BANAT'S UNIVERSITY OF AGRICULTURAL SCIENCES AND VETERINARY MEDICINE "KING MICHAEL I OF ROMANIA" FROM TIMISOARA
"YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH IN APPLIED LIFE SCIENCES"
27 November 2020

USING GEOGRAPHICAL INFORMATIONAL SYSTEMS IN ORDER TO ACHIEVE THE URBAN CADASTRE IN THE SUBCETATE NEIGHBORHOOD OF ARAD WITH THE HELP OF MODERN TECHNOLOGIES

Radu **MIȚĂ**[1,2], Mihai **SIMON**[1,2], Adrian **ȘMULEAC**[1,2], Mihai Valentin **HERBEI**[1]

[1]Banat's University of Agricultural Sciences and Veterinary Medicine "King Mihai I of Romania" from Timisoara, 300645, 119, Calea Aradului, Timisoara, Romania
[2]S.C. PROCAD S.R.L, 300391, 13, Strada Suceava, Timisoara, Romania
e-mail: mihai_simon91@yahoo.com

ABSTRACT

Studies shown in this paper were realised in the west side of Romania, on the administrative territory of Arad city, Subcetate neighborhood, with the purpose of making a situation plan of the underground infrastructure. The purpose of this study is the acquistion of the GIS data from this underground network. To create such a plan, we used the Leica Ultra Utility Detection and Trancing System pipe locator to find the network, GNSS Leica Viva GS14 and GS16 to determine the points marked on the route with the locator device, Leica FlexLine TS06 total station and Leica Pegasus: Backpack to determine the points found on the aerial connections and counters found on fences and constructions.

INTRODUCTION

If at the beginning the implementation of a geographical information system meant buying hardware and software, now the focus shifted towards collecting data and implementing personalized geographical information system.

In the last years, the number of sensors and collecting systems have developed immensely. Besides total stations and GNSS networks, the most used topographic equipment today offer many more available options for data collecting – not only for land surveying, but for many other things and areas from many different sources.

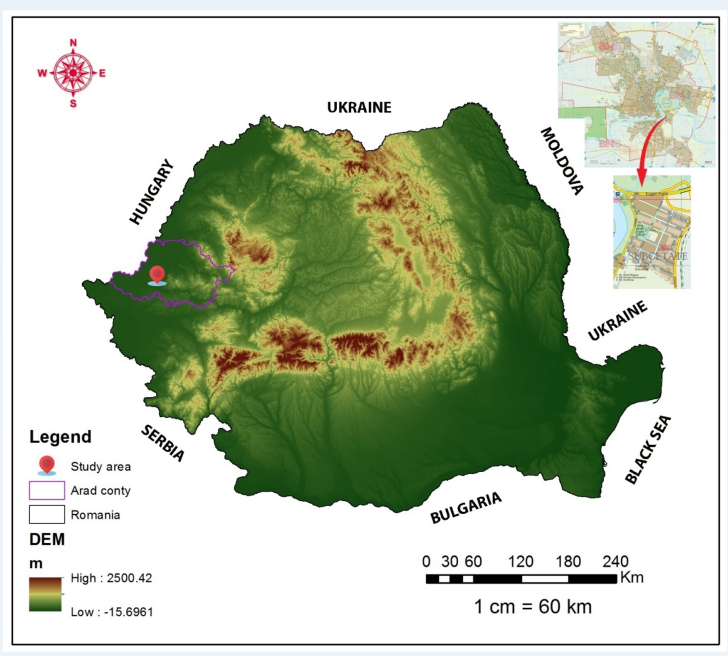
For example, MMS (Mobile Mapping System) equipments colect data as point clouds together with stereographic images by ground scanning. As needed, the range of the laser can be set but it can not pass through solid objects or in another plan for example scanning the roofs of the buildings

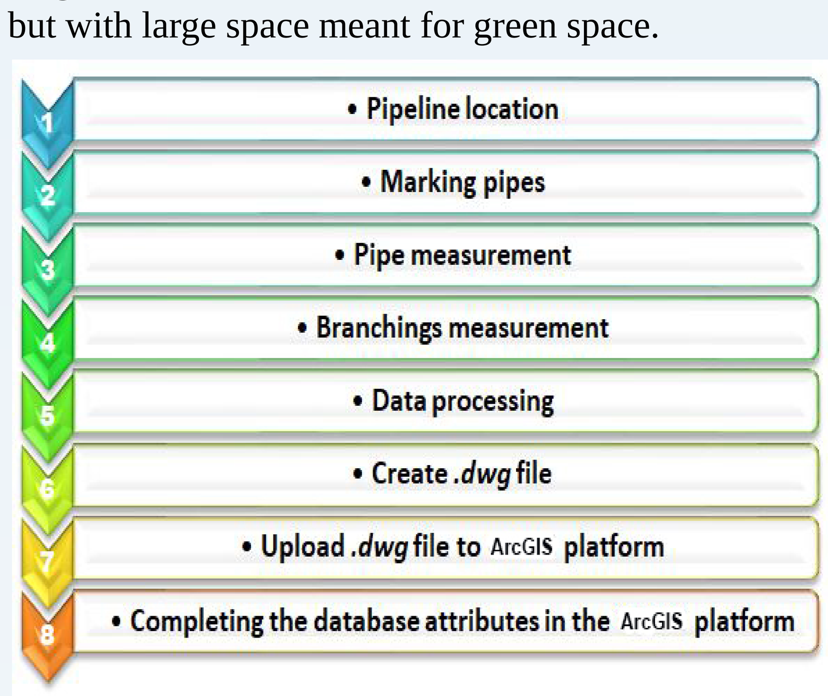
All the obtained data using equipment are complementary and the final result will be a GIS that displays the natural gas network from the chosen neighborhood.

