Gamified Point System Based On Mobile Devices

Boyang Liu

Graduate School of Information,
Production and Systems
Waseda University
Fukuoka, Japan 808–0135
Email: waseda-liuboyang@moegi.waseda.jp

Jiro Tanaka

Graduate School of Information,
Production and Systems
Waseda University
Fukuoka, Japan 808–0135
Email: jiro@aoni.waseda.jp

Abstract—Point system is a system providing points to customers according to the consumption. People can accumulate points and these points can be used to redeem for money off in the next purchase. The purpose of point system is to encourage consumption and maintain the current customers by allowing them to get a sense of satisfaction from accumulating points. However, the reduction in redemption rate increases the difficulty of accumulating points, which leads to a decrease in user interest. The goal of our research is to build a new point system framework to increase user engagement. This paper calls for a multi-player approach based on augmented reality game design to engage users. Compared with existing methods, our system generates engaging gaming experience through multi-player game design.

Keywords–Gamification; User Interactions; Interface Design; Augmented Reality.

I. INTRODUCTION

User engagement is an important research topic in many fields. Loyalty programs are structured marketing strategies designed by merchants to encourage customers to continue to shop at or use the services of businesses associated with each program [1]. Therefore, a lot of research has been conducted to improve customer retention from different perspectives [2]-[3].

Point system is the most common loyalty program methodology [4]. It provides an interesting possibility for retailers in customer relationship management [5]. Customer purchases toward a certain amount of points to redeem their reward. This framework was proved to be revolutionary. For customers, point system can help them reduce the cost of buying. For retailers, they can collect personal data, including demographic data (name, age, gender, postcode, etc.) and individual level purchase data (who bought what, where, when, and at what price) [4]. This data enables retailers to build a customer database, to profile their customers, to target them with tailored incentives, and thus to maximize the profitability of their promotional and pricing strategies. Specifically, a card is used to identify the card holder as a participant in the point system [6]. Typically, it has a barcode or magstripe that can be easily scanned. By giving such a card, purchasers can receive either a discount on the current purchase, or points that they can use for future purchases. With the development of mobile devices, digital point cards are also being used.

In the current system, point is the only feature to engage users and it is no longer as attractive as it used to be. One reason is that the customers perceive the rewards as too difficult to earn. Another reason is that current point systems focus on economic value but ignore other perceived value designs. Kreis et al. [7] divided the perceived value into three dimensions including economic value, interaction value and psychological value. Economic value relates primarily to utilitarian, instrumental benefits. Interaction value is derived from interaction with others and psychological value is derived from recognition.

There are two challenges we need to solve. One challenge is that we need to find a way to increase user engagement without changing the redemption rate. The other is that we need to consider interaction and psychological value to improve user's perceived value.

To address these limitation, we design a new multiplayer gamified point system to engage users. Since current point system is designed for single user, it is difficult to take advantage of user interactions. Our goal is to build a framework for the next generation point system. Important value including interaction value and psychological value should also be considered in the design of new point system. Besides, users desire for user interactions could be combined to increase user engagement. In this system, all users can join the game voluntarily. Users can get mission from our system in mission interface and get value points and experience value as reward in value point & pet interface after completing mission. We explore two variations of user interactions - one is the competition where the users can compete face-to-face with other users and try to win the competition to gain a sense of accomplishment, and one in which users can do non-competitive interaction with their partners to gain happiness. By adding a multiplayer element, users have the opportunity to not only accumulate rewards in the system, but also have the opportunity of compete with opponents or sharing their rewards with friends. It is considered to potentially increase a users motivation to use the system and improve the interaction between users.

The remainder of this paper is organized as follows. Second 2 describes related work. Section 3 and Section 4 describe the design and implementation of our system. Section 5 describes some discussion on our system and current point system. In Section 6, we make a conclusion about our system and come up with some ideas about our future work.

II. RELATED WORK

In this section, we discuss previous research in the areas of point system, social influence, gamification, and augmented

reality game.

A. Point System

Enzmann et al. [3] think that users refuse to use point system because they may fear an invasion of privacy. Therefore, they present two variants of a privacy-friendly loyalty system to be used by online vendors for issuing points.

