

GAUSSCAD – A WEBGIS APPLICATION FOR COLLECTING CADASTRAL DATA

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Abstract: *Starting with the National Programme of Cadastre and Land Registry 2015-2023, there is an ever-growing need to streamline the workflow of systematic cadastre works. GaussCAD application was born as a solution in the Geographic Information Systems domain, being an online tool that allows computerized integration for the procedures used in systematic cadastre: data collection for land plots, owners and possessors, importing and infilling GPS points, digitizing land plots and buildings, collecting relevant documents and saving field collected data on a server. The software runs both on tablet and desktop, having the possibility of being used as a real-time solution. The application shortens the time allocated for field data processing, having the potential to become an important innovation for the future development of cadastre in Romania.*

Keywords: *systematic cadastre, WebGIS application, workflow facilitation, WFS-T*

1. Introduction

The National Programme for Cadastre and Land Book (PNCCF) 2015-2023 was developed by the National Agency for Cadastre and Land Registration (ANCPI) for the systematic registration of all the land plots at national level in the integrated cadastre and land registry system¹. The systematic registration is realised in a process involving: public awareness campaigns; surveying all the land plots and buildings; the collection of ownership or possession documents; drafting, publication and rectification of cadastral documents; opening of land registry books².

In year 2016, 216 out of 3181 administrative-territorial units (ATUs) were being in working progress or had the contract signed³, and about 9 million out of approx. 40 million land plots have been included in the integrated information system⁴. ANCPI's plan is to steadily increase the yearly number of ATUs under systematic registration from 200 in 2017 to 560 in 2023⁵.

For such a tremendous workflow, the firms involved in this Programme need to speed up the procedures, so that the deadlines will be met. GaussCAD was developed as a solution for this problem, being a commercially available product.

¹ Government Decision No. 294/2015, Official Monitor of Romania, Part I, No. 309/6.V.2015, Art.2 (1)

² Ibid., Art.2 (2)

³ <http://www.ancpi.ro/pnccf/documente/pnccf-harta-stadiu-lucrari.pdf>

⁴ <http://www.ancpi.ro/pages/home.php>

⁵ http://www.ancpi.ro/pnccf/documente/Cadastru_prezentareMDRAP.pdf, slide 17

2. Software structure, data and procedures

The application structure was modelled based on the idea of integrating procedures for systematic cadastre. The implemented procedures can all be used online and onsite (by using a tablet), the fundamental ones being:

- Data collection for land plots and owners or possessors
- Importing and infilling GPS points
- Digitizing land plots and buildings
- Collecting relevant documents

