Mobile Based Jamshoro City Location Service (JCLS)

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Abstract—Nowadays, Mobile computing is the one of most used technology, which offers large amount of mobile services and exploits user's location as well as offers different services. Finding exact current location and path to destination is also a challenge for mobile companies. Few companies are still working in this area. Jamshoro City Location Service, a location service is proposed and designed that provides location-based information services to users such as tourists, visitors and students. The proposed JCLS is implemented and tested on mobile device where user's current location is tracked and then provides a map indicating current location of the user as well as a list of services available around by users nearest location services such as University of Sindh, hostels, Banks, Police station and Filling stations.

I. INTRODUCTION

With rising demand of mobile communications and mobile computing [1], the state forcefully for location-aware and adaptive applications is mounting. By utilizing real world objects knowledge about physical locations with the help of Location-aware applications such as mobile persons and nodes, to adjust their serviceable behaviour and their manifestation towards the user. As far as locating technologies becoming smaller, cost reducing such as GPS [2].

Furthermore, the new generation wireless multimedia networks will utilise such high radio frequencies or even infrared links, the radio cells will be limited to the room size. This will allow retrieving location information from the wireless network mobility management functions without additional costs.

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JCLS is a mobile location service which provides the current location to user through Google maps as well as services to user according to the current location of the user, JCLS is a mobile location service which provides the current location to user through Google maps as well as services to user according to the current location of the user, and also provides the direction map to a selected service by user through Google maps on their mobile phone. "Mobile based location services" location service runs on java supported, Global Positioning System (GPS) and General Packet Radio Service (GPRS) enabled mobile phones.

Jamshoro is well known as an education city, because of three famous universities UoS (University of Sindh), MUET (Mehran University of Engineering, Sciences and Technology), and LUMHS (Liaquat University of Medical and Health Sciences) are located here in parallel with Indus highway of Pakistan. Jamshoro is on of main city nearby famous tourist locations such as Rani Kot, Sehwan, Manchhar Lake and Gorakh Hill. More than ten thousands students including visitors reside in the city for the learning, business and tourism purposes. Sindh University is the second oldest as well as largest university in Asia, where more than 50 departments/institutes are running and located between MUET and LUMHS where multiple entrance points are available. That confuses a new student or visitor to find its destination particular direction and current position for their destination in the campus. There are few directional signs are placed on various points at university of sides of Indus highway, however; still they are not sufficient for a new person. In addition, there is no guidance services are available anywhere at Jamshoro. The proposed location service is designed to facilitate the students and visitor to find their directions and current location at Jamshoro city.

In this paper, a location information service is designed and developed to resolve the discussed issues. This service is an integrated system, which can show interesting facts about user's current location and his /her surroundings. It is observed that students/visitors needs location based services as long as they perceive them to be useful and generate more concern on location tracking services. This research work describes a trend that leads to Jamshoro City Location Services (JCLS) and techniques necessary for the building of JCLS.

a. Aims and Goals

Major aim of this research is to design a location service, which facilitates to the new students and visitors

to find out their current location in the campus of universities in Jamshoro city and directions towards the campus buildings as well as other services available at Jamshoro city [3].

II. BACKGROUND

The focus of this paper is the provision of the location service that facilitates mobile users to navigate his/her current location and provides services such as hospitals, library and banks according to current location of the user. In this section, background study related to location-based services is discussed. In literature various techniques (Defense, Security, and Transportation 2014; Priyantha, Chakraborty, and Balakrishnan 2000; STARLINK, n.d.) In addition, systems have been implemented for providing location based services or information to the users. Some of the positioning systems are GPS (Geiger et al. 2014),

AT&T Cambridge Ultrasonic Bats (Cambridge University Computer Laboratory, n.d.), and Microsoft Research's WaveLAN system, Active Badges, Smart Floor from Georgia Tech, Computer vision systems, and cellular phone based systems[3].

a. Global Positioning System (GPS)

The Global Positioning System (GPS) (*GPS and Relativity* 2016) is a space-based satellite navigation service that provides location and time information in all weather conditions, anywhere on or near to the earth where is an unobstructed line of sight to four or more GPS satellites and shown in figure 1.
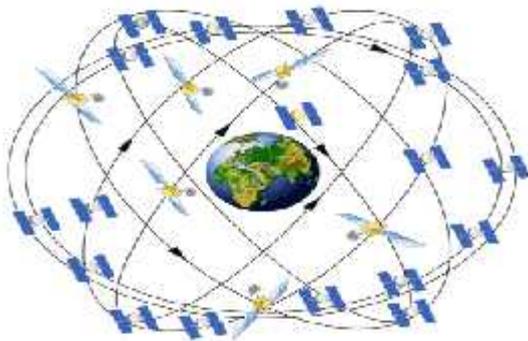

