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Creation of Product Information Sharing
Platform Using User Generated Content Database

Graduate School of Media Design,
Keio University

Andrew G. Tantomo

A Master's Thesis
submitted to Graduate School of Media Design, Keio University
in partial fulfillment of the requirements for the degree of
MASTER of Media Design

Andrew G. Tantomo

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Creation of Product Information Sharing Platform Using User Generated Content Database

Category: Science / Engineering

Summary

Distribution remains as one of the unsolved problems in the area of electronic word-of-mouth. There are still a significant amount of products in the market that hardly has any information on the web, and this becomes a major obstacle in data retrieval and raising consumer awareness. The proposed system was realized in the form of native application for iOS, titled "SHOP BANZAI!". By using game and community-building elements, we are creating an incentive for the users to contribute data to the platform. In the game system, users are able to reveal hidden "avatars" inside of items after posting a review. The community building feature encourages users to use the service as a way of self-expression through sharing owned items with their social circles.

After a round of usability testing, we have demonstrated the user-friendliness of the platform in helping users to upload and retrieve information. A content examination was carried out following that in order to examine its performance. The result has shown that the platform is able to gather a substantial amount of information that currently do not exist on the web, and diversify shared item data in terms of category and acquisition time.

Keywords:

Graduate School of Media Design, Keio University

Andrew G. Tantomo

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Chapter 1

Introduction

Word of mouth that can be found on the web, also known as electronic word-of-mouth is a fascinating area of study. In general, word-of-mouth has been regarded as one of the most influential forms of advertising throughout the consumer decision journey. Compared to the traditional word of mouth, electronic word of mouth is permanent and visible, making it a very handy information reference. However, the accessibility of word-of-mouth is not always consistent over various categories of products. The absence of incentive to contribute is a significant obstacle to content accumulation. We believe that a platform that gives users the incentive and allows them to easily upload and retrieve information would help to generate information that can hardly be found on the web.

This chapter explains the background of this research and the existing problems in more detail. The structure of this thesis is explained at the end of this chapter.

1.1. Distribution of electronic word-of-mouth

The penetration of the Internet into the daily lives of society has fostered the growth of many new services. Among these rapidly growing services, the majority of them involve the use user-generated content in one way or another. There are social networking services, blogs, and review-sharing sites, just to give a few examples. Electronic word of mouth, which can be found within these services, has been a rapidly growing sector in the recent years as the society increasingly

embraces e-commerce to a greater extent.

However, the existing systems that can be found on e-commerce and review sharing sites still have some inefficiency in handling and processing electronic word of mouth. One of the major problems is distribution, in which the spread of word of mouth across different products tends to be highly uneven. This can be seen from the absence of information in many retail items for certain categories, especially consumable goods such as foods and beverages. Some of the causes of this problem can be attributed to the lack of channel and incentive to post such content on existing platforms. Also, not all items that are sold in the brick and mortar stores can be found on the web. For example, many fresh food items such as Japanese bento or onigiri, the majority of them are only sold in physical stores. There is also the problem of clutter, in which the growth of content tends to converge around popular items. This creates a downward spiral in which it becomes harder for consumer to increase their awareness, and these products will get even less attention.

We have proposed a new system that supports the creation of product-related information and reviews in order to solve this problem. This service incorporates community building and game features to create an incentive for users to upload contents. The game system was built around the concept of personification of items and it changes the way in which product information is handled within the system. The community building features will help to create new communities for product-related information sharing and support the users in actively interact with one another. The proposed system incorporate Universal Product Barcode (UPC) barcode scanner in retrieving and uploading product data.

There are several factors that come into play in determining the impact of word of mouth, namely network, message content, sender, and message source [2]. In terms of network, a word of mouth that is spread in a close, trusted group of people has more influence than a large and dispersed network. The product features that become the highlight of advertisements do not always match with the attribute that customers are looking for. For example, while marketers try to advertise a new smartphone based on its performance and functions, some groups of customers might care about the design more than the attributes that are highlighted on the advertisements. Message sender also plays an important role,

as people who are perceived as experts will be able to exert more influence. If both the sender and recipient are friends, the message will more likely to be perceived as trustworthy. Finally, word of mouth that comes from personal experience with the product is seen as more relatable. We tried to implement some restrictions in the proposed system to gain control on some of these aspects. By doing this, we are hoping to increase the reliability of the shared information.

1.2. Raising prominence of user generated content

As explained in the previous section, user generated content is reaching a prominent status in the society as the use of social media continue to rise. The emergence of social media, such as social networking services and blogs, has made it easier for people to connect with one another regardless of time and space. They have also brought about significant changes to human interaction as the boundary of culture dissipates. In the real world, sharing of personal information has been done often within smaller communities, mainly through face-to-face meetings, phone calls, etc. However, sharing information from big events to trivial details has become an activity that many people have grown accustomed to and become one of their ways of self-expression.

In the past, user generated content has been limited in quantity. Without having a channel to contribute, people had relied on businesses to provide information through the traditional media, such as TV, newspapers, and magazines. However, the convenience that social media provide has helped to speed up the growth of user generated content. It is not surprising that social media become first source of information that many people get in contact with. Consequently, the increasing number of user-generated content, which serves as the main content of these platforms, allows them to gain ubiquity status in the society.

One aspect of social media that makes them very appealing to use is that they allow interaction that would otherwise be impossible in the real world. For example, "poking" others and "liking" posts on Facebook [8] not only has created a new way of interaction that does not exist in real life. In the same time, game systems that are implemented by some social networking services, such as

Foursquare [9], create motivations for them to use the service and enable them to look at things in a different perspective.

Social networking services have greatly diversified in the recent years. In the past, most social networking services served multiple purposes, meaning that there is no specification on the kind of content that users are supposed to share. As people start to adopt social networking services into their lifestyle, more specialized ones start to emerge. There are social networking services that specialize in sharing photos [15], locations [9], business reviews [24], etc. This is to show that the possibilities in which a social networking service can augment the life of the society is nearly limitless.

1.3. Thesis Outline

This thesis discusses the creation of the word of mouth sharing platform in order to generate the hardly existent product-related information on the web. This includes the design concept and implementation that are elaborated further in the middle part of the thesis. The latter part discusses the usability testing and content examination that were conducted on the developed system.

This thesis is divided into 7 chapters. Chapter 2 elaborates the relevant works in the area of word of mouth. This chapter shows the previous works in analyzing word of mouth from various perspectives. It also points out the problem that persists in this area. Chapter 3 discusses the concept of the proposed system, which includes the game system, community building, and real life activities reflection aspects. It also explains how these elements work together in achieving the objective of this research. Chapter 4 shows the implementation of the system, which includes the description, requirements, and system architecture. It shows the works that have been done so far in realizing the proposed idea. Chapter 5 shows the result of the usability testing and content examination based on the data that will be gathered. It elaborates more on the evaluation of the platform, such as user-friendliness, content growth, etc. Chapter 6 explains the future work for this research, including content adjustment, feature updates, and potential business models for the application. Chapter 7 concludes this thesis by summarizing the important points.

Chapter 2

Related works in the area of word-of-mouth

There have been a lot of researches done on the area electronic word-of-mouth in the recent years as as the Internet gained widespread popularity. In this chapter, the attempts of previous researches in understanding word-of-mouth and consumer awareness from various perspectives are explained. One point worth taking note is that while there many researches analyze word of mouth and point out the existing problems, there have been very few researches that focuses on the creation of a new tool to solve them.

2.1. Motivation behind the creation of word-of-mouth

Without sufficient amount of incentive, user generated content-based platforms are at the risk of lacking content. While many researches in the area of word-of-mouth focus on analyzing its content and impact, only a few have tried to dig deeper into the motivation behind it. According to a research by Thurau *et al.*, social interaction, economic incentives, concern for others, and self-expression are the major incentives for sharing such content [22]. The research has also highlighted that consumers are generally segmented, as some group of people may be motivated by self-expression, while others are motivated by altruism.

On the other hand, a research by Dellarocas and Narayan took a slightly different approach, highlighting product attributes that play a role in incentive creation [5]. Their research, which focuses on motion pictures, use average valence, marketing budget, level of disagreement, number of exhibited screens, and previously posted reviews as the attributes for measurement. The research concluded that self-expression stands as the prevailing driving factor behind posting reviews.

We can see at this point that prior researches have tried to understand the underlying factors behind content contribution on word-of-mouth sharing platforms. However, there has been no new idea proposed beyond giving traditional incentives, such as bargains, deals and opportunities for self-expression. A new kind of incentive creation is necessary to push the data growth even faster.

2.2. Helpfulness of product reviews

In major e-commerce platforms, sorting product reviews according to its "helpfulness" or other similar terms is a common attempt for businesses to provide the information that consumers look for in the shortest time possible. A number of researches have been done to explain the aspects of product reviews that contribute to the perceived helpfulness. According to a research by Pan and Zhang, the valence (positive/negative psychological value) and length of a product review have been shown to have a positive relationship with its perceived helpfulness [19]. However, the different nature of experiential and utilitarian products creates a variation in which review valence and length have an impact. Review readers also play an important role in determining its perceived helpfulness. Customers tend to exhibit positivity bias in processing information that they are heavily involved in, while they may display the opposite in other cases, such as the context of oligopoly markets in which purchase options are limited. On the other hand, another research that was done by Ghose and Ipeirotis looked into different aspects, such as subjectivity levels, readability, and spelling errors in determining the perceived helpfulness [10]. A mixture of subjective and objective, easily readable, minimum error reviews are associated with positively rated reviews.

There is a reason why relying solely on a product rating is not the wisest idea. The research by Duan, Gu and Winston discusses the persuasive and awareness

effect brought by online reviews on movie sales [6]. The research found that online ratings do not really have an impact on movie sales as much as number of postings of a movie. This highlights an important fact that raising consumer awareness is critical in order to increase the sales of a product.

2.3. Consumer awareness

A product needs to reach a certain degree of recognition among consumers before it can compete with more popular products in the market. The research by Perla highlights product awareness and its relationship with industry life cycle [20]. The research has established the fact that increasing consumer awareness brings about two countervailing results. As consumers able to choose products that best suit their requirements, market power decreases. Having the tendency to demand more of the preferred items, increased consumer awareness will boost the overall demand in the industry. As businesses may not necessarily benefit from the latter effect, increasing product awareness tends to give an advantage toward the consumer's side.

On the other hand, a research that was done by Haubl and Trifts focuses on the implementation of a recommendation agent and comparison matrix in helping consumers in making quicker purchase decisions in online shopping context [13]. One important fact is that consumers are unable to evaluate all available alternatives in detail, so they use two processes to filter out this information. At first, they select the options that are worth considering, and thereafter perform an in-depth comparison of the selected alternatives.

From this research, we can see a weakness of e-commerce platforms in raising the awareness of consumers. As sales is the main priority, businesses expose customers with the products that they want to highlight, such as new items, popular items, etc. Especially in the area of retail items, no platform is centered on the society's perspective. The absence of such platform makes it harder for customer to raise their awareness of the items outside of businesses' interest.

A market research was done by Nielsen in order to analyze the strategy that is most effective in raising consumer awareness [18]. In terms of word of mouth, the research has shown that word-of-advice from family and friends as the most

persuasive awareness-driving factors. This points out that preexisting social circles is the key factor for consumer awareness that is triggered by word-of-mouth communications. In terms of traditional advertising, in-store discovery remains as the greatest trigger of product awareness. Despite this fact, a significant amount of products of several categories on physical stores is still non-existent on the web. Thus, the current system of in-store discovery is still not the most efficient either. A media that would be able to provide users with the needed information not only online but also in the real world would increase the usability of a platform to a greater extent.

2.4. Distribution of product related information and reviews

As explained in the previous chapter, distribution is a major problem in the area of electronic word-of-mouth. As the research by Dellarocas and Narayan has pointed out, there has been an inefficient allocation of user reviews in the current system [5]. While popular items are flooded with information, many other items lack of information that is noticeable enough for consumers to be aware of. Unless this problem is solved, these little amount information would only be remotely useful in helping consumers in making purchase decisions. The research has pointed out that the tendency of people to post review on something that has a lot of online buzz. This creates the trend whereby popular items gain more and more buzz, while the others are lacking content. There is also a tendency for people to post review for either very good or very bad items, which results in the bimodality of review distribution.

Another research by Hu, Pavlou, and Zhang predicts product quality and life cycle through the analysis of online word of mouth communication [14]. One interesting highlight of the research is that the majority of product review distribution are asymmetric bimodal and have a J-shape. The main causes of this problem have been attributed to the purchasing bias, meaning that people only take time to post review of the purchased items that they like. Another cause that was highlighted in this research is under reporting, meaning that only items that give extreme impressions give consumers the incentive to post a review.

2.5. Word-of-mouth in social networking services

While in the past word-of-mouth mainly existed in verbal form, the rise of social networking services has allowed it to flourish as text on the platforms. However, the difference in how social circles on social networking services operate as compared to real life creates some differences in the way how word-of-mouth is triggered and spread on the platform. A research that was done by Chu and Kim analyzes how the attributes of online social connections, such as tie strength, homophily, trust, etc. initiates word-of-mouth behaviors [3]. It was found that homophily, which is the tendency of people to associate themselves with others who exhibit similar attributes, is the only factor that has negative relationship with electronic word-of-mouth behavior.