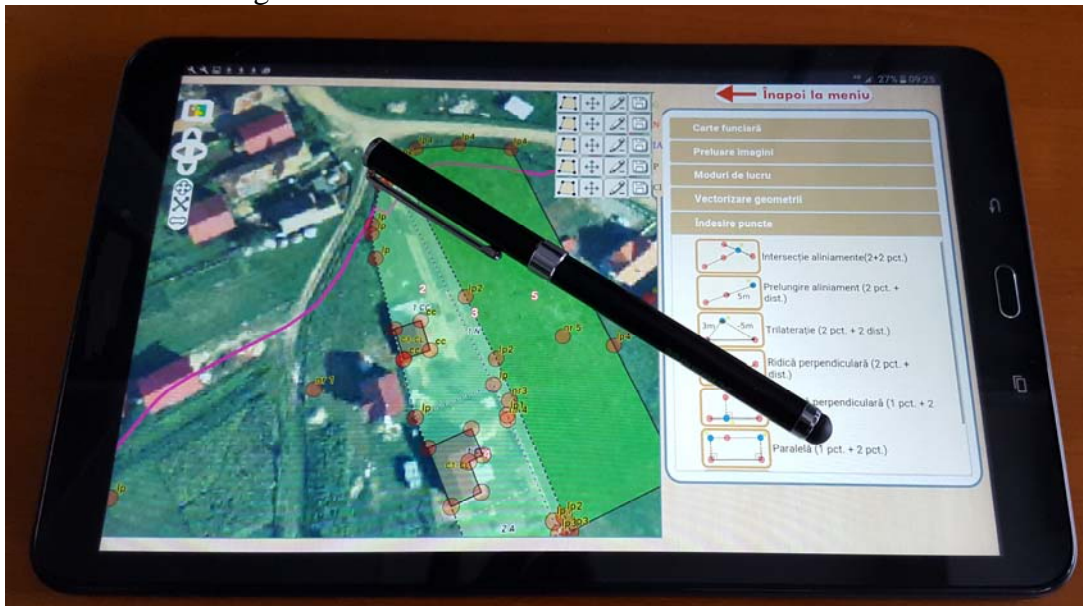


Fig. 1: GaussCAD is primarily developed for tablets (optionally handled with a stylus), but it can also be used on desktop

As an online application, the saved digitized features, containing the data collected for each land plot and building, together with the documents, will be immediately added on the server, enabling team colleagues, at office, to know, in near-real time, the field team’s work advance and benefit from it. The code behind the application gives the advantage of dealing with multiple ATUs at the same time, the indicator of the work destination and work type (field or office) being the ending of the application’s URL (e.g. www.cadastrfirm.com/GaussCAD?CommuneX!office).

The back end of GaussCAD consists of a web page, a folder system, an open-source database and an open-source server for layers. The latter contains the background layers of the application’s map (orthophoto and cadastral sectors) and links toward the editable layers (land plots and buildings), which are stored in the mentioned database.

The front end of the application is designed as a tablet application. Even though the primary destination of the solution are tablets (on-site works), GaussCAD can easily be used on desktops too. The initial opening frame consists of four buttons: *Proceed to application*, *User Guide*, *Developer* and *Thanks*. The main interface of the website is mainly divided in two unequal parts: the smaller right side, with the main menu and the bigger central and left side of GaussCAD, where the map, the forms and other panels are stacked.

The main menu is divided into five tabs: *Land Book*, *Image importer*, *Work modes*, *Digitization* and *Point Infilling*. The first two tabs refer to data collection and the last two to digitizing.

The screenshot shows the main interface of the GaussCAD application. On the left is a form titled "1. Imobil" with the subtitle "+++ Imobilul curent: 223 +++". The form contains several input fields and checkboxes for property details, such as "Număr imobil" (223), "Număr tarla" (25), "Număr parcelă/ Număr poștal" (84,85), "Suprafață acte mp" (190), "Suprafață măsurată mp" (188), "Număr topografic" (115/1/2), and "A fost cooperativizat?" (Da). There are also buttons for "Importă date dintr-un imobil aferent", "Salvare modificări", and "Șterge imobil din memorie". On the right is a main menu with a "Înapoi la meniu" button at the top. The menu items are: "Carte funciară", "Partea 1 - Imobil", "Partea 2 - Clădiri", "Partea 3 - Proprietar", "Partea 4 - Imobile aferente", "Preluare imagini", "Moduri de lucru", "Vectorizare geometrii", and "Îndesire puncte".

Fig. 2: The main interface showing the land plot form (defined as „Part 1 – Land Plot” in the menu) and the main menu in the right panel

The screenshot shows the "Preluare imagini" (Image Import) tab in the application. It features a "Înapoi la meniu" button at the top. Below the "Carte funciară" and "Preluare imagini" headers, there is a "Salvare modificări" button. The main section is titled "Imagini pentru imobilul 888" and includes a dropdown menu "Actele sunt pentru acest imobil". There are three sections for file uploads: "Câte acte? 1" with "Alege actul PDF nr. 1" and "Alege fișierul" buttons; "Alege schiță PDF:" with "Alege fișierul" and "Alege imagine JPG:" with "Alege fișierul" buttons. Each section has a corresponding "Aduagă" (Add) button. At the bottom, there are three menu items: "Moduri de lucru", "Vectorizare geometrii", and "Îndesire puncte".

