Designing, Implementing, and Evaluating a Tourism Responsive Web Application in the Cloud

Case Study: Tourism Web Application for Ecuador

Andrea Verónica Becerra Mejía

STUDENT ID: c7141384

Submitted in partial fulfilment of
the requirements of Leeds Beckett University
for the Degree of
MSc Mobile Device Application Development

Faculty of Art's, Environment and Technology

Leeds Beckett University

September, 2014
ABSTRACT

This research project was proposed to design, implement, testing, and evaluate a tourism responsive web application in the cloud. The motivation to carry out this project was contributing with the promotion of tourism in Ecuador, and consequently contribute with the improvement of the economy.

The project started with the proposal of the objectives to be reached. An explanation of the research rationale was specified. The review of literature helped to clarify the objectives and provided the foundations to develop the tourism responsive web application. Literature related to the tourism and the Internet technology, Responsive Web Design, Agile Methodology, User Centered Design were critically summarized. Design Patterns, and the advantages of developing in the cloud were identified.

The design, and implementation of the tourism responsive web application started applying the concepts reviewed before. The design patterns were applied in the design. The creation of wireframes helped to represent the functional requirements, and the information architecture. Nitorus.IO, a cloud platform to develop applications, the framework Rails were used for a quick implementation of the web application.

Testing and evaluating the responsive web application in the cloud according with the guide of the methodologies justified before was useful to identify issues. The issues of the web application related to the performance, usability and user experience figured out will allow the improvement of the application in the next development cycles.
Candidate’s Declaration

I, Andrea Verónica Becerra Mejía, confirm that this dissertation and the work presented in it are my own achievement.

Where I have consulted the published work of others this is always clearly attributed;

Where I have quoted from the work of others the source is always given. With the exception of such quotations this dissertation is entirely my own work;

I have acknowledged all main sources of help;

I have read and understand the penalties associated with Academic Misconduct.

Signed:

Date: 18/09/2014

Student ID No: c7141384
CONTENTS

1 CHAPTER ONE.................................................................................................................9
  1.1 Introduction ..................................................................................................................9
  1.2 Research Objectives.....................................................................................................10
    1.2.1 Objectives ...........................................................................................................10
  1.3 Research Rationale......................................................................................................11

2 CHAPTER TWO: LITERATURE REVIEW ......................................................................12
  2.1 The Tourism Industry and the Internet .........................................................................12
  2.2 User Centered Design..................................................................................................12
    2.2.1 Usability .............................................................................................................13
    2.2.2 User Experience .................................................................................................16
  2.3 Designing Web Applications.......................................................................................17
    2.3.1 Elements ............................................................................................................17
    2.3.2 Benefits of Web Applications ............................................................................19
    2.3.3 Software Patterns .............................................................................................20
    2.3.4 Prototype .........................................................................................................23
  2.4 Responsive Web Design..............................................................................................24
    2.4.1 Flexible Grid-based Layout ...............................................................................24
    2.4.2 Set Breakpoints and Add Media query ................................................................25
  2.5 Cloud Computing ......................................................................................................25
    2.5.1 Cloud Components .........................................................................................26
    2.5.2 Categories of Cloud Providers .........................................................................27
    2.5.3 Pros and Cons of Cloud Computing ..................................................................28
  2.6 Technologies ..............................................................................................................28
    2.6.1 Foundation 5 .....................................................................................................28
    2.6.2 Server Side Scripting / Coding .........................................................................28

3 CHAPTER THREE: THE METHODOLOGY AND RESEARCH APPROACH ..................30
  3.1 Agile Software Development .....................................................................................30
  3.2 User Centered Design Process ..................................................................................31
    3.2.1 Research ..........................................................................................................31
    3.2.2 Design ..............................................................................................................31
    3.2.3 Prototyping .......................................................................................................31
    3.2.4 Usability Test ....................................................................................................31
    3.2.5 Measuring User Experience Design ..................................................................33
  3.3 Ethics .........................................................................................................................36

4 CHAPTER FOUR: DESIGN AND IMPLEMENTATION .............................................37
  4.1 Design .......................................................................................................................37
4.1.1 User requirements ................................................................. 37
4.1.2 Functional Requirements .................................................... 39
4.1.3 Conceptual Model ............................................................... 39
4.1.4 Database Model ................................................................. 40
4.1.5 Wireframes ........................................................................... 41

4.2 Implementation ...................................................................... 44
4.2.1 Getting Started .................................................................... 44
4.2.2 Setting up PostgreSQL database ......................................... 46
4.2.3 Creating Resources ............................................................. 46
4.2.4 Implementing User Interface Design ..................................... 46
4.2.5 Implementing Functionality .................................................. 50

5 CHAPTER FIVE: TESTING AND EVALUATION ......................... 56
5.1 Testing .................................................................................... 56
5.2 Evaluation ............................................................................... 56
5.3 Performance Metrics ............................................................... 56
  5.3.1 Results of Completing Tasks ............................................... 56
5.4 Self-Reported Metrics .............................................................. 62
  5.4.1 Overall reaction to the application ...................................... 64
  5.4.2 Screen ............................................................................... 65
  5.4.3 Terminology and System Information ............................... 65
  5.4.4 Learning ........................................................................... 66
  5.4.5 System Capabilities .......................................................... 66
  5.4.6 Usability and UI ............................................................... 67
5.5 Behavioural Metrics ................................................................. 67

6 CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS ....... 69
6.1 Conclusions ............................................................................ 69
6.2 Recommendations .................................................................... 70
List of Tables

Table 1. Principles to create Consistency .......................................................... 14
Table 2. User Interface Patterns for Web Application ........................................ 23
Table 3. Functional Requirements .................................................................. 39
Table 4. Questionnaire for User Interface Satisfaction (QUIS) ....................... 63
Table 5. Marks provided by participants ......................................................... 64

List of Figures

Figure 1. Elements of User Centered Design .................................................... 17
Figure 2. Wireframes ..................................................................................... 19
Figure 3. Model-View-Controller (MVC) Design Pattern ............................. 21
Figure 4. Fixed Layout vs Relative Layout ..................................................... 25
Figure 5. Components of Cloud Computing .................................................. 26
Figure 6. IaaS, PaaS, Saas – Categories of Cloud Computing ...................... 27
Figure 7. User Centered Design .................................................................... 33
Figure 8. Chart of Level of Success by Task .................................................. 34
Figure 9. Site Map of the Tourism Responsive Web App ................................ 39
Figure 10. Database Model ........................................................................... 40
Figure 11. Wireframes for Home Page. Desktop and Smartphone layout. ...... 41
Figure 12. Wireframes for Event List Page. Desktop and Smartphone layout. . 42
Figure 13. Visual Design for Home Page ........................................................ 43
Figure 14. Visual Design for Destination List Page ......................................... 43
Figure 15. Visual Design for Destination Page ............................................... 43
Figure 16. Nitrous.IO Boxes ......................................................................... 44
Figure 17. Repository for Ecuador Project in Github ....................................... 45
Figure 18. Nitrous.IO IDE ........................................................................... 45
Figure 19. Orbit for the Event “10 de Agosto - Velada Libertaria” .................. 47
Figure 20. View of Navigation and Utility Bar ............................................. 48
Figure 21. View of navigation bar in a mobile device .................................... 48
Figure 22. View of search tabs in the web application ................................... 49
Figure 23. View of Breadcrumbs in web application ....................................... 49
Figure 24. View of Home Page for Desktop and Smartphone ...................... 50
Figure 25. Add to Plan Button ..................................................................... 50
### Definition of Terms and Abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>C&amp;C Patterns</td>
<td>Component and Connector Patterns</td>
</tr>
<tr>
<td>MVC</td>
<td>Model - View - Controller</td>
</tr>
<tr>
<td>UX</td>
<td>User Experience</td>
</tr>
<tr>
<td>ISO 8601</td>
<td>Representation of dates and times is an international standard covering the exchange date and time-related data</td>
</tr>
<tr>
<td>APIs</td>
<td>Application Programming Interfaces</td>
</tr>
<tr>
<td>IaaS</td>
<td>Infrastructure as a Service</td>
</tr>
<tr>
<td>PaaS</td>
<td>Platform as a Service</td>
</tr>
<tr>
<td>SaaS</td>
<td>Software as a Service</td>
</tr>
<tr>
<td>HTML5</td>
<td>Hyper Text Markup Language version 5</td>
</tr>
<tr>
<td>CSS3</td>
<td>Cascade Style Sheet version 3</td>
</tr>
<tr>
<td>Ajax</td>
<td>Asynchronous JavaScript and XML</td>
</tr>
<tr>
<td>REST</td>
<td>Representational State Transfer</td>
</tr>
<tr>
<td>SUS</td>
<td>System Usability Scale</td>
</tr>
<tr>
<td>QUIS</td>
<td>Questionnaire User Interface Satisfaction</td>
</tr>
<tr>
<td>CSUQ</td>
<td>Computer Usability Questionnaire</td>
</tr>
<tr>
<td>IDE</td>
<td>Integration Development Environment</td>
</tr>
<tr>
<td>VMs</td>
<td>Virtual Machines</td>
</tr>
<tr>
<td>I18n</td>
<td>Internationalization</td>
</tr>
</tbody>
</table>
Chapter One

1.1 Introduction

The development of tourism industry has been getting great improvements during the last years. Travel agencies are adopting the Internet technology and innovation to change the way to do their business to improve their productivity and competitiveness (Shouk and Elraouf, 2012). For instance, the development of tourism e-commerce has increased quickly becoming the most important platform for tourists to search information about places and things to do. Nowadays, tourists trust in online websites to find information about tourism (Bai et al., 2014).

On the other hand, the use of mobile devices with access to the Internet is increasing. Consequently, travelers use their smartphones or tables as primary source to look tourism information before, during, and after their trip. Users use their mobile devices to share opinions and thoughts about traveling in social networks. (Bader et al., 2012). Moreover, according to the World Travel Market (2013) mobile devices are expected to be the dominant tools to provide travel services within the next five years. Therefore, building tourism application to be used in mobile devices is predominant.

The tourism industry is one of the most important sectors to improve the economy of the countries distributing the wealth (Spenceley and Meyer, 2012). Many countries are taking advantage of tourism industry, and Ecuador is one of them. Currently, the Government and the population of Ecuador are focusing their efforts on improving the tourism, and consequently, improving their economy. They are promoting the beauty of the country, its great biodiversity, culture, landscapes, ethnic groups, and climate. The country has the advantage of being rich in natural resources (Tourism & Leisure-Europraxis, 2007).

