Mobility Solution:
Gamification as a way to induce behavioural change in mobility (Madeira / ARDITI)

MADEIRA

INFORMATION AND COMMUNICATION TECHNOLOGIES AS AN INTEGRATED TOOL

IN BRIEF

CIVITAS-DESTINATIONS partner ARDITI aims to promote a sustainable transport mode through gamification and interactive experiences. This solution is called MARGe – Madeira Gamification Experience, and is available for the 2 major mobile phone platforms.

For whom is this article intended?

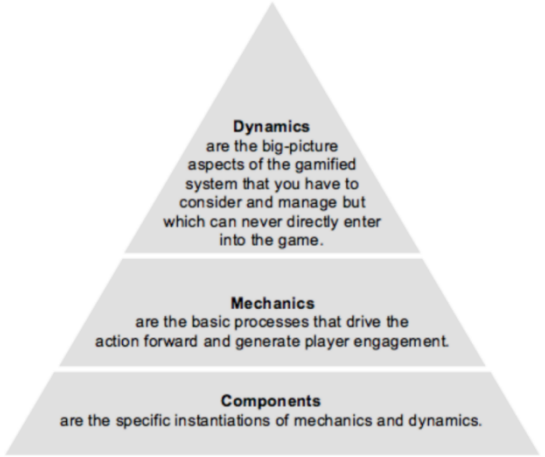
This solution offers a different experience **Cities, Municipalities and Regions** that want to induce behavioural change in mobility, offering a different experience to their customers.

This document provides an overview of the application, including its Features, Game Elements, Technical information, passive location tracking and Usability tests that were performed.

Overview: topic of CIVITAS-DESTINATIONS project being addressed

Under CIVITAS-DESTINATIONS project measure MAD6.1 (Madeira - Gamification as a way to induce behavioural change in Mobility) aims at using gamification techniques in order to motivate users to use the application. This measure is being implemented by the means of a mobile application, that resembles a mobile game, and using specific gamification techniques, it motivates users to use the bus to travel between locations, fostering a reward feeling.

Overview: Game Elements

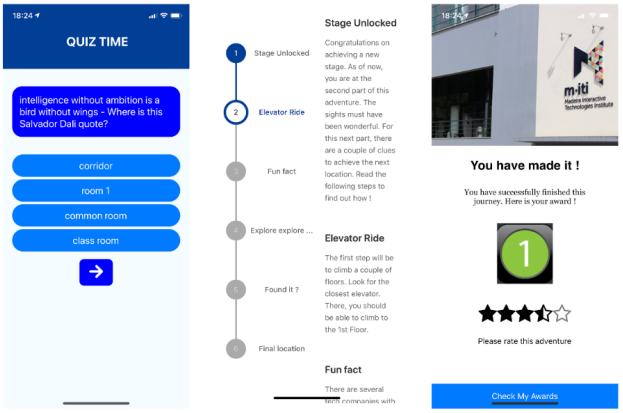


To create something that benefits from the advantages of gamification, we had to understand how game elements work, and how these influence users. In MARGe, we took advantage of some dynamics and mechanics from game design. The application benefits from having a narrative, by making each adventure a story, and progression, by providing an awards page and a summary page of the total progression.

Regarding mechanics, the part that is responsible for creating engagement with the users, we have Regards, obtained for performing tasks, Resource Acquisition, by creating different Easter eggs in the application, and challenges, by implementing a

set of clues to obtain an answer and advance onto the next stage, but also by implementing a quiz in each adventure.

Lastly, we have the components, the visual component of the elements. Since these are the state the elements take, we have several different implemented, from levels, badges, to achievements and leader board to compare results and foster competition.

