

# SMART ITINERARY TOURISM APPLICATION



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## Abstract

This project was focused on designing a mobile tourism application, tailored to Armenia that will help develop and mature Armenia's tourism market. Even though tourism is a large and important part of the Armenian economy, the tourism infrastructure in Armenia is not as robust as other more mature tourist locations around the world. By bolstering interest in and access to Armenia and developing its tourism industry, we hoped to empower a developing country.

This project was sponsored by the Armenian General Benevolent Union (AGBU) whose mission is to uphold Armenian heritage by educating through cultural and humanitarian programs. While working locally with the AGBU on this project, we were able to support the growth of tourism in Armenia, while also protecting Armenian citizen's wants, their community, and their community's future.

During our seven weeks in Armenia, we were able to discover local tourism in Yerevan along with rural tourism in different marzer, or provinces, ranging from Aragatsotn to Gegharkunik to Ararat. From our on-site research, we were able to gather information such as discovering the technology and information that is easily accessible about specific Armenian tourist locations, along with what potential users of the Smart Itinerary app would want to be included our application. Smart Itinerary stands out from other tourist applications due to its vast collection of Armenia-specific information along with its ability to provide personal recommendations and automatically build an itinerary for the user's stay in Armenia.

Overall, we believe we have designed a tourism application that will help make Armenia a more accessible tourist location, along with putting the country on the map as a popular tourist site, and cannot wait to see the success that the Smart Itinerary Tourism Application will bring to Armenia the upcoming years.

An Interactive Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science



**WPI**



## Empowering Armenia: Growth Through Tourism

Tourism accounted for 15.7% of Armenia's Gross Domestic Product (GDP) in 2017 and has increased by 37.9% over the last 4 years<sup>1</sup>. Even though tourism is a large and important part of the Armenian economy, the tourism infrastructure in Armenia is not as robust as other more mature tourist locations around the world. This project focused on designing a mobile tourism app, tailored to Armenia, which supports the Armenian tourism segment, by addressing many of the issues associated with the immature tourism infrastructure as described by the World Trade Organization<sup>1</sup>.

By bolstering interest in and access to Armenia and developing its tourism industry, we hoped to empower a developing country. In order to complete this task, we focused on the importance of tourism, the current state of Armenian tourism today, how it could be improved in the future, and what software applications could be used to help advance Armenian tourism. We used the information previously mentioned along with data collected by means of surveys in order to create the most effective tourism itinerary application design.

To inform and document the design, we accomplished the following objectives:

- I. Determined relevant Armenian tourist information
- II. Selected initial target audience
- III. Determined features and content that would be most helpful for tourists
- IV. Identified underlying technology platform and estimated budget
- V. Created a use case diagram and logic tree to model application flow



From left to right: O. Jay, B. Snyder, H. Hayrapetyan, H. Ornstein, R. Wirkala

We developed a roadmap, design, example flow and implementation plan to leverage smartphone technology to provide the most immersive experience for travelers and tourists visiting Armenia. There are many tourist applications currently on the market, but none that are specialized towards Armenia that can also provide the features that our app includes. There is a significant shortcoming between the rapidly growing tourism industry in Armenia and the availability of destination and tourist specific resources. Therefore, there is a clearly defined market and several viable use cases for a mobile platform to provide an immersive and tailored tourism experience to people visiting Armenia. By developing a platform to handle site selection, itineraries, and content management, this application can provide a viable solution for the modern tourist and showcase all the wonder-

ful attractions Armenia has to offer. In doing so, the Smart Itinerary Tourism Application team hopes to make Armenia a more accessible travel destination and consequently help the development of the Armenian tourism industry.

This project was sponsored by Ms. Hasmik Hayrapetyan with the Armenian General Benevolent Union (AGBU) whose mission is to uphold Armenian heritage by educating through cultural and humanitarian programs. This project aligned with their goals by providing the resources for people to visit and learn more about Armenia. While working locally with the AGBU on this project, we were able to support the growth of tourism in Armenia, while also protecting Armenian citizens' wants, their community, and their community's future.

## Tourism's Global and Local Impact

The tourism industry is ever changing and continuing to grow. Tourism cultivates economic growth, creates local jobs, supports local culture, and encourages more sustainable patterns of consumption and production. As the number of travelers grows, so does the need for the local community to keep up with the economic and regional ground traffic brought to their community. Additionally, as the rate of tourism continues to grow, so will the economic impact that tourism has on the world. According to The World Travel and Tourism Council, the tourism industry accounted for “10% of the total worldwide GDP and employed 230 million people”<sup>2</sup>. In order for a tourist to visit a travel location, they need a place to stay and a place to eat. Where there are many tourists, there are hotels and restaurants, and in order for a place of lodging to exist, they must be designed, constructed, and filled with employees. No matter what reason a tourist is travelling or where they are visiting, their expenses for their wants and needs throughout their trip help to grow both the local and global economy.

There are twenty main countries in which tourism takes place, known as the twenty rich countries, which includes seventeen within Europe, the United States, Canada, and Japan “that in 1995 accounted for 81.8 percent of all tourist expenditure”<sup>3</sup>. For many countries that are not included in these twenty rich countries, specifically in developing countries, tourism is one of the most important sources of income. “As a new nation or region is initially incorporated into the global ‘patchwork-quilt’ of tourism destinations, the emergent industry is characterized by relatively high levels of local involvement”<sup>3</sup>. When the local community participates in their nation’s tourism industry, it allows them to control their involvement along with the manner in which their local quality of life is maintained.

**By 2027, international tourist arrivals are forecast to exceed 2 billion travelers worldwide, generating over 2 trillion USD in expenditures.<sup>2</sup>**

## Experience Through Travel

The reasons why people travel can be divided into three different categories: personal, business, and leisure. “In 2015, more than half of international tourist arrivals were motivated by holidays, recreation and leisure-related travel”<sup>4</sup>. A personal trip can be anything related to visiting relatives or friends, going somewhere for health treatments, or traveling for religious purposes. Because business travel applies to many jobs and careers, it makes up a large portion of the tourism market. The last type of travel is leisure travel, which can be defined as “travel in which the primary motivation is to take a vacation from everyday life”<sup>5</sup>. Going on a trip is a great way to learn something different, do something you can’t normally do at home, and gain knowledge and experience, which many people find to be thrilling. The components of leisure travel previously mentioned was the focus of this project.



## Armenia's Tourism Industry: An Opportunity for Growth

Armenia is known to have rich cultural resources and beautiful landscapes, however, “only a small proportion of the global population have heard of Armenia, know where it is located or have an image of what the country has to offer”<sup>6</sup>. Additionally, there are not many well-developed tourist destinations within Armenia. Yerevan,

Armenia’s capital, is the only location which is developed enough to sustain tourism, with its city-like infrastructure, operas, theaters, and cultural attractions. Armenia has tried to develop different tourism sectors that were not emphasized until the last few years. For example, Armenia could capture many tourists with its wine market. Armenia is known to have one of the earliest vineyards and to have started grape cultivation<sup>6</sup>. Developing wine tourism could add to the growth of both the tourism and wine industries of Armenia, leading to the country’s economic growth.

In July of 2015, the United States Agency for International Development (USAID) launched a five-year partnership with Armenia in hopes to promote growth in Armenia’s rural communities by developing its tourism industry, conserving its cultural heritage, and producing more employment opportunities for Armenians to work in their communities<sup>7</sup>. In this cultural heritage program, the USAID created informational signs to be placed at Armenian tourist locations like monasteries and monuments throughout the entire country. Although these signs were recently placed, upon visits to the sites, our team has discovered that many of these signs are no longer existent, and if they are, they are in poor condition.

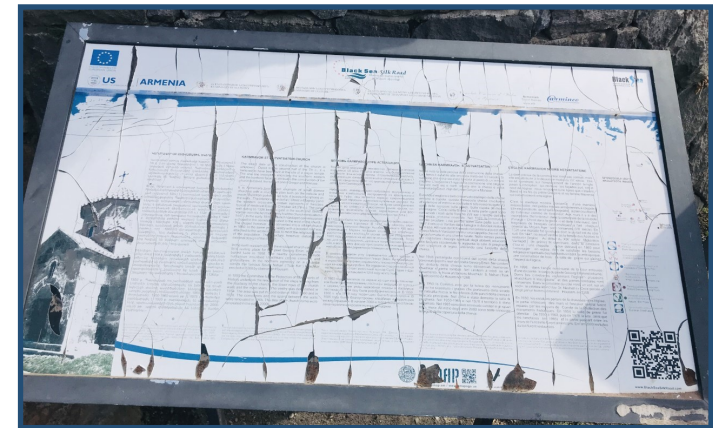


Figure 1: USAID Signage in disrepair at Karmavor Church



Currently, for someone looking to travel to Armenia, much of the tourism information can be found on the AGBU website. Here, one can find information on exploring Armenia, youth trips, summer internship programs, and much more. More travel information can be found on well-known tourism websites as well, such as Hotwire, TripAdvisor, and Kayak. That being said, there is not one singular place where one can find hotel information, tourist attractions, and education on Armenian history. Additionally, tourism information is typically found via concierge services. The goal of the concierge is to provide information and recommendations on restaurants, tourist locations, porter service, and any other things associated with tourism. This information, however, is typically only found at high-end hotels and travelers cannot use this information in advance for planning. The proposed project will aim to make the services that concierges provide easily available to all.

