

# LBS and Mobile Internet-Based Monitoring System Architecture

Kun Liu<sup>1,2,\*</sup>, Kun Ma<sup>1,2</sup>, and Wei Liu<sup>1,2</sup>

<sup>1</sup> School of Information Science and Engineering,  
University of Jinan, Jinan, Shandong, China 250022

<sup>2</sup> Shandong Provincial Key Laboratory of Network Based Intelligent Computing,  
University of Jinan, Jinan, Shandong, China 250022

**Abstract.** With the improvement of phone performance and enhancement of the quality of LBS services, mobile Internet-based surveillance is possible. We propose an LBS and mobile Internet-based position monitoring system architecture, which under the premise of ensuring information security can achieve remote management and monitoring on the host. The architecture is based on the Android platform that can provide a host of real-time location, location reporting and queries, time control, the application of applied statistics and constraints, intercept phone messages and other remote monitoring services. Host establishes the binding relationship with the controller, then you can remotely control terminal for the real-time monitoring. Control client can view the controller via LBS location and the surrounding environment, and adjust as needed monitoring methods. Meanwhile, the architecture provides a Web client query feature, with which the controller receives commands interacting with the server; the remote host can query information through the Web page, so as to achieve uniform treatment and location recording purposes.

**Keywords:** Android, LBS, Monitoring System.

## 1 Introduction

With the rapid development of mobile Internet technology, a lot of mobile terminals will have the “access” to network [1-4]. A variety of applications in the mobile Internet also profoundly change people’s lives in the information age, and location-based services (Location Based Services, LBS) and mobile network application system are “embedded” in people’s daily lives. We can monitor the situation at home or any other location of the mobile terminal condition at any time via their mobile phones [5]. For now, LBS technology is relatively mature technology, as cloud computing is the third wave of information technology through the LBS and cloud computing technology, we can achieve a complete mobile Internet technology-based monitoring system [6, 7].

As a smart phone mobile phones become mainstream products terminal and gradually replace the traditional phones, LBS technology has very good prospects for development. With the popularity of smart phones, mobile application service is unprecedented developed, which greatly enriches people’s way of life, but also

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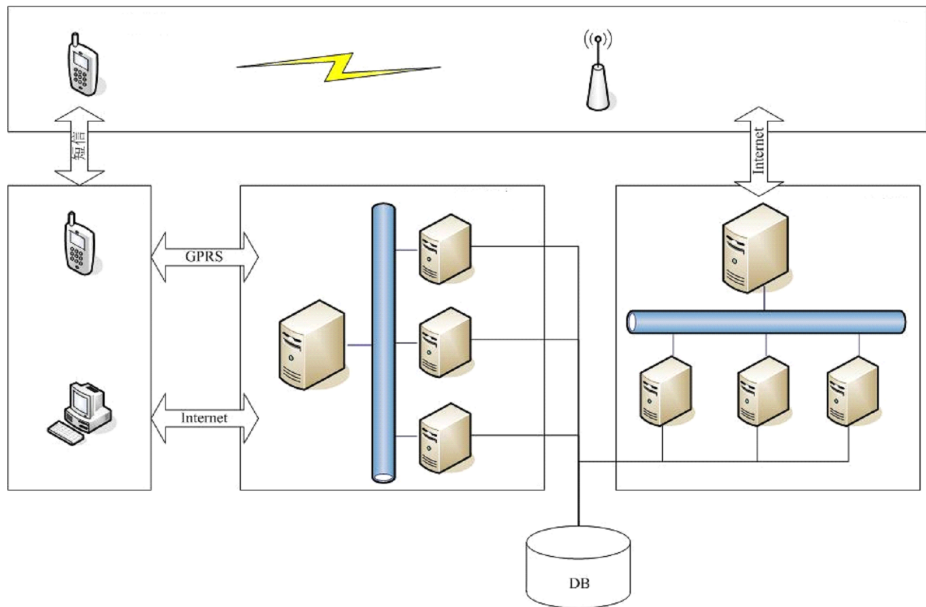
\* Corresponding author.

provides users with a convenient information service and location-based services have gained popularity possibility [8-12]. For the above, this paper, based on the Android system, design and implement a mobile Internet monitoring system architecture based on LBS and cloud platform.