Figure.1: Positioning Satellite in the orbit (Courtesy to Google images)

b. Active Badge System

The Active Badge system (Cambridge University Computer Laboratory, n.d.) Provides the location of an individual within the building by determining the location of their active badge. The active badge system is a small device worn by personal, which transmits a unique infrared signal every ten seconds. The largest active badge system has been implemented at Cambridge university computer laboratory, where two hundred to three hundred sensors are also deployed daily.

Figure.2: Active badges

The current version of the badge incorporates a small microprocessor, offering bi-directional communication, and a 48-bit address.

c. The Cricket Location-Support System

Cricket is an indoor location-support system as well as an Ultrasonic technique to detect the location of an object. Cricket provides privacy and cheaper positioning service, and works within a building; it uses randomized transmission for its beacons and receiver-decoding algorithm to estimate the location [4].
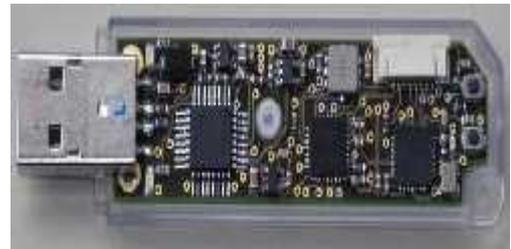

Figure.3: Cricket (Courtesy to Google images)

d. Programming Models for Location based Systems

Various toolkits and APIs have developed for developing location based location services for mobile phones. In the following section, some toolkits literature is defined, which is used in the development of location based services for mobile phones.

i. Java Micro Edition (Java ME)

Java is most famous object oriented powerful computer programming language. In Java language, there are three famous editions, Java SE (Java Standard Edition), Java ME (Java Micro Edition), and Java EE (Java Enterprise Edition).

Java ME also known as "Java Mobile Edition", it is designed for small size, low power consumption, minimum storage capacity, specially mobile phone devices programming. Initially, Java Micro Edition was developed by Sun Microsystems in 1999, and in 2010 Java ME was occupied by Oracle Corporation. Initially it was developed under the java community process as JSR 68, the different flavour of ME evolved in separate JSR (Oracle, n.d.).

Java ME is an extensible platform defines many API packages to develop mobile application for specific purpose. Optional packages also known as JSR .Each JSR used to develop different location service for mobile phone.

Location API (JSR 179), Java Technology for the Wireless Industry 1.0 (JSR 185), Wireless Messaging API 1.0 (JSR 120), Wireless Messaging API 2.0 (JSR 205), Mobile Media API 1.1 (JSR 135), PDA Optional Packages for the J2ME Platform 1.1 (JSR 75), Java APIs for Bluetooth 1.1 (JSR 82), Java ME Web Services Specification 1.1 (JSR 172), Mobile 3D Graphics API for J2ME 1.1 (JSR 184), Advanced GUI 1.1 (JSR 209), Mobile Sensor API 1.1 (256) and Java API for Bluetooth wireless technology (JABWT) 1.1 (JSR 82) are few useful JSRs (Oracle, n.d.).

ii.   Configuration of J2ME

CLDC and CDC are two types of configuration, which are supported by Java micro edition.

e.   Connected Limited Device Configuration (CLDC)

Connected limited device configuration (Oracle, n.d.) is aimed to design for the small electronic devices ranges. The CLDC plate form is a cell phone or PDA (Persona Digital Assistance) with approximately 512KB of available of memory. For this reason, the CLDC is closely touched or associated with wireless java, which is related with allowing mobile phone users to purchase and download the small java applications, which are known as MIDlets to their mobile devices. The CLDC configuration is used to embedded device like PDA and set top boxes.

f.   Connected Device Configuration (CDC)

Connected device configuration (Oracle, n.d.) Addresses the needs of devices those lie between addressed CLDC and the full desktop systems running J2SE. These devices have more than 2 MB memory, power full processors and supports completed Java software plate form. CDC is normally used in electronic PDA and in smart phones, web telephones, residential gateways, and set top boxes devices.

g.   J2ME Profile

Java ME has six categories of profiles (Oracle, n.d.). One is Mobile Information Device Profile (MIDP), second one is PDA Profile (PDAP), third one is Foundation Profile, fourth one is Personal Basis and Personal Profiles, fifth one is RMI Profile and sixth one is Game Profile. However, the two profiles are most common and often used[5].

h.   Mobile Information Device Profile (MIDP)

Mobile Information Device Profile is one such profile that is used for small footprint devices with a limited user interface in the form of a small screen with some kind of input capability.

