

Gamified App for Energy Saving and Sustainability

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ABSTRACT

This article presents the development of a web application aimed at changing user habits or, at least, raising awareness in the field of energy saving and sustainability. It has been gamified in order to increase motivation and encourage the user to better assimilate certain knowledge and favor the change towards more positive behaviors.

Author Keywords

App, gamification, sustainability, energy saving.

ACM Classification Keywords

H.5.m. Information interfaces and presentation.

INTRODUCTION

Today, the world is facing serious problems with which, from the field of information technology, we should try to help. One of them, and almost the most important one, is climate change and the degradation of the environment.

The action of the human being is devastating for nature, but it has been so for more than a century. During the last 130 years, the average temperature of the planet has increased almost 1°C, and it is expected that, by the end of this century, this increase could reach 4,8°C [1]. But the problems are not only with respect to the temperature, sea level has risen 20 cm during the last century and, according to the WHO, the number of deaths associated with climate change by 2050 will exceed 5 million [2].

There is no doubt that the cause of this problem is us and our fateful consumption habits. Therefore, the solution to try to reverse the current situation is to change our energy habits. But far from being progressing in this line, it seems that every time we move further away from achieving a sustainable way of life. The last example we have with the withdrawal of EE. UU of the Paris agreement against climate change.

It seems that, at least to this day, if we want to move towards a greener lifestyle and save our planet, we must start by changing our own way of life, since apparently large institutions do not give it much importance. Small changes in our day to day can contribute to stop the current situation and prevent future generations from suffering catastrophic consequences. In this sense, gamification [3]

can be an excellent strategy to encourage the changing of habits in the population. Thus, this work has the following goals:

- Analyze some of the gamified applications existing today related with the energy saving and sustainability.
- Design and development of a web application that allows users to motivate themselves to change their energy saving and sustainability habits.

This paper is organized as follows: first of all, the related work will be presented, then, the design and developing of the app will be described and finally, conclusions summarized the main contributions of this work.

RELATED WORKS

Gamification has been applied in different areas, since it has been seen how its use can improve the learning results and make people more involved in the subject. In [4], the authors talk about how the application of gamification affected a socio-educational project that had 161 students, who, divided into several random groups, had to draw up an intervention plan to promote sustainable development within a rural context. In order to immerse them in a playful learning experience, they used different elements of gamification, such as the use of missions or achievements, as well as classifications for the different groups.

After the completion of this project, more than 70% of the participants showed great satisfaction with the type of activity proposed, as well as with the gamification of the process. It should also be noted that the activity was not only motivated and involved more students, but also contributed to the acquisition and development of several key generic competences.

On the other hand, another research [5] deals with the issue of applying gamification to the educational process to favor learning within the field of e-learning. By using game mechanics, students are helped to gain motivation for the study and, thanks to the good feedback received, they feel more motivated to study and read. Besides, the gamification favors the generation of positive changes in user behavior. Gamifying does not imply creating a game, but making education more fun and attractive, therefore, making use of this method is a great idea when creating e-learning applications that are more effective.

But the gamification is applicable in other fields besides the educative one, in [6] it is spoken of its use applied to the

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marketing of services, scope for which the gamification could be very useful in the future. An interesting line for future research could be, for example, the use of customer loyalty cards and other marketing techniques such as gamified services. Finally, in [7] there is talk of applying gamification for the detection of noise pollution in cities.

Having data from different urban areas is crucial to know the evolution of these and know what their trends in the environmental field. Collecting observations related to environmental areas, such as noise, involves the deployment of sensor networks that can be quite expensive for local and regional governments, however, today, the smartphones that we all use are full of sensors to which you can take advantage of them to, for example, make noise measurements through their microphones. Therefore, the development of an application with gamification techniques to collect data from acoustic pollution and, the fact of gamify this application, favors that the development of tasks that can turn out to be boring and repetitive becomes something more bearable and that compromises more to the users. In this way, a large amount of information can be sent to governments with the aim of detecting the areas with the greatest problems and improving the quality of life in those areas.

