Journal of Young Scientist, Volume VII, 2019
ISSN 2344 - 1283; ISSN CD-ROM 2344 - 1291; ISSN Online 2344 - 1305; ISSN-L 2344 – 1283

A MOBILE GIS APLICATION FOR THE INVENTORY OF SOME OBJECTIVES FROM THE BUASVM TIMISOARA CAMPUS

Vasilică GEMĂNARU

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Abstract

This study wants to present the way to achieve a useful geodatabase in managing the objectives inventory projects within USAMVBT campus, namely: pillars, banks, trees, barriers, parking spaces, roads, hydrants. It is an assembly of information collected using specific methods and procedures, then properly processed by programs and finally finishing with a database (GIS). The purpose of this paper is creating a geodatabase that includes all the objectives of the University of Agricultural Sciences and Veterinary Medicine of Banat "King Mihai I of Romania" in Timişoara. This inventory will be made using state-of-the-art GNSS and GIS technology, attributes will be taken from the ground, and an on-line GIS map will be created that it can be continually updated and it will allow monitoring of objectives to protect them.

***Keywords**: Digital cartography, GIS, GNSS, Inventory, Mobile GIS*

INTRODUCTION

Humanity has experienced an intense economic and social development in the last decades, many rural settlements undergoing strong transformations turning them into urban settlements. The main basis of transformations is how to use land, more exactly in the area of urban green spaces.

The term "GIS" comes from Geographic Information System. This system is used to create, to store, to analyze and to process spatially distributed information through a computerized process. GIS technology has a wide range of uses in scientific fields such as cartography, route planning, environmental impact studies, transportation. A Geographic Information System (GIS) allows us to view, to query, to analyze and to interpret data in order to understand relationships, patterns and trends (Herbei, 2015).

Organizations and industries benefit of GIS. Currently, the interest in in economic and strategic value of GIS is steadily increasing (Grecea et al., 2013). The special features of GIS is how to organize managed information (Grecea at al., 2012). Thus, there are two types of information, namely a graphical one, which indicates the spatial distribution of the studied elements, and another in the form of a database to store the attributes associated with these elements (Moscovici et al., 2015).

A GIS stores two types of information:

- Features;
- Attributes.

A GIS map has various tools for:

- Updating with new data collected from the field by topographical methods, GNSS methods (Popa, 2018), photogrammetric methods (Pantea and Lacusteanu, 2017), (Preoţescu and Nedea, 2017) or data from other areas (Moldovan et al., 2017);
- Data display in various ways (Herbei and Nemes, 2012);
- Spatial data analysis to create new information (Tentu, 2018).

Geographic data to be used in a GIS and acquisition from land or analogue data related to a territory are organized on several thematic layers (Grecea and Moscovici, 2014).

A layer is a collection of details that have the same themes (eg. rivers, roads, settlements, etc.). The GIS Implementation Project begins, like any other design activity, with the correct understanding of intentional goals and progresses, with more detail, because the information is collected and structured (Herbei, 2018). Designing is a process that defines objectives and it identifies, analyzes and evaluates different solutions, and adopts an implementation plan. The project allows decision makers to have an overview and an instrument to control the status of work at any time during their deployment. Any GIS project must comply the INSPIRE guidelines introduced for uniformity of collection and storage of geospatial data of the field. The project also offers the possibility to include all technical aspects related to the spatial database, both as a whole and as to the interdependence of its components. Expenditure on design actually means savings during implementation and, in the absence of a project, problems can become insurmountable (Mason and Girard, 2015).

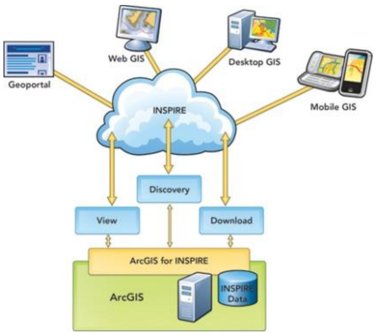

Figure 1. GIS & INSPIRE

MATERIALS AND METHODS

The purpose of this work is to realization a Mobile GIS application that will allow the acquisition of some objectives of interest from the USAMVB Campus Timisoara. This application may be useful for decision-makers the University for inventory and monitor items of interest (networks, parking spaces, barriers, etc.).

Figure 2. Study area

Description of Geodatabase

Geodatabase is a component of ArcGIS software and is used to define and access geographic objects called GeoObjects. Geodatabase includes spatial data, attributes, and behavioral elements. In another way, a Geodatabase can be defined as a "recipient" containing data collections. A Geodatabase offers a common framework for accessing and managing geospatial data in ArcGIS work environment. A Geodatabase allows the distribution of the functionality of a GIS on any desktop platform, server or mobile and also allows the storage of GIS data in a centralized location to ensure easy access and management.