Consequently, this research has the purpose of contributing to the effort of promoting tourism in Ecuador through the design and development of a tourism web application for desktops and mobile devices. The web application will take advantage of the user centered approach for the design, and the advantages of developing in the cloud.
1.2 Research Objectives

This research begins with the review of literature as the primary source of information to carry out the project. Subsequently, the research project continues with the design, development, testing, and evaluation of a responsive tourism web application for Ecuador. The web application will be designed using the user centered design approach to build an application which satisfies the users’ needs. Moreover, the responsive web design approach allows to design an application adaptable to any mobile device screen.

For the development, the cloud-based platform Nitrous.IO will be used because it provides the development environment and all that is needed to develop a web application in the cloud. Moreover, developing in the cloud is becoming an increasing trend because it is free and provide scalability and mobility. Once the responsive tourism web application is developed, it will be tested by potential user to measure and analyze their experience and satisfaction level after using it.

1.2.1 Objectives

Some specific objectives have been defined for this research project. A detailed explanation of these objectives is below:

- Designing the tourism web application taking advantage of the user centered design approach to create a good experience when users interact with the application. Therefore, persona profiles will be created to identify potential users and their requirements. Benchmarking will be carried out to identify weaknesses and strengths of other tourism web applications. In the design of the application, user interface design patterns and other best practices will be applied.

- Designing the tourism web application using the responsive web design approach to create an adaptable layout based on the size screen and the capabilities of different devices. This requires flexible grids and images, and media query, so basically everything is done in the client-side. The application will be particularly tested for two main sizes of devices, the landscape desktop screen size, and the portrait smartphone screen size.

- Developing the web application using Ruby on Rails 4, a web-application framework, which allows to develop applications using Model-View-Controller (MVC) design pattern. The advantage of using MVC is having a better control of user interface.Rails, also has the advantage of being written in ruby, an open
source programming language known for being natural to read and easy to write.

- Developing the application using Nitrous.IO, a cloud-based development environment platform where it is possible to create Rails applications. The project is taking advantages of developing software in the cloud because it is free, provides mobility and the architecture to support the development.

- Once the application has been developed, a usability test will be carried out, where the users will have to use the application to complete some tasks, and then, they will answer some questions. All this information will be used in the final analysis of this research in order to identify improvements.

1.3 Research Rationale

The tourism industry has been suffering changes, specifically for the way it is being promoted. Nowadays, many tourism agencies or institutions are taking advantage of web applications to advertise places, and offer services because access to them through the Internet is easy and quick (Shouk and Elraouf, 2012). Moreover, access to tourism websites through mobile devices is increasing as well. Consequently, the supply of web applications to promote tourism is growing.

However, if users face with a disorganized, confusing, non-responsive web application, they will discard it, they will look for others, and finally, they will choose a responsive, attractive, useful, and easy to use web application. Therefore, this project is carrying out to design, and develop a tourism web application, which satisfies the user requirements, that is the reason why the user centered design, and responsive web design approaches will be used in the design stage.

Designing and developing a responsive tourism web application for Ecuador is the case study for this research project. The web app has to be developed in order to ensure a pleasant experience for national and international tourists using the web application to contribute to the promotion of tourism of the country, and consequently, improve its economy. It is necessary to emphasize that Ecuador has to be promoted because it is a beautiful country with lots of natural resources, a great amount of biodiversity, and gentle people. Moreover, Ecuador has wonderful places, such as, their famous Galapagos Islands.
2 Chapter Two: Literature Review

In this chapter relevant literature related to the area in which the project will be carried out has been reviewed critically. Literature related to the tourism industry and its evolution adopting the Internet technology is reviewed. Methodologies and approaches to design, development, testing, and evaluation of responsive web applications, such as, User Centered Design and Responsive Web Design approaches are summarized. The design patterns to use to design a web application are evaluated. The services and the advantages that Cloud Computing offers to develop web applications in the cloud is emphasized. Finally, the technologies for both the client-side and server-side to develop web applications are critically evaluated and applied.

2.1 The Tourism Industry and the Internet

Tourists are using the Internet as a primary source of information to look for destinations and things to do. Tourist can find a lot of information by themselves accessing to the Internet. They can find videos, and pictures about destinations, hotel information, and more. The Internet has become an important way to advertise products. Many airlines, hotels, and restaurants, are promoting and selling their services and products through the Internet (Noti, E., 2013).

“Many observers claim that the Internet has been transformed from a system that is primarily oriented to information provision into a system that is more oriented to the communication and community building” (Fuchs, C., 2012). Therefore, many applications as Facebook, Youtube, Google, blogs, tourism websites, among others are using the communication and community feature of the Internet. Consequently, tourists are using those applications to share their experiences, or images about their trips, or even rating destinations (Noti, E., 2013).

2.2 User Centered Design

Users interact with systems to perform different tasks and achieve different goals, and they expect to interact with useful, easy, effortless, enjoyable, desirable, efficient, and learnable systems or applications. For this reason, systems or applications have to be designed having users in mind rather than technology. The User Centered Design approach allows to reduce negative aspects of usability, and allows to create high quality interactive systems, and consequently good experience (Rogers et al., 2011). Moreover, to get self-evident, self-explanatory applications some usability principles
have to be applied in the design; thus, the design must let users work in the application without expending any effort thinking about it (Krug, S., 2014).

There are some benefits using centered design; such as, creating better products which have low risks because the problems are solved in design stages when prototypes are tested, so fixing problems are cheap. User centered design provides analysis and research to find out opportunities to design competitive products (Allen and Chudley, 2012).

2.2.1 Usability

Usability means that something is usable. Other definitions can say that usability has attributes such as useful, learnable, memorable, effective, efficient, desirable and delightful. Consequently, designing with usability in mind allows to create products or services which users of average ability and experience will be able to use and achieve tasks without mayor effort. (Johnson, J., 2010).

2.2.1.1 Consistency

Human perceptions have implications in user interface design. There are three types of perceptions, biased in the experience, present context, and goals. Users expect to find things where they have seen them before because of the perception based on experience after using applications. Users interact with applications according to events and objects they watch at the moment, this is present context perception. Finally, users tend to filter out things that are out of their goals because of the perception biased by goals or plans in the future. (Johnson, J., 2010).

To deal with the implications that perceptions could cause in the design, the application must be consistent, so it means, the same positions for controls and information. Consistency will avoid ambiguity, and it will reduce the cognitive burden, users will learn how the application works easily and fast, and they will enjoy using the application (Lowdermilk, T., 2013).

Moreover, according to (Johnson, J., 2010) the visual perception works better with structure inputs. Users perceive better whole shapes rather than separate lines. There are some principles to display objects in applications: proximity, similarity, continuity, closure, symmetry, and figure/ground. The benefit of the principle is explained below:
<table>
<thead>
<tr>
<th>THE PRINCIPLE</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity-Similarity</td>
<td>Using proximity and similarity allows to group objects and consequently organize better the application, getting the user’s attention, and improving their experience. Users will locate, perceive, and learn the application easily and quickly (Lowdermilk, T., 2013).</td>
</tr>
<tr>
<td>Continuity-Closure</td>
<td>Applying continuity and closure will resolve ambiguity and create connected segments because the visual system try to fill gaps between objects grouping them.</td>
</tr>
<tr>
<td>Symmetry</td>
<td>Symmetry is used to resolve complexity, and it could be used to create three dimensional objects on two dimensional display.</td>
</tr>
<tr>
<td>Figure/Ground</td>
<td>Figure and ground helps to distinguish the background from the primary content. When a pop up is displayed, figure/ground helps to figure out that pop up has temporary information related to the behind content.</td>
</tr>
</tbody>
</table>

Table 1. Principles to create Consistency

A good practice after developing the app is evaluate the app with those principles in mind (Johnson, J., 2010).

2.2.1.2 Reading

When users search something in the application, they just scan the information; for this reason, the information has to be displayed in a structured and non-repetitive way to find it easily and quickly (Rogers et al., 2011). Moreover, according to (Krug, S., 2014) and (Rogers et al., 2011) the principles to support scanning are:

- Use plenty of headings.
- Think about the content of the headings.
- The level of headings have to be very different.
- Headings have to be close to the section they follow.
- Keep paragraphs short.
- Do not use topic sentences.
- Use bullet list.
- There must be a space between items in the list.
- Do not use a lot highlight or it loses the effect.
- Use common and familiar vocabulary.
- Avoid writing difficult script and typefaces.
- Avoid writing text in a noisy background, the text should be easy to read.
- Avoid centered text because users will find difficult read between lines.
- Avoid combining flaws that disrupt reading.
- Avoid unnecessary text, especially in instructions.

2.2.1.3 Recognition rather than Recall

According to (Rogers et al., 2011) the attention and memory are concepts to consider in user interface design. Attention is limited because users just scan trying to commit their goals in applications, so they try to find what they look for as soon as possible, and the rest is irrelevant to them. For this reason, the most essential information and tools related to the user goals in the application must be prominent and easy to remember (Krug, S., 2014).

Users often do not remember the task already done, so it is useful to use different marks or colors to identify finished tasks. Moreover, instructions in the application are hard to remember, so they should be available for users until they finish the task. Providing to users easy ways to recover passwords. Messages have to be clear and concise to explain the actions that users are doing or will do (Johnson, J., 2010).

Faster paths and clear information should be displayed to users, and giving feedback about the progress of the completed actions. Recognition is easy for users rather than recall. Therefore, the application must be designed to show options, and not force users to remember them (Rogers et al., 2011). Mental models and metaphors are useful to design applications easy to recognize and learn. Users will identify easily the meaning or use of any object or control which are using concepts from another domain known for users (Benyon, D., 2010).

2.2.1.4 Learning

People can perform activities learned before easily, and they do not need to apply a lot of conscience when they perform it. In order to make the user’s learning easy, designers have to analyze the goals and tasks, steps for each task, results for tasks, tools, problems, terminology, and design a simple and consistent application. If an application is consistent, it will quickly become habitual, and easy to learn (Rogers et
The vocabulary is important, and it has to be familiar and consistent, related to the tasks instead of technical. Another good practice to make applications easy to learn is do not use different terms for the same concept or the same word for different concepts (Johnson, J., 2010).

Users learn faster when the risk in the application is low, and they have the possibility to explore it. Usually, users don't make optimal choices, and they chose the first reasonable option, this is known as satisficing. For this reason, the design must allow users to go back. For users guessing is more fun (Krug, S., 2014).

