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E-Tourism A Study on Universal User Experience

Ethan Campbell
Worcester Polytechnic Institute

Isabel Morales
Worcester Polytechnic Institute

Melissa Ann Bazakas-Chamberlain
Worcester Polytechnic Institute

Noble M. Kalish
Worcester Polytechnic Institute

E-Tourism

A Study on Universal User Experience

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By

Noble Kalish

Ethan Campbell

Isabel Morales Sirgo

Melissa Bazakas-Chamberlain

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Professor Mounir Ghogho

Universite Internationale de Rabat (UIR)

Professors Laura Roberts & Mohammed El Hamzaoui

Worcester Polytechnic Institute

Abstract

The International University of Rabat (UIR) is working with the Moroccan government to develop a tourism mobile application. This application needed a user interface that was modern and intuitive for the diverse user base. We assisted UIR by making recommendations for their final user interface. We accomplished this by making user experience proposals based on features used in successful applications. We then collected data on how potential customers responded to each proposal. By the end of the project, the team delivered a user interface prototype and logo for the E-Tourism application.

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Executive Summary

Morocco's tourism industry is a large contributor to the economy accounting for 18.6% of the GDP (WTTC, 2018). More than 10 million international tourists come to Morocco annually (Bazza, 2018). To remain competitive Morocco needs to provide travelers with applications to enhance and expand the tourist experience. Mounir Ghogho, a professor at the International University of Rabat (UIR), is working with the Ministry of Tourism in Morocco to provide an application for international tourists. The application will allow users to identify a heritage site in the Rabat-Sale area through photos or searching by site name.

This project tailored a user experience (UX) proposal that would provide a richer visitor experience at Morocco's heritage sites. The nature of the application requires a user interface that is designed for international tourists. To do this we established the following objectives:

- Ascertain and rank features that make up a successful user experience
- Design user experience proposals
- Select and combine successful features from user interface proposals into a single user experience.

Benchmarking

We used benchmarking to successfully extract features from applications. Benchmarking is a process commonly used to measure the quality of a product and determine the key features that make it successful. We looked at applications with tourism, machine learning, and computer vision features. We choose these categories as they align with the main features used in our application. We evaluated the selected applications to understand the design choices that users did and did not like. We also aggregated reviews from users to determine common complaints or enjoyable features. Afterwards, we presented our findings to our sponsor for approval.

User Experience Prototypes

Next, we designed user experience prototypes, making use of the data compiled from benchmarking. User experience prototypes consist of designs of the user interface with simulated functionality. We used the web application Figma to create these prototypes. Professor Ghogho established two evenly sized teams of two WPI students and two UIR students. Professor

Ghogho made this decision in order to generate designs from different perspectives on the user interface. Each team created a mock-up of the user interface and presented the prototype for review and analysis.

Data Collection

We used focus groups and surveys to evaluate the completed prototypes. We chose focus groups because they allow us to interact with the participants in discussions about the prototypes. We presented the interactive prototypes to our focus group of international students from UIR. The focus group was administered in two phases. First, the participants explored the interactive prototype and expressed their first impressions and opinions. Next, we asked questions about each design choice and their preference. Finally, we compiled and interpreted the data from the focus group. To collect more data, we sent out surveys to a culturally diverse group of potential end users. From the surveys our team collected a large amount of data about specific design aspects. Finally, we used a systematic process called value analysis that quantifies each applications' performance against ideal criteria to measure the value of the prototypes.

Findings

After compiling and analyzing our data we developed an understanding of our stakeholder's wants and needs regarding color palette, icons, screen layout, and logo.

Color Palette

In regard to an application's color palette, we found unsaturated colors to be the most pleasant to potential users. Every application we benchmarked used unsaturated or muted colors. We showed participants in our surveys two color palettes: one with a white and blue theme and one with a red and green theme. We found potential users rated both color palettes highly, on a scale from one to five, with a difference in rating of under 0.1.

We found participants liked shades of red and green more than shades of white and blue. Focus group participants preferred the red and green color palette more because of the association with the Moroccan flag.

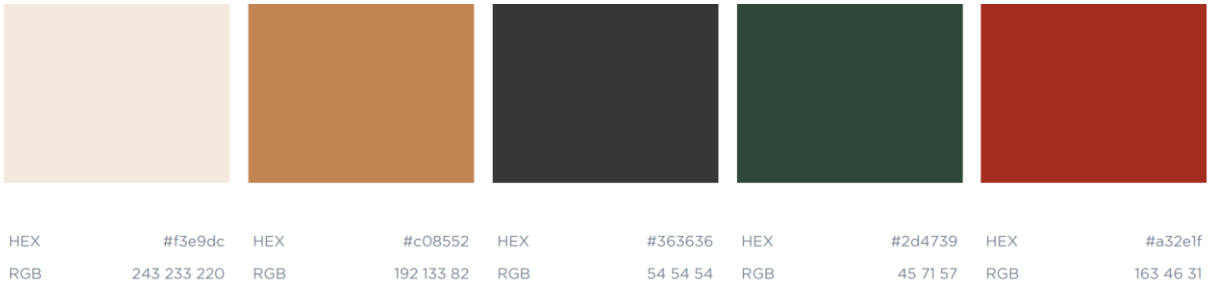

Figure 1: Red and Green Color Palette

Icons

We found that users prefer the camera, magnifying glass, heart, two photos overlapping, and three vertical dots icons.

Icon	Functionality	Finding
	Camera	Found across all applications benchmarked with this functionality. Recognized in both focus groups and surveys.
	Search	Found across all applications benchmarked with this functionality. Recognized in both focus groups and surveys.
	Favoriting	Found across multiple applications benchmarked. Recognized in surveys. Preferred by focus group participants.
	Gallery	Found across all applications benchmarked with this functionality. Recognized in both focus groups and surveys.

	Manage Settings	Found across all applications benchmarked. Preferred by focus group participants.

Table 1: Icon Findings

Logo

We found that users prefer a simplistic logo design, featuring Hassan Tower and the English word for tourism. Six out of eight faculty members at UIR preferred a simplistic logo design. A historian and designer agreed that the Hassan Tower represented the target area of the application. Additionally, during our focus groups, we found that potential users understand the meaning of the English word for tourism.

Figure 2: Final Logo Proposal

Screen Layout

Users prefer an interface that has all functionality within one click. Keeping all functionality within one step allows the user to never lose track of where they are in an application. Additionally, participants in the focus group said they wanted the main screen to be the camera screen as it is the main functionality of the application.

Recommendations

Through our research of similar applications and feedback from potential users we recommend UIR to:

1. Use an unsaturated color palette with shades of red and green.

2. Use the icons in Table 1.
3. Use a monochromatic logo, featuring Hassan Tower and the english word “Tourism”.
4. Follow a screen layout that grants direct access to the application's main functionalities.
5. Expand the use of surveys and focus groups to include international tourists.
6. Finally, Use the prototype we developed, which incorporates the first four recommendations.

Figure 3: Final UI Proposal

Conclusion

Our goal was to tailor a UX proposal that would provide a richer visitor experience at Morocco’s heritage sites. Through benchmarking, surveys, and focus groups we concluded a list of recommendations for UIR to follow. We hope our recommendations help UIR accomplish their goal of developing the E-Tourism application.

Authorship

Section	Primary Author(s)	Primary Editor(s)
Abstract	Noble Kalish	All
Executive Summary	Noble Kalish	All
1.0 Introduction	Noble Kalish	All
2.0 Literature Review	Noble Kalish & Melissa B-C	Isabel M-S
3.0 Methodology	Isabel M-S	Ethan Campbell
4.0 Findings	Isabel M-S & Noble Kalish	Isabel M-S & Noble Kalish
5.0 Recommendations	Isabel M-S & Noble Kalish	Ethan Campbell & Melissa B-C

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1.0 Introduction

To remain competitive in the travel and tourism industry, Morocco must invest in technology that travelers use. Mobile technology helps travelers learn about all the available destinations and experiences the world has to offer. The significant rise in worldwide tourism, with an increase of 140 million more tourists from 2016 to 2017 (The World Bank, 2018), coincides with the growth of 200 million smartphone users (Newzoo, 2019). Tourists use phone applications for commerce, mapping, planning, photography, social media, communication and education. As a result, tourism and travel is the 8th most popular category on the iOS app store (PocketGamer.biz, 2019). Indeed, travelers use so many applications to prepare for travel and while on a trip that their phones have become travel companions (Tussyadiah, 2012).

