

Efficient Digital Signage Layout as a Replacement to Virtual Store Layout

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Abstract—Now a days, the printed message can be displayed in digital format with the help of Digital Signage which is used as replacement to virtual store in this paper. Digital Signage is very effective tool for advertisement, merchandising and entertainment that catches customer's attention as well. The aim of this paper is to demystify the design of Digital Signage layout in order to attract customer's attention. To improve the Customer Relationship Management (CRM), the Digital Signage can be placed at subway stations, shopping malls, bus stops, airports etc and the payment can be done with the help of Smartphone application. The advantages of traditional store layouts, such as grid, freeform and racetrack, are discussed and based upon these, a model layout for Digital Signage has been proposed.

Index Terms—CRM, virtual store, digital Signage.

I. INTRODUCTION

Shopping is one of the most important activities of human life in which a customer browses their desired products they intended to purchase that has been presented by multiple retailers. Shopping may be considered as a leisure activity or an economic one. Experiences of shopping, which can be delightful or terrible, Experiences of shopping, which can be delightful or terrible, totally depend upon various factors like time consumed, customer's treatment, process convenience, products being purchased and the level of fatigue involved. However, retailers always want to make a better relationship with the customer in order to boast their sale. Different theories related to CRM have been introduced as the impact of its important of CRM study [1]. Increasing the profit by having a long term relationship with the customer is the main factor thus it was followed by many other organizations as well. In Recent years, many companies invested in the field of information technology to effectively manage the customer interaction in the purchasing process [1].

Now a days, retailers have established virtual stores that electronically offer services to customer and merchandisers as well [2], [3] such as internet store (e-commerce) can be regarded as an example of it. Virtual store is an online store that provides a list of merchandisers and an order form. As compare to traditional shopping, virtual store is more convenient to purchase products.

This is due to the fact that internet gave more information with nominal time and less effort required by the customer

[4]. Other applications of virtual store, the products are displayed as an internet shopping mall that contains virtual reality [5] and 3D techniques [6] for improving the product's presentation. It has been placed in a form of pillars and platform screen doors have been plastered with images of life-size store shelves filled with goods such as milk, apples, a bag of rice, bread, each of which carry information of QR code. Shoppers download the related application in their Smartphone and make purchases by taking the photos of product QR code. Virtual store atmosphere consists of a new concept arising from the rapid technology evolutions along with the digital business activity over the Internet and should be taken under serious consideration as in conventional retailing [7]. Because of their direct and uninterrupted link with customer and absolute product information, virtual stores are termed as 'super sales associates' [8].

The Digital signage is one of the tools and its display can serve as an example of online virtual store. Traditionally, displaying a sign board takes much time and money as well and there is no way to customized. The up-to-date Digital signage is a form of electronic display that is being widely used to advertise targeted and impacting content to large audiences at public venues such as airports, shopping malls, and universities etc [9]. As compared to the traditional signs, digital signs have the advantage of presenting multimedia digital content so that publisher has more flexibility to edit his content [9]. Recent research focuses on the value of customer's engagement with digital signage, which shows that it increases the customer's interaction [9]. In addition, the recent up-to-date technology of digital signage systems have touch screens which can capture users' finger movements on the screen and allow users to interact by touching the display pictures or words on the screen [9]. A digital sign comprised of a display device and a display controller. The display device is typically a gas plasma display unit but other technologies ranging from flat panel monitors to very large projected images are common. The display controller can range in sophistication from an ordinary DVD player to general purpose computers. Indoor digital signs often include speakers and in some cases digital cameras [9]. As the impact, this technologies allow marketers to reach their customers effectively, quickly and precisely.

Previous research showed that store layout is an appealing factor affecting consumer behavior [10] and a critical determining factor for building store image [11], [12]. Better designed layouts are extremely important because of their strong impact on shopping atmosphere. The design layout of virtual store is one of the key elements of

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virtual retailing. Retailers must know its influence on the consumer's behavior and thus can control it [13]. A poorly designed digital storefront has a bad impact on the consumers' online shopping experience [13]. In addition, many customers have expressed their frustration dealing with some virtual stores when facing problems with the products. Consumer wants to have more 'human interaction' and high service quality in the virtual stores [10]. The touch screen functionality which is offered by digital signage enables the better speed, reality based interaction with customer and ease of use. Hence, the solution is to use the Digital signage as the replacement of virtual store and its feasible layout design to solve aforementioned problem will be discussed in this paper.