### 2.2.1.5 User Satisfaction

The concept responsiveness is important because it is related to the user satisfaction and productivity. Responsiveness is the appropriate message to show users what happens after inputs or actions. To achieve responsive interaction systems there are some useful guidelines to follow as using busy indicators in order to show users that the system is working on something, and they will receive an answer soon. While users are waiting for an answer, it is better to display important information first. Users prefer to see progress actions than indicators because progress actions catch their attention (Johnson, J., 2010).

### 2.2.2 User Experience

The user centered design approach allows to design for users. Developers will know the experience of users after they test the application, and then with the provided feedback improving the design of the application. Thus, it is possible to build applications which satisfy the expectations of end users. In other words, it will help to design the right applications for users (Allen and Chudley, 2012).

To get a good user experience the applications must engage users. Designing for the user’s pleasure will ensure the application or product is usable. Users accept products that offer enjoyment, and gratification. The design has to be based on physiological, sociological, psychological, ideological pleasure (Benyon, D., 2010).

### 2.2.2.1 Being Social

A remarkable aspect for humans is being social. Human beings are interacting with other people each moment. People like to update each other, so they need to inform others about their social lives, about their activities, and feelings. The most common mechanism for social interactions is face-to-face conversations; however, the new trend is the use of social media. People are spending many hours sending instant
messages, using Facebook, Twitter and other social-networks. Different social media has developed their own mechanism to allow people to communicate with each other, and they try to simulate real social interaction. Nowadays, the use of social media is increasing. People like to take pictures and share them with friends or family. People are sharing information and content through web-based services as well (Rogers et al., 2011).

2.3 Designing Web Applications

Designing websites is based mainly in the user centered design approach. Websites has to be designed and developed with users in mind. (Benyon, D., 2010).

2.3.1 Elements

There are five elements or layers in the user centered design approach: strategy, scope, structure, skeleton and surface.

![Figure 1. Elements of User Centered Design](http://www.sean-melchionda.com/new-blog/)


2.3.1.1 Strategy

In this layer the objective of building the website has to be defined in order to have a clear idea of what the website will achieve. Defining the objective will help to understand better the users’ needs. (Lowdermilk, T., 2013). Moreover, the user requirements are specified in this layer because they are essential for interaction
design. User requirements must be documented in order to understand them clearly. Defining persona profiles would be a useful strategy to figure out who will visit the website, and their goals when they use it (Benyon, D., 2010).

2.3.1.2 Scope

In this layer the functional specifications based in user requirements are defined as well as the content requirements. In other words, in this layer is specified what the website will do and the information will hold (Benyon, D., 2010).

2.3.1.3 Structure

In this layer is defined information architecture and interaction design. For the information architecture is useful to use a flow chart where the map of the site will be drawn. It will explain the big sections, pages, files, and the behavior between them (Benyon, D., 2010). Information architecture is useful to organize the information in the website. Users will find easily what they are looking for in an organized website, so their experience will be better (Allen and Chudley, 2012). A database diagram is also useful to structure and organize the information. Having this diagram will help designers to define how save and access to the information (Lowdermilk, T., 2013).

2.3.1.4 Skeleton

Wireframes have the advantage of representing concern information, navigation and interface design all together (Benyon, D., 2010). Designing wireframes is useful to specify how the application should look in different devices (Allen and Chudley, 2012). To design wireframes the key component has to be identified and then located in the layouts (Benyon, D., 2010).
Figure 2. Wireframes


2.3.1.5 Surface

The virtual design and the consistency are essential in this layer. Style sheets are useful to design the colors, shapes, position of objects in the layouts (Benyon, D., 2010).

2.3.2 Benefits of Web Applications

- A web application is easy to access. Users do not need to install any application on their computer, so they just need a computer, access to the Internet, and a browser to access to the application.
- It is easy to maintain and update the application. Users do not have to reinstall new versions on their computers.
- The interaction between people and the web application is more familiar, so internet users can recognize easily links, submit buttons, and terminology such as home, back button, etc.
- Finally, network connectivity is growing and web technology is more reliable than before (Vora, P., 2009).
- When users are involved in the design process, their goals will be identified. The web application will be the best for them because it satisfies their needs.
- Fixing problems before the application has been launched is cheaper.
With UCD approach is possible to create a web application with lower risk of failure because the issues are identified in the design stage (Allen and Chudley, 2013).

2.3.3 Software Patterns

2.3.3.1 Definition

A design pattern allows to solve problems. A design pattern has information about how to use it, proven solutions, and the consequences of the solutions. Patterns are useful because they can be used by novice or expert designer or developers (Hunt, J., 2013).

Patterns help to focus on the problem and its context of use and then it provides a guide about when, why and how the solution can be used, so patterns are guides to get a good design, and they are practical with high level principles and strategies (Vora, P., 2009).

2.3.3.2 Classification of Patterns

2.3.3.2.1 Architectural Patterns:

There are architectural patterns which are categorized in module patterns, components and connectors patterns (C & C) and allocation patterns. For this project, the attention will focus on C & C patterns, specifically in MVC Model-View-Controller Pattern because it is applied in the context where the user interface is the most modified in interactive applications; for this reason, it is useful to have those modifications separate from the rest of the system (Bass at al., 2013).

Model View Controller Pattern

Problem: How to have user interface functionality separate from the rest of the system? How to create and maintain views of the user interface when the data changes?

Solution: Separate the application in three components: Model, View and Controller. The model has the application's data or state and contains the logic. The view is responsible to display the data and users interact with views to request or input data. The controller manages the interaction between models and views (Bass at al., 2013).

The MVC components are connected by notifications. These notifications could be events or callbacks. Because their loose coupling, it is possible to develop and test in parallel, and the changes in one will not affect drastically the other tiers. However, the
The disadvantage of this pattern is that could be costly if the user interfaces are simple (Bass at al., 2013).

The following figure shows the relationship between the components.

![Figure 3. Model- View- Controller (MVC) Design Pattern](image)

### 2.3.3.2.2 Design Patterns:

#### Benefits

- Design Patterns provide a real solution; therefore, they provide the problem and the explanation of the solution according to the context.
- Using design patterns will improve the design process because designers will not spend time reinventing things, they just have to apply them.
- Because the design patterns are reusable, they allow developers reuse them, and consequently building consistent applications. Moreover, for large companies is useful because all team will apply the same solution. Moreover, they allow sharing the same language within the team members of a project.
- Finally, using design patterns makes a web application usable because it is developed based in successful solutions, so the application could result familiar to users (Vora, P., 2009).
Inhibitors to Pattern applications

- The benefits of the design patterns sometimes are wasted. Therefore, design patterns must to be applied on the product, then evaluated after development or maintenance changes, and ensure to respect the constrains of the design patterns.
- Sometimes design patterns are difficult to understand, or documentation is not clear enough or misleading.
- For average developers could be difficult understand design pattern classifications during learning stages (Alrahmawy, M., 2010).

Some design patterns to design a web application are presented below:

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forms</td>
<td>• Show clear benefits about fill out the form.</td>
</tr>
<tr>
<td></td>
<td>• Short forms to avoid errors</td>
</tr>
<tr>
<td></td>
<td>• Grouping elements to make users fill out easy.</td>
</tr>
<tr>
<td></td>
<td>• Use default values which users entered before</td>
</tr>
<tr>
<td></td>
<td>• Allow users to use keyboard navigation</td>
</tr>
<tr>
<td></td>
<td>• Show error messages to indicate reason for errors.</td>
</tr>
<tr>
<td></td>
<td>• Show hints or formatting instructions to educate users, and reduce chances of errors.</td>
</tr>
<tr>
<td>User Authentication</td>
<td>• Allow users explore in the application without registration.</td>
</tr>
<tr>
<td></td>
<td>• Allow users identify themselves using a username and password to access their information.</td>
</tr>
<tr>
<td></td>
<td>• Allow users to log out.</td>
</tr>
<tr>
<td></td>
<td>• Offer options to recover passwords</td>
</tr>
<tr>
<td>Navigation</td>
<td>• Offer users a consistent and prominent way to navigate through the main functionality. Primary and secondary navigation in all pages.</td>
</tr>
<tr>
<td></td>
<td>• Offer users a utility bar in all pages with functions, such as, login, logout, search, language.</td>
</tr>
<tr>
<td></td>
<td>• Provide breadcrumbs to indicate the current page location to avoid users get lost in the application.</td>
</tr>
<tr>
<td>Searching</td>
<td>• Provide a consistent and prominent search engine to allow users find easily and fast what they look for.</td>
</tr>
</tbody>
</table>
### Lists
- Show in items images rather than text.
- Show action for each item in the list. For example, delete, edit.

### Social Application
- Rating items can help users to make decisions fast.
- Allow users to share content in other websites.
- Allow users to post content in the website.

### Internationalization
- Extensible design allows to design for different languages in one core web application version.
- Display date and time according to ISO 8601 recommendations.
- Display currency in their native formats.
- Allow users to select different languages. Keep users in the same page after selecting a specific language.

### Accessibility
- Unobtrusive style sheets allow easily adapt and optimize the presentation.
- Using separate JavaScript files ("Unobtrusive") makes to update the scripts and enhance interactivity easy.

### Visual Design
- Visual hierarchy helps to group and order elements, making them prominent.
- Highlight selected elements to show users what they have already clicked.
- Using icons helps users to recognize objects better.

<table>
<thead>
<tr>
<th>Table 2. User Interface Patterns for Web Application</th>
</tr>
</thead>
</table>

#### 2.3.4 Prototype

A prototype is an initial building of the application. It could be made using different techniques. Paper prototypes, wireframes, low or high fidelity prototypes displayed in the proper devise can be done to start the design quick and then test them, and then improve the design after feedback (Allen and Chudley, 2012).
The Pros and Cons of using prototypes

- According to the UCD approach is better fail first and early. It is important to involve users in the early stages to test the prototypes and find out design errors.
- Prototype is more tangible, so users will realize if they are getting what they want in the application.
- It is easy to build prototypes because there are reusable elements to use in the prototype quickly.
- High fidelity prototypes could take consuming time, so it is useful to work with a site map to identify the key components and design in the prototype first (Allen and Chudley, 2012).

2.4 Responsive Web Design

The number of users browsing websites on mobile devices is increasing; therefore, web applications has to have a specific design for mobile devices to provide good experience when users use the app in a mobile device (Frain, B., 2012).

To design a responsive web applications is important to consider that mobile users usually are more distractive. Therefore, it is useful for catching mobile users’ attention, identifying and prioritizing the main tasks. Giving quick and easy ways to achieve the tasks. Reducing the need to fill complex forms. A good guideline is doing one or two wireframes for the main sizes to design (Allen and Chudley, 2012).

