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GalapaGo!

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Date: June 12, 2020

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ENTITLED

GalapaGo!

BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREES OF

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GalapaGo!

by

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Submitted in partial fulfillment of the requirements
for the degrees of
Bachelor of Science in Computer Science
Engineering
Bachelor of Science in Web Design
Engineering
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GalapaGo!

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ABSTRACT

When traveling to the Galápagos Islands, tourists are unaware of all the Islands have to offer and only visit popular tourist spots. They bring in pests which are damaging to the ecological structure and do not contribute to the local economy. There is very limited Internet services on the Islands and not many online resources to be found. We have created a mobile and web application that show users recommendations for their visit. Because the Galápagos Islands do not have reliable internet connectivity, our application must not rely on connectivity to function. Instead, users will only need to connect once in order to download the mobile application before having full functionality of it.

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Chapter 1

Introduction

1.1 Background

The Galápagos Islands are home to around 25,000 residents, yet nearly 225,000 tourists visit each year. Despite the influx of tourists year-round, the 2010 census reveals that around 52 percent of residents on the Galápagos Islands live in poverty. Even though cruise ships constantly pass through the islands, tourists are only recommended typical tourist activities and do not necessarily get local insight on the islands or more importantly, how to contribute to the local economy. In addition, tourists also introduce issues that involve incoming pests and damaging the treasured ecological structure of the Galápagos Islands. Even if they were interested in looking up more information about the Galápagos, there is very limited (if any) Internet service on the islands.

1.2 Current Solution

There is currently no existing solution in the Galápagos Islands. Yelp and Airbnb have similar features that we are interested in, but due to the unreliable connectivity in the Galápagos Islands, tourists cannot use these applications. In addition, popular applications like Yelp usually do not contain much information for tourists in less populated places like the Galápagos.

1.3 Proposed Solution

There is a great opportunity to improve the economy and assist the residents of the Galápagos in empowering their local businesses. We plan to draw more tourists to local businesses by creating a mobile and web application that contains easily accessible information about local businesses such as dining places, entertainment, and more. The Galápagos Islands' Chamber of Tourism will be able to add entries to the mobile/web application, and users will be able to search through the listings and explore local offerings. Because the Galápagos Islands does not have reliable internet connectivity, our application does not rely on connectivity to function. Instead,

users will only need to connect once in order to download the mobile application before having full functionality.

Users will be able to rate and leave reviews of establishments on our web and mobile applications. Small businesses will be able to advertise themselves on a big platform, and tourists will be able to truly experience the unique wonders of the Galápagos Islands. By integrating our application into the tourism industry in the Galápagos Islands, we hope to attract more tourists to small businesses owned by the Galápagos residents, which in turn will bring much-needed money into the local economy.

Chapter 2

Requirements

2.1 Functional

- The application provides suggestions on the following

  - Transportation

  - Lodging

  - Food

  - Shops

  - Tourism

- The application provides information on the following

  - Science

  - Sustainability

  - History

  - Internet connectivity

  - Rules for the environment

  - Emergency contacts

  - Cultural and social customs

  - Language

  - Weather

- The application allows users to save their favorites to an favorites page

2.2 Nonfunctional

- The application has a simple and pleasant user interface that is easy to navigate

- The application can handle loss of internet connection

2.3 Design Constraints

- The application does not rely on WiFi connectivity to work

- The application is a mobile application used on Android and iOS

Chapter 3

Use Cases

This application's main goal is to provide information regarding a user's future trip to the Galapagos Islands.

