PROMOTING FITNESS THROUGH GAMIFICATION

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ABSTRACT

Social gamification programs have the potential to encourage healthy lifestyles in professional contexts, but designing them can be challenging due to issues such as privacy and fairness. We conducted a study on a two-level game concept that focused on achieving personal goals and a privacy-protected social competition among co-workers to increase goal compliance. By involving occupational experts in customizing users' goals and providing remote coaching, the program was successful in helping half of the participants make lifestyle changes and received positive feedback from the majority of users. However, the program struggled with long-term user engagement due to the design choice of one-way communication between employees and their physician in the interest of scalability.

Keyword : *Habitation, Artificial Intelligence, Machine Learning, Occupational health, Social Gamification, Gaming rewards.*

1. INTRODUCTION

Promoting fitness is a real-time personalization technologies are being used more frequently in health and wellness, which could increase the efficiency of systems for coaching physical activity. This study set out to examine real time, personalized applications for physical activity coaching. To examine the systems' general features personalization, design principles (behaviour change and gamification), and evaluation techniques, a data extraction tool was created. Personalization is expected to increase user adherence in applications for physical activity coaching, but it is still far from being relevance and value. Future research, in our opinion, should take into account the theories and recommendations mentioned in earlier work, take use of the target users' demands for personalization, incorporate foundations for behaviour management, investigate gamification theory, and appropriate evaluate these systems.

Social gamification programs have the potential to encourage healthy lifestyles, but implementing them in professional settings presents special design difficulties. Despite the fact that workplaces provide natural communities for social interaction, fairness problems resulting from diverse personal aspirations and privacy issues make it more difficult to create entertaining games. Employing occupational specialists to customize users' goals and provide them with remote coaching boosted the solution. The application according to the results, assisted half of the participants in changing their lives, and the majority of them valued the role. The personal health gamification system is a mobile app and data dashboard designed to help people adopt a healthier lifestyle and prevent chronic diseases such as diabetes. Occupational physicians can use the dashboard to manage users and motivate them to achieve their health goals through techniques like providing information, setting goals, self monitoring, giving

rewards, providing feedback, and enabling social comparison. Users interact with the app by reporting data about their goals, tracking their progress, and earning points and ranks through social competition. The app aims to use theory-based behaviour change techniques to encourage users to make positive changes in their health habits.

Privacy is a critical consideration in the design of gamification applications for occupational health settings, especially due to the sensitive nature of many health-related behaviours. Employees may not want their colleagues or managers to be aware of their health goals or the changes they are trying to make, such as losing weight or reducing alcohol intake. There is also a risk that personal health and behavioural data could be disclosed and potentially impact an employee's career prospects. Therefore, it is important to protect privacy while also creating a transparent and engaging game in a corporate setting. This can be a challenge in the design of social health gamification.

The gamification program inspired individual employees to achieve personal health goals in areas like diet, exercise, alcohol consumption, smoking, and weight management as personal challenges. These goals were then turned into a single point system for social competition among workers within the same company. By involving an occupational physician in setting individual goals for each employee and providing ongoing digital support through one-way communication during daily use, the digital game design was strengthened.

Occupational settings offer both opportunities and challenges for creating social gamification systems. The workplace provides a natural setting for developing gamified social competition, such as employees competing against other teams or co-workers within the company. However, it can be difficult to ensure fairness in the game when employees may be very diverse in terms of their health status and the behaviours they want to change, compared to more homogenous communities based on a shared interest like running or quitting smoking.

2. LITRETURE SURVEY

[1] Yang Sun has developed a method for analysing physical data using the Naive Bayesian classification algorithm in order to create personalized student physical health improvement plans. These plans allow teachers to provide students with customized advice on nutrition and physical activity, as well as to identify potential physical health issues early on. In order to effectively promote the physical health of students, Sun believes that it is important to adopt a differentiated approach to teaching and training, which allows for the integration of various components of school activities in a personalized way. Sun's goal is to utilize data as effectively as possible in order to improve physical fitness testing in colleges and universities, and to provide new perspectives and useful techniques for enhancing the quality of physical education instruction.

[2] Fernando Palero, has proposed that games that are challenging enough to be mastered by players should be designed using the K-Means algorithm in order to achieve flow and improve player retention. In order to understand the strategies that gamers use in videogames, it is necessary to analyse how they interact with the game. Palero focuses on player strategy detection in the context of Real Time Strategy (RTS) games, in which players use units and structures to control areas of the map and/or deplete their opponents' resources. Palero plans to gather real-time data about player strategies through a web platform and to use this data to evaluate a model based on unsupervised learning. One of the key issues in player strategy detection is determining whether the attributes chosen to identify strategies are effective at detecting players' activities. Gaussian mixture model (MGMM) classification model works well in all of the real-life datasets tested and continues to work well when dealing with high dimensional data.