Creating a Geodatabase is a process that involves going through several steps, namely:

- Designing of Geodatabase;
- Creating an empty Geodatabase;
- Creating a Geodatabase structure;
- Uploading spatial data.

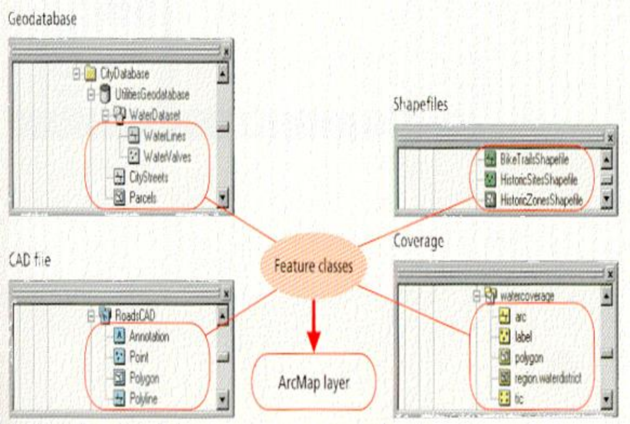

Figure 3. The structure of a Geodatabase

A Geodatabase has the following functions:

- storing complex collections of different types of data in a centralized location;
- applying complex rules and relationships to geospatial data;
- integrating spatial data with other IT databases;
- multiple simultaneous access to data by multitasking;
- maintaining the integrity of spatial data;
- defining advanced geospatial network models (ex. topologies, networks).

There are three types of Geodatabase with the following features:

- Personal geodatabases:
  - Some readers, one writer
  - Microsoft Access database-format - .mdb
  - Storage of 2 Gb of data
- File geodatabases
  - More readers, one writer per feature dataset, stand-alone feature class, or table.
  - A file geodatabase is a file folder that holds its dataset files.
  - Storage of 1Tb of data
- Enterprise geodatabases = multiuser geodatabases
  - Multiuser: many readers and many writers
  - DBMS

Advantages of using GDB are:

- Relations between layers: feature datasets
- Labels: saved as annotation feature class
- Drop-down lists
- Domains for attribute values
- Field Properties: more parameters (eg. Default value for a field)
- Surface and perimeter: automatic calculation if objects edited

The database project fully describes its architecture. The project also offers the possibility to include all technical aspects related to the spatial database both as a whole and as regards the interdependence between its components.
Forwards, a File Geodatabase will be created in the ArcGIS work environment. Fields will be created and class of features will be added, then fields of various types will be added.
After configuring the database model, a map will be created in ArcMap and then a service will be posted to ArcGIS Online account. This service will be uploaded to a map and used on the ground through a Mobile GIS application.

RESULTS AND DISCUSSIONS

Within this project, which involves the inventory of some interest objectives of the USAMVB Campus Timişoara, the following work process follows:

1. **Prepare the model for data acquisition**
2. **Sharing the model**
3. **Acquisition (collection) of field data using ZENO Collector (Leica Zeno 20 and ESRI Collector)**

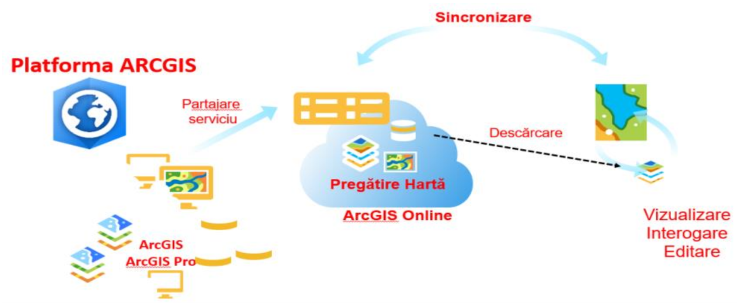

Figure 4. ArcGIS platform

1. Prepare the model for data acquisition

- *What data do we collect from the field?*
- *What attributes we want the data to be collected?*
- *Realization the spatial database.*

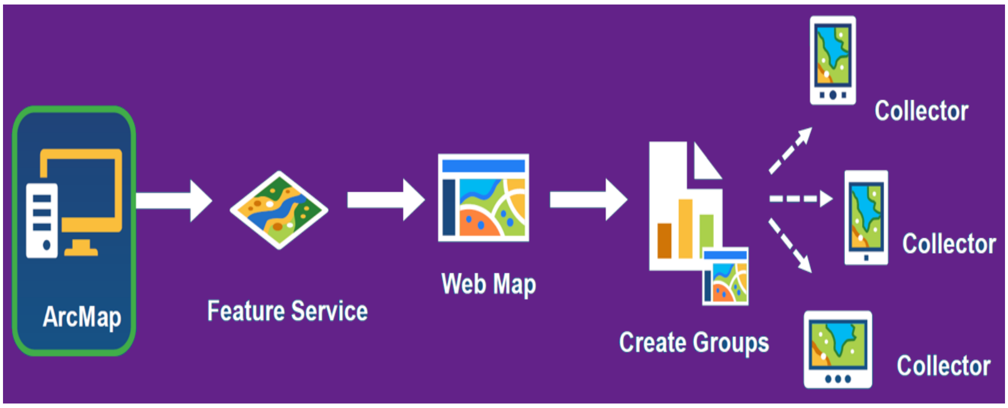

Figure 5. Workflow 1

Preparing the model involves following the following steps:

