ECE1778 Final Report

ED Concierge

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Word Count: 1703, Penalty: 0

1. Background

A visit to the emergency department (ED) is highly anxiety-provoking for patients. One of the biggest contributors to this anxiety is the lack of information the patient has upon their arrival to the ED[1]. Multiple studies have shown that clear communication from ED providers to patients have a strong positive effect on patient anxiety[2] and overall satisfaction[3-5] with their ED visit.

However, the fast pace and unpredictability of emergency medicine can be a barrier to effective communication between providers and patients. Patients are often waiting by themselves, and updates on their condition and progress can be few and far in between, particularly for low-acuity conditions and ambulatory patients. The low frequency of these updates then leads patients to seek information on their own and having to interrupt clinical staff. These interruptions have been shown to cause significant negative downstream effects[6] such as decreased workflow efficiency[7 8], increased provider stress[9 10], worsened patient perceptions on the quality of their care[11], and increased rates of medical error[12 13].

There have been different approaches to help improve patient-provider communication in healthcare settings that rely on pre-printed materials and other audiovisual methods[14-17]. While prepared information materials may not capture the nuances of each patient's specific situation, they have been shown to effectively facilitate communication.

2. Rationale

Given the need to improve patient communication, while at the same finding ways to decrease the burden of interruptions on healthcare providers, we created our application: ED Concierge. Using information published in existing medical literature, and unpublished focus group and survey data from local hospitals, we identified high-value domains that ED patients have the most inquiries about and designed our app to address each of these issues. The benefit of the app compared to some of the other more traditional information sources (e.g. patient brochures and leaflets) is that it is more interactive, can be more easily updated and disseminated, and can potentially allow for two-way communication.

3. Functionality

3.1 Registration and login
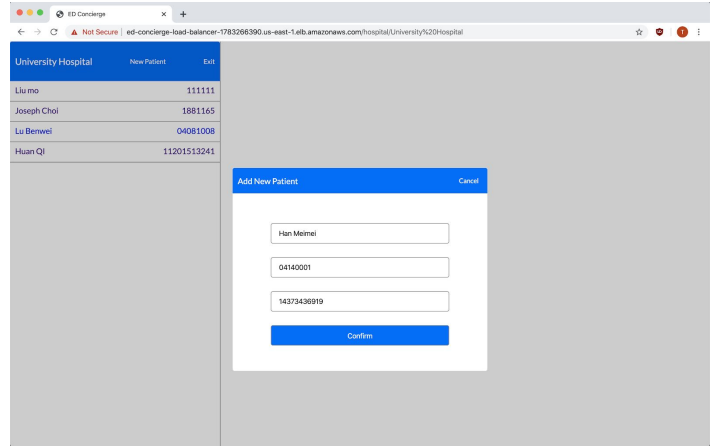


New Patient Registration in Web App
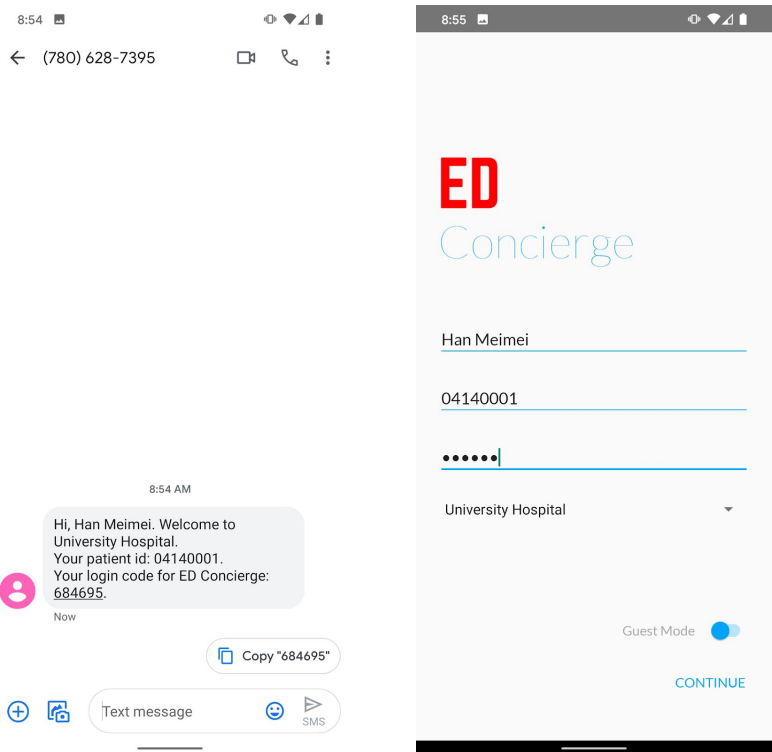
Received SMS in Patient's Cellphone

Login Page in Android App

We created a provider-facing web portal to facilitate patient registration. We created a login system where the provider creates a specific account for the patient with their name, their medical record number, and their mobile phone number. The system then sends a SMS text message to the phone number recorded with a one-time registration code for the patient to log in and verify their identity on the app. This method is an added layer of security to prevent potential identity fraud and impersonation.

