Safe Count

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1. Introduction

For our project, we had three ideas, 1) a mobile app, 2) a wearable jacket, and 3) a Google Glass app. Based on feedback from both the poster session and informal interviews with teachers and administrators, we determined that our concept for a mobile application is the most appropriate solution.

A Google Glass app was the least desirable solution, due to several reasons. First, while teachers enjoyed the idea of the level of automation it provided, they were concerned about its learnability. Administrators, as well as teachers, pointed out challenges such as cost and security - students might try to steal them. Even if the price of individual Glass units were reduced, teachers who already have glasses would have to get a custom set.

The wearable jacket was more well-received, however there will concerns about comfort and fit. Had we chosen this option, we could have addressed these topics in our design. It was also pointed out to us that if the environment has reduced visibility, for example, due to smoke, students might end up going further inside the building to follow the light of the jacket rather than out. Finally, there was evidence of the general lack of current social acceptability around wearables, particularly in a large clothing item like a jacket.

The mobile app has a few advantages to these other designs. Perhaps the most obvious is that it follows conventions of current communication methods: text messaging. In addition, it provides the necessary space and means to display information of both students and announcements made by administrators. It also provides portability on any small device. Teachers are already required to grab a red folder on their way out of their classroom during a drill or emergency, so there is no need to remember or learn anything new. Initially, we did think about eliminating the step to bring anything, but “safe” locations change for a number of reasons. Therefore, it wasn’t feasible to leave anything at the “safe” locations.

Finally, while our initial user population was K-12 teachers and administrators, for the purposes of continuing this project, we have limited our work to the high school (9-12th grade) level. This is due to two things: first, the feasibility of the project completion due to constraints like time, research approval, and communication with school employees; and second, in speaking with high school teachers and administrators to start, we learned that if we can enhance communication at the high school level during emergency situations, it can likely trickle down to the middle and elementary school levels. Both the younger schools manage their students more strictly, having their students line up in a single file line and leave in an ordered fashion. However, in high school, everyone simply leaves the building, so it is a little more chaotic. For our purposes, we have assumed “administrators” will include security personnel. Their duties will most likely align with those of administrators; for example, clearing areas of a building. Finally, we are focusing on fire drills as opposed to intruder or tornado drills because, again, it is likely the most chaotic situation with the most challenges.

2. Description of the Prototype

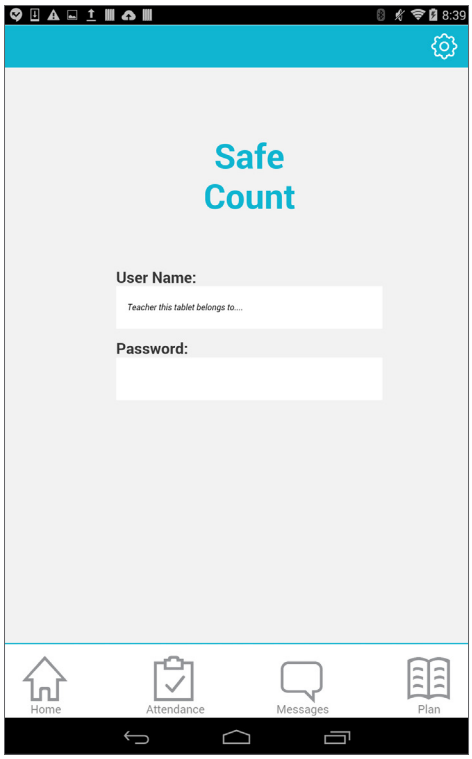
2.a. Mobile Application

The app consists of two versions—one for teachers and one for administrators. We made this decision because they have different duties during an emergency situation. Teachers are primarily responsible for the students in their class, and administrators are responsible for making sure that the building is empty and that all teachers have all of their students. A current system implemented in some high schools involves teachers holding up a green piece of paper to indicate they have all of their students and a red piece of paper to indicate that they are missing someone. Another system involves teachers writing down missing students' names on a piece of paper and giving them to an administrator. The app design removes these processes, and enables quick teacher-to-administrator, teacher-to-teacher, administrator-to-administrator, and administrator-to-teachers communication. A sample of screenshots are provided with details of interaction. Redundant screens or less important screens are omitted.

2.a.i. Mobile Application: Teachers

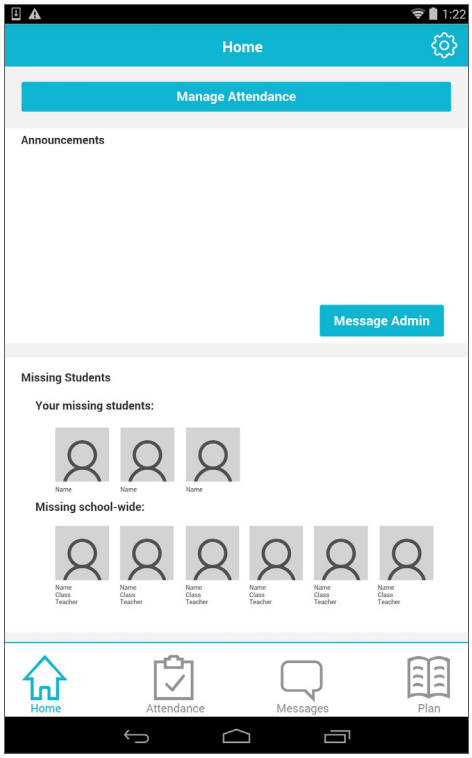
In both the teacher and administrator versions, there are similarities for consistency, including a bottom navigation bar. The navigation options vary, however, for each version. For the teacher, there are four buttons to direct them to their most important tasks, including taking attendance, messaging others and viewing the evacuation plan. There is also a "Home" button, which leads to the "Home" screen where the teacher can see real-time updates of announcements from administrators and a list of missing students.