Create a Geodatabase in ArcMap

A Geodatabase it organizes and stores the collected data in a spatial database. Most specifically, a Geodatabase stores the characteristic classes. For the creation of a Geodatabase you have to follow the best steps:

- You have to start the application ArcMap and open the "Register" folder (right)
- You have to right click in the "Register" window, in the folder where you want to create the Geodatabase and you have to choose the New-File Geodatabase option and then you have to rename the database by user.

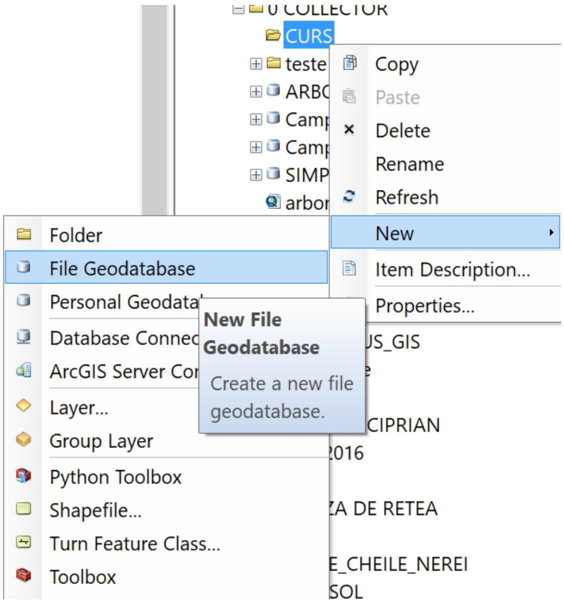

Figure 6. Creating a file Geodatabase

The definition of databasedomains

Fields have been created for the following features:

- Hydrant type
- Utility network type
- Parking place
- Trees condition
- Bench condition
- Road type
- Pillar type
- Parcels

For example, in order to inventory of objectives, from the field the following information will be collected:

- Bench condition (painted, unpainted, damaged, good condition)
- Parking place (parking for teachers, parking for visitors)
- Pillar type (lighting pillar, pillar for electrical energy, others)
- The parcel (parcel of land, parcel of lawn)