In the study of Coskun et al. [8], the design of Near Field Communication (NFC) enabled loyalty system on smart cards of NFC mobiles and development details are presented. NFC technology is a short-range, high frequency, and low bandwidth wireless technology which occurs between two devices within few centimetres. With this model, loyalty and payment applications share and exchange valuable information through NFC Loyal Database system on smart card.

Lim et al. [9] study online loyalty programs from a searchability perspective. The goal of their research is to explain how searchability can influence participation in loyalty programs.

All above research aims at increasing user engagement through utilitarian motives such as improving the security, convenience and functionality of current point system. Our research focus on enhancing symbolic motives, which are related to needs for self-esteem and social approval.

B. Social Influence

The social impact is particularly significant in commerce. For example, many people read what other people think about products by logging on to social media sites before making a purchase. Social media users trust what their friends, family, and even strangers say online about a brand or product. In-store shopping decisions are also affected, as customers use their mobile devices to look at reviews and ratings to reinforce their purchasing decisions [10].

Lee et al. [11] proposed a multi-phased model for internet shopping, which fully takes the characteristics of the internet and cyber shopping into consideration in their paper. Their results indicate that diverse communication affects the level of trust. If customers share more values with other customers and if they have more diverse means of communication, they would intend to revisit the site more repeatedly.

In the study of Zhu et al. [12], they designed and ran an experiment to measure social influence in online recommender systems. Their results show that social influence could sway peoples own choices significantly.

Li et al. [13] found that emotion played a significant role in the mobile consumption experience in their research. They suggest that attention should be paid on the social communication process between humans to improve consumption experience.

The above research shows that social influence has a positive effect in commerce. Our research is based on the combination of social influences and commerce. Specifically, we have designed two kinds of user interactions in our system to study how different social types affect user engagement.

C. Gamification

Gamification refers to the application of using game design elements and game mechanisms in a non-game contexts to enable users to solve problems and improve the contribution of users [14]. Commonly, gamification employs game design elements to improve organizational productivity, user engagement and more. Lots of research about gamification indicates that a majority of studies on gamification reveal that it exerts good effect on individuals. The gamification techniques are aiming at leveraging peoples natural desires for achievement, competition, socializing or simply their response to the framing of a situation as game or play.

Li et al. [15] design a gamified multiplayer software tutorial system called CADament. Compared with existing gamified software tutorial systems, their system generates engaging learning experience through competitions. Their study shows that their system has an advantage over pre-authored tutorials for improving learners performance, increasing motivation, and stimulating knowledge transfer.

In the paper of Dergousoff et al. [16], they think classic ways of gathering data on human behavior are time-consuming, costly and are subject to limited participant pools. Therefore, they combine both gamification and crowdsourcing techniques into a smartphone-based platform to motivate voluntary participation and provide researchers with a framework that can be used to investigate multiple research questions without the need to develop costly specialized games.

For the purpose of inspiring customers, some ideas of combining game and marketing are proposed to engage customers. Zichermann et al. [17] thought that traditional advertising is losing effectiveness as competition for consumer attention and game playing is on the rise and vying for customers attention.

Gamification is also used in education and health. Arawjo et al. [18] present a puzzle game that builds student understanding of programming concepts. Their results from a lab study demonstrate that novices can learn programming concepts by playing the game and the game was well received. In the paper of Zhao et al. [19], they present the design and findings of a study on the motivational effects of using activity tracker-based games to promote daily exercise. The results of their study show that participants preferred the gamified exercise experience over regular exercises and features related to social factors played a relatively more important role in this game experience.

The above research shows that gamification is a universal and effective means to increase user engagement. Our system incorporates gamification elements to enhance user experience.

D. Augmented Reality Game

In the research of Bai et al. [20], they present an augmented reality system enhancing social pretend play by young children. Observations showed that children are highly engaged with the augmented reality system.

Mulloni et al. [21] present an augmented reality game that strongly exploits mobility and social interaction between players as core gameplay elements. The user study showed a general enthusiasm for their game by young adults with varying interest in gaming. Simple user interface resulted in an enjoyable player experience and users asked for multisensorial feedback and 3D animations.

Baudisch et al. [22] present imaginary reality games that mimic the respective real world sport, such as basketball or soccer. Their game maintained many of the properties of physical sports, such as unencumbered play, physical exertion, and immediate social interaction between players.