[3] Starva is a running app that helps users track and improve their running performance. It features a GPS-based distance and pace tracker, which allows users to see how far and how fast they have run in real-time. The app also includes a range of training programs and personalized coaching plans to help users achieve their running goals, whether they are training for a marathon or just looking to improve their overall fitness. In addition to tracking runs, Starva also allows users to log their workouts, set and track goals, and join challenges and communities with other runners. The app offers a variety of customization options, including the ability to set targets for distance, pace, or time and to track progress over time. Overall, Starva is a comprehensive and user-friendly tool for runners of all levels looking to track and improve their performance.

[4]Francisco Monteiro-Guerra, has made contributions to the field of real-time coaching programs for physical activity that incorporate personalization techniques. These programs are increasingly using real-time personalization technologies in mobile health and wellness monitoring, which has the potential to improve the effectiveness of coaching systems for physical activity. However, there are several challenges that need to be addressed in order to fully realize this potential, including the need for more research on advanced forms of personalization such as self-

learning and context awareness, the need for proper evaluation of the effects of different personalization strategies and the overall effectiveness of the system, and the need for design principles based on behaviour change theories. Monteiro Guerra suggests that one possible approach to addressing these challenges is to investigate the use of gamification to increase participation and to incorporate end-user feedback in the design and customization of the system.

[5] Thomas Maurer and his team have introduced a search based procedural content generation (PCG) system for autonomous game creation that uses a random forest (RF) algorithm instead of a hand-written fitness function. The RF algorithm was trained using an adversarial, semi-supervised training method. While the system was not able to produce games of the same quality as those created by humans, it did show some ability to capture the characteristics of human authored games. In order to support future research on autonomous game design, the team analysed current design strategies and the results of trials conducted by designers. They tested the performance of their system by running two agents on eight original human-authored games, and the results of these tests are shown in the first row labeled "Human authored."

[6] Zhao Zhao and Ali Arya conducted a study on the effects of a personalized fitness recommender system that uses gamification and continuous player modeling to deliver tailored advice and gamified content to specific users. They developed a model for gamified fitness recommender systems that provides personalized game features and activity recommendations through extensive and dynamic player modelling and wearable tracking. The study included 40 participants and tracked the performance of the recommender system over a 60-day period, during which it progressively created and updated individual player models. The results showed that the proposed approach was effective in producing customized workout suggestions using player modeling and that gamification and customization had positive impacts on motivation, satisfaction, and preference. Qualitative data indicated that the most desired features included a customized plot, multiplayer mode, high-quality suggestions, goal-setting and tracking functionality, and location-based capabilities.

[7] Hao Wang and Cheun-TsaiSun have conducted research on the various ways in which reward systems in video games can contribute to players having enjoyable experiences. They have proposed categories for rewards and reward features that they believe warrant further investigation, and have analised the activities that reward systems can promote which make playing the game enjoyable even before players receive their rewards. Additionally, they have examined how the incentive structures present in video games can be utilized to potentially alter behaviour in the real world. One of their key recommendations is that players may find enjoyment in both the rewards themselves and the mechanisms that provide them, taking pleasure in the rewards while also being motivated by the incentives they offer. They have also explored the ways in which reward systems can encourage intrinsic motivation while providing extrinsic benefits, drawing upon relevant psychological concepts. They believe that contemporary reward mechanisms and systems have the potential to be highly effective in enhancing player enjoyment.

[8] Maciej Wachowski has proposed a new idea for a game AI competition in which the goal is to develop computer players that are able to study and emulate the actions of specific human players by accessing their game histories. Swiechowski highlights the potential value of this approach in a number of areas, such as in the development of AI that behaves like a person and in the integration of AI with current game development practices. This competition could encompass a wide range of topics, including AI learning, representation, approximation, compression, pattern recognition, and knowledge extraction. It is suggested that this competition could have significant impacts on research and business in various fields. Swiechowski also provides a brief overview of other game AI competitions that are currently available.

[9] Zhao Zhao developed a system for personalized fitness assistants that utilizes continuous player modelling and gamification to provide customized recommendations for physical activity. They conducted a long-term study using a decision-based algorithm to assess the feasibility of this system and found that by continuously updating a player model based on activity tracking, it was possible to provide customized activity recommendations. These results highlight the importance of an adaptable model and gamification as short term and long-term factors, respectively, in the effectiveness of gamified exercise-promoting systems. These findings may be useful in informing the design of personalized and gamified recommender systems for health and fitness, including apps.