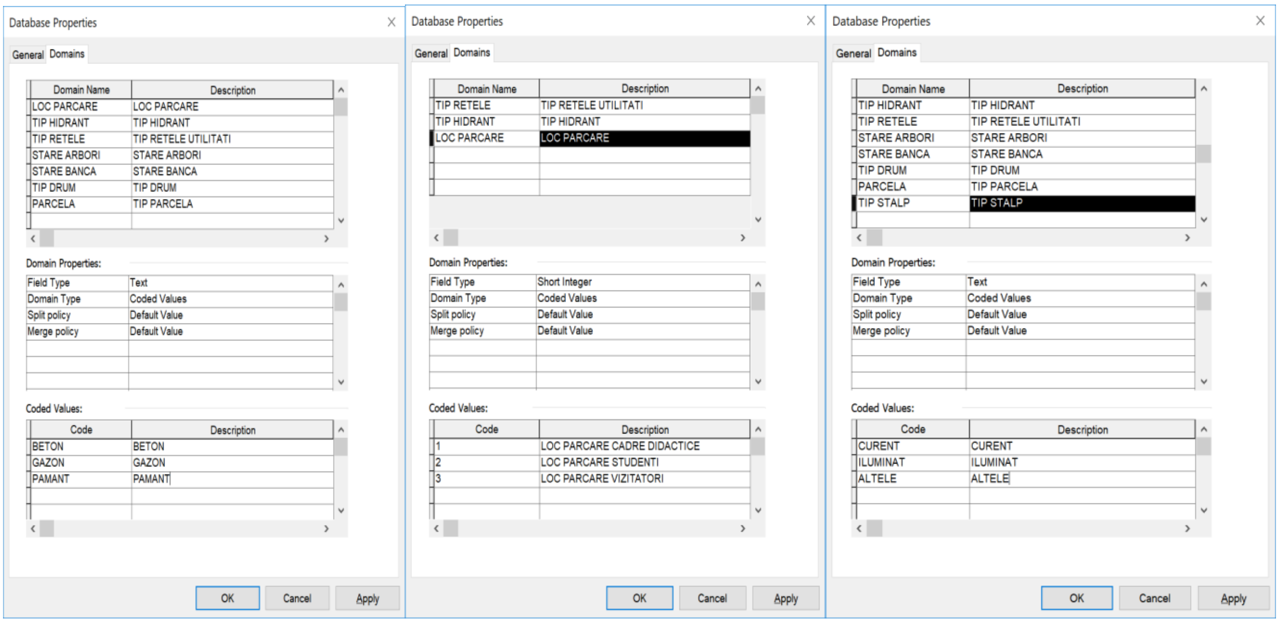

Figure 7. Examples for definition of fields

Creation of features class (point, line or polygon)

The next step is creating a feature class to be populated with collected information. The feature class are similar to a box in which information is stored, which have the same characteristics, meaning, the same geometry (point, line or polygon) or the same attributes.

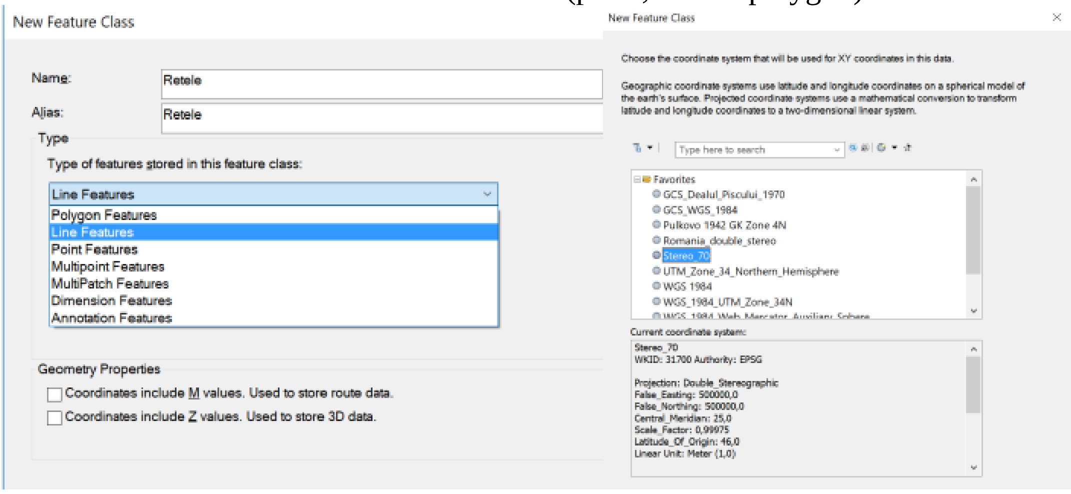

Figure 8. Example of creating a feature class – Type: Line

The setings of fields

The fields are essential part of the model. This provides the structure of information which will be collected from the field and offers rules for the types of information collected about a feature.

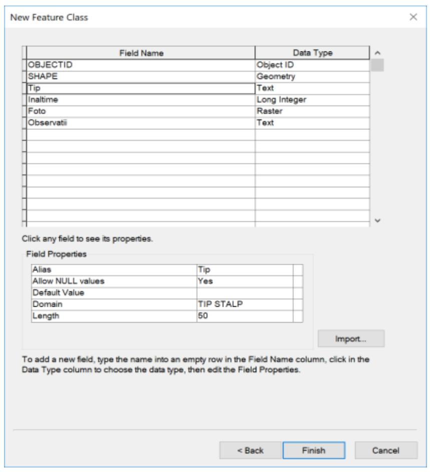

Figure 9. Example of creating fields for a feature class

The simbology of data

Forwards we have to define how to view and symbolize the map data, which will be done with the collected data from the field.

