Mobile Application Based on Android Platform for Referent Points of Third Order in the City of Prishtina

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SUMMARY

Location-based services exist more than 10 years. On year 2010, these services had increased their usability. For this, the use of GPS on various mobile devices, including mobile phones, had crucial importance. Today, we are seeing that location-based services are increasingly approaching with mobile phones forming a new group of applications which are becoming a model for the world of mobile devices, which especially relates to smartphones. Nowadays, we are using smartphones and tablets, which will potentially replace the desktop calculator for other purposes also. We have a significant number of cases where a person sitting in a bar needs to get information and relevant data for that location! This need is offered to us through location-based services. Location-based services offer many advantages to users of mobile devices to obtain information on their current location and to process that information about their location nearby. With the help of GPS in mobile phones and through the web services, location-based services can be implemented in devices that use the Android platform to deliver these kinds of services.

Within this research, the development of a mobile application "PR3" on the Android platform is presented. The main goal of developed application "PR3" is to enable quickly locating on reference points of third order network in the area of the city of Prishtina (area with 565 geodetic points). Technology which has been used to display items on the screen is called Augmented Reality. Application has been developed within bachelor degree thesis on surveying department of Prishtina University "Hasan Prishtina", by Atdhe Buzhala and his mentors Prof.Dr. Ismail Kabashi and Prof.Dr. Bashkim Idrizi.

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1. INDTRODUCTION

Although location-based services exist more than 10 years, on year 2010 their usability have been increased. Therefore, the use of GPS in various mobile devices, including mobile phones, had crucial importance.
Nowadays, we are seeing that location-based services are increasingly approaching with mobile phones forming a new group of applications which are becoming a model for the world of mobile devices, which especially relates to smartphones. Smartphones and tablets utilization, will potentially replace the desktop calculator for other purposes also.
We have a significant number of cases where a person sitting in a bar needs to get information and relevant data for that location! This need is offered to us through location-based services. Location-based services offer many advantages to users of mobile devices to obtain information on their current location and to process that information about their location nearby. With the help of GPS in mobile phones and through the web services, location-based services can be implemented in devices that use the Android platform to deliver these services:

1.1 The Platform Features

As the first referred open source platform for developing application, Android operative system has increased its popularity in the continuity way from 2007, years in which appeared first SDK [3]. Developed from Google in corporation with Open Hands Alliance, after purchase by the original creator Android Inc. in year 2005, this operative system today is the most used for mobile devices in the world.
Operative system Android is system based in Linux and developed for mobile equipment, smart phones and tablets. It is characterized by the open code and certain features which enabled to benefit from mobile hardware characteristics. Android is an software setting which contain operative system based in Linux, different structures application, different app for users, library, multimedia, integrated support and more, tools and API used for mobile app development offered by Android SDK.
Unlike their greatest rival IOS from Apple, Android could be placed in hardware equipment. As a result of this, today around 4000 different mobile equipment, smart phones and tablets, produced by different producers which constitute a huge part of the global market, use operative system Android.

1.2 Location and Application

Traditionally, the location was the main answer of the question: ”what is important when we want to buy a real estate”, other question that have been asking lately are:”what is important on worlds smart phone services”? The answer were found exactly at, The Location. Furthermore location started to become fundamental aspect in world mobile devices, enabled by Web and have revolutionized our daily way of life.
So, today, greater value of most applications and mobile services determined key factor: user’s accurate location at the moment of using the service. If you are in a new place or taking a walk in a new area or making “check in” on any social network, each of this is pointing out the location. Ability of knowing current position or how to go to another place, already passed by a new opportunity offered from mobile telephone to daily necessity.

Application with information on location and services based on Location, at the beginning were promoted from mobile operators, in purpose to increase using mobile telephone, and all the time have found support by users who first request were to have, the Location. Nowadays when we mention the app with information about location, we have to do with a lot of application and web service, produced to work effectively in mobile equipment which uses one of positioning technologies or ant technique of position.
Location quickly is spreading and is becoming ever more present in mobile app, although there is strong evidence that these applications possibly would be commercialized.

