

# A Knowledge Management-extended Gamified Customer Relationship Management System

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**Abstract** – The growth of Smart Cities often depends on global trends, human capital, foreign investments and partnerships, as well as citizen participation. With these drivers in mind, we focus on the question of how to attract and maintain customers first through a Gamified Customer Relationship Management System and subsequently, its enhancement via a Knowledge Management approach. The design of the gamified customer relationship management system and subsequently, its extension via a Knowledge Management approach are presented along with simple text mining on data from the Website's forum. Findings towards user acceptance and user satisfaction are positive and directly lends towards possible Big Data and possibly, IoT applications in the future.

**Keywords** – Smart Cities, Gamified Customer Relationship Management System, Knowledge management, text mining, applications to analytics, IoT

## I. INTRODUCTION

Smart Cities are usually known for connecting multiple information and communication technologies, Big Data and Internet of Things solutions in a secure fashion to manage a city's resources. The city's resources can include local departments' information systems, schools, libraries, transportation systems, hospitals, power plants, water supply networks, waste management, law enforcement, and other community services [1].

However, to be successful, a Smart City needs to focus more on what the city and citizens actually need. This creates one of the best opportunities to change the lifestyle, and quality of life for everyone in the city. Many countries such as US, UK, China, India, Singapore, Japan and Korea have started Smart Cities. They seek to understand what their citizens need and thus have created a reasonably positive level of sharing. Most cities face the challenges of

utilizing these to create good healthcare, a balanced lifestyle and alleviate traffic congestion by integrating IoT (Internet of Things) and ICT (Information and Communication Technology). Following suit, Malaysia has started Smart City projects, in Cyberjaya and also Nusajaya, Johor [2].

According to Dr. Mazlan Abbas, CEO of REDtone IoT, the most important solutions to making the Smart City better is not making more revenue but providing better services to the citizens [3]. Hence, building good communication and citizen-driven participation/ services is important. Consequently, needs analysis/user requirements, information systems and analytics are important factors.

### A. Problem

To communicate, we need to first understand perceptions towards Smart Cities. There are many perceptions towards Smart Cities. Everyone sees it differently. It's actually what and how we want it to become. So, what can be done to improve Malaysians' quality of life in general and e-commerce particularly?

### B. Objective

We present a case study on a gamified customer relationship management system, J&J Service Centre, transformed by a knowledge management approach, alpha-beta user testing findings and basic analyses using simple text mining to identify main interests for future work.

Though our sample size is small, we hope that these findings would contribute to the larger initiatives and encourage more participatory and collective

responsibilities to build a better future together with other countries.

## II. RELATED WORK

### A. Customer relationship management system (CRM)

The most common CRM features are customer data, contact management, marketing/sales, service/call center and analysis [4]. Beyond these features, additional modules are added to suit different customers' needs. Examples are Pipedrive, Zoho CRM [5] and [6].

### B. Gamified customer relationship management system (CRM)

Gamification is a concept that brings game design or mechanics into non-game contexts to make it more attractive and interesting but it is not considered as a game [7]. In terms of e-commerce, Groupon, eBay and Zalora allow users to buy and sell their products online. How do these websites try to attract users and maintain them, and attract more and more users to visit the websites?

The Nike+ Running App system allows people to track, share and compare exercise results while earning "fuel points". NikeFuel is a metric that helps you get active and stay motivated. It measures the ways you are active in a day, making it easy to see trends across activities, over time and in comparison, to friends [8]. There is also a leaderboard for different time frames such as weekly and monthly. Users can display their info on the leaderboard and show to other people.

In 2007, the number of Nike+ membership is 500k people. The following year in 2009, the number of memberships increased to 1.3 million. In 2011, it reached 5 million. In 2013, the number of membership jumped to 11 million. According to the result, the Nike+ community earns more than 1 billion fuel point per day [9].

Starbucks use the mobile app to earn stars. For example, a first time use of the program will receive 1 star. It allows customers to get a free food or drink reward on their birthday. If 5 stars are collected, the membership will turn to a green level and the member will get free coffee and tea refills in the store. For 30 stars, the membership will upgrade to gold level. The customer will get a personalized gold card, free food or drink reward for every 12 stars and a special offer when purchasing a product [10]. Although the program was launched in 2009, the number of My Starbucks Rewards membership reached 2 million in 2010 meaning that the program is popular for the people. According to the result, 80,000 new members join weekly on this program. This is one of the reasons why Starbucks is so successful and famous around the world.

