QR Code Fabric Tag for Textile Companies in Turkey

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ABSTRACT—*All textile companies keep archive of information related to sales, prices, customers, type of cloth, production factory etc. We propose a system in which all this information is digitalized and easily accessible by the users. The QR code will be placed on the cartel of the fabric used in the production. The code grants access to all the vital information. When the QR code is scanned by a Smartphone or any electronic device with a scanning capability, the link will open to the necessary information. We have designed a system containing of a web site, database containing the records and a mobile application using PHP, MySQL and Java. Through this application, the companies that manufacture or sell fabric will avoid infollution. Textile companies will be able to more easily access the information about the fabric they wanted.*

Keywords— QR Code Fabric Tag, QR Code, Fabric Tag, Textile in Turkey

1. INTRODUCTION

Firstly used in automotive industry in early 90s, QR Code (Quick Response) [1]- [3] is now seen frequently in any domain of our daily lives. The most important reason of it is the time- and cost-saving advantages that it provides through its technology. Another important feature is its wide utilization in every domain and sector. It is widely used in medicine packages, products in markets, job advertisements, and even in restaurant menus and museums in global scale. Through the QR Code, one can easily access the information such as image, text, video and/or RSS through barcode-scanning applications and the camera of the mobile device. It is believed that the QR Code will gain significant place in mobile payment systems and NFC applications. The awareness about the usage of QR Code increases in parallel with the increase in number of smart phone users. Nowadays, the smart phone users closely follow the QR code campaigns. There are many services and campaigns provided through QR Codes [4].

Defined as a special matrix barcode type that can be scanned through the cameras of mobile devices such as cell phone and tablets, the QR Code allows the companied to interactivate all they had from contact information to service and product information. Used easily via price-free QR Code applications and offering many advantages, such as being able to be scanned from any angle, in proportion to classic barcodes, the QR Code brings prestige to many companied as a technologic solution easing the access to many information such as business card info, webpage address, advertisement video, and etc., while it allows the customer to reach the company info easier. The more the info is shared, the more accurate products, application and service the customers can reach.

You can easily create a QR without any cost (there are many free QR Generator applications in market), and use these codes in order to offer new services, products or campaigns to customers, to expand the information provided by the product by displaying its label, to link the users to explanatory videos or product ads, and even to offer useful data to people having specific allergies or health problems [5].

The QR codes are one of the game changers in mobile marketing domain of these days. The use of QR codes in marketing has affected the settled approaches. The use of these codes allows the marketers to create and design extraordinary interactions with the potential and/or existing customers [4].

Cesar [6], a dog food manufacturer, has organized a different advertisement campaign via QR code and Pandora. User, through the posters prepared with QR Codes, can reach the music and radio service by scanning the QR Code. They can listen to the company's radio channel through Pandora. In this cannel, there are particular songs that can also be listened by dogs.

World-wide known Kellogg's Co. [7], a well-known cereal and wheat flakes, has used QR codes for advertisement of its new cereal flakes named "Crunchy Nut". Through scanning QR Code, a mobile webpage containing the campaign's

video titled "It's Morning Somewhere" opens up. Containing 13 videos, the mobile page drew more than 50,000 visitors. Kellogg's, which accomplished a very successful campaign with videos watched more than 38,000 times, could introduce its new product to customers immediately. Another important point is to advertise by triggering the interest of the customers without any pressure.

eBay [8], offering online world-wide purchasing opportunities, has used extraordinary and significantly successful QR code campaign besides its internet advertising. In a study carried out in New York, separate QR codes have been prepared for each of the products located on the booth. By scanning the QR Code of the desired product, the user can easily purchase the product via eBay's application.

In order to improve the brand recognition, the companies increasingly participate into social responsibility projects in recent period. Many companies are the sponsors of the social responsibility projects in domains related with them.

One of the examples for that is the QR Code work of Heinz Co. [9] manufacturing especially the food sauces. By adding QR codes to its environment-friendly bottles, the company has made an extraordinary design. The customers scanning the QR Code via their mobile devices may donate for Wounded Warrior Project operating in America. As a result of their work with QR Code, 1 million of codes have been scanned, and a very successful campaign has been accomplished.

