6-12-2019

GalápaGo!

Jeffrey Nguyen
Sally Park
Manuel Sanchez

Follow this and additional works at: https://scholarcommons.scu.edu/cseng_senior

Part of the Computer Engineering Commons

Recommended Citation
Nguyen, Jeffrey; Park, Sally; and Sanchez, Manuel, "GalápaGo!" (2019). Computer Engineering Senior Theses. 138.
https://scholarcommons.scu.edu/cseng_senior/138

This Thesis is brought to you for free and open access by the Engineering Senior Theses at Scholar Commons. It has been accepted for inclusion in Computer Engineering Senior Theses by an authorized administrator of Scholar Commons. For more information, please contact rscroggin@scu.edu.
I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Jeffrey Nguyen
Sally Park
Manuel Sanchez

ENTITLED

GalápaGo!

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

BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND ENGINEERING
BACHELOR OF SCIENCE IN WEB DESIGN AND ENGINEERING

[Signatures]

Thesis Advisor
Department Chair
GalápaGo!

by

Jeffrey Nguyen
Sally Park
Manuel Sanchez

Submitted in partial fulfillment of the requirements
for the degrees of
Bachelor of Science in Computer Science and Engineering
Bachelor of Science in Web Design and Engineering
School of Engineering
Santa Clara University

Santa Clara, California
June 12, 2019
ABSTRACT

The Galápagos Islands are the tourism hub in Ecuador. The islands greatly benefit economically from the tourism industry, but tourism also affects the conservation of the islands and the local businesses. Locals are suffering due to the impact of tourism. Tourists from around the world go to the archipelago seeking the beauty of the islands. People come on cruise ships to ports, but many aren’t aware of the local businesses and etiquette on the islands, preferring to stay on the ship or near the ports. GalápaGo! is the solution for locals and tourists on the Galapagos Islands. The goal of GalápaGo! is to show tourists local businesses, and to inform them about island etiquette. This document outlines the specific technological requirements of GalápaGo! within the Requirement, Use Cases, Activity Diagrams, Conceptual Models, Technologies Used, and the Architecture Diagram chapters. Additionally, the project management scope is outlined through the Design Rationale, Testing, Risk Analysis, and Timeline chapters.
# Table of Contents

1 Introduction .................................................. 1

2 Requirements .................................................. 3
   2.1 Functional ........................................... 3
   2.2 Non-functional ........................................ 3
   2.3 Constraints ........................................... 3

3 Use Cases ...................................................... 4

4 User Interface .................................................. 6
   4.1 Onboarding Screens .................................... 6
   4.2 Home ................................................... 7
   4.3 Selected Options ....................................... 8

5 Activity Diagram ............................................... 9

6 Technologies Used ............................................. 10

7 Architecture Diagram ......................................... 11

8 Design Rationale ............................................... 12

9 Testing .......................................................... 13
   9.1 White Box Testing ...................................... 13
   9.2 Black Box Testing ...................................... 13
   9.3 Validation Testing ..................................... 13
   9.4 Verification Testing ................................... 13

10 Societal Issues ................................................. 15
   10.1 Ethical ............................................... 15
   10.2 Social .................................................. 15
   10.3 Political ............................................... 15
   10.4 Economic ............................................. 15
   10.5 Health and Safety .................................... 16
   10.6 Manufacturability ..................................... 16
   10.7 Sustainability ......................................... 16
   10.8 Environmental Impact .................................. 16
   10.9 Usability ............................................... 16
   10.10 Lifelong Learning .................................... 17
   10.11 Compassion .......................................... 17

11 Difficulties Encountered ....................................... 18
   11.1 Learning New Skills .................................... 18
   11.2 Connecting to a Database .............................. 18
List of Figures

3.1 Use Case Diagram .......................................................... 4
4.1 Onboarding screens of system ........................................... 6
4.2 Homepage of system ....................................................... 7
4.3 Selected options .......................................................... 8
5.1 Swim Lane Diagram ....................................................... 9
7.1 Architecture Diagram ................................................... 11
Chapter 1

Introduction

The Galápagos Islands are the main tourism hub in Ecuador. The islands greatly benefit economically from the tourism industry, but tourism also affects the conservation of the islands and the local businesses. Locals are suffering due to the impact of tourism. Tourists from around the world go to the archipelago seeking the beauty of the islands. People come on cruise ships to ports, but many aren’t aware of the local businesses and etiquette on the islands, preferring to stay on the ship or near the ports. Local residents need a way for tourists to learn about local businesses and ways to behave to best conserve the natural beauty and splendor of the Galápagos Islands.

