



AUTOMATION OF CADASTRE WORKS USING THE LISP PROGRAMMING LANGUAGE

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Abstract:

Time is a resource never enough or at hand in the most important moments, a resource that we are forced to rationalize. No matter how hard we try, the time itself will not be manageable, only the activities that are carried out in a certain period. Planning and staging the way of working is a method of ensuring control for the fulfilment of all tasks necessary to complete the general cadastre works, but also removing distractions from the objective, thus obtaining optimization at management level. The use of AutoCAD software for cadastre works has become more and more frequent with the passage of time, thus facilitating the development of new applications that can be loaded and used within the basic software. These applications are written using the AutoLISP programming language developed by Autodesk, which is derived from the LISP programming language. Knowing how to work to complete the general cadastre works, we can deduce the stages that can be automated within the AutoCAD software and develop applications according to the needs of each stage. This paper aims to use Visual Studio Code software to write and edit application code customized according to identified needs, but also by testing applications within AutoCAD software and presents how to work within a general cadastre project, carefully following each stage in order to automate them.

INTRODUCTION

For today's society, time has become one of the most important resources. Time costs, it is a value in itself. No one can afford to waste time (CUCOS, 2023). Superficial management or lack of management turns time, or rather, lack thereof, into the main stress factor and cause of various ailments, which lead to aging of the body long before its time. For this reason, time management highlights a vital issue both professionally and personally, constantly influencing quality of life (https://thewoman.ro). In this context, planning and staging the way of working is a method of optimizing time to accomplish all the tasks necessary to complete the general cadastre works, ultimately leading to time optimization and good quality management (https://learn.microsoft.com/ro). The existence of the general cadastre on administrative territories and the creation of related cadastral databases, as well as their assembly into cadastral databases at the level of counties and the entire country, requires time, funding, technical resources and cadastre specialists (OPREA ET ALL, 2013). Given that real estate transactions have intensified with the passage of time and land restitution, this has imposed a fairer record of real estate in terms of cadastre. The importance of the cadastre lies in the fact that through it are provided real information regarding real estate - position, size, use, owner - information necessary in all branches of the national economy.

MATERIAL AND METHODS

For carrying out general cadastre works, time is an essential factor where the approach to the way of working makes the difference in terms of its completion on time. That is why automation is an essential component in the execution process of cadastre works, implemented at each stage, we will know that the delivery deadline can be easier to meet due to reduced working times.

SOFTWARE APPLICATIONS USED:

- 1. LIPS, AutoLISP LISP, an acronym for LISP Processing, is a programming language that has been designed for easy manipulation of data strings. Developed in 1959 by John McCarthy, it is a language commonly used for programming artificial intelligence (AI). It is one of the oldest programming languages still in relatively wide use (GREEN, 2008).
2. AutoCAD AutoCAD is a computer-aided design (CAD) software developed by Autodesk Inc. California, USA. This software is used by designers from several fields, such as: mechanics, robotics, electronics, electromechanics, civil engineering, architecture, industrial design, etc. With a user-friendly interface rich in drawing and modeling tools, AutoCAD offers the possibility to realize detailed projects, both in 2D and 3D (https://www.itlearning.ro).
3. Visual Studio Code Visual Studio Code (https://code.visualstudio.com/) is a lightweight yet powerful source code editor that runs on the desktop and is available for Windows, MacOS, and Linux. It comes with built-in support for JavaScript, TypeScript and Node.js and has a rich ecosystem of extensions for other languages (such as C#, Java, Python, PHP and Go as well as runtimes (such as .NET and Unity). It allows you to expand your capacity through extensions. Visual Studio Code extensions can add more features to the overall experience, making it easier for programmers (https://docs.microsoft.com/).
4. Microsoft Office Excel Excel is a very powerful tool to extract meaning from large volumes of data. It also works very well for simple calculations and to keep track of almost any type of information. The key to harnessing your full potential is the grid of cells. Cells can contain numbers, text, or formulas. We can put the data into cells and group it into rows and columns. This will allow adding data, sorting and filtering, putting in tables and building great-looking charts.



Figure 1. Application code example written in AutoLISP programming language [source: Author]

1.3 The role of the selected stage

Because the generation of CGXML files will be done with the help of another software specialized in managing and populating databases (HERBEI & SALA, 2016) with the help of elements that can be inserted into DWG files, it is very important that the text insertion step in DWG is performed correctly. That is why we need the information from the created registry to be entered correctly on the specific layer, inside the assigned plot precisely so as not to mis populate the database that will be created in the next stage.

2. WORK STEPS FOR AUTOMATION

2.1. Understanding the problem

In order to be able to start planning the automation process of the text insertion stage in DWG, it is necessary to know the execution steps and understand the commands used in AutoCAD to achieve them.

The stage is carried out in the following way:

- Create layers, where we use the Layer command accompanied by the New Layer function to create all the necessary layers;
-Insert Text, where we use the Text command to insert a single line of text on the currently selected layer;
-Text alignment and positioning, where we use the Move command to move the text in the desired plot but also the Rotate command to rotate the text according to the orientation position of the plot.

