Mobile Solution for Metropolitan Crime Detection and Reporting

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ABSTRACT

The proliferation of computational capabilities of mobile handheld devices has made them a viable medium for carrying out a wide range of activities, involving information exchange. One new area where mobile technology is gaining great usefulness in society is crime detection and reporting. One major problem hindering crime detection and reporting is lack of efficient communication platform between the police and the general public: the general public and the police lack a common platform for exchanging real time information about criminal activities, crime suspects and those under investigation for various crimes in the society. Lack of readily accessible information of crime trends in major towns and cities is also a key setback to public security needs. In this paper, a mobile infrastructure for detecting, reporting and investigating for various crimes in the society. Lack of readily accessible information of crime trends in major towns and cities is also a key setback to public security needs. In this paper, a mobile infrastructure for detecting, reporting and investigating for various crimes in the society.

1. INTRODUCTION

Recent researchers have identified mobile handheld devices as a possible tools for effective crime detection and reporting [5],[6]. Technological advancements have led to the invention of extremely powerful mobile handheld devices and have brought about large and high speed data transfer capabilities through mobile communication networks. Functions of mobile devices have evolved from merely making calls to performing complex computations over the past three decades [1],[2],[3],[4]. The high computational power of smart phones, tablets and PDAs accounts for their high demand and usage by the general public. Smartphone shipments worldwide reached 485 million in 2011, increased to about 655 million in 2012, and expected to rise over one billion smart phones by 2016 [7],[8].

Another key factor making mobile phone technology a viable medium for fighting crime is the advancement of cellular networks technologies. The introduction of 3G/4G cellular network technologies by most mobile network operators has improved the communication demands for mobile users [9]. With these two factors in place, development of dedicated mobile platforms for detecting and reporting criminal activities is a great possibility. The solution proposed in this paper is based on the client-server architecture. It is a platform that can be implemented as a security assistant of the police for metropolitan crime control purpose.

2. COMPUTERISED CRIME DETECTION AND CRIMINAL TRACKING SYSTEMS

The advancement of computer technologies has led to the advancement of computer technologies has led to more effective ways of detecting and fighting crime in society [10]. Today, engineers and researchers have proposed and developed a number of computer based systems, especially for crime detection and reporting. This section presents an overview of some of the most powerful computer based crime fighting systems developed within the past six years. The overview pays attention to functionalities and principles of operations of these systems.

Crime Stoppers, New Orleans has launched a new free mobile crime-fighting app, for Android and iPhone platforms, called Tip Submit [11]. The app was created by Tip Soft and crime Reports and is known to be the first anonymous tip submission mobile software. By design, Tip Submit allows citizens to submit crime tips to Crime stoppers securely and anonymously. The system identifies tipsters by their tip number only, which it assigns to the tip. The Mobile App allows tipsters to upload photos or video and is able to send the location of the video by a GPS locator. Other key feature of Tip Submit is that, it has no limits on the amount of text as with sending SMS text messages. Also, it maintains two-way dialogue and real-time chat between the tipster and Crime stoppers. Engineers in the University of Virginia have developed software which helps the police easily access crime data online [12]. The system, called Webcast allows establish trends on the data, showing the types of crimes that commonly occur, and the places with which they are associated. By typing in specific dates, types of crimes, locations, and selecting names of weapons used, Web-Cat produces graphs, reports, and maps of high crime areas. Another powerful computer based crime fighting tool is Mobile Vic PD [13]. Mobile Vic PD is a recently releases mobile application, released by the Victoria police in Canada for fighting crime. The mobile application can be used to report minor crimes, offer anonymous tips to police, stay updated on crimes in progress, receive missing child reports or check on stolen property. Accurint is produced by LexisNexis for the iphone and ipad. This Mobile app connects government
and law enforcement agencies to more than thirty billion public records and critical investigative tools needed to verify information in the field, and rapidly follow-up on new leads as they develop. The most widely used tactical lead generation tool for law enforcement in the United States is cop link mobile plus app, created by i2 [14]. The app runs on iphones, ipads and Android platforms. The app enables officers to achieve better situational awareness with automated geospatial searches of recent events, as it allows the searching of state and local crime records from multiple jurisdictions’ databases. Another great feature of the app is its ability to organize vast quantities of seemingly unrelated data to assist in making tactical, strategic and command-level decisions.

