Technology Review Document
Capstone Project

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Abstract

our new abstract should here XXXXXXXXXXXXX

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Contents

1 Introduction

1.1 Team number and project name

We are group #43, and project name is Santiam Wagon Trail Mobile App.

1.2 Team members and role in the project

Jiawei Liu: The role as a UI designer which work on iOS UI, Web Control Panel UI, and Remote API Interactions.
Charles Henninger: xxxxxxxx
Duncan Millard: xxxxxx

1.3 What you are trying to accomplish ???

I (jiawei) talked about this in my pieces, so deleted it if we don't need it.

2 Jiawei Liu's Section

2.1 iOS UI

Since the project required to design a mobile app on iOS platform. Therefore, the usability is an important part of the project. In iOS user interface design section, the problems are designing and implementing the UI for selecting content packages, downloading and removing them, as well as basics for tour layout. For solving these problems, there are three technologies are effectual, which are mobile web pages, Xcode and OpenGL ES.

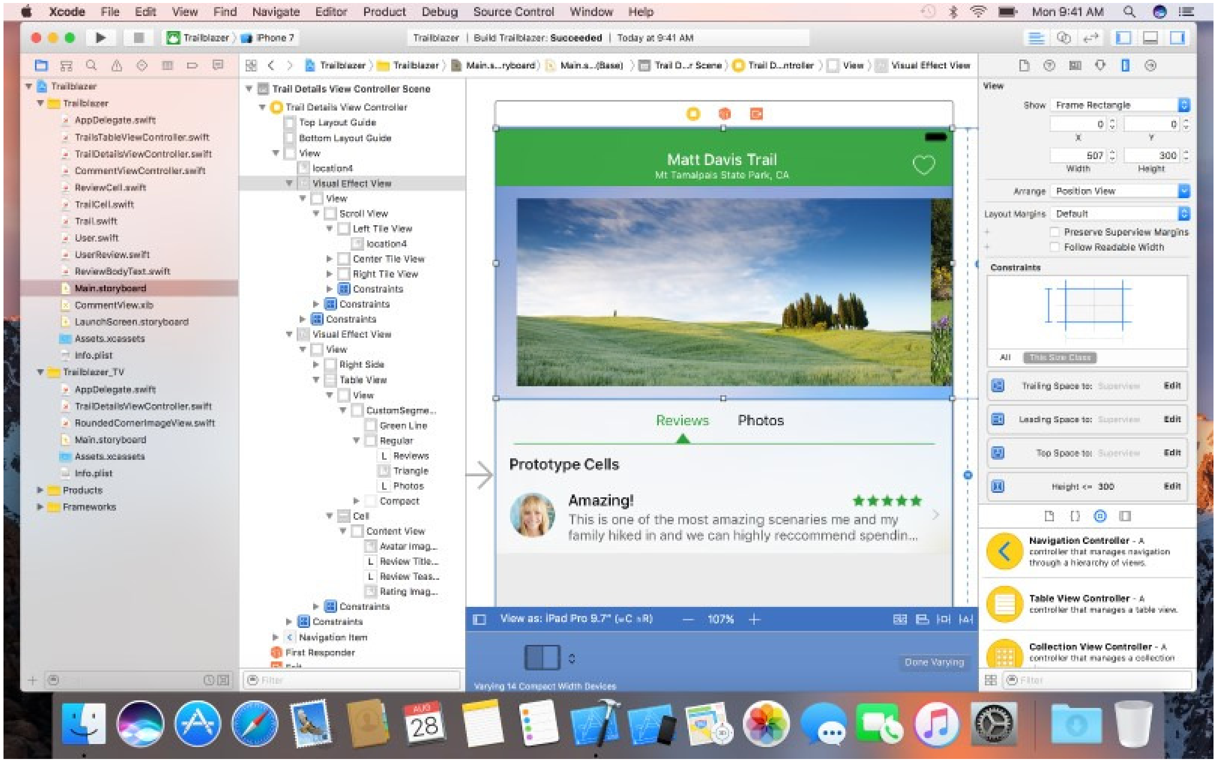
Solution A: Mobile Web Page
A web page is a page that displays on web browsers via an internet connection. The mobile web page is a kind of webpage that optimized for mobile devices such as smart phones and tablets. The purpose of using a mobile web page is displayed the map on screen, allow user select and download content packages and provide the tour information.