Fig. 3: The image importer tab, allowing the user to insert (multiple) documents PDFs, sketch and plot images

The *Land Book* is structured into four forms (*Land Plot*, *Buildings*, *Owner* and *Attached Plots*), with data relevant to systematic cadastre. The *Image importer* allows the user to pick PDFs containing documents or plot sketches, from the tablet and export them to the server. It also allows the operator to take a photo (directly, with tablet) of the plot and adding it on the server.

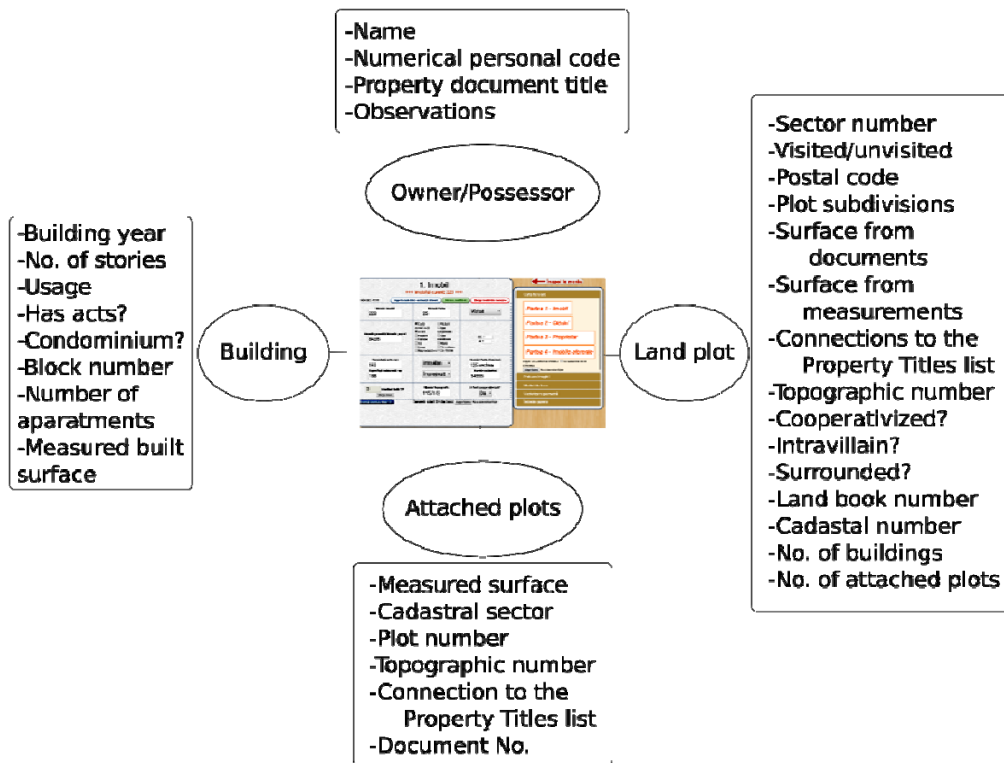


Fig. 4: Data fields in the four forms available in the application

The *Work Modes* tab contains the switcher between three working modes:

1. Navigation, digitizing and infilling points;
2. Distance and angle measurement;
3. Land plots and building data viewing.

The *Digitizing* tab contains a GPS-point importer, snapping options and other buttons regarding point generation (from existing polygons) and deletion.

The *Point Infilling* tab has seven functions that allow the user to create new points from existing GPS or polygon-derived points. They require the user to select the input points and optionally insert distances, resulting new, geometrically precise, points. The implemented functions are:

- alignment intersection
- alignment extension
- trilateration
- perpendicular raising
- perpendicular construction (from external point)
- parallel
- „circle” arc (with 8 sides)

The map has two control panels. The one in the upper-left side contains a layer switcher, four navigation buttons, zoom-in, zoom-out and zoom-to-max-extent buttons. The

control panel in the upper-right part of the maps displays four digitizing buttons (draw, edit, delete and save) for each of the layers on the map (visited land plots, unvisited land plots, attached land plots, land plot divisions, buildings).