IPOL-mobile is an iPhone application used for crime fighting by police in Geneva, Switzerland [15]. It enables the police to have immediate access to various information such as the latest burglary or violence incident as well as the identities of culprits of such crimes. With the help of this application, officers can track ownership information of vehicles by simply entering its number plate into the Smartphone application. Officers can also get important real time information about their duties (patrol hours and location), police directories, lawyers and translators and their availability hours using the application.

<table>
<thead>
<tr>
<th>Application</th>
<th>Advantages</th>
<th>Platforms</th>
</tr>
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<tbody>
<tr>
<td>Submit Tip</td>
<td>• Allows Anonymous tips</td>
<td>Android / iOS</td>
</tr>
<tr>
<td></td>
<td>• Tracks location of uploads</td>
<td></td>
</tr>
<tr>
<td>Webcast</td>
<td>• Associates crimes with places where they occur.</td>
<td>Web-based</td>
</tr>
<tr>
<td>Mobile Vic PD</td>
<td>• Allows Anonymous tips</td>
<td>iOS</td>
</tr>
<tr>
<td></td>
<td>• Allows updates of crime in progress</td>
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<tr>
<td>Accurint</td>
<td>• Verification of information in the field</td>
<td>iOS</td>
</tr>
<tr>
<td>Cop link</td>
<td>• Quick situational awareness and geospatial searches</td>
<td>iOS/ Android</td>
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<tr>
<td>IPOL-Mobile</td>
<td>• Latest crime awareness</td>
<td>iOS</td>
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<tr>
<td></td>
<td>• Vehicle-ownership checks</td>
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From table 1, it is clear, that, apart from Webcast, all the analyzed crime fighting mobile applications run on either Android or iOS or both. This is a limitation as there exist many other mobile operating system platforms such as Windows Phone OS, BlackBerry OS, and some others [16],[17]. Another limitation possible with these applications is that, the crime culprits themselves can trick the police by sending false information. False information may draw the police’s attention to one part of the metropolis while the criminals carry out criminal operation (such as burglary) at another part. Thirdly, with these applications, the general public does not have ready access to information about people who are currently on police wanted list.

This work therefore, proposes a solution with the following key capabilities:

- Web-based mobile access; platform independent.
- Tracks the geo-location of anyone which sends information to the police for at least forty-eight hours.
- Provides ready access to the information of anyone on police wanted list.
- Provides ready crime trends information for major cities.

3. DESCRIPTION OF PROPOSED SOLUTION

We propose a design of a mobile communication infrastructure to help the police and the general public fight crime within a metropolis. The infrastructure serves as a common platform for both the police and the general public to interact and exchange information about criminal activities and to track crime perpetrators. The system must ensure ready and up to date information access of crime suspects and criminal activities in all localities within the metropolis; facilitating the tracking down of crime perpetrators.

3.1 Basic Design and Concept

The proposed architecture of the system is client-server. The client side is a mobile app running on the handheld device of the user (police/general public). Information about criminal activities and crime perpetrators are uploaded unto the server by the police and partly by the general public remotely using a mobile device. Apps running on the users’ handheld device communicate directly with the server; retrieving and providing real time information about crime and criminal activities of places within the metropolis. The basic concept of the system is shown in fig.1.

![Fig 1: Basic Concept](http://www.cisjournal.org)
3.2 Upload of Crime Related Information

The three categories of information which the police can upload unto the server are:

i. Descriptions of people on police wanted list and their related crime information
ii. Description of missing items and their related information
iii. Information about latest arrests made by police

The general public is able to upload:

i. Found items information – information of the whereabouts of items reported to the police as missing. This information is meant only for the police.
ii. Tip-offs of people on the police wanted list – Information of the whereabouts of people who are on the police wanted list.
iii. Tip-offs of on-going crimes – Information of criminal activities which are currently taking place.

Personal details or at least descriptions of criminals on police wanted-list are uploaded unto the server. Common information about such criminals may include: Name, age group, facial looks, complexion, weapons in possession, crime involved, other crimes associated with in the past, etc. Missing items reports contains the descriptions of items that are reported missing. Such information is uploaded onto the server by the police administration of the metropolis. Information regarding such items may include name of item, Description, the last time and the place where the item was last seen. Information about latest arrests are also uploaded unto the server by the police. Various categories of tip-offs are also uploaded to the server. Any member of the general public who has the app running on his/mobile phone can conveniently and silently post suspicious activities in the vicinity to the server for action to be taken by police. They can also report people whose descriptions match those on the wanted list by uploading information quietly on the server using the mobile app. On the other hand, items found matching the description of items in the police list of missing items are also uploaded unto the server by the general public. Fig.2 summarizes the information upload categories.

