QR CODE - INTERACTIVE MOBILE MARKETING TOOL OF AUGMENTED REALITY TECHNOLOGY

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ABSTRACT
With the development of ICT technologies we encounter a variety of fantastic and unreal concepts and technologies, such as the concept of Augmented Reality. It is a technology that represents real objects on the superimposition of layers of information and images. The most widespread tool of this technology is the QR code. It is widely used in advertising, marketing, e-commerce and other fields of business. This paper aims ro study the development of the technology and its application in the field of marketing through QR codes.

Key words: Augmented reality, QR code, ICT, marketing, advertising, interface

1. DEFINITION OF AUGMENTED REALITY (AR) TECHNOLOGY

The term „Augmented reality'' does not have a universal translation in Bulgarian. Most bloggers and experts settle on „augmented reality" , „supplemented reality'' , „magnified reality'' or „expanded reality''. This article adopts the term "augmented reality". (AR)

Augmented reality is considered to be a continuation of the well familiar to us Virtual reality (VR). Computing machineries are not powerful enough for VR to be able to handle this technology due to the fact that they can't maintain the necessary resolution. Many authors adopt the simplification that AR connects the 'real environment' with the virtual.

AR is defined as a direct or indirect observation of the image of the real environment, which is carried out in real time. To this picture has been added additional information that is pre-generated by the computer and useful for the consumer.(1)

The AR technology is aimed at simplifying the life of users. It provides not only information

about the virtual world around them, but also any indirect painting, such as text, images, streaming live video. AR creates conditions for increasing of user's experience and interaction with the real world and in a real time as opposed to the technology for virtual reality (VR) or virtual environment, as it is called by Professor Paul Milgram, which immerses them in a synthetic and artificial world.

One of the biggest advantages of AR is its usage for increasing and replacing of absent sensory perception in humans: increasing and adding additional sound signals in users with visual impairments or adding visual cues for users with hearing impairment.

2.PRINCIPLE OF APPLICATION OF AUGMENTED REALITY TECHNOLOGY
2.1.CONNECTION

Connection can be online by using the Internet connection on the device itself and the software for AR. An example of such a connection are the main databases of the largest online library in the world, Wikipedia and the biggest search engine Google, which supply information about the subject that interests us. Separate applications for AR are used in social networks (Facebook, Twitter, Google) and the information about

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certain objects and objects in them is given by their users.(2)

2.2.RECOGNIZE THE OBJECT
The technology has a marker and non-marker realizations.

The marker recognition is realized with the help of a marker, also known as glyph. The glyph is black and white, in rare cases, a colored square, printed on paper or another surface, such as QR code, Data matrix code, Microsoft tag. Typically, this surface is flat, but it may be curved - as on a bottle.

Figure 1. Coca Cola QR campaign

The non-marker recognition is direct, aimed at logos, images of posters and images of real-world objects.

During recognition both methods use the camera of the device. The software is developed specifically for each application.

In marker recognition software for AR reads the information stored in the tag, and it becomes accessible or visible to the user. More often these are links to websites or applications related to the subject.

In applying non-marker recognition sensors for location are used - GPS and digital compass on the device. Here, besides the desired information, the user also receives directions how to get to other sites.

Recognition of objects is considered not only for recognition of buildings and objects. The AR

technology is too large to be confined to this.(2) Through the instrument QR code the technology is used with great success in the promotion of goods, services and campaigns in different business areas.

3. INTERFACE (SOFTWARE) FOR AR
One of the most important aspects of AR is to develop appropriate techniques for intuitive interaction between the user and virtual information through applications with different content for AR.

There are several ways of interaction in applications for AR. For example, physical (tangible) interface, common interfaces, developing multimodal interfaces, interfaces for mobile projection and more.

