

Proactive Safety

Designing & Implementing a Mobile Application

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The Texas A&M Health Science Center's (HSC) Environmental Health and Safety (EHS) and Security offices are charged with ensuring the safety and security of all faculty, staff, students and visitors at eight campuses dispersed across Texas. This geographical dispersal presents several problems: 1) ensuring management and control of safety and security information; 2) consistently presenting campus-specific safety and security information through a single, simple-to-use portal; and 3) designing the portal to ensure that a user will see sufficient value in the system to use it regularly.

The eduSafe mobile app was designed to address all three of these problems by providing rapid access to:

- campus-specific contact information;
- all emergency procedures without requiring a data connection;
- a method through which to submit nonemergency hazards or concerns;

- one-touch access to the user's campus-specific security desk;

- access to regularly used research compliance information and forms.

Creating expanded access to safety and security information, and adding value through the inclusion of regular-use information will help users remember that they have access to the emergency procedures that can empower them to handle many situations of both an emergency and non-emergency nature, regardless of a data connection. The HSC's safety and security departments believe that this "in-hand" approach is a best practice and part of their mission to continuously improve and provide proactive safety.

IN BRIEF

- Texas A&M Health Science Center needed a consistent, single access point to provide campus-specific safety and security information in an intuitive and user friendly manner across its geographically dispersed campus.
- The mobile-centric nature of the campus user population called for the safety and security information to be presented by a mobile-friendly method.
- The research team used focus groups to develop icons and layout, and present information in a way that would be intuitive and easy to navigate without formal training.

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Problem: Effective Communication

Traditionally, emergency procedures at higher learning institutions are contained within printed flip charts that are typically located within each room where they may be easily accessed. A major drawback to this method of communicating emergency procedures is that they are not present in the minds of the room occupants due to infrequent use. HSC safety and security staff were concerned that, in the event of an emergency, faculty, staff, students and visitors would not think about or refer to the flip charts, but would instead look for information to be relayed to them in some other format (e.g., radio, television, announcement, external media sources) (Lindell, Prater & Perry, 2007). Emergency procedures not consulted during an emergency have little value and offer no assistance to those in need. These flip charts are in use at HSC and, while a valuable tool, their effectiveness is of concern.

Additionally, given HSC's multiple campuses, contact personnel are different for each campus. The on-site safety and/or security officers for the HSC campus in McAllen, TX, are necessarily different from those filling safety and security roles in Dallas, Round Rock, Temple or Houston. Furthermore, many faculty, staff and students frequently travel between campuses in the course of their studies or duties. A student travelling to a campus that is not his/her primary place of study is no better prepared for an emergency situation on that campus than a visitor. Thus, ensuring quick access to campus-specific information is of paramount importance. A more proactive safety and security environment would supply not only campus-specific emergency procedures where global procedures do not apply, but also campus-specific contact information so that visitors can quickly reach the appropriate safety or security representative should the need arise.

Finally, the team needed to address the problem of encouraging use of the app through added value. The mobile app can organize information that

faculty, staff and students regularly use—information that may be inconveniently located in many separate locations. This creates the draw necessary to ensure that the app will be regularly used.

For example, a principle investigator or his/her staff may need to access a lab's animal use protocols, or may need to register the lab with the safety office, or verify whether lab personnel must register for the occupational health program. All of that information and respective forms were in separate locations that required the user to either remember multiple web addresses or have multiple bookmarks. Embedding the information and forms directly into the app, or providing links to web-based content when embedding was not possible, was identified as an added value that could encourage regular use by the HSC community.