## Armenian Tourism: The Potential

Although Armenia is not a well-known tourist destination, the country's tourism sector is quickly growing and successfully attracting tourists from around the world. In total, Armenia accepted 1.5 million tourists in 2017, with an average increase of 9% per year over the last four years<sup>1</sup>. This growth is especially significant as it represents the 5th fastest growing tourism industry in the world by GDP<sup>8</sup>. On average, tourists travel to Armenia in groups of four and stay slightly over two weeks, allowing a considerable amount of time to explore the country<sup>7</sup>. To reach Armenia, 51% arrive by air to one of the country's two airports<sup>9</sup>. The remaining tourists travel by road or by train from Georgia in the north or across the southern border with Iran<sup>11</sup>. Of the three categories of tourism, leisure is the most common reason for travel to Armenia totaling 51% of inbound tourists and 89% of expenditures<sup>10</sup>. The remaining portion is split approximately equally between personal and business travel.



## Armenia Has Complicated Borders

While the majority of travelers to Armenia are from neighboring countries because of their sizable Armenian populations, Armenia's relationship with its neighbors is complicated due to several historical factors. Political relationships with neighboring countries can have a significant impact on tourism. Most notably, Armenia does not have a positive political relationship with Turkey because of Turkey's continued denial of the Armenian Genocide in the early 20th century, which is the reason Armenia's western border with Turkey is closed<sup>11</sup>. As a founding member of the Soviet Union, Armenia maintains positive relations with Russia and Georgia which borders the country to the north. Armenia is currently a member of the Commonwealth of Independent States (CIS), and 63% of travelers to Armenia are from other former Soviet states<sup>10</sup>. While Armenia maintains positive relations with most CIS states, Armenia's eastern and southwestern borders to Azerbaijan remain closed due to an unresolved border dispute over the Nagorno-Karabakh region<sup>10</sup>. The closure of Armenia's two largest borders has likely had a negative effect on land tourism to the country. The only open border aside from Georgia is the narrow southern border with Iran. The southern neighbor is a critical trade partner and its residents represent 14% of inbound tourism to Armenia<sup>10</sup>. Despite half of Armenia's borders being closed to land travel, its neighbors combined still account for over three quarters of the country's visitors.

## Tourism Plays an Important Role in Armenia's Economy

One of the greatest economic sectors across the world is the tourism sector. It creates jobs, generates exports by selling goods and services to foreign people thus bringing in new money to the economy, and increases the overall prosperity of countries around the globe. This is no exception for Armenia. As the number of visitors increases, beneficial effects on GDP and employment take place. In Armenia in 2017, travel and tourism directly generated 44,500



Figure 2: Map of Armenia and its Surrounding Countries<sup>13</sup>

jobs, which is about 3.9% of the total employment<sup>8</sup>. Specific industries affiliated with the tourism sector have seen increased employment in areas such as lodging, food and beverage, transportation and entertainment. The total impact of tourism on the employment sector in Armenia accounts for about 14.7% of jobs<sup>8</sup>. In addition to the direct benefit on jobs, there is also an indirect benefit to job creation in supporting industries such as retail, restaurants, transportation and lodging. According to the World Travel and Tourism Council 2018, Armenia ranks 112th out of 185 countries in tourism's contribution to employment<sup>8</sup>. This increase in employment along with the increased GDP has helped Armenia grow as a nation. Improving the tourism sector would continue to improve job creation and help industries flourish, thus improving Armenia as a whole.

## Technology is Necessary for the Modern World Traveler

Technology dominates nearly every aspect of travel and tourism including flight planning, lodging, and planning itineraries. The drastic and transformative changes technology has brought has been disruptive to countless industries, and tourism was not excluded. The internet has also made a wealth of information that used to be exclusive to travel agencies easily accessible to the public. Technology, especially mobile technology, is a necessity for the modern world traveler. A Google Travel study found that 74% of travelers plan their trips on the Internet<sup>12</sup>. Leveraging technology can be extremely beneficial for helping tourists as well as promoting tourism across the globe.

Countless apps are currently available that address every facet of tourism. There are several specialized and targeted apps for different regions, countries, and cities. Each of them boasts the most in-depth information and best tourism experience for their site. These tools work great when information on a destination is readily available, however, in less developed countries or tourist destinations, such as in Armenia, they cannot provide a comprehensive list of possible attractions and they begin to fall short. Our application aims to address this gap, and by doing so, we hope to make Armenia a more accessible travel destination and consequently help the development of Armenia's tourism industry.

## Smartphone Capabilities Will Enhance the Tourist Experience

The ubiquity of smartphones and internet connected devices has improved technology at such a rapid pace that now people are able to carry an incredible amount of computing power in their pockets at all times. These devices are also loaded with powerful sensors to



Figure 3: Team Site Visit to Karmravor

detect and analyze information from their surrounding environments. From geofencing, augmented reality, social media integration, and more, the capabilities smartphones provide to enhance the tourism experience are plentiful.

Geofencing is commonly used in location based services as a means to tell when a user is in a certain area. In the context of tourism, this technique could provide them with information relevant to the site they are visiting. Augmented reality can be used in conjunction with the powerful cameras available in most smartphones. By pointing the camera at a certain object, building, or piece of artwork, the app can recognize what the user is looking at and provide helpful information. Social media can also be linked to help users share their experiences and help

spread the word on all of the wonderful opportunities Armenia has to offer tourists. These capabilities are just the tip of the iceberg in mobile and ubiquitous computing. This field lends itself to positively impact tourism by providing powerful and relevant capabilities to enhance the tourism experience, as given in the examples above. Our application is incredibly visionary with features integrated that will provide an unparalleled user experience, our expectation is that 5G will provide a whole new set of features and functions that we cannot currently fathom to be included in our application in the future. Mobile computing is not only feasible, but can improve the experience by offering a lot more information than simple signage, for a much lower cost, and with many more capabilities.

## Building the App: Content Management System

The content management system is going to be the core part of the Smart Itinerary Application and is what will truly set this apart from its competition. There are many applications that can optimize the process of booking flights and hotel reservations for a trip to Armenia, but none of them capture the plethora of unique tourist experiences available in the country. Working closely with the AGBU (AMAP and USAID) to gather this information so that it would easily be able to be implemented into the content management system was crucial to its design. The AGBU currently publishes several ebooks and a tourism application<sup>13</sup>. These resources were extremely helpful to draw from for the content curation of Smart Itinerary. Through close collaboration with the AGBU, Smart Itinerary can leverage their extensive online library of content.

## Building the App: Development Process

Every app available through the Google Play Store or Apple App Store has gone through some form of a software development life cycle (SDLC) and review process.

Software development processes can vary to a wide degree regarding deliverables and time frames. There are typically seven phases of a SDLC which are:

- I. Planning
- II. Systems Analysis and Requirements
- III. Systems Design
- IV. Development
- V. Integration and Testing
- VI. Implementation
- VII. Operations and Maintenance<sup>14</sup>

This project is focused on the first three phases of the SDLC process, from planning the application to actually designing it. The expected outcome of this project was to fully design a working smartphone application that includes all of the features that would be included in the minimal viable product. We have created a product that can be brought to a software development company to complete the remainder of the phases until the application is fully deployed. Every software development process includes, at a minimum: need finding and analysis, design, coding, testing, deployment, and maintenance. The order of these steps can vary, with certain methodologies repeating steps several

times before arriving at a final product. The two most popular SDLCs are waterfall and agile, and both of these approaches are detailed in our project supplemental materials. In addition to a design process, apps must adhere to their respective distribution platform policies. In order to be published on the Apple App Store<sup>15</sup> or Google Play Store<sup>16</sup>, applications must follow strict guidelines. By using a reputable third party software development company, Smart Itinerary will be built in accordance with the appropriate policies and standards.

## Smart Itinerary: Filling the Gaps in the Tourism Application Market

Several apps already exist on the market to simplify the task of finding attractions in Armenia for tourists, however none of them successfully combine the conveniences of modern technology with the historical context of potential destinations. Two popular travel applications, TripAdvisor and Google Trips, each already have a large user base, information about sites, as well as massive databases of reviews. While these apps currently have the most users, there are many other apps on the market that implement some of the potential functionality for a Smart Itinerary app. Travel Local is a website which allows the user to generate an itinerary for their trip based off of budget, general interests, and any other constraints that they may have. This is probably the most comparable tourism service in regards to Smart Itinerary, mainly due to the fact that it is able to generate itineraries, however, there is no mobile application version of their website. The trvlGenie app allows users to set a budget, number of people, dates, a starting location, and a destination which can be as specific as a city, or as vague as a continent. This could be useful for choosing countries to visit, and allow users to share their trips, but would not be helpful for tourists to Armenia. Another app, called Sygic Travel, provides a far more complete travel experience to users. Sygic Travel allows users to search for points of interests by category, or using a map