Fig. 1



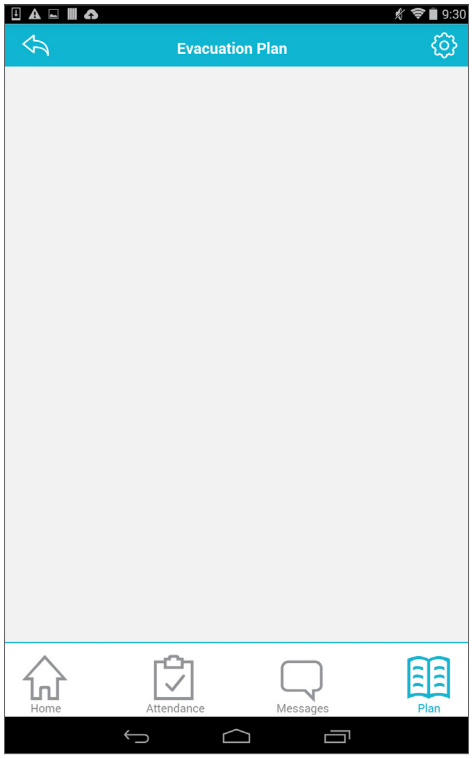
Login screen: To avoid a long, complicated login process, each teacher's app will already have their username filled in. This way, upon opening the app, the teacher only has to enter their password. To provide a way for teachers to share their devices with the application, in the event of a teacher not having their own, it is possible to re-access this screen and switch users.

Fig. 2



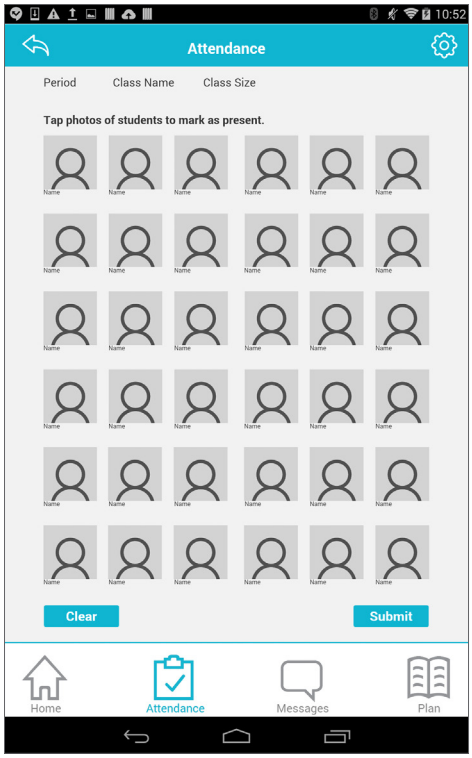
Home screen: Once the teacher has logged on, this is the screen they are brought to. Here, teachers can tap on the "Manage Attendance" button to take attendance of their students. This is their first priority once they have reached the safe area with their students. Teachers can also see, at a glance, real-time updates of announcements made by administrators and the missing students reported by other teachers. They can also send message to administrators by tapping onto the "Message Admin" button underneath the list of announcements. The content in this page is structured by priority, from top to bottom.

Fig. 3



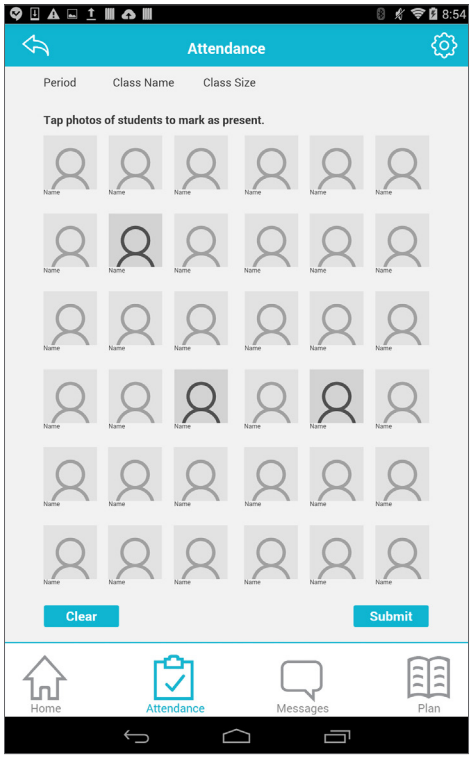
Evacuation Plan Screen: This screen exists and can be accessed from the bottom navigation bar. We have left it empty as it will be school-specific. It should contain the evacuation plan for the individual teacher or administrator, so they are focused on their own requirements. Administrators should also be able to view all plans.