As a significant contributor to the Moroccan economy, tourism is vitally important. There were 10.3 million international tourists in Morocco in 2018 (Bazza, 2019). These tourists brought 2.3 billion USD to Morocco (OECD, 2018). Many Moroccan citizens rely on tourists to make a living as one out of every ten jobs are supported through tourism (WTTC, 2018). Tourism also accounts for 18.6% of the country's GDP (WTTC, 2018). To further the value of tourism, countries have turned to digital tourism. As France and Spain lead in the number of tourists that come to Morocco, 1.4 million and 600,000 respectfully, there is a need to develop applications appealing to both cultures (OECD, 2018) as well as all types of tourists. Different cultures view user experience in different ways; there needs to be research on what successful user experience is to these customers. This diverse audience has different concerns for privacy, aesthetics, and functionality in user experience.

Professor Mounir Ghogho, the current Dean of Doctoral College at the International University of Rabat (UIR), and the Ministry of Tourism in Morocco are working on a tourism application that allows users to experience a self-guided tour through pictures of heritage sites. Our goal was to tailor a user experience (UX) proposal that would provide a richer visitor experience at Morocco's heritage sites. UX is the positive look and feeling of an application. Potential users will choose an application over another because of the user experience (Gong, 2004).We explored similar applications and received insight from international students studying in Morocco. This project delivered a user interface design to Professor Ghogho that incorporates a universal user experience.

In this paper we present our background research, looking at the concept of tourism as well as its importance in Morocco. Then, we present the research done on the concept of user experience as well as existing digital tourism applications that tourists are using in other countries. We describe the strategies we used to collect the data and the steps we followed to produce a user experience prototype for the application. Finally, we present our findings and recommendations which we provided to UIR to further develop the E-Tourism application.

2.0 Literature Review

In this chapter, we examine the importance of tourism in Morocco and the need to integrate technology into the industry. To begin, we describe the value of tourism internationally and how it has grown in recent decades. Next, we explain the importance of the tourism industry for the Moroccan economy and work being done to promote its growth. Finally, we explore the technologies being used by the International University of Rabat to modernize tourism in Morocco. To gain a better understanding of the strategies and technologies used to implement digital tourism, we looked at past projects and research being done in different countries.

2.1 Benefits of Tourism

The global tourism market is growing rapidly. Many diverse countries have and do rely on tourism as a key contributor to economic stability due to the job creation and income brought by the industry. According to the World Travel and Tourism Council, a private trade organization, in 2018 tourism directly and indirectly contributed to 10.4% of global GDP, a value of 8.8 trillion USD, and 319 million jobs worldwide (WTTC, 2019).

Since the economy of a country can be largely affected by tourism, private companies are incentivized to create their businesses around travel destinations. This, along with the influx of travelers, creates a need for infrastructure in the communities relying on the industry.

The positive potential effect of tourism on the economy of a country encourages governments and private companies to develop around local and regional destinations. The increase in tourism traffic also puts pressure on the infrastructure of communities relying on that industry. Private and public infrastructure that tourists rely on include roads, transportation, public sanitation, communication networks and travel resources. In order for an area to be a viable tourist destination, there needs to be adequate public infrastructure (The Centre for Spatial Economics, 2015). Ideally, nations, regions, and localities should invest in improving infrastructure, such as travel resources like phone applications, when tourism is important to the economy. There are reciprocal and indirect economic benefits to investment in infrastructure for tourism such as employment opportunities. The Center for Spatial Economics did a report for the Canadian government that predicted a $50 billion CAD investment in public infrastructure would create between 81,000 and 88,000 jobs (The Centre for Spatial Economics, 2015). The model

displayed in Canada can be applied to many countries when looking at the benefits of public investment. For example, residents benefit directly from an investment in public transportation because it allows greater access to medical care and job opportunities (APTA, 2019). Tourism benefits the infrastructure of a country by driving a country to invest more resources into its infrastructure.

2.2 Tourism in Morocco

The tourism industry in Morocco is a significant contributor to the economy. In 2018 travel and tourism contributed 18.6% of Morocco's GDP (WTTC, 2018). Additionally, money coming in from tourism is not confined to businesses within the industry, such as hotels and transportation. Tourists in Morocco spend money at local marketplaces and restaurants which in turn puts money into the local economy. In Morocco 86.6% of travelers' spending was on leisure (WTTC, 2018). As a result, tourists' spending ultimately ends up helping the Moroccan people by providing about 1.9 million jobs (WTTC, 2018). In order to maintain a competitive advantage as a tourist destination, it is crucial for Morocco to adopt and offer infrastructure such as applications to provide a modern travel experience.

2.3 Digital Tourism

With the advent of the internet, tourists can easily access travel applications and websites. Where previously tourism information and consumption were largely accessed through travel agencies, tourists are now in control of their travel experiences and purchases (Happ & Ivancsó-Horváth, 2018). Digital tourism is the use of the government and private travel websites, and phone applications to plan, and purchase travel as well as support the tourist experience through education, activities and resources (Benyon et al, 2014). Digital tourism can be a recommendation system to help find accommodations during a vacation (Ardissono et al, 2003), a digital tour-guide on the tourist's smartphone while away (Abowd et al, 1997) or the ability to view photos taken after the tourist's vacation (Apted et al, 2006). When researching 16,000 tourists from across the globe, TravelPort found the average tourist used 7-8 tourism apps when away (TravelPort, 2018). Tourism applications aim to enhance the travel experience for anyone wanting to use them. These applications provide a wide range of uses from clarifying TSA rules or ridesharing, to streamlining international monetary exchange through ecommerce.

A case demonstrating the significant effect of access to digital travel and tourism resources can be seen with Hungary. In 1991, only 1% of the population in Hungary had internet access, 58% by 2010 and 79% access in 2016 (Happ & Ivancsó-Horváth, 2018). While tourism was rapidly growing there, Hungary was just beginning to adopt the internet demonstrating a unique microcosm compared to countries such as the United States where tourism developed alongside the internet. Hungary had developed tourism without the internet. By looking at Hungary's tourism before and after 2010 and their use of digital tourism, the advantages of digital tourism are pronounced.

Once Hungary had adopted the internet, in 2016, almost 50% of the hotels in Hungary had their own websites (Happ & Ivancsó-Horváth, 2018) leading to significant increase in revenue for hotels. Tourists took advantage of the increase in websites leading to 45% of domestic accommodation revenue through hotel websites (Happ & Ivancsó-Horváth, 2018). The ability to access a hotel's website greatly increased the accommodation revenue even when coming from within the country. Hotel websites offer the benefits of 24/7 availability, independence and convenience for tourists (Happ & Ivancsó-Horváth, 2018). The increase in digital access also increased the promotion of an owner's business. Through social media, visual ads, and search engines, a business can successfully promote themselves through digital means (Happ & Ivancsó-Horváth, 2018). Happ & Ivancsó-Horváth looked at digital tourism in Hungary through hotel websites, but this example can be applied to any country that adopts digital tourism. In Morocco, digital tourism can be applied in different ways to give Morocco a competitive edge as a destination choice, and to enhance tourism experiences such as the ability to learn about the country's history, traditions, and religion. One popular approach to digital tourism is mobile applications.

2.3.1 Mobile Tourism Market

Mobile applications have become the main focus for tourism, because of the increasing number of mobile users. For example, the number of smartphone users is estimated to reach 3.8 billion by 2021 (Newzoo, 2019). This growth has driven the mobile application market to become one of the fastest-growing media outlets in the history of consumer technology (Newark-French, 2011). As a result, travel applications are the eighth most popular category in the iOS App Store (PocketGamer.biz, 2019). With tourism applications being so popular, it is important

for mobile tourism developers to have a firm understanding of the mobile application market and to see what they may be lacking (Kennedy-Eden & Gretzell, 2012). Due to the popularity of travel applications, it is natural for Morocco to adopt this branch of digital tourism. Private institutions have begun to partner with Morocco's Ministry of Tourism in order to move into the mobile tourism market.

2.4. Our Project

To further advance digital tourism in Morocco, the International University of Rabat (UIR) has asked for consultation on user experience for their mobile application which allows users to take photos of heritage sites and presents them with historical information. Our sponsor for this project is Professor Mounir Ghogho, the current Dean of Doctoral College at UIR. His research focuses mainly on machine learning, data mining, signal and image processing, and wireless communication networks. It is Professor Ghogho who is leading the development of the application. This application allows tourists to take photos of a heritage site and through machine learning, identify said site providing additional information. Professor Ghogho's application targets international tourists coming to Morocco. There is a need for a user experience that satisfies the many different backgrounds of tourists. The user experience includes the user interface, the user interaction with the app, and user's emotions concerning the application.

