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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**

1. Smartphone;

2. Android OS;

**In the field work were involved:**

3. Google Earth and AutoCAD WS;

4. *.dxf/*.dwg file of the specialized map.

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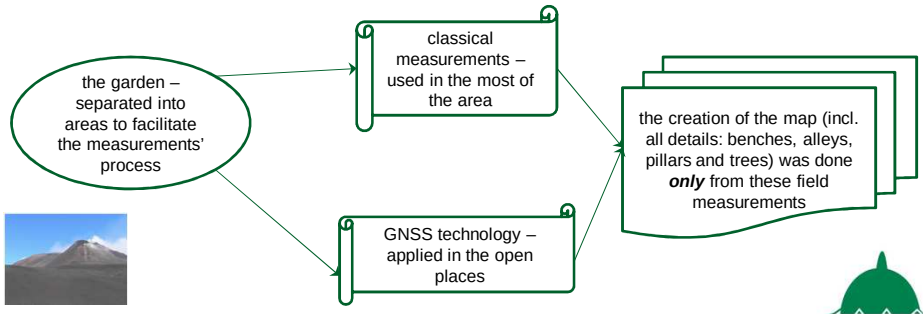
**4. Technology and Conducted Geodetic Measurements, used for the Creation of the map of the Garden**



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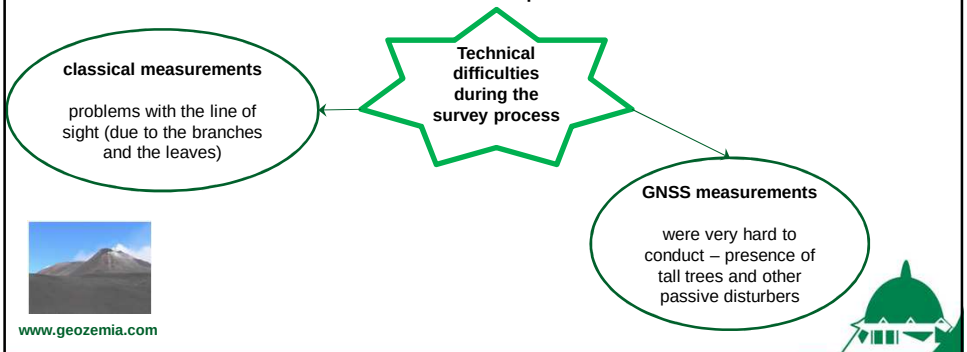




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### 5. Mathematical Processing of the Geodetic Measurements. Quality Assessment of the Results.

| 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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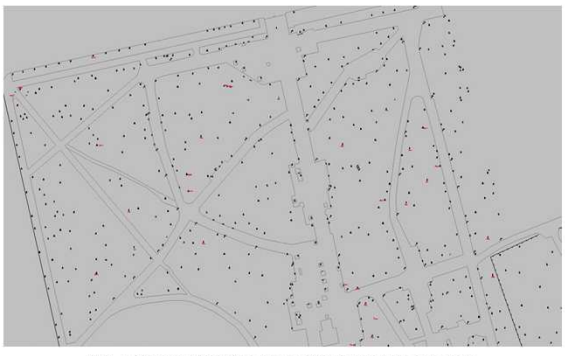

Fig. 1 Window from the map of the large urban garden

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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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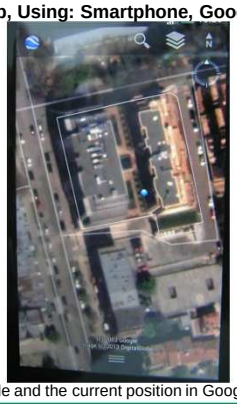

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Fig. 3 - *.kmz file and the current position in Google Earth

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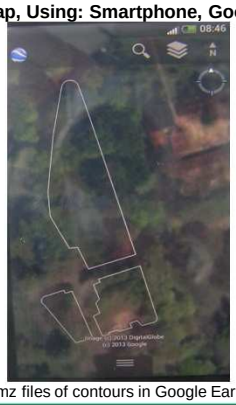

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Fig. 4 - *.kmz files of contours in Google Earth

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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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**REFERENCES:**

**Used software:**

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2. Geomax Geo Office;
3. GNSSTransformations;
4. Google Earth;
5. Heights-Network;
6. PhDPolarSurvey;
7. Total-convertTS.

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