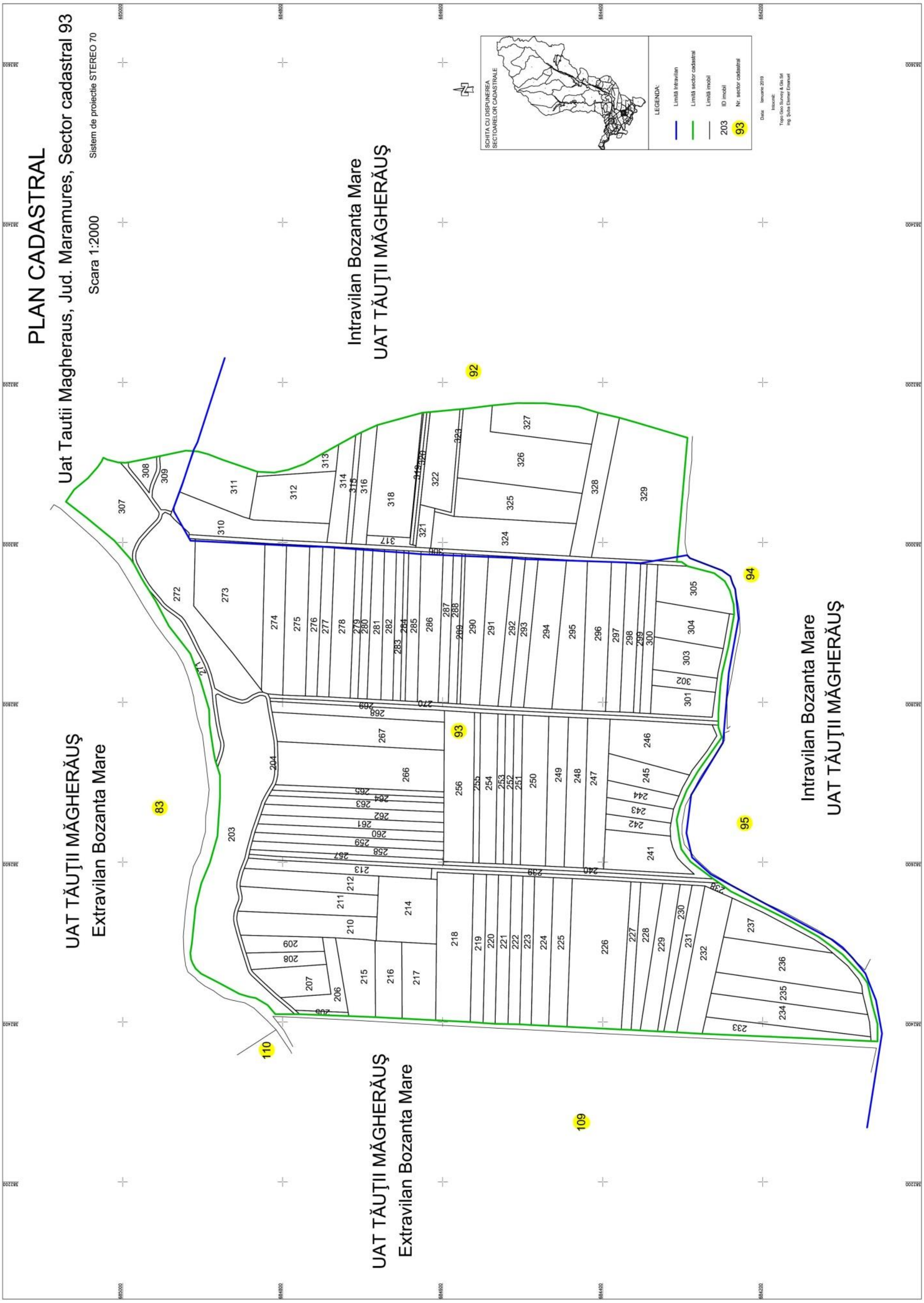

Image 3.21. Cadastral plan

For each property, the textual data from the database were imported into the CadGen application, later attaching it to the geometries. Images 3.22, 3.23 and 3.24 show the steps to follow in order to enter the data in cadence.