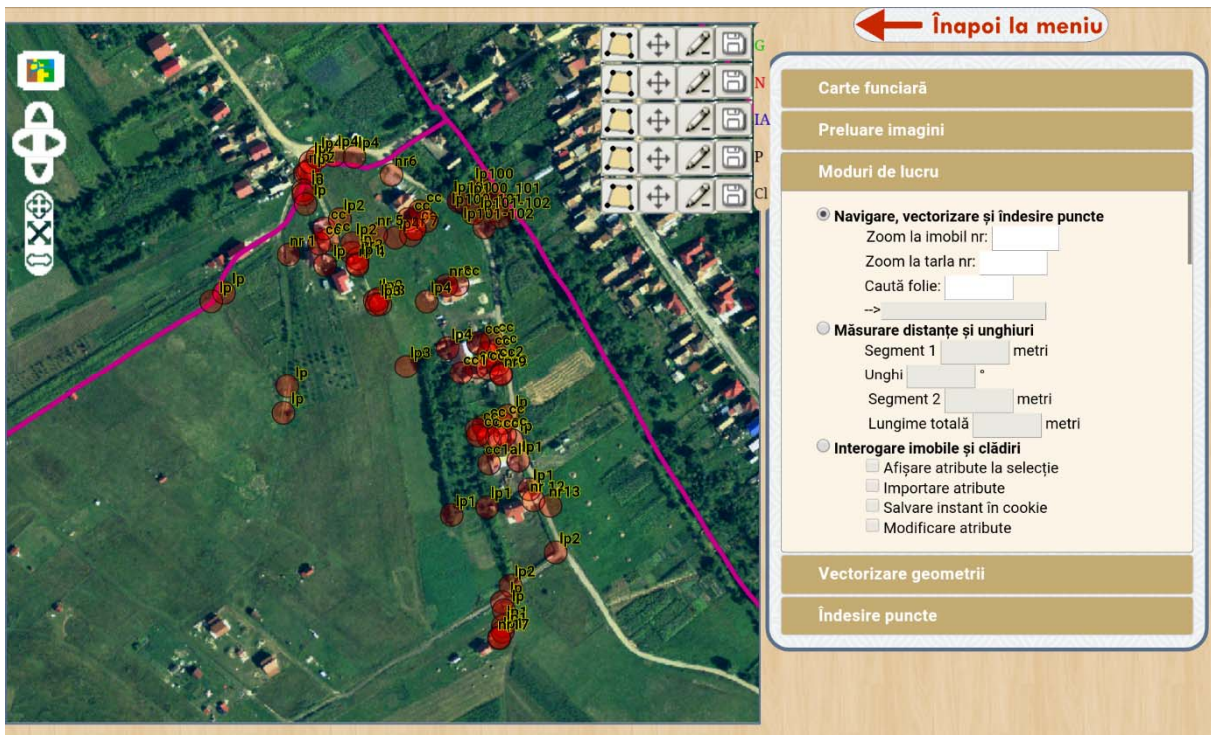


Fig. 5: The GPS points imported by Bluetooth from the high-precision GPS device

The data to be imported on the server-side before the project in an ATU starts needs to be in *ESRI Shapefile* format (for vectors) and in *TIFF* format (for rasters).

The optimal and ideal (field) work procedure is defined as following:

- A team consisting of two is going on field and starts surveying land plots.
- One of the team members takes GPS point of the land plot and buildings, using also a laser rangefinder for certain distances. He makes a sketch of each plot.
- The other team member interviews the landowner, completing the forms in the *Land Book* tab.
- He takes pictures of the documents and of the sketch using a PDF scanner application (like *Genius Scan*⁶) and exports them to the server.
- After multiple land plots, the first colleague sends the CSV-converted GPS job to the second's tablet using Bluetooth.
- He inserts the points on the map, infills the necessary points, based on the sketch, and digitizes the plots and buildings. He saves the work.
- The colleagues at the firm's headquarters can see the work done and use the data if needed.

