CONSIDERATIONS FOR USING SMARTPHONES IN MODERN TOPOGRAPHY

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***Abstract**: With the advent of humanity in the digital age, the technology industry has seen an amazing development that now brings the user a wide range of useful applications, some of which can be used successfully in the field of modern topography.*

In this article, we set out to present some considerations on topographic applications developed in the field of smartphones.

***Keywords:** topography, GNSS, application, virtual reality, augmented reality, smartphones.*

1. Introduction

The beginnings of mobile telephony over time include a series of events beginning with the advent of the first mobile phone created in 1910 by Swedish inventor and businessman Lars Magnus Ericsson, their development and evolution has made it possible for us today to benefit with the help of intelligence from a series of applications.

So far, the surveyor's profession has also known and experienced a wide range of methods and means, some even at an advanced stage, which we believe there will be no slowdown in the near future in the context of current socio-economic development.

Starting from the two remarks mentioned, there is a parallel development of them, in which the common point is the current technology that has made today, so that today's surveyor can enjoy the benefits of mobile phones with the help of applications developed on the basis of artificial intelligence. In this regard, we find that modern topography is constantly adapting to emerging technologies in a useful tool for everyday applications, namely the mobile phone.

2. Materials and Methods

Current trends force us to know that virtual reality (VR) and augmented reality (AR) are two different notions.

a) virtual reality (VR) is a virtual world generated by computers and programming, it is a closed environment that is completely captivating, usually requires an ancillary device, a limitation related to programming and computer skills, is based on real world conditions , but in a fictitious setting, it can allow users to have experiences that are not physically possible in the real world and represent in our percentage 75% virtual environment and 25% real environment.

b) augmented reality (RA) is usually based on real physical places, it is an open environment that is partially captivating, the user controls the environment and combines virtual elements and experiences with real world conditions, applications can be accessed by

computer, tablet and smartphone. It is useful for viewing and evaluating the product, and in our opinion it represents 75% of the real environment and 25% of the virtual environment.

Fig. 1 Virtual reality vs. augmented reality [1]

If, for the surveyor, the use of virtual reality technology is only a means of documentation, he will not use virtual reality as much as augmented reality, due to well-founded reasons, especially related to the required accuracy of the projects he carries out.

Compared to augmented reality technology, it is still in its infancy, but once it becomes a true tool of the future, we believe that augmented reality will come first as an interest in modern topography, in terms of 3D modeling, location determination, specific calculations conforming in engineering topography, surface determination, applicability in GIS, etc.

However, in the future we have chosen to present a series of means and methods that can be integrated into mobile telephony equipment and that today's surveyors can enjoy.

It is well known that metadata and artificial intelligence have revolutionized the world, so the use of augmented reality is a lifeline when the user is at a standstill.

If in the past the use of digital location data was a problem in case of unwanted accidents, calamities and other situations that required location, now the development of GNSS technology allows the geographical location of a requested element based on integrated applications in either a tablet , either a smart system or a mobile phone.

Currently, a number of applications are being developed internationally in the field of smart telephony, from which we can obtain the necessary information to start a digitization process in terms of modeling building information - BIM, 3D representation, creating a GIS, adaptation of GNSS technology in topographic works, realization of photogrammetric data with the help of UAV systems or LiDAR equipment, but also data obtained by SLAM time remote sensing.

At the same time, since the creation of the 5G network mode, it has been found internationally that computing power is greater than ever, the coverage area is wider, and data storage in cloud systems is more accessible in a much cheaper storage space, so we can create and develop more than most of us have ever dreamed of.

Following this article, we have chosen to present a series of applications developed in the field of smart telephony that modern topography can successfully master

2.1 Mobile Topographer Pro application

It is a professional niche application that will be very helpful for any surveyor, whether beginner or advanced in the secrets of the discipline. The application allows operations such as: modeling in 3D landscapes, collecting information about the field, creating contours, linking maps, tracing points in the field, making statistics, automatic use of GPS data, being easy to use, we can specify that this application has been developed in recent years in the area of GIS.

