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A NOVEL LOCATION-BASED ANTI-THEFT IMAGE CAPTURE APPLICATION WITH CULPRIT IDENTIFICATION FOR SMARTPHONES

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ABSTRACT
An Android smartphone application, "A Novel Location-based Anti-theft Image Capture with Culprit Identification for Smartphones", has been proposed in this work. This application helps the user track the current location of the mobile that has been lost/stolen and identify the person(s) who stole the smartphone. Location tracking techniques have been applied for tracking the stolen mobile phone. Using handset-based location techniques, the handset detects the signal transmitted from multiple base stations and/or satellites and uses these signals to determine the location of the phone. Once the proposed mobile application service is activated, the stolen phone automatically sends a text message of its current address (location) to registered contacts through short messaging service (SMS) even when the stolen mobile has been switched off. In addition, if someone tries to change the subscriber identification module (SIM) card of the stolen phone, then the proposed mobile application will automatically capture the image of that person. Every time the phone is rebooted, the application will check the status of the current SIM card. When there is a change of the SIM card, the proposed service is automatically activated and tracks the phone's location along with capturing snapshots of the person changing the SIM card and sends the information to registered contacts. The key significance of this work is capturing the snapshots of the person and sending the information to email ids of registered contacts in every reboot along with the location as a text message to registered contacts. This mobile application is highly helpful for users to recover their stolen mobile phones, particularly to those who cannot afford to lose their expensive smartphones with confidential data.

Keywords: Android mobile, SIM tracking location, GPS, GSM, SMS, Email.

1. INTRODUCTION

The loss and theft of mobile devices is a growing risk that is yet to be addressed in detail by the research community. This study extends the literature significantly by examining the roles of key information and threat appraisal developments [1]. Communication technology plays an important role in our everyday life. With mobiles becoming fancier, more popular, and more expensive, they are increasingly liable to theft. Therefore, people would definitely want to know how to trace their stolen mobile phones.[2]. The proposed work, Anti-theft Image Capture application, is a research work that helps people track the lost/stolen smartphone. If the subscriber identification module (SIM) card of the stolen phone is changed, the application will automatically send a text message through short messaging service (SMS) or e-mail topre- registered contact numbers.
In this paper, anti-theft tracking system for image capture is proposed to track the lost/stolen smartphone. The rest of the paper is organized as follows. Section II describes the literature survey and existing research conducted in this area. Section III explains the overall architecture and theft identification methodologies. Section IV discusses the various modules used in the proposed system. Section V presents the proposed system's experimental results. Finally, Section VI presents the conclusion.

2. LITERATURE REVIEW

2.1 The Existing System

The existing system finds the location of the missing mobile phone using Global Positioning System (GPS) and General Packet Radio Service (GPRS) techniques. Global Positioning System techniques help in finding the location of the particular device. However, identifying the location and image of the person is not possible [3]. Existing systems are not able to find the person without connecting to the Internet. This proposed system works without being connected to the Internet. There are many existing applications to track lost/stolen mobile phones,

but the user cannot predict if the phone will be connected to the Internet. If the phone is not connected, then it may not be possible to find its GPS coordinates.
Location tracking techniques can be categorized into two methods: network-based location tracking techniques and handset-based location tracking techniques [4]. In network-based location tracking techniques, the signal transmitted from a mobile station
is used to determine the location of the phone [4]. The main advantage with these techniques is the easy implementation, which does not require any software or hardware modification to the handset. Usually, the mobile station is totally passive and does not play any role in the location determination process. This allows the use of legacy handsets. The disadvantages of the network-based location tracking techniques lie in their lack of accuracy when compared to GPS-based positioning [5]. In handset-based location techniques, the handset detects the signal transmitted from multiple base stations and/or satellites and use these signals to determine the location of the handset. The implementation of these techniques normally requires certain software or hardware modifications to the handset. These modifications make implementation expensive and difficult. Some of the handset-based location tracking techniques are network-assisted GPS methods.

Disadvantages of the Existing System:

belongs to the owner, this system will not perform any activity. In case a SIM change occurs, TICS opens the camera to capture images of the possessor(s) of the phone and sends a text message to the configured buddy list (friends'/relatives' phone numbers which should have been registered while installing the application) already stored in the database of the stolen mobile. The buddies can easily identify if the mobile has been stolen. This application automatically runs every 5 seconds and the Internet will become enable.
- The existing system does not offer solutions to find the person responsible for the loss/theft. However, location tracking is possible using this method.
- It is not possible to predict GPRS connectivity and positioning with GPS.

