

Waste Management App (Phase II) for the City of Sault Ste Marie

Emma Ude

Supervised by Professor Zamilur Rahman

Algoma University

Department of Computer Science and Mathematics

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I. INTRODUCTION

With the rise of global warming, waste management has become even more crucial. With the evolving times, the City of Sault Ste Marie took it upon themselves to make their Waste Management information more accessible to the general public. In this vein, they partnered together with Algoma University to create a mobile app. This project is a continuation of the Waste Management Project Phase 1 that was implemented in the Spring/Summer semester in 2022. This report details the goals, specific requirements and implementation of the second phase of this project.

II. MAIN GOAL

. In the previous phase of this project, the City had tasked the university with creating a user-friendly application for citizens to use to have easy access to information about the city's waste management system. In this phase of the project, the city tasked us with adding some more features to the app. These features included items such as push notifications, search engines, etc.

III. RATIONALE

Upon hearing about this project, it seemed intriguing. Waste management is a pertinent issue in this city and upon speaking to the city representatives that became even more apparent. Their goal of creating an app to spread awareness about the city's waste management policies seemed like a noble undertaking.

IV. SCOPE

In Phase 2, the city was most concerned with making the app look as app-like as possible. The city had specifically recommended the following features:

- Push Notifications
- Search Engines
- Accessibility Services

In addition to the requirements that the city had asked for, I suggested a few other additions that would also help them achieve their goal for this app. These additions include:

- Splash Screen
- Refresh Controls
- Pop-up Messages

A. Push Notifications

A push notification as defined by the Cambridge dictionary is “a message sent to a smartphone relating to one of its apps, even when it is not running” [7]. This is an important feature of any mobile application. It allows the city to be able to make announcements to the users without making direct updates to the app information. An example of this information would be informing users that the Hazardous Household waste Depot has been closed for the season.

B. Search Engines

Search Engines are important for a multitude of reasons. One major reason is for a accessibility. While discussing with the Waste Management team, it became apparent that a majority of the target demographic was from an older generation. For that reason, one of the major additions was to put a search engine on the Home page. This search engine was supposed to allow the user to navigate through the different pages in the app more efficiently. To move to a new page, the user only has to type in either the title of the page or a keyword that is associated with the page. For example the Contact page can be searched up by typing words like information, contact, phone, email, etc.

A search filter was also added to the Frequently Asked Questions page. This allows the user to search through the questions in the FAQ page. Typing in any word or group of words in a question narrows down the list of questions. That means that only questions containing the phrase in the search filter are displayed.

C. Accessibility Services

The City Landfill is very important since this is where hazardous waste, tires, and metals are processed. Information regarding the hours of operation as well as various landfill locations was provided [1]. For this reason, a text-to-speech feature was added to the app. There is now a button on every page that once clicked, reads out the information on the page.

D. Splash Screen

A splash screen is the first screen a user sees on an app. It introduces the user to the app, and gives them basic information on the app. This usually includes the app's icon, its name, and at times a slogan [6]. I designed a splash screen for this app on Figma. The splash screen has the sault ste marie icon, as well as the title for the app “Waste Management”. It lasts for 2 seconds before the user is taken to the Home Page.

E. Refresh Controls

The app from Phase 1 was static. Meaning that information on the app did not change unless it was closed and then reopened. In this phase, I added the ability for the user to refresh the app and reload information without closing it. This allows for information such as links to certain websites to be reloaded if any changes are made.

F. Pop-Up Messages

When discussing with the Waste Management team, it was decided that pop-up messages should be added to the app. These messages would pop up on the Home page when the app is initially opened. For now the information includes a title “Did You Know?” and the messages are

answers to Frequently Asked Questions. The message that is displayed is chosen randomly whenever the app is opened. Once the message is closed, the user cannot reopen it until the app is restarted.