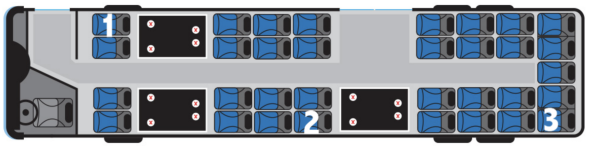


Overview: Passive Location tracking

Since the beginning, there was the intention of integrating short-range wireless communication technologies, based on radio signals. These would be used as locators for the application, by creating interaction with the user. At the time, three different technologies were discussed. The project would either beneficiate from Near Field Communication (NFC), the communication protocol that works at a short distance, Radio Frequency Identification (RFID), which resembles NFC, except that it does not have to be in a line of sight, and the iBeacon protocol. While the use case was not sufficiently refined at the time, the decision could jeopardise how dynamic the app would be. This technology would have to be compatible with react native, reliable and also work on different environments such as high-temperature scenarios, crowded places or high precision location situations. Although the first two were interesting, they would require interaction between the users mobile phone and the NFC/RFID tag, making it unreliable in case the user was far away from the tag. The decision was for the iBeacon protocol, but a modified version, with added features.

Developed by Estimote, the estimote proximity and sticker beacons, are relying on location and feature exclusive cloud access to make bulk changes to every beacon. Ranging from 7 to 30

meters, the beacons also include NFC, temperature and motion sensors. The usage of external hardware is crucial to connect the application(user) to the location(beacon). We are using Bluetooth Low Energy Beacons to assist on adding interaction in the app.

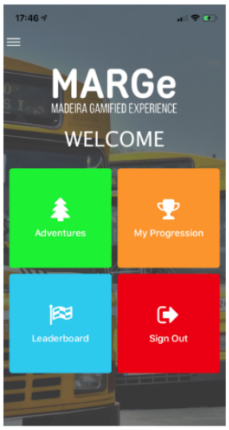


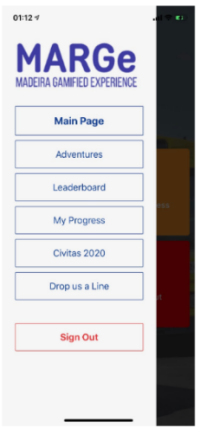
We have tested these devices inside different bus models. The beacons were installed at the bus station, so that nobody would tamper with each beacon inside the bus. For each beacon location, there were 2 beacons, one sticker and one beacon. The test would compare both beacon emissions at a certain time, being both at the same specific place. Using a beacon scanner, the vast amount of data would then be analysed to understand how the beacons reacted to the environment. The results were positive. For the estimote proximity beacons, there is a significant number of broadcast beams for the observation time. With each trip having a duration of between 20 and 40 minutes, having between 7.50 and 10 broadcasts per minute is more than sufficient to detect that the player is inside the bus, and heading to the place where the adventure takes place. As these results show, if there is passive tracking inside the bus, then it is required to have at least two estimote stickers inside the bus, or one estimate proximity beacon since these have a stronger signal.

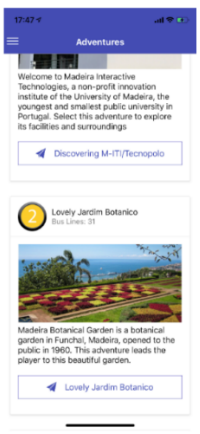
Overview: Description details of this solution

MARGe
MADEIRA GAMIFIED EXPERIENCE

Of several different names and acronyms that were thought to this application, the one that obtains consensus was MARGe. The idea was to have a name that connected with the island of Madeira, but also that reflected gamification. MAdeiRa Gamified Experience was the result. MARGe is an android and iOS application, compatible with Android 8 and iOS11 and above. We have implemented a secure authentication process, based on Google's Firebase, and added compatibility with the Estimote proximity beacons and the iBeacon protocol. MARGe is heavily based on gamification techniques.