⁶ <https://play.google.com/store/apps/details?id=com.thegrizzlylabs.geniusscan.free&hl=ro>

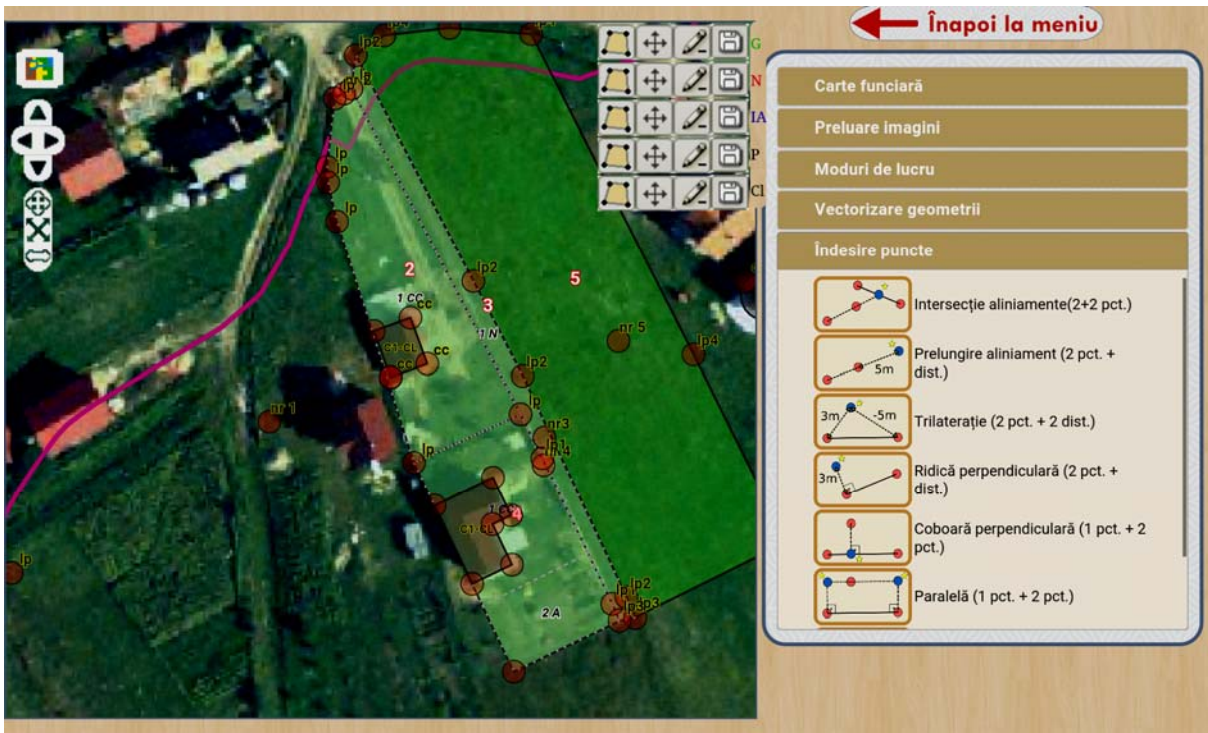


Fig. 6: The main interface showing the map with the imported GPS points and the digitized plots and buildings

