

Report

QRioCity



First version



Author(s):

- Jakob Zschocke
- Chloé Herlange
- Anita Pyciak
- Lina Blaschke
- Bram Blauw

Acknowledgement

Glossary

Abbreviation	Description
EPS	European Project Semester
ISEP	Instituto Superior de Engenharia do Porto
IoT	Internet of Things
QR	Quick Response
NFC	Near Field Communication
PWA	Progressive Web Application

1. Introduction

The European Project Semester (EPS) offers students the opportunity to complete a project at a partner university under academic supervision over the course of one semester. It is designed to prepare engineering students, and others, to face the challenges of today's world. Students work on a project in multinational and interdisciplinary teams. Project participants communicate in English and receive guidance from supervisors on how to focus on both the product and the project.

This report describes all the steps that reflect the work and research done by Team 3 during the European Project Semester at the Instituto Superior de Engenharia do Porto. This chapter will introduce our team members, a description of the problem, and our main goals.

1.1 Presentation

Our team consists of five international students from different backgrounds. The members, and information about their country of origin and field of study are shown in Table 1. Under the guidance of a team of professors from ISEP, we will work on a multidisciplinary project whose topic is "Our city experience". We will combine our knowledge and skills to create a product that will solve the problem of young tourists being overwhelmed by the number of possibilities of exploring a city while being limited in time and money, and will also help the city municipality to attract new tourists as the current system is a bit outdated.

Table 1: Team Members

Name	Field of Study	Country
Jakob Zschocke	Industrial Engineering	Germany
Chloé Herlange	Engineering	France
Anita Pyciak	Business and Technology	Poland
Lina Blaschke	Media Technology	Austria
Bram Blauw	Industrial Product Design	Netherlands

1.2 Motivation

Our motivation to participate in the European Project Semester was primarily to expand our knowledge and go out of our comfort zone. Studying abroad gives us the opportunity to explore other perspectives and develop out-of-the-box thinking. Moreover, by working on the project we improve our English skills as well as learn about other cultures and the differences between them. Finally, we want to improve our ability to cooperate in a multicultural group to achieve a common goal.

1.3 Problem

During this semester, we decided to address a problem that affects us as well. The topic that we have chosen was "Our city experience." We decided to focus especially on tourism. According to our observations, as well as the information we acquired during our research, young tourists need a way to get the best experience out of their stay, but they are overwhelmed by the vast number of possibilities while being limited in time, money and local insights. They find the current options boring and not entertaining, it's hard for them to explore a new city. Moreover, our product also solves the city government's problem, because they need a way to easily attract new tourists as existing tourism solutions are often outdated. As we all know, the more tourists a city has, the better the reputation of the city, the better the profits for the city and the more opportunities for development.

1.4 Objectives

Our goal is to provide an unforgettable experience for young tourists by creating an urban game that will allow them to explore specific aspects of a city. The city that we decided to focus on is Porto, but the solution that will be created by us can be used also in other places. To attract users, we plan to create a public display in a public place, and the game will be created as a web application that the user can open on his smartphone. This objective includes designing, building and programming, and testing a prototype. Marketing perspectives, environmental and ethical issues must be considered and applied throughout the project to meet the requirements.

1.5 Requirements

Initial requirements:

- Use low-cost hardware solutions;
- Comply with the following EU Directives:
 - Machine Directive (2006/42/CE 2006-05-17);
 - Electromagnetic Compatibility Directive (2004/108/EC 2004 12 15);
 - Low Voltage Directive (2014/35/EU 2016-04-20);
 - Radio Equipment Directive (2014/53/EU 2014-04-16);
 - Restriction of Hazardous Substances (ROHS) in Electrical and Electronic Equipment Directive (2002/95/EC 2003-01-27).
- Mandatory adoption and use of the International System of Units;
- Use open-source software and technologies.

Limitations of the project:

- A maximum budget of 100 €.

Usability requirements:

- Easy to use for the users;
- The user must have a mobile phone (smartphone).

1.6 Functional Tests**1.7 Project Planning****1.8 Report Structure**

The report is organized in 8 chapters as can be seen below in Table 2.

Table 2: Report Structure

Chapter	Description
1 Introduction	Presentation of the team, topic of the project, the motivation, the problem to be solved and requirements.
2 State of Art	Research and analysis of the solutions connected to our problem that already exist in the market.
3 Project Management	Definition and analysis of aspects important for the project; scope, people, communications and risks.
4 Marketing Plan	Research and analysis of the market, definition of the marketing strategy that will be used and applied in our solution.
5 Eco-efficiency Measures for Sustainability	Description of sustainability of the project from social, economic and environmental level. Making our product as sustainable as possible.
6 Ethical and Deontological Concerns	Analysis of ethical challenges and limitation of the challenges associated with our product.
7 Project Development	Design and prototype of the product and carrying out the final tests and their results.
8 Conclusions	Summary of the work that has been done, stating possible improvements of the product in the future.

2. State of the Art**2.1 Introduction**

In this chapter different topics that in some way relate to this project were researched, important

aspects were summarized. First, the aspects in tourism to which the project could be applied were investigated. The need for organized group activities became apparent and how tourists increasingly look for personalized and engaging experiences. Secondly, it was explored how today's technology can enhance the tourism experience. Two trends became visible, the use of machine learning and the use of smart devices and Internet of Things (IoT) systems. Machine learning was mainly used to improve recommender systems and smart devices make touristic destinations smarter and more connected. Furthermore, the concept of gamification and its impact in tourism were explored. Gamification is an underestimated tool in most business sectors even though it can benefit both users and brands/companies. The use of gamification, among other things, creates an engaging and fun experience for the user and it promotes brand loyalty and can bring useful user data to the company. After researching different theoretical topics, developing options were investigated to find the perfect fit for this project. Market research helped to see what current applications are available and what elements could be implemented or improved. Lastly, specific options for implementing the project were compared, Near Field Communication (NFC) versus Quick Response (QR) codes and (progressive) web applications (PWA) versus native applications. After all this research a conclusion was drawn to create a clear concept of the project.

2.2 Group activities

Current tourism not only focuses on destinations or places but also on creating experiences. This market experienced a major push from information and communication technologies. Tourism must be understood as a customer-focused experience both online and offline and not just as a service. The customer seems to derive added value from outstanding, unforgettable and personal services or products. Experiences are no longer passively consumed, but actively, dynamically and participatory co-created. Therefore, experiences aren't just designed and delivered suitable for the masses, instead they are collectively created by providers and consumers (tourists)(=Experience co-creation). It is therefore easy to understand why digital technologies play an essential role in connecting different parties (B2B, B2C, C2C). "The pre-trip phase can be described as an active and socially intensive phase. Tourists use a variety of technologies and media to help them inspire, plan, transact, book, and interact with service providers (B2C) and other consumers (C2C). For example, consumers search for travel information, photos, and reviews on TripAdvisor or booking sites to facilitate decision making. Another example of the pre-trip phase is innovative inspiration and idea generation platforms, such as PixMeAway (Pixmeaway.com), which use intuitively selectable images to inspire consumers and recommend suitable countries, cities and regions for future trips. Especially in the pre-travel phase, virtual reality (VR) has gained great importance, in addition to the already established online websites" **[Barbara Neuhofer, Mattia Rainoldi, 2016]**. During-Journey: Mostly the highlight of the customers journey. Key technologies: location based services and products, VAR. There are quite a lot of digital approaches. "

Tourism organisations create and amplify the experiences, impressions, experiences and magical moments that guests should experience from and in specific travel regions. Product development in tourism is strongly linked to the creation of unforgettable experiences. Understanding travel as a social and psychological phenomenon (longing for rest, relaxation, adventure, a counter-world to everyday life, enriching experiences, valuable encounters and memories) is the basis for aligning tourism product experiences with guests' travel motivations. Even the modern travellers sharing their experience - called bloggers, Instagrammers or influencers - are in real and digital life going after the experiences of the region and not after the hotels, arrangements or the number of slopes.

The vast majority of tourism value is created locally in the context of culinary, local transportation,

and experiential services. The fact that the majority of market and value creation potentials in experience services (gastronomy, transport, culture, sports, experience, encounter, ...) are created locally has been treated rather stepmotherly by tourism professionals for years. Digital distribution of experiential services was also dismissed for a long time by tourism organizations as "not scalable," "too small-scale," or "not digitally relevant." Internationally, however, this trend has long been established and online reservation platforms, so-called activity booking engines for experiences, leisure activities, tours and guides have been around since 2007. These platforms, on which experience and leisure providers can offer their own offers ranging from mountain tours to beauty treatments and archery courses to paragliding tandem flights, are the "suppliers" and, as so-called consolidators, technical-organizational partners for the true sales giants of touristic experiences, tours and activities - the experience sales platforms and experience brokers. Similar to OTA - Online Tour Operators - these bundle the inventory from activity booking engines into online sales platforms - we therefore call them OAA - Online Activity Agencies: - Jochen Schweitzer (Jochen Schweitzer 2018, n.d.), - Viator (Viator 2018, n.d.), - MyDays (MyDays 2018 n. p.), - Jollydays (Jollydays 2018, n. p.), - Get your Guide (Get Your Guide 2018, n. p.). This is also exactly what is at stake today more than ever when trying to efficiently implement tourism brand management: Place-making with authentic, honest stage paraphernalia such as attractions, museums, city centres, rivers, lakes, mountains and natural landscapes. Place branding follows as a logical consequence and uses contemporary communication channels from Youtube to Snapchat, from Twitter to Google Earth, to carry the authentic stage paraphernalia of the world's most attractive destinations around the world as snackable content. " **[Daniela Wagner, Martin Schobert, Georg Christian Steckenbauer, 2019]**

2.3 Modernising Tourism

When considering to modernise and digitize the tourism sector a few trends are visible. At first there were mobile applications that came with the rise of the smart phone. Now there is a plethora of applications that make traveling easier. From booking a flight to finding a hotel and getting reviews on every place you could visit. By now this is not new anymore. What is new is for example the use of deep learning in recommender systems. For example **[3]** produced an application with case-based reasoning, so the user was asked to enter personal information and choose some preferences and then got recommended the matching attractions. Due to the sheer overload on information available, recommender systems are becoming increasingly important. So new and improved methods are emerging with more focus on personal recommendations. Although new methods are being developed, they can not be adapted easily due to the workload connected to data collection and labelling. Aside from recommender systems for separate attractions, **[Chenzhong Bin, T. Gu, Yanpeng Sun, Liang Chang, Lei Sun, 2019]** proposed a tangible travel tour (inside one point of interest) recommender method using smartphones and an IoT environment. First they tracked tourists travel data with Bluetooth low energy beacons and could then recommend a calculated travel route to a new user. This project was not yet implemented in a real life situation because of problems related to data collection.