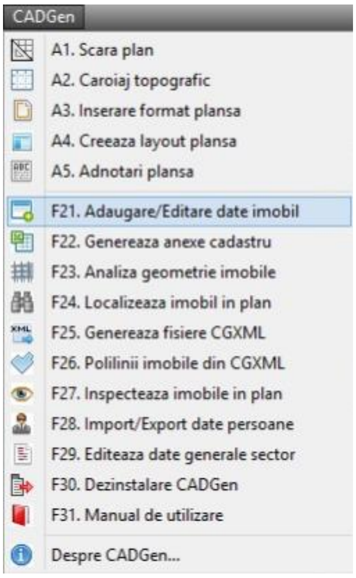

Image 3.22. CadGen application interface

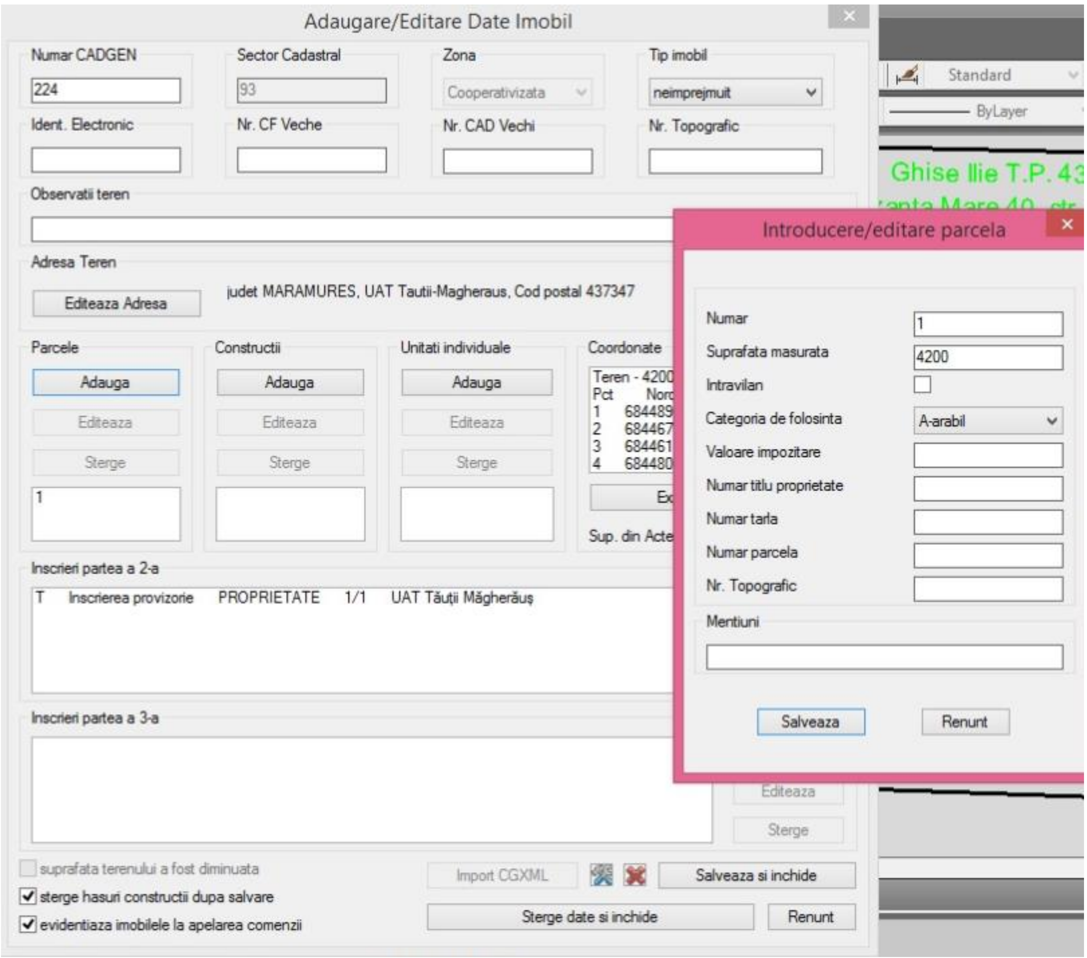

Image 3.23. Interface for adding/editing textual data

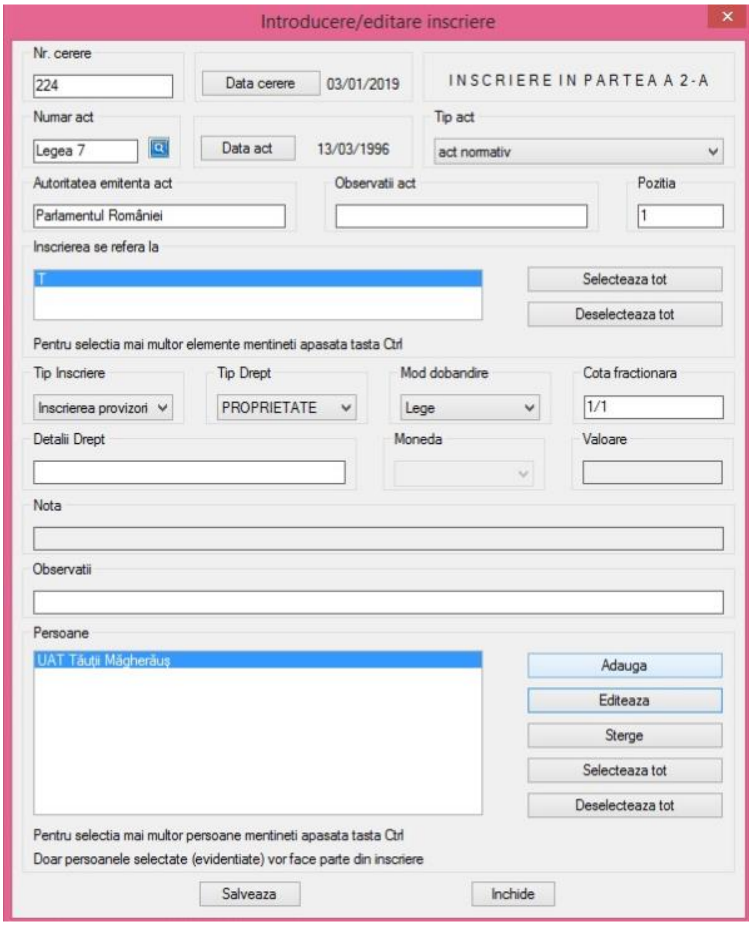

Image 3.24. Real Estate Register editing/entry interface

After entering the data and entries related to the property, the annexes can be generated, as can be seen in image 3.25

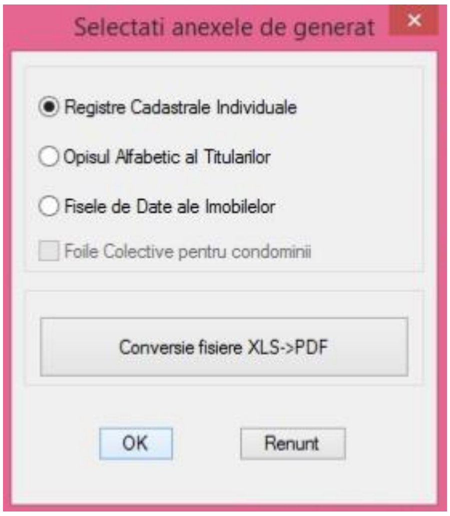

Image 3.25. CadGen annexes generation interface

These annexes are generated in eterra compatible format, thus having the possibility to upload them on the online platform. Images 3.26 and 3.27 show the data uploaded on the eterra3 platform.

