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The Research on the Tracking and Positioning Platform Based on the Android Smartphone

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Abstract. The 3G era, the smartphone market share is higher and higher. The mobile phone based on the Android platform accounts for more than half of the market share. Once the user lost the phone, it is not only hard to find, but also to face important data leak and privacy security issues. So, the demand to provide mobile phone found function appears increasingly urgent. If the mobile phone is lost, this platform can get information on replaced mobile phone SIM card to boot for the first time, and upload the new mobile phone number and current phone location information to the server. It provides users with inquiry function on the web in order to achieve the purpose of tracking the lost mobile phone. The application prospect of this study is widespread, not only limited to track the missing phone, also involves other position service in the life need. The relevant mobile localization algorithm is detailed in this paper.

Introduction

Smartphone headed by android is more and more popular. Android [1] is an open source operating system. Its main advantages include: platform openness, rich hardware selections, seamless combination of Google apps, free of operators. Smartphone has brought infinite business opportunities and new economic growth point to mobile communication.

Mobile phone positioning is to point to obtain the position information of mobile phone (mainly the latitude and longitude data) by mobile communication network and positioning technology. The smartphone with powerful functions and friendly interface is bringing a lot of convenience for the user. Its market share is getting higher and higher and the life of people is becoming more and more inseparable from the mobile phone. But once the phone being lost, it is not only hard to find, also faces many questions such as the important data lost, contact information disclosure and all kinds of security privacy issues. Therefore, it is particularly important that we develop a remote mobile positioning and tracking platform. Because of the characteristics of most smartphones connecting to the Internet, we can track and locate in the position about the current phone user. Now, only a handful of mobile phone comes with a similar back function, this platform has strong practical value. This study mainly involves the following:

(1) Once the phone is lost, it can get the current location information automatically when the phone card is replaced, as well as the current user's information such as the latest mobile phone number. This information would provide clues to find the current mobile phone.

(2) The mobile phone can send position information to server. The system can also be used as a guardian to grasp the whereabouts and directions on children and old people and other vulnerable groups.

Function Framework and Related Techniques

This system is developed by using the android SDK and JavaEE and the struts 2 framework technology. The program structure is in line with the MVC structure.

FUNCTION MODULE. Mobile terminal: The program can start automatically when the phone is open. To a certain degree, it can prevent unloading and restart automatically after being stopped. It can also detect changes in SIM card information such as mobile phone number and sent the new phone number to the server. In addition, it can get the current location information and upload it to the server.

Web Server[2]: user can check his phone number change and the current number after logining server. The phone's current location can be able to find on the map. The functional framework is illustrated in Fig. 1.

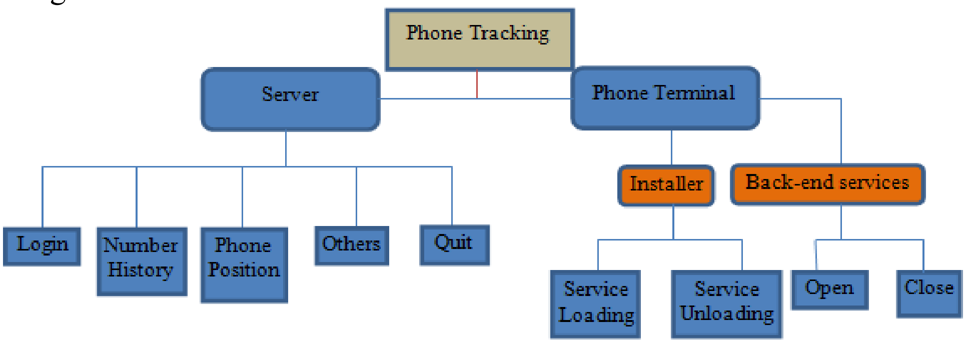

Fig.1. The functional framework of the platform

We can know from the diagram above that this system includes two parts: a web server and mobile client. The client includes an installer and back-end services. Web server includes four sub modules to view the user equipment and SIM card replacement and geographic location information. Those are history number, mobile phone location, login and about. The client installer is used to install and uninstall the background service [3] and open the hidden service management interface. Background services are running in the background after the start, monitoring system broadcasts, uploading information on geographic position and phone card.

To be on the safe side, this platform includes monitor service, opening and unloading services. Because the service program is needed to achieve certain concealment, so this platform hides the program icon, not directly enters the program, so a loader is necessary to start and stop the services.

TECHNIQUES and DATABASE. The system technology is using the bootstrap front-end framework, developed by twitter, based on CSS, HTML and jquery. The framework is perfect relatively, more personalized and compatible with most of the jquery framework. It contains abundant components, which can make web development more rapid and simple. Table 1 is one of the typical database tables[4].

Table1. One of the typical database tables

NAME	TYPE	LENGTH	POINT	IS NULL
number	varchar	20	0	□
phone	varchar	15	0	□
location	varchar	50	0	√
date	datetime	0	0	□

SYSTEM AND EXPERIMENTAL RESULTS. Fig.2 is one of the screenshots of the system interaction on server. This interface shows the mobile number change history of the equipment that is belong to the user. If no number, it will give a remind information without a phone number.

