Research Article

User Acceptance of QR Code based Mobile Application in Interactive E-Commerce

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Abstract: Advertisement on products or services can be found in many forms; video, banners, pamphlets, etc. However, these advertisements only function as a one-way communication as consumers are only presented with the product information and the seller. Further action on purchasing the product is absent or is to be made separately. Such an approach may not guarantee a sale for the seller as the customer may only retrieve the information of the product but purchase it elsewhere. Hence, this study demonstrates the use of QR code technology not only in marketing but also in e-commerce. The technology is realized in "On the GoShop" mobile application that has two types of users: seller and buyer. Sellers are people who wanted to promote their product and/or services while buyers are the ones who have a desire to purchase. An evaluation study on the acceptance of the mobile application was then performed on a total of 50 respondents and it is learned that the proposed e-commerce application is well accepted. Ninety percent of the respondents agree with the usefulness of the application and are looking forward to using the application in daily routines. The use of QR code technology not only facilitates consumer in purchasing their desired product but also contribute to cost-effective marketing.

Keywords: *QR code; digital marketing; e-commerce; digital advertising*

1. Introduction

A modern business environment challenges enterprise to be different from their competitors to gain attention from potential customers. Various competition arises in business and these competitors utilize numerous techniques to market their product and/or services. In today's fast-moving era, the size of a business does not matter as similar economic challenges are faced in attracting and retaining customers [1].

It is learned that most product promotions were made using hard copy documents that include flyers, brochures, and pamphlets that are manually distributed to residentials and organizations. Such an approach is not cost-effective as it adds a financial burden to the business operators as well as to the environment. Furthermore, the promotions are a one-way communication as buyers are only provided with the product information. Any action further action on purchasing the desired product need to be made separately by visiting the business outlet. Hence, creating financial and time cost on buyers.

Since quick response code (QR code) has been widely used as product identification, various work has been found to extend it as product descriptor. In line with such movement, this study extends the literature to employ QR code as an interactive e-commerce application. This study demonstrates the use

of QR code technology in e-commerce where sellers can promote their product while buyers can perform the purchase. Information on the product or services is stored in a QR code and the code is used as an advertisement. The QR code image can be printed and distributed either by hardcopy or online. Interested buyers can then scan the code to retrieve the product information. Upon agreement, buyers are then directed to the purchasing process. This approach is realized as an e-commerce application known as "On The Go Shop" and is hoped to facilitate both parties (i.e seller and buyer) as it is cost-effective.

2. QR Code

Barcode is a graphical image representation, which is capable of storing digital information about an object such as ticketing information, tracking location, unified resource locator, contact list, and many others. Barcode becomes a popular data storage medium as it provides good retrieval accuracy, minimal retrieval time, and cost-effective [2]. There are two categories of the barcode; one- dimensional (1D) and two-dimensional (2D) or also known as matrix barcode [3]. Technically, the difference between these two types of barcodes includes the width of the bar, character set, encoding method, checksum, and specifications [4]. According to a study [5], the 1D barcode is mostly known as "product identification", while the 2D barcode emphasizes "product descriptions". This is because the storage in 1D is limited as compared to the 2D barcode. The 1D barcode contains various widths and parallel space lines while the 2D barcode is represented in the form of a graphical image which is capable to store data horizontally and vertically [6]. Figure 1 shows samples of 1D and 2D barcodes.
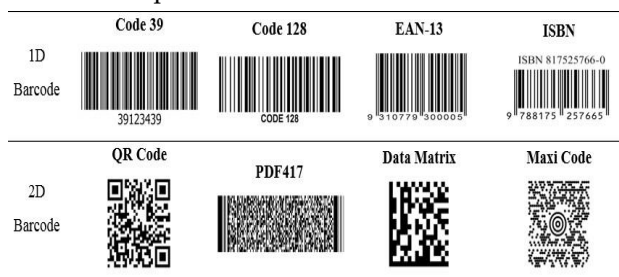

Figure 1. Examples of one-dimensional barcode and two- dimensional barcode [7]

The 2D barcode has two main categories, namely stacked and matrix symbologist. The stacked symbology is developed with two or more small linear rows of barcodes, which are stacked on top of each other. Examples of stacked symbologists are Portable Data File with 4 bars and spaces and each pattern is 17 units long (PDF417), Code 16K, Code 49, and GS1 DataBar [8]. The matrix symbology, on the other hand, is mainly arranged in a grid with the geometric shapes of dark and light colors. It is commonly used in small-item marking, unattended, and high-speed reading applications. Examples of matrix symbologies are Data Matrix, MaxiCode, Aztec Code, Code One, and QR Code [9].

This study focuses on the quick response code (QR code) [11–14] which is categorized under matrix symbology barcode. QR code was first introduced by a Japanese company, Denso Wave Incorporated, in 1994. It was then approved in 2000 as an AIM standard, JIS standard, and ISO standard [7], [14], [15]. Figure 2 shows an example of a QR code.

Figure 2. An image of QR code

To date, the QR code has the largest capacity storage among 2D barcodes, which is approximately 3 kilobytes [16] and for the coloured barcodes, it has approximately 3 to 100 kilobytes [17]. For all QR code versions, the size of the storage relies on the size of the metric column [18]. The more metric columns exist in a QR code, the more data can be stored in it.