2.2 Proposed System:
The proposed application overcomes the forementioned problems rampant in the existing systems. This application automatically runs every five seconds and the proposed system also captures images and sends these images automatically to registered contacts through text and email messages. The GPS coordinates of the person(s) with whom the phone is present will also be sent to the registered contacts. This helps the user narrow down on suspects if the
phone is stolen.
Advantages:
- The proposed work captures and sends the images of the person(s) with whom the phone is present to registered contacts through text and email messages.

- The phone will automatically connect to the Internet without user interaction.

- This work also tracks the location of the phone and the image capturing process may not be recognizable by the possessor(s) of the phone.

3. METHODOLOGY

3.1 Overall System Architecture

The proposed anti-theft mobile application helps users track the lost/stolen smartphones. This Android application is different from other existing mobile tracking applications in that it allows the user to configure a buddy list and tracker email ids. Every five minutes the application automatically runs and checks whether the mobile is lost/stolen. The owner of the phone should have configured a buddies list that has been registered in the database. The proposed work will verify the owner of the mobile phone. If the SIM

Fig. 3.1.Overall System Architecture

3.2 Network-Assisted GPS (A-GPS)

The assisted GPS (A-GPS) allows mobile receivers to obtain information from network resources to assist in satellite location. A-GPS significantly improves the startup performance of a satellite-based positioning system [6]. This method uses the signals acquired from several GPS satellites and auxiliary network information to calculate the location of the lost/stolen phone. Mobiles are fixed with GPS receivers and base stations feed satellite information through air interface. The information includes a barcode containing the identity number of the satellite, which sends the signal. It also contains information about the position of the satellite and the time at which the signal was sent. The handset calculates the difference between the times at which the information was sent and the time at which the information was received. This time difference is used for calculating the distance of the handset from the satellite. The distance measurement of the handset from various base stations gives the reference position of the location.

Fig. 3.2. Network A-GPS

3.3 Enhanced Observed Time Difference (E-OTD)

This method using E-OTD positioning technology is used to monitor a group of base stations. The mobile measures the time difference of arrival (TDOA) between the serving base station and the neighbouring base stations of signals [7]. In the Global System for Mobile Communications (GSM), this TDOA is called the observed time difference (OTD) and is required information for handoff. Location measurement units (LMUs) throughout the network are used to estimate TDOA. Measurements of TDOA and OTD are used to estimate the position of theftmobilecurrent location.

4. Module Implementation

The application installation module is used to build the application in a development environment using Eclipse with the Android software development kit. Emulator is started for developing the proposed new technology. It is one of the main modules that should be developed to create an innovative Android application for anti-theft mobile tracker for smartphones [8]. Finally, install the application in the mobile phone. The application will fetch the data from the user and store the data in the database using the Structured Query Language (SQL). In the application installation module, first select the user interface where the user has to provide the SIM details,International mobile subscriber identity (IMSI)number, and an alternate number and then click the “Submit” button. Finally, the applicationwill store the information to the database.

4.1 One-Time Registration Module

The one-time registration is a mandatory process in which the user can log in with the registered credentials to access the application. The user authentication process is to check whether the authorized user is logged in, and the user authentication process verifies if the given user name and password is valid.

4.2 Auto Checking Module

The auto checking module checks and monitors whether a SIM change has occurred in the mobile. In case the SIM change occurs, the mobile will send an alert to the preregistered numbers in the database that were configured previously by the user.

SIM Serial Number Verify Module

During the time of registration, the application will check the SIM number and store the same in its setting. Every time the application is restarted, this module will check the SIM number and validate the login. If there are any changes, it will alert the user.

4.3 Tracker Mail Module

This module is used to store the email id and password of registered contacts required for sending the images to the contacts' email. It is also used to check whether the authorized user has logged in. During the time of any SIM change, the application will proceed to capture the images of the possessor(s) of the phone and will send these images to registered contacts.

4.4 Capture Module

During the time of any SIM change or restart, the application will launch in a fraction of a second and capture images using the front camera. When the application goes for SIM validation and there are any changes or failure in validation, the camera will be launched and image(s) will be captured.

