

112 Emergency Call Positioning Message Support Application for Smartphones

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Abstract - In this study, an application sending location via short message(SMS) has been developed for smartphones using Android operating system while internet is disabled in case of emergency. If Global Position System(GPS) of user's phone is disabled, the application warns the user by vibration and screen message. In emergency calls is to inform emergency call center by sending SMS or to send SMS to a predetermined number about the coordinate of caller by using A-GPS(Assisted GPS) feature. Developed application has tested both indoors and outdoors as well as on different brands and models of Android. The error rate of outdoor tests is approximately 10-15 meters and the indoor result is approximately 15-30 meters. Transmission times of SMS are 14-32 seconds and 20-92 seconds respectively. SMS transmission time differs from region to region depending on connection time to base station and magnetic pollution.

Keywords – Smartphone, location, emergency call center, emergency call.

I. INTRODUCTION

Nowadays, GPS system commonly used for positioning. GPS system is consist of 6 orbital with 4 satellites on each. The altitude of satellites is 20,200 km. The system is consist of three sections. These sections are space, control and user. The frequency of the system is given reference[1-2]. GPS receivers do positioning by processing the signals received from GPS satellites[1]. Smartphones use A-GPS(Assisted GPS) system as shown in figure 1.

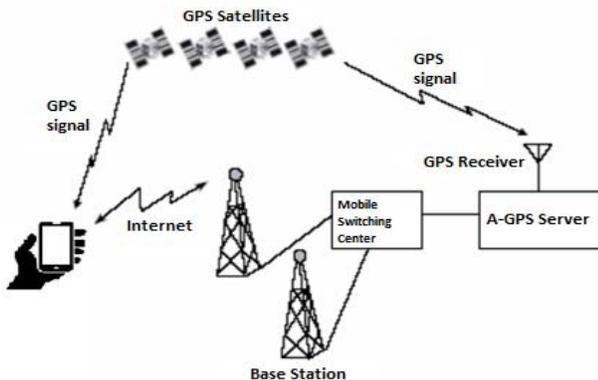


Figure 1: A-GPS general structure [3].

In A-GPS system, GPS satellite information can be gotten via mobile network. As a result of this, A-GPS system works faster, in comparison to GPS[4]. If satellite signals get weaker because of physical obstacles, data transmitted by these signals may not be acquired. In this case, cellular base stations provide that data[5].

There are different applications for location sharing on smartphones. Some of these are WhatsApp, Snapchat, Facebook Messenger, Google Maps. Internet connection is needed for these applications.

In this study, an emergency application has been developed for use on smartphones. There is no need to make any adjustments for the operation of the application beforehand. While applications such as Google Maps, WhatsApp, Snapchat and Facebook Messenger require internet connection, there is no need internet connection for this application.

II. ANDROID SYSTEM ARCHITECTURE AND APPLICATION COMPONENTS

Android is an open source application of the Linux operating system[6]. Android system architecture can be seen in figure 2.

Linux Kernel is the bottom most layer in the Android system architecture. Details of the system are given in references 7, 8 and 9.

Application components are used to create an android application. An android application has a lot of application components such as activities, services, broadcast receivers and content providers[10-12].

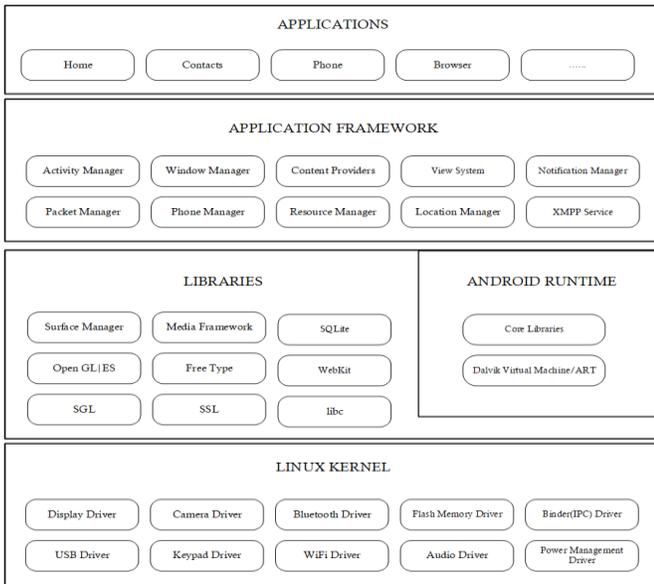


Figure 2: Android system architecture[7].

III. COMPONENTS OF EMERGENCY APPLICATION AND WORKING PRINCIPLE

112 emergency application has five components which are broadcast receiver, intent, service, manifest and activity. Broadcast receivers get broadcast messages sent by Android operating system to the application whenever a call is made. While intent component is usually used to initiate a service or activity, in emergency application, it launches the location finding service and runs activity that shows the location setting screen to the user. Service component is used to obtain accurate location of phone. To get location information, Location Manager class in application framework of android architecture is used. Manifest component is configuration file of application. Components defined in the manifest file of application are activated whenever phone is switched off and on. If activities, services, content providers and filters are not specified in manifest file, they are not activated by the system. To send location information via SMS, `sendTextMessage()` method of the `SmsManager` class is used. Activity component is a visual interface presented to the user and it represents location setting screen presented to the user to activate the GPS of the phone in developed application. Operating principle of the application is as follows:

In a call made from phone, After broadcast messages sent by Android operating system are received by broadcast receiver component, dialed number information is obtained with the intent component. If dialed number is not 112, no action is taken and next broadcast message is waited for. If dialed number is 112, location finding service is activated via intent component. A timer is started to stop the service after a period of time(2 minutes). If GPS of phone is disabled, an activity is started via intent. With this activity, location setting screen of phone is shown to the user to enable the GPS of phone. At the same time, user sees a warning message “GPS is disabled, Please enable it” on the phone screen. As well as this warning message, the phone is vibrated with 5 seconds to raise

awareness for the user. Accurate location information including latitude and longitude is displayed on the phone screen. At the same time, by using `SmsManager` class which manages short message services and its methods, SMS including location link is sent to Emergency Call Center automatically. When predetermined time by timer expires, location finding service is stopped and activities of methods obtaining location of phone are terminated.