2. MOBILE APPLICATION “PR3”

The main purpose of the application is to enable tracing of points of the third order in the area Prishtina city, placed in all city in strong places as street and sidewalks (figure 1)

Figure 1. The third order reference point in Pristina.

Third order referent points are very important for surveyors and those who deal with geospatial work. Each point is defined with spatial coordinates (X, Y and H) in state spatial reference system KOSOVAREF01 (table 1).

Nr	Y	X	H
190001	7510591.477m	4724827.473m	598.619m
190002	7510737.000m	4724659.466m	599.697m
190003	7510887.340m	4724508.866m	601.790m
190004	7510967.716m	4724438.797m	602.937m
190005	7511087.077m	4724337.882m	604.599m
190006	7511150.289m	4724283.090m	604.436m

Table 1 Extract from the list of coordinates of the third order reference points in Pristina.

The application is based on the list of coordinates as in table 1, further transformed in world coordinates system WGS84, in order to make them compatible with the mobile GPS functions.
In general, position defining options of mobile device are categorized in three levels-models (figure 2):
- *High accuracy* - in this model the device uses three types of positioning elements GPS, WI-FI and mobile network cell ID;
- *Battery saving* –equipment uses only two types of positions elements, Wi-Fi and mobile network cell ID; and
- *Device only* - this model present only equipment that exploits GPS, device without Wi-Fi and mobile network.

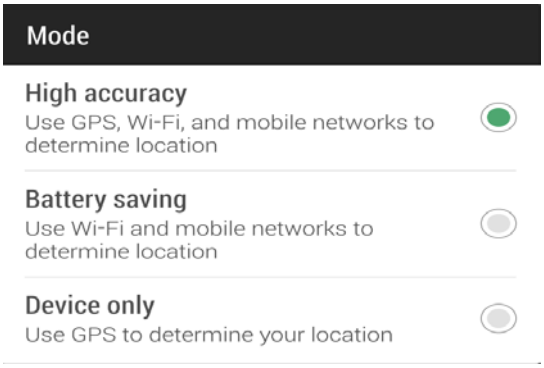

Figure 2. Accuracy types/levels that provide mobile devices

Application "PR3" is developed in order to use three positioning types: position system with satellite navigator GPS, WI-FI position system and position system by cell ID. Each of them is connected to application, by locating position as fast and accurate mobile device.

2.1 Application Functionalities

The application enables:

- Appearance of the points in camera and the distance between the phone user and the points (by using Augmented Reality technology),
- Direction to the seek point,
- Sorting the closest points in relation to the user (in radius action ex.50m, 100m, 200m, 500m and so on to 1km)
- Appearance of points in Google Maps, followed by the information on the points.

Applications main interface is shown in bellow figure 3, which is very simple for wide everyday utilization by surveyors, by appearing the photo and coordinates of geodetic reference points, as well two signs in upper right corner. *Sign nr. 1* (with red color in figure 3) expresses option Google Maps, in which all third order points of Prishtina can be seen by their location on the Google maps; while the *Sign nr. 2* (with red color in figure 3) expresses option Augmented Reality, which gives opportunity to appear points in screen and obtain orientation to them in relation with the app user.

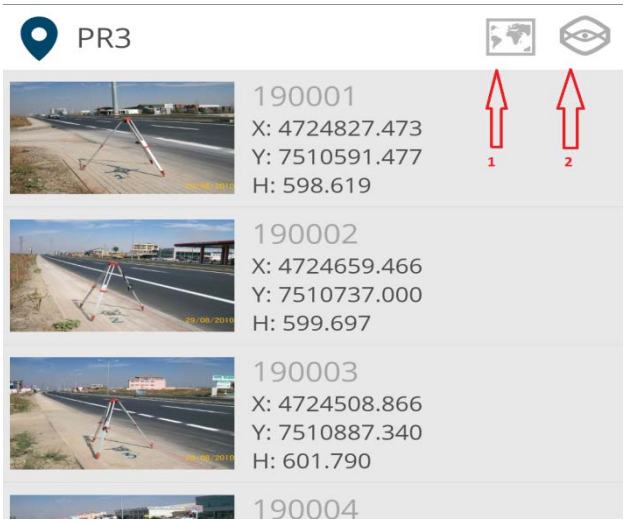

Figure 3. – View of points in application PR3 (190001 – 190565)

