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Applying of the Mobile Versions of Google Earth and AutoCAD for Field Control of a Specialized map of a Large Urban Garden

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1. Introduction

The mobile technologies nowadays:

- -provide users with various types of devices
- -the smartphones increase their influence in the human life
- -WEB provides both free and paid apps

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a) To implement and analyse one possible application of the mobile technology in surveying and cadastre;

b) To conduct the necessary classical and GNSS measurements required for the map's creation;

c) To analyse their quality;

d) To test the overall performance of the mobile IT, when used for geodetic purposes;

2. Tasks of this paper

e) To execute the required field control of the specialised map.

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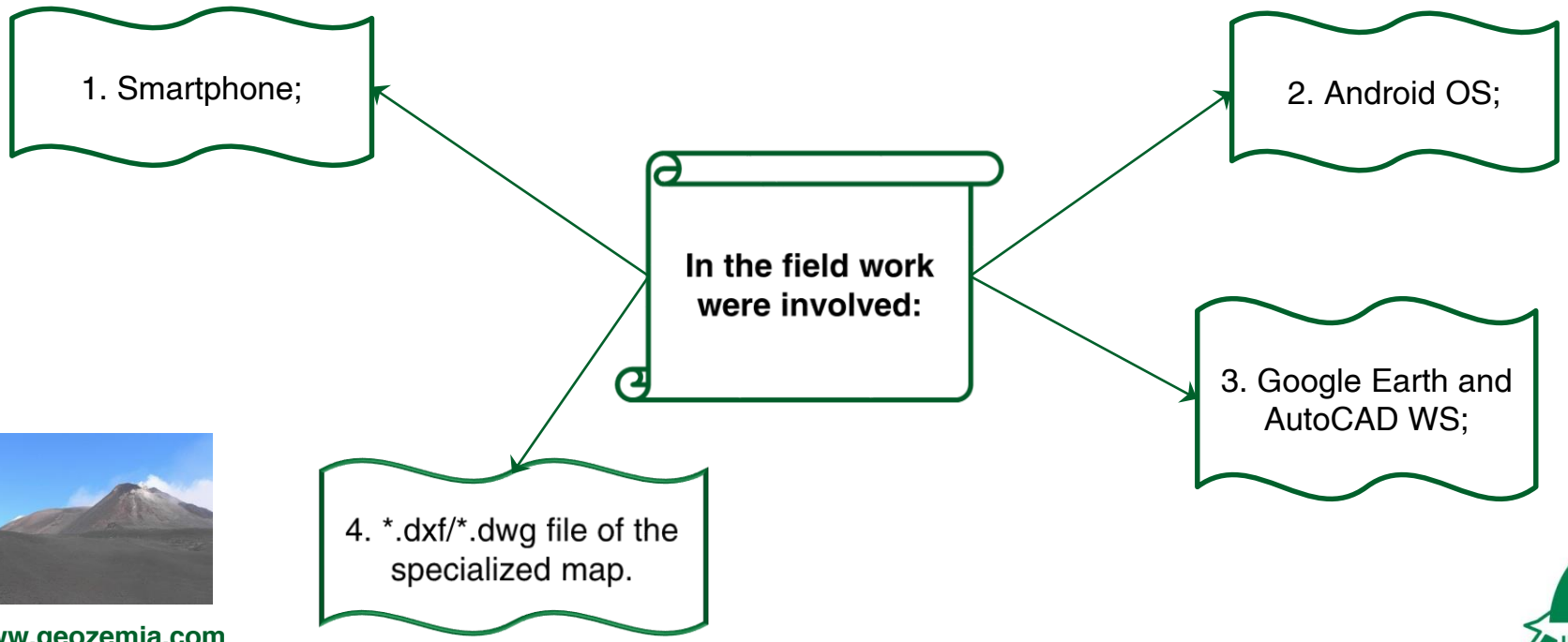
3. Used mobile IT



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4. Technology and Conducted Geodetic Measurements, used for the Creation of the map of the Garden

the garden – separated into areas to facilitate the measurements' process

classical measurements – used in the most of the area

GNSS technology – applied in the open places

the creation of the map (incl. all details: benches, alleys, pillars and trees) was done ***only*** from these field measurements

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4. Technology and Conducted Geodetic Measurements, used for the Creation of the map of the Garden

Technical difficulties during the survey process

classical measurements

problems with the line of sight (due to the branches and the leaves)

GNSS measurements

were very hard to conduct – presence of tall trees and other passive disturbers

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5. Mathematical Processing of the Geodetic Measurements. Quality Assessment of the Results.