In order to analyze the current state of the gamification, a search of different applications has also been carried out, which are described below:

- *Virtual Energy Advisor* [8]: It is an application created by the Catalan company Enerbyte, which is committed to improving energy efficiency. It is developed with the support of the city council of Barcelona, and is available to any neighbor of the city that wishes to make use of it, for which they have to register in the web of the city council. This application not only offers the user data about their energy consumption, but also helps the user to use that information to save on the invoice at the end of the month. Some of the features it offers are that it allows the user to know which is the cheapest time to use the appliances (washing machine, dishwasher ...), or if the power that is currently contracted is the most convenient for your home. It has been proven that a change in behavior is linked to an energy saving of approximately 10%, and that is what this platform pursues, that the user knows how much they consume and motivate them to maintain good habits over time. Therefore, it offers elements of games that allow the user to compete with himself and with the rest of the community, thus encouraging a competitive spirit to see who saves more.
- *Changers CO2 Fit* [9]: This application fights against change climate promoting a more sustainable way of life and trying to change the habits of its users, which are encouraged to make responsible use of energy and reduce their CO2 emissions using the bicycle or public transport. The application has a version for both individual users and companies, so that companies can offer their employees a sustainable app. The application uses a rewards model in which the user is given a Recoin for each kilogram that has stopped emitting to the atmosphere or for each kilometer traveled on foot or by bicycle. In this way, users can win prizes, badges and climb positions in a world ranking, feeling more motivated to continue doing these practices. In addition, the Recoins can be exchanged for different prizes, such as a meal in the company cafeteria, a training session or for different accessories for a bicycle. It is also possible to make individual raffles within the company. Another attraction offered by this application is that each user has the possibility of planting a tree, since for every 100 kilometers traveled on foot or by bike, a tree that will be planted in an ecological reforestation forest in Germany is unlocked. In addition, you can also organize a donation project to any desired NGO, such as doctors without borders.
- *TRIBE 2020* [10]: This application was born from a European project whose objective was to save energy in public buildings, and incorporates gamification with the aim of promoting habit changes in the user and make it more efficient. This application shows us a simulation of a building, and what is sought is that the user minimizes as much as possible the energy consumption of it. The main objective of TRIBE (Training Behavior Towards Energy Efficiency) is to achieve energy savings in public buildings by influencing the behavior of users and using ICT solutions. This project is developing a pack of solutions so that administrations can apply it in their buildings. This pack consists of five phases: conducting an energy audit and initial diagnosis, developing a virtual building pilot, developing a specific monitoring plan for the building, developing a financing scheme and carrying out an awareness campaign that addresses the energetic behavior. In addition to this, as has been mentioned, gamification is also used as a vital tool to promote the change of behavior in users. With this objective, a videogame has been developed that includes: development of groups of profiles of user behavior, identification of 250 energy efficiency measures, development of a replicable methodology when designing and implementing an ICT monitoring and development system of a simulation engine.

ECOLIFE: GAMIFIED APP

EcoLife [11] is a web application (web-app) whose objective is to change the habits of users or, at least, raise awareness in the field of energy saving and sustainability. It includes some elements of gamification that seek to motivate the user and encourage the latter to better absorb certain knowledge and change their behavior towards more positive ones.

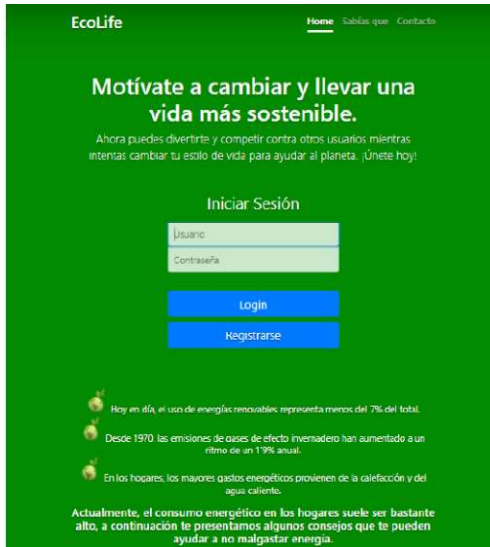


Figure 1. Main page of Ecolife web-app [10]

To be able to use the application, users must log in or, if they do not have it, register in advance (Figure 1). Once the registration is made, the user will be redirected to the initial page so that he can log in. In the following Figure 2 you can see the page that the user sees after having logged in. In the upper part there is a navigation bar that allows access to the different sections (Points, Achievements and Ranking) and close the session. Below this bar, there is another one in which the data related to the user is displayed, such as the avatar, the user name, the current level or a progress bar with the experience obtained to date. In the case of the image, the user can change it whenever he wants by simply clicking on it and selecting a different one.