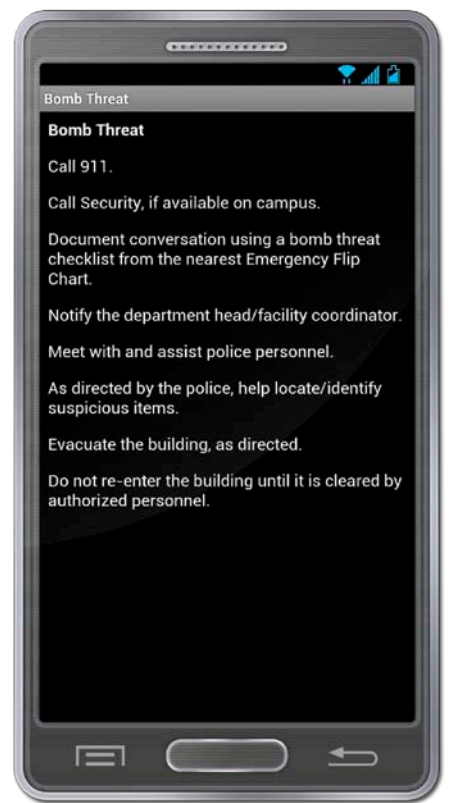
Application Design

As of this writing, the eduSafe app includes nine modules that present a mix of essential and added-value information. The combination not only ensures that users have access to vital emergency information, but also encourages frequent use.

Contact Module

The contact module is a campus-specific phone number listing with one-touch dialing. When the user touches the phone number on the screen s/he is taken to the dialer program to place the call. The user selects his/her campus, then touches the phone number to dial a safety, security or parking representative.

HSC-managed security and parking are not available on every campus, as some of the HSC-operated buildings are within another university's campus (e.g., the HSC campus in Kingsville, TX, is located within the Texas A&M University-Kingsville campus). On those campuses, only the HSC safety representative is listed and can direct calls as needed.



The emergency procedures module contains all of HSC's emergency procedures in quick-reference format similar to what is found in an emergency flip chart.

The one-touch dialing feature displays phone numbers for reference, and users attempting to dial from a device without that ability (such as a tablet) receive a message to that effect from the app.

As will be noted through the remaining module descriptions, the contact module is designed to be high contrast. The background is black and the phone numbers are white bold text to make the display easy to read in high or low light conditions, which may exist outdoors or during an emergency.

Emergency Procedures Module

As noted, the emergency procedures module was the original impetus for creating the application. It is designed with the same high contrast and for the same reasons as the contact module. This module contains all of HSC's emergency procedures in quick-reference format similar to what is found in an emergency flip chart. It is important to note that HSC's official emergency action plan is not accessible via the app, as it was determined that widespread access to the complete institutional action and response plan would be a security risk. The quick-reference emergency procedures are accessible regardless of cellular, WiFi or Bluetooth connectivity, as they are stored locally within the app and thus in the mobile device's memory.

Report Hazard Function

The report hazard function allows users to report nonemergency hazards or security concerns. It is not intended for reporting emergencies; users are encouraged to call 9-1-1 in those cases. However, nonemergency hazards and concerns often go unreported due in part to the lack of a well-defined reporting method. This feature expands the "eyes and ears" of the safety and security departments through stakeholder participation in a well-established safety culture.

The user inputs the location of the hazard, chooses the type of hazard as either safety or security, and provides a description. The user may include identifying information or remain anonymous. Once the user touches the submit button, the information is sent to HSC's safety and security director.

HSC Alert Module

The HSC alert module briefly describes HSC's mass notification system and includes a link to sign up for text message alerts. Just before launching version 1.0 of the eduSafe app, the notification system provider released an updated version that allowed for push notifications to applications such as eduSafe. Incorporating this technology is planned for a future revision.

Clery Reports Module

Federal law requires HSC and other higher education institutions to comply with the conditions of

the Jeanne Clery Disclosure of Campus Security Policy and Campus Crime Statistics Act (Clery Act). The Clery reports module was developed to enhance compliance efforts, provide greater transparency and increase response time for the annual security report (ASR) request.

The module lists the ASR for each campus. When the user selects a campus ASR to view, the report is downloaded as a PDF from the HSC website. Android users are prompted to select a viewing method (e.g., Adobe Reader). For users of iOS devices, the ASR will load in the device's PDF viewing software within the eduSafe app. These differences are expected device-specific behaviors and were designed intentionally to comply with best practices and expected user experiences for each platform (Resources for Apple Developers; Google).

Because the links within the app are generic (i.e., the URL does not change when the ASR is updated), the latest ASR is always available.

Escort Request Module

The escort request module was added to raise awareness and encourage use of HSC security department services where available. This security service provides an escort for faculty, staff and students to their car, another building or other campus location at night or other times that HSC personnel are concerned for their safety. Within the app, the user selects a campus location and the module displays the phone number for the corresponding security desk and allows one-touch dialing. The user can then arrange a meeting place and time with the security officers. Placing this function within the app makes it more accessible, adds convenience and increases participation in the service.

