The Mobile Application for the Environment Monitoring System

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Abstract. The basic principle of the Android application development technology and the framework of EMS(Environment Monitoring System) is discussed in this paper. A mobile application for EMS3000 based on Android is developed. It provides user login, connection testing, alarming, real time data monitoring, message notification and other functions. The monitoring items and quantities which user concerns are showed in "my concern" module. The system was tested completely to provide user a better operation experience.

Introduction

As the mobile Internet technology development, smart phone was facilitate with real-time mobile applications for people. Based on the original EMS environmental monitoring system of Sunwe Co., this application was developed to allow users to quickly understand the running information of the EMS by Mobile Internet. A reasonable system and smooth operation was designed.

Android Architecture

Android is a software platform for mobile devices, which offers a mobile phone software solutions. It is opened development tools based on Linux kernel, ensuring portability and diversity of content. The system architecture of Android consist of application layer, application framework layer, the system runtime layer and the Linux kernel layer [1]. Application framework is API which is usable for writing core application, developers can use the framework to develop their own programs to simplify architecture design. The main API framework of the Android application framework layer consist of Views, Content Providers, Resource Manager, Notification Manager and Activity Manager[2]. There are four components in Android system, include activity, service, content provider and broadcast receiver [3].

Activity and Service

Activity is the major components, all operations of activity is a component responsible for interacting with the users, and closed by users. Activity displays the specified widget. An Activity is a separate page that can display widgets, listen and respond to user events. Activity is managed by stack in the system. Figure 1 is the activity life cycle.

Service is an application component running in the background. Other application components can initiate Service, and when the user switches to another application scenarios, Service will continue to run in the background. A component can bind to a service and interact with it. There is a "bound" state service, started by bindService() and destroyed by unbind().

Content Provider and Broadcast Receiver

Content Provider facilitate the use of storing and retrieving data in multiple applications. This is for the sharing data across applications, In android system, there is no common memory area for multiple APP to share data stored[4].
Broadcast is widely used mechanism of transferring information between applications, a lot of message in android system are distributed and received by broadcast, broadcast would be created and run once the message is arriving, and destroyed when the message finished[5].

![Android activity life cycle](image)

**System Analysis and Design**

**Functional Requirements**

(1) The function of parameter settings verifies IP and ports. Mobile client sends the IP and port information to the server through the network, when the server response it, then the connection was setup, the client and server can exchange data, otherwise the error message is returned, and the current configuration of IP or Port is mismatched.

(2) Login function is used to verify the user's identity. Mobile client sends the number and password to the server through the network, then the server queries the database, if the number and password matches, the user information and content of database would be delivered to client, otherwise the error message is returned.

(3) Alarm function is divided into two modules, one is sure alarm allowing users to query host, sensors, detection of the situation, the user refreshes the alarm that has been checked by pulling down. The other one is unsure alarm module to query or check alarm that has not been checked.

(4) Message notification is a function that is still monitoring the current alarm when users exit the application. The mobile application will send request to the server per 30s which is default to get the data of current alarm then show the message in the notification bar.

(5) System Settings, users can operate on system settings, users can query their own role, exit to go back to the page of login, select alarm interval of checking, whether to get message after exiting or not, whether to alarm or not, whether to vibrating or not, and query relative information of this product.

**Mainly Monitoring Data and Format**

(1) Temperature and humidity sensors: XX.X℃, YY.Y%
(2) Single-phase power meter: XXX.XV
System Module and Design

EMS user client mainly contains 7 modules, including connection testing, login, my concern, the current alarm, message notification, real-time data, system settings. Mainly modules are my concern and the current alarm (includes message notification) and real-time data module and system settings. The main function of the structure of the system, see Figure.2.

Communication Protocol

Basically Android uses HTTP to communicate, considering integration with other monitoring platform, controlling mobile client traffic, and parsing data, JSON which is lightweight, fast and highly scalable maintenance is the most suitable data format. Using JSON’s transmission mode, you won’t to check the integrity of data the same as socket. Similarly as the XML, JSON parsing data will check the format and the integrity. All communications is based on active request of client, the data types of transmission are JSON, and resolve data after receiving, formatting data before sending.