2.5 User Experience

The term user experience has no agreed upon definition and has been critiqued for being vague and elusive (Hassenzahl & Tractinsky, 2006). We now understand user experience to mean the look and feel of the application. Originally, user experience was pointed towards functionality and usability without any desire to optimize "beauty" (Hassenzahl & Tractinsky, 2011). However there were multiple opposing definitions, for example, an opposing school of thought suggested that user experience (UX) was a person's experience at the moment of exposure (Whiteside and Wixon, 1987). It took nearly a decade after Whiteside and Wixon for the community to adopt their beliefs (Hassenzahl & Tractinsky, 2006). Eventually, it became a priority to view user experience through the lense of aesthetics (Holzinger, 2008). To understand the need of how important user experience is, is to understand that beauty has intrinsic value that satisfies a human need (Holzinger, 2008). The app we are developing will not only frame

heritage sites which all have inherent beauty but do so aesthetically using colors and fonts that enhance the user's positive experience. The overall design of the app will be pleasing. For this project user experience is derived from the interaction and aesthetics of the app.

The user needs to be able to understand the functionality of the application for them to want to continue making use of it. The emotions of the user are an important consideration when designing the user experience since it is, "focused on positive emotions" (Holzinger, 2008). Positive emotions are emotions that empower the user. If the user became frustrated with the interface, the user would not want to use the application. Therefore, it is important that the descriptions and information that will attach to images of heritage sites be thoroughly researched then written in a concise manner that is both educational and entertaining. Tourists faced with too much information or details beyond retention may become frustrated with the app, thus the text will consider these needs.

Because there is no single definition for user experience, it can be difficult to establish what makes a good user experience. Hassenzahl and Tractinsky define their user experience as a method to enrich current product quality with non-instrumental aspects to create a more complete, holistic human-computer interaction (Hassenzahl & Tractinsky, 2006). User experience is meant to achieve the functionality of the product and what Hassenzahl calls the products Hedonic goals (Hassenzahl, 2008). Hedonic value is the basic human need that a user feels fulfillment when using the product (Hassenzahl, 2008). The pragmatic approach of usability first does not satisfy the human need for fulfillment. Hassenzahl goes into depth about how a user feels fulfillment when using an application such as being able to understand the functionality in order to want to continue making use of it. Through his study, Hassenzahl has found that autonomy and competence were the greatest ways participants felt fulfillment through an application (Hassenzahl, 2008). The users experienced positive emotions when there was no feeling of defeat when using the application and showed positive emotions when the application did not try to control what the user did (Hassenzahl, 2008). Taking this into consideration, navigational tools, links and other aspects of the app design will be user driven. When creating a user experience the project is interested in the effect and consequence the application has on the user and their emotions (Hassenzahl & Tractinsky, 2006). In designing a successful user experience, our goal will be to satisfy the autonomy and competence determined by the various groups of users targeted by the application.

2.5.1 User Experience for Moroccan Tourism

Morocco is reliant on tourism being such a significant part of GDP. There were about 2.9 million domestic tourists in Morocco, and approximately 10.3 million international tourists from across the globe in 2018 (OECD, 2018). Having an audience from diverse places and backgrounds creates a difficult challenge for designing a user experience that fits these multiple cultures and identities. User experience is not a unified experience, ranging from culture to culture. But by examining the main groups that visit Morocco and gathering data on their likes, dislikes, levels of technology comfort, depth of interest of sites, reading levels and attention spans, this project examined the main groups that visit Morocco. In doing so it allowed a unique user interface to appear for each of these groups.

2.6 Conclusion

There are many challenges when designing a user experience for a large set of cultural backgrounds. The goal for this project was to tailor a UX proposal that would provide a richer visitor experience at Morocco's heritage sites. The next section of the paper is the methodology. The methodology discusses the various objectives and methods followed to deliver a complete and useful user experience proposal.

3.0 Methodology

In order to achieve goal of tailoring a UX proposal that would provide a richer visitor experience at Morocco's heritage sites the following objectives were accomplished:

- Ascertained and ranked features that make up a successful user experience;
- Designed user experience proposals;
- Selected and combined successful features from UX proposals into single user experience.

The objectives were broken down into tasks including analyzing resources we needed as well as possible challenges that we may have faced when completing each. The proposed timeline that was followed can be found in Appendix A.

3.1 Ascertained and Ranked Features that Make Up a Successful User Experience

> *Benchmarking - Measure of the quality of an organization's products, and their comparison with standard measurements, or similar measurements of its peers.*

We accomplished this objective by looking at academic research on what makes an organized user interface. Additionally, we determined and ranked features with successful user experiences by benchmarking applications with features similar to the application with which we worked. We then analyzed and quantified this data in order to justify decisions made in further objectives.

3.1.1 Background Research

After consulting multiple background sources, we put together several questions to bring to an expert about User Experience. We interviewed Soussan Djamasbi, a professor at WPI's Foisie Business School. The script used to conduct the interview can be found in Appendix B. We compiled the data from the interview and obtained additional background literature from her which was used to tailor the content of our focus group script.

3.1.2 Evaluated Competitive Applications

Finally, we identified common design patterns on tourism, machine learning, and computer vision applications. The design patterns taken from these applications were based on the criteria in Appendix C. We created a matrix with the criteria to compare the applications. The

criteria was derived in a way that allowed us to visualize features commonly used by applications at the top of their field, as well as features and constraints that commonly led to negative reviews from the users. Data collection for each of the applications included downloading and interacting with the user interface as well as looking through reviews to find patterns in the user complaints. This process allowed us to identify features and designs that were used in our own application.

3.2 Designed a UX proposal

> *Unified Modeling Language (UML) - A standard modeling language used by software engineers to visualize, specify, and construct the systems of a project. It is a collection of best engineering practices proven to be successful for modeling large and complex systems.*

Next, we designed user experience prototypes, making use of the data collected in the previous objective. To use the information collected effectively we split into two teams, each team consisted of two WPI students and two UIR students. The composition of the teams was made in order to generate designs from more diverse perspectives on the user interface. The two teams were tasked with creating mock-ups without knowledge of each other's designs. Finally, each team presented their prototype for review and analysis.

3.2.1 Unified Modeling Language Diagrams

To ensure each prototype satisfied the same requirements we created UML diagrams. The UML diagrams specified the requirements that the user interface must allow the user: 1) take or select a photo and 2) identify the heritage site in the photo and 3) search for heritage sites by name. Each team then followed the UML diagrams to ensure each prototype allowed the tourist to perform every required action.

3.2.2 Software Tools

> *Interactive Prototype - A semi functional model of the user interface.*

To develop the interactive prototypes, we made use of Figma; a vector-based user experience design tool for web and mobile applications. We opted for this platform because it

allows for real time collaboration that facilitates and encourages contribution from all team members. For UML diagrams, we opted on using LucidChart which is a website that allows real-time collaboration on various diagrams.

3.3 Selected and combined successful features from UX proposals into a single user experience

Our third objective was selecting and combining features from both UX proposals in order to form a single recommendation. After finishing the initial UX prototypes, we presented the prototypes to Professor Ghogho and his cohorts. We then received feedback from Professor Ghogho to update the proposals. Afterwards, we conducted focus groups on the two proposals to further refine the prototypes. Finally, we conducted surveys for users to rate features and design choices combining the best features of both proposals into a single, final recommendation.

3.3.1 Focus Groups

We used focus groups consisting of international students at UIR to receive feedback on our user experience proposals. The initial approach for the focus groups involved questioning tourists at heritage sites, however, local authorities restricted this interaction. We adjusted our questionnaire, found in Appendix D, to obtain information from international students currently residing in the Rabat-Salé area. The focus groups that the team conducted had a semi-structured process. They included a set of open questions that allowed the subjects to voice their opinion and discuss as a group, in a way that would not be possible in a structured interview (Gibbs, 1997). There were several factors as to why focus groups were chosen as the primary data collection tool over other methods. The first reason being that focus groups allowed the team to interview many people at the same time. There was a limited amount of time for data to be collected while the team was in Morocco and this method allowed efficiency in time and data volume. The second reason for focus groups was that they allow subjects to exchange ideas off of each other. The justification for both of these reasons comes from a study done by Anita Gibbs where she says that the main purpose for a focus group is to obtain an individual's beliefs in ways that would not be realistic using other methods (Gibbs, 1997). She then goes on to say that these beliefs are more easily brought out in a social gathering like a focus group (Gibbs, 1997).