Another way to modernise the tourism sector is to use smart devices and IoT applications. According to the survey analysis of **[Ahmadh Kariapper, Pirapuraj Ponnampalam, Suhail Razeeth, A C M. Nafrees, Ahamed Sabani Mohamed Jamaldeen, 2020]** the tourism industry can obtain considerable advantages through using smart devices, mainly wearables and IoT applications. Wearables are especially useful seeing as tourists move quickly from one place to another. They beat smartphones in the regard of battery performance and charging time. Every device has some drawbacks but when combined and suited for the situations they can be mitigated. **[Xudong Guo,**

Yuxuan Wang, Jieqiong Mao, Yiming Deng, Felix T. S. Chan, Junhu Ruan, 2021] propose that with the help of 5G and IoT technologies smart tourism can be promoted to the maximum. They define this as IoT enabled tourism. "IoT enabled tourism is an IoT enabled system which applies various information and communication technologies to interconnect all the five elements of tourism: tourists, generating regions, transit routes, destination regions, and the tourist industry and makes all these tourism elements smart by the interconnection of IoT devices in the tourism." **[Xudong Guo, Yuxuan Wang, Jieqiong Mao, Yiming Deng, Felix T. S. Chan, Junhu Ruan, 2021]**

2.4 Gamification and Interaction

Another big trend in (not only) tourism is gamification and (interactive) installations. Making an experience extra enjoyable through games or art, engaging the user through added incentive. According to **[Maria Giovina Pasca, M. F. Renzi, R. G. Mugion, Martina Toni, L. D. Pietro, 2020]** gamification in tourism does not only attract tourists and engages them to co-create experiences but also helps to build destination loyalty. In various phases of travelling, gamification is known to bring benefits not only for the consumer but the company as well used as an innovative marketing tool. Tourists might strive for interaction, connecting with others and socializing and games or game-like experiences offer that. Benefits for the user include creating an entertaining and personalized experience, it also improves retaining information about the destination. For the company it can provide useful user-information, increase brand awareness and bind the customer to the company. A game to combine all these benefits must be based on the customers motivations and objectives as well as their profile. **[Feifei Xu, Dimitrios Buhalis, 2021]** even call gamification the cutting edge trend in tourism. Examples of gamification can be literal games like quizzes or scavenger hunts, either online or with tangible objects. Other versions might indulge the user in a roleplaying story that they emotionally connect to. Mobile applications being the easiest to implement or market to users. Another way to gamify is to only use game mechanics like giving points or rewards or introduce levels or rankings. This can give users extra incentive to engage with the proposed service. Especially rewards can motivate people to for example leave reviews or sign up to services. As **[F. B. P. Prakasa, S. Suyoto, A. W. R. Emanuel, 2021]** mention gamification can be implemented in many ways, most accessible are applications, desktop, mobile or web, augmented reality is mostly used in museums to educate, virtual reality is used a little less but geocaching is a convenient way to implement some kind of treasure hunt. In conclusion gamification can be an innovative, entertaining and personalized engagement for tourists and additionally can be beneficial for all parties involved.

If the tourist is interested in art or taking part in an installation, technology can also improve these experience. Museums that provide options for visitors to interact with physical objects are more attractive to a wider range of people than solely visual forms of teaching information. Simply providing physical buttons or technology-enhanced physical objects to navigate information already improves the visitors experience. **[George Margetis, Dimitris Grammenos, George Paparoulis, Constantine Stephanidis, 2017]** created a digital catalogue for various use cases like public display or heritage information which can be navigated through touch or context designed physical objects (windmills, a ship's wheel,...). Another kind of interactive installation was made by **[Kate Galloway, 2018]** where she used geolocation to create a soundwalk through a specific area in Canada, playing poems, sounds and interviews through the listeners device. Interactive installations can be a creative outlet for builders and visitors, it can create lasting memories but also have teaching effects. It can be used as a marketing strategy but rather classifies as creative or educational.

Another great way to interact with tourists are public kiosks. **[Partteam & Oemkiosks, 2020]**

summarize the functionalities and benefits of using a display/kiosk to help or attract tourists in their article. It's a great tool to distribute information, to purchase tickets, design interactive experiences, WIFI hot spots, unmanned check ins/outs, etc. In Porto it is also often used for queue management. These displays not only have many use cases but also many benefits, including, mitigating language barriers, improving the tourists experience, increased revenue for local businesses, catches users attention and sparks curiosity and so on.

2.5 Comparison between development solutions

Table 3: Pros and cons of QR codes

Pros	Cons
Easy to program	Not really secured
Standardized, any device can scan it	Easy to falsify
Cheap to produce	
Easy to use	

Table 4: Pros and cons of NFC tags

Pros	Cons
Easy to program - there are special apps	Less secure than QR Codes
It can connect to any link	High price - around 1€ per tag
	Not all phones have NFC in their functions
	If it is not secured, it's easy to steal

Table 5: Pros and cons of (progressive) web app

Pros	Cons
Works on every device if designed responsive	Needs constant internet connection
Doesn't use too much storage	Slower/less advanced in features
Easier to get up and running/maintain	
Quick and easy to build	
Security not automatically guaranteed for the user	
PWAs have to run on https	Geofencing only on app
No installation	Interaction with other apps only on app
Not as much space as app	Other smart functions only on app
PWA Performance better than WA not than native app	

Table 6: Pros and cons of android/IOS - Apps

Pros	Cons
Works completely offline - how much Data does a webapps safe?	Needs to be adapted for different phones
Context aware	Users are more opposed if you have to do smth
Quicker access to camera	"more expensive"
Faster, more efficient, safer	"long wait to get approved"
Easier to build due to developer tools	"how is it connected Place-making with authentic, honest stage paraphernalia such as attractions, museums, city centres, rivers, lakes, mountains and natural landscapes is the order of the day. with the display?"

2.6 Conclusion

Based on this study of the state of the art, the team decided to adopt the following components: a progressive web application which should create an engaging, competitive game for groups of all sizes around the city of Porto, plus a public kiosk/display to attract users. This set up was chosen because gamification is one of the best ways to give users a personalized and engaging experience whilst educating about a tourist destination and can at the same time promote local businesses. The crucial points for choosing a web application were time and accessibility. Seeing as progressive web apps come really close to adapting all positive features of a native app as well as our time for developing being limited and the need to cater to as many people as possible, a PWA seemed like the better fit. This way every tourist with a phone can easily participate without having to be convinced to download an app, the only concern being that tourists do not always have an internet connection but Porto provides an free Wi-Fi connection so this problem can be mitigated.

3. Project Management

3.1 Scope

Document the boundaries of your project. Document the product scope (the extent of what your project will produce) and the project Scope (summary of the work needed to produce it).

Figure 1. shows Work Breakdown Structure (WBS) of our project:

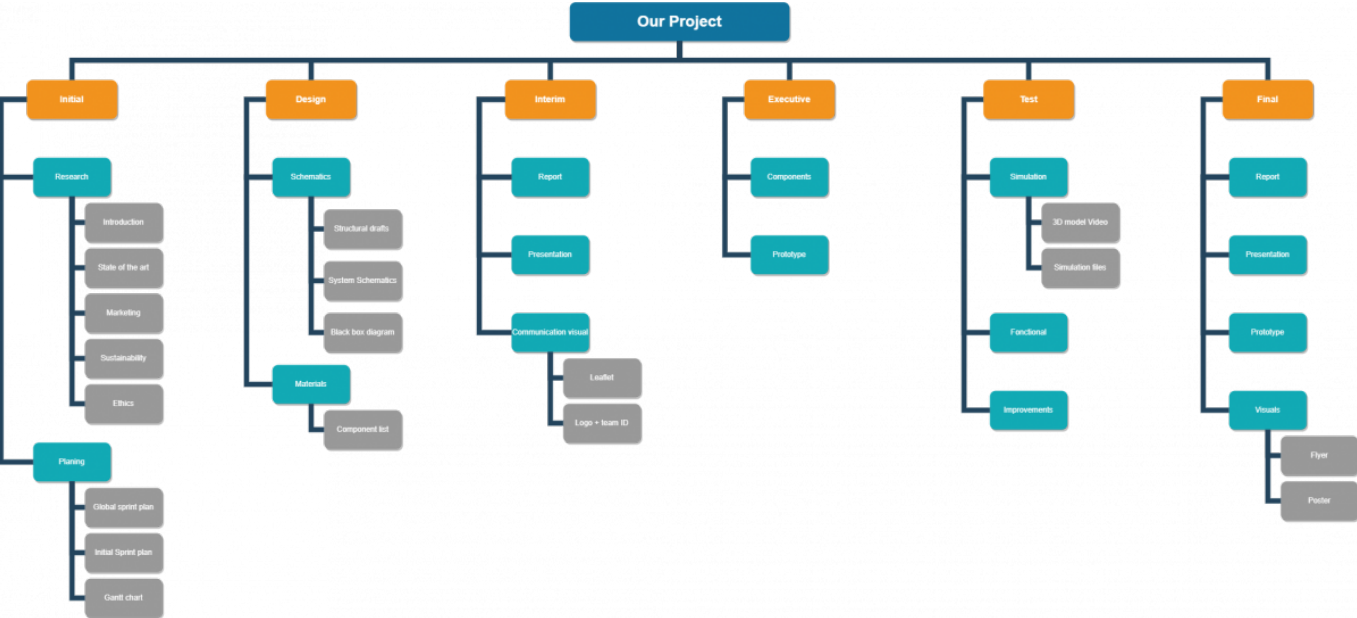


Figure 1: Work Breakdown Structure

3.2 Time

Document the key milestones of your project, mapping key phases to reference deadlines.

3.3 Cost

Document the planned vs. effective costs of your project.

3.4 Quality

Document quality metrics that will apply to your project deliverables, associated thresholds and how they should be reviewed.

3.5 People

Identify key people related to the project and associated roles.

The people associated with a project (stakeholders) are one of the key factors in project success. It is important to identify them in advance in order to properly manage them during project implementation. In **Table 7**, we have outlined all project-related stakeholders and their roles, as well as their influence and power during the project.

Table 7: Project Stakeholders

Key	Stakeholder	Role	Power	Influence
A	Team Members	Owners	High	High
B	Benedita Malheiro	EPS Coordinator	High	High
C	Supervisors	Supervising the project development	High	Medium
D	Teachers	Providing resources and support	Medium	Medium
E	ISEP	Main Sponsor	High	Medium
F	Customers	Client	Medium	High
G	Tourists	Final Users	Medium	High
H	Citizens	Final Users	Medium	High
I	Suppliers	Providing Materials	Low	Medium
J	Investors	Financial or Material Sponsors	Low	Medium
K	Competitors	External Influence	Low	Low
L	Local businesses (restaurants, museums, cafes, cinemas, bars, gift shops, traditional shops, fado's events)	Sponsoring cooperation	Low	Medium

3.6 Communications

Communication is crucial in a project where many people work together. If the team is not communicating properly and effectively, the project will be hard to complete successfully. Communication is important not only within the project team, but also between other stakeholders. It is important to communicate on an ongoing basis and to report on changes from time to time so that changes can be made when they are needed. It is important to ensure that all members have the opportunity to express their beliefs and that issues that arise during the project are addressed appropriately. Communication is one of the pillars of a good project.

During the project our communication channels are:

- Between team members: Online and offline meetings, WhatsApp, Teams, and the wiki to share all the information.
- Between supervisors and team: Teams and wiki to share some information about the progress of the project, weekly meetings.
- Between team and external stakeholders: flyers, poster, advertisement, leaflet.

