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Gamification and Coaching in Remote Monitoring and Care Platforms

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Abstract. Nowadays, several e-health systems are equipped with advanced features for patients monitoring and care. Among these features, gamification and operations supporting the patients' adherence to therapeutic and care plans have been found to be quite useful and valuable. Among others, the introduction of intelligent patient coaching and the provisions of recommendations are very popular. The aim of this paper is to present specific gamification and coaching approaches that could be employed in the context of an existing eHealth system for remote monitoring and care for elders. The "Points, Badges and Leaderboards" gamification approach was followed. Specifically, parameters related to the application usage (daily points), the physical activity (number of daily steps), the sleep quality (sleep score) and other measurements (i.e. weight) were utilized to accommodate elders needs for motivation and engagement. Regarding the coaching, motivational messages and notification for the mobile devices were selected to deliver the relative information to the elders. A prototype health information system with a corresponding mobile application was adapted to include gamification and coaching features to motivate elders in order to achieve the maximum adherence on their monitoring and care health plans. The paper presents the design issues and summarizes the technical details.

Keywords. Gamification, PBL, coaching, elders, eHealth, mHealth, IT systems

1. Introduction

During the last decade, mobile health technologies and wearable devices have been broadly used for physical activity tracking and for the promotion of the people's well-being [1,2]. In addition, several systems have been developed lately for chronic patients and senior adults to support their care needs, to offer higher quality of life, and to promote patient independence [3-6].

Meanwhile, in the last few years, a lot of health information systems tend to support advanced features related to the prevention of diseases and the promotion of healthy lifestyles [7-10]. Among these features, gamification and operations supporting the patients' adherence to the healthcare plan have been found to be useful and valuable in patients monitoring and care [11-14]. Points - Badges - Leaderboards (PBL) gamification approach has been recently used in such prototype e-health systems revealing some promising outcomes [15].

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Moreover, the concept of intelligent (autonomous) patient coaching in modern healthcare information systems is very popular and acceptable, since the individual provision of information, advice and incentives can offer a richer, safer, and more effective user experience. The intelligent patient coaching can be characterized as a valuable tool in the remote care systems as it can provide multiple advantages for the patient, such as defining individual care plans or suggestions for each user while adapting them according to the patient's performance or preferences. Based on the international literature, coaching can be delivered using motivational messages [16] which can improve the user's confidence, while could develop a rapport between the system and the user [17,18]. In addition, the push notifications technology in mobile devices have also been found to be suitable for the coaching support [19]. The content of both motivational messages and notifications can be either informative on general topics (for example, the user can be updated or informed regarding healthcare issues while he/she takes a break from his/her daily activities) or could be adapted to the individual program specified for a specific user based on his/her personal performance to receive personalized information.

The aim of this paper is to present the gamification and coaching approaches that could be used in the context of an existing eHealth system for remote monitoring and care for elders and chronic patients. The introduction of the gamification and coaching features on eHealth systems may lead to the increase of patients' motivation to adapt their behaviour for a healthier lifestyle and improved quality of life.

2. Methods

As already mentioned, in order to implement a gamification feature on an eHealth platform, the PBL gamification approach can be followed. Specifically, parameters relative to the application usage (daily points), the physical activity (number of daily steps), the sleep quality (sleep score) and other several measurements (ex. weight) can be utilized to accommodate elders needs for motivation and engagement.

In the initial design of the envisaged system, one of the requirements is the ability to record the aforementioned factors for each user. The above factors' data analysis [15] produce specific points based on the user's performance. The collection of the points leads to the user award with badges. The number of the different badges per factor and the required points for each badge can be defined by the system administrator in collaboration with the healthcare professionals who can assess the importance of each badge. Another requirement of the system includes the information of the user for his/her rank among the other users of the system. The rank is calculated based on the collected points on the above factors. Specifically, functions such as *min*, *max, sum, count* can be applied on raw collected data for points calculation. In addition, the collected data may be also combined with the measurements' time to produce more complex badge types.

Regarding the coaching requirements included, motivational messages feature was selected as an informative approach to support and motivate the elders in combination with the above-mentioned gamification approach. Finally, the usage of notification feature for the mobile app users was also be considered as an available option to enhance the elders coaching.

3. Results and Discussion

The gamification and coaching features were developed with a modular based architecture and were integrated with a homecare platform for validation. The platform interface was redesigned, to be friendlier and understandable to elders. Figure 1 presents the "My Badges" screen where the user can be informed about the earned badges and the points on each task/mission/factor. The points calculation is held using cloud computing and relative microservices that are followed by the platform. The current prototype includes badges for the application usage by measuring the frequency of use, the daily physical activity by analysing the number of steps, the sleep quality by analysing the sleep score and the user's weight. All the above data can be collected by smart devices such as smartwatches or fit trackers and smart scales that are compatible with the platform and support direct or indirect data exchange.

