

# **A gamification framework for co-creation, policy making and social foresight**



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## **Abstract**

The goal of this thesis is to develop new ways to harness the potential of public engagement and participatory foresight in complex governance decisions. The communication between governments and population is a remarkable problem. People don't feel socially and politically engaged, leading to a loss of trust in public powers. Therefore, it's important to find a way to innovate the governance in order to improve engagement and participation.

In order to reach such objective, multiple studies about people behaviour and gamification have been analysed, followed by papers covering similar problems in both similar and different contexts. Afterwards, it has been designed a framework exploiting the collected conclusions and developed a prototype of the platform. In order to validate the applied ideas, two experiments have been carried out: one with the goal of analysing and validating the principles behind the framework, while the other consisted in testing the engagement, intuitiveness and usability of the developed prototype.

The results are overall positive. The participants of the first experiment stated it was an enjoyable and engaging experience, even though there is still room for improvements. The second one pointed out which sections and aspects of the developed platform are more engaging and appreciated, and also which elements should be revised.

The findings confirm the effectiveness of the framework principles and provide useful feedback for future development. Therefore, the next step could be to apply them in a larger context.

## Abstract

L'obiettivo di questa tesi è quello di sviluppare nuovi modi per sfruttare il potenziale del coinvolgimento pubblico e una visione comune del futuro in decisioni di governance complesse. La comunicazione tra governi e popolazione è un problema importante. Le persone non si sentono socialmente e politicamente coinvolte, portando a una perdita di fiducia nei poteri pubblici. Pertanto, è importante trovare un modo per innovare la governance al fine di aumentare il coinvolgimento e la partecipazione.

Al fine di raggiungere tale obiettivo, sono stati analizzati molteplici studi sul comportamento delle persone e sulla gamificazione, seguiti da articoli che coprono problemi analoghi sia in contesti simili che diversi. Successivamente, è stato progettato un framework che sfrutta le conclusioni raccolte ed è stato sviluppato un prototipo della piattaforma. Al fine di validare le idee applicate, sono stati condotti due esperimenti: uno con l'obiettivo di analizzare e validare i principi alla base del framework, mentre l'altro con lo scopo di testare il coinvolgimento, l'intuitività e l'usabilità del prototipo sviluppato.

I risultati sono complessivamente positivi. I partecipanti del primo esperimento hanno dichiarato che è stata un'esperienza piacevole e coinvolgente, anche se c'è ancora spazio per miglioramenti. La seconda ha sottolineato quali sezioni e aspetti della piattaforma sviluppata sono più coinvolgenti e apprezzati e anche quali elementi dovrebbero essere rivisti.

I risultati confermano l'efficacia dei principi del framework e forniscono feedback utili per lo sviluppo futuro. Pertanto, il prossimo passo potrebbe essere quello di applicarli in un contesto più ampio.

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# Chapter 1

## Introduction

### 1.1 Context and problem statement

Lately, the communication between European governments and the population has worn thin, leading to a loss of faith and interest in politics. People feel like their voices and efforts have no impact on modern society, they don't even feel represented properly by those who lead the local government. All these factors lead to a reduction of the population's interest in politics.

Sometimes this happens because decision-makers are trained in environments and perspectives far from the population's needs, leading to cultural and economic partitioning, also taking decisions that divert from the thoughts and desires of society.

As stated in [25], people often feel neglected by public powers, and thus give up on exercising their participatory rights. Furthermore, the lack of innovation in governance generates decline in trust and engagement from citizens.

The decrease in public engagement can be highlighted by inspecting the affluence percentages of the most recent European elections held on 26th May 2019 in which, on average, only the 50.6% of the European population expressed their votes. The countries with the lowest percentages were Slovakia, Czech Republic and Croatia, while the highest ones were Belgium, Luxembourg and Malta. Considering Italy, as stated in the reports from the European election, only 54,5% of those having voting rights expressed their preferences, while regarding the political elections held on 14th March 2018 that percentage is 73%, the lowest value recorded since 1948.

A recent study<sup>1</sup> by the ECFR (European Council on Foreign Relations) reveals that there is a sharp difference between people's lived reality and their views on the future of the European Union. It also shows that most Europeans think that the EU could collapse. Most

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<sup>1</sup>[https://www.ecfr.eu/publications/summary/what\\_europeans\\_really\\_feel\\_the\\_battle\\_for\\_the\\_political\\_system\\_eu\\_election](https://www.ecfr.eu/publications/summary/what_europeans_really_feel_the_battle_for_the_political_system_eu_election)

respondents think it's likely that the union would fall apart in the next 10-20 years. Still a positive result comes from the survey. Indeed, it has been found that only a minority of voters felt that the identity of the European Union was less important than the national identity.

Another useful note<sup>2</sup> is that in recent years the way people take part to the political debate has changed. Indeed, despite voting is still perceived as the main way to participate to public debates, "new" forms of participation, like demonstrations and strikes, are spreading, particularly among the youngest generations, as seen in the recent demonstrations against the climate change. Regardless of the wide use of the social media and the internet, only few people think these are useful tools to make their voices reach decision-makers.

As stated in [38], political alienation has been identified as a typical trait of contemporary societies, and is primarily associated with young people. Thus, in order to solve the problem of alienation successfully, it should be tackled in a way that appeals to younger generations of future voters and/or policy makers. Traditional political elites (are beginning to) recognize youth's most powerful weapon: their skilful use of new technologies.

Concluding, a new way to increase the engagement in public debates and decrease the distance between decision-makers and the citizens is necessary.

The European Union wants to address this problem through a project called TRIGGER (Trends in Global Governance and Europe's Role), whose final objective is to provide EU institutions with knowledge and tools to enhance their actorness, effectiveness and influence in global governance and to develop new ways to harness the potential of public engagement and participatory foresight in complex governance decisions, thereby also tackling emerging trends such as nationalism, regionalism and protectionism.

### **1.1.1 Extending Mission Oriented Innovation Policy**

As the amount of global challenges is constantly growing, it is necessary to find a way to tackle them.

Mission Oriented Innovation Policy provides a strong and organized way to exploit public policy to give direction to economic growth and innovation in order to tackle societal and technological challenges. It doesn't focus on any particular sector. Indeed, it focuses on problem-specific societal challenges, which many different sectors interact to solve. The main aspects of this approach are the focus on problems and the collaboration between public institutions and private actors.

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<sup>2</sup>[https://ec.europa.eu/assets/eac/youth/policy/documents/perception-behaviours\\_en.pdf](https://ec.europa.eu/assets/eac/youth/policy/documents/perception-behaviours_en.pdf)

A challenge is a broadly defined area which a nation may identify as a priority, like climate change or pollution. Missions, on the other hand, involve facing specific problems, like increasing the percentage of plastic recycling over the year.

In a much broader sense, since this thesis aims to sensitize the users on a set of different global and social challenges and it can be seen as a contribution to the cooperation aspect between public and private, extending it to every single member of the society.

## 1.2 Proposed solution

The problem this thesis faces is the creation of a communication channel whose goal is to operate as a mediator between the communities and the government leaders of the European states, in order to find out a meeting point between the government's actions and the people's vision of the future.

The final outcome is a web-based platform built following gamification principles, taking particularly care of the engagement and usability aspects. It is made of three different areas, each one dedicated to a specific type of user:

- The administrative side, intended for the representatives of the governments, whose role is to manage the different sections of the platform
- The analytic side, intended for social scientists, whose goal is to analyse the data coming from the platform, leading to relevant results for the governments. It contains a set of analytic tools, which allow to explore and inspect both visions and thoughts shared by the users.
- The user side, meant for the population, organized in several sections, each of them with its own different mechanics and objectives. Initially, this side aims to generate an awareness in the users. Then, thanks to modern gamification techniques, the user is prone to share his own thoughts under different shapes (text, images, etc.) with other users, cooperating and interacting with them.

Experiments have been performed and the results have been analyzed to understand how much the users feel engaged by the platform and what functionalities they would use the most.

## 1.3 Structure of the thesis

The thesis is structured as follows:

- Chapter 2 consists of relevant scientific results which have been exploited while working on the thesis.
- Chapter 3 consists of a set of related works, which deal with similar problems as the thesis, the methods they exploited and the results they achieved.
- Chapter 4 consists of the design of the proposed framework and a brief introduction to the implementation, alongside the tools and the technologies exploited.
- Chapter 5 consists of the experiments and tests that have been carried out, alongside their results and the considerations they led to.
- Chapter 6 consists of a short summary of the work done, alongside a discussion of the results and future works.

# Chapter 2

## Background

### 2.1 Relevant Scientific Result

#### 2.1.1 Introduction

In recent years, there has been an increasing interest in motivating people, enhancing engagement and/or triggering processes behind behaviour change.

One of the most relevant development in this area has been gamification. Its goal is to promote the intrinsic motivations of people towards different activities, by exploiting game elements and game design techniques, such as points, levels, leaderboards, achievements, badges and many others. Several studies have been performed in the context of gamification, showing how people perceive and use the services which implement it.

It has been proved the effectiveness of gamification when it comes to induce a specific behaviour or to keep the user engaged. Hamari et al. [28] showed that none of the analysed documents, selected among a large set using certain criterions, reported a negative impact of gamification on their experiments, at worst no effects were achieved. A positive result comes from the educational context, in which it has been proved that gamification is an effective approach.

#### 2.1.2 Self-Determination Theory & Intrinsic and Extrinsic Motivation

The various game elements makes use of people's motivations, which can be split into extrinsic ones and intrinsic ones. Extrinsic motivation occurs when people are motivated to perform a behaviour or engage in an activity due to a separable outcome, like earn a reward or avoid punishment [56]. Instead, intrinsic motivation involves engaging in a behaviour

because it is personally rewarding, interesting or enjoyable; essentially, performing an activity for its own sake rather than the desire for some external reward [35].

As explained by the Self-Determination Theory (Ryan & Deci, 2000) [49], which is used to understand human motivation, everybody has three innate psychological needs:

- Competence (People are always wishful to learn new skills and mastery tasks)
- Autonomy (People need to feel in control of their own behaviours and goals)
- Relatedness (People always need a sense of belonging and attachment to other people)

Achieving those needs will enhance the motivation, the mental health and individual growth. According to Ryan and Deci, the three elements can be helped or hindered by different factors.

Extrinsic rewards can cause a decrease or undermine the intrinsic motivation. They also proved how people perceive the external rewards (as controlling or as informational), influence the intrinsic motivation and the needs of competence and autonomy. As the behaviour becomes increasingly controlled by external rewards, people begin to feel less in control of their own behaviour and intrinsic motivation is diminished. This phenomenon is also known as the overjustification effect. However, [8] has shown that incentives given for boring tasks might actually increase intrinsic motivation. Other interesting evidences are that the competence will not increase intrinsic motivation unless there is a sense of autonomy and that the positive feedback can boost self-determination. Ryan and Deci suggests that offering unexpected positive encouragement and feedback on a person's performance on a task can increase intrinsic motivation. This type of feedback helps people to feel more competent, which is one of the key needs for personal growth.

Lin et al. [37] demonstrated how usefulness, enjoyment and network externality factors, such as the number of platform members, the number of friends (peers) and the perceived complementarity<sup>1</sup>, influence in a positive way the usage continuity.

Cerasoli et al. [9] demonstrated how both kinds of motivation produce a gain in performance, but only the intrinsic one improves the learning outcomes, creativity, self-esteem and general well-being. It also increases the performance and the quality of effort that people put in a task. Amon Rapp [46] shows that the game elements which makes use of extrinsic motivators help to motivate the user at the first stages, but the lack of meaningful rewards and progression makes the user experience poor, instead of providing a gameful one.

The author [46] stated that the gamification should not rely solely on extrinsic motivators in order to create a long-lasting user engagement, indeed he reveals that some people found

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<sup>1</sup>Perceived Complementarity: a relationship or situation in which two or more different things improve or emphasize each other's qualities.

the extrinsic motivators useless, while the remaining part asserted that even though these elements kept them engaged at the beginning, this effect slowly faded away as the time was passing by.

Despite that, it is not possible to determine in an absolute way whether extrinsic motivators are bad or not. It depends on the use cases. It has been shown how it can be useful to induce interest or to induce people to acquire skills or knowledge. The extrinsic motivators should be used to achieve a burst in the number of users performing activities of the system. The design of rewards should be done in such a way that these support meaningful in-system purposes [46].

This thesis mainly aims to develop intrinsic motivation since it has been identified as the best one for a long-term user engagement.

### 2.1.3 Social aspects

The attitude towards a gamification service can be influenced by the social factors. These can anticipate how gamification is perceived by the users, and their willingness to continue to use the service and/or recommend it to others.

Social and utilitarian aspects influence more the attitude formation, whereas the enjoyment ones have positive direct relationship with behaviour, but not with attitudes. Therefore, enjoyment aspects (intrinsic motivators) drive the actual use, while the utilitarian and social ones (extrinsic motivators) affect attitude, and through that, affect intentions [27].

Social norms and attitudes spread are supported through the network, highlighting its importance in creating a service to promote the activeness and the participation of the users. Hamari et al. [26] demonstrates how a community of people committed to the same goals has a relevant impact on users. Hamari and Koivisto show that enabling users to get exposed to attitudes of others and also to receive feedback directly from other users can positively influence the attitude towards using a gamification service. They found that social interaction enhance social influence and the perception of reciprocal benefits, so the social aspects are important to create engagement. Mahnič [39] recommend playfulness as an essential element for engaging people into a certain community. If games are designed in a way that promotes collaboration in general, this behaviour results in people's tendency towards helping others. Still, it's needed to consider people diversity.

People who are extroverted and agreeable tend to prefer and perform well in cooperative tasks, while people who don't have such characteristics tend to prefer competitiveness. So, there should be both competitiveness and cooperation among users in order to maximize the users' satisfaction [1].



Further differences can be considered. Women receive more benefits from the reciprocity between users and give more value to the ease of use [57][33], their network of friends [33] and the social aspects of gamification, which is perceived as a more playful experience. Women also have a more positive view of the social community [37], and they are directly influenced by their peers. Men perceive that expanding their own social circle is useful as well. They also demonstrated how both genders are influenced by both usefulness and enjoyment and how gender makes a notable difference in the effect of perceived benefit and network externalities on the continued intention to use social networks.

Elderly give more importance to the existence of the network due to higher affiliation needs. As a result they have an higher perception of its benefits; moreover, as the age increases, it only seems the users experience less the ease of use.

#### 2.1.4 Bartle Taxonomy of Player Types

Over the years, alongside the gamification studies, the necessity of analyzing player types and their motivations has become essential. In 1996, Bartle classified players based on their preferred actions, creating a taxonomy based on a character theory (Figure 2.1). This theory consists of four characters: Achievers, Explorers, Socializers, and Killers.

Studies carried out afterwards regarding the player types were mostly based on this classification [29].

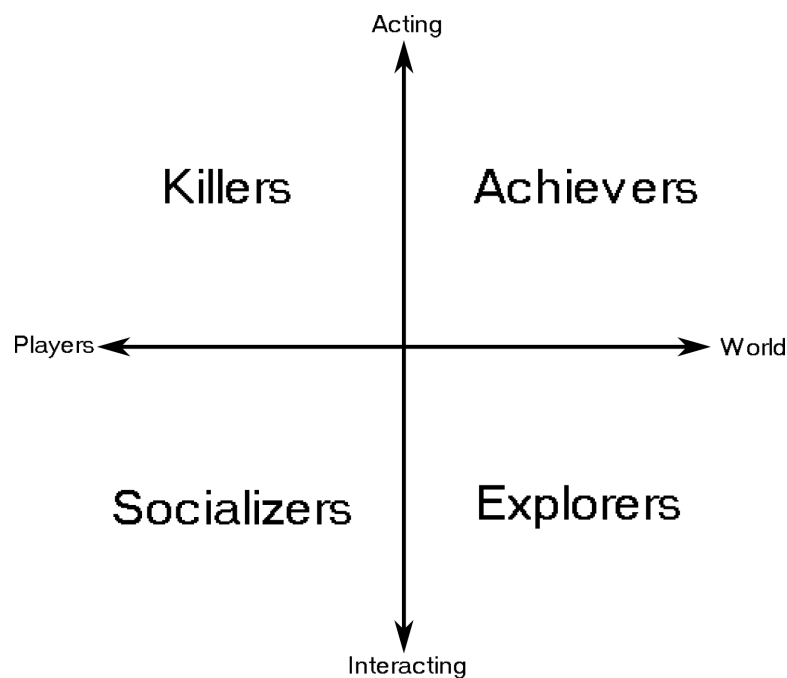


Figure 2.1 Bartle's taxonomy

Achievers are players whose objectives are to obtain points, levels or equipment, in general they want to obtain anything that measures their success, just for the prestige of having it.

Explorers are players whose favourite action is to constantly explore the world, discovering new and hidden locations. Therefore, they do not like to be time-restricted or limited in any other way.

Socializers are players who give more value to the social aspect, interacting with other players. They are usually engaged by games with a strong player community. Cooperation offers infinite possibilities to this type of players.

Killers are players who enjoy competition and prefer to confront with real opponents.

Considering this simple taxonomy, it would be possible to introduce ad hoc gamified mechanics, in order to keep all the different types of players engaged at the same time.

Hamari et al. [29] clarify how Bartle's theory has a few weak points. One of them is that people's behaviour and motivations may change in time and are based upon the context, therefore it can be difficult to pinpoint exactly to what category a person belongs to. Another point is that in reality players have multiple motivations existing simultaneously, but the magnitude of different motivations differs across players and player types. The most important consideration is that each player can be classified as many different player types, not only in a specific one. By analyzing several taxonomies, the dimensions they found to be most commonly used to characterize each player type based on their motivations and behaviours are Achievement (Achievers), Exploration (Explorers), Sociability (Socializers), Domination (Killers) and Immersion. The latter is new with respect to Bartle's categories.

In conclusion, the number of player types is pretty low to represent reality complexity. Moreover Bartle's taxonomy only provides ground for further measurements of the player traits and motivations, supporting the formation of a more refined understanding about them.

Even though Bartle and many others built a behavioural profile of the different types of user, it is a really complex task since user behaviour will vary depending on the context. Therefore, it is useful to have only a general idea of the different characteristics of the users which would be engaged in the system, in order to improve its functionalities.

### **2.1.5 Gamification Ingredients**

A lot of gamification practices have been developed all over the years. Following, the most common concepts to which one refers in the context of gamification are explained.

### **Reward-based Gamification**

It is possible to notice how several gamified behaviours are already applied to everybody's daily life. For example, most supermarkets have their own "loyalty card", thanks to which every customer can collect points that can be traded with physical rewards. The more you spend, the more points you earn, the better the prizes. Gamified systems like the mentioned one are also known as "Reward-Based", and the corresponding gamification technique is called "Reward-Based Gamification". It is one of the most common gamification method based on extrinsic motivation since the person is moved to perform an action by the reward it will or may obtain.

It has been demonstrated how Reward-Based gamified systems are effective as long as the rewards keep coming. In the IT context, they are suited only for a small set of cases, in which the objective is to create a spike in engagement, however when the objective is a long term usage of the system, they are counter-effective.

### **Points**

Points are the most common form of reward, which can be turned into levels or achievements, usually exploited to rank users. Generally, points are employed to keep track of the user status/advancement, even though sometimes there are better ways to do so. In gamification, the approach of awarding users with points is also known as "Pointification". As shown from different studies, points awarding is not generally effective by itself, in fact:

- Awarding users with points undermines intrinsic motivation, since this approach is an extrinsic motivation factor.
- Points are useless if they cannot be exploited for something the user perceives useful.

Farzan et al. [17] provides a significant proof. They show how awarding users with points boosts users' contributions when initially introduced, but it doesn't increase the participation. Indeed, the same users who were encouraged to give their contribution by the point system would have given this contribution anyway. They also assert that the point system could be used in case you want to generate a burst in user activity, and in addition it could be seen as a way of controlling the users' behaviour to generate a predictable result at a given time. The users provided some useful feedback about the point system. They wanted a way to opt out from it, since some of them thought it was a violation of their privacy. They also complained that points were not reflecting the quality or meaning of the contributions. In conclusion, in order to make "pointification" effective and sustainable it must be combined with other strategies.

### **Achievements**

Achievements can be seen as “virtual trophies”, which are awarded to users whenever they meet certain requirements, granting a sense of self-satisfaction to those who achieve them. They can be exploited to show the progresses of the user within the system and/or their status within the community.

Usually the word “achievement” and “badge” are considered synonyms. When referring to achievements this thesis refers to an element composed by a badge (a picture representing the achievement), the name of the achievement and its description, explaining the objective the user must reach to obtain it.

### **Leaderboards**

Leaderboards are exploited to rank users in a gamified system. Their objective is to generate a feel of notoriety to those at the top and to incite those below to raise their rank.

It is important to notice that leaderboards are not perceived by each user in the same way and they are not suited for all contexts. Indeed, there are a few considerations to keep in mind while designing systems involving leaderboards:

- Leaderboards should always be encouraging, never discouraging, otherwise they could end up being counter-effective.
- Absolute leaderboards may create a feeling of achievement and status to those at its top, while new users may either feel overcome or challenged. In the first case the leaderboard would end up being counter-effective. A relative leaderboard instead display the position of the user with respect to the similar ones, removing the feeling of never reaching the top, since you are less aware of your position in an eventual absolute leaderboard.
- As stated in [5] leaderboards are not suited for all contexts. It is necessary to be careful not to generate hatred among the users, since leaderboards are prone to raise the level of competitiveness leading the behaviour displayed in the Figure 2.2.

Position	Player
1	Someone I Hate
2	Someone I Hate
3	Someone I Hate
4	Me
5	Someone Who Hates Me
6	Someone Who Hates Me
7	Someone Who Hates Me

Figure 2.2 How a player may perceive a leaderboard

### Missions and Challenges

A mission is basically a task users need to complete. They can serve as guidelines which help users to adapt within a system, to learn how to use it and to improve their skills by accomplishing one mission after another.

Challenges are a way in which players are involved to complete difficult but achievable tasks.

In [16], it has been shown how overcoming non trivial challenges creates an experience of competence. By choosing to tackle a challenge for the sake of enjoyment, users perceive themselves as acting with high autonomy.

It is important to balance those challenges based on the player's perceived current ability, in such a way that they would appear neither too hard, nor so easy [14].

Challenges are really useful when it comes to learning, since it has been shown how balanced challenges ended up being a strong motivation factor [32][42].

All of the above mechanisms could also be applied within a whole community (e.g. a group) instead of a single user, having them to cooperate to achieve goals. For example, Rigby et al. [50] demonstrated how overcoming challenges collaboratively satisfies the needs of relatedness.

A table containing all the "Gamification Ingredients" that have been considered during this thesis design will be introduced at a later stage.

# Chapter 3

## Related Work

Different applications of gamification in various contexts have been analysed during the research phase. Following, their methods and relevant results have been reported, grouped based on the context.

### 3.1 Civic Context

During the research phase most of the considered material explores the effects of gamification in the civic context.

The Table 3.1 points out the most exploited gamification techniques in the analyzed papers, sorted based on the usage frequency.

Gamification Ingredients	Papers
Leaderboard	[2][3][5][8][13][15][19][20][21]
Mission / Challenges	[2][3][5][6][7][15][19][23]
Points / Levels	[2][3][5][11][15][19][23]
Rewards	[5][6][7][12][18][20]
Competition	[2][3][8][11][15][23]
Badges / Achievements	[5][8][11][19][23]
Skill Learning	[5][16]

Table 3.1 Gamification ingredients found in the papers

As mentioned in the previous chapters, this thesis concerns about different aspects, three of which are awareness, communication between population and politics, and engagement, with a particular focus on the latter. Over the years many different solutions covering or partially covering those aspects have been developed. The ones covering mainly the

engagement aspect will be dealt first, leaving the ones involving the communication aspect later.

