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Trip 4 All: A Gamified App to Provide a New Way to Elderly People to Travel

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Abstract

Older adults have much to gain from bringing technology into their daily lives. The extent to which this is possible strongly depends on careful design and accessible, easy to use products, developed using an elderly centered methodology. The senior tourism is a market in expansion and the old travelers need new and innovative technologies to help and support their trips. These technologies should contribute to a fun and safe experience, while promoting feelings of pleasure and self realization. In this paper we follow this design approach and put it to the test in developing the “Trip 4 All”(T4A), an application that works as a gamified virtual assistant to the elderly during a walking tourist visit. The gamified interaction with the visited environment intend to improve motivation to accomplish the visit and make the content absorption more fun and easier. The T4A works on georeferenced maps where the users’ geoposition is a trigger to launch storytelling content and/or challenges based on the aspects of the visited site as such: geographical, art, religious, historic, cultural and human. The success in the challenges give the user prizes, new resources and abilities to try more complex challenges that brings more valuable prizes and so on. Furthermore, the proposed application intend to work as a companion that provides self confidence, support and social integration to elderly tourists.

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1. Introduction

1.1. Concept of Senior Tourist

The World Tourism Organization¹ defines tourists as people “traveling to a country other than that in which s/he has his/her usual residence but outside his/her usual environment for a period not exceeding 12 months and whose main purpose of visit is other than the exercise of an activity remunerated from/with the country visited, and who stay at least one night in a collective or private accommodation in the country visited”¹.

The age at which a tourist is defined as senior is no consensus among authors and organizations. Alén² defines senior tourist as tourist with more than 65 years, but other institution define a senior tourist as a tourist with more than 50, 55 or 60 years. This age is associated with the decrease of professional activity and family responsibilities as caring for children.

1.2. The Elderly Tourism and Traveling Market

Currently more than 128 million citizens in the European Union are aged between 55 and 80 years, representing about 25% of the total population³. Worldwide, the proportion of people over 60 years is growing as a result of the decline in fertility rates and increased life expectancy, due to improvements in nutrition, in basic care and health care, and control of many infectious diseases⁴. The increase in the number and proportion of elderly is accompanied by a change in the age structure of the population. It is expected that in 2050, globally, the number of elderly will exceed the number of young people under 15 years⁵. All European countries are facing a similar demographic trend³.

This demographic development is having a considerable impact on the increase of the tourism demand⁶.

During the recent economic and financial crisis in Europe, the over 65 age group significantly contributed to counterbalance this negative impact: between 2006 and 2011 the number of tourists dropped in all age groups except for the over 65, posting a 10% increase over 2006⁶. In 2011, the over 65 group made 29% more trips and 23% more overnight stays than five years earlier. Their tourism expenditure grew by 33% and accounted for 20% of all tourism spending of Europeans, compared with just 15% in 2006⁶.

At the same time, the senior touristic market quota is in expansion, and it is going to be even more accentuated in new generations, in contrast with the major part of the present older population, being much used to travel, which shall be reflected in their future behaviors, even in more advanced ages⁷.

In general, older people in retirement ages have more free time and are willing to spend it on tourism. Increasingly, as a result of the changes in health care and society, seniors are healthier and wealthier than in previous generations in many European countries. Besides that, the tendency is that this population show an increase in savings and assets with fewer financial commitments, especially in the early years of retirement. They also tend to be increasingly quality conscious and demanding, particularly committed with safety, responsible and sustainable services and infrastructures. Nevertheless, there are also seniors with less purchasing power and seniors with health problems. In fact, seniors are rather a heterogeneous group of individuals with different needs and motivations⁶.

Seniors are more flexible in travel patterns and take advantage of low seasons offers that appeal senior travellers, such as less congested facilities and lower prices⁶. Nowadays seniors present a much more agile profile, much wider interests and a bigger desire to experience new things, until an advanced age.

The European Commission considers that the contribution of senior citizens to the European tourism industry is indeed significant and should be reinforced to face the challenge of seasonality, stimulating economic growth and jobs in Europe³. This is still a new market area as just 3 out of 10 senior European citizens travel abroad. Therefore there is clearly a high potential for increasing the number of travels undertaken by this segment of the market⁶.