Nowadays, the QR code has been adopted in the areas where 1D barcode was utilized. These applications include retailing, healthcare, life sciences, transportation, office automation, marketing, and advertising [19]. The QR code can transmit information through a print-scan channel [19]–[21] and display the information in the forms of numeric and alphabetic characters, kanji, kana, hiragana, symbols, binary, and control [22]. QR code is very similar to matrix barcode [23], [24], however, the data stored in a QR code is much higher. This leads to a more utilized technology as various data can be stored in it.

Currently, in practice, people use a phone camera to scan the image of a QR code that contains contact information, short messages, authorization to a wireless network, or to open a web page in the telephone's browser that is linked to the webserver [25]. To fully utilize this practice, this study proposes the same action to facilitate the process of purchasing products and/or services. The scanned QR code will lead users to obtain more product information and connects users to the purchasing process.

3. Methods

To undertake the study, 5 phases of activities have been completed and this includes theoretical study, data acquisition, application design, and development and evaluation. Figure 3 illustrates the stated phases along with their outcome.

In the first phase, a literature search has been performed to identify problem arises in marketing product and/or services by business operators. It is learned that existing practice is costly and not environmental. Hence, the study proposes the employment of QR code technology in an e-commerce application that facilitates both involved users: seller and buyer. Before designing the application, relevant data on the chosen product were obtained. This has been identified from flyers and pamphlets distributed by the business operator. During the third phase, the collected information is then stored in QR code. In detail, this study realizes QR code in an application known as On the GoShop that is developed to facilitate two groups of users: seller and buyer. As for the seller, the application design includes a marketing medium that allows them to store information about the product or services. Among the functions that can be operated by the seller is the add product, edit product, remove a product, and generate QR Code. The application generates a QR code based on the information provided in the product inventory database.
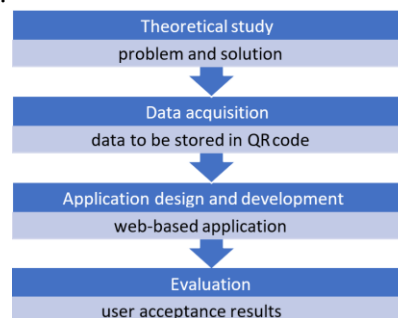

Figure 3. Research phases and outcomes

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On the other hand, buyers are consumers who are looking or searching for products or services. A buyer who is interested in a product needs to scan the advertised QR code (i.e through their smart gadget) to retrieve information about the product. To ease the buyer, On the GoShop application will then lead the buyer to a purchasing site that allows him to proceed with the purchase order and payment. In general, a buyer can scan the QR code, submit an order of the desired product, and make the required payment. Once the purchase process has been completed, the product inventory database will be updated to depict the current product availability. Once the On the GoShop application is ready, it was evaluated by 50 users that include 20 sellers and 30 buyers. The main objective of the evaluation was to investigate the usability of On the GoShop from the seller and buyer perspectives. Furthermore, it is also to evaluate the functionality of On the GoShop application.

4. Results

In this study, the results of user evaluation focus on ease of use, usefulness, and user satisfaction. Table 1 depicts the ease of use as evaluated by seller and buyer.

Table 1. *On the GoShop* Application: Ease of Use

	Seller	Buyer
Strongly agree	10	18
Agree	9	12
Neutral	1	0
Disagree	0	0
Strongly disagree	0	0

It is noted that both users evaluated the application as easy to be used. Such an outcome also leads to positive feedback on satisfaction where Table 2 includes the relevant data.

Table 2. *On the GoShop* Application: User Satisfaction

	Seller	Buyer
Strongly agree	11	17
Agree	8	11
Neutral	1	2
Disagree	0	0
Strongly disagree	0	0

Besides, both types of users also have a similar opinion on the usefulness of On the GoShop. This can be seen in the data depicted in Table 3 where 90% of both types of respondents agree that the application is useful. Such a positive outcome is due to the capability of On the GoShop that save users time and meets their need. Data in Table 4 depicts the number of users who agree and disagree on the matter.

Table 3. The usefulness of *On the GoShop* Application

	Seller	Buyer
Strongly agree	10	12
Agree	8	15
Neutral	2	3
Disagree	0	0
Strongly disagree	0	0

Table 4. Benefits of *On the GoShop* Application

	Save users time		Meet users' needs	
	Seller	Buyer	Seller	Buyer
Strongly agree	14	21	10	16
Agree	4	7	9	11
Neutral	2	1	1	3
Disagree	0	1	0	0
Strongly disagree	0	0	0	0

5. Conclusion

Nowadays, the use of smart gadgets such as handphones can be seen everywhere and at any time. People spend a lot of their time on the internet, either for business or pleasure. Hence, employing QR code in an e-commerce application facilitates users in buying their desired product, especially the ones who are busy and always on the road. This paper provides another means of using QR code in e-commerce. The developed On the GoShop application has received encouraging feedback from the users as QR code is cost-effective for sellers due to the cheap medium of providing consumers with product information. Furthermore, consumers can easily and directly purchase any of the advertised products or services from the seller.

The work presented in this study can further be extended into exciting directions that includes expanding the QR code data storage by using color combination so that more information and various type of information can be stored in it. This may include a video on how the benefits of the product as well as on how to use it. Besides, security issues of using QR code in e-commerce should also be considered.

Acknowledgment

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