II. METHODOLOGY

Message communicated through the digital signage system has a meaningful impact upon customer's purchase behavior in retail stores. It is progressed by simply replacing paper signs to becoming an interactive and entertaining medium. Interactive displays can deliver product information in effective way. It can enhance the shopping experience, build loyalty and enhance sales. By showing the new promotions and content on the display, we can attract customers which help us to have better customer relations. When a customer uses the Digital signage, it has touch screen function so that customer can browse the required product. After Searching and selection, customer can download the mobile application and the purchase could be done by capturing the QR code of the product and delivered as per his requirements.

In this part, the three conventional layout patterns, the grid, racetrack and free form, are discussed and based on its benefit, the design of digital signage layout can be developed. The characteristics of conventional store layouts which must be considered for designing the digital signage layout such as; it follows the same regulations and properties that govern their operation in conventional retailing. It also keeps all the key influencing factors like color, prices, product variety, sound and quality in sequence in order to eradicate any unwanted effects on buying behavior of customer [13].

The store layouts in conventional and virtual retailing have been discussed with their corresponding advantages while their comparison has also been shown on specific factors [15], the detail discussion can be seen as follow.

A. Store Layout for Conventional Retailing

Conventional retailing store layout theory explains that there are three major types of store layout [13] detail discussion can be seen as follow.

- **Grid:** The grid layout is a rectangular arrangement of displays and long aisles that generally run parallel to each other. The aisles of the store are arranged parallel to one another and lead to the checkout lanes located at the front of the store where customers enter and exit [13]. **Advantages:** It has advantages which are efficiently used by the store space. It has low cost, customer familiarity, ease of cleaning, simplified

security, self-service possibility, efficient use of space, easy to navigate. People have seen this type of layout used in grocery, discount and drug stores. The grid layout is depicted in the Fig. 1.

- **Free-Form:** This type of layout is a retailer's primary choice when it comes to Layout Planning or Designing. The freeform layout increase the time consumers want to spend in the store. It's easy to use structure, makes it easier for shoppers to browse and allow customers to move in any direction within the vicinity of store [13], [14]. The customer enjoys considerable freedom to move in any direction within the store. **Advantages:** Its ease to be used in small stores where customers wish to browse, amicable working for same type of merchandise, provision of flexibility and visual appeal to customer in intimate relaxed environment are some of the advantages of free form. Free form layout is shown in Fig. 1.
- **Racetrack:** This kind of layout has a center point that directs towards various sections of the store. The racetrack store layout helps the customer along specific paths to visit as many store sections or departments as possible. This is because of the main aisle/corridor which facilitates customer movement through the store. The retailer who adopts this type of layout creates an entertaining and interesting shopping environment [13]. **Advantages:** This layout exposes shoppers to the greatest possible amount of merchandise by encouraging browsing and cross-shopping, Loop with a major aisle that has access to departments. This kind of layout is used in departmental stores. The racetrack layout is shown in Fig. 1.

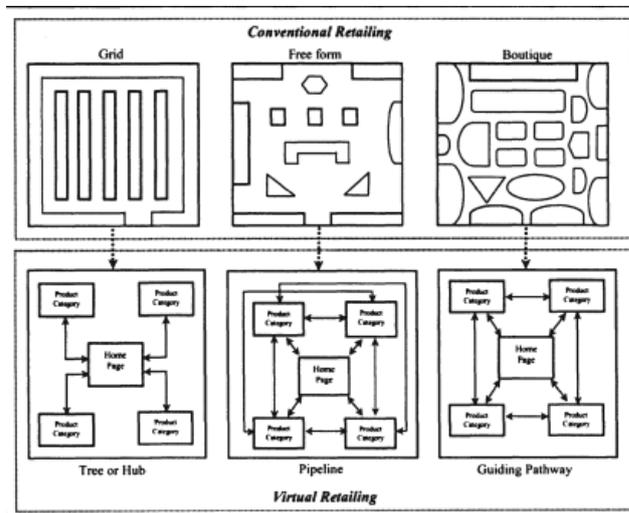


Fig. 1. Store layouts in conventional and virtual retailing [14].