Users can view recommendations for services such as food, shopping, and tourism as well as logistic recommendations such as lodging and transportation. Additionally, users can favorite these recommendations. The Galapagos Chamber of Tourism can advertise small businesses on this platform so tourists will be able to truly experience the unique wonders of the Galápagos Islands. Furthermore, there will be information provided regarding the history and science of the islands along with rules and emergency procedures for while they are visiting.
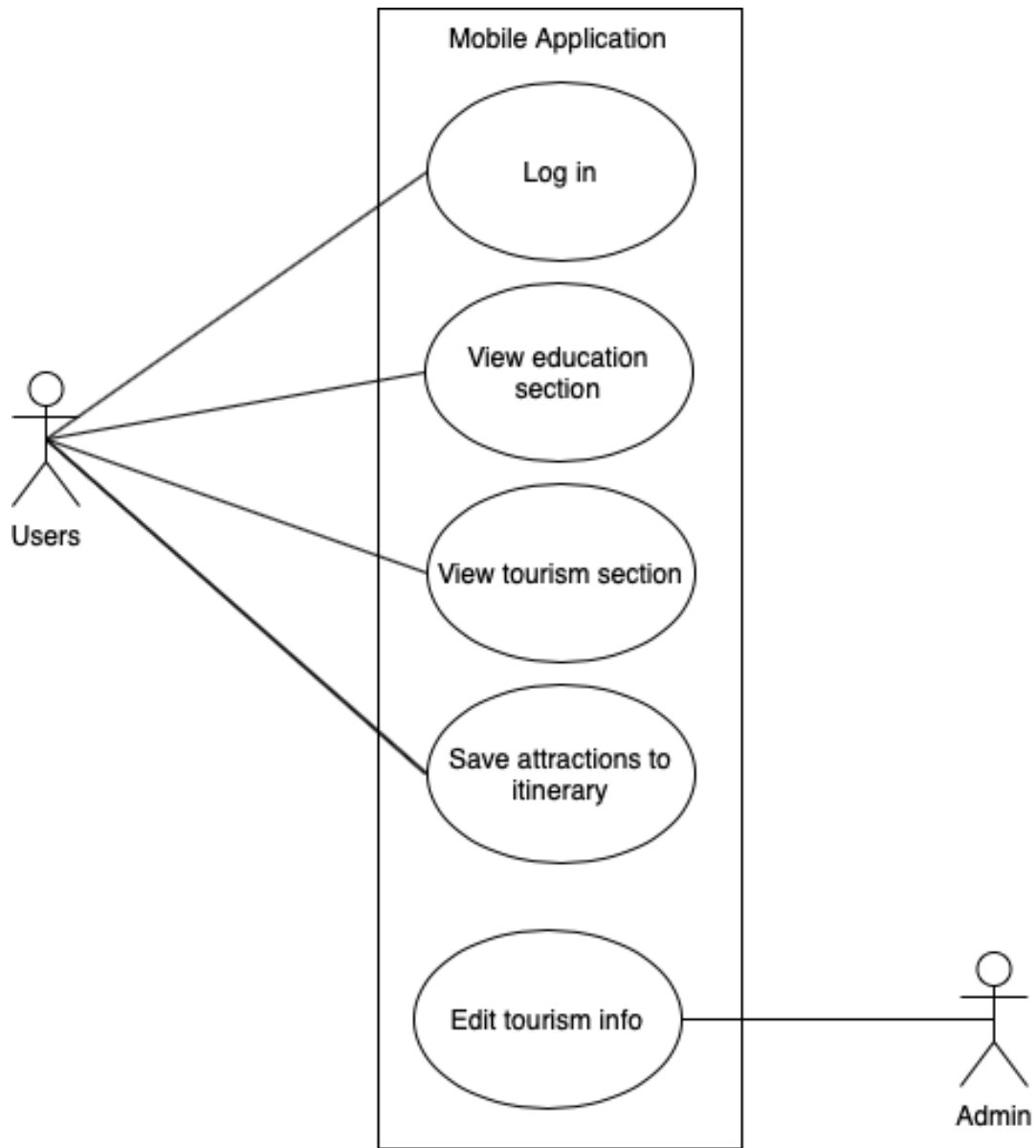
Figure 3.1: Use Case Diagram

Chapter 4

Activity Diagram

As seen in the figure of the activity diagram below, the user will first need to download the app, which can be found in the Apple App Store or Google Play Store. Then, the user will have the option of visiting three main sections: the education section, the favorites section, or the tourism information section. From the tourism information section, the user can access the general tourism tips page or view the attractions on the Galapagos Islands. In addition, the user will be able to favorite any entry in the "tourist attractions info" section to save into the favorites section. At the end of their visit, the user will have the option to send photos or comments back to the Galapagos Island Chamber of Tourism.