III. SYSTEM DESCRIPTION

To realize the purpose of leveraging user to engage users, we designed and implemented an augmented reality based gamified point system deployed on mobile devices. Our system should be designed based on current system: 1) points will be rewarded if users complete shopping; 2) redemption rate should be consistent with current system.

We present a multi-player approach based on game design in our system to improve user engagement. A theme of raising a pet is chosen in the proposed system because 1) pet reflects user's status; 2) user can get the satisfaction of accumulating value points because redeeming gifts can be much easier in the game; 3) the theme of pet raising can create a relaxing and enjoyable game environment for user interaction.

A. System Structure

In the current point system, shopping is the input and the point is the output. However, points can compensate users for their spending but cannot support value creation in the purchase. For example, an environmental protection enthusiast may be more likely to buy energy-saving lamps because it is for the purpose of protecting the environment rather than accumulating points. Therefore, we designed a new point system on the current point system framework. As shown in Figure 1, the blue line part indicates the current system framework while the red line part is our new design.

Our system can be divided into two modules. One module is the individual module (see Figure 1). In the individual module, new input (mission) is designed. To motivate users to create value from shopping activities, we designed new feedback including value points, pet and food as new output.
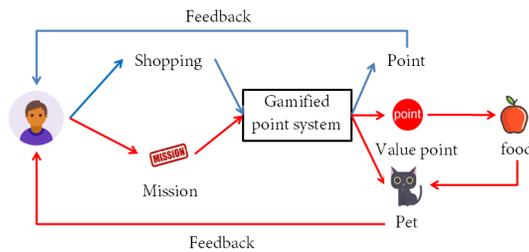

Figure 1. Individual module.

The other module is the user interaction module (see Figure 2). The design of these new feedback increases user engagement by leveraging user interactions including competition and non-competitive interaction. Value point and food are designed to motivate the non-competitive interaction between users. Pet is designed for user competition.
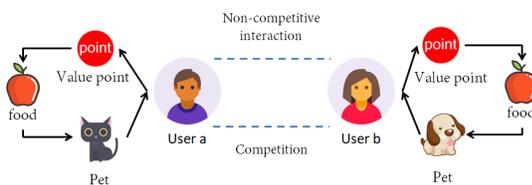

Figure 2. User interaction module.

B. Mission

The mission is designed to remind users of multi-value creation. We developed a set of mission for shopping for our prototype. In an actual deployment, we can create various mission with different value guidance or mission that includes multiple value guidance. Personalized mission could be created based on the purchase information and user information recorded in the point system to provide personalized experience. Previous mission can be easily replaced by new mission and displayed in this interface. The mission could be completed in the purchase. At checkout, mission will be automatically confirmed. For example, a user selects the mission that requires the user to buy low calorie food. The product information will be read automatically by scanning the barcode of the product to confirm whether the mission is completed at checkout. The difficulty of mission could increase gradually and eventually reach a reasonable level. Users can select the mission they want to accomplish in a set of mission.

C. New Feedback

Our gamified points system does not force users to participate. After the users complete the shopping and mission, our system will give feedback to participants to promote their intentions. In our system, users can still earn points from shopping as current system. At the same time, we design some new feedback.

More precisely, there are three new elements:

1) Value Point: We propose a design named value points inspired by the design that users can get points from shopping. Users can get the value points if they complete mission. Value points can be used to buy virtual food to feed pet. Value point is the feedback for mission.

2) Pet: In our system, user can feed a virtual pet. Pet will gain EXP if user completes the mission. If the EXP of pet reaches threshold, the pet will level up. The energy of pet will gradually lose and it will influence the upgrades of pet (if the pet is more energetic, it can get more experience points for the completion of mission). It is designed to motivate users to complete mission continuously. Pet reflects the status of the user.

3) Virtual Food: In this system, user can use value points to buy virtual food. The food can be used to help pet get energy. Users need to get value points continuously to keep their pets in good condition. Food can also be given to other players as gift. The food given to other players can also help the pet get energy. The design of food not only motivates users to accumulate value points, but also encourages them to interact with others.

D. Usage

During shopping, users can start the system deployed on the mobile devices. In the mission interface, users can view the content of mission and select mission. Users can select goods according to the selected mission. At the time of checkout, goods information such will be read and the data will be used to confirm whether the mission selected by the user is completed or not. If purchased is confirmed, user can get points as current system. If mission is confirmed, user can get value points and users pet will get EXP.