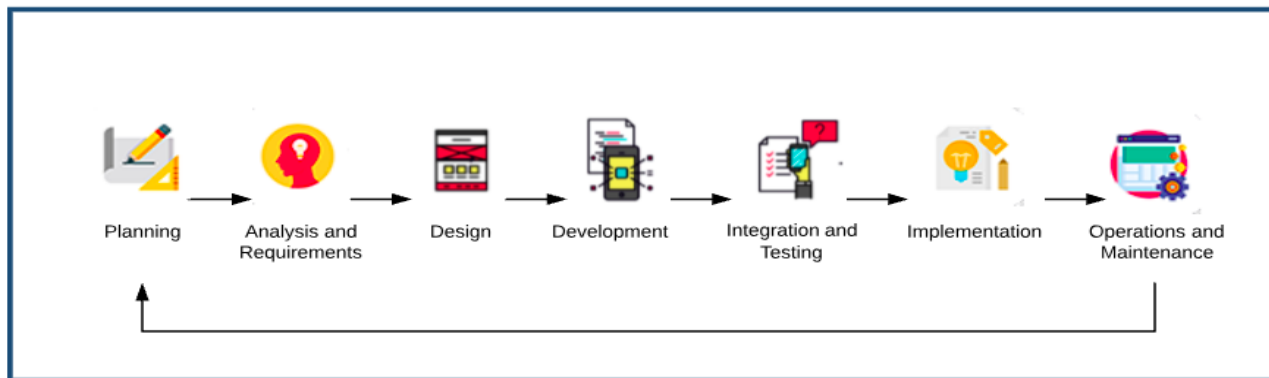














Figure 4: Seven Common SDLC Phases



Table 1: Summary of Functionality of Existing Tourism Applications

												
	Google Trips	Trip Advisor	Sygic Travel	TripIt	trvlGenie	Blink	Travel Local	Armenia Guide - Your Yerevan Guide	Armenia Travel Guide - Triposo	Armenia Tourist Guide	AGBU Kids Travel App	Visit Armenia
Ability to Review and See Reviews	✓	✓	✓				✓	✓				
Includes Hours of Operation Information	✓	✓						✓				
Provides Local Travel Information	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
Site Specific Information			✓				✓				✓	✓
Itinerary Generation	Automatic from Selections		Manual From Searches	Manual	Automatic from Budget		Automatic from General Interests					
How Far Does this Application Reach?	Worldwide	Worldwide	Worldwide	Worldwide	Popular Tourist Cities	Popular Tourist Cities	Worldwide	Yerevan	Armenia	Armenia	Armenia	Armenia
Number of Google Play Installations	5,000,000+	100,000,000+	1,000,000+	1,000,000+	N/A	5,000+	N/A	1,000+	1,000+	N/A	100+	500+

with icons. The app has guide information about many sites, and allows users to add sites to a trip. The Blink Travel app finds sites that tourists might be interested in with a simple user interface to swipe based on interest.

There are tourist apps designed specifically for Armenia, but they do not leverage the full capabilities of a smartphone, and are limited by small amounts of content and limited user bases. The most relevant app specific to Armenia is the Armenian Guide app<sup>17</sup>. This app has extensive information about current museum exhibits, performances

and other forms of entertainment. The app has information on hours of operation, and will locate nearby points of interest on a map, but will not generate any form of itinerary. The app is very useful for finding entertainment within Yerevan, but has very few points of interest outside of the city. Additionally, while Armenia Guide does have a paragraph about each destination, there is potential for an app to provide significantly more content to contextualize attractions. Other apps such as the Visit Armenia app claim to have more local content such as audio guides, but still are underutilized and crash as soon as the app is opened.

A summary of the functionality of the apps already on the market can be found in Table 1. The most successful apps are the ones with the most content and simplest user interfaces. Based on our research and analysis of competing apps and websites we believe there is a compelling need for a tourism application, such as Smart Itinerary that can make personal recommendations, automatically build itineraries, propose innovative features (such as geofencing and artificial intelligence capabilities), and have a vast collection of Armenia specific site information.



## Significant Content is Available to be Re-Purposed in Smart Itinerary


































As the objective of our project was to make a platform to deliver content to tourists, we first had to identify the existing content available to tourists. This served the dual purpose of identifying gaps in the experience provided by existing content sources, and identifying underutilized resources that could be useful to the app.

To understand the gaps in existing content, we searched for content from the perspective of a tourist. This included searching for content online, using existing apps to plan trips in Armenia, and visiting a variety of locations to understand the content available on site along with issues that visitors may have. For each site we visited, we noted any material we could find in existing travel apps, the usefulness of signage at each site, as well any other observations about the tourist experience. The standardized form that we used to record this information can be found in the Supplementary Materials. We also visited sites both in bus tours with a guide, and with only a driver in order to understand how much more information a guide adds to the experience. The objective of these visits was to understand the current ways tourists can find information about the sites they visit, and identify potential to improve the experience for travelers.

We also looked into sources of content that would add to the tourist experience and could be included in our application. This included a deeper review of existing materials such as ebooks available from the AGBU, websites such as Armenian Heritage<sup>18</sup> and Black Sea Silk Road<sup>19</sup>, and any other sources we could find to gather information for tourists.

Our primary observation was that it is difficult to find content online and the quality of signage varied between sites. The sites that we visited include Khor Virap, Garni, Geghard, Oshakan, Karmavor, Hovhannavank, Saghmosavank, Areni Cave, and Noravank.

Table 2: Summary of the Smart Itinerary Site Visits

Available Online Information		Available On-Site Information		Condition of Signs	
	Some		Some		Good
	A Lot		A Lot		Bad
<b>Khor Virap</b>     Language of the Signs: Armenian, Russian, English, French and Italian		<b>Garni</b>     Language of the Signs: Armenian, Russian, English, French and Italian, also in Braille		<b>Geghard</b>     Language of the Signs: Armenian, Russian, English, French and Italian	
<b>Oshakan</b> 		<b>Karmavor</b>     Language of the Signs: Armenian, Russian, English, French and Italian		<b>Hovanovank</b>	
<b>Saghmosavank</b> 		<b>Areni Cave</b>     Language of the Signs: Armenian and English		<b>Noravank</b>      Language of the Signs: Armenian, Russian, English, French and Italian	

Saghmosavank, Areni Cave, and Noravank. The information gathered at these sites are summarized in Table 2. For the places that we visited, most mobile applications, such as Google Trips and TripAdvisor provided a few simple sentences describing the site, and possibly basic information about when it was built. While these applications were useful utilities for navigating and finding places to eat, they did very little to improve the experience at a site. We also found

tools such as Google Maps to be less reliable than they are in other countries. On multiple occasions, we were directed down closed roads or to restaurants that no longer exist. We also observed that there are no online or mobile tools in English to navigate the public transportation system, especially outside of Yerevan, which would have simplified the task of cheaply navigating the country.

When we were on the ground we observed that if there was any signage, it was in very poor condition, and did not convey as much interesting information as a professional tour guide. Guides proved to be the most useful way of learning about a site, but guided tours cost more. Additionally, when we repeated visits to two sites with different guides, we discovered that they had very different and often contradictory information despite being hired through the same company. This raises the question of the accuracy of the information provided by the guides. Of the nine sites we visited, only three had signs in good condition that provided a significant amount of information about the site. One of these well maintained sites is shown in Figure 5. The majority of the signs we did find were placed by the Armenian



Figure 5: Observing the Well Maintained Signage in Garni

Monuments Awareness Project (AMAP) through the Black Sea Silk Road Corridor (BSSRC) project sponsored by the USAID, and European Union. The AMAP signs were in five languages, and we found that the limitation of each language to just one fifth of each sign prevented the full use of graphics, and headings that would have made the sign more interesting to read.

In our search for content we discovered that there are already several sources of interesting digital content, but none of them are easy for tourists visiting Armenia to discover. The BSSRC project included all of the content used on the signs in both a website and a mobile application but both are very difficult to find. The website does not appear in a Google search for “Black Sea Silk Road Corridor” until the second page as most of the results are news articles about the project. The BSSRC project also included an app that we had not discovered in our search for existing apps as it has been removed from both the Apple App Store and the Google Play store because of unpaid fees. We do not know if or when the app will become available again, but it is currently unlikely to reach a large market as it is only available on the Blackberry and Windows Phone stores. Similarly, the ebooks produced by the AGBU Armenian Virtual College (AVC) have a significant amount of information that is useful to tourists but is not currently widely used. The AVC eBook Exploring Yerevan shown in Figure 6 has advice for travelers, suggested itineraries for exploring the Yerevan area, a directory of places to stay, visit, or eat around Yerevan, and materials such as a list of Armenian phrases that are useful to tourists. While the eBook has useful content, it is difficult to find, and because of limitations in the Apple iBooks store it cannot be downloaded in Armenia or Russia. While this content is not currently accessible to most smartphone users, we found it would be useful to include in Smart Itinerary. With permission from the AGBU and the AMAP, Smart Itinerary could present this information to more tourists in a more portable and usable form and improve the experience of visiting Armenia.

We determined that it is currently difficult to get

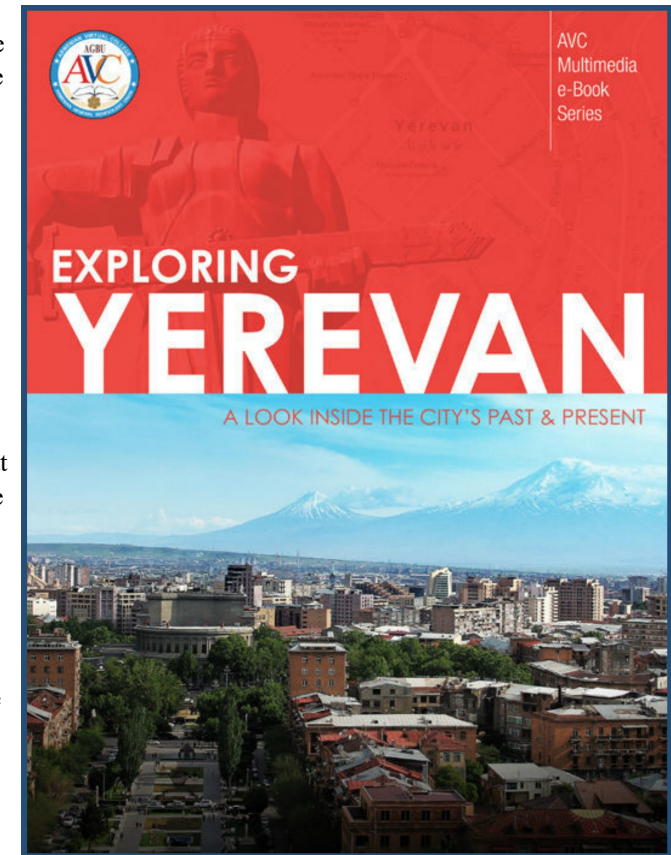


Figure 6: Exploring Yerevan<sup>20</sup>

the complete experience of visiting sites without a guide, but there is an opportunity for Smart Itinerary to change that by making existing data more accessible to visiting tourists. While current travel apps excel at helping to find flights, hotels, restaurants, and directions, the lack of information about sites leaves a gap in the experience of travelers who rely on digital information when travelling. Smart Itinerary can solve this.