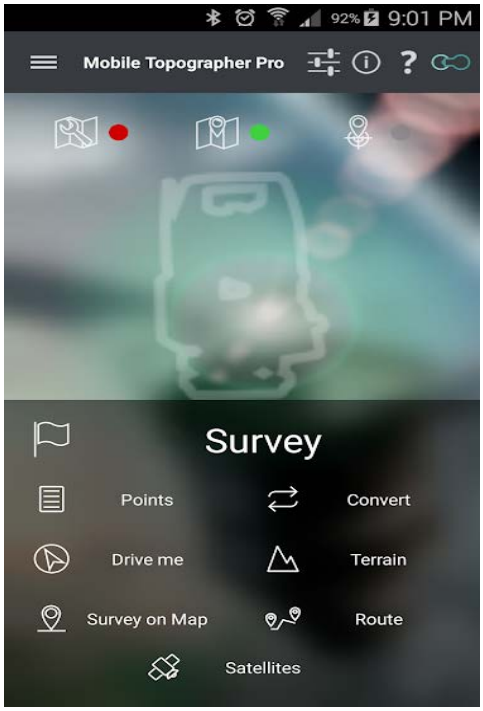


Fig. 2 Mobile Topographer Pro application interface [2]

Some of the possibilities of this application will be presented graphically below:

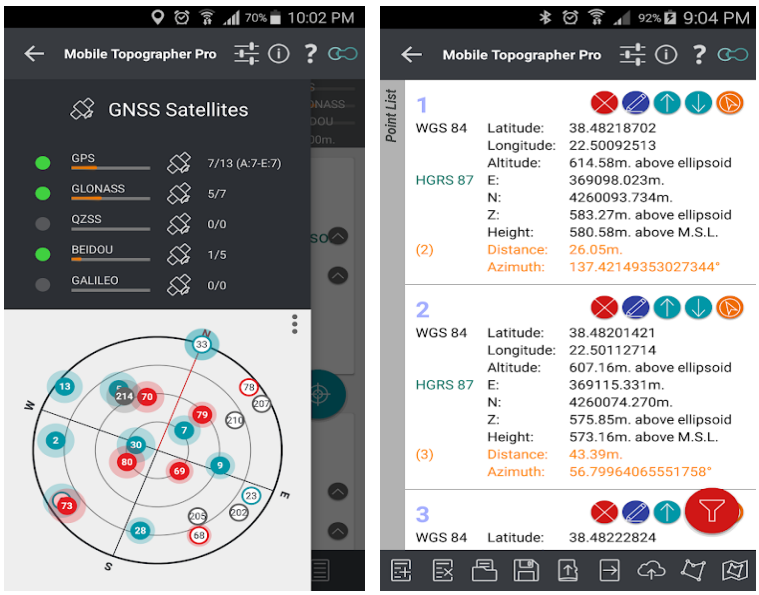
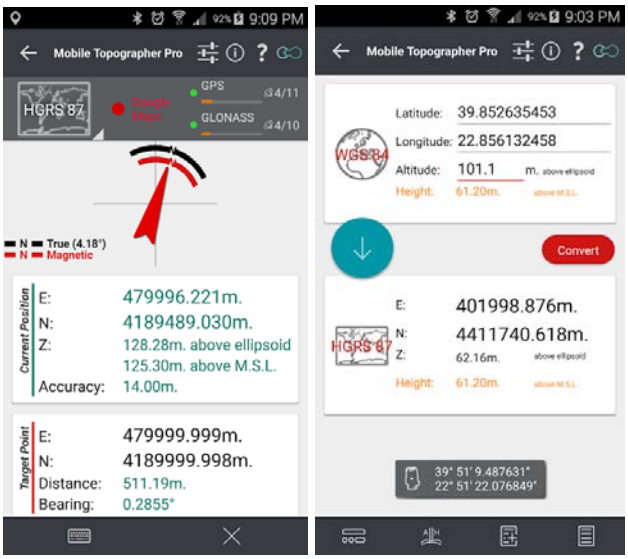


Fig. 3 Determining points using GNSS technology [2]



a b

Fig. 4 Setting-out detail points in the field - a and converting points from one projection system to another - b [2]

Fig. 5 Calculation of the 3D model of the terrain and creation of level curves [2]

