A Mobile Homecare Application Combining with Alarm Clock and GPS Positioning Function

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Abstract. Along with the recent development of orange technology, there is a growing concern for homecare issue for the elderly. According to official statistics, it shows by the end of 2010, there have been 2,487,893 elderly people over 65 years old in Taiwan, occupying 10.74% of total population, and the number is growing continuously. According to the latest population projection conducted by Council for Economic Planning and Development (CEPD), it is estimated that in 2017, Taiwan will become an aged society, while in 2025 become a super aged society. In comparison with some European countries, such as Germany, France and United Kingdom, it demonstrates rapid population aging in Taiwan. Due to the coming of an aged society, homecare service becomes more and more important.

Smart phones have the characteristics of personalization, multi-function and portability, therefore, it is suitable to develop a mobile care system with high portability on the platform. This study utilizes Android open platform to develop a homecare system for the elderly combining with alarm clock, GPS global positioning system and call catcher. Alarm application reminds the patients to take the medicine regularly, while call catcher prevents the elderly from being fraud. And further, combining with GPS, it is also effective to prevent the elderly from getting lost.

Keywords: Android, Homecare, GPS, Clock.

1 Introduction

The coming of an aged society represents the ratio of chronic disease is increasing. Based on data prepared by Dept. of Population, Ministry of Interior, it shows chronic disease for the elderly in Taiwan occupies a ratio of more than 60 % of total. Chronic disease even occupies 7 causes of Taiwan Top 10 causes of death. However, taking medicine regularly is beneficial for controlling or improving the chronic illness. In consideration of the importance of regular medicine taking of chronic patients, we design simple alarm function combining with text message to

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remind the patient to take medicine on time. After users set their medicine taking time, when set time is up, the alarm will be triggered to remind the patient to take medicine. Meanwhile, the system will send text message to the family member's phone automatically, allowing family members to remind or express concern for medicine taking of the elderly.

Recently, there are many fraud organizations taking mainly the elderly or children as object worldwide. According to the statistics of Police Administration, money that people are swindled is up to 100 billion NT dollars, and there have been over 350 thousand people falling victim to fraud in Taiwan in recent years. This is an unignorable number. Hence, to provide better homecare service for the elderly and children, this study designs a homecare application combining with alarm clock, GPS and call catcher and hides GPS and call catcher under the alarm clock. The alarm application provides functions including: setting alarm, repeating alarm and sending text message when alarm rings. GPS receives text messages to trigger GPS application in mobile phones and reply text message to notify the present location. Call catcher utilizes text message to notify the number of incoming calls.

As to filter telephone number, when there are calls from unknown users, mobile applications will send text messages notifying the number of the incoming calls to the family members automatically. The family members are able to filter the number of the incoming calls after receiving the message. If the numbers are unfamiliar or suspicious, family members can call to express their concern timely, preventing the elderly from being fraud or loss of money.

Usually, along with the increase of age, memories of the elderly deteriorate and are possible to get lost. Due to the regulations, in Taiwan, the police only handle cases with people who have got lost for more than 24 hours, thus, police organizations usually fail to offer timely assistance. Under this circumstance, this system compensates this deficiency, utilizing message trigger Global Positioning System (GPS) to identify the location of the elderly. When family members find their elderly are lost, they can send text messages to the mobile phone held by the elderly. This mobile phone would identify the longitude and latitude of the location automatically and send text messages to the family member's mobile phone, allowing the family member to find their lost family member at the earliest time.

In addition, this application has theft-proof function. Because GPS and call catcher hide under the alarm clock, normal users would not be suspicious of the application. When mobile phones are lost, users can utilize message trigger GPS to obtain the present location of the mobile phone. Or when SIM cards in the mobile phones are replaced and unable to obtain number of this mobile phone (also unable to use message trigger GPS). When people call the one who takes the mobile phone, call catcher can get the phone number and further start GPS in the phone. This greatly enhances the possibility of finding the lost mobile phones.

The remainder of this paper is organized as follows. Section 2 introduces framework of Android development platform and basic components; Section 3 introduces the proposed implementation method; Section 4 introduces implementation layout of applications; Section 5 is conclusion of this study.