### C. Text mining

Research in content mining and learning is still in an extraordinary flux. Text mining utilizes procedures from data retrieval, data extraction and also interfacing strategies for content mining and insights. The procedures of text

mining involve long and numerous methods which can be used with a specific end goal to acquire important outcomes [11].

### D. J&J Service Center (A Gamified CRM)

J&J Service Center [12] is a gamified customer relationship management system designed on [13]'s Octalysis. Initially designed based on information systems analysis and design principles, only four out of the eight Octalysis aspects, have been included in the design.

To attract customers, we focus on interaction design. Interaction design is a term that roughly translates to the 'design of interactive products, systems, and devices'. There are two aspects, i.e., interface design and behavior design. In the interface design, the concern is to display the products' features and so the design of the graphic layout is important. In behavior design, how navigation should be designed so a user can easily navigate on the site is important.

The use case diagram is illustrated in Fig. 1. First of all, when users successfully browse the website, it will pop out a subscribe message for users to get the latest company news in Facebook. Second, users can choose either to sign up to become a member or continue to browse the website. If the users are not members of the site, they would not be able to purchase the product and create any new post in the forum.

In the main page of the website, the menu bar allows users to choose which pages they want to go to such as to see the profile of the company, product sales, online service provided by the company, any upcoming events, polling system and forum. For the J&J Service Center, they are able to manage the user account, payment system, user comments and update any news in the forum. User testing results are positive and promising.

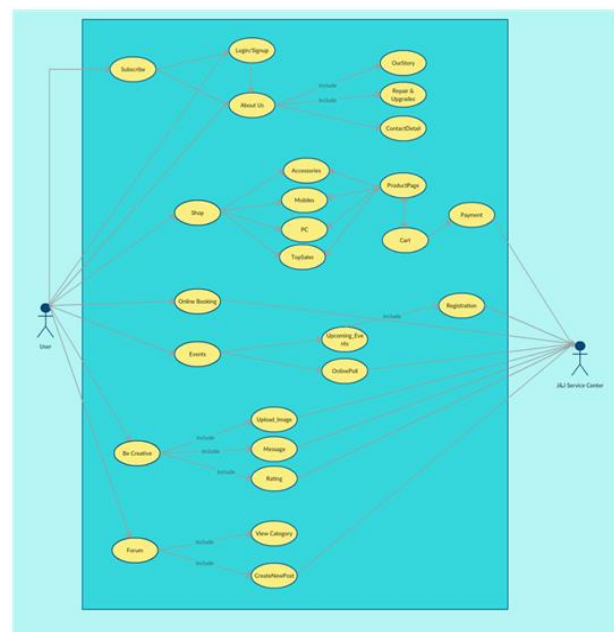


Fig. 1. Use Case Diagram

### E. Knowledge management

Knowledge management plays an important role to produce an informative and creative individual, processes and organizations. The knowledge management approach we are concerned with are [14]'s four processes i.e., knowledge sharing, knowledge translation, knowledge creation and knowledge mobilization. These processes have been utilized to extend the J&J Service Centre from a gamified CRM.

## III. METHODOLOGY

### A. Samples

Understanding how a user thinks and reacts towards a website would be difficult but through the survey conducted, better understanding can be discovered. The survey was distributed through social media.

For alpha testing, 40 people participated, 42.5% are male and 57.5% female. However, for beta testing, there are 51 participants, 54.9% are male and 45.1% female. For alpha testing, 55% of the participants are students while 25% are students and working professionals. For beta testing, 68.6% are students whereas 31.4% are working professionals.

### B. Procedures

Gamification and knowledge management are closely interlinked. Hence, a simple form of knowledge management was in J&J Service Centre. This extended work follows the Software Development Life cycle and [14]'s four cycles of knowledge management, extending from [10] in terms of knowledge translation and knowledge creation.

For the preliminary design, the aim is to obtain user perception towards our knowledge management approach to e-commerce. J&J Service Center (Fig. 2), (hitherto renamed VPSF, as a Google search revealed another J&J Service Center but in the automotive industry), provides knowledge sharing by having a forum page and a chat box where it allows users to participate and engage with the community, giving their opinion to the society. By doing so, the user gets more opinion and feedback from the questions asked and they will have a better idea and chance to make a firm decision whether to purchase or not to purchase an item.