1. Business logic, user drops down the list of hosts, the server will return the host data; when user clicks host, the client will send request of the sensor data, the server will return the sensor data of the host; when user clicks on the sensor, the client will send request of the monitoring data, the server will return the monitoring real-time data of the sensor.

2. Clients data showing, host: host name, host real-time status, sensor: the sensor name, sensor real-time status, sensor real-time data, monitoring data: sensor name, the sensor is frozen, monitoring the amount of description, real-time status, real-time data, data acquisition time and the sensor automatically unlock time.

3. Communication protocols: communication protocol see table1.

<table>
<thead>
<tr>
<th>Code</th>
<th>Request parameters</th>
<th>Return to contents</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>Emvuid(User id), Role(User Roles)</td>
<td>RtItemGroupDTO(Host Data)</td>
<td>Returns object is data collection</td>
</tr>
<tr>
<td>42</td>
<td>Emvuid(User id), igKey(Host id)</td>
<td>RtItemDTO(Sensor Data)</td>
<td>Returns object is data collection</td>
</tr>
<tr>
<td>43</td>
<td>Emvuid(User id), igKey(Host id), itKey(Sensor id)</td>
<td>RtQuantityDTO(Monitoring data)</td>
<td>Returns object is data collection</td>
</tr>
</tbody>
</table>
System Analysis and Design

Connection Testing and Login Module

The configuration parameters of server are null when the mobile application first installed. The IP address and port are both cleared. When user starts the application, need to click the “set” button which open the page to set the configuration parameters of server, and users should input IP address and the port of server. If IP or port address have errors, users can click cross button or use virtual keyboard to clean. Users can click the button of connection testing to test. The button will show a status of waiting when clicked. If the application can connect to the server successfully, users input the name and password which can be chosen to save or not, and after click the button of login, the button will show the status of waiting, if login success, the main page would be opened, and save the number and password if the users need. If failed, the error message would inform user.

Current Alarm and Message Notification Module

When login success, interface will switch to main page. The default module is my concern. Users can click current alarm button to the page of current alarm. In this page, there are two sub menu, certain alarm which is the default and the uncertain alarm. Users can check the information of certain alarm in the page and click the menu of uncertain alarm to check the relative information and confirm the uncertain alarm.

Message notification is an assistant module belong to current alarm module, which can get message of alarm when the mobile exits from the alarm page. The mobile application would send request to the server per 30s which is default value to get the data of current alarm, and the message would be displayed in the notification bar. Users can click the message to the page of current alarm.

System Setting and My Concern Module

The system settings can display the name and the authority of current user, and exit from the application back to the login page when click exit button in the right side. There are alarm interval checking and alarm interval displaying in this module, the default value is 30 seconds. The option of notification bar showing alarm is selected acquiescently, the alarm message would still be accepted even if application exit. Light and mobile indicator would blink when alarm occurred.

My concern shows the monitoring item, monitoring quantity which users concerned. Users could click the icon of orange star to cancel the concern. see Figure.3. The list of my concern was stored in the server users could update in different platform. (1)The item with the tag of alarm is in high priority, it would be shown on the top of list. (2)Otherwise the item would be shown by the follow order: host->monitoring item->monitoring quantity.

Real Time Data Module

(1)There are 3 levels of page consist of real-time data, included the page of status of EMS host, the page of monitoring item, the page of monitoring quantity. Considering the mobile phone traffic, real-time data would update the data when users click the relative page or pull down the page.

(2)When click the real-time data at the bottom, it would skip to the page of real-time data to show the relative message of EMS host. Click the description of EMS host, it would skip to the page, see Figure.4.

(3)Clicking the back icon on the page, return to the page of host. Clicking the item of monitoring item to skip to the page which describes the monitoring item in detail, including the description of monitoring item, the data acquisition time, data item locking and unlocking, etc., see Figure.5.

(4)Air conditioner, include cooling, heating, dehumidification, automatism etc.
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References