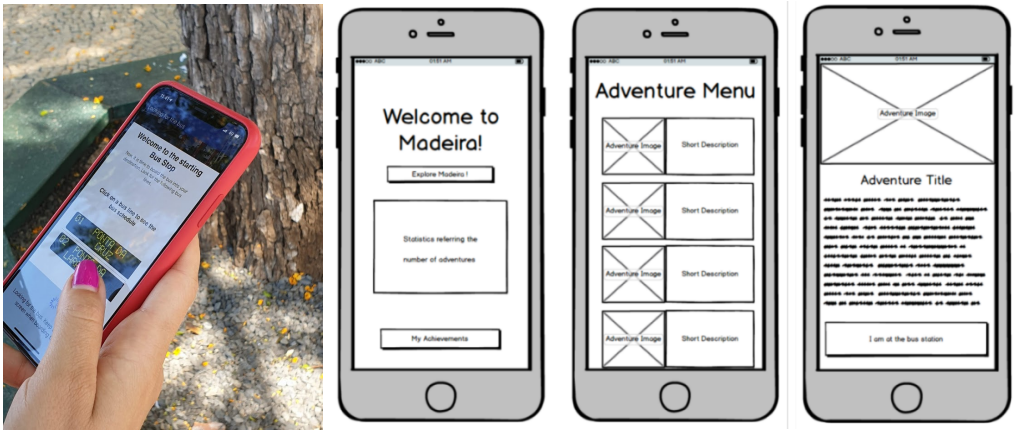






Overview: Technical information

This application was developed using a JavaScript framework called React Native. With this, we can follow the CORA – Code Once Run Anywhere rule and develop for Android and iOS at the same time. The application is programmed to load all content from the internet, to make sure it is easily updatable, without requiring new installations for most updates. This truly is an advantage on the final application size.

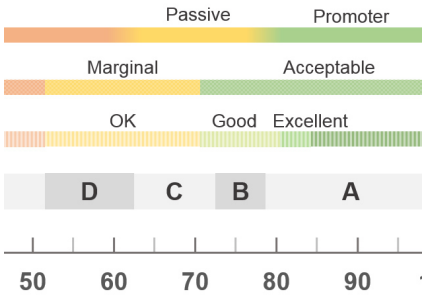


Usability Tests

We have obtained 8 different usability tests. For the different tasks, there is a big difference in the observed values and variation.

- For the first task, where the goal is to perform a simple action that requires pressing a button, the values range from 7 seconds to 32 seconds, where the average is of 15 seconds and the deviation of 8 seconds. There was only 1 error in 1 test, and it was unintentional. The user told the right name but mistook the button.
- For the second task, where the goal was to complete an adventure, going through every stage of the adventure, and waiting for the beacon detection, the results were positive. The average time for this task was of 4 minutes and 54 seconds, with a deviation of 1 minute and 33 seconds. For this test, there was only 1 error at one screen, when a user, after completing a question on the quiz, wanted to go back and change the selected option. This is a bug that should not happen, and the feedback was of high value.
- The third task was a simple one, yet, it actually led to some error making. The task consisted of checking the overall percentage and score. This involves accessing the Awards screen. For most users, the task was completed successfully in no time, but for some users, this was a difficult task, leading to up to 2 errors. Some users opened every screen until finding the percentage, while others simply chose the right button in the first try. The average time for this task was of 16 seconds, with a deviation of 9 seconds. The average number of errors for this task was considered high, as it reached 0.8, with a deviation of 0.92. This was due to the users that searched for the feature, pressing the different buttons in the main page.
- For the last task, where the users had to look for the feedback screen, the average time for this task was of 1 minute and 38 seconds, with a

deviation of 54 seconds. The feedback feature is regarded as a secondary feature, although important, and was moved to the side menu, instead of being in the main page. This was on purpose not to clutter the main menu. Due to this, the expected number of errors was higher than in the previous tasks. The average number of errors for this task was of 1.7, with a deviation of 1.83. Most users completed the task successfully with zero errors, yet, there are users making 2, 3 and 4 errors, while looking for this feature



We have also obtained 8 different answers on the SUS. The System Usability Scale test has determined a percentile ranking with the value of 83, which, according to the general requirements for the SUS, is graded as A, being on the Promoter level, and also on the Acceptable level. As for an overall appreciation, these results are on the border between "Good" and "Excellent"

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