Table 8: Project Communication management

Key	Stakeholder information requirements	Timeframe/Frequency/Trigger
A	Provide update on project progress, Provide input to requirement, Direct communication with supervisor	weekly and ad hoc as needed, ad hoc as needed, weekly
B	Provide advice and deadlines, Receive report, schedule and feedback about project	weekly and ad hoc as needed
C	Provide advice	weekly and ad hoc as needed

Key	Stakeholder information requirements	Timeframe/Frequency/Trigger
D	Provide resources and support	During classes and ad hoc as needed
E	Provide facilities	Daily
F	Receive information about product	At the end of the project
G	Receive advertisement about the game	During using of the product
H	Receive advertisement about the game	During using of the product
I	Suppliers	Providing Materials
J	Receive information about project, provide funding	
K	Receive advertisement about the game	During using of the product
L	Receive advertisement about the game, Provide fee	before and during using of the product

3.7 Risk

Risk is an uncertain event that may or may not occur during a project and affects it to specific extend with specific probability and impact. [\[ProjectManagementInstitute, 2008\]](#) Once the key risk factors are identified, there is also a need to consider whether or not they are relevant and how they can be addressed. Risk management is the process of identifying, assessing and controlling risks to a project. Risks can come from many different sources, including technological problems, strategic management failures, accidents, or natural disasters. [\[15\]](#) Ranking hazards is the way to help determine which risk is the most serious and thus which to control first. In our project, we decided to assess risks based on impact and probability using a scale from 1 (lowest) to 5 (highest).

Table 9 presents the risk analysis of our project:

Table 9: Risks

No	Risk	Category of the risk	Cause	Effect	Probability	Impact	Resolution
1	Not enough information presented during a trip	Technical	Lack of testing / Small amount of testing	Frustration of participants, necessity to stop the game	2	4	Adding more information, test game properly
2	Destroyed authenticity of local places	External	Too many tourists in local places, worse experience because of crowded space	Destroyed authenticity, uniqueness of the place	2	4	Find balance between amount of people visiting one place in one time

No	Risk	Category of the risk	Cause	Effect	Probability	Impact	Resolution
3	Conflicts inside the team members	Internal	Misunderstanding, communication problems	No cooperation and delay of work	1	4	Dividing and fulfilling the tasks on time, find ways to compromise
4	Lack of appropriate skills and knowledge	Internal	Lack of specialists in the given field	Delay of work, tasks done incorrect	3	3	Doing the research, use the help and directions from supervisors
5	User is getting bored during game	External	Lack of proper testing, to less amount of testing, boring tasks	Puzzle too easy to solve, game become useless, not interesting for people	2	4	Test the tasks before for different types of personalities
6	Programming errors/Bugs in software	Technical	Human error, lack of testing	Non-working device	1	2	Repairing the error

Figure 2. shows Risk Assessment:

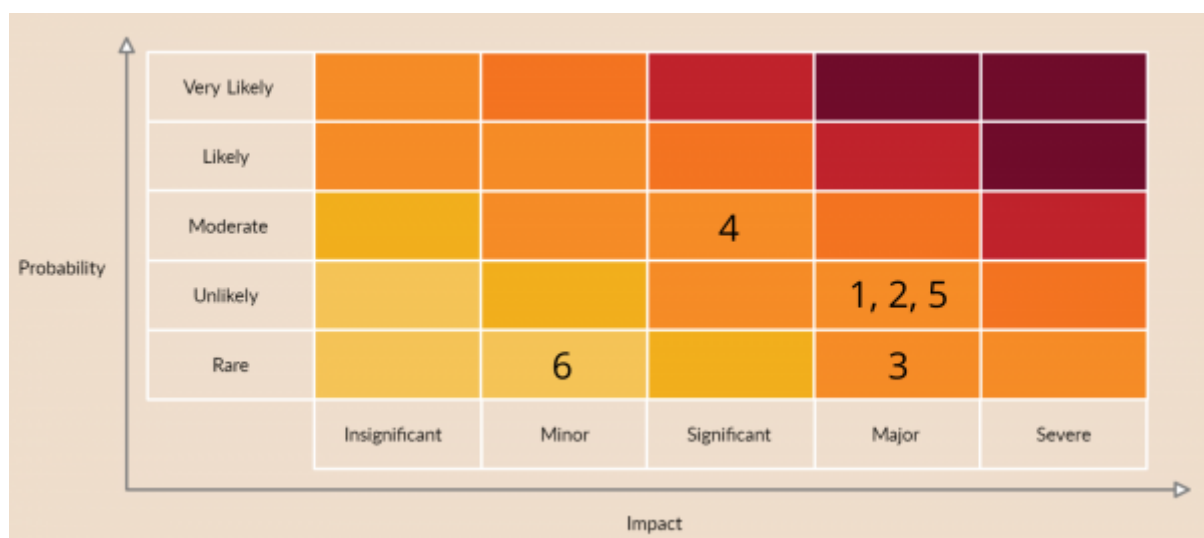


Figure 2: Risk Assessment

3.8 Procurement

Document your procurement management strategy including make vs buy decisions, materials/services to be acquired, sources, costs, timings, etc. For the proof of concept there are two options because we already have some components in our possession but they wouldn't have been the first choice never the less it also works with these ones.

Table 10: Comparison between presence sensor

Component	Name	Link	Price(€)	Range	Power needed	temperature resistance
A	SEN0381	https://www.digikey.pt/en/products/detail/dfrobot/SEN0381/13545233	11.71	0 - 200 cm	5 V	- 10°C ~ 60°C
B	SEN0239	https://www.digikey.pt/en/products/detail/dfrobot/SEN0239/8019052	11.71	0 - 200 cm	3 V - 5 V	- 15°C ~ 60°C
C	28015	https://www.digikey.pt/pt/products/detail/parallax-inc/28015/1774419	0	3 - 300 cm	5 V	0°C ~ 70°C

Table 11: List of components for prototype Option 1

Component	Link	€
Optical sensor	https://www.digikey.pt/en/products/detail/dfrobot/SEN0381/13545233	11.71
Adafruit Trinket 1501	https://www.digikey.pt/pt/products/detail/adafruit-industries-llc/1501/4990770	6.31
Laptop with touchscreen	https://www.worten.pt/outlet/informatica-e-acessorios/portateis/portatil-hibrido-acer-spin-5-sp513-51-537m-outlet-grade-a-13-3-intel-core-i5-7200u-8-gb-ram-256-gb-ssd-intel-hd-graphics-620-7404696	
Speaker (from laptop) or + SP-2027NW speaker	https://www.digikey.pt/en/products/detail/soberton-inc/SP-2027NW/9924407	3.54
Jumper Wires		

Table 12: List of components for prototype Option 2

Component	Link	€
Ultrasonic Sensor 28015	https://www.digikey.pt/pt/products/detail/parallax-inc/28015/1774419	already in possession
(Elegoo) Uno R3	https://www.elegoo.com/products/elegoo-uno-project-super-starter-kit	whole set in possession
Piezo from set or speaker from Laptop	https://www.digikey.pt/pt/products/detail/fsi-products-international/BZR-PC23095-12V-W/15822160	
Laptop with touchscreen	https://www.worten.pt/outlet/informatica-e-acessorios/portateis/portatil-hibrido-acer-spin-5-sp513-51-537m-outlet-grade-a-13-3-intel-core-i5-7200u-8-gb-ram-256-gb-ssd-intel-hd-graphics-620-7404696	

Public Kiosk

For the real project an all in one solution would be the best option, seeing as it would be unnecessarily complicated to have every function handled by a different component when there are options that combine everything. The programability is also simplified, because the software is already connected to the hardware. PARTTEAM & OEMKIOSKS (<https://oemkiosks.com/?page=home>) offer a variety of ready set or custom solutions. For this project an proximity sensor and Wifi hotspot could be added to one of their digital interactive billboards to make an attractive starting point to our game. The PlasmV (<https://www.youtube.com/watch?v=HJvIn7PbRe8>) would be one of these options but we are currently in discourse with the company to find the best solution. One downside is that they already informed us that the kiosk is not able to be entirely powered by solar panels.

Solar panels

Figure 3. shows the comparison between the different solar modules:

	Monocrystalline	Polycrystalline	Thin film / amorphous	Thin film / CIGS
Efficiency	18 - 25 %	15 - 17 %	6 – 13 %	Ca. 17 %
Performance in bad condition (Shade, diffuse Light)	Declines	Declines	Only small declines	Only small declines
Performance in high temperature	Declines - 3 %	Declines - 3 %	Only small declines	Only small declines
Long-term testing	High performance, long lifetime	High performance, long lifetime	Less performance and lifetime	Less performance and lifetime
Weight Flexibility	High No	High No	Very low Yes	Very low Yes
Costs	Most expensive	Cheaper than monocrystalline and CIGS	Cheaper than monocrystalline and CIGS	Cheaper than monocrystalline
Area needed for 1 kWp	6 – 9 sqm	7 – 10 sqm	-	-

Monocrystalline PV	Standard PV	PV with module optimization	PV with output optimization	PV with individual output optimization
Additional inverter needed?	yes	yes	yes	no
Performance in bad condition (Shade, diffuse Light)	bad	Very good	Very good	good
Effort to install	high	high	high	low
Costs	+	++	++	++ / +++
Costs with additional inverter	++	+++	+++	++ / +++

Figure 3: Solar panels

→If there is a lot of free space for solar panels, a lot of diffuse light and not the perfect orientation possible ⇒ thin film solar panels →If there is limited space for solar panels, not a lot of diffuse light ⇒ Mono-/Polycrystalline solar panels

Parallel connection between solar modules needed? (More expensive in construction) →Only necessary if some parts of the string (chain of solar modules) have different amount of light/shade. ⇒ for us not really necessary because we can decide the shape of the roof on which the solar panels are placed

→Orientation and good light conditions can be chosen, and not a lot of solar panels will be used → not worth buying a PV inverter, cheaper in the end and also less effort to install

solar_panels.pdf

3.9 Stakeholders Management

In the stakeholder management it's important to identify all the different stakeholders and to find the best strategies in order to incorporate them in the process and keep them happy. This chapter will discuss the identification of the stakeholders, followed by the strategy in order to keep them satisfied.

3.9.1 Identification

The main two stakeholders of this project are the users and the city hall of Porto. City hall can be split into different groups. These groups are:

City board - In order to get the right licenses to be able to place and operate a public display and different QR codes throughout the city, we need to be in close contact to the board of city hall. Usually boards of city halls are very hard to get into (quick) contact with, but it's our most important stakeholder. Big chances that we will get in contact with an employee of city hall responsible for public products instead. Whoever we're in contact with, it's extremely important to keep them happy, otherwise the project won't be able to be realized.

Tourism of Porto (Turismo de Portugal) - It's important to work well together with the tourism office of Portugal since they can provide us with a lot of valuable information. Since it's a product with tourists as it's target audience, the tourism office will be important since it's very interesting for us to work together with them. There's a big chance they have a multiyear plan for the future of tourism in Portugal and this product needs to adhere to that plan.

City cleaning - Keeping the city clean is usually the job from a department of city hall. It's important we take them into account since there might be certain instructions needed in order to properly clean the screen. Since this is very hard to implement, it's more interesting to clean the screens ourselves since we're also maintaining and repairing the screens. This stakeholder is less important since we will be offering service together with the screen, this includes maintenance and cleaning could be part of maintenance.

Tourists - This group will be our users, it's mainly important in the process of designing to really look at what they want and what they value. The group is hard to get involved since it's a group of people with no real representatives (except for Turismo de Portugal), so that's why it's important to always keep them in the back of our minds.

Mechanics - The mechanics will be employees of QRioCity and will get a course in how to install our display screen and QR codes. Furthermore they will get a course on how to maintain the display. This will include cleaning, repairing, updating and everything else related to maintaining the display. It's important to keep them in mind during the design process, just like with the tourists.

3.9.2 Strategy

In this chapter the strategy concerning the satisfaction of the stakeholder will be discussed. It will be discussed how they will be involved in the project and how (often) they will be updated.