The motivations more frequently referred on behalf of old people to enjoy holidays are: get away from routine, rest and relax, social motives /socialize (as well as to do new friendships as to be in family), as well as cultural motives (to enlarge horizons, visit new places, experience new things) and the carrying out physical activities, mainly outdoor⁸.

1.3. The Traveling Experience

The creation of more services and tourist activities, including individual and group tourism, is a necessity at the destinations during the low and medium seasons⁶. The tourist demand of the elderly focuses on varied types of tourism.

In terms of traditional tourism the most common are: cultural, urban, religious, rural, cruises and health/thermal tourism⁹. On the other hand, there is also a kind of tourism whose character, in the case of senior tourism, can be considered innovative: adventure tourism, eco-tourism, trips for tourists with special medical needs, educational trips and inter-generational travel.

The strong potential of this tourism segment requires a differentiated and appropriate approach by the tourism industry and other intervening factors in the development of this sector. This approach should be supported by a thorough knowledge of the characteristics, needs and expectations of older tourists. A diversified combination of activities that include, among others, activities that promote the knowledge of culture of the visited destination, activities that encourage a high interaction and social interaction and open door activities.

As travelers get older, they tend to become less self-confident, more apprehensive and concerned about safety and unexpected changes in travel arrangements. Elderly travelers prefer to travel with escorted and credible groups. Permanent accompanying of seniors by people with training in languages and that have a good knowledge of the spoken language in the visited destination and the own destination may also be appreciated by the senior population⁸. In this situation, a virtual companion that works as a virtual assistant for the travel seems to be a good strategy.

1.4. Why Gamification?

Considering the report published by Gartner Group in 2012⁴, by 2015 more than 50% of innovative organizations will use gamified process, and more than 70% of the biggest organizations of the world will use, at least, one application based in games in their business. This report, calculated the gamification market in some about US \$2.8 billion dollars^{10,11}. The authors of this paper did not find any report of Gartner Group confirming or refuting this prediction, but the game market is rising substantially in the past years and, with this growth, the term "gamification" became a very important subject when the discussion is about people's motivation.

The Y generation phenomenon (people born between years of 1980 and 2000) is not new and is a challenge for educators as for CEOs. This people was raised playing games and using the game thinking in a lot of life fields, and represent something about 25% of economically active population. Nowadays they are leading some companies in the world and, for them, think about a game as a business process is not something unreal or unexpected^{11,12}.

Gamification refers to the process of using game thinking and game mechanic for traditional solving problem process or for engaging. In other words, it is the use of game elements in a non-game context. The use of these techniques has became common to achieve behavioral changes especially when it comes to encouraging people to adopt new technologies and/or methods to accomplish their tasks. This is forcing to change the traditional model of design focused on functionality for the design focused on human needs. Unlike the game design aimed at the sole purpose of entertaining, the gamification intend to use the mechanism of the games to transform or develop new behaviors^{11,12}.

Johan Huizinga¹³ established that the act of play is set in the most diverse social relations, such as politics, work, poetry and even the nature. Thus, the game is a cultural element which is much more than a physiological phenomenon or a psychological reflection¹⁴.

According to Maslow's hierarchy of needs theory¹⁵, gaming could be related to the top position since it is classified as a desirable activity, but not essential for survival. Ysmar¹¹ points out: "it is understandable that we have created games, as they quench more easily, quickly, and efficiently clear this constant search that plagues us for securing or meet goals when our relations and day by day work is composed by fuzzy rules, no feedback and rewards that are too small or normally absent". Bernard Suits, in his book The Grasshopper: Games, Life and Utopia¹⁶, says that "playing a game is the voluntary attempt to overcome unnecessary obstacles"

For the design of an application for the senior tourism it is perceived that the target audience is not defined in the data presented above. This population certainly did not have access to various technological equipment which their grandchildren are familiar. These people however also had their childhood and also had times when games were very important things. Within this context and considering the fact that the technology is now an everyday factor in everyone's life, the development of an application whose experience provided to elderly users is fun, engaging, intuitive, motivating and socializing, is a real challenge. But, from the point of view of an active aging process, is a challenge that will decrease the technical gap between them and their grandchildren.

