MyOcean

Improving an exhibition visit with wearable technology

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A vida é feita de escolhas.

Anonymous

Acknowledgments

It was the 17th of September of 1994 when I gave the first step onto this journey. Today, after 23 years, I reach its end. It is not humanly possible to acknowledge every single one who've helped me surpass the many obstacles that came along my way. Some may have simply encouraged me to carry on and some may have teached me everything I know. I'm grateful for every single individual that crossed my path and that, in their way, lead me to this moment.

My most profound gratitude goes to you. Yes, you.

Abstract

This is the technology era. Every single day the world leaps forward and discovers new ways to improve and make our life better. This evolution influences almost every corner of society such as our work, our transports, our culture and even us. Everything today has an app. Museum and art galleries are not an exception. In fact, there has been a large growth of museum applications, supported by different types of hardware. We took that step and experimented the usage of wearable technology using Lisbon's Oceanarium as the main case study. The main target for this project, were users with ages between 10 and 15, considering this group is a big part of the visitors of our case study. Through games and a very fluid application, we tested their reaction. Although this experiment was not tested in the field, it has shown some positive results on using an application to visit this museum, considering it currently does not have one. We also obtained some negative results related to the chosen hardware, such as excessive weight or an unfocused screen. The main conclusion was that this hardware, considering the current developments of the technology, it is not the ideal solution for this type of projects.

Keywords

wearable, eyeware, immersive, museum, tour, tourism, ocean, jet

Resumo

Esta é a era da tecnologia. Todos os dias damos um pulo e descobrimos nvoas formas de melhorar o nosso estilo de vida. Esta evolução influencia todos os aspectos da sociedade como, por exemplo, o nosso trabalho, os nossos transportes, a nossa cultura e até mesmo a nós próprios. Hoje em dia, tudo tem uma app. Os museus e as galerias de arte não são exceção. Aliás, tem havido um crescimento de aplicações de museus, suportadas por diferentes tipos de *hardware*. Nós demos esse passo e fizemos a experiência de utilizar uma tecnologia *wearable*, tendo o Oceanário de Lisboa como o nosso caso de estudo. O público alvo desta experiência foram os utilizadores com idades compreendidas entres os 10 e 15 anos, dado que são uma fatia grande do público geral deste museu. Com ajuda de jogos e de uma aplicação fluída, testamos a reação dos mesmos. Apesar de não ter sido testada no Oceanário, obtivemos alguns resultados positivos em relação à utilização da aplicação, especialmente porque o mesmo ainda não possui nenhuma. Por outro lado, também obtivemos alguns resultados negativos perante a escolha do *hardware*, relacionados com o excesso de peso ou até mesmo a desfocagem do ecrã. A conclusão principal é que este *hardware*, com os desenvolvimentos atuais da tecnologia, não é a solução ideal para este tipo de projectos.

Palavras Chave

óculos, imersivo, museu, rota, turismo, oceano, aplicação, visita

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Abbreviations

C4B Card4BSystems, S.A.

LO Lisbon's Oceanarium

MO MyOcean

TC Tour Creator

AG Audio Guides

OS Operative System

1

Introduction

Contents

This document presents an evaluation on the benefits and drawbacks of using technology to improve the experience of museum visitors.
This project was developed under the guidance of Card4BSystems, S.A. (C4B), a Portuguese company related to several IT services for smart cities. Within these sectors, C4B has been exploring the benefits of the most recent technology, such as smartphones or tablets, for some time. More recently, they've invested in a specific cultural area: museums and art galleries. Explained in subsection 2.2.2, C4B developed a platform called MyMuseum. This web form allows its user to organize a very complex and complete back office, which can be used for various types of structures, such as, like mentioned before, museums or art galleries.
Due to this connection with art and culture and, in order to have clearer results on this study, Lisbon's Oceanarium (LO) was chosen as the main case study for this experience, due to its relevance within its sector, its dimension, its complexity and also because it does not own any type of mobile application to offer its visitors. In order to perform this social experiment, it was necessary to develop an application for visitors to try out and evaluate their experience. Thus, this document also reports the design, development and implementation phases of an Android application called MyOcean (MO), a project that also belongs to C4B.

1.1 Context

"Smartphones" and "applications" are two very well known terms these days. There were times when a mobile phone was basically used to communicate by written messages or to make a phone call and talk to someone on the other end of the line[5]. Today, a smartphone allows its user to learn, for example, learn history, watch movies and, of course, also communicate by text or voice with other people. Technology leaps every day and now everyone carries a computer in their pockets.
Although smartphones have become an extremely popular computing device, smart wearable devices, such as Google Glass[1] and the Apple Watch[2], are now providing even more effective means to bridge the gap between humans and smart objects[6]. A fun fact is that although for some it may sound recent, the wearable technology concept goes back several centuries. One of the first known wearables was developed in China, in the 17th century, and it was a "smart ring", called "The Abacus Ring"[7]. So the concept is not that new but as technology has evolved it has become more common to see it on the streets.
There are many types of wearable technology these days, from t-shirts to watches[8] and glasses. This project aims to improve a museum visitors' experience by using wearable eyewear technology.
For the past few years, the search for culture has been improving. Along with the attendance and technology evolution, art galleries and museums have been cooperating with IT companies and releasing mobile applications specifically designed for their line of work, in order to accompany technological evolution and engage their visitors with a modern type a visit[9].

[1] https://www.google.com/glass/start/
[2] http://www.apple.com/pt/watch/

The LO opened its doors in 1998 with an exhibition called ”The oceans, a heritage for the future”. With a million visitors per year, the LO aims ”To encourage people to learn more about the oceans and make all citizens aware of their duty to conserve their natural heritage, by changing their behaviour.”[10]. Although there are many offers to explore and get to know this modern aquarium, such as the guided tours[11], where you get to see and know the people that do the work behind the scenes, or the ”Sleeping with the sharks”[12] program, where you can sleep over near the shark tank and wake up near the ocean, there is not yet available a modern application for the visitors to explore on their smartphones or tablets. The relevant information is near the tanks and spread out along the halls on billboards. There are also the audio guides that complement this information. But, in the end, in order to pay attention to the information on the audio guide and/or to the extensive written information near the tanks or billboards, the visitor is, in a way, distracted and loses his focus.
By looking at the available programs, it is possible to conclude that one of LO’s main target are the children or young adults who they can inspire and fascinate by showing presenting them with several different experiences. But are they learning anything? Are they enjoying their visit? Are they being entertained?

1.2 Objective

The objective of this project is to develop a non-intrusive mobile solution for the LO, on a wearable hardware, and then evaluate the public response by gathering opinions on whether it improves the experience or not. The main target of this application will be visitors with ages between 10 and 15 years.

1.3 Solution Proposal

The proposal consists on a social experiment that will measure the improvement of the visiting experience using an Android application, specifically designed for the target museum and users, respectively, the LO and visitors between the age of 10 and 15.
The implementation part of this solution consists on a Client-Server architecture: The Server is a web forms project, developed in asp .NET C# and it communicates with its clients using JSON queries, developed by C4B, called MyMuseum. It allows the user to define every aspect of the museum, from its name to the properties of every item that it holds. The Client is a wearable eyeware called Jet, developed by Recon, with an installed Android application called MO. This hardware has Wi-Fi and Bluetooth available. These features allow the communication to exist between the Server and the iBeacons, Bluetooth devices that are used, in this case, for indoor location.
After the implementation, the experiment part will be dealt by two inquiries that will help to evaluate the success of the proposed solution.

Figure 1.1: Solution Proposal

As seen on Figure 1.1, this solution's application is tested by the visitors of the target museum and then these are invited to answer an inquiry related to the usability of the application and another related to the satisfaction of the visit, regarding the hardware and the experience it granted.

1.4 Document Structure

This document is divided into six chapters. The first and current one, is the Introduction. The second chapter is called State of the Art and it contains the results of the research done on the different areas that relate to this project. Next, there is the Case Study chapter. It begins with a first person experience of a tour at the LO. Then, the research done on the available hardware on the market, based on the necessities defined in the previous point, is presented.
After the introduction and research sections, there is the solution section which begins with a chapter that has that same name. In the Solution chapter, there is a detailed description of the proposed solution, divided by its components. This chapter is followed by the Evaluation and Conclusions chapters where the results are present, evaluated and discussed.

2

State of the Art

Contents

This chapter presents the analysis on the related work researched. As mentioned in the previous chapter, the goal was to develop an application that would have to be non-intrusive, provide information to the visitor and, most importantly, improve the visitor's experience. In order to achieve such a goal, this research was divided into two sections or, more specifically, two different types of solution: The first is the Museum apps, which includes four applications designed for different types of museums. Each possess specific properties such as indoor location, audio guides or that simply exist to be used as information points. The second one is the Platforms, which contain two solutions that consist on a back office for these applications.

2.1 Museum Apps

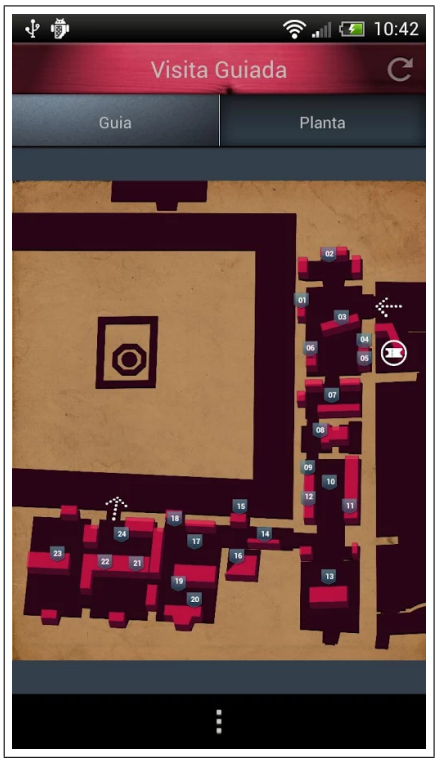
2.1.1 Museu da Marioneta[1]

Figure 2.1: Riddle Section

Available on Android or iOS, for tablet or smartphone, the mobile application of "Museu da Marioneta" can be acquired on Google Play, Apple Store or through a QR Code, located on their website. Designed for this museum, with Samsung's support, this application offers different ways to explore the space and different paths (Figure 2.2(a)), thus guaranteeing an unique visit every time.

In order to reach younger users, this application also offers a game section (Figure 2.1) which presents a riddle to the visitor and requests him to find different items, hidden in the museum. Not only it is entertaining but also fun for a family activity.

Besides the relevant information about the interior of this museum (Figure 2.2(b)), the application also gives important information about its surroundings allowing the user to schedule his day regarding meals, leisure or even other museums.



(a) Guided Tour Map

(b) Guided Tour Information

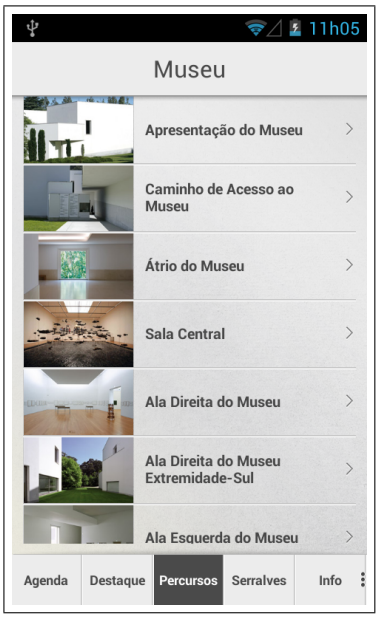
Figure 2.2: Museu da Marioneta's Screenshots

2.1.2 Fundação Serralves[2]

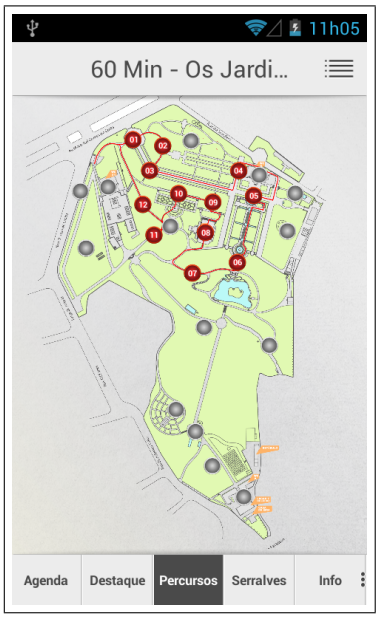
Figure 2.3: Museum History

Available for Android and iOS, the "Fundação Serralves" application allows visitors to explore the world of Serralves in a very easy and intuitive way.