A high-caliber mobile web page relies on various technologies such as HTML, Cascading Style Sheets (CSS), JavaScript and PHP. In general, HTML is the standard markup language employed to create web pages and its elements form the building blocks of all websites [1]. HTML can only serve as a basic web page. CSS and JavaScript are the necessary technologies for beautify and add more functions in the web page. If the web page uses database to hold website data, PHP is an efficient technology to connect and modify the database.

Nowadays, our life is flooded with web pages. For example, Facebook, one of the most popular social website; Google Maps, a popular map website; YouTube, a famous video website. These websites are make-up of HTML, CSS, JavaScript and PHP. In addition, most websites also provide mobile version web page to bring better user experience with mobile devices.

Solution B: Using Xcode with Swift
Xcode is an integrated development environment (IDE) that developed by Apple. Developers can use Xcode to develop both iOS and macOS applications. The purpose of using Xcode is designing and implementing the UI by a tool or a IDE, Due to the high integration of Xcode, this can bring some convenient and save our time to build the development environment.

For using Xcode with swift, it is necessary in order to get acquainted with Xcode. As Figure 1 show, Xcode has the object library on the right side, and allow developers to drag an object from the library to the application. There are not that many techniques in the UI design section, it basically selects the object from the library and drags it to the design area. It is simple and visible.



This is one of the most amazing scenaries me and my family hiked in and we can highly reccommend spendin...

Navigation Controller - A controller that manages navigation through a hierarchy of views.

Table View Controller - A controller that manages a table view.

Collection View Controller - A controller that manages a collection

Figure 1: Xcode Interface [6]

Xcode is the official IDE for developing iOS application, and is offered for free. Therefore, most iOS applications are developed by Xcode. For example, Safari, eBay, Expedia, etc.

Solution C: OpenGL ES
OpenGL ES is a royalty-free, cross-platform API for full-function 2D and 3D graphics on embedded systems - including consoles, phones, appliances and vehicles [2]. Therefore, OpenGL ES is the third option to design the UI for provide tour information, view the map and interact with content packages.

OpenGL is the core technology used for 2D and 3D graph. OpenGL ES is a simplified version of OpenGL that eliminates redundant functionality to provide a library that is both easier to learn and easier to implement in mobile graphics hardware [3]. Therefore, OpenGL ES is an efficient development tool to design iOS application UI.

Most of iOS games are developed by OpenGL. For example, Flappy Brid can be developed by OpenGL ES easily. In addition, currently most iOS games are developed by OpenGL ES.