On the mobile (patient-facing) platform, there is a dropdown menu that patients will choose the institution they are visiting. This was created so that the app can be a single app that multiple hospitals can use and modify to suit their local needs and content.
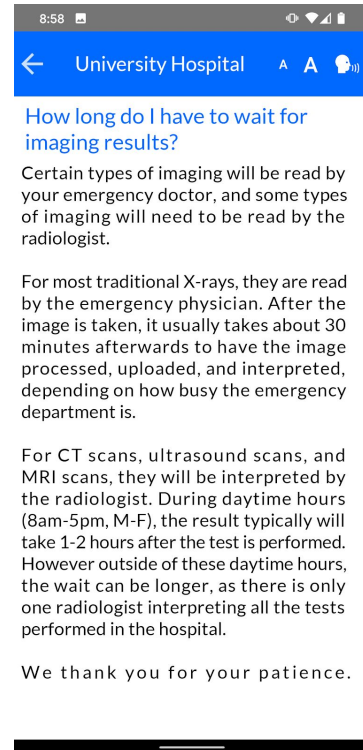
3.2 Information delivery
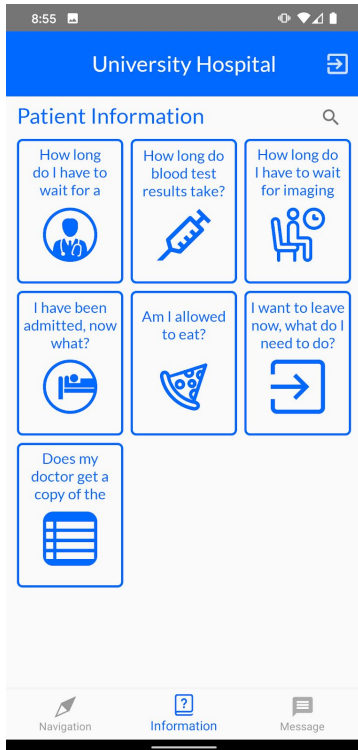
Patient Information List
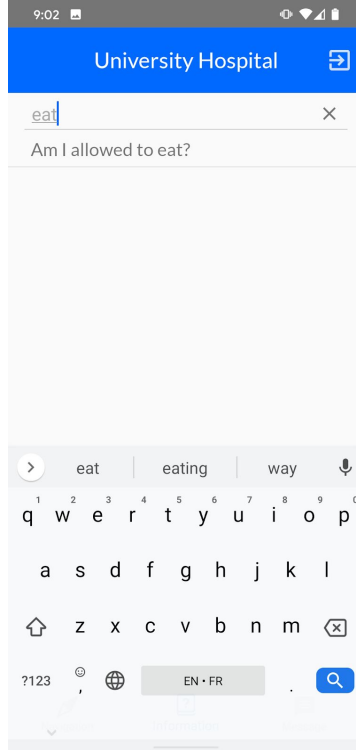
Information Search

Answer Page

Through review of multiple ED patient information leaflets and brochures available from hospitals in Toronto, as well as published focus group and survey data, we devised a short list of high-yield, frequently asked questions. In order to maximize accessibility, we incorporated features such as font size control and text-to-speech for those who may be vision impaired.