B. Store Layout Transformation to Virtual Retailing

In this part, based on the conventional store layout, the design of virtual store can be retrieved. The example of virtual store is e-commerce which can be seen as a store website. Website design has the potential to influence planned shopping behavior [13], [14]. Similarly, in a virtual context; store layout influences the length of time that customers spend within the website [13]. Based on the corresponding store layout alternatives for virtual retailing, as shown in Fig. 1, are described as follows [13].

- **The Tree or hub:** It is called *grid* in conventional retailing. Customers navigate the online store through a hierarchical structure from product category to product sub-category and lastly End product. It provides the home page button which facilitates users need to pass through a hub or use the back-forward bar in order to visit the product categories [13]. The Tree layout is shown in Fig. 1.
- **The pipeline:** The objective of the *freeform* layout is to provide consumers freedom to move in any direction. In conventional retailing it is known as free form. Customers can have access to their desired products at once by utilizing the multiple links provided at each search outcome webpage of the store (e.g. either through the use of a search engine or by selecting any of the items/options permanently displayed on every page. This layout provides the home page and the search button. It is more appropriate for browsing and easy store navigation [14]. The Pipeline layout is shown in Fig. 1.
- **The guiding pathway:** It is commonly known as *racetrack* in conventional retailing. The racetrack layout uses two online “corridors” on each web page and customers are guided by the system to navigate through specific paths in the store in order to reach the products. In this case direct access is possible only to the neighboring categories .Whereas it does not provide any of the aforementioned buttons. So, it forces customers to reach only neighboring product categories at once. [13], [14]. The guiding pathway layout is shown in Fig. 1.

C. The Comparison of Conventional and Virtual Retailing Store Layout

Table I [15] provides a comparison of research findings under conventional and virtual retailing that which layout is useful in what way.

TABLE I: CONVENTIONAL VS. VIRTUAL RETAILING STORE LAYOUT FINDINGS

Variables	Conventional Retailing	Virtual Retailing
Perceived Usefulness	Grid	Free-Form
Ease Of Use	Free-Form	Grid
Entertainment	Racetrack	Free-Form
Time	Free-Form	Racetrack—Free-form
Promotion Effectiveness	Racetrack	Not Affected by Store Layout
Impulse Purchases	Racetrack	Not Affected by Store Layout

As showed in previous research [15], the six output variables have been used for the evaluation. The first variable is *perceived usefulness* which mostly related with shopping activity of customer. The result showed that the free-form layout proved to be the most effective one in facilitating routine and planned shopping behavior. As it helps in facilitating customers' shopping activity towards searching, locating and buying their shopping list products within a store in virtual retailing while in contrast of conventional one grid is more appropriate. Furthermore, the grid layout proved to be the clearest, most flexible, understandable and easiest to operate by customer’s visiting

the store. Thus it provides “*ease of use*” in virtual retailing while in conventional free-form is best to used. From the view point of *entertainment*, the Free form was perceived to be more enjoyable as compared to grid and racetrack over internet. Retailers should adopt free form layout when the basic objective is to provide an entertaining shopping experience. The result also showed that the customers can spends more time in free form and racetrack layouts in stores on web. In addition, as compared to conventional retailing the layout of grocery store on web does not affect the impulse purchases and promotional effectiveness.

D. The Proposed Design of Digital Signage Layout

Digital signage for advertisement could be used in virtual store for providing touch screen interaction, thus it provides more ‘Human interaction’ and high service quality. It worked as digital screen where customer can browse and select their relevant product. Due to the similarity of the factor between virtual store and digital signage, the result from previous research regarding the virtual store layout [15] can be considered as our inputs. The most important factors that should be considered in digital signage layout such as *convenience to use and more entertaining* which represents the benefit of the ‘human interaction’ in digital signage application. Thus as explained in previous research [15], the use of *grid* (*tree* in virtual retailing) and *freeform* (pipeline in virtual retailing) are more representing our proposed idea and expected to work more efficiently in digital signage application. Thus it will give the benefit for both parties, increasing the customer satisfaction and the company revenue.

The Racetrack layout considerably affects the time that customers spend for shopping. From previous researches it was found to be the most difficult to use and the least useful one towards locating shopping lists products [15]. That’s the most obvious reason racetrack layout not merged with other layouts in defining the final design for digital signage.

Based on our proposed idea in digital signage which is ‘*more convenience to use and entertaining*’, with the combination of benefit from previous research [15] in virtual store layout, thus the initial design of digital signage layout can be retrieved in Fig. 2.