Similarly to the contact module, when the dial button is pressed on a tablet, the user is notified that the device cannot make calls and that s/he must use a phone; if pressed on a phone, then, via the device-specific behavior, the phone will dial the number and contact the relevant security desk.

Parking & Maps Module

The parking and maps module was incorporated into the app as added value. The module provides contact information to the central administration parking office that can be utilized by touching either the phone or e-mail information to open those functions on the mobile device. The module

also includes access to HSC's T2 parking system, a vendor-provided parking management system, via a website link to the HSC's web portal into the account management system, a list of frequently asked questions (FAQs), and maps of each HSC campus and parking lot.

Through the T2 web portal, users can access their parking permit account to renew their permits, and pay or appeal parking citations. The FAQ section is stored within the app for user convenience and is designed in the same high contrast manner as described earlier. Each campus' maps are organized in the same manner as the campus-specific contact information to ensure that the user has a cohesive experience while interacting with the app. The map locations are stored as GPS coordinates and opened using the device's native mapping process. iOS devices will utilize the data provided by Apple Maps, while an Android device will present what is found within Google Maps.

At present, automatic navigation based on the user's current location is not provided; navigation is planned for a future update to the app, allowing a user to touch the map marker on the screen to initiate the device's default navigation tools.

Currently, when a user selects a campus, then a building or parking lot, the app returns either a satellite map with the selected location pinned with a red thumbtack icon (iOS), or a hybrid satellite-road map overlay with a red dot marking the chosen location (Android). The satellite-only map version was chosen for iOS devices, as Apple Maps had outdated road maps and, in some instances, was displaying roads that did not exist. The map feature can be used to help campus visitors locate their building of interest or a parking lot for which they are permitted.

Safety & Compliance Module

Another significant added value is the safety and compliance module. Think of this module as an EHS department in a box. It contains a wealth of information gleaned from every major safety sub-department including fire life safety, laboratory safety, occupational health, biosafety and radiation safety. Users can access safety program forms and training schedules, submit radioactive material orders directly to the radiation safety officer, register their lab with EHS, view important nonemergency safety procedures, access safety self-inspection checklists, and preview examples of checklists used during EHS inspections.

By granting easier access to information about safety performance criteria that HSC personnel are graded on, long-term compliance should increase as users become more familiar with the safety departments' expectations. Also, providing frequently used forms in one place offers greater service to stakeholders.

Links Section

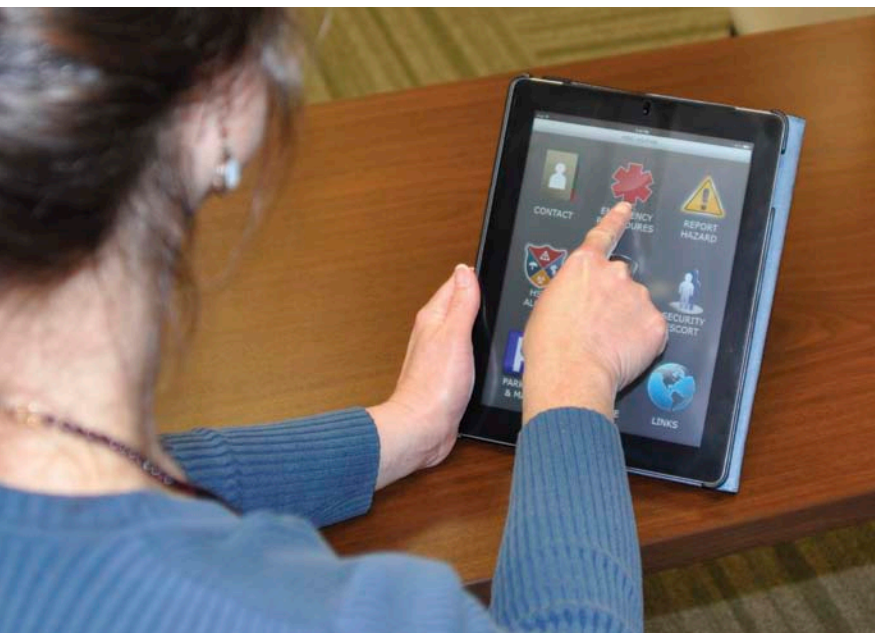
Finally, the links section of the app provides supplemental information to the user via Internet links to HSC faculty, staff and students. This section includes links to websites such as the HSC main web page, HSC EHS web page, CDC and FEMA websites, and an MSDS database site.

