

Gamification for healthier lifestyle – User Retention

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Abstract. Gamification is gaining in popularity and is increasingly showing potential to benefit humans. Numerous applications have been developed but more research is required on the key motivational factors responsible for user adherence. The purpose of this research is to investigate strategies to encourage people in adopting a healthy lifestyle using gamification and identifying the key factors responsible for retaining users. The research will not be limited to certain activities such as gym or sports but motivates people to emphasize on small activities, for example, doing household work, walking and many others. This research endeavors to develop an application using Unity and C# which is a real-time platform supported by iOS and Android. The research focuses on Behavior Change Techniques and Self-Determination Theory to tackle the issue of user adherence.

Keywords: Gamification, User Retention, Behavior Change Techniques, Game Application, Healthy Lifestyle.

1 Introduction

Nowadays, a sedentary lifestyle has become a major issue and is a worldwide problem. According to World Health Organisation [1], 39 million children under age of 5 are obese in 2020, more than 340 million of age group 5 – 19 are overweight and 39% of adults are overweight and 13% are obese i.e. 650 million adopt unhealthy lifestyle in 2016. The main reason for this is owing to minimal mobility and exercise, causing an adverse effect on human wellbeing and leading to incurable ailments such as diabetes, obesity and cardiac issues. It has become a challenge to adopt a healthy lifestyle and stay motivated in the longer term.

The contemporary lifestyle health risks are increasing due to the health behaviour of the people's individual behaviour. The change in behaviour can significantly improve well-being. However, the behaviour such as physical activity, exercise and diet require motivation and behaviour change. In the area of health and well-being, gamification has been increasing in importance [2]. Gamification is defined as “use of game design elements within non-game contexts” [3]. The advantage of using gamification is to enhance user engagement and user experience. Gamification is used in various industries such as the health sector [4], social media [3], education [5] and many more. Game-

based technology, also known as gamification, is used to promote intrinsic motivation. It increases the level of involvement and motivation. There are two types of motivation, namely, the intrinsic motivation rises from doing things 'for own sake' while extrinsic motivation rises from external factors [2]. Extrinsic motivation which includes feedback such as money or vocals while intrinsic motivation includes group quests [6].

According to Kasurinena and Knutas [7], Crowdsourcing and Game of Health is used in the context of gamification. Crowdsourcing is an online task to socially interact where a group of people participate in a task of different levels to gain a mutual advantage. An Example of crowdsourcing is image labelling. On the other hand, Game for Health is to enhance the fitness level of the user by motivating users for health-based activity. It is designed to train the user to be physically active while playing games. It promotes exercise gaming to improve the user's way of living.

However, user adherence is a key factor in the domain of gamification. More insight is required for the driving factors responsible for user retention [8]. The goal of this study is to focus on user retention and encourage them to live a physically active life. The next section provides a state of the art summary of relevant work on user adherence, we explain which retention features we have considered and how we implemented them in the current system. We finalize explaining the various mechanisms we used for continuous assessment of the product and the embedded retention strategies.

2 Literature Review

This section focuses on the research closely related to user retention. The research conducted by Rose et al. [9], designed a gamified mobile health application known as 'MYSUGR' to examine behavior of a group of diabetic patients over 12 weeks. The outcome of this research was positive. Improvement in the blood result was observed. However, the challenge faced by them was to keep users engaged. The retention rate of the app users was 88% but dropped after 28 weeks to 70%. Hence, further investigation is required on factors contributing to user retention.

Findings reported in Stinson et al., [8] suggest that the '*mhealth*' pain assessment tool has positive outcome on cancer patients. The quality of life and user participation was improved in teenagers aged between 9-18 over 2-week observation. The tool helped teenagers in pain management. Although the outcome was positive, it still has some drawbacks. The limitation of this study was that more analysis was required for the fundamental factors behind user's engagement, for instance, rewarding systems.

Nathália et al. [10] research developed two types of an m-Health application for hypertension monitoring, one with the game mechanics and other without it, 14 patients with hypertension were categorized in the evaluation stage into four groups such as no gamification with assistance, no gamification and no assistance, gamification with assistance and gamification with no assistance to verify user engagement in health care.