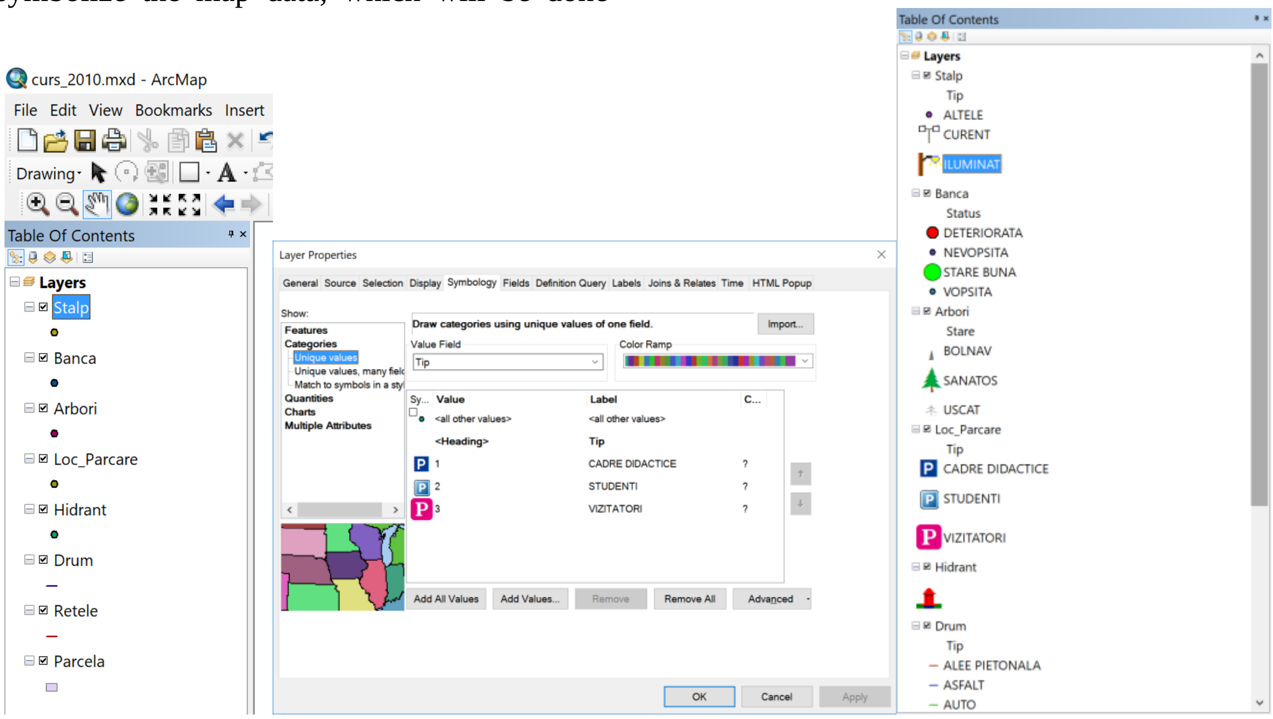

Figure 10. Simbolyzing the layers

2. Sharing the map

For the data can be used on the field, these must be shared. The data can be transmitted either to a ArcGIS server or to the ArcGIS Online account.

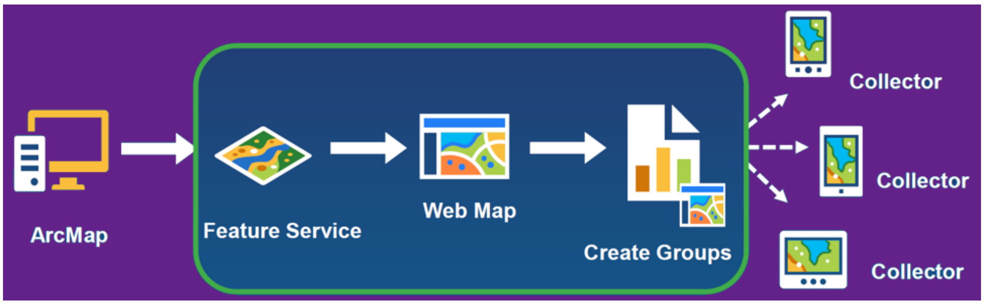

Figure 11. Workflow 2

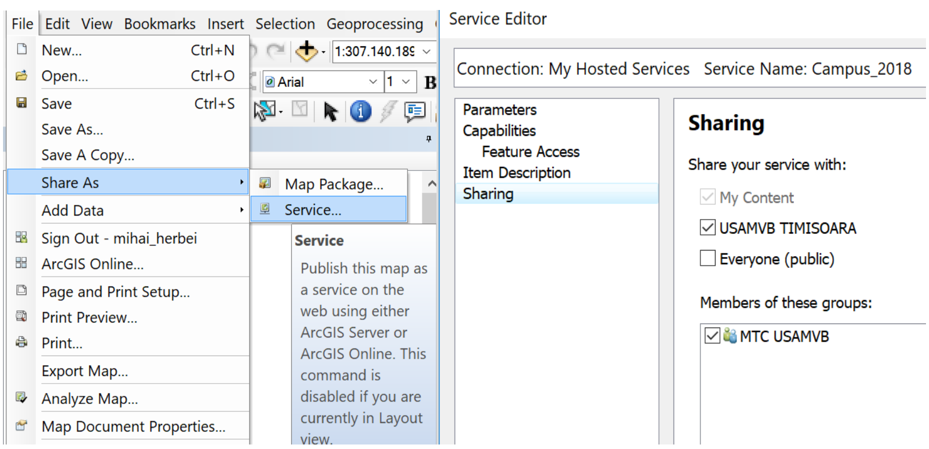

Figure 12. Data sharing

Journal of Young Scientist, Volume VII, 2019
ISSN 2344 - 1283; ISSN CD-ROM 2344 - 1291; ISSN Online 2344 - 1305; ISSN-L 2344 – 1283

After the sharing process have been done it will be created a map which will be used in the field in order to collect the necessary data and information. The map will be done starting from a base map over which a new layer will be added with the objectives which will be inventoried. It can be configured the data collection mode and the settings of the collection application can be customized.