App Management

These modules are examples of how a mobile app can accomplish the goals of both providing emergency procedures and organizing useful information into one easy-to-use access point to encourage greater safety and security stakeholder buy-in and participation.

HSC manages and controls the safety and security information contained in the app. If the information within the app becomes obsolete, HSC staff can push an updated version of the application to both Google Play and App Store. Typically, these updates become live within a few hours on Google Play and within 6 to 10 days in the App Store (Resources for Apple Developers; Google). Additionally, should HSC stop maintaining the eduSafe app in the future, staff can push an update that will "blank" the app or make it useless. Blanking the app removes all emergency procedures and contact information, which is a better and safer protocol than risking the information becoming outdated due to lack of maintenance or for someone to be given a false sense of security or be injured while attempting to call invalid phone numbers. The earlier in the emergency that the user can be directed to the correct safety information the better. Removing any chance of misdirection or misunderstanding is crucial.

The eduSafe app is free to download from both Google Play and App Store to encourage greater



use and so that no monetary barrier exists between HSC personnel and potentially critical emergency procedures. Covering the cost of the app at the institutional level was considered an ethical issue and a liability issue given the sensitive nature of the information within.

Code Development

It took two EHS personnel 11 weeks to develop the eduSafe app from concept to completion. It was written using Titanium Studio, a free multiplatform app authoring software suite from Appcelerator Inc., installed on Apple MacBook Pro computers. Apple computers were required to develop the app for iOS, as Apple restricts access to its software development kit (SDK) and authenticating tools. In addition, the Android device emulation software runs more smoothly in the iOS environment than on Windows.

The code structure was written using a combination of HTML and javascript, which was then interpreted by Titanium Studio into the appropriate languages for the iOS and Android devices: Objective C and Java respectively (Appcelerator).

This multiplatform approach allows the HSC developers to maintain one source code for the app rather than two device-specific source codes. While developing the code in this manner makes multiplatform development substantially easier and much less expensive in terms of both material costs and labor, there were a few tradeoffs. Chief among these tradeoffs were complications using each device's native map application navigational features, and challenges encountered when compiling, or translating and packaging the single javascript source code into the respective destination code languages.

The javascript translation issue was particularly challenging as Java SDK Version 7 (preloaded on the MacBooks) did not authenticate the translated Android version of the app source code correctly; a process known as app signing with the keytool and zipaligning, which is necessary to meet with Google's developer specifications and to ensure the security and quality of the apps published to Google Play. This problem was resolved by removing Java SDK version 7 and installing Java SDK Version 6 manually, a laborious process.

The graphics and image files used in the app were developed by EHS personnel using Adobe Photoshop with input from other EHS and non-safety personnel to ensure that the images used for the module icons were representative of the information contained within, and different enough from each other to eliminate confusion. The app was designed with the user in mind so that immediately upon loading the user could quickly navigate to needed information without necessarily having to read each button title.

To collaborate efficiently, the two developers used separate computers to actually write the code,

which required a method of storing and tracking changes to the source code. The developers used BitBucket as the online repository to store the code, and maintain a backup and version history. Using this tool, both developers could synchronize the source code copies on their respective computers with the online version. Each time a change was made by one of the developers, he could sync his copy with BitBucket along with notes on each edit to ensure that everything was tracked. If an error was encountered in the new code, the developers could institute a rollback from the online source code history. Other online repositories are available, but the developers selected BitBucket because it offered a free account with sufficient security to meet HSC's needs.

Testing & Lessons Learned

The eduSafe app was tested on various devices prior to launch to ensure that it would function properly. The HSC team had access to iPads and an iPod, and these devices were linked as test devices to HSC's Apple Developer account, which Apple requires to test development code on an iOS device. The developers also had access to personal Android devices, which they used as test-beds. Finally, HSC purchased a Google Nexus 7 to test the Android tablet functionality.