The outcome of the result shows that gamification favoured the engagement and promoted intrinsic motivation in the users. The group with gamification elements managed to control their health in comparison to the group without gamification.

2.1 Motivational Factors / Gamification Elements

Some of user adherence features used by other researchers are as follows:

Competition- Competition caused by leader-boards can create social pressure to increase the player's level of engagement and sense of not being alone [3].

Setting Goals- According to Munson et al. [11] research, setting primary and secondary goals has a positive impact on the application users. If one goal becomes unattainable, the other may still be a realistic goal. If app users are having a good week, they may push themselves to achieve the goal.

Online trophies- Munson et al. [11] research came to the conclusion that Online trophies and ribbons failed to engage most participants, which raises questions about how such rewards can be designed to encourage users to stay active for a long term.

Liking- According to Ozanne et al. [12], Liking behavior can be used for various reasons. One of the reasons is bonding, it is used for congratulating or showing support to others by liking.

2.2 Behavior Change Techniques.

BCTs are techniques in which individuals change their behavior to adapt to a healthy lifestyle. It's a key factor for motivation. Michie et al., [13] listed 93 BCTs which are categorized in 16 groups such as Reward, Feedback and Monitoring, Repetition and substitution, Goals and Planning. Self-monitoring was the most effective group among other groups. However, the combination of BCTs results in an increase in physical activity. BCTs are useful and can be used for a long time [14].

2.3 Self- Determination Theory.

According to Sailer et al. [3] and Shi et al.[15], Self-Determination Theory (SDT) is a theory in which individuals motivate themselves through intrinsic and extrinsic motivation. It is self-engagement where a person feels motivated. In SDT, there are three factors for motivation:1) autonomy is freedom of taking decisions of your own choice without any pressure, 2) competence is a feeling of success and achievement, 3) Relatedness is feeling connected to others. However, Bovermann et al. [16] discuss four

factors of SDT: a) Autonomy, b) Competency, c) Relatedness and d) Purpose which means desire to make something meaningful. ‘Purpose’ is intrinsic motivation which is to do activities willingly and retain them for a longer term. The SDT factors are necessary to understand which give insight on how the gamification engagement and motivation works. Therefore, this motivation is a key factor for user retention. The study is conducted using SDT and BCT strategies to keep users engaged in physical activity using the *OnTheMove!* App.

2.4. Problem Definition.

Many applications such as MyFitnessPal, FitBit, Pokemon Go and Runkeeper [17] have been developed to overcome this problem but still user retention is a major challenge and needs more research. Pokemon Go failed to keep its users engaged for the long term. 57% of users left the app due to boredom and 29% due to not being able to reach a high goal [18].

Therefore, to overcome the problem of obesity and to keep user engagement for a longer term. The application is designed for this research to have a user adherence feature using techniques such as BCT and SDT.

3 Implementing Motivational Factors in OnTheMove!

The aim of this research is to overcome the problem of user retention and implement the factors that keep users motivated and engaged for the long term.

3.1 Overview of OnTheMove! Application

The *OnTheMove!* application has been designed using BCTs and self-determination theory. Some of the BCTs and SDT used in this app are Goal Settings, Habit Formation, Self-Monitoring Behavior, Rewards and Competitions. The application mainly focuses on user retention and encourages users to stay active using small physical activities. It gets users' steps and then converts it into virtual coins. (Fig.1). The coins can be used to buy avatars or real rewards. Some of the bonus rewards are daily, weekly, monthly and “personal best” reward to keep users motivated. The users can also transfer their steps to different goals or team competitions. There are different types of incentives, some are increased rewards for more activity, but we also have the age factor to bring into account where old age users get benefits for their efforts. One of the main tools used in the app is QR code which is complementary to step counting and used to associate rewards to user behaviors. It allows users to be rewarded for more than steps counting, for instance, activities which cannot measure well with steps such as swimming or perhaps lifting weights.

