HAMPP: A Handheld Assistant for Military and Police Patrols for HA/DR Missions

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HAMPP: A Handheld Assistant for Military and Police PatROLS for HA/DR Missions

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Abstract

Military and police patrols are an important component of Humanitarian Assistance and Disaster Relief missions. These patrols need to access timely, relevant information about events and conditions along their patrol route, both historical, and ongoing. In the current practice, this information is gathered manually prior to the commencement of the patrol through the use of historical databases, current event repositories, and by conducting a review of records that may be relevant to the area to be patrolled. Being manual, this process is fraught with several problems including high-cost, slow-speed and low-reliability.

We are developing HAMPP (Handheld Assistant for Military and Police Patrols) to enhance the effectiveness and security of the patrol units and reduce the cost and time required for patrol planning. HAMPP is designed to assist with gathering detailed information about relevant events along the patrol route and alert the patrol unit when they are in the vicinity of these areas during the patrol. In addition, it performs several other activities which relate to the security of the patrol unit. The goal of this paper is to present our system architecture for a device-independent mobile software system that enables planning of the patrol route and linking of related information to that route, and as the patrol starts, tracking the unit’s current location and providing real-time information and alerts about areas of interest along the route of a patrol. Any deviations from the planned route are flagged and alerts sent to the command post.

Keywords: mobile; handheld; device-independent; geolocation; alerts

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1. Introduction

Military and police patrols during Humanitarian Assistance and Disaster Relief (HA/DR) operations serve the important purpose of protecting property, maintaining security, to perform search and rescue, and to aid the injured. As discussed by Fuentes & Hunt [7], after Hurricane Katrina over 600 state troopers and police officers from New Jersey formed an emergency response team that conducted patrols through the Second, Third, and Sixth Districts in New Orleans. These patrols were primarily focused on search and rescue, but they also assisted with force protection for emergency responders, general police patrols to prevent looting and vandalism, and to assist the Louisiana State Police and the Federal Bureau of Investigation with the collection of intelligence about criminal gangs or groups which might hinder rescue operations. During the response to the 2010 earthquake in Haiti, the United Nations sent troops to patrol the streets to maintain public order and to guard food and other aid deliveries during the relief effort [8].

Military and police patrols have a need for access to timely, relevant information about events and conditions along their patrol route, both historical and ongoing. In many cases, this information is gathered manually prior to the commencement of the patrol from historical databases, current event repositories, and by conducting a review of organizational records that may be relevant to the area to be patrolled. It is easy to imagine situations where information might be available from a previous shift, or become available during a shift that, if reviewed by an officer on patrol, could provide him with the means to disrupt criminal activity, make an arrest, or collect additional information relevant to an open investigation [3].

The purpose of this paper is to discuss HAMPP (Handheld Assistant for Military and Police Patrols), a prototype system designed to enhance the effectiveness and security of the patrol units while at the same time expedite the planning of patrol missions and reduce the cost of planning. HAMPP assists with gathering information from multiple databases about events, people, and activities along a patrol route, tracking the progress of the patrol on a map using geolocation, and alerting the patrol when they are in the vicinity of those events, people, or activities during the patrol. In addition, as their patrol progresses, HAMPP allows patrol members to capture new information about persons or items of interest they encounter and share it in real-time with other patrols via a wireless connection.

2. Background and related work

For military patrols, the current processes require the patrol commander to gather necessary intelligence about their patrol route and any activities of interest that may be encountered along the route, to brief the members of the patrol and then to remember and review, assess, and update that information as the patrol progresses [1]. Information about Improvised Explosive Device (IED) activity, suspicious persons, insurgent activities, and key people in the community (both antagonistic and friendly) is all useful to the conduct of a military patrol [2].

For police patrols, the access to intelligence information relative to the patrol route is dependent on the resources of the department. In many cases, intelligence-type information is passed during the department’s daily roll-call brief. Information that has been changed or updated in the previous 24 hours is discussed, including “daily beat and vehicle assignments, recent crime and crime trends, wanted persons and vehicles, teletype messages, missing persons, persons hazardous to police, reminders for court notifies, information from previous shifts, general information, review of staff notes, procedure changes and training” [9]. Many of these are intelligence items that patrol officers need to be able to reference during their patrol. In some cases, the department is too geographically dispersed to conduct daily roll-call briefs or does not have the intelligence or communications resources to receive and push information out to each officer on patrol [3]. In such cases, a procedure or tool is necessary to get this important information pushed out to each officer.