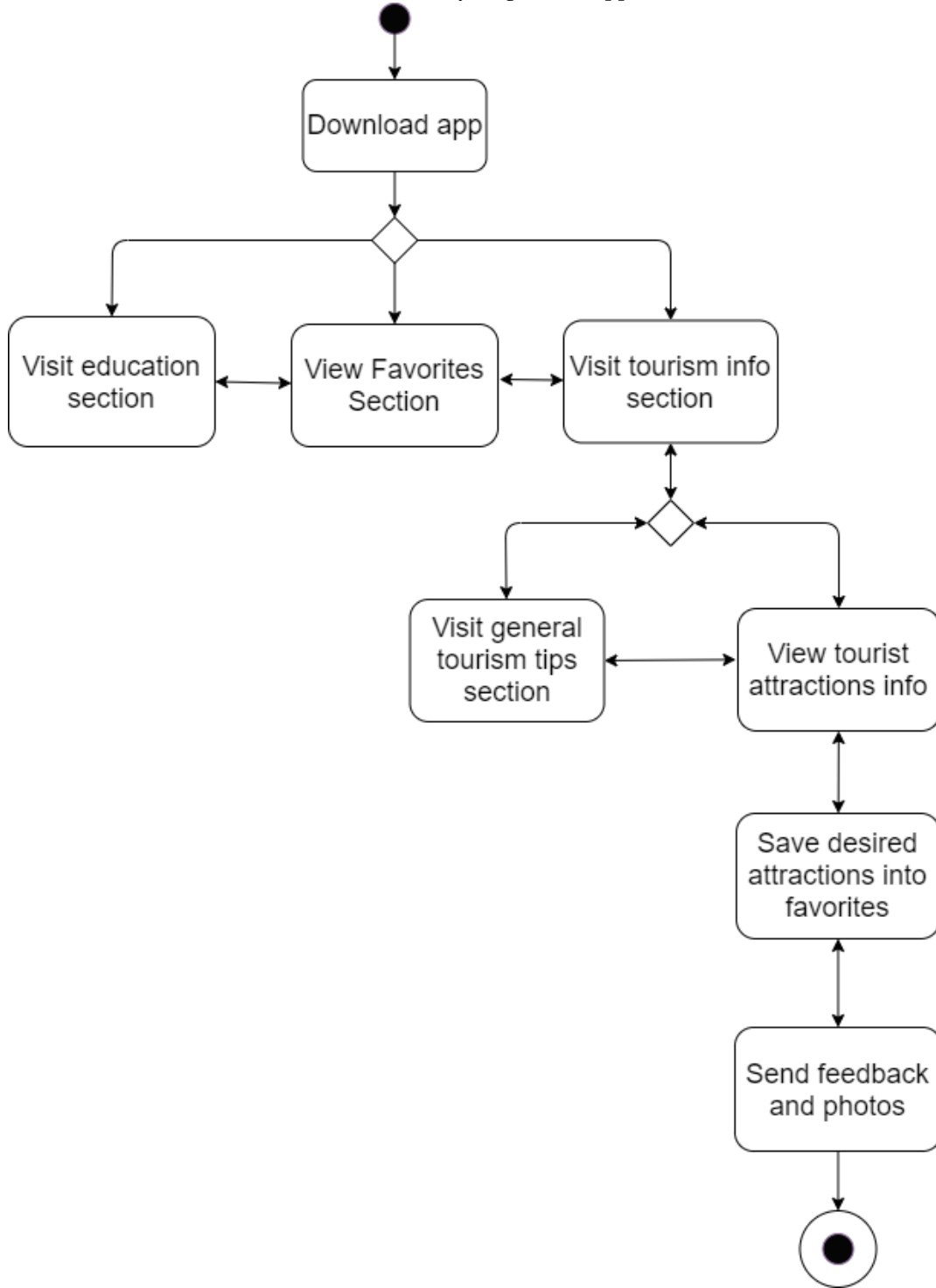Below is the model of activity diagram for application users.

Figure 4.1: User Activity Diagram

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Chapter 5

Interface Design

5.1 GalapaGo! Mobile Application

For a complete demo of the GalapaGo! mobile application, please visit https://bit.ly/GalapaGoMobile. Upon entering GalapaGo, users have three navigational options: Learn, Explore or Favorites.
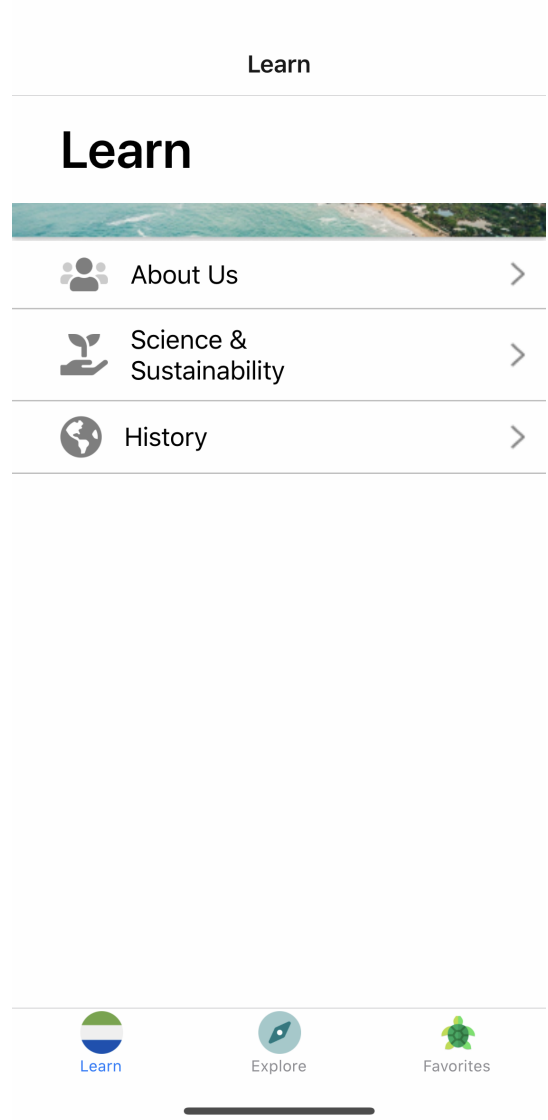
Figure 5.1: GalapaGo! Landing Screen