2 Background

According to the research reports, handset mobile phone has become one of the most commonly seen personal items of modern people. Meanwhile, built-in CPU of handset mobile phone is able to process great amount of computing data now and supports a variety of wireless access technology. In consideration of future development of mobile communication, thus, in 2007, Google initially established Open Handset Alliance (OHA), developing an open platform for mobile devices named Android.

To enable application developers to develop applications for more easily, Google provides full-function API, e.g. layout arrangement, layout conversion, data exchange between applications, etc. in Android SDK. It allows application designers can utilize services such as Google Map or Gmail to develop applications on open mobile development platform. To make application development of handheld device easier, Android also provide abundant support for mobile communication and various sensors, e.g. GPS, Video-Camera, compass, 3D Accelerometer and map/location function.

As shown in Fig 1, execution environment of Android contains the built-in core Libraries, thus, it can support most function of core Libraries of Java language. When executing program, every Android application would run the routine provided by the operation system separately and has individual Dalvik virtual machine (DVM). To make Android more applicable in mobile phones, Linux kernel of Android also enhances Interprocess Communication (IPC) and Power Management. Meanwhile, Linux Kernel (Version 2.6) also plays the role of abstract interface among all hardware and application, providing basic functions such as thread and memory management.

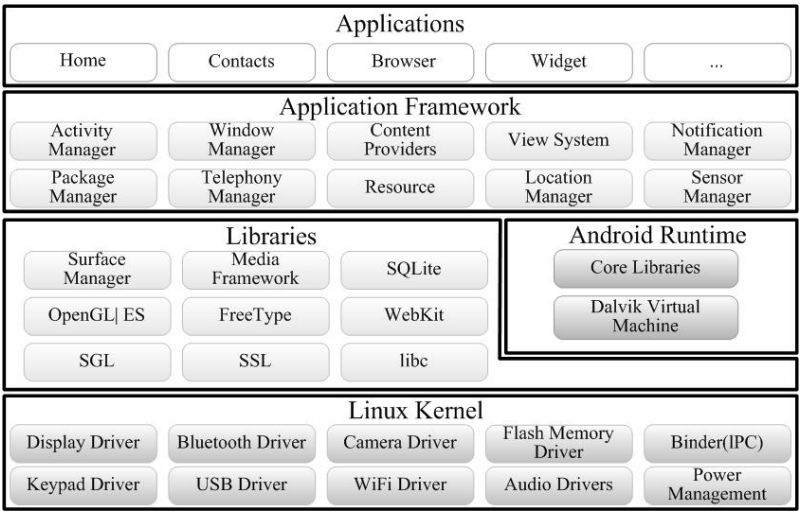


Fig. 1. Android system architecture

In general, most Android applications are comprised of four components: (1) Activity (2) Service (3) Broadcast Receiver and (4) Content Provider. In Android, users can make interaction through Activity. Activity displays View consisted of user interface and responds to events. When implementing in context for long time without interacting with users, it can utilizes Service component to provide service.

When the system is working, Android can start Activity, Service or Broadcast Receiver in the application through Intent messages. Intent is a Runtime binding mechanism which can build connection between two components. Intent has similar mechanism as Event, but there is still some difference from it. Traditional Event processing mechanism focuses on triggering Handler. When an Event occurs, the system would call Event Handler or directly transfer the Event to applications and then, applications decide the handling method. But in Event handling concept of Intent, Android attempts to explain the Event as Intent of applications or Intent of users and tries to explain the intention of the Intent through Intent. If Android can understand Intent of the application, it would process the work should be executed by the Intent. Every Intent message is followed by an Action and respond according to the Action.

Android is an open mobile platform, so it also supports call, SMS, data connection, SIM card and other phone services. The framework of phone service is consisted of four parts including Modem, RIL (Radio Interface Layer), phone service framework and applications. Because the 2G/3G module in mobile phones has been mature, there are a variety of consistent and simple software interface available for hardware service. Therefore, users only need to insert SIM card into the module and turn on the power to start working. Phone modules even finish the initialization such as searching the network and network registration. After initialization is done, phones can be used to make calls and send text messages.

On Android platform, positioning system plays a crucial role. Among the widely applied positioning systems, the most commonly seen is GPS and AGPS system which utilizes Cell signal to assist positioning.

3 System Implementation

The developed homecare application is consist of three components: (1) alarm clcok, (2) global positioning system and (3) call catcher. Following gives a brief discussion.

