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USING GIS FACILITIES IN ORDER TO MAINTAIN EVIDENCE OF PROPERTIES

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Abstract

The Earth, through his specific characteristics - immobile, indestructible, limited and perceptible for everyone - it's fundamentally different from the rest of goods required to meet the basic needs of individuals, and by his nature he is necessary for basic needs of human being, providing food and housing. For the state, the land is one of the safest sources of income through "land tax". For this reason, ever since the states, their leaders paid particular attention to land inventory and registration in public registers of holders of rights and legal relationships

Key words*: GIS, GPS, GNSS, RTK, STOP&GO, MAPSYS, INTERGRAPH, ACCESS, TIFF, DWG, DXF.*

INTRODUCTION

Nowadays, many local government institutions are increasingly concerned to achieve geographical information systems (G.I.S.). This interest came in front because a lot of the decisions taken at the local government level, requires spatial reference information.

Many institutions of transport, design, public services, emergency services, insurance, environmental protection and, of course, institutions of record of property and urban networks can benefit from an integrated and automatized system of computer records.

But a GIS is not implemented by simply purchasing programs and data processing equipment. These and many other system components must be made in accordance to the needs and specific activities of a particular institution.

To determine what functions must the system meet, which data must be entered in the database thereof, which are the procedures for processing and accessing these data and which will be the formats and data types exported, purpose of seeking the implementation of the system must be defined correctly and full.

This paper describes the stages of projecting design and implementation of a geographic information system (GIS) which aims to introduce and maintain general cadastre.

Initially, the client of the project, wanted to finalize the operations of establishing the rights of private property on land.

To complete documentation of livery agricultural land situated in the administrative territory of "Sinca Veche" village, we have taken the following steps:

1. Delimitation of the territorial administrative unit - including setting urban limits;
2. Delimitation of special purpose lands (SPL);
3. Delimitation of land belonging to the public people;
4. Updating existing topographic and cadastral plans (recovery of parcelling plans);
5. Identifying the land's categories of use;
6. Identifying the owners;
7. Restoration of cadastral numbering;
8. Calculating the surfaces in and between urban areas;
9. Preparing property bodies's sheets;
10. Preparation of technical documents (of the general cadastre):

- cadastral register of land plots;
- alphabetic index of owners and their residence;
- cadastral register of owners;
- register of property bodies;
- Centralizing sheet, cadastral parcels by owners and categories of use;
- Cadastral plan.

And finally:

11. Drawing plans of parcels, reports of livery and sketches of site.

MATERIALS AND METHODS

GEOGRAPHICAL LOCATION AND GENERAL ASPECTS OF THE AREA

"Sinca Veche" village is located in centre of Brasov County in the south-east extreme of Fagaras area. Administrative territory of the village stretches from "Persani" mountains, in the north and east sides, through the Fagaras Mountains, in the south, with a wide opening to Fagaras depression in the west side. (Figure 1)

Figure 1. Geographical location of "Sinca Veche"

The commune's territory consists of hills crossed by numerous rivers of which the most important one is "Şinca" River, an affluent of Olt River. In the mountain area are districts of forest consisting mainly of beech and mixed beech and resinous. Mountains have an average height, the most imposing one being "Taga" massive with a height of 1648 m.

"Sinca" village has a population of 3575 inhabitants, distributed in six villages: Şinca Veche, Valcea, Ohaba, Şercaita, Bucium and Persani, in 1408 houses and 1299 households, on a total area of 18059.95 hectares, of which:

Build-up area: …….293,90 ha

Outside build-up area: 17766,05 ha

By categories of use:

- Agricultural ……..3345,18 ha
- Non-agricultural …743,38 ha
- Pasture ……2541,45 ha
- Hay …….2961,29 ha
- Forest ……..8131,40 ha

LEGISLATIVE CONTENT

In making this piece of work, involving the realization of technical documentation, necessary for reconstitution or establishment of property right and maintenance of property records, have been respected the following laws:

- Land Law no. 18 of February 19, 1991;
- Law 1/2000;
- Law of cadastre and real estate advertising No.7 / 1996;
- Law 247/2005 and the law of technical standards and implementing regulations of these laws.

PROJECT'S STRUCTURE AND INFORMATION RELATING TO GIS

G.I.S is a set of informational flow streams organized into a unitary concept. It is getting input processes, which it processes and provides outputs. The inputs and outputs of an information system are data, information and decisions.