3.3.2 Surveys

Once in Morocco, our team decided to implement surveys on both our user interface prototypes, Appendix E & F, as an additional method for data collection. Our team's timeline was adjusted to satisfy our sponsor's requirements, reducing the time allocated for data collection. In order to be flexible, the surveys were shortened allowing us to reach a larger number of potential users. Additionally, the use of surveys permitted our team to extract quantifiable data at a larger scale than our focus groups. This method also provided both qualitative and quantitative data from which we were able to make recommendations. We sent out the surveys to international students at UIR and fellow students at Worcester Polytechnic Institute.

3.3.3 Value Analysis

> *Value Analysis - A systematic method of comparison for determining the options that best fit a set of criteria defined by the relation of a stakeholders needs and the user base's wants.*

For the team to go more in depth with this project, we conducted a value analysis to accurately compare and identify key features in our prototypes. This analysis was used to generate a relation between customer requirements and stakeholder's resources. This analysis consisted of multiple steps. Step one, was defining the customer requirements, this is what the end user needs and wants from the product. Step two was defining the customer rankings, once the specific attributes had been defined they were ordered according to priority. For these two initial steps we relied on the information gathered from both the expert interview and the focus groups. Step three was defining design attributes, this consists of defining the methods and resources needed to meet each of the customer requirements. These were determined by the application's stakeholders, in this case, Professor Mounir and UIR. Step four was building a "House of Quality", this consisted of building a matrix, defining a relationship between the customer requirements and the design attributes. The fifth and final step was to evaluate our prototypes against the resulting needs/hows relationship (Miles, 1989). During the value analysis phase, we used the techniques of Lawrence D. Miles, author of *Techniques of Value Analysis and Engineering*. Miles was an engineer and is credited with creating value analysis and all things related thereof. The "House of Quality" that we built was used to evaluate the

performance of our compiled recommendations, or our “final proposal” against our previous prototypes. This allowed us to measure the increase in value once our set of recommendations are implemented.

3.4 Ethical Considerations

This project was submitted for approval of the Institutional Review Board. Since we collected data from human subjects we have included a consent script at the beginning of our focus groups. In this script we pointed out that participation in this study is completely voluntary, and a subject may step out when no longer comfortable. We also shared the purpose of the study as well as the type of data we collected.

3.5 Our Deliverable

Once the final modifications to the user experience prototype were completed, we compiled our deliverable. The deliverable included a set of recommendations, exemplified in our user experience prototype, surveys and focus group templates, and feature rankings and justification for value analysis. This final deliverable allowed our sponsor to continue to build on the project after leaving Morocco. In the next chapter we discuss our findings.

4.0 Findings

After compiling and analyzing our data we developed an understanding of our stakeholder's wants and needs regarding color palette, icons, screen layout, and logo.

4.1 Color Palette

We found unsaturated colors to be the most pleasant to potential users. Every application we benchmarked used unsaturated or muted colors. Facebook and Snapchat, some of the most popular applications in the iOS App Store, both used muted colors. We showed participants in our survey two color palettes: one with a white and blue theme and one with a red and green theme. Figure 4 showcases the results of our survey regarding both color palettes. Potential users rated both color palettes highly, out of a scale of five, with a difference in rating of under 0.1.

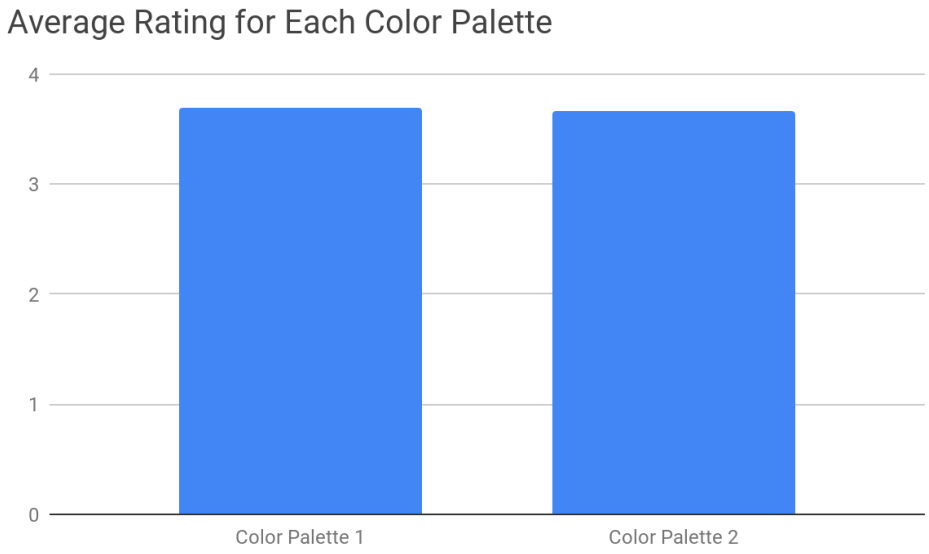

Figure 4: Color Palette Rating

Shades of red and green were preferred by participants of the focus group. They preferred this color palette because they were able to immediately identify the connection to the colors of the Moroccan flag, Figure 5.

Figure 5: Moroccan Flag

4.2 Icons

We found that users prefer the camera, magnifying glass, heart, two photos overlapping, and three vertical dots icons. During our research of relevant applications, we found that icons being used for the same functionality remained consistent across applications. Both teams implemented conventionally used icons but made sure to choose different icons when multiple options were available.

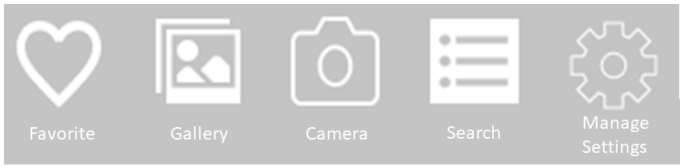

Figure 6: Prototype One Icons

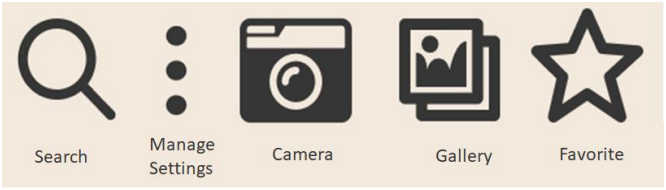

Figure 7: Prototype Two Icons

From our survey and focus groups we found that potential users correctly identified the functionality of the magnifying glass, the camera, gallery, heart, and star icons. Focus group participants interacted with the application and found it easier to relate the heart icon to favoriting than the star icon. We found that users were not able to identify the meaning of the

three vertical dots when they were simply shown an image of the icon. However, focus group participants identified the functionality of the icon when interacting with the application.

Icon	Functionality	Finding
	Camera	Found across all applications benchmarked with this functionality. Recognized in both focus groups and surveys.
	Search	Found across all applications benchmarked with this functionality. Recognized in both focus groups and surveys.
	Favoriting	Found across multiple applications benchmarked. Recognized in surveys. Preferred by focus group participants.
	Gallery	Found across all applications benchmarked with this functionality. Recognized in both focus groups and surveys.
	Manage Settings	Found across all applications benchmarked. Preferred by focus group participants.

Table 2: Icon Findings

4.3 Logo

Potential users preferred a logo featuring Hassan tower. The initial iteration of the application will focus on the two major historic sites in Rabat, Hassan Tower and Chellah. We presented the logo in Figure 8, along with others created by UIR, to our sponsor. Six out of the eight faculty members who voted, including our sponsor Professor Ghogho, selected the logo in Figure 8.

Figure 8: Team Two's Logo Proposal

International tourists will understand the application's purpose more if the English word "tourism" is used. We presented the logo, Figure 8, to participants in our focus groups and asked for their thoughts. Participants stated they were confused with the Arabic transliteration for the word tourism, "Siya7a". Participants told us the transliteration did not remind them of tourism and suggested the English word "Tourism" as a substitute. Additionally, looking at the demographic data from tourists coming into Morocco, we found the most common languages spoken were French, Spanish, and English. The word tourism in all these languages contains "tourism", making the English word easiest to recognize for our potential users.