4.5 SMS and Email Send Module

After capturing the image(s), the application will process to send an email and an SMS alert will be sent to the user with the current GPS location of the phone. This process will be repeated at certain intervals of time, which should have been programmatically predefined.

4.6 Methodology Block Diagram:

The proposed application should be installed in the mobile. The application will fetch the real data from the user and store the data in the database using the SQL. In this module, the blockdiagramfirst user interface is where the user has to provide SIM, IMSI number and alternate number and then click the "submit" button to store the information to the database. In case SIM change occurs, the application will automatically send SMS or email to registered contacts. Fig. 3 depicts the block diagram.

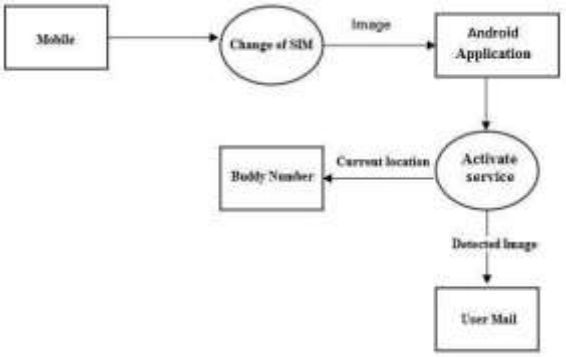

Fig. 4.7. Block Diagram

5. Experimental Results

This experiment has been conducted in the University of Madras, Guindy campus. The participants were students with Android mobiles from the Computer Science, Nanoscience and Technology, Chemical Sciences, Physical Sciences, and Life Sciences departments. The outcomes are based on Android mobiles (95%) rather than Apple (iOS) or mobiles with other operating systems. The results of testing in various mobiles is shown in Table 1.

Table 1: Results of testing in various mobiles

No. of Mobiles	Android Version	Apple (iOS) Version	No. of Successes	Percentage
130	124	6	124	95.38%

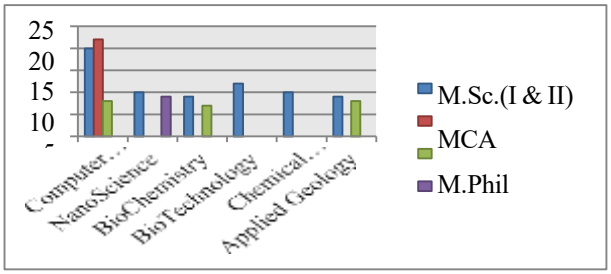

Fig. 4 shows the bar chart of 124 mobiles.

The application has retrieved the information about the lost mobile with 100% accuracy for Android mobiles. Table 2: Results of testing in Android mobile.

S. No.	Name of the Mobile Brand	Name of the Model	Android Version	Test Result
1	Samsung	Galaxy(GT365 2)	4.1	Pass
2	Huawei(Honor)	P30Lite	5.1	Pass
3	Nokia	Nokia 3	7.0	Pass
4	Redmi	RedmiY1 Lite	7.1.2 N2G47H	Pass
5	Samsung	Jelly Bean	4.1 - 4.3.1	Pass

International Mobile Equipment Identity (IMEI) is a unique 15-digit code authorized by GSMA, just like an identity certificate for a phone. Every time a phone uses a particular network to make or receive a call, send or receive a message, its IMEI number is automatically emitted and tracked. Because the police and service providers have databases in which these ID numbers fall into white and black lists, an owner can report his/her IMEI number and make it blacklisted after a loss/theft. This experiment has been extended to various mobile operating systems as shown in Table. 2 which shows the results of location tracking in different places. The system can retrieve the mobile information of the lost phones with 95% accuracy in several of the Android mobiles. The information could not be retrieved in 5% of the mobiles with Apple iOS mobile operating system.
The user authentication process is to check whether the authorized user is logged in. User authentication process verifies the given user name and password. Figures 5.1 & 5.2 show the user registration and email registration screens.

Fig. 5.1 User Registration

Fig. 5.2. Email Registration

In this experiment, an SMS alert will sent to the user with the current GPS location of the phone. This process will be repeated at certain intervals of time, which should have been programmatically predefined. The results of the location tracking and messages are shown in Figures 5.3 & 5.4.