Fig. 4



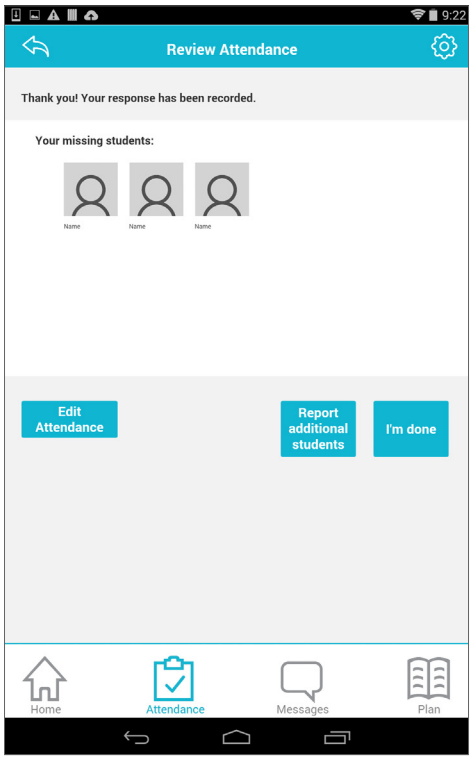
Attendance screen: On this screen, teachers can tap photos of their students that are present. If they make a mistake, they can reverse action by tapping again on the photo. The photos are first presented with an opacity of 100%. After the photos are tapped, or marked as present, the opacity decreases to 75%. This way, the most important things (the missing students) are the most visible. This carries over to the home screen, where the missing students' photos are shown at 100% opacity. If the teachers are disrupted during their attendance-taking process or make too many mistakes, they can tap the "Clear" button on the left bottom corner of the screen. This is followed by an "Are you sure…?" prompt to avoid accidentally hitting this critical button.

Fig. 4a



Attendance screen: Here, three students are left unselected, indicating they are missing.

Fig. 5



Review Attendance screen: After teachers submit their attendance, this "Review Attendance" screen is displayed, where they can see a summary of their missing students. If the list is incorrect, they can either tap on the students' photos to mark them as present or go back by tapping "Edit Attendance." Fig. 5a and Fig. 5b show the former. If they think the list of missing students is correct but they have extra students that don't belong in their class, they can tap "Report additional students." Otherwise, they can tap "I'm done" to finish the task of taking attendance.

Fig. 5a

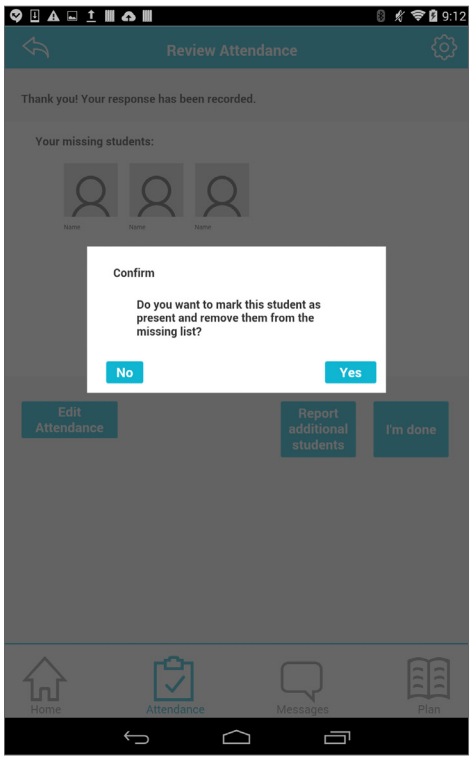


Fig. 5b

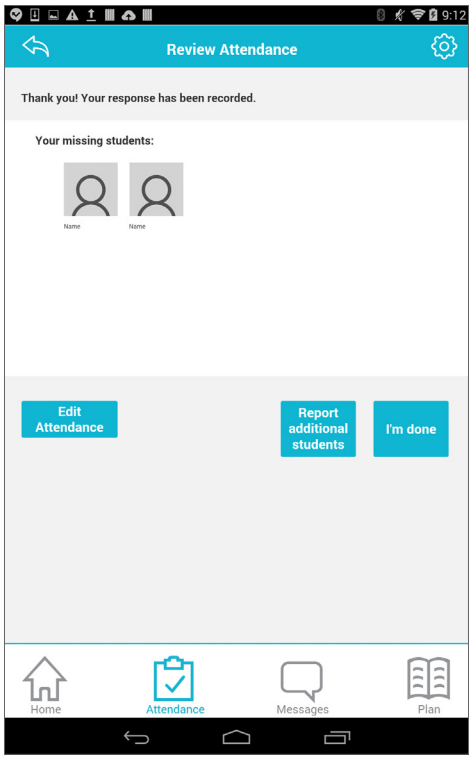
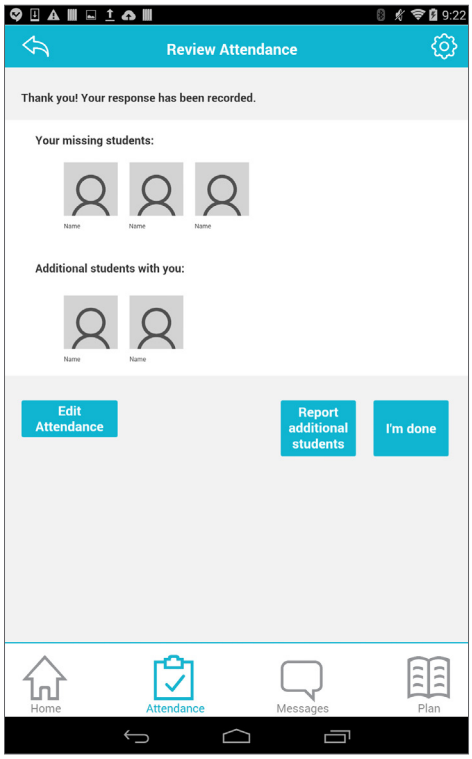


Fig. 6



Review Attendance screen, after teachers report additional students: Teachers will see a summary of their missing students and additional students on this screen. If there any mistakes, the teacher can either tap on the students' photos to remove them from the list, or go back by tapping on "Edit Attendance" or "Report additional students". If they think the information is correct, they can tap on "I'm done."