5.1.1 Learn

Within the Learn section, users can explore About Us, Science and Sustainability, and History. The About Us section provides important information about the admin of the app - the Chamber of Tourism in the Galapagos Islands. Science and Sustainability contains information about Galapagos flora, fauna, how to protect them, endangered species, and new species. Lastly, the history section displays a timeline of Galapagos history, some information about the locals, and a blurb about the islands' natural history.
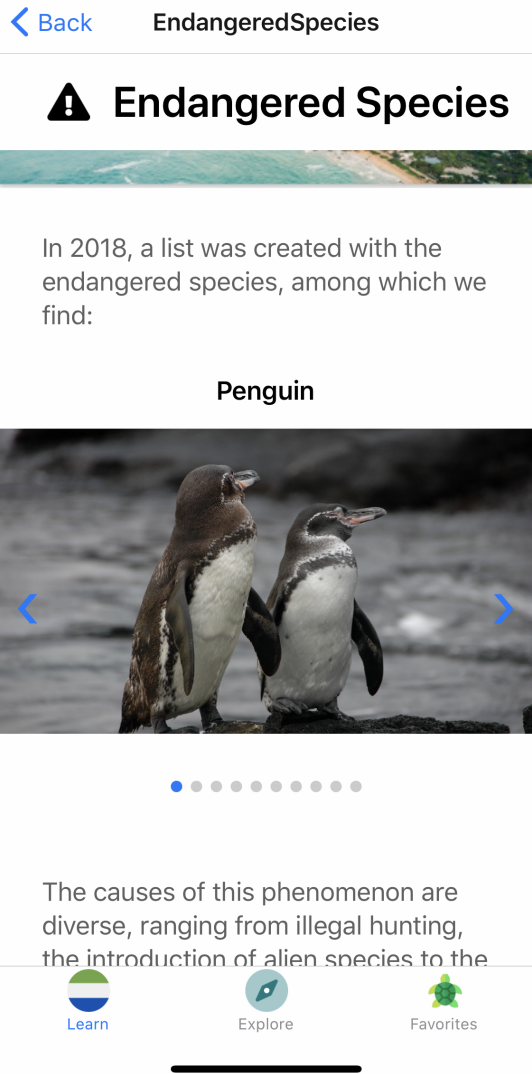
Figure 5.2: Endangered Species Screen

5.1.2 Explore

We anticipate that tourists will spend more of their time using the Explore section of the application. From the main Explore page, users can either explore the "Know Before You Go" section or "Plan Your Trip".

From the "Know Before You Go" page, users can explore the Language, Cultural and Social Norms, or Rules of the National Park pages. We also provide a blurb on Internet and Connectivity and the emergency number to call

when in the Galapagos.
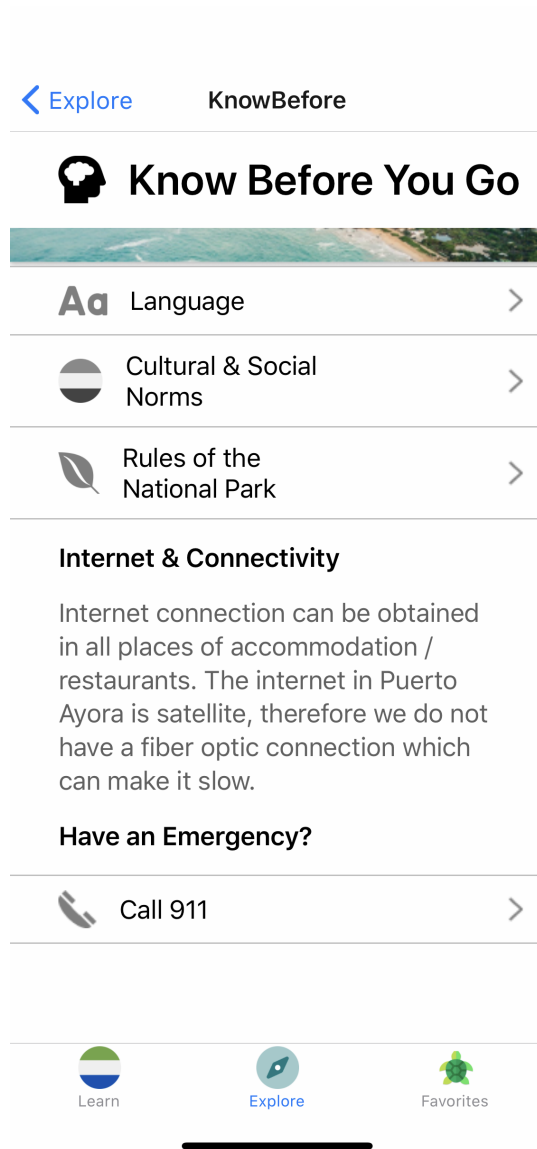
Figure 5.3: Know Before You Go Screen