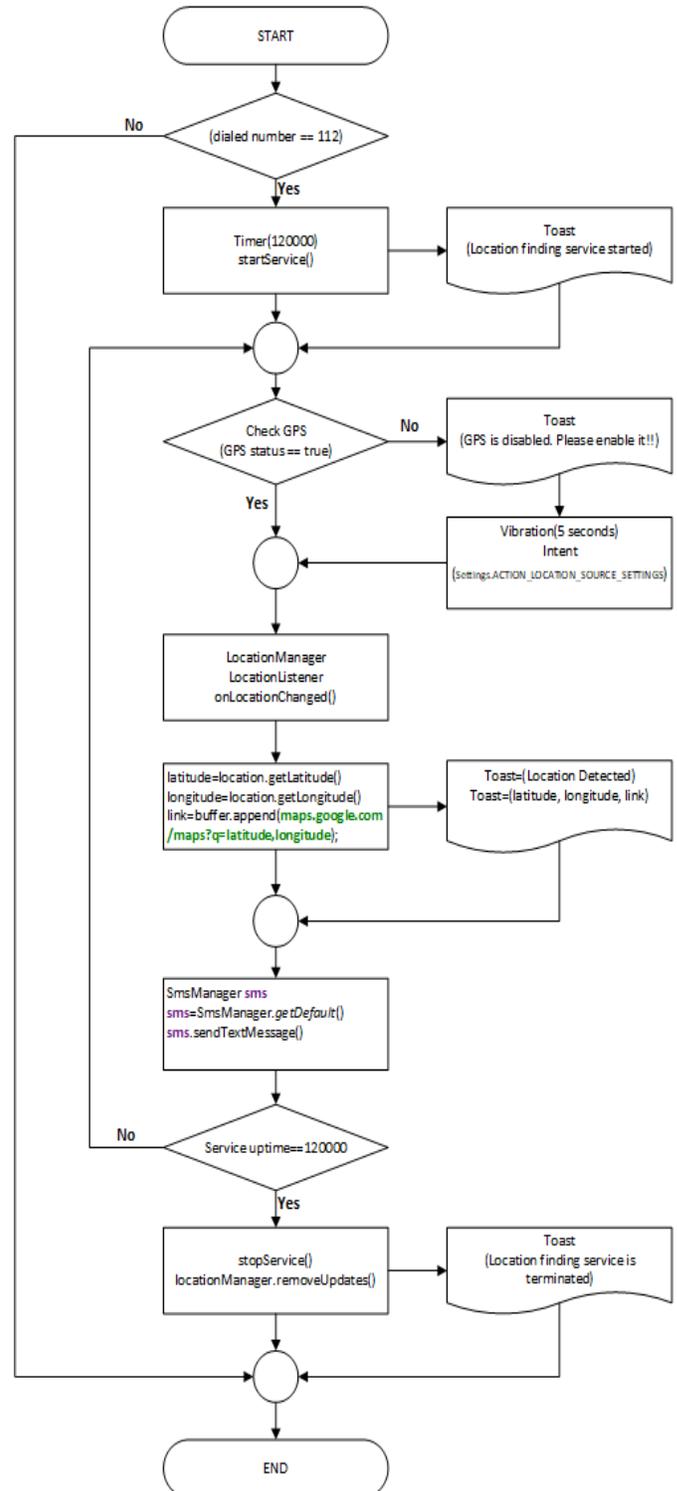


Figure 3: Application flowchart

IV. FIELD TESTS

112 emergency application has been tested on 4 different brand mobile phones, which have A-GPS receiver and android operating system, and different versions of Android. Emergency application was tested indoor and outdoor. Outdoor tests were carried out in Kızılay Square in Ankara. Indoor tests were carried out in ground floor of a building in Kızılay. During tests, predetermined arbitrary number(1234) was dialed as emergency number instead of 112. SMS containing latitude and longitude was routed to predetermined mobile phone number. An example of the SMS is seen in figure 4.



Figure 4: Outgoing SMS to emergency call center

Table 1: Indoor Tests

	Smartphone Brand	Android Version	Transmission Time (second)	Error Rate (meter)
1	Lenovo P70-A	4.4.4	32 s	<15m
2	HTC Desire	6.0.1	14 s	<10m
3	Vestel Venus	6.0.1	25 s	<15m
4	Xiaomi	7.0	17 s	<10m

Table 2: Outdoor Tests

	Smartphone Brand	Android Version	Transmission Time (second)	Error Rate (meter)
1	Lenovo P70-A	4.4.4	52 s	<25m
2	HTC Desire	6.0.1	20 s	<15m
3	Vestel Venus	6.0.1	92 s	<30m
4	Xiaomi	7.0	24 s	<15m

Depending on GPS receiver of phone and mobile network density, average location transmission times differ. A-GPS feature of phones was utilized both indoor and outdoor tests.

V. CONCLUSION AND DISCUSSION

In this study, in case of emergency, location finding application has been developed based on smartphones using Android operating system without the need for an active internet connection.

The aim of the study is to develop an application which sends automatically the GPS coordinates of caller's location to emergency call center via SMS without using any utility application. If GPS is disabled, the application warns the user

by vibration and screen message. The functionality of this application has been successfully tested on different brands and models of android.

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