Fig. 6a

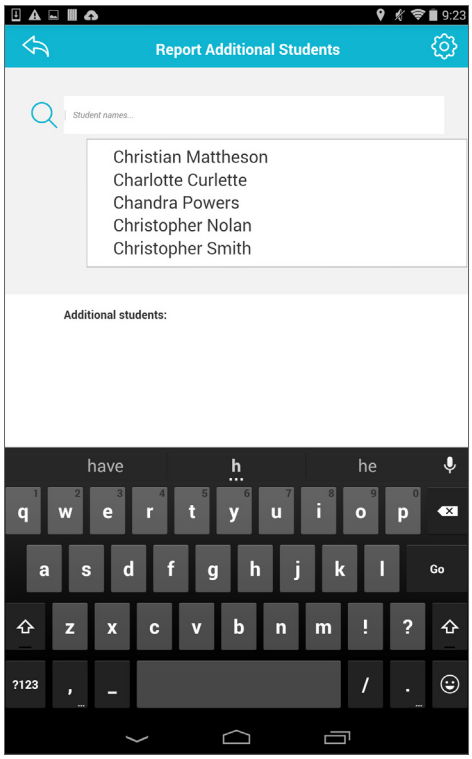


Fig. 6b

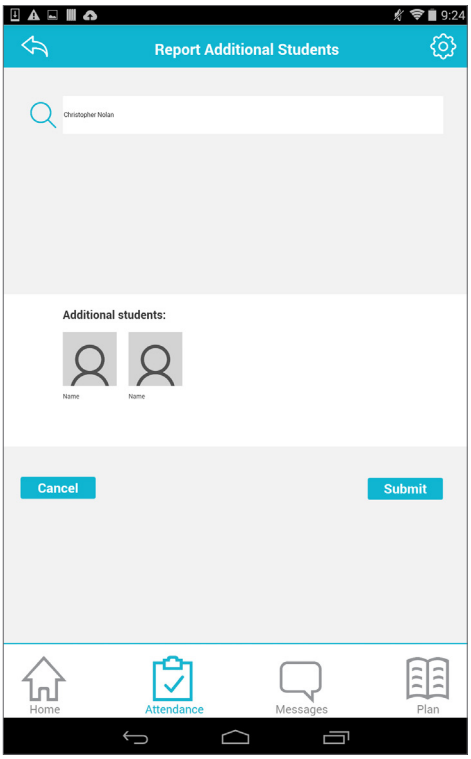
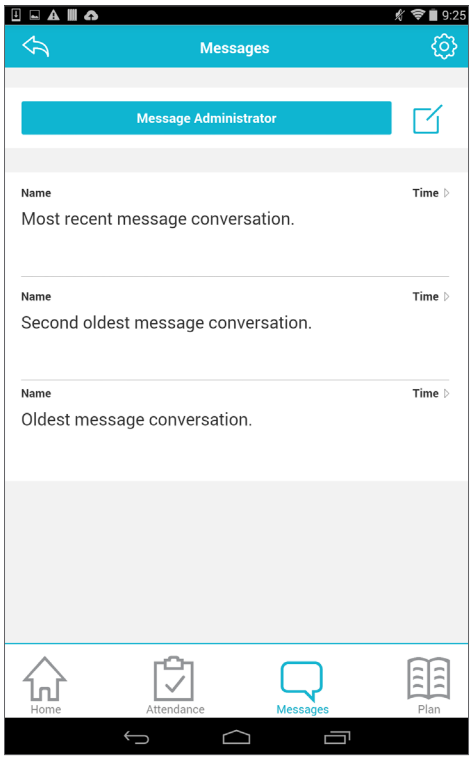


Fig. 7



Messages screens: There is a standard "Messages" screen, accessed by the bottom nav bar, where teachers can view a summary of ongoing conversations and access them individually to send new messages within the conversation. Teachers can also either click on the "Message Admin" button or the "Compose" icon. The "Message Admin" button leads to a screen (Fig. 7a) where the teacher can send a message directly to the administrator(s) that they are assigned to. The "Compose" icon leads them to a typical messaging screen (Fig. 7b), where they can message anyone, teacher or administrator, by typing their name in the "To" box or locating them in the "Contacts" page.