## 2 A System Architecture Design

### 2.1 Overall System Architecture

The system should achieve three application subsystems, and each system is a client. The first part aims to design the Android desktop application side with the capability of an implementation of the real-time location, location reporting, remote command response, time control, application information, statistics, application usage constraints and telephone message interception. This is the main part of the system, which is being monitored. The second part aims to design a monitoring client to interact with the server, to receive process and respond to the host's request. The third party designs control software for the host to convenient remote monitoring and management to reduce the difficulty of the operation, and the overall system architecture is shown in Figure 1:



**Fig. 1.** Overall architecture based on the location of LBS and mobile Internet monitoring system

### 2.2 The Monitored Client Functions

Through SMS interception, it achieves a set of practical, complete remote instruction system, based on TCP / IP protocol communicates with the server through Socket way, using a local database cache failed messages;

It uses a Baidu positioning API to implement GPS, WI-Fi, GPRS environment of the mobile phone positioning, and uses the Alarm mechanisms to ensure the phone's normal operation of positioning in sleep mode;

It uses timing detection means of the Service and Handler to inspect and correct the operational status of the system;

It designs a reasonable time limit system to facilitate remote host restriction on the use of mobile applications;

It designs a family numbering system and desktop shortcuts plug, and within the time limit intercept non-family number calls;

Through the local database and FTP, it achieves application statistics and reporting, and adopt encapsulate data in JSON format, increasing portability;

### 2.3 Server-Side Functionality

Based on TCP / IP protocol, it communicates with the monitored through Socket-side and respond to the request of monitoring client;

Record all uploaded data being monitored.

Functionality of the controller:

The host can bind with the monitored side, and send remote commands after the success;

Through the host controller, it sends commands to see the location, application usage statistics;

## 3 System Architecture Analysis Functions

System mainly consists of hosts, the controlled, Socket server and Web server side, and the function of each part is shown in Figure 2:

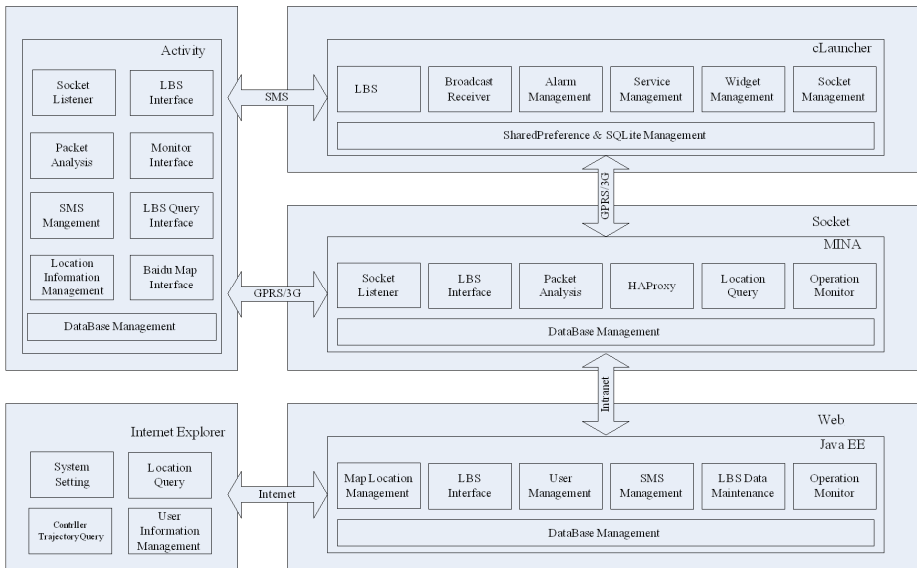


Fig. 2. Position monitoring system function chart based on LBS and mobile Internet

**LBS Interface:** Using Baidu LBS interfaces to easily implement phone positioning in WI-Fi, GPS, and GPRS network. Callback interface provides developers with the current location of the mobile phone details, and developers can be personalized based on these data processing.

**Launcher:** applications on Android are divided into many varieties, such as desktop applications, general applications, lock screen applications and so on. Launcher application is the default when you start your phone system, if there are multiple it will prompt you to select. Common applications are not automatically displayed. Android provides an interface to obtain an ordinary application, thus the task of indicating the application entry falls on the Launcher. Android comes with Launcher which provides the basic functions needed by a desktop application, such as sliding around, add a desktop shortcut, the application list display and other basic functions. Therefore, we can develop customized desktop applications on the basis of the Launcher.

**Broadcast Receiver:** The broadcast mechanism in Android phones which used for passing messages between different applications. Many functions of the phone are achieved like this, for example, switch machines, receive text messages, incoming call, etc., the monitoring system is inevitable to use this feature in large scale. Broadcasting can be used in two ways, one is through the register and its subclass to implement a receiving system provides good news. Such as registering a receive SMS broadcast, when the phone receives a broadcast, it firstly runs methods written by us for processing, and then decides which to perform certain operations or intercept messages. The same approach also applies to telephone interception and switch machine messages. Another is to declare it a broadcast which can be achieved in the context of two different deliveries of messages. Further, the broadcasting system can use the Internet as a data carrier body Intent, so you can easily transfer data.