If at the beginning the implementation of a geographical information system meant buying hardware and software, now the focus shifted towards collecting data and implementing personalized geographical information system.

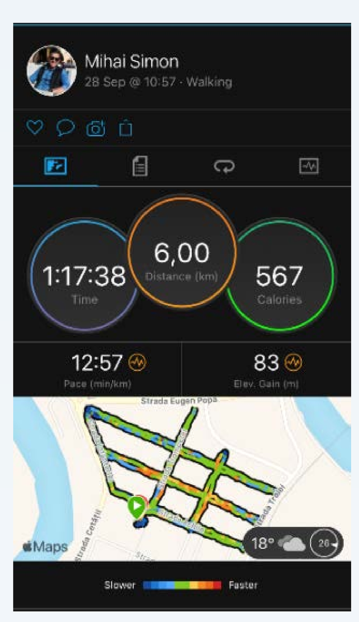
MATERIAL AND METHOD

The research presented in this paper was done in Arad city, on the limit between historic regions Banat and Crisana. The city is situated between both sides of the Mures river in Crisana and Banat. The case study presented further was done in the Subcetate neighborhood. The street structure is uniform without a main street but with large space meant for green space.





The working methodology underlying this study has been divided into several stages The underground network was found using the Leica ULTRA equipment and the points on the network were marked using topographic sprays. These points were determined afterward using Leica Viva GS14 and GS16 equipment.



To improve the time management, we decided that we should use the mobile scanning device Leica Pegasus: Backpack. Using this equipment, the time spent on the job went down a lot. For example, a total street length of 6 km was scanned in 1 hour and 17 minutes, activity which was registered with the help of the Garmin Fenix 3HR smartwatch.

Equipments used

To determine the points marked on the network we used the GNSS position technique. The determinations were done using GNSS Leica Viva GS14 and GS16 receiver which allow the determination of the point we want using the RTK method (Real Time Kinematic).

To determine points found on aerial connections and counters, we firstly used the TS06 total station with traverses that go from known points on the street network and then return on the other side of the network. We gave up on using topographic surveys with the total station and instead opted for a newer device: Leica Pegasus Backpack.

Software used:

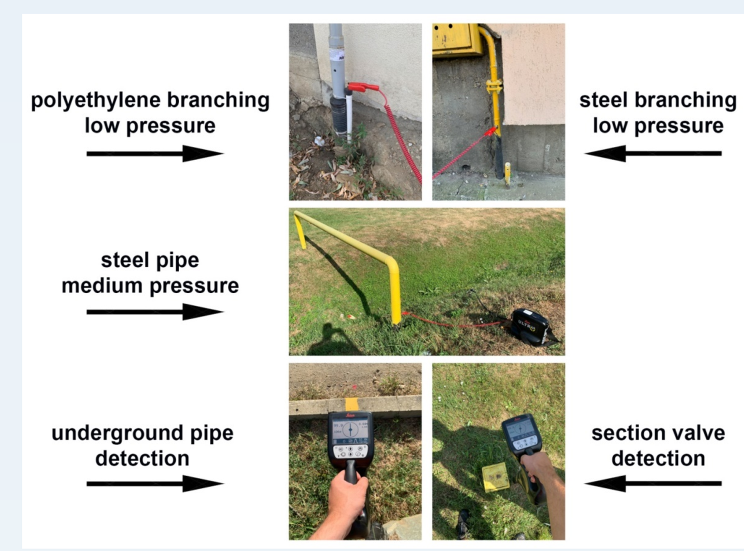
The use of modern equipment and the taking of data from the field led, implicitly, to the use of the programs with which it was equipped, but also programs for processing. In this respect, in view of the operations carried out, the following programmes have been used:

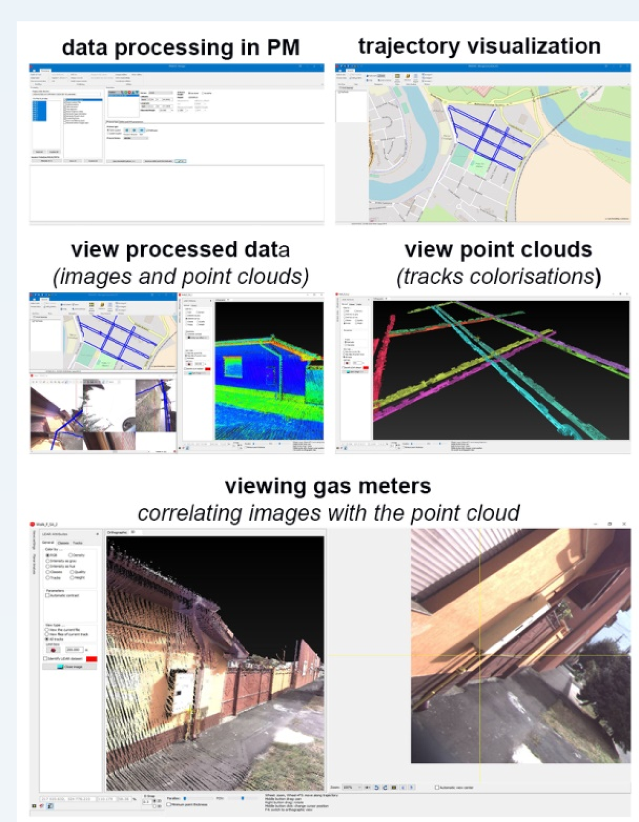
- Intertial Explorer for trajectory correction
- Leica Infinity to transform WGS '84 coordinates into STEREO '70
- Pegasus Manager for MMS data processing
- Leica Cyclone for point cloud extraction and processing
- AutoCAD for plan realization
- ArcGIS for database creation

RESULTS AND DISCUSSIONS

The discovery of the underground utilities require different methods that fit certain situations. There is a variety of technologies that can be used to detect underground networks. Because every technology has its advantages, the best solution is always the most flexible. The best technologies used to detect utilites are: electromagnetic induction (EML) and the ground penetration radar (GPR). The solution used by us in this study is that of the electromagnetic induction (ELM) because the purpose of this job is to analyze the natural gas network in order to measure it. The solution used by us in this study is that of the electromagnetic induction (ELM) because the purpose of this job is to analyze the natural gas network in order to measure it.

The natural gas network is made out of steel or polyethylyne. The localization was done by connecting the inductive of a generator and by finding the route with a receiver. The location device has two cables. The red one must be tied to the gas pipe if its made from steel. If the pipe is made from polyethylyne it must be tied to a conductive wire which is located at the base of the connection and follows the whole length of the pipe. The black wire must be tied to a metal which is then put in the ground because it substitutes grounding. After tieing up the cable, the generator and receiver must be turned on, the work type and signal selected and then the route can be followed.

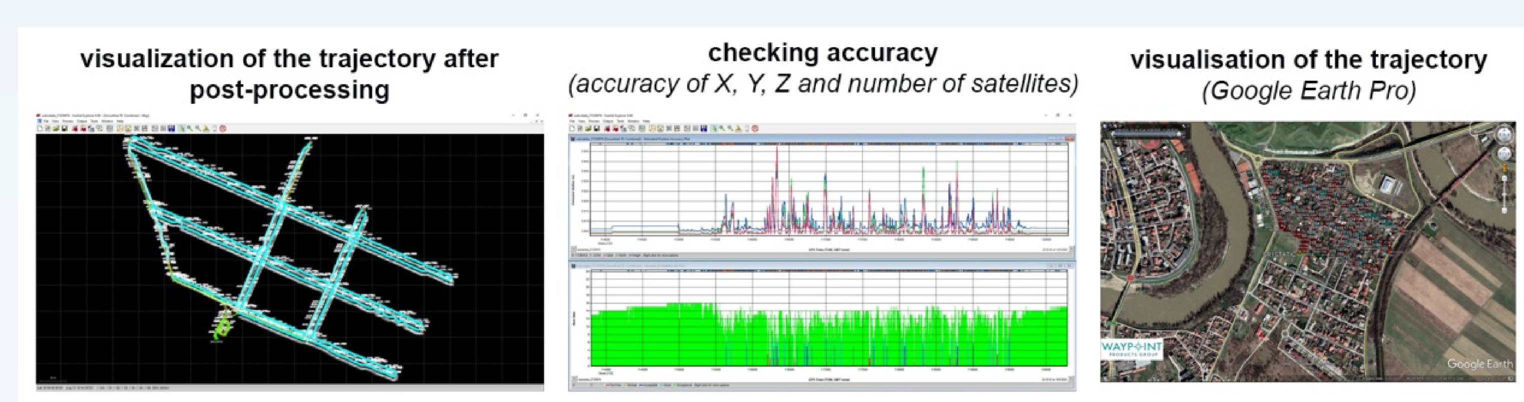




The GNSS determination of the marked points was done using the RTK method with the help of GNSS equipment. After finishing this process, we have the data needed to create the plan for the natural gas network. In the end we need the data obtained by using the 3D laser scanner on the aerial connections, counters and postal codes.