Responsive Web Design is designing a web application to display it in a responsive way in different devices with different size screens. It means, that the elements on the website are not fixed anymore. The elements are rearranged according to the screen size (Bohyn, K., 2013). "Responsive Web Design consolidate three techniques such as flexible grid layout, flexible images, and media and media queries" (Frain, B., 2012).

2.4.1 Flexible Grid-based Layout

According to the information architecture designed in the wireframes for the different screen sizes, the next step is to develop the fluid elements to be displayed for each size. To create fluid elements, the dimensions have to be defined as relative rather than absolute measure. For instance, instead of having a div with width= 960 pixels, it
must be expressed in percentage such as width= 90%. The width of child containers are relative to their parent containers (Frederick, K, 2013).

![Fixed Layout vs Relative Layout](image)

**Figure 4. Fixed Layout vs Relative Layout**

### 2.4.2 Set Breakpoints and Add Media query

Media query will allow to target specific CSS style or rules based on the capability or feature of the devices. The most important features for responsive design are screen size and orientation. To start using media query, the most suitable breakpoints must to be defined (Snell, J., 2013). Media query can be used inside CSS files. For example, in the code below, all h1 will be green when the device has a screen of 400px (Frain, B., 2012).

```css
@media screen and (max-device-width: 400px) {
    h1 {color: green}
}
```

### 2.5 Cloud Computing

“Cloud Computing is best described as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Bcs The Chartered Institute For It, 2012).

Cloud computing provides infrastructure and platform services. Companies could take advantage of this, so they could have the development infrastructure set up in hours, using the best practices and mature tools since the beginning in the case of infrastructure services. Otherwise, companies could use platform services to build and host their application on the cloud. Finally, the availability of cloud-based services and the network effects are increasingly allowing employees get the benefits of it. (Spinellis, D., 2014).
2.5.1 Cloud Components

There are three elements: Client computers, datacenter, and distributed services. Each element has its goal and an explanation of each element is done next.

![Components of Cloud Computing](http://gregwebdev.blogspot.co.uk/2011/07/cloud-computing.html)

**Clients**

Clients are devices categorized in: mobile, thin, and thick. Using those devices end users interact with the information stored in the cloud. Mobile devices include smartphones or tablets. Thin clients are computers without hard drives, where servers display the information. And thick devices which are regular computer with access to the Internet and web browsers (Velte et al., 2010).

**Datacenter**

This is the collection of servers where are hosted subscribed applications. It could be understood as a room full of servers in any place of the world which is accessed by the Internet. The trend is virtualizing many servers in one physical server (Velte et al., 2010).

**Distributed Servers**

The servers could not be together in the same place geographically located, they could be in different places around the world. Therefore, it is helpful because it provides flexibility and security. If one of them fails, the services will not stop because it could be possible to use the others (Velte et al., 2010).
2.5.2 Categories of Cloud Providers

Basically, there are three types of clouds classified according to the capability and services. Cloud computing development built on infrastructure services offering application development capabilities, models, APIs to create products or services in the cloud and then consumed by end users (Buyya et al., 2011).

*Infrastructure as a Service (IaaS)*

It is physics and virtual resources. It provides physical storage, networks, and processing. Virtual machine provisioning and migration services help to IT people save time and effort. For instance, when a new server needs to be installed to the physical infrastructure, the IT team has to follow some specific hand tasks to do it. Now, with the infrastructure provided in the cloud computing it is possible to do the same tasks will take just minutes (Buyya et al., 2011).

*Platform as a Service (PaaS)*

This service allows to developers build their applications and host them in the cloud without paying for servers to host their apps (Velte et al., 2010). In other words, this provides a platform to manage the cloud infrastructure and provides a development environment, and administration tools (Barry et al., 2013).

*Software as a Service (SaaS)*

This provides software or applications. It provides only software, such as, social networks, calendars, documentation management. Software as a Service is also known as on-demand software (Barry et al., 2013).

Figure 6. IaaS, PaaS, SaaS – Categories of Cloud Computing
2.5.3 Pros and Cons of Cloud Computing

Pros

- Cloud computing reduces the cost to invest in infrastructure and resources to manage it.
- Availability continuously is provided by cloud computing because the server infrastructure.
- Mobility. The access to the cloud is not limited. It is possible to access from any part of the world.
- Scalability – when the business grow, the space in the cloud grow as well
- Cloud Computing gives the advantage of quick development supporting the development environment.

Cons

- Security and privacy in the cloud are the biggest issues. Users have to trust in the cloud service vendor
- The information in the cloud is more vulnerable for hackers.

2.6 Technologies

2.6.1 Foundation 5

Foundation 5 is a responsive front-end framework. Using foundation 5 is possible build applications for mobile first, and then for larger devices. It is customizable; it means, that the developers could use or remove certain elements, colors, sizes of columns, and more. Basically, everything is semantic. Foundation is fast to learn. It could be used with any back end, but it works better with Rails (Zurb, 2014).

2.6.2 Server Side Scripting / Coding

Executed or interpreted by the web server

2.6.2.1 Ruby on Rails framework

Rails is a framework to develop, deploy, and maintain web applications in an easy way. Rails uses modern and professional techniques as Model-View-Controller (MVC) architecture. The advantage of Rails is that the development starts with a basic working application with three different layer views, model, and controller. Rails caters testing support during the implementation of an application (Ruby and others, 2013).

Rails has default configurations to make the application works, and this allows for the developer to write less code and overwrite those conventions. Rails integrates features
such as RESTful interfaces and Ajax. With Rails is possible to deploy different releases. Furthermore, this framework is agile. Rails is written in Ruby, a modern programming language. Ruby is an object-oriented language, which has an elegant syntax easy to learn. Ruby is a programming language natural to read, and easy to write (Ruby and others, 2013).

**Conclusion**

The adoption of the Internet technology in the tourism industry definitely has created new ways to promote it. Travel agencies are using web applications to offers products and services, so users are using web applications as the primary source of travel information and as a channel to share their travel experiences to others. The User Centered Design (UCD) approach allows for understanding potential users and their goals, and to create the best tourism web applications because the approach allows users to provide feedback to build the application. The UCD approach allows to build low risk applications. The use of mobile devices to access tourism web app is increasing. For this reason, the responsive web design approach to design and development is adopted. Moreover, the use of design pattern for web application is useful to create more robust applications. The use of the Rails framework for developing the web application has some advantages, such as, using the MVC design pattern, separating the user interface from the logic and the model. Version control and a structured approach to development, testing, and deployment is essential in any project and Git is used to manage versions and branches of the application. It is written in ruby, a programming language easy to write. Rails environment supports the installing and configuration of gems to implement common functionality. Gems are complete modules written to a specification, as such they are very modular and can be combined to deliver robust, well tested, and secure applications. For instance, internationalization is implemented using gems to provide a secure multi-lingual application.
Chapter Three: The Methodology and Research Approach

In this chapter there is a summary of the methods and approaches used to design, develop, and evaluate the responsive tourism web application. The explanation of Agile Software Development and the advantages of applying it in the development of a project is discussed. An explanation of each stage of the User Centered Design (UCD) process to understand the cycle to follow in each iteration is outlined. There is a summary about how to collect, measure, and analyze user experience. Finally, ethics for the project is considered.

3.1 Agile Software Development

Agile emerged in response of users demand to interact with better products in terms of quality and functionality. To develop products which satisfy the end user needs, the traditional development life cycle had to change. For instance, the waterfall model development has some challenges to deal when user requirements change because a complete cycle has to finish for finding the errors instead of identifying them at the design stage, so development time is wasted. Another disadvantage of traditional methods is every team, such as designer, developers, and quality team work in their tasks without communication amongst each other, resulting at the end a product which does not match with the initial requirements. Consequently, Agile Manifesto emerged as a result of experimenting new techniques such as extreme programming, scrum, and other methods. Agile is a set of values to guide software development (Brown, D., 2013).

Some practitioners created Agile Software Development to reduce costs and manage changes. Methods and approaches such as scrum, extreme programming, and test-driven design have been created based on the Agile Manifesto which values are:

- "Individual and interactions over process and tools,
- Working software over comprehensive documents,
- Custom collaboration over contract negotiation,
- Responding to change over following a plan" (Babar et al., 2014).

The development of some products are very time sensitive with tight time schedules. Agile would adhere to the following: Collect requirements informally. Collect the most
representative requirements to start the design and implementation quickly. Documentation for maintainability is not the most important instead having a well-structured readable code. Incremental development realising approved versions. Requirements are defined such as scenarios and the tests are written at the same time. Testing would be done during the development.

3.2 User Centered Design Process
The design of this research project will be done using the User Centered Design process because this process allows for building a product based on end user experience. Therefore, the right thing for users will be created. This process is a successive iterative process.

3.2.1 Research
This process starts with the research stage, where the end users for whom the application will be designed have to be identified. A competitor analysis to find usability issues, to understand their strengths and weakness. In this stage is important to recognize the goals of potential users.

3.2.2 Design
In the design stage the last ideas have to be structured, and some techniques can be used to do it, so these techniques can be process flows, customer experience maps, information architecture, database models, and wireframes.

3.2.3 Prototyping
Building a prototype is the first implementation of applications. Doing a prototype will be useful to show users, the initial design and understand if the design match the user needs and expectations, and get good feedback. Low or high fidelity prototypes can be done. Being low-fidelity a basic building through paper-prototypes, or high-fidelity which has more complete features, almost the final result.

3.2.4 Usability Test
Once, the prototype has been built, then a usability test could be carried out to get feedback from users. The usability test involves users exploring the application or trying to achieve some scenarios, how users interact with the prototype, and observe the problems that they face using it. The objective of the usability test is not testing users, so the purpose is testing the design of the application. The phases in the usability test are: Planning, doing, analyzing, and reporting.
3.2.4.1 Planning

Some things have to be considered before to start a usability test. The objectives of the research have to be defined to choose the right material. The purpose of the research has to be identified. Consent forms to get permission of users to be part of the usability test. The material to be tested, sketches, wireframes, or fully functioning websites. Define who will be part of the test and how many people are needed. Writing questions for interviews or questionnaires to get information. Thinking about the locations logistic and tools to record interviews. Finally, try to carry out a pilot usability test is useful.

3.2.4.2 Conducting the usability test.

To conduct the test, it is important to establish the facilitation team. Generally, one person is in front the users asking questions and observing their gestures, and taking notes. Another option is having two people, one for conducting the test and another to take notes and observe the interviewee. In some cases there are other team members in other room observing the user interaction through video recording. Other aspects to consider is the duration of tests. The test should not last more than sixty minutes because people could get tired and lost interest.