In the end, the created map will be distributed to field users who will collect and populate the data with field information. To use the map by field users, this one needs to be shared. This is done with the "Share" button. In this moment the map can be populated with field information by the users.

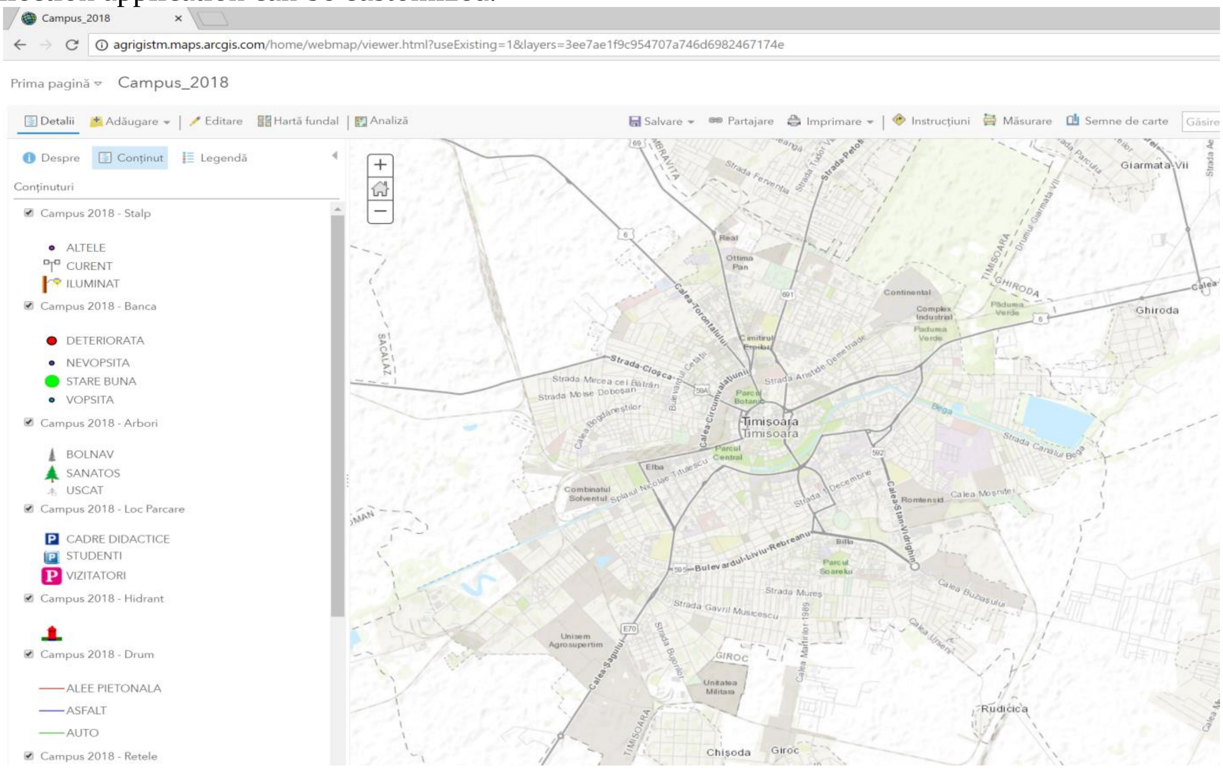

Figure 13. Displaying the map in ARCGIS online

3. Acquisition (collection) of GIS data using ZENOCollector (Leica Zeno 20 and ESRI Collector)

Within this project was used a high precision GIS instrument, namely Leica Zeno 20. The Leica Zeno 20 is a high precision GNSS receiver based on the ANDROID Operating System, dedicated to the acquisition of GIS data from the field.

Zeno Collector is a portable tool that combines Collector for ArcGIS application, produced by ESRI company, with the precision of a geodetic instrument, Zeno 20, produced by Leica Geosystems company.