In addition, users may access the "Plan Your Trip" section. It contains information on Top Activities, Santa Cruz Island restaurants and hotels, Travel Agencies, and Transportation between islands. Within this section, we provide information commonly requested by tourists.
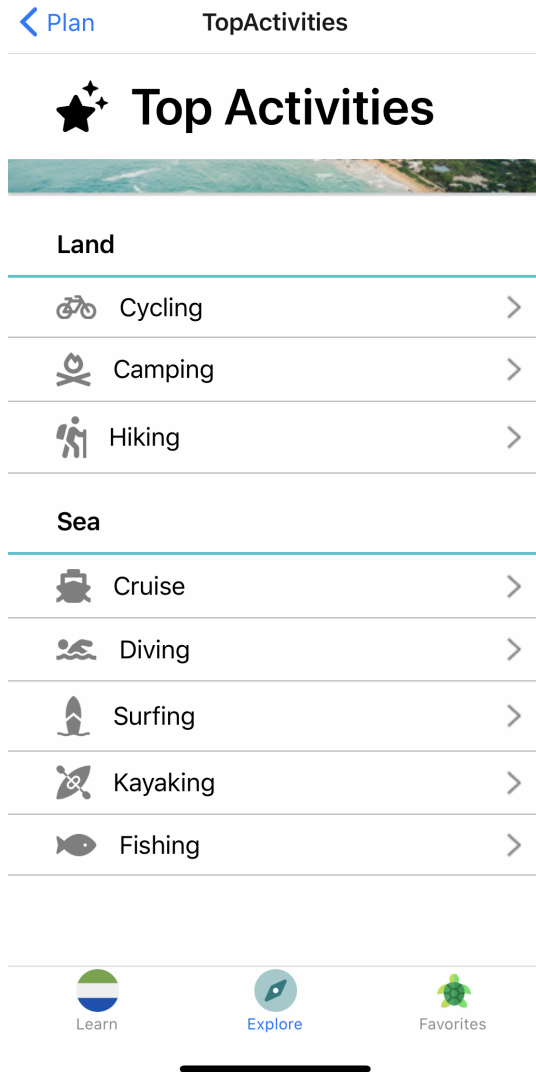
Figure 5.4: Top Activities Screen

On the Santa Cruz restaurants, Santa Cruz hotels, Travel Agencies, and Transportation (Want to Island Hop?) pages, we give users the opportunity to explore photos, call, email, or check the website of the business. They can also Favorite the item by pressing the turtle and the word "Favorite". This functionality will be explained below.
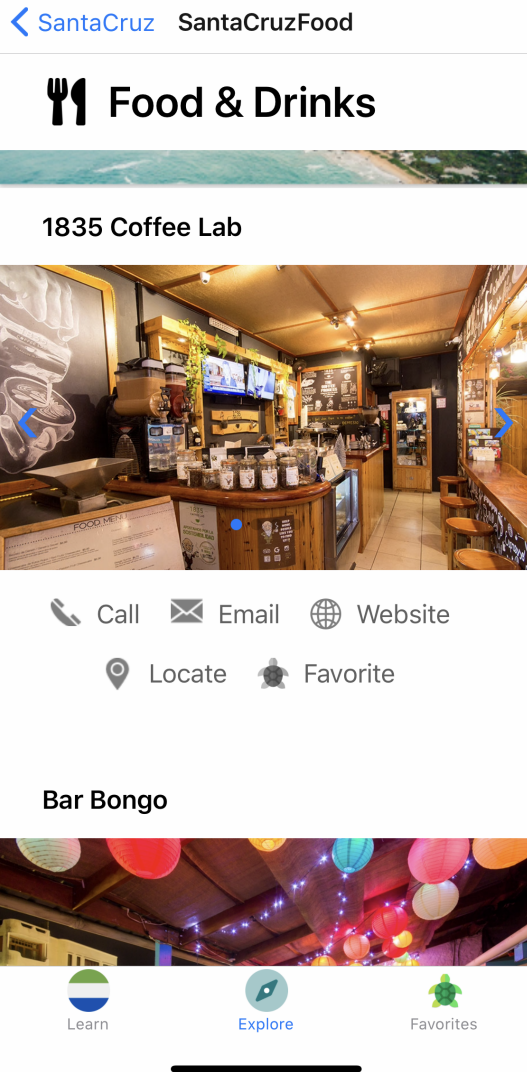
Figure 5.5: Favorites Button to Save Content Locally

5.1.3 Favorites

The Favorites section will be populated with items that users Favorite throughout the four sections previously listed. As there is little to no Internet connection in the Galapagos Islands, the favorite items are stored locally on users' phones.

