Abstract:
Crime in College Park, both on campus and off, is a serious problem. It harms students, faculty, staff and the prestige of the university. Current solutions, like the blue public emergency response telephones (PERT), M-urgency, and other smartphone applications are purely reactive. Our mobile application, SafePath, will have the ability to guide the user through safe routes as well as alert police if an emergency does occur. Its effectiveness will be judged by changes the level of crimes committed against pedestrians as measured by the campus police. The app will benefit students, faculty, staff, or anyone who needs to walk around the campus or its surrounding area by providing them with the information they need to take the safest route.

Introduction
The University of Maryland - College Park has long been recognized as an elite research university. Ranked nationally as 17th among public universities by U.S. News and World Report, UMCP’s reputation at the forefront of academics is contrasted by its dismal safety ranking [13]. Its perceived safety among its own students is rated as a “C,” whereas the national average is a “B+” according to a popular college comparison website [2]. Email notifications about crime incidents on and around campus are daily reminders that UMCP students, faculty, and staff are not safe.

While the campus has a number of safety mechanisms in place to prevent and respond to crime incidents, crime statistics from the UMCP Uniform Police Reports indicate that these steps have been inadequate thus far [2]. Current solutions include the Campus Escort service, NITE Ride, and University Police patrols. Both the Campus Escort service and NITE Ride are limited to operation on campus grounds and sometimes stricken by slow response to user requests. Also, with a campus that spans nearly 1500 acres police patrols can hardly be expected to be everywhere at once [10].

A successful solution would result in a statistically significant reduction in crimes incidental to walking or biking (e.g. assault, theft, sexual assault, etc.) across campus and UMCP’s surrounding neighborhoods or at least an increase in the perceived safety of the campus by the College Park community. Actual reductions in crime will be based on metrics derived from UMCP and City of College Park police data [2]. Increases in perceived security will be measured using a campus-wide survey. More concretely, the application will consist of a functional proof of concept. The prototype will allow the primary user group (students, faculty, and staff) to select a destination and will generate visual and/or audio navigational instructions to reach this location. The program will be designed in such away as to encourage adoption and use by prioritizing ease of use, customizability and accuracy.
Background / Review Past Work

Safety is a relevant concern to many and as such many systems have been developed in order to address personal security, both on campus and elsewhere. College Park in particular is an area where security is a prime concern with 72 cases of assault and 350 cases of theft in last year alone [3].

Therefore the University of Maryland has a marked interest in providing a safe environment for their faculty, staff, and students. As such, the university employs the “UMD Alerts” system to keep students informed of recent emergencies as well as the recently released “M-Urgency” app [Fig 1.1] that allows students to report any emergencies via pictures, video and location data to first responders [11][12]. UMD Alerts can be improved upon by increasing its reach when there is no cellular reception; our app will push notifications derived from a UMD Alerts email and take advantage of the ubiquity of WiFi connectivity on campus to increase the likelihood the user will see the alert. While M-Urgency’s quintessential use case is that of a non-crime related emergency (e.g. response to fire), SafePath is intended to be used to prevent crime primarily, though it will also be useful for reacting to emergency situations. California State University San Marcos has developed a similar safety app [Fig 1.2] which incorporates an ability to contact campus police during an emergency and features a campus map [1]. Our proposed solution will expand the campus map functionality through the integration of a superimposed heat map. This map will quickly and visually communicate safety information to the user as well as provide input to a navigational route generation algorithm.

Fig 1.1: M-Urgency

Fig 1.2: CSU San Marcos Campus Safety App

There are a number of apps available on both the Android and iOS markets that attempt to provide security by alerting friends, family, and authorities in the case that one is assaulted. Their implementations range from a simple panic button that alerts your friends and family while taking
pictures of your attacker\textsuperscript{[Fig 2.1]}, to a timer you set that alerts authorities if you don't disable it in time\textsuperscript{[Fig 2.2]}, to a live operator that will stay in contact with you for the duration of your trip\textsuperscript{[Fig 2.3]}\textsuperscript{[4]}\textsuperscript{[6]}\textsuperscript{[7]}. On top of that, some of these personal safety apps require the users to pay monthly or yearly subscription fees\textsuperscript{[Fig 2.1]}\textsuperscript{[Fig 2.3]}. While all these alert methods are beneficial they are all, again, reactive -- they do not keep the user safe but only attempt to send aid as quickly as possible. SafePath, however, endeavours to prevent users from ever being put in such a situation by providing them with safe routes to their destination. Yet, SafePath's team realizes that even under ideal conditions preventative measures are not 100% effective and as such our application would incorporate a similar “panic” feature to alert the UMD police.