Professor Mohamed Kbiri Alaoui, a historian whose focus is in the Rabat-Sale area, agreed that Hassan Tower represented our target location. However, he also mentioned that the ratio between the tower and the pillar made the site hard to recognize. Future iterations of the logo showcased variations of the monument, Figure 9.

Figure 9: Additional Logo Proposals

We consulted with a professional designer that commented that the use of a single-color traced logo maintains simplicity and versatility over different color backgrounds and textures. Additionally, during our focus groups, potential users agreed that the use of a single color made the logo less visually demanding.

4.4 Screen Layout

We found that users became frustrated with the application if access to functionality took more than one step. Research shows that reducing the number of operations needed to perform common tasks within an application is a key factor in the ease of use of mobile devices (Gong, 2004). We found that potential users struggled to access all functionality in both user interface prototypes. In our focus groups potential users were unable to reach a screen if it took more than one step and became lost within the application. Keeping all functionality within one step allows the user to never lose track of where they are in an application.

We found that users prefer when the first screen they interact with is the main functionality of the application. The applications we benchmarked implement their main functionality as their initial screen. For example, Snapchat introduces the user to the camera screen directly allowing the user to use the main functionality without any additional steps. Participants in the focus group said they wanted the main screen to be the camera screen.

The surveys and focus groups were important to confirm what we found from benchmarking. These findings were essential to create recommendations for UIR. In the following chapter, we present our recommendations.

5.0 Recommendations

Through our research of similar applications and feedback from potential users we recommend that UIR:

1. Use an unsaturated color palette with shades of red and green.
2. Use the icons in Table 2.
3. Use a monochromatic logo, featuring Hassan Tower and the english word “Tourism”.
4. Follow a screen layout that grants direct access to the application's main functionalities.
5. Expand the use of surveys and focus groups to include international tourists.
6. Finally, uuse the prototype we developed, which incorporates the first four recommendations.

5.1 Use an unsaturated color palette with shades of red and green

Our first recommendation is that UIR use a color palette that consists of unsaturated shades of red and green with complimentary shades of beige and gray.

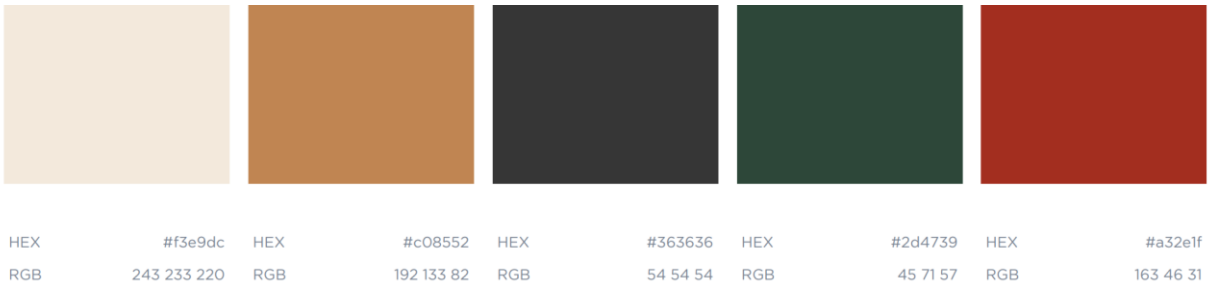

Figure 10: Final Color Palette Proposal

Picking a visually appealing color palette is important to the success of any application. We made use of unsaturated colors due to convention found when we benchmarked applications. During our focus groups users preferred the color palette that used shades of red and green over the color palette with shades of blue and white. Focus group participants were reminded of the Moroccan flag when presented with shades of red and green.

5.2 Implement Conventionally Used Icons

Second, we advise that UIR use a camera, magnifying glass, heart, two photos overlapping, and three vertical dots icon for the application.

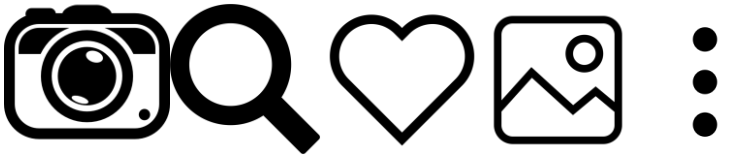

Figure 11: Final Icon Proposal

We asked potential users if these icons represented the desired functionality, on a scale from one to five. Participants agreed that the icons represented their functionality with an average score of 4.65 out of 5.

5.3 Use a monochromatic logo, featuring Hassan Tower and the English word "Tourism"

We recommend that UIR use a monochromatic logo that features the Hassan Tower and the word "tourism."

Figure 12: Final Logo Proposal

Participants in our focus groups said a monochromatic logo was visually pleasing to them. Professor Alaoui, agreed that Hassan Tower was easy to recognize and represented the target location. Looking at the demographic data from tourists coming into Morocco, we found the most common languages spoken were French, Spanish and English. The word tourism in all these languages contains "tourism," making the English word easiest to recognize for our potential users.

5.4 Follow a screen layout that grants direct access to the application's main functionalities

We recommend that UIR implement a screen layout that grants direct access to the application's main functionalities. Participants of the focus group became frustrated when accessing a functionality took more than one action. Users are less likely to be confused when all functionality is available within one step. We also recommend that the camera screen be the first screen a user interacts with. Potential users preferred the camera screen because it is the main function of the application.

5.5 Expand the use of surveys and focus groups to include international tourists

We recommend that UIR expand the use of surveys and focus groups to include international tourists. UIR will be able to conduct effective focus groups and surveys using our templates. The templates will give UIR quantitative and qualitative data to use for the continuous development of their application’s user interface. During our focus groups participants were confused with the lack of functionality. We expect results to be more detailed when potential users can interact with a functional application. Continuous surveys and focus groups will be essential for the user interface to stay competitive in the growing market of tourism applications.

5.6 Implement the Final User Interface Prototype

We recommend UIR implement our final user interface prototype. The final prototype, Figure 13, is built based on our recommendations and addresses the needs of our sponsor and stakeholders.

Figure 13: Final User Interface Prototype

The results of our competitive value analysis, Table 3, show the increase in value after implementing our set of recommendations. Our final UI proposal scored between 46 and 49 points higher than our mid stage prototypes, representing a 27% value increase. A more detailed view and interpretation of the results can be found in Appendix I. As UIR continues to develop the application, we recommend that they use our provided criteria to conduct value analysis. This will help ensure that additions to the application will effectively add value rather than downgrade it.

UI	Logo	Color Scheme	Flow	Icons	Total
Prototype A	3	8	6	9	181
Prototype B	8	8	4	8	184
Final Design	9	8	8	8	230

Table 3: Value Analysis Results

5.7 Conclusion

This project designed a UX proposal to provide a richer visitor experience at Morocco's heritage sites. We conducted benchmarking, surveys, and focus groups and developed recommendations for UIR to follow. We hope our recommendations assist UIR in accomplishing their goal of developing the E-Tourism application.

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Appendices

Appendix A: Proposed Timeline

The following timeline is a visual representation of the time allocated to complete the tasks defined for each of the objectives discussed. PQP refers to the period of time available to us pre-departure to the project site. The 7 weeks at the project site were used to assess tasks that required field research and work based upon the result of that research.

Task	**PQP**	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**
Background research on tourism								
Background Research on User Experience								
Benchmarking Competitive Applications								
UML Diagrams								
Prototype Development								
Focus Groups								
Surveys								

Recommendations & Final Proposal development								

Appendix B: Expert Interview Questions and Results

Background Questions:

- What is your role at WPI?
- How long have you been at WPI?
- How long have you worked with user experience?
- Have you done research with user experience?
    - If so what research with user experience have you done?

User Experience Questions:

- What do you believe is the most important aspect of user experience?
- Do you believe in a universal user experience?
    - If not what do we need to consider when designing for many cultures and languages?
    - If yes what would one think about when making an app with universal user experience
- What are some aspects of user experience that are intercultural?
- What are the important considerations when thinking about user experience?