A GIS is a system consisting of three interconnected components, each one being equally important and necessary. These components are:

- Spatial data;
- Software / hardware tools;
- Specific studied goal or problem.

Creating a GIS is a problem linked to:

- Establishing the clear purpose for achieving the system;
- Identification of the types of data that must be included;
- Defining the specific functions that must be fulfilled;
- Creating graphic and non-graphic databases;
- Developing or obtaining capabilities of obtaining information;
- Selecting and implementing of software and hardware appropriate making changes to procedural, organizational and personnel required for successful use and operation of the system.

In this way, knowledge of how the system will be used will be the basis of determining the procedures by which the information will be stored in the system and what additional technical, organizational and legal resources will be required to allow the use of information. Actually, there is already a hierarchy of functions and activities of each department, of how they determine necessary data and procedures by which the data will be processed to fulfil these functions.
Data and how they will be processed, in their turn, helps to determine the necessary hardware and software, which, in their turn, will have a major impact on staff and its training for maintenance and operating the system.

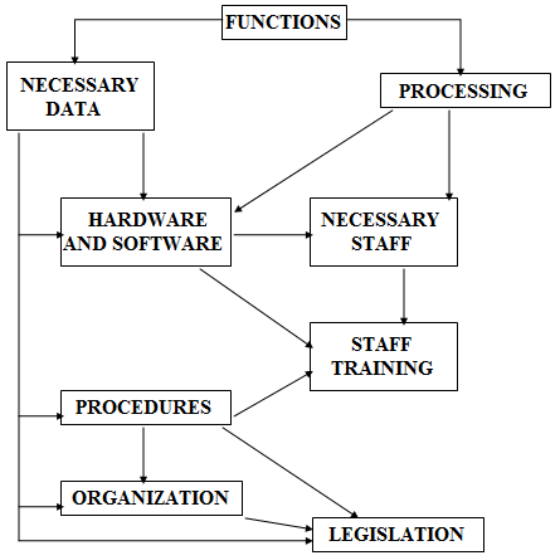

Figure 2. Scheme of hierarchical process

DOCUMENTATION BY CONSULTING MAPS AND TOPOGRAPHICAL PLANS

In the initial stage, we have achieved the following:

- have identified the geographical administrative order of studied territory;
- analysed topographic and cadastral documentation previously prepared and have been selected the materials that may be used in this paper;
- materials provided by the client were the following:
  - "Sheets of possession" made in the 50s;
  - Sketches of lots made on the basis of "Sheets of possession";
  - an agricultural register - for the years 1959 - 1973;
  - a validated annexes to the Land Law, from the Law 18/1991 to the Law 247/2005;
  - At the request of a contractor of the project, was also viewed the Land Register (lagarbuch) from 1932, and sketches of lots annexes.
- were purchased, from the National Geodetic Fund and OCPI Brasov, cadastral plans at 1:20000 scale, topographic plans at 1: 5000 scale (Figure 3) and georeferenced digital photographs (orthophotomap) (Figure 4) for the identified geographical area;
- on these graphic materials were identified: administrative boundaries of the studied area, limits of the buildable area, limits of surfaces with special purpose, geodetic points from the national reference network (Figure 5), channels of communication, waterways, etc.

Figure 3. Topographic plan

Figure 4. Orthophotomap

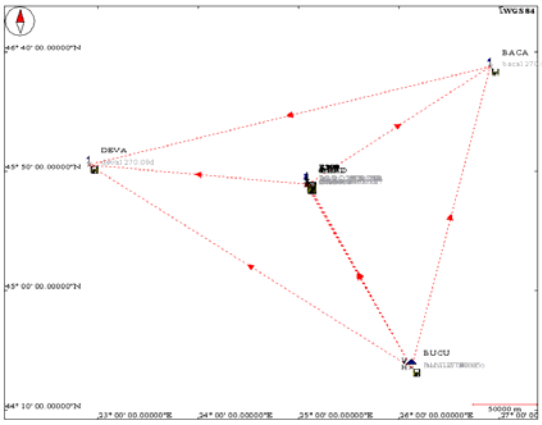

Figure 5. Geodetic points from the national reference network

TYPES OF TOPOGRAPHIC, GEODETIC AND INFORMATIC USED EQUIPMENTS

Execution technical solutions chosen for implementation of this work are:

- measurements are made with GPS equipment from "survey-mapping" precision class, namely:
  - Trimble 4600LS receiver (for-GRAD - pole of lifting network)
  - receiving terminals for collecting descriptive information (GIS type):
  - Trimble PRO XR TDC1 collector;
  - Thales PROMARK3 with incorporated terminal.
- GPS data processing is performed with:
  - GPSURVEY (Trimble) - support and lifting networks;
  - GNSS and MOBILE MAPPER OFFICE for radiated points (determined by "stop & go" or "real-time" measurement types.
  - Personal applications for a transformation of coordinates in national reference coordinate system.
- graphical data processing is done with the following programs:
  - MOBILE MAPPER OFFICE;
  - INTERGRAPH Civil Office - for importing data from GPS applications,
  - INTERGRAPH Iras Iras-B and Iras-C - for processing digital aerial photographs and scanned plans;
  - INTERGRAPH - Parcel Vec and Geo Vec for vectorization of images (where necessary);
  - MAPSYS - for processing in terms of cadastre (lots, cadastral numbering, etc.)
  - Database applications.

For network points of support / lift, measurements were performed using the static method, and method for lifting topographic details, STOP & GO and RTK methods.

RESULTS AND DISCUSSIONS

DATA PROCESSING AND STORAGE

Cadastral measurements are the technical basis of cadastre, representing the biggest part of topographic measurements. These measurements should contribute to establishing the boundaries of properties, while providing the necessary data for graphic representation of properties and determine their areas.

To introduce the general cadastre in an administrative territory, is necessary to wade through, in a mandatory sequence, some certain stages of works whose complexity and volume are established according to the following situations:

- age and quality of topographic plans that exist in the area and the condition, in the pitch, of the geodetic network points markings;
- quality and age of documentation about oldersystems for recording lots (land registration, land cadastre, real estate cadastre);
- size and category of use of the total surface of the land;
- density of topographic details, etc.

The sequence of these steps is shown in Table 1, the structure of which is as follows:

- Nr. order = serial number of stage of works;
- Phases of work = description of work's phase;
- Entries = type of works or other mentions;

Table 1 - Sequences of topographic-cadastral works

Order number	Sequences of works
1	Drafting the technical project for the entire job, based on analyzes of existing documentation and and territory's size and complexity.
2	Cadastral delimitation and marking cadastral administrative territory borders with terminals, perimeters of build-up areas and other destinations which occupy large areas of land.
3	By case determination of geodetic points for providing the support network, necessary for locating photogrammetric surveying.
4	Field measurements for preparation of new topographical and cadastral plans or updating those obtained by selecting and extracting content from other types of plans.
5	Calculations for stages 3 and 4 (if necessary).
6	Execution of land originals (compilation) on the basis of new measurements or by derivation from basic topographic plan of the country.
7	Identifying the property owners on the field and land's categories of use.
8	The cadastral numbering and equipping topographic plans with symbols of updated categories of use.
9	Surface calculation.
10	Uploading data files and organizing the general cadaster database for the administrative territory.
11	Writing cadastral records by automatic data processing devices and data output listing devices.
12	Mapping and editing (basic scale) cadastral plans and multiplication in the number of copies required for users.
13	Mapping and editing the overall cadastral plan of the whole administrative territory (smaller scale than the basic cadastral plan) and multiplying in the number of copies required.

Considering the quality of topographic and cadastral existing plans, from step 4 described in Table 1, came off two categories of works:

a) For the areas in which was ascertained the need of topographical surveys in order to update cadastral plans, or, if there are some previous surveys, useful for the system, will be performed the following:

- Making networks of support and thickening for studied areas;
- Identifying new or modified details;
- Execution of the topographic and geodetic measurements, necessary to determine coordinates of new detail points;
- Processing data resulted of surveying and preparing them for introducing into the system;
- Introduction in the system, by categories and layers, of elements measured in the field. Verification and validation of graphical and non-graphical data and the links between them;
- Verification and introduction in the system of any previous measurements;

b) For areas where it was found during the phase of projecting the system that cadastral and topographic plans correspond to the situation in the ground, will be performed next operations:

- The distribution of digital model in drawing files corresponding totopographic and cadastral plan sections;
- Scanning and plugging topographic and cadastral plans that match the area where are made measurements into the system. Checking raster files;
- Manual or automatic introduction, in database tables, of alphanumeric information associated to graphic details contained by topographic and cadastral plans;
- Indexing database's tables and defining relationships between them;
- Defining procedures of interrogating the system;
- Generate numeral reports and printed documentation (result of graphic and non-graphic queries).