Date	Tr(Q)	M number	N number	Tod's number	condition	M sq. [mm]	M ar. [mm]
19-th of Oct	0.04	3.76	1.36	155.86	6.03E-16	20	20
21-st of Oct	0.21	69.62	5.18	1048.38	6.90E-15	19	19
23-rd of Oct	0.15	17.71	2.64	354.67	2.34E-15	7	7
28-th of Oct -I	0.12	2.06	1.03	35.02	4.57E-16	29	29
28-th of Oct -II	0.04	3.05	1.3	125.19	5.79E-16	11	11
29-th of Oct	0.19	23.04	2.02	553.64	2.69E-15	42	42
20-th of Nov	0.1	28.66	4.85	786.52	4.31E-15	73	73

Table 1 Values of the quality criteria – plane geodetic network

The created classical geodetic network was adjusted and analysed (software PhdPolarSurvey).

The overall quality of the plane geodetic network could be denoted as "***good***" (see values of: "condition" criterion, M sq. and M ar. errors)

The values of all quality criteria *satisfy the accuracy requirements* for the map.

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Date	Mp [mm]	Mh [mm]
24-th of Oct	341	619
	343	596
25-th of Oct	68	77
	25	175
26-th of Oct - I	44	88
26-th of Oct - II	138	50
	87	162
28-th of Oct	572	645
20-th of Nov	34	73

The largest values for Mp are coloured in red.

These points (situated close to large trees) were re-measured, using total station.

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Table 2. Quality assessment of the GNSS measurements in RTK mode

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6. Creation of the map of the Urban Garden

The objects in the garden were recorded with these attributes: description, point number, x, y.

Mkad was used as a platform for the creation of the digital model of the map.

The final product – the digital map, see next on fig. 1 was exported in *.dxf format for further analysis.

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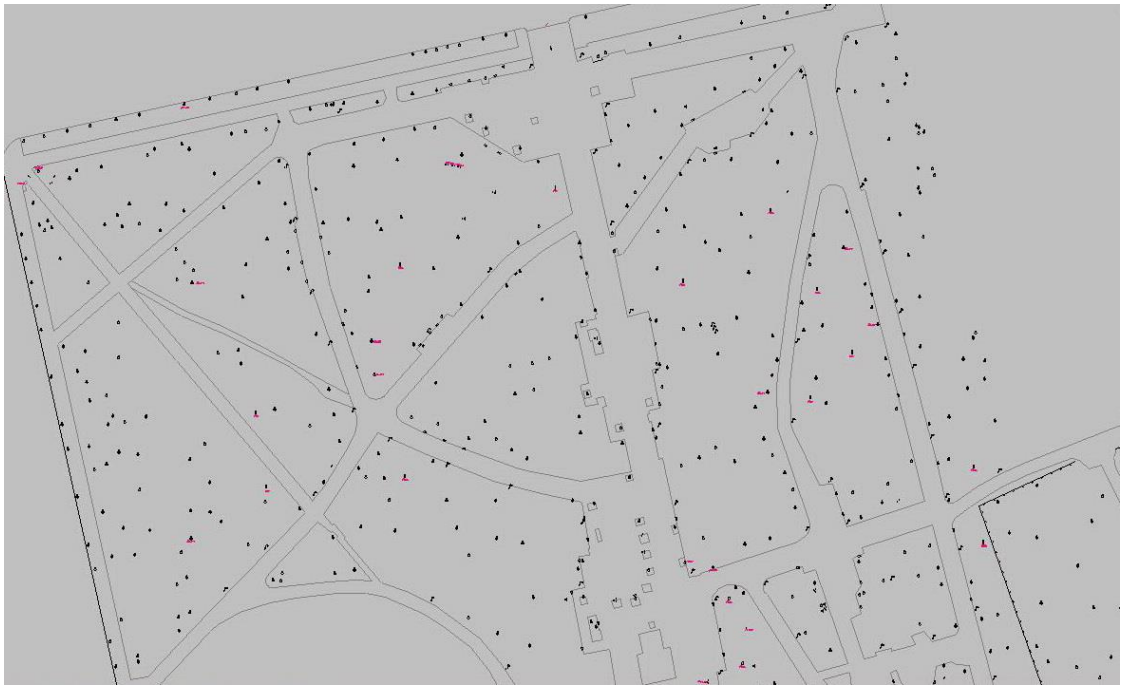

Fig. 1 Window from the map of the large urban garden

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7. Field Control of the map, Using: Smartphone, Google Earth and AutoCAD WS

The created digital model of the urban garden was subject of field checks to ensure the completeness of the information.
The entire situation of the garden was controlled and compared both on site and in the model.
Usage of a hardcopy (traditional way) - not possible - due to the area 82274 sq. m. of the garden.