Appendix C: Benchmarking Table

Application/Project	Used in Morocco ?	Target Users	Similarity	Language	Is released app	Rating/# users	Platforms
Culture Trip	Yes	Tourists (English)	Tourism	WordPress and Java	Yes	4.8/1M+	WEB
Google Lens	Maybe	Everyday Users	Computer Vision	Not Disclosed	Yes	4.6/100M+	Android iOS
Cam Find	Yes	Everyday Users	Computer Vision	Not Disclosed	Yes	2.8/301	Android iOS
LeafSnap	Yes	Plant Enthusiasts	Computer Vision	C++	Yes	4.3/10K+	Android
Snapchat	Yes	Everyday Users	Machine Learning	Java and Python	Yes	4.3/1B+	Android iOS web
Aipoly Vision	Yes	Visually Impaired	Machine Learning	Not Disclosed	Yes	3.5/100K+	Android iOS
Instagram/Facebook	Yes	Everyday Users	Machine Learning	Django, Gunicorn	Yes	4.4/1B+	Web Android iOS
Tours & Travel	Yes	Tourists	Tourism & Augmented reality	Not Disclosed	No	4.3	Android iOS
MacauMap	No	Tourists (English)	Tourism	Not Disclosed	No	4.5/100K+	iOS
Deep Map	Yes	Everyday Users	Tourism gps	Java	Yes	4.2	Android
MONUMENT TRACKER	No	Tourists	Tourism gps	java	No	0/0	Android iOS

Appendix D: Focus Group Questionnaire

We are a group of students from Worcester Polytechnic Institute in Massachusetts. We are conducting a survey of international students to learn more about the needs and preferences of international users when using mobile applications. We strongly believe this kind of research will allow us to perform a value analysis on the aspects of an application and later on design a user experience that is close to universal.

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. This is a collaborative project between the UIR and WPI, and your participation is greatly appreciated.

For more information about this research contact gr-Rabat-E-Tourism-C20@wpi.edu or IRB Manager (Ruth McKeogh, Tel. 508-831-6699, Email: irb@wpi.edu) or Human Protection Administrator (Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu).

1. What is your age?
2. What is your nationality?
3. Which user interface did you see first?

Splash Screen

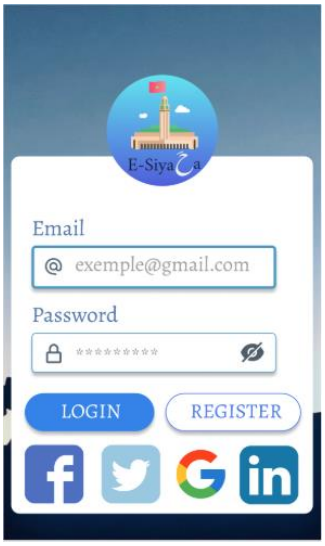
How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen reminded me of Morocco
    a. Why or Why Not?
2. I like this screen

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen reminded me of Morocco
    a. Why or Why Not?
2. I like this screen

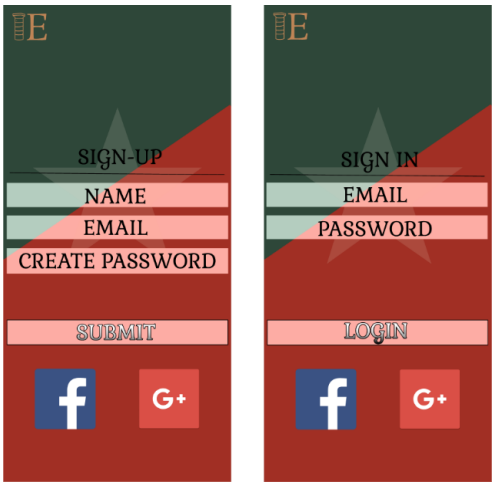
Login Screen



1. What do you think the social media icons do?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

2. I like this screen

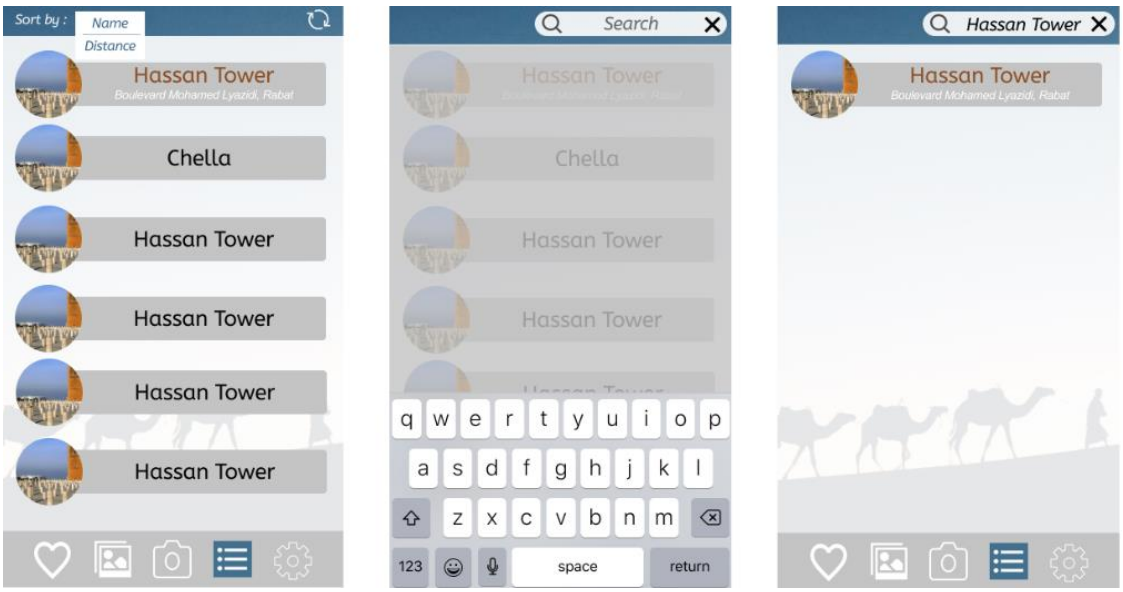


1. What do you think the social media icons do?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

2. I like this screen

Search by Name Screen



What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen was easy to find
2. I understood the purpose of this screen
3. I like this screen

What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen was easy to find
2. I understood the purpose of this screen
3. I like this screen

Camera Screen

What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen was easy to find
2. I understood the purpose of this screen
3. I like this screen

What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen was easy to find
2. I understood the purpose of this screen
3. I like this screen

Gallery Screen

What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

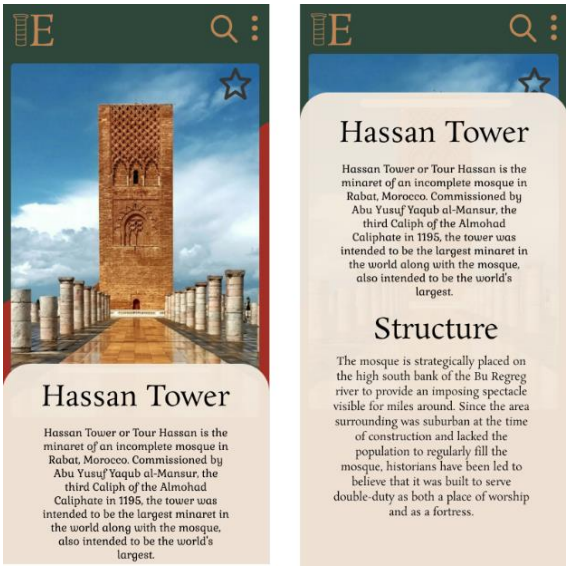
1. This screen was easy to find
2. I understood the purpose of this screen
3. I like this screen

Site Information Screen

What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen was easy to find
2. I understood the purpose of this screen
3. I like this screen

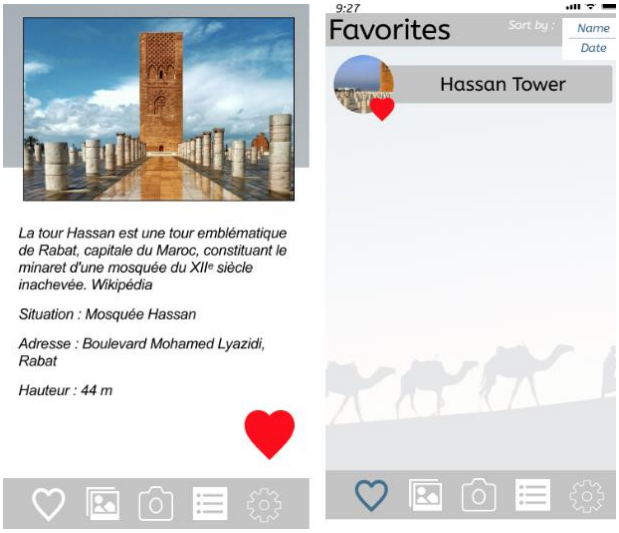


What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen was easy to find
2. I understood the purpose of this screen
3. I like this screen

Favorites Screen



What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen was easy to find

2. I understood the purpose of this screen
3. I like this screen

What do you think the purpose of this screen is?