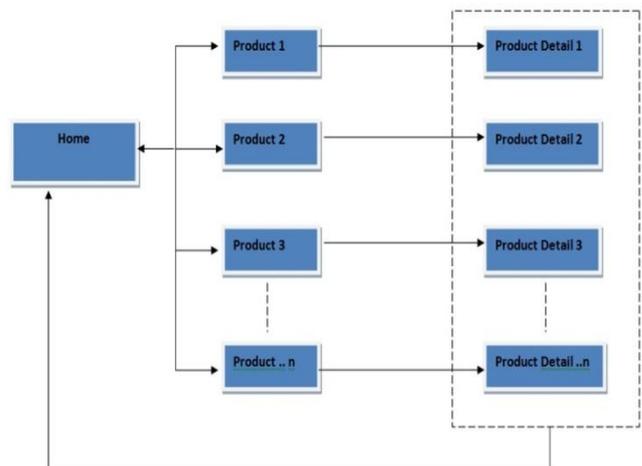


Fig. 2. The initial design of grid and freeform layout for digital signage.

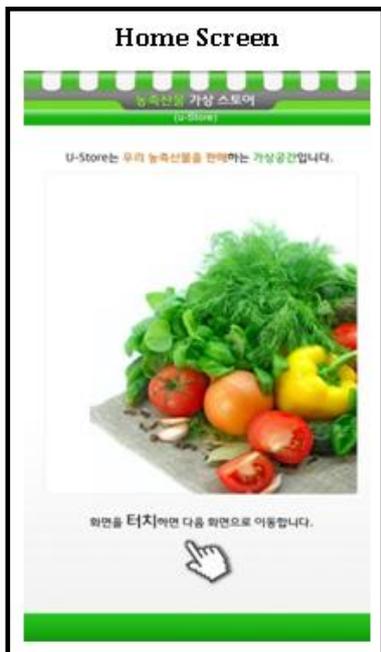


Fig. 3a. Home screen.

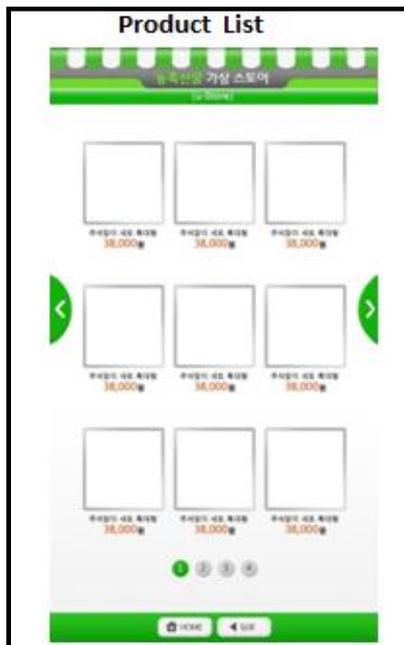


Fig. 3b. Product list.



Fig. 3c. Product detail.

As can be explained in Fig. 2, the grid layout will give the user *convenience to use* while the freeform design makes the user more enjoyable using digital signage. The customer can select the product and its detail very easily by using the touch screen functionality which is provided by digital signage. The *back button* will allow the customer to discover the products more easily. The model also shows products by its group thus it will help the customer to easily explore the product items.

III. RESULTS AND DISCUSSION

Based upon previous design of store layouts and its benefit the Table I, thus the proposed layout can have a both grid and free form layout structure which has functionality such as perceived to be useful, convenient to use, more entertaining. The final proposed virtual store layout in context of digital signage can be seen as in the Fig. 3.

The proposed layout showed the first button, *home screen* which is shown in Fig. 3a. Next to it is the *product list* which is shown as Fig. 3b while the product detail is shown in the Fig. 3c. The layout depicted has touch screen functionality and by a single click the customer can start viewing the products. While checking the products from the list, layout shows “Home Screen” and “Back” button so that any time customer can go back or move to home screen. The “Home Screen” of digital signage, which has a number of products in it, is also eminent in the figure. By the next click customer can see “Product List” which shows a number of Product items. Customers are able to click their required product, once it happens the next screen which shown is “Product Detail”. This functionality has the detail information about product price, quantity, quality etc. The next step, customers are able to capture the QR code and process the payment with the help of Smart phone application. Once the system approved the transaction, the product will be delivered to customer house by his instructions. The layout discussed above is user friendly and

more entertaining. So, customer can spend more time in it. This layout is more useful which compels the customers for purchase.