With this application, the visitors can quickly access the activities agenda, which is regularly updated and contains the information of all the programs that occur from expositions to dance and cinema events. they can also choose one of the four possible paths to travel through the "Parque" (Figure 2.4(b)) and learn about each space with help from the images, texts and audio that the application provides (Figure 2.4(a)); Finally, visitors can also search and access the "Coleção da Fundação Serralves" where they can see and get to know the history (Figure 2.3), the patrimony of the institution and learn many details about the artists involved.



(a) Museum's Info



(b) Guided Tour Map

Figure 2.4: Fundação de Serralves' Screenshots

2.1.3 Museu Benfica - Cosme Damião[3]

Figure 2.5: Main Menu

Available on Android and iOS, the "Museu Benfica - Cosme Damião"'s application gives access to the achievements, scores, pictures and videos of every sport that the club participates on (Figure 2.5). Besides general awards, it is possible to explore the personal history and statistics of every athlete, coach or even president that has passed by "Sport Lisboa e Benfica" (Figure 2.6(b)).

(a) Throphies

(b) Players and Coaches

Figure 2.6: Museu Benfica - Cosme Damião's Screenshots

2.1.4 Museu Nacional dos Coches[4]

(a) Main Menu

(b) List of Exhibition Items

Figure 2.7: Museu Nacional dos Coches's Screenshots

Only available for iOS, the "Guia & Jogo do Museu Nacional dos Coches" offers a fun way to explore this museum by using several points of interest, throughout the rooms, and providing the visitors with fun facts, fun animations, tricky questions and storytelling. Although it may look like an application much more focused on younger users, many critics point out that this gamified idea[13] is very compelling and interesting to older users also.

(a) Museum Map

(b) List of Exhibition Items

Figure 2.8: Museu Nacional dos Coches's Screenshots2

2.1.5 Mab Experience

Figure 2.9: Mab Experience's Main Screen

The MAB, Bilotti Open Air Museum (Museo all'Aperto Bilotti) is located along Corso Mazzini's pedestrian area between Piazza Bilotti and Piazza dei Bruzi, in the city of Consenza, Italy. This museum exists thanks to a special donation of an italian collector called Carlo Bilotti, native to Consenza. His art collection was donated after his death in 2006. Every sculpture is positioned over a pedestal made of plexiglas which has a sound system capable of reproducing musical instruments or an actual introduction to the museum itself. The Mab Experience application offers an extra level of information to the MAB visitors that own Google Glass. Being near the sculpture and looking at it, Google Glass uses an image recognition algorithm and, after recognizing the item, it shows the user extra information regarding the art piece and its author.

2.2 Platforms

2.2.1 GuidiGo Studio

”Every place has a story to tell”[14], says the GuidiGo slogan. This project aims to reinvent the visitor experience by allowing others to create stories to follow. GuidiGo Studio is the name of the platform on which the users can create tours and develop games just by adding pictures, basic information and route options.

As Tour Creator (TC), the user begins by naming the tour, describing it, selecting the available languages, its estimated duration, choosing three related topics and by adding additional information, so the users are attracted to it. After this introduction, it is necessary to build the tour and, for that purpose, GuidiGo allows the TC to specify and define each stop, which are the places where the visitor is supposed to pass by and learn the information that the TC has to offer (p. e. Monument’s name, Street’s history). After all the stops are defined, GuidiGo offers the opportunity for the TC to look at a map and overview his tour and, by using simple gestures such as dragging or clicking, he can modify or arrange it. Finally, it is necessary to input some personal information in order to understand what the tour is about and make emotional connection with the people who choose to take it. After publishing your tour, it becomes available for everyone using the GuidiGo application, which is available on Android, iOS and Google Glass platforms.

”It’s like having a personal human guide with you all the time. A unique experience that’s only possible with GuidiGO for Glass.”[15] said David Lerman, the CEO of GuidiGO.

2.2.2 MyMuseum (Universal Museum Guide)

”Your collection with a new dimension”[16] is the goal behind MyMuseum, a solution, developed by C4B, that aims to build a tool for art galleries and museums which will allow them to self-manage their physical space, collections, exhibitions and automatically generate a multimedia guided tour, for mobile platforms, that will grant access and orientation to the visitor, without being too intrusive.

This solution is composed by two modules: a web based back-office and an Android/iOS mobile application. As said before, the main focus is the self management, which can be achieved with the first module, the web based back-office. A web form project, developed on asp .NET C#, using a SQL server for the database and jquery for communication, this back-office has a simple and intuitive design which makes the organizing task quite simple. The idea is to build an hierarchy of objects. The first piece is the museum/art gallery. The user fills in the name and the space specifications of the building. After that, it is time to insert new exhibitions and routes, and defining their specific locations inside the building. Finally, add information about every single object or art piece that each exhibition contains.

Having completed the previous described steps, this solution presents the other module: an Android/iOS mobile application. After importing the information about the specific museum/art gallery, the application grants access to pre-defined routes which act like a private guided tour that complements the visit with audio, video and pictures, if available. Besides the pre-defined routes, the visitor is invited to take the app and explore the museum by himself using the explore tool that allows him to identify or locate a certain object/art piece through and identification number search, image/shape recognition, QR-code reading, iBeacon(Bluetooth Beacon) or NFC(Near Field Communication). The MyMuseum solution also grants an indoor location system, using bluetooth and iBeacons, that makes it possible to identify a close object to the visitor or the location of the visitor himself.

2.3 Overview

In this section, the previous presented applications get compared based on different specifications that allow to understand what is currently being offered to these application's users.

Table 2.1: Operative System and Platform Specifications

Application	Available on (OS)		Platform		
	iOS	Android	Smartphone	Tablet	Wearable
Museu da Marioneta	✓	✓	✓	✓[1]	
Fundação de Serralves	✓	✓	✓	✓	
Museu Benfica - Cosme Damião	✓	✓	✓	✓[1]	
Guia & Jogo do Museu Nacional dos Coches	✓		✓	✓	
MAB Experience		✓			✓

In Table 2.1, Operative System (OS) and Platforms are compared and it can be observed that these applications are almost all available both on Android and iOS and, except the MAB Experience, specially developed for a wearable device, they were all developed for smartphones but only some of them were also developed for tablets. Being developed for smartphone and used on a tablet may result in a deficient experience due to resolution, screen dimension or hardware capability, such as processor performance or memory.
Another known OS is Windows but none of these applications are available for it. Since no application, available for Windows, was found during the research for this project, this OS was not contemplated on this comparison.

Table 2.2: Museum and Exhibition Apps Specifications 2

Application	Games	Concierge	Routes	Museum's Info	Agenda
Museu da Marioneta	✓	✓	✓	✓	✓
Fundação de Serralves			✓	✓	✓
Museu Benfica - Cosme Damião					
Guia & Jogo do Museu Nacional dos Coches	✓		✓		
MAB Experience					

Table 2.3: Museum and Exhibition Apps Specifications 3

Application	Multimedia			Languages	Versions	
	Text	Images	Audio		Online	Offilne
Museu da Marioneta	✓	✓	✓	EN, PT		✓[2]
Fundação de Serralves	✓	✓	✓	EN, PT	✓	
Museu Benfica - Cosme Damião	✓	✓		EN, PT, Gesture		✓[2]
Guia & Jogo do Museu Nacional dos Coches	✓	✓		PT		✓[2]
MAB Experience	✓	✓		EN		✓[2]

The specifications on Tables 2.2 and 2.3 were chosen based on the most complete application which is the Museu da Marioneta's app. As it can be seen, Museu da Marioneta's app offers games, information and has all types of multimedia available. On the other end, Museu Benfica - Cosme Damião is basically an app that replicates their website. Fundação de Serralves's app has important information on their agenda and has several routes that help the user along their visit but it demands a live Internet connection.

After comparing the most direct and higher level specifications, they were installed in their preferable platform and explored. From top to bottom, the Museu da Marioneta's app offered a simple design and a quick menus. Except for audio, the media content is downloaded in the beginning, granting a more fluid usage of the app. The guided tour section is a little slower than the rest of the app and it took some time to load. After loading this section (see Figure 2.2(a)), the user has a button that allows him to take pictures along the visit but, as it can be seen on the picture, the button is hidden. Thus, in order to take a picture, the visitor has to take two or three steps to reach the camera. Next, we had the Fundação de Serralves app. Compared to the Museu da Marioneta's app, this was much slower in the beginning, when it downloaded some content, but also along its usage. Going from one section to another took some time. The menus were well organized and there was an interesting feature called "MySerralves" where the user can see his pictures that were taken, by him, during his visit and has the option to share them online. The experiment continued with Museu Benfica - Cosme Damião's app. This app was easy to navigate, had an interesting image and due to color choice and design, it seemed very connected to the museum itself. The only problem is that it contained almost the same information as the website, bringing nothing new to its user. Another problem is that it took some time to initiate, like the Fundação de Serralves' app but, while the user waits for it to begin, on the bottom of the page there is a percentage that informs the user how much information has already been downloaded. Finally, the last app to be tested was the Guia & Jogo do Museu Nacional de Coches. The first obvious limitation was that this app is only available for iOS. Compared to other apps, it had a quick start. The high point of this app is the game section. Unfortunately, the MAB Experience app was not tested since it was designed to Google's Glass and there was none available.

[1] Only developed for smartphones
[2] The application only needs to download information at the beggining or if a refresh is requested

3

The Case Study

Contents

This chapter includes the main research sections: The first is named Oceanarium and it will present a visitor's perspective, based on the current state of the LO, and also the application requirements, based on the previous defined objectives. The second section is named Hardware and it will present the scope of this research, defined by the results of the first section and also the hardware requirements, based on the previous objectives.

3.1 Oceanarium

3.1.1 Visitor's Experience

This research began with a visit to the LO, in order to understand the visitor's perspective and the needs he might have along the way.
The structure is divided into two types of exhibitions: the temporary, which is an exhibition, arranged by one or more invited artists, that occupies a single room and can contain any kind of art pieces or species; and the permanent, which is the main exhibition and the focus of this project.
To enhance the quality of his visit, the visitor has two additional options: Audio Guides (AG), with a previous recorded guided visit, available in six different languages, that presents the information in a dynamical and appealing way. When entering a new space, there are symbols on the wall, as seen in Figure 3.1, that inform the visitor which audio they should select to listen to the respective sample. These guides contain some interviews and some scientific curiosities that are not available on the posters, present in every room. Besides, this technology allows visitors with moderate visual and hearing disabilities to really understand and enjoy the visit; the guided tours, which give accompanied access to the entire facility. These special "passes" allow the visitors to know how the LO really works, by visiting the backstage rooms and getting to know the many professionals that keep the engine running. These tours also guarantee a guide, which accompanies the visitor along the way, explaining and answering questions.

Figure 3.1: Audio Guide's markings

The visit consists in a single route, divided into two floors. Both floors have access to the five main areas, which are the Temperate Pacific, the Antarctic, the North Atlantic, the Tropical Indian and the Central Aquarium, which is the concept of the permanent exhibition and it represents ”the one ocean”.