Another example from Tesco [10]. In globalizing world, people work more, and they have less time for shopping. Having the awareness of the situation, Tesco designed the billboards like market shelves rather than organizing billboard advertisings. Hence, 10,287 customers purchased something while waiting for the metro. Therefore, the online sales of the company raised by 130%.

Thanks to QR bracelets, people can give all their personal information to their friends by scanning the code.

In New York's Central Park "World Park" [11] campaign, an interactive game has been prepared for Arbor Day. Many QR codes have been distributed throughout the park in order to draw the attention of young people. These QR codes have been carrying different information.

The Association Media & Publishing [12] conference has been organized as a paperless event last year. That conference has utilized QR codes at various locations in order to guide the participants. Through the QR Codes, the organizer of the conference have provided information about the speakers and events, offered local restaurant options, received the opinions of the participants, and show the conference plan. The QR codes have also been used in name badges that have been used like a virtual business card.

The Cleveland Museum of Art [13] (just like many other museums) uses QR codes in order to guide the visitors to the online or audio tours via smart phones, or in order to offer more detailed information.

During Google's [14] Favorite Places campaign, approximately 100,000 companies within the borders of United States have been tagged as "Favorite places on Google." Each of these companies has received a unique QR code to be attached on the window. Through these QR codes, the people passing in front of the companies can find information about the company, reviews of previous visitors/customers, and star the business as their favorite.

For Mercedes-Benz Fashion Week, L'Oreal [15] has established a partnership with Glamour, and then transformed a certain number of cabs into Taxi Shops by placing QR codes. The customers of the taxis were able to purchase the products during their trips. The L'oreal mobile app has been downloaded by 90% of the passengers that have been used their smart phones. 1/3 of the passengers scanned the QR code, and 25% have purchased product(s). Because of the traffic in New York City, most of the taxi passengers are bored in vehicles during the trip, and these results of the campaign indicate a great success in terms of utilization of QR code.

Walmart [16] has recently introduced its new app named Scan & Go that enable clients to scan and bag groceries as they shop. After completing shopping, the clients go to the self-checkout register, and tap the "Transfer Scan & Go Basket" button on the checkout display. The items are transferred from the phone to the register by scanning the QR code located on the screen. After this process, the customers can pay the bill as they normally would.

SoftTech [17], through the mobile payment system "Parakod" developed by them for İş Bankası [18], used the QR Code for payment purpose for first time in Turkey. Hence, without any physical credit card, it became possible to purchase by scanning the QR Code in display of the POS device via customer's mobile device through Parakod application in IşCep. This technology also allows us to avoid from entering our personal and financial information such as name-surname, credit card number, expiration date or security code in internet shopping. SoftTech aims to make it available to pay the bills via scanning the barcode or QR Codes on the bills.

Developing mobile applications, Pozitron [19] prepared a project of "withdrawing money from ATM via QR codes"

for Türk Ekonomi Bankası (TEB-Turkish Bank of Economy) [20]. Thanks to this feature that is first in both Turkey and world, the users can withdraw money from ATM through the code they created with their iPhone.

Jack Daniel's [21] prepared a QR code campaign for its special cocktail Lynchburg Lemonade. Through the QR code used in special packages and brochures, the customers desiring to continue enjoying the Jack Daniel's Lynchburg Lemonade in their houses were provided with the access to the video explaining how to prepare a Lynchburg Lemonade. Jack Daniel's explains the feedbacks of their campaign as follows; "More than 30,000 single users watched the video by downloading to their mobile by using QR code. There are also the watchers of the video in addition to this number." Now, the Jack Daniel's Turkey Facebook page is reached through QR codes both on gift-packs and other communications with customer.

Thanks to QR Code application started by Divriği Ulu Camii and Darüşşafaka, listed in UNESCO's "World Culture Heritage" and accepted as "El-Hamra of Anatolia", the visitors are offered the opportunity of the presentation in 4 languages via smart phones and tablet computers without need for any guide. [22]

Türkiye Newspaper [23] delivers its important news, photo portfolios, and news videos to its readers via QR code. Linking the newspaper pages to internet via smart phones, Türkiye Newspaper connects from paper to digital media for the first time in Turkey. Readers scanning the QR Codes of the important news within the papers of newspaper via the cameras of their smart phones will be able to reach the rich photo content and the video of the news within seconds.