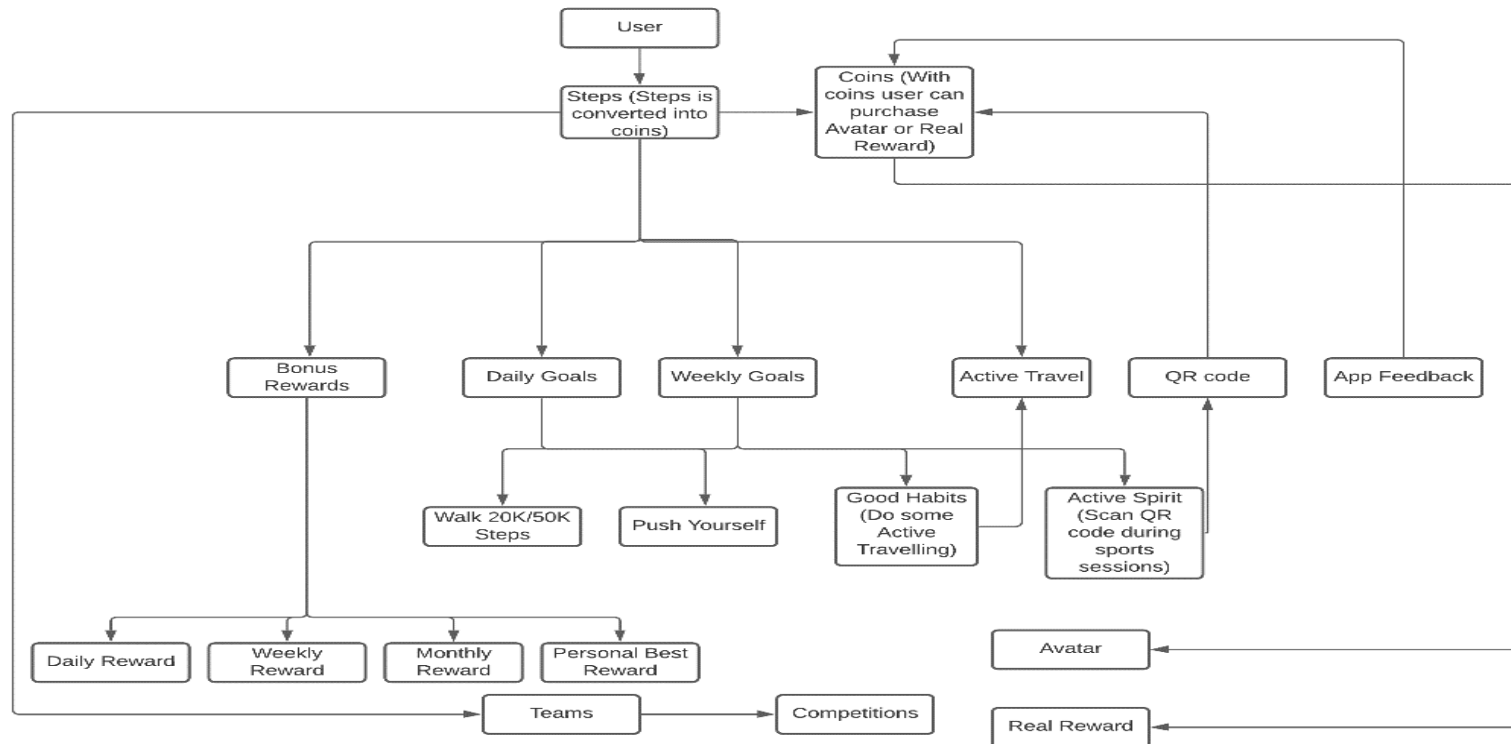


Fig. 1. Application Architecture

Some of the features of the application:

Goal Setting- Goal Setting is to self-regulate and monitor the behaviour. It also satisfies the user's need for autonomy and purpose. Users can set and change their daily and weekly goals. (Fig.2). The experiment conducted by Munson et al. [11] states that the outcome of having primary and secondary goals was positive. If a user fails to achieve one goal, they can still work on the second goal.