In modern times, everybody owns a small computer always at hand through which he is able to perform many different tasks: a smartphone. Many of the analysed papers exploit this reality, implementing their solutions on mobile phones, enhancing their possibilities through the features they provide.

In [53] Sarah-Kristin Thiel compared the effect of social and reward-based gamification in public participation by implementing a mobile application in which users had to perform contributions, namely geo-referenced descriptions of suggestions or issues identified in a city. The application exploited points, awarded for performing certain activities, missions and two different kinds of leaderboards: one global, and one relative to user's score. The trial consisted of two phases: the field trial and the discussion round. The participants were split in two groups: one using the social gamified application (with missions, lifetime mechanic and the reputation system), the other using the application with reward-based aspects. Two surveys were filled by the participants: one before the trial, the other after. Then this information was complemented with the data regarding the usage of the application. The outcome revealed that social gamification seems to motivate citizens more towards participations than reward-based gamification. Indeed, reward-based gaming elements have a higher risk of citizens questioning the seriousness of the participation process. However, due to the limited sample size and social gamification consisting of only one game, the findings should be regarded as tendencies only.

Another study [55] by Thiel et al. (October 2017) was performed on a slightly modified version of the same application, without the social features. The scope was to explore the effectiveness of gamification in location-based public participation, to understand which types of motivation encourage engagement and whether gamification could provide motivations to engage. In this experiment they deployed two different versions of the same application, one with game elements, the other without them. The participants had to walk around pre-defined areas in the city and post about aspects they came across which were worth sharing. The users had to post and discuss contributions of other people. They collected a sample for both versions on which analyses were performed. The results exhibited an increase in active and constructive participation in the usage of the app with game elements. This paper remarked that the intrinsic motivation was lower when game aspects were introduced, which confirmed that a reward-based system reduces this kind of motivation. Furthermore they found extrinsic motivation to be only slightly higher with respect to the other type of application. This means that the decrease in intrinsic motivation because of game elements was not balanced by a boost of motivation caused by those elements. Finally, they asserted that while the intrinsic

motivation certainly played a role, the extrinsic one is more relevant for encouraging citizens to become active in urban decision-making and public topics.

The experiment [54] performed by Thiel et al. (December 2017) was based on the same application used in the previous study. In this case, the objective was to test the effectiveness of gamified participation by analysing the impact of gamification on motivations to engage. The users had to perform discussions about suggestions and issues, dialoguing with city representatives. The experiments showed the citizens primarily motivated by their interest in urban developments, over which gaming had little influence. Gamification affected people motivation irrespective of whether they were interested in games or not, but only people who were already interested in the application were motivated by the game elements. Indeed, they detected that gamification does not necessarily lead to an increase in participation.

An interesting study by Romano et al. [48] aimed to increase civic engagement during emergency situations through an application allowing its users to perform different assistance activities, like posting content about real time problems or providing first aid. One of the most relevant aspect of the application was the introduction of a “Training Room”, a specific section in which users could learn how to act in emergency situations. The system exploited a leaderboard, missions, achievements and experience points, awarded when certain actions were performed. The outcome outlines that the mobile application was able to successfully foster civic engagement, although users didn’t perceive exchanging points with physical rewards as ethical. Instead, they expressed their appreciation for a social reward, like a recognition, a certificate or having more weight in the local political decisions.

Lehner et al. [36] increased the participation of citizens through mobile pervasive gaming for urban planning. A questionnaire revealed how people wanted to compete and socialize, and how they feel satisfied when they are awarded with levels and achievements. “Community Circles”, a location based mobile application in which citizens could generate, upvote or downvote, and comment contributions, was developed following those guidelines. The long term goal of this application was to make the community grow while keeping it alive. The application collected positive feedbacks, leading to further testing.

Anne Bowser et al. [6] wanted to explore the effect of gamification in citizen science campaigns, in particular in attracting group of Millennials. To reach such goal, they developed a mobile application in which users had to gather plant phenology data through the completion of tasks based on two fundamental primitives, one consisting in identifying new plants, the other in indicating the current phenological state of the plant. Users were awarded with badges upon the completion of an activity and a leaderboard was built on such rewards. A group of 71 Millennials has taken part in the trial and their opinions were gathered through surveys on which the research group performed some analyses. The latter turned out the



application was able to engage additional user group of Millennials who might not find the traditional motivations of citizen scientists inspiring. Indeed, they were motivated by gamification in the form of “earning badges” and “competing with my peers”. Further findings revealed the social aspect should be supported by the application design and the gamification should be pervasive and well designed. However, despite the aforementioned results, the research cannot conclude that a gamified mobile app can engage Millennials, or can engage them over extended periods of time.

The last example of mobile application is “DoGood”. Rehm et al. [47] developed it to motivate citizens in joining civic activities in their local communities, having the competition between different activities as its core. Each activity had a score, increased whenever a user decided to join it and used to define its influence radius, and a deadline, set either by developers or by the users. The competition among users was stimulated by publicly announcing the user’s commitment to complete an activity, instead of using a leaderboard, increasing the social pressure without forcing competition. They performed a five week trial involving two surveys, whose analyses reported an increase in motivation, engagement and awareness. Interesting results came from the experiment, revealing how users wanted to conform themselves to what others were doing and not to directly compete in the context of doing good. Moreover, it was reported how deadlines encouraged people to complete activities, especially the ones defined by the users, granting them a feel of autonomy. Achievements logging and notifications were proven to be two positive motivating factors as well. In the light of the results, the authors asserted that no single gameful element works for everyone, so only a combination of different elements leads to a successful system.

Most of the times when someone thinks about gamification they immediately associate it with elements like leaderboards or points. Sometimes gamified systems do not involve only those aspects, but also real games.

[4] promoted public participation using a board game through which small teams of managers and front-line staff together could learn how to involve citizens in their work. It didn’t include win-or-lose mechanics, instead the game encouraged participants to discuss about new ideas, collaboration and learning. Each team involved from 7 to 20 people, grouped up around the canvas board game, provided with sticky notes and pens. Each team picked up a concrete issue for which it was required more input from citizens, leading to a dialogue among the participants. A deck of 200 cards, representing participation tools used in the past, was placed on the board during the game progress. The results coming from this trial were positive. Indeed, the game involved more than 200 employees and it has been played for about 250 times (at the time the article was written). It also contributed to

several changes, like consolidating 30 city departments into 4, and involving more citizens in decision making.

In 2014, Poplin [45] designed another type of game (a digital one), whose objective was to support both playful learning and civic engagement. An online application was used to collect design proposals made by citizens for a marketplace. Users could vote the proposed designs which were ranked in a leaderboard. Moreover there was a chat through which citizens could talk with other inhabitants or experts. The pilot study was lead in a school where the students had to play the game and answer a questionnaire. The application was tested also by elderly retired people, who unfortunately encountered few usability complications. In this experiment, the majority of participants appreciated the use of a digital game in the context of urban planning, in particular because online participation needed less effort than attending public meeting and it has better accessibility for disabled people.

Even though some papers addressed civic engagement as their main focus, others considered improving the communication between population and politics as their core objective, while still acknowledging the engagement aspect as the one of the main factors to achieve it.

The most common exploited method to increase the communication between the population and the (local) public institutions is to create a channel through which citizens could express their own opinion or interact with the (local) administration.

Devis et al. [2] promoted a two-way exchange of proposals between politicians and citizens, who may discuss in a structured and goal-oriented way, while satisfying three levels of participation: provision of information, engagement and empowerment. They involved two groups of people from two different cities, having them to use two different applications over a month: during the first two weeks a non-gamified one and a gamified one during the rest of the month. The application allowed citizens (users) to create and vote proposals, while the politicians (administrators) should answer to those proposals in a given number of days. Administrators could also propose quests to the users. Citizens were rewarded with points, levels, medals through the application and their results were ranked exploiting different kinds of leaderboards. After the gamification aspects were introduced, the number of solution details and the total number of activities carried out increased, leading the users to contribute to build a constructive debate about the problems and initiatives shared within the community. As a matter of fact, they proved how gamification increased both participation and the quality of the provided content.

“Love Your City” [52] exploited mobile technologies to allow citizens to take part in different participation paths. Indeed, the platform allowed users to directly address to fellow citizens or authorities (“Addressing”), create solutions to a proposed problem (“Co-creating”) and organize events (“Organizational”). Certainty, communication, sympathy, freedom,

responsibility and support were identified as major contributing factors. Images representing the person's emotions were exploited as an easy way to share people's feeling.

Developed in the U.S.A., [23] is an online platform for citizens, allowing members of the community to express, support and comment proposals. Its main functionalities involved submitting ideas, feedbacks, and photos, answering to questions on common themes and proposing their own solution to real life challenges. Those challenges also rewarded the user proposing the best solution. The effectiveness of the platform was proved by its numbers. In fact, about 5 years ago, MindMixer had been used by 1.6 million people all around the U.S.A., who submitted around 100'000 new ideas.

Also few European cities experimented their own methods to improve their communication channels. In Ovar, Portugal [41] a method called "Participatory Budget" allowed citizens to express their support for different budget proposals. A leaderboard was exploited to drive people to turn out to vote. The experiment carried out a successful result: about 25% of the city residents voted on proposals for the city budget, allowing the local government to save time and money. The most successful result was that people were asking their friends and families to express their votes, greatly impacting the overall engagement. Inspired by this success, other cities pursued the same objective, like Windsor in Ontario. In order to incentivize the engagement, most of the times, funds were instantiated in order to realize either the most voted proposal or the one which was considered the best from the public administration, providing an evident form of feedback for the citizens.

At Emerson College [40], a game involving themes and challenges was developed. Each theme had a set of missions, whose completion rewarded the citizen with coins which could be spent either to propose project ideas or vote other citizens proposals. When the time ran out, the three projects with the highest number of coins were awarded with money for their realization. More than 50% of the two populations involved, respectively 58% of 1000 people from Detroit and 70% of 4000 people from Salem, declared how they would have not attended normal civic meetings without being involved through this experiment.

In Reykjavik (2011) [11][31][3] an attempt to give people a stronger voice in the political process and build back up trust between the people and the public institution was carried out through a an online consultation forum. The dialogue between citizens and the city council was accomplished through the sharing and the evaluation of ideas. The most voted ones were analysed by a standing committee, who would eventually propose a process to actuate them, sharing both the idea and the suitable process on the forum. The project was proven to be successful. Indeed, about 58% of the population took part in this experiment, proposing about 7'000 ideas of which over 1'000 have been accepted and over 18 million euros have been allocated for their realization.

Despite all the positive results previously mentioned, not all the studies proved to be successful. “Decide” [21] is an online platform through which citizens could propose and vote new laws and opinions about the city proceedings, debate and rate how to redistribute the city’s budget among projects. In order to be approved, proposals must survive through a complex process after which the decision on whether to implement the proposal or not is taken. Expenditure projects should be authorized after a similar procedure, also involving a feasibility evaluation phase. Both processes requires a lot of time. As stated on the information page of the platform: “One of the main missions of the platform will be to ensure the inclusion of everyone in the participatory processes, so that all voices and wills form a part of them and no one is left out”. Those words perfectly exemplify the concept of engagement. Despite that, the platform failed achieving its objective because of those though and time-expending proposal evaluation procedures. Indeed, from 2015 to 2018 about 20’000 proposals were submitted and only 2 of them reached the final phases of the evaluation process, a discouraging result for the users.

Finally, the last example reported in this thesis which tries to increase civic engagement is Brigade, founded in 2014 by Sean Parker [18]. The online application integrates a newsfeed-like vertical scroll of topics, for which each user can express his opinion (“Agree”, “Disagree” or “Unsure”) and also compare his beliefs with the friends’ ones. Moreover, whenever a friend changes his mind, the user receives an alert. Besides this, users can perform further actions inside the platform, like creating surveys, groups of followers and commenting hot topics.

As stated before, other contexts have been considered. However, only the exploited gamification elements together with the most important considerations and results will be reported.

## **3.2 Ecology Context**

In the ecology context, gamification is the main channel through which the user is instructed and made aware about many different contextual aspects, like recycling or pollution, leaving motivation and engagement as an intrinsic need for that goal: the more engaged you are, the more you will learn.

Like in the previous sections, it is possible to notice how some of the most common gamification techniques have been applied.

In [19] points were awarded based on the provided information and actions taken through an online portal, whereas in [24] those activities were performed within a game. In other

cases, providing [12] or gathering [43] useful information rewarded users with points. Instead, in [34] they were awarded for creating and completing missions for the local communities.

Levels in [19][43] were acquired through points and/or badges. In [19] leaderboards were based on the number of points earned, whereas in [34] they were based on the number of missions completed. Badges were awarded for completing goals [19] or missions [34] in the platform.

Competition was introduced exploiting different mechanisms. In [43], using the dedicated application, each player was able to claim areas around the city while gathering data, while in [22] each player should reduce his energy consumption as much as possible, competing against the other team and their own teammates too.

Other well known elements used are the missions [43][12][34] and the custom games [19].

From the analysed literature an indirect and a direct form of rewards were identified. The latter came in physical form, like gadgets [19], coupons [10] and real world incentives [34][7], while the indirect one is strictly correlated with the intrinsic learning process induced by those kinds of systems [12][22]. For example, [12] showed how users saved from 10% to 30% on energy bills thanks to the provided energy-saving information.

In conclusion, many different results were carried out. [22] demonstrated how a well developed competitive aspect increased the motivation of the participants, also boosted by social demand and peer pressure between team and player. Instead, [34] demonstrates how the system increased the awareness of the participants about both climate change and its connection to lifestyle choices. Crowdsourced and social interactive aspects were motivating and users found the experience fun and engaging. Besides, participation affected behaviours beyond the scope of missions.

[7] showed how physical rewards can sometimes be successful. Indeed, the citizens participation increased by 32.2%, while the recycled waste increased by 17.2%.

### **3.3 Education Context**

Gamification techniques exploited in the education area focus on keeping the students engaged and motivated while learning, also attempting to improve in-class participation and lecture attendance. In order to reach these goals, the considered experiments relied on points, badges and leaderboards. In [44] the first two could be earned by correctly answering to online quiz, by solving online puzzles or through the participation and attendance of the student. In [13], the same elements were received upon the completion of a task or a course and badges were awarded upon the completion of an achievement. In [20] gamification was

applied to a music class in which students could earn badges in many different ways, like completing multiple related pieces or maintaining a constant practice. They also earned points depending on the amount of time they practice with respect to their average practice time.

In [44] the points could be used by the student to get in-game objects which helped them in solving the problems, whereas in [13] they were used as experience (XP) to level up and earn artworks for their avatar. In the latter, the XP were used to track the progression in the course, which was used to provide statistics and analytics to the students. The leaderboards were built based on points [44][13][20], badges [44] and/or missions [58]. [44] and [13] reported successful results. Indeed the participation/attendance improved and the test results as well [44]. Moreover students were keeping ahead in school work [13]. Besides missions, [58] also made use of quests<sup>1</sup> and storytelling game mechanics through which the game involved about 20'000 people from all over the world and some of the provided ideas were turned into real projects which received different rewards each.

Both [30] and [15] achieved divergent results with respect to the previous ones by performing analyses on the aforementioned elements exploiting a different methodology. In both experiments, two systems were used by two different groups of students, one gamified with points, badges and leaderboards, the other without such elements. [15] also included the possibility to provide feedback to other students through the comment section included in the system. [30] awards students with points and badges upon completing certain tasks, while in [15] rewards are assigned depending on their contributions and activity through the gamified system.

In conclusion, [30] demonstrated how motivation, satisfaction and empowerment in the gamified class decreased over time, leading to a reduction of the intrinsic motivation, harmed by those “problematic gamification elements”. [15] instead focused their studies on badges, showing how even though the global participation increased a little, they weren't proved to be that effective since they did not impact student perceptions of the learning value of the exercise. Indeed, also [20] found out how some learners have strong negative feelings about the use of badges in college courses.

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<sup>1</sup>Each quest is a question through which the user writes his own story.

# Chapter 4

## Design and Implementation

### 4.1 Introduction

This chapter aims to illustrate the main idea of this work, explaining each considered elements during the design process, and the relevant technologies and tools exploited for its implementation.

Throughout this process, the sets of roles, assets and tasks have been listed. Those elements which have been identified as negative or irrelevant are not even included in this section (like points or leaderboards).

For each asset, the corresponding relevance, coming from the analysis performed on the literature, has been classified in three tiers: High Relevance (H), Medium Relevance (M) and Low Relevance (L).

The classification process exploited tiers instead of a leaderboard, since it is really difficult to compare assets among each others. This organization contributed to the design of final high level solution, whose implementation is explained later on in this chapter.

### 4.2 Framework Definition

This thesis aims to conceptualize a framework supporting the development of applications promoting social and political engagement, exploiting gamification mechanics and principles.

First of all it is necessary to find out which are the different roles of the users involved, in order to define the set of elements required by each one of them.

The different types of users identified throughout the design process are displayed in the Figure 4.1.

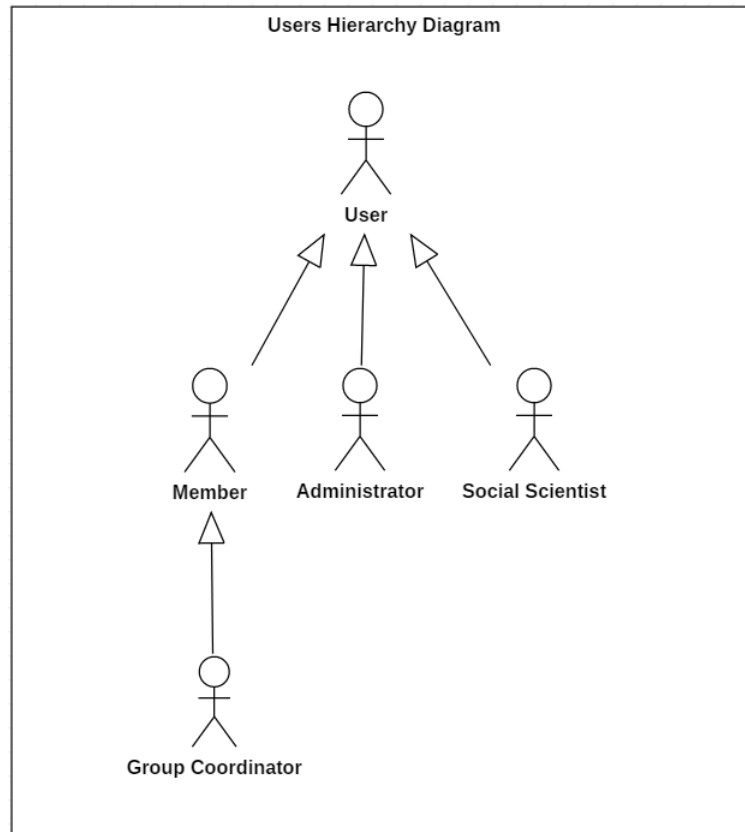


Figure 4.1 Users Hierarchy Diagram

Each one of them has a different set of different assets and tasks.

### 4.2.1 Roles

Each role represents one of the different kinds of people the framework is built for. The Table 4.1 provides a small description for each one of them.

Role	Description
Social Scientist	A social scientists is a user who analyzes the data provided by the platform.
Administrator	An administrator is a user who manages the platform.
Member	A member is a user which uses the platform.
Group Coordinator	A coordinator is a particular type of member which manages one or more groups of the platform.

Table 4.1 Brief description of each user role



### 4.2.2 Assets

The framework includes a set of assets for the roles explained in the previous section. The tables (Tables 4.2, 4.3, 4.4, 4.5 and 4.6) only reports a list of those assets alongside their description and some noticeable considerations made (listed in the “Notes” column). In the following tables the \* symbol before the asset name points out a sub-asset of the previous asset without the star. Same reasoning with \*\*, which indicate sub-sub-asset of the previous sub-asset.

Asset	Description	Notes	Relevance
Topic, Challenge	Real world problem on which the members of the platform will discuss and learn. Each topic has its dedicated area.	-	H
* Vision	A subcase of topic regarding a specific argument.	-	H
Content Creation	Each member is able to create content, in the shape of posts, tags, images, etc.	The content will be inserted in a general feed, so that the member can feel more engaged in the community. The main downside is that the content could be not related at all with the topic or the context in which it is generated. This feature is honor-based. It means it's in the interest of the member of the platform to generate coherent content, avoiding uncorrelated or offensive elements.	H
* Image	A photo taken by a member which shows some concrete example regarding a topic.	-	H
* Discussion	People arguing a matter of interest pertinent to a certain topic.	-	H
Keyword	A special word assigned to an image. It is meaningful to identify the represented content.	-	M
Community	People who want to contribute to the platform's goal.	-	H
* Chat	An element through which members can interact and exchange messages with their friends and/or the members of a group.	Through this feature, members can keep in touch and coordinate while taking part in group events. It would increase the platform engagement and allow people to achieve better results in group missions. An option allowing members of the group to abstain from chatting should be provided.	L

Table 4.2 Assets Specifications I

Asset	Description	Notes	Relevance
* Circle	Members are allowed to add friends to their friend list in the platform.	Having a circle (a group of friends) can increase the feeling of belonging to a community and may allow friends to play together in the same match of an eventual playable game. This feature has been shown to be more important for women, as mentioned in the previous chapters.	H
* Group	Members can join or create groups to compare their opinions and cooperate.	This small community would eventually compete against other groups in groups-generated missions. Groups allow people with shared thought to stay in touch and also to increase engagement, since some community member could be engaged by cooperative activities.	H
Profile	The profile is the representation of the member inside the platform.	-	M
* Statistics	A set of statistics displayed to the member about their activity in the platform.	Examples of statistics are the number of posts created or the photo with the highest rating. These could lead the member to perceive a sense of accomplishment or incentivize self-improvement, however, not everyone can appreciate them, undermining person's motivation, or having no effect at all since not everybody could be interested.	L
* Avatar	A customizable image inside the profile.	It allows each member to have a more unique profile. Predefined avatars could be used as a reward.	M
* Activity Level	A border around the avatar which shows the level of activity and in which kind of activity the member is mostly engaged.	It's a form of "Status as Reward", which has been demonstrated is a good way of increasing engagement, moreover it allows members to find people which are worth to be engaged with because of common activities or topics of interest. However, it is necessary to define an accurate system in order to award members with those items (e.g. just looking at the hours the platform has been used is obviously not enough to determine whether a member is active).	M

Table 4.3 Assets Specifications II

Asset	Description	Notes	Relevance
Event	A live initiative organized by a member, in which the community performs a certain task defined by the organizer.	Events allow people to meet each other and do something concrete, increasing motivation and engagement.	M
* Geo-Localization	A feature enabling the platform to keep track of the position of the member, exploited either to find nearby events or to invite nearby people to an event.	It would allow to check whether a member is taking part in the event they were interested to, even if this feature could be cheated by someone. Still, some could argue about their privacy.	H
Game	A playable game included in the platform.	The game's goal is to increase both engagement and awareness on a certain topic. It should be intuitive and fun, since a complex game may be counter effective.	H
* Quiz	A game whose goal to inform people on the topic, making them aware of the relevant aspects and problems of the latter.	-	H
* Custom Game	A custom game which may have different goals depending on the platform.	-	H
News Feed	It keeps members informed about the most relevant and recent news about a certain topic.	-	L
Notification	An informational message sent to a member whenever a certain action takes place.	-	M
* Time Customizable Notification	The member is able to setup when the platform sends them notifications in order to avoid to bother them while working or performing important activities.	This asset gives the member more control on the platform's behaviour and improve usability since some of them may be stressed out by constantly receiving the notifications. This aspect should be well designed to make it less time expensive as possible to setup it correctly, and even in this case, some people who exhibit a different routine every week may find this feature pretty useless (it would be better to receive all notifications or no notifications at all).	L

Table 4.4 Assets Specifications III

Asset	Description	Notes	Relevance
Privacy	Members can choose which information exhibit on their profile, hiding those they don't want to be public and visible to others.	The only downside is that the effects of other elements (e.g. "Display Chosen Achievements") can somehow be reduced.	H
Missions	It's an objective which rewards a member with something, like an achievement, once reached.	Since each member of the platform has a task to accomplish, they could be more engaged, but at the same time this feature makes use of extrinsic motivation, possibly undermining the intrinsic one. Missions could be used to lead members to perform certain activities.	L
* Community Missions	Administrators can create missions which can be shared and performed by the members of the platform.	-	M
Feedback	The member receives some feedback from the platform, showing them whether their efforts and activities are effective.	It has been revealed people appreciate feedback because they know they are achieving something and also increase their satisfaction.	H
Rewards	Something received upon the completion of a mission or an activity.	-	M
* Achievements	An item composed of a name, a description and an image. There may be different tiers of the same achievements.	Achievements can generate a sense of gratification in those who achieve it, also allowing people to compare their progress with others. Nevertheless, these items should be useful for something, otherwise it has been shown people perceive them as something virtual which has no meaning at all after some time, or maybe someone will start to complete missions only to earn achievements and not to give a useful contribution to the final goal of the platform.	H
** Achievements visible on Profile	Each member can select a small set of achievements they unlocked, which are displayed on their profile.	This feature could incentivize an indirect competition, since other members of the platform may want to achieve a badge a member has already unlocked. Still, it has been shown that not everyone appreciated this features, but it could be solved by allowing people to decide whether to show them or not, although the feature would become useless.	H

Table 4.5 Assets Specifications IV

Asset	Description	Notes	Relevance
** Event Achievements	The member(s) who organize(s) an event can create their custom achievements in the platform, which are then awarded to the members who join the event.	Event achievements could lead to an increase in the participation. Still, there are problems to check whether a member took really part in the event.	L
* Information as Reward	The member is provided with interesting information and curiosity about the topic they are exploring.	The goal of this asset is to allow members to learn even more about their interests. It could increase the intrinsic motivation, but, at the same time, some people may not perceive information as a satisfying reward. Furthermore the information sources must be reliable.	H
Dashboard	-	-	H
*Analytics Dashboard	The analytics dashboard allows social scientists to analyze the different data coming from the platform. It displays data in a detailed or compact way, organizing them depending on challenges, visions, sections or time.	-	H
**Analytics Tools	A set of analysis tools are included in the dashboard dedicated to social scientists, allowing them to perform the most common analysis in an automated way exploiting the data they selected.	-	H
**Representation Tool	A set of tools allowing social scientists to represent the data through diagrams and graphs.	-	H
*Area Configuration Dashboard	The configuration dashboard is the interface through which the administrator is able to configure new areas of the platform, providing the required parameters and/or elements.	-	H

Table 4.6 Assets Specifications V

### 4.2.3 Additional Aspects

In the Table 4.7 are illustrated the sub-assets the regarding mission asset.