City board - There will be weekly meetings with the city hall representatives and their opinion is the most important for this project. The meetings will be in person and a weekly summary of the meeting will be sent to them by email.

Turismo de Porto - Turismo de Porto will be invited to the city board meeting and will be send the same summary. There will be a two weekly separate meeting planned with them in order to discuss further details with them which won't be concerning the city board.

City cleaning - There will be one meeting with city cleaning during the design process in order to identify their needs for the product. Furthermore there will be a second and final meeting with city

cleaning in order to get feedback on the product and make final adjustments.

Tourists - In the meetings with Turismo de Porto the tourists will be somewhat represented but it's not quite the full representation we're looking for in order to fully satisfy this group. Two different focus groups will be held during the design process in order to find out all the needs that tourists have when it comes to the display and the game.

Mechanics - There will be a supervisor appointed who will be responsible to take the mechanics needs into an account. That supervisor will be present for all the design meetings and will have a say in the decisions in order to keep the mechanics happy.

3.10 Sprint Outcomes

Include the outcomes of all sprint reviews (what was the sprint backlog, completion status, planned capacity vs. achieved velocity).

3.11 Sprint Evaluations

Include the summary of all the sprint retrospectives, including any actions implemented as part of the team's continuous improvement strategy.

3.12 Conclusion

Provide here the conclusions of this chapter and introduce the next chapter.

4. Marketing Plan

4.1 Introduction

The role of marketing in an organization is to create strong and profitable relationships with customers. The marketer's role is to select the right people to reach, capture interesting market opportunities, communicate what products or services to offer and at what price, and decide on a distribution system. A marketing plan is an important element when developing a new product. It helps to know the actual market and to make the product visible to the public from a business point of view. In short, a marketing plan constructs a product so that it becomes profitable and valuable in the marketplace. However, marketing is not only about selling and advertising the product, the purpose of the marketing plan is to analyze and identify the needs of the customers and use them in such a way that the product can sell to the public. The product must communicate the value it holds in the best way possible so that the customer is fully satisfied and a long term relationship is formed. The purpose of this chapter is to develop a marketing plan for our product, considering the current

market. In this chapter, we will introduce several things.

First, a market analysis to gather the information needed to develop a marketing strategy and specific marketing activities. Second, SWOT analysis, which aims to identify the internal and external factors that are favorable or unfavorable for a profitable company/product. Third, we will determine what the strategic objectives of the product are using an intelligent methodology. Then we will define and visualize the brand and the position of the product in the market. Next, we develop a Marketing Mix, consisting of the four P's (product, price, place, promotion) to find the right combination of factors to provide value to target customers. The final step is to control the budget and strategy to ensure the marketing objectives are met.

Our goal is to create a product that not only meets the requirements of the target audience, but is also useful and innovative so that the created project can be sustained in the market for a long time.

4.2 Market Analysis

In the market analysis the available apps and displays on the market will be discussed and analysed. This will be done in order to get a clear view of what is and isn't available on the market. This way we can avoid copying other products and innovating a new one. An app and a display market research has been done. First the app market research will be discussed:

Questo



Figure 4: Questo logo [16]

Questo (Figure 4) is an app that sells tours/games to tourists that want to find a new innovative way of exploring a city. The app makes a game out of exploring a city by giving you clues in order to find your destinations. After reaching the destination, you get asked a question which you can only answer with information found on the locations the app is leading you to. <https://questoapp.com/>

ENIGMAS TOUR



Figure 5: Enigmas tour logo [17]

Enigmas tour (Figure 5) is a Spanish company that offers city tours comparable with Questo. The biggest difference is that the tours from Questo is community driven, while the tours from Enigmas tour are from the company only. This means that the Enigmas tours are way more local and less tours

available. Questo has tours all over the world, Enigmas tour has tours mainly in Spain.

<https://enigmastour.com/en/>

City game



Figure 6: City game logo [18]

City game (Figure 6) can be played in Lisbon and for about 15 euros you can get a city game extremely similar to the ones mentioned before. It's a fun way to explore a city through different clues. Users can pick routes with themes and parts of the city they want to explore.

Goosechase



Figure 7: Goosechase logo [19]

Goosechase (Figure 7) is a game which is less about exploring a city, but more about exploring the world with your friends. Users can make lobbies with their friends and everyone will get an assignment, for example 'make a picture of a man with a top hat' and for each completed assignment they get points.

Actionbound



Figure 8: Actionbound logo [20]

Actionbound (Figure 8) is a free to play game with a similar concept to last ones, although the big difference is that all tours are free and made by the public. Creators of the tours do not get money, the main difference between Actionbound and Questo. Since the tours of Questo cost money for users, the expected quality and process of making a tour is way more complicated compared to Actionbound. That means that there are way more Actionbound tours, but the quality is less insured. The disadvantage for playing free tours.

Geocaching



Figure 9: Geocaching logo [21]

Geocaching (Figure 9) is an international initiative which is all about going on an 'adventure'. It's a free app where you get GPS locations of a 'cache' of all different shapes and sizes. If you find one you can write down your name in its notebook and sometimes even exchange random items. There are millions of Geocaches all around the world and it's free for everyone. There's no commercial reason

for the app so it's fun for everyone.

Streetography



Figure 10: Streetography logo [22]

Streetography (Figure 10) is a city exploring app for photographers. It shows all the hot spots for the best photos and of each street/neighbourhood it has beautiful high quality photos of the surrounding to inspire photographers.

Pokémon GO



Figure 11: Pokémon Go logo [23]

Pokémon GO (Figure 11) is the most popular exploration game. It's less about showing people different (parts of) cities but more about collecting virtual characters. It uses GPS and you can only play the game by going out into the open and walk around.

Tripadvisor



Figure 12: Tripadvisor logo [24]

Tripadvisor (Figure 12) is an extremely famous app in which tourists, locals and everyone else can look for fun activities, restaurants and masterclasses in certain cities. You can tell the app your budget, interests, location, type of activity and much more. It's being used over the whole world and it even offers to make reservations for you.

Display marketresearch On Figure 13 there a wide array of different displays and kiosks that are available. Most public displays/screens are custom and have their own specific requirements. Most screen have been designed by design studios specialised in public displays. An example of a company like that is PARTTEAM & OEMKIOSKS which are based in north of Porto. They categorize different public display in 6 different categories.

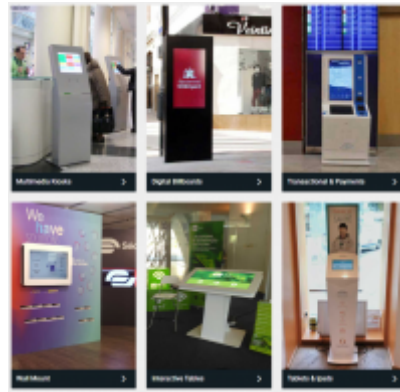


Figure 13: Available displays [25]

- Multimedia Kiosks
- Digital Billboards
- Transactional & Payments
- Wall Mount
- Interactive tables
- Tablets & iPads

The difference between all is unsure, but it does give a list of the possible features a display can have. Things like a touchscreen, a waterproof design, sensors, NFC tags etc. There is a lot possible if it's designed well. There aren't any public displays on sale, so there will be a display that needs to be designed ourselves.

4.3 Problem statement and Value Proposition

Problem statement

Users

Young tourists need a way to get the best experience out of their stay, but they are overwhelmed by the vast amount of possibilities while being limited in time, money and local insights.

Businesses

Cities/municipalities need a way to easily attract new tourists, because existing tourism solutions are outdated.

Value Proposition for users

FOR	young tourists
WHO	want to experience a city in an engaging way
THE Q(R)UEST IS	a city exploration game
THAT	offers personalized tours to discover the local scene in a unique way for any group size
UNLIKE	(expensive) generic city tourism
OUR	game avoids tourist traps and introduces a competitive element

Value Proposition for businesses	
FOR	cities/municipalities
WHO	want to improve their tourism
THE Q(R)UEST IS	a city exploration game
THAT	offers a maintenance free display promoting tourism
UNLIKE	outdated tourist information channels
OUR	display reinvents the way tourists explore your city

4.4 SWOT Analysis

SWOT analysis is a useful and yet simple tool for developing a business strategy. The main purpose of the analysis is to identify the internal and external factors that are beneficial or detrimental to a company or product. SWOT analysis involves dividing the information gathered into four groups:

- S (Strengths) - anything that is an asset, an advantage;
- W (Weaknesses) - everything that constitutes a weakness, barrier, disadvantage;
- O (Opportunities) - everything that creates an opportunity for beneficial change;
- T (Threats) - anything that poses a danger of unfavorable change.

The use of SWOT analysis brings the entire team together, facilitates commitment to implementing the company's strategy, and promotes a shared awareness of key issues that affect performance. We decided to create two SWOT analyses - one for our team (Figure 14) and another to review our final product (Figure 15).

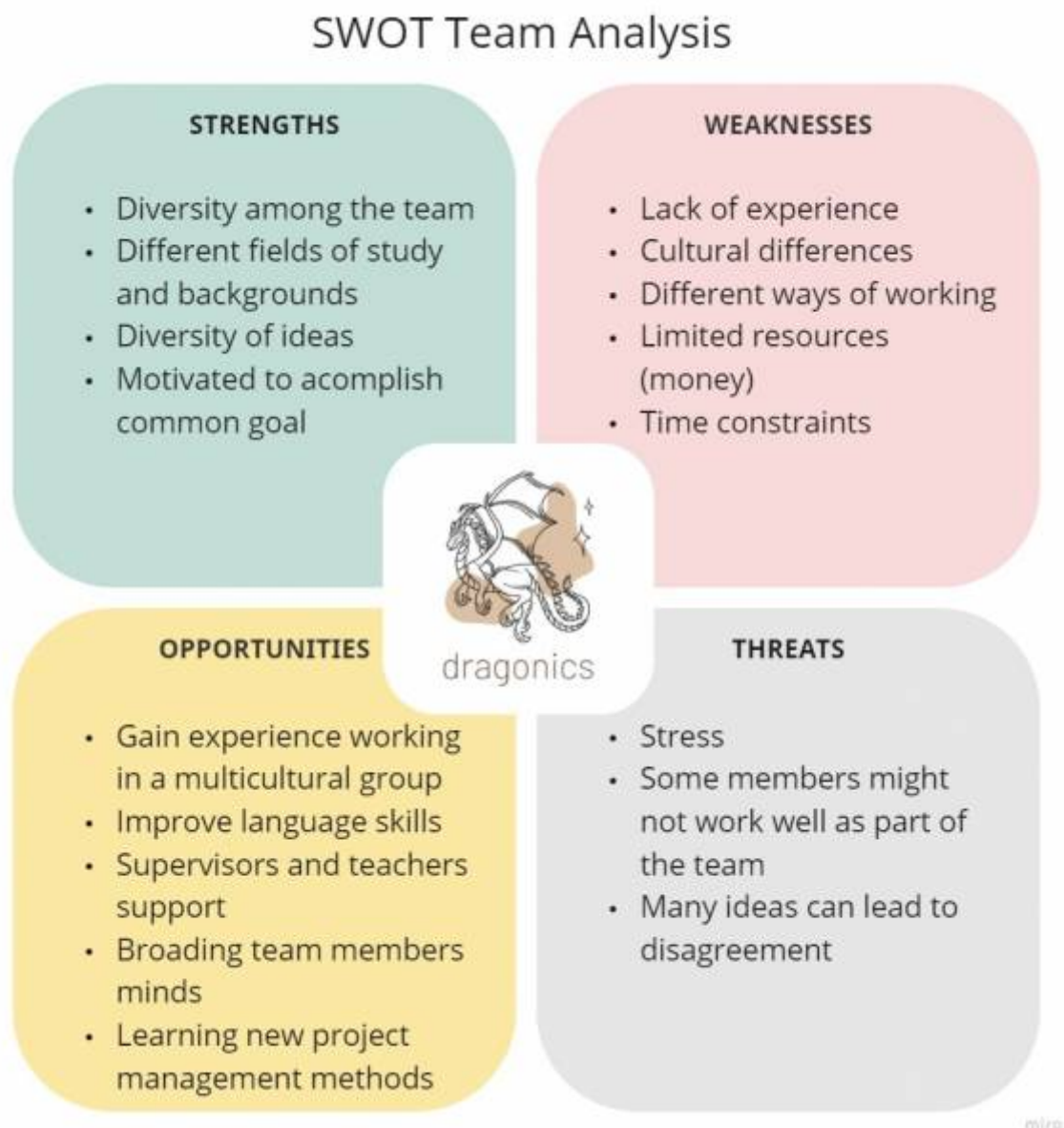


Figure 14: Team SWOT

SWOT Product Analysis



Figure 15: Product SWOT

4.5 Strategic Objectives

4.6 Segmentation

4.7 Strategy/Positioning

4.8 Adapted Marketing-Mix

4.9 Budget

4.10 Strategy Control

4.11 Conclusion

Provide here the conclusions of this chapter and introduce the next chapter.