There is another research by Jansen *et al.* that focuses on analyzing microblogging as a method for word-of-mouth communications [16]. One interesting topic that was highlighted in this research is the presence of word-of-mouth in Twitter, which was used as the example. It was shown that only around 19% of microblog content talks about a brand, and only 20% among this share contains some sort of sentiments towards the brand [16]. This has shown that the amount of word-of-mouth is very little on these platforms. Consequently, the content that can trigger consumer awareness or purchase decisions is still limited at best.

The previous researches have analyzed how social networks can help to initiate word-of-mouth behavior, and how it can be used as a communication tool. However, these researches have not yet explored the potential of social networks in generating the hardly existent product information. Instead, they focus more on the creation of word-of-mouth for the items that are already existing on the web (advertisement initiated by businesses, then transmitted from one user to the other).

Chapter 3

Design of word-of-mouth sharing platform

The proposed system was designed to accomplish the main objective of generating new product information and review that can hardly be found on the web. The social network and gamification aspect of the system will help to achieve this through incentive creation. Using this system, users would be able to form new communities for product-related information sharing. Some of the restrictions for sharing information are implemented to increase trustworthiness of information. This chapter explains more detail of the design of the system and the formulated hypotheses based on that.

3.1. Service concept

3.1.1 Game system implementation

As mentioned in the previous chapter, there is still a significant amount of product information that hardly exists on the web. In extreme cases, the product reviews and basic information are missing altogether. User generated content has a good potential to increase the quantity of product-related information. However, employing it is only as effective as how much motivated the users are to use the service. This is the reason why engaging users are crucial to any platforms that use user generated content as the main data source.

Many e-commerce platforms offer deals and discounts to customers who post product reviews. Social networking services are creating an environment that supports the interaction between people to fulfill their need for social connection. In social media such as blogs, people are driven by the desire for self-expression in creating contents. This is to show that there are plenty of possibilities in giving people the motivation to contribute contents.

There is a very good reason why relying only on businesses to provide complete information is insufficient. At the present moment, it is difficult for those enterprises to provide a complete database of retail items to consumers. As retail items constantly go in and out of the market, it has reached a point in which it is nearly impossible to keep up with the change. Even though the barcode of each retail product is unique, currently there is no single comprehensive database that contains every bit of this information. It is up to the users' activity and involvement on how extensive a retail item database can grow into.

Unfortunately, product information sharing is one of the areas that are still rather unexplored, and there is little incentive for people to contribute information. There have been a few businesses that have made the attempt to generate more information by involving consumers in the process. There were several word-of-mouth sharing applications that utilize barcode scanner to enable the users to upload information that can be used as a source of information for others [11]. However, these services still have a limitation in terms of motivation to use, mainly because they do not provide much incentive beyond the conventional information sharing. Many times, these platforms are unable to provide the data of the scanned items' barcode, which severely reduce the its usability.

The proposed system uses a game system as one method to create an incentive. The game environment within the application creates an abstraction of the network layer and was aimed to provide an added value to the user experience. One concept that is unique to this service is the personification of retail items, treating items similar to real people.

In the principle, there are some attributes of retail items that can be linked to real people. Items have product names, manufacturer's names, manufacture dates, etc. In the platform, instead of treating these attributes "as is", we changed the way in which we handle this information. For example, the platform treat

manufacturer's name as the "family" in which the item belongs to. The date when the item's barcode was first scanned becomes the "birth date" of the item. These attributes, such as family names and birth dates are displayed in the user interface. One important attribute that ties the whole concept together is that we are creating a persona of each item through the use of avatars, also called as "item avatars" within the application.

Figure 3.1: Item avatar example

In the system, every retail item contains an item avatar (Figure 3.1). While originally hidden from the users, these avatars can be revealed by posting a review of the related item, like the analogy of getting to know a real person. In this system, barcode scanning is used as the main method for uploading and retrieving contents. When a user tries to upload an item's information that has not been registered, he will be brought to the item registration page. When a user has successfully posted a review of the item, the avatar will be added to his items list that serves a similar function to normal friends lists on social networking services. This information will then be shared on the newsfeed with all users within the network. In this way, users are encouraged to discover the items around them by revealing this hidden information in items. In short, the item avatars act as an extension of retail items. Each avatar represents an item and owns a social account in the system. Users can use these profiles to retrieve item's information. The game system implemented added an extra layer of abstraction that hides some of the item's information, such as the avatar's image and name.

This research would examine the potential of this platform in motivating the users to upload information by observing the growth of content along the user test period. The amount of growth each day will be analyzed. We would also like to see the proportion of the item categories to see to what extent this application can cover the various kinds of products in the market.

3.1.2 Community creation for item information sharing

Many popular services effectively combine word of mouth sharing features with community building. Yelp [24] is one example of a review sharing service that utilizes this feature to encourage the interaction between users. Foursquare [9] enables users to check in at the places that they have been into, and share this information with their others. There are many others services that incorporate both features to increase the amount of content on the platform.

Apart from the game element, there are several other aspects that distinguish the proposed system from existing word of mouth sharing services. The first difference is the area and scope of service (Figure 3.2). The proposed system focuses on retail items, which is still a rather unexplored area for word-of-mouth sharing. While Kakaku [17] also cover retail items, their coverage is broader as they also cover services such as broadband Internet, insurance, etc., which is out of this service's scope. Their emphasis is towards price comparison, which is something that the proposed system does not involve. We have decided not to incorporate price, as it is an attribute that is highly volatile and does not really fit into the concept of the service. Their focus on price comparison also means that review amount is not the point of concern for the service. This can be seen from the substantial amount of items without any reviews on the platform. While it has some social networking features, Kakaku [17] may not be the most convenient place to gather product reviews. Epinions [7] is also similar to Kakaku [17], except that it operates on a worldwide scale. However, the quantity of information in this platform is very limited as a significant amount of products do not have any reviews either.

Even though e-commerce services have proven their capability of gathering a significant amount of product-related word-of-mouth, the platform-based nature creates a limitation to the kind of items that are displayed on the website [1] [21].
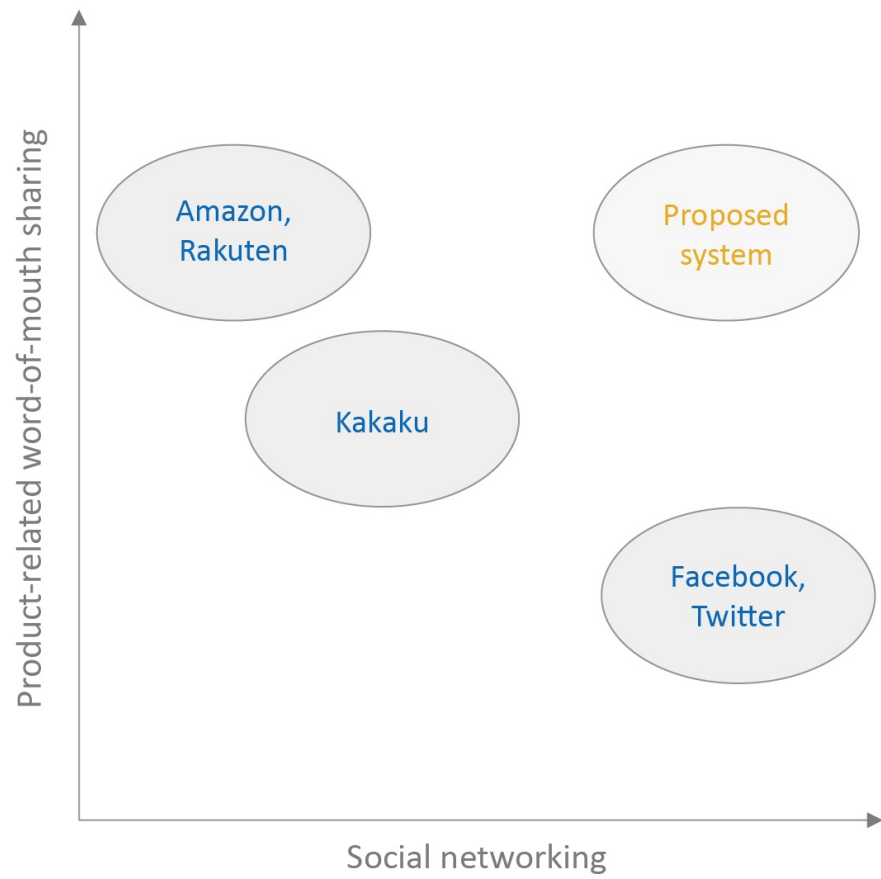
Figure 3.2: Comparison of existing systems and the proposed system

On the other hand, pure social networking services such as Facebook [8] and Twitter [23] are also able to gather product-related word-of-mouth to a certain degree. However, there are inconsistencies in the content that are shared on these platforms. As the main purpose for social networking platforms is the social connection, word-of-mouth-related problems such as data accuracy and completion come second. Consequently, it is hard to find specific information about products as they usually exist in form of posts or comments.

The proposed system is not the first platform-independent service. Consumer Reports [4], as one of the most popular review magazines in the United States, has been able to maintain its status as an independent and non-profit organization over the years. The revenue that it gathers through the user subscriptions keep the service running. However, the range of item category provided by this platform does not go beyond the typical review sharing sites, as most reviews fall under the electronic products and home appliances.

There are a few fundamental differences on how this platform operates compared to others. Because of the nature of review sharing services, users are more often than not post a review after the consumption of goods/services. In other words, the point of consumption acts as the main trigger of posting a review. The proposed system is built from the perspective of a social network in which point of consumption is not necessarily the trigger for content posting. It can be a liking towards an item that they own for a long time. The system enables users to easily upload their purchased items as well as their already owned items through barcode scanning.

Expanding the context of review posting will naturally enable different kind of review content. Reviews that are triggered from consumption tend to be the result of a shorter period of use. However, the nature of a social network enables one to post reviews about the items that they might not have purchased recently, but something that they have been using for a long time, allowing them to share those whole experience. This would increase the diversity of the reviews that are shared on the network.

Therefore, this research would examine the potential of the platform in helping people in sharing product-related information. The effects of the community building features will be examined from the diversity of content that the platform

is able to accumulate. The first examination would be information availability. Each sampled item will go through this check on search engine and e-commerce platorms. The second point of interest is item acquisition time. The ratio between already owned item and recently purchased items will also be examined to gain an insight of the propensity of each user to upload certain information.

3.1.3 Reflection of real-life activities

Services that support the communication between users have to determine the level of anonymity that the users would have to follow at some point. However, anonymity is a double-edged sword in social networking services. It gives users more privacy and freedom to share information, while in the same time it compromises the trustworthiness of shared information. With minimum level of anonymity, users are pressured to be consistent and credible in sharing information, which is a positive attribute. However, users who wish to keep their privacy will more than likely to feel reluctant to use the service. To get the best of both worlds, it is important to establish the right balance of anonymity.

The main measure of reliability for most word-of-mouth sharing service is other user's rating. This is usually followed by the rewarded "expert" status after reaching a certain point. This status may increase the relatability and credibility of the reviewer in some cases, but it still has its limitations. Consumer products can be divided into two big categories according to the consumption, namely experiential and utilitarian products. While utilitarian products can be safely assumed to provide the same results/benefits to the consumer, experiential products yield different impacts across the different demographics. For example, while rock music may not be someone's cup of tea, there are other person who will listen and able to appreciate the same music. However, the existing platforms are indiscriminate with regards to these aspects.

The proposed system is designed to allow users identify one another if they know one another in real life. In order to support the community creation, basic facts such as name and country are displayed on the user's profile. By allowing people who know each other in real life to interact using the platform, it would minimize the inconsistency of experiential product review's impact on the recipient.

The social network environment of the proposed system is created to reflect the real-life activity of the users. Aside from the basic facts, user profile shows the activities of the user within the network, such as the number of reviews that they have posted so far, the number of discovered items, as well as the chronologically sorted list of reviews that they have posted. The proposed system is based on the concept of "upload as you go", encouraging users to post both their purchased items and already owned items in an instant. This would create a list of items that closely reflects the users activities.

This research would like to examine the potential of this service in generating word of mouth that closely reflects the user's real life activity. In order to be able to gain an insight on how fast it can help users to upload information, a test for user friendliness is necessary. The amount of time required for users to register and upload information will also be a good measure on how "real time" the data can be. It is known for a fact that the most common items that people purchase on regular basis are consumable goods. Therefore, whether the platform is able to accumulate data focused in this category, such as foods and beauty products, will be examined.