#### Missions

Asset	Description	Notes	Relevance
Never Ending Missions	Different missions are regularly offered to the members of the platform.	Members are constantly engaged, giving them an additional motivation to keep using the platform. However, by organizing the missions in such a way, some people may not feel a sense of accomplishment since there is no fixed number of quests they have to complete.	L
Balanced Missions	The missions are balanced for each member.	As seen in SDF and relative papers, the competence need of the person can be satisfied.	H
Non-Predictable Missions	The member shouldn't be able to predict and get ready for the incoming missions.	By preventing the members from getting ready to complete a mission as soon as it is published, they feel more challenged, increasing the engagement.	L

Table 4.7 Mission Assets Specifications

In the Table 4.8 are illustrated some other additional assets.

### Other

Asset	Description	Notes	Relevance
Self Improvement	The platform should generate a feeling of self improvement in its members, in such a way they feel like they are gaining new skills or expanding their knowledge using the platform.	This aspect is important, since people feel like they are improving over time, generating an even greater feeling of engagement. However, it could be hard to achieve since it may depend on the person's interests, knowledge and awareness of the topic.	H
First Steps	It keeps track of the progress regarding the first things a member of the platform should achieve, like setting up their profile, uploading an avatar or posting their first photo.	This feature is used to lead members during their first steps while using the platform, explaining them the platform characteristics. It has been shown that a progress tracker can generate a good initial engagement.	H

Table 4.8 Other Assets Specifications

### 4.2.4 Tasks

Each asset has its own set of tasks which can be performed by each role (Figure 4.2). A table representing the subsets of tasks each role can perform, alongside which asset each task belongs to is included in the appendix (A.1, A.2 and A.3).

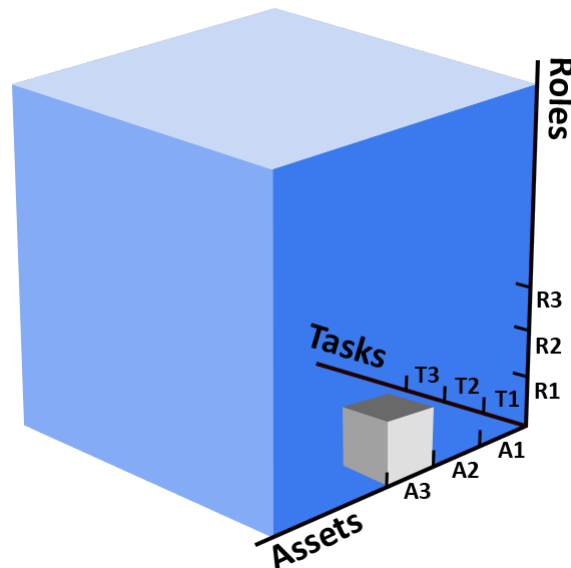


Figure 4.2 A visual representation of the role, assets, tasks mapping

## 4.3 Main Principle

The platform is designed following the idea that each member should develop his awareness gradually. In first place members learn and play alone in the “Quiz” and “Shared Vision” section, while the following steps will gradually increment the amount of people they interact with. Indeed the next sections are “Change My Mind” in which the member interacts with another one and “Discussion Groups”, in which groups of people interacts through discussions.

Summarizing, by default, the platform sections are progressively unlocked during the platform usage in the following order:

- Quiz, which contributes to generate awareness (unlocked by default).
- Shared View, allowing the member to explore different views created by other members.
- Change My Mind, allowing one on one interactions.



- Discussion Group, allowing group interactions.

## 4.4 Member

A member of the platform is a particular type of user who can access the different challenges area to discuss, learn and play, either alone or with other members. They can also read feedback, visualize the missions assigned them by the administrators and the corresponding progress. Each mission can be divided into two categories: personal, assigned automatically to each member, and community, which are missions whose completion is collaborative. The Figure 4.3 sum up the actions a member can perform in the challenge area.

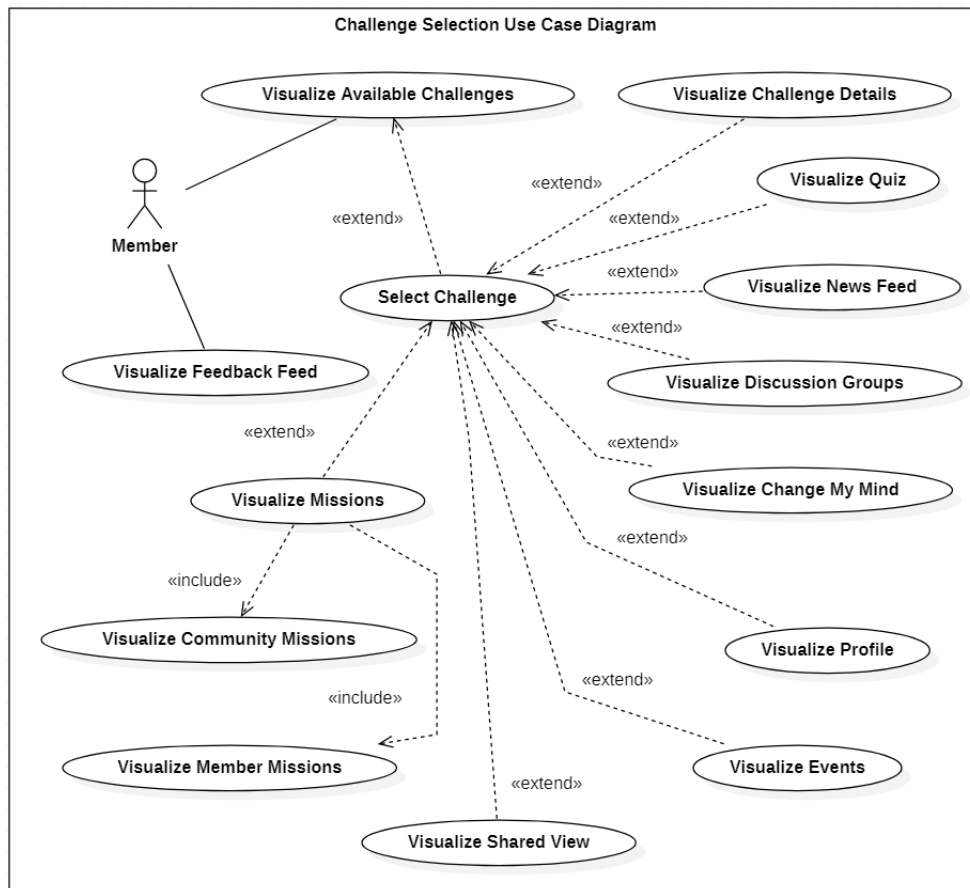


Figure 4.3 Challenge Selection Use Case Diagram

### 4.4.1 Shared View

Members can create shared views inside the platform. Those are sorted and displayed into four different feeds:

- Recent (Views sorted depending on the creation date)
- Top (Ranked views, sorted based on the “Adjusted Relevance Parameter”<sup>1</sup>)
- Friends (Views created by friends)
- Personal (Views created by the logged member)
- Vision (Views organized per vision)

Each shared view is composed of an image, a list of keywords (at least one) and a vision. A keyword is just a word or a set of words merged together. They do not involve any symbol or number. Members can add keywords when creating the view, while further keywords can be added (or removed) at a later time. In contrast, after the vision has been chosen it cannot be changed anymore. The maximum number of assignable keywords and the list of visions among which each member can choose are established by the administrator during the challenge configuration procedure.

Members can rate shared views, upvote keywords and suggest keywords. The behaviours of those two actions are different:

- Each member can assign ratings to a shared view. There are three different attributes that can be evaluated:
  - Relevance (Inappropriate - Relevant)
  - Need (Secondary - Impelling)
  - Radiosity (Gloomy - Bright)

Ratings can be changed whenever they want. A summary of all the ratings received by an image is shown only to its owner.

- Each member can upvote one or more keywords assigned to a shared view. The number of keywords each member can upvote for each view is up to the administrator when the configuration procedure is performed. Those keywords are the ones or the one the member consider more relevant based on the challenge and the view. Upvotes can be changed at any time.
- Members are allowed to suggest keywords that can be added to a shared view by its owner when editing it. If the maximum number of keywords is reached, the owner is allowed to remove some in order to add new ones.

---

<sup>1</sup>It is explained in the “Image Sorting Formula” subsection

Members can rate their own views and upvote their own keywords, since there is no downside in letting them do so.

The Figure 4.4 shows the activities which can be performed by a member in the Shared View section.

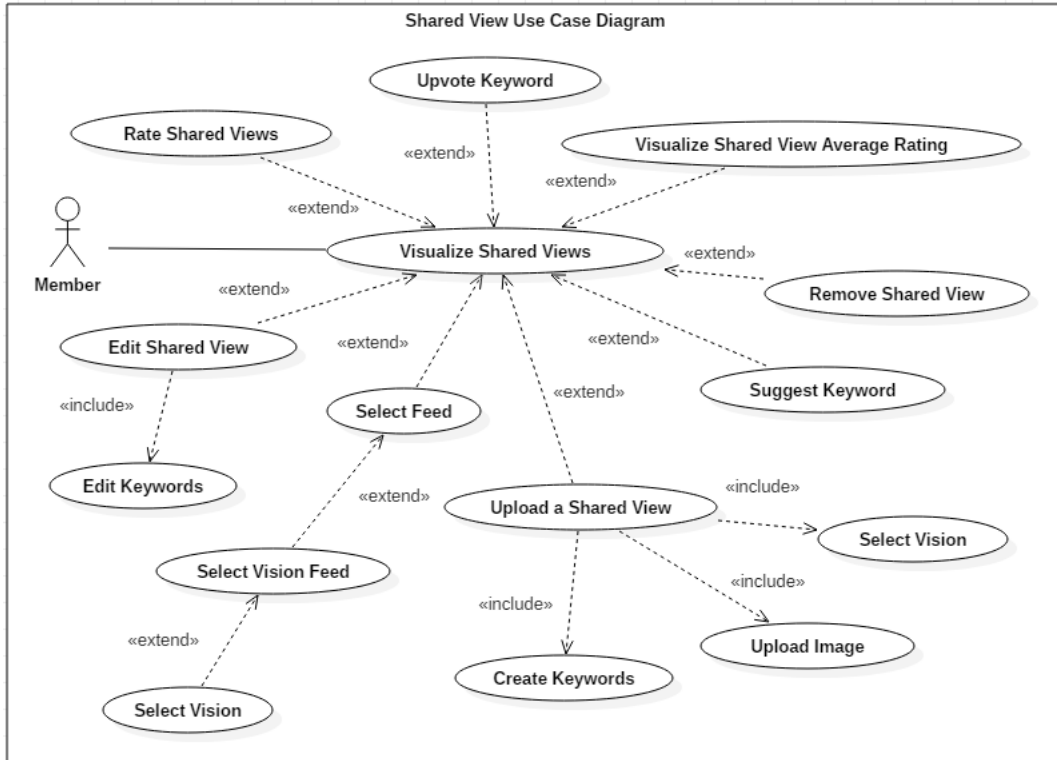


Figure 4.4 Shared View Use Case Diagram

#### 4.4.2 Quiz

It's the basic game provided by the platform. It is a typical quiz which consists in a bunch of multiple choice questions. Each question comes with four answers, a curiosity, which is displayed after the question is answered, and eventually an image. Only one of the available answers is correct. Members can play the quiz whenever they want. The platform may include several different quizzes among which they can choose which one they want to play.

In Figure 4.5 is shown the simple quiz use case diagram.

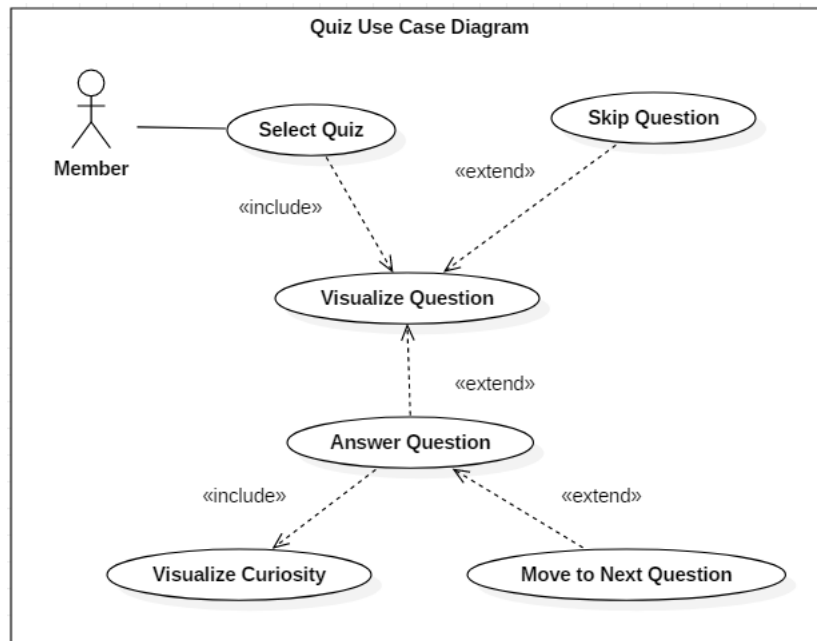


Figure 4.5 Quiz Use Case Diagram

### 4.4.3 ChangeMyMind

Figure 4.6 summarize the different activities made available in Change My Mind, a custom game which involves two members sharing their opinions on a view they both rated in the “Shared View” section. The current member is referred to as player, while the other member is referred to as challenger. When the game is selected, several sections are presented to the member:

- A brief description explaining how the game works and its objectives is presented.
- The member can create a card. A card is just a view coupled with the player thoughts about the rating they gave. Obviously, it is necessary to rate at least one view to be able to create a card. Each player can create maximum one card per rated view.
- The player can play a match. Both their thoughts and the challenger thoughts about the same view are displayed. The player has to explain on what they agree and disagree with respect to the challenger’s opinion. At the end of the match the player is asked whether they would keep or change the current rating. In the latter case they are also asked to provide a new one. It is possible to play a match against another player only if there is a couple of cards, regarding the same image, each of which created by two different members. Each match is unidirectional, meaning that given a couple of cards

there are two possible matches: player versus challenger and challenger vs player. In order to generate a match, a card should not have previously been matched against another one.

- Two different match histories can be visualized: one made of the matches played by the current player and one including the matches played against him. If the reverse match hasn't been played yet, the player is able to play it from the match history.

The game is completely asynchronous. It can be played at any time if the player and another member both have created a card which can be coupled, otherwise it is necessary to create new cards.

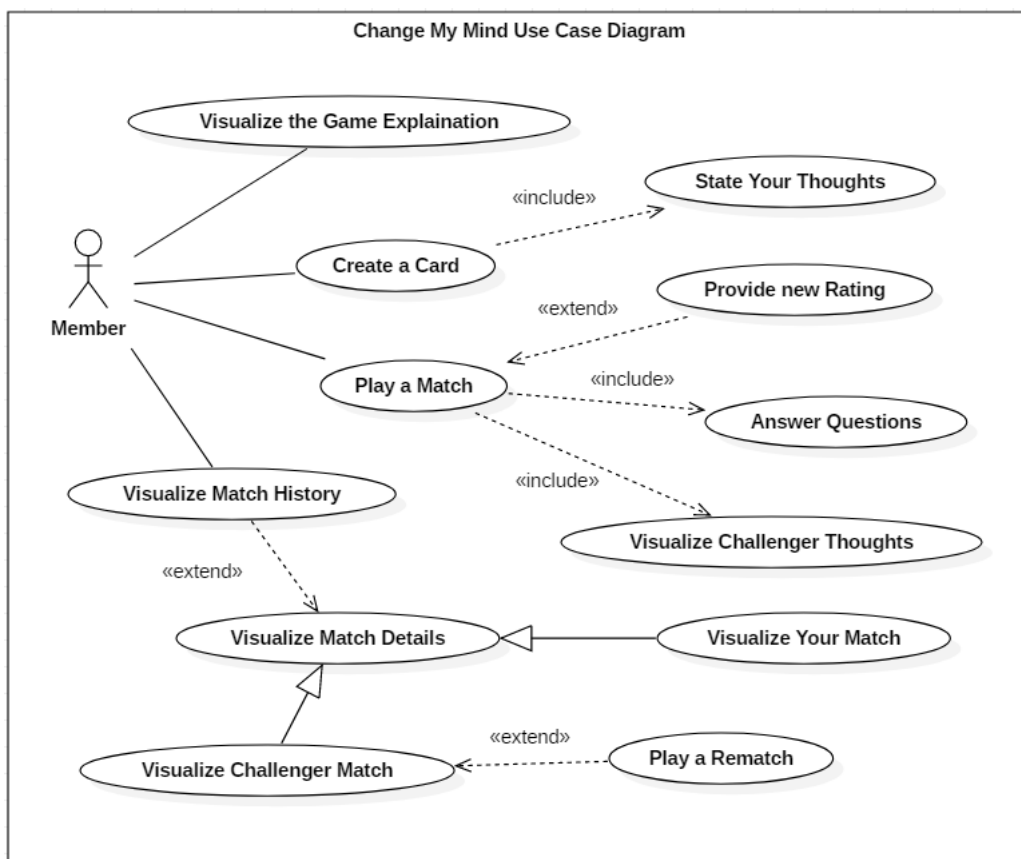


Figure 4.6 ChangeMyMind Use Case Diagram

#### 4.4.4 Discussion Groups

Discussion groups consist of members that are interested in a certain set of topics or subtopics about which they want to discuss. Discussion Groups can be created by any member (as shown in Figure 4.7). Each discussion group has a name, a description and a set of topics



Each week a poll is held, moving group members to express a feedback on which topic they would like to discuss about. Proposing a topic requires a member to provide the name of the topic and a brief description, which will begin the discussion if the topic is chosen. Each member can propose only one discussion topic per week. They are able to vote as many proposals as they want. When the poll ends the proposal with the maximum number of votes will be the topic of the next discussion. Sometimes it could be possible for groups to have no ideas on which topic they want to discuss, in this case, they can keep the previous discussion as the active one.

In a discussion, each member can post a comment, reply to a comment and either edit or remove their own comment.

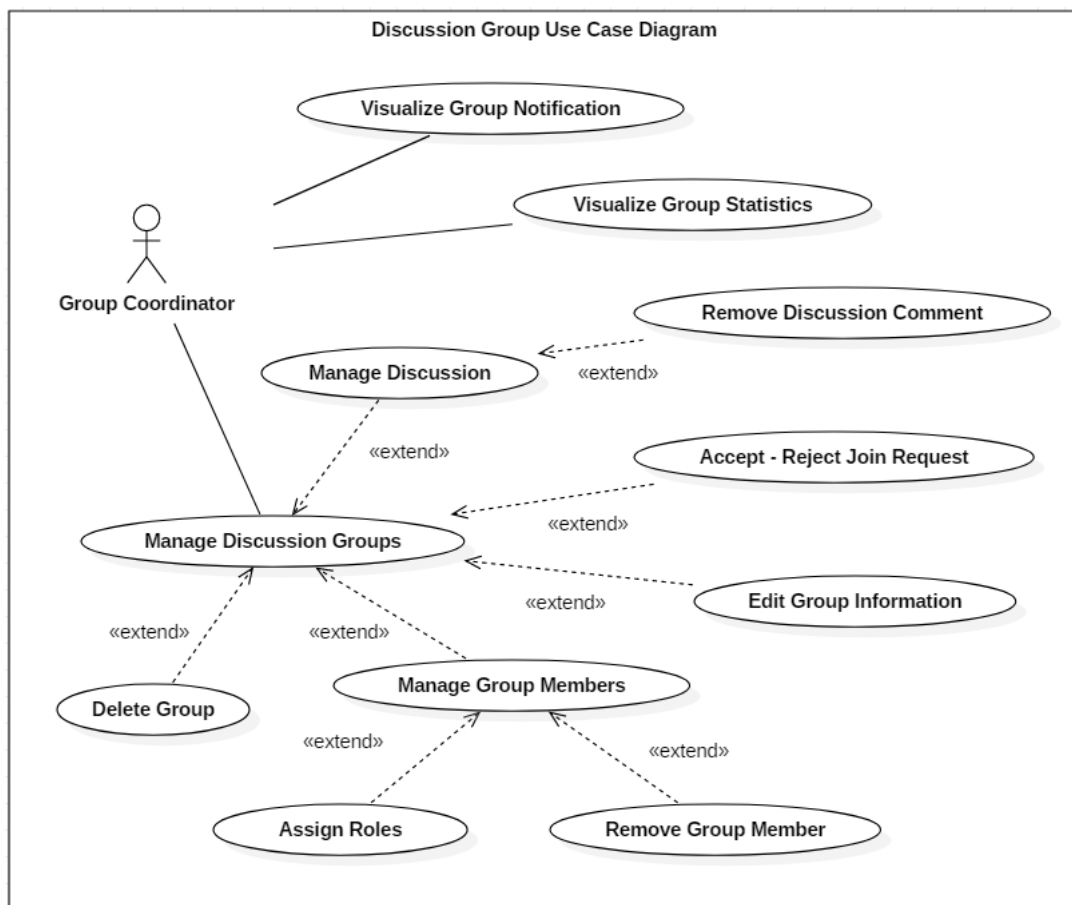


Figure 4.8 Discussion Group Coordinator Use Case Diagram

#### 4.4.5 Event

An event is a physical meeting organized by a member of the platform. Figure 4.9 shows how each member can exploit this section. Each member may express their participation

status in three different ways: Interested, Participating or Ignore. Each event is defined by different elements which must be specified by the member who organizes it:

- Location
- Interval of time in which the event takes place
- Description (optional)

After those information have been provided, the event is ready to be published. Members won't be allowed to create private events, since those events will automatically exclude some people from participating and cooperation is an important principle the platform focuses on. Members can invite their friends, who will receive a notification for the corresponding event. As soon as the event starts there will be no more possibility for any member to express their participation status. Events are displayed based on the applied filter:

- “My Events”, in which the events organized by the member are displayed.
- “Upcoming Events”, showing the events that take place nearby in the future, sorted starting from the closest event. Those events can be filtered based on the distance, choosing it from a range of values (e.g. 10 km, 20 km, 30 km, etc.). This last feature requires Geo-Localization to be enabled.
- “Followed Events”, including events for which the member was interested or they are taking part to, sorted from the closest event.
- “Nearby Events”, available only if the Geo-Localization option is enabled. It allows the member to find nearby events.
- “Search Event”, in which all the events are filtered by a starting date and a location. The outcome will be sorted based on the the distance from the chosen location, starting from the closest event.
- “Friend Events”, in which all the events to which the friends of the current member are taking part or interested to are displayed.