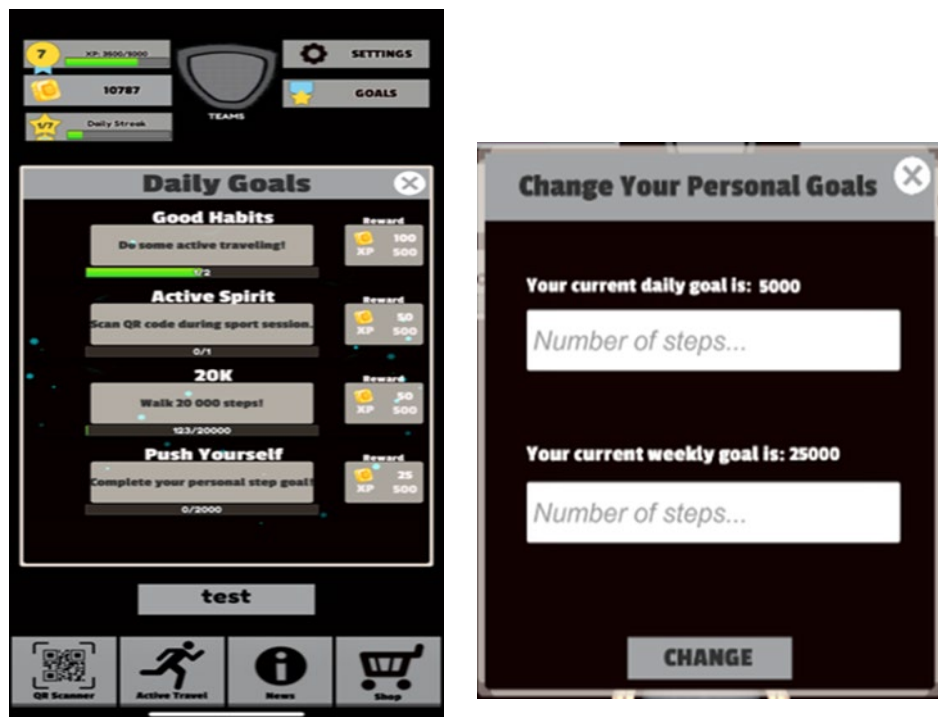


Fig. 2. Daily Goal and Change Personal Goal

Daily Streak- Daily Streak is used in the app to form new habits. This habit formation which becomes a long term habit after repetition of behaviour. Daily Streak is when the user is active and opens the app seven days regularly. They get some rewards. If the user will miss one day of completing a daily goal or challenge, the streak will be broken, and the user will start over again. The 7-day streak should keep the user motivated to complete any goal or challenge daily in order to collect bigger rewards once completing the 7-day streak.

Weekly Reward- The weekly reward is implemented to help users to develop a new habit of staying active. This is for user retention where after a certain period of time users get stuck to the routine due to behavior change. When the user is active throughout

the week and has more than 10000 steps in a week. The weekly reward window appears on Monday and the user can claim their reward. The weekly reward will keep the user motivated throughout the week. Also, the reward given to users on the basis of fidelity and effort.

Reward Effort- The main aim of this feature is to reward the effort of the users. This is to reward fidelity or loyalty of the users. If a person is physically inactive and more engaged in activities like watching TV or sitting and playing video games for a long time, they are determined to change their lifestyle. This feature will encourage them by rewarding the user for the effort and courage to change the lifestyle from sedentary to active. However, the aim is to make people physically active not necessarily by running, swimming or jogging. The user will get rewarded for changing their lifestyle. This is done by using the concept “*Personal Best*”. The term Personal Best is used in athletics. The algorithms are used to know the best time users have ever done the specific task such as running, jogging etc. *For example*, for a beginner it could be 35’ for 5K, but after running for a couple of years it could be 20’ (depending on age). If one day the person does S steps and next time s/he increases her/his latest PB by I%, with a fixed I%. This I coefficient will have to start big and diminish with time. For example, if a person’s first walk is 100ms it should not be that difficult to walk another 100 ms (which is a 100% increase!) however after a year or so if that person manages to walk 10K, a 100% increase will be 20K which is too big of a jump. To start with some minimum distance D (easy but meaningful, can be 500ms) and first reward 100% improvement of that initial PB, then reduce the expectation in a factor of a constant C, i.e., $(100-C)\%$, then $(100-2C)\%$, then $(100-3C)\%$, etc. Example if $C=10$ we go 100%, 90%, 81%, 73%, 64%, and so on. This feature is used in this app to praise and encourage users which satisfy the need of purpose and competence.