Alarm Clock

Usage of Alarm Clock Application getSystemService(ALARM_SERVICE) obtains AlarmManager and utilizes setrepReperating to implement this alarm clock.

Step 1. Assign to implement CallAlarm.class in Set alarm time

```
Intent intent = new Intent(Clock.this,CallAlarm.class);
PendingIntent sender =
PendingIntent.getBroadcast(Clock.this,1, intent, 0);
```

Step 2. Implement the alarm repeatedly：setRepeating()

```
AlarmManager am;
am=(AlarmManager)getSystemService(ALARM_SERVICE);
am.setRepeating(AlarmManager.RTC_WAKEUP,c.getTimeInMill
is(),times,sender);
```

Step 3. When implementing CallAlarm.class, Intent would be created and it would call AlarmAlert.class and send reminding text messages

```
public class CallAlarm extends BroadcastReceiver
{  public void onReceive(Context context, Intent intent)
{Intent i = new Intent(context, AlarmAlert.class);
Bundle bundleRet = new Bundle();
bundleRet.putString("STR_CALLER", "");
i.putExtras(bundleRet);
i.addFlags(Intent.FLAG_ACTIVITY_NEW_TASK);
context.startActivity(i);
SMS ();} }
```

Where **SMS** () is a function of sending text message.

Step 4. Call AlarmAlert.class and reminder window pops up

```
new AlertDialog.Builder(AlarmAlert.this)
.setIcon(R.drawable.clock)
.setTitle("TIME UP!!")
.setMessage("you have to take the medication!!!")
```

Furthermore, to add code android.permission.RECEIVE_SMS to AndroidManifest.xml, it can be correctly executed only when applications obtain the user right for sending text message.

3.1 GPS Global Positioning System

Step 1. GPS application utilizes its built-in GPS satellite positioning to identify the location of users. When receiving the text messages, it utilizes LocationManager component provided by Android system to obtain the coordinates of users. Usage of LocationManager is shown below:

```
Bundle bunde = this.getIntent().getExtras();
if (bunde != null)
{ localManager =
(LocationManager)getSystemService(GPS.LOCATION_SERVICE);
locationListener = new MyLocationListener();
localManager.requestLocationUpdates(LocationManager.GPS
_PROVIDER, 0, 0, locationListener);
} else{finish();}
```

Updates of GPS location to get coordinates address and identify the present location via sending text message:

```
if ( loc!= null){
strlatlon1 = "Lat" + String.valueOf(loc.getLatitude())
+ "Lon" + String.valueOf(loc.getLongitude());  }
```

When developing an application, it is applicable to adopt DDMS tool to detect faults and conduct test. Furthermore, to add code android.permission.ACCESS_FINE_LOCATION to AndroidManifest.xml, it can be correctly executed only when applications obtain the user right for positioning service.

3.2 Call Catcher

This application obtains TELEPHONY_SERVICE system service, obtaining call state and number of the incoming number. Then it sends text messages to notify number of the incoming number of the third party.

Step 1. Obtain TELEPHONY_SERVICE system service

```
mPhoneCallListener phoneListener=new
mPhoneCallListener();
TelephonyManager telMgr =
(TelephonyManager)getSystemService(TELEPHONY_SERVICE);
telMgr.listen(phoneListener,mPhoneCallListener.LISTEN_C
ALL_STATE); mTextView1 =
(TextView)findViewById(R.id.myTextView1);}
```

Step 2. Obtain call state and number of the incoming number, and then, it sends text messages to notify number of the incoming number of the third party.

```
public void onCallStateChanged(int state, String
incomingNumber ) { switch(state)  { case
TelephonyManager.CALL_STATE_RINGING:mTextView1.setText
( getResources().getText(R.string.str_CALL_STATE_RINGING)
+ incomingNumber );
SMS();
break;  default: break; }
super.onCallStateChanged(state, incomingNumber);}
```

4 Achievement Display

Firstly, enter the Initial Menu of Alarm (As shown in Fig 2). In this layout, users can set alarm. When there are setting errors or they want to cancel the alarm, they can click on delete button to cancel the setting.