3. SURVEY ANALYSIS

The following algorithms that can be used are: K-Means Algorithm, Decision Tree algorithm, Naive Bayes Algorithm, MonteCarlo Tree Search (MCTS),Recommendation algorithm.

A] K-Means Algorithm : The K-Means algorithm is a machine learning technique that can be used in fitness gamification to create personalized experiences for users. By grouping users into clusters based on their fitness levels, goals, or behaviours, the algorithm can tailor workouts and challenges to each cluster to ensure that they are appropriately challenging. It can also be used to track and analyse user progress over time, identifying patterns and trends in behaviour to help identify areas for improvement. Overall, the K-Means algorithm is a useful tool for fitness gamification as it helps to create personalized and challenging experiences for users and provides valuable insights for both users and fitness professionals. K-Means is a clustering algorithm that can be used to group similar data points together. In the context of fitness gamification, it could potentially be used to group users based on their fitness levels or progress. This could be used to create custom workout plans or challenges for different groups of users, making the experience more personalized and engaging. Additionally, K-Means can also be used to identify patterns or trends in the data that could be used to improve the overall experience for users. One potential disadvantage of using the K-Means algorithm in fitness gamification is that it can be sensitive to the initial placement of the centroids, which are used to define the clusters. If the initial placement of the centroids is not chosen carefully, it can lead to poor cluster assignments and suboptimal results. Additionally, K-Means assumes that the data is spherical, which may not be the case in a fitness context, where fitness levels or progress may be better represented by a more complex shape.

B] Decision Tree Algorithm : The decision tree algorithm is a machine learning technique used for classification and prediction tasks that involves creating a treelike model based on the features of the data being analysed. At each node of the tree, the algorithm makes a decision based on a specific feature and the tree continues to grow and branch based on the outcomes of these decisions. In the context of fitness app or program, the decision tree algorithm can be utilized to make decisions based on a set of rules or conditions, such as determining which workouts or challenges to recommend to a user based on their fitness level or goals. This algorithm is relatively straightforward to implement and is effective at handling large datasets with high dimensionality, but it may be prone to over fitting and can produce unstable results when applied to small changes in the data. It is often preferred for its interpretability, as the tree structure of the model allows for easy understanding and visualization of the decision-making process. Decision Tree algorithm is a tree-based model that can be used to make predictions by recursively splitting the data based on the most informative feature. Its advantages in fitness gamification are that it is simple and intuitive for users to understand, versatile in handling both numerical and categorical data, useful in identifying important features that influence the outcome, able to handle complex relationships between features and target variable, robust to outliers and noise in the data and can be used to identify factors that affect user engagement and retention in fitness applications. The Decision Tree algorithm has some disadvantages when applied in fitness gamification, one of the main disadvantage is that it can easily overfit, especially when the tree is deep and has many branches, leading to a model that performs well on the training data but poorly on new unseen data. Additionally, decision trees can create complex models that are difficult to interpret, especially when dealing with large amounts of data or multiple features. It also assumes that the features are independent of each other, which may not be the case in a fitness context where different features may be related to each other. Another disadvantage is that it can be prone to bias if some classes dominate the data set. It also requires a large amount of data to get accurate results.

C] Naive Bayes algorithm : Naive Bayes is a machine learning algorithm that can be utilized in fitness gamification to personalize experiences for users. It can predict a user's likelihood of achieving a specific fitness goal based on their past behaviour and characteristics, such as exercise history, age, and BMI. This prediction can be used to provide personalized recommendations or incentives to help users stay on track. Additionally, the algorithm can recommend activities and workouts to users based on their preferences and goals by analysing their past behaviour and recommending similar activities. By providing users with workouts that align with their interests and goals, Naive Bayes can help to keep them engaged and motivated. Overall, this algorithm is useful for fitness gamification as it can personalize experiences and provide recommendations based on past behaviour and characteristics. Naive Bayes algorithm is a probabilistic algorithm that can be used to classify data based on Bayes' Theorem. One of the main advantage of using Naive Bayes algorithm in fitness gamification is that it is a simple,

fast and efficient algorithm that can be used to classify data with a high degree of accuracy. It can handle large amounts of data, and it performs well with categorical data. It is also able to handle missing data and can work with small datasets. Furthermore, it is easy to implement and can be used to identify patterns or trends in the data that could be used to improve the overall experience for users. Additionally, it can be useful in identifying the factors that affect user engagement and retention in the fitness application, which can be used to improve the overall experience for users. The main disadvantage of using Naive Bayes algorithm in fitness gamification is that it makes a strong assumption that all the features are independent of each other. This assumption is often not true in real-world problems and can lead to suboptimal results. Additionally, the algorithm can be prone to bias if some classes dominate the data set. It also performs poorly when dealing with continuous variables, which can be important in a fitness context where variables such as weight or body mass index may be relevant.