2.2 Topo Tools application

Topo Tools is a coordinate calculation application in the 1970 National Stereographic Projection System developed by a Romanian specialist, which allows the location of coordinates on the map, precise navigation to the coordinates concerned, calculation of topographic orientation between two points, calculation of distance between two points,

transformation of coordinates from the 1970 National Stereographic Projection System to the WGS84 International Geodetic System and vice versa. The following images show some of the workings of this application

Fig. 6 Topo Tools application interface [3]

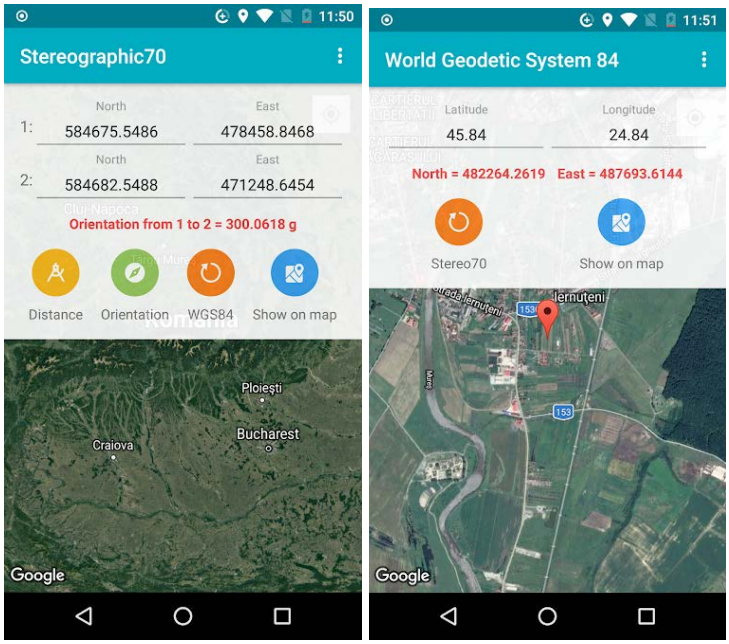


Fig. 7 Calculating the topographic orientation between two points and locating a point on the map [3]

2.3 TopoBot application

The application of Romanian origin, TopoBot is an autocorrection system based on topographic algorithms, allowing the measurement of the terrain only if you are at the respective location [4].

This application is designed to accept as valid only Romanian coordinates, in the Stereographic 1970 projection system, which can be taken exclusively from official documents, ie only from your property deeds [4].

Fig. 8 TopoBot application interface [4]

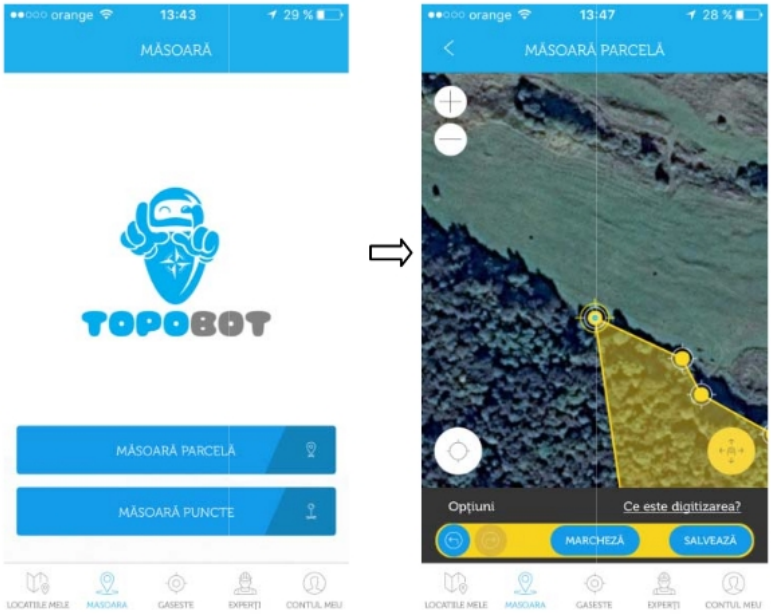


Fig. 9 Measurement module [4]