Fig. 2. Website homepage

Based on feedback, the website is revised. The user is able to perform voting based on the brand and product they prefer the most. Polling (Fig. 3) will allow us to perform analysis based on customer preference. Hence, we can improve a particular item for sale. Users are allowed to view the most voted product in each category so that they can produce, describe and upload their own creation at the 'Be Creative' page. Then, others will rate their creation.

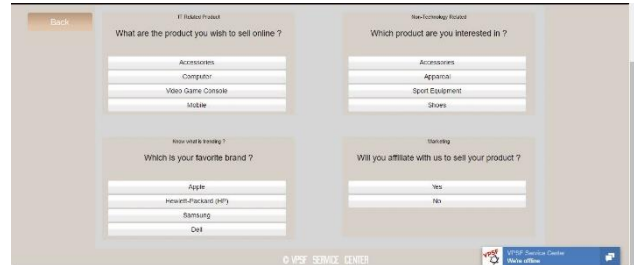


Fig. 3. Polling page

In addition, in this website, text mining can be done easily with the extraction of textual content from the forum where we will be able to understand the trending topic most customers speak or share about. By identifying the current topic, it would be a way for us to keep ourselves and the business updated. This will result in more customers visiting our website as it will be changing according to the market. The changes that would contribute to this business through text mining analysis will also be a helping hand as we will be more involved and recognized in the market presence. Furthermore, the user's behavior towards purchasing, interaction and sentiment analysis will also be a measure for better development of the business as well as the development of the growth of services and products.

In order for us to ensure that the website meets user acceptance and knowledge management criteria, two types of testing is carried out throughout the process. Firstly, alpha testing to test the functions and customer reaction towards the website. Feedback from the customer plays an important role for us to improve to a better one. Besides, it gives a better understanding of customer behavior towards knowledge management based e-commerce. After improvements to the website, beta testing is carried out to make sure that objectives and goals are achieved.

## IV. FINDINGS AND DISCUSSION

### A. Alpha testing

To the question of how they find us, 57.5% answered friend & family along with social network because most of the users are in social media. A high number of customers (52.5%) are interested in discounts, 47.5% are into customer service, 32.5% promotion, 32.5% price and 12.5% others.

Most users (35%) change their device every 3 years, whereas 27% regard every 2 years to be the minimum period needed to change their products, 17.5% every year, 15% every 6 months and 5% monthly. This definitely indicates that the users try to keep themselves updated with

technology growth. Although the technology is progressing faster than ever, the customer does keep in touch with the trend so that they know when they need to purchase new products.

To know if the users would find the website user-friendly and would be able to attract new and existing customers, 52.5% said yes, the website is able to attract customers, 30% maybe and 17.5% said no. They also state their reason for saying no is because the website is not sufficiently attractive and insufficient details on the products. A higher number of yes implies possible higher chances of more customers using the website as a platform for knowledge sharing and information retrieval.

In addition, a high rate of 67.5% said that J&J responds to inquiries in a timely manner. This will help customers to obtain short and interesting insights about their inquiries in any matter related to technology.

Furthermore, 37.5% strongly agree that they are very satisfied with the performance of J&J in their business while 32.5% agreed as well, giving a rounded figure of 70% more than outstanding results on customer satisfaction towards the website and the services provided.

### B. Beta testing

For the beta testing, the younger generation today chooses to purchase things online. Hence, to the question of whether the users are willing to share their opinions related to computer devices in the forum page provided, 84.3% said yes. This gives a good impact on the business as knowledge sharing and transfer can help the business.

In addition, 76.4% agree that the service provided at the VPSF website has sufficient information and knowledge that enable customers to decide which product is better/trending products in the current market. As the customer keeps in touch with the trend, they will know when they will need to purchase new products. Moving forward to the polling page in our website, 92.2% of the users said that the polling feature does help to identify trending products.

Moreover, 42.5% agree that J&J is making positive contribution to the community through the product design component while 30% strongly agree to this. This is actually an outstanding result as a total of 72.5% of participants are positive about this e-commerce. The positive reviews are because J&J delivers their contribution to the community by helping customers to upload their creation to the website, and the most liked creation would be able to associate business with J&J as it would be a good platform for the customers to develop their skills.

Moreover, 88.2% like the mobilization services provided e.g. website maintenance. This high number of yes would encourage VPSF Service Center to keep up with the performance. Majority of the users (84.3%) are satisfied with the services provided. A higher number of yes gives a positivity on the chances of more customers using the website as a platform of knowledge sharing and information retrieval.