Fig. 7a

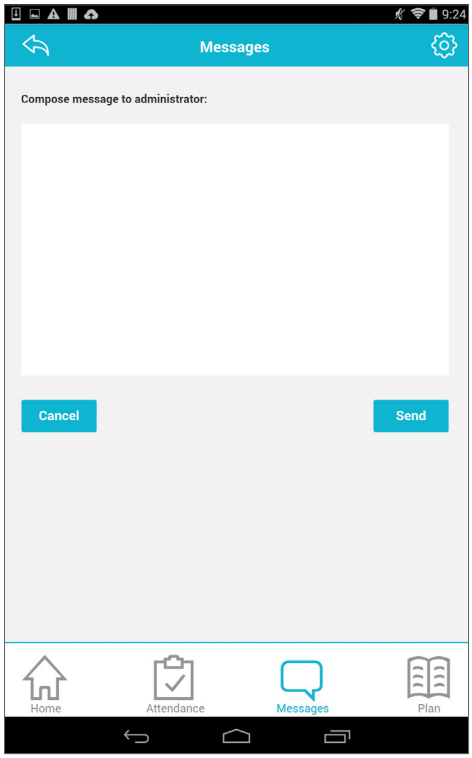
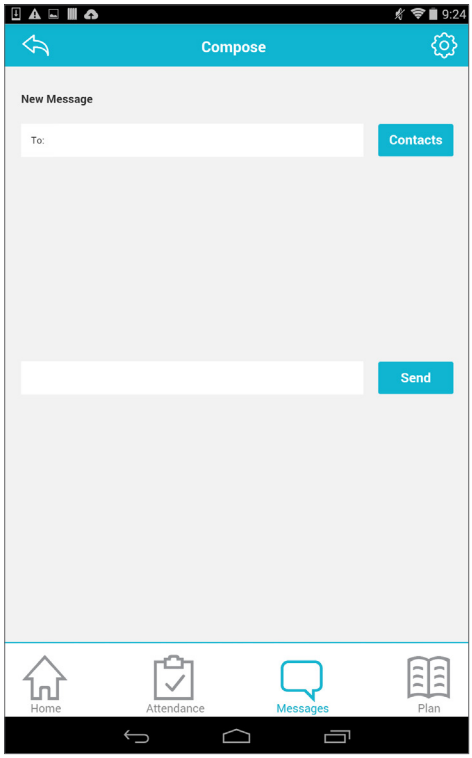


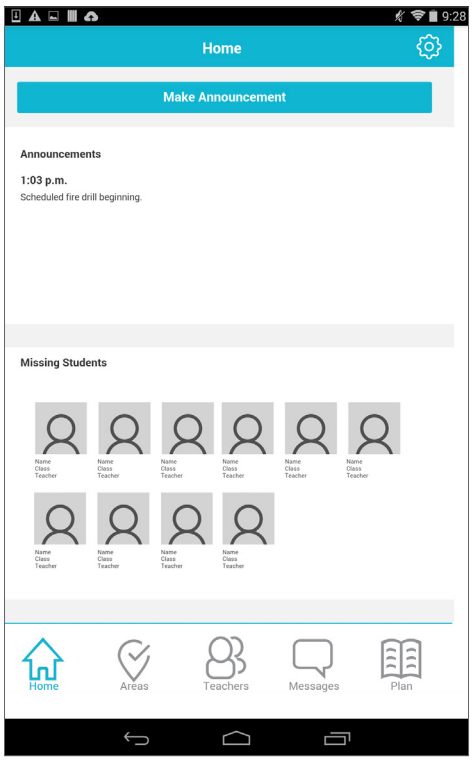
Fig. 7b



2.a.ii. Mobile Application: Administrators

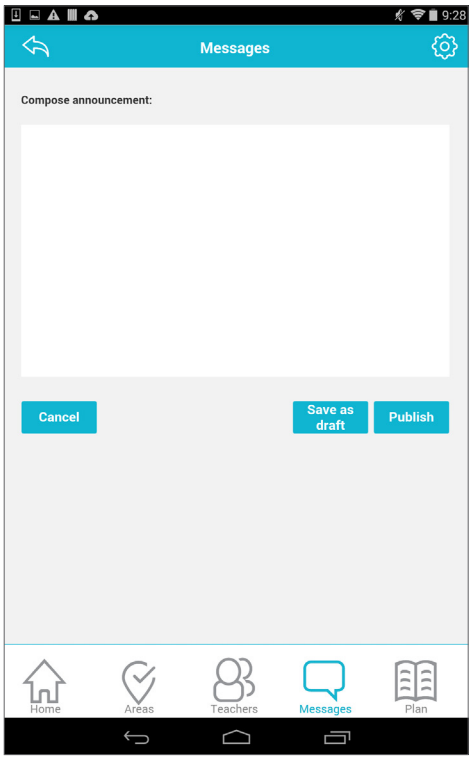
In the version for administrators, there are five buttons on their bottom navigation for their most important tasks. These include clearing areas within the building, checking teachers' reports of student attendance, messaging others and viewing the evacuation plan. By tapping on their "Home" button, administrators can see announcements and all missing students from all the teachers. Their main "top" botton is to make an announcement, rather than "Take Attendance" like the teachers have.

Fig. 8



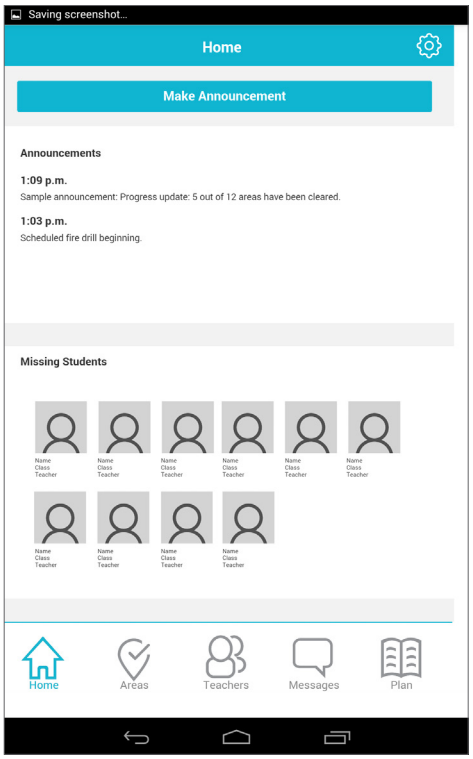
Administrator homescreen: On this screen, administrators can see real-time updates of announcements made by other administrators and a list of missing students. They can tap on the "Make Announcement" button to make an announcement to all other users. Additionally, if the administrator has found a missing student, they can tap on their photo and confirm the student is found. This information is then relayed to the teacher of the student, who receives it as a push notification.

