Interactive Point System Supporting Point Classification and Spatial Visualization

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Abstract. Point system is structured marketing strategy offered by retailers to motivate customers to keep buying goods or paying for the services. However, current point system is not enough for reflecting where points come from. In this paper, concept of point classification is put forward. Points are divided into different categories based on source. We introduce mission into point system. Mission content is designed to guide consumption. In our system, point, mission and virtual pet will be spatially visualized using AR technique. The state of virtual pet depends on the evaluation for users. Users need to adjust themselves to keep their pets in a good state. Users can manipulate on the GUI or use gestures to interact with system.

Keywords: Interactive system · Spatial visualization
Gesture interaction · Value creation · Gamification

1 Introduction

Point system is structured marketing strategy offered by retailers to encourage consumers to keep buying goods or paying for the services. According to the spending in consumption, retailers give consumers a certain amount of points as reward. These points can be exchanged into goods or service [1].

On May 1, 1981 American Airlines launched the first loyalty marketing program of the modern era which was called a Advantage frequent flyer program [2]. This revolutionary program is thought to be the first one to reward frequent fliers with miles that can be accumulated and redeemed for free travel. Many travel providers and airlines saw the incredible value in offering customers an incentive to use a company exclusively and be rewarded for their loyalty. After the success of this program, dozens of travel industry companies launched similar programs within a few years. This program is also considered as the initial modern consumer reward program.

In early part of 2010, Card Linked Offers appears as a new loyalty marketing technique for retailers, brands, and financial institutions, stemming from a rise

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in popularity of both coupons and mobile payment [7]. Loyalty cards are a form of tracking and recording technology that enables retailers to collect data about their customers' demographic and purchase behaviors [3,8]. As recompense for recording data from consumers, customers can receive loyalty points which can be redeemed for exclusive discounts and rewards [9]. Many vendors apply loyalty systems to collect customer-specific data that may be exploited for many reasons, e.g., price discrimination and direct marketing [4,10]. There are some findings clearly show that there is significant evidence of the effect of all loyalty programs on building and maintaining customer retention [5].

For the purpose of inspiring customer loyalty, some ideas of game-based marketing are proposed to engage customers [6,12]. People play games everywhere. Frequent Flyer Programs (FFPs) and other loyalty systems prove that gaming and marketing can fuse together perfectly. Modern FFPs use a number of gaming elements to engender loyalty, including point accumulation, level climbing, rewards and challenges [6].

2 Problem

The first noticeable problem is that all the points are treated the same way in current systems. In spite that points come from a certain amount of consumption and can be used as electronic money in payment, it is not appropriate to focus only on the number of points and ignore the difference of their source.

Point system is a model of transaction. After purchase, customers can get point as reward. However, it is not advisable to get points from spending without considering the value created in consumption. Current systems with single criteria need to be improved to make consumption comprehensive.

Users usually get point information from textual description and cannot keep the impression or even ignore these textual description. Point is one type of immediate feedback mechanism to reward users who meet requirements. However, the limitation of static display makes it not appealing.

3 Goal and Approach

The goal of research is to create an interactive point system with multi-value criteria that supports point classification and spatial visualization.

The source of points is used to classify points. Points obtained from different kinds of goods are considered different. Mission is put forward in the system to introduce multi-value criteria into consumption. We will combine the theme such as healthy diet, environmental protection into content design. If users succeed in completing these valuable tasks, level will be upgraded to reward their efforts. Compared to the current systems that only reward consumption, mission is a complete change in shopping. By doing that, we aim to arouse public attention on the value creation in consumption.