V. TIME TABLE

WEEK	GOAL	DESCRIPTION
Week 1	Introduction	Introduction to project and work done in Phase I
Week 2-4	Knowledge	Learning React Native and Expo to work on the App
Week 5	Meeting	First Meeting with the city representatives to hear what their expectations were
Week 6-7	Prototyping	Create prototypes and wireframes of application features
Week 8-11	Implementation	Implementation of requirements
Week 11	Final Feedback	Receive final feedback from city representatives and make changes accordingly
Week 12	Report and Presentation	Write report and present finished product

VI. LANGUAGES AND LIBRARIES

In the previous iteration of this application, Phase 1, it was decided that it would be best to implement this app using React Native. One of the major requirements that needed to be fulfilled in the previous iteration was that the app needed to be cross platform. That means it needed to be designed in such a way that it would work on both iOS and Android mobile devices. For this purpose, it was decided that React Native would be the best tool.

A. *React Native*

React Native is an open-source framework that allows for cross platform development of an app. It contains various resources such as built-in components and libraries that can be used in mobile app development. It allows a developer to render an application in the natural operating system of an iOS or Android device, without having to write the code for each operating system separately. It is similar to React which is a JavaScript library. However, unlike React Native, React is used for web-based applications and is mainly used for front-end web development (Coursera).

1) *Advantages:*

There are other cross-platform frameworks, but React Native stands out. Some of these advantages include;

- React Native runs your application on a separate UI thread, which increases performance.
- Unlike some cross-platform frameworks, React Native actually transforms the codebase into native UI elements. Thereby using the existing rendering capabilities of the operating system.
- There are strong developer tools and detailed error messages in React Native, making it easier to use for developers [5].

2) *Disadvantages:*

While React Native is a great framework, it also has its disadvantages. A major disadvantage would be that the framework is still quite young, having been created in the year 2015. For this reason, some libraries may still have bugs in them and certain iOS and Android features may not be supported by React Native. However, the framework continues to grow and evolve with each new version [5].

B. Expo

Expo is a group of tools built around React Native that allows developers to build and start their applications faster. It is used in the creation, testing and distribution of React Native applications. There are various tools in Expo such as Expo Go, Expo SDK, and Expo CLI [4].

Expo Go is an application that can be downloaded on any mobile device and allows the developers to instantly test their React Native app on their mobile devices. It is this Expo Go application that is currently being used to test and run this app on mobile devices.

Expo SDK is a group of React Native modules that can run on iOS or Android systems. it includes packages and libraries that are available in bare React Native applications.

Expo CLI is a useful command line tool that allows for React Native applications to be built, tested and published using command prompt.

C. Libraries

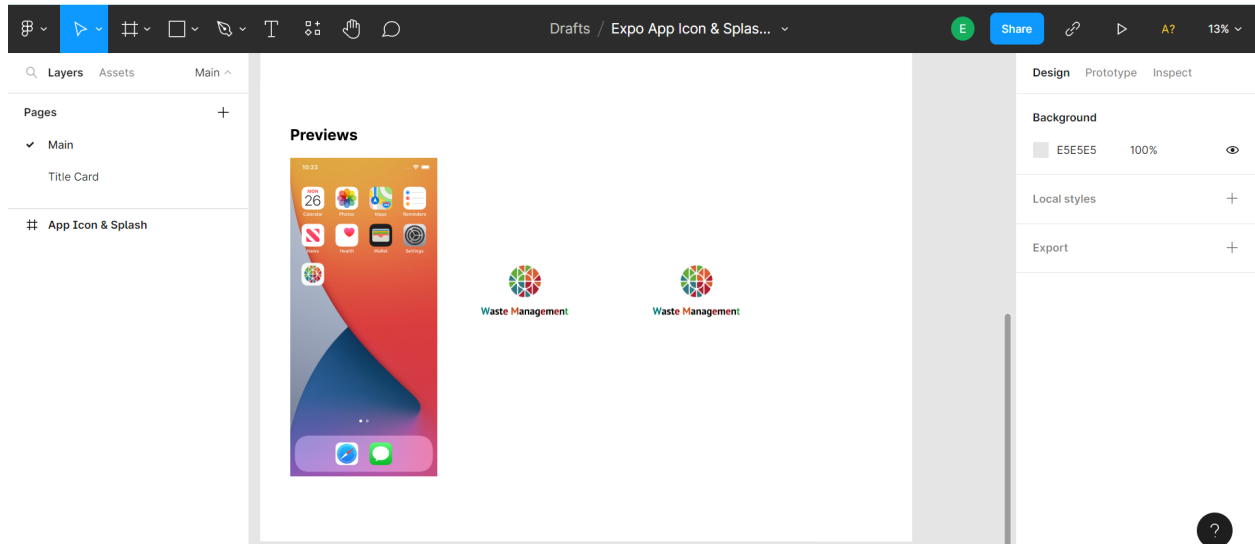
Most of the React Native or Expo modules are maintained by their respective teams. However, because React Native is open-sourced, there are some modules created by developers. While creating this application, I used mostly React Native and Expo's modules as they had fewer bugs. The bugs in the developer modules caused some issues during the implementation process of this application.