Real Rewards- Real rewards are provided by the stakeholders which includes hot meals, Sandwich, Gym and swimming sessions. (Fig.3). This reward raises extrinsic motivation. It gives a sense of achievement and appreciation.

Team Competition- In the *OnTheMove!* App users can create, join and view teams. Also, they can create and join competition. The competitions can be between two or more organizations. (Fig.4). The Team Competition is used to give users the feeling of competence and relatedness with other users.

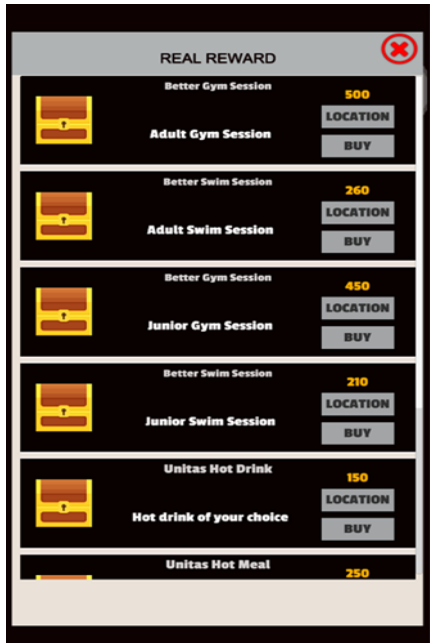


Fig. 3. Real Reward

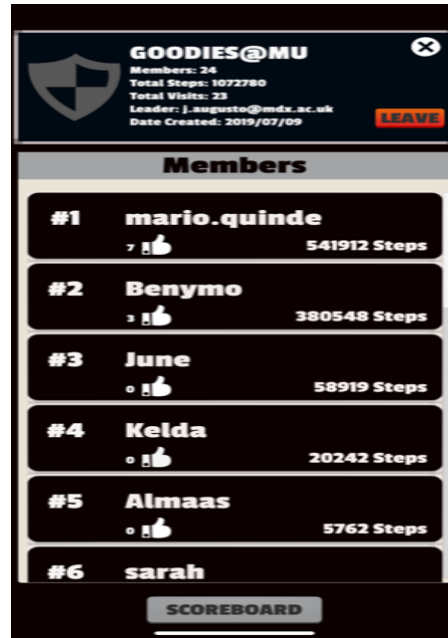


Fig. 4. Team Competition and Like

Age Band- Users can add their age. Steps are incremented according to users age e.g. if users age is 51 and steps walked is 112 then $112 * 5.1 = 571.2$ steps (Fig.5). If the users are above the age of 40, the steps are adjusted accordingly. This is for user adherence and to make it achievable for older users. In addition, to reward them for their efforts.