Current solutions are inadequate/non-existent. While popular travel apps such as Yelp and TripAdvisor serve the Galápagos islands, the lack of a reliable and strong signal on the islands impacts the performance and the use of these apps significantly, as they ideally operate on a reliable network connection. The process to register a place of business with these search services can quickly consume business resources. Several forms must be filled out, and places of business must exist within a database such as Google Maps or Yelp for Business Owners. Some small business owners on the island are computer illiterate, complicating their registration process even further. This means that the larger businesses on the island with the resources to take advantage of these platforms are often the ones seen on the front page of search results, leaving small businesses with little to no brand exposure and opportunity for growth.

In terms of physical locations, some small businesses are not placed on main streets but on smaller, unnamed roads, meaning that consumers must rely on landmarks to navigate to the business. However, the only consumers that know this are the locals who have lived there for all of their lives. These factors prove a challenge to those apps trying to help inexperienced tourists, such as Yelp and TripAdvisor, as they do not have the resources to document and accurately reflect these details on their apps. Vacation home rental services such as Airbnb provide places to stay outside of hotels, but are not an adequate resource for navigating the island.

Working in collaboration with David Lansdale from the Universidad San Francisco de Quito and the SCU Frugal Innovation Hub, our solution provides an application that will allow local restaurants to advertise their business. It will also tell users how to behave on the island. Our application will be split into sections to allow users to browse
through the application effortlessly. The three sections will be tours, hotels, and businesses. In the business section there will be information such as a list of restaurants, the location of the restaurant, and the type of food offered at the restaurant. The tours section will have a list of tours and their duration. This solution is flexible since it will have an administrator who lives on the Galápagos. Businesses can talk to the administrator in order to update the information on the application. The application, *GalápaGo!*, will not require constant network connectivity so that users will be able to access it and its contents whenever and wherever. Information on the application will be updated when users have access to a solid network connection.
Chapter 2

Requirements

Requirements and constraints are shown in order of highest to lowest importance.

2.1 Functional

- The app will support at least 2 languages (English and Spanish) with additional languages supported based on the ease of implementation of the first two.
- The app will have a business section detailing local business locations, such as restaurants.
- The app will display hotels and hostels on the island, including those nearest to the user.
- The app will have a travels/tours section, detailing the available tourist attractions on the island.

2.2 Non-functional

- The app will be free to download.
- The app will be accessible/usable with and without internet.
- The app will be aesthetically pleasing, containing images of the Galápagos Islands (San Cristobal).
- The app will be have little to no overhead, allowing for a smooth viewing experience.
- The app will be available on both iOS and Android.

2.3 Constraints

- Network connection is extremely poor, with speeds less than 1 Mbps.
- The app needs to be lightweight in terms of download size (can’t be 50 MB+)
- The app needs to be efficient to run on older generation phones.
Chapter 3
Use Cases

As seen in Figure 3.1, in our app there are two actors: Tourists and Admins. Tourists are the primary user of the app and will be browsing three different types of listings, and the Admin will manage those listings.

Figure 3.1: Use Case Diagram
The use cases are as follows:

- **Browse Local Businesses**
  - Goal: To view local businesses, primarily restaurants, on the islands
  - Pre-conditions: None
  - Post-conditions: Displays all local listings according to the search query or sort method
  - Exceptions: None

- **Browse Tours**
  - Goal: To view tours on the islands
  - Pre-conditions: None
  - Post-conditions: Displays all tours according to the search query or sort method
  - Exceptions: None

- **Browse Hotels and Hostels**
  - Goal: To view hotels and hostels on the islands
  - Pre-conditions: None
  - Post-conditions: Displays all hotels and hostels according to the search query or sort method
  - Exceptions: None

- **Manage Business and Tour Information**
  - Goal: Manage and maintain the businesses and tours displayed on the app
  - Pre-conditions: Listings exist
  - Post-conditions: All listings that are approved will be shown to the user.
  - Exceptions: There are none
Chapter 4

User Interface

The models below show what the user interface of the system looks like.

4.1 Onboarding Screens

Figure 4.1 shows the landing page for first-time users. On this page, users will see reminders to respect the island and its ecosystem and to be courteous ecotourists.