For the limitation of displaying the information in textual form, we propose a new approach – spatial visualization [13]. Spatial visualization can display the

traditional textual information in the form of spatial model. In spatial visualization, points are represented as visualized objects. They are visualized as different objects according to the source. The number of points will also be emphasized through the visual feedback mechanism. Mission is visualized as the star in game scene. The content of mission will be given in textual form on the screen after users click the star. Inspired by tamagotchi [11] and game-based design [6], a virtual pet is visualized in our system. Our system measures users' state from two aspects – point and pet. Based on spatial visualization, we provide graphical user interfaces (GUI) for users. In our system, users can not only see the visualization, but also interact with the system by clicking on screen or using gesture as input. In the system, users can get mission instruction and complete it. If mission is done, dynamic animation will be displayed to give visual feedback to users and level of pet will be upgraded. Our system will measure result of points and pet's health state and show the information to the user through the GUI. The state of pet includes level and two indicators. The number of completed mission is reflected by the level of pet. Different level corresponds to different stage of pet. Pet evolves if the level goes up. Two indicators reflect the number of points and variety of points. The two indicators will be combined to measure the health state of pet. If the pet is not in good state, users need to adjust themselves to help the pet recovers. If the pet is healthy, users are expected to continue their efforts.

4 Our System

Our system classifies points by the source and visualizes them as virtual objects. It is different from current point systems which accept a single input (money) to generate a single output (point). Mission is designed as input of our system to remind users of multi-value in consumption instead of only money. We expand the feedback mechanism from single output to two kinds of output – point and virtual pet. Our system presents feedback by spatial visualization instead of the traditional two-dimensional textual information. The way of interaction is expanded from only operation on two-dimensional screen to the spatial gesture interaction.

4.1 Point Classification

Quantity, time limitation and use range of points are taken into consideration in current point system. However, the source of point is an important feature indicating the difference between points. In this paper, we propose the idea of point classification. We classify points based on where they are collected from. Points are from various source such as food, book or flight. In our system, there several types of points indicating the source of points. Points from same source are classified into the same category. By using AR, users are reminded of the source of points and can know the number of each category in a more intuitive way.

4.2 Multi-value Creation

Point system is a system rewarding points to encourage spending. Rewarding points for spending is a way to promote consumption and retain customers. It is economy-oriented. However, such design ignores other important factors in the consumption. Many value factors are critical for making decision, such as health diet and environmental protection. These factors are not taken into consideration in current design. Therefore, we import the mission into our system to remind users of multi-value which cannot be reflected with only points [15].

In the system, mission will be given during shopping. Users can get point from a certain amount of consumption and get feedback from virtual pet after the completion of mission. It motivates users to take full account of the value of consumption.

4.3 Interactive System with Spatial Visualization

The point system is actually a reward system based on gamification theory. Point is a mechanism for immediate feedback and tracking progress. In the current system, customers are informed of point information in the textual form. The problem is that this immediate feedback cannot be fully expressed by static textual description. It prevents point systems from showing appealing reward in a dynamic way.

Point. Point is visualized in our system. The source of points is reflected by the objects which the points are visualized as. One object represents one category of points. Coin models are placed next to the object that represents the source of the points. Users can get a rough idea of how many points there are by spatial visualization. Users can know the specific number of each category after clicking the coin model. The spatial visualization of points is shown as Fig. 1.

Virtual Pet. The spatial visualization of virtual pet is shown as Fig. 2. In the picture, state of pet is different. In subgraph (a), two indicators are high and the pet is active without illness. In subgraph (b), two indicators are normal and the pet looks calm. In subgraph (c), blue indicator is low and the pet looks unhappy. In subgraph (d), two indicators are low and the pet is sick. The characters are colorful and simplistically designed creatures based on animals and people. These pets look like common animals. At the same time, they can make movements like human beings. Users can decide pet's name according to their preference. After the pet interface is opened, the pet will appear on the screen. Its name and level is displayed at the bottom-right corner of the pet. Information about the pet's state is displayed in the top-right conner of the screen. There are two indicators to determine how healthy and happy the pet is. Each indicator is a measure of consumption. If user gets many points, the green indicator will be high. If user gets many kinds of points, the blue indicator will be high. These indicators have a direct relationship with the user's consumption. The two indicators are