3.3 Messaging
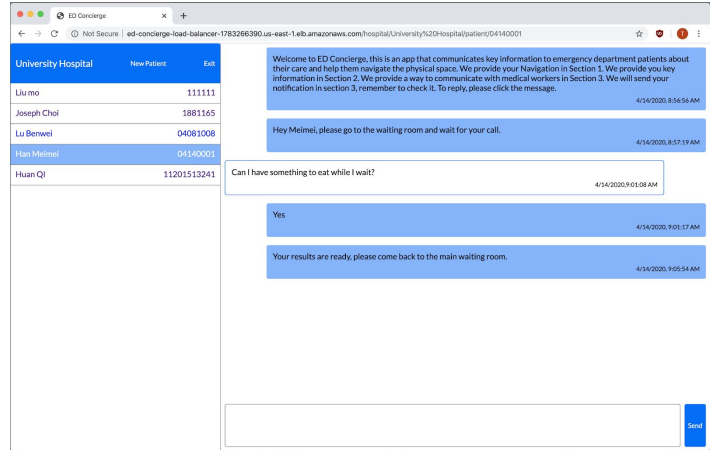
Messaging page in Web App
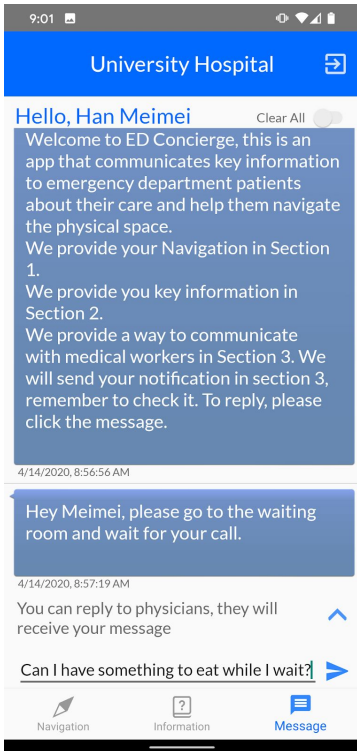
Send a Message to the Doctor
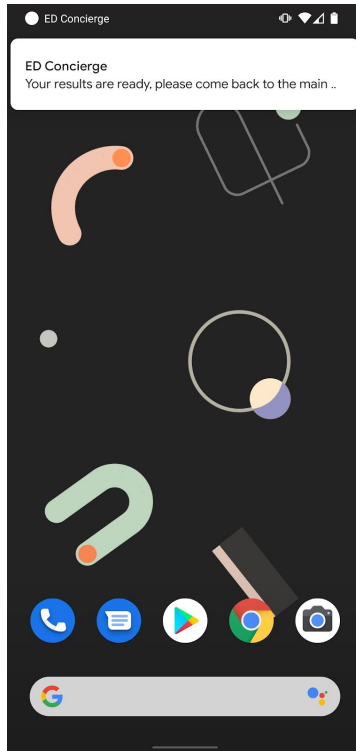
Notification
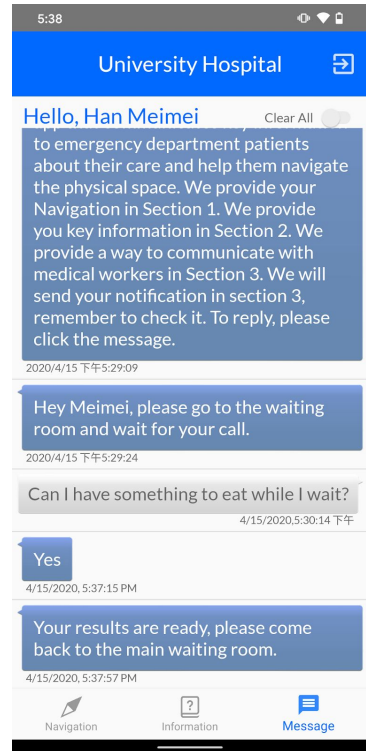
Patient Message List

This feature allows for asynchronous communication between patient and provider. Instead of the current model, where patients seek out a provider, get their attention, wait for them to task switch, and then get the information, our messaging platform allows patients to submit their question in a secure manner electronically to a provider. This platform has several advantages. Providers can batch questions and find a convenient time to tend to them when

they are not actively engaged in another task. Alternatively, specific providers can be delegated to answer questions on the platform, reducing the burden on clinicians. Questions are centralized and can be done in rapid succession. Patients do not feel the frustration and the feeling of being ignored as they seek a providers' attention. Finally, they can ask questions from anywhere and not just in clinical areas. An example of this would be that a patient is in the food court, and they can inquire about their status. They can also be alerted by the ED when they need to return to the ED, and they do not feel the uncertainty of potentially missing their turn, or not being present when important events take place.

3.4 Navigation

| Destination List | Destination Selection | Path Render |

We developed a point-to-point navigation feature in our app. A frequently mentioned pain point for hospital visitors (not just ED patients) is the lack of clear signage and confusing wayfinding. Our app will load hospital blueprints into the platform, and using a pathfinding algorithm, draw the most effective path between two locations.