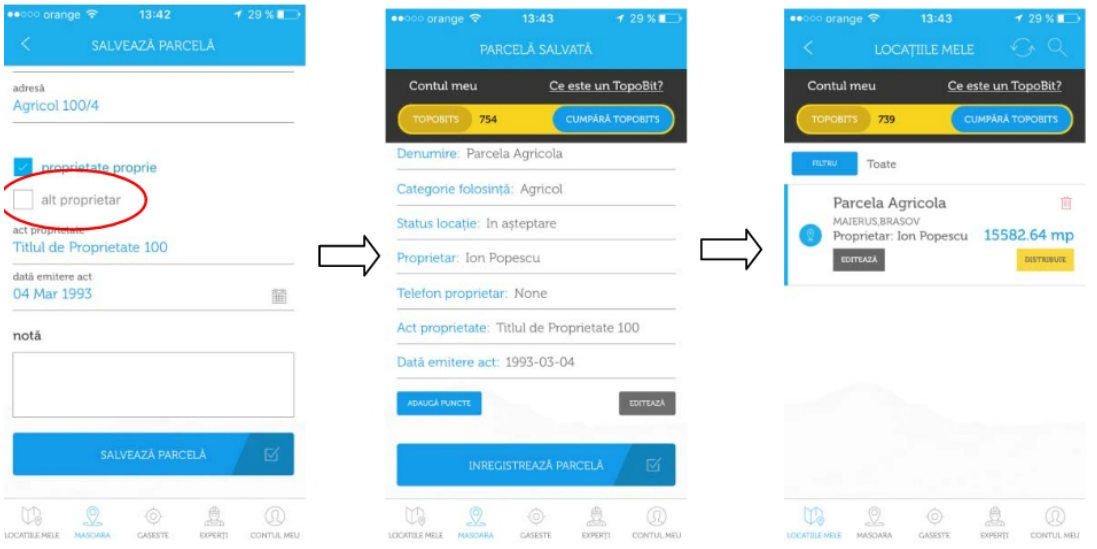


Fig. 10 Storage of measured data [4]

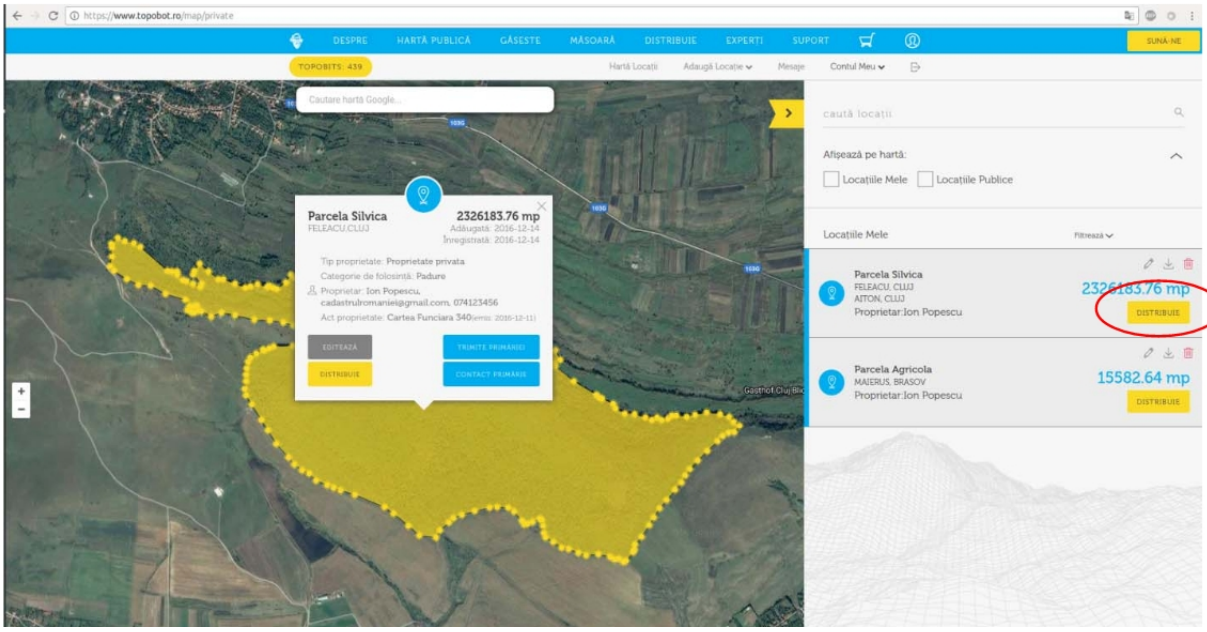


Fig. 10 Measured Data Expert [4]