Fig. 9



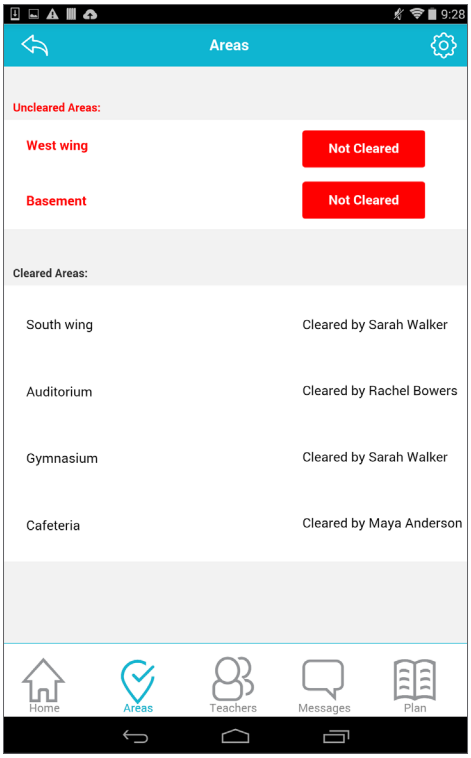
Make announcement screen: From clicking on the "Make Announcement" button, the administrator can compose the announcement in the text box. If there is a disruption they can click on "Save draft" and the "Make Announcement" button on home screen will be changed to "Edit Announcement." We chose this functionality over saving a long list of announcements because it is unlikely administrators will return to old announcements as they will be outdated.

Fig. 9a



Admin Home screen, after making an announcement: After publishing an announcement, they are redirected to the home screen where they can see their new announcement.

Fig. 10



Clear Areas screen: Administrators can see what areas of the school have been cleared and by which administrator. If the user has cleared an area, they can tap on the “Not Cleared” button to move the area to the “Cleared Areas” section (Fig 10a). If they incorrectly tapped on it, they can easily tap again to undo the action.

Fig. 10a

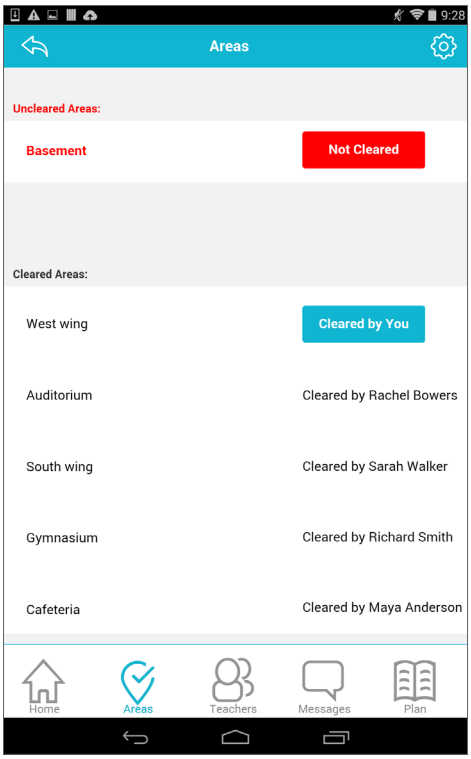
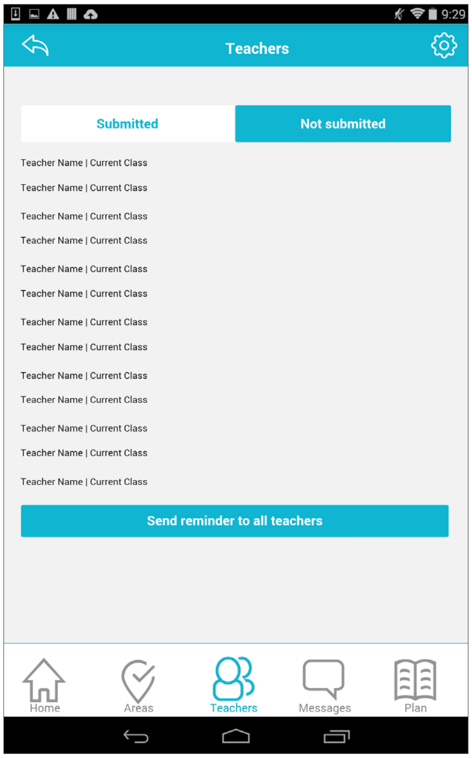
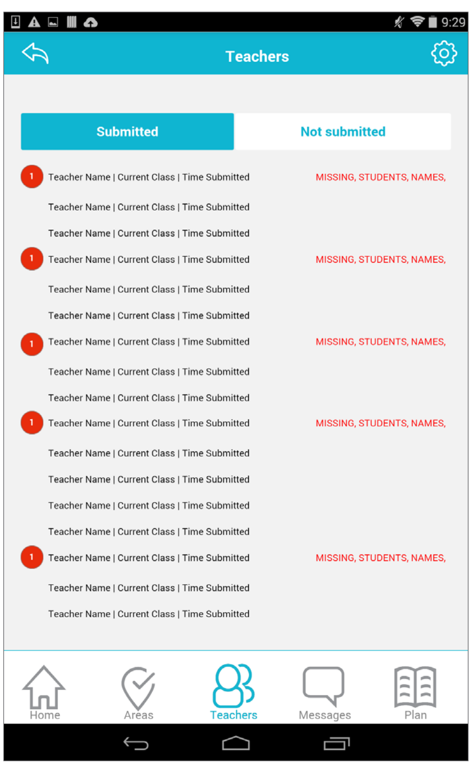