Observation and Interview

The observation and interview is useful to collect the data to evaluate, figure out issues, and consequently improve the design of the web application. Observation will allow to get experiences, feelings, and opinions about the user interaction with the application. Interview is useful to collect data because it allows to ask users about their opinions. Following the UCD approach after finishing the development of the high fidelity prototype, the next stage is testing. Taking notes or recording users to collect this data. The natural behaviour of users have to be captured (Denscombe, M., 2010).

Interviewing participants face to face allows for understanding what they think and feel about the application. A clear explanation about the purpose of the research, and the objectives of the interview has to be done before to start. Everything before the interview has to be planned. For instance, decide the tools to do the interview. Preparing the questions and consent forms (Allen and Chudley, 2012).

3.2.4.3 Analysing

The analysis of the data will be according the metrics chosen. With the results, some issues will be identified, which will help to improve the product. Once done the changes
in the application, the cycle starts again, designing the improvements, implementing in the prototype and then testing again.

![User-Centered Design](image)

**Figure 7. User Centered Design**

### 3.2.5 Measuring User Experience Design

The objective of this research is measuring the experience and satisfaction level, this study will be carried out through a formative usability, which allow identify the usability issues, what aspects work well, the most common errors in the design, and then improve them and test again until to release the final version (Albert et al., 2013).

#### 3.2.5.1 Choosing the metrics

**Performance Metrics**

Moreover the performance and satisfaction will be measured. Performance is related to how users interact with the product. Some measures could involve the degree of users can complete a task, how much time take to do it, or the number of errors they mistake. Satisfaction is related to what users think about the application. The study scenario chosen for this research is completing transactions, where the metric to be examined is task success, and specifically measuring the level of success. To measure this metric some tasks has to be defined and asked to participants to complete them. The percentage of people completing the task will inform that there is a usability issue. For instance, if just a 20% of the target participants are able to complete the task, so it indicates that there is a usability problem (Albert et al., 2013).

**Collecting data for task success**

This is the most common usability metric. It can be used to measure the usability for many products. Measuring task success is not a big deal, so it does not require complex explanations. To collect data for this metric is useful to give users the possible
answers, it means giving multiple-choice responses of level of success. The level of success will be examined in terms of user experience. The scoring to be used is: No problem, Minor problem, Major problem, and Failure (Albert et al., 2013).

**Analysis and Presenting results**
To analyze the result, a stack bar chart with the task in one axe and the percentage of users in each category.

![Levels of Success, by Task](image)

**Figure 8. Chart of Level of Success by Task**

**Self-Reported Metrics**
Another way to get User Experience (UX) data is using self-report metrics, and it would be collected after the session with rating scales. Self-reported data is important because collect the perception of users and how they interact with the product. This metric allows to collect what users think and feel about the product because users will use again products they like, easy to use (Albert et al., 2013).

**Collecting data**
The most common way to collect data for this metric is using rating scales. The approaches are Likert scale or semantic differential scale. For this research the semantic differential scale will be used. It consists of giving two opposite words and one scales within them (Albert et al., 2013).
The techniques to collect data is recording the answers of users, which is good for users because they do not have to write anything; however, it could demand more effort for researches because they have to listen again and transcribe the answer. Paper forms are easy to create, but the manual input data could bring difficulties. Online forms usually is another option. There are some websites that provide the service to create surveys on line (Albert et al., 2013). However, for this research paper forms will be used in order to collect the answers.

Analyzing Rating-scale Data
To analyze the data, a numeric value has to be assigned to each scale position and then calculate the average. Using the concept degree of intervalness, which is the assumption of the same interval between each scale position. In the analysis is most important to focus on the frequency distribution of responses is very important rather than the average. It is important to show users the number assigned to each scale position. It is convenient to start the scale with zero or one. In any case, the initial number in the scale for the analysis will be 0%.

Specifically, self-reported metric will be used to measure the overall perceived usability in the website when users have finished the interaction with it. There are some useful techniques to collect data such as System Usability Scale (SUS), Questionnaire for User Interface Satisfaction (QUIS), Computer Usability Questionnaire (CSUQ). In this case, the QUIS will be used, which is divided in five categories: overall reaction, screen, terminology/system information, learning, and system capabilities.

Behavioural metrics
In a usability test participants do more than just completing tasks and answer questions. They also express what they feel and think with their gestures, smiles, movements. There are three ways to measure emotions. The first one is skin conductance, facial expressions, and the electroencephalography (EEG).

Observing and coding verbal expressions
Unprompted verbal expressions can give us information about how the emotions and the mental state of participants. Many times, participants give comments without being
asked. For instance, they could say positive comments as “it was easy”, or negative as “This is hard”. To analyze this data, the comments have to be cataloged and then categorized in positive, negative and neutral. Consequently, a graph with the percentage of positive or negative will say if there is any issue in the application.

3.3 Ethics

This research project is involving the participation of users for testing the responsive tourism web application. The participation of users is not anonymous. For this reason, users have to grant their participation in the project. They have to sign on a consent form to continue with the testing. They will be informed the steps to follow during the test. Users will know about the video recording during the usability test. They will know that their participation is voluntary, and they can stop at any time. Participants must know that the data provided by them will used just for the aim of this project and ensuring the confidentiality of the data.

Conclusion

Developing the project based on Agile Development has allowed the development of the application quickly. Involving users in the design of the application is important to figure out issues and improve them in the early stages development leading to high quality product. User Centered Design (UCD) Process allows for high fidelity prototypes; therefore, users could have a better idea of the final product. For evaluating the application, the usability test allows to collect data. To measure the user experience three metrics are used. The performance metric to measure the efficiency of an application. Self-Reported metrics where usability is measured, and behavioral metrics to know the feelings of users using the application.
4 Chapter Four: Design and Implementation

In this chapter all of the theory gathered in the previous chapters is applied to design and development of the responsive tourism web application in the cloud. The design starts identifying the user requirements through specifying persona profiles, and consequently, to define functional requirements. Model conceptual, database model, wireframes, and visual design are built with design patterns in mind. The implementation of the application is based on the design proposed previously using the technologies specified in the Literature Review, such as, HTML5, CSS3, JavaScript, Ajax, Ruby on Rails framework, and Nitrous.IO for development on the cloud, taking advantage of their features and benefits.

4.1 Design

At this point, it is important to remember the objectives of this research, mainly identifying the user experience for a tourism responsive web application for Ecuador to develop an attractive, easy to use web application in order to promote international and national tourism, and consequently contribute with the improvement of the economy. For this reason, the design has to consider what goals users want to achieve in a tourism web application.

The first and the foundation stage is the design, where the user interface design patterns, and other considerations to create a great user experience have to be considered. The five elements to design web applications based in user centered and interaction design will be established at this stage.

4.1.1 User requirements

To create great user experiences, users and their needs have to be identified. There are some techniques to achieve it. The specific technique used in this project is person profiles which allow to make a representation of user needs and core tasks.

**Personas Profiles**

Considering that tourists could be people over 18 and 40 years old because they could be really interested in travelling with friends or family. It doesn't matter their gender. The knowledge level about computing will be not predominant. They just need to know how to navigate in the Internet. Some person profiles are described following:

**Anna**

“I love traveling and discover new places. I like the adventure and extreme sports”
Age: 27  
Lives: Leeds - England  
Goals and Needs  
- Know exotic places  
- Practice extreme sports  
- know people  

The website must:  
- Have information about places which offer adventure  
- Have information about activities, specifically extreme sports  
- Maps to know how to get those places  
- Show pictures and videos  

Juan  
“Traveling with the family is important. I prefer relaxing places for the whole family”  
Age: 50  
Lives: Buenos Aires - Argentina  
Goals and Needs:  
- Travel to relaxing places than adventure  
- Travel with the family  
- Secure places  
The website must:  
- Have general information about the place, visa requirements, security, emergency contacts, and weather.  
- Information about relaxing places  
- Display pictures  

Michael  
“I like travel to meet people, places, events, and then share my experiences, and pictures with friends”  
Age: 36  
Lives: New York - USA  
Goals and Needs  
- Use mobiles rather than computers  
- Meet people  
- Use of social networks
The website must:
- Do activities in the place to visit
- Blogs and posts
- Possibility to share pictures with friends
- Directions to get the places
- Pictures and videos

### 4.1.2 Functional Requirements

<table>
<thead>
<tr>
<th>Website</th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartphone apps</td>
<td>Hotel booking</td>
<td>Information</td>
<td>Sharing experiences</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Destinations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Costs</td>
<td></td>
</tr>
<tr>
<td>Languages</td>
<td>Information</td>
<td>Transportation</td>
<td>Blog</td>
</tr>
<tr>
<td></td>
<td>- Destinations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Visa information</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- General</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Videos/Images</td>
<td>Planning</td>
<td>Maps-directions</td>
<td>Sharing destinations</td>
</tr>
<tr>
<td>Search engine</td>
<td>Weather</td>
<td>Event calendar</td>
<td>Ranking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- By month</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- By day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Type of destination</td>
<td></td>
</tr>
<tr>
<td>Ease of use</td>
<td>Ranking</td>
<td>Event booking</td>
<td></td>
</tr>
<tr>
<td>Navigation</td>
<td>Links to social</td>
<td>Image gallery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Membership</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Functional Requirements

### 4.1.3 Conceptual Model

![Figure 9. Site Map of the Tourism Responsive Web App](image-url)

---

39
4.1.4 Database Model

![Database Model Diagram]

**Figure 10. Database Model**
4.1.5 Wireframes

4.1.5.1 Home Page Desktop and Mobile

Figure 11. Wireframes for Home Page. Desktop and Smartphone layout.
Figure 12. Wireframes for Event List Page. Desktop and Smartphone layout.
4.1.5.3 Visual Design

This visual design is based on the wireframes. This visual design will be helpful for the development of the application because it provides the predominant colors and styles to apply in the application. Even, it is displaying some images to be used in the real application. It caters a clear idea of how the application should look.

![Figure 13. Visual Design for Home Page](image)

![Figure 14. Visual Design for Destination List Page](image)

![Figure 15. Visual Design for Destination Page](image)
4.2 Implementation

4.2.1 Getting Started

Once the design has finished, the next stage in the process of this project is building the application based in the documentation of the design. The web application will be built using Nitrous.IO platform which is a cloud-based development environment with a web-based IDE (Integration Development Environment) and cloud VMs (Virtual Machines). Nitrous.IO provides everything to develop Ruby applications, and provides a collaborative online environment. It is important to remember that Ruby on Rails framework was chosen for this project because it works with the MVC design pattern, which allows to manage the user interface which is the predominant aspect for the application. Moreover, developing an application in Nitrous.IO has not any cost.

