SafePath

Don’t Go There!

User Research, Task Analysis and Sketching

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Overview
As part of the greater DC area, the pervasiveness of crime has long been a stigma of College Park. Although crime rates have been decreasing in recent years, many in the UMCP community still feel unsafe when walking both on and off campus, especially at night. Our proposed solution is SafePath, a personal safety application for Internet-enabled mobile devices. SafePath’s primary use will be to generate a safety heat map that shows how the likelihood of a crime occurring varies with your location on and around campus, and to use this data, along with other safety information, to create a safe route that the user can follow to get to their chosen destination. SafePath will also contain contact information for existing safety programs available on campus and a panic button that alerts police if an emergency happens.

Related Work
Past attempts at addressing personal safety have approached the problem in three main ways: panic buttons, escort services, and information.

Panic buttons are applications or services which are used to alert trusted contacts or emergency responders quickly while an emergency is occurring. This implementation takes many forms. They may record your attack in order to assist authorities (M-Urgency [7], SOS-Link [3]), they may set a timer that if not deactivated or extended with a pin in the given time activates the panic button (BScope [8]), while some are simply a button that immediately notifies authorities (CSU San Marcos Safety App [1]). Through SafePath we attempt to prevent such applications from needing to be used by providing users with the information necessary to avoid dangerous situations.

Escort services, on the other hand, attempt to deter crimes and assist while one is occurring by providing a person to travel along with the user. This is implemented both live, with escorts who walk or drive the user to their destination (UMD Escort Service, NITE Ride) and virtually, where operators stay in contact with the user through either chat or phone call and contact authorities in case of emergencies (StreetSafe [5]). While these are very effective because they put into practice the mantra “safety in numbers”, live escorts are typically not available for every destination and virtual escorts, like panic buttons, cannot actively prevent the crime.

Finally there are services which provide the information that is necessary for users to make informed choices concerning their path. This information is available in multiple forms such as the UMD Alerts system [6] which notifies subscribers of recent crimes on campus, crime and safety information from campus police [2], and locations of user reported crimes throughout the city shown on a map by SpotCrime [4]. Most of this information is presented as raw data (such as text or sets of unfiltered geotags) which may be difficult for users to understand and utilize. SafePath will integrate much of this information into a map, making the data accessible to even those unfamiliar with campus.
Contextual Inquiry Participants

Participants were chosen for our inquiry if they fit into our primary user group, which includes students, faculty, and staff of UMD as well as visitors to campus. Potential participants were approached in person and asked to participate and were included if they agreed. We believed that sampling in this way would provide us with a reasonable range of users. While our sample size was small (N = 14) we attempted to vary the types of users we interviewed to include as many different types as possible. Those interviewed included new students to campus, students who have been here for a short while, graduates and near graduates who had been in the area for years, parents, and visitors.

Since it would be difficult to accurately observe our primary users in a natural setting as they decided on a path to travel across campus at night, we opted to simulate the decision making process. First we asked interviewees questions about how familiar they were with campus, their level of crime awareness, and what actions they took to bolster personal safety. Interviewees were then given a map of a subsection of campus and asked to draw the route that they would take if they were traveling from one point to another late at night, based on their current knowledge. In preparation for our inquiries we created a Matlab script that randomly generated 15 locations on the same campus map just discussed (see Fig. 1.2 below). They were then asked to repeat the same task as before (drawing a route on a campus map), but this time using the map marked with these random fictional mugging locations. We asked interviewees to verbalize their thought process while they were deciding on the path that they would take. They were asked to supply reasoning for some of the key decisions they made like “Why did you make that turn?” and “Why did you avoid that area?”

Fig. 1.1: Example user data (control condition)  
Fig. 1.2: Example user data (experimental condition)
Contextual Inquiry Results

The table depicted below (Fig. 2.1) summarizes a subset of our participants’ answers. On average, our participants self-reported moderate awareness of crime (mean = 5.00) and moderate knowledge of dangerous areas on campus (mean = 5.03). In general we did not observe correlations between the variables depicted in the table and the route length data derived from the map experiment (discussed in detail to follow). We found a slightly positive correlation between the number of years our participants have lived in the College Park area and their corresponding self-reported ranking of knowledge of dangerous areas on and around campus ($r^2 = 0.34$); how long participants have lived in College Park was also slightly positively correlated to a participant’s self-ranked awareness of crime($r^2 = 0.37$). It is noteworthy that none of our users had any safety apps, although almost all of them had UMD Alerts.

<table>
<thead>
<tr>
<th>Participant Initials</th>
<th>Years in the College Park Area</th>
<th>Awareness of crime (1[Low] - 10[High])</th>
<th>Knowledge of dangerous areas (1[Low] - 10[High])</th>
<th>Do you have an Android device?</th>
<th>Do you use any mobile safety apps?</th>
</tr>
</thead>
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<tr>
<td>LM</td>
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<td>4</td>
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<td>NO</td>
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<tr>
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<td>1</td>
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</tr>
<tr>
<td>DO</td>
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<td>7</td>
<td>6</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>AA</td>
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<td>7</td>
<td>6.5</td>
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</tr>
<tr>
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<td>3</td>
<td>5</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
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<tr>
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<tr>
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<td>10</td>
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<tr>
<td>LL</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

Fig 2.1: Subset of data collected during the contextual inquiries
While completing the task that we gave them, many of the interviewees voiced similar concerns and observations. In addition to the obvious heuristic of avoiding mugging locations, the main factors that the study participants sought as they drew their routes were bright lighting and proximity to high traffic areas. Many also gravitated towards paths with lots of open space, or that went through areas that they were familiar with.