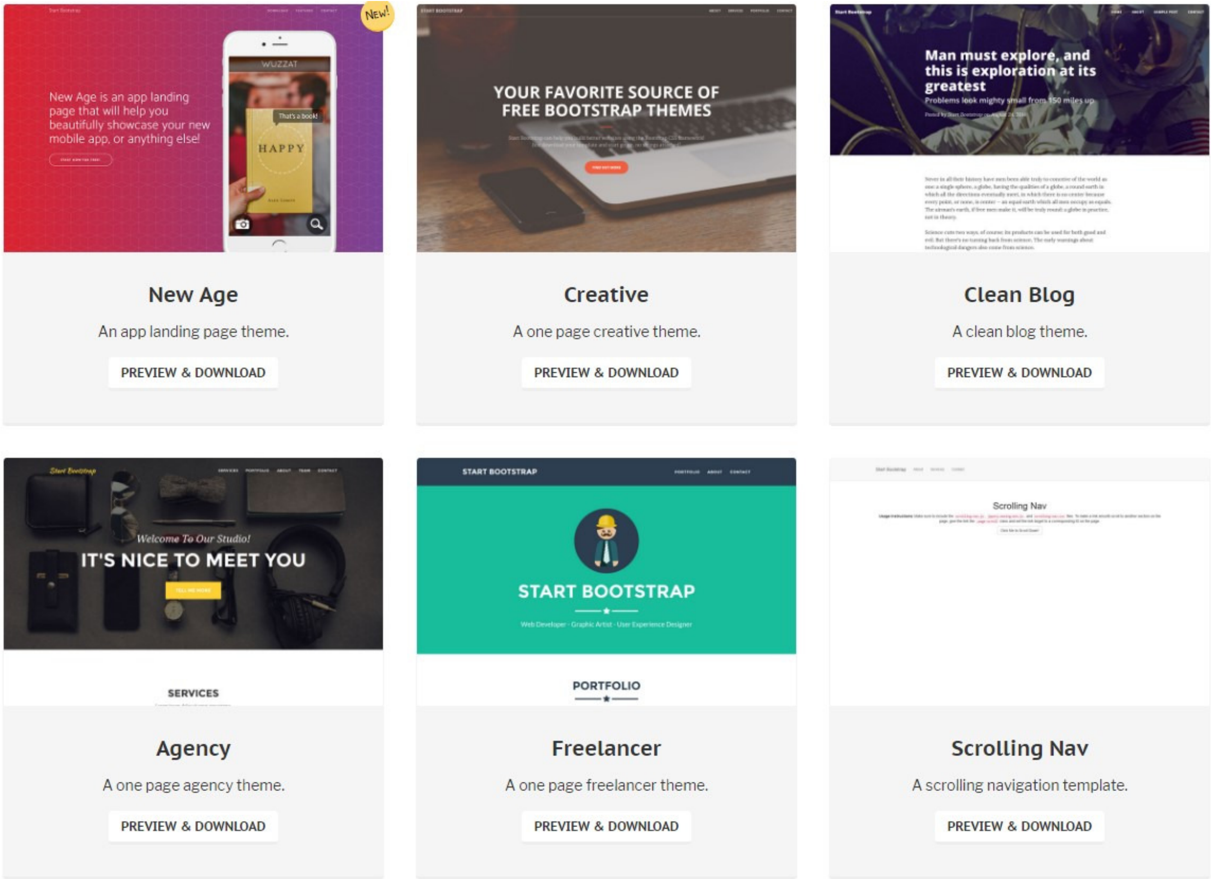
In conclusion, we are planning on going with our second solution, Xcode. Because we are going to write an iOS application, not a 2D or 3D game. Therefore, OpenGL is not the best solution for us. Our application also requires to use without an internet connection. Hence, the mobile web page is not fit in this situation. Xcode is the official IDE that provided by Apple. It includes a suite of development tools for iOS, macOS, WatchOS and tvOS. Due to high integration of Xcode, developer can develop software with minimal troubles. Even Xcode is offered for free, it only available on macOS. Two of our team members are using windows laptops. Thus, they need to set the virtual machine to access Xcode.

2.2 Web Control Panel UI

What has to be accomplished in this part of the solution is designing and implementing the tour creation. We need to design a website to allow administrators such as our client, Nancy to setup for map frame, click to add waypoints, click waypoints to add texts and videos. In order to control resource on the web, we need to design a dynamic website with a clear UI. Therefore, there are multiple methods that we can use for creating web control panel UI.

Solution A: Bootstrap
Bootstrap is the most popular HTML, CSS, and JavaScript framework for developing responsive, mobile-first web sites [4]. In addition, Bootstrap is offered for free. Everybody can download and use it. The purpose of using Bootstrap is creating a dynamic website as the web control panel for our client to control online texts and videos resources.

In general, syntax of Bootstrap is similar with HTML, which mentioned on "Mobile Web Page" section. However, Bootstrap is more powerful than HTML because it provided more functions such as preprocessors and universal framework. In addition, as Figure 2 shows, there are abundant themes available for free. We can apply these themes to create the website with an aesthetically pleasing UI.


New!
New Age is an app landing page that will help you beautifully showcase your new mobile app, or anything else!
WUZZAT
That's a book!
HAPPY
YOUR FAVORITE SOURCE OF FREE BOOTSTRAP THEMES
Man must explore, and this is exploration at its greatest
Problems look mighty small from 150 miles up
Welcome To Our Studio!
IT'S NICE TO MEET YOU
SERVICES
START BOOTSTRAP
Web Developer - Graphic Artist - User Experience Designer
PORTFOLIO
Scrolling Nav

New Age

An app landing page theme.

PREVIEW & DOWNLOAD

Creative

A one page creative theme.

PREVIEW & DOWNLOAD

Clean Blog

A clean blog theme.

PREVIEW & DOWNLOAD

Agency

A one page agency theme.

PREVIEW & DOWNLOAD

Freelancer

A one page freelancer theme.

PREVIEW & DOWNLOAD

Scrolling Nav

A scrolling navigation template.

PREVIEW & DOWNLOAD

Figure 2: Free Bootstrap Templates [7]

As the most popular framework for developing websites, there are a number of websites are using Bootstrap, such as NBA.com, Walmart, gliffy, etc.