E. Game Types

In our design, we leverage user interactions to engage users and help them to create value from purchase. By designing user interfaces, we want to build interactions between users. We explored two different game modes to motivate users, competition and non-competitive interaction.

In competition mode, users can use the point card as an identification of personal status to compete with other users. It will motivate users to continuously improve their personal status to win the competition. Figure 3 shows the assumption scenario where three users participate in the competition. Each of the three users has a mobile phone with a gamified point system installed. Each of them has a digital point card in their client. When three users participate in competition, they put their digital point cards together on the table. The gamified point system on the laptop is running and captures the video stream through the web camera. Based on the level information obtained from the database, the result of competition will be displayed in competition interface.
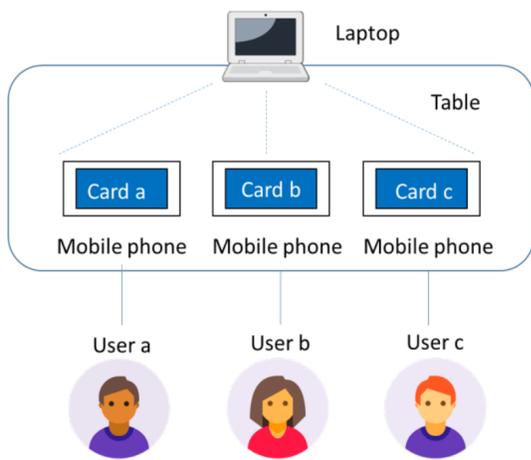

Figure 3. Assumption scenario for competition.

In non-competitive interaction mode, users can interact with other users. Figure 4 shows the non-competitive interaction between two users. Users can get the joy of sharing from giving virtual food to their friends via mobile devices.
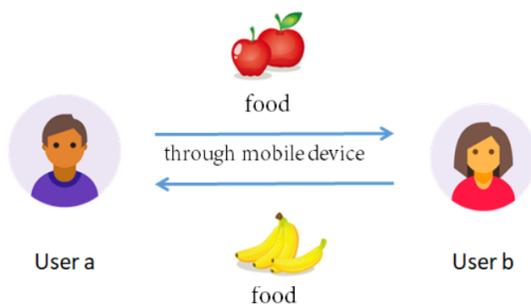

Figure 4. Non-competitive interaction.

Both designs attempt to engage users through interactions between users. In competition mode, users can gain a sense of accomplishment from defeating other users. In non-competitive interaction mode, users can gain the joy of accumulating value points by sharing virtual food with friends.

F. User Interface

In the gamified system, we mainly designed four different user interfaces based on augmented reality visualization.

1) Mission Interface: In the mission interface, user can browse different mission by swiping the screens. The content will be displayed to the user in text form (see Figure 5). Users can click the left arrow and right arrow to view the content of different mission. When users decide to select mission as a shopping target, they can click the choose button. Then, mission information will be stored in the database. It will be confirmed at checkout. If it is confirmed, user can get reward. If it is not finished, it will be deleted from database after checkout.
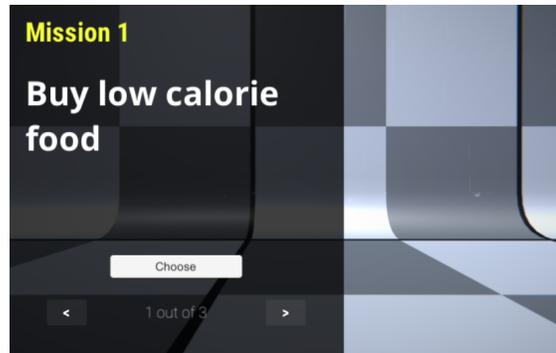

Figure 5. Mission interface.