VII. DESIGN LAYOUT

The app was designed using the Tab Bar pattern. With the Tab Bar pattern, in the lower tab, top-level navigation options are given their own icons (Home, Schedule, Recycle, Garbage) while other pages are put in the More section. To add the Splash Screen, Figma was used to first prototype a design to use. Other features such as the pop-up message and the search screen were prototyped in Marvel.

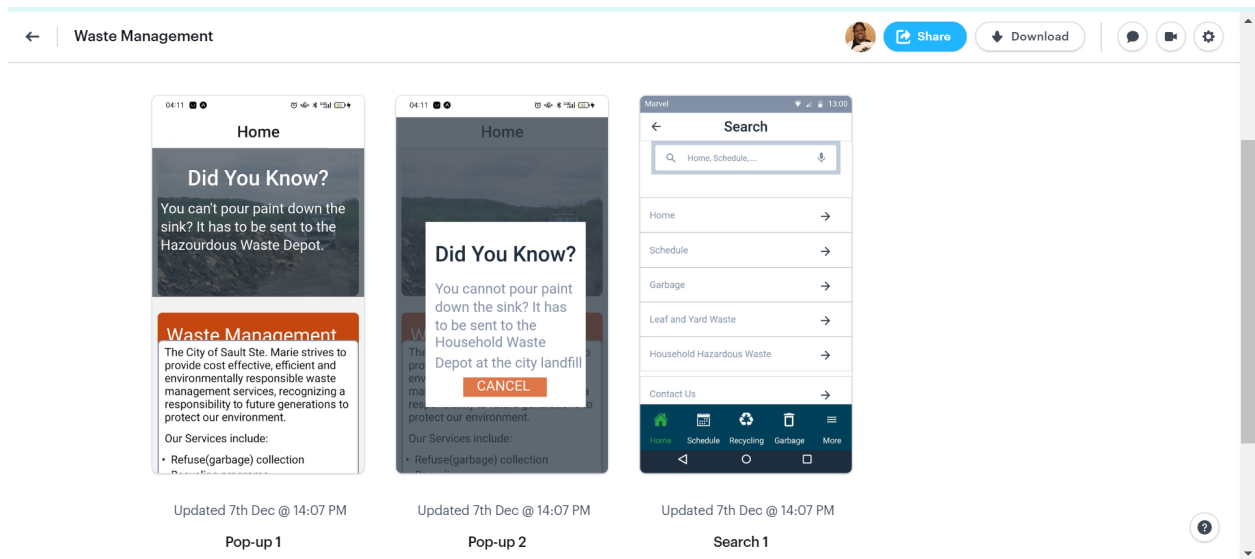
A. Figma App

This is a design tool that is used to design app icons, splash screens and other graphical elements in an app. The Figma app was used to create a splash screen for the app.



B. Marvel App

This is a rapid prototyping tool that allows users to test and prototype an app before the implementation stage. This prototyping process includes features such as wireframes and design of the various components. It can be used to create prototypes for platforms such as Windows, Linux, Android, and IOS.