In order to start creating a new project, the first step in accessing to Nitrous.IO website and create an account. Then, create a box to store the project.

![Nitrous.IO Boxes](image)

**Figure 16. Nitrous.IO Boxes**

Nitrous.IO allows to connect with Github which is Git repository web-based hosting service, which provides source code management and distributed revision control. Therefore, the connection is possible by adding ssh keys to save the project in repositories in Github. Consequently, Github is used to manage versions of the application code. Another benefit that Github provide is the possibility to create branches to code specific functionality in each one, and then merge them. Finally, it is a free service.
The web IDE that Nitrous.IO provides is shown in the figure below. Nitrous.IO provides the console, the file browser, the text editor, and a chat window. To create a new project the command “rails new NameProject” in the terminal or console, and automatically it will generate the foundation folders and files to start with a basic application.
4.2.2 Setting up PostgreSQL database

For the development of this project the PostgreSQL database will be used because it is an open source relational database, highly programmable and extendible, and it provides stability. It is possible to install the database in Nitrous.IO using autoparts. It is done running the command >>parts install postgresql. To connect the database via Rails, it is needed to start the database through the command >> parts start postgresql. Then, in the config/database.yml file the configuration to use PostgreSQL database for each environment has to be established.

4.2.3 Creating Resources

Rails scaffolding is the quick way to create resources, it creates the model, views, and the controller for the resource. The resources for the next objects has been created: Country, Region, City, Destinations, Events, Activities, Type Activities, Type Destination, Articles, Plans, and Line Destinations, specifying the attributes to be created in the corresponding table in the database. The relationship between the tables as well can be defined in the same command. The command could be like this.

To create resources for Country:

$ rails generate scaffold Country name:string description:string image:text geography:text weather:text population:text currency:text

To create resources for Region:

$ rails generate scaffold Region name:string country:belongs_to image:text description:text

4.2.4 Implementing User Interface Design

4.2.4.1 Foundation

Foundation5 is a responsive front-end framework, and this project is using this framework because of their advantages. Foundation allows to develop for any device, it is possible to customize or restyle elements, so it helps to develop the application quicker. Foundation uses HTML, CSS and JavaScript. To use foundation the next steps have been done.

Add Foundation to the application

Add the following in the Gemfile of the project: gem ‘foundation-rails’

Then run in the console the command line $ bundle install
Configuring
In the console run this
$ rails g foundation:install

Add Foundation to CSS
In the file app/assets/stylesheets/application.css file has be:
/*= require foundation

Add Foundation to JS
In the app/assets/javascripts/application.js file add:
//= require foundation
$(document).foundation();

Add Modernizr and set viewport width
Make sure that Modernizr is included in the <head> of your page:
javascript_include_tag "vendor/modernizr"
<meta name="viewport" content="width=device-width, initial-scale=1.0" />

Orbit
Images give more information than words, specifically in a tourism website. Tourists can have indirect experiences through images. Users enjoy watching pictures of places. Therefore, orbit is implemented to display images of each destination, event and activities. Orbit allows users to slide the pictures. Three images for each destination and activity are sliding automatically while users stay in the page. Also, the user can use the arrow to slide the images. The result is shown in the next figure:

10 de Agosto - Velada Libertaria

Figure 19. Orbit for the Event “10 de Agosto - Velada Libertaria”
**Top Bar**

To implement the menu will be used the top bar feature, which is displayed in a responsive way according to the size of the device. The presentational classes allow to give different styles at the top bar. For instance, it allows to create the title area, the left, the right area, and the dropdown list. This feature is really helpful because it allows to create a navigation bar quicker according the design specifications.

![Figure 20. View of Navigation and Utility Bar](image)

Moreover, the top bar in mobile screens hides the items on the list and just displays the menu icon which on touch in mobile devices displays a dropdown list with the menu items.

![Figure 21. View of navigation bar in a mobile device](image)

**Tabs**

Tabs will be used to group the search options for destinations, events and activities to provide an easy and quick access to these options, and show them in an organized way. Implementing this search in tabs will allow users to find events, destinations and activities by city, type of destination, and type of activity in an easy and quick way without going to each section on the application.
Figure 22. View of search tabs in the web application

**Breadcrumbs**

Following the best practices, breadcrumbs to show the path from the home page is shown in the current page. Foundation provides a fancy style for breadcrumbs. A class of breadcrumbs is specified in an ul element, and then the links starting from the home page have been added. Adding breadcrumbs give users the clear idea where they are in the application, and the possibility to go straight to the prior pages or the home page.

In the figure below there is an example of the breadcrumb for the destination page. This is displayed at the top of the page, below the navigation bar.

Figure 23. View of Breadcrumbs in web application

**Grids**

Foundation allows to create layouts quickly and easily for different devices with the default 12-column. To create flexible grids, divs elements with class row has to be coded, and then inside those divs, add other divs with column class with the specific size of the column.

For the elements displayed in the home page are defined two rows with two columns, the left one with size 7, and the right one with size 5. The advantage of the grid is the rearranged of the elements when the application is displayed in a mobile device like is shown in the figure.
4.2.5 Implementing Functionality

Ruby is the programming language used in Rails framework. This project will take advantage of using ruby gems which are third-party libraries to implement some features.

To install a gem, it has to be added in the Gemfile file like below:

```ruby
gem 'devise'
gem 'globalize', '~> 4.0.0.alpha.2'
gem 'geocoder'
gem 'gmaps4rails'
```

And then, run the command `$bundle install`.

4.2.5.1 Devise for User and Authentication

“Devise” gem is installed and configured to implement user authentication. User can sign up and login in the web application to create later trip plans, or rate destinations. It automatically creates user model, registration and session controller, and views for registration, session, passwords, confirmations, and e-mails.

**Database authenticable:** encrypts the password and validate the authenticity of users when they login.
**Confirmable**: confirms whether an account has been confirmed

**Recoverable**: allows users reset passwords and send reset instructions

**Registerable**: allows registration process, and it allows edit or delete user accounts.

**Validatable**: validates email and password, however it can be customizable.

### 4.2.5.2 Internationalization (I18n) and Globalize

The web application was designed to allow access to international tourists; consequently, there must be the option to select different languages to provide a better user experience.

To translate static content of the website, the i18n gem allows for doing that. Keys have to be defined, and then the corresponding translation has to be specified in the locale files for each language. For instance, the translation for the items in the navigation bar are done like shown below:

In the html:

```html
<li><a href="#" title="About Ecuador">About Ecuador</a></li>
<li><a href="#" title="Events">Events</a></li>
<li><a href="#" title="Destinations">Destinations</a></li>
<li><a href="#" title="Activities">Activities</a></li>
<li><a href="#" title="Tips">Tips</a></li>
```

And then the corresponding translation in each locale file:

**es**: layouts:

```yaml
header: 
signup: "Regístrate"
signin: "Inicie Sesión"
profile: "Perfil"
logout: "Terminar Sesión"
ecuadorTourism: "Ecuador Turismo"
destinations: "Destinos"
aboutEcuador: "Sobre Ecuador"
activities: "Actividades"
tripPlanner: "Planificador Viaje"
experiences: "Experiencias"
events: "Eventos"
book: "Reservaciones"
home: "Inicio"
```

**en**: 

```yaml
ecuadorTourism: "Ecuador Tourism"
layouts:
header:
signup: "Sign Up"
signin: "Login"
profile: "Profile"
logout: "Logout"
destinations: "Destinations"
aboutEcuador: "About Ecuador"
activities: "Activities"
tripPlanner: "Trip Planner"
experiences: "Experiences"
events: "Events"
book: "Booking"
home: "Home"
```

![Figure 26. HTML code – Translations keys](image)

![Figure 27. Locale files. es.yml and en.yml](image)
Ruby provides the globalize gem to create translation tables of the object saved in the database. Therefore, the gem has been installed and some configuration has been done to define the languages. The app at the moment is implemented in English and Spanish.

The attributes of the object to translate has to be specified in the model file of the object.

![Figure 28. Country model with attributes specifications to translate](image)

Then, the tables for the translations has been created.

![Figure 29. Migration file to create translation for country table](image)

And finally, the select tag to give the option to select the language was added on the utility bar in the header:
4.2.5.3 Gmaps4rails for localization and Maps

One of the functional requirements is displaying maps for destinations. To implement maps, the gem gmaps4rails has been installed. Then, in the HTML the div element to display the map is added.

Google scripts have been added in the dom

```html
<script src='//maps.google.com/maps/api/js?v=3.13&amp;sensor=false&amp;libraries=geometry' type='text/javascript'></script>
<script src='//google-maps-utility-library-v3.googlecode.com/svn/tags/markerclustererplus/2.0.14/src/markerclusterer-packed.js' type='text/javascript'></script>
```

In the asset pipeline the line is added: //= require gmaps/google.

Finally, the JavaScript code is added to display the map according to variable defined in the controller.

```javascript
@hash = Gmaps4rails.build_markers(@destination) do |destination, marker|
  marker.lat destination.latitude
  marker.lng destination.longitude
  @destination = Destination.find(params[:id])
end

<script type='text/javascript'>
  handler = gmaps.build('@Google');
  handler.buildMap({
    provider: {},
    internal: {id: 'map'},
  }, function() {
    markers = handler.addMarkers(@hash.to_json);
    handler.bounds.extendWith(markers);
    handler.fitMapToBounds();
    handler.getMap().setZoom(14);
  });
</script>
```

The map will display the address specified in the latitude and longitude attribute of each destination.
4.2.5.4 Fullcalendar for Calendar

Calendars could be a good idea to display events because they could be organized by month.

Fullcalendar gem allows to create a calendar and then

![Figure 35. Calendar div in web application]

**Conclusion**

Following the User Centered (UCD) design approach to design the application has been useful to identify the user requirements. The use of wireframes has allowed for representing the functional requirements, design patterns, information content, and responsive design for mobile devices. In the database model it is possible to define the structure of the information, how it is saved, accessed, and the relationship between tables. The visual design is really helpful to design the style of the application, the colors, images, and typography.
The development has been done following the design carried out previously. The use of Nitrous.IO, the cloud-based platform has been really useful because the development environment on the cloud server at the start of the development. Nitrous.IO provided the development environment, the web server, the installation of the database, the programming language, and Rails the framework to develop the application. Using Foundation, the front-end framework has been useful to create responsive elements quickly and easily. Git the distributed version control has been used to create branches at each stage of the development, and then merge to a master branch. The use of gems has been used to implement quickly and easily some functionality, such as, internationalization, geocoder, globalize, social buttons, sliders, authentication, pagination, breadcrumbs, and more.
Chapter Five: Testing and Evaluation

In this chapter, the approaches to testing and evaluation of the web application are applied according to the methodology chapter. The usability test is carried out to collect data for the three metrics defined, such as performance, self-reported and behavioral metrics. The usability test involves seven participants, where they have to complete eight tasks, and then provide their answers about the level of success completing the task. After completing the tasks, they have to answer a questionnaire to analyze the usability of the application. And finally, the behavioral metric is collected from the videos recorder during the test, and their expressions and gesture are analyzed.