Another approach, which is closer to SafePath’s primary function, is to provide crime tracking maps so that people are aware of which areas are dangerous. One website that does this is SpotCrime, which compiles a database of user reported crimes and displays them on a map where a small icon represents each reported incident\textsuperscript{[5]}. While this can be informative, in some areas the map can become very crowded with icons, and it can be difficult to interpret in a way that is practically useful\textsuperscript{[Fig 3.1]}\textsuperscript{[5]}\textsuperscript{[1]}\textsuperscript{[1]}. It also relies mostly on self designated “crime spotters” to provide the data. By providing heat maps based on actual crimes reported to the police and walking directions that avoid problem areas, SafePath will be more accurate and present the information in a way that is clear and useful to the user. Microsoft recently patented an idea to use safety as a criterion for pedestrian route generation\textsuperscript{[9]}. The proposed invention constructs a direction set that provides the quickest path to a destination while keeping the user safe relative to a global safety threshold. Our solution will employ a similar method but will differentiate itself through its incorporation of UMCP-specific safety factors in the direction generation process (lamp locations, crime type and location data, population density information, campus camera locations, PERT sites, etc.)
Target Users

The primary user group for our application is UMCP students, faculty, and staff. All of these groups have a need to walk around and whatever method they are going to use to do this safely needs to be simple and reliable. It would also be useful for people in this situation to have all of the contact information for relevant services such as local police, escorts, and NITE ride, which they may not have readily available. In the case that they have or witness an emergency, they need a fast way to contact police.

SafePath aims to fulfill these needs first by providing accurate and pertinent information about local crime through an easy-to-read heat map and by suggesting walking routes that will avoid high crime areas. It will also have buttons for contacting both non-emergency services and for reporting that an emergency is occurring. In this way, students, staff, and faculty will have both actionable safety information and assistance easily accessible.

The secondary user group is that of UMD police. Our application will reduce the police's current response time by providing real-time location data in crime situations as they are happening throughout campus without the need for countless patrols. Because the application incorporates UMCP-specific safety factors (such as lamp and camera locations) into the route generation algorithm the benefit of existing safety infrastructure is bolstered.
Scenario Walkthrough

Ralph is a student who lives at South Campus Commons 7 and wants to party with his friends at Cornerstone bar. New to campus, he brings up Google Maps on his smart phone and finds the shortest walking route [Fig 4.1]. As Ralph is following the directions Google Maps indicates that he should make a slight left turn towards Knox Rd. As he is walking by Knox apartments a shadowy figure emerges. “Give me all your money! Now!” the masked man demands. Ralph pulls out his wallet. Before he can call the police the robber has snatched his wallet, no where to be seen. Dazed and confused, Ralph laments the fact that there isn’t a way to travel safely by foot in College Park.

![Fig 4.1: Ralph’s best route as determined by Google Maps](image)

Next Saturday night Ralph is again headed out to Cornerstone, but he is very concerned with his safety after his previous experience. He pulls out his Android-enabled device and opens SafePath, looking at the map of College Park that is displayed. A safety heat overlay shows that his previous route from last week is unsafe, and recommends a new path through campus where there is lighting and fewer crimes have occurred [Fig 4.2]. The app sets up a timer based on his estimated travel time. Along the way he encounters his friend Sarah and starts talking about their group project. An alarm on his smartphone rings, warning him that an alert will be sent to campus police if he doesn’t check in soon. He enters his PIN, updates the time allotted for his trip, wraps up the conversation with his friend, and walks to Cornerstone safely. Once there, the app deactivates the timer based on his arrival at his intended destination as determined by his GPS location.
Fig 4.2: Ralph's best route as determined by SafePath

References

Appendix

Original Proposal:

After living in the city of College Park for almost 3 years now, crime alerts are a part of daily life. Those, along with the thought of all the crime that is not reported, leave me with no choice but to be paranoid while walking on campus, mostly at night [1]. With an application like the Stay-Safe App, college students who live in areas that are not the safest would have the ability to feel comfortable and safe while walking on campus at all hours of the night. The University attempts to keep campus safe with police auxiliary and escort services, but they have proven time and time again to not be enough to keep students safe. Police auxiliary could easily be mapped and tracked, allowing users to either meet up with or easily locate them. With campus escort having questionable wait times and infrequent bus schedules, students often take the less complicated route of braving the area and walking home, however far it may be [2]. With this application, walking escorts could also be tracked, also providing an estimated time of a university escort to walk or drive with. A database with local emergency and non-emergency contact numbers are also easily accessible. Areas on campuses would be mapped and tracked, allowing users to see where the brighter, safer areas on campus are (indicated with a green satellite layer), medium brightness and safe areas are (indicated with yellow), or paths that are not recommended are at the time of day. The application would also allow users to see where the most highly trafficked areas are, giving them the opportunity to choose the safest route, fastest route, or best overall route. This application could also cater to families and children, mapping their walks home as well as their neighborhoods. Individuals who have been stationary in one location would also show up on the map as a red dot, indicating the user to look out for the area. Recently reported crimes would create a push notification on the device. Criminals or
those convicted of sexual assault would also show up on the safety levels of the overlaying map. This application would also be very easy to use for the elderly by providing an easy to use interface. This could be the perfect safety companion for long nights of studying, for alerting officials of suspicious activity or accidents, or smaller incidents like calling animal control for a lost dog.

References


   From the original proposal, we decided to follow the major idea of creating a heat map tracking local crime, and using this to recommend paths to users. Some of the ideas that we felt were peripheral, impossible, or simply irresponsible were eliminated, such as tracking police auxiliary and individual sex offenders. It will also be targeted more specifically at students, faculty, and staff of the University, rather than families and the elderly. We also decided that a feature should be added to quickly alert police so that the application could be used in emergencies.