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5.2   Admin Web Application

For a complete demo of the web application, please visit https://bit.ly/GalapaGoWeb.
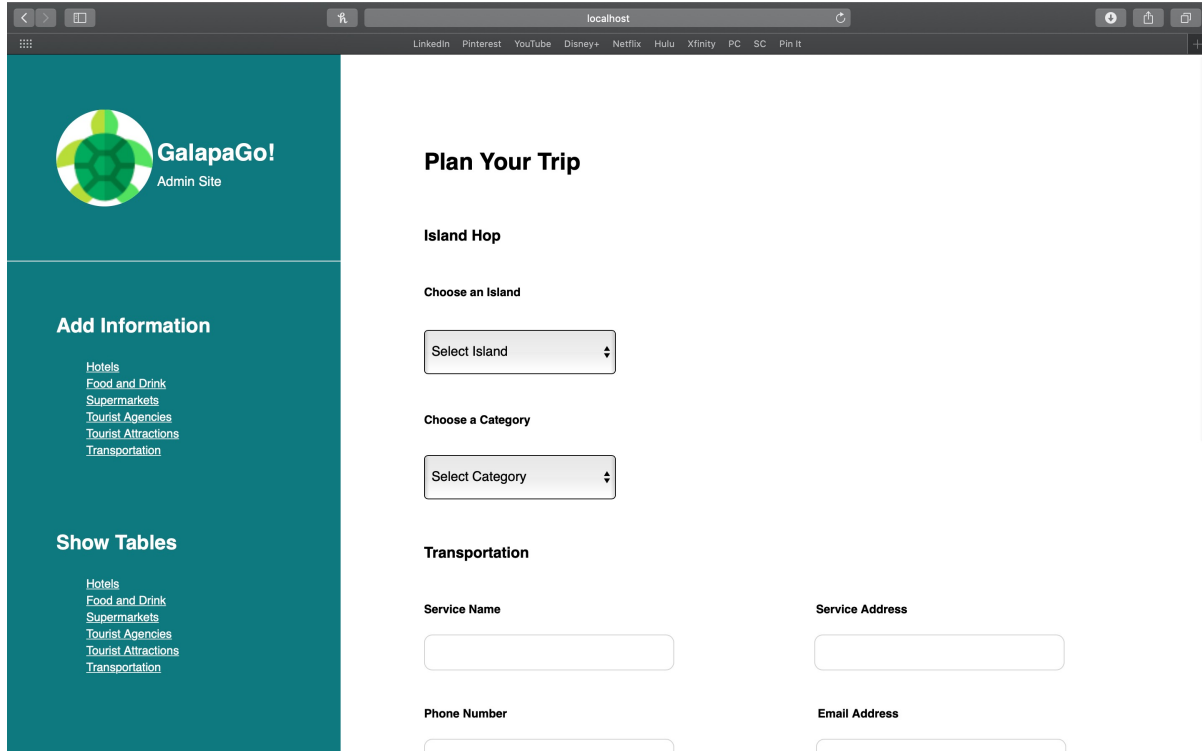
Figure 5.6: Admin Web App Landing Screen

5.2.1   Add Information

In the Add Information sections, the administrator can add new hotels, restaurants, supermarkets, tourist agencies and attractions, and transportation to the database. From each page, the user is able to get to any other page using the Choose a Category selection or the sidebar links.

Figure 5.7: Populated Database Screen

5.2.2   Show Tables

In the Show Tables sections, the administrator is able to see what is currently in the database for each section. There is a delete button next to each entry to give the administrator control to either delete the entry or leave it as is.

5.2.3   Connecting to the Mobile Application

Our web application is not yet connected to the mobile application. Once it's connected, the admin users will be able to make updates to the entire mobile app through the web application.

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Chapter 6

Technologies Used

6.1 User Interface

Our mobile application interface was developed using React Native. React Native has plenty of opportunity for code reuse as well as a large community of developers. Having a large community makes information more available for help when a team member was to run into issues when implementing our solution. Additionally, an iOS and Android application can be created simultaneously, therefore saving time and money. Finally, a team member has experience in using React Native, hence eliminating a decent amount of time that would be spent learning a new language.

6.2 Database

For our application, administrators needed to be able to update information regarding tourist services. In order to do this we had to have a database to store the information. For this, we chose to create a MySQL database using AWS. AWS was useful because it required minimal set up and did not require server infrastructure to power apps with data. Furthermore, it has the potential to store a copious amount of data.

Chapter 7

Architectural Diagram

7.1 Architecture

For our design project, we decided to go with a simple design to make it easy to implement and reduce the potential for bugs and errors. As you can see in Figure 7.1, our information is hosted in a MySQL database. This information can be added, edited, or deleted through the website and is then loaded into the mobile app from the database. Information such as favorited items are stored locally in the app.
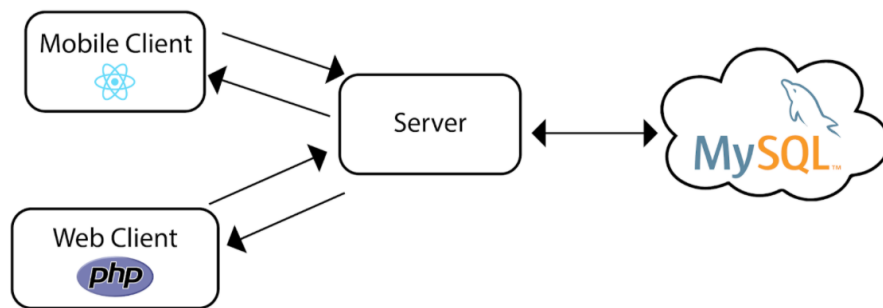
Figure 7.1: Architectural Diagram

Chapter 8

Design Rationale

8.1 User Interface

We chose an easy, intuitive, and aesthetic design for our interface. Our target users include tourists, locals, and anyone interested in learning more about the Galapagos. The potentially broad spectrum of users requires an intuitive interface. As a result, we only included a few choices on each page to reduce potential frustrations or confusion.