3.2. Hypotheses

The hypotheses for this research are drawn upon the objectives of the proposed system mentioned in the previous subsections. The formulated hypotheses are as followings:

H1: Use of proposed system leads to the growth of product-related information across various categories

H2: Use of proposed system leads to the distribution of product-related information that gravitate towards consumable goods

H3: Use of proposed system leads to a larger share of already owned items information being shared on the platform

H4: Use of proposed system leads to the creation of product-related information that hardly exist on the Internet

Hypothesis H1, H3 and H4 were formulated based on the game and community building elements of the proposed system. They measure how the proposed platform can create an incentive for users to contribute item data with diversity in terms of category and acquisition time. Hypothesis H2 was based on the platform's ability to reflect real-life activity of the users. These hypotheses will be evaluated in the later chapter through content examination.

Chapter 4

Implementation

In order to accomplish the objectives of this research, we proposed a new platform for sharing product information and reviews. This chapter begins with the section that explains the description of the platform and the works that have been done so far. The reasons for incorporating certain elements into the system are elaborated in the next section. Finally, the last section shows the system architecture and how each of its element fits into the big picture.

4.1. Description

The proposed service was built as a native mobile application for iOS and titled "SHOP BANZAI!" (Figure 4.1). The first prototype, which includes the barcode-scanning, item registration, and review-posting functions, was created in April 2013. In order to realize the idea, a real working app was developed in April 2014. The working app is compatible with any iPhone/iPod running iOS 7.0+, both 3.5 and 4 inches retina display, and is equipped with all the functions necessary to conduct the research. The front end of the application was made using Objective C with Xcode 5.1. The developed native application contains 4 layers (Figure 4.2).

Figure 4.1: Main screen of SHOP BANZAI!
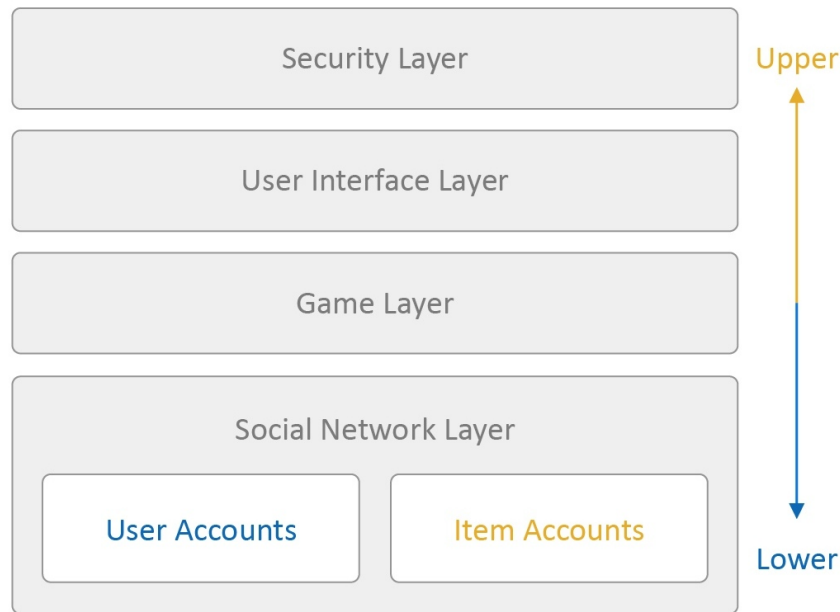
Figure 4.2: Layers of SHOP BANZAI! Application

4.1.1 Social network layer

The social network layer is at the very bottom layer of the application (Figure 4.2). It consists of an interconnected network of items and users. Like most social networking services, users have their social profiles (Figure 4.3) on the network. As explained in the previous section, these profiles display the basic information, recent uploaded contents, as well as the record of the users' activities on the platform. The platform use "hearts" as rating points to rate the performance of other users and this is one of the methods to affirm their credibility. User profiles are currently visible only to friends.

Aside from user profile, item profiles (Figure 4.4) are a major part of the social network. In the network, items are not treated as a dead object, but they have their own social network profiles like users do. There is a similarity on both types of profiles in the sense that both display basic information and uploaded reviews of the item. Item profiles also contain the item photos uploaded by users. One major difference of the review list is how they are sorted. To put an emphasis on recency, the reviews on a user's page are sorted chronologically. On the other

Figure 4.3: User's profile screen

Figure 4.4: Item's profile screen

hand, to help users in getting the desired information in the shortest time possible, the reviews on the item page is sorted according to the ratings from other users.

As the proposed system allows any uploaded content of any users to be visible by anyone within the network, another measure has to be taken to prevent fraudulent contents. A content reporting system has been developed to carry out this task. Users can flag other users, item data, reviews, and photos that are considered inappropriate. The administrator will then examine this content and the necessary action will be taken. Contents that are blacklisted will be completely inaccessible and considered non-existent.

4.1.2 Game layer

In order to provide the users with a rich user experience and extra motivation to use the platform, a game layer (Figure 4.2) is added on top of the social network layer, which is the basic foundation of the system. As explained in the previous subsection, items in this social network are treated similarly as real users. In fact, the interface of an item profile and user profile are made similar as to blur out the difference between the two. Each item has their avatars, which are randomly generated from the UPC barcode of the item.

As the concept of the game is "rediscovery" of items, we want to give users the curiosity to discover the items around them. In order to do this, the avatars of these items are initially made hidden from the users. In order to reveal these avatars, users would need to post a review of the related item. In order to post a review, users are required to scan the barcode of the item. If the item has not been recorded on the database, a new item registration page (Figure 4.5) will appear.

When the item has been successfully registered, the review-posting page (Figure 4.6) will then appear. After successfully posting a review of the item, the item avatar's complete profile will become visible to the user. This review information will be automatically shared with other users on the network, but only friends are able to see the avatar (Figure 4.7) (assuming that other users have not posted the review).

As of the current version for testing, there are 6 avatars of each gender, totaling up to 12 item avatars. These avatar IDs are generated from the algorithm within the application. Through this algorithm, some avatars seem to appear more often

Figure 4.5: New item registration screen

Figure 4.6: Review-posting screen
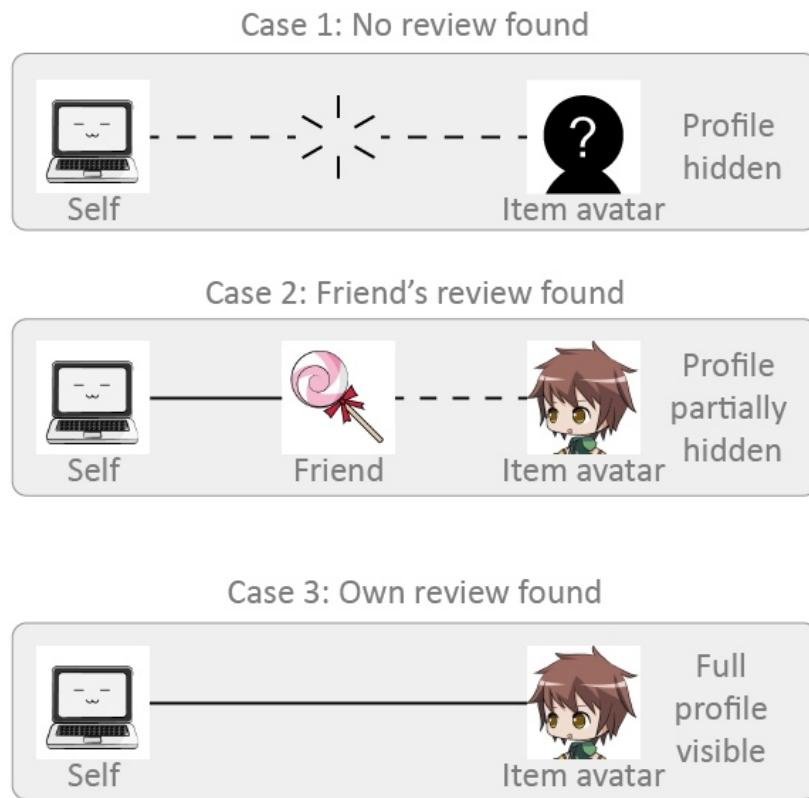
Figure 4.7: Item avatar discovery system

than the others, giving more value to find less common avatars in some items. In addition, every avatar is given its own unique first name that is randomly generated from the system. The application uses a simple formula to create an avatar's full name, which basically constitutes of "first name + manufacturer's name". For example, if an item from SONY brand were given the avatar name "Mike", then the final name would be "Mike SONY". Another purpose of doing this combining of names is to categorize the items according to their manufacturer's name. For example, if a user is currently looking at an item manufactured by SONY, he can easily look up other item within the SONY company. This naming of avatars is implemented to help users to identify and avoid duplication of avatars. As in the current system only 12 avatars are available, it is more than likely that the user will encounter the same avatar image more than once in different items. By adding the first name, it is more unlikely that avatars will have both the same name and icon. By adding the last name/manufacturer's name, it will be highly unlikely that an avatar has the exact same three variables.

4.1.3 User interface layer

The User Interface is the second layer from the top (Figure 4.2). The application has 5 main menus, namely "Home", "Search", "Upload", "Friends", and "Items". These menus are placed in the tab bar at the bottom of the user interface, allowing easy access to any of the items whenever the user is on the root page.

The "Home" menu (Figure 4.8) serves as the central page for the users. This is the page in which users can receive information about other users' activities through notification and newsfeed. The newsfeed is also capable of filtering users' recent purhases according to the user's affiliation/country, item's category, and social connection status (friend or normal). This is the main method for the application to let users gather information passively.

The notification list is able to display various kinds of information, such as a recently posted review by a friend, approval of friend requests, etc. Other than the notification list, the "Option" button (Figure 4.9) allows users to manage their account, such as viewing and editing own account, purchasing additional features through in-app purchase, etc.

As the main emphasis of this application is the retrieval and uploading of item
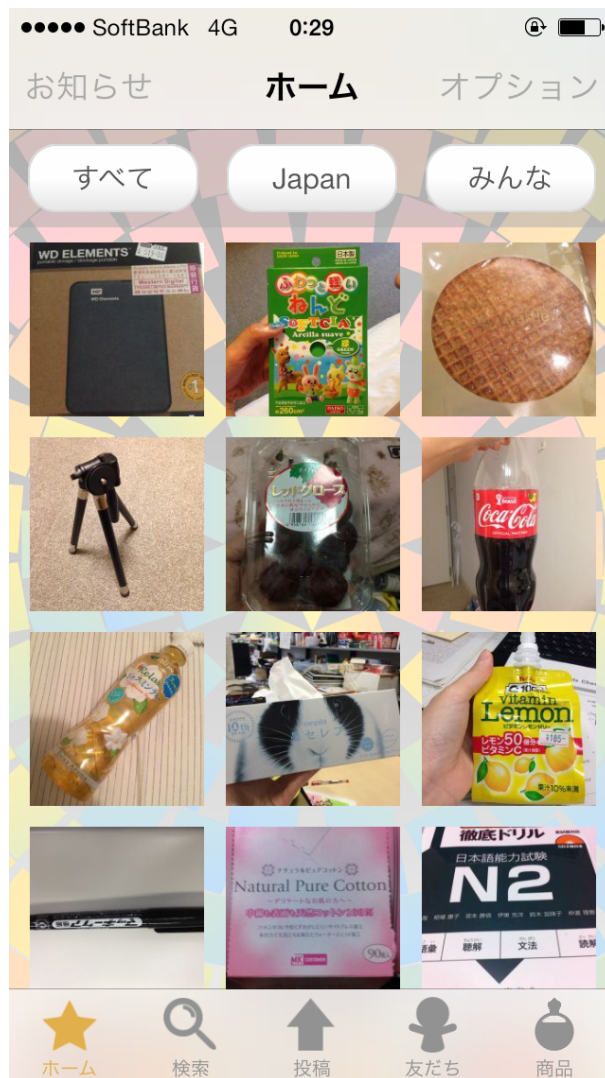
Figure 4.8: Home screen

Figure 4.9: Option display

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Figure 4.10: Search screen
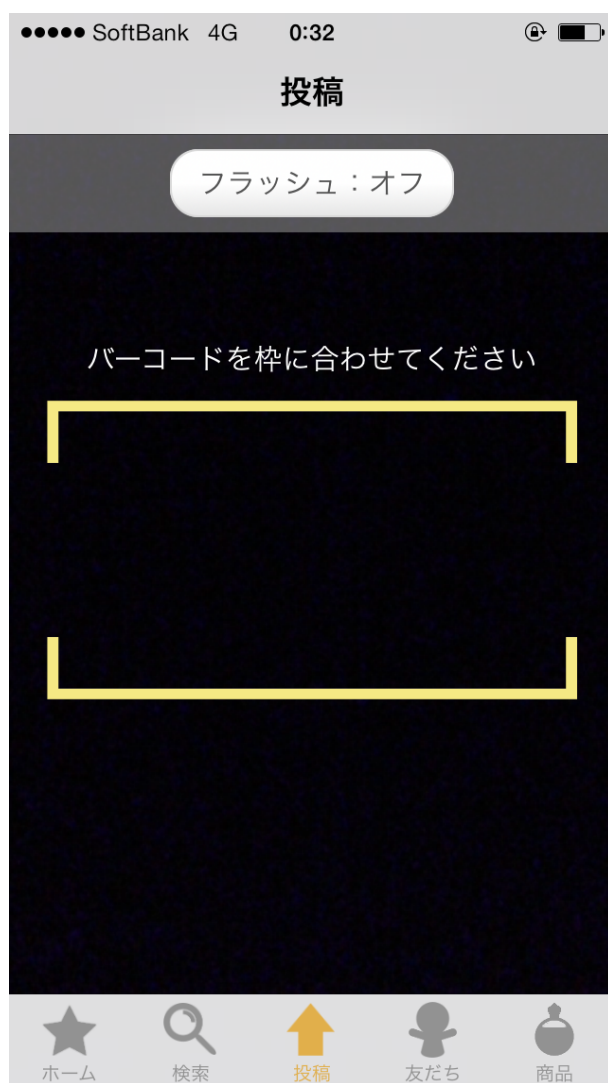
Figure 4.11: Upload screen

information, these two vital functions are placed in the "Search" (Figure 4.10) and "Upload" (Figure 4.11) menus respectively. As explained in the previous section, barcode scanner is used as the main method for information upload and retrieval to ensure efficient data storage and precision, as well as improving information trustworthiness. However, keyword search is enabled for information retrieval to give more flexibility. Once the "Upload" menu is opened, barcode scanner will be launched immediately to minimize session time.