Solution B: JavaScript
JavaScript is the programming language of HTML, and can be considered as a functional extension of HTML. JavaScript's syntax is obvious and easy to learn. JavaScript can modify the web page's layout such as HTML content, attributes and CSS. JavaScript's functions are based on HTML and CSS, but JavaScript is a separate and high-level programming language. JavaScript also provided two useful features, which are AJAX and JSON. Both of them are helpful for our project. JavaScript is popular. There are some websites are using JavaScript: MapsTD, The Local Palette, tota11y, etc.

Solution C: jQuery
jQuery is a library of JavaScript. The purpose of using jQuery is it easy to learn and apply in the web page.

The jQuery library contains these features, which are HTML/DOM manipulation, CSS manipulation, HTML event methods, Effects and animations, AJAX and Utilities [5]. With jQuery, developers can write less code to achieve the same goal on web pages.

Since jQuery is a JavaScript library and has many features of HTML, it based on JavaScript, HTML and CSS. We can consider jQuery as a highly integrated development tool to simplify web development process.

jQuery is a necessary technology for developing dynamic web pages. Therefore, a lot of famous websites used jQuery, such as Google Maps, Google Doc, Netflix, etc.

In conclusion, our group is going to use both Bootstrap and jQuery due to design a high-quality dynamic website as the web control panel. JavaScript is a satisfactory technology. However, Bootstrap presents a wide range of convenient because of the highly-integration and better visual effect. jQuery simplifies JavaScript programming greatly. Therefore, we choose to utilize both Bootstrap and jQuery to design our web control panel.

2.3 Remote API Interactions

In this section, we are going to provide a solution that allows users download content packages to their iOS devices. Users also permit to see all available content packages and select the package that they wish to download. After users choose the package, the application start to download the package by making an API call to the web server. To achieve this goal, we have three technologies available, which are WKWebView, NSURLConnection and download from a phone browser.

Solution A: WKWebView
WKWebView is a class of iOS to interactive web content, such as for an in-app browser [8]. The purpose of using WKWebView object in our application is interactive with our server and load content package list for users. There is a symbol in WKWebView called loading content. With this symbol, we are able to set the webpage contents and base URL for users, then the user can select and download the package. Here is an example about creating a WKWebView programmatically [8].

```
import UIKit
import WebKit
class ViewController: UIViewController, WKUIDelegate {

    var webView: WKWebView!

    override func loadView() {
        let webConfiguration = WKWebViewConfiguration()
        webView = WKWebView(frame: .zero, configuration: webConfiguration)
        webView.uiDelegate = self
        view = webView
    }
    override func viewDidLoad() {
        super.viewDidLoad()

        let myURL = URL(string: "https://www.apple.com")
        let myRequest = URLRequest(url: myURL!)
        webView.load(myRequest)
    }}
```

WKWebView was starting at iOS 8. It is based on iOS operating system. Besides, most iOS web browsers and in-app browsers are using WKWebView. For example, Safari and Twitter's in-app browser. WKWebView is popular and necessary for iOS development.

Solution B: NSURLConnection
NSURLConnection is similar with WKWebView. It is also a class iOS. A NSURLConnection object lets you load

the contents of a URL by providing a URL request object [9]. Therefore, the purpose of using NSURLConnection is loading content packages from the web server by a URL request.

As a class of iOS, it is built on iOS operating system, and has it own syntax. Most iOS applications are using NSURLConnection to connect to server and load packages. For example, some huge iOS games are required download data packages to the device. These games used NSURLConnection technology. And then, this situation is analogous with downloading content packages to iOS devices.

Solution C: download from phone browser
Since we have a web control panel for administrators, we can create a web page for users, and users can use phone browser such as Safari to view and download to phone storage. The purpose of using download from browsers is it is easy to implement and understand how this process works.

Downloading directly is popular in Windows and Android. For example, users download a mp3 file from the internet, and use music software to play this mp3 file. This process can also be implemented in iOS. Downloading directly is relying on many internet technologies such as Http, ftp, web pages, etc.

In conclusion, we are going to use NSURLConnection technics to download content packages from the web server. For display and select the available content packages, we will use WKWebView to display the available package data from our server. The reason that we don't choose downloading directly is iOS has strict limitation on file operating. In addition, there is not any file explorer on iOS. This will bring a lot of trouble for users. Therefore, we choose the native iOS API, WKWebView and NSURLConnection to accomplish our project.

