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A Web-based Location Tracking System

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Abstract: Currently there exists many applications of tracking systems in everyday life of human being from tracking a vehicle, monitoring a patient in hospitals to tracking products in a manufacturing industry. It is due to the advancement in positioning technology, such as GPS (global positioning system). GPS was first developed for non-civilian purposes, however currently it has several civilian applications ranging from navigation to tracking and monitoring of people and everyday objects or handheld devices, such as mobile phones. In this paper, we have presented the design, implementation and testing of a location tracking system. The proposed approach is mainly software-based, however in order to increase its scope a hardware unit can be integrated as well. At the moment, we have used mobile phones embedded GPS capability to obtain the positioning information. The proposed system is mainly composed of five components. These are interlinked with each other to provide the location services to its users through an easy to use web interface. The implementation and testing of the proposed approach is also presented. The overall testing results are encouraging.

Keywords: Location Tracking, Positioning Technologies, GSM/GPRS, GPS-enabled devices, J2ME/J2SE.

1. INTRODUCTION

Nowadays global positioning system (in short GPS) is more commonly used in smart phones to capture the location or positioning data that enable users to know their own location through identifying the location of their cell phones (Tsui, 2000; Wikipedia, 2015; papadoglou *et. al*, 2001). In this paper, we present such a system that exploits the built-in GPS units of the cell phones to track their position. The proposed system is different from other existing positioning systems (such as: Elahi *et. al*, 2009, Malkani *et. al*, 2009; Ward *et. al*, 1997; Priyantha *et. al*, 2000) that only registered users will be tracked by their family members or friends regardless of whether they have smart cell phone or not. In fact the family members or friends of the smart-phone owner can track him through a web interface.

The main objective of the proposed system is to provide a generic interface, such as a web portal, to its every user in order to track and monitor his/her registered objects/devices or family members and friends. The developed application provides several benefits, such as tracking people and objects in disastrous situation (e.g. fire, flood or earthquakes, etc), tracking vehicles, monitoring patients in hospitals, monitoring of children, etc.

The remaining part of the paper is organized as below: section 2 is materials and methods, which describes the high level system architecture of the proposed approach, section 3 is results and discussion in which we have given the implementation and testing details of the proposed system and finally section 4 concludes the paper.

2. MATERIALS AND METHODS

2.1 Proposed System

Fig.1 illustrates the overall working of the proposed system. The proposed system is divided into five major components: remote database server, J2SE server, J2ME Bluetooth client, user/client tracking midlet (i.e. mobile application), and the web portal. The brief description of each of the components is given in subsequent subsections.

2.1.1 Remote Database Server

The relational database management systems (RDBMS) are used to store the data efficiently in form of tables so that it can be used later on whenever needed. There are many RDBMS available nowadays, such as MySQL, ORACLE, MS-Access and so on. Some of them are open source and available free of cost, while others require to purchase the license to use them. In the proposed system, we decided to use MySql RDBMS. There are several reasons to use this. Firstly, MySql is free of cost and there is no need to purchase the license for it. Secondly, it is open source and different versions can easily be downloaded from the web. Thirdly, it is easy to install, use and maintain and have less memory and system requirements as compared to other RDBMS, such as ORACLE.

In this system, database is not only storing the useful data, but also act like a bridge between web portal and J2SE server application. Both web portal and J2SE server applications are connected to same database and communicate with each other via this database. ER diagram showing the relationship between various tables of the database is shown in **(Fig. 2).**

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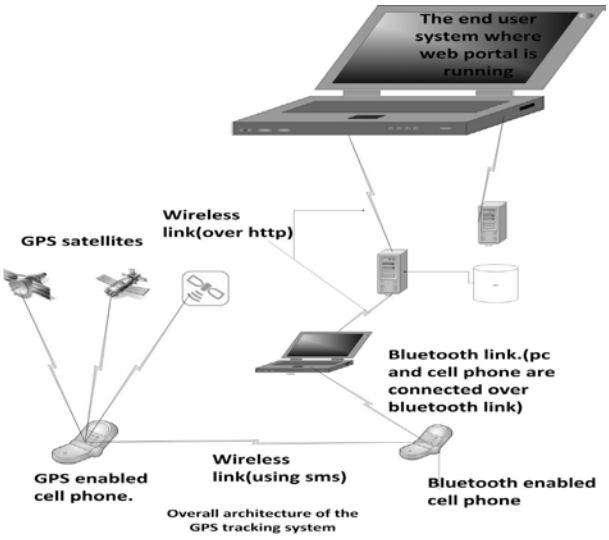