Fig. 2. Initial Menu of Alarm

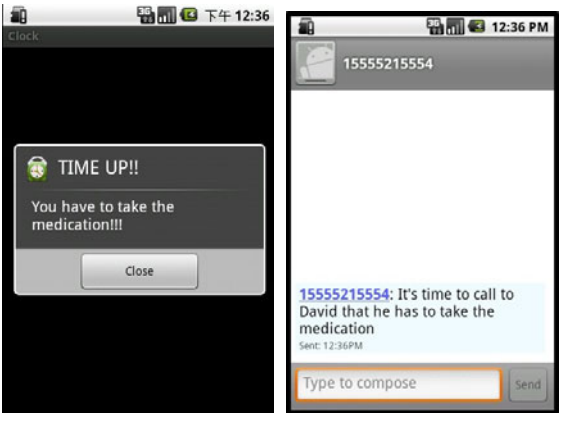
Then click on the alarm setting button to enter the layout of setting alarm and repeating alarm (As shown in Fig. 3).

Fig. 3. Set Alarm Time and Repeating Alarm

After completing the setup, the menu would display the set time and repeating interval (As shown in Fig. 4).

Fig. 4. Setup Complete

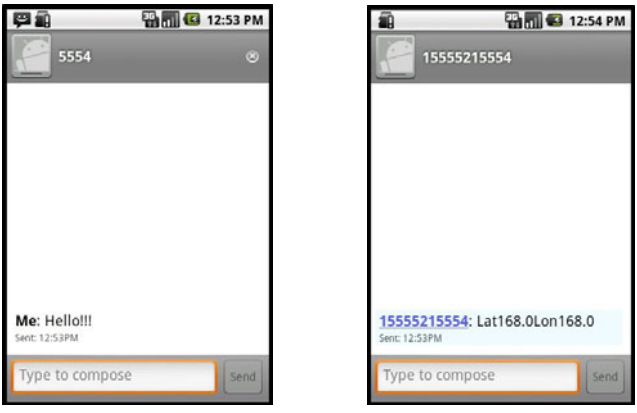
When the alarm rings, reminder window pops up and send text message to family members. (As shown in Fig. 5).



(a) Reminder Window (b) Sending Text Message

Fig. 5. Alarm, Reminder Window and Sending Text Message

The target mobile phone uses message to trigger GPS function. After receiving the text message, the target phone will notify its present location (As illustrated in Fig. 6).



(a) Send Text Message (b) Obtain GPS Location

Fig. 6. Mobile phone uses message to trigger the target GPS function

Finally, we show implementation of call catcher below. In the example below (See Fig. 7), while the unknown user calls the user being monitored (see Fig. 7(a)), owing to the user being monitored starts using call catcher in the mobile phone and receives a call from unknown number (see Fig 7. (b)), call catcher will send the number of the user being monitored is calling to monitor via SMS (Illustrated in Fig. 7(c)).

(a) A unknown user calls the user being monitored

(b) The user being monitored receives calling from unknown number

(c) Call catcher sends the obtained number to monitor via SMS

Fig. 7. Illustrated of Call catcher

5 Conclusion

Smart phones have the characteristics of personalization, multi-function and portability, therefore, it is suitable to develop a mobile care system with high

portability on the platform. This study utilizes Android open platform to develop a homecare system for the elderly combining with alarm clock, GPS global positioning system and call catcher. Alarm application reminds the patients to take the medicine regularly, while call catcher prevents the elderly from being fraud. And further, combining with GPS, it is also effective to prevent the elderly from getting lost.

6 Future Work

The future goal in this field will be using 3G network to solve this problem. Presently, GPS positioning has been widely applied in various fields. But the biggest limitation of GPS is it requires environments to have Line of Sight (LOS) with satellite system. Thus, if the place is located indoor or inside the building, owing to wireless signal is unable to be transmitted to user equipment, GPS fails to retain its accuracy under this situation. Furthermore, using GPS in smart phones consume much power, causing the standby hours shortened, failing to work for long time and finally, leading to service interruption.

Along with popularity of mobile device and WiFi technology, devices such as laptop, smart phones, etc can support services such as 2.5/3G, WiFi and so on. Using 3G network positioning can solve failure of satellite signal acquisition of GPS in indoor environments, and compared with using GPS, power consumption of using 3G network positioning is greatly decreased, extending the time for service.

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