2.2 Location of geodetic points in Google Maps

Based on geodetic point coordinates in WGS84 spatial reference system, all points of third order reference network are able to be seen over the Google maps in their right-accurate location, followed by options for finding of users position, as well zoom tools (figure 4). This option gives high visibility opportunities for searching the nearest point, needed point, as well based on logical expressions. At the middle photo of picture 4 are shown closest points to the users position, in which by clicking to points on mobile screen appears item data, while in right photo of picture 4 are shown point data and ON-OFF button which activates signal for navigating to the selected point.
For all 565 points stored in app "PR3", bellow information can be obtained, as it is shown in both photos of figure 5:

- Point number
- Orthogonal coordinates and altitude in state coordinate system KosovaRef01 (Y, X, H)
- Geographic coordinates in WGS84 geographic reference system
- Original appearance of the point
- Photo sketches (description of the objects around the points) and
- View of point and users position in Google Maps

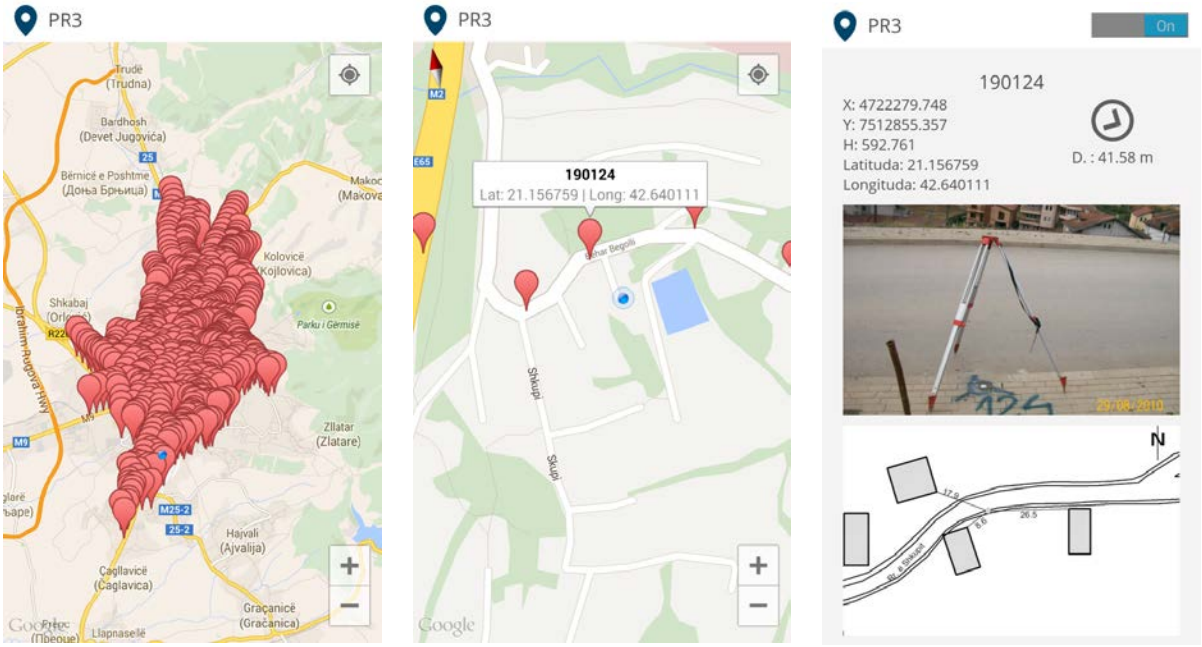

Figure 4 – View of all third order reference point in Google maps and position of user.

