THE ADVANTAGES OF USING MOBILE GIS TECHNOLOGY

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Abstract . Mobile GIS applications are evolving along with development of mobility, geoinformatics. It represent user knowledge of the geographic details of the application area and the user's ambition to explore geographical maps anywhere, anytime. Network analysis is a major requirement and necessity for many smartphones users who need to know where they are or manage their travels and journeys. This idea faces many challenges in navigating online from exact user position to a destination point using algorithms and solutions for navigation software, in the same time fixing issues that can show in the process . This research paper presents a Mobile GIS application and emphasizes the role of mobile network analysis for mobile users with embedded GIS applications. This type of work differentiates mobile GIS from other GIS achievements, such as desktop GIS and Web-GIS. Mobile GIS works have a low or zero cost because there is no need to buy special devices so that works can be done with a smartphone with GPS. Anyone who wants to work and add improvements to these platforms can do it by creating an account. For geodetic precision, there are solutions to the problem as connecting a GNSS antenna to the mobile device for field data collection (smartphone, tablet, etc.). For accomplishment of the field work there were used smartphones as Apple Iphone 6S, Apple Iphone 5S, and a tablet, Allview AX4 Nano with the Here Map Creator mobile application installed, and the field data has been processed at the office directly on the Here Map Creator online platform. Mobile GIS applications have been made in the Mehala and Circumvalation neighborhoods, located in the N-V part of Timisoara, on the streets with blocks of flats and in the area with houses. The Here Map application was used to map and update field data, and Mapillary was used to build the street view map in which it was used. The work took place in several stages of the field, then at the office where the data was processed. The purpose of the paper was to upload the results to an on-line database. At the final stage, a review of the entire work was made using a comparison between updated map and other Mobile GIS platforms such as openstreetmap.org and Google Maps.

Keywords: Mobile GIS, Here Map Creator, Database, GPS.

INTRODUCTION

Mobile GIS is taking Geographic Information Systems (GIS) out of the office and into the targeted field. Mobile GIS allows folks out in the field to manipulate, update, analyze, capture, display and store geospatial data and information. Mobile GIS has as an important technologies, the following: mobile handheld devices , Geographic Information System (GIS) software , the Global Positioning System (GPS). (GRECEA, CARMEN, COSMIN CONSTANTIN MUSAT, and CLARA-BEATRICE VÎLCEANU, 2012).

The purpose of this paper is to present the possibilities offered by Mobile GIS applications, to improve maps by marking points of interest, roads, house numbers and the advantage of uploading pictures for even better orientation. At the same time, volunteering is supported by whoever can bring information that leads to updating the map, with a minimum cost and only a mobile phone equipped with GPS receiver.

MATERIAL AND METHODS

GIS is the acronym derived from the Geographic Information System (sometimes translated as SIG in Romanian). This system is used to create, store, analyze and process spatially distributed information through a computerized process. GIS technology can be used in various scientific fields such as resource management, environmental impact studies, cartography, route planning (HERBEI OCTAVIAN, HERBEI MIHAI VALENTIN, 2011).

Specifically of GIS is the way in which the information is organized. There are two types of information: a graphical one indicating spatial distribution of the studied elements and another as a database to store attributes associated with these elements (exemple for a road is: length, width, number of bands, construction material, etc.).

Mobile GIS is a part of GIS technology and brings mobile technology from the office into the targeted field. Mobile GIS brings together technologies like: (http://articles.extension.org/pages/40150/what-is-mobile-gis):

■ Mobile devices
■ Global positioning system
■ Internet access for GIS devices

This technology can be used to add real-time field details into specialized companies servers database, so they can have updated maps using an easy work process. (MASON, BRUCE & GIRARD, 2015).

At the base of all GPS and mobile GIS navigation systems is implemented the WGS84 coordinate system(SALAGEAN, TUDOR; RUSU, TEODOR PORUTIU, ANDRA; ET AL. , 2016).

WGS 84 is an Earth-cantered, Earth-fixed terrestrial reference system and geodetic datum. WGS 84 is based on a consistent set of constants and model parameters that describe the Earth's size, shape, and gravity and geomagnetic fields.

The tools used for Mobile GIS can be professional geodetic devices which have a high precision and accuracy, but the price of acquisition is high. They can be bought from specialized companies such as Trimble, Leica, Garmin. (Figure 1)

Figure 1. Specialized Instruments for Mobile GIS

With nearly similar results for different Mobile GIS applications, both mobile phones and new generation tablets equipped with a GPS receiver and an Android or IOS operating system can be used. The main advantages of these devices are that they are handy to any mobile user, they are easy to use and have little purchase cost compared to professional tools.

The paper was technically made using a smartphone produced by Apple and an Android tablet.

iPad and iPhone - Consumer Tablet and Phone(Figure 2)

Pros:

•   Elegant hardware and slick interface

•   Multiple GPS/field data solutions available from App Store

•   Excellent display

Cons:

•   No SD card option

•   Dependence on iTunes for data transfer

Figure 2. iPad and iPhone

Android-Consumer Tablets and Phones(Figure 3)

 Pros:

-Inexpensive (good choices start under $200)

-Many hardware options - from phones to oversized tablets

-Multiple GPS/field data solutions available from Play Store

-Excellent display on many models

-Supports MB&G's MobileMap mobile GIS application

Cons:

•Inexpensive devices may lack durability in tough conditions

Figure 3. Android Tablet

The Here map creator application was used to map and update field data, and Mapillary app was used to create a street view map.