Java applications that run on MIDP devices are known as MIDlets. A MIDlet consists of at least one Java class (Oracle, n.d.).

Personnel Profile is targeted towards higher end mobile devices like set box, PDA. Various Database technologies are used for location based location services

for mobile phones. In the following section, MySQL has been discussed[5].

i.   MySQL

MySQL ("PHP.pdf," n.d.)(Bertrand Matthelie-Oracle 2012) is relational database management system (RDBMS), and it is free for every kind of task or project. MySQL database provides a facility to its end users to save or search for data. MySQL server controls the unlimited numbers of the users, where provide fast access to reach and provide the high quality security. Because of only authorized users can access the database.

MYSQL is a multi-user, multi-thread database server, which runs on the SQL (Structured Query Language) which is standard language of various databases. MYSQL is available for common purposes since 1996 but it was originally introduced in 1979. MYSQL is world's famous open source database, it has won the award of Linux General Reader Award various time.

Various operating systems does not support to everyone operating hardware. They depend on each other. The best facility of PHP and MYSQL is that they run on the approximately every type of the operating system. You may run the MYSQL on Apache, Linux or PWS, IIS and Windows no anyone have the object to not run it on. You may operate anyone operating system or web server, you always finds MYSQL is well [6].

j.   Database Connectivity Model for Location based Systems

Various techniques and technologies are used to connect the database. In the following section, we provide some background of PHP technology.

PHP ("PHP.pdf," n.d.) Is a general-purpose platform independent server side scripting language. As it is platform independent, so it can be used on any operating system. This is the main advantage of using PHP as compared to other platform dependent server side scripting languages. PHP is most widely used in the conjunction of MySQL database, for performing server side queries of a user. PHP can be used on a number of free as well as licensed server software like Apache, IIS (Kramer 1999) of Windows, WAMP (June 2014 Web Server Survey 2016)and XAMPP (June 2014 Web Server Survey 2016)etc[7].

III.   ARCHITECTURE OF PROPOSED JCLS

JCLS is designed and implemented, which allows user to get their current location and services to their location such as nearby hospitals, banks, central library, and locations on their mobile phone. In this section, design and implementation of JCLS are described:

a.   Overall System Architecture

The high-level system design provides the current location and services according to user current location as shown in fig: 4. the system architecture has six components: Mobile Phone, GPS Satellite, Cellular Tower, Internet, Google Maps and Services. In this section, each of these components is discussed.

Figure.4: Overall System Architecture

There are so many mobile phone models are available in market to facilitate users. This location service is design for mobile phone, which is GPS and GPRS enabled to provide the current location and services according to current location of user. In this location service, mobile phone gets the GPS coordinates from GPS satellites and then sends obtained coordinates to Google maps and database. GPS satellite detects the position of mobile phone, provides coordinates of current location to mobile phone on the earth in numbers and mobile phones are enabled cellular towers for communication via using GSM signals Internet also plays an important role of allowing mobile phones to use Google maps and other database services[8].

In this system mobile phone send the coordinates of its current location and get the services like (hospitals, banks, central library, locations, etc) from database according to coordinates.

b.   Location Service Architecture

The high-level location service design as shown in Fig.5, which shows how location service can work. The location service architecture has five components: HelloMIDlet, Current Location Map, Services, Services Information and Direction Map. In this section, each component is described [8].

i.   HelloMIDlet

HelloMIDlet is a starting point in this location service which function is to display main interface, communicate with GPS satellite to get current location coordinates and send these coordinates to Current Location Map.

i. Current Location Map

Current Location Map get the coordinates from HelloMIDlet than send these coordinates to Google maps

to get current location map, after than display received map on mobile screen.

ii.   Services

The function of Services in this location service is to fetch the data from database according to current location of user[9].