2. QR CODE IN TEXTILE INDUSTRY

Textile sector is one of the firsts using QR code. QR Code, seen especially while shopping, offers the chance of having detailed information about the product when scanned via mobile device. Again, it increases the satisfaction of the customers, who like to shop alone and who don't want to interact with store personnel within the crowd.

Manufacturer can keep the records of the customer habits via scanned QR codes. Due to this advantage of them, the mentioned technology is now used by any marketing and sales channel aiming to "touch" the end user.

Victoria's Secret [24], a world-wide known underwear company, allows its advertisements in America to be demystified through QR Codes. Victoria's Secret's QR Code campaign "Sexier Than Skin" has got very good responses in America.

Macy's has placed QR codes on clothing signage. These QR codes were providing fashion hints to the clients from the designers about how to wear the clothes consumers purchased. It has been observed that this implementation has brought increase in sales.

The QR-3D project designed by Sally Fort [25] focuses on integrating the matrix bar codes into textiles. The codes are cross-stitched into samplers, quilted onto clothing, printed onto fabric, and knitted straight into a sweater. With their pixel-based formats, QR codes resemble two-color textile patterns of many varieties, which inspired Fort to challenge textile artists to combine high tech and artisanal craft.

A very useful technology for tracing the textile production process has been developed by "HeiQ" [26], a Swiss textile technology innovator, and "tracekey", its German technology partner. The application named IDENTITY verifies the authenticity and accountability, it also aims to satisfy the customers requesting ever more. The operation of the IDENTITY technology is based on the unique serial numbers (like Swiss banknotes) located in an individualized QR code. Through these unique serial numbers, all of the traceable components determined by the brand can be traced. By easily scanning the code located on the hangtag or textile care label, the clients can easily track the information about each of the components such as its origin, its consumer labels certifications, and even the name of production personnel and the date. By using IDENTITY by HeiQ, the clients can transparently reach the information about the products they are about to purchase. The important part of this technology is that it offers the guarantee to its customers about the full product accountability and authenticity from fiber to point of sales; it is a first in industry.

The R Cert [27] is a consumer-facing standard for recycled textile clothing. It has been announced for a second time for the "Recycled Collection by Esprit" in a breakthrough indicating the new era for Asia's sustainable fashion innovation. The R Cert is now available in many markets such as Mainland China, Taiwan, Singapore, Hong Kong and Malaysia. It is planned to reached New Zealand and Australia before the end of the year. The R Cert has been designed by Redress, an Asian fashion NGO, in order to encourage the brands for recycling their textile wastes and for educating the users about positive effects of using recycled clothes. Through this technology, the users can track the whole process of recycled textile product from the factory to the store only by scanning the QR code located on the product. Then the users will be directed to their brand's customized, mobile-friendly animation that allows them to reach information about how the recycled clothes have been manufactures and about the contributions of recycled clothes to the environment. Users can also use the R Cert webpage for this purpose.

Many of large brands and well-known retailers such as Harrod's [28], H&M [29], and Ralph Lauren [30] have

announced that they are planning to use QR codes for targeting a new customer base. H&M placed QR codes on billboards and magazine advertisements in order to direct the users scanning the code to the official H&M webpage. In this page, the users will be provided with the color and size options of the product they saw in the ad. They can also place an order, and pay the price through mobile payment.

In year 2008, Polo Ralph Lauren has introduced its new QR-Code based mobile commerce service. The codes were distributed to various locations and sources. The distributed QR codes were directing the users to a site featuring Ralph Lauren's limited edition 2008 U.S. Open collection. Through these codes, the users were also be able to read the RL Magazine, to access style guides Q & A, to watch exclusive RLTV videos and tennis videos, to read tournament articles, and to experience the brand fully.