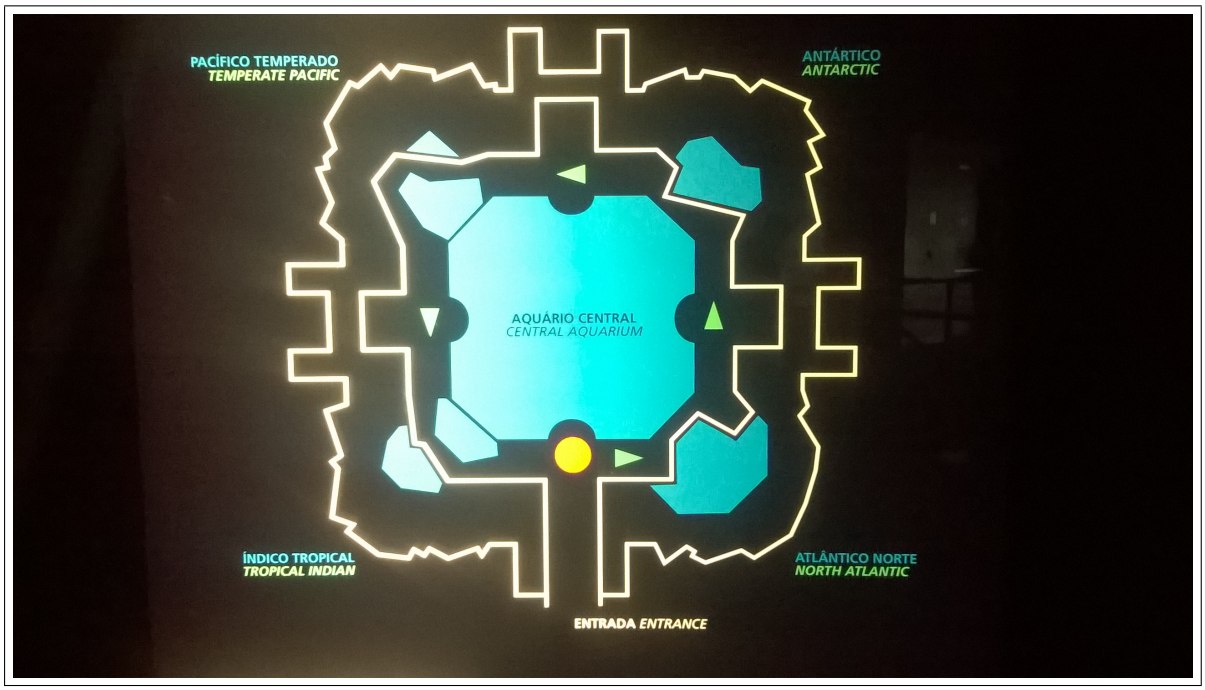


Figure 3.2: Lisbon’s Oceanarium’s Map

After the main section, there are two other small areas: the Amphibians, a section that contains many different species of amphibians and a large amount of information on this type of animals; and the House of Vasco, an environmental friendly house that teaches young visitors what to do and not do regarding the planet’s health, through games and interactive objects.
Considering the simple visit, no AG or personal guide, the first thing the visitor notices is the contrast of light intensity between sections. The halls around the Central Aquarium are very dark and so every information is on an illuminated billboard but, when a new section is reached, the light is the opposite because, not only abut also, natural light is used.
When going from section to section, the visitor does not have a clear message on this transition because the section names are almost hidden due to the pipes and the air conditioning system (see Figure 3.3). Only when he looks for information, which is when he realizes that the posters have a different section names.

Figure 3.3: Section's Name

On every step of the way, security is guaranteed by signs and emergency maps, and also, if needed, there are many benches for people to rest or even stare at the aquariums. Many visitors use these benches to feed their children or to take pictures with the animals.
Unfortunately, for safety and health reasons, visitors are not allowed to take pictures using flash because of the damage it may cause on the animals. Besides the souvenirs, it is complicated to bring a quality "memory" from the aquariums.

3.1.2 Requirements

Based on the tour and the necessities encountered, as visitor, along the way, a list of general requirements was designed and composed by the following points:

- Good quality screen - Due to the variations of lighting along the building it is necessary to guarantee the visitor can read under different lighting
- Indoor location - Although every section began with a sign and its name, sometimes these signs were covered by air conditioning vents or columns. Thus, the visitors need help to understand where a section ends and where a new one begins
- Favorites - Being an exhibition composed by so many aquariums and different species, it would be interesting to allow the visitors to maintain a list of their favorite species. This list may be used later to gather and send the information to an email, as a souvenir
- Games - Like the House of Vasco section, and as seen on other applications, the idea of adding games and riddles along the entire visit can improve the attention and amusement of the younger visitors

3.2 Hardware

3.2.1 Scope

Choosing the right hardware for this solution started as a very simple research on what was available on the market. After finding out that there are many types of wearable eyewear and several different manufacturers, the first step was to reduce the scope and only search for non-intrusive eyewear. This solution aims to combine technology with the classical visit and eyewear such as OculusRift[1] would not allow a typical visit due to the covered sight (see Figure 5.1).

Figure 3.4: Oculus Rift

3.2.2 Requirements

Considering the mentioned scope, in the previous number, and the list of requirements gathered in the previous section, these were the minimum requirements defined for the hardware of this project:

- Battery with minimum lasting capacity of 2 hours - In order to guarantee a single tour, which lasts approximately 1 hour
- Bluetooth 4.0 - Needed to implement an indoor location system that will allow the application to inform the user where he is
- WiFi - Needed to communicate with the back office
- Camera - Needed to read QR Codes

3.2.3 Specificiations

Based on the previous requirements, the several possibilities were narrowed down to a list of four equipments, which are shown below along with some important specifications regarding the solutions objectives:

Glass by Google

- Specifications
  - Price: 1500$
  - Weight: 50g
  - Display: 640x360 pixels
  - Battery: 1 day
  - Operative System: Android 4.4.2

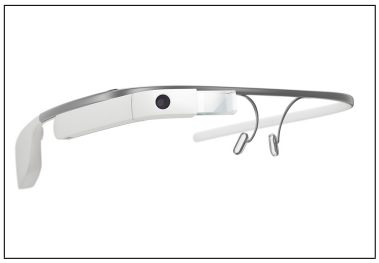


Figure 3.5: Google's Glass

[1] https://www.oculus.com/en-us/

Jet by Recon

- Specifications
  - Price: 700$
  - Weight: 60g
  - Display: 428x240 pixels
  - Battery: 4 to 6 hours
  - Operative System: Recon OS based on Android 4.1

Figure 3.6: Recon's Jet

ORA by Optinvent

- Specifications
  - Price: 950$
  - Weight: 80g
  - Display: 640x480 pixels
  - Battery: 3 hours
  - Operative System: Android 4.4.2

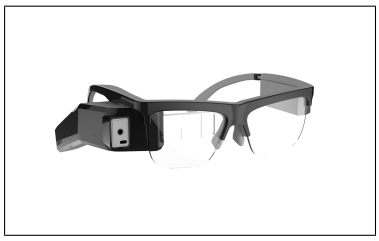


Figure 3.7: Optinvent's ORA

M100 by Vuzix

- Specifications
  - Price: 999$
  - Weight: 80g
  - Display: 428x240 pixels
  - Battery: 1 to 2 hours
  - Operative System: Android 4.0.4

Figure 3.8: Vuzix's M100

3.2.4 Overview

Table 3.1: Hardware Specifications

Hardware	Operative System	Battery(h)	Display(px)	Weight(g)	Price(€)[1]
Glass by Google	Android 4.4.2	24	640x360	50	1330,00
Jet by Recon	Recon OS based on Android 4.1	4 to 6	428x240	60	620,00
ORA by Optinvent	Android 4.4.2	3	640x480	80	840,00
M100 by Vuzix	Android 4.0.4	1 to 2	428x240	80	880,00

Based on the requirements, the first equipment excluded was the M100 by Vuzix. Although M100 is the only equipment that is usable on the left and right eye, which would allow a visitor with a lesion on his right eye to enjoy the experience anyway, its battery capacity is extremely low, compared with the other devices.

Having reduced the list to three equipments, ORA by Optinvent still presents a low battery capacity, even though it is higher than the limit established by the requirements. Besides, considering the visitor must wear the equipment during the entire visit, which lasts from 1 to 2 hours, the weight is an important issue. Adding that to the lowest battery capacity, ORA was the next equipment removed from the list.

Finally, we are left with Jet by Recon and Glass by Google. Both guarantee the minimum requirements, so the choice had to be done considering other factors, starting by the price. Google's Glass costs more than twice the Recon's Jet. Besides the price, there was a critical factor that lead to the final choice. Google stopped selling Glass because of a massive criticism from users that were having problems due to privacy and safety concerns. Even though Google did not stop sending Glass to companies, to test and develop new applications, the choice had been done and the Jet by Recon was selected.

[1] approximate conversion based on http://www.xe.com/ on 21st March

4

Solution

Contents

This chapter is divided into four sections: the Architecture, where the proposed architecture for the solution is presented; the BackOffice, where the previous work done by C4B is presented. Beginning with the website, then explaining the structure of the information and, finally, the communication services and the queries necessary to use them; the Jet, a section dedicated to present the details of the chosen hardware; the Application, where the main work will be presented, following the development steps of requirement analysis, use cases definitions and the design/development phase.

4.1 Architecture

This is the starting point of the project.

Figure 4.1: Architecture Level 1

This project aims to add a middle level in this architecture. A bridge through technology, between the visitor and the museum, that not only will not interfere with the ”normal” visit but which will also add a new entertaining level. This Android application improves the visitor’s experience by giving him space notion, games and a memory slot, to save his favorite information.

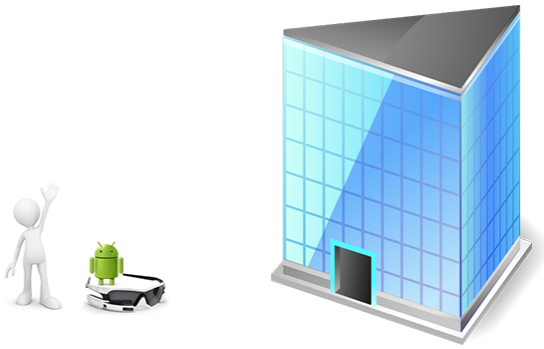


Figure 4.2: Architecture Level 2

In order for the application to gain space notion, it will have to communicate by Bluetooth with Bluetooth beacons, spread out along the area.

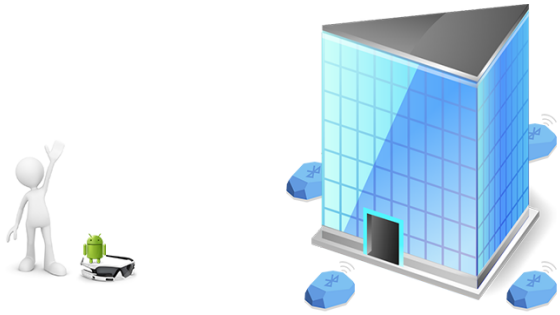
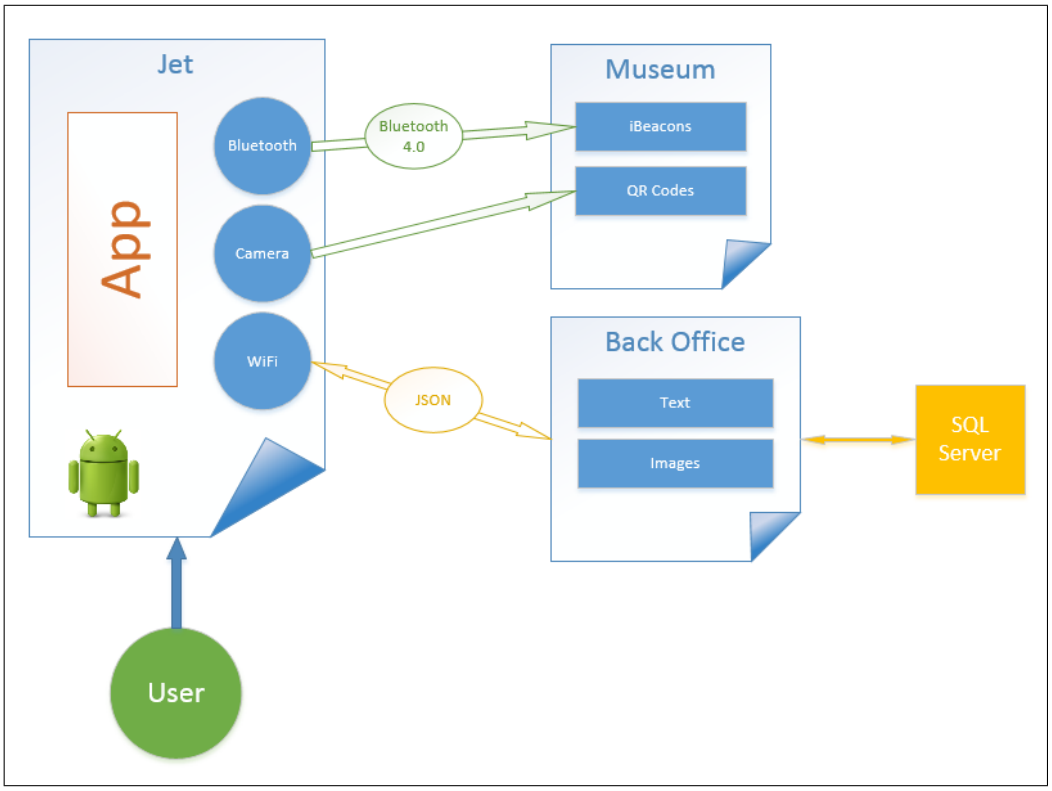


Figure 4.3: Architecture Level 3

And finally, to obtain and save all the information necessary to provide a great experience to the visitor, the application will communicate through Wi-Fi with the back office.