## An Initial Target Audience was Identified

Smart Itinerary was designed to be used by the tech savvy tourist. Mobile travel apps target a large demographic of millennials and digital natives because they are the most comfortable adopting and using new technology. A study by Harris Group found that 72 percent of millennials prefer to spend more money on experiences such as tourism, than on material things<sup>21</sup>. Therefore, our app is primarily targeted towards millennials. Since many millennials are also early adopters of technology this allowed for the utilization of more advanced features made possible by the pervasiveness of mobile computing. By targeting millennials, the app may not reach the largest audience possible right away, but it would reach a very active audience that would be instrumental in providing feedback and a beneficial launch environment.

## Significant Information was Gathered Through the Survey

To gather information that served as the foundation for development of our app, such as useful travel applications, their applicable features, and the target demographic for our application, we conducted a survey, which can be found in the Supplementary Materials. This survey was aimed at anyone who has ever travelled and used a travel application to help them plan their trip for the purposes outlined in Table 3. WPI Interactive Qualifying Project (IQP) Advisors along with students that have previously travelled for their IQP fit this profile. The travel applications ranged from plane booking sites to online itineraries. Additionally, the survey identified an exhaustive list of features potentially available in travel applications and asked the person taking the survey to rank each feature's desirability. Knowing whether a person has used other travel apps is crucial to understanding how important certain features are, such as weather integration and route planning. If the survey partici-

pant had a substantial amount of experience with travel apps, we gave their responses more gravity than those who had less experience with these types of apps. Guiding design choices by the wants and needs of the target audience is an efficient and cost-effective approach.

The survey screened for previous travel to Armenia, and these tourists were asked to provide additional demographic information, which, in addition to being used to inform app design, provided new information on the characteristics of travelers to Armenia. We wanted to

know their age, their identified gender, what country they are from, and their reason for visiting Armenia. Additionally, we included a question within our survey that asked the user how comfortable they are using technology. This provided us with information on how to design the user interface of the application. Because we designed an application specifically for tourists visiting Armenia, it was important that we designed the app to a level where the users would be comfortable with the technology, and that it would not overwhelm the average Armenian tourist.

Table 3: Importance of Collecting Feedback<sup>22</sup>

### Why Collecting User Feedback is Important for Mobile UX



1. It will help save money: Developing a mobile app can be an expensive undertaking. Adding new features and altering existing ones can be quite costly if these decisions are based on presumptions alone. By collecting feedback from customers, you can be much better equipped to make meaningful changes to your app.



2. Familiarizes you with your customers: In addition to providing you with insights into the customer journey and how your customers are experiencing the app, feedback can also provide you with detailed information about your customers. This information can then be used to create not only a more personalized experience for your customers but also develop an app you know they'll like.



3. Improves App-User Connect: Feedback provides an opportunity to build a 2-way communication channel with your users. Opening this feedback channel helps build a relationship between you and your customers, leading to better engagement.



By asking the same questions to both the general group of tourists, and the specific travelers in Armenia, we hoped to get a better idea of the tourist applications that people visiting Armenia use and get their opinions on how these applications excel or fall short. This information was then used to determine the best practices of the current applications, so we could mimic the ones they liked or eliminate them if they would not be beneficial to our application.

We decided to conclude the survey after three weeks even though a statistically significant sample was not achieved. We felt that the survey combined with our independent research provided enough information to make informed design choices. We attempted to survey tourists at numerous sites, including Oshakan, Karmravor, Hovhannavank, Saghmosavank, Geghard and Garni, however, we had extreme difficulty finding tourists who spoke English and were willing to take our survey. We also tried to find tourists at more local destinations, including Republic Square and the Cascades in Yerevan.

We traveled on weekdays, for the most part, which may have been a factor as to why we were not able to survey as many people as we had wished. Another large factor is that it was not peak tourism season. Armenia's peak tourism season tends to occur during the summer months, usually beginning sometime in May. This is due to the nicer weather, allowing for more outdoor activity and the ability to enjoy the gorgeous views that Armenia has to offer. Therefore, the primary source of our data collection came from online surveys.

With help from our sponsor at the AGBU, we were able to broadly distribute our survey online and obtain responses from people who have been to Armenia. We sent our survey to the Peace Corps in Armenia, Birthright Arme-

nia, as well as friends and colleagues that our sponsor was willing to share our survey with. With all of these sources of participants, we were able to achieve a total of 166 responses, with about 127 of those respondents fully completing the survey. A majority of our respondents fell between the ages of 18-33 and were mostly from the United States, making

our survey biased towards our target demographic of English-speaking millennials. Having our survey biased towards our target audience did have its benefits. We were able to tailor the initial design of our app around what our target demographic wanted, along with some additions and subtractions made by the team that we felt were necessary.



Figure 7: Tourist Site “The Cascades” Without Tourists<sup>23</sup>



BIRTHRIGHT  
ARMENIA



facebook



Outlook



slack



Peace  
Corps

## App Features were Selected to Meet the Needs of the Target Market

In order to select the features that were included in our final design, we had to brainstorm innovative ideas, do market research to find out what features current tourism applications have, and analyze our survey data to discover the features and capabilities that potential users of our app would actually want to be included.

An effective travel site allows the user to get the most with their budget and make the most of every minute while they are on vacation. These applications should make it easy to quickly organize all the different components of a trip. According to reviews posted on a competitor's website, called TripAdvisor, the users are looking for a site that will allow them to create trip packages (such as combining hotel, car rental, etc.) along with those that promote savings and convenience<sup>24</sup>. To achieve the ultimate goal of this project, we gathered information on three specific areas: how app users plan their trips, how they prioritize various features, and the constraints and considerations they have when building their trips. Additionally, it was important to take complexity into consideration when designing how the application will run; if the software is too complicated for a basic user, it can turn many users away.

Throughout this project, we have designed an app through which the user can create a customized trip plan for Armenian travel based on their interests, group size, time frame, personal needs, and accessibility needs. This app surpasses the competition on the market by providing information on Armenia at a level of depth and detail significantly greater than all other travel apps, filling in gaps that exist for locations and attractions found on other apps and showcasing less well known Armenian sites and destinations that will create an exceptional travel experience.

The information gained from our research was nec-

essary in the design of a user centered travel app. When building any product, it is crucial to determine the needs of the target audience. This design approach is especially relevant when building mobile applications. It is painfully apparent when applications are not built with a strong user centered design. These types of apps tend to include features that provide no value to the problem they are trying to solve and are not desired by the user base. In creating a successful product or application, collecting accurate market data and understanding the needs of your users is paramount<sup>25</sup>.

From our survey, we were able to analyze which features our users believed to be the most important to include in our application. We looked at this data as an overall ranking of features, and then broke it down using different demographic information. We looked at how different age groups ranked each feature; however, we noticed no differences besides slight variation between a few features. We

also looked at how tourists who use different means of planning trips would rank each feature. We thought that people who use travel agents might rank the features differently than those who use travel applications; however, we again saw little to no variation in the feature rankings. We created a Pareto chart to look at the overall rankings, as displayed in Figure 8. As it shows, the three most important features according to the survey participants are ratings and reviews, GPS navigation and a currency converter. We decided to color code the features on the chart according to the technology required to develop each feature. An example of this would be GPS implementation. If we were to include GPS navigation, then it would be quite simple to also implement features such as a dining locator, public toilet locator, location tracking, etc.

Our survey analysis identified the sought after features in a travel app, however, including all of them was not