When the barcode scanner in this app finds an item that has not been registered yet on the database, it will bring the user to the item registration page. In this page, users have to fill in all the necessary details about the item, such as item name, category, and manufacturer's name. Lastly, the user should take a picture of the item to finalize the registration process. The moment this page is launched until data submission, a timer in the program is initialized. This timer will be used as a measure for the user friendliness of the user interface.

Otherwise, when the item registration process has been finished, or when the barcode scanner finds an item that has already been stored in the database, the user will be brought to the review-posting page. In this page, user can fill in all necessary details such as rating, location of purchase, as well the text review. This page allows users to go back to the item registration page, which is renamed as "Edit info page". This page enables users to edit any information that might have been inaccurately input by other users. This will also create a platform where everyone can collaborate with one another in creating a comprehensive database for product search. A timer is also implemented in this page, which will count the time taken by the users to submit a review. Again, this will be used as a measure to understand the user friendliness of the user interface.

The "Friends" (Figure 4.12) and "Items" (Figure 4.13) menus are used to display friends and items list respectively. As the service run as a standalone social network, users would need to add other users manually by inputting the relevant user's username. Adding users will provide users with two benefits. Being friends will allow the user to get an update whenever his friends post a review, allowing him to follow his friends' activities. Also, friends have the privilege to recommend item to one another, give them flexibility in adjust the scale of sharing, not necessarily to the whole network. The item list works pretty similar to the

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ホーム 検索 投稿 友だち 商品
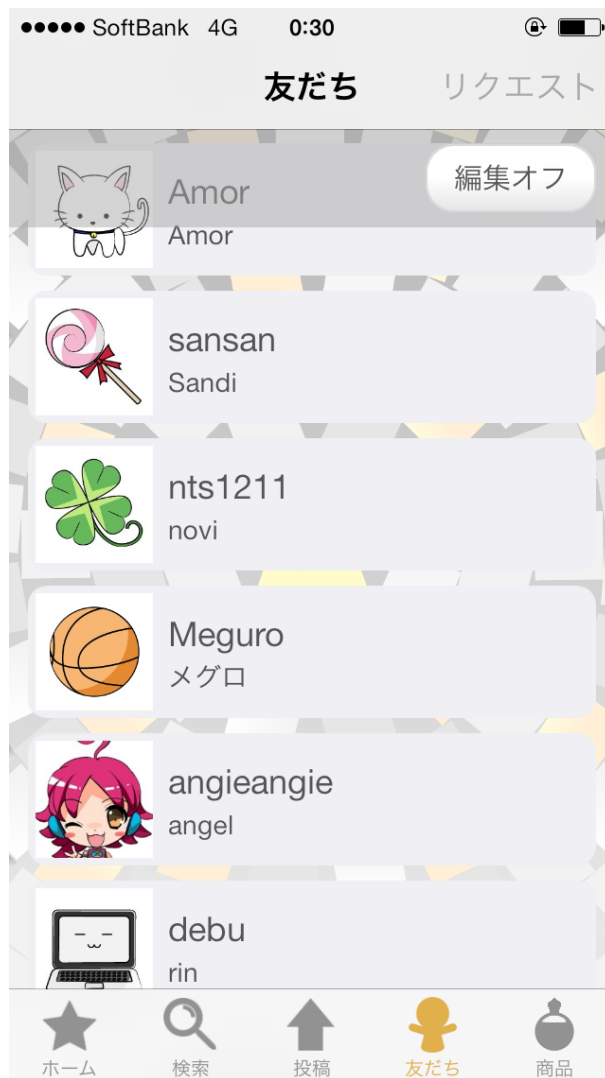
Figure 4.12: Friend list screen
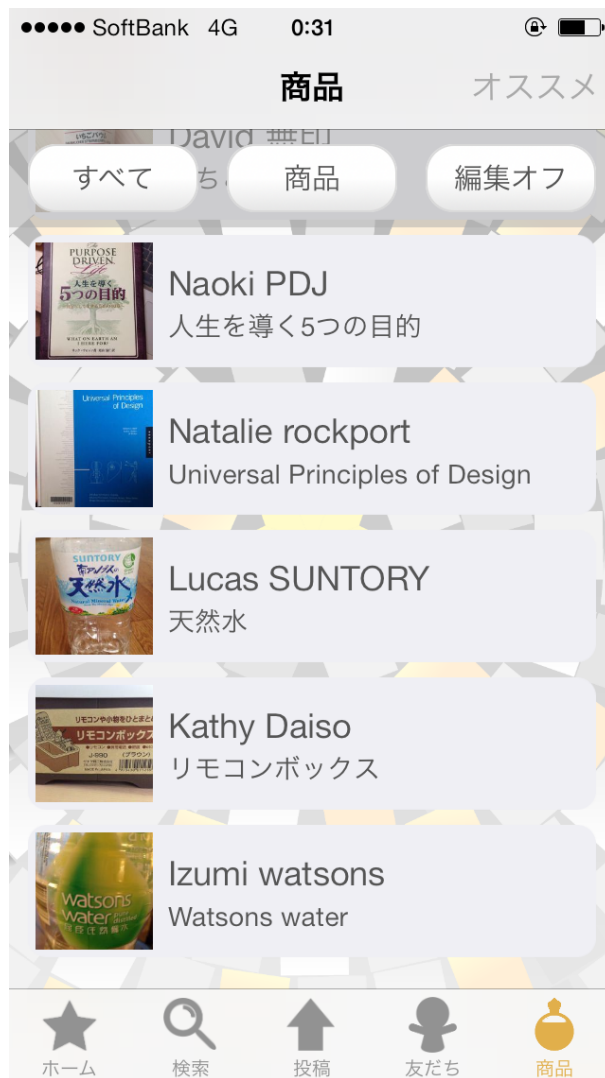
Figure 4.13: Item list screen

friends list, except with a few extra functions. Item list enables a user to filter the item data according to the category (food & beverages, health & beauty, books, etc.). As an item has two usable icons, which is the avatar and the product image, another button enables them to switch between the two displays. Both friends and items list are editable, meaning that the items within the list can be removed. Removing an item in the items list will remove the posted review from the user altogether. Again, this is used as a preventive measure for abusive users.

4.1.4 Security layer

The security layer is the topmost layer of the application (Figure 4.14). The service currently runs as a private social network. To get started using the application, users need to sign up for the service on the relevant sign up page and input all the necessary data that will be used for their social profiles. The sign up process also requires an email authentication, in which an email with the authentication password will be sent to the user's email address. This is one of the measures taken to prevent fraudulent users, as the nature of mobile application makes it a little bit trickier to manage the security of the platform. Without any form of authentication, blacklisting a user will not have much effect, as the user can remove the app and download a new one right away. This makes it necessary for the application to incorporate an authentication system to prevent abusive use.

After the user has finished creating his account, he will be able to start using the service right away and view the contents uploaded on the platform by other users. In the implemented system, user account validation is carried out every time the user opens the application, meaning that the effect of blacklists will be in effect immediately.

4.2. Requirements

In order to realize the proposed system, there are some requirements that need to be fulfilled. This subsection explains the details and implementations of each required elements.

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Figure 4.14: Sign up screen

4.2.1 User generated content database

As explained in the previous section, there is currently no single comprehensive database that contains all information about an item's UPC barcode. In the case of e-commerce, they are not extensive enough to cover all the items in the market outside of their platform. Users' involvement is still vital in generating the currently non-existent information.

In order to turn the platform into a collaboration tool, we decided to use user-generated content as the main source of data. This collaboration aspect is most apparent at the item registration and edit info page, in which people who carry the item can freely edit the details. This mechanism also to ensure that only people who actually physically own the item can edit the information. In order to make users feel more heavily involved in the platform, the involvement from a third party is minimized.

As with any other user-generated content, user-submitted content have to be closely examined by the administrator. Any inappropriate content, erroneous information, or spam will be considered violation of use. Users that fail to comply with these rules will be blacklisted and no longer be able to access the service. On the other hand, when the content that is blacklisted is an item, photo, or review, these contents will be simply removed from the platform.

4.2.2 Universal product code

Most of the retail items in this world have a unique barcode attached to it. Most UPC barcode comes with 13 digit numbers, while product with smaller packages contains only 8 digits. Using barcode ID as an identifier has some advantages and disadvantages. One of the major advantages of using barcode ID is that it is unique to a product, meaning that no other products would have the same barcode ID. Even the same product with different packages will have different barcode ID. For example, if a single canned soft drink of brand A has a barcode ID of "xxxxxxxxx1111", a bundle package containing a dozen cans of soft drink A may have a barcode ID of "xxxxxxxxx1212". However, the exact same soft drink A will have the same "xxxxxxxxx1111", no matter where they are sold. This makes it easier to organize the item into the database neatly. It also enables

the system to just use the barcode ID captured from the scanner "as is", there is no need to further manipulate the ID in order to store them into the database. Also, it enables a high degree of accuracy, as when a person finds a barcode of an item and tries to retrieve the data from it, assuming that the data is already available, the returned data can be ensured that it really comes from the exact same product, not other variants of the product. In other words, it can help to minimize human error in both storing and retrieving the data.

However, there are some weaknesses of using barcode ID as identifier. Barcodes are meant to identify every item sold in a store, so when they are scanned at the cashier, the name and price of the product can be retrieved. However, some products such as fresh groceries have different price according to the product's weight. Having different price means that they also carry different barcode IDs, even though the items are identical apart from that minor difference.

Other than storing and retrieving information, this barcode is used as the input data to create an item avatar. The first three digits of a UPC barcode contain the information about the country in which the product's manufacturer is registered on the GS1 member organization [12]. So there is no definite way to get the name of the country where the product was made just by using this code. The game system of the application uses this GS1 prefix as the item avatar's country of origin just for the entertainment value.

4.2.3 Web service

The proposed system requires a web service to enable communication between devices. We have decided to use web service with JSON response format. Putting transaction data on the remote server as much as possible will make it easier to expand the service to other platforms in the future. The program uses AFNetworking framework for Objective C for iOS to send HTTP Requests to the remote server.

Except for a few user settings, all of users' data are stored in the database. Important data such as reviews and social connection, until the trivial ones such as the read/unread statuses of messages are all handled externally. In the current system, all displays/views in the application are built using the UIKit framework for iOS. All messages that these views receive are all sent to the server for further

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processing. Data are stored in the remote server as much as possible to allow more flexibility for expansion in the future. This way, deploying the same service to other platforms would be less difficult, as only the user interface and user interface-related logic of the service need to be re-created, but all the user data is transferable without any discrepancy.

4.3. System Architecture

This subsection focuses on the system that has been developed for this research, and how each part fits into the system as a whole. The proposed system consists of the native application as the client and remote server (Figure 4.15) as the host. The native application also contains the social network environment, which was specifically built for this research.

4.3.1 Client-side application

The client-side application makes up the first half of the whole system (Figure 4.15). The whole native application is built using Objective C, incorporating outside framework and library such as AFNetworking and ZBar Barcode Reader. AFNetworking helps to send objects, such as strings and files, to the remote server. The function that was built using this framework will dispatch an HTTP request, which will be processed further by the PHP script on the remote server. Some user interactions that trigger multiple calls to the command will be dispatched sequentially, and each of the dispatched operation will be treated as independent transactions.

The above command will launch as an operation. When it has successfully carried out the operation, it will get back the data from the server in JSON format. First, the program will detect whether there is any error during the HTTP request or not. After the first error check is complete, the program will peel another layer of the JSON object, putting all the requested data to the variables inside the program. For array of objects, these objects will also be put in array before passing them to the user interface variables.