2) Value Point & Pet Interface: In this interface, we can view the visualization of value points and pet which is superimposed on a digital point card (see Figure 6). If user gets new value points, the volume of value points will increase. This design allows users to get intuitive visual feedback from accumulating value points. The pet will gradually lose energy and the movement of pet will change according to its energy. Therefore, user needs to buy virtual food to help pet recover energy. This design motivates users to complete mission or get food from friends to feed pet. When the user completes a certain amount of mission, users level will increase. This change will be reflected in the size of pet and the level of pet. The level of pet is shown near the pet. Pet needs to research specific level to unlock a new shape.
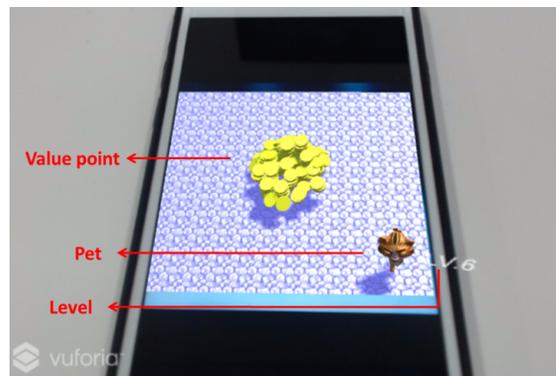

Figure 6. Value point & pet interface.

3) Competition Interface: We designed a face-to-face competition interface for multiple users. In this interface, users can see their pets. When multiple users put their point cards together, the gamified system deployed on the mobile device will identify their cards and get their level information from

the database. Users level information will be reflected in their pets level. In this interface, our system will give ranking results according to the level. For example, the pet with the highest level will stand on the highest podium with a golden crown over its head while the pet with the second highest level will stand on the second highest podium with a magenta crown over its head (see Figure 7).

Figure 7. Competition interface.

4) Non-competitive Interaction Interface: Users can purchase virtual foods with value points in the non-competitive interaction interface. When the value point is spent, the volume of the value point will decrease. The virtual food bought will be displayed in the interface. Users can use virtual food to feed their pets or give food to their friends. If the pet is fed, it will get a certain amount of energy and give motion feedback to the user. If a user receives food from his or her friend, the food will be displayed in the user's interface with a label indicating the sender. This design allows users to socialize with other users by sharing their reward (see Figure 8).

IV. SYSTEM IMPLEMENTATION

The main hardware devices used for the development of our prototype system include a tablet PC, a webcam and a smartphone. Windows 10 Home Edition is installed in the tablet PC. The processor is Intel(R) Core(TM) i7-6500U CPU @2.50GHz 2.59GHz. The RAM is 8.00 GB. Webcam is connected to the tablet PC to capture real-time video and send video stream to the tablet PC for processing. The development software is Unity 2017.2.0f3 (64-bit), a cross-platform game engine. Unity 3D is used to build and render our three-dimensional system. Vuforia SDK is used for augmented reality implementation, which uses computer vision technology to recognize and track images. After recognizing the image of point card on the smartphone, virtual objects created in Unity 3D will be superimposed on the smartphone. After that, users can see the 3D objects and interact with them. As for the database, we used WampServer Version 3.0.6 32bit consisting of the Apache web server, OpenSSL for SSL support, MySQL database and PHP programming language. Apach and MySQL
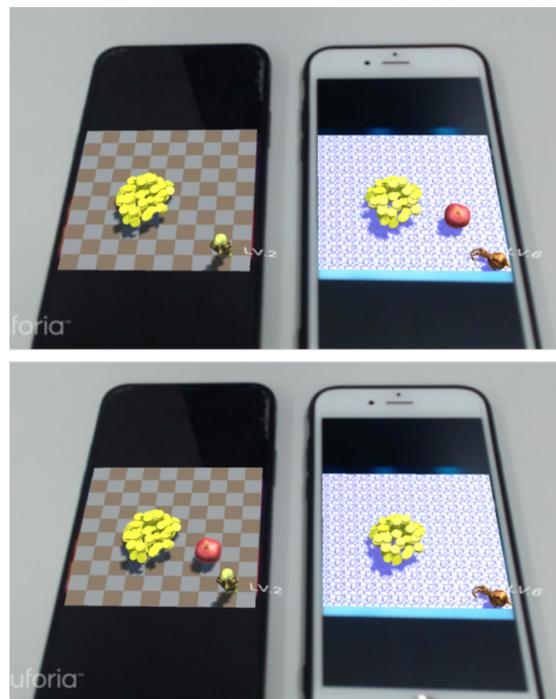

Figure 8. Non-competitive interaction interface.

are always running on the server. Communication between the mobile devices and the server is implemented in PHP.