3.2 Information Access and Access Control

For security and control purposes, there is a restriction as to what information is available to which user category. Missing items information and description of criminals on the police wanted list are readily accessible to anyone running the app on their handheld mobile devices. By making missing items information and description of criminals on police wanted list accessible to the general public, members of the general public may readily lead to the criminals arrest by sending tip-offs to the server, which is readily available to the police, on their mobile phones.

Tip-offs about suspected criminals and information about found items uploaded to the server by the general public are not accessible to anyone, except the police. This is to prevent an incident whereby the criminal himself, through his handheld device becomes aware that, a tip-off has been sent about him to the police. Also, if a member of the general public sends a tip-off to the police, the sender’s location information as well as his registration details are also recorded on the server for such sender’s movement to be monitored at least for twenty-four hours by the police. This is necessary to prevent situations whereby criminals themselves deceive the police by sending false information to deceive and sway off the police. This is summarized in fig.3 below:

3.3 Security Trends Analysis

Another key requirement of the system is statistical analysis of crime trends countrywide. Users would always be updated with the current crime trends of any given part of the country with the help of the app running on his handheld device. By simply entering the name of the town into the app, one can get reports and graphically represented information about different categories of crime trends for different periods of time.

4. PROPOSED ARCHITECTURE AND COMPONENTS OF SOLUTION

The server consists of the following major modules:

i. Data Storage: A database management system for storing uploaded information
ii. **Access Controller**: A module for identifying and authenticating user categories 

iii. **Listener**: This module detects client connection and request 

We present the logic of interactivity of these modules as a layered architecture as shown in figure 3 below:

![Layered architecture](image)

The **Listener** is the module that detects requests from clients. The request is then forwarded to the **Access Controller**. The **Access Controller** is composed of the View, Update and Reject sub modules. View allows the client to retrieve and view information from the either the Database or the DB Analyzer. Update allows the client to add data to the database. If the **Access Controller** is not able to process a request due to improper input, then the it rejects it using the Reject sub module.

The database contains the following information:

i. Descriptions of people on police wanted list 

ii. Descriptions of missing items 

iii. Arrests made by the police 

iv. Found items 

v. Tip-offs about suspects 

vi. Tip-offs about on-going criminal event 

The database is structured to contain information units in Text, picture and video data formats. The DB Analyzer module analyzes the database and establishes crime trends in the metropolis.

Both the police and the general public use the same client app on their mobile devices to interact with the server. Whereas the police have the privilege of accessing all sort of information on the server, the general public is not. The server identifies each user category by their IDs. The police are identified by their service numbers while special groups of IDs are generated for the general public during installation. The logic for identifying the users and applying the appropriate access control is expressed as follows in pseudo code.

```
If user-Request = Retrieve and User_Id = Police_Id 
Then store user login details in log file and allow universal upload 
Else if Request = update and User_Id=Public_Id 
Then store user login details in log file and allow upload of found items or Tip-off about suspects or tip-off about on-going crime 
Else if user-Request = Retrieve and User_Id = Police_Id 
Then store user login details in log file and allow universal access 
Else if Request = Retrieval and User_Id=Public_Id 
Then store user login details and allow access to information of people on police wanted list or information about missing items or information on current arrests or crime trends 
end Else if.
```

The terms universal upload and universal access in the above script simply means the police are not restricted as to what they can upload and retrieve. The other important function of the server side is the generation of crime trend analysis based on the uploaded data. The programming module fetches crime information for each place for a given period of time, placing each under a specific date. Figure 4 is a use case diagram showing the interaction of the general public with the server.

### 4.1 The Client App

The client app running on the mobile devices of users performs the following functionalities:

i. Presents a platform for connecting and interacting with the server using the appropriate Id; 

ii. Presents users with widgets for querying the server remotely; 

iii. Allows users to browse the mobile device’s file system for selecting files for uploads 

iv. Provides a structured interface for displaying information retrieved from the served.

Figure 4 shows the interaction between the general public and the server using the app.
The interaction between the police and the server can best be illustrated by the use case shown in figure 5.

5. CONCLUSION

This paper identifies mobile phone technology as a crime fighting platform in society, as its use can effectively bridge the communication gap between the police and the general public in crime fighting. A mobile communication framework has been suggested, based on the client server model; allowing both the police and the general public to interact more effectively with the help of a mobile application. Our future research will be concerned with implementing this design and carrying out a survey to test our hypothesis stated earlier.

REFERENCES