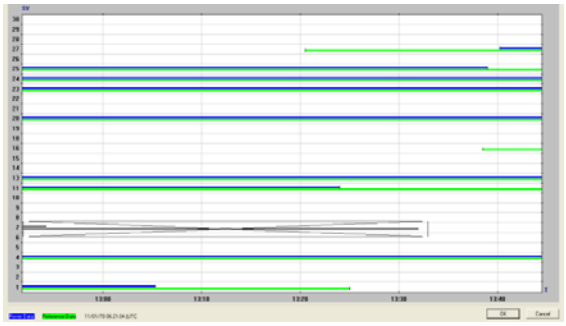

Figure 6. Processing of GPS measurements

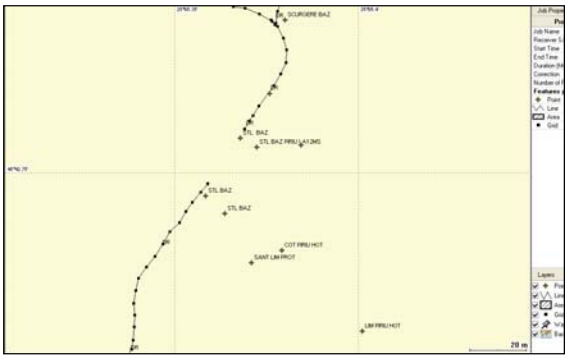

Figure 7. Automatic creation of digital model

DRAWING PLANS AND DIGITAL MAPS

As previously stated, in a GIS can be found two broad categories of data: graphical and non-graphical data.
The graphic data are digital descriptions (computerized) of images and elements of detail shown on plans and maps.
The images and topographical detail elements are converted to digital format by determining (measuring) 2D coordinates of their positions in a known projection system. Using this data, system will generate digital plans that will be displayed on the computer screen or printed on a printer or a plotter.
Graphic data can be obtained by various methods:

- Digitizing from sheets of maps and plans;
- Scanning plans and then vectorization of resulted raster image;
- Photogrammetry;
- Topographic surveying;
- Measurements with GPS technology - (Global Positioning System)

Depending on their origin, graphical data can be:
Raster files resulted by scanning:

- Satellite images;
- Old plans and maps;
- Schemes and other drawings;
- Photos of studied objects.

Files with vector representation (digital model of terrain), resulting from:

- Vectorization of scanned images;
- Digitizing old plans;
- Processing topographic surveys.

Non-graphic data from a GIS are generally tabular data. They are recorded in the database in the form of alphanumeric characters and codes that describe the characteristics of different topographic details and other associated entities of them.
Tabular data can be:
identification data (legal, administrative or geographical);
data that define parcels (indexes, descriptions, etc.);
Specific data of software application system (functions, primary data).
Basic identifiers of a geographic information system are usually the address of property and parcel identifier, and join, in the digital terrain model, the centroids of surfaces (gravitational centers of surfaces).
Address of real estate defines the geographical position of the lot towards street network. This link is usually provided through the cadastral index plan.
Parcel identifier can be:
an index automatically generated by the system;
postal parcel's number;
topographic number of the parcel (if assigned);
cadastral number of the plot (if they have completed general cadastre works in the studied area).
Non-graphical data can be extracted from:
- Field notepads;
- Files of object identification (ex. Real estate file, artery file, etc.);
- Cadastral registers;
- Nomenclatures, etc.;
- Document files (* .doc, * .txt, * .dat, etc.);
- Tabular files (* .xls);
- Databases of textual data, created in ACCESS, INFORMIX, ORACLE, etc.

Digital files format differs depending on the programs CAD or GIS solutions used to create a digital terrain model.
Thus, graphical data that will be integrated into the system it is advisable to have one of the following standard formats of digital files:
• TIFF, JPEG, BMP, etc. - Raster files with standard formats, usable in most applications CAD / CAM / GIS, that can be used into the system as reference information (history), or will be vectorised in order to create a digital model;
• DXF, DWG - files containing vector elements, usable in CAD / CAM / GIS products of Autodesk, Bentley, Intergraph, ESRI, Microsoft, etc ;
• DGN - digital files specific of CAD / CAM / GIS programs made by Bentley, Intergraphand Microsoft.