Ref. [31] aims to introduce the technologies that support Semantic Web Technologies (SWT) in order to ensure the useful traceability in supply-chains, particularly for the textile sector. The main objectives are the identification throughout the supply-chain, managing the orders, and tracking and reporting the problems. The traceability provided by these solutions can also contribute to the customer satisfaction through providing them with additional data about the product, company and/or etc. Within the scope of this paper, the implemented methodology, the design and implementation preferences, and the test results are presented. The unique contribution of this research is the utilization of Semantic Web in real-world industrial traceability solutions that have been verified in Switzerland and India. The presented solutions have started to be commercialized.

Via the Mobile-Life application developed by Pierre Cardin [32], the first for Turkish textile industry, and it eliminates the obligation of carrying the credit card physically. Customers can use fashionality card number in purchasing from Pierre Cardin stores, they don't need to carry the card. They can display bonuses from purchases, can use bonuses in purchases via QR code without needing the card etc.

The use of QR codes and the number of QR Code scanning applications increase as the number of QR Code implementations on textile sector increases. The use of QR codes on the labels brings many new benefits such as:

- **Marketing:** By adding a QR Code on the label, one can allow the user to scan it and to get the embedded information. So, a woven label involving a QR code becomes a new marketing too that communicates the user with the company's website or with a promotion.
- **Engagement with social networks:** Through adding a QR code on the label, the companies can allow their customers to reach the companies' official social media pages such as Twitter or Facebook profiles. This strategy will bring the closeness, and also allow the company to use the social media more productively.
- **Traceability:** Adding a QR code on a woven label will allow the customers to easily obtain the information about the product they are interested in. Some of the information that can be obtained through QR Codes are the country of manufacture, composition of the fabric used in the product, instruction and washing conditions, season, line, campaign, and etc.
- **Identification:** By sewing the woven label onto the label and adding a QR code will enable the development of many new opportunities in terms of identification. The woven labels involving QR code for personal identification can be utilized in clothing. This implementation may be useful for identifying the person in some cases such as accidents, business purposes, and etc.

In order for a company operating commercially to survive in market environment, it must know the R&D information and unit costs of the product it manufactures or sells. The companies that manufacture and sell fabric keep an archive of the fabrics they produce. In this archive, there is all the information about the fabric. This information includes the brand of fiber needed for fabric, its price, the name of contract manufacturer and the information about the machine producing the fabric, raw weight of the fabric, contract manufacturing cost of the fabric, in which dye house the fabric has been dyed, dye prices, the dyeing and finishing procedures, dye loss of the cost, and the cost of the fabric. The price offered to customer is specified. The USD and € prices (according to the actual exchange rates) are included in this archive. This archive is very important for fabric manufacturers. When reproducing the fabric, the manufacturers utilize the archive information as reference. So, there will be no need for a new R&D operation for the fabric. It is required to prepare a chart from the manufactured fabrics, and to keep it in archive folder. When client wants to see the fabric, he/she can more easily make a decision about making an order by observing the touching of the fabric.

It takes too much time to gather all the information about the fabrics and to file them. These files occupy very large places. For this reason, they need to be classified after a while. In order to eliminate this classification operation and the excessive filing, the QR code application has been put into action. Through this application, the data can be processed more accurately. The situations such as excessive number of files or not being able to find the file would be eliminated. We would be able to obtain the data, which we requested, more easily from our mobile phones or computers.

There will be a QR code on the fabric. When we scan this QR code, then a web application will open. For this reason,

the application will operate through a mobile phone or tablet, namely a device operating on IOS, Android or Windows Mobile operating system and having a camera and internet, and it will display all the required information.

3. QR CODE

3.1 What is QR Code

In year 1994, the QR Code has been developed by Denso Wave [1], [2]. Example of QR Code is depicted in Figure 1. That version was a 2D Code, since it has been coded in vertical and horizontal directions. Through that design, it was possible to store larger amount of information into the code. There are also other types of 2D Codes available on the markets. Each of them has unique advantages and disadvantages.