After the event took place, it is stored and excluded from query results.



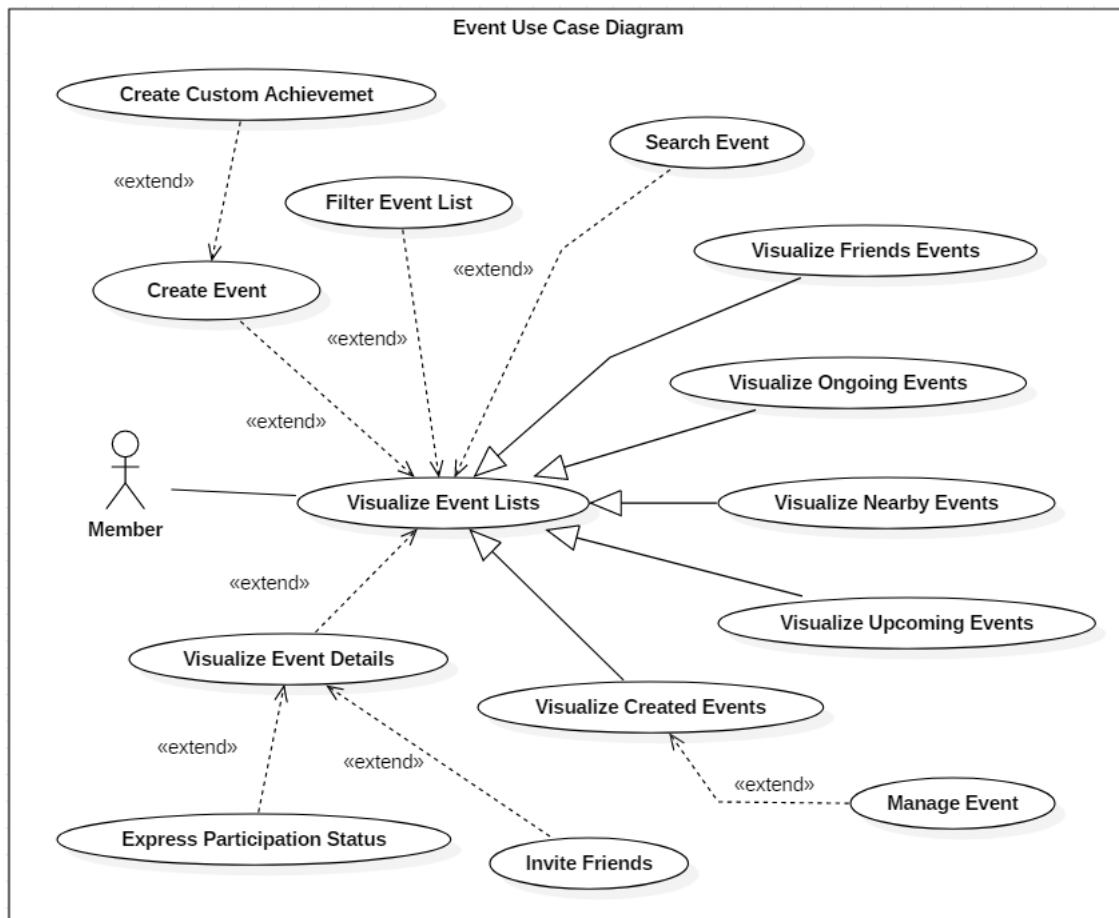


Figure 4.9 Event Use Case Diagram

#### 4.4.6 News Feed

There is a different news feed for each challenge. Inside this section each member can access to articles and news provided by external sources (as shown in Figure 4.10), in order to increase his awareness on the chosen challenge. The news feed section also includes a “suggestion field” which allows each member to suggest a website from which the articles could be taken. Those are inspected by the administrator of the platform, who will check the trustworthiness of the suggested websites, deciding whether those sources should be added to the ones from which the information feed is built.

News that have already been read by the member are marked as “read”. Members can mark some articles as “favourite”. RSS sources can be marked in the same way, granting articles from those sources priority when displaying the general news feed.

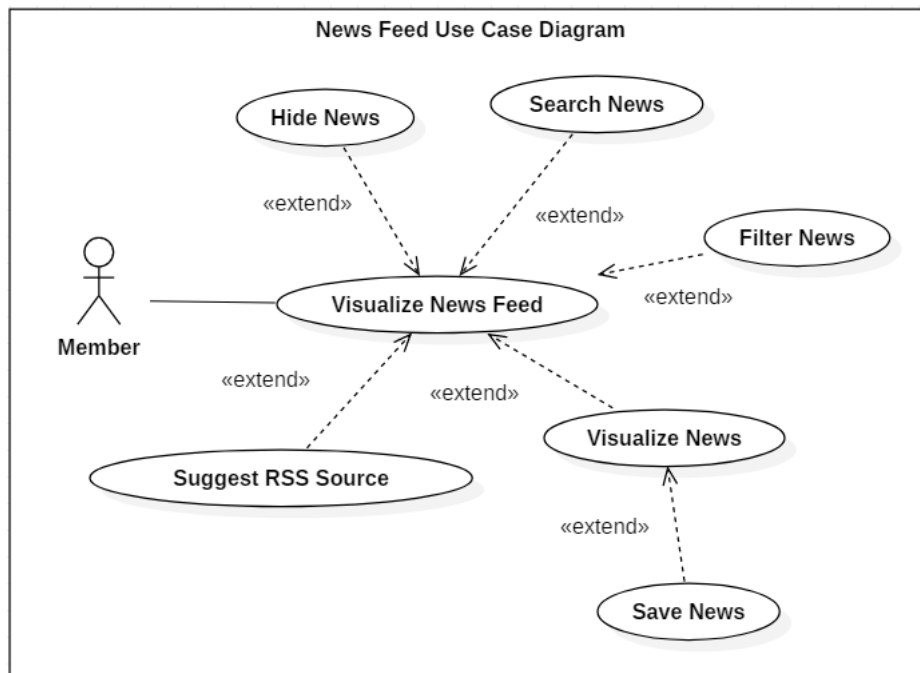


Figure 4.10 News Feed Use Case Diagram

#### 4.4.7 Profile

A profile is made of several different elements:

- Avatar
- Username
- Birth Date
- Account Creation Date
- Nationality
- Circle Size and Circle. Visualizing your Circle also allows you to look for and add a friend or to remove one
- Displayed shared view images
- Displayed Achievement (Name and Badges)

Each element, except for the Avatar and the Username, can be hidden to other members, making it private by configuring the privacy settings in the dedicated section of the platform.

The achievements and the images of the shared views displayed on the profile are chosen by the member. Up to 4 - 5 achievement can be displayed. The same applies to views. It would be possible to introduce a section of the profile in which the logged member can see their statistics. All the operations available in the profile are summarized in Figure 4.11

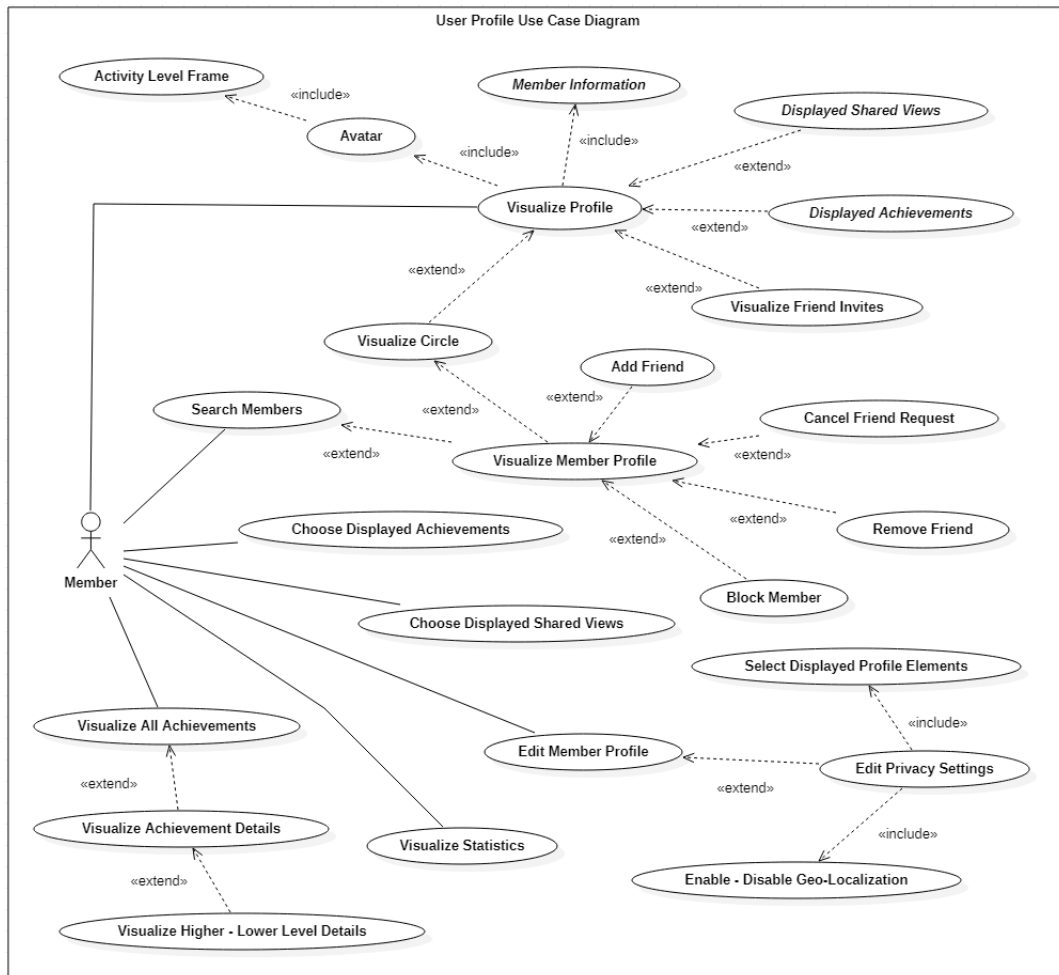


Figure 4.11 Profile Use Case Diagram

## Achievements

Achievements are made of three components: a name, a badge, which is an image assigned to the achievement, and a description, which define the objective related to the achievement. Each achievement may have different "levels" (e.g. LV 1: "Add 5 friends to your Circle", LV 2: "Add 25 friends to your Circle", etc.). It is possible to assign different Badges to each level.

### 4.4.8 Chat

Any member can create a chat to communicate with friends, members of a group or people interested in the same event. It is not possible to create a chat mixing those different “classifications” of members. The owner of the chat can perform all the most common management actions, like adding or removing people (as summarized in Figure 4.12). Each member can leave the chat whenever they want.

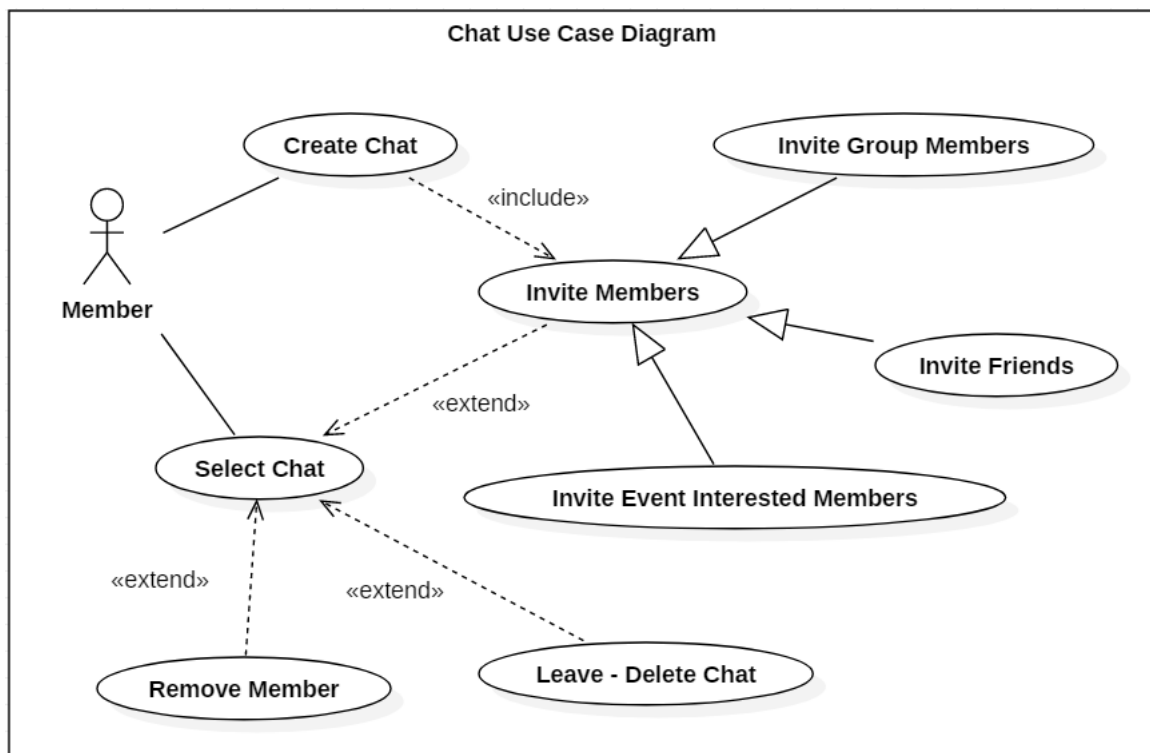


Figure 4.12 Chat Use Case Diagram

## 4.5 Administrator

Figure 4.13 shows how an Administrator is able to manage the platform and create challenge areas. The latter are generated through a “Challenge Creation Procedure”, in which an administrator should choose which sections will be included for each challenge. For each of those sections there are a set of parameters which can be configured. Both the set of the configurable parameters and the adaptation guidelines for each section are provided below. Each challenge area can be edited anytime, but only a few settings can be changed after they have been chosen the first time.

An activity diagram representing all the steps the administrator goes through is available in the appendix (A.9).

The administrator can also configure the order and conditions of unlock of the different section of the platform for their members.

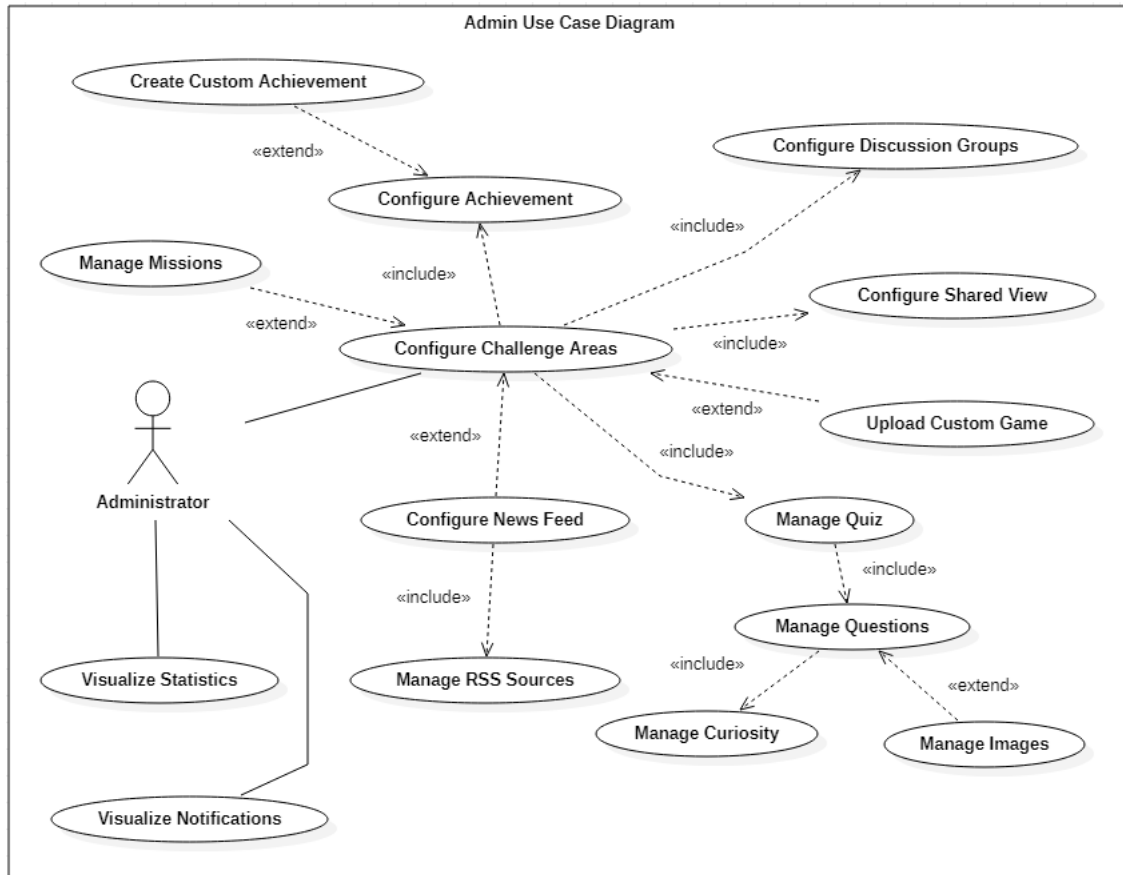


Figure 4.13 Admin Use Case Diagram

### 4.5.1 Adaptation Guidelines

Following are explained the adaptation guidelines for each element, which define whether an element should be included in the platform by the admin during the configuration process.

#### Shared View

“Shared View” is really useful when applied to challenges for which members can take photos and upload them inside the application. Those are used to perform analysis, so it is necessary for this section to be included when the uploaded content is relevant. It is less effective when applied to challenges for which photos aren’t likely to be taken, but probably downloaded

from the web and then re-uploaded inside the platform. This section is mandatory for each challenge.

Allowing members to rate a view is really useful when it comes to increase the engagement. It is also meaningful when selecting the views to display in the profile, since anyone would like to show their best rated or favourite ones instead of the low-rated ones.

Keyword rating could be really useful when performing analysis on the uploaded content. Ranking the views, based on the ratings assigned and the upvotes of the corresponding tags, allows the selection of the image representing each challenge. It also contributes to create a genuine competition among members, since inside the “Top View” section the views are sorted based on their ranking.

Ranking could be exploited to perform checks on the relevance of the uploaded content. Indeed, a shared view with a low rating will slowly disappear inside the feed.

### **Quiz**

The quiz is mandatory and cannot be excluded from the platform since it has the purpose of improving the level of awareness and knowledge of the members about a challenge.

After a certain number of days, the administrator should change the questions in order to keep the members of the platform engaged and maintain a high level of awareness.

The questions which have already been included in a quiz, shouldn't be included, at a later time, in another quiz.

### **Custom Game**

The administrator can upload a custom game on the platform. The framework offers a pre-built custom game named “Change My Mind”.

### **Change My Mind**

It is mandatory since it moves members to compare their opinion with others. Reading opinions of other members may result in self improvement, exploring new ways of reasoning and point of views.

### **Groups**

Discussion Groups are mandatory since each member has their own opinions and point of views, therefore they contribute to build constructive and interesting discussions. Obviously the engagement efficacy of each group depends on the people who are part of it. Members

would feel really engaged by groups in which constructive discussions with smart people take place, while those leading to stupid or meaningless discussion would cause the engagement efficacy of the group to decrease.

In general, discussion groups will be relevant inside this platform since members are expected to be acting propositively. Also group coordinators are expected to be really engaged by the group itself, so that they will keep it as organized as possible, by dealing with non-propositive members.

Sometimes it may happen that some groups remain inactive for a long time. Although they are meant to be groups of people actively discussing, it is not necessary to take any measure against them, since active platform members will slowly leave the group and join another one.

### **Events**

The event section should be used when the organization of events regarding the chosen challenge it's considered relevant, so that platform members can actively do something to bring benefit to a given cause (for instance, regarding the privacy and data on the internet topic, people cannot arrange something concrete. The only thing that could possibly be organized is a conference where specialized people talk and discuss about the topic).

The event section should be avoided whenever the considered topic is a sensitive one, in which case it may lead to manifestations or generate conflicts among people, bringing no concrete useful result. Therefore the events section is not mandatory since it's not always useful.

Some events can reward members who take part in it with achievements. They are automatically assigned after the event has ended and only if the event has achieved a certain number of real participants. Since checking for the participation is a difficult task and it is also cheatable in many different ways, this feature requires further analyses.

### **News Feed**

This section is meaningful when the sources, from which the articles are taken, are reliable and also when the chosen websites are publishing frequently, since this would allow people to receive frequently updated news.

One of the counter-effects of using this component is the fact that it may cause bias, depending on the news published by the information sources. Therefore it is necessary for the set of websites to be as heterogeneous as possible, in order to reduce this biasing effect. Because of this biasing effect this section is not mandatory.

## **Profile**

The profile is one of those components that cannot be removed since it contains important features and all the members' information.

## **Missions**

Administrators can generate missions to keep the members engaged overtime. Community missions are exploited to build a much more stronger sense of cooperation among the members of the platform, having them to cooperate to complete a requirement. Missions must be exploited when the objectives which must be completed are relevant, meaningful and balanced for each member otherwise it may end up causing undesired effects. Therefore they are not mandatory for each of the sections of the platform, sometimes they may fit the requirements, sometimes not.

### **4.5.2 Configuration Procedure**

Some aspects of the previously mentioned sections can or must be configured. Following, the customization required by each section is defined. Some of the configurable parameters default values are provided in case the administrator want to include a section without investing time configuring them.

#### **Shared View**

In this section, the number of upvotable Keywords, the set of visions and the maximum number of keywords must be configured. Regarding the number of upvotable keywords, two strategies can be chosen:

- Each member can upvote only the keyword they consider the most relevant.
- Each member can upvote all the keywords they consider relevant (default).

A set of possible visions among which the members can choose must be defined. There is no limit to the amount of visions that can be defined in the configuration process, but it is necessary to define at least one of them. Further visions can be defined at a later time.

The maximum number of keywords assignable to an image ranges between 5 and 30 and its values are only multiples of 5. Its default value is 10. Once this value has been chosen it can no longer be reduced, although it is still possible to increase it.