![Onboarding screens of system](image)

Figure 4.1: Onboarding screens of system
4.2 Home

Figure 4.2 shows the homepage of our system. Here, the users will select the option of what they are looking for. The design was intentionally kept simple with three choices for users to select from so as to not overwhelm them with options.

Figure 4.2: Homepage of system
4.3 Selected Options

Figure 4.3 shows the selected option pages. Upon selecting an option from the homepage, the users will be redirected to the corresponding page. Each page has expanding cards for each business and the option to search and sort.

The inn is divided into two bodies, one is the main house with three bedrooms, three bathrooms, living, dining, large kitchen fully equipped. Also, there are three suites. Double room suite, one for two singles with the possibility of adding a couple of inflatable mattresses in case four friends want to share one large bedroom or if there is a large family.

Figure 4.3: Selected options
Chapter 5

Activity Diagram

Activity diagrams are a visual flowchart depicting how activities flow from one part of the system to another. Figure 5.1 is an overview of how our product operates as a unit.

In Figure 5.1, this swim lane diagram shows how each actor will interact with the system. The diagram is split up between the admin and users. In our application, admins have the ability to manage the information on the app. When users download the app, the information that the admins have added will be there. There are three main functions that the users can use this app for. Users can either browse the local businesses listed on the app, browse available tours, and browse hotels and hostels.
Chapter 6

Technologies Used

In this chapter, we will provide a short description of the various technologies in our stack and their uses within our system.

For our front-end, we used React Native as that allowed us to create a mobile app for both iOS and Android without needing two different code bases. For the backend, we selected Firebase. We chose to use Git as our version control system because of Git’s status as industry standard, and we accessed Git through Bitbucket. These are the details on the technologies used:

- **React Native**: an open source project that allows developers to build cross-platform mobile apps using JavaScript
- **Firebase**: a commonly used database management system that provides real-time database connection.
- **Git**: a version control system to handle changes and coordination of files
- **Bitbucket**: a web-based version control repository hosting service
Chapter 7

Architecture Diagram

An architecture diagram is a visual representation of a system’s architectural components, and it provides an overview on how a system’s users might interact with the system.

Figure 7.1: Architecture Diagram

Figure 7.1 provides an overview on how the users on our system will interact with the system. The figure shows the data-centric architecture of our system. The arrows show the kind of access the different actors have to our database. In our diagram, administrators can both input and retrieve data from the database. On the other hand, users can only read data from the database.
Chapter 8

Design Rationale

In this chapter, we will cover the reasoning behind our design choices.

- **Lightweight App**
  
  - Internet connection is unstable in the Galápagos Islands, so the app cannot rely on constant connection. As a result, we intentionally designed and implemented the app to have offline capabilities.

- **Language Selection**
  
  - English and Spanish are the two languages that the app will focus on initially as most users will be able to understand one of the two. As users expand, more language options will become available. The app currently only has support for English, but Spanish is planned to be added soon.

- **Landing Page for First-Time User**
  
  - This displays a set of guidelines for tourists to follow while on the islands to best preserve the beauty of the islands and encourage respectful behavior.

- **Expanding Cards for Listings**
  
  - This helps differentiate the businesses visually and allows for quick viewing while keeping a lightweight mobile app with fewer clicks.

- **Administrator**
  
  - This abstracts having to update business pages, and it allows for a single point of contact for developers and users.
Chapter 9

Testing

9.1 White Box Testing

- Inserting special characters (&, *, é, â, á, etc.)
- Boundary values (Minimum and maximum pricing for goods such as hotel reservations, restaurant pricing)
- Exercising each line of code

9.2 Black Box Testing

- Using app without knowledge of code
- Confirm that outputs are expected outputs.
- Have a friend who has no knowledge of app development use the app and try to achieve something (e.g., “Try to submit a review, try to find a tour you’d like”).

9.3 Validation Testing

- Use app in varying levels of network connection, from an ideal connection (Strong WiFi available, strong cell phone connection) to worst-case connection (No network connection available)
- Ensure that every functional requirement is met

9.4 Verification Testing

- Unit Testing
  - Test each separate section of the app: restaurants, hotels, and tourism
  - Test the different functionalities of the app: loading images, loading maps, updating information
• Acceptance Testing

  – Meet periodically with our client, David Lansdale, to ensure that the app is meeting standards
Chapter 10

Societal Issues

In this chapter, we will discuss fourteen different societal issues and how our project addresses each of these issues.