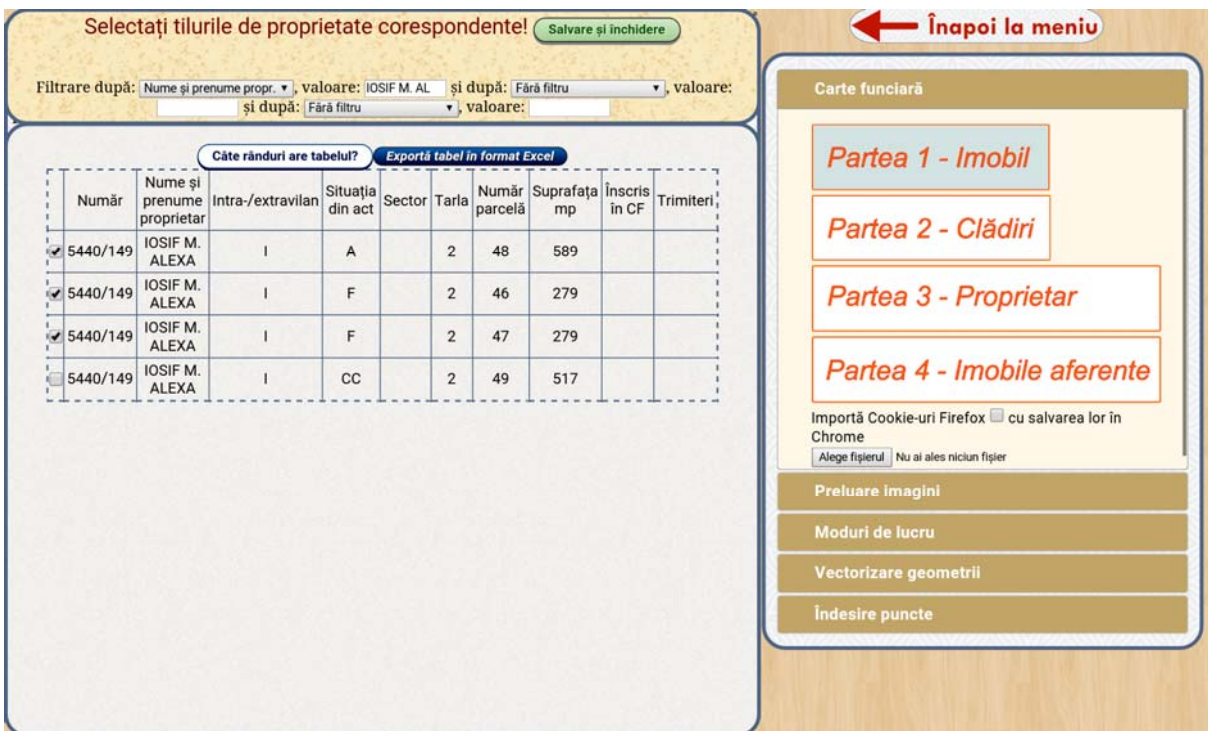


Fig. 7: The Property Titles selector allows the user to make connections between plots and rows from a Property Titles list. The selector can query the list by up to three parameters. It can also show just the rows that were already linked.



Fig. 8: After activating the selection mode, the user clicks on a plot or building and sees the information attached, besides the links toward the attached documents, sketch, and plot image.

3. Results

GaussCAD helps improving the workflow of cadastral works by:

- Making interviews, surveying land parcels and buildings and collecting documents;
- Building up the early database and populating it with documents and land owners data;
- Populating the database with the existing buildings data in order to obtain further necessary documents to be issued by the authority of the ATU, employed in the land registration process;
- Other data necessary to the process of collecting information about land plots and buildings.

4. Conclusion

The National Programme for Cadastre and Land Book 2015-2023 is a huge and crucial project that will further develop our Romanian society. It is a priority of the Romanian Government, the implementation of the Programme being vital for the national economical development⁷. The success of the project will be highly dependent on the capacity of firms to ease their procedures so that the deliverables are sent on time.

⁷ Government Decision of Urgency No. 35/2016, The Official Monitor of Romania, Part I, No. 489/30.VI.2016, introduction

GaussCAD is an application that successfully helps cadastre firms to speed up the workflow of systematic cadastre, offering tools that help creating a spatial database with geometries and information, and a document database, linked to the former. It also offers an interactive interface to spatially view all the information in the databases.

5. References

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