Fig. 10



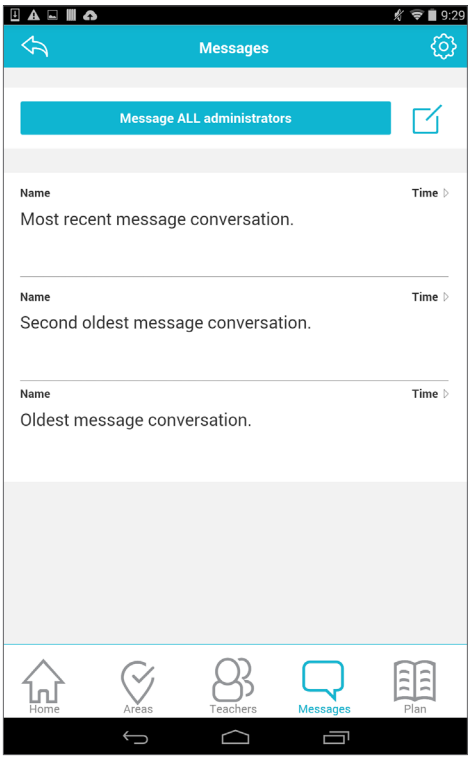
Teachers' reports screen: In this section, administrators can see two lists: one, of teachers who have submitted their attendance reports, and whether they are missing students (if so, who), and two, of teachers who have not yet submitted their attendance reports. In the list where teachers who have not yet submitted their attendance reports, there is a button for the administrator to send a request to the teachers reminding them to submit.

Fig. 10a



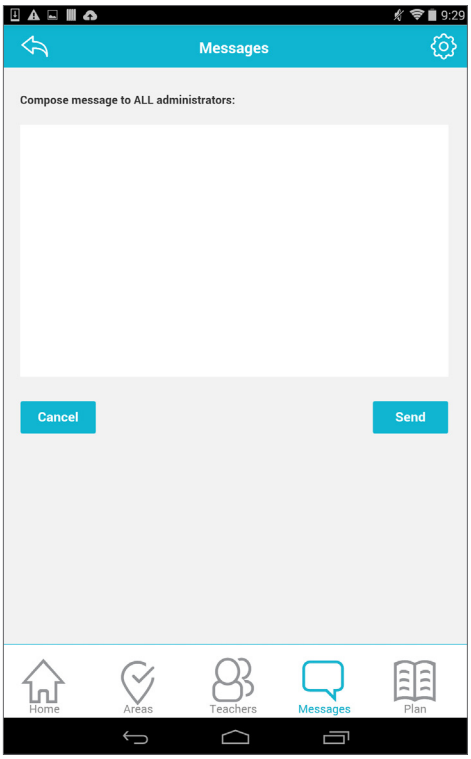
Teachers' reports screen: For teachers who have submitted reports and also have missing students, there is a red bubble indicating how many students they are missing, with the missing students' names displayed. Details for each submission include the teacher name, their current class name, and time submitted.

Fig. 11



Administrator Messages screens: Similar to the teachers' messages screens, administrators can compose and send messages to any user by tapping onto the "Compose" button. Alternatively, they can also choose "Message all administrators" if they want to share important information with all other administrators (Fig. 11a). Like most messaging systems, they can also tap on a specific conversation to continue.

Fig. 11a



2.b. Implementation Challenges

We originally planned on developing an usable Android app which could be used during testing as well as afterwards if any of the schools wanted to adopt it. However, due to the project time and the lack of back-end programming knowledge and experience in our team, we decided it would be much more feasible to create a high-fidelity wireframe prototype to use for evaluating the system. For this we are using Axure. Axure is great for implementing application flow, from one screen to another, and changing the content on a screen as the result of an action. However, one challenge is accepting every possible interaction from the user. Another is creating real communication between the administrator user and the teacher user. We address this challenges in our evaluation plan, which is described later.

2.b. Design Justifications

As mentioned in P2, we have chosen to create an app to solve the problem of accounting for and managing high school students during emergency and drill situations. We based our decision on feedback we received from the poster session and interviews we conducted with teachers and administrators. Most high school also have tablets already available to them, so this implementation would be low cost and familiar to those who would be using it.

We chose the colors in our design carefully. The background of the app is a neutral, light gray color, which does not distract users from their task and adds organization to the elements with a white background on the page. As an accent color we chose a blue-green color, which produces feelings of calmness, necessary if the app were to be used in a real emergency situation. We only used one bright color, red, as an alert color which follows the normal convention. The presence of it is very small, so it only draws attention to the specific area where attention is needed. For people who are color-blind, there will still be a distinction between blue and red, even if they can't "see" the red. To guide our design, we followed the current conventions of Twitter and YikYak, both apps for communication.

3. Usability Specifications

1. **Easily accessible:** Users should be able to use the system easily and without difficulty

   We attempted to make our system easily accessible by making it similar to the system that is currently in place in most schools according to our initial interviews.

2. **Learnable:** Users should be able to learn how to use the system quickly, and understand it provided little to no training.

   This goes hand in hand with the previous point, in that the system is similar enough to what teachers and administrators are already doing as part of drill and emergency situations. The system only displays the necessary information in simple language, and matches the conceptual model the users already have.

3. **Error averse:** Users should not be confused about functions of the design and should make none or few mistakes during the emergency.

   Icons in the design are clearly displayed and action-driven. Pop-up boxes check with users that the action they have just completed is the one they meant to complete when the consequences would be severe, such as checking students as present/missing.