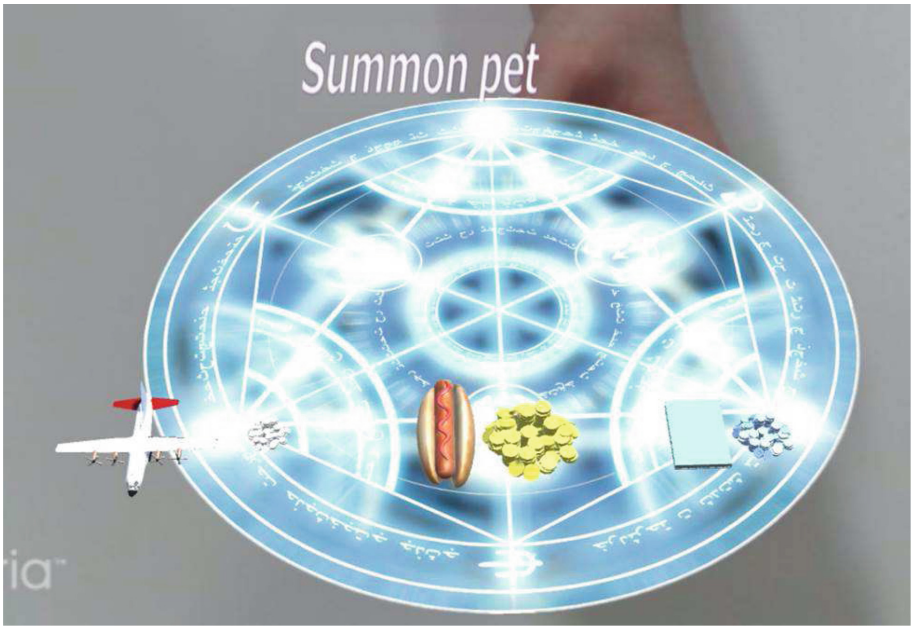

Fig. 1. Spatial visualization of three kinds of points in the system.

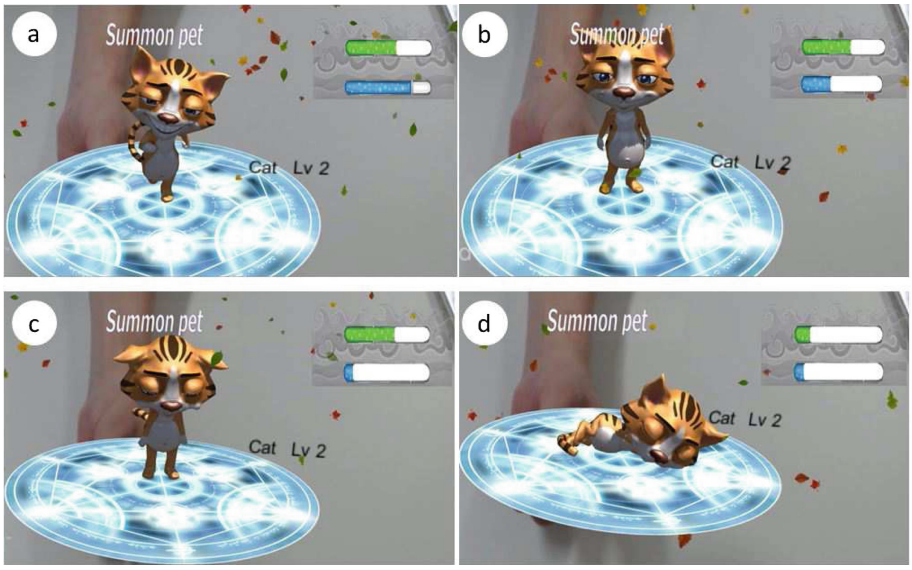

Fig. 2. Spatial visualization of virtual pet with different expression. Pet is energetic in subgraph (a). Pet looks calm in subgraph (b). Pet is unhappy in subgraph (c). Pet is sleeping in subgraph (d).

combined to evaluate the health of the pet. The expression of pet is influenced by the health of pet. If both indicators are high, it will be active. If two indicators is normal on average, it will look fine. If one indicator is not good, pet's expression will be unhappy. If both indicators are not good, pet may be ill. The pet goes through several distinct stages of development throughout its life cycle. Each stage lasts a period of time, depending on the level of pet. The level depends on mission completion. If mission is done, pet will get experience value. When the threshold is met, level will be upgraded. After reaching a certain level, the pet reaches a new stage and its appearance changes, which is the evolution of pet. The body shape of the pet varies depending on how many points there are. By introducing the level and two indicators to evaluate the health state of virtual pet, user's consumption are evaluated and the result is shown to user by spatial visualization.