Fig.2. One of the screenshots of the system interaction on server

Fig.3 is another of the screenshots of the system interaction on server. The interface above in the form of a list on the left shows all of the user's equipment. The selected equipment can be obtained the latest latitude and longitude information and seen the device's location on the map. When the equipment is selected, map location will change to mark the latest coordinates with pointers. In obtaining location service, we can set up our own map server. We can also get the location information through to get the best provider, such as Google map etc. By setting a series of conditions, we can get the best provider of the conditions. Though the GPS module sometimes has been opened, but it still needs to use the base station positioning. So we would be able to get normal longitude and latitude information such as indoors or other unpredictable weak signal.

Fig. 3. Another of the screenshots of the system interaction on server

Algorithms Description

Positioning algorithm implementation in this study is the current popular location algorithm. We try to realize the location optimization in the research. Now the positioning of the methods are many, the MSA (Mobile Assistance) and the MSB (Mobile Base) method are used frequently. MSA and MSB are the location ways assisted by global positioning system (AGPS), namely by the network to provide satellite ephemeris data or satellite information. They can simplify the process of search satellite terminal and increase the speed of the terminal for GPS positioning. The MSB is using GPS positioning, which can only be used in outdoor. MSA way indoors can use a variety of different calculation method of the position when no GPS signal .Fig.4 shows the MSA positioning process. In the process of positioning, the PDE locating entity can select the appropriate calculation [5] according to the satellite signal searched by the terminal and wireless network signal quality.

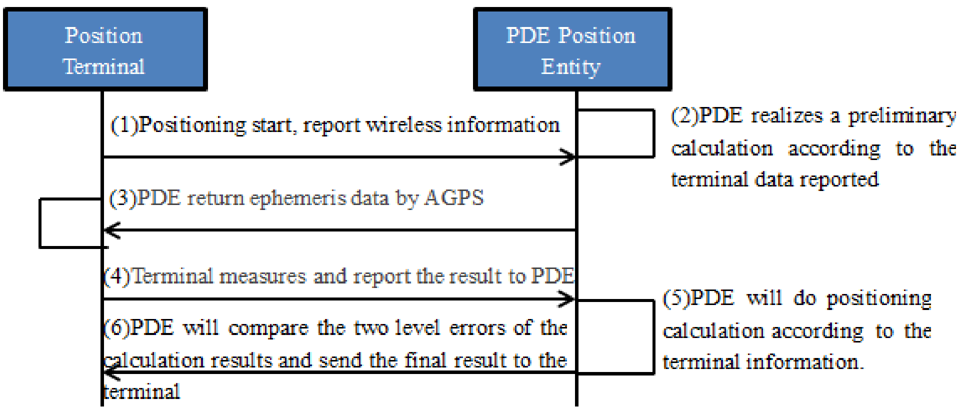

Fig.4. MSA positioning process

System and Prospect

It is necessary that this system is tested on each functional module. The main test includes client and server communication of real time, the client and server function integrity, performance and power consumption of the background. After the examination, each function module has been realized as expected. Program and data are running normally. System execution efficiency is higher. Table 2 shows the test data analysis for some important functional modules.

Table2. The test data analysis for some important functional modules

	Module	Test Result
Phone Terminal	Card Change Detection	That can detect phone card replacement, and be able to get the right result.
	Obtain the latitude and longitude	Part of the base stations are unavailable, little influence on the results
	Loader Start	Normally jumps to the client management interface
Server	Card Change History	Display Normally all the devices used by the user, and show correct record for phone card replacement
	Phone Position	Can display correctly mobile phone location

The mobile client and server side have completed the function of this platform through test. Mobile client program can check and test the mobile phones of the current card when the android system is starting up and network is switching. Once detected change mobile phone cards, mobile phones will upload the new number and the current location information to the server by background services. Also, mobile terminal can use the boot loader for installation and service and unload loader after installing and starting the service. The service has no icon itself to achieve certain concealment, preventing from being not uninstall or being unloaded forcibly. Server provides a good interactive interface easy to use, which can query the phone card history of change and check the location on the map.

This research has a broad application prospect. In the future for 4G, 5G, the huge market demand will promote greatly the development of China mobile location services market. It is not only confined to track the lost phone, in the backdrop of the city scale extension, the importance of mobile location services is appearing gradually. 80% of the information will be related to the position. If Opening the services based on location, the client users can easily know the location of themselves or others at present, can query the information on all sorts of places and people near him with terminal, such as hospitals, Banks, hotels, the old man children's position and so on, can also upload the information to the server if needed. In short, the charm of the location services is apparent. As industrial chain of the market is more and more perfect, the user consumer consciousness is more and more improving, mobile positioning services will be the next hot of mobile terminal applications.

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