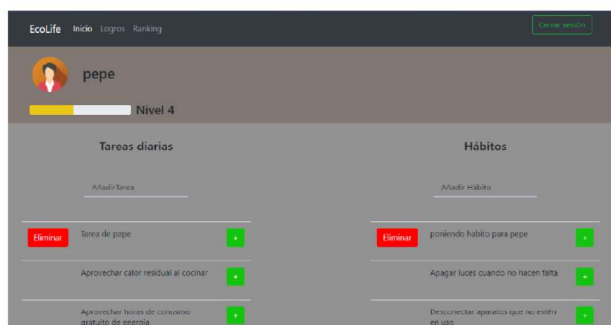


Figure 2. User interface with habits and tasks.

Users can see their tasks and habits. In each of them there is a series of predetermined activities that the user cannot modify, but he is given the option of adding any type of action that he considers appropriate. All those tasks or habits that have been added by the user may be deleted later if desired. Both columns have the same purpose, to encourage the user to perform these actions and to mark them as done, the main difference is that the tasks, as the name suggests, can only be done once a day.

Regardless of whether the action performed is a task or a habit, the user will accumulate experience as they mark them as completed, even if they are added later. That yes, will add something less than the rest. On this same page, in case the user has not done anything that day, a notification will appear as a reminder to encourage him to interact and continue progressing. Also, the user can check all those achievements that have been unlocked over time and the performance of different activities. In the beginning, all the achievements will be blocked, because this will not take too much time using the application or you will not have interacted enough, but as you complete different tasks and habits you will unlock different badges that they recognize the dedication that has been placed. In the following figure 3, it shows how a user has managed to unlock an achievement corresponding to the habit of recycling:

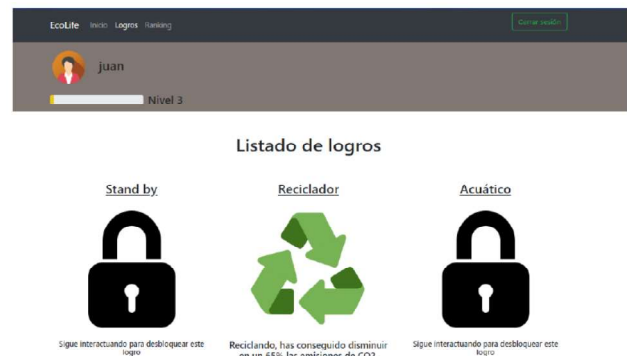


Figure 3. Sample of blocked and unblocked achievements.

In order to notify the user, and that he knows when he has managed to unlock a certain milestone, he will be notified at the time the user has achieved it, so that he can go to the corresponding section to see it. In addition, if the user wanted, has a series of buttons at the bottom of this page to share by social networks that has obtained an achievement in the application. In addition, the user can access to see a classification of all those who use the application, so that they feel motivated to continue with the execution of the different tasks to overcome the rest of users.

By default, it will be shown first to that person who has a greater amount of experience achieved, but, if one wishes, you can select according to what value you want the table to be displayed. If you click, for example, on Level, the

ranking will be ordered according to user levels, both ascending and descending. The same would happen, for example, when ordering according to the name.

EVALUATION

To verify the correct operation of the application, we proceeded to do some tests with real users, so that they experienced the sensation of using the tool and provided feedback that could be used to improve it. The way in which these tests were carried out consisted of usability tests in the laboratory with said users in which they explained the task of the application and showed them how to access it so that they could use it and check its operation. The reaction of all those who performed the tests was very positive, noting that it was a great idea that could help many people to change their habits, because you feel incited to perform the activities to progress. Some improvements suggested by the users are the following:

- *Profile summary.* Add a button or link that allows the user to view all the information of their personal profile (avatar, level, total experience, achievements unlocked, number of total achievements ...).
- *Option to delete account and change password.* Add option to the user that he can change his password or can, if he wishes, delete his account since, nowadays, the accounts can only be deleted by an administrator who can access the database.
- *Language.* Add option that the user can choose to change the language to, at least, English.
- *Add default activities automatically.* Taking into account all those tasks and habits that each user enters individually, you could automatically check which are the most repeated and transform them into predetermined activities that are available to all users

In addition, they were passed a test in order to evaluate the application and know data and opinions about this and the customs of each.

CONCLUSIONS AND FUTURE WORK

To lead a more sustainable and efficient way of life is one of the objectives we must fulfill if we want to stop destroying the environment and ensure that future generations suffer the consequences of our actions. However, to date, the existing data is not entirely encouraging.

In this paper we have presented the first functional prototype of EcoLife, an application that was born with the aim of helping people to become aware of this issue and, consequently, change their habits for others more respectful with nature, creating habits that help combat the problems of pollution and energy waste. As further work, we plan to continue the developing of the web-app, including new functionalities, improving the graphic design of the interface and testing with user the web-app in their real life.

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