Mission. Mission is an important method in our system to introduce the multi-value criteria (Fig. 3). In our system, the content of the mission is displayed in a game-like environment. The process of obtaining mission is designed to be a dynamic animation. Users can know the content of mission from reading text on the screen. After completing the mission, the system will play fireworks animation to create joyful environment in which users can feel successful.

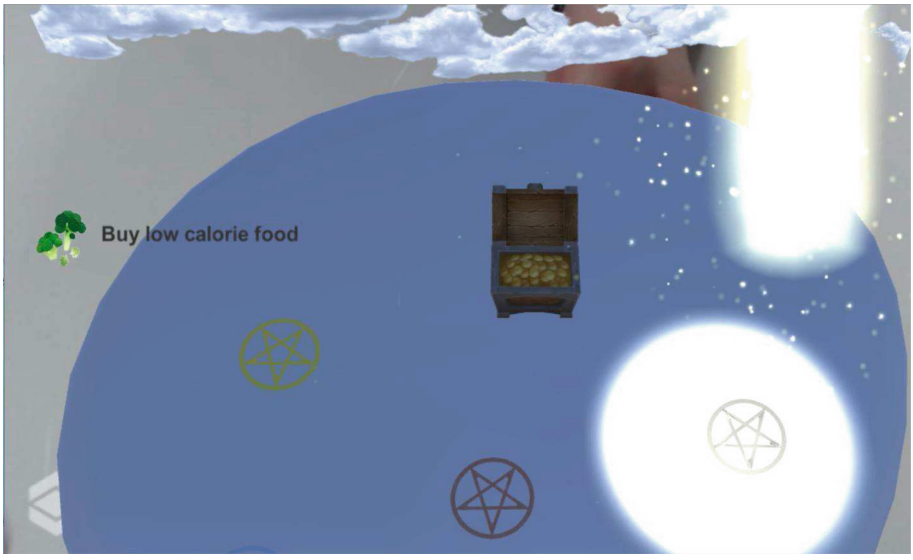

Fig. 3. Spatial visualization of mission.

Usage. When users go shopping, they can start point system and enter mission interface. There is one box in the center of the screen. The white clouds float in the air. After users click the box, it will emit light and the box will open.

After the animation stops, a star will rise into the air. After users click the star, it will blow up and users can see several patterns on the ground. If users click the pattern, they can view the content of mission displayed on the GUI (Fig. 3). If users complete the mission, it will be confirmed by the system after the consumption. If it is confirmed, the pet will receive the experience value and it will be recorded.

The number, variety of points and the completion of mission will affect pet's health state. On the pet interface, virtual pet will appear after some animations. The pets life cycle stages are baby, child, teen, and adult. There is a state bar at the top right corner of the screen indicating how healthy and happy the pet is. In state bar, there are two different indicators – Hunger and Happy.

The higher each indicator is, the better the pet's state is. Hunger is related to the number of points earned by the user. After the user gets points, Hunger indicator will rise. Happy is related to the variety of points. If user gets points from various source, the Happy indicator will be high. Filling up the Hunger can be achieved by obtaining points. Filling up the Happy can be achieved by getting points from buying different goods. The two indicators will be considered together to assess the health state of virtual pet. Virtual pet will make different action with different expression according to the health state of virtual pet (Fig. 2) and the expression of pet will change.

Level is used to describe the pet's current life stage. The pet's experience value increases after the user completes mission. After the experience value reaches threshold, the pet will level up. When it reaches a certain level, the pet will go to new life stage, which is considered as evolution.

The results, including points, mission and virtual pet, are presented to the user via spatial visualization.

Spatial Gesture. Users can interact with the system based on the GUI provided by the system. When users interact with the system, they can operate on two-dimensional screen. However, this makes the virtual world created by AR cannot be well integrated with the real world. This reduces the users' interest in the system to some extent. In order to improve the interactive experience of the point system, we consider replacing the traditional two-dimensional interaction with the spatial gesture interaction. We use leap motion to capture the user's real-world hands movement and map it into the virtual world. Users can interact with system using gesture (Fig. 4).