CREATING GIS DATABASE

Methods of inputting data into the information system are directly dependent on the source of the data.

Applying the technical functions of the system can modify the organizational conditions regarding the training of personnel, structure of departments and tasks of constitutive services.
Once the functions that must meet system have been set must be established technological flow of takeover, processing and data maintenance. The following figure reflects a general pattern of technological flow.
For each stage of data processing, must be mandatory to achieve their validation in accordance with the law, the functions that must meet the system and the structure.

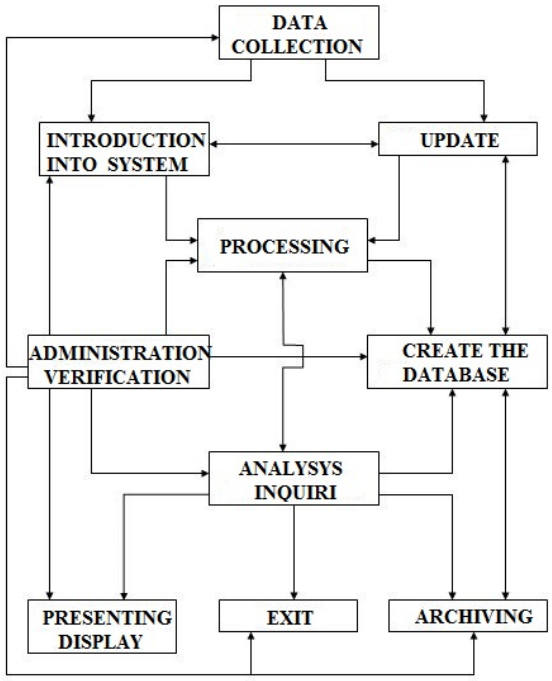

Figure 8. Data flow in a GIS

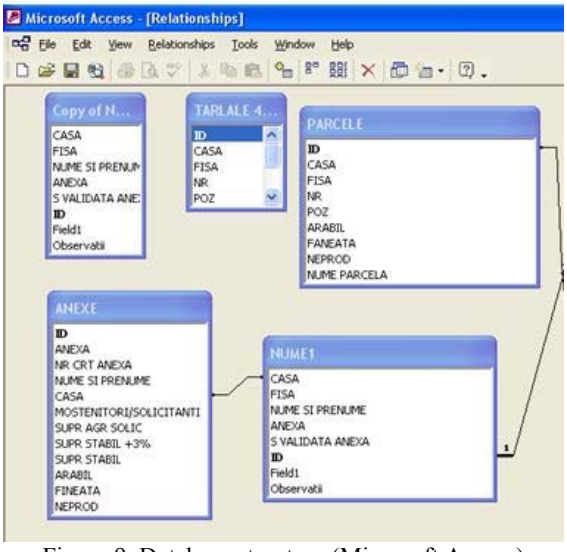

Figure 9. Database structure (Microsoft Access)

Management functions of the database are:
The association of attributes to the graphic details;
Facilities of introducing information referring on data quality;
Facilities recording the number of data's rows;
Facilities of tracking transactions or updates;
Access to attribute type data:
- directly - through attribute's identifier
- directly - by selecting geographic detail;
- Via a relational "key";
- through natural language or SQL instructions
Creating, displaying and manipulating complex data functions;
Operations in the database:
- sort tabular or graphical files according to attributes or locations;
- calculating new values through arithmetic or logic expressions;
- binding ("link") data files by common small identifiers;
- defining the rules governing the component elements of data;
- creating, storing, reconstituting and generating standard reports;
Generating status reports of database and system;
The ability to add files without being necessary to size or scale;
System security features:
- access password protection;
- selecting the "read only" access or "read write" for different users;
Computer network operations:
- access to common data files in the file server;
- procedures to verify the data input / output;
Geographic data automation functions are:
Manual digitization of bi-dimensional data like dot, line, or polygon;
Automatic "Bonding" ("snap-to") to previously digitized detail;
Incorporate photogrammetric digitized data;
Methods to determine geometric coordinates:
- tracing lines, angles and curves;
- Linear intersections (create "nodes")
- Bisecting angles, determining tangents;
Association functions of attributes are:
Associating attributes of topographic details;
Setting attributes;

Check on the attributes
Verifying the format of attributes;