(a)



(b)

Figure 4.4: Architecture Level 4

4.2 Back Office

4.2.1 Website

After the login, the user is confronted with a step by step tutorial on how to configure his museum. The website display is separated into two different areas: the tools (Figure 4.5), a series of drop down menus that allow the user to navigate along the website and all of its sections; the webform (Figure 4.6), where the user will insert all of the information concerning each section. Available in three different languages, the back office offers a simple way to define every single aspect of the museum.

Figure 4.5: Welcome and Tutorial Screen

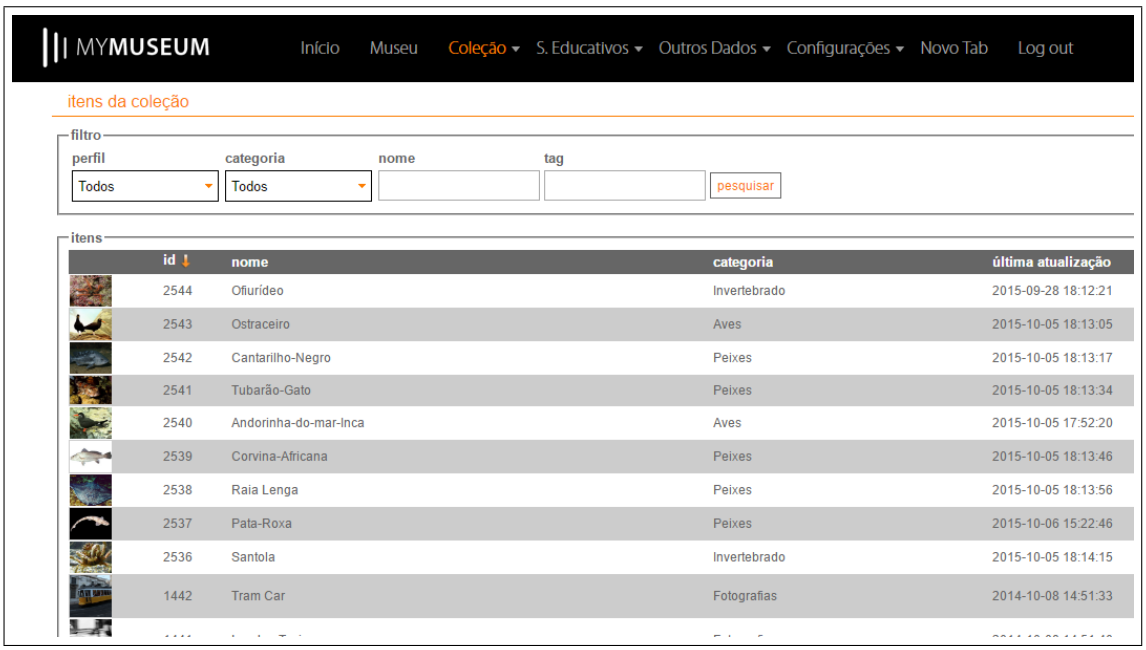


Figure 4.6: Data Editor

4.2.2 Data Structure

The back office acts like a mask, which grants an user-friendly display and simplifies the complex hierarchy behind the data, defined in the SQL Server that works as the database.

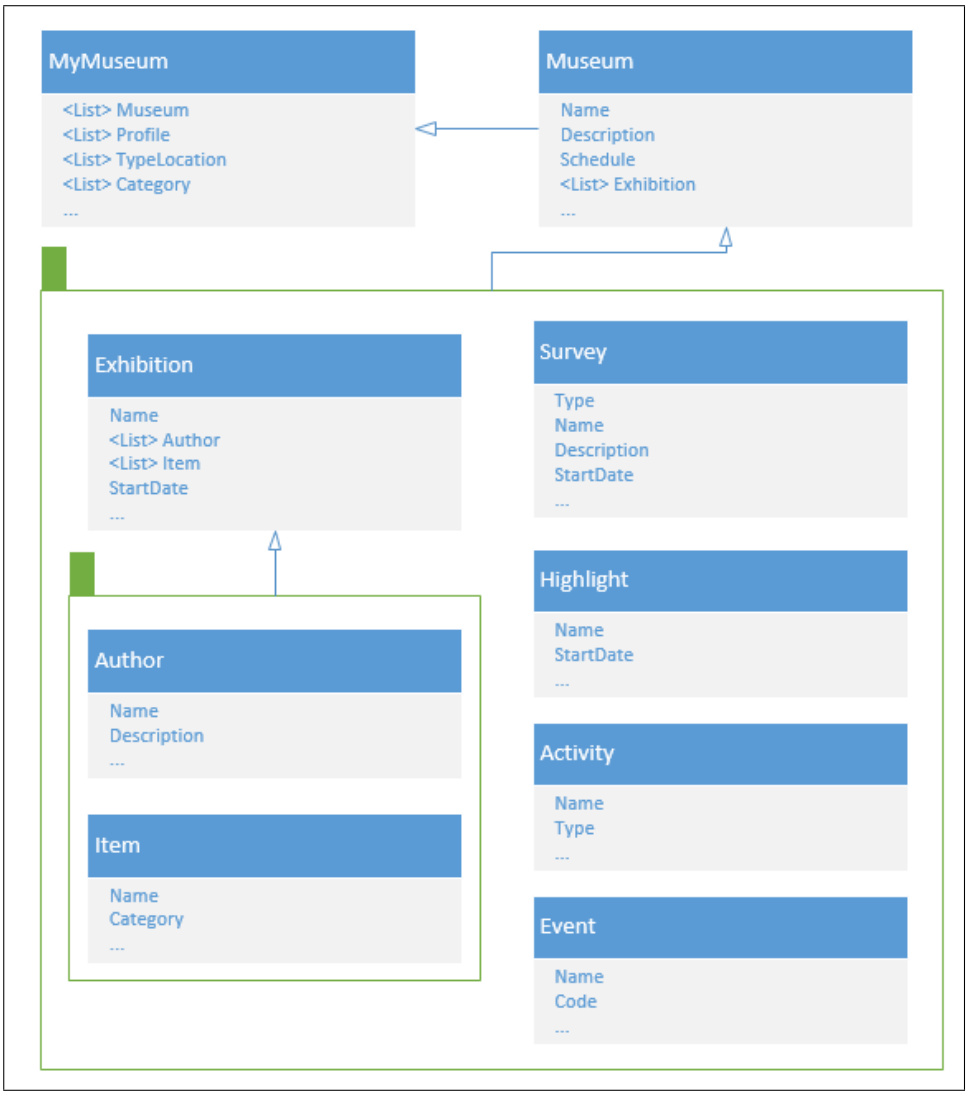


Figure 4.7: MyMuseum's Webform Object Hierarchy

This diagram is only part of the complete structure of the hierarchy behind this webform. As it can seen here, it is very complex but also very detailed, which allows the user to completely define the information available for the visitor.

4.2.3 Communication

It was previously mentioned that the communication between server and client was done using JSON, which consists on a text format that compiles information, on a specific structure, that both client and server can interpret. The previous diagram presents many different types of detail but, in this solution, only a few of them are used. Next, examples of successful communication between

client-server are presented, regarding the museum details that are used in this solution: The request that collects every information regarding a specific museum; a request that returns the details of an exhibition; and finally a request that presents the detailed information about a specific item.

- Museum
  - **Request**
    http://mymuseum-staging.beware.pt/handlers/JsonProtocolHandler.ashx?Request=[museum=true;customerId=CCED08E1-D369-4026-B475-4EA771CA5251;applicationId=57]
  - **Response**
    {”museum”: {”id”: 1,”lastUpdated”: ”2014-12-31 10:30:59”,”physicalLastUpdated”: ”2014-12-31 10:30:59”, ”nameCode”: ”Museu XPTO”,”descriptionCode”: ”Descrição Base do Museu”,”timetableCode”: ”De segunda a sexta - 10h às 22h”,
    (...)
- Exhibitions
  - **Request**
    http://mymuseum-staging.beware.pt/handlers/JsonProtocolHandler.ashx?Request=[item=true;exhibitionid=282;listitens=2544;customerid=CCED08E1-D369-4026-B475-4EA771CA5251;]
  - **Response**
    {”exhibitions”: [{”id”: 282,”nameCode”: ”name_1”,”startDate”: ”2014-01-31” ,”endDate”: ”2014-06-31”,”lastUpdate”: ”2014-12-31 10:37:30”,”exhibitionType”: ”permanente / temporária / whatever”,”virtualLocations”: [{”id”: 1,”profiles”:
    (...)
- Items
  - **Request**
    http://mymuseum-staging.beware.pt/handlers/JsonProtocolHandler.ashx?Request=[item=true;listitens=760;customerid=CCED08E1-D369-4026-B475-4EA771CA5251;]
  - **Response**
    {”items”: [{”id”: 760,”lastUpdate”: ”2014-12-31 10:37:30”,”information” :{”general”: {”nameCode”: ”Aquario”,”descriptionCode”: ”Descrição do item para o perfil Geral”,”legendCode”: ”Legenda”,”contents”: [
    (...)
- Other services available
  There are several other services that the back office provides such as Routes, which are used to define specific physical or virtual paths for the visitors to follow, or the Events, which consists on a challenge, defined by the user, to occur on a specific place or time, during the visit, but due to the environment of this solution, these services were not used but remain available for future versions.

4.3 Jet

Recon's Jet, similar to other Recon's projects, was developed with a specific user target: a sports practitioner, since that was the main market of the company. On the other hand, being part of Intel, one the largest IT companies in the world, the equipment is prepared and available for other purposes, such as, in this case, a tool to improve the visitor's experience inside a museum.