Based on this market/economic analysis, the team decided to create <specify the type of product> intended for <specify the market niche> because ... Consequently, the team decided to create a product with <specify the features>.

5. Eco-efficiency Measures for Sustainability

5.1 Introduction

Eco-efficiency is a concept that aims to achieve sustainable development, taking into account environmental impact. Eco-efficiency is the combination of the two words “eco” - economics and ecology, in order to combine the value of a product with the environmental impact. The primary goal of eco-efficiency is to increase the net value of a company/product/process and to achieve greater profitability using fewer raw materials or resources to reduce waste and pollution - “Do more with less”. This concept contributes to satisfying human needs and ensuring quality of life without impacting the environment and with minimum consumption of non-renewable natural resources.

Among the aspects to be taken into account when it comes to eco-efficiency are:

- Promote recycling of used materials;
- Reduce energy consumption by goods and services;
- Reduce the consumption of materials by goods and services;
- Minimize the release of toxic substances;
- Expand sustainable use of renewable resources;
- Help educate the public about natural and energy resource management;
- Maximize conscious use of renewable resources, promoting sustainability;
- Extend product durability [\[John R. Ehrenfeld, 2005\]](#).

Sustainable development is a doctrine of economics that assumes a quality of life at a level that current civilizational development allows. The Brundtland Commission (the commission that aims to bring countries together to pursue sustainable development) released its final report entitled “Our Common Future,” which defines sustainable development as “development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.” The Commission successfully unified environmentalism with social and economic concerns on the world’s development agenda [\[27\]](#).

The idea of sustainability is based on the constant search for balance between its three key pillars: social, environmental and economic (Figure 16).

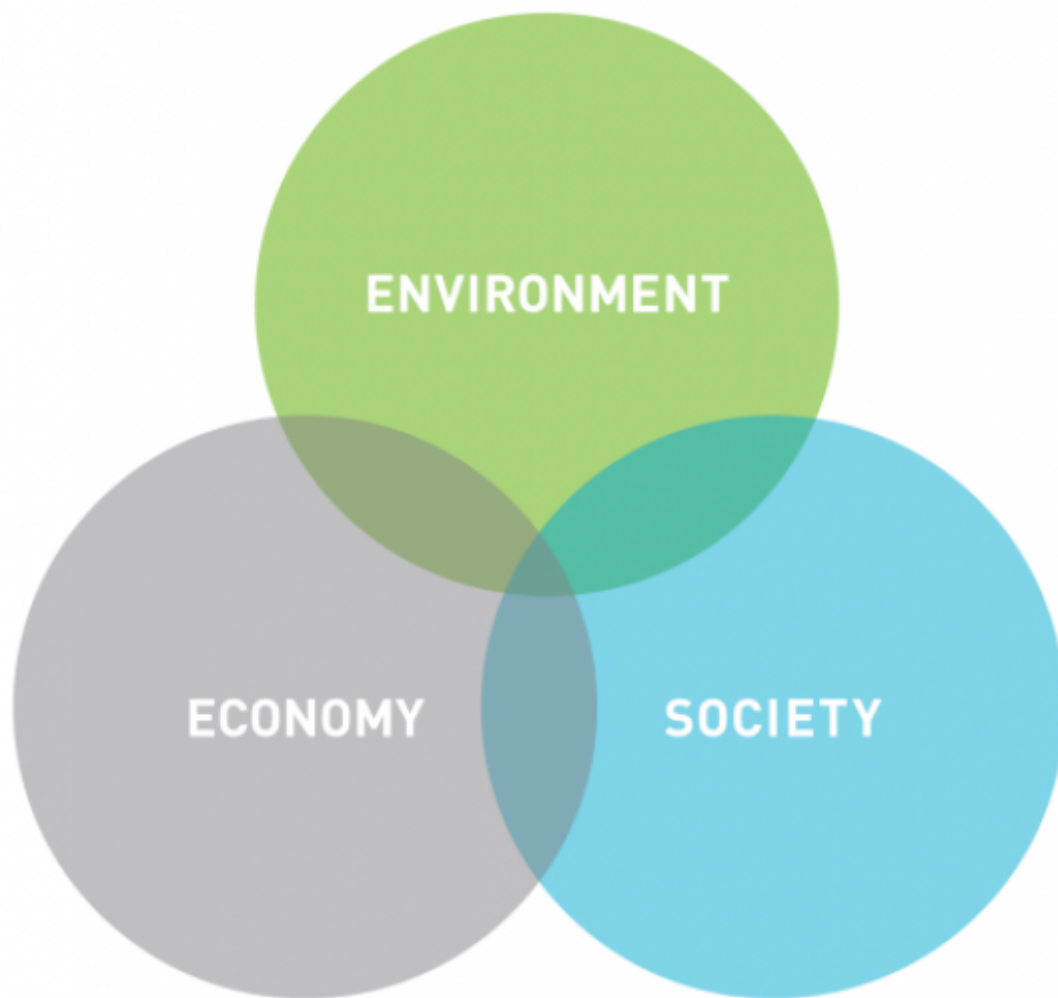


Figure 16: Three pillars of sustainability [28]

Social Sustainability

Healthy communities have fair leaders who provide personal and labor security, and respect cultural rights. All people are protected from discrimination.

Environmental Sustainability

Ecological integrity is maintained when all of Earth's environmental systems are kept in balance; when natural resources are consumed by humans at a rate that allows them to replenish themselves.

Economic Sustainability

Communities around the world are able to maintain their independence and have access to the resources - both financial and others - that are needed to meet human needs [29].

When developing a product, we want to maximize our ideas to achieve an innovative product that not only improves the quality of life for consumers, but is also eco-efficient.

5.2 Environmental

Environmental sustainability is about meeting the needs of present and future generations for resources and services without compromising the health of the ecosystems that provide them, i.e., as a state of balance, resilience, and interconnectedness that allows human society to meet its needs without exceeding the capacity of supporting ecosystems to continually regenerate the services necessary to meet those needs, or diminishing biodiversity as a result of our actions. [\[John Morelli, 2011\]](#)

We can identify several guiding principles that we should follow to ensure environmental sustainability. We can distinguish several main categories: Societal Needs, Preservation of Biodiversity, Regenerative Capacity, Reuse and Recycle and Constraints of Nonrenewable Resources and Waste Generation.

- Societal needs - Don't produce anything that would require future generations to be vigilant; Design products/services that contribute to more sustainable development; Support local employment and fair trade
- Conserve biodiversity - Choose raw materials that maintain the biodiversity of natural resources; Use environmentally responsible and sustainable energy sources and invest in improving energy efficiency
- Regenerative capacity - Maintain harvest levels of renewable resources within the regenerative capacity of the natural system that produces them; keep the rate of depletion of nonrenewable resources below the rate at which renewable substitutes are developed.
- Reuse and recycling - Design with reuse and recycling in mind and think of processes as closed-loop systems that reduce emissions
- Limitations associated with non-renewable resources and waste generation - Keep waste emissions within the assimilative capacity of host ecosystems; develop transportation criteria that will have a low environmental impact. [\[John Morelli, 2011\]](#)

5.3 Economical

“As mentioned in the introduction, both sustainability and eco-efficiency have an economic dimension. Economic sustainability refers to the economic performance and its continued existence. Economic goals concern, for example, improved competitiveness competitiveness or profitability” [\[Cornelius Moll, 2019\]](#). “Eco-efficiency offers a number of economical benefits, such as (Government of Canada, 2013):

- Reduced costs through more efficient usages of energy and materials
- Reduced risk and liability by “designing out” the need for toxic substances
- Increased revenue by developing innovative products and increasing market share
- Enhanced brand image through marketing and communicating improvement efforts
- Increased productivity and employee morale through closer alignment of company values with the personal values of the employees” [\[Lidija Čuček, Jiří Jaromír Klemes, Zdravko Kravanja, 2015\]](#).

5.4 Social

“Sustainability differs from eco-efficiency in considering social aspects. Social sustainability aims at a fairer and more appropriate social system to increase well-being, health, wellness and social equity” **[Cornelius Moll, 2019][V. N. Amrutha, S. N. Geetha, 2020]**. “Concrete measures for organisation and its employees in connection with a product or service can address issues such as better working conditions, development opportunities or an increased quality of life. When it comes to measuring social sustainability there are several criteria which should be taken into account: “self-determined life and mixed work; satisfaction of basic needs; reliable and sufficient security system; equal opportunities, participation, democracy; social innovations; intergenerational equity; objective and subjective basic needs; objective and subjective social resources; objective and subjective equal opportunities; subjective participation; objective sustaining oneself; cultural diversity; and solidarity and tolerance” **[Gregor Schönborn, Cecilia Berlin, Marta Pinzone, Christoph Hanisch, Konstantinos Georgoulas, Minna Lanz, 2019]**. In terms of the value of the three mutually influencing sustainability dimensions, a weak and a strong understanding of sustainability differ. A weak understanding of sustainability is dominated by economic action and relates primarily to the efficient use of resources and the reduction of environmental impacts within predefined, economic guidelines (=eco-efficiency). In contrast, in a strong understanding of sustainability, the economic, ecological and social components are equally important” **[Cornelius Moll, 2019]**.

5.5 Life Cycle Analysis

5.6 Conclusion

Provide here the conclusions of this chapter and introduce the next chapter.

Based on this sustainability analysis, the team chose *<specify here the design, technique(s) material(s), component(s)>* for the following environmental reasons...

6. Ethical and Deontological Concerns

6.1 Introduction

Provide here the summary of this chapter.

“In deontological ethics an action is considered morally good because of some characteristic of the action itself, not because the product of the action is good. Deontological ethics holds that at least some acts are morally obligatory regardless of their consequences for human welfare.” **[38]**

Ethics and deontology are two very important concepts to take into account when creating a product or service. Indeed, every new thing must be able to respect the moral rules that govern our society. It is therefore necessary to ban from the solutions envisaged anything that could physically or morally

harm someone, to try to include the maximum number of users without discrimination

6.2 Engineering Ethics

In this chapter we will look at the ethics of engineering. Each country in the world has its own code of ethics, and even more so each profession has its own rules of ethics. However, the main guidelines are the same and are part of everyone's education. Some examples are: telling the truth, being good to others, not cheating or doing things that we know are wrong to others.