iii.   Services Information

Services Information shows the information about selected services on Services screen in texture form and allows getting direction map about selected information.

iv.   Direction Map

Direction Map get the direction map from Google maps according to selected information on Services Information screen and display that map on mobile screen.

v.   Implementation

In engineering and computer science, an implementation is the practical location service of a methodology or algorithm to fulfil a desired purpose. For example, one might create a computer program that sorts a list of numbers in ascending order. To do so, one would implement a known method of sorting[10].

vi.   Technologies

For the implementation of this location service, J2ME, PHP and MySQL technologies are used.

c.   J2ME

Java 2 Micro Edition is a technology used for the development of mobile location service, which is Java enabled. J2ME is discussed in literature section. J2Me is used for development of our location service, which is installed on java-supported mobile phone.

d.   PHP

PHP is a server side web applications development language. PHP is also discussed in literature section. PHP is used to access and connect the database, which is available on internet or cloud.

e.   MYSQL

MYSQL is DBMS, which allows creating and manipulating the database. MYSQL is also discussed in literature section. MYSQL is used to create database for our location service [11].

IV.   RESULTS AND DISCUSSION

User (student/visitor) performs several steps, which are defined below to get his/her current location and other services according to current location.

a. *Interface*

The main GUI (Graphical User Interface) of location-based services on mobile system is providing a welcome note to the user and it displays two buttons. As shown in Fig.6 "Location" button is use to get current location of the system and "Exit" button is use to close the location service.

Figure.6: Main Interface of location service

b. *Current Location*

When a user runs location service, then location service provides his/her current location map using Google map as shown in Fig.7 automatically or by clicking on the "Location" button on main interface of location service. In this screen there are two buttons provided "Services" button is use to get services according to current location and "Back" button is use to go back to the main interface screen.

Figure.7: Google map according to user current location

c. *Services*

When a user clicks on "Services" button in current location map screen than location service accesses services according to user current location from database and shows these services to user on mobile phone as shown in Fig.8. In this location service, multiple services are listed and shown in fig 8 and which are nearby a user if user click any service location service shows the information about selected services and also provide button "Back" for go back to current location map screen.

Figure.8: Services according to user current location

d. *Administration Building(AC2)*

When a user clicks service such as administration building which provides information about AC2 to user as shown in Fig.9. If user click on information than location service shows the direction map and also provides button "Back" to go back to the services screen.

Figure.9: Information about administration building to user current location

e. *Bank*

When a user clicks on the service such as bank which provides nearest banks' information to user as shown in Fig.10. If user click on information than location service shows the direction map to the selected bank and also provides button "Back" to go back to the services screen.

Figure.10: Information about HBL banks

f. Central Library

When a user clicks on service such as central library, which provides Central Library information to user as shown in figure 11. If user clicks on information then location service shows the direction map and provides a button "Back" to go back to the services screen.

Figure.11: Information about Central library to user current location

g.   Hospital

When a user clicks service such as: hospital and it provides nearest hospitals information to user as shown in figure 12. If user click on information than location service shows the direction, map to the selected hospital and provide button "Back" to go back to the services screen.

Figure.12: Information about nearest hospitals to user current location

h. Police Station

When a user clicks service such as police station, which provides nearest police stations information to user as shown in figure 13. If user click on information than location service shows the direction map to the selected police station and also provide button "Back" to go back to the services screen.

Figure.13: Information about nearest police stations to user current location

i. Filling Station

When a user clicks on service (e.g. filling station), it provides nearest filling stations' information to user as shown in figure 14. If user clicks on information then location service shows the direction map to the selected filling station and provides a button "Back" to go back to the services screen.

Figure.14: Information about nearest filling stations to user current location

j.   Nearest Locations

When a user clicks service such as nearest location, which provides nearest locations information to user as shown in Fig.11. If user clicks on information then location service shows the direction map towards the selected nearest location. It also provide button "Back" to go back to the services screen.

Figur.15: Information about nearest locations

k.   Direction

When a user clicks service such as direction, it shows the direction map to selected information to user as shown in Fig.12. It also provides a button "Back" to go back to the services screen.

Figure.16: Direction map to selected service information using Google maps

V.   CONCLUSIONS

This paper addresses the research question of "how to provide the current location through the Google map to users? And also provide direction map to a selected service." Such as University of Sindh Allama I.I.kazi Campus, hospital, Fuel filling stations, banks and police station through Google map based on current location of a user on his/her mobile phone".