4.3.1 Controls

The chosen hardware for this solution has two types of controllers available:

- the optical touchpad, or directional pad (also known as D-Pad), which can register directional swipes: forward, backward, up and down

Figure 4.8: Jet D-Pad

- the two button rocker, one assumed as the select button and the other as the back button

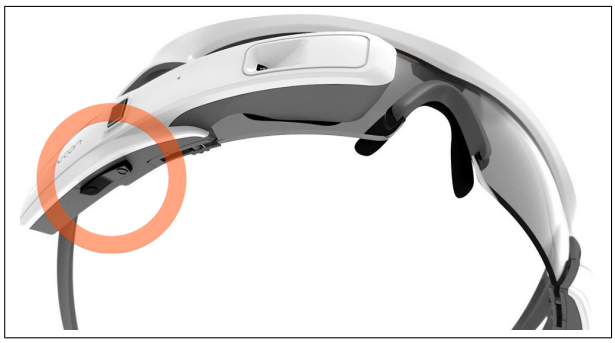
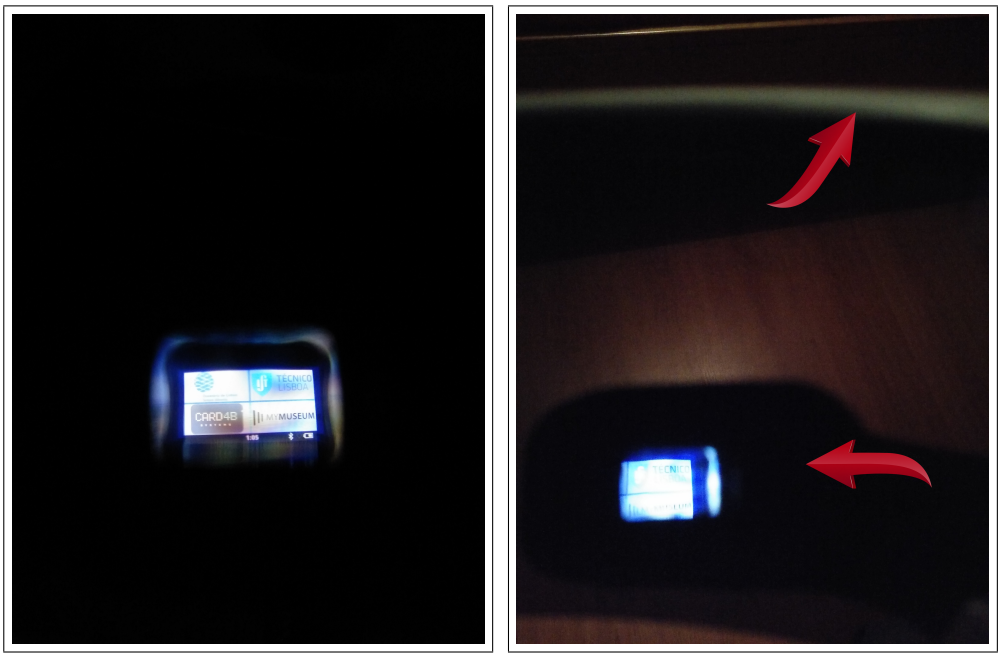


Figure 4.9: Jet Buttons

Adding the four directional swipes and the two buttons, the Recon's Jet has six available controllers. Horizontal (backward and forward) swipes are the easiest to execute. Button presses rank second in ease of use, and vertical swipes rank third.

4.3.2 Screen

The description given by Recon is that the Jet's "display looks equivalent to a 30' screen viewed from 2m away". Although both pictures lack quality, they give an idea of what it looks like looking at the Jet's screen.



(a) Jet's Screen **(b)** Approximation of the user's point of view

Figure 4.10: Jet's Screen

These pictures were taken in an adapted environment to simulate the low light present in some areas of LO. As seen on Figure 4.10(a), the Jet's screen has a strong light and this can be helpful for users but, if exposed for a long duration, it may be harmful to the user's sight. On Figure 4.10(b), there are two arrows pointing at two parts of Jet that are always present when wearing them. The bottom arrow is aiming to the frame surrounding the screen. Since this hardware is supposed to be non-intrusive, the user must have visibility all the time. Thus, the structure that holds the screen is always visible from this point of view. The other arrow is pointing at a grey line which are lenses of the glasses. These are not optional because the part that is supported by the user's nose is attached to the lens but there are different types of lenses. Being an hardware designed for sports, it must be prepared for different types of environment. Thus, Jet has, for now, three types of lenses for sale and one them is completely transparent, allowing the user to see without any type of shading.

4.4 Application

In this section there are two major groups: the Requirement Analysis and Use Cases, which represent the objectives and necessities gathered along the research phase and also help to define a course for the next phase. As seen later on this document, these Use Cases were also used in the experiment with the users and were directly related to the tasks that they were invited to complete; the Design and Development, is where all the steps to create the tool that was used to execute this experiment are presented and explained.

4.4.1 Requirement Analysis

- Non-intrusive - The visitor should not spend more than a few interactions with the application
- Bluetooth - The application must be able to be triggered by Bluetooth beacons. These will allow the application to locate the hardware indoors
- QR Code - The application must have a QR Code reader in order to the visitor to read the codes that contain the information about each animal or section
- Favorites - The application must have a favorites' section where the visitor can save his its favorites along the visit
- Games - The application must provide games along the visit in order to entertain the visitors

4.4.2 Use Cases

- ”I want to start my visit”
  Description: The user opens the application for the first time and gets the start screen
  Pre-Conditions: The user has downloaded the app successfully onto the device and the application is launched successfully
  Steps:
  1. The user launches the application
  2. The visitor touches the pad or presses one of the buttons
  3. The app does not show a message and advances to the next screen
  4. The app shows a message and remains on the start screen
  5. The app waits for step 2
- ”I want to learn the controls”
  Description: The visitor uses this tutorial to learn the controls for the app
  Pre-conditions: The app successfully completed its tasks and the visitor pressed one of the buttons or touched the pad
  Steps:
  1. The visitor touched the pad / presses button 1 / presses button 2
  2. The app checks the tutorial's swipe control / button 1 control / button 2 control
  3. The app advances to the next screen
- ”I want to choose a language”
  Description: The visitor uses this screen to define the language of the application during the visit
  Pre-conditions: The visitor has successfully completed the tutorial
  Steps:

1. The visitor touches the pad / The visitor presses the select button
2. The visitor presses the select button
3. The app advances to the next screen

- ”I want to read a QR Code”
  Description: The visitor finds a QR Code and decides to read it
  Pre-conditions: The visitor enters a new area, the app encounters an iBeacon, which represents a new area
  Steps:

  1. The app enters the Area Screen
  2. The visitor presses the back button
  3. The app turns QR Code reader on
  4. The visitor aims at the QR Code
  5. The app reads the QR Code successfully
  6. The app advances to the next screen
  7. The app does not read the QR Code successfully
  8. The app shows a message
  9. Back to step 1

- ”I want to add this to my Favorites”
  Description: The visitor wants to save a specie’s page to his favorites
  Pre-conditions: The visitor successfully read a (normal) QR Code
  Steps:

  1. The visitor presses the back button
  2. The app changes the color of the star icon

- ”I want to play a game”
  Description: The visitor wants to play a game
  Pre-conditions: The visitor successfully read a (game) QR Code
  Steps:

  1. The visitor answers the challenge
  2. The app gives feedback to the visitor
  3. The visitor was correct - the app advances to the next screen
  4. The visitor was incorrect - the app gives negative feedback
  5. Back to step 1

4.4.3 Design and Development

- Method

  Based on the visitor experience, mentioned before, both phases were done based on a progressive method. This helped the design and development process to become more precise regarding the needs of each screen.

Figure 4.11: Course of the tour

  In order for this method to succeed, the application's code had to be structured in a specific way that would allow changes along the process without damaging the work already developed.

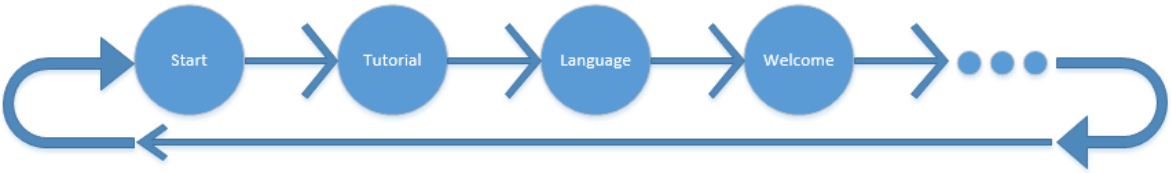


Figure 4.12: Course of the development method

- Process

  Since the app was to be used continuously by several visitors for a complete day, there is not really a starting point but a common point between the end and the beginning of a new visit. Thus, this was the point to consider to start the design/development phase.

  – Start Screen

    After his tour, the visitor hands the hardware to the museum to be used on the next tour but the app has the preferences of the previous visitor and so it needs a reset. Since this process can take a few moments, the first screen to be designed was the start screen. This screen had two purposes: first, to keep the visitor entertained while the app was resetting and second, present the entities that participated on this project.

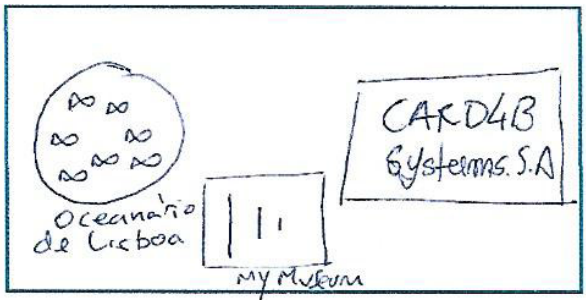


Figure 4.13: Start Screen's design phase

Figure 4.14: Start Screen's final phase

– Tutorial Screen

Being an unknown hardware for most visitors, after the information is returned from the server and the controls are unlocked, the visitor is likely to interact with it. Thus, any interaction will make the application advance to this next screen. The tutorial screen allows to get to know the controls and when and how to use them. First, there is a picture with the location and respective icons of each controller and then, a simple task to complete by the visitor that allows him to test his newly obtained knowledge on the controllers and their icons.

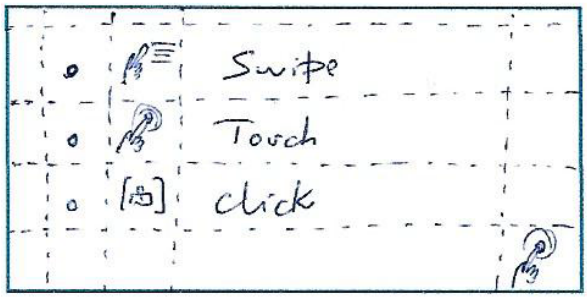


Figure 4.15: Tutorial Screen's design phase

Figure 4.16: Tutorial Screen's final phase

– Language Screen

A museum needs to be accessible to every visitor and so the necessity to be a multilingual application appeared right from the start. Thus, after the visitor gets to know the available controls, the application requests him to choose his preferred language. The tutorial screen had to be in English, not only to be understandable by almost every audience but also because the terms used on it belong to the smartphone language, already established around the world.

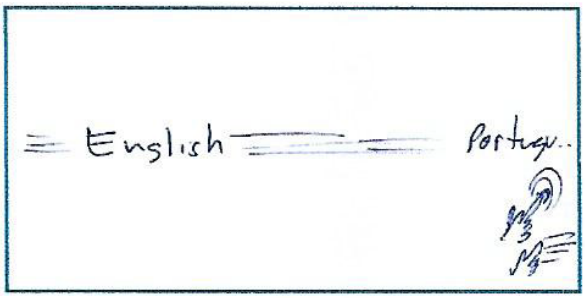


Figure 4.17: Language Screen's design phase

Figure 4.18: Language Screen's final phase

– Welcome Screen

Having explained the controllers and selected language, the last step is to explain the concept of the visit to the visitor. Although it aims to be non-intrusive, the application has some specifications that need to be explained in order for the visitor to enjoy and explore all there is to it. To accomplish that objective, the application presents the welcome screen. With just a couple of words and images, the visitor gains the necessary knowledge to

complete the visit using the given tools. The first difference between this screen and the previous ones is that it will not go into another screen unless the visitor steps into another area. In a way, this screen represents the beginning of the tour.

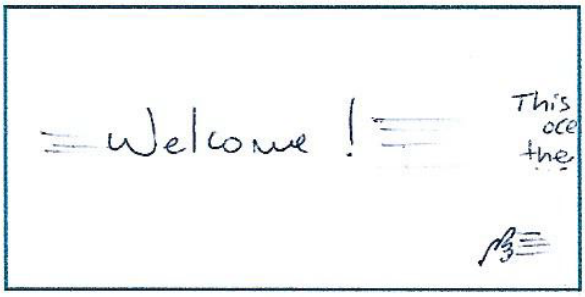


Figure 4.19: Welcome Screen's design phase

Figure 4.20: Welcome Screen's final phase

– Area Screen

When entering a new area, the application, triggered by a Bluetooth beacon, presents the area screen. A custom screen that adapts itself according to current area where the trigger was fired. First, the visitor will be presented with information about the oceans the area includes, from temperature to location. After that, has it was informed in the previous screen, the visitor is invited to find and use the application to read the QR Codes around the area. There are two types of QR Code along the visit: the regular and the game QR Code. Although they look the same, the result of their reading leads to different screens.