1.5. An Alternate Reality Game

As mentioned before¹⁵, the games are connected to the search of the human being by the feeling of satisfaction and happiness. Therefore, the inclusion of gamification in daily activities can be a way to provide to individuals a set of good experiences, basic condition for what is known as happiness^{17,18}.

McGonigal¹⁹ describes three basic attributes of the rewards found in games that meet the requirement of meeting basic psychosocial needs of human beings:

1. (More) Satisfactory Work: the tasks offered in games are oriented by clear goals, achievable and motivating on which it is always possible to see the direct impact of the efforts. This relates to the persistent and obstinate behavior shown by players. This type of behavior faces failures as necessary steps to achieve victory and not as a failure situation.
2. Social Connectivity: possibility of creating social ties among participants. This feature is common in online games where users form communities.
3. Adherence to socially relevant projects: associated with the communities, raise collaborative sense to join forces in favor of the major causes instead of personal interests both within the fictional universe of games like in the real universe of players

Since our users are elderly from whom is not expected knowledge or use of current technology, the choice of games that can work together real and virtual reality seems to be the best for obtaining the engagement of these new players. These kind of games are called Alternative Reality Games (ARGs) and they are considered an interesting way to conduct a gamification of some real activity or task.

The purpose of the T4A is to encourage and motivate the elderly to create the behavior (or change an existing one) to visit tourist sites on foot. In other words, the ARG used as a process of gamification has the main objective to get the engagement and motivation of the elderly user. For this to happen it is necessary to understand the reasons why the games get a motivated and engaged behavior of its members, and for that, the BJ Fogg's Behavior Model (FBM) was used²⁰. It is a valuable tool for determining why people react in certain ways, or even why they fail to react in the manner expected. As Fogg notes: "if users are not performing a target behaviour, such as rating hotels on a travel web site (or completing an eLearning course), the FBM helps designers to see what psychological element is lacking".

According to the FBM there are three key elements involved to influence the activation of a targeted behavior: motivation, ability and triggers. The activation demands that these three elements are provided simultaneously²⁰.

Users may be able to solve a problem, but if there is no motivation for them to do so, why should they? The user can be motivated but this is absolutely not sufficient to do something he/she is not capable of (ability). But motivation and ability alone are not enough to determine behavior. There is the need of something that prompts the user to complete a certain action within a defined time-frame (trigger).

1.5.1. The T4A Gamification

The gamification process of the application T4A is based on a platform called RPGT4A. The RPGT4A is a platform for development of Role Playing Games (RPG)²¹ that can be used as a tool to support the process of engagement of people, preferably elderly, in virtually assisted touristic tours by foot.

The platform consists of a set of hierarchically interlinked georeferenced maps. The application interacts with the player using the tourist real time location provided by the geolocation smartphone system. The maps are divided into several areas of interest that make the interaction occur. Each area of interest may be related to multimodal storytelling information based on text, sound, image or video, as well as related to challenges.

The exploitation of the areas of interest of the maps will cause the application to give the player the possibility to have access to information and challenges based on a story that takes into account geographic, artistic, religious, historical, cultural and human aspects of the places that are been visited. The success in the proposed challenges is rewarded with points, improving the player score and unlocking new and more complex challenges to access more valuable prizes. Thus, the character that represents the player (avatar) is improved at each step with more resources to help address the new challenges presented.

The challenges are considered as minigames coupled to the main application, allowing each challenge to be treated as an independent application. That is, respecting the communication protocol between the main application and the

minigame, generic challenges may be attached to the platform without any changes in the core application. This flexibility allows the same content to be approached by many different challenges whose creation can be left to third parties. This allows not only strengthening of the content but also the diversity that makes the activity becomes interesting to play.

The main application will use a multiagent system based on agents with affective perception focus implementing a virtual assistant^{22,23,24}. Based on the user's profile and context (environment), this virtual assistant will offer the help needed by the user during the visit including personalized information on the site visited. The agents with affective perception focus allows customization of agent behavior to make it compatible with each user's profile. Additionally, the assistant will be based on the multimodal architecture presented by Teixeira²⁵.