Fig. 4 shows some screenshots of the beta testing survey results.

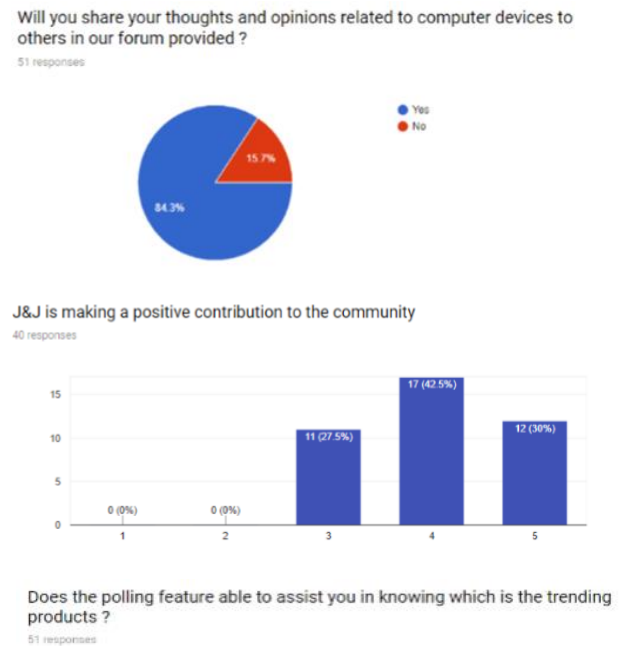


Fig. 4. Screenshots of beta testing survey results

### C. Significance

Fig. 5a (top-alpha, bottom-beta) shows positive differences between alpha-beta testing outcomes in terms of perception/acceptance towards information provided.

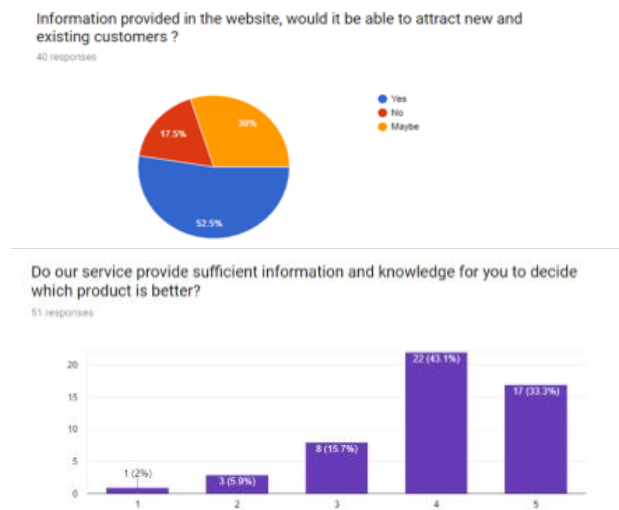


Fig.5a. Alpha-beta user acceptance comparison

Satisfaction increased for the beta testing results compared to alpha testing (Fig. 5b (top-alpha, bottom-beta)).



Fig. 5b. Alpha-beta satisfaction comparison

#### D. Text mining

For text mining [10], we first looked into feature extraction. We examine the content extracted from the forum segment accessible in the J&J site using SAS Text Miner. The algorithm used for clustering is expectation – maximization. These have enabled us to recognize what the clients are sharing and discussing and extract meaningful features.

In Fig. 6a, the highest frequency descriptive term is *knowledge transfer* with a frequency of 74. In addition, the top two terms are *research* and *technology*. Fig. 6b shows the terms that are kept and dropped by SAS Text Miner. The top three terms kept are *knowledge transfer*, *research* and *technology*.

For clustering, we tried to reduce dimensionality only to meaningful clusters. We find that 2 clusters are able to represent our users, for personalization in the future. From 7 to 10 clusters, the results remain the same. As such, since personalization does not have to be too fine, we choose 2 clusters as the number of meaningful clusters for personalization.

In Fig. 7a, we observe of the two clusters, a bigger percentage is interested in operational matters whereas a smaller percentage of users is interested in research, activity, knowledge transfer, work and technology. For cluster ID2, the RMS Std. is 0.1278. The two clusters are able to discriminate quite well (Fig. 7b). These text mining processes have helped in understanding the textual content at the VPSF forum website and gained useful business insights.