What about engineering?

"Ethics are principles followed depending upon the moral responsibility that a person feels. The study of related questions about moral ideals, character, policies and relationships of people and organizations involved in technological activity, can be termed as Engineering ethics." [39]

An engineer must therefore make ethical decisions because what he creates and produces will have a significant impact on people's lives and safety. The aim being that this impact should be positive, the product or service created must be safe so as not to harm people or at least not to have the vocation of harming the user during use. Furthermore, the engineer must behave ethically in relation to the world around him or her and therefore mainly the environment. Today it is important to avoid creating something that is too polluting, too expensive or inaccessible.

6.3 Sales and Marketing Ethics

As a company we have the ethical obligation to not discriminate any groups of people in our marketing. This means that if we are going to use images as marketing, it's important to include people from all ages, races and genders. When it comes to selling our service, we have an obligation to the municipalities to take care of our products as much as possible and make sure that the city will always have the service they're paying for.

6.4 Environmental Ethics

We have an obligation in today's world to make sure our product doesn't have a big impact on the environment. This can be achieved on multiple levels. On a business model level, materials level and power supply level. We're offering this product as a service, this means that the product stay as the possession of the company meaning we can easily take it back to recycle, repair or refurbish. Using materials that are recyclable, have a low impact on the environment and are biodegradable makes the product way more sustainable. Finally on a power supply level, we're using solar panels in order to power our product and minimize the energy it uses from power sources like coal plants.

6.5 Liability

6.6 Conclusion

Provide here the conclusions of this chapter and introduce the next chapter.

Based on this ethical and deontological analysis, the team chose *<specify here the design, technique(s) material(s), component(s)>* for the following ethical reasons...

7. Project Development

7.1 Introduction

After analyzing all the previous chapters and considering all the features and strategies proposed for product development, in this chapter we will present the evolution of the product and its design, from the first sketch to the final product. Our main goal is to find a suitable public kiosk design that will be interesting to the user, attract their attention and encourage them to play. Once the product is completed, all functionality tests and preliminary simulations will be performed.

7.2 Ideation

Our idea was to combine a public kiosk/display along with a web application that the user will use on their personal smartphone. Figure 17 shows our idea. The user's attention will be caught by the public display and there the service will be introduced. The built-in sensor will detect that a person is in front of the screen and will change the image to encourage the user to interact. The user will use their phone to enter the game and start exploring the city. The public display will be powered by solar panels and energy will be stored in a battery.

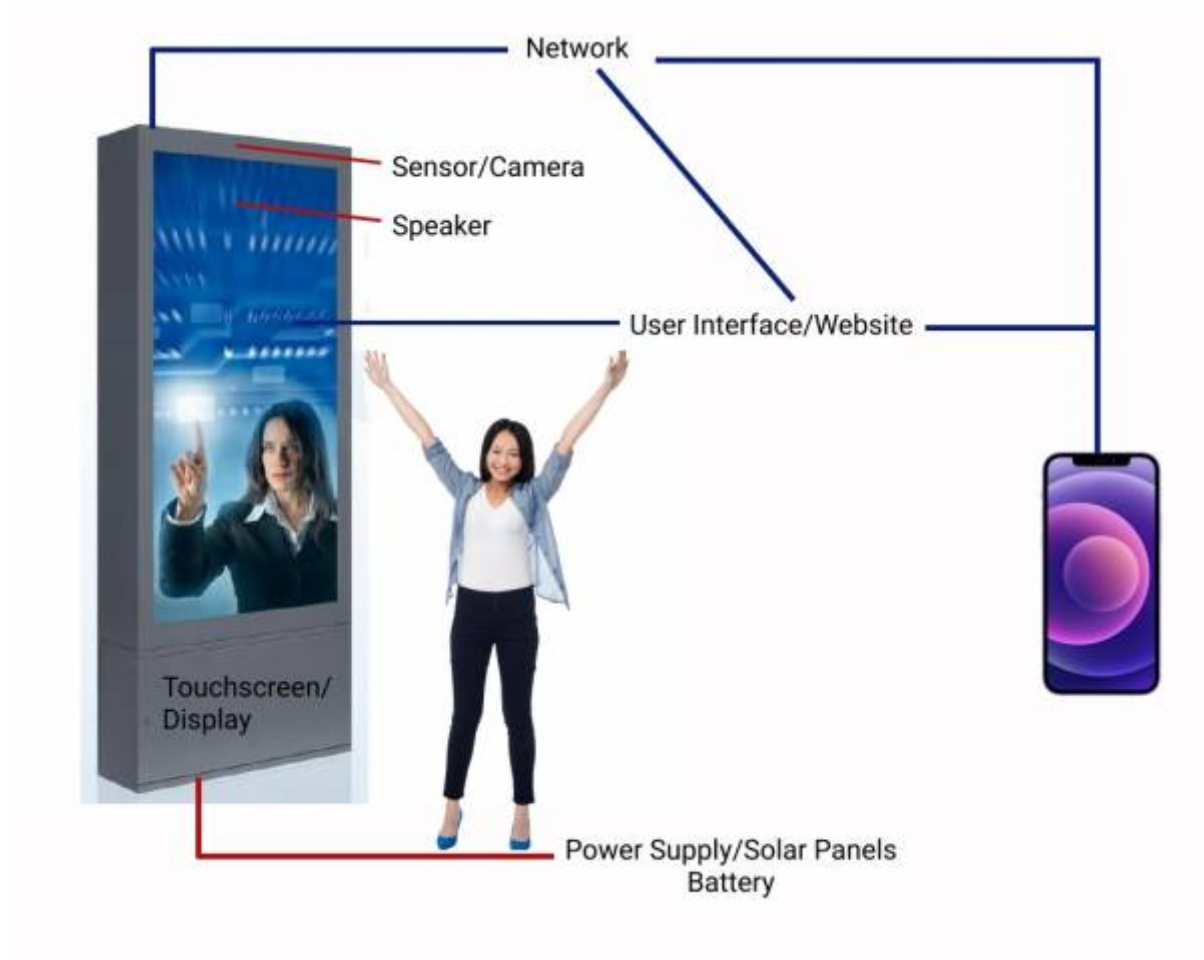


Figure 17: Idea diagram

7.2.1 Black Box Diagrams

A black box diagram is especially focused on the input and output of a system. A black box model receives inputs and produces outputs, but its performance is unknown. Black box models are increasingly used for decision making in financial markets. Advances in technology, especially in machine learning, make it impossible for the human mind to accurately analyze or understand how black box models produce their conclusions. [40]

Figure 18 shows the BlackBox Diagram for Public Space:

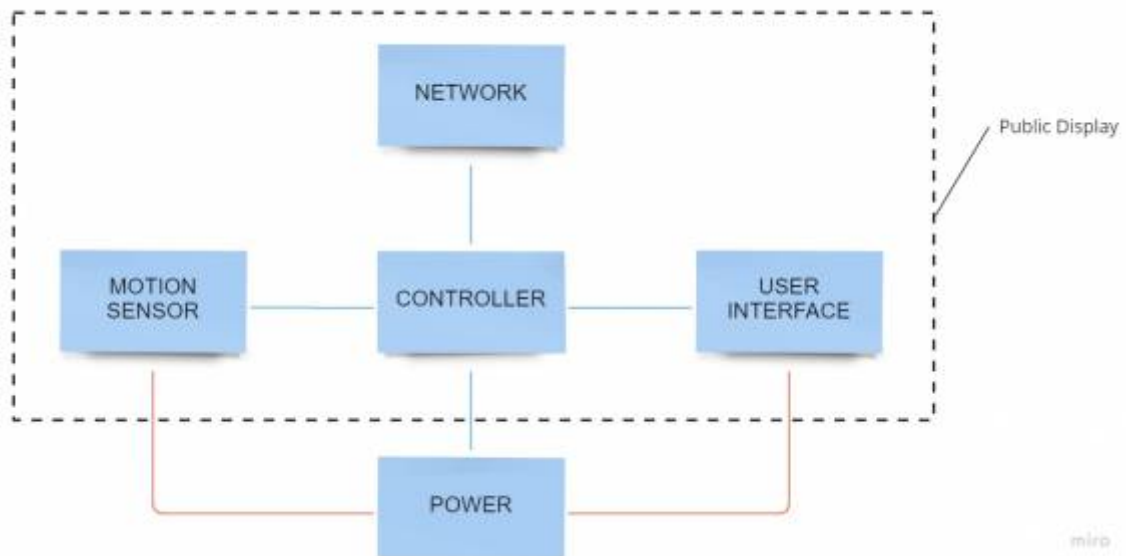


Figure 18: Blackbox diagram for Public Space

Figure 19 shows the BlackBox Diagram for WebApp:

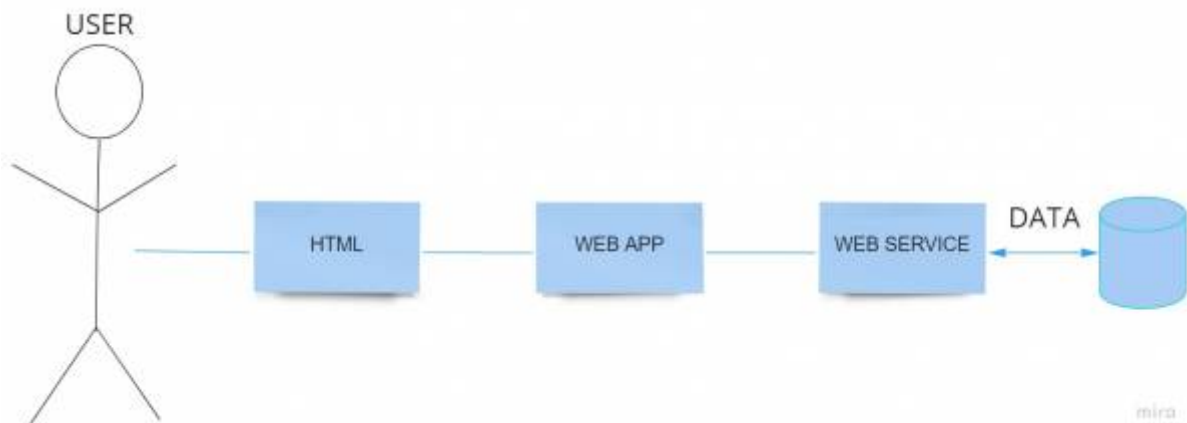


Figure 19: Blackbox diagram for WebApp

7.2.2. First design sketches

The first design sketches that have been made can be seen in Figures 20, 21 and 22. Figure 20 are main first ideas and a collection of a few ideas. Figure 21 is one of the better ideas, it's a classic clean design and will have wooden legs on the side. The design is a little generic and since the screen has to grab attention, a more 'funky' design has been made too. The design is based on a water drop, but upside down. If you look at the screen from the side it's an exclamation mark to grab attention. This can be seen in 22.