10.1 Ethical

The main ethical question that arose was whether it was right to only allow businesses that were registered with the government into the database. This was not addressed directly by our system, but it was discussed when we were in the first stages of conceptualizing the product.

10.2 Social

Because our project is planned to directly impact the tourism industry in Ecuador, it has the potential to increase the revenue for local businesses in the Galapagos Islands. Although it can increase revenue for local businesses, one consequence is that it could hurt the businesses who are not on the application. This is mainly because these businesses will get less exposure than the others.

10.3 Political

The political impact of our project is primarily the impact that boosting tourist traffic to more businesses on the island will have on society. If businesses on different parts of the islands are becoming more popular, this may draw the government’s attention to developing these areas further. In addition to this, foreign countries may become interested in investing in the island, which may cause tensions or open up opportunities for relations with Ecuador.

10.4 Economic

Although it did not cost much to initially create our app, there are a few expenses that may arise in the future. The main expense would be the cost for a database subscription. Currently there is only a small number of entries in our
database. If the app gets more popular and more businesses want to display their information then more storage space would be needed to hold that information.

10.5 Health and Safety

Since our product primarily focuses on listing businesses and directing users to these businesses, there is no direct threat to the health and safety of the user. Despite this, there should be a way to ensure that these businesses are legitimate. There should be a way to verify all the businesses that decided to list their information on our application. Although it is important to guarantee the health and safety of our users, adding a verification feature is beyond the scope of this project.

10.6 Manufacturability

One main problem is that users may have a hard time retrieving data from our database due to the poor connectivity on the island. Although our app works offline, users still need to connect to the internet at the start to get the information from the database.

10.7 Sustainability

To ensure that the information on the app is relevant and up to date, there will be an admin that will have the ability to update the database. The main sustainability issue in the Galapagos island is the negative impact that tourism has on the ecosystem of the islands. As a result, tourism damages the resources on the island, which we attempt to minimize by interacting directly with the tourists coming onto the island.

10.8 Environmental Impact

One of the features in our application is landing pages for first time users. On these landing pages, island etiquette is displayed to help educate, guide, and remind users to be mindful of the environmental impact that their trips inevitably have on the fragile ecosystem of the islands.

10.9 Usability

The product has gone through many design iterations to meet usability standards and guidelines. In the final design of the app, we selected a color palette with high contrast and a sans serif font for accessibility and readability purposes. The design of the app is intentionally simple and straightforward for end users to be able to easily learn and adopt the system. We minimized the amount of actions the end user needs to perform to get to their destination by implementing a scrolling page with all of the businesses listed for each of the different sections. Users are presented with all the
important information of business on the cards, simplifying the browsing experience and reducing the amount of actions needed.

10.10  Lifelong Learning

When we began working on the project, none of us knew how to use the technologies that we had decided to use for the app. As such, the project gave us valuable experience in exploring and learning popular technologies in industry. We are still learning how to use each of the technologies and have been inspired to continue developing our skills in each of the technologies.

10.11  Compassion

As one of the members on the team grew up on an island with tourism as one of its biggest industries, we found the problem presented to us easy to sympathize with. Our team recognized the problem as an issue with long term impact, and we felt that we had the tools and people necessary to begin the process of helping these islands and their people and ecosystem.
Chapter 11

Difficulties Encountered

11.1 Learning New Skills

The difficulty wasn’t so much learning new skills by itself, as it was learning new skills while balancing school work. We had to learn some JavaScript and React Native to make sure we had a solid understanding of the app prototype, as well as how the app could manage to communicate with a database. Doing this without having the guidance of a lecture to attend or class slides to view proved a challenge.

11.2 Connecting to a Database

Pulling information from a Firebase database was a difficult challenge for us. Spanning over a few weeks, we finally managed to follow the right steps to populate the app with information. While this feature has yet to be implemented to its full potential, the groundwork that this achievement provides is significant.
Chapter 12

Potential Changes

12.1 Implementing a Review System

Currently, *GalápaGo!* does not support a review system for the businesses on the island of San Cristóbal. This is due to the lack of a reliable network connection on the island, and the unlikeliness that a user will continue to attempt to upload a review amidst a challenging connection. Throughout our design process and implementation, we worked with the idea in mind that the app would be completely reliable in areas of poor network connection, making it part of what separated it from other tourist aid apps.