## Quiz

The quiz section may include multiple quizzes among which the members can choose when playing. Configuring a quiz requires the administrator to provide a set of questions for each of them. For each question of a quiz it's needed to define:

- A question
- Four responses
- The correct response
- Some explanatory curiosity about the question/topic
- Eventually, an Image which will be shown alongside the question

When creating a quiz it is necessary to provide at least three questions. Further questions can be added at a later time. Questions can be updated at any time.

## Change My Mind

There are no parameters or features that can be configured for this custom game.

## Groups

During the creation of a new topic it's required to define the maximum size of the groups. The size is a numerical value and it must be the product between a digit (0-9) and one of the powers of 10 (e.g. 10, 20, 300, 4000, etc.). This number cannot exceed 5000. After the challenge area has been created on the platform, this parameter can no longer be reduced, although it is still possible to increase it.

## Events

There are no parameters or features that can be configured.

## News Feed

The News Feed section requires to select a set of RSS sources (or web sites) from which the information about the chosen topic will be taken. Those links will provide the articles that will be shown in the feed, so it is necessary for them to be as relevant as possible.

### Profile

The profile section cannot be modified in any way. The only thing related to it which can be customized are the achievements. Indeed, the administrator can create new ones for a specific challenge, in which case, they have to define all the required components and eventually all the different “levels”.

### Missions

Some personal missions are available inside the platform by default, even though it is still possible to include more. Community missions instead are generated by the administrator, who must set a requirement and an eventual reward under the form of information or achievements.

## 4.6 Social Scientist

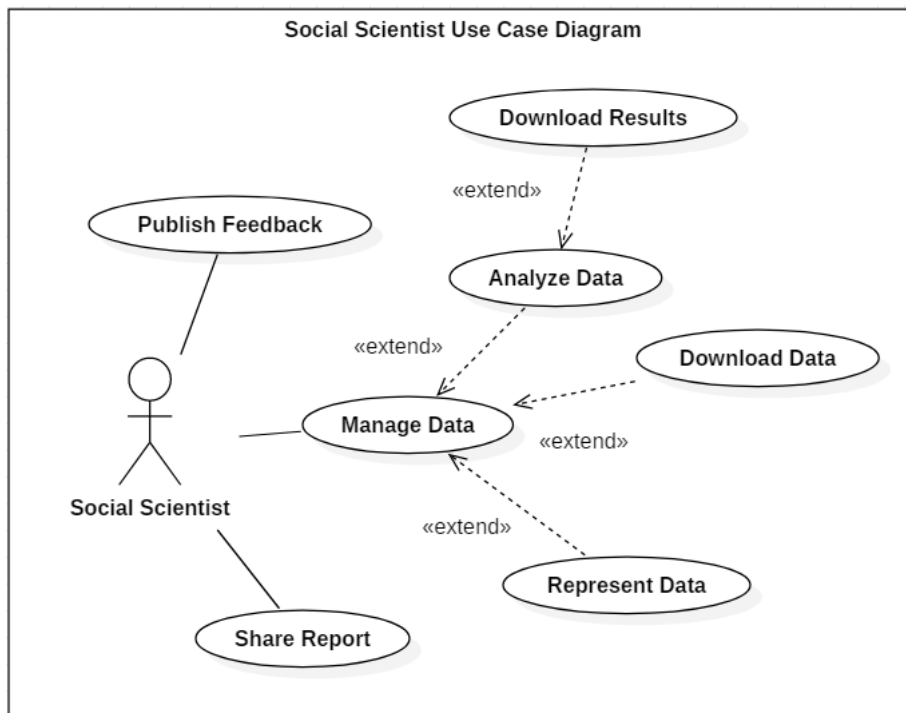


Figure 4.14 Social Scientist Use Case Diagram

From the activities performed by the members inside each of the mentioned sections it is possible to extract both raw and derived data made available to social scientists for their analyses and studies (Figure 4.14).

A social scientist can use some of the analysis tools provided by the platform to perform the most common analysis. Starting from their results, they can send a feedback to all the members of the platform about the outcomes. The set of data available inside each section and some example of the analysis which can be performed are provided below.

### 4.6.1 Shared View

For each view, social scientists can explore the following data:

- Upload date
- Rating
- Ranking
- A.R.P. value
- Owner

Other information come from the members, like:

- Their activity level
- Their ratings
- etc..

### 4.6.2 Quiz

The social scientist can examine some stats regarding the quiz, such as:

- The number of members involved per day, week, month or quiz
- The average number of responses (total, correct, wrong) per quiz or overall
- The average time of response per day, week, month, quiz or based on the member type
- The time of the day in which there are peak in the quiz usage
- The average number of times the members has played the quiz

It is also possible to perform analysis on the data gathered, such as:

- Classification of the members based on the number of correct/wrong questions

- Classification of the members based on the average number of question answered
- A ranking regarding the most wrong-answered questions for each quiz or overall
- A ranking regarding the most correct-answered question for each quiz or overall
- The trends regarding the previous statistics

### 4.6.3 Change My Mind

The most important output generated by this game are the thoughts from the members, which are useful to understand their opinions, also detecting the most frequent ones. It is also possible to track how often members change their mind when they face another member's opinion and whether there is a correlation among thoughts and members changing their mind.

### 4.6.4 Discussion Groups

Social Scientists are able to gather a lot of information and perform a lot of different analysis on groups. The following information can be obtained by analyzing each group and their members individually:

- The level of activity of its members (members involved in the weekly discussion and voting members)
- The average number of proposed topics per week
- The average number of votes per week
- The trend of the number of members that joined by invitation and invited
- The trend of the number of members inside the group
- The trend of the maximum number of comments received by a discussion topic
- The trend of the maximum number of votes received by a topic

All those results can be used to classify groups and members into different categories:

- Depending on the trend of the number of members it is possible to classify a group in 3 categories: Growing, Decline or Stable
- Depending on the level of activity of the members inside the groups it is possible to classify a group in 3 categories: Active, Inactive or Ordinary/moderate

- Depending on their level of activity the members can be classified in 4 categories: Active, Ordinary/moderate, Passive, Inactive.

By combining the results mentioned above it is also possible to determine some features about the challenge in which the group has been created.

### 4.6.5 Events

The social scientist can visualize all the information about all the created events, including the archived ones. These information are:

- Participants and interested people
- Event location and date
- Event description
- Event creation date

Further analysis would also allow to describe the behaviour of the member, in terms of the types of events they take part to, so that it is possible to provide for each one of them:

- The type of events the member is more involved in
- The number of events in which the member was interested
- The number of events which the member took part
- The number of friends the member invited
- The number of event the member organized

Those information can be further combined in order to analyze the general behaviour of the members given a specific topic. If an event is reproposed over different periods of time, it would also be possible to provide some trends about:

- The number of interested or participating members
- The number of members invited to the event

### 4.6.6 News Feed

There are few information that can be extracted/analyzed from this section:

- The number of members who read each article
- The number of articles read by each member
- A trend of the member reading the news each day
- A ranking of the most favourite RSS sources

### 4.6.7 Achievements

For each achievement it is possible to analyze:

- The percentage of members who achieved it
- The average level to which members achieved it

By considering the percentage of completed achievements for each member, it is possible to obtain the overall percentage of completion for the members of the platform. It would also be possible to classify members in 3 categories: Achiever, Ordinary or Sloth, depending on the number of achievement achieved. It would be possible to analyze whether there is a dependency between an achievement and the corresponding requirement (e.g. if an achievement requires you to add 50 friends and the members add 50 friends and then stop, there could be a dependency between the achievement and the member behaviour (Achiever)).

### 4.6.8 Profile

Performing an aggregated analysis of all the profiles, it would be possible to obtain:

- The platform usage based on the nationality of the member
- The platform usage based on the age of the member
- The average activity level of the members
- The average circle size

Those can be performed globally with respect to the platform or locally for each topic.

### 4.6.9 Missions

From the missions is possible to obtain different information, like:

- The percentage of members who completed a personal mission
- The contribution of a member for a community mission
- The average contribution of a member for all the community mission since their registration

## 4.7 View Sorting Formula

As previously mentioned, in the Shared View section of the platform, a subsection named “Top Views” is included. Several elements have been identified as relevant for the sorting factor computation: keywords, ratings and also the time passed since the image was posted. Because of all those elements, the use of a customized formula is required. It is important to notice how it is necessary to apply this formula to each topic individually, since there is a possibility that the same keywords may appear in many different topics, influencing the value of the parameters. Following, all the different parameters involved and how they have been computed is explained.

### 4.7.1 Keyword Frequency

The tag frequency for a generic keyword  $k$  is defined as the ratio between the number of images to which the keyword  $k$  is assigned and the total number of uploaded views.

$$N_k = \text{Number of views with keyword } k$$

$$N = \text{Number of uploaded views}$$

$$f_i = \text{Keyword frequency} = \frac{N_k}{N}$$

### 4.7.2 Keyword Relevance

The tag relevance parameter is defined both local with respect to the view  $i$  and a keyword  $k$  and global with respect to a keyword  $k$ .

$$v_{k,i} = \text{Number of votes of keyword } k \text{ related to view } i$$

$N_k = \text{Total number of view with keyboard } k$

$J_i = \text{Total number of keywords of view } i$

### Local Relevance

The local relevance is defined as the ratio between the total number of votes received by the keyword  $k$  in the view  $i$  and the total number of votes received by all the keywords in the view  $i$ .

$R_{k,i} = \text{Local relevance of keyword } k \text{ with respect to view } i$

$$R_{k,i} = \frac{v_{k,i}}{\sum_{j=1}^{J_i} v_{j,i}}$$

### Average Global Relevance

The average global relevance is defined as the ratio between the sum of all the local relevance of the keyword  $k$  and the total number of view to which the tag have been assigned.

$R_k = \text{Average global relevance of keyword } k$

$$R_k = \frac{\sum_{i=1}^N R_{k,i}}{N_k}$$

### Average Relevance

The weighted average vote is the average of all the ratings given to the Relevance parameter of the view  $i$ .

$V_i = \text{Relevance vote related to view } i$

$$r_i = \text{avg}(V_i)$$

### 4.7.3 Adjusted Relevance Parameter

The adjusted relevance parameter is the final result applied to sort the views uploaded in the platform. It involves several terms which are further explained below the formula.

$N_i = \text{Number of ratings related to view } i$

$D_i = \text{Days passed since view } i \text{ publication day}$

$K_i = \text{Number of keyword related to view } i$



$$ARP_i = (1 - \min(0.9; 0.03 * D_i)) * \log_{10}(1 + N_i) r_i \sum_{k=1}^{K_i} R_k$$

$(1 - \min(0.9; 0.03 * D_i))$  reduces over time, and it has been introduced to penalize old views, allowing new ones to reach the top. It reaches its minimum after 30 days, penalizing the final result by 90%.

$\log_{10}(1 + N_i)$  grants a multiplicative factor depending of the magnitude of the number of ratings the view  $i$  received.

$r_i$  is the average relevance for the view  $i$ .

$\sum_{k=1}^{K_i} R_k$  is the sum of all the average global relevance for each keyword  $k$  assigned to the view  $i$

## 4.8 Implementation

The implementation includes only a subset of the features presented before. This particular subset revolves around the Member and its subclasses since the main objective is to keep those slice of the members engaged, while it is obvious that Administrators and Social Scientists would use the platform. In particular Event and News Feed have been excluded, since they are complex to manage and it is also really difficult to evaluate the impact of those sections from a practical point of view. Also missions have been excluded, since they are more suited for an open environment, not a contained one. The remaining sections have been implemented inside the prototype of the platform.

### 4.8.1 Integration

Each element included in the platform either requires a custom implementation or an integration exploiting an external component. An analysis of which components could be integrated, alongside their pros and cons, is proposed. The conclusions are drawn based on how well the integration software's features fit the platform needs. The considerations done during the analyses of the integration components are showed in the Tables 4.9 and 4.10.

Ingredient	Tools	Pro	Cons	Conclusions
Shared View	Instagram	<ul style="list-style-type: none"> <li>- Widespread</li> <li>- Well-known</li> <li>- Reach young people</li> <li>- Importing photos and keywords (tags)</li> <li>- Sharing</li> </ul>	<ul style="list-style-type: none"> <li>- Users may upload non pertinent images with correct tags which may be automatically transferred inside the platform</li> <li>- A public profile is required to access the photo</li> <li>- Develop ad-hoc code</li> </ul>	A partial integration with Instagram could be performed.
Events	Eventbrite	<ul style="list-style-type: none"> <li>- Satisfy all the events properties</li> <li>- Event dashboard</li> <li>- Event sharing on social media</li> </ul>	<ul style="list-style-type: none"> <li>- Private events</li> <li>- Paid events</li> <li>- Develop ad-hoc code</li> </ul>	Although there are few features which are not suited for our application, Eventbrite could be adopted since it meets all of our needs and doesn't require a monthly subscription or additional fees. Other solutions have been analyzed, but since they are build for different kind of users with respect to the platform ones, they haven't been reported in this summary.
Quiz	Google Modules	<ul style="list-style-type: none"> <li>- Well-known</li> <li>- Automatically perform few built-in analysis</li> </ul>	<ul style="list-style-type: none"> <li>- No timed questions</li> <li>- Mostly suited for surveys</li> </ul>	After evaluating the tools that could be integrated, it has been decided to realize an ad-hoc implementation of the quiz, since both of them doesn't completely satisfy the needs that were previously pointed out in the quiz definition.
	Brandquiz	<ul style="list-style-type: none"> <li>- Perfectly match the requirements and the specifications for this section</li> </ul>	<ul style="list-style-type: none"> <li>- Monthly Fee</li> <li>- Limited number of manageable members</li> </ul>	

Table 4.9 Considerations done during the integration components analysis I

Ingredient	Tools	Pro	Cons	Conclusions
Discussion Groups	Commento	<ul style="list-style-type: none"> <li>- Satisfy discussion group structure</li> <li>- Automated spam detection</li> <li>- Moderator tools</li> </ul>	<ul style="list-style-type: none"> <li>- Designed for comments, not discussions</li> <li>- Anonymous comments</li> <li>- Monthly fee</li> </ul>	<p>Many different solutions have been analyzed. Reddit has been excluded since it carries too much management effort. Discord has been excluded especially because it isn't meant to be used as a discussion management tool. Commento ended up requiring a monthly fee while Isso is comment-oriented and thus not suited for our case. In the end all the features included in the discussion section require a custom implementation.</p>
	Isso	<ul style="list-style-type: none"> <li>- Satisfy discussion group structure</li> </ul>	<ul style="list-style-type: none"> <li>- Designed for comments, not discussions</li> </ul>	
	Reddit	<ul style="list-style-type: none"> <li>- Widespread for discussions</li> <li>- Well-known</li> <li>- Designed for discussions</li> <li>- High readability</li> </ul>	<ul style="list-style-type: none"> <li>- Requires to manually manage invites and permissions in private subreddits</li> <li>- Requires to create a private subreddit for each group</li> <li>- Subreddit naming problem</li> <li>- Public subreddits allow every user on reddit to read and comment</li> </ul>	
	Discord	<ul style="list-style-type: none"> <li>- Widespread</li> <li>- Allow creating text channels</li> <li>- Allow management through custom built channel bots (manage polls, discussion creation, etc.)</li> <li>- Requires an invitation link, preventing external users to join the channel</li> </ul>	<ul style="list-style-type: none"> <li>- Designed for voice chat</li> <li>- Low readability</li> <li>- Invitation link can be easily shared through secondary channels</li> <li>- Manually assign Coordinator permissions</li> </ul>	

Table 4.10 Considerations done during the integration components analysis II

## 4.8.2 IFML

In the appendix (A.1, A.2, A.3, A.4, A.5, A.6, A.7 and A.8), a set of IFML (Interaction Flow Modeling Language) Diagrams are reported to give a general idea on how the interface of the implemented platform is made and how the different elements interact with each other.

Following, an example comparing the IFML diagram of the Quiz (4.15) and a screenshot of its implementation (4.16) is provided.

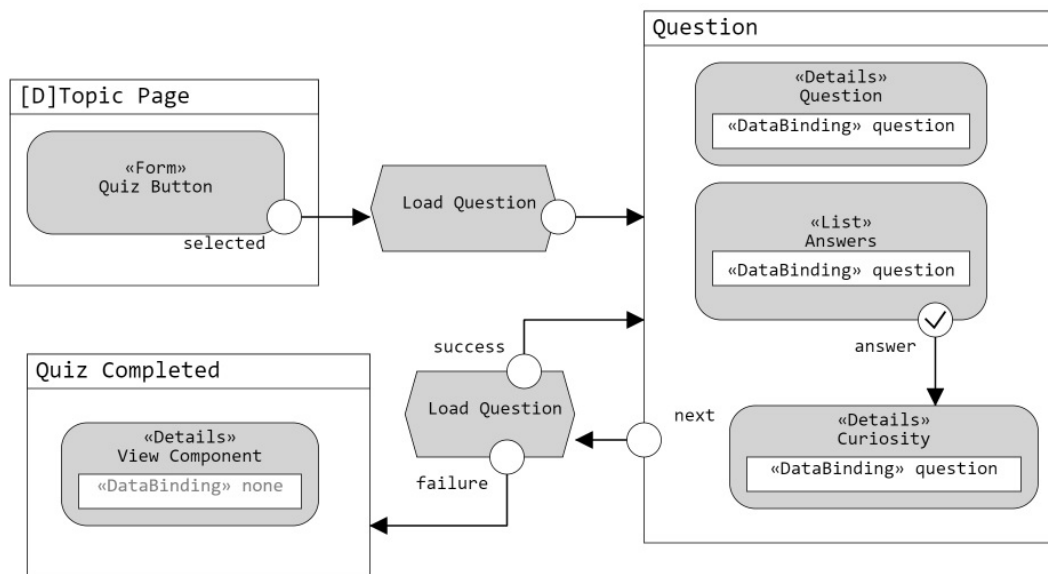


Figure 4.15 Screenshot of the Quiz section



Figure 4.16 Screenshot of the Quiz section

### 4.8.3 Relevant Technologies

In this subsection the set of the most relevant technologies exploited during the implementation of the platform are explained. A description of the most important libraries used is also provided.

#### MVC<sup>2</sup>

MVC stands for Model-View-Controller. It is defined as a way to organize software structure in iterative applications. Its main goals are functional separation and maintainability. Basically, it separates the software in layers and defines the interfaces between them (Figure 4.17). It can be used both for traditional applications and web based applications (presentation framework).

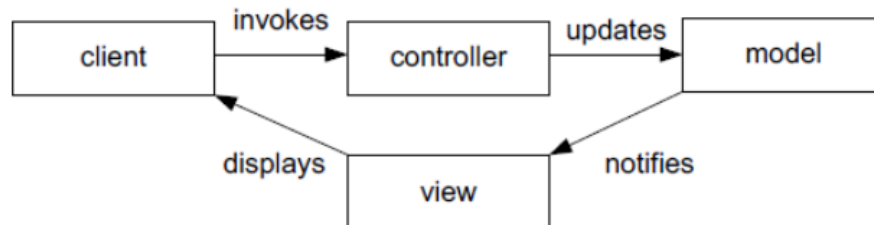


Figure 4.17 The different layers and interfaces defined by MVC

Each component has different features:

- The client sends requests and displays updated interfaces with the responses content.
- The controller receives requests and decides which component shall be invoked to compute the response.
- The model represents the inner state of the application and offers functionalities aimed at processing the requests and updating the state of the application
- The view displays the inner state off the application as a user interface that can be used by the client

MVC impose a hierarchical organization of software components, starting from the client and following the arrows as shown in the schema above. MVC has its own advantages

- The same application can provide multiple views to different clients.

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<sup>2</sup>From [51] and "Advanced Web Technologies courseware, P. Fraternali"

- It is possible to change the business logic without affecting the presentation (views), assuming that the representation of the state is left unchanged.
- It is possible to change the control logic (that replies to a specific request) updating the controller only.

and disadvantages

- Request life cycle tends to be longer, due to the processing performed by the controller.
- It is not possible to perform some local optimizations, e.g. partial re-computing of the view when requests concern only part of the interface.

MVC components are implemented exploiting the Web architecture and Java JEE APIs. The Figure 4.18 provides a schema of the MVC implementation for java.

- The client is a browser, which requests and responses are HTTP.
- The front controller (dispatcher) is a servlet, that processes all the requests.
- The model is a set of Java objects (state objects).
- The front controller is bound to the model objects by proxy objects (controllers in Spring).
- The view is (normally) a JSP page template.

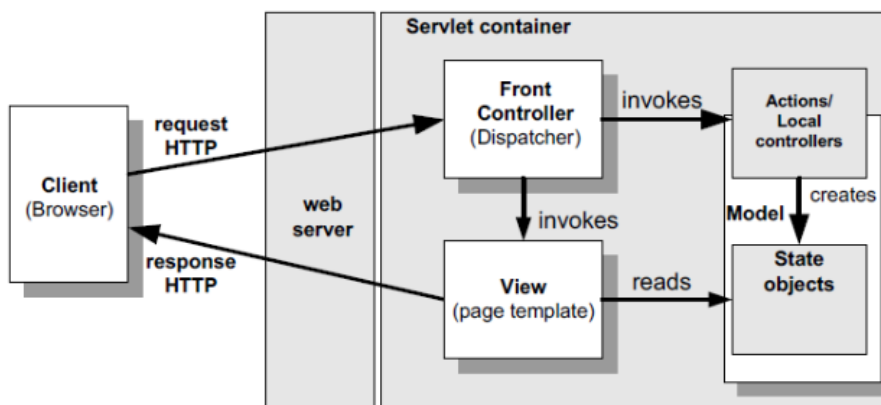


Figure 4.18 MVC implementation for Java

### Spring<sup>3</sup>

Spring is defined as a comprehensive software framework for enterprise application development. It focuses on many different aspects:

- The presentation tier development exploits Spring MVC.
- Allows configuration through managed objects and Inversion of Control (IoC), which allows dependency injection and dependency lookup.
- Allows multi-paradigm interfaces for data access, like JDBC, JPA, Hibernate, etc.
- Allows code annotation through metadata (“data about data”) alongside Java classes, methods and fields.

Spring MVC manages the lifecycle of the request-sending objects, implementing and exposing several interfaces that govern the request handling process.

Spring MVC architecture includes several interfaces, as represented in Figure 4.19

- DispatcherServlet: dispatches HTTP requests to registered handlers for processing, providing mapping and exception handling facilities (built-in).
- Controller: receives HttpServletRequest and HttpServletResponse instances just like a HttpServlet but is able to participate in an MVC workflow (implemented by the developer)
- HandlerMapping: defines a mapping between requests and handler objects, typically controllers (built-in)
- View: responsible for returning a response to the client.
- ViewResolver: selects a View based on a logical name for the view (optional).