Most importantly, we wanted different pieces of the application to really reflect the Galapagos Islands, which we considered greatly when choosing colors and icons.

8.2 Technology

We have used React Native to develop the mobile application and React for any web component that may be used by admin to check on and input information. React Native allows for cross-platform usability and React is a responsive language that allows users to access the admin site on Desktop or mobile phone.

We originally started using Firebase Real Time Database. We found some issues with using this and were only able to use it for one month. It required that us to add strong security rules and even after doing so, it would not allow us to access the database. After struggling with this for a while, we decided to switch to MySQL which

we were a little more familiar with. There was still a learning curve with using this database but we found more online resources to help us than we did with our original database.

Chapter 9

Test Plan

9.1 Interface Testing

We conducted usability testing on GalapaGo! throughout the development process. We collected feedback on our interface and design by having people test our application before releasing it. This step in testing is extremely important as our application is targeted towards tourists coming to the Galapagos Islands, so our application must be easily accessible and well-organized in order to meet the tourists' needs. In addition, our app is intended for people who desire to learn more about the Galapagos Islands, so the contents of our app must be easily understandable by a wide range of people. We were able to ensure that we meet these goals through usability testing.

9.2 Alpha/Beta Testing

We also regularly conducted testing on all software components during our development process to ensure that all aspects of our application worked as intended.

Chapter 10

Risk Analysis

- Delay in obtaining information

    - We experienced some delays in receiving information from the Chamber of Tourism, which in turn delayed our development timeline. We tried to mitigate this by checking in regularly with the Chamber of Tourism to get information sooner.

- Time

    - We initially had a time constraint of finishing by Spring Break so that we could travel to the Galapagos during that time. This deadline ended up becoming obsolete as we were no longer able to travel internationally which actually gave us extended time to finish some of our features. Because of the added time, we were able to finish both our app and website more fully. With that said, there are still many next steps that need to be taken and we will dicuss that later.

- Illness

    - We did our best to fight this by eating healthier, sleeping well, wearing masks, and working through any sickness.

- Bugs

    - We combatted this by trying to write clean code, maintain consistent style, write comments, and read documentation.

- System not fully completed on time

    - We set deadlines for ourselves and prioritized key features so the important things got developed first.

- Too few system testers

  - Since we were unable to test our app in the Galápagos, we have asked our families to try our app and website to find bugs and ensure the functionality was there.

- COVID-19

  - Because of the pandemic, it made working together significantly harder. We were unable to continue partner coding in a traditional manner and the differing timezones made finding a time to work on the project more difficult. Lastly, not all of us have reliable internet connection which made it harder to load and add information to the database because the request would time out before loading.

Chapter 11

Development Timeline

11.1 Fall

- Met as group with advisors and clients to learn more about the project.

- Learned about the components and requirements of the project.

- Applied for travel funding.

- Created architectural and activity diagrams to confirm the needs of the project.

- Collected content information for the mobile application from the client.

- Learned more about the technologies needed to build the project.

11.2 Winter

- Created conceptual model (design) of the mobile and web applications.

- Shared and confirmed conceptual model with the client.

- Finished design and conducted information usability tests.

- Presented GalapaGo! Design Review.

- Narrowed down the best database for our team.

- Began developing the web and mobile applications.

11.3   Spring

- Finished first iterations of mobile and web app development.

- Tested the application with beta users to receive immediate feedback.

- Made iterations from feedback.

- Presented our project during the 2020 Senior Design Conference.

Chapter 12

Challenges

12.1 Technical

- We needed to test out several different databases before finalizing the best one for our mobile app.

- Implementing the Favorites action and storing it locally on a users' phone were challenging.

- Overall, unfamiliarity with React Native prevented us from progressing as quickly as we would have liked to.

12.2 Non-Technical

- Easy of meetings, consistent communications, and maintaining motivation were all disrupted by going remote.

- We had originally planned to do a series of in-person tests to get feedback from clients within the Galapagos Islands. As we had to do that remotely, we have not collected information as effectively as we originally planned.

Chapter 13

Lessons Learned

- We learned that it was important to stay in contact with our client to create the best product for their needs and check in regularly to make sure the product was what they were looking for.

- It is also valuable to document what each person has done so far to keep track of our goals.

- Additionally, we found beneficial to talk to our teammates regularly, especially if they were working on different parts of the project, to stay on the same page.