Fig. 1: High level system architecture of the proposed approach

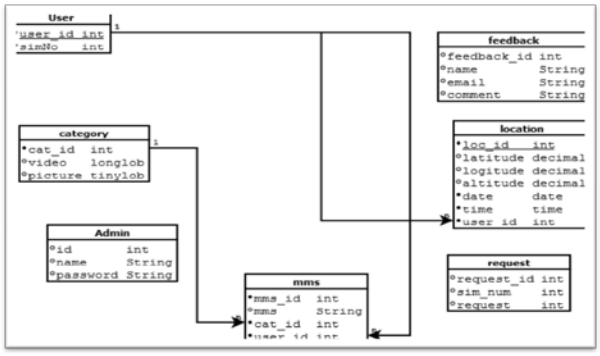


Fig. 2: ERD of the remote database used in the proposed system

2.1.2 J2SE Server

We named this component as J2SE server due to the fact that it is developed in Java 2 standard edition (Herbert Schildt, 2010). This is the component that serve the purpose of bridge between the web portal and J2ME client application components. This server is connected to the same database to which web portal is connected and at the same time it is also connected with J2ME client application.

2.1.3 J2ME Bluetooth Client Application

This is a mobile phone application. It is developed using Java 2 Micro Edition (J2ME) based emulator. The emulator used in this case is Wireless ToolKit (WTK) version 2.5. This application can only be used on Bluetooth enabled cell phone which support java (MIDP).

This application exchange data between desktop application (J2SE server application) and clients / users tracking Midlet. It is connected with desktop J2SE server application over a Bluetooth network and on the other side it exchange data with client's application through SMS (short message service).

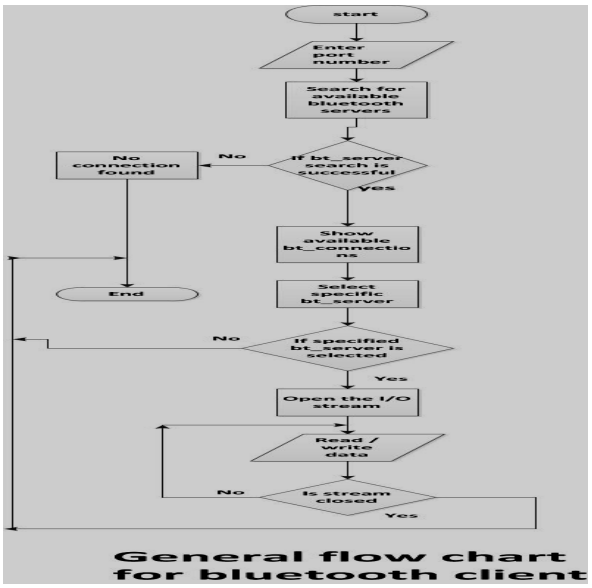


Fig. 3: **Flow chart of J2ME Bluetooth client application**

Fig. 3 shows the flow chart of the overall working of this component. One can note from the flow chart that when the application first starts, it prompts the user to enter the port number that will be used to listen the incoming SMSs. Once port number is entered, it searches for the Bluetooth server. If the server search is unsuccessful, the application will be terminated. In case search operation is successful, it shows the list of available servers and allows to establish the connection with it. Once the connection is established successfully, the path for exchanging data stream between J2SE server and J2ME client will be opened, and hence the data can easily be exchanged between these two applications (i.e. J2SE server and J2ME client).

2.1.4 User/Client Tracking Midlet

This is the application developed in J2ME and is directly related with the user. It can be installed on any java (MIDP) supported GPS enabled cell phone. This application uses the GPS of the cell phone to find its coordinates and send these to the server, which store this information into the database, and thus interested users can then easily track the position of that cell phone through the developed web portal.