When the camera scans the surrounding scenes, the features of point card are extracted and compared with the recorded features. After that, the coordinate system of real world and screen coordinate will establish mapping. User's hand movement is obtained by leap motion and it is shown in the real-time video captured by webcam. Users can see the real-world movement of their hands on the screen. The virtual objects are superimposed to real world in the real-time video. Therefore, users can adjust the position and movement of hand to touch and interact the virtual objects as if they were objects in real world.

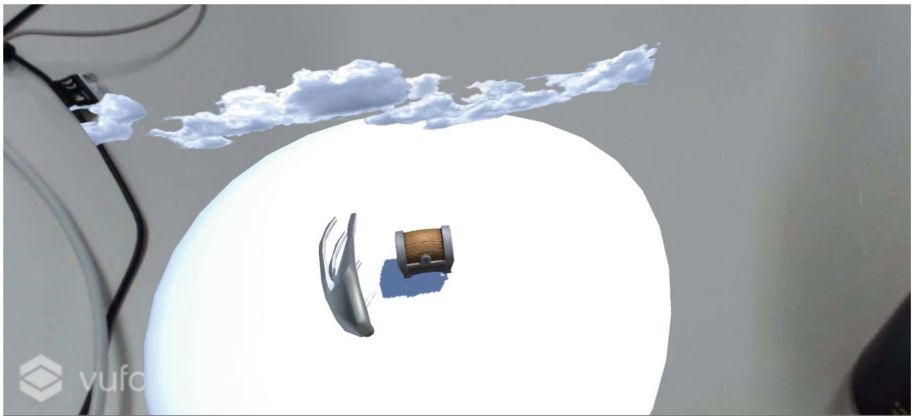

Fig. 4. Spatial gesture interaction in the system.

5 Implementation

5.1 Development Environment

The hardware devices used for the development of the prototype system include a laptop, a webcam, a smartphone and leap motion. Windows 10 Home Edition is installed in the laptop. The processor is Intel(R) Core(TM) i7-6500U CPU @2.50 GHz 2.59 GHz. The RAM is 8.00 GB. Webcam is connected to the laptop to capture video and send video stream to the laptop for processing. The development software is Unity 2017.2.0f3(64-bit), a cross-platform game engine. Unity 3D is used to develop and render three-dimensional system. Vuforia SDK is used as a foundation for AR implementation, which uses computer vision technology to recognize and track image targets and simple 3D objects in real-time. After recognizing the image on the smartphone, virtual objects created in Unity 3D are superimposed over the image. After that, users can see the spatial objects and interact with them. The Leap Motion controller is a small USB peripheral device placed on a physical desktop, facing upward. Using two monochromatic IR cameras and three infrared LEDs, the device observes a roughly hemispherical area, to a distance of about 1 meter. The LEDs generate IR light and the cameras generate reflected data. It is sent via a USB cable to the laptop and analyzed by the Leap Motion software. Leap Motion is used to get the high-precision gesture information. With the information provided by leap motion, spatial interaction can be detected and sent to laptop as input data.

5.2 Main Work

In our system, the image of point card are used as the target of recognition. Image database is created and the image of point card is uploaded to the database. The image will be analyzed by the algorithm of image recognition. The database

containing the image and Vuforia SDK are imported into unity. We connect the webcam to the laptop and configure the webcam information in unity. We install the leap motion software on the laptop, download and import unity core assets into unity.

In this research, we propose mission into our system. We expand the feedback from only points to point and virtual pet. Spatial visualization is used to give visual feedback instead of textual information. To make our point and level meaningful, we try to combine game with point system and design how users interact with our system. We define game rules to connect the point system with new design.

Specifically, Unity project is bulit and spatial models of different objects representing different points are created in the project. Coin model is set up next to visualized points to inform users of number information. Point models are set to receive and react to user operation. Point, level and some other information are recorded in our system. Data transmission and interface jump are processed to keep system consistent.