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if (int.Parse(userData[11]) >= 40)
{
    todayStepsDisplays.text = (int.Parse(userData[5]) * int.Parse(userData[11]) / 10).ToString();
    dailyStepCount = (int.Parse(userData[5]) * int.Parse(userData[11]) / 10);
}
else
{
    todayStepsDisplays.text = userData[5];
    dailyStepCount = int.Parse(userData[5]);
}

```

Fig. 5. Avatar Customization

Liking- To keep users motivated, a Like feature has been implemented. The users can like the steps of other users to congratulate or show their support. (Fig.4). This feature has been implemented to give users a sense of social support and relatedness.

QR Code- The QR code feature is implemented to reward efforts of users, for instance, PE teachers reward students with positive attitudes even if they have perhaps not been the fastest in a race or reward people with more efforts to change and stick to a healthy lifestyle. (Fig.7). This feature is to reward people who have shown positive behaviors such as trying the hardest, or being more cooperative with the rest of the team, or the one that has improved the most. The QR code helps in habit formation. This feature not only helps in developing new habits but also rewards competence which helps in user retention.

Avatar Customization- The user can customize the avatar skin color, dress, glasses, hair including other features. (Fig.6). This feature gives a sense of personalization, autonomy and relatedness. If the user has not walked, the avatar gets upset. However, to make it a happy user has to walk 10% of the average of daily steps.



Fig. 6. Avatar Customization

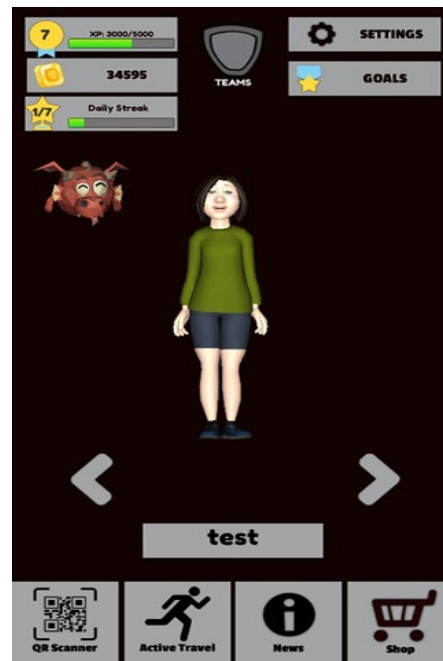


Fig. 7. Main Scene of the Application

4 Research Design and Methodology-

The methodology used to achieve the objectives of this research follows the User-centered Intelligent Environments Development Process [19]. A state of the art analysis through the technical literature has been used to get initial insights of the research area and to update with new developments. Our project discusses the challenges faced by other researchers to gain involvement of citizens and to keep users engaged for a longer term. Intertwined with knowledge acquisition we performed several iterations of system development with continuous improvement. The feedback has been gathered from colleagues, users and stakeholders using questionnaires, surveys, validation exercises, workshops and competitions to improve the application.

Workshop with Colleagues- At the start of this project the workshop was conducted in Middlesex University with Colleagues from the Psychology Department, Management Leadership and Organizations Department and London Sports Institute. The aim of this workshop was to get understanding and feedback from colleagues by sharing knowledge in their area of expertise. The term ‘user adherence’ was introduced in this workshop which is used interchangeably in this paper and is a part of the internal project terminology, it does not affect game users.

Workshop with Stakeholders- A workshop was conducted with the stakeholders in November 2019. This workshop took place in London with 8 participants including GLL Manager. The workshop started with the presentation of the app by Bene et al. [20] who was working mainly for a teenage group. Then it was followed by the discussion of how to improve the app and make it available for all the users. A list of requirements was set to work on. The aim of this workshop was to gather feedback and key requirements. The feedback from stakeholders is taken continuously after implementing the features. The requirement list is updated after each iteration which is every month. Currently, we are tackling 77 requirements. Some of them are achieved and some are still under development.

Pilot with users- This work evolved from Bene et al. [20], an MRes student who worked on a thesis which mainly focuses on teenagers. However, this is now for all users, regardless of their age. The data is collected from the users of different age groups such as children, teenagers and adults. The Age Band feature is implemented for different age groups which has been discussed in the previous section. The first pilot was conducted in Unitas, London with 25 users participating in two weeks ‘Step Challenge’. The users with more steps wins the competition. The first, second and third winners got a prize. The purpose of this challenge was to gather feedback from users and to enhance the functionality of the application. Most users enjoyed the real reward and avatar feature of the application.

5 Conclusion

In conclusion, this study conducts a comprehensive analysis on the fundamental elements that contribute to encouraging and retaining the users to become more physically active and focus on their health. The strategy is to keep people engaged by using gamified app and inspiring them to stay fit. The main factor in gamification is user adherence. Hence, in this research we developed an application to focus on user retention. Based on BCT and SDT, the key extrinsic and intrinsic motivational elements such as autonomy, purpose, competence and relatedness have been implemented to boost motivation in users to adapt to an active lifestyle for the long term.

The user retention features implemented in ‘*OnTheMove!*’ are Bonus Rewards, Real Rewards, Like, Personal Best, Competitions between different teams, Goals and Age Band. This app is for all age groups. An age band coefficient is used for people above the age of 40. It gives a feeling of relatedness with younger users. Moreover, it aims to ensure that the activities are achievable for them. Moreover, QR code is used for the activities that cannot be counted. It is to ensure that the users are rewarded for behavior change. It also emphasizes on the social interaction of application users to get a better result. These system features have been considered after various activities to gather feedback from various project stakeholders. Some of these activities are ongoing, for example, a pilot conducted in the London Borough of Barnet.

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