What could be implemented in the future, however, would be a review system that only attempts to upload a review once the network connection is reliable enough. A user could write and submit their review at or soon after visiting a restaurant, and the review could be uploaded at a later time. There are a few foreseeable challenges with this implementation. The user would be required to open up the app at a later time to complete the upload of the review, unless the app works in the background and detects when there is a reliable network connection and uploads the review itself. The former is a huge challenge, as it’s unclear how many reviews will actually be submitted if the user forgets to open up the app or even cares that much about it. The latter, if even possible, would be difficult to implement as well. However, if a background review upload is possible, this could be a huge boost for the usefulness of the app.

12.2 Adding an Adequate Map

While *GalápaGo!* provides an address for a business location, there is not a map setup within the app to further assist users with navigating to their destination. Part of the reason for this was because the app would have to cache the map to be accessible outside of a reliable network connection. However, this would contribute to an app that is already struggling to keep itself as lightweight as possible, as images of businesses are critical for users to make decisions on where to enjoy themselves.

While an image of a map could have been added to *GalápaGo!* we found that this wasn’t very useful to a tourist if there weren’t many features available for it (e.g., zooming in, landmark assistance) and thus decided to keep it out.
of the app and view it as a future addition for *Galápagos*!
Chapter 13

Lessons Learned

Throughout the course of the GalápaGo! development process, our team encountered and overcame numerous hurdles. We learned many valuable lessons along the way, which we have narrowed down into three major ones.

Creating an app involves many different parts: Our team quickly learned that there are many small components to creating an app. When we initially set up to begin work on the app, we were surprised to find that we had to download multiple software that took over 4 hours alone to setup. While this was for the initial setup of the app, the lesson stayed in our minds and we allocated much more time for technological changes during our implementation process.

Initial technologies will not necessarily be the final technologies: We had to make a few technology changes while working on GalápaGo! Initially, we had focused our database technology on MongoDB, our app development tool on Xcode, and our version control development platform on Bitbucket. However, after doing more research, we switched our database from MongoDB to Google’s Firebase after discovering that it works better with our app goals. Firebase supports mobile app development and has offline capabilities, meaning that it has the potential to have data persistence once pulling from the database. Xcode was swapped in favor of Sublime Text as a code editor and Expo, a free toolchain, was quicker than Xcode’s iPhone simulator and was designed specifically for the React Native app development. These technology changes weren’t made lightly, and most were made after having made some progress on app development. However, the decisions to switch were made for the best, and we feel that the technologies that we ended with helped make for a capable, stable app.

The small things matter in UI design: For some of us, this was the first time that we interacted this heavily with CSS styling guides. Making a few changes in some alignment properties or text wrapping can have a drastic impact on the app. As an example, it took a few days for us to do something as simple as center aligning the text within the three buttons on the home screen. We had gone through our CSS styling code several times, only to finally discover that property inheritance was not allowing some changes to take effect as we had hoped. This taught us that, just like many other strongly typed programming languages and styling guides, the small things matter.
Chapter 14

References


Appendix A

Installation Guide

Prerequisites:

- Google account to utilize Firebase
- Android or iPhone to view app changes in realtime
- Bitbucket or Github account for version control and backup

Instructions:

1. React Native is a tool created by Facebook that builds mobile apps using JavaScript and React. It abstracts the native app code (Swift) from the user and provides a more friendly user experience. Navigate to facebook.github.io/react-native/ and select "Get Started".

2. Follow the instructions shown under the tab "Expo CLI Quickstart". In the event of future changes to this site, the steps taken for the development of this version of GalápaGo! are here.

3. Begin by downloading the most recent version of Node JS to your machine. Navigate to nodejs.org/en/download/ and select the download for your operating system.

4. Download the files for the GalápaGo! app from our Bitbucket repository here: bitbucket.org/mansan15/galapago/src/master/

5. On your command line interface, navigate to the directory where you have the GalápaGo! files and type in the following command to install the Expo Command Line Interface (CLI) tool. This will help you preview the app in realtime.

   - npm install -g expo-cli

6. While this is running, download the Expo client app onto your iPhone or Android. The website is expo.io and the app is accessible via the App Store or Google Play Store.
7. After the npm command finishes, type in the following command to open Expo in the command line.

- `expo start`

8. Once it finishes loading, your browser will open up a status window with a scannable QR code. Your command line interface should also show the same QR code. Scan it with your phone, and it will open the Expo app on your phone displaying *Galápagos!*

9. To navigate to the database, visit `console.firebase.google.com/project/galapago-scuc/` and for access, please contact SCU’s Frugal Innovation Hub.