CREATING THEMATIC MAPS AND INQUIRY OF DATA
Were made different types of thematic maps which show, for example:
situation of land by categories of use (Figure. 10);
lands belonging to the same owner; (property body, cadastral match, etc.);
lands belonging to public domain;
special purpose lands;

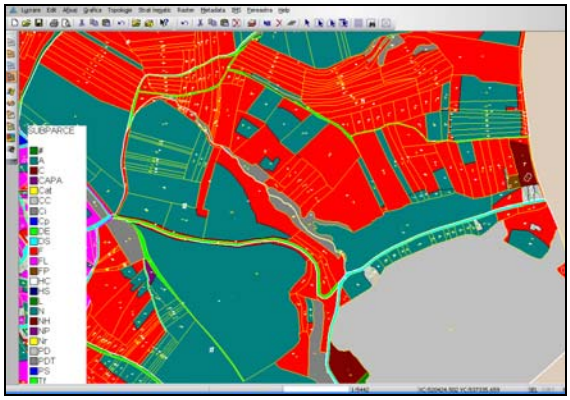

Figure 10. Situation of land by categories of use

For viewing, enquiring, but also modifying or supplementing nongraphic and graphic database were created following reports and interfaces ("forms"):
1. Tabular reports generated solely from the nongraphic database that comply with technical norms for introducing general cadastre:

- APPENDIX 4.6.1 - Sheet of body ownership;
- APPENDIX 4.6.2 - Cadastral register of parcels;
- APPENDIX 4.6.3 - Alphabetical index of owners and their residence;
- APPENDIX 4.6.4 - Cadastral register of owners;
- APPENDIX 4.6.5 - Register of property bodies;
- APPENDIX 4.6.6 - Centralizing sheet of cadastral matches by owners and by categories of use;

And other reports required for the project, created by the author of this paper:

- APPENDIX 4.6.7. - Centralizing the surfaces from (validated) appendixes on property laws (Figure 11);
- APPENDIX 4.6.8. - Report containing the original data extracted from old sheets possession (Figure 12);

ANEXE VALIDATE

NUME SI PRENUME	CIRSTEA ELENA						CASA
ANEXA	NR CRT	MOSTENITORI/SOLICITANTI	SUPR AGR SOLIC	SUPR ARABIL	ARABIL	FINEATA	NEPROD	6
22	76	CIRSTEA ELENA	5.09	0.15	0	0	0	
2A	48		5.09	4.79	3.4	1.39	0	
		Suma	10.18	4.94	3.4	1.39	0	S+N 4.94

Figure 11. Appendix 4.6.7

TABEL CENTRALIZATOR - DIFERENTE ANEXE - FISE DE POSESIE

CASA	TOTAL CASA DIN ANEXE	TOTAL CASA DIN FISE	DIFERENTA ANEXE - FISE
6	494	493	1

NUME SI PRENUME	CIRSTEA V VICTOR				FISA	53
	S VALIDATA ANEXA	Sum Of ARABIL	Sum Of FANEATA	Sum Of NEPROD	TOTAL FISE	331
	0	180	151	0		
Suma	0	180	151	0		
NUME SI PRENUME	CIRSTEA V ELENA				FISA	54
	S VALIDATA ANEXA	Sum Of ARABIL	Sum Of FANEATA	Sum Of NEPROD	TOTAL FISE	162
	494	128	34	0		
Suma	494	128	34	0		
Suma CASA	494	308	185	0		

Figure 12. Appendix - 4.6.8

- APPENDIX 4.6.9. - Report showing the difference of area between the values contained in validated appendixes and those from property sheets (Figure 13);

FISE DE POSESIE

CASA 6 — Sumar pentru 'CASA' = 6 (25 inreg): Suma A 308 F 185 N 0

SUNT DE ACORD DA / NU — Total arabil 493
NUME SI PRENUME — SEMNATURA — Arabil + neproductiv 493

NUME SI PRENUME: CIRSTEA V VICTOR (16 inreg)
FISA: 53 — Suma A 180 F 151 N 0
Observatii: A: 2A SA=4.79 — Totalpers. 331