4. **Low network usage:** Users should be able to access the system without consistent Internet.

   The system is 4G enabled, so schools with low internet connectivity are able to use it without issues.

5. **Low cost:** The design should not be too expensive.

   An app that can work on any device (tablet, smartphone) can easily be downloaded, requiring no additional hardware. It will be up to each individual school whether or not they want to designate a specific tablet for this purpose, or use a tablet that already exists for another use. It will also be up to the school whether or not they allow phones to be used.

6. **Universal:** The design should be usable for all kinds of teachers and administrators.

   The system has administrator and teachers versions, each with their specific user interfaces matching the tasks the specific users need to complete.

7. **Safe:** The design should not pose a security threat related to private information.

   The system is password protected, and only teachers and administrators are able to have accounts and log in.

8. **Real-time:** Users should receive instant feedback during the emergency and should not need to wait for the system to load.

   Users receive immediate feedback from other users and their own system when in use.

4. Evaluation Plan

4.a. Introduction and Rationale

A challenge we faced in terms of evaluating the prototype with users is having to submit an application to receive the high school's IRB approval as well as Georgia Tech IRB approval. This proved difficult due to the time restrictions placed by the course, and getting in contact with school administrators. We therefore had to replace our plan of testing the app during a real fire drill - in which case we would also have needed a working app - with a mock fire drill situation with volunteer teacher participants.

To evaluate our app we will be conducting a simulated fire drill with volunteer teacher participants. Participants will first be introduced to the tablet app and briefly taught how to use it. They will then be instructed to go to different parts of the room where they will each find a piece of paper with different randomly generated student names. Participants will be asked to pretend they are in a fire drill and account for students as they would using the app. They will have to match the students' names on the piece of paper to those that appear as being part of their class in the app. They will also need to enter any additional student that may be on the list that do not belong to the class as shown on their app, and they will be shown which of their students are missing. Messages will be sent and received by them from other teachers or administrators.

We decided to conduct a mock drill, and not implementing our system during a real one, is that the prototype of the application does not currently have all the functions necessary to deem it useful in a real fire drill situation. If we had tested our prototype during a real fire drill, it would have only distracted teachers from important tasks such as accounting and managing their students, and relating the student information to the administrators. We would also like to test our prototype with administrators as well, but may not be able to get any participants in that category.

The tasks we have chosen for the users to complete during our evaluation (outlined below) represent the main functionalities necessary for teachers to have access to during a fire drill.

We chose the location of the prototype evaluation, the East Cobb Library, based on a few criteria. First, we needed a location that was private enough so that participants would not be distracted from their task or the interview/questionnaire sections of the evaluation. We had originally considered conducting the evaluation at Georgia Tech, but because our participants will be teachers from Cobb County (due to previously established contacts with teachers in this county) we needed a location closer to their place of work to increase their likelihood of participating in our study. We chose the East Cobb Library

because it is in close proximity to the high school where most, if not all, teachers will be coming from. This library also has large rooms that are available to be booked by the public and that allow us the opportunity to spread out participants around the room as they would during a fire drill.

Part of the evaluation will be a questionnaire that participants will complete individually after the simulated drill has ended, and a group interview. We chose to use a questionnaire instead of having individual interviews because there will likely be more participants than researchers during the study, so individual interviews would mean some participants would have to wait around for their fellow participants to have finished their individual interviews. Individual interviews would have also required us to isolate participants for their interviews and while waiting to be interviewed, which did not seem feasible. We therefore chose to create a questionnaire in which participants are able to provide open-ended responses. The teachers we have already spoken to as potential participants have expressed great interest in the study, and we therefore believe they will provide thorough answers to the questionnaire questions (a common concern when using open-ended questionnaires, and usually why individuals use interviews instead of questionnaires). There will also be a group interview after the individual questionnaires in which participants will be able to provide us with more feedback, and they will be able to discuss features of the app between each other in our presence, which may create new ideas for participants. This will provide us with a more thorough evaluation of the app.

4.b. Benchmark Tasks

Teacher:

Take student attendance of their own class
Report missing students
Report additional students
Check that a missing student is found
Message another teacher
Message an administrator

Administrator:

Track cleared areas
Mark area as cleared
Make an announcement
Check student attendance submissions from teachers
Message individual teacher OR message teachers who haven't submitted attendance
Check that a missing student is found

4.c. Expert Review

We have paired up with another HCI team that is also focusing on the context of high schools and education. We will evaluate and discuss each other's prototypes. This will take place on November 10.

4.d. Event Testing

During the evaluation of our system, all teacher participants will complete the same tasks (i.e., take attendance, report missing students, report additional students, etc.). While this may be unrealistic during a real drill or emergency situation, it is necessary so the participants have all completed the same task before filling out the questionnaire and conducting group interview. Our solution for this is to implement user tasks in a more timely, spaced out, manner in the hopes of them being more realistic. The mock fire drill will follow a story, so teachers will have specific names and events to manage, which our Axure prototype will be designed for. A draft of the event script is attached.

4.e. Questionnaire

The questionnaire (attached) is composed of a series of questions about participants' likes and dislikes in regards to the tablet app. Participants will be able to write in their answers and make them as thorough as they would like.

4.f. Group Interview

The group interview is intended to receive more detailed information than that from the questionnaire, as well as additional information that is not the present in the questionnaire about specific features. The interview will also allow participants to discuss the features among themselves, while we are present, which may lead to different ideas than those presented in the questionnaire.