**Alarm Management:** Sometimes, a Service background operation does not meet our needs. For example, we hope when we do not use the phone, the system can also perform some operations for us at the regular time. The service does not work this time, because we no longer use the phone for some time, a Linux kernel will put the Android system into hibernation in order to save resources. In this state, Android system will only retain some of the necessary process, and stop other operations. Based on this model, if you want to achieve a background operation, the easiest way is to implement a timing clock, and the alarm in Android is implemented based on this approach. When Android phone in hibernation, Alarm remains valid. When the specified time arrives, the clock program can send a broadcast, which is we can accept broadcast and do the appropriate action.

**SQLite:** It is a lightweight database on Android, with basic data storage capacity that can be used to store some application data. In addition, many of the data in the system are also stored in this database.

**Service:** As the name implies, it is the service component in Android phones. When the phone screen is not stuck in the current application, Service still can perform certain actions in the background, which is one way to achieve the usage of a cell phone monitoring software. The application program can start particular Service components through Start Service method, and then run a timer in the background detection program in order to achieve timing detection function.

**Shared Preference:** It is the most simple data storage methods in Android. The system creates a storage location for each application that can be used to store some configuration information to key on the way to save.

**App Widget:** Desktop plug-ins in Android, which can be placed directly on a screen desktop application, and quick dial controls need this.

**Socket:** Communication between the server and the phone using Socket transmission through a particular protocol encapsulation over binary data.

## 4 System Technical Architecture Analysis

The host and the controlled systems are developed based on the Android platform ADT, as Socket server uses Apache Mina framework, and Web server uses the lightweight Java EE framework.

The front-end of Socket server uses Apache Mina framework, which is a multi-threaded non-blocking Java Socket component, loading a lot of long connections to meet the client's interaction with the mobile; business process layer uses the Spring framework to manage the business logic Bean; persistence layer uses Hibernate framework to interact with the database. In Web server technology architecture, the system is divided into DBMS, OP, BP, RP and UI. The OP provides persistence services for entity in the system; BP achieves specific business operations, and is responsible for business process management system; the control later plays an adaptive role in the BP and the UP and is responsible for exception handling and diary; the UI achieves customer interaction.

## 5 Business Process Design

To ensure the information security, the host needs to go through the appropriate certification process, and then obtains monitoring data of the controller.

The entire system process is divided into three phases, namely: binding phase, phase and binding service lift phase. The main business processes are as follows:

The host remote sends SMS through "bind" request command to the controlled.

The controlled deals with local host settings to determine whether to allow binding, and then return the binding results to the host.

Establish accounts for the controlled and the host, and store monitoring data.

Create a Web account for the host to and store monitoring data for the monitoring client.

The host receives and processes SMS messages, and stores the results locally.

The host send request through text message for the controlled.

The controlled deals with local settings, check the location information, package the location information and request instructions and sent them to the server.

The server receives and parses the package instructions, calls the network interface, accesses to data, and saves the local database.

The server packages the data and returns it to the host.

Receive and parse the data, and edit the message returned host.

The host receives and processes SMS messages via the corresponding interface display.

The host sends “Bind release” command to the host via SMS.

The controlled process local settings, lifts and remotes bindings, unbinds results and returns them to the host.

Delete account associated between the host and the remote, and change the monitoring data into historical data.

Remove the remote Web account, and change the monitoring data into historical data.

The host receives and processes SMS messages, and stores the results locally.

## 6 System Implementation

### 6.1 Remote Management Command

Management Directive is a command used by the host to send commands to the controlled through text messages. Only the host needs to send a simple character or text to the controller; you can view the monitoring client location, modify the time setting, and modify family number and so on.

The controlled side decides whether to respond binding instructions through intercepting the received messages, query letters numbers and bind numbers.

The controlled, after receiving instructions, would do different treatments which can be divided into two types: one is the direct handling and response; the other is that they request processing firstly and response to the control after obtaining the results.

The remote management commands include: “binding”, “registration”, “location”, “map”, “unbind” and so on. In which binding instructions can direct response registration, location, maps and other formatting commands.

### 6.2 Timing Positioning

First, the timing position reporting feature in this system uses Android-based Baidu map development interface. Baidu map provides developers with a range of LBS interfaces, with separated positioning and mapping interface, increasing developer flexibility of use. The system selects only positioning interface provided by Baidu maps. Using Baidu positioning interfaces on the Android platform simply needs to import the appropriate library file, and then implement a callback listener following the instructions in the help documentation, and set the parameters before the start, such as location update interval, the return data content, to receive the current location information in circulating within the set time.