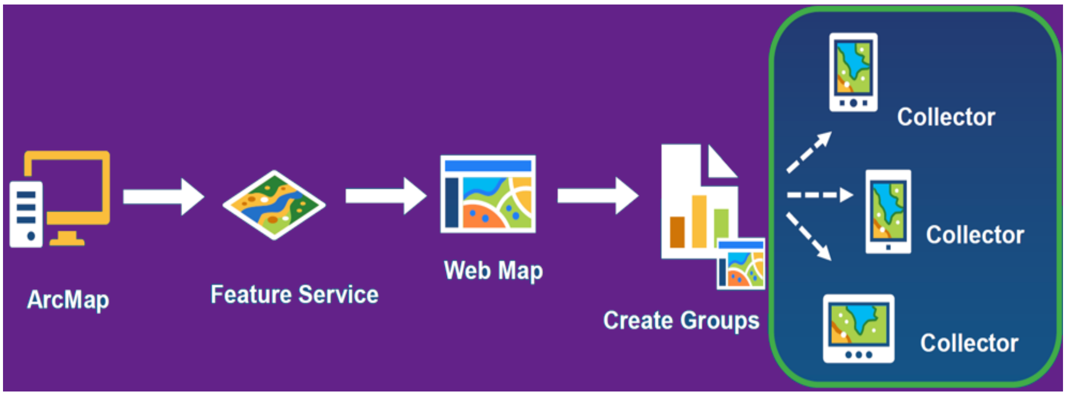

Figure 14. Workflow3

Figure 15. Description of Leica Zeno 20

On Leica Zeno 20 it was downloaded the ESRI Collector application and we sign in with the University Esri account. We Open the WEB Map created before for navigation and GIS data aquisition. The map can be downloaded for working offline.