In order to minimize fraudulent users, the ZBar Barcode Reader's scope has been narrowed down to UPC barcodes, meaning that non-numerical barcode such
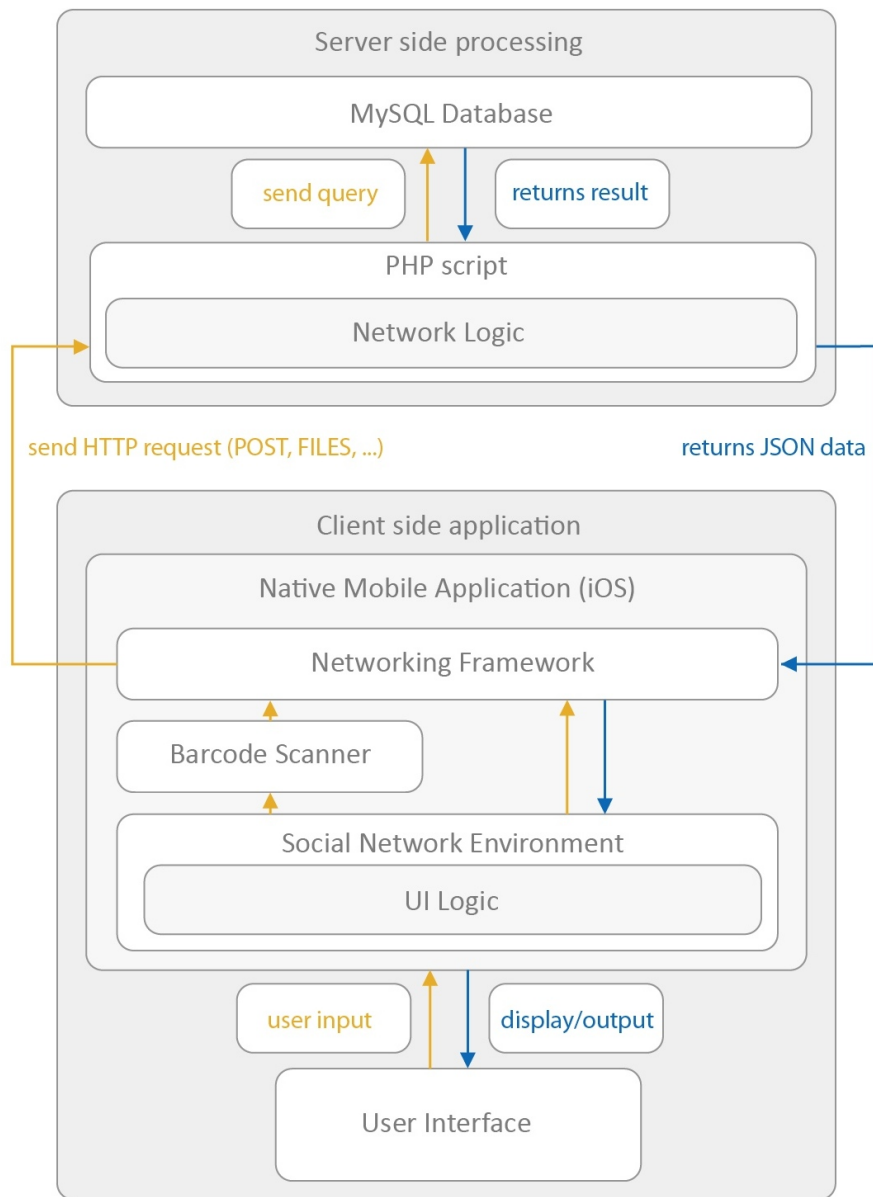
Figure 4.15: System architecture of SHOP BANZAI!

as QR code will be excluded from scanning. When the barcode ID has been successfully captured, it is usually used as a variable to send request to the remote server, whether to check information availability, review availability, etc.

Social network environment

The social network environment (Figure 4.16) makes up a major part of the developed native application. The system is built according to the model-view-controller (MVC) model. In this model, the controller receives user input that will manipulate the model, which will be updated in the view. However, in this case most of the logics are stored in the server to maintain portability.

In order to increase customer awareness, several functions have been developed to create new channels for users to gain information from various sources. Fundamentally, users are allowed to freely explore the network of items right from the start by navigating through the newsfeed. As they use the service, users are encouraged to make connections with other users and items. The connection with other users is equivalent to friend connection on regular social networks. By connecting with friends, users can follow their information and see what items they have purchased, reviews, and photos. The connecton with items works in a slightly different way. Instead of friend requests, item connections are established through review posting. After doing so, the reviewed item is automatically added to the user's item. This information will then be shared with the user's social circle.

The main concept about the social network is that we want to allow user to retrieve information through both active and passive means. Searching through these items and friends list is the one where they are actively involved and requires participation from the user. The other method is the one in which users can gain information through the recommendation, notifications, and newsfeed from friends. In these methods, the users do not have to be actively engaged necessarily as the information is supplied by the application. As explained in the previous section, they still have the flexibility to filter this information according to their preferences.
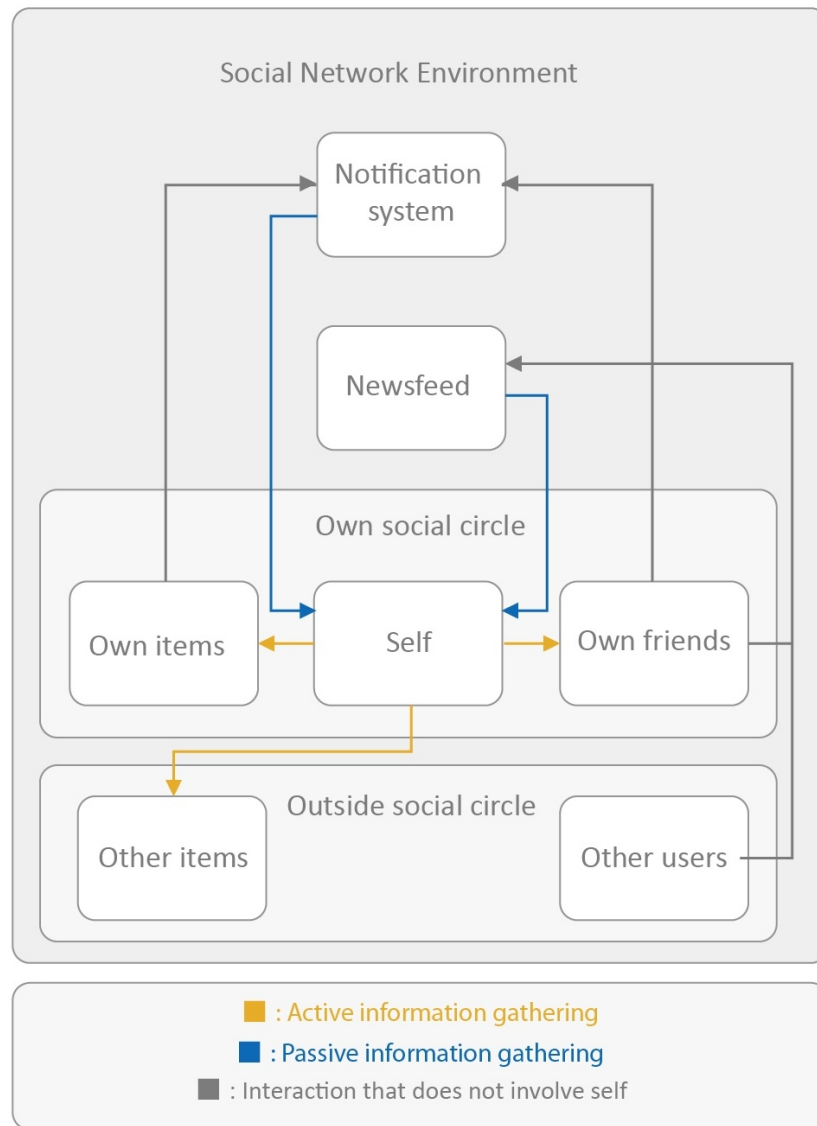
Figure 4.16: Social network environment of SHOP BANZAI!

4.3.2 Server-side processing

Server-side processing makes up the other half of the system. The remote server is the data backbone of the entire application, right from the user to activity log data that is used for content examintaion.

There are three PHP files used for the server-side processing. One file is responsible for the API, another one for libraries, and another one for handling of commands received from the native mobile applications. These PHP files work together harmoniously in communicating with the MySQL database. After sending queries successfully, the returned data will be encoded in JSON Format, which will be processed further by the client side application.

MySQL database for the proposed system contains 23 tables (Table 4.1), and each of them serves different purpose.

The tables that start with the word "access_" are used to log the access to respective items within the system. The "flag_" tables are used to log user's report for fraudulent contents in respective areas. The table "user" and "item" contains the data for all the users and items account in the social network, while "friend_connection" and "item_connection" are used to record the social network connection for the respective accounts. The latter also contains the data for item review of the user. "user_activity" table is used to log the time period of user activity as they open the app and stops as they closes them.

For the image storage, the server contains the following folders: User avatar image, item avatar image, and product photo. The first two are static in the sense that they do not grow according to user's activity and all contents were pre-set by the developer. In the system, more than one user may choose the same user avatar, but the database will only contain the pointer to this file image, so no extra storing of image would be necessary. The product photo folder is the only dynamic one of the three. Every time a user registers a new item and uploads an image of a product, two new images will be created and stored into the database. One image is used for thumbnail, and the other one for the full display. Each user is able to store one photo data for each item, but one item can have several submitted photos from different users. This also allows an environment for sharing photos in which users can see photos uploaded by other users through this platform.

Table name	Column
access_item	4
access_photo	4
access_recommendation	4
access_review	4
access_user	4
app_version	2
flagged_item	5
flagged_photo	5
flagged_review	5
flagged_user	5
friend_connection	6
in_app_purchase	4
item	13
item_connection	9
notification	7
photo	5
recommendation	5
recommendation_connection	5
recommendation_content	3
review_rating_connection	4
user	10
user_activity	4
user_confirmation	3

Table 4.1: Tables of SHOP BANZAI!

Chapter 5

Evaluation

In order to evaluate the platform, a usability test was conducted for a period of one week, followed by a content examination. This chapter is dedicated to explain the details and results of both tests. While there more than 40 users registered on the platform, 15 users have been specifically selected for the usability testing. During this period, users are free to use the system as much as they do in other social networking services. We created a simulation of people from different communities and social circles interacting by using this application as a platform for product information sharing.

5.1. Evaluation points

The usability testing main purpose was to evaluate the user friendliness of the platform. This test measures users activities and accesses to various items in the application. In terms of performance, this research is mainly interested in measuring the ability of the proposed platform in generating diverse product information and reviews in terms of category, existence, and acquisition time. In the area of category, the registered items on the database will be organized according to the category in order to make further data analysis. In the area of existence, the product information availability on major e-commerce platforms will be observed through the use of search engine. In the area of acquisition time, the proportion of already owned item would be compared recently purchased items to make further analysis.

5.2. Platform usability

The usability of the platform was estimated according to the activity of the users on the platform. This usability testing requires more people than normal as a lot of contents are needed to create a real life simulation of a social networking service. During one week period of the usability testing, all user activities on the platform are traced, such as their session time of overall app usage, item registration, and review-posting. Also, each access to major clickable content (social profiles, photos, reviews) within the application was closely traced.

5.2.1 User activity session statistics

The user activity session is measured by the amount of time spent on the platform. In order to be precise in the session measurement, a set of tracking code has been implemented.

The code (Figure 5.1) is written under the AppDelegate.m file, which contains all the functions that controls the state of the app. To be more specific, the code will be executed when the application is opened and closed by the user. Every recorded session will be logged to the database the next time the application return into active mode. This will help to understand the frequency of the app being used by the user in a daily basis, giving some insight on how it gives the motivation to the user to use the app frequently.

Traced data	Value (two decimal places)
Session count total	131
Session count daily average	18.71
Session count daily average (per user)	1.24
Maximum daily session count	47
Maximum daily session count (per user)	3.13
Minimum daily session count	6
Minimum daily session count (per user)	0.4

Table 5.1: Session count

The table (Table 5.1) indicated that users tend to use the application slightly more than once every day. During its peak, each user uses the application more

```
//records time when user quits the application
- (void)applicationDidEnterBackground:(UIApplication *)
application
{
    //...
    if([[API sharedInstance] isAuthorized]){
        //...
        self.activeTime=[NSString stringWithFormat:@"%02i:%02i:
        %02i",hours,minutes,seconds];
        self.pendingTimer=YES;
    }
}


//activates timer when user opens the application and send
last recorded time interval
- (void)applicationDidBecomeActive:(UIApplication *)application
{
    if([[API sharedInstance] isAuthorized]){
        if(self.pendingTimer){
         //... (sends last recorded time interval to remote
         server)
        }
        self.sessionTimer = [NSDate date];
    }
    //...
}
```

Figure 5.1: Code to track overall session time

than 3 times in a day, while during the lowest, the application was used 0.4 times in a day. This is telling us that not all of the users use the app on a daily basis.

Aside from the session count, the session length was also measured. Following the code (Figure 5.1) previously explained, the recorded time interval as the application opens and closes will be logged as the application returns from background state. This helps data will give an insight on how this application can engage the user to stay on the platform for an extended period of time.