Analysis of the map data revealed that the degree to which participants avoided the fictional mugging locations varied considerably. We measured the extent to which the knowledge of crime locations made a difference in the length of the paths generated by the participants. The mean percent increase in route length (going from the control to the crime knowledge condition) was 12.6% and the sample standard deviation was an increase of 12.7%. Figure 2.2 shows a histogram of the percent increases in route distance between the control and experimental conditions. Visual inspection of the histogram leads the authors to believe that the degree to which participants are willing to increase their walking distance based on knowledge of crime locations may follow a log-normal or Pareto distribution.

![Increase in Route Length Histogram](image.png)

Two participants actually decreased their walking distance when presented with the fictional crime knowledge condition. We consider these data to be an artifact of our experimental method and believe the reason why these participants decreased their route length was because upon a second exposure to the campus map they were able to better optimize their route to minimize distance. Indeed, contextual interviews with these two participants informed us that they did not consider the mugging locations an especially important factor when generating their routes, preferring other heuristics such as location knowledge and pedestrian traffic density. A more rigorous scientific method would vary the order in which the control and crime data conditions were presented to the participants to minimize the impact of this type of order effect.
A few other participants essentially ignored the mugging locations and stuck to routes that they believed were safe based on other criteria. Most would ignore a single mugging if it was along their desired path, but would significantly alter their route if a number of muggings had occurred. Participants reasoned that multiple crimes indicated to them that the area was unsafe.

We also noted a number of unique responses that did not generalize across our group of participants. One participant, AA, would be willing to take a route with more crime as long as it has open spaces and allows her to get to her destination faster. Participant ME was very concerned with avoiding areas with buildings on two sides, since it limited escape to only one direction. Since participant TX usually rides a bike, avoiding stairs was a major consideration for him when creating paths.

**Task Analysis**

During our contextual inquiries we asked if our participants had phone numbers for campus police, NITE ride, or campus escort services. While many of our participants were familiar with these services, none kept the phone numbers on hand. As such, one simple task that is important for our users is to contact existing campus safety services. This is fairly straightforward and would normally be accomplished by calling 411 or having these numbers pre-programmed into your phone. Safety information posted at many campus buildings also display these numbers. SafePath would facilitate this task by containing the contact information for UMD safety services, which would be more convenient than having to call to get the numbers or record them ahead of time. Also such a compilation of information may make users knowledgeable about important safety services available to them which they would otherwise be unaware of.

We also found that few of our participants paid any attention to the location of blue PERT phones, and almost none knew enough about campus to plot a route based on lighting. Based on this, we decided that a moderately hard task for our target users would be to find safety information regarding a certain area they are unfamiliar with on or around campus. In this instance users would be going to this area for the first time and are understandably worried about their security. They wish to know what sort of crimes have occurred in the area and with what frequency in order for them to gauge the overall safety of the area. They would also like to know what, if any, security controls are in place to deter crime or assist them in the case that a crime has occurred. To do this they would have to research the area, compile police reports, determine the locations of lighting, emergency telephones, and cameras, and find out the amount of pedestrian traffic during the time they are planning to spend there. SafePath would assist them in this by colligating this information for them and presenting it in such a way that it would be easily understandable, allowing them to determine the area’s relative safety at a glance.

In our contextual interviews, many participants, when presented with a map containing mugging locations, either struggled to find a route they found acceptable or essentially gave up and just went with the shortest path they could find. Therefore the most difficult task for our users is to
generate a safe path from ones’ current location to a chosen destination on or around campus. This task is the most common one that SafePath aims to solve, for both those users who are new to campus and those who are very familiar with it. Users would normally complete this task by simply looking at a map and choosing a path based on their own criteria. Often this means the user goes towards main roads, open spaces, and well lit areas, to the degree that he can based on prior knowledge while simultaneously minimizing the distance he has to travel. One problem with this is that the user is navigating from a first person perspective and may simply start walking in the intended direction without planning the entire route in advance. A second issue is that the user’s knowledge or memory may be incomplete. Learning and keeping track of all of the relevant information on ones’ own could hardly be expected of the user and would be impossible once one was already in a situation where one needed it. Such partial knowledge can result in the user walking through areas that he would have wished to avoid. SafePath can make this task much easier by providing an overhead map with up to date information on crime and safety features, and by plotting out the full route before the user begins travelling. In this way, the user can know exactly how they will get to their destination before they set out, and avoid inadvertently entering an unsafe area.
Sketches

Program Flow
Safety information is provided on a map with safety features marked and locations of crime represented in the heatmap as well as pins in specific locations.
Navigation of an optimally safe path is displayed via a top down map of the area with relevant safety data still displayed.
An alternative method of navigating the generated path. Users are provided voice directions either through a headset (Bluetooth or via headphone jack) or through the handset’s speaker. This provides them with the ability to either keep the phone out of sight or give the illusion that one is speaking to someone on the phone.
Information categories are displayed as a list that users can choose from, user selects the category they are interested in to receive detailed information about it.
An alternative method for users to query needed information. Users select natural language style statements that reflect their needs and relevant information pertaining to those needs are provided.
References

[5] Street Safe. Retrieved February 12, 2012 from PeopleGuard, LLC:
http://www.streetsafe.com/
newsdesk.umd.edu/universitynews/release.cfm?ArticleID=2492