1.6. Related Works

Applications using the user's geoposition as a trigger are not new as the REXplorer project²⁶ demonstrates. This is an interesting project of a pervasive game for tourists. Following the experience developed on 2007 and 2008 in the city of Regensburg, Germany, some guidelines that helped the design of the T4A were found, as such: about the sequencing problems of storytelling associated with the site seeing, the hot zones associated with the georeferenced map and the importance of the game not became more important than the touristic view. The T4A developed an platform to store all the information about the storytelling and the challenges using these guidelines. The result was a platform that allows use the application in any site and with different gamification processes. Furthermore, The T4A application was developed using the elderly centered design and work as a customized virtual assistant.

Others expiriences that worth to be cited are the Travel plot Porto²⁷, the Tripzoon project²⁸ although it is not directed to tourists, but it is about walking behavior, and the applications JITT City Guides¹ developed by iClio² that works as managers for audio storytelling content. All these works use gamification to improve the user's experience but none of them were developed using an elderly centered design and, also, none of them intent to be a customized virtual assistant for the user.

2. Elderly Centered Development Method Over the First Prototype

The development method was made according with a three phase spiral: obtaining the requirements (phase 1), prototype creation (phase 2) and evaluation (phase 3). This iterative methodology continues with additional cycles of requirements, prototypes and evaluations towards an increasingly refined application as shown in Figure 1.

Each phase of the development method was accompanied by a specific evaluation process based on the methodology described in²⁹. This evaluation methodology consists in submitting each phase (requirements, prototype and evaluation) to a evaluation process based in the following steps: conceptual validation, prototype test and pilot test.

In what follows, a general description of the overall aspects involved in each of the phases of the development method is described below.

2.1. Requirements

This phase intended to verify if the idea of the T4A was sustainable in terms of functionalities to be included and interface trough the implementation of methodologies such as personas and brainstorming.

- The persona was constructed based on the literature about elderly tourists', as described in Section 1.2.
- The brainstorming was planned and oriented in accordance with Rawlinson³⁰.

The results of both this methodologies were used to decide the requirements of the very first prototype of T4A. For the next spiral cycle this process will be repeated based on the results of the evaluation process applied on the evaluation phase of the development method.

¹ <http://jitt.travel/>

² <http://www.iclio.net/>

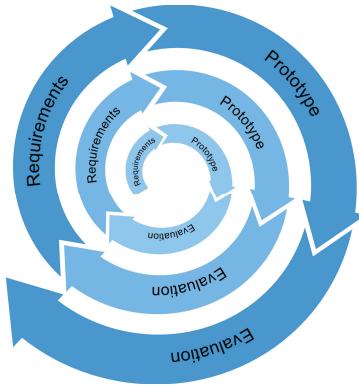


Fig. 1. The methodology consists in an iterative process, in which multiple development cycles increasingly refine requirements and prototypes.

2.2. Prototype

The T4A prototype was developed as a way to mediate the interaction between the end users and the developers³¹. This will be accomplished using the different evolutions of the application prototype. Without discarding the possibility of changes along the different iterations, to better accommodate the refined requirements, the architecture initially adopted for the prototype should account, as best as possible, for the incremental nature of the work to be carried out, minimizing the development effort and time.

2.3. Evaluation

During the development of an application, designed taking into account the accessibility and usability features of end users, the application is evaluated several times (several iterations of phases 1 through 3). As described in²⁹ the prototype test intended to collect information regarding the usability and user satisfaction. The prototype test is conducted in a controlled environment. When this prototype can no longer evolve, and the users are satisfied with the functionalities and usability, then this prototype is ready for a pilot test. This test intends to evaluate, in addition with usability and satisfaction, the meaning that a product or service has on users' lives. For this reason, this last step of testing differs from the prototype phase in the context where it happens. The product or service should be installed in users' homes and integrated into their daily live routines.

3. Overall System Architecture

The Figure 2 shows a basic illustration of the technological structure used in the development of the T4A application.

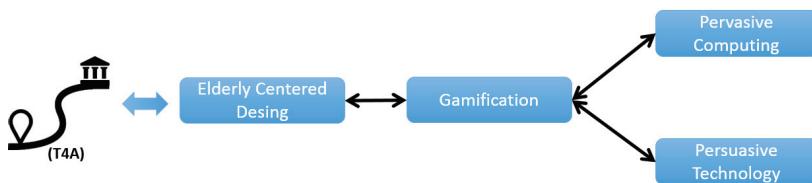


Fig. 2. The technological structure of the solution T4A.