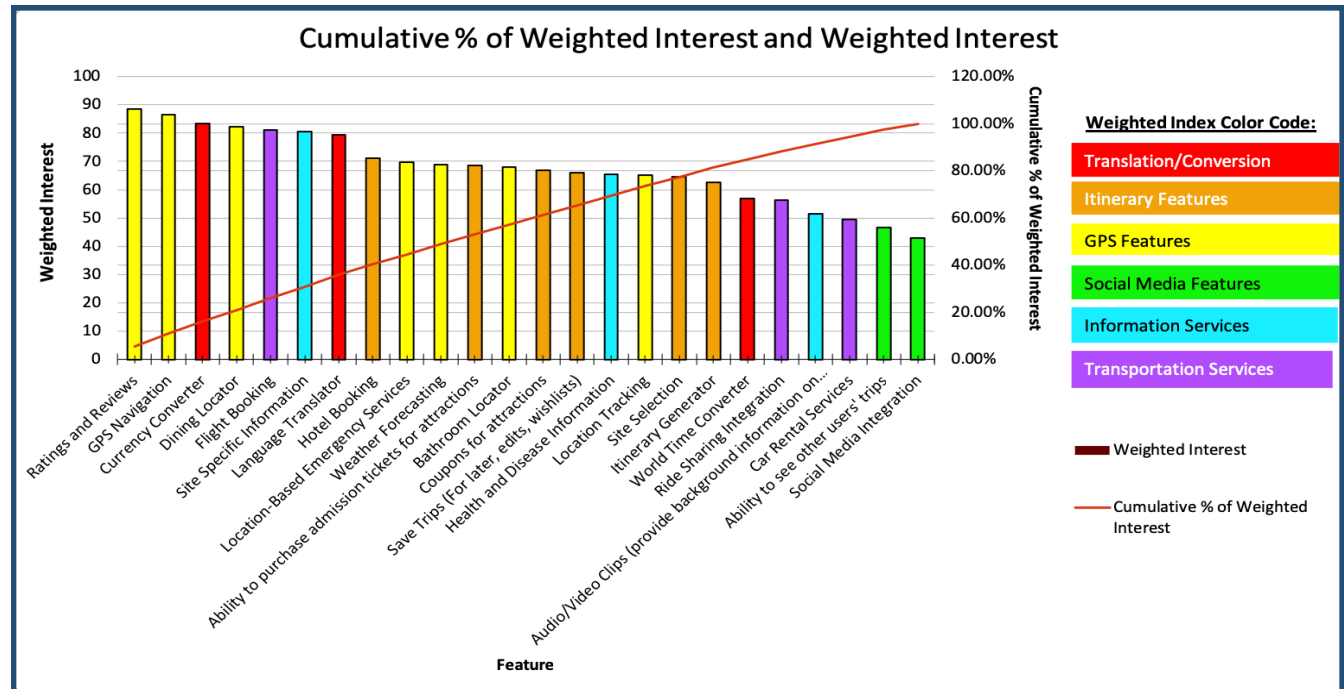


Figure 8: Importance of Features to Users

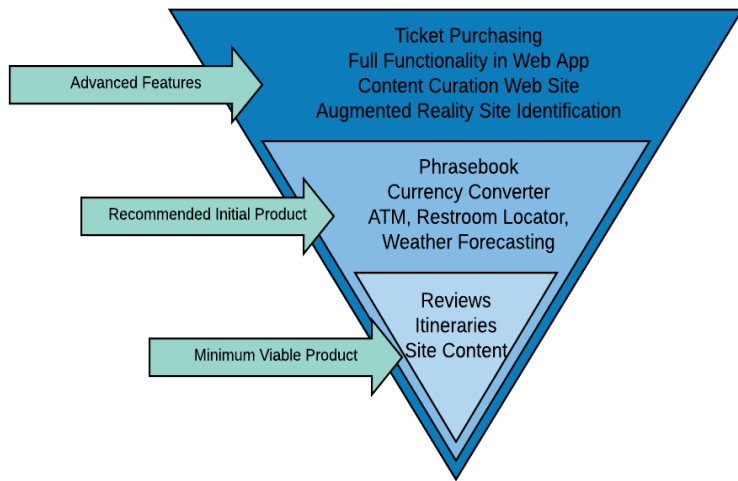


Figure 9: Differentiated Feature Set Tiers

feasible. Determining what features were attainable was dependent on the timeframe and budget for this project. Although some features will not be implemented in the first version of our application, we recommend these features be included in the future releases. Based on the complexity to implement and the value each feature would provide, we grouped the features into three tiers as shown in Figure 9. The first tier is the minimum viable product which only includes the core content delivery, ratings and reviews, and itinerary generation functionality of the application. The next tier represents the features which we recommend for the initial release of the app. Our recommended basic product includes additional features that we identified as valuable to

the user such as finding nearby ATMs and restrooms, a currency converter, weather forecasting, and a phrasebook. The more advanced features were separated into a third tier of functionality that, while valuable to the user, would add significantly more complexity to the development of the app. We recommended that the advanced features are not included in the initial release as we do not want to risk delaying the project to include non essential features. After determining this list of features, our team contacted several software development companies with our design and constraints and began the conversation on what was possible given the time and budgetary restrictions laid out to us.

Additionally, we were able to determine the con-

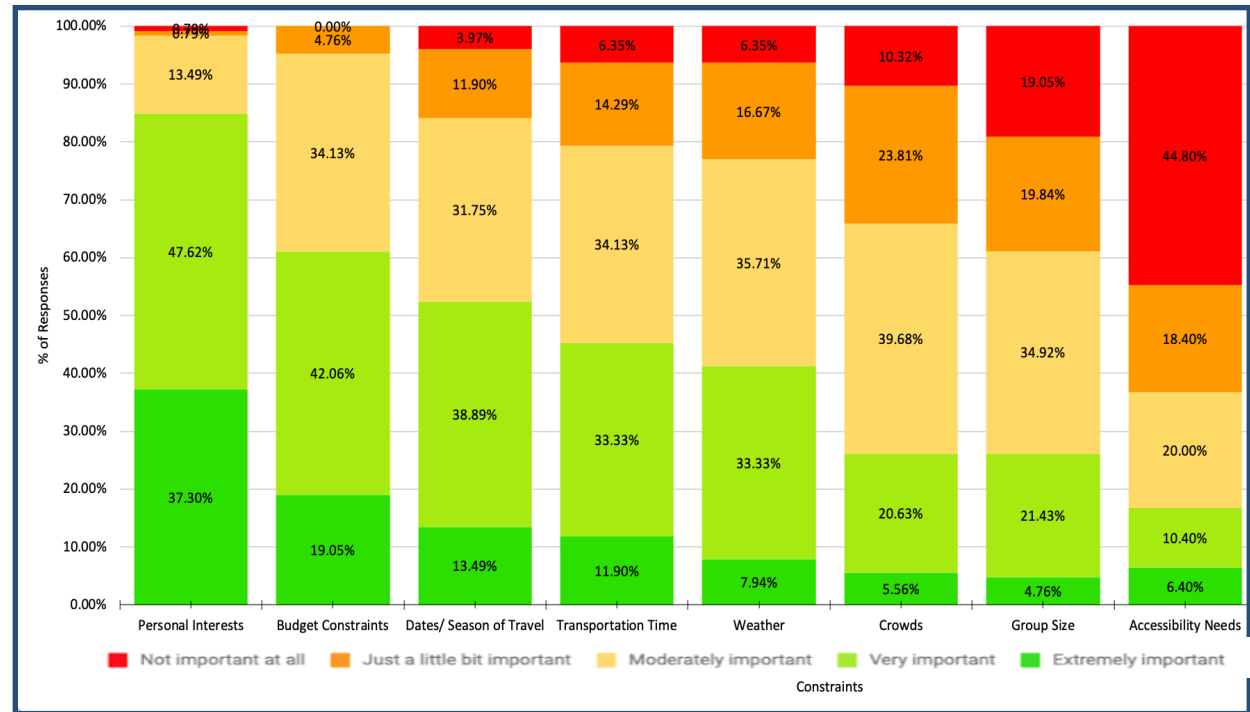


Figure 10: Overall Constraint Importance Chart

straints that were most important to our users. We again looked at this data as an overall ranking as well as splitting it into different demographics. We focused mainly on age groups since we thought that they would have the most variation, however, similar to the features, we saw little to no variation between the data. According to their answers displayed in Figure 10, the users found it most important to pick a site based on personal interest, budget constraints, the season of travel, the transportation time to the location, the crowd size, group size, and the accessibility of the location. These constraints informed the filtering criteria for our application, allowing the user to narrow down their travel options to align with their ideal trip.



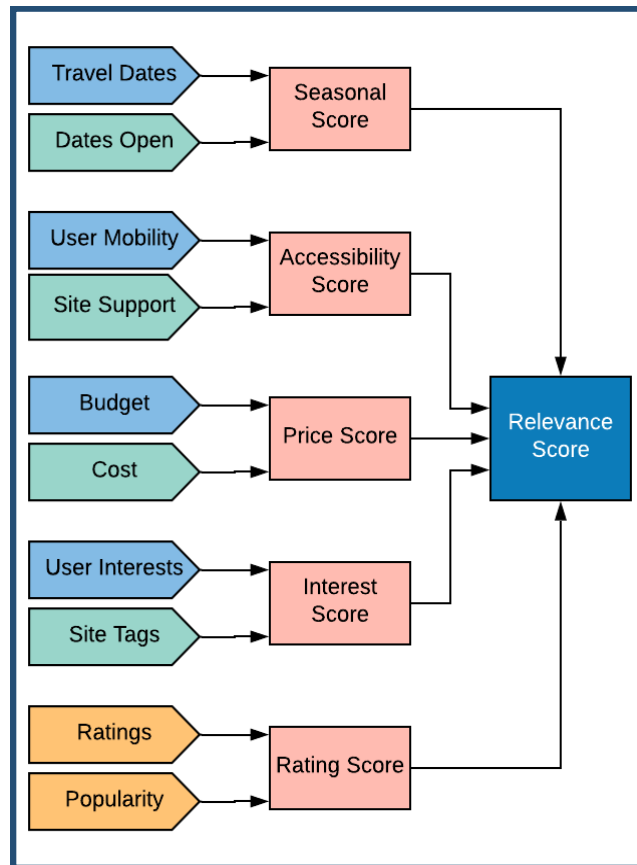


Figure 11: Filtering Process

## An Algorithm Selects the Itinerary User Interests and Constraints

Having determined the constraints our respondents valued when planning trips, we designed a formula for determining how relevant a site is to each user. As displayed in Figure 11, the process is broken into two main steps: comparing user interests and constraints to the site data to generate subscores, and combining the subscores into a final relevance score.

vance score that represents how likely the user is to want to visit the given site. The subscores represent how well the site meets each of the users constraints. For example if the user indicated they were interested in history and religion, an old monastery would have a high interest subscore. If the user indicated they wanted a low budget trip, an expensive winery tour would have a low price subscore. After the subscores are calculated they are combined into a final relevance score. If any of the subscores are disqualifying such as the site not being open during the user's visit, the relevance score would automatically be zero to prevent the site from being recommended. If there are no disqualifying subscores, the relevance score will be the product of the subscores. This will ensure that the recommendations factor in all of the user's preferences and constraints. The sites with the highest relevance scores are suggested to the user, who can then decide which sites they want to visit using an interface, similar to the dating app Tinder, in which they swipe right to include the site in their itinerary, or left if they wish to remove the site.