- Lastly, it was helpful for us to maintain a schedule to prioritize what must be done first.

Chapter 14

Next Steps

14.1 GalapaGo! Mobile Application

One future step would be more interface testing. Due to COVID-19, we were prevented from traveling to the Galapagos Islands to conduct user testing. However, we would still like to collect more feedback to ensure that our mobile app's interface is easy to use. We plan to deploy the app on a mobile app store so that test users assigned by the Galapagos Chamber of Tourism can send our team more feedback. We will collect the feedback and create new iterations of the mobile application.

14.2 Admin Web Application

As of right now, the administrator can add to the database, see what is currently in the database but cannot delete or update existing data from the admin site, so this functionality is one of our main next steps. Additionally, we would like to find a more convenient way for the administrator to add a picture to the database with an upload file option. Finally, we are going to host our website on AWS and make sure that we have a password protected log in for the administrators. Once these are completed, we would like to do some more interface testing and implement final changes based on the feedback we receive.

Chapter 15

Societal Issues

15.1 Ethical

Our app is meant to promote local businesses in order to stimulate the local economy thereby helping the families that live there. Furthermore, it is well-known that the biodiversity in the Galápagos is extremely important and should be protected. We have provided information about the environment, history, and important rules to follow while in the Galápagos.

15.2 Social

Our hope with our app is that we will create more dialogue and interactions between the tourists and locals. By advertising local businesses to tourists more, they will get to meet more locals they probably would not have. In addition, if locals choose to use our app they can also interact more with each other.

15.3 Political

Our app and website do not look at any political issues in the Galápagos.

15.4   Economic

Part of our hopes with this app is that it will help stimulate the local economy in the Galápagos Islands. When tourists visit, many of them only frequent well-known tourists attractions. By creating our app, tourists will now have knowledge about smaller businesses that do not have a website.

15.5   Health and Safety

Due to this project being a mobile application, there are not many health and safety concerns regarding it. In terms of the information within the application, there are emergency contacts if a tourist were to get in any trouble as well as guides for the plants and animals that will be encountered on the Galapagos Islands.

15.6   Manufacturability

Because this is a mobile application, it only needs to be built once. Therefore, once it is on the app store, anyone can download it. The biggest issue would be in downloading this application once the user arrived in the Galapagos rather than before they left the United States due to the lack of internet connectivity on the islands.

15.7   Sustainability

The information in this application is meant to be maintained over time by the administrators, therefore keeping it current and up-to-date as time goes on. Because much of the information in the application is currently static, there will not be a large need for immediate updates.

15.8   Environmental Impact

There is a significant amount of unique flora and fauna on the Galapagos Islands. Our application provides information to future tourists about these parts of nature and what they can do in order to avoid harming them.

15.9   Usability

15.9.1   GalápaGo! Mobile Application

From the various usability tests conducted throughout development, we believe that our mobile application is usable. We purposefully made the navigation and language throughout the application easy-to-use and memorable.

That being said, as of now, our application is in English and is not offered in Spanish yet. This could potentially hinder certain user groups from understanding our application and using all of its features.

15.9.2   Admin Web Application

As the web application's purpose is to allow for admin users to add, edit, and delete from the application, we believe the form-style web page is clear and to-the-point.

15.10   Lifelong Learning

This project was definitely helpful in pushing us to pursue subjects not necessarily taught in class. We felt that it forced us to be resourceful and consider options we have never explored before. To learn new materials was an expected need as we progressed through the project.

15.11   Compassion

Working with the Frugal Innovation Hub requires both empathy and compassion. Without either of these, our team would not have been able to create a product that actually solved a need or issue with our client. Engineers solve problems; in order to solve people's problems effectively, they must be extremely compassionate and empathetic. They are required for a product that solves the right problem for users.

Chapter 16

Conclusion

Throughout the past few months, our team has been developing a mobile application named GalapaGo! dedicated to showcasing the wonderful local businesses that the Galapagos Islands has to offer. In addition, we have created a web application where admins from the Galapagos Islands Chamber of Tourism can add or edit the contents of the mobile application. We hope that future visitors to the Galapagos Islands will take advantage of GalapaGo! to explore and discover local restaurants, inns, attractions, and more.

Through the GalapaGo! project, we gained not only technical skills, but also more universal knowledge of the challenges faced by other communities. We feel fortunate to have the resources and ability to use our skills to build an application that benefits others. The project, overall, forced us to empathize outside of the norms of our personal lives to adequately build the applications.

While our mobile application is a excellent way for encouraging visitors to explore local businesses in the Galapagos Islands, tourists must know that GalapaGo! exists for our app to be effective. Thus, an important aspect for our app would also be some kind of advertisement to get the word out and have people download our app.

Our team would like to thank the Frugal Innovation Hub, Dr. Silvia Figueira, Allan Baez Morales, and the Chamber of Tourism in the Galapagos Islands for including us in such an impactful project.