Our system is implemented based on client-server network structure (see Figure 9). Gamified point system will be deployed on mobile device as a client. The retailers can manage and update user information. Users access data when registering their own information and obtaining their information from database. We use the WWW class and the WWWForm class to send and receive data from Unity. When receiving from the database, the information is converted to JSON format and received. After receiving it on the Unity side, it is decoded into a string format.
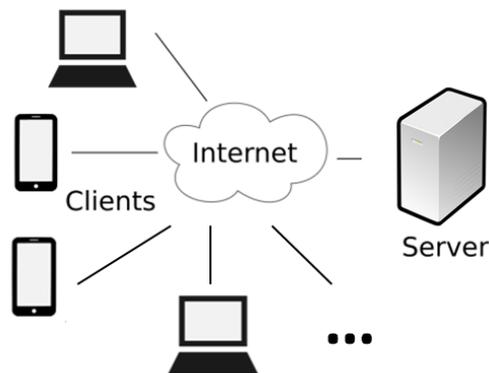

Figure 9. System network structure overview.

V. CONCLUSION AND FUTURE WORK

Point system is a system designed to attract consumers. However, due to some problems like the decrease of redemption rate and changes in consumption choice, the attractiveness of system goes down. In this paper, a gamified point system on mobile devices is introduced. Gamified point system presents a

method for engaging users using multiplayer game design. As an important advantage over current point system, each user can participate in a game experience to interact with others.

Compared to the current point system, our system has the following advantages:

1) Multi-value shopping guidance by mission.
2) Engaging game experience by four game elements design.
3) User interaction by
   a) Competition.
   b) Non-competitive interaction.

Current point systems only focus on the economic feedback. If users complete the shopping, they can get points as rewards. However, many other value factors should also be considered in consumption such as health and environmental factors. Our system is designed based on current system structure. By adding mission into our system, we remind users of multi-value factors. To motivate users to pay attention to value creation, we design new feedback to improve the system. By adding these game elements, we create a game-like environment for users. Users can get more enjoyable game experience by participating in our system than current system. In order to improve user engagement, two kinds of user interactions are designed with the four game elements. Users cannot only conduct individual mission to get rewards but also can get satisfaction from competition and non-competitive interaction with other users.

Users can choose to participate in the game or not. In the game, there are four game elements. The mission is the task that users need to accomplish. The content of mission combines multiple values. For users that go shopping with the goal to get a particular object and leave the store, we can add some mission related to consumption so that they can also participate in the game. For example, when they spend a certain amount of money, they will also get value points. If users complete the mission during shopping, they can get value points and their pets can get EXP. Users can use value point to buy virtual food which can be used to feed their pets. When the EXP reaches a certain amount, the pet will upgrade. If the pet is not fed for a long time, the pet will become inactive. Therefore, users need to constantly earn value points in exchange for virtual food to keep pets active.

Pet and virtual food are designed for user interaction. In competition interface, users can compete with others with pet. The ranking result will be displayed in the interface according to level of pet. In non-competitive interaction interface, users can buy virtual food and share the food with others. Both of two designs take advantage of users' desire for socializing.

In the future, we would like to investigate other important elements in multiplayer games, such as collaboration and social communities. It would be interesting to further investigate the effect of each game elements. In the future, we would like to further evaluate the effect of our gamified point system by carrying out some experiments. First of all, we will compare gamified point system with the baseline condition to verify that if our system increases engagement by evaluating usage frequency and duration. Then, we will evaluate game elements in our system. We will evaluate three kinds of mission (buy local goods, buy low calories foods and buy recyclable goods) by evaluating mission completion rate. Three kinds of pet (cat,

dog, turtle) will be evaluated to understand the impact of pet. Two kinds of user interaction will be evaluated to study the impact of different interaction.

REFERENCES

[1] B. Sharp and A. Sharp, "Loyalty programs and their impact on repeat-purchase loyalty patterns," International journal of Research in Marketing, vol. 14, no. 5, 1997, pp. 473–486.

[2] A. Hupfeld and C. Speed, "Getting something for nothing?: A user-centric perspective on loyalty card schemes," in Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. ACM, 2017, pp. 4443–4453.