VIII. INSTALLATION

This section will focus on the installation process for React Native and Expo CLI as well as how it run for testing purposes;

A. Environment Setup:

Install Visual Studio Code: <https://code.visualstudio.com/download>

Install Node 18 LTS or greater: <https://nodejs.dev/download>

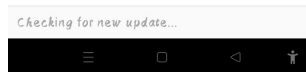
Through the Visual Studio Code terminal, install the Expo CLI using: `npm install -g expo-cli`

B. Running on a device(iOS or Android):

1. Start up Visual Studio Code, then start up the terminal
2. Navigate to the project directory in the Visual Studio Code terminal
3. Run “npm install” to install the node modules locally into the project directory
4. Run “expo start” to run the React Native application.
5. For physical devices, install the Expo GO app on your iOS or android device.
6. On Android, use the Expo app to scan the QR code.
7. On iOS use the Camera App to scan the QR code, this will then redirect you back to the Expo GO app.
8. For virtual devices, first download the required software to run the emulator, Android Studios for android emulator and XCode for iOS emulator (NOTE: XCode can only be downloaded on a Macbook).
[Android Studio Download Link](#)
[XCode Download Link](#)
9. Start up the emulator in its respective software
10. Ensure that steps 1-3 have been completed.
11. Run “expo start –android” or “expo start –ios”

After following these steps, the following code you should see the following splash screen on your device

22:00 2G 3G 4G 5G • 100% 100% 100%



IX. IMPLEMENTATION

During the development process, weekly meetings were scheduled with the Waste Management team, where changes were discussed and feedback was given. This helped me make more informed decisions during the entire process.

The implementation process ran smoothly with only a few hiccups. One major issue I encountered was implementing the Push Notifications. I tried various techniques to create them.

Firstly, I downloaded the library “react-native-push-notifications”. Then I wrote the code to allow me to send push notifications to the user. I tried to have everything written locally into the app. When I ran the code, it gave me a Null Pointer Error, specifically that I was calling a null object. I could not figure out how to solve this error.

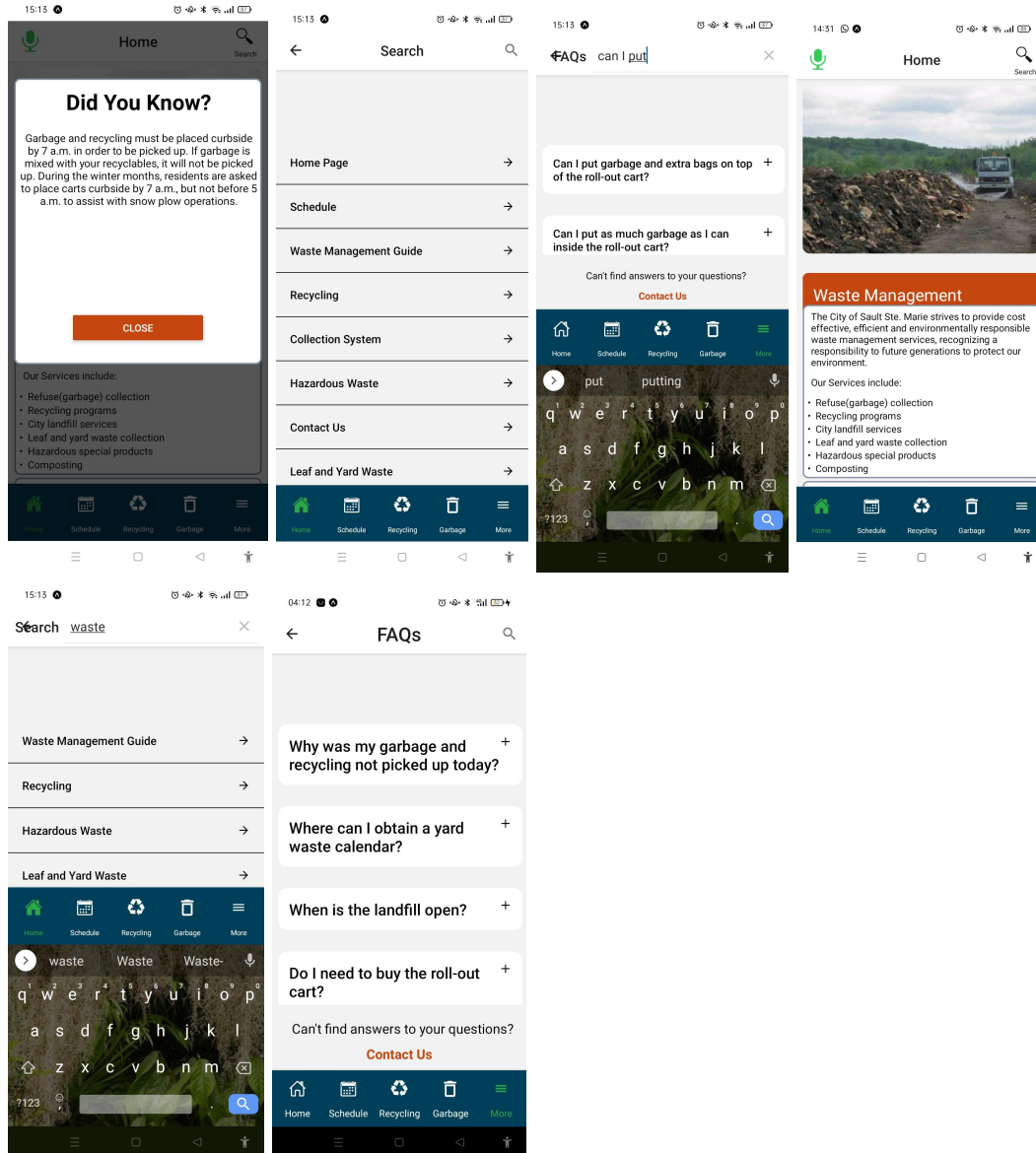
The second thing I tried was to not write the code to run push notifications locally. Instead I would use the “react-native-push-notifications” library to connect the app to Firebase. Firebase is a Google run database that allows app developers to store information that is collected from app users. It can also be used to send push notifications. When I first ran the program, it worked. However, other iterations after the first one were producing errors.