5.1 Testing

For the usability test seven participants have been involved. Users had to sign in the consent form, specifying their agreement to be part of the research. They were informed about the purpose of the project. An explanation about the way to carry out the usability test was provided. They knew that a camera was recording them during the test. Before the usability users were informed about a voluntary participation. The data was collected by paper questionnaires. On for performance metrics and the other the Questionnaire for User Interface Satisfaction (QUIS).

5.2 Evaluation

Question 1. What is the purpose of the web application?
All of the participants answered that the purpose of the web application is to promote tourism for Ecuador. Provide information about places, activities and events in Ecuador. Booking services. Searching by cities and type of destinations.

Question 2. Could you identify the main sections of the application?
Every participant identify the options in the navigation bar as the main sections.

5.3 Performance Metrics

5.3.1 Results of Completing Tasks
5.3.1.1 Task 1 - Sign up in the website and check confirmation email

In the completion of this task have been identified some facts. All of the participants have achieved the task. They have clicked in the sign up button in the header, they have filled out the information in the form to register, have clicked in the sign up button on the form, and then all of them have checked the confirmation email and they have found it in their inbox mail. Observing how users have achieved this task and according to their answers, everyone has found the button to sign up in the header easily, so there are no issues about the position of the button. The labels in the form are clear, and the sign up button in the form is identified clearly as a button. Finally, users realize that they are logged in the web application after the register.

Moreover, another fact is 70% of the participants had no problems to complete the task. However, 30% found some difficulties to achieve the task. Users found some
issues in this task corresponding to the functionality. When users do not input eight characters as minimum in the password, the application displays an error page, so it means, that there is a problem with the validation module. The second issue was related to the link provided in the confirmation email. In some cases, the link was clickable, but when users clicked on the link an error page was displayed. In other cases, the link was not clickable. It is important to emphasize that the task does not failed because the task ends when users check the confirmation email; however, users wanted to go beyond, which was good because it was possible to find issues that will be corrected in the next cycle.

5.3.1.2 Task 2 - Find the description of a destination (“Mindo”)

In this task the results shows that every participant has finished the task. More than 80% of participants did not found problems. However, despite all of them answered the task as not failed, two of them did not find the description, they found the summary displayed in the list of events and they assumed they found the description.

According to 20% of the participants who had some difficulty, and after observing the records, it was possible to identify that users who used the navigation bar to access to destinations, they did not have any problem finding the destination specified. However, when users tried to use the search box in the home page it did not work, so when they try to go to the destination search tab, nothing happened.
5.3.1.3 Task 3 - Find the name and place of the event on date (“September 23”)

The task 3 was achieved for all of the participants, they found they name of the event because it has a good position, it is prominent and the beginning of the page. However, some users found some difficulties finding the place of the event because it was under the orbit used to display images for the event, and sometimes when the page loaded, the images did not load correctly and they hide the place. For this issue, the orbit load has to be improved, and probably another location for that information has to be redesigned.

5.3.1.4 Task 4 - Share with friends the event (“Carnaval de Guaranda”) through facebook

For this task, the results show that every participant completed the task, and just less than 20% of the participants found a minor problem. It can be said that participants
found the specific event, and they found the event easily because they learned with the
previous task how to find events, so it means that the web application is learnable. The
button is located in a good position.

5.3.1.5 Task 5 - Comment in the article (“Discovering Cotopaxi National
Park with family”)

The results of this task show different answers, having a higher percentage the no
problem answer; followed by a minor problem, and with the same percentages the
answers major problem and failure. Some of the users were able to comment in the
article; however, other users faced some issues. For some participants was difficult to
find the article. They explore the web application, leaving the blog section as the last
option. Some users needed help to find the article. Other users found the article easily,
probably because they are familiar with the term blog, but the section to comment did
not appear, so they did not comment, and others refresh the page, and the comment
section appeared, and they achieve the task. Therefore, there is a functional issue
displaying the comment event because it does not display when the page is charge the
first time.
5.3.1.6 Task 6 - Find tips about security

In this task all users have answered that they did not find any problem doing this task. However, evaluating the video records, it is possible to realize that there is an issue achieving the task. Users found easily the tips section, and they found the button for security tips; however, when they clicked in the security button, the information did not display. Probably, they assumed they found the tips but do not. The security tips are not displayed after the page is loaded, they are displayed after the page is refreshed, so there is a functionality issue.

5.3.1.7 Task 7 - Search the activities by the type of activity (“Gastronomy”)
The result for this task show that more than 40% of participants completed the task with no problem, the same percentage found a minor problem, and more than 10% failed. Therefore, 80% of the participants found the tab to search by type of activity; however, when they clicked in the tab, the content for the tab did not load, so cause confusion on the participants. Thus, once again there is a functional issue.

5.3.1.8 Task 8 - Find information about the weather of Ecuador in About Ecuador section in a mobile phone.

![Figure 44. Chart of results for Task 8](image)

Participants found the especific section, and the weather information; however, some of them found some difficulties because when they clicked in the menu bar, the web app did not charge the dropdown menu.

5.4 Self-Reported Metrics

<table>
<thead>
<tr>
<th>Questions:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVERALL REACTIONS TO THE APPLICATION:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terrible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wonderful</td>
<td></td>
</tr>
<tr>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Easy</td>
<td></td>
</tr>
<tr>
<td>Frustrating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Satisfying</td>
<td></td>
</tr>
<tr>
<td>SCREEN:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characters on the computer screen</td>
<td></td>
<td></td>
<td></td>
<td>Hard to read</td>
<td>Easy to read</td>
<td></td>
</tr>
<tr>
<td>Highlighting on the screen simplifies task</td>
<td></td>
<td></td>
<td>Not at all</td>
<td></td>
<td>Very Much</td>
<td></td>
</tr>
<tr>
<td>Organization of information on screen</td>
<td></td>
<td>Confusing</td>
<td></td>
<td>Very Clear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequences of screens</td>
<td></td>
<td>Confusing</td>
<td></td>
<td>Very Clear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TERMINOLOGY AND SYSTEM INFORMATION:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of terms throughout system</td>
<td></td>
<td>Inconsistent</td>
<td></td>
<td>Consistent</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Computer terminology is related to the task you are doing

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position of messages on screen</td>
<td>Inconsistent</td>
<td>Consistent</td>
</tr>
</tbody>
</table>

**LEARNING:**

<table>
<thead>
<tr>
<th></th>
<th>Difficult</th>
<th>Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning to operate the application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remembering names</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SYSTEM CAPABILITIES:**

<table>
<thead>
<tr>
<th></th>
<th>Too Slow</th>
<th>Fast enough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Reliability</td>
<td>Unreliable</td>
<td>Reliable</td>
</tr>
<tr>
<td>Application tends to be noisy</td>
<td>Noisy</td>
<td>Quiet</td>
</tr>
<tr>
<td>Correcting your mistakes</td>
<td>Difficult</td>
<td>Easy</td>
</tr>
</tbody>
</table>

**USABILITY AND UI:**

<table>
<thead>
<tr>
<th></th>
<th>Poor</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of colours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application response to errors</td>
<td>Awkward</td>
<td>Gracious</td>
</tr>
<tr>
<td>Application messages and reports</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Application clutter and UI noise</td>
<td>Poor</td>
<td>Good</td>
</tr>
</tbody>
</table>

Table 4. Questionnaire for User Interface Satisfaction (QUIS)

The results are shown in the next table:

<table>
<thead>
<tr>
<th>Question</th>
<th>P 1</th>
<th>P 2</th>
<th>P 3</th>
<th>P 4</th>
<th>P 5</th>
<th>P 6</th>
<th>P 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
All of the aspects for this evaluation are measured in a scale from 0 to 5, being 0 the worse mark and 5 the best one. With this in mind each section of this test will be analyzed.

### 5.4.1 Overall reaction to the application

![Figure 45. Chart of results for Overall Reaction to the Application](image)

Three aspects related to the overall reaction to the application were evaluated in this section. The appearance, the difficulty, and the satisfaction of the application. The chart shows that users gave marks between 3 and 5; therefore, it means that users have a good appreciation of the application. This would be a positive fact considering that this the first iteration of the process. Analyzing the following questions it is possible to figure out the area to be improved.
5.4.2 Screen

![Chart of results for Screen](image)

In relation to the screen, the chart shows that more than 40% of the participants found easy to read the characters on the screen. However, there is a small percentage that give a mark of 2 below the average, so this indicates that some improvements in the typography must be done for the next iteration. The highlighting in the application is not helping users to simplify tasks. More than 40% of the participants think that the organization of the information is good. A little effort related to the sequences of screens must be done. Probably, it would help making more prominent the breadcrumbs.

5.4.3 Terminology and System Information

![Chart of results for Terminology and System Information](image)

The chart shows that most of the participants gave to these questions an answer of 4. Therefore, the terminology is consistent, and it is related to the tasks in the application. However, for the next iterations it should reach a mark of 5.
5.4.4 Learning

In relation to the learning, the chart indicates that user remembered the names easy. Therefore, it could be interpreted as the names used in the application are familiar for users, and they are appropriate. The same amount of the participants gave a mark of 4 and 5 to the level of difficulty to learn to operate the application. It suggests that the application is easy to use, but it could be improved.

5.4.5 System Capabilities

Most of the participants gave a mark of 4 and 5 to the speed of the application. It means that in the speed of the application is good, considering that some images are displayed. More than 70% of the participants think that the application is not noisy. It could indicate that there is nothing prominent to disrupt their attention.
5.4.6 Usability and UI

In relation to usability and UI some lower marks can be identified, so some improvements have to be done related to the feedback, the response to errors, and messages displayed to inform users what is happening in the application. A deep analysis about where the messages should be displayed should be done.