TARLA	POZ	ARABIL	FANEATA	NEPROD	NUME PARCELA
2	101	13	0	0	DUMBRAVA
6	301	14			G.MINEI-CIMPSOR
10	151	30			C. GASPOR
20	55	17			RACHITA
21	50	18			C. DUMBRAVII
21	108	28			C. DUMBRAVII
23	36	22			C DUMBRAVII
31	112		17		PESTE MANEA
36	48		28		RADACINI
37	98	13	13		MALIN
39	131	15			INTRE VAI
40	54		10		RASTOCI CV+V
41	13		16		GHIRCIUG
47	20	10	12		VIRFU POENII
47	106		18		VIRFU POENII
55	61	0	37	0	CARPENE

NUME SI PRENUME: CIRSTEA V ELENA (9 inreg)
FISA: 54 — Suma A 128 F 34 N 0
Observatii: — Totalpers. 162

TARLA	POZ	ARABIL	FANEATA	NEPROD	NUME PARCELA
2	94	21	0	0	DURAITOARE ???
6	46		5		TARNAROAGE
6	300	28			G.MINEI-CIMPSOR
8	73		9		TRESTIE+VALE
9	70	32			GRUI
26	22	24			GOGOSIE
41	12		12		GHIRCIUG
50	9	23			VADICI
54	26		8		SEST

Figure 13. Appendix 4.6.9

2. Reports resulted from the system interrogation (+ nongraphic and graphic data):

- APPENDIX 4.6.10. - Protocol of livery and annex draft;

- APPENDIX 4.6.11. - Parcels plans;

3. Interfaces (Forms) for introducing and interactive enquiring of data:

- APPENDIX 4.6.12. - Introduction and/or textual data enquiry (Figure 14);
- ANNEX 04.06.13. - Introduction and/or graphic or textual data enquiry;

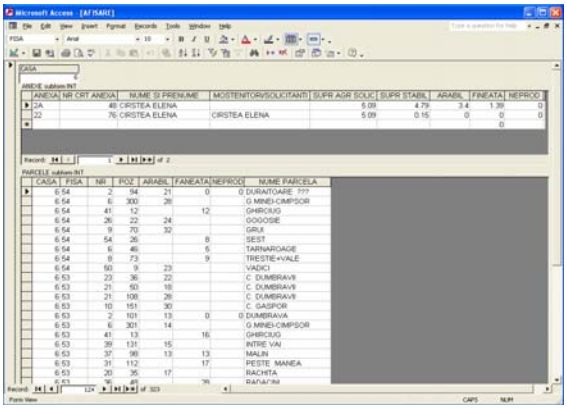

Figure 14. Appendix 4.6.12

CONCLUSIONS

The purpose of achieving and implementing an integrated information system that provides the necessary support for automatic processing, in particular of data for the preparing, updating and maintaining specific database record property, have been started from the basic idea to develop a project of execution of a flexible information system, open, multifunctional, which can be used in the near future in other areas of special social interest, such as:

- Introduction of the general cadastre;
- Registration of population;
- Monitoring of environmental pollution, floods, etc.,
- as well as any other areas that require an information system based on a precise digital model and its associated relational database.

Whether a small business, a multinational organization, a government department or a local authority, however there are at least two items in common, namely:

- A big part of the handled information should be geographically referenced;
- As the volume of information grows, it will be harder to manipulate and interpret them.

It is an already known fact that more than 70% of all information in circulation has a common denominator: their geographical location (geographic reference). In this situation, GIS becomes important for the information's user as it helps in making decisions that are based on geographic located information.

Unlike any other type of applications that manipulate information, information system can interpret the concept of geographic location.

Consider, for example, a system that allows the user to combine and manipulate demographic data, or referring on the living standards of the population or other data of social or economic-specific areas, in order to determine the appropriateness of developing business. This process of social and economic prediction and monitoring grows the chances of success in a new business.

The processing, recording, storage and playback of cadastral records content should be standardized and codified.

Dramatic advances in computer technology have opened up new opportunities for achieving cadastral records. To use electronic computers for achieving these records, raw data must be processed and converted to standard formats, as simple as possible, including basic information on study objectives.

The use of automatic devices of achieving cadastral records offers a lot of advantages:

- reducing the time for routine work such as:
  - The introduction of new data;
  - Study existing data;
  - Releasing some excerpts through various printing equipment of the system.
- optimize the maintenance work and updating the information contained in the database system;
- reduce costs of maintenance by increasing productivity records;
- increase the amount of information that can be processed and stored (compared to manual methods);

- performing some complex enquiries on information about the properties, landlords, utility networks, etc. (This information can be selected and combined in different variations depending on user requirements)

In conclusion, the future belongs to geographical information systems.

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