2.1.5 Web Portal

This is one of the important part of the overall working system. In order to use the proposed tracking system, the user has to first create an account using the developed web portal. This registration process is mandatory for every user to use the tracking service. The important functionalities of this web portal includes: users' sign-up and sign-in, easy download of the essential Midlet application that needed to be installed into the user's GPS-enabled cell phone, and enables the user to view the registered objects (in this case cell phones) location/position on map.

3. RESULTS AND DISCUSSION

In this section firstly we discuss about the working mechanism of the proposed system and then show how the proposed system is implemented and tested. The overall implementation and testing results are encouraging.

3.1 Working of the Proposed Implemented System

The working mechanism of the proposed system is consisting of several steps/phases, which are described below:

Registration of an Account: When a user wants to use the tracking services provided by the developed system, he/she has to first sign-up himself through the web portal as designed as part of this project. While the interested users visit the web portal, they will find easy to use steps to register themselves. For example, they have to click on the registration tab first, where they have been provided some fields to fill-in. The way we have decided to register the users is through his/her cell phone number. Once, you finished with providing information in all the necessary fields, you just click on the submit button. As soon as you click on submit, your registration information becomes the part of the registered users database and thus, the next time you are not supposed to do this all again. After successful registration of your account, now you are ready to proceed ahead.

1. **Signing-in:** Once users are registered in the system with their unique cell phone numbers, they are ready to be tracked. Note that users are supposed to provide the cell phone number(s) whom they are interested to track. During Sing-in process, the users need to provide the same cell phone number and password that they created during the registration process. Once sign-in details are checked in the system's repository, the users will be allowed to sign-in. Once the users are successfully signed-in, two additional tabs (i.e. MAP and DOWNLOAD) will be visible to them. The purpose of these two tabs is described in next step.

2. **Download and Installation of Midlet:** Once the users are successfully registered and signed in as well, they can download our developed application that can exploit their GPS enabled cell phone as a tracking unit. So, in this step users need to download the jar file available through our designed web portal and install it on their cell phones. Once it is down, the users are ready to track their registered object (in this case cell phone).

3. **Map and Track:** If all above steps are successfully done, the system is ready to track your registered objects/cell phones. Click on the tab captioned (mentioned) as MAP. In this tab, you will find Google Map, which is an integral part of this portal. This map is provided in the web portal using Google map APIs and a scripting language (i.e. JavaScript). You can zoom in and out as well with this map and you can change the view from map to satellite and vice versa. Beside map, there is also a button captioned as "Track Me". By clicking this button, tracking process is initiated and if it is successful, you will find the location of your object on the map.

3.2 System Testing

In this section, we discuss the testing of the developed system while in running state. **(Fig. 4)** shows the J2SE server application in running state. This is responsible for database connection, Bluetooth server creation and connection with J2ME client and exchange of data. In fig. 4, one can note the message saying database connection successful. It indicates the successful connection establishment with the remote database. Below the first message line, one can note other messages indicating that the creation of Bluetooth server is successful and it is waiting for the client to connect to it. Hence, now it is ready to exchange the data between J2SE Server and J2ME client application. Subsequently, when you run the J2ME (Bluetooth) client application, it will open its Bluetooth network and searches for the available servers. When you select the particular server, it tries to connect with that server. If it is successful to make a connection, then it opens a network stream for exchange of data.

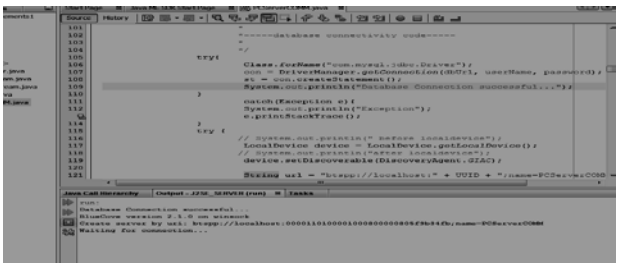


Fig. 4: J2SE Server running on Netbeans



Fig. 5: Home page

Fig.6 shows the registration page of the web portal. Here user can register its account. After successful creation of account user can sign-in. **(Fig. 7)** shows the snap after successful sign-in. Note that after successful sign-in a user can see two more options named as map and download on the web portal. Now the registered user is able to download the trackme.jar file **(Fig.8),** which contains the client application. It is necessary to install that application on the GPS enabled mobile device intended to be tracked. The last indentified location will be shown on map page of the web portal when user clicks on track me button **(Fig. 9).**