IV. CONCLUSION AND FUTURE WORK

The proposed layout for digital signage discussed in this paper is a mixture of freeform and grid layouts. The point to ponder is that this design offers better navigation for customer, ease of use and effective customer interaction. Effective co-operation among different disciplines, like Human Computer Interaction (HCI), is a key for designing a better and effective Virtual shopping environment. Therefore the touch screen functionality which is offered by digital signage enables the better speed, reality based interaction with customer and ease of use. In this paper, the proposed model which use the *grid (tree in virtual retailing)* and *freeform (pipeline in virtual retailing)* are discussed. The result showed that the proposed model give the user *convenience to use* while the freeform design makes the user shopping experience more enjoyable by using digital signage.

Future research initiatives should include a questioner and a combination of grid and freeform layout, which shows the advantages of both layouts while avoiding their respective disadvantages, could be designed in that way. In addition, with the help of digital signage and customer’s interaction in real situation, better results can be acquired. A real shopping environment can also be achieved through the provision of a real shopping budget.

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REFERENCES

[1] T. Bohling, D. Bowman *et al.*, "CRM Implementation: Effectiveness Issues and Insights," *Journal of Service Research*, vol. 9, no. 2, pp. 184-194. 2006.

- [2] D. L. Hoffman *et al.*, "Commercial Scenarios for the Web: Opportunities and Challenges," *Journal of Computer-Mediated Communication*, vol. 1, no. 3, 1996.
- [3] M. Yesil, *Creating the Virtual Store: Taking Your Web Site from Browsing to Buying*, New York: John Wiley, 1997.
- [4] T. P. Monsuwe, B. Dellaert, and K. Ruyter, "What drives consumers to shop online A literature review," *International Journal of Service Industry Management*, vol. 15, no. 1, pp. 102-121, 2004.
- [5] Y. Lee, "The effect of 3 dimensional graphics on consumer information processing process in online shopping malls," Master's Dissertation, Yonsei University, Korea, 2001.
- [6] T. E. Miller, "Integrating Realistic Human Group Behaviors into a Networked 3D Virtual Environment," Master's Thesis, Naval Postgraduate School, 2000.
- [7] S. Elliot and S. Fowell, "Expectations versus reality a snapshot of consumer experiences with internet retailing," *International Journal of Information Management*, 2000, vol. 20, no. 5, pp. 323-336.
- [8] J. Alba *et al.*, "Interactive home shopping: Consumer, retailer, and manufacturer incentives to participate in electronic marketplaces," *Journal of Marketing*, vol. 61, no. 3, pp. 38-53, 1997.
- [9] Q. Chen *et al.*, "Interacting with digital signage using hand gestures," in *Proc. the 6th International Conference on Image Analysis and Recognition*, pp. 347-358.
- [10] D. A. Griffith, "An Examination of the Influences of Store Layout in Online Retailing," *Journal of Business Research*, vol. 58, pp. 1391-1396, 2005.
- [11] D. Orenstein, "Human Touch Crucial to Internet retailers Success," *Computerworld*, vol. 33, no. 4, p. 8, January 25, 1999.
- [12] R. Tilson, J. Dong, S. Martin, and E. Kieke, "Factors and Principles Affecting the Usability of Four E-commerce Sites," presented at Forth conference on Human Factors and the Web, Basking Ridge, New Jersey, USA, June 5, 1998.
- [12] P. Steiger, M. Stolze, and M. Good, "Beyond Internet Business-as-Usual," in *Proc. CHI 98 Conference Summary on Human Factors in Computing Systems*, pp. 210, October 1998.
- [13] A. Vrechopoulos, R. O'Keefe, G. Doukidis, and G. Siomkos, "Virtual Store Layout: An Experimental Comparison in the Context of Grocery Retail," *Journal of Retailing*, vol. 80, no. 1, pp. 13-22, 2004.
- [14] A. P. Vrechopoulos, G. Papamichail, and G. I. Doukidis, "Identifying Patterns in Internet Retail Store Layouts," in P. Pardalos and V. Tsitsiringos (Eds.), *Financial Engineering, e-Commerce and Supply Chain*, Kluwer Academic Publishers, 2001.
- [15] A. P. Vrechopoulos, *Virtual store atmosphere in internet retailing: Measuring virtual retail store layout effects on consumer buying behavior*, 2001.



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