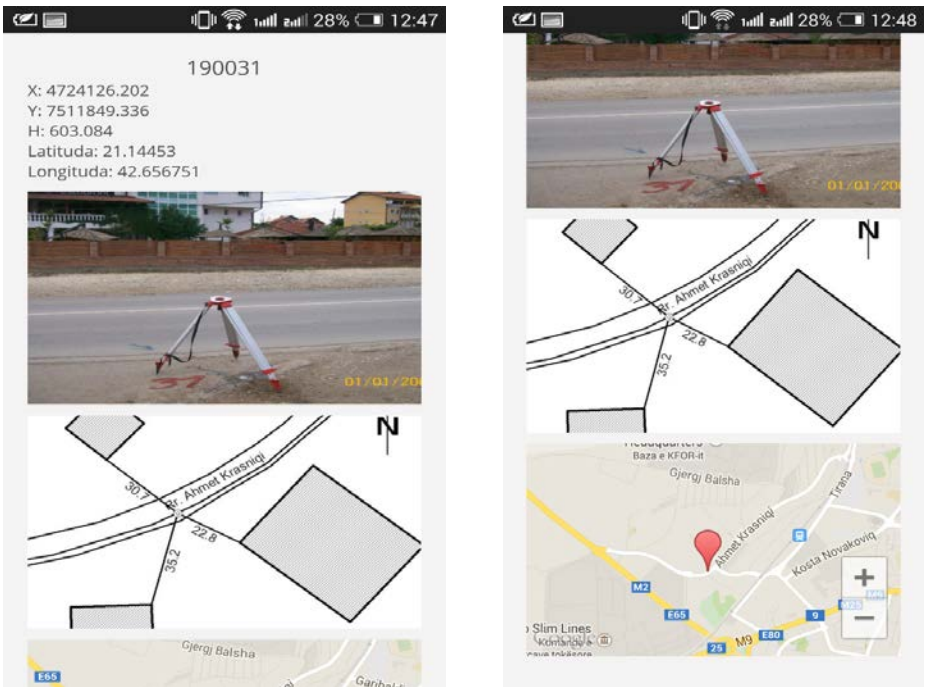

Figure 5 – Example, point 190031 and its data.

2.3 Augmented Reality mode in “PR3”

Augmented Reality is a vivid picture of physical environment by using the smart phone camera or tablet devices. It is related to a general concept called mediated reality, in which mediation is a smart phone or tablet device.
Augmented Reality works based on phone camera, GPS, Accelerometer and compass. All these elements are integrated in phone equipment, i.e. in phone device.

Within the developed application”PR3”, augmented reality function works in order to visualize/find geodetic points at given direction and radius-distance. At bellow figure 6, a random view from a mobile camera can be seen. Beside the view of environment in mobile camera, on mobile screen are shown other-customized elements signed as 1, 2 and 3.
- Sign 1 is radar for 360º which indicates the direction of the camera and azimuth angle.
- Sign 2 presents one of points that we are looking for, followed by direction and distance from mobile users to point. In radius of 360º, maximum number of points is ten that can be shown on screen. From screen, any of points can be clicked and furthermore get information for each point.
- By sign 3 is presented slide bar, which show the radius of action in relation of mobile devices and the geodetic point. This function is limited to 1km radius from the position of mobile user, and gives opportunity to be defined by the user’s custom requirements, i.e. if the slide bar is defined in 200m, than on screen will be shown all geodetic points within 200m the user’s position.

The accuracy of getting points in mobile screen by using this mode is quite large, and it depands on the device type, as well to usage of High Accuaracy option on mobile device

Figure 6. View of third order reference point by device camera (Augmented Reality technology) and other application elements.

3. FURTHER EXTENSION/DEVELOPMENT OF APPLICATION "PR3"

Location is a new exiting dimension which is in everyday usage. By fast rates of technology development, easily we conclude that soon all mobile devices in world will be able to determinate location and users will require entering in mobile applications. Integration of content and information on location makes the most important application for users.
With this app, time for finding the third order points in Prishtina is reduced drastically. This app is a real relief, maybe unthinking before, but now is a completed project and in everyday use.
Opportunities for further development of this project-application currently are going parallel in three ways:

- Including all geodetic points within the area of the Republic of Kosova;
- Upgrade of application with new functionalities and keeping compatible with new operating systems; and
- Increasing the accuracy by using the external devices.