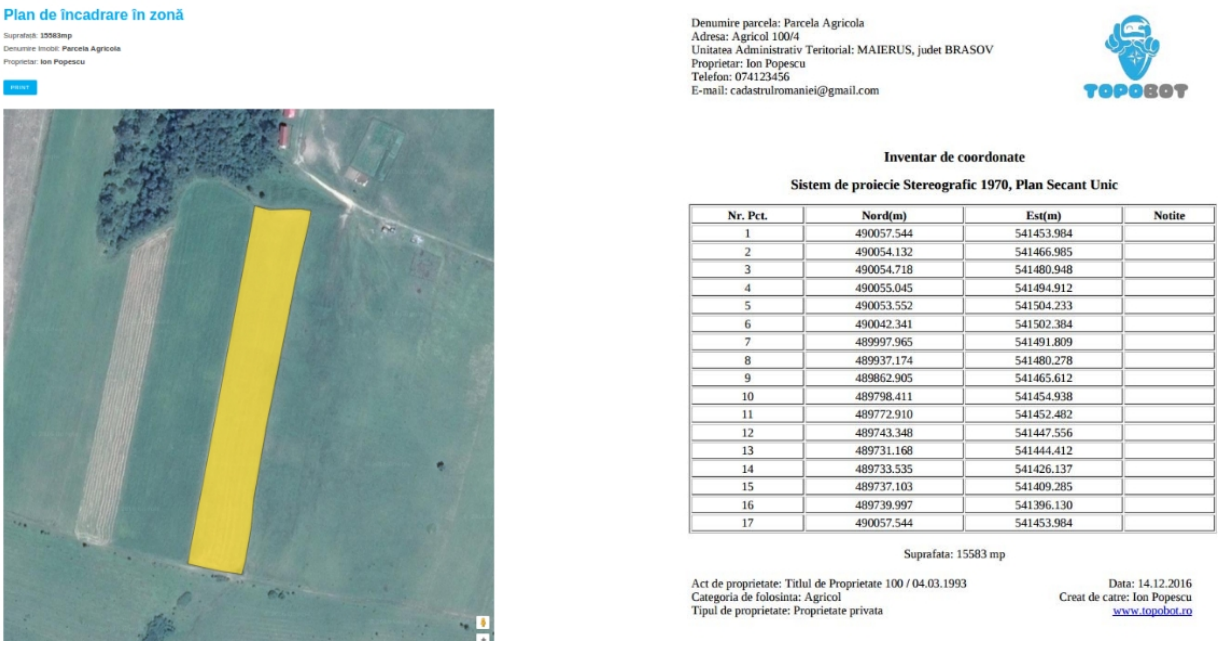


Fig. 11 Generated model for area framing plan and coordinate inventory [4]

The applications presented represent only a tiny segment in terms of the opportunities offered by smart telephony systems, currently there are a wide range of applications created internationally in order to optimize and streamline production in modern topography.

3. Conclusions

The so-called "Key to the Neck" generation, ie the generation of those born in Romania during the communist regime, has now come to realize that due to the speed of technology development, the fruits of this industrial revolution in the field of topography can not be fully implemented. The current generation, namely generation Z, although it lacks the

experience of those like us, has the ability to see the substrates of modernization differently from us. Smartphones, tablets, computers, and even the latest data collectors are designed with them in mind, and they have grown up playing virtual reality-based computer games.

The world we live in is 80% digital, which is why we believe it is time to make room for ambitious young people and give up certain principles, because we have so much to learn from each other. We are convinced that only together will we be able to prepare future specialists for the next generations.

It was an exemplary profession, due to the rigor and quality of the work undertaken at that time, for those who attended courses and professional training during the communist regime, it is a wonderful profession for us who began to taste the topography by the appearance of total stations and the first GNSS systems, but for today's young people we are convinced that the amazing developments they have and will have, will make them take modern topography to another level, agreeing to teach Generation Z, which we inherited over time, with firm conviction that I contributed to the development of modern topography.

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