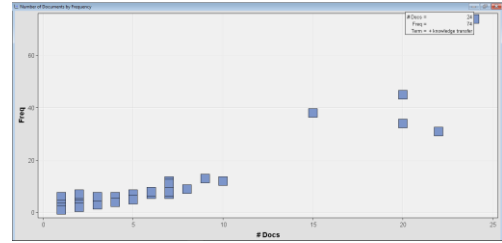


Fig. 6a. Number of documents/posts by frequency plot

Term	Role	Attribute	Status	Weight	Imported Frequency	Freq	Number of Imported Documents	# Docs	Rank
+ knowledge...	Alpha	Keep		0.251	73	74	24	24	1
+ research ...	Alpha	Keep		0.278	45	45	20	20	3
+ technolog...	Alpha	Keep		0.391	10	38	5	15	5
+ work ...	Alpha	Keep		0.475	9	9	8	8	8
+ easy ...	Alpha	Keep		0.475	9	9	8	8	8
+ create ...	Alpha	Keep		0.500	7	7	7	7	11
+ people ...	Alpha	Keep		0.515	9	9	7	7	11
+ time ...	Alpha	Keep		0.599	6	6	5	5	18
+ mean ...	Alpha	Keep		0.586	5	5	5	5	18
+ look ...	Alpha	Keep		0.644	4	4	4	4	24
+ activity ...	Alpha	Keep		0.644	4	4	4	4	24
+ follow ...	Alpha	Keep		0.644	4	4	4	4	24
+ always ...	Alpha	Keep		0.644	4	4	4	4	24
+ great ...	Alpha	Keep		0.644	4	4	4	4	24
+ personal ...	Alpha	Keep		0.644	3	4	3	4	24
+ add ...	Alpha	Keep		0.658	5	5	4	4	24
+ organizati...	Alpha	Keep		0.658	5	5	4	4	24
+ show ...	Alpha	Keep		0.658	5	5	4	4	24
+ start ...	Alpha	Keep		0.644	4	4	4	4	24
+ s ...	Alpha	Drop		0.000	31	31	22	22	2
+ be ...	Alpha	Drop		0.000	34	34	20	20	3

Fig. 6b. Terms Status (keep/drop), frequency and weight

Cluster ID	Descriptive Terms	Frequency	Percentage
1	+easy +create people +mean time +follow +look +organization +personal +show +start add always great +technology	38	78%
2	+research +activity +knowledge transfer +work +technology	11	22%

Fig. 7a. Clustering Results with High SVD Resolution

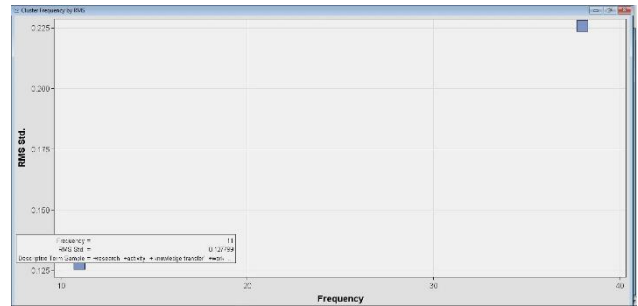


Fig. 7b. Cluster Frequency by RMS

#### D. Limitation

It is a new site acquainted with people in general so as to comprehend the customer’s needs and perception towards knowledge management-based e-commerce. Our sample size is small. Hence, findings are still very preliminary. Based on the present outcomes acquired, we trust we can perform more investigation once we have adequate information that will enable us to have the capacity to settle on better choices to improve the system.

#### IV. CONCLUSION

Knowledge management plays a huge role in developing Smart Cities. The levels of knowledge involved in a particular website will demonstrate how good and informative it is to the customers. J&J Service Center is also a design of a business that would be able to handle a huge amount of data that can be used for decision making and obtaining useful insights. Big Data Analytics can especially help to increase the ICT (Information and



Communication Technology) industry growth and understanding perception from participants towards IoT (Internet of Things) enables many knowledgeable people to know how the process of involving Big Data and knowledge management interrelates.

In conclusion, user testing results are positive for both the original website and the KM-enhanced website. For the enhanced website, participants initially started out not sure about the purpose of the website but as they went through the website and survey, they realized the various services and products of J&J Service Center.

The text mining analytics has been helpful in understanding further topics discussed, to increase the latest products, including current study on a specific product that will give a wider range of ideas for customers.

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