2.2. Drawing up the automation plan

The automation plan (POPESCU ET ALL, 2016, SMULEAC ET AL, 2012) will be fragmented into two distinct parts:

- Development of automation plan, where we will specify the necessary functions to make automation possible;
-Development of automation plan solution, where the approach of an efficient automation solution will be presented;

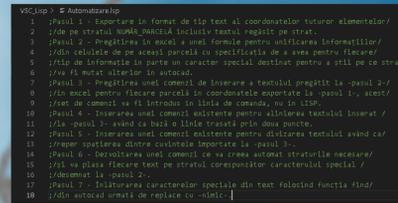


Figure 5. Automation plan commented [source: Author]

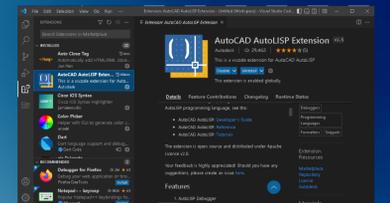


Figure 6. Visual Studio Code source code editing software [source: Author]



Figure 7. Exemplifying the use of comments [source: Author]

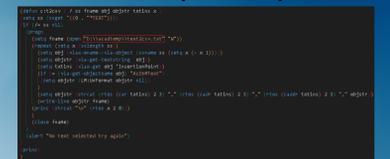


Figure 8. Value of the frame variable to be changed [source: Author]

Results AND DISCUSSIONS

1. IDENTIFICATION OF WORK STAGE WITH AUTOMATION POTENTIAL

1.1 Criteria required for automation

This paper presents the working method used on a general cadastre project closely following each stage, in order to determine the possibility of their automation. To achieve this, the following criteria will be taken into account:

- The degree of repeatability of the steps that make up the stage
- The difficulty of producing the stage manually
- Time needed to complete the manual stage
- Possibility of automation

Table with 10 columns: No., Nr. parţelă, Suprafaţa terenului, Categoriile terenurilor, Suprafaţa terenurilor, Suprafaţa terenurilor, Suprafaţa terenurilor, Suprafaţa terenurilor, Suprafaţa terenurilor, Suprafaţa terenurilor

Figure 2 Registry surface area 58/2 [source: Author]

1.2 Description of selected stage

The chosen step will be called text insertion in DWG, where we will take as an example parcel 58/2 within sector 16 of the Coşteiu territorial administrative unit, where the identification of the surface area and parcels was carried out and the information thus obtained was entered into Excel and saved under the name of parcel registry 58/2, as can be seen in figure 1.

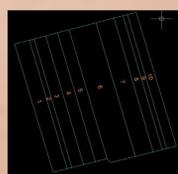


Figure 3. Surface area parcelling 58/2 [source: Author]

Table with 2 columns: Status, Name. Rows include CATEGORIE_DE_FOLIOSITATE, IMOBIL, NUMAR_CARTE_FUNCIARĂ, etc.

Figure 4. Layers created according to the registry [source: Author]

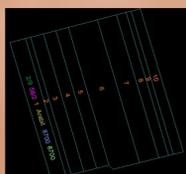


Figure 5. Manual input of information by layers [source: Author]

Table with 10 columns: No. parţelă, Suprafaţa terenului, Categoriile terenurilor, Suprafaţa terenurilor

Figure 12. Register of the surface area with the Concatenate formula applied for all plots [source: Author]

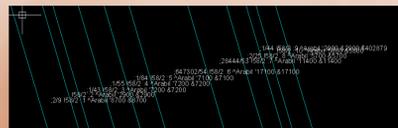


Figure 18. Text string with special characters inserted in DWG [source: Author]



Figure 19. Text aligned after plot outline [source: Author]

3.3 APPLICATION OF THE DEVELOPED AUTOMATION PLAN

After solving and developing the automation application, we will open the DWG in which a parcelled surface area is found, then load the .lsp file into AutoCAD using the APLOAD command, from where we will search for the AutoLISP application path and click on the Load button, then on the Close button, as can be seen in figure 14.

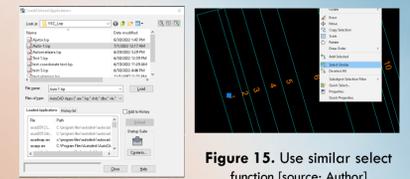


Figure 14. Loading AutoLISP function [source: Author]

Once the application has been loaded, the steps will be followed as planned:

- Step 1 - Select all elements on the NRPARCELATP layer using the select function and use the EXPORTCSV command according to figure 15.
Step 2 - In the surface area register, apply the formula CONCATENATE written to the usage part of Microsoft Excel to unify all the information on the row of each parcel.
Step 3 - Delete all text elements from DWG, then open the file exported in step 1, figure 16, to correctly write the coordinates necessary to insert the text obtained in step 2 inside the plots but also the Excel file with the formula for completing the text insertion command, figure 17, and copy and paste directly into AutoCAD as can be seen in figure 18. Step 5 - The t2w command will be used to divide the text string by the space between words.
Step 6 - To change the layer of each text that was separated in step 5, the ExchangeLayer command will be used, which will have the role of doing this automatically.
Step 7 - After we have successfully completed step 6, the find and replace function will be used for special characters, in DWG only the information from the surface area register remains, as can be seen in figure 20.

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CONCLUSIONS

At this point, we can say about the implementation of automation that it is a process that can consume more time than performing the stage of inserting text into DWG manually, but after materializing the automation plan, it can be used for countless projects, gaining time when automation is applied to an entire cadastral sector.



For a small surface area, the time required to implement the developed automation plan may be similar to the time to achieve it manually, but as the number of plots increases, the implementation time of the automation plan will be lower compared to that of performing the manual stage.

Another important aspect to mention is that this automation plan is not complete, it can be constantly improved with new ideas, but only if it is applied constantly you will be able to notice those small details that can bring extra time saved in the execution of that stage.

By resuming the resolution plan, we can also observe other ways of approaching the current solution and reach a faster improvement than if we observed the way the plan works in execution.