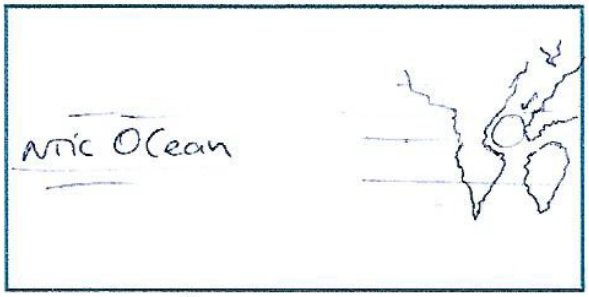


Figure 4.21: Area Screen's design phase

Figure 4.22: Area Screen's final phase

– Regular QR Code Screen

This screen will be presented to the visitor once he reads a Regular QR Code. Here the visitor can learn about a specific animal or specie. The application presents information on the origin, the species' family, where and how it lives, what it eats and any other relevant data the user inserts on the back office in order to share with the visitors. This screen also allows the visitor to save the information in a favorites section. This data may be sent to his email, by the end of the tour, along with other information that the application does not show right away due to the reduced space available on screen.

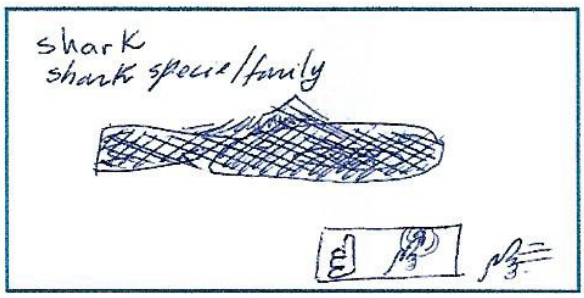


Figure 4.23: Regular QR Code Screen's design phase

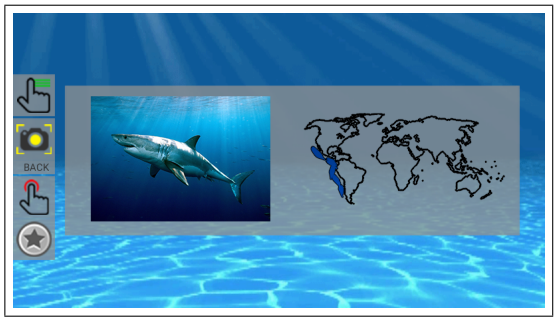


Figure 4.24: Regular QR Code Screen's final phase

– Game QR Code

If the visitor reads a Game QR Code, these are the three different possibilities that can be presented by the application, chosen by the user. The first game is the "Belongs", where a picture is shown to the visitor and he has to decide whether that animal belongs to that area or if it does not. Then there is the "Finder" game, where the visitor is invited to search and find the golden QR Code within the given time. The last game available is called "Counter" and, as the name suggests, it asks the visitor how many animals does he see, similar to the one shown on the screen. All of these games intend to grab the visitor's attention and improve their experience by challenging them and also provoke their competitive side.

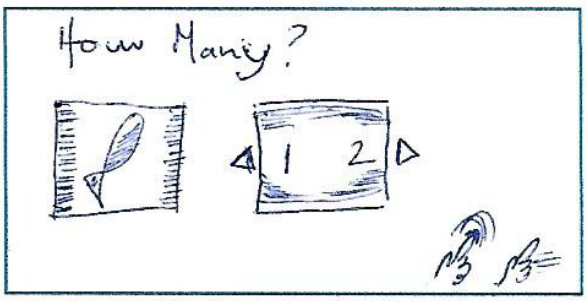


Figure 4.25: Game QR Code Screen's design phase

Figure 4.26: Game QR Code Screen's final phase

– End Screen

Triggered by the last Bluetooth beacon, the application presents the visitor with end screen. Like many other service providers, the application shows the visitor a thank you message for their choice and hoping its service improved their experience.

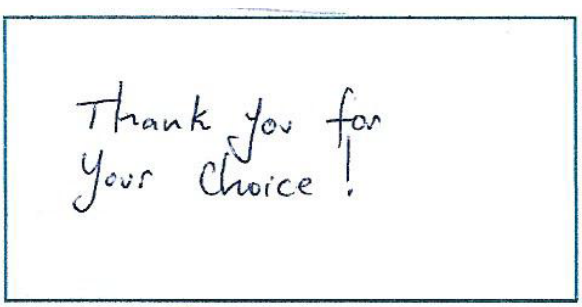


Figure 4.27: End Screen's design phase

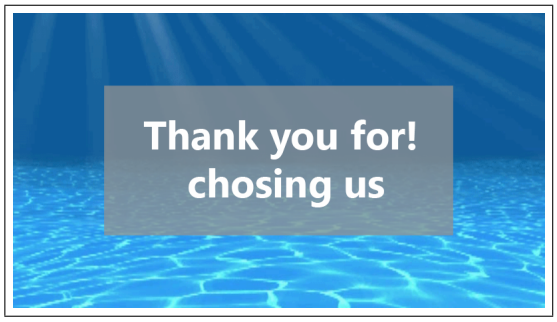


Figure 4.28: End Screen's final phase

5

Evaluation

Contents

This chapter is divided into four sections: the Testers, where it is presented the group of testers chosen for this project; the Application, where it is explained how and why it was necessary to simulate the environment instead of developing the tests on field, and also how the users reacted to the usability tests; the Jet's Impact, where it is shown how the users were challenged and inquired about the comfort, likeability and influence on the visit of the Jet; finally, the Results section presents the numbers and answers of the users concerning the two previous sections.

5.1 Testers

As it will be shown in the next number, due to calendar availability, it was not possible to develop the test phase on the field. Thus, the environment was simulated within several rooms. Having a simulated environment, lead to a different group of testers that were first thought for the experiment. This project aimed to develop an application and experiment it with a group of users with ages between 10 and 15 years. Due to the possible conditions, the group was also adapted. The group of 10 testers was divided in these subgroups:

- 2 young adults, both 23 years old, with knowledge on technology and information systems
- 2 adults, 54 and 56 years old, with small knowledge on technology and information systems
- 6 teenagers, all around 13 and 14 years old, with some knowledge on technology and information systems

5.2 Application

As said before, it was not possible to test the application where it was first thought. So, to simulate the environment, the test phase occurred in two different places: at C4B's office and at the house of the student who participated in this project. As seen in the previous number, the group of testers was divided in three subgroups and it was the first group, the young adults, who completed the test phase first, at C4B's office. Then, at the other location, the teenagers and the adults also completed the test phase.

Figure 5.1: Information points (solution)

In the next pictures, the test environment is presented, showing pictures of LO and the simulated space. As it can be seen, there is a large contrast with light and darkness between the rooms at the LO, so this was also simulated, by closing doors and curtains.

Figure 5.2: Information points

Figure 5.3: Sector's Name

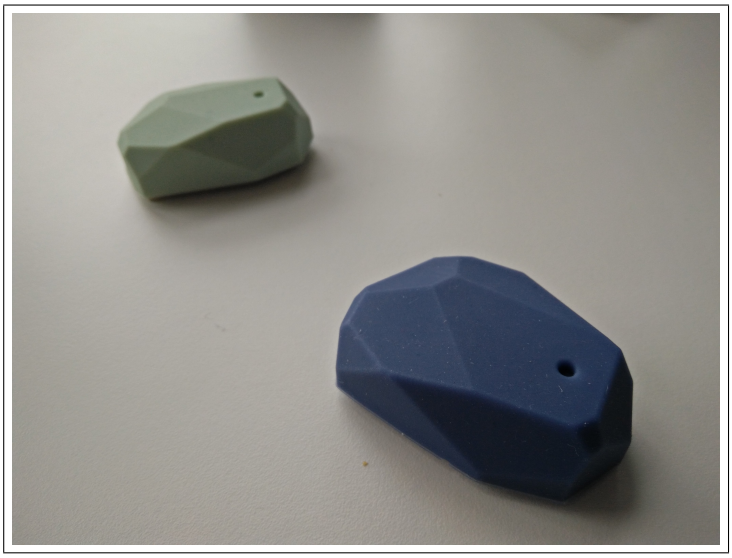


Figure 5.4: iBeacons to help localization

Figure 5.5: Sector's Name (simulated)

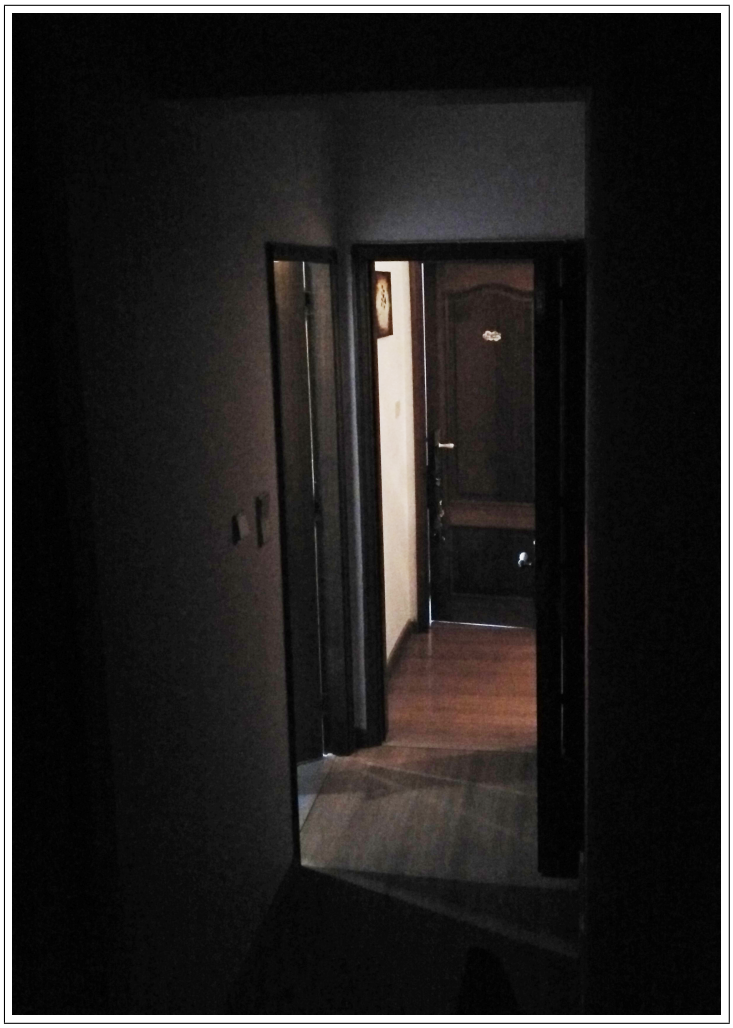


Figure 5.6: Different Rooms (simulated)

In order for the application's success to be evaluated, the testers were invited to complete the use cases, mentioned in Section 4.4.2, and were told that their actions would be recorded and graded, considering the usability table shown below, designed specifically for these use cases.

Table 5.1: Usability Test Values

# Use Case	Number of Interactions				Max Time (seconds)
	Worst	Best	Expected	Max Moves	
1	3	1	2	6	6
2	5	3	4	10	10
3	4/5	1/2	2/3	9	6
4	3	1	2	6	10
5	3	1	2	6	6
6	3/4	1/2	2/3	7	15

This test phase was divided into two parts:

- 3 minute introduction about the test
- 6 use case tests

Each use case test consisted in:

- 1 minute briefing
- {max time of use case} user test
- 1 minute hardware preparation for the next test

After completing every use case test, the user advanced to the second phase of the tests, the evaluation of the Jet's influence on the visit.

5.3 Jet's Impact

This test phase was developed within the simulated environment but also on the street, in order to understand how others would react and how the user would feel knowing he was being observed.
Since the tester had already completed the previous phase, there was already a notion on how to control the device but since the previous phase consisted in a set of separate tests, the tester did not had the time to understand how it felt to wear the device for a longer period of time. Thus, this phase consisted in a 20 minute usage of the device, where the tester was invited to explore the app, the space and to pay attention to details like the weight of the device, the eye dryness and other factors that usually an individual does not pay attention to.

5.4 Results

This section presents the results of the ten testers who tested the application in the simulated environment. As mentioned in the two previous numbers, the test was divided in two phases. First, the results on the usability test are presented in Table 5.2.