Main aspects (*not necessary to be executed one by one*)

-The model of the garden was imported in *.dxf/*.dwg file in AutoCAD WS- fig. 2;
-It was applied parallel with the usage of Google Earth - fig. 3;
-The model was divided in parts (when necessary) and generated in *.kmz files - fig. 4;
-The data were imported in Google Earth and visualized with the current position.

The described steps *facilitated* the field control of the map.

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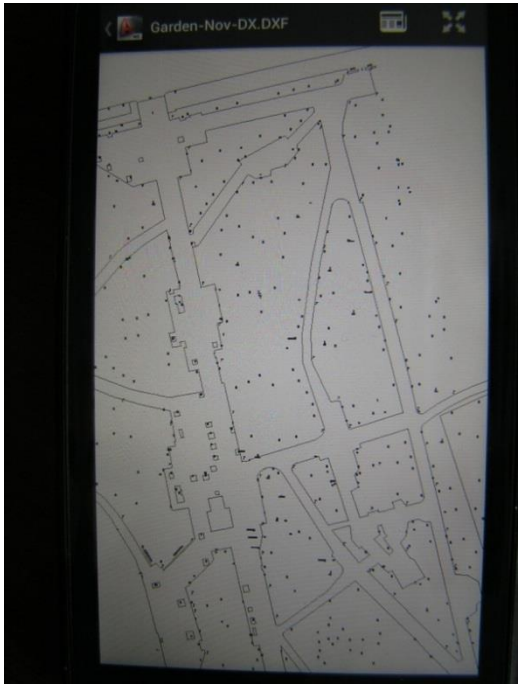

Fig. 2 - Part of the urban garden in AutoCAD WS

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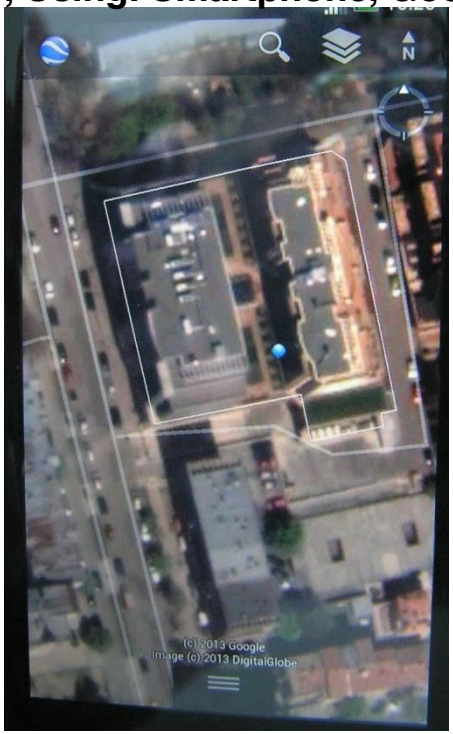

Fig. 3 - *.kmz file and the current position in Google Earth

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Fig. 4 - *.kmz files of contours in Google Earth

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8. Analysis of the Applied Method for Field Control of the map

Key details:

1. the values of the quality criteria met the accuracy requirements of the map;

2. the points with low quality were re-determined using classical method;

3. a few points were re-measured;

4. usage of other ways for coordination of the objects was ***not recommended***.

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8. Analysis of the Applied Method for Field Control of the map with the Mobile IT

8.1 Advantages:

-easy, convenient navigation within the digital model in the smartphone;

-very small size and low weight of the mobile device;

-suitable use of the mobile applications – i.e. small window of the app on the display of the smartphone;

-the used apps are freeware and with a number of functions.

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8. Analysis of the Applied Method for Field Control of the map with the Mobile IT

8.2 Disadvantages:

-significant power consumption when: using GPS or scrolling within the graphics;

-the visualization on the display of the device is difficult, if working in an open area with (strong) sunlight;

-in some occasions the software worked unstable – it may need improvement.

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9. Conclusion

1. The disadvantages did not lead to problems with the field control. They could be used as recommendations for *improvements of the mobile IT*;

2. The application of the described method significantly *facilitated and optimized* the work process (according to the overall performance of the equipment);

3. Based on the quality assessment of the results from geodetic measurements, it could be noted that the digital map of the garden represents the urban situation with *high accuracy and reliability*.

4. According to the gathered experience with the applied method, it could be summarized that nowadays the mobile IT could be used successfully not only for general purposes, but also for *specialized geodetic tasks*.

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Thank you for your attention!

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