Here Map Creator (http://mapcreator.here.com) is a mobile GIS service launched in November 2012. This give users the possibility to map their neighborhood and other places which they know better. Also they can add new roads, edit a existent roads, add and edit points of interes. (Figure 4)

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Figure 4. Here Map Creator Website

Mapillary offers a new approach to traffic photos. With the help of computers, Mapillary creates the 3D reconstruction of streets in spatially coordinated photographs. Anyone can contribute by taking photos at street level and editing on the map. To date, the Mapillary community has contributed more than 75 million photographs covering 1.7 million kilometres globally. Learn more about Mapillary (www.mapillary.com)(Figure 5).
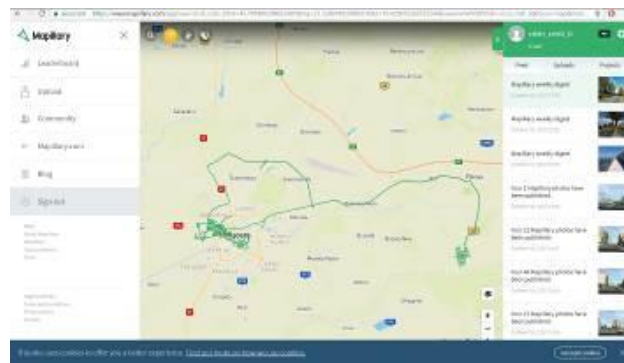

Figure 5. Mapillary Website

RESULTS AND DISCUSSION

Mobile GIS applications have been made in the Mehala and Circumvalation neighborhoods, located in the N-V part of Timisoara. (Figure 6)

Figure 6. Map of Mehala And Circumvalitiunii Neighborhood

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In the first stage of the work were recognized and analyzed the land and streets of the two districts. Were established the routes on the work days and the directions on which the data updates will be executed.

In the second stage using the Here creator map application, the following procedures were performed:

1) Non-existent points of interes were introduced in the online application map such as such as stores, pharmacies, medical clinics, etc. There were also corrected the location of actual POI's that were mistakenly mapped by moving them to the right place using the GPS of the phone in the field or in the office, helping us with the satellite map.

As we can see in the pictures below, we introduced the "Bardi Auto SRL" point of interest, which is a car parts shop (Figure 7).

Figure 7. Identify commercial spaces

2) Numbers of houses or blocks have also been entered as can be seen in the photographs below. (Figure 8)

Figure 8. Identification of house numbers

3) Street geometry has changed where necessary and pedestrian paths or walkways have not yet been added to the online map. (Figure 9)

Figure 9. Updating street geometry

As can be seen on the Map Here Creator, our interest points and house numbers updated by us are only visible from a great zoom. (Figure10)

Figure 10. Map with house numbers and POI's

Mappilary was also created with street view map depending on the parameters that we selected in the application menu.

So a smartphone was mounted on the car's windshield and the photos were automatically taken directly by the application that was connected to GPS and the internet. (Figure 11)

Figure 11. Mapillary software in the field

Later, at the office, we uploaded the pictures directly from the application with the smartphone connected to the wi-fi. Once the upload has taken place, the photos have been automatically deleted from the smartphone memory. These photos appear automatically on the

Mapillary website and on the map from Here Map Creator, ticking the mapillary coverage layer and can be viewed by any user of the two mobile GIS platforms. (Figure 12)

Figure 12. Images uploading procedure

The Mapillary application automatically records and stores street view works, so you can manage all the areas where work was done, and the date of the last update. (Figure 13)
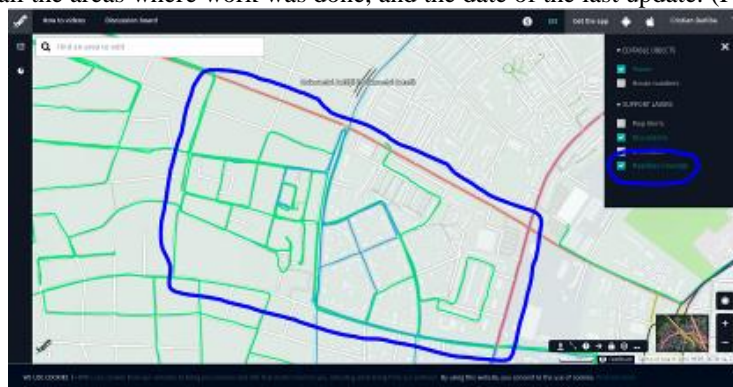