Table 5.2: Tester's results on the usability test

# Tester	# Use Case					
	1	2	3	4	5	6
1	1	4	2	2	3	2
2	2	4	4	1	2	1
3	1	4	2	2	2	2
4	1	3	6	2	2	2
5	2	4	3	2	1	2
6	1	4	2	2	2	2
7	3	3	3	2	2	2
8	1	4	2	1	2	3
9	2	3	3	2	3	3
10	1	3	2	2	2	2

When compared to the values on Table 5.1, the results are very positive. In the first use case, only one tester obtained "Worst" and on the second use case, none did. On the third use case, where the tester is asked to choose a language, two testers got "Worst" classification. On the forth use case, once again, all testers managed to complete the task within the "Expected" result. Then, on the fifth use case, two testers also had some difficulties and failed the test, getting the "Worst" classification. Finally, on the sixth use case, regarding that each tester had already gained some contact with the application, each improved their result and obtained the "Expected" or "Best" classification.
After presenting the general results, it is almost impossible do decipher which results belong to which group. Nonetheless, in order to achieve other conclusions, in the next table, the testers are presented with the group they belonged to, which were the young adults (assigned with the letter 'Y'), the adults (assigned with the letter 'A') and the teenagers (assigned with the letter 'T').

Table 5.3: Tester's results on the usability test with age group identifications

# Tester	# Use Case					
	1	2	3	4	5	6
1 (Y)	1	4	2	2	3	2
2 (Y)	2	4	4	1	2	1
3 (A)	1	4	2	2	2	2
4 (T)	1	3	6	2	2	2
5 (T)	2	4	3	2	1	2
6 (T)	1	4	2	2	2	2
7 (T)	3	3	3	2	2	2
8 (T)	1	4	2	1	2	3
9 (A)	2	3	3	2	3	3
10 (T)	1	3	2	2	2	2

Having terminated the first phase of this evaluation, the testers were then invited to use the application for 20 minutes, within the simulated environment and also on the streets, as mentioned in the previous number, and then finish the test by answering an inquiry about their experience.
The complete results are shown in Appendix C but, in this section, only three answers were chosen to be shown due to their relevance regarding ergonomics and the application's influence on the visit.

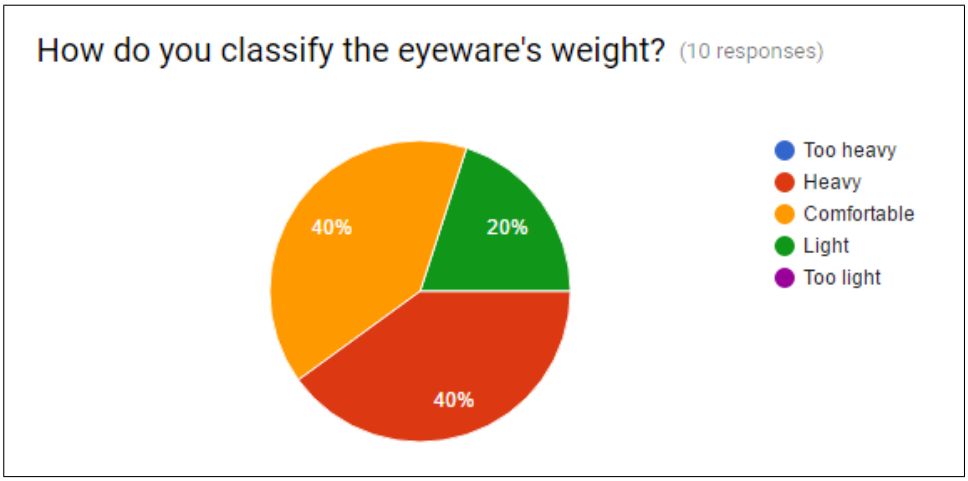


Figure 5.7: Question 1's Results

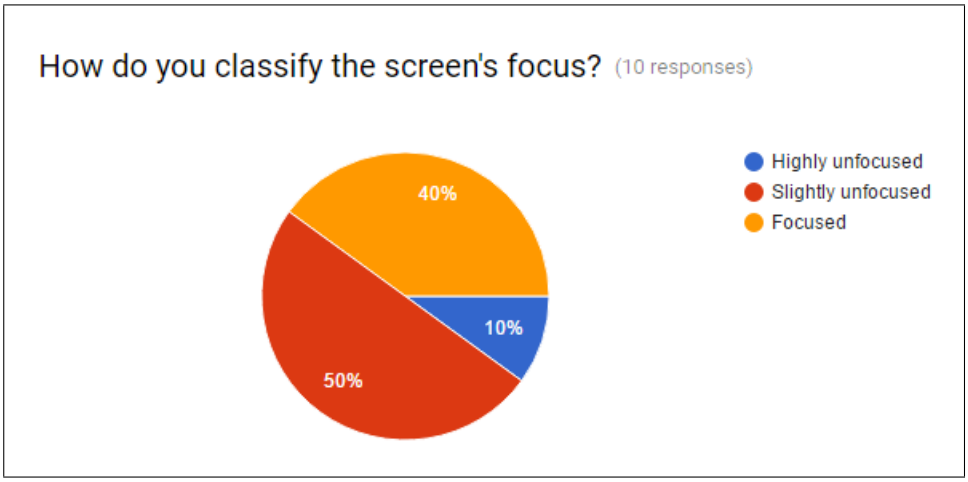


Figure 5.8: Question 2's Results

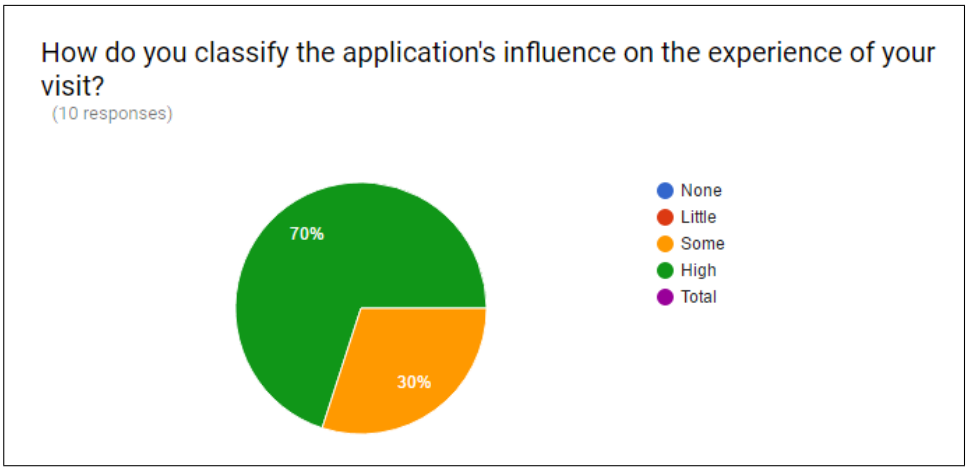


Figure 5.9: Question 3's Results

6

Conclusions

Contents

This chapter is divided into three sections: the first is the Overall, where the main conclusions are presented; the second is the ”What I’ve Learned” section where the knowledge gained along the project is shown; finally, the third section is the Future Work where the ideas that appeared during the different phases of this project and that could not be taken into action are presented.

6.1 Overall

The first and main conclusion of this project is that there is still space for development and improvements in this area. Although the results show a positive reaction to the application, the opinion on the chosen hardware for this solution is not very positive and considering the different options available, the results may have not been so different. Considering the current developments on this type of technology, we concluded that it is unwise to use them until the concept is improved or . One of the problems found on the Jet was the nonexistence of the single touch event that smartphones users are used to. It was challenging to choose another method to simulate the touch interaction, by the user, that was identically intuitive. Also, the two buttons were quite challenging for the users because they had to use the entire hand to hold the device and press the buttons using the thumb. Another problem was its weight. Considering the other hardware to which it was compared, the Jet was one of the lightest and was, even so, considered heavy and that it brought some discomfort the tester. Knowing a visit lasts around an hour and the testers only wore them for about 25 minutes, with some interval between, this can be a problem that leads to failure.
Considering that the tests were not developed inside the expected environment, they could have been different. In addition, a larger number of testers could have improved the weight of the result. Nonetheless, this reduced but varied group of testers shown that the solution was accessible to any age or knowledge on technology and information systems. The main focus was to offer the same information but in a more attractive way. Not only was this achieved, but it was also considered, in a general way, easy to use. It was also an objective to improve the visitor’s experience but without intruding too much. This was achieved by requesting the least interactions possible and by adding games along the way, so the visitor would not get too attached to the controls, using them only when requested, or to complete the games.
The use of the Bluetooth beacons had a very positive result and that addition to the visit was noticed by the testers for their location was known, every step of the way, and even if the simulated signs appeared covered, the beacons helped the visitor to know his location. Also, the fluidity of the application was noticed and successfully achieved, confirmed by the good results and opinions of the testers.

6.2 Future Work

The first idea appeared during the research phase and that is there were not found any wearable eyewear hardware compatible with iOS. Although many iOS products related to smartphones and wearables such as smartwatches, iOS as yet revealed any work on eyewear. Thus, it would be inter-

esting to explore this possibility.

Regarding the application, it would be very interesting to identify a specie just by looking at an animal, in this case. Even if the hardware is not capable of supporting an image recognition algorithm, perhaps it is possible to take a picture, send it to a server and do the recon service up there. This process could transform, even more, the idea of tourism we have today. Instead of reading a billboard, instead of reading a QR Code, the visitor would just have to get close enough to an item, an animal, a painting or even a building, look at it and then system would try to recognize it and inform the visitor what he was looking at.

In this project, audio was left aside but it would be interesting to incorporate audio into the application as well. Adding an audio level to the application could also bring another types of games, experiments and experiences. In order to do that, the hardware must be capable of directing the sound to a single user instead of spreading its sound through a small speaker.

Another interesting point that could be explored is an emergency button for this type of hardware. When applied to a small scale museum or art gallery it does not sound very important, but if we imagine a large and dark museum, like this project's case study, it is not that hard for a child to get lost. Having an emergency button installed, in certain situations, it could help the child inform the museum she is lost. In addition, a service that, with help from iBeacons or another type of indoor location, could inform the parent where the child is, or more precisely, where the hardware is. Thus, the parent would only need to take a look at his smartphone and, in a second, see where his child was at that moment.

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A

Inquiry about ergonomics and application - EN

MyOcean - Inquiry EN

Ergonomics

1. **How do you classify the eyeware's weight?**
   Mark only one oval.

   - Too heavy
   - Heavy
   - Comfortable
   - Light
   - Too light

2. **How do you classify the eyeware's balance?**
   Mark only one oval.

   - Leaned to the left
   - Balanced
   - Leaned to the right

3. **How do you qualify the screen's location?**
   Mark only one oval.

   - Too far
   - Far
   - Adequate
   - Near
   - Too near

4. **How do you classify the screen's focus?**
   Mark only one oval.

   - Highly unfocused
   - Slightly unfocused
   - Focused

5. **How do you classify the screen's quality?**
Mark only one oval.

- Very weak
- Weak
- Acceptable
- Good
- Very good

Application

6. **Did you noticed the commands getting blocked between the first and second screen?**
Mark only one oval.

- Yes
- No

7. **How adequate to the application do you consider the tutorial to be?**
Mark only one oval.

- Not adequate
- Slightly adequate
- Adequate

8. **How do you classify the tutorial's complexity?**
Mark only one oval.

- Highly complex
- Complex
- Adequate
- Easy
- Too easy

9. **How do you classify the available information on each ocean?**
Mark only one oval.

- Insufficient
- Adequate
- Excessive

10. **How do you consider the QR Code's reading?**
Mark only one oval.

- Very hard
- Hard
- Moderate
- Easy
- Very easy

11. **How do you classify the available information on each specie?**
Mark only one oval.

- Insufficient
- Adequate
- Excessive

12. **How do you classify the "Belongs" game difficulty?**
Mark only one oval.

- Very hard
- Hard
- Moderate
- Easy
- Very easy

13. **How much fun do you consider the "Belongs" game?**
Mark only one oval.

- Very little
- Little
- Moderate
- Very much

14. **How do you classify the "Finder" game difficulty?**
Mark only one oval.

- Very hard
- Hard
- Moderate
- Easy
- Very easy

15. **How much fun do you consider the "Finder" game?**
Mark only one oval.