## User Experience Design is Essential to Attract and Retain a User Base

Smart Itinerary's user experience (UX) must be clean, professional, and streamlined in order to attract and retain a user base. Consequently, every interaction with the user interface (UI) must be carefully planned and designed to provide a powerful, effortless experience. Several different tools and techniques were employed to achieve these results including a mood board and wireframe with inVision Studio and a mock use case with Android Studio. Throughout the creation of all of these resources, UX/UI design best practices have been utilized and documented in our design document included in the supplementary materials.

To kick off our design process, a mood board was created in inVision Studio. The purpose of this tool is to get all design ideas, elements, and inspiration in one central location. The most important outcomes from this board were a

color palette, font, and UI design library as displayed in Figure 12. The color palette was created with Adobe Color CC which is a tool used to create color themes by using an interactive color wheel and a combination of custom and preset setting options<sup>26</sup>. The color palette that we generated was based on the shade of blue found in the Armenian flag. The font we chose is Limerick Serial – the font used in the AG-BU's logo. The design library that we picked is Google's Material Design library which is widely accepted as the industry standard in mobile and web development. Material is an adaptable system of guidelines, components, and tools that support the best practices of user interface design<sup>27</sup>. Our mood board was kept internal to the team as opposed to undergoing user/customer feedback due to our tight deadlines and project requirements. The board was a great way to initiate the design process and it provides a glimpse into the deliberate decision making process that goes into a carefully planned application design.

The next step was to create screens and the general flow of the application. The best medium to achieve this was the freehand tool in inVision Studio. Freehand allowed us to create wireframes and draw relationships between screens and features. Freehand is a powerful tool to communicate large UX concepts and logical flows with our sponsor and advisors. Creating the wireframe screens was a time intensive process as nearly every screen had to be created from scratch with the only guidance coming from the mood board. Completing the wireframes was an iterative process that required a great deal of creativity and resourcefulness. The wireframes generated valuable dialog about the features and smaller details of the app that have the potential to make or break the UX. These conversations pushed the team to deliberately weight and consider every design decision and feature. For example, adding augmented reality into our application would be a feature that would enhance our user experience while creating an interactive way in which the user can gather information about a specific site. With all of positive aspects that augmented reality would bring to our application, including it in our application would cause for a

time consuming and pricey development process. Creating an application with augmented reality could cost anywhere from \$50,000 to \$250,000, and in some extreme cases, up to \$2,500,000<sup>28</sup>.

After the wireframes were in a stable state, we had to make our vision for Smart Itinerary come to life. We created a mock use case that shows how the actual application would be used and how different features would be implemented. The first attempt at this was to use the prototype tool in inVision Studio. However, we quickly discovered that accomplishing our initial design goals and implementing Material Design concepts would be held back by the limitations in the tool. Extensive photoshop experience is required to achieve what we needed to achieve. We also would not be able to use inVision Studio on Windows. Therefore, we transitioned to developing the mock use case in Android Studio. This tool required more technical expertise because it required java and xml code to be written, but it had a greater return when it came to the final product. By using Android Studio, we were able to fully implement material design concepts, showcase potential features, and have something to hand off to developers for them to base their work on.

The design document ties all of the previously discussed steps in the design process together. This document explains and records all of the decisions, features, and design aspects over the course of the entire project. The design document is where we propose a minimum viable product and rationalize the feature set with the cost and benefit that each feature will contribute to the design. We also outlined future work to be completed if the app gains future funding or significant success. The core guiding principles of sound UX design are also pervasive throughout the document: user-focused design research, patterns for product consistency, consistent actions/interactions, and content<sup>29</sup>. Keeping these guiding concepts in mind during the design process has proved crucial to a successful product. This document can be found in the supplementary materials.

The findings and outcomes of this process is the final product and ultimately the app design. A moodboard, wireframe, and mock-up were created to give an idea of the look of the app along with the flow between screens. These documents can be found in the supplementary materials.

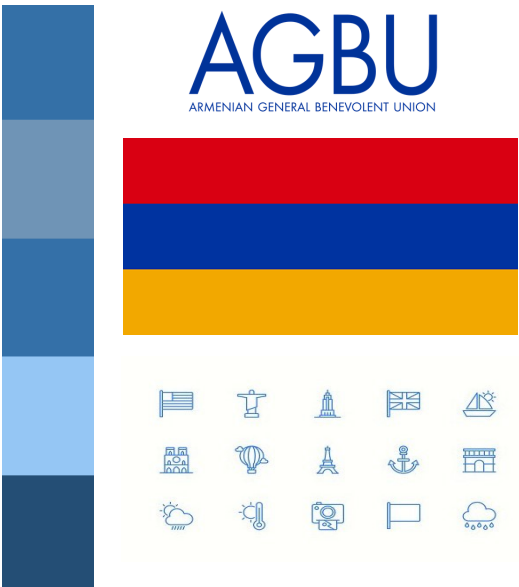


Figure 12: Design Elements Included in the mood board

### Smart Itinerary Team Determined Content Sources

Once we knew the features we wanted to implement and the content sources available, we were able to identify gaps in the existing content that would need to be filled to implement the features we need. We had already identified local content from the AMAP, and AGBU AVC, as well as potential APIs from Google and TripAdvisor. Using our selection of prioritized features, we then evaluated

each potential data source by its benefit to the user, and how difficult it would be to include in the app. For any features that would require the collection of additional content, we suggested options for closing the gap to provide a complete experience.

While we decided the specific implementation of the database was beyond the scope of our project, we determined the requirements of the database and made recommendations on the type of database to store and manage the data. This included analyzing the type of data required, and all the mechanisms that would be necessary to store content and reviews.

Ratings and reviews were the most important feature identified in our survey, so we decided to include reviews from Google or TripAdvisor that already have years of reviews from large user bases. We sampled the total number of reviews on both platforms for the nine sites we visited, and found that Google had only 5% more reviews than TripAdvisor. As the two data sources had a similar number of reviews in Armenia, and Google could offer more information about the site, we decided it would be simpler to use the Google Places API for reviews. Google Places API will also provide the necessary data for the app to find nearby restaurants, hotels, and ATMs. The downside is the API cost for Google Places can be up to \$40 for every thousand searches<sup>30</sup>. Similarly, the Google Maps API can provide all the necessary information about maps, and navigation. There is no cost to use the Google Maps API to embed simple maps in the application. The Google Route API for directions charges \$5 per thousand API calls. We can additionally reduce the challenge of the route planning by using the Advanced Directions API to optimize the route between sites for \$10 per thousand API calls. Each month the app would have a \$200 credit toward Google APIs, so the first 10,000 API calls each month would be free and it is likely there would normally be no API usage cost. Using the Google APIs would allow us access to nearly all of the data necessary for our app, but could add a small cost to maintaining the app if it becomes widely used.

We identified that the best way to set our app apart from other applications is with content, so while this app should be able to combine several of the best content sources available, we decided the app should be a platform for continuous improvement. We requested permission to use all content from the AMAP on blackseasilkroad.com and armenianheritage.org which includes historical information about several popular tourist sites. We also can include the content from the eBooks produced by the AVC which includes recommended itineraries, a phrasebook, tourist advice, and a directory of sites relevant to tourists. The AVC also plans to complete additional eBooks for each Marz in Armenia. To be able to include new content as it is produced, we concluded that there should be a system for people without technical experience to add content to the database. We also want users to be able to contribute content to the app, with the approval of the administrators maintaining the application. This would allow the content to continue to grow without significant cost for the organization maintaining it.

Figure 13 shows the online links between the content sources for the application. As detailed above, the APIs from Google and TripAdvisor would provide site reviews and maps. The application would receive site information, curated trips and reviews from the database, and post the user's trip reviews to the database. There would then be a mechanism to add content to the online database from a desktop computer as specified above.

We identified two options for how to maintain this database that are popular in the industry. One option is to maintain a custom server in Armenia. This allows the most customization, but could be difficult to maintain uptime considering the lack of consistent power and internet in Armenia<sup>31</sup>. The simpler option is to use a commercial cloud service such as Google Cloud or Amazon AWS. Both of these companies are very popular worldwide and have a reputation for high uptime<sup>32</sup>. We decided to recommend using a commercial service to maintain the cloud functionality app to improve reliability and simplify maintenance, although we

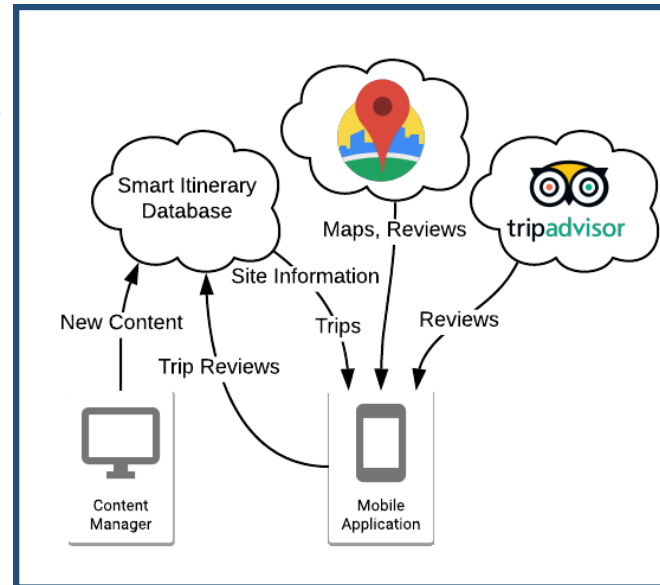


Figure 13: Cloud Content Flow

suggested the developer select the specific service based on which they are most familiar.

## Why a Mobile Application is Most Viable

Mobile applications are much more viable than a web interface for tourists who are traveling. Applications are much easier for tourists to reference when traveling due to their design and their ability for offline access, unlike websites. Using a mobile application also allows the user to take advantage of the technology provided by the smartphone, including, but not limited to, sensors and cameras. This technology helps with the use of GPS navigation as well as the potential for more complex features such as augmented reality.