Fig. 6: Registration page



Fig. 7: After successful sign in



Fig. 8: Download page

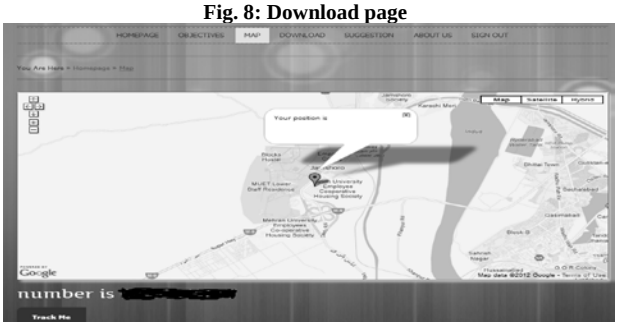


Fig. 9: Google map showing last checked location

4. CONCLUSION

In this paper, we have proposed and implemented a location tracking system to locate the GPS-enabled devices through a web interface. The proposed system offers several benefits. For example, in several devastating situations this system could be beneficial to find out the locations of objects and/or people in order to provide them a rescue service. Another example could be vehicle tracking. Consider the situation when a rent a car service provider company needs to track its vehicles. By deploying this tracking system in their cars, they can easily track the location of their cars. In some memory disorders like Alzimurs patient cannot remember the common things like their home path etc. In such conditions patient's need 24/7 vigilance. By placing this tracking system with the patients, their doctors or family members can easily monitor and take care of them any time. When parents send their children to schools, they are much worried about them; however, by using the proposed system, they could be able to locate and track their children easily.

REFERENCES:

Elahi, M. A., Y. A. Malkani, and M. Fraz. (2009). Design and implementation of real time vehicle tracking system. in IEEE 2nd International Conference on Computer, Control and Communication (IC4-09): ISBN: 978-1-4244-3313-1. 1-5.

Herbert S. (2010). JAVA J2SE 1.4: The Complete Reference. Publisher: McGraw-Hill Osborne Media.

Lionel M N., Y. Liu, Y. C. Lau, and A. Patil. (2003). Landmarc: Indoor location sensing using active, RFID. In IEEE International Conference in Pervasive Computing and Communications (Percom 2003), Dallas, TX. 407-415.

Malkani Y.A. and L.D. Dhomeja. (2009). Location aware device discovery for physically constrained environments. in IEEE 2nd International Conference on Computer, Control and Communication (IC4 09) 2009: ISBN: 978-1-4244-3313-1. 1-5.

Papadoglou N. and E. Stipidis. (2001). Investigation for a global system. IEEE transactions on Intelligent Transportation Systems (ITS), Vol. 2, Issue 3, 121-126.

Priyantha, N. B., A. Chakraborty, and H. Balakrishnan. (2000). The cricket location-support system. In Proceedings of the 6th Annual International Conference on Mobile Computing and Networking, Boston, Massachusetts, United States. 32-43.

Ritier S. and J. MCCoy (1977). Automatic Vehicle Location: An overview. Vehicular Technology, IEEE Transactions, Vol. 26 Issue 1. 7-11

Tsui. J. B. (2000). Fundamentals of Global Positioning System Receivers. 1st Edition. John Willey & Sons Inc.

Easy GPRS User Guide. 80000ST10028. (2007). Telit Wireless Solutions.

Transportation District's Automatic Vehicle Location System. (2008). http://www.itsdocs.fhwa.dot.gov/. Last accessed on: 27-02-2015.

Vehicle Tracking Systems–Overview. (2008). http://www. roseindia.net/technology/vehicle-tracking/ Vehicle TrackingSystems.shtml . Last accessed on: 22-02-2015.

Wikipedia.org. Global Positioning System (GPS). (2015). http://en.wikipedia.org/wiki/Global_ Positioning System Retrieved on: 03-02-2015.

Ward, A., A. Jones, and A. Hopper. (1997). A new location technique for the active office. IEEE Personal Communications, Vol. 4, No. 5, 4247Pp.