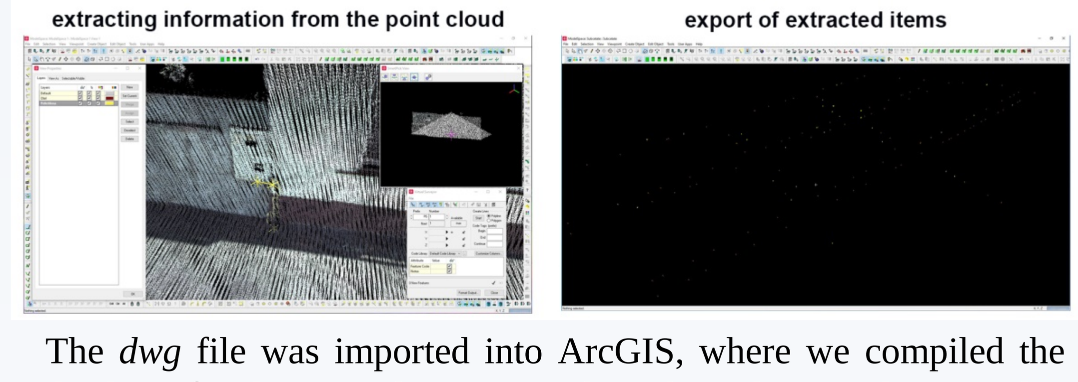
LiDAR data obtained through scanning has been processed in the Pegasus Manager program, which is a reality capture software for mobile mapping, for processing, analyzing and extracting information from point clouds and purchased images. Precise mission planning, data processing, automatic function extraction, integrated quality reporting and online publishing make Pegasus Manager a unique efficient workflow for high-precision deliveries.

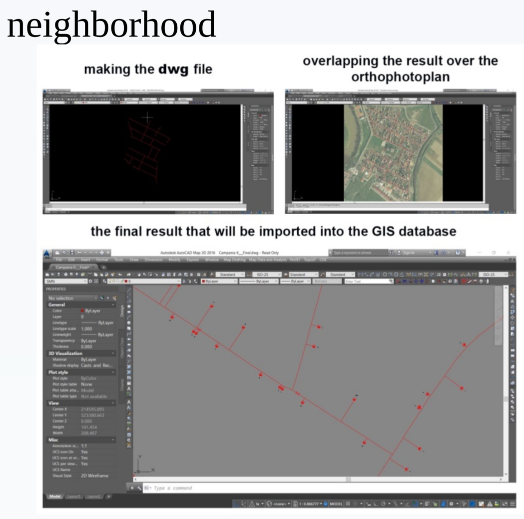
We have the possibility to do a quality control and correct the trajectory if we are not satisfied with the result with the help of the program Inertial Explorer .



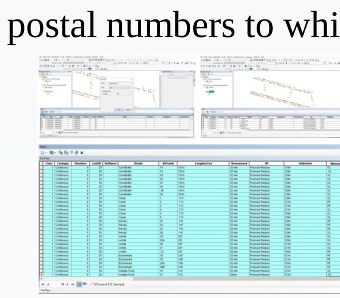
In the case of this study, it was not necessary to correct the trajectory, the average accuracy being up to 2 cm . After processing in PM – Pegasus Manager and obtaining the point cloud, it will be imported into a software for extracting the necessary information, namely Leica Cyclone.

The required points were extracted using the *Virtual Surveyor* module and were exported as a *dwg* file. This file was copied over the first file in which we had the main network plan, both being in the same coordinate system, thus obtaining a final file with all the information for the respective neighborhood





The *dwg* file was imported into ArcGIS, where we compiled the database for the natural gas network in the Subcetate district. This database contains information about the main network, as well as about the branches. We have entered information on the material from which the pipes and branches are made, at what depth they are buried, what is their pressure regime, what lengths the main networks as well as the branches have, but also on which streets are and what are the postal numbers to which they are connected



CONCLUSIONS

The advantages of using geographical information systems and their applicability in many areas has led to the spread of this concept. Most institutions, companies working with spatial data have initiated a GIS project. The complexity of underground utility networks is constantly increasing, and obtaining accurate information on the location of buried utilities has never been more important.

ACKNOWLEDGEMENT

We thank the company PROCAD Timisoara for making available the equipment necessary to carry out this study.