Secondly, the system requires timing reporting their position as long as the phone is on, but the phone screen is not always on. When the user stops operating after a period of time, Android system will automatically enter the sleep state. Therefore, the system uses the high-level process component Alarm Management coming to the Android

platform. Alarm Management can also run some operations when the system is in dormancy, and the monitoring system obtains its instance through the Android system static method and registers a loop Alarm. So every once in a while, the alarm will send a Broadcast Receiver message to tell us that it's time to update the position. We perform a location update our block in previously registered Broadcast Receiver's on Receive method. In this way, monitoring system achieves a regular position acquisition function.

Finally, after getting to the location information, we should package it in accordance with the provisions of good server communication protocol encapsulation, and the encapsulated system has got a string of binary data. Then the corresponding port connected to the server to establish Socket communication connection to the server before sending the encapsulated binary data string.

### **6.3 Application Usage Restrictions**

The control system is required to make certain restrictions for the controlled applications to use. The system is divided into the controlled mode and normal mode. In normal mode, you can use the phone's full functionality, and set binding register numbers binding after the time limit.

Before coming into the alleged mode, you must select this system as the default desktop before the application of the system. Desktop applications in the Android system are distinguished from the general applications based on a marker. After the phone starts, if there is no default desktop, it will list all desktop applications to allow users to choose, and the common application is to start from the desktop.

The system provides application interfaces using the time limit set for the master in normal mode. The master can easily set up the mode and limit of the controlled in the normal mode. In controlled mode, if in limit time, in addition to desktop applications, other applications are not allowed to be used. The system default time of day is divided into four time periods, each of which can be set individually, and the time also can be set by day.

### **6.4 SMS and Call Blocking**

In the remote command, we have introduced a way of intercepting SMS, which intercepts and filters the received SMS by registering a broadcast. In addition to blocking the host's command, the system also intercepts non-family number for the controller.

Call blocking. Get the Telephony Manager through Android system statically; call it a listen method to monitor our custom Phone State Listener. As a call outages or incomes, the on-call State-Changed method will be called. Its parameter contains three states: `CALL_STATE_IDLE` (hang up), `CALL_STATE_OFFHOOK` (answer), and `CALL_STATE_RINGING` (Bell). For a non-family member, the monitoring system will automatically call their shield.

## 6.5 Application Usage Statistics

The application usage statistics are a more difficult part, and this module is only doing its simple implementation. I.e., statistic the frequency of use, stores the number in a database, and then regularly uploads it to the FTP server. This is achieved as follows:

When you start other applications, in fact, you start an activity of the application. Then the activity displaying in the system (i.e. Launcher Desktop) will call its life cycle functions on-Stop. While monitoring the system, we will obtain the current top application through the tools Activity-Helper (the Android system is running an Activity-Task, then we can learn the running application program through getting the top of the stack Activity). At this point, we start the application and its state statistics, and store it in the local database.

## 6.6 Family Numbers

Monitoring system provides users with desktop plug-ins with a family number speed dial. SOS Widget Provider is a subclass of App Widget Provider, which corresponds to a desktop plug. On the plug-in board, there are five family number buttons such as the top, bottom, left, right, and center. When you click a button, it will trigger the five different broadcasting.

## 7 Conclusion

The issue, with the current development trend of mobile applications, according to the needs of the mobile device monitoring, designs and develops a monitoring client monitoring system based on the Android platform, achieving the functions of a remote command, timed positioning, messaging and telephone interception, application usage statistics, family number of settings and other functions for mobile application development.

The thesis analyzes shortcomings and development status of the existing project host monitoring software, summarize their functions, and improve some of the features, enhancing its usability and providing a reference for subsequent similar software.

The topic, based on the Launcher, expands and modifies the source code to reduce the workload, providing developers with experience. At the same time, it does a lot of research on the Launcher desktop mechanism, learns a lot of them and gained a lot of experience in the future of the Android application development.

The project, based on the Android platform, employs a large number of Android components and mechanisms, including the use of basic knowledge to cover almost the majority of the knowledge required for application development, so the design of this system is also a very good understanding and learning Android development opportunity.

The subject achieved a viable monitoring client monitoring system based on the Android platform, although whose function should be further improved and enhanced, but it basically meets the needs of existing applications and can solve some of the everyday problems for people.



In achieving results at the same time, because of the technology and energy constraints, there are also some shortcomings and deficiencies in the application of statistical areas which need further improvement and upgrading.

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