Some of the features, which are thought to be useful for clients, of QR Code are listed below:

- First its Data capacity, QR Code can contain up to 4296 Alphanumeric data or 7089 Numeric data or 2953 Binary data. It means in clear that you can write a text long of 4296 character within your code that will be readable by any translating software.
- In order to translate the barcodes, there are many price-free applications in online application stores. Through these codes, you can not only code the important product info into the code, but you also can provide your clients with direct interactive links.
- This code can be used in textile forms, and it will still be able to be scanned and read.
- Should the code be smudge or partially damaged QR Code system has an error correction capability up to approximately 30%.
- In order to keep the same amount of data stored by a traditional 1D Barcode, the required space is only 10% of the space that is required in case of Barcode.
- It can also encode the Kanji Characters (漢字) .
- It is capable of 360 degree high speed reading.
- In this system, 1 Code can be divided up to 16 smaller codes. This feature is useful when it is needed to print on smaller surfaces.

Figure 1. QR Code.

3.2 How does it work?

There are many free QR code applications that can create a code from the data. User enters the data to be embedded into the code, and then the application creates the QR code that can be used in digital form or in printed form. In order to decode the data embedded in the code, the camera of any mobile device such as smart phone or tablet PC that includes QR Code scanning application can be utilized. After the user scans the code, then the application decodes it [1].

QR codes are capable of storing significantly complex information into a small matrix. The common denominator glue is the mobile phone. The new social interactions generally make use of various sources such as face to face meetings, voice calls, SMS, email, IM chat, social applications such as Twitter & Facebook and many others.

4. QR CODE FABRIC TAG

All textile companies keep archive of information related to sales, prices, customers, type of cloth, production factory etc. We propose a system in which all this information is digitalized and easily accessible by the users. The QR code will be placed on the cartel of the fabric used in the production. The code grants access to all the vital information. When the QR code is scanned by a Smartphone or any electronic device with a scanning capability, the link will open to the necessary information, refer to Figure 2.

Member has to provide information and transactions related to each fabric used by the company. When the process is completed a QR Code Fabric Tag is generated for each fabric. QR Code Fabric Tag can be printed and placed on the cartel of the fabric. Users can change their information any time by logging in into the web system. QR Code Fabric Tag does not have to be issued again as it does not contain the information, it contains the link to the password protected web page.

The QR code will be placed on the cartel of the fabric used in the production. The code grants access to all the vital information. When the QR code is scanned by a Smartphone or any electronic device with a scanning capability, the link will open to the necessary information.

Figure 2. QR Code Fabric Tag.

We have developed a system containing of a web site, database containing the medical records and a mobile application using PHP [33], MySQL [34] and Java [35].

Although PHP is a server-side scripting language that has been designed for web development, it is also utilized as a general-purpose programming language. It has thousands of programming functions easing almost any task.

MySQL database was used to keep the medical records. MySQL is the world's second most widely used open-source relational database management system.

In order to design applications which will be operated on any device, notwithstanding the operating system, we prefer the PHP and MySQL since utilization of PHP scripting and MySQL database eases the task of programmers.

We developed a mobile application for Android mobile phone. Android [36] operating system has been designed based on the Linux kernel with a user interface based on direct manipulation, its primary targets are the touchscreen mobile devices such as smartphones and tablet computers. We prefer to use the Android, because it is, as of the year of 2011, the largest installed base of any mobile OS and, as of the year 2013, the devices using Android has been sold more than the sum of devices using Windows, iOS and Mac OS. Besides the Android, we also plan using other mobile operating systems while developing applications.

Android application was developed using the Java language. Java is a very popular programming language developed by Sun Microsystems (now owned by Oracle).

5. CONCLUSION

In this paper, we proposed a QR Code Fabric Tag system for textile companies in Turkey. Through this application, the companies that manufacture or sell fabric will avoid infollution. They will be able to more easily access the information about the fabric they wanted.

We will only prepare a regular chart from manufactured fabrics, and keep it. Through the QR codes on these charts, we will be able to access the needed information. Because the information includes the entire history of the fabric, this application will be used only by the company. None of the clients will be able to access this information. Through this application, the fabric manufacturing and selling companies will be able to offer more accurate service to their customers.

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