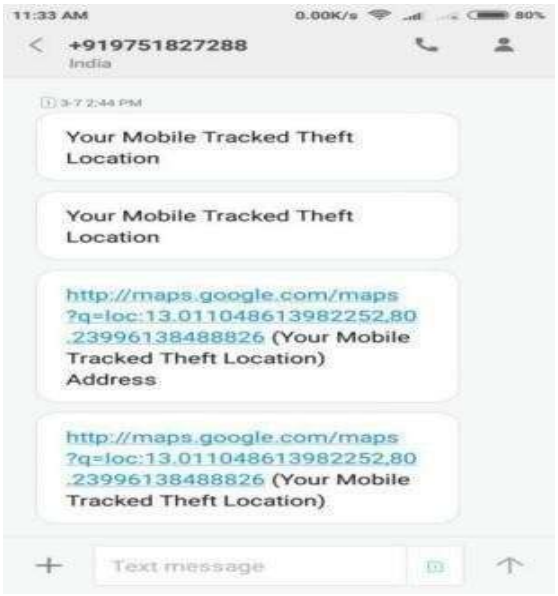

Fig. 5.3. Information Retrieved from the Stolen/Lost Mobile.

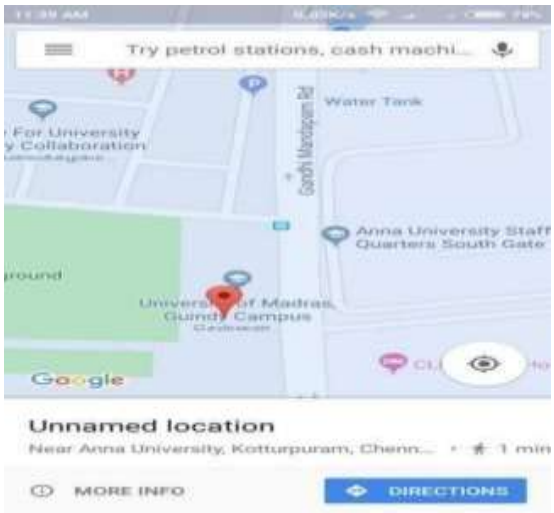

Fig. 5.4. The Result Represented in Google Maps.

6. CONCLUSION

The proposed application helps the user track the lost/stolen mobile and identify the possessor of the phone. This application checks the SIM whenever the mobile rebooted and in case SIM change occurs, the application will automatically activate the monitoring mode with the help of GPS coordinates of the device and send messages to predefined buddy numbers at regular time intervals. The image(s) will be taken using the mobile camera and those images will be sent to the already registered buddy email addresses. The application has been developed with secure personal data. In future, this experiment can be extended to various mobile operating systems in smartphones.

REFERENCES:

[1] Z. Tu, O. Turel, Y. Yuan, "Mobile device loss or theft", Inf.Manage (2015), http://dx.doi.org/10.1016/j.im.2015.03.002
[2] S. Sukaphat, "Location-Based Service System with cell Identifier for Detecting Lost Mobile", Procedia Computer Science 3 (2011) 949-953.
[3] S. Arieanna, Unprotected Mobile Devices at Risk with Growing Mobile Theft Epidemic, 2013 http://blogs.absolute.com/blog/unprotected- mobile-device-at-risk-with-growing-mobile-theft- epidemic/.
[4] Y.S. AMIETE & N.Rajpal, "Mobile Location Tracking Techniques", journal homepage:

http://www.tandfonline.com/loi/titr20.
[5] S Wang, Marilynn Green Maged Malkawi, "Mobile Positioning Technologies and Location Services",IEEE Radio and Wireless Conference, pp 9-12, August 2002.
[6] FCC, FCC adjusts its rules to facilitate the development of nationwide enhanced wireless 911 systems, FCC Publications,2000.
[7] M O Sunay & I Tekin, “Mobile Location Tracking in DSCDMA Networks using forward link time difference of Arrival and its Application to Zone based billing”, IEEE Global Telecommunications Conference, vol 1, pp 143-147, 1999.
[8] Android Developers, Resource. [Online]. Available:http://developer.android.com/index.h t ml. [Last Accessed:March 1, 2010].
[9] A.M. Marshall & C. Tompsett “Identity theft in an online world”, Computer Law and Security Report (2005) 21, 128-137.
[10]M Taylor & G Hughes, “Digital evidence from mobile telephone applications”, Computer Law &Security Review 28(2012) 335-339.