GPS has become ubiquitous in smart phones and tablets, and it is becoming commonplace to see applications that allow users to correlate information with a relevant geographic location. A quick search of the app store for Android, Windows Mobile, or Apple handhelds reveals several hundred mobile applications which provide the capability to display the user’s location on a map. Surveying the list of applications, one sees that there are different map types, maps focused on different areas, and some which will still work when network access is not available. A number of the applications provide the ability to superimpose additional information, such as subway locations, bus
stops, garage sales, and restaurants on the map. The additional information that can be displayed tends to be specific to the subject the application designer has chosen for his focus.

There are several applications that focus on providing alerts for disaster type events to the user. These include Emergency Communications Network, LLC’s CodeRED mobile alert app which provides weather, disaster, and community alerts to users in localities that subscribe to the CodeRED emergency notification network [4], and the Pacific Disaster Center’s Disaster Alert application which plots earthquakes, severe weather events, and other disaster type events on an interactive map for the user to view [5].

Plotting known information about activities and events on a map of the patrol area will enable the commander of the patrol to develop situational awareness of the big picture. It will allow him to see how events in his patrol area interact with surrounding areas. It may alert him to information gaps, or assist him with focusing on areas where events are prone to occur.

3. Use Case

The ability to “drill-down” and receive additional information once alerted to an event will affect the user’s response. For example, an officer responding to a domestic violence call at a specific location might be alerted by the application that there were numerous previous incidents at that location. He would have the ability to quickly display the information about the parties involved in those incidents and additional relevant information, like the fact that one of the parties has been cited before for weapons violations, or that one of the parties doesn’t speak English. Having this information readily available will enable the officer to manage his approach to the situation and improve the outcome. The ability to collect additional information and disseminate it real-time to other patrols, as well as updating the intelligence analyst will prevent information fragmentation [3]. For example, if an officer is investigating a crime and determines that an individual who is not present needs to be questioned, he can input the information he has about the person into the system. Another officer who is patrolling the area where that suspect is known to reside would receive an alert regarding the person of interest. That officer can then be on the lookout and if he encounters that individual, he can query additional information about how they’re relevant to the investigation and determine whether to detain or question the individual.

During search and recovery operations after Hurricane Katrina, the rescue teams had to mark with spray paint each house that was searched, and then transmit information via radio back to the Louisiana State Police command post about the location, number of people rescued, number of bodies if any, the date and time, and which team performed the search [7]. Many houses were searched multiple times because it was difficult to locate bodies in the debris and the first search left people unaccounted for or because water or debris blocked entry into portions of the house. An application, such as HAMPP, would automate the process of collecting information about the residence, transmit it back to the central events server, and make it available both to the command post and other teams operating in the area. For locations where the command post received information from a family about the number of residents in a house, that information could be put into the database to help the rescuers know the number of people they were looking for. Information flow to the command post would be made more efficient, and rescue teams would be more aware of which houses had been searched and which might have to be returned to because of water or debris blocking entry.

Military patrols want to be aware of areas that are associated IED activity and want to focus their efforts on disrupting insurgent activity and interacting with the local population [2]. If a patrol is able to visualize areas of previous IED activity along their patrol route, they can be more vigilant in these areas and reduce the danger of an unexpected IED encounter. Knowing the locations of the residences and business places of key leaders in the community would enable the patrol to focus their efforts on engaging those leaders. Having the ability to plot locations where known insurgents have been seen and being able to drill-down and view information such as a photo of the person and their vital statistics would help the patrol keep a lookout for them.
4. System Design and Architecture

We are prototyping HAMPP, a device-independent software system that gathers information in advance of a patrol from relevant databases, tracks the user’s location during the patrol, and provides real-time alerts based on selected alert criteria. HAMPP allows the user to obtain more detailed information about each alert. It also allows the user to capture additional information and share it with other patrols or other members of the same patrol.

Different organizations have different requirements for handheld devices and are influenced by different procurement requirements, including cost, supportability, and security. In order to support the ability for multiple different organizations to use the application, it is necessary to design the application to be device independent. As noted by Abrams & Phanouriou in [6], developing a user interface that will run on multiple types of devices presents numerous challenges; different devices may require different implementation languages which will require the application developer to create and maintain multiple code bases. Maintaining a consistent user experience on devices with different implementation languages can become quite complex [10]. In addition, different devices have different hardware capabilities, including screen size and resolution, GPS capability, wireless connectivity, and other sensors. Ideally, an application should take full advantage of the sensors available on a particular device, but should still operate acceptably on a device with lesser capabilities.