Traced data	Time interval (in second)
Session length total	12468
Session length daily average	1781.14
Maximum session length	606
Minimum session length	0
Session length average	95.18
Session length mode	2
Session length median	43
Session length standard deviation	118.72

Table 5.2: Session length

According to the table (Table 5.2), the users' session time intervals on the platform sums up to roughly 1781 seconds per day, which is around half an hour. Every time a user opens the application they usually stay for around a minute and a half before they quit. However, this distribution is positively skewed, as there are quite a number of sessions that only contain 2 or even 0 seconds, meaning that the users open and close the app repeatedly for a short period of time. On the other end, there was a user who stayed around 10 minutes within the application.

5.2.2 Access statistics

A set of tracking code (Figure 5.2) are implemented to log the access of the users to certain content of the application.

The numbers of accesses to certain items within the application are measured to gain an insight about the user-friendliness of the platform. Other than that, it also shows certain traits of the content that attracts more accesses into it.

```
//executed every time a users or items profile is opened
-(void)refreshProfile
{
    //... (logs profile access to database)
}


//executed every time a photo thumbnail is tapped
-(void)reloadPhoto
{
   //... (logs photo access to database)
}


//executed every time review table cell is tapped
- (void)tableView:(UITableView *)tableView
didSelectRowAtIndexPath:(NSIndexPath *)indexPath
{
    //... (logs review access to database)
}
```

Figure 5.2: Code to log access to various objects

For other contents such as review text box, photo thumbnails, understanding the number of access also gives an insight whether the current placement of these content is effective enough to gain users' attention.

Traced data	Value (two decimal places)
Item profile access count daily average	51.71
Item photo access count daily average	6.14
Item review access count daily average	14.86
User profile access count daily average	12.14

Table 5.3: Access count to various objects within the application

From the table (Table 5.3), we can see that "Item profile", which is the central part of the application, is the most accessed item in the system. "User profiles", which is the second most important part of the social networks, are accessed around 12 times in a day. "Item photo" which can be accessed by tapping on the product image thumbnail of the item profile, gets around 6 accesses in a day.

5.2.3 Item registration session statistics

While the access count of the previous subsection gives an insight to the user-friendliness of the interface that involves data retrieval functions of the app, the session length for registering an item and posting a review deals with those that involve data submission. This subsection analyzes the time spent by users in registering item information. A set of code (Figure 5.3) to track the time interval has been implemented. There are 4 fields that users need to fill in before they can register the item information. These fields are item name (normal text field), category (action sheet pop-up), manufacturer name (text field combined with search bar), and photo (clickable button that will activate the phone's camera).

From the table (Table 5.4), it can be seen that registering an item through the platform normally takes around 1.5 minutes. This distribution is positively skewed as most registration processes took approximately 1 minute to finish. The longest time it took for a user to finish registering new item information is approximately 10 minutes, while the shortest took around 28 seconds to finish.

```
//starts timer when the view controller loads
- (void)viewDidLoad
{
    [super viewDidLoad];
    self.sessionTimer = [NSDate date];
//...
}


//stops timer when user submits data
- (void)alertView:(UIAlertView *)alertView clickedButtonAtIndex
:(NSInteger)buttonIndex
{
    if (buttonIndex==0) {
        //...
    }else{
        //...
        NSString *timeInterval=[NSString stringWithFormat:
            @"%02i:%02i:%02i,hours,minutes,second];
        //... (sends recorded time interval to remote server)
    }
}
```

Figure 5.3: Code to track session time for registering an item

Traced data (111 items)	Time interval (in second)
Maximum session length	369
Minimum session length	28
Session length average	90.36
Session length mode	64
Session length median	73
Session length standard deviation	54.18

Table 5.4: Item registration session length

5.2.4 Review posting session statistics

This section deals with the latter part of the data submission functionality of the application. Again, a set of code (Figure 5.4) to track the time interval has been implemented. There are 3 fields that users need to fill in before they can post an item review. These fields are item rating (star rating by slide gesture), location (normal text field), and review text (text view).

```
//starts timer when the view controller loads
- (void)viewDidLoad
{
    [super viewDidLoad];
    self.sessionTimer = [NSDate date];
//...
}


//stops timer when user submits data
-(IBAction)submitButtonTapped:(UIButton *)sender
{
//check existing review
    if(self.itemConnectionIdCache){
        //...
    }else{
        //...
        NSString *timeInterval=[NSString stringWithFormat:
        @"%02i:%02i:%02i", hours,minutes,second];
        //... (sends recorded time interval to remote server)
    }
}
```

Figure 5.4: Code to track session time for posting a review

From the table (Table 5.5), it can be seen that posting an item review through the platform normally takes around 48 seconds. This distribution is also positively skewed as most review-posting processes took approximately 30 seconds to finish.

Traced data (112 reviews)	Time interval (in second)
Maximum session length	263
Minimum session length	9
Session length average	47.85
Session length mode	29
Session length median	33
Session length standard deviation	41.86

Table 5.5: Review posting session length

The longest time it took for a user to post a review is around 3 minutes, while quickest time was 9 seconds.

5.3. Content examination

This is another major point of evaluation of the platform. As the main emphasis is the platform, all users registered in the network are taken into account in analyzing the data, unless narrowing down the scope would be necessary. In that case, the previously selected 15 users would be used as the sample for examination.

5.3.1 Content growth

Before the usability testing was started, there was already an amount of data that serves as the base (Figure 5.5). These data was accumulated throughout the prototyping phase until the latest development of the application around the span of four months. Therefore, the data shown in the graph (Figure 5.5) is the contribution of more than 15 users. In this subsection, the rate of growth of the item content of the application was traced each day.

From the table (Table 5.6), we can see that on average 15 new item profiles are registered every day throughout the usability testing. The growth reaches its peak in the middle of the testing. On its peak, the platform was able to gather 22 new product data in a day, while during its lowest period it gathered 8 data. A few days after the usability testing, the database ended up with 203 item data.

Even though the process of registering an item is automatically followed by re-
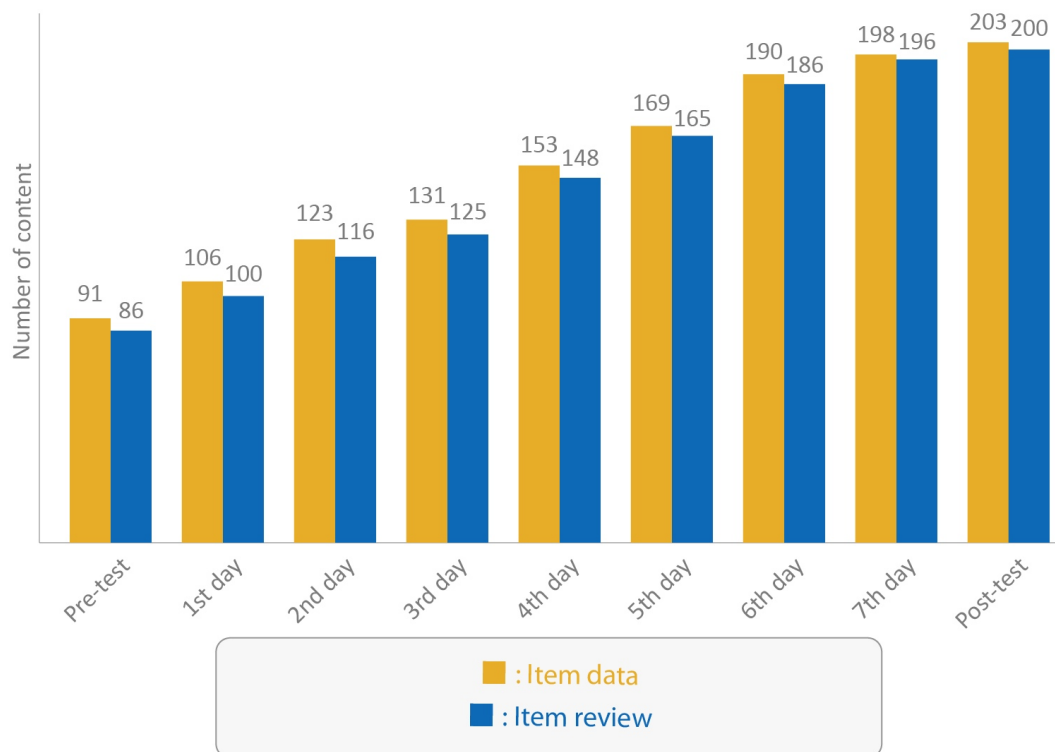
Figure 5.5: Content growth

Trace period	Number of items registered
Pre-test	91 (base)
First day (May 17th)	15
Second day (May 18th)	17
Third day (May 19th)	8
Fourth day (May 20th)	22
Fifth day (May 21st)	16
Sixth day (May 22nd)	21
Seventh day (May 23rd)	8
Post-test (May 24th-25th)	5

Table 5.6: Registered item data in trace period

view postings, there are cases whereby users fail to post a review for some reasons, creating some discrepancy in the number of item registered and reviews posted. Also, as one item may contain several reviews, this causes another difference in the amount of content in these two items.

Trace period	Number of reviews posted
Pre-test	86 (base)
First day (May 17th)	14
Second day (May 18th)	16
Third day (May 19th)	9
Fourth day (May 20th)	23
Fifth day (May 21st)	17
Sixth day (May 22nd)	21
Seventh day (May 23rd)	10
Post-test (May 24th-25th)	4

Table 5.7: Posted item review in trace period

From the table (Table 5.7), we can see that on average 16 new item reviews are submitted every day throughout the usability testing. Similar to the item data counterpart, the item review growth reaches its peak in the middle of the testing. On its peak, the platform was able to gather 23 item reviews, while during its lowest period it gathered 9 reviews. As the time of evaluation, the database has 200 item reviews.

5.3.2 Item category distribution

In order to be able to understand the kind of items that the user gravitate towards in uploading item information, a category for each item has been established. After the usability testing has ended, the database ended up with 203 items. In this subsection, the amount of items in each category is shown.

Looking at the table (Table 5.8), we can see that most uploaded items belong to the food & beverages category. While the distribution gravitate towards these items, the rest of the categories have roughly equal amount of items. Health and beauty took the second place for the most uploaded item on the platforms.

Item category	Quantity (out of 203 items)
Food & Beverage	120
Health & Beauty	43
Fashion	0
Books	10
Entertainment (DVD, game)	4
Electronics	3
Office	5
Home	9
Toys	5
Sports	0
DIY	0
Others	4

Table 5.8: Category distribution

However, there are some categories in which the items are still non-existent in the platform, which include fashion, sports, and DIY.

5.3.3 Item acquisition time

The last thing that was observed to determine the performance of the platform is the acquisition time of the items that were uploaded on the platform. The test was mainly interested in finding out the proportion of recently purchased/owned item and already purchased/owned items. In this context, "newly purchased items" include the items that were purchased in less than a week, counting backwards from the date of upload. "Already owned item" include the items that were purchased prior to that. This subsection narrows down the scope of observation to the previously selected 15 users, as the focus is the propensity of each individual to upload an item they already own or recently purchased.

The result of the usability testing (Figure 5.6) shows that on average, users post 45.52% recently purchased items and 54.48% already owned items. There is a slight higher tendency for people to create a word of mouth about the items that they already own. Depending on the users' behavior and preference in sharing

Recently purchased items (%)	Already owned items (%)
50	50
50	50
10	90
80	20
0	100
20	80
64	36
68.75	31.25
15	85
60	40
100	0
50	50
30	70
15	85
70	30

Table 5.9: Proportion of recently purchased items and already owned items

Figure 5.6: Overall comparison of recently purchased items and already owned items

information, the proportion may differ greatly, as some users share 100% new items or the opposite (Table 5.9).

5.3.4 Item data existence

One very important thing that this platform is trying to achieve is the creation of information that currently does not exist on the web. While it may seem that the Internet are not lacking any information surrounding retail products, there are significant amount of items that actually do not have any reviews yet. In this test, 20 random samples were taken from 203 registered items on the database using random number generator. Then, the barcode is used to look up for the item's information existence on the web using Google search engine.

For item reviews, two experiments were conducted. First, we look for the item reviews from search result of the previous table. To treat all samples equally, search for reviews is only done on the websites that appear on first page of the Google search result. Even though there is still a slim chance that a review might be found on the second page or after, we assume that those reviews are too hard to find for users who needs that information quickly.

Knowing that the connections between item name and barcode ID are not always readily established, a second search for product reviews was carried out. This time, the search was done using the item name as the keyword, and the review availability was checked on Rakuten [21] and Amazon [1], as they are the two e-commerce giants in Japan. The amount of reviews in these two websites are summed up to create the review count total listed on the table (Table 5.11).

Compared to searching using ordinary keyword (Table 5.11), which normally yields millions of search results, searching for product information using barcode ID yields limited results (Table 5.10). For the extreme example, the chicken mayonnaise onigiri from the table above could not be found using Google search.