4. CONCLUSIONS

Applications with information on location and location-based services, initially have been promoted by mobile operators in order to increase the usage of mobile phones, and throughout time have found users support who sought in the first place their location. Mobile devices which gives the information on the location, deal with a long string of applications and web services that are built to work effectively on mobile devices that use positioning technology and methodology.
Within this research, development of mobile application on the Android platform has been reached! The main goal was enabling of quick positioning by mobile phones, in order to find the third order geodetic reference points in the area of Prishtina. Besides overlapping of geodetic points on Google maps, the augmented reality technology for displaying points in mobile screen has been applied to the developed application also.
Given the importance of geodetic reference points for surveyors and everyone who deals with geodetic work, we intent, through the developed application on the Android platform, easiest and quick finding geodetic reference points of third order in the cadastral area of Prishtina, recorded as point numbers from 190001 to 190565.
By using the developed android application "PR3", time for finding geodetic reference points in the city of Prishtina is extremely reduced. Now, Albanian surveyors in Prishtina are able to reach to geodetic points in very simple and fast way, by using just one mobile device with installed app "PR3", and without need for additional paper forms/documents/maps.
Extending of the project, further upgrading of application, updating existing database, as well covering entire area of the Republic of Kosova by including of all geodetic reference points in application, are main challenges for upcoming period!!!

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BIOGRAPHICAL NOTES

Bashkim IDRIZI, was born on 14.07.1974 in Skopje, Macedonia. He graduated in geodesy department of the Polytechnic University of Tirana-Albania in 1999year. In 2004, hot the degree of master of sciences (MSc) in Ss.Cyril and Methodius University-Skopje. In 2005 he had a specialization for Global Mapping in Geographical-Survey Institute (GSI) of Japan in Tsukuba-Japan. On year 2007, he held the degree of Doctor of sciences (PhD) in Geodesy department of Ss.Cyril and Methodius University–Skopje. He worked in State Authority for Geodetic Works from May 1999 until January 2008. During those period, in 2004 he appointed for head of cartography department, i.e. geodetic works. From October 2003 up to January 2008, he worked as an outsourcing lecturer in State University of Tetova. From February 2008, he works as a cartography and GIS Professor at the State University of Tetova–Tetova. He continuo with working as outsourcing lecturer in geodesy department of the University of Prishtina-Kosova. He is the author of three cartography university books, and more than 90 papers published and presented in national and international scientific conferences related to geodesy, cartography, GIS and remote sensing. From March 2010, he is appointed as president of Geo-SEE Institute (South-European Research Institute on Geo Sciences). From November 2011 to February 2014, he was first President of Pan-national Association of Albanian Surveyors " Karl Gega".

Dr. Ismail KABASHI was born in Gurrakoc, Kosova. He graduated in geodesy department of the University of Saraevo-Bosnia and Hercegovina in 1992 year. In 2003 year, he held the degree of Doctor of sciences (PhD) in Geodesy engineering department of TU Wien. Currently he is employee in Vermessung ANGST GmbH ZT as project manager for Planning and execution of Cadastre and Geomonitoring Projects. From year 2004, he works as a geodesy engineering Professor at the University of Prishtina-Kosova. Since 2011 as a visiting professor at the Polytechnic University of Tirana, Faculty of Civil Engineering and Architecture, Department of Geodesy. Since 2013 as a visiting professor at the University "Haxhi Zeka", Faculty of Agrobusiness. He is the author of many papers published and presented in national and international scientific conferences related to geodesy and engineering geodesy, as well as the author of script for students in geodesy engineering field.

Atdhe BUZHALA practice as a young one his current profession Geodesy. He was born on august of the year 1990 in Pristina, capital city of Kosovo. His education from primary school , secondary school and the university finished in his birthplace so in University of Pristina. With high grade and with good average he graduated at the Civil Engineering and Architecture Faculty in Geodesy departament. Besides membership in many organizations in different fields, Atdhe had many commitments like IT as he develop his interest to the connection these two directions as IT and Geodesy in one product like it is his latest succes at the mobile application whom he presented at the university, Geodesy organization, municipality of Pristina ,which increase his to expand and advance to the near future this necessary application. His actually commitment is in municipality of Pristina in Geodesic field, in the process of legalization of illegal buildings .

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