---

<sup>3</sup>From [51] and "Advanced Web Technologies courseware, P. Fraternali"

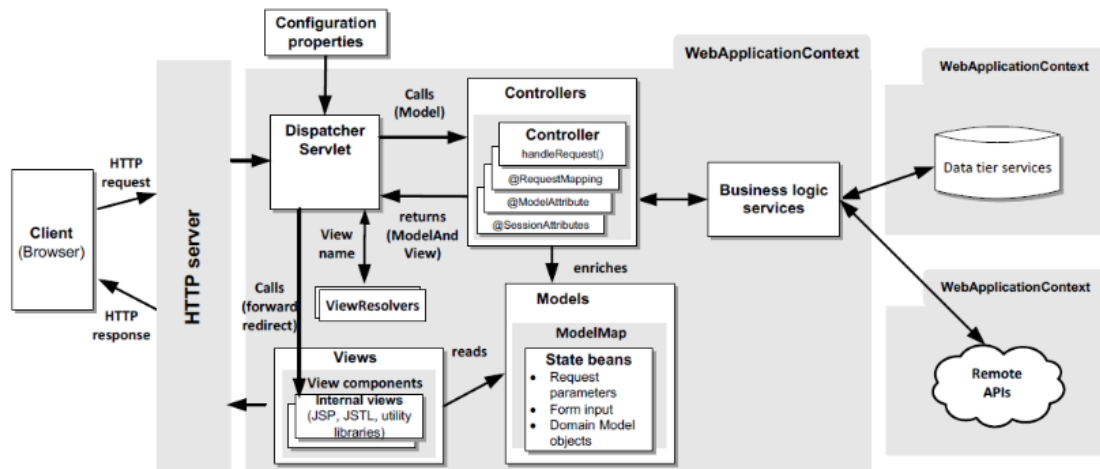


Figure 4.19 Spring architecture

## Thymeleaf

Thymeleaf is a modern server-side Java template engine for both web and standalone environments. Its main goal is to bring elegant natural templates to development workflows. Exploiting modules for Spring Framework, a host of integrations with most tools and the ability to plug in custom functionalities, Thymeleaf is ideal for HTML5 JVM web development. HTML templates written in Thymeleaf still look and work like HTML, letting the actual templates run in any application to keep working as useful design artifacts. HTML is correctly displayed in browsers, also working as static prototypes, allowing for stronger collaborations in development teams.

## Bootstrap

Bootstrap is a free and open-source framework for developing with HTML, CSS and JS. It's a front-end library used to build responsive, mobile-first projects on the web. It contains CSS and (optionally) JavaScript-based design templates for typography, forms, buttons, navigation and other interface components. Bootstrap provides basic style definition which results in a uniform appearance for HTML elements across web browsers. The framework also comes with several JavaScript components in the form of jQuery plugins, providing additional user interface elements. The layout of a web page can be organized through a responsive grid system offered by the library.



## MySQL

MySQL is a free open source relational database management system based on SQL (Structured Query Language). It is used for a wide range of purposes, however its most common use is for the purpose of a web database.

### 4.8.4 Libraries

#### JQuery

jQuery is defined as a lightweight JavaScript library. Its purpose is to make it much easier to use JavaScript, wrapping complex common tasks into methods that you can call with a single line of code. It simplifies a lot of the complicated things from JavaScript, like AJAX calls and DOM manipulation. Even though there are a lot of javascript frameworks, JQuery is the most popular and most extendable one available.

#### Spring Boot

Spring Boot has been used mainly because it allows to accelerate the development by reducing the need to write a lot of configuration and boilerplate code. It allows to create a stand-alone Spring applications without the need to configure a container, like Tomcat. The application can be executed simply by running the main method of a class annotated with `@SpringApplication`. Moreover, it simplifies the configuration process by configuring the most common registered beans and the 3rd party libraries whenever possible, and it doesn't require the XML configuration anymore. It also helps in the dependency management, indeed Spring Boot will put the most commonly used libraries while developing Spring MVC.

#### Spring Data JPA

It allows to easily implement JPA based repository and automatically import Hibernate, for the ORM, and HikariCP, for the JDBC connection pool.

#### Spring Security

Spring Security is a framework which provides both authentication and authorization features. Moreover, it offers protection against some common security attacks and it can be integrated with Servlet API and Spring Web MVC.

**Lombok**

Lombok is a java library which automatically plugs into the editor and builds tools. It has been mostly exploited for one of the annotation it provides, the `@Data` annotation, which automatically defines getters for all fields, setters for all non-final fields, and appropriate `toString`, `equals` and `hashCode` implementations that involve the fields of the class. It also provides a constructor that initializes all final fields, as well as all non-final fields with no initializer that have been marked with `@NonNull`, in order to ensure the field is never null.

**MySQL Connector**

MySQL Connector is a java library which manages the communication between java and MySQL. In particular the connector that has been exploited is the `Connector/J`, which provides connectivity for client applications developed in the Java programming language.

**HikariCP**

HikariCP is a "zero-overhead" production ready JDBC connection pool, which is fast, simple and reliable. It has been demonstrated through microbenchmarks how it is able to provide higher performances with respect to other JDBC connection pools, like Tomcat.

# Chapter 5

## Experiments

This chapter aims to exhibit how the different methodologies, discussed in the previous chapters, have been tested. Two different experiments were carried out. This chapter will describe them, also explaining their results. Each experiment were carried out following different procedures, involving different kinds of people and different scenarios.

### 5.1 Group Experiment at TRIGGER Meeting

The first test involved 15 people from the TRIGGER meeting held in Fiesole (European University Institute, Villa Schifanoia) on 14th November. Its objective was to gather feedback on how the principles behind the platform, in particular how the principle which progressively increase the size of the interactions, would work in a cooperative and interactive environment. The chosen topic for the experiment was artificial intelligence. The experiment was divided into five different phases. For each one of them, before its beginning, an envelope containing all the material useful for that phase was provided to each participant (or group of participants). The people involved in the experiment were experts in the political and social field. Because of that, they were asked to identify themselves as a simple citizen.

#### 5.1.1 Challenge Awareness

The first envelope contained all the papers useful to understand the chosen scenario (challenge). Alongside a textual explanation (Figure 5.1), three different sheets with different real life situations were provided:

- One displaying how your artificial intelligence reschedules your agenda depending on the accidents.

- One displaying how your artificial intelligence schedules an appointment with the doctor, because of an abnormal measurement of your vital signs.
- One displaying how your artificial intelligence dynamically updates your preference list depending on what you are doing and where you are, suggesting you things to do or buy.

Those sheets contained a practical example, they were not provided under the form of pure text. For example, the first one involving the rescheduling of the agenda was provided as a photo of a digital agenda in which the artificial intelligence notified the person about the changes.

**Please read the text below and take your time to understand and process the information**



Artificial intelligence (AI) makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks. Most AI examples that you hear about today – from chess-playing computers to self-driving cars – rely heavily on deep learning and natural language processing. Using these technologies, computers can be trained to accomplish specific tasks by processing large amounts of data and recognizing patterns in the data. AI systems demonstrate some behaviors associated with human intelligence such as planning, learning, reasoning, problem solving, knowledge representation, perception, motion, and manipulation and, to a lesser extent, social intelligence and creativity. The biggest breakthroughs for AI research in recent years have been in the field of machine learning, in particular within the field of deep learning.

This has been driven in part by the easy availability of data, but even more so by an explosion in parallel computing power in recent years, during which time the use of GPU clusters to train machine-learning systems has become more prevalent. Not only do these clusters offer vastly more powerful systems for training machine-learning models, but they are now widely available as cloud services over the Internet. Over time the major tech firms, the likes of Google and Microsoft, have moved to using specialized chips tailored to both running, and more recently training, machine-learning models.

AI is ubiquitous today. Each of the tech giants – and others such as Facebook – use AI to help drive myriad public services: serving search results, offering recommendations, recognizing people and things in photos, on-demand translation, spotting spam – the list is extensive. But one of the most visible manifestations of this AI war has been the rise of virtual assistants, such as Apple's Siri, Amazon's Alexa, the Google Assistant, and Microsoft Cortana. Relying heavily on voice recognition and natural-language processing, as well as needing an immense corpus to draw upon to answer queries, a huge amount of tech goes into developing these assistants.

Oxford University's Future of Humanity Institute asked several hundred machine-learning experts to predict AI capabilities, over the coming decades. Notable dates included AI writing essays that could pass for being written by a human by 2026, truck drivers being made redundant by 2027, AI surpassing human capabilities in retail by 2031, writing a best-seller by 2049, and doing a surgeon's work by 2053. They estimated there was a relatively high chance that AI beats humans at all tasks within 45 years and automates all human jobs within 120 years.

In the following mock-ups you will find three different examples of an AI Virtual Assistant use

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Figure 5.1 Text describing the chosen scenario

### 5.1.2 Individual Activity - Case Selection

The envelope for the second step involved two different sheets for each participant and a common billboard. The first sheet contained 4 different artificial intelligence application cases in the form of text printed on tags. Each case was introduced by “I am ... and my virtual assistant through an AI algorithm is capable of...”, followed by an action:

- “... answering with my own voice to the phone calls I receive while I am busy with other activities, simulating my voice and acting on my behalf to postpone the call”

- “... rescheduling my agenda according to the inconveniences and shifts in my schedule (i.e. to automatically book a new flight to NYC for the next week after a last moment invite, to postpone the tennis class due to a severe delay for traffic jam)”
- “... calling and booking an appointment to a Cardiologist after having tracing my vital parameters (with a wearable device) due to an anomaly in my heartbeat”
- “... organizing my shopping list and my meal plan accordingly to my family agenda, business trips and my jogging sessions”

Each participant had to choose only one of the proposed cases, depending on their thoughts. For each case, two identical tags were provided.

Please take one tag out of the four you can find on the first column. Please consider the facts you find on the tags to be realistic, as much as you can imagine.


Before doing anything else, please ask yourself:

- Does this fact represent a fear to me?
- Otherwise, does it represent a hope?
- What is my perception about this fact?

Once you have decided if this is a hope or a fear, please think about the change it can bring in our shared life.

- Does it represent a radical and disruptive change or it is more an incremental shift?
- What is my perception about this fact?

After having reflected on these questions please take your position on the matrix sticking the tag in the position you think fits better your feeling. Please, be sure there is your name on the tag.



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Figure 5.2 Explanation of the second phase of the experiment

After choosing the case, the participant was requested to write their name on the corresponding tag and stick it on a billboard (Figure 5.3), on which a graph was represented. The latter involved two different axis, the x-axis ranged between “incremental” and “disruptive”, while the y-axis ranged between “fear” and “hope”. The position of the tag on the graph was determined by the considerations each participant made on the chosen case. The Figure 5.2 contains the questions the participant had to answer before placing the tag on the billboard.

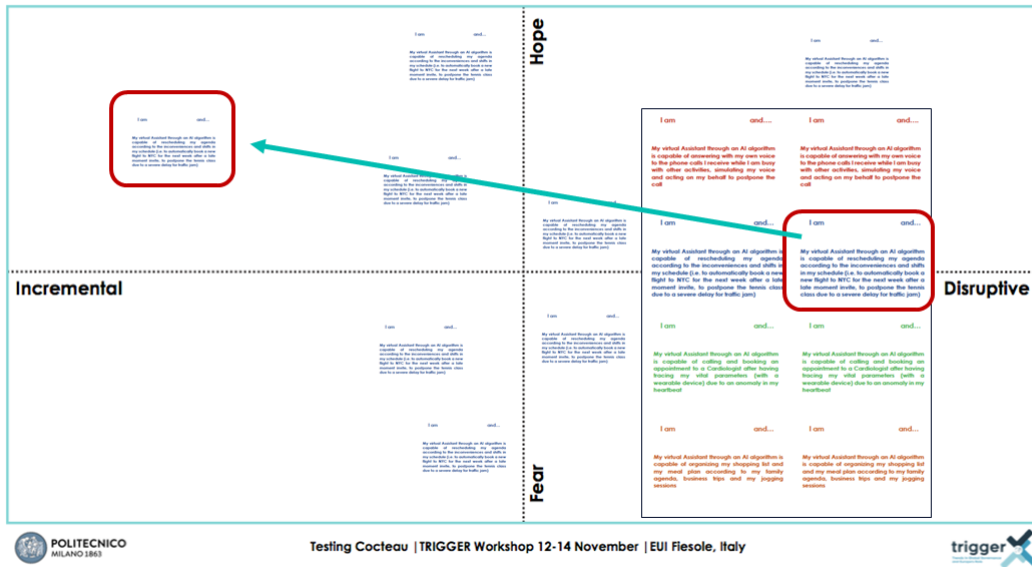


Figure 5.3 Digital representation of the billboard with tags

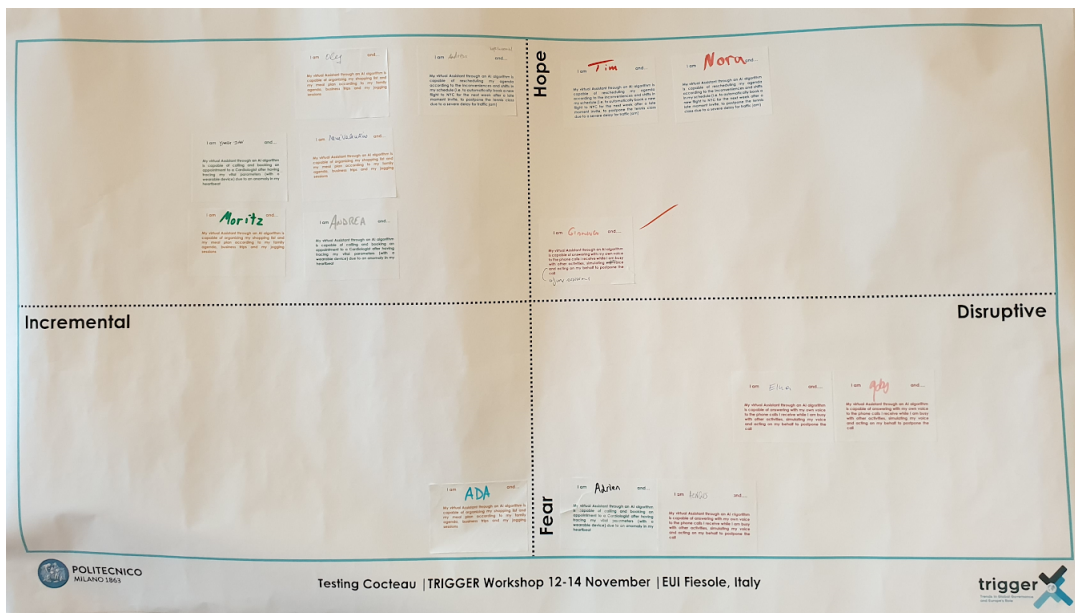


Figure 5.4 A photo of the billboard with the tags chosen during the experiment

After sticking the tag on the billboard (Figure 5.4), each participant was asked to stick the corresponding identical tag on the second sheet. On the latter (Figure 5.5), they were asked to write their name and the motivations for the positioning of the tag on the billboard.



After having discussed in pairs your respective vision, please take a minute to reflect on the following questions:



<p style="text-align: right;">+</p> <ul style="list-style-type: none"> <li>• Which part of his/her view was convincing?</li> <li>• Which part of his/her view I do consider to bring value to my perspective?</li> <li>• Do I consider my vision still valid?</li> <li>• What would I change now?</li> </ul>	<p style="text-align: right;">-</p> <ul style="list-style-type: none"> <li>• Which part of his/her view was not convincing?</li> <li>• Which part of his/her view I do consider confirm my perspective?</li> <li>• Do I consider my vision still valid?</li> <li>• What would I change now?</li> </ul>
<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p style="text-align: right;"></p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p style="text-align: right;"></p>

Figure 5.6 The sheet on which write the final thoughts after the discussion



Figure 5.7 A picture of two couples discussing about a topic

### 5.1.4 Pair Activity - Convergence

After the discussion, a picture based game was performed. Each couple was asked to pick one picture representing a common vision about the future relation between humanity and artificial intelligence, paste it on the provided sheet and write three keywords meaningful for the vision they want to represent (Figure 5.8). Both members of the team should agree on the chosen picture.

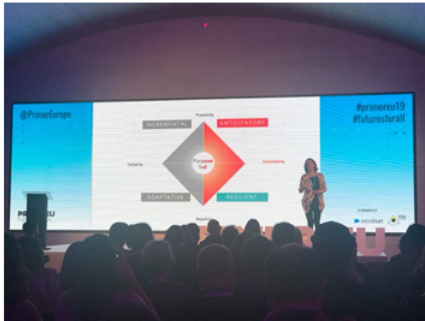


Some couples chose multiple pictures instead of one, cutting and merging them together into a single image. They asserted their vision was too complex to be represented with a single picture and none of the pictures among the ones they could choose from was perfectly matching their vision. This occurrence pointed out how sometimes physical testing is better than digital, since it is pretty hard to implement a similar operation in a digital environment. This step was meant to have both members of each couple to converge on a single image and a single common vision (Figure 5.9).

This template has been created by →


Please stick below the image from the sample you consider to be metaphorically coherent with a joint vision of your pair. In picking the right metaphor, please ask yourself

"How do you perceive the future relationship with AI in our life?"



Then, please indicate below three keywords that embrace the value of your vision

#  
#  
#





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Figure 5.8 The sheet on which paste a picture and write three keywords

Afterwards, all the sheets have been positioned on a table (Figure 5.10). Each couple read all the generated visions and voted the ones they would like to be matched with for the next activity. The resulting groups were built based on the votes. It was noticed that the groups built in that way were composed by people whose thoughts were mostly similar.




Figure 5.9 A photo of the couples choosing the pictures



Figure 5.10 A photo of the voting phase

### 5.1.5 Group Activity - Convergence and Sharing


The last step increased the interaction size even more. The aggregation of the couples, exploiting the voting phase in the previous step, led to three groups with different sizes: a group of four people, a group of five people and a group of six people. A final sheet (Figure 5.11) was assigned to each group on which they pasted each vision built by the pairs in the previous step. Then each group discussed and converged to a single vision among the ones they had, for which they had to provide a title, their thoughts and three new relevant keywords (Figure 5.12). Afterwards, all the groups were asked to illustrate their results to all the other groups, sharing their vision and their thoughts with the “community” (Figure 5.13).

**TITLE** 

**1st pair**

**2nd pair**

+

AI, in our shared vision, will empower/hinder people to/from.....  
 .....  
 .....  
 because.....   
 .....  
 .....


Now please indicate 3 keywords to associate to this vision  
 #  
 #  
 # 

Figure 5.11 The final sheet on which the groups should work



Figure 5.12 Groups discussing about the final conclusions



Figure 5.13 Groups explaining the final results they achieved

### 5.1.6 Summary

Summarizing, the process involved five steps (summed up in Figure 5.14), each of them with a specific focus as displayed in the picture below.

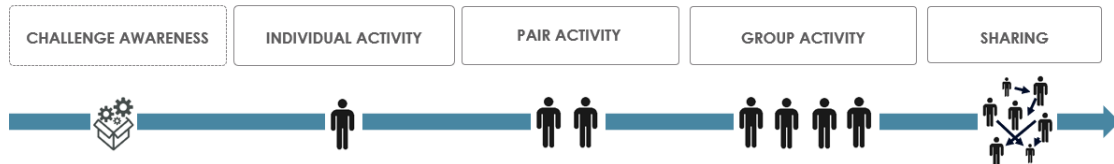


Figure 5.14 A line displaying the size of the interaction for the participant in the different steps of the experiment

In the end the experiment was successful. All the groups converged to a single shared vision. The participants stated that the experience was really enjoyable and engaging.

They also stated how there's still room for improvement. One of the most criticized aspects were the ranges on the axis in the "Case Selection" step. They stated how "fear" and "hope" were too extreme to represent their feelings about the proposed cases and how the meaning of the different axis were too complex for this application, especially for the x-axis ("incremental" and "disruptive"). They also claimed how the proposed challenge was too much restricted, since of the four cases provided in the second step, only one would have been chosen.

Also few ideas to improve the overall process were pointed out, like the one explained in the "Pair Convergence" step.

## 5.2 Individual Platform Testing

The second experiment instead involved around 20 people aged mainly between 20 and 25 years old, with few exceptions. All of them were able to easily navigate through a website and understand english. They went through a set of steps which objective were to guide them through the platform. Each step involved a set of operations each tester should perform without any hint. Some hints were provided if they weren't able to perform an operation after a certain amount of time. Before exploring each section, a small description regarding its content, objectives and functionalities was provided. Each test was performed independently from the others, preventing participants from exchanging opinions or suggestions about the task to perform or the platform itself.

The test was divided into seven steps, in the following order:

- Home Page and Login
- Challenge Selection
- Quiz
- Shared Vision
- Change My Mind
- Discussion Group
- Profile

Each participant was asked to provide feedback while exploring the platform and compile a questionnaire when the experiment was over, gathering data on the different aspects of the platform. The survey was made of 15 questions, including both qualitative and quantitative questions, asking the participants to express their thoughts, ratings and ranking the different aspects of the platform.

The tester was given the feel of being enrolled in a fully functional platform. Two different challenges among the identified ones were implemented: “Renewable Energies VS Fossil Fuels” and “Environmental Pollution”. The tester could choose between them without influencing the test. Each challenge was provided with some content before the beginning of the testing phase:

- The “Shared View” section contained around 12 views
- The “Discussion Group” section included 6 pre-created groups
- The “Change My Mind” section already included around 10 cards
- The “Quiz” section contained 8 questions

The content uploaded during the testing were not removed after each test, contributing to the content provided to the following testers.

The questionnaire, alongside the list of the steps each participant went through and the provided descriptions, is included in the appendix.

### 5.2.1 Results

The questionnaires pointed out how some of the sections and features implemented are well designed and useful while it is necessary to rework others. This section illustrates all the strengths and weaknesses emerged during the testing for each section and feature, also outlining some of the best improvements provided by the participants.

### **Section Unlocking**

As mentioned in chapter 4, the different sections were unlocked one after another, following the previously explained criterion. One of the most common comments was that the order of the sections in the section selection bar didn't correspond to the order in which those sections would have been unlocked, leading to a decrease in the overall intuitiveness of the platform.

It was stated how, despite some of the meaning of the icons in the bar were not intuitive, ordering them could have possibly reduced the confusion generated by such icons.

### **Quiz**

The tests pointed out how the quiz was perceived as the most intuitive and the most appreciated section of the platform. Many users stated how the curiosity included for each question was really interesting, explaining them things they didn't know. Indeed most of the participants, when they were asked to complete at least three questions among the ones implemented for the test, completed all the questions. Also, the questionnaire pointed out how most of the participants would mainly use this section, if they were members of the platform.

After the completion of the quiz, few people asked "Where are my points?", "Isn't there any recap of the answers I gave? Like the percentage of correct answers" and "I would like to see a leaderboard when the quiz is over, ranking myself with my friends". Those comments revealed how sometimes a quiz is perceived as a competition or a game involving points and leaderboards, and how, even though they were told this section was meant to give the user a sense of initial awareness, some people would like to compete.

The most important complain was about the icon chosen to represent the quiz section in the section selection bar, which all of the participants identified to be not intuitive at all. Indeed when they were asked to navigate to the quiz section, most of them ended up navigating through all the sections before finding the correct one.

In the end, this section of the platform achieved an average rating of 8.75 out of 10, the highest among the ratings achieved by all sections, showing how the participants still appreciated the features it provides.

### **Discussion Groups**

Discussion groups was the second mostly appreciated section. Indeed, it achieved an average rating of 8.4 out of 10. The results showed how it was identified as the least interesting section, probably because most of the features this section provided are commonly exploited in forums and discussion websites. The same reasoning could be used to explain the fact that

the intuitiveness of this section ended up being really high. Most of the participants stated how they would spend most of their time discussing.

As mentioned in chapter 4, users can propose a discussion topic for the weekly discussion, once per poll. Users can vote those proposals and the next discussion will be regarding the most voted one. This feature was really appreciated by the participants, who gave the features an average rating of 8.5 out of 10. The proposal voting method involved only an “upvote”, while someone also expected a “downvote”, probably because of their rating habits, coming from other websites involving a “like - dislike” evaluation method.

Most of the participants mentioned how it is really difficult to manage the members of the group: “I do not understand which users are coordinators. The frame around the profile picture of the member is not enough” and “I wouldn’t expect that button to promote the member to a coordinator”. Some of those misunderstandings were probably caused by the usage of symbols, text and graphics elements considered intuitive during the design phase, which were proven wrong by the tests.

Someone also stated how the labels assigned to each group were meaningless without a dedicated search function, allowing the members of the platform to look for a group based on its labels.

It was also stated how some elements should have been reorganized inside the section.

### **Change My Mind**

“Change My Mind” was identified as one of the most controversial section of the platform. Indeed, most of the participants appreciated the idea behind it, while others were confused by the game. In particular one of the participants stated it is difficult to gain the correct mindset to play the game, and it would be nice to support the player to achieve that.