Given the importance of the prototypes, in the described development methodology(Section 2), the chosen architecture should be able to support the incremental refinement of the prototype, minimizing the development efforts. To support the development was adopted an architecture based on two main blocks: the smartphone and web services to complement its capabilities.

To combine more ways of interaction, giving users others possibilities to interact with the application and leading to greater ease of use, the W3C Multimodal Interaction (MMI) Architecture³² was adopted. This is, a loosely coupled and extensible architecture supporting multiple modalities. Modalities can be added or modified without any changes in the application core and this flexibility allows the developer of the application to code without having knowledge about the modalities, this way he only have to focus on the applications and other developer would focus only in the modalities. Previous experience³³ showed that for instance speech can easily be integrated in our project using this architecture.

3.1. Modalities

In the adopted architecture, three modalities were initially consider, the graphical user interface, speech and touch. One of the advantages of working with decoupled modalities is the chance to easily exchange them by improved versions or even by new modalities. This is important because it allows the developers to focus on the application core and use readily available modalities, instead of having to develop them from scratch, which might be a complex task.

3.2. Services

Only part of the modalities are implemented in the smartphone and they use cloud based services, this ways completing the work of the modality. Considering the speech modality, for example, the ASR and TTS are provided by services communicating with the modality. The modality sends data (e.g. the audio of a spoken utterance to be recognized or a message with information to be read) and receives the required results.

Another important service, which is already considered, is the natural language generator (NLG). It can be used to generate more natural sentences, with particular information. It uses a statistical machine translation system and includes a trained language model that can be adapted depending on the requirements^{34,35}.

The data for all users is gathered in the User Service manager, freeing the smartphone from providing persistent storage and allows synchronization between applications and devices.

This set of generic services, considered from the start, can be expanded with the addition of specialized services to encompass the gathered requirements.

3.3. Georeferenced Gamifying Platform

As previously explained, the T4A application was developed taking into consideration the users' geoposition as a trigger. The data structure was designed to be attached to the map used by the main application, so it is possible to use the same structure at any place.

The data structure has to be filled considering that a Base Map is composed of at least one Sub-Map, each Sub-Map has to have at least one Area of Interest and, finally, each Area of Interest has to have at least one Point of Interest (PoI).

The use of digital games as an instructional framework has proved to be interesting by allow the playful insertion in the learning process³⁶. The playful, brought by games, helps making the instructional content more interesting, interactive, meaningful and challenging³⁷. The Georeferenced Gamifying Platform called RPGT4A has as main objective the easy and fast development of RPGs (Role Playing Games) that can be used as a support to people engagement process in virtually assisted walking tours. The use of RPG games can provide interactivity and encourage participation in the instructional process³⁸. This type of game is an effective tool to assist in the complex issues of questioning people's lives, such as urban violence, social inequality and racial conflicts, as well as learning curricula³⁹.

Figure 3 shows the Georeferenced Gamifying Platform RPGT4A connected hierarchies. As can be seen, the maps hierarchy is connected to the storytelling hierarchy, which in turn, is connected to the challenges hierarchy. The main application of T4A receives this configuration through a Json ³ file.

³ <http://www.json.org/>

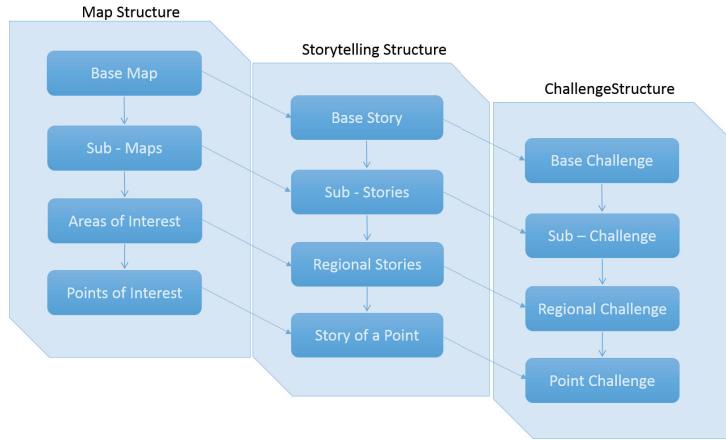


Fig. 3. Overall architecture of georeferenced gamifying platform used in the prototype.