5.5 Behavioural Metrics

Observing the videos recorded, it was possible to figure out the user expressions or gestures; it means, their emotions. It was possible to see if they feel confident completing the tasks because some of them smiled. Other participants felt frustration trying to achieve some tasks. Some of them express what they did, and how they found completing the tasks. For example, they used expression, such as, nice, good, it was easy, or it was simple. Some of them expressed surprise after watch videos or images. Some participants experimented confusion when they expected that something happens in the applications after clicking on a specific element. In overall, according to the expressions, and gestures of users showed, it is possible conclude that the application is neutral.

Conclusion

After conducting the testing and evaluation it is possible to conclude that the purpose of the responsive tourism web application for Ecuador is clear for users. They have figured out that the website is to promote tourism in Ecuador, and they can find
information about destinations, places, events, and bookings. Referring to the performance of the website, some issues have been found. Many of the issues are related to the functionality rather than the user interface. Concerning the usability some improvements have to be related to typography, and the absence of feedback and messages to inform users what is happening in the application after actions or inputs. All the issues highlighted with the test and evaluation have to be corrected or designed in the next iteration of development.
6 Chapter Six: Conclusion and Recommendations

6.1 Conclusions

- The trend of using Internet technology in the tourism industry has allowed great improvements in this sector. Tourists around the world are using web applications for looking places to visit, booking services, or sharing their experiences with friends, among others. Therefore, developing this responsive tourism web application for Ecuador satisfying the user’s needs will definitely contribute to the promotion of the tourism in Ecuador.

- Agile Software Development was considered for this project because the team for the project was only one person, the team had basic experience about the technologies to be used in the implementation. The development time was limited, and there was a big expectation of changes during the development. Following the Agile Software Development guides allowed for the design and implementation the application quickly.

- The User Centered Design (UCD) approach allowed to identify the potential users and their respective requirements using person profiles and benchmarking. The use of the site maps, database model and wireframes allowed to structure the functional requirements, the architecture information, and the user interface design patterns to be implemented in the application. The most important part of using UCD is the feedback provided by users after testing the application to improve the design.

- The use of Ruby on Rails for the implementation of the web application allowed for rapid implementation. It allowed easy implementation for the front-end because it uses MVC design pattern, and Foundation framework to implement the styles, and responsive elements. To implement the functionality, there was a time constraint because of the inexperience using the Ruby programming language. However, with the continuous practice these issues were resolved. The use of gems was useful to implement some functionality quickly, such as, internationalization, maps, pagination, sliders, and authentication.

- Developing with Nitrous.IO, a cloud-based platform allowed to optimize the time because the platform provides the development environment, the rails framework, support for the ruby programing language, and it allows to install the
database to start the implementation of the web application without major effort configuring the infrastructure for the development. Moreover, it provides mobility, scalability, and low costs.

- After the testing some results showed that the purpose of promoting tourism for Ecuador was clear for almost all of the participants. They could identify the main sections of the web application. However, there are some issues to correct in the application. A high percentage of participants were able to complete the tasks provided in the usability test. A lower percentage faced functionality issues rather than user interface design issues.

- Overall, modern web development has become a significant and rapidly expanding part of software engineering. The project shows that with careful selection of design patterns, development environments, cloud services and methodology, it is possible to analyze, design, develop, and deploy a responsive, secure, scalable, internationalized web application in a relatively short period of time with a few agile development cycles.

6.2 Recommendations

- The development of the responsive web application has reached the implementation, and testing stages because the scope of the project merited it; however, the final product should be released to contribute to the promotion of tourism in Ecuador. Therefore, the next agile development cycles should be carried out to deploy the final web application.

- One of the requirements identified in the design stage of this project was booking for services, such as, hotels, flights, restaurants, among others. Because of time constraint, it was not possible to implement this functionality. Therefore, the booking functionality should be implemented to provide a web application which satisfies all the user requirements.

- The scope of the project was developing a responsive tourism web application for Ecuador; however, if users have no access to the Internet, they would not be able to use the application. It should be solved catering the possibility to install in their devices a native application.
REFERENCES


Appendix 1

Social-share-buttons for social buttons

Black Mama

Figure 51. Social Buttons to share Black Mama Event

Fancybox for displaying images

Figure 52. Fancybox to display image gallery

Planning

Figure 53. Plan Trip div element
TESTING A TOURISM RESPONSIVE WEB APPLICATION IN THE CLOUD

Usability and User Experience evaluation for Research Project

Principal Investigator: Andrea Becerra

THE PURPOSE OF THE STUDY
This study aims to evaluate the experience after using of a tourism responsive web application in the cloud for Ecuador. Regard, that this test evaluate the application, not you. Thank you for volunteering to participate in the test, by doing so you are helping me to improve the design and content of the application which is as part of the research project.

THE STUDY
Firstly I would like you to complete:

1. An Informed Consent form
2. **Task-based experiment:** to explore the website looking for certain information required to complete the task. The testing equipment to be used are:

   - **Observation:** Real-time observations of the user in the environment. Video recorder will be used to record the expressions and voice and analyse the users’ experiences and behaviours, hesitations, confidence, and verbal protocols.

3. **Usability Interview:** After the tasks have been completed you will be asked to have an interview asking for feedback on aspects of the site and the conduct of the test.

Any Questions?

I believe that there is effectively no risk involved in the participation in the proposed research. All participation in the research is entirely voluntary, and can be stopped at any time. At the end of each session participants will have the opportunity to comment on the way the research was conducted. Data will be held for research analysis by Andrea Becerra. All personal data will be treated confidentially, and no one will be identified in published material.
INFORMED CONSENT FORM

I agree that by signing I am agreeing to take part of this evaluation which is part of a
master research project. I have read the Explanatory Statement. To take part
means that I am willing to:

- To be observed during my interaction with the tourism responsive web
  application in the cloud.
- To be captured on video record
- To have an interview asking me about my experience

Data Protection

I understand that any information I provide is confidential, and that no information
that could lead to the identification of any individual will be disclosed in any reports on
the project, or to any other party. No identifiable personal data will be published.

Withdrawal from being a participant in the study

I understand that my involvement as a participant is voluntary, that I can choose to
withdraw my consent to be a participant in the evaluation part of the research project
without being penalised or disadvantaged in any way.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Full name</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/10/14 2:18</td>
<td>FRANK ETOUNG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INFORMED CONSENT FORM

I agree that by signing I am agreeing to take part of this evaluation which is part of a
master research project. I have read the Explanatory Statement. To take part
means that I am willing to:

- To be observed during my interaction with the tourism responsive web
  application in the cloud.
- To be captured on video record
- To have an interview asking me about my experience

Data Protection

I understand that any information I provide is confidential, and that no information
that could lead to the identification of any individual will be disclosed in any reports on
the project, or to any other party. No identifiable personal data will be published.

Withdrawal from being a participant in the study

I understand that my involvement as a participant is voluntary, that I can choose to
withdraw my consent to be a participant in the evaluation part of the research project
without being penalised or disadvantaged in any way.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Full name</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/9/14 13:30</td>
<td>BRIAN MUMFORD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Participant: Brian Mungo

Please answer the next questions:

<table>
<thead>
<tr>
<th>Questions:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVERALL REACTIONS TO THE APPLICATION:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terrible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Wonderfu</td>
</tr>
<tr>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Easy</td>
</tr>
<tr>
<td>Frustrating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Satisfyi</td>
</tr>
<tr>
<td>SCREEN:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characters on the computer screen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard to read</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Easy to read</td>
</tr>
<tr>
<td>Highlighting on the screen simplifies task</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Very Much</td>
</tr>
<tr>
<td>Organization of information on screen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confusing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Very Clear</td>
</tr>
<tr>
<td>Sequences of screens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confusing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Very Clear</td>
</tr>
<tr>
<td>TERMINOLOGY AND SYSTEM INFORMATION:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of terms throughout system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inconsistent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer terminology is related to the task you are doing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Always</td>
</tr>
<tr>
<td>Position of messages on screen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inconsistent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Consistent</td>
</tr>
<tr>
<td>LEARNING:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning to operate the application</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Easy</td>
</tr>
<tr>
<td>Remembering names</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Easy</td>
</tr>
<tr>
<td>SYSTEM CAPABILITIES:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too Slow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Fast enough</td>
</tr>
<tr>
<td>Application Reliability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unreliable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>Reliable</td>
</tr>
<tr>
<td>Application tends to be noisy</td>
<td>Noisy</td>
<td></td>
<td>Quiet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------</td>
<td>---</td>
<td>------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correcting your mistakes</td>
<td>Difficult</td>
<td>✓</td>
<td>Easy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>USABILITY AND UI:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of colors</td>
<td>Poor</td>
<td></td>
<td>Good</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application feedback</td>
<td>NA</td>
<td>✓</td>
<td>Good</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application response to errors</td>
<td>NA</td>
<td>Awkward</td>
<td>Gracious</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application messages and reports</td>
<td>NA</td>
<td>Poor</td>
<td>Good</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application clutter and UI noise</td>
<td>NA</td>
<td>Poor</td>
<td>Good</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LIST THE MOST NEGATIVE ASPECTS:**

1. Impact of boxes over image on home page.
2. Finding searchway section
3. No security check on users when creating user

**LIST THE MOST POSITIVE ASPECTS:**

1. Consistent colors
2. Easy to navigate
3. Good social media connection
Appendix 5

Participant: FRANK ETOUMO

Scenarios:
- Watch the home page and answer:
  - What is the purpose of the web application?
  - Could you identify the main sections of the app?

- Task 1: Sign up in the website and check email confirmation
  - How easy was to achieve the task?
    No problem  Minor problem  Major Problem  Failure
    *Sign up was simple and easy, but the login link sent by email did not work*

- Task 2: Find the description of a destination ("Mindo")
  - How easy was to achieve the task?
    No problem  Minor problem  Major Problem  Failure

- Task 3: Find the name and place of the event on date ("September 23")
  - How easy was to achieve the task?
    No problem  Minor problem  Major Problem  Failure

- Task 4: Share with friend the event ("Carnaval de Guaranda") through facebook
  - How easy was to achieve the task?
    No problem  Minor problem  Major Problem  Failure

- Task 5: Comment in the article ("Discovering Cotopaxi National Park with family")
  - How easy was to achieve the task?
    No problem  Minor problem  Major Problem  Failure

- Task 6: Find links about Security
  - How easy was to achieve the task?
    No problem  Minor problem  Major Problem  Failure

- Task 7: Search the activities by the type of activity ("Gastronomy")
  - How easy was to achieve the task?
    No problem  Minor problem  Major Problem  Failure

- Task 8: Find information about the weather of Ecuador in About Ecuador section in a mobile phone.
  - How easy was to achieve the task?
    No problem  Minor problem  Major Problem  Failure