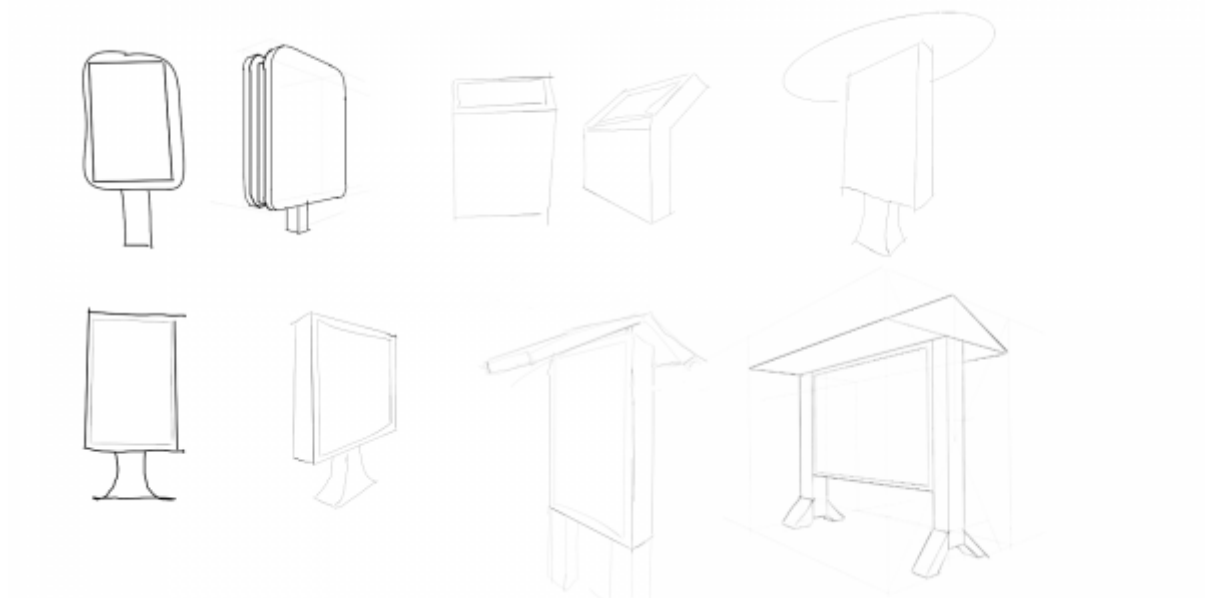


Figure 20: First sketch 1

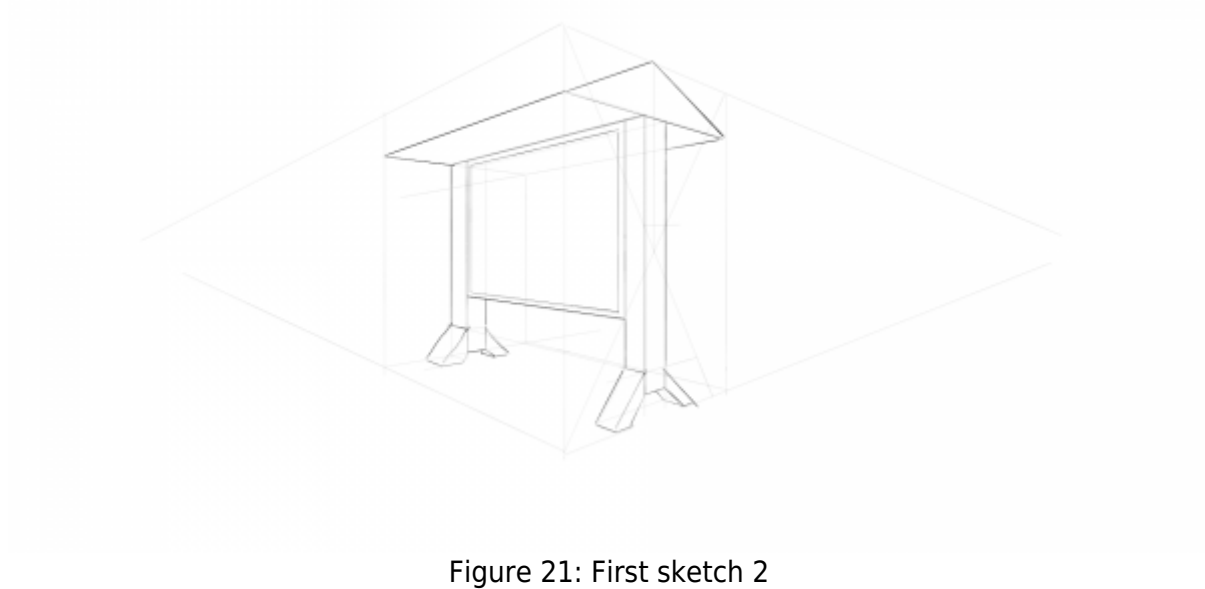


Figure 21: First sketch 2

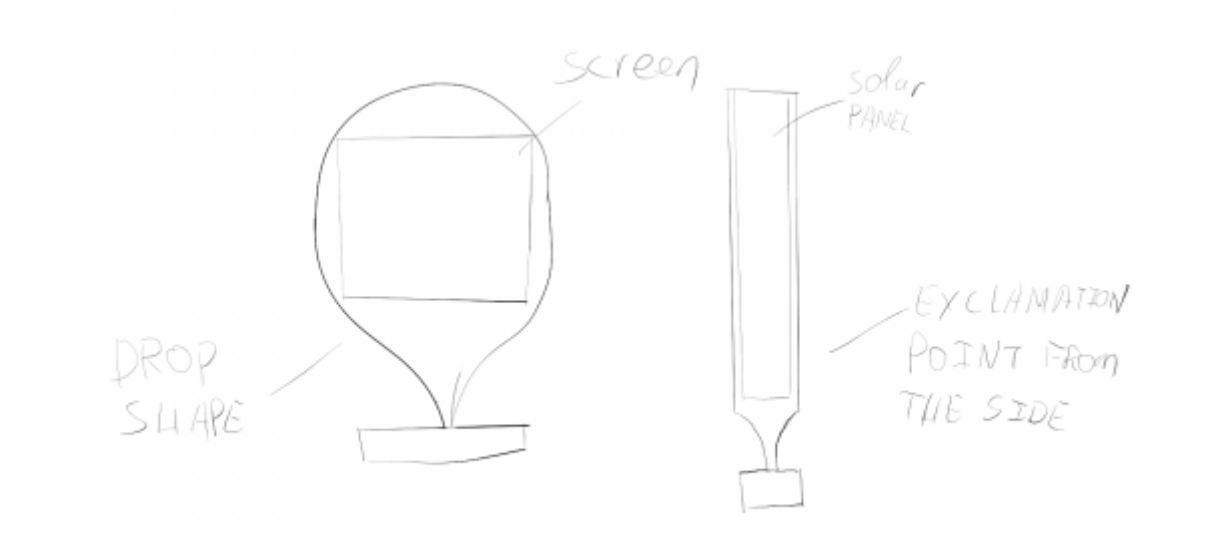


Figure 22: First sketch 3

7.3 Concept

(logo, elements, requirements, concerns and regulations)

Functionalities of Public Display

1	Displaying possible routes
2	Changing languages
3	Giving information about game
4	Choosing the option of game (how many groups are playing)
5	Display QR code to enter game
6	Possibility to see ranking
7	Displaying pictures/text/videos

Functionalities of App/Website

1	Scanning and understanding QR Codes
2	Giving information about location and task/question/points
3	Giving information about success or failure in doing task/answering question
4	Measuring/showing time
5	Counting points
6	Giving clues/help
7	Possibility to skip the tasks
8	Possibility to see the end result compared to the opposite team, as well as placement in general ranking
9	Storing information when phone is closed
10	Possibility to choose voucher after game
11	Game can be stopped at any time
12	Collecting personal data/sign up (e-mails/...)

7.4 Structural Design

(selection of materials, detailed drawings, load and stress simulation tests)

On Figure 23 the first version of the public kiosk can ben seen.

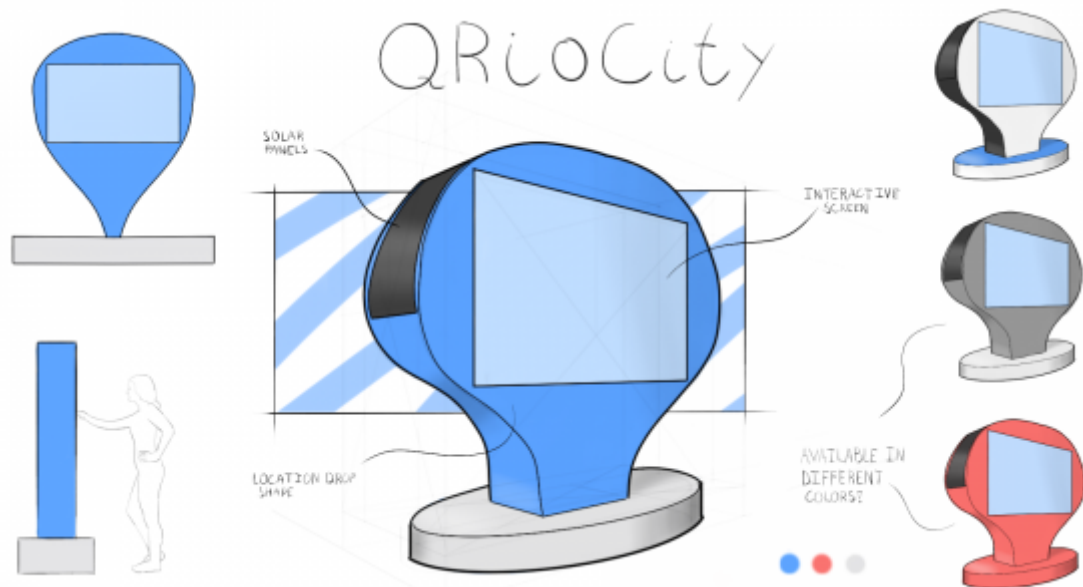
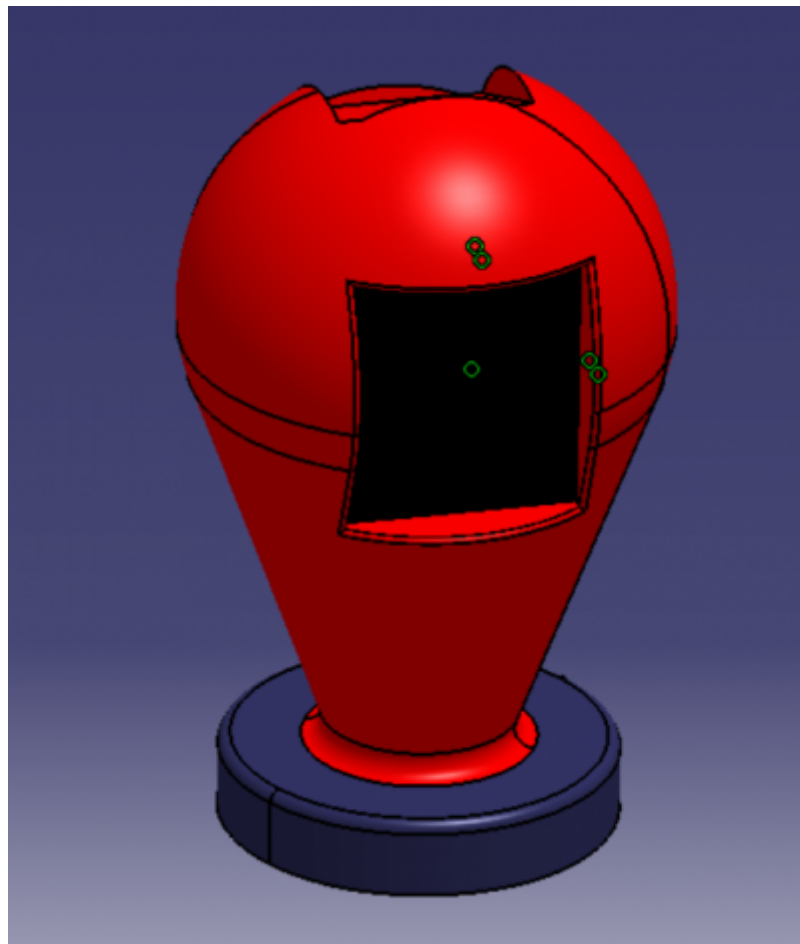