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen was easy to find
2. I understood the purpose of this screen
3. I like this screen

General Questions 1

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I like this screen
2. Was it clear what each symbol meant

   a. Why or Why Not?

3. What screen do you think should come after the login screen? Why did you choose this screen?
4. Do you believe the user interface was easy to use?

What do you think of the color palette of this user interface?

General Questions 2

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I like this screen
2. It was clear what each symbol meant

   a. Why or Why Not?
3. What screen do you think should come after the login screen? Why did you choose this screen?
4. Do you believe the user interface was easy to use?

What do you think of the color palette of this user interface?

Appendix E: User Interface 1 Survey

We are a group of students from Worcester Polytechnic Institute in Massachusetts. We are conducting a survey of international students and faculty to learn more about the needs and preferences of international users when using mobile applications. We strongly believe this kind of research will allow us to perform a value analysis on the aspects of an application and later on design a user experience that is close to universal.

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. This is a collaborative project between the UIR and WPI, and your participation is greatly appreciated.

For more information about this research contact gr-Rabat-E-Tourism-C20@wpi.edu or IRB Manager (Ruth McKeogh, Tel. 508-831-6699, Email: irb@wpi.edu) or Human Protection Administrator (Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu).

The user interface shown in this survey is a proposal made for a tourism mobile application. This application will allow users to identify heritage sites using different methods. Users will be able to take a photo of the site, select a saved photo for identification or search by site name. Once the site is identified, a user will be able to view historical information on the site and store desired results to their favorites.

1. What is your age?
2. What is your nationality?

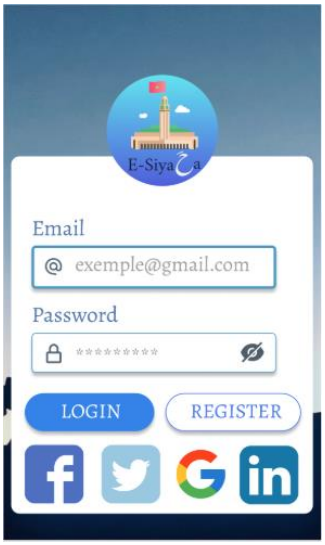
Splash Screen

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen reminds me of Morocco

   Why or Why Not?
2. I enjoy looking at this screen
3. I like the colors of this screen
4. I like the background photo

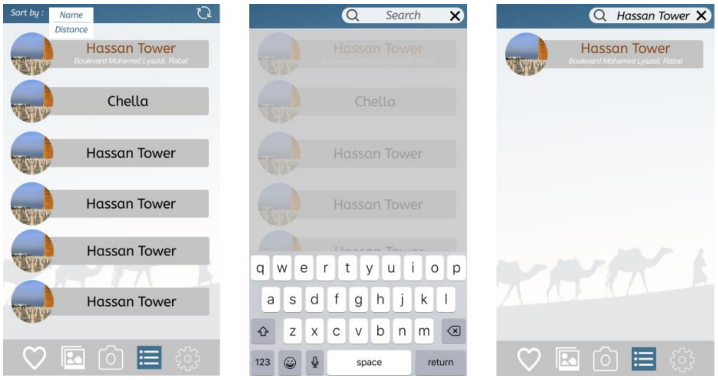
Login Screen



How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understood what the social media icons did
2. I like this screen

Search By Name Screen



How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understand the purpose of this screen
2. I like this screen

Camera Screen

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

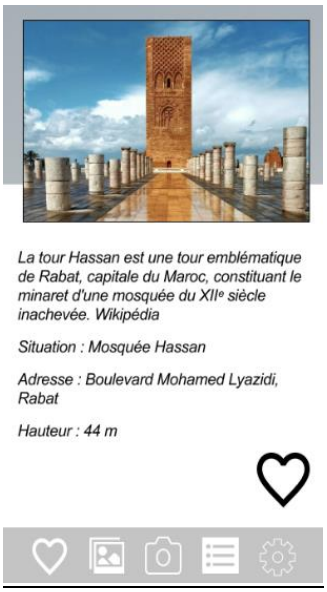
1. I understand the purpose of this screen
2. I like this screen

Gallery Screen

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understand the purpose of this screen
2. I like this screen

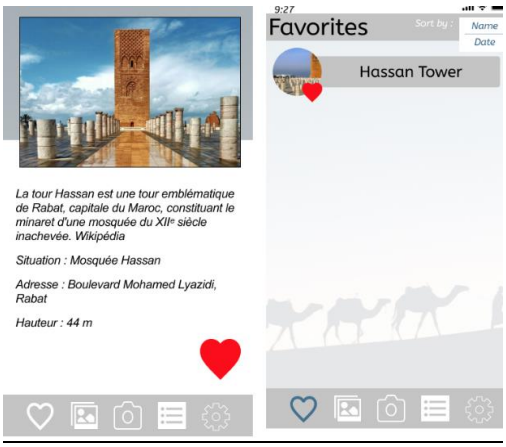
Site Information Screen



How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understand the purpose of this screen
2. I like this screen

Favorites Screen



How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understand the purpose of this screen
2. I like this screen

Icons

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This icon accurately represents the camera feature

2. This icon accurately represents the search by name feature

3. This icon accurately represents the gallery feature

4. This icon accurately represents the favorites feature

5. This icon accurately represents the settings feature

Color Scheme

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I like this color palette

Appendix F: User Interface 2 Survey

We are a group of students from Worcester Polytechnic Institute in Massachusetts. We are conducting a survey of international students and faculty to learn more about the needs and preferences of international users when using mobile applications. We strongly believe this kind of research will allow us to perform a value analysis on the aspects of an application and later on design a user experience that is close to universal.

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. This is a collaborative project between the UIR and WPI, and your participation is greatly appreciated.

For more information about this research contact gr-Rabat-E-Tourism-C20@wpi.edu or IRB Manager (Ruth McKeogh, Tel. 508-831-6699, Email: irb@wpi.edu) or Human Protection Administrator (Gabriel Johnson, Tel. 508-831-4989, Email: gjohnson@wpi.edu).

The user interface shown in this survey is a proposal made for a tourism mobile application. This application will allow users to identify heritage sites using different methods. Users will be able to take a photo of the site, select a saved photo for identification or search by site name. Once the site is identified, a user will be able to view historical information on the site and store desired results to their favorites.

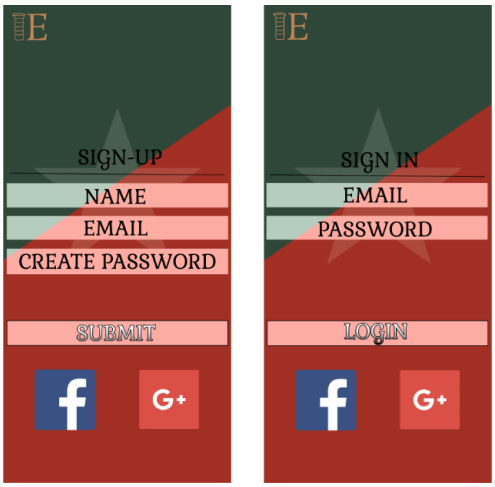
1. What is your age?
2. What is your nationality?