[3] M. Enzmann and M. Schneider, "Improving customer retention in e-commerce through a secure and privacy-enhanced loyalty system," Information Systems Frontiers, vol. 7, no. 4-5, 2005, pp. 359–370.

[4] S. G. Magatef and E. F. Tomalieh, "The impact of customer loyalty programs on customer retention," International Journal of Business and Social Science, vol. 6, no. 8, 2015, pp. 78–93.

[5] A. D. Smith and J. A. Potter, "Loyalty card programs, customer relationship and information technology: an exploratory approach," International Journal of Business Innovation and Research, vol. 4, no. 1-2, 2009, pp. 65–92.

[6] C. Mauri, "Card loyalty. a new emerging issue in grocery retailing," Journal of Retailing and Consumer Services, vol. 10, no. 1, 2003, pp. 13–25.

[7] H. Kreis and A. Mafael, "The influence of customer loyalty program design on the relationship between customer motives and value perception," Journal of Retailing and Consumer Services, vol. 21, no. 4, 2014, pp. 590–600.

[8] V. Coskun, B. Ozdenizci, K. Ok, M. Alsadi, and F. Soylemezgiller, "Design and development of nfc enabled loyalty system," in Proceedings of the 6th international conference of advanced computer systems and networks: Design and application, Lviv, Ukraine, 2013, pp. 16–18.

[9] S. Lim and B. Lee, "Online loyalty programs viewed from a search-ability perspective," in Proceedings of the 14th Annual International Conference on Electronic Commerce. ACM, 2012, pp. 255–262.

[10] Y. Kim and J. Srivastava, "Impact of social influence in e-commerce decision making," in Proceedings of the ninth international conference on Electronic commerce. ACM, 2007, pp. 293–302.

[11] J. Lee, J. Kim, and J. Y. Moon, "What makes internet users visit cyber stores again? key design factors for customer loyalty," in Proceedings of the SIGCHI conference on Human Factors in Computing Systems. ACM, 2000, pp. 305–312.

[12] H. Zhu, B. Huberman, and Y. Luon, "To switch or not to switch: understanding social influence in online choices," in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM, 2012, pp. 2257–2266.

[13] M. Li, Z. Dong, and X. Chen, "Factors influencing consumption experience of mobile commerce: a study from experiential view," Internet Research, vol. 22, no. 2, 2012, pp. 120–141.

[14] K. Huotari and J. Hamari, "Defining gamification: a service marketing perspective," in Proceeding of the 16th international academic MindTrek conference. ACM, 2012, pp. 17–22.

[15] W. Li, T. Grossman, and G. Fitzmaurice, "Cadament: a gamified multiplayer software tutorial system," in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM, 2014, pp. 3369–3378.

[16] K. Dergousoff and R. L. Mandryk, "Mobile gamification for crowdsourcing data collection: Leveraging the freemium model," in Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems. ACM, 2015, pp. 1065–1074.

[17] G. Zichermann and J. Linder, Game-based marketing: inspire customer loyalty through rewards, challenges, and contests. John Wiley & Sons, 2010.

[18] I. Arawjo, C.-Y. Wang, A. C. Myers, E. Andersen, and F. Guimbretière, "Teaching programming with gamified semantics," in Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. ACM, 2017, pp. 4911–4923.

[19] Z. Zhao, A. Arya, A. Whitehead, G. Chan, and S. A. Etemad, "Keeping users engaged through feature updates: A long-term study of using wearable-based exergames." in CHI, 2017, pp. 1053–1064.

[20] Z. Bai, A. F. Blackwell, and G. Coulouris, "Exploring expressive augmented reality: The fingar puppet system for social pretend play," in Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems. ACM, 2015, pp. 1035–1044.

[21] A. Mulloni, D. Wagner, and D. Schmalstieg, "Mobility and social interaction as core gameplay elements in multi-player augmented reality," in Proceedings of the 3rd international conference on Digital Interactive Media in Entertainment and Arts. ACM, 2008, pp. 472–478.

[22] P. Baudisch, H. Pohl, S. Reinicke, E. Wittmers, P. Lühne, M. Knaust, S. Köhler, P. Schmidt, and C. Holz, "Imaginary reality gaming: ball games without a ball," in Proceedings of the 26th annual ACM symposium on User interface software and technology. ACM, 2013, pp. 405–410.