In the next section will be explained the implementation process used for the first prototype of T4A and the content of the georeferenced gamifying platform used.

4. Trip4All - T4A

For this first prototype an application area nearby the development lab was chosen in order to avoid long shifts and improve the testing/correction process. The map of campus Santiago of the University of Aveiro was used as the base map for the prototype design.

The T4A application will be based on the multimodal architecture presented by Teixeira²⁵. Because of this, the prototype of T4A has been initially developed for Windows Phone 8.1 using the Visual Studio 2013 IDE. To future work the application intends to work in all architectures of mobile devices available on the market.

Figure 4 shows the map structure used in the prototype development. The map structure was composed by two sub-maps identified by CSM_1 and CSM_2 . The first sub-map was composed by two areas of interest identified by $CSM_1.CAI_1$ and $CSM_1.CAI_2$. For each of these areas of interest there is a point of interest identified by $CSM_1.CAI_1.PoI_1$ and $CSM_1.CAI_2.PoI_1$ respectively. The second sub-map is composed by one area of interest identified by $CSM_2.CAI_1$ and this area has one point of interest identified by $CSM_2.CAI_1.PoI_1$.

To start the gamified experience the users needs to: 1) log in; 2) choose location of the visit and 3) start the visit walking through the site. To the extent that the visit is happening the visitor's geoposition works as a trigger to start the associated storytelling and challenges. Figure 5 shows an example of the concatenation of callbacks considering the visitor is walking through the base map, entering in a sub-map, then entering in a area of interest and, finally, achieving a point of interest.

For the first prototype a very simple storytelling was defined explaining only the basics about the architecture of the buildings pointed by the points of interest. The points of interest were placed in front of the library building, in front of the the main door of the rector building and in front of the main door of civil engineering department building. The main objective of the prototype is obtain a proof of concept so there are callbacks functions defined only for the PoIs. That is, the first three steps shown in Figure 5 do not starts anything in the application, only the fourth step starts a pop up with a storytelling and a link pointing to a challenge when the user achieve the PoI area.

The challenges were created using the web language package HTML5/CSS3/JS and they are initialized by the main application as web-views. This approach grants the use a huge quantity of games and features available in the internet and the possibility of easier development of new components for the T4A. Three kinds of challenges were developed for the prototype, a crossword game to be used in the PoI of the library building, a treasure hunt for the PoI of the rector building and a quiz to be used in the PoI of the civil engineering department. Figure 6 shows some snapshots of the T4A prototype application.

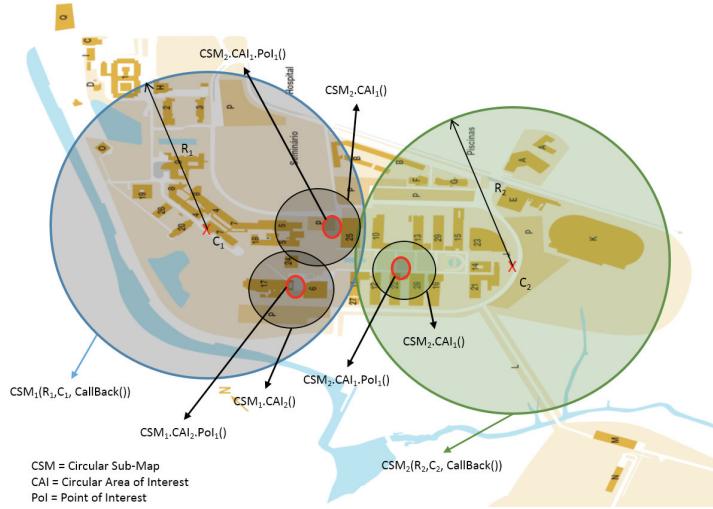


Fig. 4. Maps hierarchy used in the Prototype.