The team tested the app across all devices and on various versions of both Apple and Android OS. Android OS versions 2.2.x, 2.3.x, 4.1.x and 4.2.x were tested across a Droid X, Google Nexus 7 tablet, Samsung Galaxy Note II and a Google Nexus phone. Apple iOS versions 4.x, 5.x and 6.x were tested across the iPod and iPad.

It is important to test the application on an actual device, as the software can behave differently from the emulation environment on the development computer (Debug Your App; Google). For example, certain pages (screens) in the app are designed in webViews (a term for the method of coding used). The Android emulator ceased to function properly (crashed) when attempting to render webViews due to issues within the emulator code itself. However, these webViews will operate without error on the actual Android devices. Other crashes or variances in behavior between emulator and device are impossible to predict and must be tested.

The app was tested for function and code errors. Given the desire to create an app with an intuitive



An example of eduSafe's home screen. The images used for the module icons are representative of the information contained within, and different enough from each other to eliminate confusion.

message and purpose, the team tested the app to ensure that it was user friendly. The app was loaded onto all of the testing devices and handed out to HSC personnel in the campus operations, safety and parking departments including all staff levels from administrative assistants to EHS program managers. Based on feedback, the team made revisions to ensure that the desired user-friendliness was achieved.

Promotion

A useful tool is of little value if it is not used, and a tool will not be used if no one is made aware of it. Therefore, an important part of the implementation plan for any application is the method(s) by which it is promoted. HSC took a diversified approach to promoting the eduSafe app by conspicuously placing posters at each campus, including a flyer in the orientation materials for new students and employees, posting a press release on the HSC website, conducting an aggressive word-of-mouth campaign, and setting up display tables with giveaways in high-traffic areas during student orientation. All print materials included QR codes to guide the user to the eduSafe page of the App Store or Google Play for download.

Community Response

The eduSafe app received a warm welcome from the HSC community with several hundred downloads logged before the team conducted any promotional efforts. Executive administration was supportive of the app and positive comments were received from faculty, students and staff. The HSC EHS department was awarded a Model of Efficiency by *University Business* magazine in August 2013 for the app.

Since the app launched, other schools within the Texas A&M University System (TAMUS) have become interested in their own versions. HSC has been working with those groups to launch additional school-specific versions of the eduSafe app with appropriate branding, emergency procedures and contact information. As of this writing, there are two additional versions of eduSafe in both Google Play and the App Store: TAMU eduSafe for Texas A&M University-Texarkana, and TAMUG eduSafe for Texas A&M University-Galveston. Upon the release of the app's first version, the Texas A&M University System Office of Technology Commercialization saw the app's potential and worked to prepare a license of the intellectual property for commercialization outside of TAMUS.

Further Development

Any good software development team always strives for continuous improvement. As the launch of eduSafe version 1.0 approached, EHS personnel were already amassing a list of new features and upgrades planned for future rollout. These

upgrades include solving the device-native map application navigation issues; allowing users to submit an image or video of a hazard in the report hazard module; redesigning the layout of the home screen to improve the user experience and intuitive navigation; and designing an online database where TAMUS personnel can update contact information and emergency procedures, which would then sync with the various app installations without the need to upload a new version every time a phone number changes. At the time of this writing, many of these upgrades were already in development.

Conclusion

In an effort to foster an environment of proactive safety and security, the HSC EHS staff developed an application for use on mobile devices. The eduSafe application was designed to work on both iOS and Android devices. It accomplished the following goals:

- 1) ensuring management and control of safety and security information;
- 2) presenting campus-specific safety and security information consistently through a single, easy-to-use portal; and
- 3) incorporating valuable daily-use information to encourage frequent user interaction.

With continuous improvement plans and by taking feedback from users and other TAMUS school safety departments, HSC EHS team hopes that the app can empower faculty, students and staff to handle many situations they may encounter, both of an emergency and nonemergency nature. HSC's safety and security departments believe that maintaining a proactive approach to safety and security by seeking out new and innovative ways to interact with those they serve is an important part of their mission, and that the eduSafe app is a best practice to help them carry out that mission. **PS**

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