The results displayed how it is necessary to improve this section of the platform, modifying the existing features and including new ones. It can also be noticed from the average rating (7.4 out of 10) assigned to the section. During the test the participants were asked to create at least three cards and then reply to a match played against them. Even though the symbol assigned to that action was quite intuitive, especially because the other button available on the interface was meant to allow the sharing of the match on Instagram, several participants were confused and navigated through the whole section again, before successfully completing the request.

While creating the card associated to a shared view, the latter is chosen randomly among the ones the member evaluated. Some participants stated how it would be better to visualize a list of all the rated views, alongside a preview of its details, having the member to choose one of them to create a card. The same comment was made for the matchmaking: “It would



be better to allow the member to choose the card they want to play with instead of choosing it randomly”.

A participant also suggested to introduce a further link between this section and “Shared View”. In particular they explained how it could be really useful to be able to create a card as soon as the shared view has been rated, by pressing a dedicated button which would appear if the player has unlocked “Change My Mind”.

Some aspects of this section should be made more clear. One of them is that while creating a card it is not possible to change any rating that has been previously made inside “Shared View”, even though it is still possible to provide a new one in the corresponding question of the match.

### Shared View

Despite “Shared View” was evaluated as the second most interesting feature, only a small set of participants asserted they would mostly use it, probably because of the way it has been implemented, since it was considered the least intuitive section. Its average rating (6.85 out of 10) reflects the above considerations.

The major complaints were regarding the keyword vote and keyword suggestion because these actions were not considered clear and intuitive.

During the test, the participants were asked to give their interpretation and associate a meaning to each icon used to represent the rating attributes (Relevance, Need and Radiosity). The goal was to understand how much each icon was self-explanatory and let the user deduce the meaning of the rating attribute, without explicitly define it to them. The results revealed the icons to which most of the users gave the right meaning were the ones related to the Relevance attribute. The other two rating attributes were not considered as clear, indeed, the icons related to Need and Radiosity were given the wrong or a quite different meaning most of the time. The results of this survey are reflected in the average rating (Table 5.1) the users gave to each couple of icons representing each attribute.

Attribute	Average Rating
Relevance	8.3 / 10
Need	4.5 / 10
Radiosity	6.35 / 10

Table 5.1 Average rating for each Shared View’s attribute

However, it can be noticed that even if the Radiosity attribute was not considered clear, the average rating the users assigned to it is higher than the one related to the Need. This is probably because the participants were giving the ratings after they were told the meaning of the icons and they considered more appropriate the icons associated to the Radiosity rather than the one related to Need. They also suggested new icons, like two different clocks or a stick man standing still and another moving for the Need attribute.

An aspect some of the testers suggested to modify was the way the attribute ratings are expressed. Some of them also suggested to integrate the slider with numerical values or replace them with stars. A similar comment was made for the average of the ratings received by a view, using numbers (percentages) instead of symbols, so that the owner of the view is able to see in details the average of those ratings.

A feature, which will be included in the future works and it was provided only through a dummy implementation in the platform, is the possibility to import and export images from and to its own Instagram profile. This functionality was considered useful by almost all the participants, which stated how social medias would improve the platform under many aspects. For example, to name a few: versatility, sharing, content creation and user-friendliness.

### **Privacy**

Inside the profile each participant could edit their privacy settings, disabling the information they do not want other members of the platform to visualize. This feature achieved a rate of 9.3 out of 10 among the testers, which mentioned how privacy nowadays is one of the most important aspects and being able to edit those settings was really appreciated.

### **Additional Features**

Overall, during the whole testing phase many different additional features were proposed by the participants. They weren't informed about the whole design around which the prototype was built. Some of the features included in the design and excluded from the implementation were suggested, in particular: "I would like a section where I can look for events and meeting about a topic", "I would like to chat with the members of a group and my friends" and "I would like a section in which I can read the most recent news about a topic". Those sentences perfectly exemplify three of the elements that were excluded from the implementation: the event section, the news feed and the chat.

Few participants also mentioned they would like to introduce more competition inside the platform under the form of points and leaderboards.

About the community aspects many users pointed out it would be great to have a way to invite people to the platform and their friends to the discussion groups. Another noticeable suggestion about the sharing aspect came from the Instagram functionality. It has been suggested to include also the sharing of discussions and comments on social medias, so that each user is able to share content in a form different than pictures.

# Chapter 6

## Conclusions

Remarking the content of chapter 1, the goal of this thesis is the creation of a communication channel between the communities and the government leaders of the European countries, contributing to create a meeting point between the government's actions and the people's vision of the future. The final result is a framework through which the different members of each community can express their opinions and thoughts, leading to a shared vision of the future.

### 6.1 Summary

After a deep analysis of the literature involving the principles behind gamification and its application to different sectors, the design of the system has been defined. An approach focused on content creation, community-based and reward-based elements have been exploited. A framework has been developed by defining the tasks and activities each user role can perform on the platform, outlining a profile for each of them. Three types of user have been delineated: Member, Admin and Social Scientist. In particular, the member's sections, the adaptation and configuration guidelines to create a challenge for the administrator and the data management and analyses tools available to the social scientist have been described.

After defining the design and the implementation of the platform, two different kind of test were performed to validate the ideas and understand how to improve the methodologies. The first was organized in a TRIGGER meeting held at the European University Institute in Fiesole. The goal of this test was to analyze and evaluate people interactions and the process developed to lead to a meeting point and create a common vision. The objective of the second test was to understand how much the different functionalities of the platform would have been interesting, intuitive and used by the participants.

## 6.2 Final Considerations

Besides the possible improvements, the testing performed in Fiesole was a first confirmation that the process and the principle on which the different sections are built is indeed effective: increasing the size of the interaction of the user step by step guides the user, progressively developing their awareness and reasoning. It would still be useful to perform further testing, after reworking the experiment according the provided advices.

Regarding the second testing phase, the final implementation included only the most relevant elements identified in the design phase. They have all been proven to be interesting, while regarding their future usage and the intuitiveness the best sections were “Discussion Groups” and “Quiz”. Both “Shared View” and “Change My Mind” require a series of improvements under both the graphical and functional aspect, which were mainly pointed out during the testing. It has also been shown how, despite the findings from the literature, some of the users would have enjoyed some of the gamification ingredients excluded from the design, like leaderboards and points, and also some of those included in the design, but not included in the prototype, like the events section and the news feed. Few of the features tested must be improved, for example the labels of the discussion groups should be exploited for a dedicated group search, otherwise they are not too much different from the group description. The same for the keywords in the "Shared View" section.

Overall, it is necessary to improve the intuitivity of some sections of the platform.

## 6.3 Future Works

The results achieved are a starting point for many future experiments and improvements.

Future works will include the full testing of the features listed in the design phase for each user role, also fixing the problems stated for the currently implemented elements. After an accurate indoor testing, the deployment of the platform on the web would allow to study the level of engagement it can reach in an open environment, involving real users from the different realities considered during the development. As mentioned in the previous chapter, an integration with the most famous social media (e.g. Instagram, Facebook, etc.) could be carried out, improving the platform and extending the amount of reachable users.

It could also be possible to modify the design a little bit, including all the gamification elements that have been excluded, like points and leaderboards, testing whether their effectiveness in this field is negligible or counter-effective, as stated by the literature, or excellent.

The framework is developed in order to involve people from different cultures and countries. The platform will allow to choose among several languages. Each member will be able to choose between the “European” platform and the “National” platform, targeting the corresponding administration.

Another relevant aspect would be identifying and rewarding the most honorable and respectable members of the platform, awarding them with some form of digital status, like a frame or a special achievement displayed on the profile.