4. Overall Design
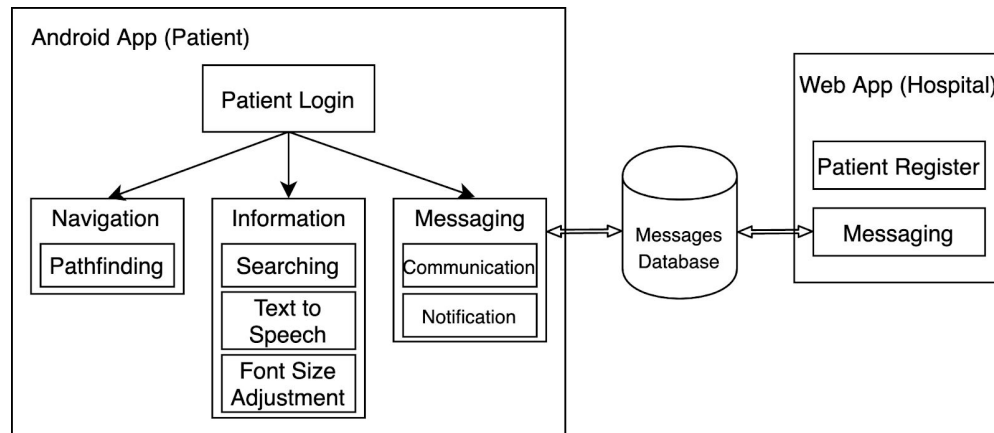
Block Diagram

In the android app, after login, the patient can use the three modules in the app, navigation, information, and message.

- **Navigation** contains a pathfinding submodule, which generates a path from the current location and destination the user provided.

- **Information** contains three submodules: searching, text to speech, and font size adjustment submodules. The searching submodule enables the user to search questions by inputting keywords, the text to speech submodule can read the answer out, and the user can also use the font size adjustment submodule to adjust the font size.

- **Messaging** module contains the communication submodule, which enables the patient to communicate with the doctor, and the notification submodule, which will give the patient notifications when the doctor sends messages if the app is not on the screen.

We also implemented the web app for the emergency department. The web app contains two modules, new patient registration and messaging, enabling the doctor to register a new patient and communicate with patients.

5. Reflection

We learned a lot through the project. Initially, we had too much emphasis on the navigation part. However, based on the feedback from the professor, tas, and peers, we tried to really think from the patients perspective. Then, we changed our focus to the communication part to

provide the patient with directly useful information. So we got the app more useful to the patient.

Besides, we learned the spiral model that really helped us to work efficiently. In each spiral, we came up with, implemented and tested new features. The spiral methods made our project grow quickly.

Also, we may become programmers in the future. As programmers, cooperating with product managers is very important. In this project, we learnt ways to cooperate with our specialist, which will benefit our future career.

6. Contributions

Joseph Choi was the specialist for this project and acted as the domain expert. He provided the initial conceptual framework of the application as well as its priorities. He was involved in feature design, UI/UX design, backend logic design, and quality assurance of the app. He served as the overall project manager for the application and the other course requirements.

Huan Qi was the programmer for this project. He implemented navigation, backend pathfinding algorithm, Android-side communication, keyword searches and UI design & optimization. He also actively communicated with group members and set up meetings.

Tianyi Liu was another programmer for the project. He implemented the user login, information delivery, web-side communication, and notification functions. The backend database was designed and maintained by him. And he also implemented and polished part of the UI of the Android App.

7. Specialist Context

As a practicing emergency physician and a leader in quality improvement and patient safety at the University Health Network, I believe this application has immense potential in improving the patient experience in the ED. As ED patient volumes continue to increase every year, it is imperative that we find innovative ways to serve patients better with dwindling resources. This mobile app and platform can be a cost-effective entry point for many different hospitals to easily create and disseminate information that is specific to their own local context. The low cost and barrier to implementation means that hospitals can redirect precious financial and human resources to other patient care objectives.

As a healthcare quality researcher, this platform can help rapidly iterate and evaluate different communication strategies rapidly and across multiple sites. With the two-way capabilities of the app, patients can anonymously rate and provide feedback on the information provided instantly, rather than having to conduct resource-intensive pre- and post-implementation evaluation studies. Not only is this app directly useful for the patients and providers, but can serve as a valuable research and data collection tool as well.

8. Future Work

We wish to expand the current functionality of each of the core components of the current app, as well as build new features that may be helpful for patients, providers and researchers. We discuss some of these aspects below:

Information

We want to expand the accessibility features of the information platform by providing content in multiple languages to reflect the multicultural composition of Toronto (and elsewhere). As more content is created, we want to create a more robust way for patients to find the information they are seeking. We currently have keyword searches, but want to design a natural language understanding system that can match queries in natural language to entries in the database. We also want to expand the provider-facing platform to allow organizations to easily add and customize content specific to their own institution.

Messaging

We wish to polish the UI/UX of the messaging system to more closely resemble commercially available messaging platforms. We also want to explore integration into electronic health record (HER) systems so patients can potentially receive alerts generated in the EHR (e.g. when lab results return, or imaging reports are posted). This would further give patients a sense of empowerment over their own care.

Navigation

To build a more robust live navigation system, we want to build a wayfinding network throughout the ED (and the hospital) using low-energy Bluetooth beacons. Having live location and navigation, it will give patients more confidence in their ability to find their own way, and can identify when they veer off track.

Permissions

Post video/report/code
Yes to video, yes to report, yes to code.

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