## The Minimum Viable Product for Smart Itinerary

The purpose of this application was to provide a free resource to tourists visiting Armenia to help them plan their trips, and better appreciate what Armenia has to offer. The app is designed to make personal recommendations of sites to visit in Armenia to simplify the decision of where to visit, and ensure the visit is relevant to the user's interests. The app will also deliver detailed content about the sites to visit, place the sites in context, and make visits more interesting.

The navigation menu for the app will be accessible from any screen within the app. It will allow the user to navigate to any primary screen within the app, including the 'My Trips', 'Site Information', 'Find Nearby', 'Phrase Book', 'Currency Converter', and 'About' screens.

The most important feature of the app will be the Itinerary Builder. This trip building feature will allow users to create custom itineraries that are perfectly tailored to their specific needs. Initially, the app will ask the user to input any of their interests and constraints that they have for their trip. Once the user has entered this information, the app will begin suggesting sites that the user is potentially interested in, then give the user the option to choose which sites to visit, and ultimately generate a complete itinerary. Implementing this feature will involve building a system to allow the user to input interests and constraints, followed by a process to match specific sites with users based on the information they provide. Lastly, basic route planning must be created to order the sites into an optimal itinerary. A simple version of the route planning could be completed with the Google Routes API.

Once the user has arrived to the site, the application will show the user any information about the site that is available to give the user an idea of where they are as well as the history and importance of the site. The application will pull detailed information about sites to visit from an



online database. Sites will have a combination of photos, text descriptions, and audio guides that the application will present to the user. Ideally, the user will be able to download this information prior to their trip so that they have the ability to access the information offline. This information is provided by the AGBU and the Armenian Virtual College through the ebooks that they have created. Reviews of these sites will also be provided using the Google Places API and TripAdvisor API so that the user can know if the site is popular or not. A small map displaying the location of the site will also be available using the Google Maps API.

The app will also include a utility to find restaurants, hotels, ATMs, etc. that are in close proximity to the sites that are being visited. These locations will appear on a map using the Google Maps and Google Places APIs showing the user where to go and how to get there. Reviews will again be pulled from the Google Places or TripAdvisor API and displayed for each restaurant, hotel, etc. This will allow the user to easily find the best options for hotels and food in their area.

One of the most difficult parts of visiting a foreign country is the language barrier. Smart Itinerary aims to reduce this issue by providing a phrase book within the app. This feature will contain numerous phrases that are common to the Armenian language, along with an audio clip for each phrase to help with pronunciation. This feature will also be available offline so that there is no limitation to usage. The content for this phrase book will also be provided by the Armenian Virtual College ebooks.

Smart Itinerary will initially rollout in the English language. However, in the future, the plan is for the app to work in seven languages: English, Eastern Armenian, Western Armenian, Russian, Farsi, French, and Spanish. The app will be able to display as much of its content as it can in the user's preferred language, and any other relevant information, including ratings and reviews, will have the ability to be translated using Google Translate.

Another feature the app will provide is the ability to help the user convert currency. It will include a simple, yet effective, calculator that will be able to convert from AMD to any currency that the user needs.

The developer does not need to provide any of the content for the app, but does need to build a resource that would allow people without technical experience to add or modify content for the app's database. This database would include pre-built itineraries, audio guides, images, and plain text descriptions of sites, and any other information that is provided by the application.

### Complexity Analysis will Determine Potential Features

We performed a complexity analysis to determine which features are most viable for the minimum viable prod

uct. In Figure 14, we show each feature's development requirements versus the additional content required to implement the feature<sup>33</sup>. The lower the value on the 'Development' axis, the less effort it is to develop that feature. Similarly, on the 'Additional Content' axis, the lower value means that less additional content is required to implement that feature set. These features are divided into three subcategories, content delivery, convenience, and trip planning. The following sections will take an in-depth look into each of the feature sets shown on the chart.

### Simple Guide App is the Simplest Version of Smart Itinerary

A simple guide application could be made by effectively reformatting the current AVC ebook content into application format. This feature would allow users to select from pregenerated itineraries that include existing content

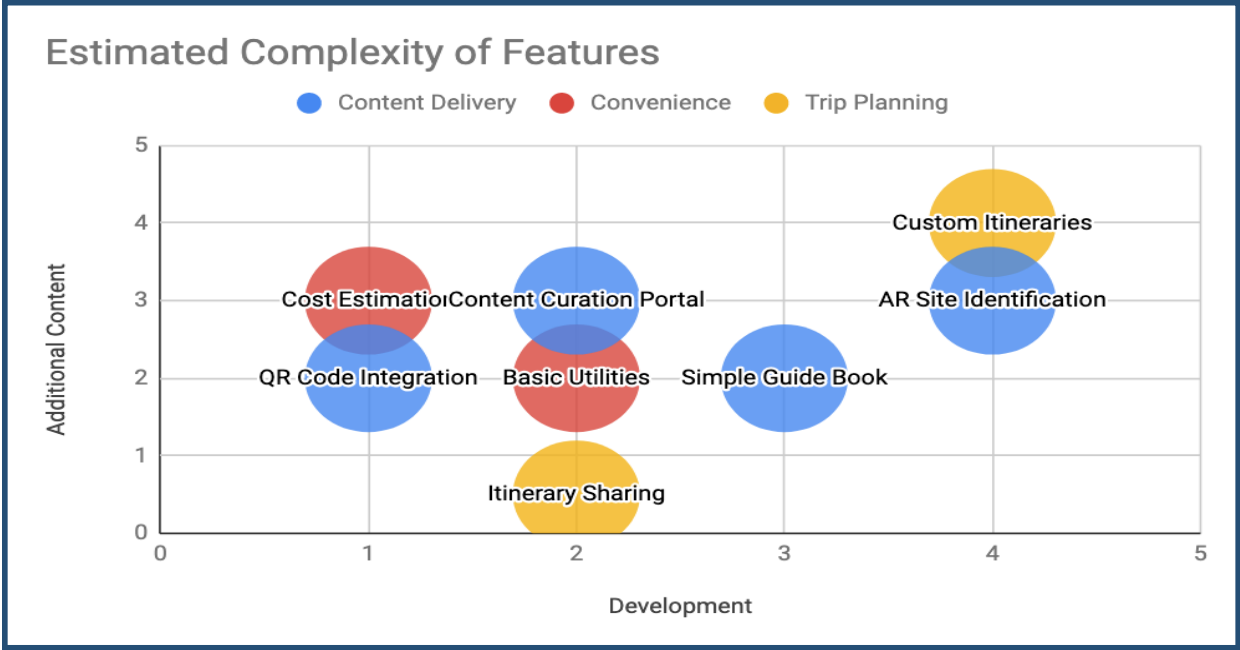


Figure 14: Estimated Complexity of Features

about each site, and general guidebook information from ebooks on the market. This would be comparable to many apps on the market, but would be distinguishable by better content. The content required to implement this feature would include the existing guidebook information from the AVC ebook collection. The AVC's collection includes content reaching outside of just Yerevan which would help to promote rural tourism. Potentially more content could be retrieved from the Black Sea Silk Road Corridor (BSSRC). Developing this feature would involve developing simple navigation. Anyone who has ever made an app before could make a simple barebones version of this; The most complex element in developing it would be an interactive map with the sites in an itinerary. This could allow tourists, particularly millennials who look for digital content, to get more out of their visits.

## Basic Utilities are Important for a Tourism Application

Basic Utilities include simple features that could be easily integrated to the application, such as a tool for finding ATMs, a phrasebook, and a link connecting our application to HikeArmenia, which is an application working towards making Armenia's hiking trails more accessible to tourists. All these features are easily implemented with existing content or APIs. None of these would individually involve much work for the developer to implement, but each is one more feature to implement and test which could lead to an increased cost. Including basic utilities could add convenience, making the tourist experience more enjoyable. Many respondents to our survey said they would find these features helpful in a travel app.

## Cost Estimation will Help Users Budget their Travel

The cost estimate feature involves estimating the cost of different tourist sites, and therefore, the itineraries as a whole. It could include cost estimation for a gg taxi, muse-

um entry, guided tour, student / senior discounts and more. The biggest challenge with this is gathering data on the cost of different activities. Museums often have complicated pricing schemes depending on age, academic affiliation, etc.

Looking up and summing costs is a fairly simple task and estimating the cost of gg taxis should be fairly simple, however, the challenge arises that calculating the sum is only useful if the cost of every activity at each tourist site is known. Budget is one of the biggest factors listed in planning trips, so people would definitely value an app that takes budget into account. Additionally, most existing apps do not do a great job showing overall costs, or have an incentive to drive customers to buy expensive tours, so if Smart Itinerary were to include a cost estimation feature, it would draw more users to our app, therefore increasing its popularity.

**The best travel apps work in real time, keeping you in the know. They deliver not only information, but also advice, insights, tips, and warnings...From the time you start thinking about your next destination to the moment your feet hit the welcome mat back home, having the right travel apps on hand can make the whole experience smoother and less stressful.<sup>34</sup>**

## A Custom Itinerary Generator Sets Smart Itinerary Apart

The custom itinerary generator is the main feature that sets the Smart Itinerary Tourism Application apart from all other tourism applications on the market. With this feature, the user will input basic interests and constraints, and the app will build a personalized itinerary. The quality of this product would be strongly correlated to the amount of

content included. An extensive database of sites with cost, accessibility, typical visit duration, hours, seasonal interest, etc. would be very valuable. A minimalistic version of this feature would just look at a small database of information in which a basic filter, based on interest, will be applied. The effectiveness of the feature will depend on the accuracy of the logic. Ideally, the app would take into effect many complex factors such as seasons, travel distance, weather, reviews, popularity, etc. This could include numerous APIs to inform the factors, and a complex AI to find the ideal selection and order of sites. There is a Googleway API which has a simple algorithm to choose the ideal order selection based on location and transportation. Within our own class of 23 people, most people felt they didn't know where to go within the country, and as a result have so far mostly stayed in Yerevan. If an app would make personal recommendations, people would be more likely to see more things, and have a more enjoyable trip to Armenia.