JCLS, this location service designed and implemented to facilitate mobile users by providing them current location along with extra information about services based on user current location on their mobile phones. The proposed JCLS have been successfully tested and implemented in a limited geographical area of Jamshoro city. This service can run on any java supported and GPS enabled mobile phones. The main component of JCLS is a J2ME application, which installed on the mobile phone, it enables the mobile phone to provide the current location to a user where he/she is in the Jamshoro and also it shows Google map to user according to his/her current location. JCLS has its own database, which holds all the information about the services, which are available in the surroundings of Jamshoro.

VI.   FUTURE WORK

The implemented system enables the mobile phone users to provide the current location of the user in the premises of University of Sindh, Jamshoro campus and few services nearby his/her location of Jamshoro city. Future improvements may involve extending the system to cover other geographical areas of MUET, LUMHS and Jamshoro. Currently this system is only compatible with Symbian OS (Symbian Foundation, n.d.) of Nokia (Nokia, n.d.) Company; further, the system architecture can be developed as a general system that could be installed and used by other mobile phone devices that uses some different operating systems Such as Android, Windows.

REFERENCES

[1] Aloudat, Anas, Katina Michael, Xi Chen, and Mutaz M. Al-Debei, 2014, "Social Acceptance of Location-Based Mobile Government Services for Emergency Management." Telematics and Informatics 31 (1). Elsevier Ltd: 153–71. doi:10.1016/j.tele.2013.02.002.

[2] Bertrand Matthelie-Oracle, 2012, "With Its MySQL Database-as-a-Service CERN Empowers Scientists." https://blogs.oracle.com/MySQL/entry/with_its_mysql_database_as. Cambridge University Computer Laboratory. n.d. "The Active Badge System."

[3] Chung, Kyung Yong, Junseok Yoo, and Kuinam J. Kim, 2014, "Recent Trends on Mobile Computing and Future Networks." Personal and Ubiquitous Computing 18 (3): 489–91. doi:10.1007/s00779-013-0682-y.

[4] Defense, Department of, Department of Homeland Security, and Department of Transportation, 2014, "Federal Radionavigation Plan," 184. doi:DOT-VNTSC-RITA-08-02/DoD-4650.05.

[5] Geiger, Philip, Marc Schickler, Rüdiger Pryss, Johannes Schobel, and Manfred Reichert, 2014, "Location-Based Mobile Augmented Reality Applications: Challenges, Examples, Lessons Learned." 10th Int'l Conference on Web Information Systems and Technologies (WEBIST 2014), Special Session on Business Apps. http://dbis.eprints.uni-ulm.de/1028/1/Geig_2014.pdf.

[6] GPS and Relativity, 2016, Astronomy.ohio-state.edu. Accessed June 25. http://www.astronomy.ohio-state.edu/~pogge/Ast162/Unit5/gps.html. June 2014 Web Server Survey. 2016. Netcraft. Accessed June 25. http://news.netcraft.com/archives/2014/06/06/june-2014-web-server-survey.html.

[7] Koyuncu, Hakan, and Shuang Hua Yang, 2010, "A Survey of Indoor Positioning and Object Locating Systems." International Journal of Computer Science and Network Security (IJCSNS '10) 10 (5): 121–28.

[8] Kramer, Dave, 1999, A Brief History of Microsoft on the Web. Microsoft. http://www.microsoft.com/misc/features/features_flshbk.htm. Nokia. n.d. "Nokia." http://www.nokia.com/pk-en/.

[9] Priyantha, Nissanka B., Anit Chakraborty, and Hari Balakrishnan, 2000, "The Cricket Location-Support System." Proceedings of the 6th Annual International Conference on Mobile Computing and Networking - MobiCom '00, 32–43. doi:10.1145/345910.345917.

[10] Spink, a, B Locke, N Van Der Aa, and L Noldus, 2013, "{TrackLab} - An Innovative System for Location Sensing, Customer Flow Analysis and Persuasive Information Presentation." 2013 {ACM} Conference on Ubiquitous Computing, {UbiComp} 2013, 985–90. doi:10.1145/2494091.2496008.

[11] STARLINK. n.d. "RVL-1 GPS Fiber Optic Link System." http://starlinkdgps.com/products/gps-fiber-optic-link-installation-fibre-gnss/.