Figure 13. Mapillary Coverage Map

In the final stage a check of the whole field work was made using a comparison between Here Map Creator (Figure 14) and other mobile GIS platforms such as openstreetmap.org (Figure15) și Google Maps (Figure 16).
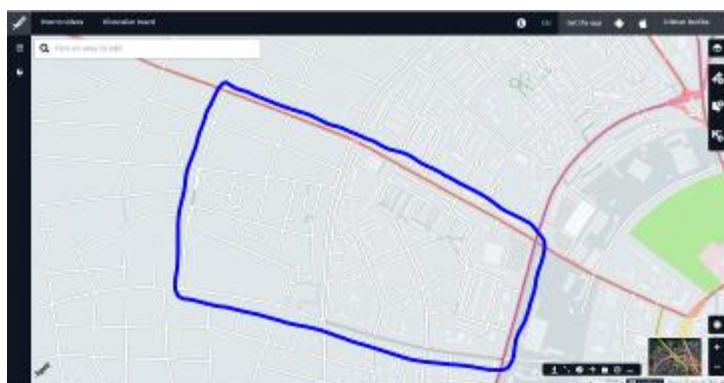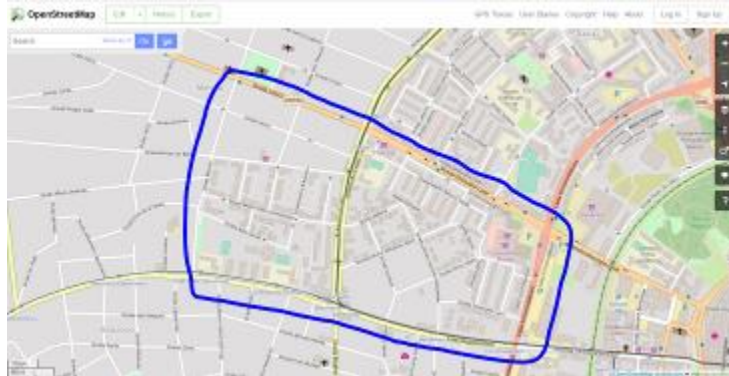

Figure 14. Here Map Creator View
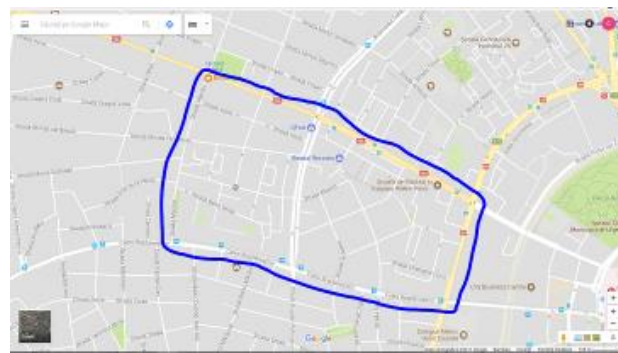
Figure 15. Openstreetmap View

Figure 16. Google Maps View

CONCLUSIONS

Mobile GIS works have a low cost because there is no need to purchase special devices, works can be done with a smartphone with GPS. Anyone wishing to improve these platforms can do it by creating an account.

This Mobile GIS technology has as main advantages: live updates , more people can work simultaneously knowing each other.

Every user can update the area he lives in, because he knows it the best.

Works can be done with a smartphone that has a GPS receiver and an Android or IOS operating system, can be the basis for volunteering, which requires a low cost. If GIS works are highly accurate, there are Mobile GIS solutions to solve this problem using the latest generation GNSS antennas that can be connected to a mobile receiver (exemple: phone, tablet) and which allows connection to the national system of reference stations ROMPOS.

Mobile GIS has the following benefits: live updates can work more people at the same time to improve the platform and everyone knows each other. As a disadvantages are: the fact that there are satellite images that are not updated and often are not georeferentiated correctly. Geometry of the streets is not overlapped with the satellite images and users can make mistakes in introducing new or upgraded GIS data.

BIBLIOGRAPHY
1. MASON, BRUCE & GIRARD, 2015, Mobile GIS Technology for Efficient Field Data Collection;

2. GRECEA, CARMEN, and ANCA-MARIA MOSCOVICI, 2014 - "Phonic pollution and strategic acoustic mapping with geographic information systems." Environmental Engineering and Management Journal 13.9 (2014): 2229-2232;

3. GRECEA, CARMEN, COSMIN CONSTANTIN MUSAT, and CLARA-BEATRICE VÎLCEANU, 2012 - "GIS, Efficient Support for Urban Planning-Framework of Timisoara, Romania." International Multidisciplinary Scientific GeoConference: SGEM: Surveying Geology & mining Ecology Management 2 (2012): 1057;

4. HERBEI OCTAVIAN, HERBEI MIHAI VALENTIN, 2011 - Cartographic Projections, , Universitas Publisher Petrosani;

5. SALAGEAN, TUDOR; RUSU, TEODOR PORUTIU, ANDRA; ET AL. , dec 2016 - Aspects regarding the achieving of a geographic information system specific for real estate domain; agrolife scientific journal Volume: 5 Issue: 2 Pages: 137-142;

6. http://articles.extension.org/pages/40150/what-is-mobile-gis;

7. http://mapcreator.here.com;

8. www.esri.com/mobilegis;

9. www.mapillary.com.