## Itinerary Sharing will Greatly Improve the User Experience

Itinerary Sharing would be a very useful feature in which users can sync their itineraries with members of a group, or share them online for other users to explore. There would be no content required to implement this feature as it is purely a technical challenge to execute. Unlike the preceding features, this would require a server that user data would be uploaded to. This adds something more to maintain and makes development slightly more complicated, but would be necessary for other more complex features as well. Any experienced software development firm would be very familiar with this type of feature. It is worth noting that this is distinct from the simpler task of sharing an itinerary description over social media. With this feature, it could be easier to organize groups, or travel with friends if everyone has access to the same content. It would reduce pressure on the one person with the itinerary on their phone, and ensure access to resources if a phone dies, or the group separates.

Additionally, if people share their trips with friends or on social media it could bring more users to the app, and more people to Armenia.

## Content Curation Portal will Allow Constant Updates to Content

The content curation portal would involve a web interface for people managing the content in the app. From the portal, we recommend there be a content manager that could complete, add, and edit content such as event descriptions, images, site descriptions, and audio guides for each individual site. This feature would only need to be included if there were organization interested in maintaining and adding content to the application. The only change for the app, in terms of development complexity, would be the simple requirement of pulling curated content from a server, but it would require the development of the web portal for users to manage content. This is again a common task that experienced web developers would be familiar with, but would add to the cost of the project. A simpler alternative would be to give a content manager a user account for database entry software, but this might be harder for third party contributors. With the ability for more people to easily add content to the app, the app could grow a far richer database of content that is useful to tourists. Additionally, if museums or other organizations maintaining sites use the app to build the tourist experience of their sites, they are more likely to promote the app to tourists at their site.

## QR Integration will Help Spread Smart Itinerary

A QR code is a machine-readable code made of black and white squares, used to store information such as URLs that is accessed by reading via a smartphone camera. QR codes can be integrated to our project by being strategically placed at tourist locations, and once scanned, it would prompt the user to install the Smart Itinerary application if it

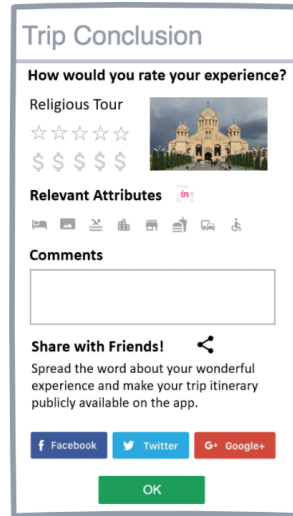


Figure 15: Snippet from Wireframe

is not already on their phone, and if it is, it will open the app to a page with all the relevant content regarding that tourist site. This would make it easier for users to find the content for where they are, indicate to other existing users that there is content for where they are, and demonstrate to potential users that there is an app with content relative to the site. To integrate this into our application, it would require that QR codes are installed at different sites around Armenia either on existing signs or brand new ones, with specific content to open for each site. In terms of implementing this into the application, URL redirects and QR scanning are both fairly simple to develop, so this would not be technically difficult or costly to develop.

## Augmented Reality Identification of Sites

Augmented Reality is a feature of the future. With this included in our application, users could point their phone at something identifiable, such as the front of a building, or a monument, and the app would then identify where the user is and display relevant content regarding that specif-

ic site. Although this feature could greatly improve the user experience of our application, it would require a lot of time, money, and effort to create. For example, in order to train the artificial intelligence, it would require a dataset of images of each tourist site. Someone would have to go to every location and take pictures of every building or monument from as many angles as possible to ensure the artificial intelligence has enough information to identify a site on its own. There are many tools to make the development of this type of tool simpler, but it is still not something that many developers would have experience in doing. There is a nonprofit venture called TUMO that teaches workshops on TensorFlow, meaning it could be possible to find developers within Armenia that are familiar with implementing this technology, but their experience, timeframe, and cost is still unknown. Additionally, because augmented reality, unlike QR codes, is not marked for the user to find, users will not know which sites include this feature by any way other than pointing their camera at the site and seeing if any information appears. Although this feature is extremely costly to implement, the impressiveness of the technology could make the app stand out and excite users about using the app and therefore boosting its popularity.



Figure 16: Example of Augmented Reality<sup>35</sup>



## Selecting a Developer is Vital to the Success of Smart Itinerary

In order to begin the development process for the application, a developer must be selected. This selection process is important in order to create the best possible version of the app for the initial rollout. Three main factors must be considered when selecting a developer: cost, quality, and time. Our requirements in choosing a software developer can be found in the supplementary materials. One thing we have noticed is that timelines here in Armenia are much more stretched out than those in the United States. Typically six months of development in the U.S. would take about two years here in Armenia. This creates an issue of a timely release of the app. The timeline for the launch of Smart Itinerary cannot be too long or else the application could become obsolete by the time it is released. In order to get this process started, we have reached out to three developers to help with the selection<sup>36</sup>.

The most interested developer we reached out to was Zoom Graphics. In our meeting with Zoom we could tell that they properly understood the project and understood the largest challenges to completing the project. They suggested developing the application with agile and scrum, which would allow the AGBU to see regular progress made on the application. They had also completed an application to track and share fitness data for companies such as Google, Uber, Tesla, and Twitter which demonstrated they are familiar with the necessary underlying technologies, and had the experience to deliver a quality product.

## The Smart Itinerary App is an Ongoing Service

Once the Smart Itinerary team leaves Armenia and a software development company takes over, the work on this application does not stop. Rather than being a project with a specific start and end date, the Smart Itinerary Tour-

ism Application will be an ongoing service. At the conclusion of our time in Armenia, this application will hopefully begin to be developed by a software development company funded by the AVC or AGBU. After the application is finished, there will need to be someone from the AVC appointed to manage and curate this application. This person will be considered the “Product Manager” and will have many jobs ranging from maintenance, enhancements, and refinements of the app, additions and refinements to the content, establishing agreements with strategic partners and arrangements with outside content providers, and creating awareness and promoting of the app to potential users. First, this person will decide which content is necessary to include in the application. Once they have this large selection of information to choose from, the Product Manager will have to pick the tourist sites that they want to be featured in the application, along with determining the content that is most relevant to this site that every visitor should know. Currently the AVC has content for the tourist locations in two of the eleven regions in Armenia, and is currently in the process of developing that content for the remainder of the country, but this content would need to be added into the database.

An important feature included in our application is social media integration, where the users of our application may include their feedback on a previous trip for all other users to see along with sharing their experiences through common social media pages such as Facebook, Instagram, and Twitter. Due to the possible complications that this feature could cause, such as someone posting something inappropriate or slanderous, this is something that needs to be constantly monitored by someone that owns the application. The Product Manager must delegate someone to monitor the feedback to make sure it is appropriate and follows all laws in place to prevent slander.

As time progresses, and technology becomes more sophisticated, the Smart Itinerary application will have to keep pace. This requires the Product Manager to be in charge of all maintenance, enhancements, and refinements that the application may need over time to allow it to be con-

tinuously improving as an ongoing service, as explained in Figure 17. In the Supplementary Materials we have included a list of potential features that can be added to the Smart Itinerary Tourism Application in the future. This list of potential features included visionary elements such as Augmented Reality and Geofencing capabilities, meaning the user would be able to point their smartphone camera at a monument or statue, and the application will use its ability to track where the user is along with image recognition capabilities to display specific content about exact user’s location. In order to make sure new technology is included into the Smart Itinerary application as it is created, the Product Manager will be responsible for choosing which technology will be implemented into the application and which company will do it.

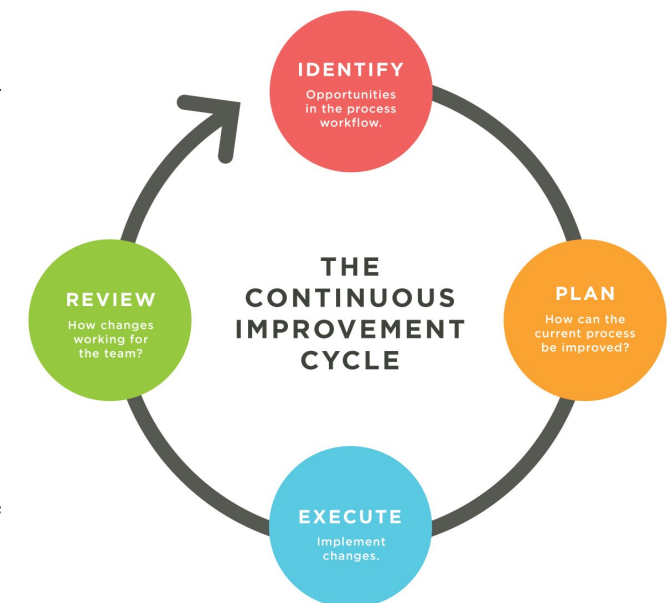


Figure 17: Continuous Improvement Cycle<sup>37</sup>

## Smart Itinerary is Armenia's Future

Currently, Armenia's tourism infrastructure is not as robust as other countries. Smart Itinerary hopes that, with our application, we can help to make Armenia's hidden treasures more accessible to the public. With more publicity and knowledge on the tourism opportunities in Armenia, we hope to encourage more travelers to include Armenia on their destination list, giving the traveler a trip of a lifetime, and the country its well deserved opportunity to flourish both culturally and economically.

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