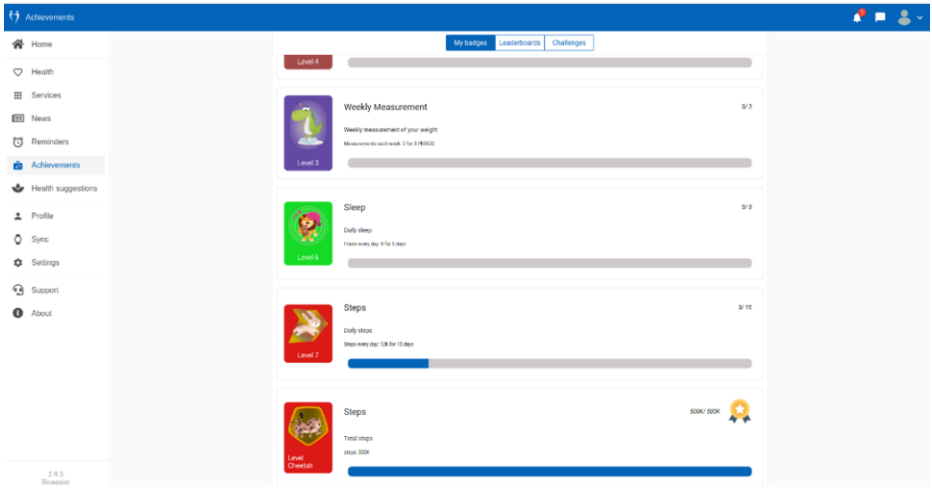

Figure 1. The "My Badges" screen

In order to increase the user's motivation and to promote social aspects of the system the gamification leaderboard and comparison graphs were developed. Figure 2 shows the user's performance comparison graphs. Each user can locate his/her place on the leaderboard and can also find the other users' performance for the same task/mission.

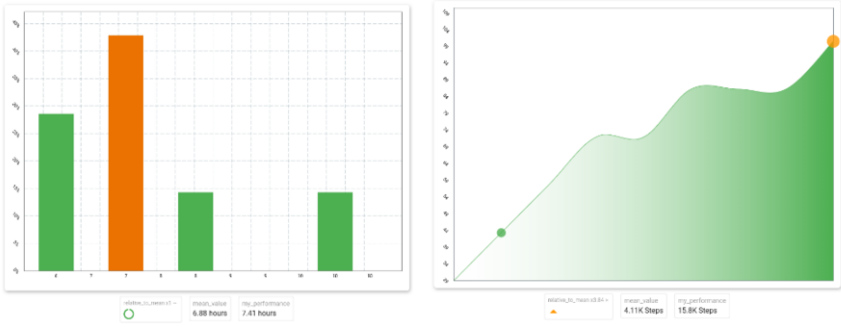

Figure 2. Patients' Performance Comparison Graphs

Using the figure 2 graphs, users can be informed regarding their performance for several factors. Their performance comparison with other similar users can lead them to adjust their behaviours in order to "win the game" and fulfil their targets.

Personalised motivation messages feature was also developed and used in combination with the platform's notification function. Based on the user's rank on the leaderboard, his/her condition, personal characteristics and activity, the elders can receive through the mobile application personalised motivation messages to continue the suggested by their care plan activities. The application of gamification and serious games for personalized health has been previously discussed on other relative studies [20].

Several health information systems have been used lately having similar features based on specific gamification or coaching approaches with very promising results. Gamification and Coaching functionalities seem to be incorporated with Electronic Health Records (EHR) to produce more accurate calculation on target setting and better ranking of the patients at leaderboards [21,22]. On the other hand, the usage of large EHR and the formulation of medical data silos to support the above functionalities arises issues related to the health data remote control and access by different eHealth platforms. Other relative studies present the usage of gamification for smoking cessation [23] or older adults support [24] and the strong relation with the mHealth apps [12, 25]. The relative advantage of the proposed system is the combination of the gamification features with the motivation messaging functionalities and the ranking of the users in dynamic leader boards.

4. Conclusions

A prototype health information system with a relative mobile application were adapted to include gamification and coaching features to motivate elders in order to achieve the maximum adherence on their monitoring and care health plans. The proposed solution is fully flexible and follows modular design as can be applied and integrated in any similar system. Limitations of the current work include the modules development based on the requirements for specific factors. Also, the presented prototype's integration with an real-world care plan and its role in the shared decision making process are not examined yet. Further examination and introduction of other related factors as well as extensions with additional user competitions are included on the project's future work. In addition, possible implementation of the proposed coaching feature in Electronic Health Record systems and Remote Care systems where healthcare professionals access the patient's holistic health records and they can set new targets, are also some of the future ideas for expandability and exploitation.

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