3 Charles Henninger's Section

3.1 Map Rendering

What needs to be accomplished in this part of the solution is making a map visible and capable of interaction with the user. We will need to display a relevant map of the tour area, capable of zooming, refocusing on the location of the user, and displaying waypoints on the map that contain relevant information about the area, including videos and text files. In order to get quality offline map tiles that we can use in our application, we have decided to use libraries connected to OpenStreetMaps, a project that provides free geographic data for use in rendering maps. OpenStreetMaps has many libraries that may provide us the means to render maps offline.

While there are many libraries that use OpenStreetMap data, we will only be using one. The first option is a library called LibosmScout. LibosmScout is a simple client side library commonly used in smaller applications that need to render map tiles using OpenStreetMaps data offline. LibosmScout offers offline rendering of map tiles in a simple and easy to use library, as well as some minor features for drawing and editing a map offline, which could be valuable for this projec. LibosmScout is compatible with both IOS and Android platforms, and is written in C++ and Java. LibosmScout is a relatively new library, written under an LGPL license and maintained by a single developer. LibosmScout's codebase is often changed and updated, which brings into question it's reliability in the long term. LibosmScout seems to meet the bare minimum for what we need to do in rendering an offline map that the user can interact with, but it's volatile codebase might make it too unreliable to use in our solution.

Our second option is a suite of open-source libraries made by Mapbox used for rendering and navigating maps based on OpenStreetMap's data. Using the SDK libraries provided in the Mapbox GL suite for both Android and IOS, we will easily be able to render maps offline at a commercial quality level. These libraries have a target language of Java for the Android SDK and Swift for the IOS SDK. Mapbox GL has a well maintained codebase that seems stable and professional, and is offered for free.

The last option that we researched was a rendering service called Cartotype. This service is a high quality rendering service that works with online or local map tiles. The functionality is very similar to the Mapbox suite of libraries, although at a slightly higher quality. Cartotype is under a proprietary license, and will cost an undisclosed amount to use.

At this point in time, we are planning on going with our second option, Mapbox GL, for implementation on both the IOS and Android platform. Due to the volatility of LibosmScout's codebase, and the cost that would be required to use Cartotype, neither are considered to be a viable option for this solution. Mapbox GL is a free service that offers high quality rendering and mapping features offline, and brings with it many useful extra features such as custom waypoint and path editing.

3.2 Android UI

This piece of our solution will be the UI of the mobile app on the Android platform. We plan to conform to the Android UI guidelines for the layout of most of the UI. The technology we could use here, i.e. the main language used to create the UI, ranges from XML to SDL or Java. SDL, while great for animations and high end graphical features, is too complicated compared to the other two options, especially because it wouldn't help us all that much. Using Java for the UI would be slower, and would only benefit us if we needed tight control of the UI, which we don't.

The decision to use XML for our UI on our Android platform didn't take much thought. XML is simpler, cleaner, and faster than other options like Java or SDL.

3.3 Remote API Interactions

This piece of our solution involves how we will download our content package files from our server onto the mobile device. Users will view available content packs in app and select which content packs that they want to download. Once a user confirms a download, the mobile app will make an API call to our web server and begin downloading the file. There are multiple methods that we can use to initiate and facilitate the download, both native and non-native to the Android platform.

Our first option, Retrofit, is a networking library that can facilitate downloading files from an online source. Retrofit is very easy to implement, and is faster than any of the other options that we looked at for this piece of our solution. Retrofit uses standard methods, which is why it is so easy to work with, but doesn't have the capability for custom methods of caching and retrying. Unfortunately, Retrofit is geared towards smaller files than we will be working with for this application.

Our next option, Volley, is very similar to Retrofit. Volley is another networking library used to facilitate downloading files on an android platform, and offers much more customizability in how it handles caching and retries compared to Retrofit. While slightly slower, Volley could potentially give us more control in the downloading process. Like Retrofit, Volley is meant for slightly smaller files than we will be downloading in this app.

Our last option is the native networking method for Android, the DownloadManager service. This service comes with many build in features, such as notifications for completed downloads, that would have to be manually added with Volley and Retrofit. DownloadManager is meant for larger files that require long running downloads. While Volley and Retrofit do provide more control over the downloading process compared to DownloadManager, more control simply isn't necessary for this application.

Implementing our application with either Volley or Retrofit would require more work and troubleshooting compared to using DownloadManager, and wouldn't provide us any extra functionality for the app. For this reason, DownloadManager will be the service that we use for downloading files on the Android platform.

4 Duncan Millard's Section

4.1 Server Configuration

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4.2 File Integrity Verification

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4.3 API and Database Design

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