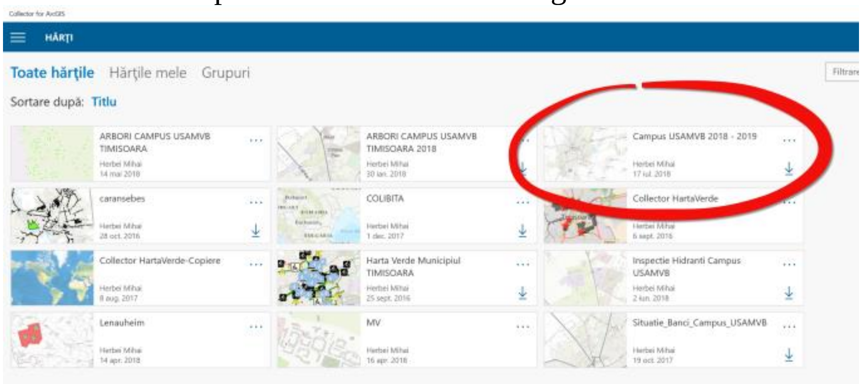

Figure 16. Open the map in the collector application

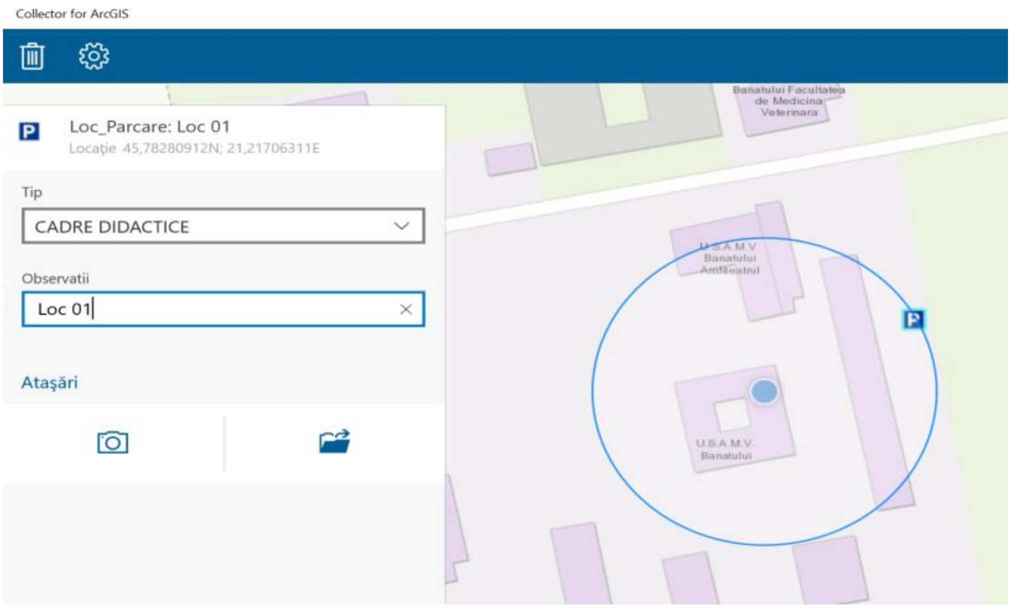

Figure 17. Example of Data Acquisition in ESRI Collector- Parking space

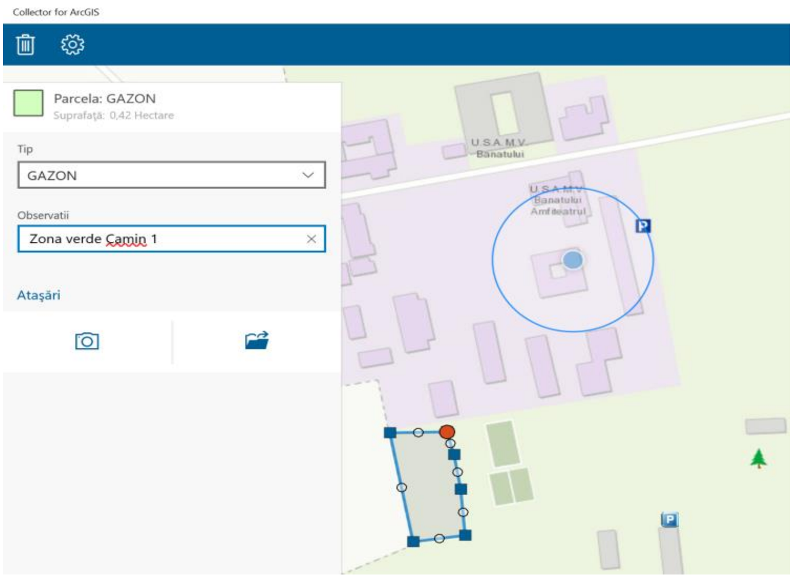

Figure 18. Example of Data Acquisition in ESRI Collector–Parcel

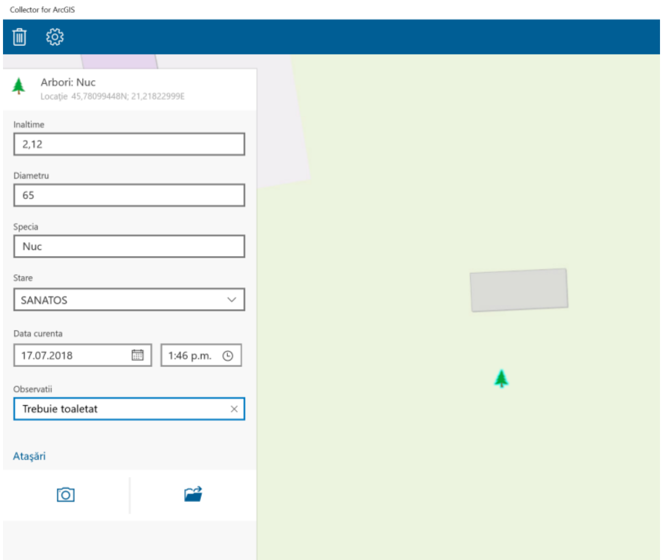

Figure 19. Example of Data Acquisition in ESRI Collector–Trees

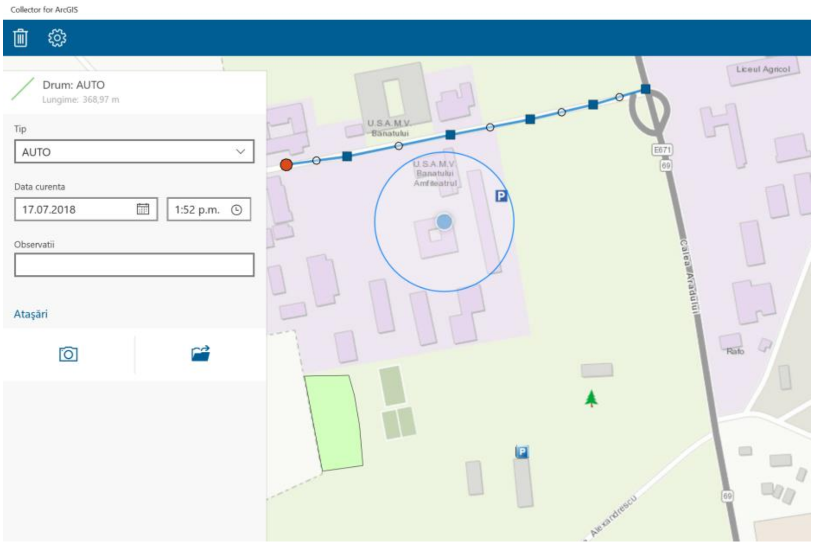

Figure 20. Example of Data Acquisition in ESRI Collector Roads

CONCLUSIONS

Thanks to this project, we can invent all the objectives in the USAMVB Timisoara campus.
By creating this database anyone can access the online site and use this work.
These data helps to improve and beautify the USAMVBT teaching park and the environment.
The purpose of the collected data is to represent the material needed to perform the various queries essential to the detailed analysis.

ACKNOWLEGMENTS

The authors thanks to the GEOMATICS RESEARCH LABORATORY and to the GIS Scientific and Remote Sensing Student Circle from USAMVBT "King Michael I of Romania" Timisoara, for the facility to study the objectives of interest for this research.

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