![HAMPP System Architecture](image)

Figure 1 shows a high-level architecture of HAMPP. We compile the alert information from several external databases such as the Theater Counter-IED database, or law enforcement criminal event databases that already have information collected that is relevant to the user’s patrol. In addition, the HAMPP database houses any additional intelligence that a patrol collects and it will share it with other patrols if the information is relevant to the geographic area of that patrol. The patrol unit’s HAMPP system communicates with the command center as well as with other patrol units.
Key design features of HAMPP include:
- Device independent implementation
- Query external events databases for information relevant to patrol routes (by geographic location)
- Work with both online and offline maps using a variety of mapping providers (OpenStreetMaps, NGIS maps, others)
- Web browser interface at Command Center for entering or changing patrol routes
- View status of patrols at Command Center
- Patrol interface display of nearby patrols
- Patrol user alerts to events based on notification preferences and proximity to event
- Patrol user capture and addition of intelligence data or events to the database and sharing with the other patrols and the Command Center
- Patrol user alerts to deviation from assigned patrol route
- Patrols without connectivity to the Command Center can share data locally through short-range wireless communication

5. Implementation

In order to make HAMPP device independent and limit it to a single code base, we have chosen to develop the application using HTML5, CSS, and JavaScript running on top of the PhoneGap 3.02 framework. This provides the ability to develop a single code base that will run on multiple devices. Differences in screen size and resolution can be managed by using CSS media queries and adjusting the amount of information displayed to the user. HAMPP interfaces with a MySql database via a PHP server. The MySql database contains the alert information compiled from several external databases.

In our first implementation, we used the Google Maps API for our mapping interface. This resulted in a number of limitations, as Google’s free API places limits on the number of map tiles that can be downloaded in a given time period. In our current implementation, we are using Leaflet, an open-source mapping interface to allow the use of additional map tile providers and to provide support for offline maps. HAMPP is designed to provide increasing levels of functionality depending on the capabilities of the device. The use of HTML and JavaScript as the development language enables the application to be run as a webpage (Figure 2). This allows the user to use a large screen display for functions such as creating alert areas, designing a patrol route, and managing the database of alert information.

Fig. 2. HAMPP in a desktop browser.
The phone or tablet based application has reduced functionality due to the limited display space, but it has a similar look and feel to that of the webpage (Figure 3). This makes the user experience consistent regardless of the device the application is running on. By using PhoneGap to run the application on the mobile devices, the user does not have to interact with the mobile web browser. As far as the user is concerned, the application functions as if it was written in native code.

![Fig. 3. HAMPP running on a Samsung Nexus S Phone](image)

HAMPP has been tested on multiple devices with different screen sizes and sensor capabilities. It has been tested and runs in all major desktop browsers, in Linux, Windows, and OSX. In a desktop browser, it has been tested with network-level geolocation and with a Bluetooth GPS receiver. HAMPP has also been tested on Apple iPad, iPhone, a Samsung Galaxy Tab 2 7.0, and a Samsung Nexus S with similar functionality available on all devices. The tablet devices provide additional display capability and user options for viewing alerts due to the additional screen real-estate. HAMPP adapts the amount of information displayed to the size of the screen. It also handles screen orientation changes to allow the user to use the device in whatever orientation is most convenient.

<table>
<thead>
<tr>
<th>Function</th>
<th>Browser</th>
<th>Tablet</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a patrol route</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track location along patrol route</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Display additional detailed information about an alert</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Add alert area to the database</td>
<td>X</td>
<td>X</td>
<td>limited</td>
</tr>
<tr>
<td>Change existing patrol route</td>
<td>Planned</td>
<td>planned/limited</td>
<td></td>
</tr>
<tr>
<td>Alert user when deviating from route</td>
<td>Planned</td>
<td>planned</td>
<td>planned</td>
</tr>
<tr>
<td>Share collected data between users</td>
<td>Planned</td>
<td>planned</td>
<td>planned</td>
</tr>
<tr>
<td>Display nearby users on map</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

6. Conclusion and Future Work

Table 1 shows the current state of implementation. Our next step is to transition to an open-source mapping library in order to provide the capability to use multiple map providers and add offline maps. We plan to add the capability to add patrol routes to the database and download them to the mobile device in order to track the user’s progress on the patrol and provide alerts when the user leaves the designated patrol route. Additional work is
required to implement an automated algorithm for selectively choosing and forwarding data to the mobile devices based on its geolocation and relevance to the selected patrol route; the current prototype synchronizes all of the data to all of the devices. Although the design takes into account the limited connectivity options that may be available in areas with damaged or non-functional infrastructure, additional testing will be necessary to determine the extent to which limited or no connectivity will impact use of the application.

We plan to test HAMPP in as realistic a setting as possible prior to its deployment. This testing is planned at Camp Roberts in California and with a variety of different skilled users. We plan to get the Monterey Police Department involved in our testing.

Disclaimer

The views expressed in this document are those of the authors and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

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