Splash Screen

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. This screen reminds me of Morocco
    a. Why or Why Not?
2. I enjoy looking at this screen
3. I like the colors of this screen
4. I like the background photo

Login Screen



How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understood what the social media icons did
2. I like this screen

Search by Name Screen

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

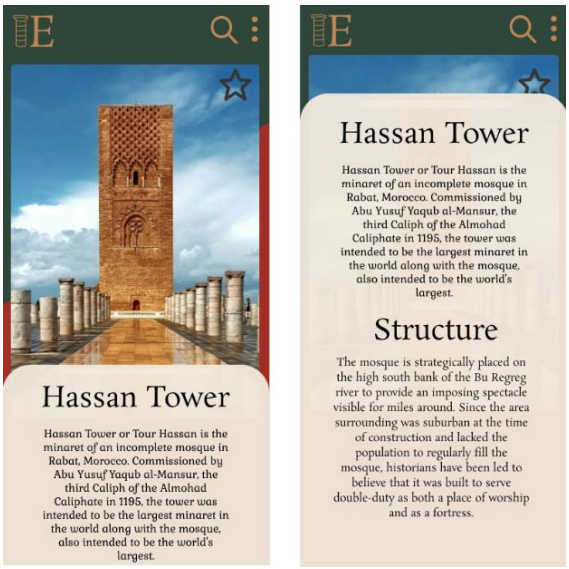
1. I understand the purpose of this screen
2. I like this screen

Camera Screen

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understand the purpose of this screen
2. I like this screen

Site Information Screen



How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understand the purpose of this screen
2. I like this screen

Favorites Screen

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I understand the purpose of this screen
2. I like this screen

Icons

How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

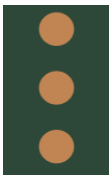
1. This icon accurately represents the camera feature

2. This icon accurately represents the search by name feature

3. This icon accurately represents the gallery feature

4. This icon accurately represents the favorites feature

5. This icon accurately represents the settings feature

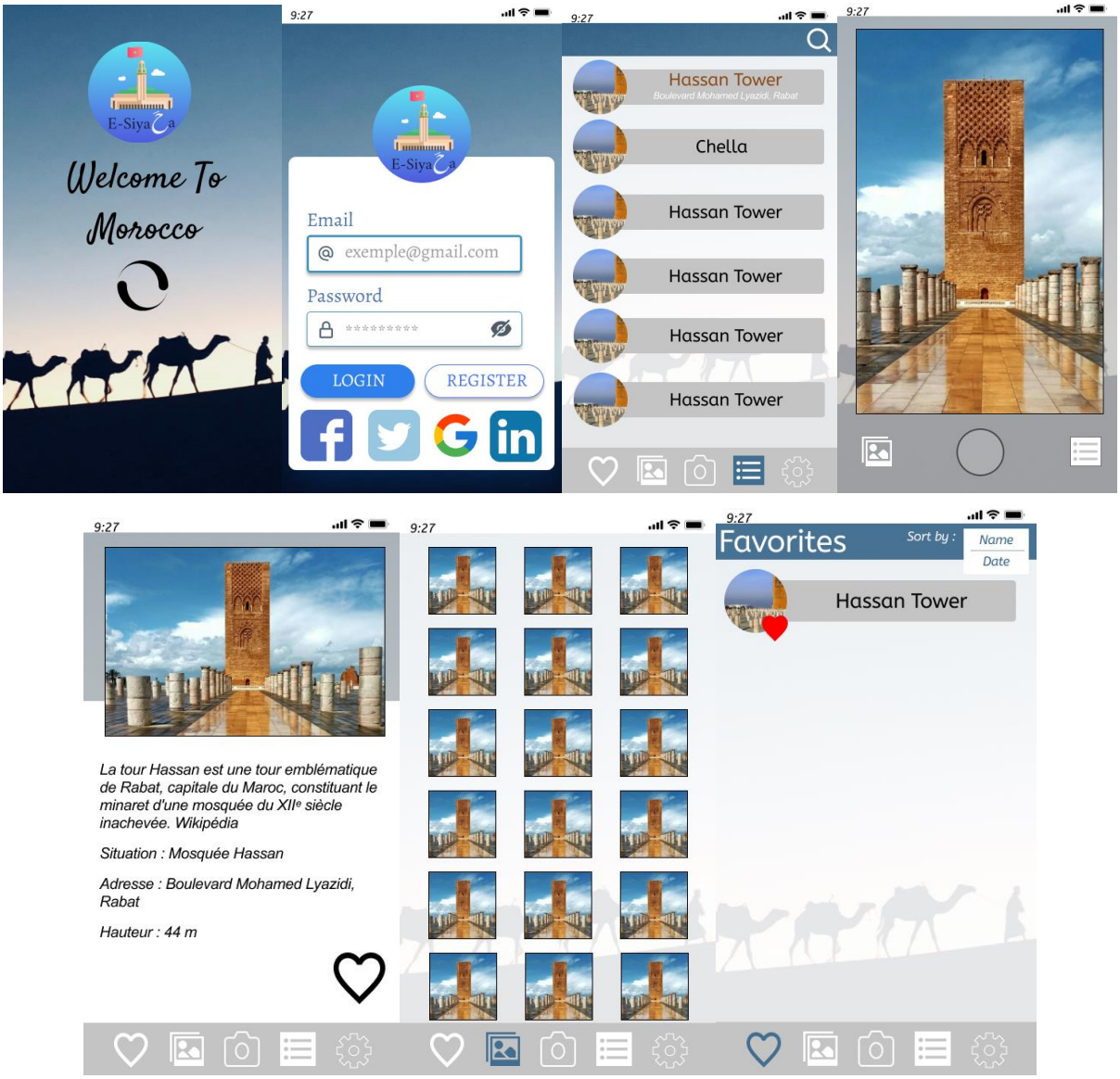


Color Scheme

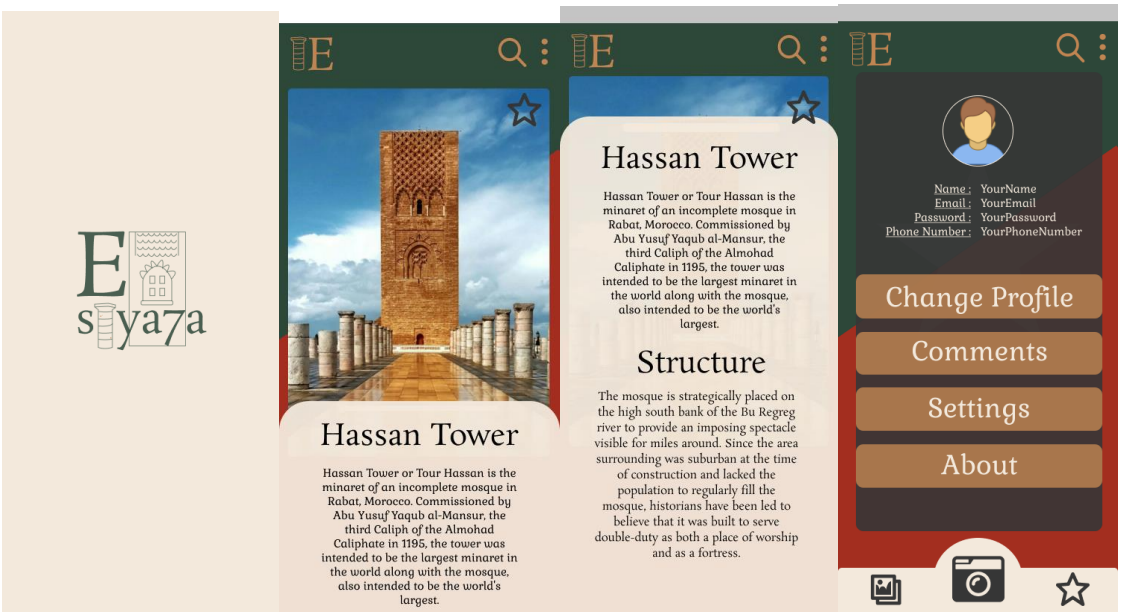
How much do you agree with each statement? Please rate on a scale of 1 to 5, 1 meaning you do not agree and 5 meaning you completely agree.

1. I like this color palette

Appendix G: User Interface 1



Appendix H: User Interface 2



Appendix I: Value Analysis “House of Quality”

Feature Ranking

In order to perform value analysis, we first defined the customer requirements, in this case the UI features needed to satisfy an international user base. Additionally, we adjusted the requirements to fit in with our stakeholders demands for functionality. We then moved on to rank these features by importance for both our end users and stakeholders. The process consists of determining the weight of the feature by adding up the value the feature holds for the stakeholder [1-5] plus the value it holds for the potential end user [1-5]. Based on our data collected we defined the following weighting criteria.

Feature	Weight
Logo	6
Color Scheme	5
Flow	10
Icons	7

Competitive Value Analysis

Applications are then looked at individually, grading their performance based on data collected. The following table showcases the total scores of all three UI proposals when run against the criteria defined above.

UI	Logo	Color Scheme	Flow	Icons	**Total**
Prototype 1	3	8	6	9	181
Prototype 2	8	8	4	8	184
Final Design	9	8	8	8	230

Based on our criteria, the perfect UI design would obtain a maximum of 280 points total when run through this value analysis. However, the whole purpose of value analysis is to obtain the highest value possible while making compromises to satisfy both parties involved.

Appendix J: Final Design