- Very little
- Little
- Moderate
- Very much

16. **How do you classify the "Counter" game difficulty?**
Mark only one oval.

- Very hard
- Hard
- Moderate
- Easy
- Very easy

17. **How much fun do you consider the "Counter" game?**
Mark only one oval.

- Very little
- Little
- Moderate
- Very much

18. **How do you classify the application's influence on the experience of your visit?**
Mark only one oval.

- None
- Little
- Some
- High
- Total

19. **If you came back to Oceanarium, would you ask for the application again?**
Mark only one oval.

- No
- Yes

B

Inquiry about ergonomics and application - PT

MyOcean - Inquérito PT

Ergonomia

1. **Como qualifica o peso dos óculos?**
   Mark only one oval.

   - Excessivamente pesado
   - Pesado
   - Confortável
   - Leve
   - Muito leve

2. **Como qualifica o equilíbrio dos óculos?**
   Mark only one oval.

   - Inclinado para o lado esquerdo
   - Equilibrado
   - Inclinado para o lado direito

3. **Como qualifica a localização do ecrã?**
   Mark only one oval.

   - Demasiado longe
   - Longe
   - Adequada
   - Perto
   - Demasiado perto

4. **Como qualifica a focagem do ecrã?**
   Mark only one oval.

   - Muito Desfocado
   - Ligeiramente desfocado
   - Focado

5. **Como qualifica a qualidade de imagem do ecrã?**
Mark only one oval.

- Muito fraca
- Fraca
- Aceitável
- Boa
- Muito boa

Aplicação

6. **Notou que os comandos ficaram bloqueados entre o ecrã de patrocinadores e o ecrã de tutorial?**
Mark only one oval.

- Sim
- Não

7. **Quão adequado à aplicação considera o tutorial?**
Mark only one oval.

- Nada adequado
- Pouco adequado
- Adequado

8. **Como classifica a complexidade do tutorial?**
Mark only one oval.

- Muito complexo
- Complexo
- Adequado
- Fácil
- Demasiado fácil

9. **Como considera a quantidade de informação disponível sobre cada oceano?**
Mark only one oval.

- Insuficiente
- Adequada
- Excessiva

10. **Como considera a leitura dos Códigos QR?**
Mark only one oval.

- Muito difícil
- Difícil
- Acessível
- Fácil
- Muito fácil

11. **Como considera a quantidade de informação disponível sobre cada espécie?**
Mark only one oval.

- Insuficiente
- Adequada
- Excessiva

12. **Como categoriza a dificuldade do jogo "Belongs"?**
Mark only one oval.

- Muito difícil
- Difícil
- Acessível
- Fácil
- Muito fácil

13. **Quão divertido considera o jogo "Belongs"?**
Mark only one oval.

- Muito pouco
- Pouco
- Aceitável
- Muito

14. **Como categoriza a dificuldade do jogo "Finder"?**
Mark only one oval.

- Muito difícil
- Difícil
- Acessível
- Fácil
- Muito fácil

15. **Quão divertido considera o jogo "Finder"?**
Mark only one oval.

- Muito pouco
- Pouco
- Aceitável
- Muito

16. **Como categoriza a dificuldade do jogo "Counter"?**
Mark only one oval.

- Muito difícil
- Difícil
- Acessível
- Fácil
- Muito fácil

17. **Quão divertido considera o jogo "Counter"?**
Mark only one oval.

- Muito pouco
- Pouco
- Aceitável
- Muito

18. **Como categoriza a influência da aplicação na satisfação da sua visita?**
Mark only one oval.

- Nenhuma
- Pouca
- Alguma
- Muita
- Total

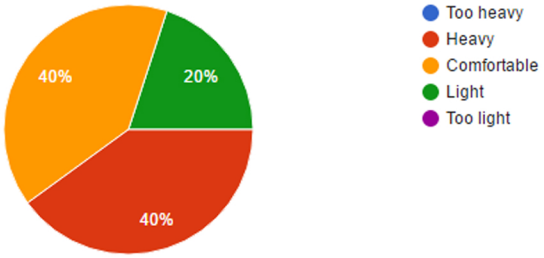
19. **Se voltasse a visitar o Oceanário, voltaria a utilizar a aplicação?**
Mark only one oval.

- Não
- Sim

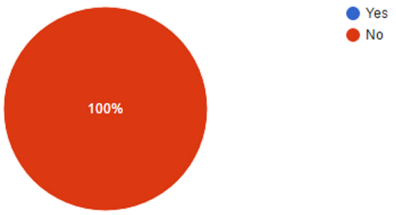
C

Inquiry Results

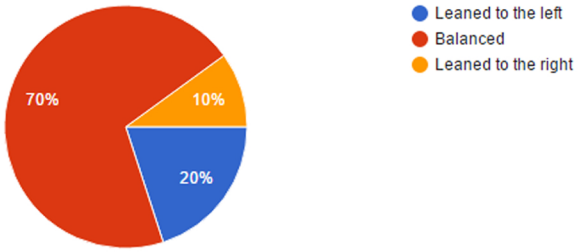
How do you classify the eyeware's weight? (10 responses)



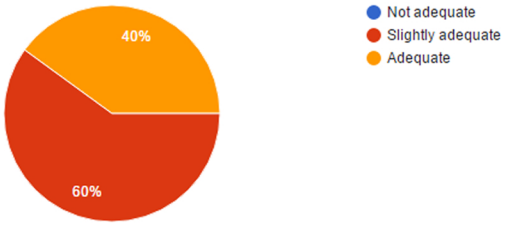
Did you noticed the commands getting blocked between the first and second screen?
(10 responses)



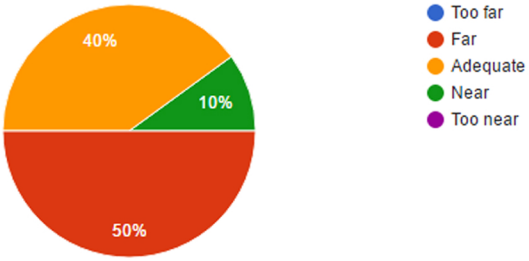
How do you classify the eyeware's balance? (10 responses)



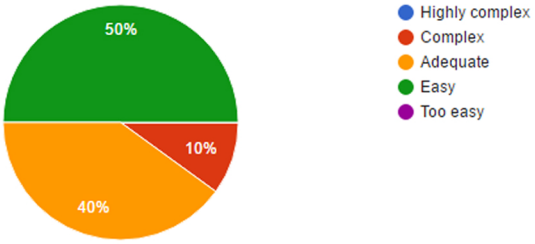
How adequate to the application do you consider the tutorial to be?
(10 responses)



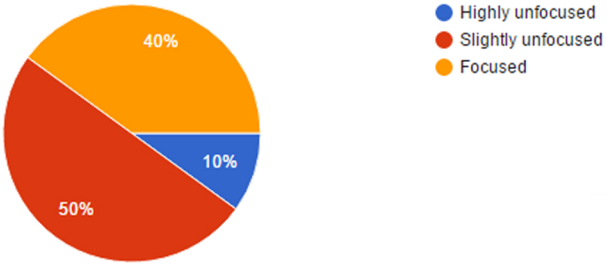
How do you qualify the screen's location? (10 responses)



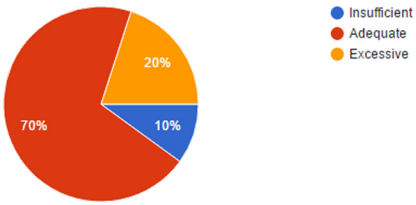
How do you classify the tutorial's complexity? (10 responses)



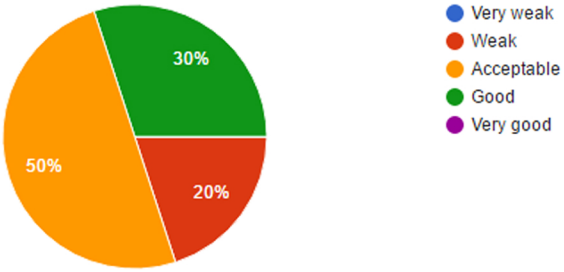
How do you classify the screen's focus? (10 responses)



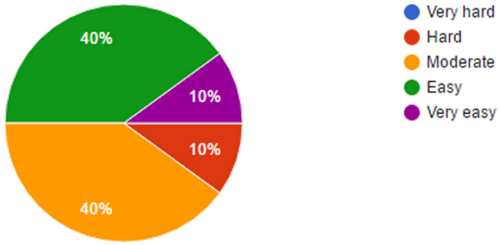
How do you classify the available information on each ocean? (10 responses)



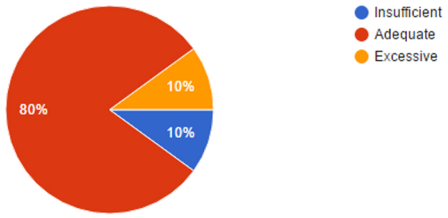
How do you classify the screen's quality? (10 responses)



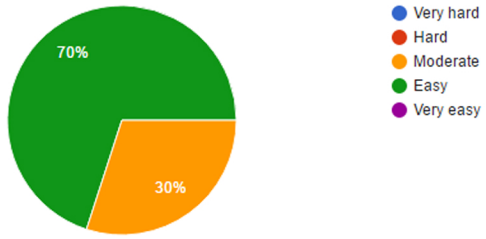
How do you consider the QR Code's reading? (10 responses)



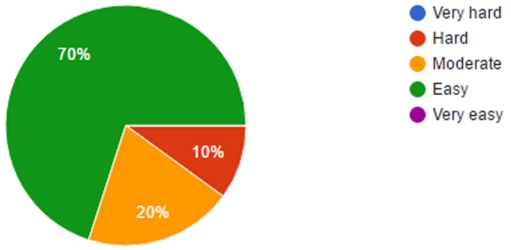
How do you classify the available information on each specie? (10 responses)



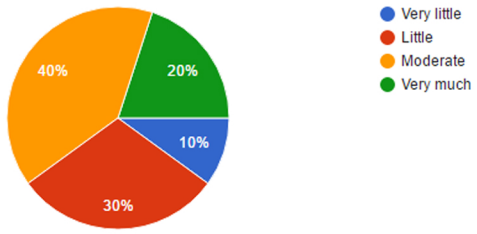
How do you classify the "Counter" game difficulty? (10 responses)



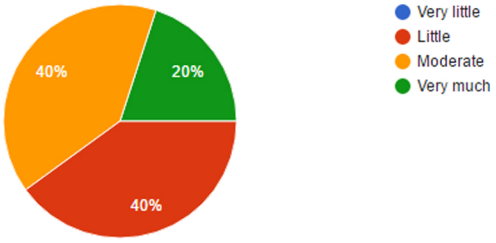
How do you classify the "Belongs" game difficulty? (10 responses)



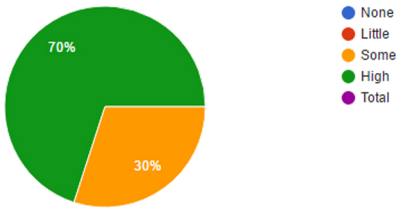
How much fun do you consider the "Counter" game? (10 responses)



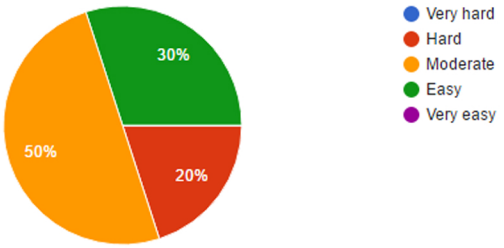
How much fun do you consider the "Belongs" game? (10 responses)



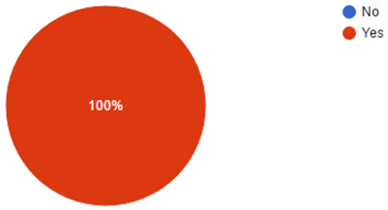
How do you classify the application's influence on the experience of your visit?
(10 responses)



How do you classify the "Finder" game difficulty? (10 responses)



If you came back to Oceanarium, would you ask for the application again?
(10 responses)



How much fun do you consider the "Finder" game? (10 responses)