Searching for product reviews using barcode ID yields no result at all most of the time. Looking from the table (Table 5.10), only 20% of the items have a review related to the barcode. People will have better chances using keywords to look up for reviews instead. From the result of the item name search test (Table 5.11), around 45% of the items' review could be found by using the item name for search on e-commerce platforms. Nevertheless, only around half of these items

Barcode ID	Search engine results	Reviews found
4901326040045	1250	0
4902210548999	131	0
4902102106139	9	0
4906064104653	5	0
4904131636731	36	0
4571266354313	7	0
4901360309870	950	0
4511413403648	2310	0
4958764102910	3	0
4903110084235	2	1
8993410111034	7	1
4953103895508	1070	0
4901515349836	3	0
4901777246270	143	0
4901777018686	1650	0
9784757419100	605	0
2312467926532	0	0
4901301023247	1340	11
4901002887032	919	3
8999999197049	155	0

Table 5.10: Data availability check using barcode ID

Barcode ID	Item name	Reviews found
4901326040045	メロングミ	0
4902210548999	豆乳カフェ	2
4902102106139	ドクターペッパー	11
4906064104653	Minions set	0
4904131636731	日本食研やきとりのたれ	0
4571266354313	スチームクリーム	3
4901360309870	アルフォートミニチョコレート抹茶	0
4511413403648	DHCの健康食品 DHA	25
4958764102910	レッド グローブ	0
4903110084235	クロワッサン	0
8993410111034	Sambal Pohon Cabe	0
4953103895508	液晶用	19
4901515349836	Spicy teriyaki	0
4901777246270	ボス シルキーブラックホット	1
4901777018686	天然水	614
9784757419100	N2 drill book	0
2312467926532	シーチキン マヨネーズ	0
4901301023247	スムーザー 花王	13
4901002887032	本わさび	6
8999999197049	Blue band	0

Table 5.11: Data availability check using item name

with reviews have more than 5 reviews, which tells us that the amount of content itself is still very lacking.

5.4. Discussion

5.4.1 Platform usability

From the result of the usability testing, we can infer the user-friendliness of the platform. As this system runs as a native mobile application, it is slightly trickier to track users' sessions as a whole. This was shown by the positively skewed distribution of the sessions, in which there are numerous sessions lasting for 2 seconds or less. These short sessions are more of an "incomplete session", in which users quit the application in the middle of using. As the program stops the timer in the process, the session that was supposed to be measured as a whole became fragmented. The session length average would be a better representative of the user's "full session", meaning it measures the full time of the user opening the application and closing it after he completed his objective (perhaps after posting a review). Looking at the session count, the result shows that on average each users use the application slightly more than once per day, meaning that the application has a moderate ability to attract the users to use the app repeatedly.

As for the access count, the distribution of access to each of the examined items was as intended by the developer. As "Item profiles" serve as the main highlight of the service, the high number of access to this item is considered favorable. The number of accesses to the rest of the items, while comparatively lower, has shown that users on the platform access them on a regular basis. Item photo gets the lowest access, as its function was only to zoom in a thumbnail that was already visible to the users. We can say that the platform in overall has been successful in directing the users to the intended part of the application.

One of the vital functions of the application is the data submission, namely the item registration and review posting. While on average it took around 1.5 minutes for users to upload an item data, most users were able to complete it in around a minute. These data have shown that registering items were done relatively fast, as there are 4 items that users need to complete and each works

differently. After submission, this item will be neatly organized by the system according to the submitted data. On the other hand, review posting took shorter time as expected, as there are only 3 items that users need to complete. While the time that it takes to post a review depends on the length and type of review written, the average length of 47.85 seconds are relatively short to complete the whole session. We can conclude that the data submission functions of the app are user friendly in general.

5.4.2 Content examination

The platform started with 91 item data and 86 reviews before the day of user testing, and during the period of one week the amount increased by more than double. During testing, people from different social circles were gathered together to interact through the platform. Part of the rapid growth of content can be attributed to the social interaction that happens through sharing items. Even though the growth of the item reviews slightly differ compared to item data in terms of quantity, they follow the same trend.

The check on category distribution has shown the proposed system's ability in gathering products of various categories to a certain extent. However, there are some categories of items that the platform failed to capture, namely fashion, sports, and DIY products. After seeing this trend, we could conclude the reason behind the absence of these categories is because barcodes rarely present in these items. While for new items barcode maybe attached to the product label or package, many users upload the information about the item that they already own. This makes it impossible to upload the information for the items without barcode. In the future, the necessity of these categories on the platform will be reconsidered. As has been stated in the earlier chapters, the proposed platform were designed to reflect the life of the users, thus a lot of the uploaded contents are expected to gravitate towards consumable goods, such as foods, beauty products, etc. As predicted, the consumable goods uploaded on the platform (food & beverage, beauty, and office products) gained the most popularity, occupying around 80% of the total items. Food and beverage ranks the top among the consumable goods, much like in people's real life, they are the products that people buy most often. The fact that they can upload the foods and drinks that they purchase on the go

also contributes to the growth.

The examination that was done on the acquisition time of the items uploaded by users has shown that there is a slightly higher propensity for users to upload the items that they already own. As the basic foundation of the platform is social networking service, users are encouraged to upload the information of the item around them. Thus, this removes the strong tendency of people only posting reviews after they make a purchase like in other existing services. The first benefit of having a bigger share of already owned item shared over the network is that it allows the creation of information of items that may not exist on local e-commerce platforms and review sharing sites. For example, there was a user who uploaded information of an Indonesian chili sauce bottle that cannot be normally found in Japan. While searching for this product in Japanese e-commerce sites will not yield any result about it, this platform allows any user to do so. In a sense, this platform is not limited by national boundaries, and can help to raise awareness about such products to the users. The second benefit would be that it allows people to understand other people better by looking at the items that they own, or the items that they choose to share.

The check for item existence has shown that most of the items uploaded on the platform has limited amount of content on the web at best. The search engine test has explained why most item information sharing service that use barcode hardly works; most items' relationship with the barcode is not yet established on the review sharing sites. For example, a can of softdrink A has barcode of "xxxxxxxxx1111", but using "xxxxxxxxx1111" as they keyword for search may not return the page with the review that the user is looking for. This applies to most of the sample items of this test. Even doing a manual search using the product name itself on major e-commerce platforms does not yield that many results most of the time, showing us that the amount of product reviews is insufficient.

To further complicate the problem, even though an e-commerce site may contain the product what the user is looking for, most food & beverage products on e-commerce are sold in a bundle. For example, an e-commerce site sells softdrink A in a package of a dozen cans. As those packages comes with different barcode, it is impossible to use a single can's barcode ID to get the information about the product that comes with the package on the site. This has been tested for

Dr. Pepper softdrink can as one of the 20 samples taken for this test. This has shown that proposed platform has enabled the users to target specific products precisely in retrieving and uploading contents. The majority of reviews that the platform has gathered do not exist for the same item on the web for the previously explained reasons. Looking at the result, we can say that the platform has been generally successful in generating and organizing both currently non-existent and inefficiently stored data.

5.5. Contribution

Through this research, we have shown the ability of the platform in generating word-of-mouth that hardly exist on the web, both in the form of item data and reviews. Currently, the word-of-mouth that can be found in regular social networks are not well-organized. While some posts contains both elements, many of them only have either one of them. On top of that, if multiple users talk about the same item in different threads, these posts cannot be combined into one as they do not have a unifying attribute. On the other hand, review sharing sites are able to organize item data pretty well. However, they do not provide the flexibility for the users to register information easily. Many of them still fall into the trap of not having enough incentive to motivate the users to upload more contents. The result of this research has an important implication, as in the proposed system all item data are organized neatly according to their barcode ID. When a user scan an item's barcode, users can rest assured that the retrieved data is about the exact same item. In other words, the amount of inaccuracies can be minimized in storing and retrieving data as the same products have the same ID. Also, this system provides the flexibility for users to upload any item information that they have, so they are not restricted by the items that are registered on the platform. In this research, we have successfully created a unique product information sharing platform by combining the advantages of both system in the world of word-of-mouth advertising.

Being able to generate item information that is not normally found in normal social networks also brings another benefit. Many businesses are trying to understand their customers by looking at their purchase history. However, it has been

shown in this research that "already owned products" make up a huge part of their item collection. Thus, by having an access to these whole new area, businesses would be able to analyze this data further to gain additional insights to understand consumer trend to a greater extent. In the future, these data can be used to create a new recommendation system for consumers. Of course, when such data mining system is implemented, user consent needs to be confirmed beforehand to avoid privacy concerns.

The fact that the system runs as an independent service allows it to gain the neutral position. The items that are displayed in e-commerce sites are platform dependent, meaning that there is a limitation to the kinds of product that the platform may carry. While other neutral platform like Kakaku [17] carries diverse products, there are still a lot of products that do not have any reviews. As the proposed system puts review posting function as an integral part of the item registration process, the growth rate of item data and review will most likely to go hand in hand. This way, we are opening up a new potential for such platform to accumulate word-of-mouth content. Other than word-of-mouth accumulation capability, the main purpose of both platforms are different. While Kakaku [17] focuses on price comparison, but the proposed platform focuses on increasing consumer awareness, which is still an unexplored area in product-related word-of-mouth sharing services. By increasing awareness, it would help to ease the entry of new products into the market.

Chapter 6

Future works

The implementation of the proposed system for sharing product information has been shown to be able to generate product information that hardly exists on the web. This kind of service would be helpful in providing the currently non-existent information and raising consumer awareness. However, there are still some parts of the service that we believe can be improved further. We are also planning to implement new features in the future to make this service more interactive and informative for the users.

6.1. Content adjustment

From the result of the usability testing, we noticed a few things about the application that should be considered for adjustment. In order to make it more sharing friendly, the placement for photo upload frame should be placed on the review page instead of the item registration page. Putting it on the item registration page makes it a little bit harder and counterintuitive for users to upload and share their photos. The current system gives the impression that once an item has been registered to the database by a user, the next user would have to use the previous user's photo when posting a review. By putting it on the review page, everytime a user post a review they can upload their own photos, and this will help to create a bigger library for photo sharing.

The content examination has also highlighted several weaknesses of the current system. As mentioned in the previous chapter, there are some categories of

products that the system failed to capture. However, rather than removing them away, we have decided to keep them, just in case users who happen to have the barcode try to upload them in the future. One thing that we could do for now is to move the less used categories to the bottom of the categories list, to make the action sheet slightly quicker and easier to use.

There is also a problem of item packaging, in which items that are exactly the same but comes in different quantities. Right now, the only way for the app to organize this information is through the manufacturer's name. However, this kind of categorization indiscriminate towards the brand. So, right now the app is only able to show the item within a manufacturer's range of products. It would be good if the categorization can be made more specific, for example, products within the same brand. This can be done by adding one more attribute to fill in during the item registration, which is item brand.

In the current system, users need to input the location of purchase when they want to upload an item review. However, after examining the content submitted by the users, there are a lot of inconsistencies in the way they input the location name. As there is no guide given by the application, some users input the name of a convenience store, while others input the name of an e-commerce store, while others a country name. Looking at this, we conclude that the presence of the location field does not affect the user experience that much. We also realized that not all of the items shared were purchased by the users, some of them are given from other people, making it difficult to input the location of purchase in this page. Therefore, we are thinking of removing this location field altogether in future updates.

6.2. Feature updates

Other than adjusting the content of the application, we are planning to implement new features that are not present in the current system. As the current system runs as a private social network, opening it up to the public would be a good idea to attarct new users to use the system. One way of doing this is, instead of forcing new users to login or signup during their first use of the app, they can take a tour around the content of the app and use the data retrieval functions for

their personal use. Only when they want to make a data submission (registering an item and posting a review) creating a new account would be necessary.

The game that was implemented in the system may have created some confusion to the users. In fact, some users mistook the presence of the "item avatars" as other users' accounts. In order to solve this problem, we need to implement a guide system to introduce the game system to the users during their first use of the application. As the service runs as a combination of social network and a game system, it is important to give a clear explanation about the concept of item personifications that was built into the app.

Currently, the avatars are chosen based on the barcode ID of the item, therefore there is no way of generating the avatar based on the item's attribute, for example category, color, etc. If a correlation can be made between item avatars and the item's attribute, it would improve the user experience and may reduce the confusion surrounding the game concept.

We are also thinking of a way to make the recommendation system of the app more appealing to use. For example, a user can get a notification after his friend post a review of an item recommended by him. This shows that the user was successful in persuading his friend to buy something. Following that, the recommending user may accumulate points from the successful recommendations. Also, creating some leaderboards to rank users' performance by using the "heart" points would give the users a sense of achievement if they can reach higher ranks. To make the item profiles more interactive, items that have been added to a user's items list will post a notification to the user once they get a new reviews from other users. This way, users are able to follow the item's updates.

6.3. Business model

In order to bring the proposed platform beyond research, we have come up with a few possibilities for the business model. The appeal of this platform in providing the currently non-existent information and accumulate consumers' attention would serve as the base in realizing a "freemium" business model. Following the nature of smartphone applications, a major part of the revenue can be gathered through in-app purchases. The application is free of charge for the initial download

in order to gather as many users as possible. However, the more advanced features of the application would only be usable if the user purchase and download them through the in-app purchases. For example, user and item profiles only display the recent 10 reviews by default. By upgrading the features, users can retrieve more information beyond these 10 reviews, and also filter them according to their preferences. In the current system, users start with the 15 default user avatars that can be used for their profile display. In order to download additional avatars, users would be have to purchase them as another part of the in-app purchases. A part of this revenue will be used for the system and content maintenance.