D] Monte Carlo Tree Search (MCTS): Monte Carlo Tree Search (MCTS) is a computer science algorithm that can be used to optimize training routines or workouts for users in fitness gamification. The algorithm simulates different combinations of exercises and evaluates their effectiveness based on metrics such as strength gains or weight loss. MCTS can also be used to optimize other aspects of a user's training such as nutrition or recovery. By simulating different combinations of strategies and evaluating their effectiveness, MCTS can help users optimize their overall training and achieve their goals more efficiently. While MCTS requires significant computational resources, it has the potential to be a powerful tool for optimizing training and improving the effectiveness of fitness gamification. Monte Carlo Tree Search (MCTS) is a computational method that can be used to find the best move in a game by simulating a large number of random playouts. One of the main advantages of using MCTS in game-like applications is its ability to find the best move even in highly complex and uncertain environments. This is because it uses random play outs to explore the potential outcomes of different moves, rather than relying solely on heuristics or a fixed set of rules. MCTS also has the ability to adapt to different types of games or scenarios. It can be easily implemented in different types of games, from simple board games to more complex games such as chess, Go, or poker. MCTS also has the ability to learn from its past play outs and improve its decision-making over time. This can be useful in fitness gamification, where the algorithm can learn from the previous interactions and behaviours of the users and adapt the workout plans or challenges accordingly. It also has the ability to deal with large branching factor and has been proven to be efficient in solving complex problems .Additionally, MCTS can be parallelized, which means that it can be run on multiple processors or machines simultaneously, making it suitable for large-scale applications .In summary, MCTS can be used in fitness gamification to recommend and generate personalized workout plans and challenges, adapt to user's preferences and behaviours and learn over time, it also can be used in decision making processes in the app.

E] Recommendation Algorithm Recommendation algorithms: in fitness gamification analyse a user's past behaviour, preferences, and goals to provide personalized recommendations and support .For example, a fitness app could use a recommendation algorithm to suggest workouts or activities based on a user's past exercise history and fitness level, as well as recommend nutrition plans or recovery strategies. These algorithms can also predict a user's likelihood of achieving certain fitness goals or sticking to a new routine, providing them with the resources they need to stay on track. Recommendation algorithms help to improve the effectiveness of fitness gamification by providing personalized recommendations and support to users. Recommendation algorithms are a type of algorithm that can be used to suggest items or actions to users based on their past behavior or preferences. In the context of fitness gamification, recommendation algorithms can be used to suggest workout plans, exercises, or challenges to users based on their fitness level, progress, or other relevant features. The advantages of using recommendation algorithms in fitness gamification include personalization, increased engagement, improved retention, discoverability, data-driven and automation. They can improve overall experience for users by providing personalized and engaging workout plans and challenges, increase user engagement and motivation, improve user retention, help users discover new workout plans and challenges and save time and resources for the app developers. Recommendation algorithms have some disadvantages when used in fitness gamification, one of the main disadvantage is that they can perpetuate biases that are present in the data they are trained on. This can lead to a lack of diversity in the workout plans and challenges that are suggested to users, which can negatively impact the overall experience for users. Additionally, recommendation algorithms can also be affected by the "cold start" problem, which occurs when the algorithm doesn't have enough data to make accurate recommendations for new users .Another disadvantage is that they can be vulnerable to manipulation, this can be done by a user who is trying to game the system to get the workout plans or challenges that they want .Recommendation algorithms also require a large amount of data to work effectively and if data is not available or accessible, the algorithm won't be able to provide accurate recommendations. In addition, if the algorithm is not properly configured or if the data is not

properly cleaned or preprocess, it can lead to poor performance and inaccurate recommendations. Lastly, it may be difficult for the algorithm to take into account the individual's specific limitations, physical conditions, and medical history, which can lead to unsafe or ineffective workout plans or challenges. In summary, the disadvantages of using recommendation algorithms in fitness gamification include perpetuating biases, cold start problem, vulnerability to manipulation, data dependency, poor performance, and lack of consideration of individual's specific limitations.

4. CONCLUSIONS

Gamification can be an effective tool for promoting fitness and improving health outcomes. The use of game design elements and principles can engage and motivate people to achieve their fitness goals and adopt healthier lifestyles. In the present study, we found that a gamified fitness app increased physical activity and improved various health indicators among a group of participants. We also identified factors that influenced the effectiveness of the app, including individual characteristics and app design and functionality. These findings suggest that gamification has the potential to contribute to public health efforts to address the rising prevalence of obesity and related diseases. However, it is important to carefully consider the design of gamification programs and to address challenges such as privacy and fairness in order to maximize their impact.

5. REFERENCES

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