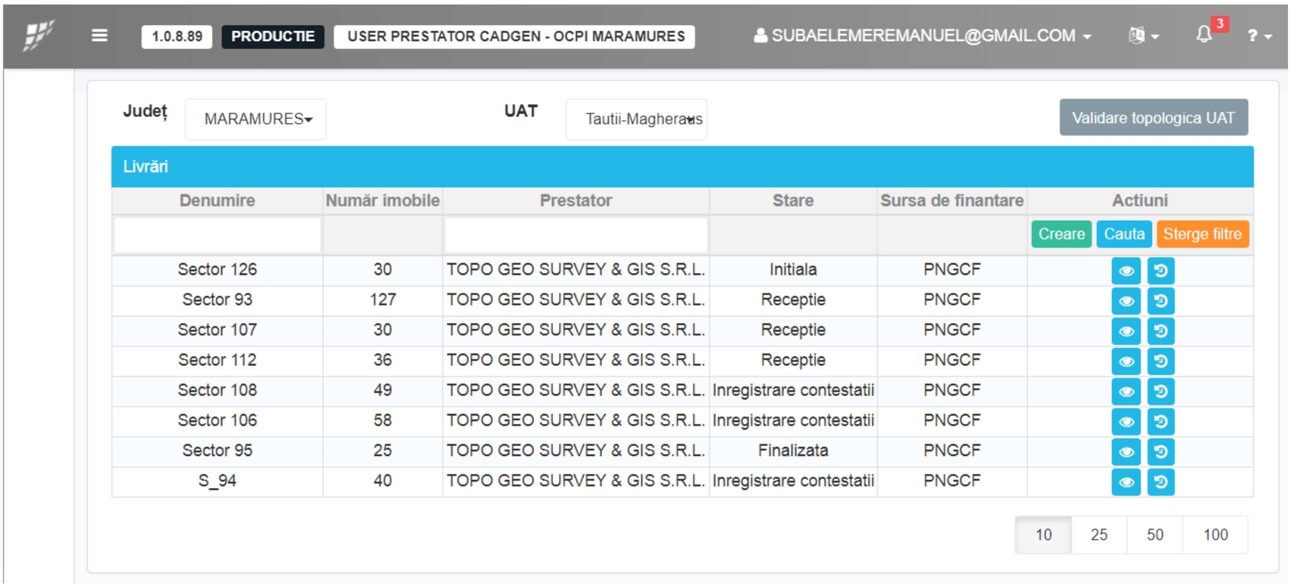

Image 3.26. List of deliverables uploaded on the eterra3 platform

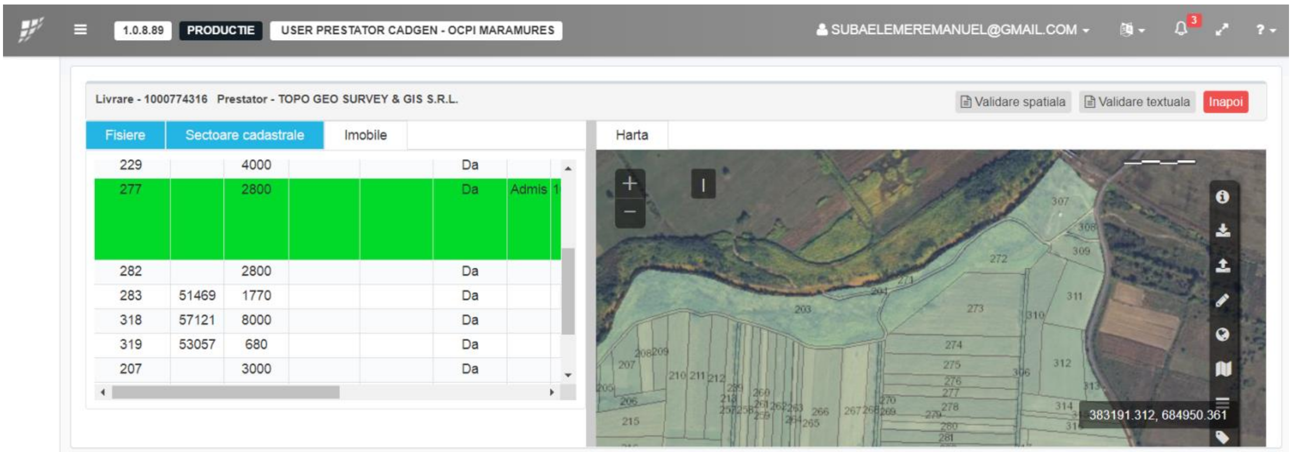

Image 3.27. The buildings that make up the cadastral sector 93 loaded in the eterra3

4. Conclusions, proposals, research perspectives

In conclusion, we can express the fact that the databases, respectively the GIS environment facilitate the optimisation of property records in the real estate register.

The new available and highly accessible applications make it possible to cadastre in a relatively short time and with a relatively high efficiency. The UAV photogrammetric technology for taking data from the field, combined with the GIS databases and the mobile applications presented make the cadastral operation look like a game.

Of course, there are shortcomings, such as the initial investment required, both for the purchase of the drone, a graphics station for processing photogrammetric data, but also auxiliary equipment, gadgets, etc. But the biggest problems of the cadastre are the lack of plot plans on certain areas and the chaotic restitution of land, factors that implicitly influence the accuracy of identification of properties based on the property documents submitted.

Given that law 18/1991 initially provided for the restitution of properties in the land, one after another depending on the applications submitted, without taking into account the old sites, practically the old situation of the real estate register was effectively completely ignored.

The major problems appear with the application of the provisions of law 247/2005, which allowed the submission of additional requests for restitution, especially for those holders, who, for various reasons, did not have the opportunity to request them within the terms of law 18/1991. This law provided for restitution, based on the proving documents, especially on the old sites, but due to the previous application of law 18/1991, which did not take into account the old sites, many situations of conflict arose, many of them not being resolved by the courts even today.

Many landowners present themselves to the identification of lands within the works of systematic cadastre with old extracts from the Real Estate Register and with validations of the land commission, but they lack the property titles, as they were not issued, the sites being occupied.

Also, another challenge in the works of systematic cadastre is the fact that, prior to 2004, 2005, even until 2007, property titles were registered on the old topographic numbers, respectively in the old Real Estate Register. These entries were made on the basis of the identification of topographic numbers by an ANCPI/OCPI representative, an identification that was most often made from the office, no measurements were made on the spot, which is why many areas in the Real Estate Register that are not found on the real location were erroneously registered.

Considering the low price per property established by ANCPI in order to finance the systematic cadastre works, the exploitation of the UAV technique, respectively the integration of both old and new data in a unitary database is a necessity.

As a research perspective, I propose to use modern technologies of measurement, processing and calculation, in order to carry out cadastral works in a much shorter time and in a more efficient way. I intend in the doctoral thesis entitled *‘Research on the computerisation of property registration in the Real Estate Register’* to address modern issues presented in the 3 research reports.

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