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# Appendix A

## A.1 IFML

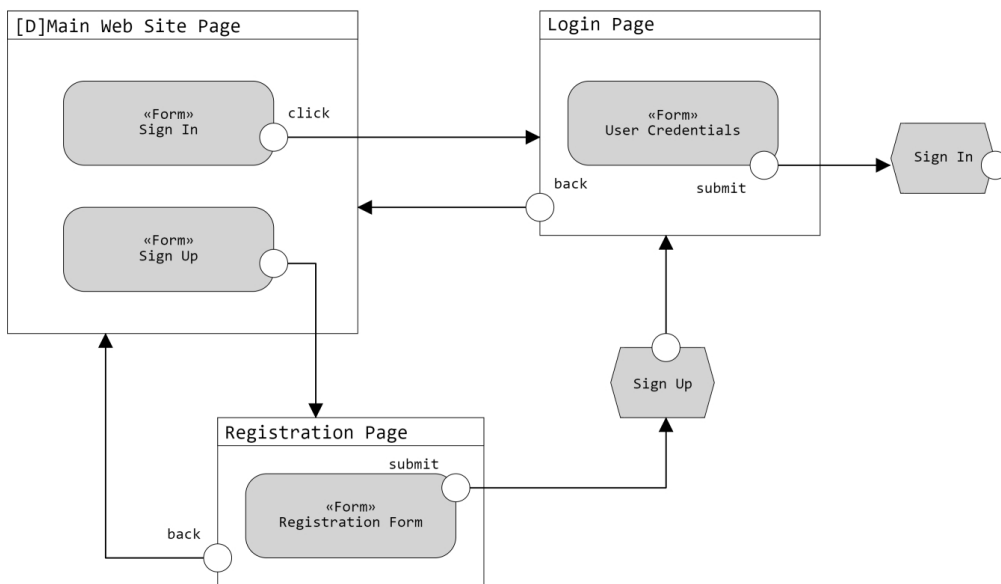


Figure A.1 The IFML diagram of the main page of the platform

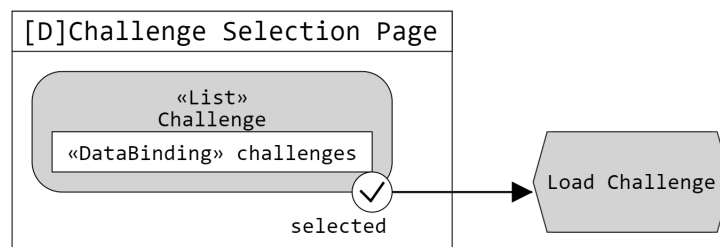


Figure A.2 The IFML diagram of the Challenge selection page of the platform

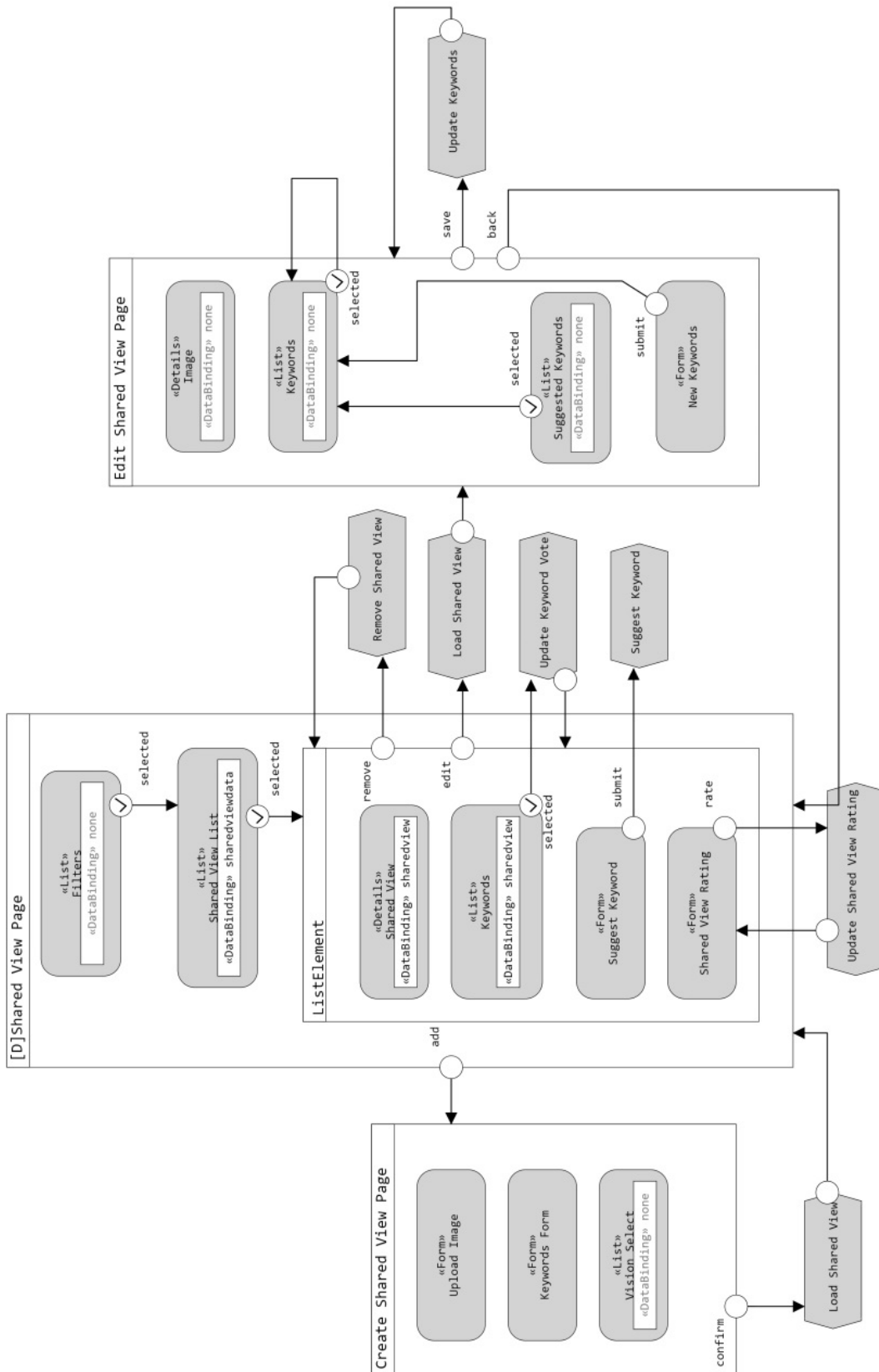


Figure A.3 The IFML diagram of the Shared View section of the platform

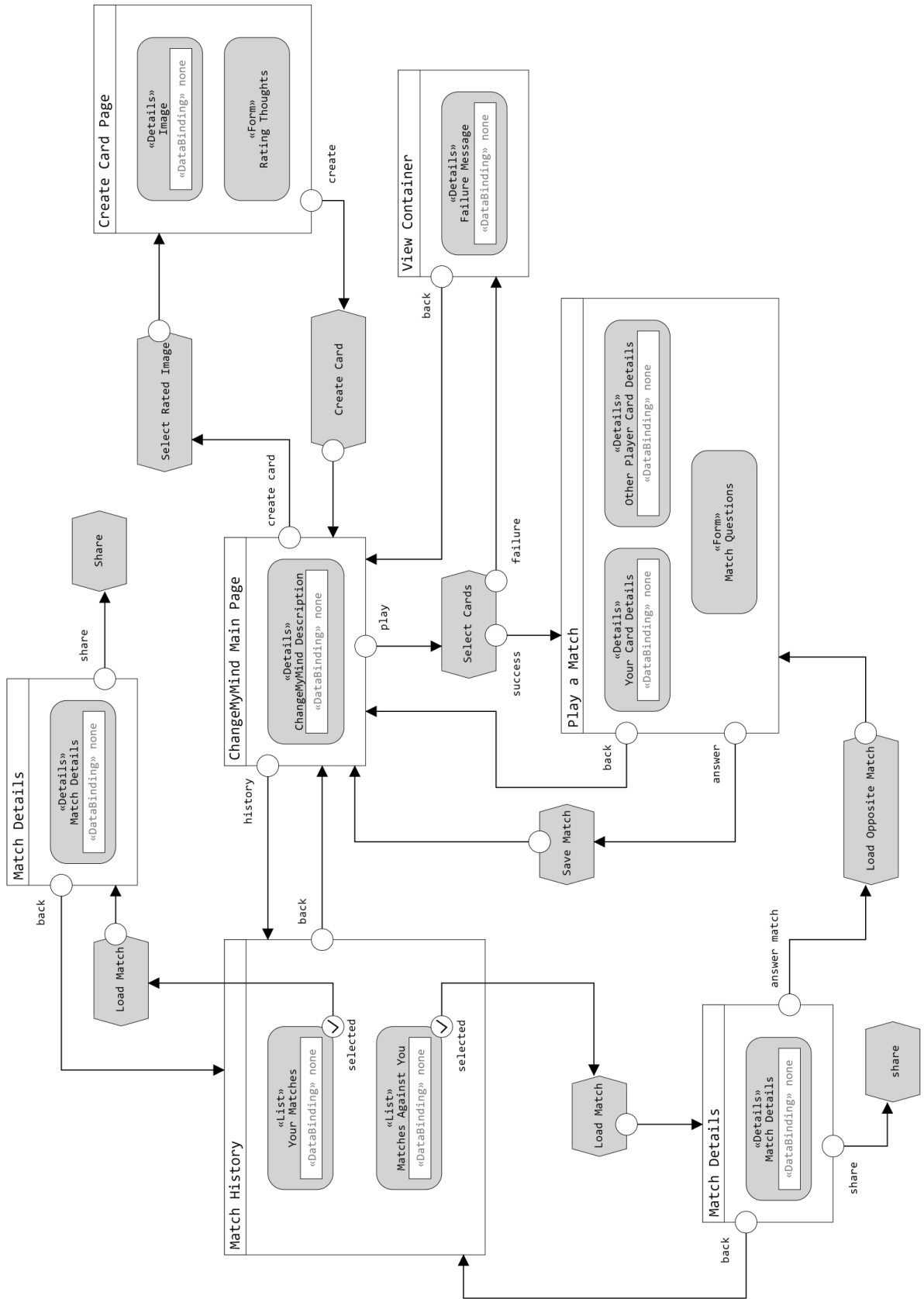


Figure A.4 The IFML diagram of the Change My Mind section of the platform

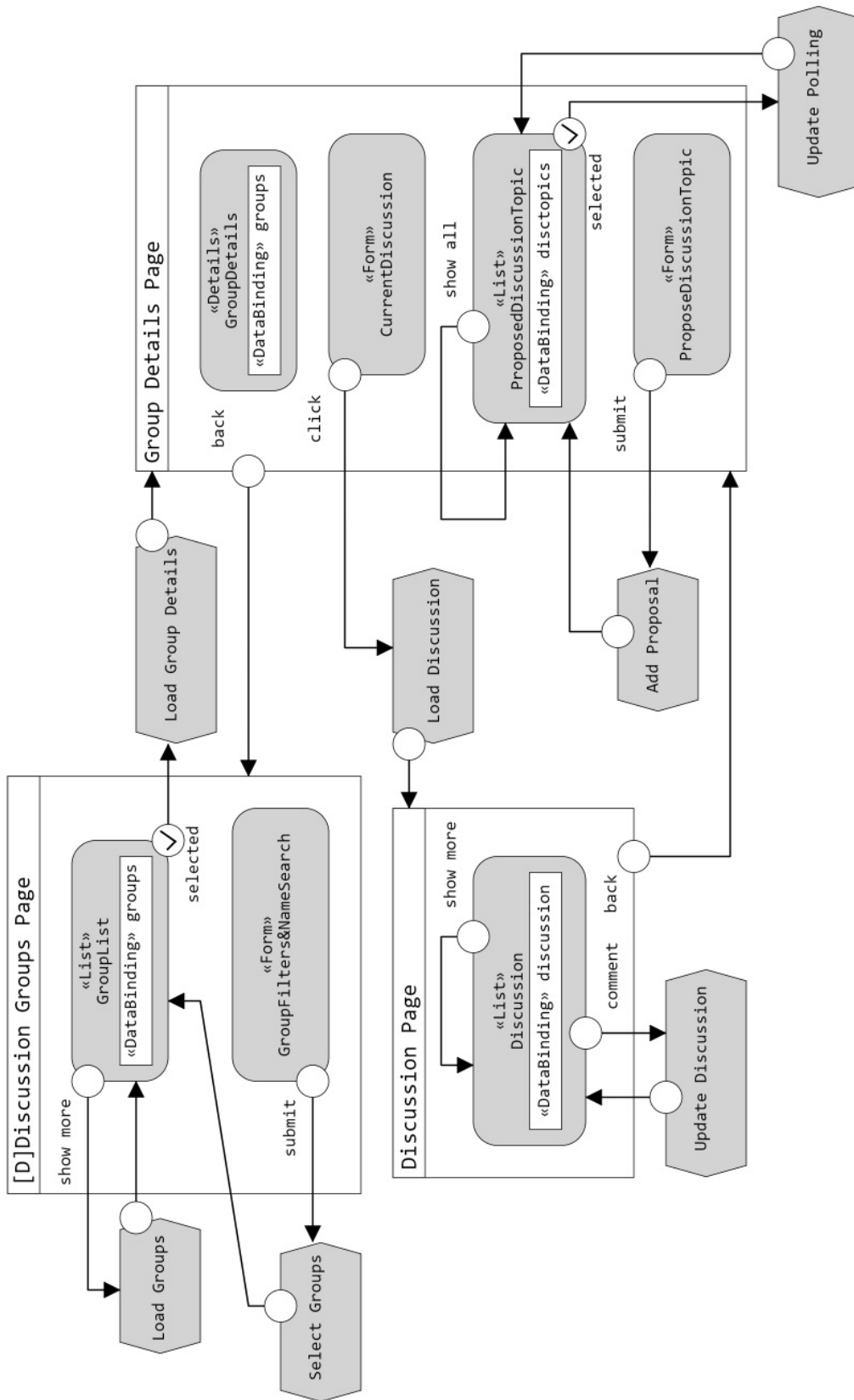


Figure A.5 The IFML diagram of the Discussion Group section of the platform I

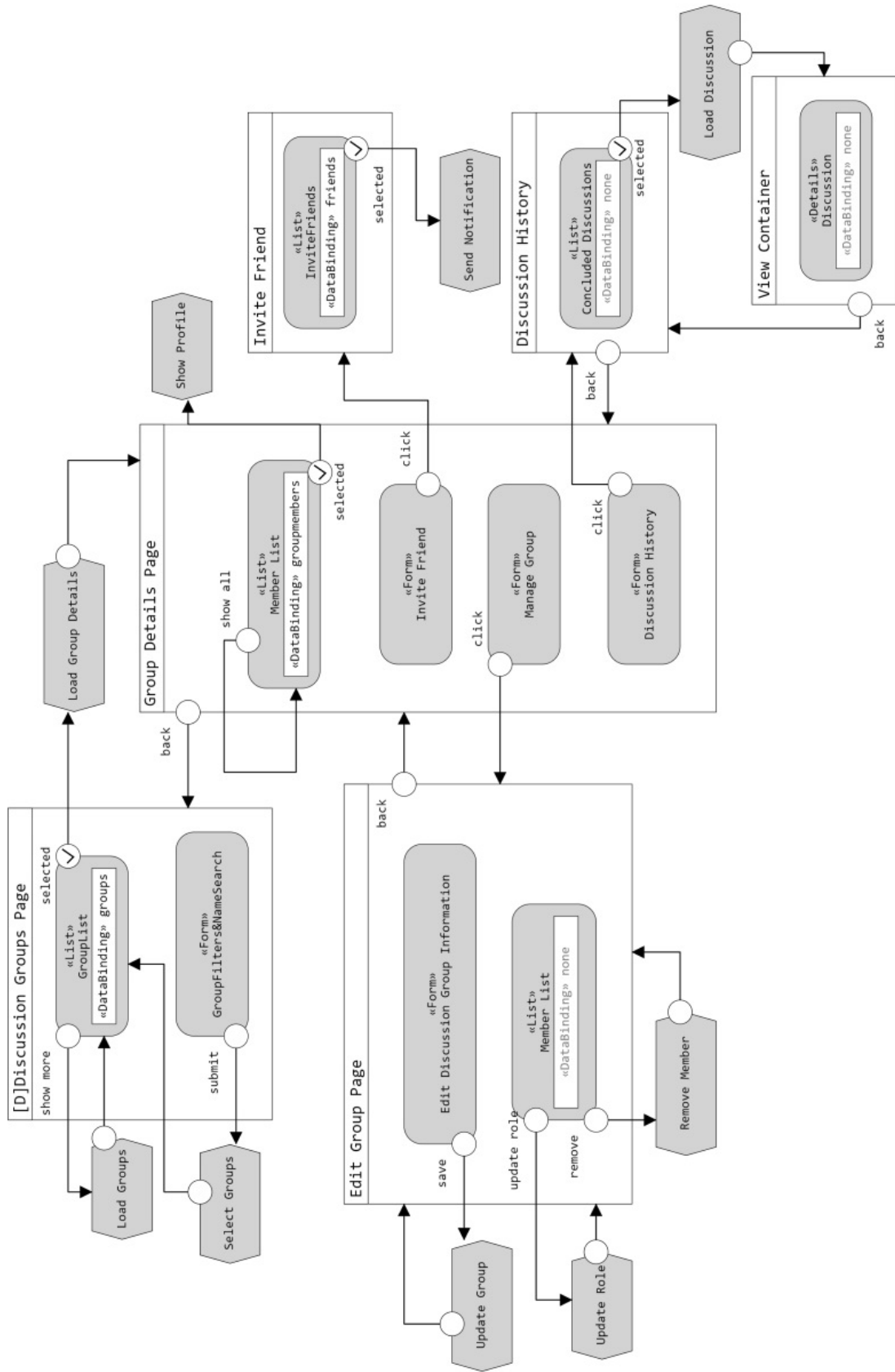


Figure A.6 The IFML diagram of the Discussion Group section of the platform II

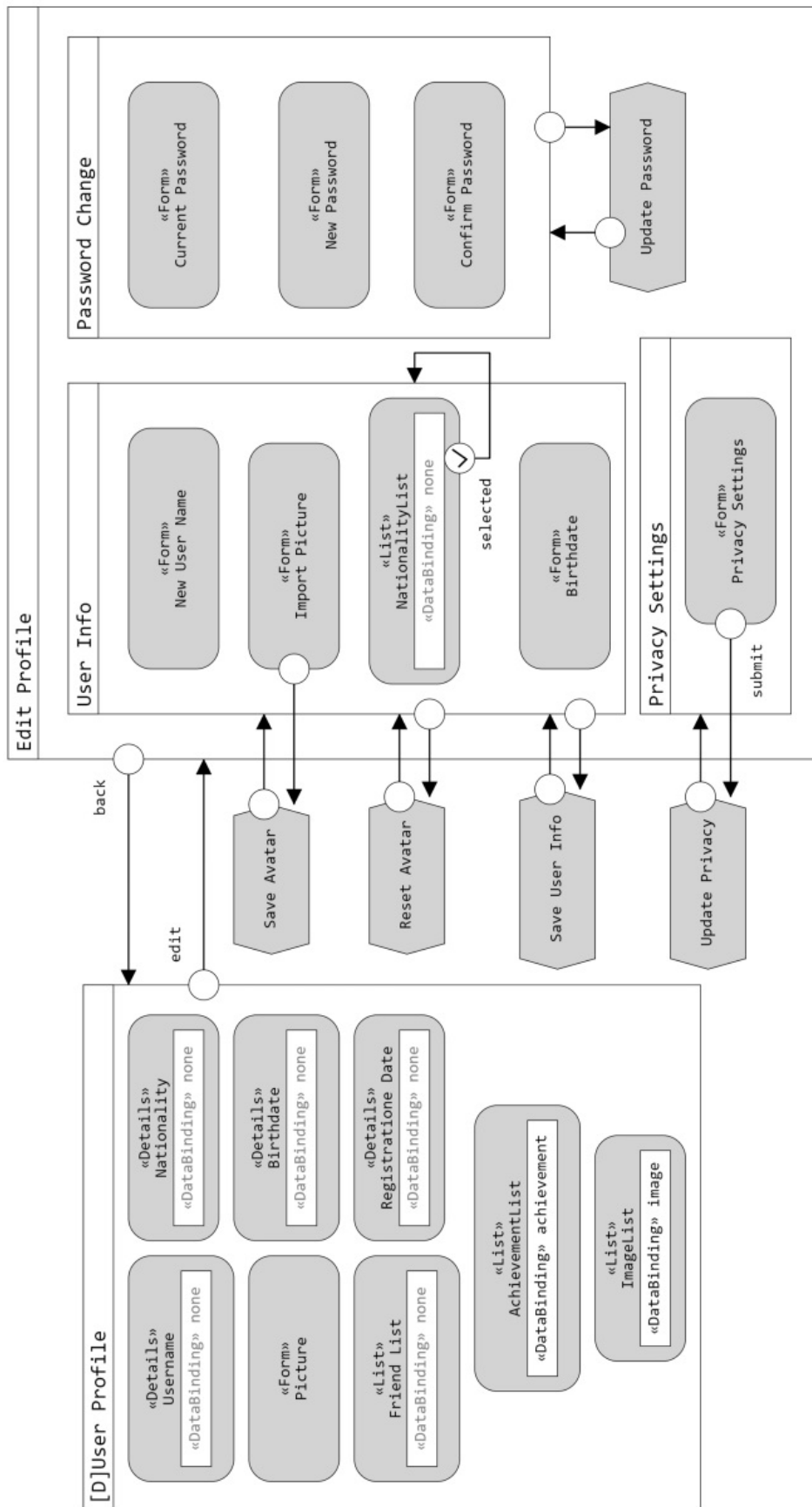


Figure A.7 The IFML diagram of the User Profile I



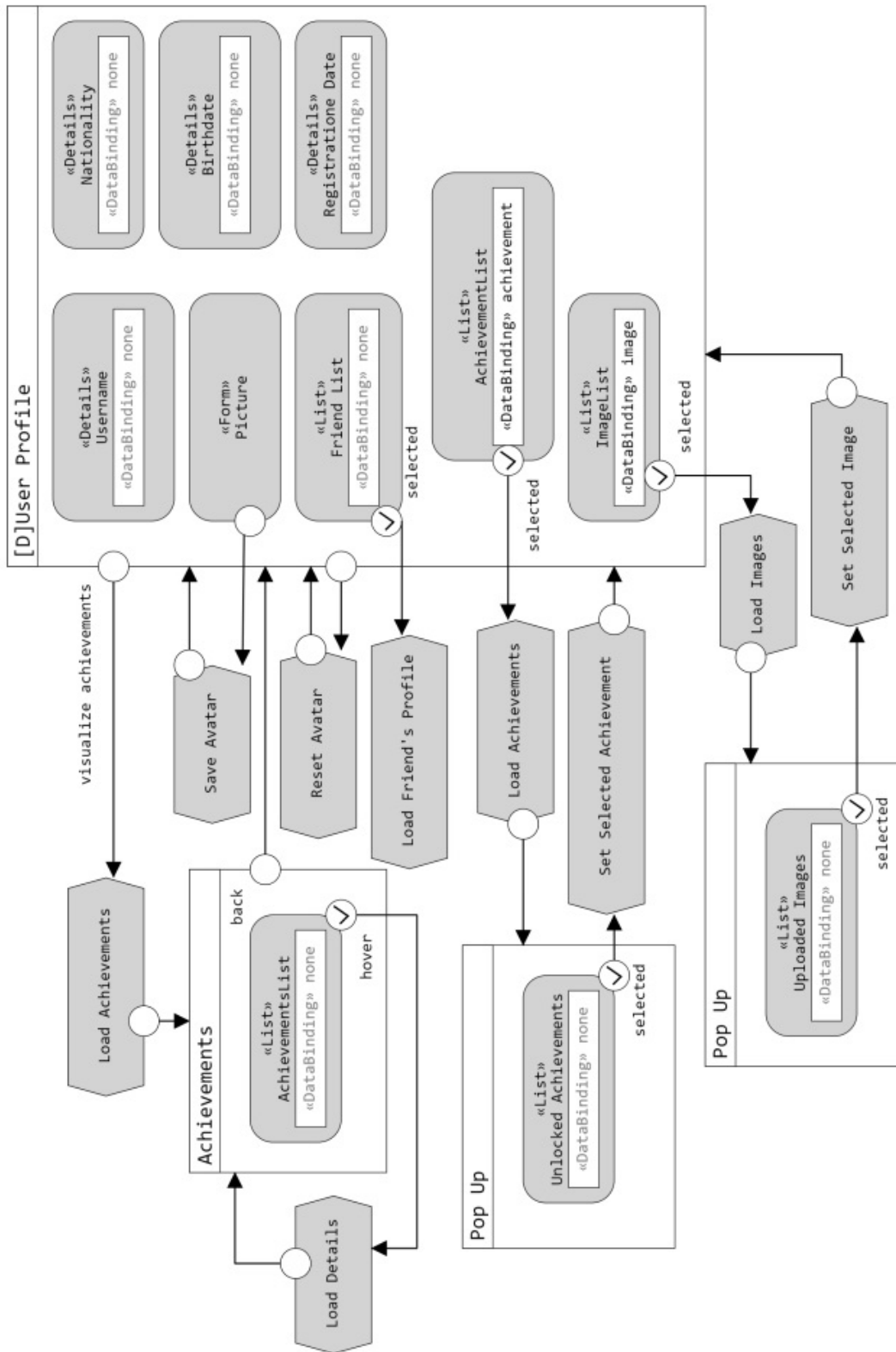


Figure A.8 The IFML diagram of the User Profile II

## A.2 Activity Diagram Administrator

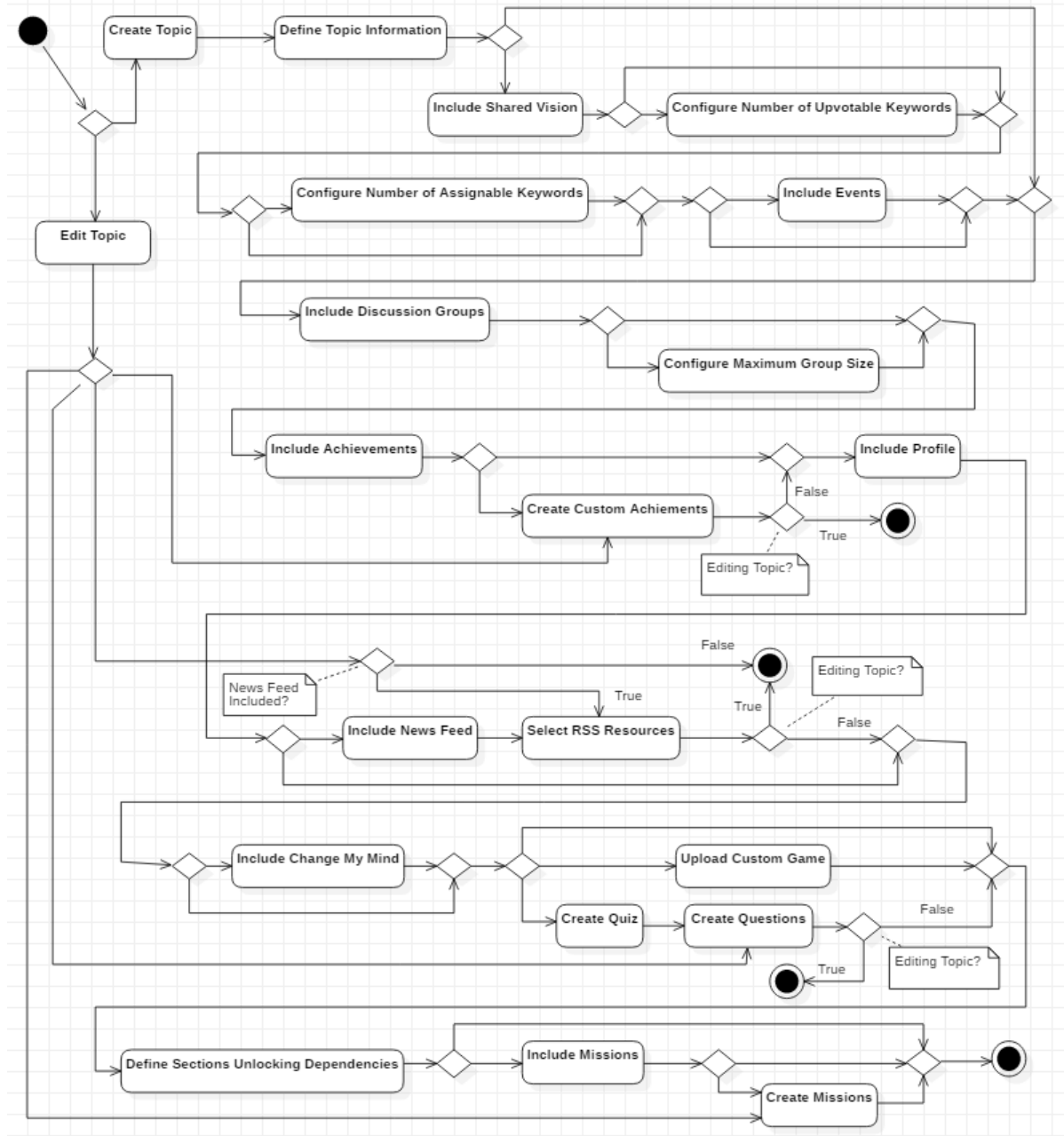


Figure A.9 The activity diagram to configure a new Challenge

### A.3 Task Tables

Role	Asset	Task
Social Scientist	Notification	Notification from completed analysis Notification from “Share Report”
	Feedback	Publish Analysis Feedback
	Analytic Dashboard	Visualize/Filter/Aggregate/Download Data Share Report
	Analytic Tools	Perform Regression/Clustering/Classification Download Analysis Results
	Representation Tool	Visualize Graph/Table/Diagram
Admin	Notification	Notification for Topic Edit
	Area Configuration Dashboard	Publish Analysis Feedback
	Analytic Dashboard	Create a new Topic Area Add/Configure/Remove Section Load Custom Game Quiz Management
	Quiz	Create/Enable/Disable/Remove a Quiz Create/Edit/Remove Quiz Questions Upload/Edit/Remove Quiz Image Create/Edit Curiosity
	Missions	Create/Remove/Publish Missions
	News Feed	Create/Remove RSS Source
	Statistics	Visualize Quiz/Custom Game Statistics

Table A.1 Table representing the mapping between Roles, Assets and Tasks I

Role	Asset	Task
Member	Topic/Challenge	Select Topic Area Visualize Topic Area Details
	Vision	Select Vision Visualize Vision Images
	Shared View	Upload Shared View Edit/Remove/Rate Shared View
	Discussion	Join/Visualize Discussion Write/Edit/Remove/Reply (to) a Comment Visualize Past Discussions
	Keyword	Upvote/Create/Remove/Suggest Keyword
	Chat	Create/Delete Chat Select Member/Group/Event Chat Invite Friend to a Chat Remove Member from a Chat
	Circle	Visualize Circle Send/Accept/Reject Friend Request Visualize Friend Profile Remove Friend Block Member
	Group	Join/Create/Leave a Group Create/Vote a Proposal Search/Filter Groups
	Profile	Visualize/Edit Profile Information
	Statistics	Visualize Account/Achievement Statistics
	Avatar	Upload/Select/Remove Avatar
	Activity Level	Select/Remove Activity Level Frame
	Event	Create/Edit/Delete an Event Express Participation Status Visualize Event Details Invite Friends to an Event Search/Filter Events
Geo-Localization	Enable/Disable Geo-Localization	

Table A.2 Table representing the mapping between Roles, Assets and Tasks II

Role	Asset	Task
Member	Quiz	Select a Quiz Answer/Skip Question Visualize Curiosity
	Custom Game	Play/Select Custom Game
	News Feed	Visualize News Feed Visualize/Save/Hide News Suggest RSS Source Search/Filter News
	Notification	Friend Request Notification Suggested Keyword Notification Join Group Request Accepted Notification Achievement Unlocked Notification Started Discussion Notification
	Time Customizable Notifications	Enable/Disable Notifications Visualize/Edit/Reset Notification Reception Timeline
	Privacy	Edit/Reset Privacy Settings
	Missions	Visualize Mission Details/Progress
	Community Missions	Visualize Community Mission Details/Progress
	Feedback Achievements visible on Profile	Visualize Social Scientists Feedback Select Achievements to Display
	Event Achievements	Create Custom Achievement for an Event
	Information as Reward	Visualize Curiosity for Quiz
Group Coordinator	Discussion	Remove any Comment
	Group	Change Member Role Remove Member Accept/Reject Member Join Request Edit/Delete Group
	Statistics	Visualize Group Statistics
	Notification	Member Join Request Notification Member Request Accepted/Rejected Notification

Table A.3 Table representing the mapping between Roles, Assets and Tasks III

## A.4 Testing Procedure

The testing procedure is divided into a general description for each section and a list of actions asked to the tester.

### A.4.1 Introduction

This platform has been developed as a side project of an European one, whose goal is to improve people's engagement in political and social settings, with the aim of making people aware of these days' problems, having them to argue and think on such topics, highlighting the important ones. The final goal of the platform is to operate as a mediator between the communities and the government leaders of the European countries, in order to find out a meeting point between the government's actions and the people's vision of the future.

Our aim is to analyze the users' behaviours and the usability of the platform. During the demo you will be asked to perform some tasks which you will have to abide by. At the end of the guided demo, you will be free to explore the platform as much as you want. Afterwards you will be asked to fill out a questionnaire composed of 15 questions.

- Read the introduction page
- Sign Up
- Confirm E-Mail
- Login

### A.4.2 Topic

The topics you can explore are listed in this section. For the purpose of this demo, we ask you to choose between the first two proposed topics: "Environmental pollution" or "Renewable energy VS Fossil fuels". This restriction will not affect the test in any way.

- Topic Selection

Choose between "Alternative Energy VS Fossil Fuels" and "Environmental Pollution"

### A.4.3 Quiz

The aim of the Quiz is to increase the user awareness on the chosen topic initially leading the user to inquire deeply about the topic, and then to actively participate on the platform,

arguing and proposing solutions to the challenges we face these days. In the demo there are about 8 questions for each topic.

- Select the “Quiz Section”
- Answer to 3 or more questions
- Visualize the Notifications for the Achievements obtained

#### A.4.4 Shared View

The goal of “Shared View” is to let the users share their thoughts and visions through an image. Every view has a vision which describes a sub-case of the chosen topic, a set of keywords useful to describe the idea the user wants to express and 3 parameters to rate the view, whose meaning will be explained later on. The idea behind this game is that users take pictures with their smartphones or cameras and share them on the platform instead of simply searching and uploading pictures from the web; so that they can share and argue about problems closer to them. For demonstrative purpose a set of images is made available. You will upload one of them and play with the ones already on the platform. This game includes various sections, among which you will be asked to surf.

- Select “Shared View”
- Upload an Image
- Edit an Image by adding 1 keyword (A keyword has been suggested)
- Which is the meaning of each rating under each view? You can look around the page to answer.
  - Relevance: how much the image is relevant to the topic
  - Need: the need of performing actions in the short period
  - Radiosity: the future which the image inspire to you
- Rate at least 3 Images
- Suggest a tag to another user
- Vote a Tag
- Change the Feed to visualize the different types of Feed
- Select a Vision to visualize the Images from that Vision

### A.4.5 Change My Mind

“Change My Mind” is a game developed to allow users to read and reason on other users’ thoughts. The game is split in two phases: the creation of the cards, in which you will be asked to explain the motivations behind one of the ratings you expressed, and the match phase, in which one of your card will be coupled with another one created by another user, both regarding the same image. During this phase, you will be shown both yours and the other user’s thoughts and you will be asked to express your opinions on what your challenger wrote. Finally you will be able to change your mind on the evaluation you previously gave to the view. At the end of the match it will be possible to visualize the information about the match in the dedicated section of the platform. You will play one match by answering a match already played against you.

- Select “Change My Mind”
- Read the initial description
- Create at least 3 cards
- Visualize the match history
- Answer to the match you’ll find in "Match History"

### A.4.6 Discussion Groups

“Discussion Groups” is the final section of the platform, where users can join one or more groups, in which discussions take place on a weekly basis. For each group, the discussion argument depends on the proposals and the votes made by their members. It would be possible to read those Discussions even after their conclusion. You will be guided through all the functionalities available inside a group, also having you creating your own.

- Select “Discussion Group”
- Join a Group
- Propose a Discussion Topic
- Vote a Proposal
- Join a Discussion
- Make a Comment



- Answer to a Comment
- Edit a Comment
- Create a Group
- Edit a Group
- We will join the new group
- Promote a user to Coordinator
- Remove the user
- Delete or Leave the Group

#### **A.4.7 Profile**

In this section of the platform you are allowed to update your profile. You will be able to pick the images from your most successful views and the achievements you earned to share them with others when they visit your profile. You can also define which information you want to make public.

- Visit “User Profile”
- Edit the Privacy Settings
- Select the Images for the profile
- Visualize all the Achievements
- Select the Achievements for the Profile
- Select the Images for the Profile
- Search for another user and add them as friends
- We will accept the friend request
- Visualize the other User profile
- Logout

## A.5 Questionnaire

The questionnaire of 15 questions to which the participant had to answer after the test is reported below. An Italian version was made available too.

Name ..... Age ..... Gender .....

1) Sort the features provided by the platform based on how much interesting they are in your opinion (e.g. Quiz, Shared View, Change My Mind, Discussion Group).

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2) Sort the features provided by the platform based on how much intuitive they are in your opinion (e.g. Quiz, Shared View, Change My Mind, Discussion Group).

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3) How would you make those functionalities even more intuitive for new users?

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4) Which of the features implemented in the platform would you use the most if you would become one of its users?

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5) Based on the sections implemented in the platform, assign an evaluation on a scale of 1 to 10 for each one of them, basing your rating only on their functionalities.

Quiz

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Shared Vision

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Change My Mind

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Discussion Groups

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6) In “Shared Vision” some icons are used to represent different concepts for each different evaluation. The first one is the “Relevance”, which is represented using a target without any arrows (low Relevance) and a target with an arrow in its center (high Relevance). How clear is this representation on a scale of 1 to 10 in your opinion?

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Propose some icons that could replace the current ones.

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7) In “Shared Vision” some icons are used to represent different concepts for each different evaluation. The second one is the “Need”, which is represented using two different thermometers, one recalling cold (Secondary) and one recalling hot (Impelling). How clear is this representation on a scale of 1 to 10 in your opinion?

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Propose some icons that could replace the current ones.

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8) In “Shared Vision” some icons are used to represent different concepts for each different evaluation. The third one is the “Radiosity”, which is represented using a thunderstorm (Gloomy) and a rainbow (Bright).

How clear is this representation on a scale of 1 to 10 in your opinion?

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Propose some icons that could replace the current ones.

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9) In “Shared Vision” there is a functionality which allows each user to suggest a Tag to another user for a specific image, how much is this function relevant on a scale of 1 to 10 in your opinion?

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10) In “Shared Vision” there is a functionality which allows each user to express their preferences about one or more Tags assigned to an image, how much is this function relevant on a scale of 1 to 10 in your opinion?

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11) In “Shared Vision” there will be a functionality which allows each user to import and export photos from other Social Medias (e.g. Instagram). Would you use this functionality? (Yes/No, Why?)

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12) Inside each “Discussion Group” each user can express their own preference on each week about what they would like to discuss about, how much is this function relevant on a scale of 1 to 10 in your opinion?

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13) Inside the “Profile” it is possible to set which information would be shown to other users, how much is this function relevant on a scale of 1 to 10 in your opinion?

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14) Which aspects of the platform would you improve?

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15) Which features would you add to the platform?

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