Figure 23: First sketch

On Figure 24 the first 3D proposition can be seen



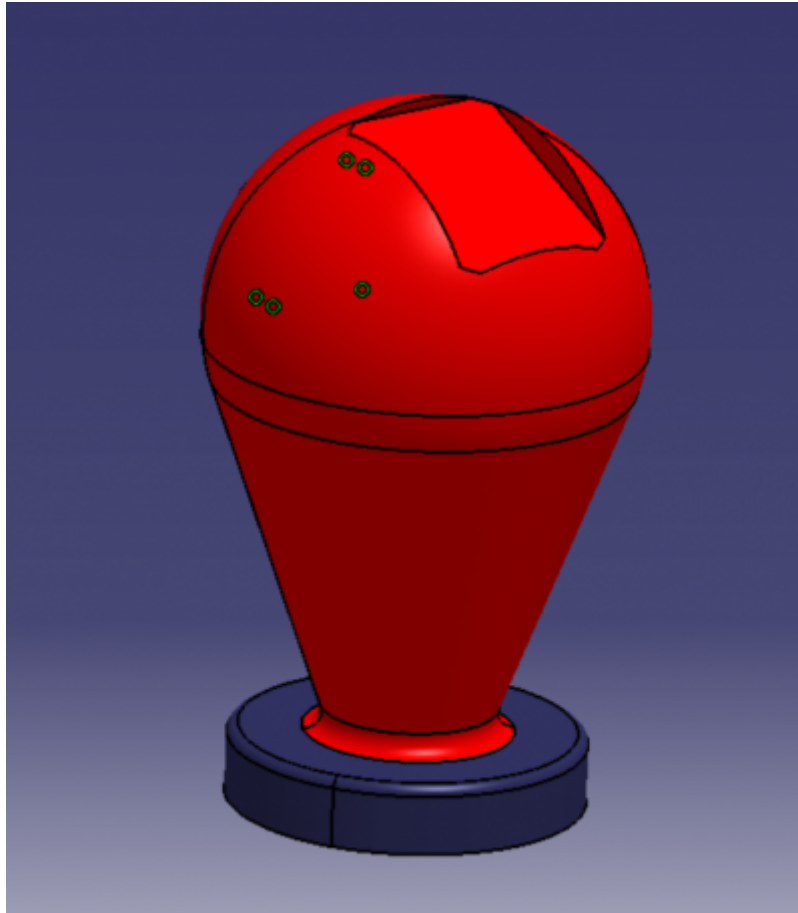


Figure 24: First 3D proposition

7.5 System Design

(choice of components, detailed schematics, simulation)

7.6 Prototype

(in case it is a downsized version of the designed product)

7.7 Tests and Results

7.8 Conclusion

Provide here the conclusions of this chapter and introduce the next chapter.

8. Conclusions

8.1 Discussion

Provide here what was achieved (related with the initial objectives) and what is missing (related with the initial objectives) of the project.

8.2 Future Development

Provide here your recommendations for future work.

Bibliography

Will be added automatically by citing, in the body of the report, entries specified in BibTeX format and stored in the <http://www.epswiki.dee.isep.ipp.pt/doku.php?id=refnotes:bib> file

PS - If you have doubts on how to make citations, create captions, insert formulas, etc. visit this [page](#) with examples and select "Show pagesource" to see the source code.

[Barbara Neuhofer, Mattia Rainoldi, 2016] Barbara Neuhofer, Mattia Rainoldi, 10 2016.

Experience Economy und Digitalisierung im Tourismus: Was wir brauchen sind unvergessliche Erlebnisse. *Tourismus Wissen Quarterly*, 6, pp.259-262.

[Daniela Wagner, Martin Schobert, Georg Christian Steckenbauer, 2019] Daniela Wagner, Martin Schobert, Georg Christian Steckenbauer, 2019. *Erlebnissenese: Bedeutung und Nutzen?*.

Experience Design im Tourismus – eine Branche im Wandel: Gestaltung von Gäste-Erlebnissen, Erlebnismarketing und Erlebnisvertrieb, Wiesbaden: Springer Fachmedien, pp.3-20, ISBN 978-3-658-24513-9.

[3] rani_case-based_2021

[Chenzhong Bin, T. Gu, Yanpeng Sun, Liang Chang, Lei Sun, 2019] Chenzhong Bin, T. Gu, Yanpeng Sun, Liang Chang, Lei Sun, 2019. A Travel Route Recommendation System Based on Smart Phones and IoT Environment. *Wirel. Commun. Mob. Comput.*.

[Ahmadh Kariapper, Pirapuraj Ponnampalam, Suhail Razeeth, A C M. Nafrees, Ahamed Sabani Mohamed Jamaldeen, 2020] Ahmadh Kariapper, Pirapuraj Ponnampalam, Suhail Razeeth, A C M. Nafrees, Ahamed Sabani Mohamed Jamaldeen, 2020. *Influence of Smart Devices and IoT Applications in Tourism: A Survey Analysis*. pp.56-67.

[Xudong Guo, Yuxuan Wang, Jieqiong Mao, Yiming Deng, Felix T. S. Chan, Junhu Ruan, 2021], [Xudong Guo, Yuxuan Wang, Jieqiong Mao, Yiming Deng, Felix T. S. Chan, Junhu Ruan, 2021] Xudong Guo, Yuxuan Wang, Jieqiong Mao, Yiming Deng, Felix T. S. Chan, Junhu Ruan, 2021. *Towards an IoT enabled Tourism and Visualization Review on the Relevant Literature in Recent 10 Years*. *Mobile Networks and Applications*, ISSN 1572-8153.

[Maria Giovina Pasca, M. F. Renzi, R. G. Mugion, Martina Toni, L. D. Pietro, 2020] Maria Giovina Pasca, M. F. Renzi, R. G. Mugion, Martina Toni, L. D. Pietro, 2020. Gamification in tourism context: a systematic literature review. *GamiFIN*.

[Feifei Xu, Dimitrios Buhalis, 2021] Feifei Xu, Dimitrios Buhalis, 2021. [1 Introduction: Gamification in Tourism – The Cutting- Edge Trend in Tourism](#). *Gamification for Tourism*, Channel View Publications, pp.1-10, ISBN 978-1-84541-823-6.

[F. B. P. Prakasa, S. Suyoto, A. W. R. Emanuel, 2021] F. B. P. Prakasa, S. Suyoto, A. W. R. Emanuel, 2021. [Designing mobile application gamification for tourism village in Indonesia](#). *IOP Conference Series: Materials Science and Engineering*, 1098, pp.032033, ISSN 1757-899X.

[George Margetis, Dimitris Grammenos, George Paparoulis, Constantine Stephanidis, 2017] George Margetis, Dimitris Grammenos, George Paparoulis, Constantine Stephanidis, 2017. [Creating a Playful Digital Catalogue System Using Technology-Enhanced Physical Objects](#). *HCI International 2017 – Posters' Extended Abstracts*, Cham: Springer International Publishing, pp.158-163, ISBN 978-3-319-58750-9.

[Kate Galloway, 2018] Kate Galloway, 2018. [Curating the aural cultures of the Battery: Soundwalking, auditory tourism and interactive locative media sound art](#). *Tourist Studies*, 18, pp.442-466, ISSN 1468-7976.

[Partteam \& Oemkiosks, 2020] Partteam \& Oemkiosks, 2020. [The role of digital kiosks in the development of tourism](#). *PARTTEAM \& OEMKIOSKS Blog*.

[ProjectManagementInstitute, 2008] ProjectManagementInstitute, 2008. [Risk analysis and management](#). [Accessed in April 2021].

[16] noauthor_questo-logojpg_nodate

[17] noauthor_logo-enigmas__transparentpng_nodate

[18] noauthor_logotipo-06png_nodate

[19] [GooseChase Blog](#). *GooseChase Blog*.

[20] [Actionbound](#).

[21] Geocaching. [Geocaching](#). *Geocaching*.

[22] Streetography. [Streetography](#).

[23] PokÃ©mon GO. [PokÃ©mon GO](#).

[24] [Tripadvisor: Over a billion reviews \& contributions for Hotels, Attractions, Restaurants, and more](#). *Tripadvisor*.

[25] PARTTEAM. [PARTTEAM \& OEMKIOSKS \textbar Digital Kiosks For The World](#). *PARTTEAM \& OEMKIOSKS*.

[John R. Ehrenfeld, 2005] John R. Ehrenfeld, 2005. [Eco-efficiency Philosophy, Theory, and Tools](#).

[27], [28], [29] MCGILL. [What is sustainability?](#). 2017. [Accessed in April 2022].

[John Morelli, 2011], [John Morelli, 2011] John Morelli, 2011. [Environmental Sustainability: A Definition for Environmental Professionals](#). *Journal of Environmental Sustainability*, 1, pp.1-10, ISSN 21592519.

[Cornelius Moll, 2019], [Cornelius Moll, 2019], [Cornelius Moll, 2019] Cornelius Moll, 2019. [Nachhaltige Dienstleistungsinnovationen in der Logistik: Ein Ansatz zur Entwicklung von Entscheidungsmodellen](#). Wiesbaden: Springer Fachmedien Wiesbaden, ISBN 978-3-658-28037-6 978-3-658-28038-3.

[Lidija Čuček, Jiří Jaromír Klemeš, Zdravko Kravanja, 2015] Lidija Čuček, Jiří Jaromír Klemeš, Zdravko Kravanja, 2015. [Chapter 5 - Overview of environmental footprints](#). *Assessing and Measuring Environmental Impact and Sustainability*, Oxford: Butterworth-Heinemann, pp.131-193, ISBN 978-0-12-799968-5.

[V. N. Amrutha, S. N. Geetha, 2020] V. N. Amrutha, S. N. Geetha, 2020. [A systematic review on green human resource management: Implications for social sustainability](#). *Journal of Cleaner Production*, 247, pp.119131, ISSN 0959-6526.

[Gregor Schönborn, Cecilia Berlin, Marta Pinzone, Christoph Hanisch, Konstantinos Georgoulis, Minna Lanz, 2019] Gregor Schönborn, Cecilia Berlin, Marta Pinzone, Christoph Hanisch, Konstantinos Georgoulis, Minna Lanz, 2019. [Why social sustainability counts: The impact of corporate social sustainability culture on financial success](#). *Sustainable Production and Consumption*, 17, pp.1-10, ISSN 2352-5509.

[38] *deontological ethics* \textbar Definition, Meaning, Examples, \& Facts \textbar Britannica.

[39] *Engineering Ethics - Quick Guide*.

[40] *What Is a Black Box Model?*. Investopedia.

From:

<https://www.eps2022-wiki3.dee.isep.ipp.pt/> - **EPS@ISEP**

Permanent link:

<https://www.eps2022-wiki3.dee.isep.ipp.pt/doku.php?id=report>

Last update: **2022/04/19 13:51**