In the end, I discovered that the issue was the “react-native-push-notifications” library. I discovered that this library was not made and maintained by Expo and it contained a lot of errors. I then discovered Expo’s push notification library, “expo-notifications”. Using this library, I was able to successfully implement push notifications. This involved creating a method that would first request permission from the user to send them push notifications. Once the user’s permission is received, their Push Token is saved. A Push Token is a unique identifier for each device that has the app on it. Once received, this token is used to register the device to receive

push notifications in the future. This method is asynchronous, so that it is constantly on standby for notifications. Once a notification is received, it is then displayed in the notifications bar of the device.

X. RESULTS

Below are some images of the mobile app:



XI. CONCLUSION

I did my best to meet the requirements of this Phase. However, this is not the end for the app. The next phase will possibly include connecting the app to the server and databases for the

Waste Management Team. This will allow the Waste Management team to save useful information about the users. It will also allow them to send push notifications to multiple users at once. The app will also have to be beta-tested before being released into the public. The project, in its current form, has been uploaded for private access by the Waste Management team and stakeholders. Their feedback on this phase, will be included in future iterations of the app

XII. REFERENCES

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- [7] “Push notification.” Cambridge Dictionary. Accessed: December 5, 2022. [Online]. Available: <https://dictionary.cambridge.org/dictionary/english/push-notification>
- [8] “Push notifications explained.” Airship. Accessed: December 5, 2022. [Online]. Available: <https://www.airship.com/resources/explainer/push-notifications-explained/>

XIII. APPENDICES

For the appendix, I will be including the QR code to access the app, as well instructions to download the Expo GO app.

Step 1: Install Expo Go app from the Play store or Apple store. Note: For iOS devices you'll need to create an account in the Expo Go App

[iOS Download link](#)

[Android Download link](#)

Step 2: After installing Expo Go on your phone the next step is to do either one of the following:

- Scan the QR code (for iOS, use your camera app)



- OR, open this link on your Device

`exp://exp.host/@cosc4086/WasteManagementProject?release-channel=default`

After following the step above you should be able to see the splash screen of the App.