Virtual pet spatial model are set in the center of point card. The changes in the shape of pet are controlled to reflect the change in the number of points. Pet is given a variety of animations in reaction to user operation. We change the pet's state dynamically and visualize the information in state bar.

We design the way to get mission and presented it in the form of animation in reaction to user actions. We render the scene in real time to provide a precise visual effect. We create a gamified environment with light, sounds and dynamic particle effects. Multi-value are imported into mission content and mission is visualized on GUI. Animations are designed and points are rewarded after the completion of mission.

We define some spatial gesture in the system to interact with spatial objects. Leap motion is used to capture the user's real-world hands movement and the movement is mapped into the virtual world spatial gesture. Input data is processed and feedback is given via visualization.

6 Related Work

Our research is a new exploration of point system. Although there are no research similar to our system, some theoretical researches are the basis of our system. Zichermann and Linder considered harnessing the power of games to create extraordinary customer engagement with Game-Based Marketing [6]. They thought the most powerful way to create and engage a vibrant community is game mechanics – points, levels, badges, challenges, rewards and leaderboards.

The research conducted by Choi and Kim investigated why people continue to play certain online games [14]. Their results shows that people continue to play online games if they have optimal experiences and personal interaction can be facilitated by providing appropriate goals, operators and feedback.

The research conducted by Neal et al. proposed the idea that value drives loyalty. They thought buyers who are considering a purchase in a particular

product or service category scan their product/service options and develop a consideration set, in which they develop a hierarchy of products based on their assessment of value.

The paper written by Annika Hupfeld et al. explicated how people's everyday shopping practices and orientations are shaped by loyalty scheme and contribute to the creation of value through personal data. Although our system emphasizes value creation, the methods are quite different.

7 Discussion

We propose a new interactive point system based on current point system. Compared to the current system, our system has the following advantages:

1. Point classification
2. Spatial visualization
   (a) Point
   (b) Virtual pet
3. Multi-value criteria

Current point systems only focus on the time limitation and application conditions. Our system explores the value of point. In our system, point is different from electronic money. We focus on the source of points because it reflects their preferences in the past. We propose a new method to classify points in our system. With new point classification, our system can have a positive impact on evaluating consumption.

We propose the spatial visualization method which is not available in the present system. Users can know information more directly and it is easier for them to retain the impression. The user's behavior is also measured and presented to the user by spatial visualization of virtual pet. It is a unique feature in our system. The current system affects the user's consumption behavior through rewarding points. However, in our system, multi-value criteria are proposed. We introduce mission into our system. Our system assists users to asses their shopping from many aspects, which can help them make comprehensive decision. The value of consumption is explored and created in our system.

In addition, the attraction and interaction between users and point system is greatly enhanced in our system. We use the game design in our system. We expand the feedback from only points to points and virtual pet. Points are used for rewarding spending. Virtual pet is created for giving the intuitive feedback to the user. The user can adjust his shopping habit to help the pet in a good state. User can have a more enjoyable experience via interaction with the game-based system.

Based on the spatial visualization, we expand the interaction on two-dimensional screen to the three-dimensional interaction. The three-dimensional interaction allows users to interact with the system in a more natural way, thereby enhancing the sense of immersion in the game-based system.

However, there are disadvantages in our system. Spatial visualization system requires a large number of predefined models. Building different models for various consumption is a complex and huge project even if consumption is classified. As the number of points increases, the cost and difficulty of spatial visualization increases.

8 Conclusion and Future Work

In this paper, a new interactive point system is introduced. The whole system is designed and implemented based on game design. We propose a new idea of point classification, paying attention to the source of points. Points are visualized to facilitate information browsing and virtual pet is visualized to indicate the user's consumption. Mission is given to instruct users to make a comprehensive thinking during consumption. The purpose of our system is to help users make better choices. User can obtain points from consumption and get feedback from pet after completing the mission given by the system. Depending on the number of points and the variety of points, the state of the virtual pet will change. Users need to complete mission with value creation to care their pets.

In the current system, interaction is limited between users and the system. We consider combining the SNS features into our system to enhance interaction between users. The mission in the system is given randomly. We consider customizing mission for each user based on their personal information.

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