Even though the application runs as a platform independent service, this does not mean that a third party can not be involved in the process. The game system as one of the major incentive creation elements of this platform, can be used as a channel for businesses to advertise their products. At the moment, item avatars are randomly distributed without any particular assignment system. By partnering with businesses, rarer avatars can be assigned to specific items to direct consumer attention towards these items. The game system can be expanded to include a scavenger hunt environment that can complement the avatar discovery system. For example, by doing certain quests, users would be able to locate the presence of rare avatars and have additional incentives to buy a product. Collecting item avatars and comparing them with their friends would also give the users a sense of achievement. By assigning new avatars on a regular basis, users would be encouraged to repeatedly purchase newer products.

Chapter 7

Conclusion

Through this research, we have been able to analyze the current problem in the area of electronic word-of-mouth, propose a system to solve it, and evaluate the performance of the developed system. We set the scope of the research by focusing in the problem of distribution in the area of word-of-mouth. The distribution of word-of-mouth content on most e-commerce platforms and word-of-mouth sharing services tend to converge on popular items, leaving the less popular ones with little amount of content.

The problem distribution does not only apply to popular or unpopular items, but also to items in certain categories, especially foods & beverages. As many of these items are goods that people consume on regular basis, people have more tendency to buy them on physical stores as compared to e-commerce platforms. The consequence of such behavior is that there are fewer chances for these items to accumulate enough word of mouth content on the web that would be useful enough as an information reference and for increasing consumer awareness. Aside from that, there is not much incentive provided to share content beyond the traditional economic deals, self-expression, etc. A new tool that would be able to generate an incentive to upload user-generated content would be necessary in boosting the growth.

In this research, a word-of-mouth sharing system that incorporates game system and community building features was proposed. The game system creates the concept of discovering "item avatars" in retail items in giving the users the extra motivation to upload more information. The community building aspect of the

application would also encourage more content contribution as it enables users to follow one another's activities. The application was also designed in such a way that uploading and retrieving information would take a very short time. Unlike other platform for sharing product-related information, the proposed system uses social network as the basic foundation, and it fundamentally changes the way in which it operates. This system was designed so that users are also compelled to share the items that they already own, not just the ones that they recently purchased. This would help to expand the context of word-of-mouth and diversify the content of the system.

The proposed system was realized in the form of native application for iOS, titled "SHOP BANZAI!". The application had been developed through the period of one year since April 2013. As of the time when the usability testing was conducted, the application runs as a full service. The client side application consists of the following layers from bottom to top order: social network, game, user interface, and security. The social network layer manages the social network accounts within the system, which mainly consists of user and item profiles. The game layer creates an abstraction of the social network layer, hiding certain information to give the user curiosity to find out about them. The user interface layer displays the 5 main menus of the application that the user can navigate. The main function of the application is to upload content such as item information and review to the platform through barcode scanner. The security layer implements some measures, such as user authentication and content flagging. This is to ensure that there will be no fraudulent content within the system. From the design concept of this application, we have come up with hypotheses that we would be testing during the evaluation.

The whole system architecture consists of the client side application and server side processing. The client side application mainly contains the previously mentioned social network environment, and also a few libraries and frameworks for barcode scanning function and network communication part of the app. The social networking environment of the client side app was designed to allow users to gain access to information in several ways. Users are able to gather passive information through the newsfeed and referrals from friends. In addition, they can engage in active search by using the search engine and barcode scanner func-

tion in the app. The remote server handles these objects passed from the native application and returns the query result in JSON format.

For the evaluation of the system, we conducted a usability test for a period of one week starting from May 17, 2014. During this usability testing, 15 people from various social circles were gathered and asked to use the system. The usability testing has shown that users did not have any trouble in using the upload information and review function, which is unique to this application. In general, the application has a moderate ability to attract users to keep using the app. This was shown from the data that on average users use the app a little bit more than 1 time per day.

Through the period of one week, the number of contents within the application has more than doubled. The middle period of user testing was the time in which the growth of the content reached its peak. The content examination of the platform has shown that food & beverages and beauty products are the most shared information, and both of them fall into the category of consumable goods, which this research is particularly interested in. In addition, the system was able to gather item information of various categories to a certain extent, as there have is a substantial amount of data in most of the categories. The diversity of items in terms of acquisition time was also examined. The platform was able to gather a slightly higher proportion of already owned items on the platform. This also gave us an insight that the platform was able to encourage users to express themselves through this application, allowing them to interact with one another using this information. After doing another separate examination through sampling 20 items out of the 203 registered items in the database, it has been shown that more than half of the products uploaded on the platform have no more than 5 reviews on the web even after doing a keyword search. The barcode search test result was even worse, only 20% of them can be found on the web.

Moving forward, we are planning to do some content adjustment to the app and preparing another update in the near future. There are some features that we think plays a little significance to the user experience, which is the location field of the review-posting page. Taking the categorization capability to the next level, an additional attribute, namely the item brand, will be added to enable more rigid categorization of items. Additional features, such as recommendation

confirmation, image recognition, will be considered for future updates to make the application more interactive for the users. In order to increase reach, we are trying to enable the public view version of the app so that unregistered users can also make use of the app's function. Only when they want to contribute data, they will have to create a new account.

The Internet is not yet a perfect tool for product information sharing as there are some inefficiencies in the way how data is stored. However, being able to generate new information that hardly exists on the web brings us one step close towards realizing a more user friendly Internet. As the web is ever evolving, we believe that the day will come when information is accessible to anyone at a greater scale, both in terms of quantity and reach. Taking this into consideration, we believe that this research provides a stepping stone in moving towards that future.

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Appendix

This appendix is dedicated to elaborate the tables and codes that are explained explained throughout this thesis in more detail. The first section gives a brief explanation about the version history of SHOP BANZAI! application.

A. App version
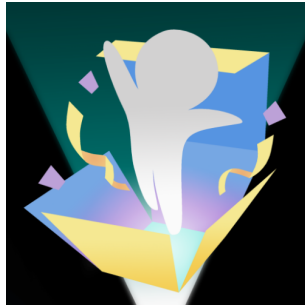
Figure 7.1: SHOP BANZAI! icon

The application was first released (v1.0) on the App Store on January 9, 2014. The version that was used for the usability testing was SHOP BANZAI!2.2. The latest version of the app (v2.3) was released on May 27, 2014.

B. Database table structures

The server that provides the data backend for SHOP BANZAI! contains 23 tables. In this section, these tables are grouped according to their primary functions.

user	type
id_user	int(11)
username	varchar(45)
password	varchar(100)
email	varchar(250)
id_user_avatar_image	varchar(10)
user_avatar_name	varchar(45)
country	varchar(100)
active	varchar(1)
join_date	datetime
blacklist	varchar(1)

friend_connection	type
id_friend_connection	int(11)
id_user1	int(11)
id_user2	int(11)
status	varchar(1)
time	timestamp
read	varchar(1)

user_activity	type
id_user_activity	int(11)
id_user	int(11)
active_date	timestamp
active_time_interval	time

user_confirmation	type
id_user_confirmation	int(11)
id_user	int(11)
passcode	varchar(128)

Table 7.1: User management tables

item	type
id_item	int(11)
id_barcode	varchar(13)
id_item_avatar_image	varchar(10)
item_avatar_name	varchar(100)
product_name	varchar(100)
country_of_manufacture	varchar(100)
first_scan_date	timestamp
category	varchar(45)
manufacturer	varchar(45)
id_finder	int(11)
id_last_editor	int(11)
blacklist	varchar(1)
registration_time_interval	time

item_connection	type
id_item_connection	int(11)
id_user	int(11)
id_barcode	varchar(13)
purchase_date	timestamp
purchase_location	varchar(100)
product_rating	int(10)
product_review	varchar(255)
visible	varchar(1)
posting_time_interval	time

Table 7.2: Item management tables

access_item	type
id_access_item	int(11)
id_barcode	varchar(13)
id_user	int(11)
time	timestamp

access_photo	type
id_access_photo	int(11)
id_photo	int(11)
id_user	int(11)
time	timestamp

access_recommendation	type
id_access_recommendation	int(11)
id_recommendation	int(11)
id_user	int(11)
time	timestamp

access_review	type
id_access_review	int(11)
id_item_connection	int(11)
id_user	int(11)
time	timestamp

access_user	type
id_access_user	int(11)
id_user2	int(11)
id_user	int(11)
time	timestamp

Table 7.3: Access log tables

flagged_item	type
id_flagged_item	int(11)
id_barcode	varchar(13)
id_reporter	int(11)
report	int(11)
time	timestamp

flagged_photo	type
id_flagged_photo	int(11)
id_photo	int(11)
id_reporter	int(11)
report	int(11)
time	timestamp

flagged_review	type
id_flagged_review	int(11)
id_item_connection	int(11)
id_reporter	int(11)
report	int(11)
time	timestamp

flagged_user	type
id_flagged_user	int(11)
id_user	int(11)
id_reporter	int(11)
report	int(11)
time	timestamp

Table 7.4: Flagged content tables

recommendation	type
id_recommendation	int(11)
id_user	int(11)
message	varchar(255)
time	timestamp
visible	varchar(1)

recommendation_connection	type
id_recommendation_connection	int(11)
id_recommendation	int(11)
id_user2	int(11)
read	varchar(1)
visible	varchar(1)

recommendation_content	type
id_recommendation_connection	int(11)
id_recommendation	int(11)
id_barcode	varchar(13)

Table 7.5: Recommendation system tables

app_version	type
id_app_version	int(11)
version	varchar(13)

in_app_purchase	type
id_in_app_purchase	int(11)
in_app_purchase_name	varchar(100)
in_app_purchase_product_id	varchar(100)
explanation	varchar(255)

Table 7.6: App management tables

photo	type
id_photo	int(11)
id_barcode	varchar(13)
id_user	int(11)
time	timestamp
blacklist	varchar(1)

notification	type
id_notification	int(11)
id_notifier	int(11)
id_recipient	int(11)
type	varchar(1)
id_barcode	varchar(13)
time	timestamp
read	varchar(1)

review_rating_connection	type
id_review_rating_connection	int(11)
id_item_connection	int(11)
id_user	int(11)
enabled	varchar(1)

Table 7.7: Other tables

C. Native application codes

In this section, some of the codes that are used to manage the user interface-related logic of the native app are elaborated. For user profiles (Figure 7.2), three HTTP requests are dispatched every time the profile is accessed. For item profiles (Figure 7.3), four calls are made.

```
//executed every time a user profile is opened
-(void)refreshProfile {
    //retrieve user's basic info
    [[API sharedInstance] commandWithParams:
    [NSMutableDictionary dictionaryWithObjectsAndKeys:
                        @"displayusersstatus",@"command",
                        //... (other parameters)]
        onCompletion:^(NSDictionary *json) {
                        //... (displays basic info on UI)}];
    //retrieve user's contributed reviews
    [[API sharedInstance] commandWithParams:
    [NSMutableDictionary dictionaryWithObjectsAndKeys:
                        @"displayusersreview",@"command",
                        //... (other parameters)]
        onCompletion:^(NSDictionary *json) {
                        //... (displays reviews info on UI)}];
    //logs access
    [[API sharedInstance] commandWithParams:
    [NSMutableDictionary dictionaryWithObjectsAndKeys:
                        @"useraccesscount",@"command",
                        //... (other parameters)]
        onCompletion:^(NSDictionary *json) {
                        //... (returns nothing)}];
}
```

Figure 7.2: Code to retrieve user account information

```
//executed every time an item profile is opened
-(void)refreshProfile {
    //retrieve item's basic info
    [[API sharedInstance] commandWithParams:
    [NSMutableDictionary dictionaryWithObjectsAndKeys:
                        @"displayitemsstatus",@"command",
                        //... (other parameters)]
        onCompletion:^(NSDictionary *json) {
                        //... (displays basic info on UI)}];
    //retrieve item photo info
    [[API sharedInstance] commandWithParams:
    [NSMutableDictionary dictionaryWithObjectsAndKeys:
                        @"displayphotosubmitterdata",@"command",
                        //... (other parameters)]
        onCompletion:^(NSDictionary *json) {
                        //... (displays photo info on UI)}];
    //retrieve item reviews
    [[API sharedInstance] commandWithParams:
    [NSMutableDictionary dictionaryWithObjectsAndKeys:
                        @"displayitemsreview",@"command",
                        //... (other parameters)]
        onCompletion:^(NSDictionary *json) {
                        //... (displays reviews info on UI)}];
    //logs access
    [[API sharedInstance] commandWithParams:
    [NSMutableDictionary dictionaryWithObjectsAndKeys:
                        @"itemaccesscount",@"command",
                        //... (other parameters)]
        onCompletion:^(NSDictionary *json) {
                        //... (returns nothing)}];
}
```

Figure 7.3: Code to retrieve item account information