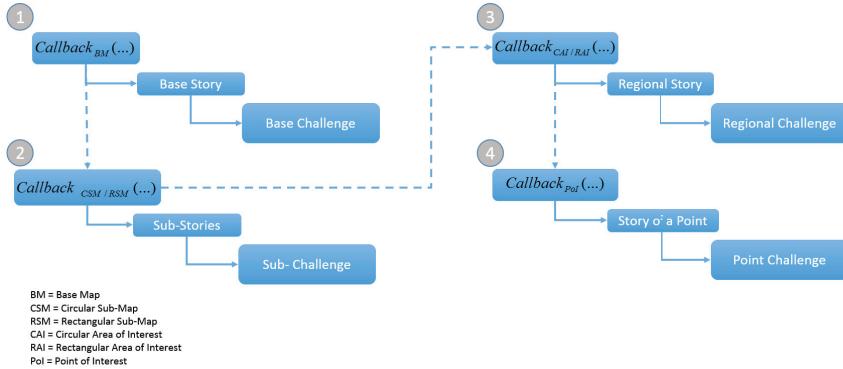


Fig. 5. Concatenation of call backs used in the Prototype.

5. Conclusions and Future Work

The main idea behind the Elderly Centered Design Method is the focus in the inclusion of the end-user in the development process since the beginning to achieve faster and more productive iterations. The participation of the user is crucial to generate better ideas in the brainstorming sessions to a more refined development of personas and scenarios. In addition, their participation is important to a development of an accurate knowledge about the real needs and capabilities to enable a process of continuous development of the application by successive refinements and redesign.

The application T4A is just starting the evaluating phase of the first cycle of the process requirements, prototyping and evaluating. Because of that, there is still no complete data set to point out the strengths and weaknesses of the current stage of development, but the initial feedback provides the feeling that the work is in the correct way.

Considering this prototype as a proof of concept for the Georeferenced Gamifying Platform (discussed in section 3) the main goal was achieved. The design of the platform is functional and can be expanded to be used in any desired site. The hierarchical structure of maps, storytelling and challenges using Json configuration files proved to be easy to use and to maintain. The use of HTML5/CSS3/JS to develop the challenges show that it is possible to incorporate to the main application a lot of new features with little programming effort.

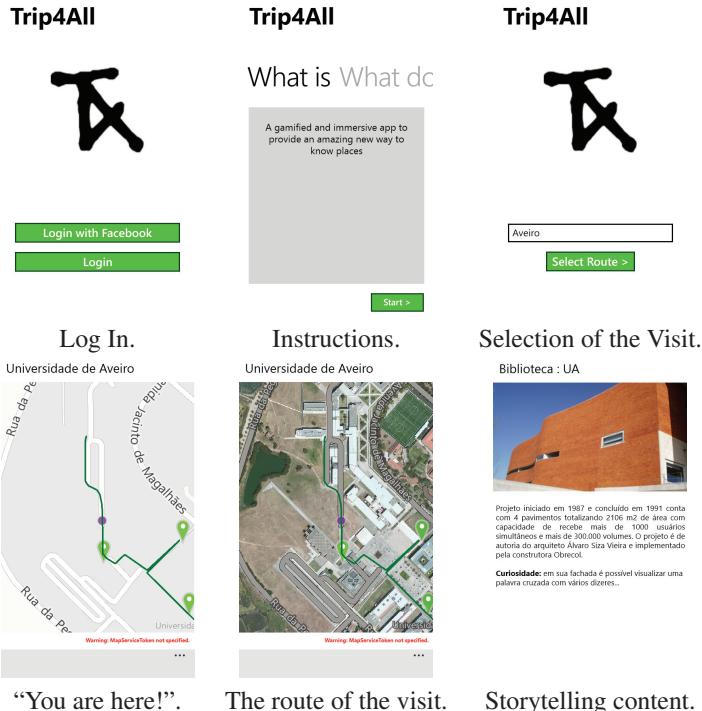


Fig. 6. Snap shots of T4A application prototype.

With the concept of the Georeferenced Gamifying Platform settled, the new step is the development of a road map for the historical midtown of the city of Aveiro, using as the gamified aspect of the application the history of the salt exploration and the cultural aspects of the moliceiros boats. This will be take place in a partnership with the Tourism Departament of University of Aveiro and City Hall of Aveiro.

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