3.1. PHYSICAL OR TANGIBLE INTERFACE FOR AUGMENTED REALITY
Physical interface supports direct interaction with the real world by using real, physical objects and instruments. A classic example of the power of physical user interface is VOMAR (Manipulation of virtual object desktop environment AR) developed by H. Kato and others.(3) This interface enables a person to choose and implement its desired design for your room using the AR, and order the furniture in your living room with rowing movements of the hands. Rowing movements are transformed into intuitive gesture commands and as a "scoop" of the object to be moved or gesture of the hand, similar to a stroke, which recognizes the device as a command object to be removed.

3.2. MULTIMODAL INTERFACES FOR AUGMENTED REALITY
Multimodal interfaces combining the introduction and recognition of real objects with naturally occurring forms of language and behavior, such as speech, touch, sight, natural hand gestures. These types of interfaces are new. Examples of multimodal interfaces are the "sixth sense" (MIT's sixth sense). MIT reliable gestural interface called Wear Ur World (WUW).(4) WUW brings the user the information projected onto surfaces, walls and physical objects through natural hand gestures, movement of the subject and/or interaction with the object itself.

3.3. INTERFACE FOR MOBILE PROJECTION APPLICATIONS FOR AUGMENTED REALITY

Nowadays, mobile phones are involved in a wide range of activities in everyday life. They are adaptable to a variety of applications, making them universally accessible means of our lives. With the increase in processing power and memory as an obstacle to their use remains small size of their display and its resolution. In order to preserve the characteristics of these devices, such as portable, good mobility and comfortable to use, the screen size is limited. And even though the resolution of these displays is increased, yet the information which can be projected on the display is small in volume.

With today's mobile phones one can examine information such as coordinates and address of the card content of web pages, so there is no need zooming or panning.(5)

4. QR (QUICK RESPONSE) CODE
4.1. NATURE AND STRUCTURE.

Figure 2. Visualization of the differences between the QR code and barcode standard

The most widely used tool of AR technology is QR code. It is a type of a barcode, similar to that which is located on the packaging of a product commercially available. It is capable of storing various types of information, such as numbers, letters, symbols, binary code. Up to 7,089 characters can be stored in a code. QR code contains information by vertical and horizontal directions, while the bar code contains information only horizontally. QR code was invented by Denso Wave Incorporated in 1994, where "QR" stands for "quick response." According to the official website of Denso Wave (6), QR code has not only a high capacity but also can store many different types of information. It even has a high rate of error correction. This means that even if 30% of the characters is dirty or torn, QR code can still be read correctly.(7) That way the QR code contains significantly larger amounts of information.
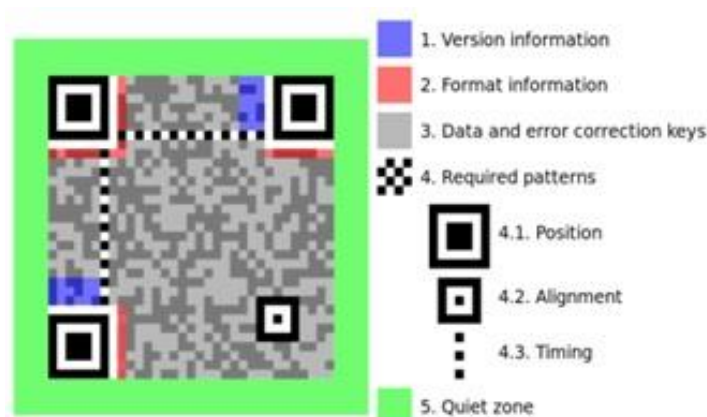
Figure 3. Structure of QR code

It contains data that can be read by the camera of the mobile phone, smartphone, tablet. This type of barcode consists of black modules arranged in a square pattern on a white background. The information encoded may be text, image, URL (eg link to website) or other.

Figure 4. Different types of content in QR codes

Nowadays QR Codes are everywhere - on product packaging, in commercials, in magazines and even in ads for Real Estate. Located there - increasingly popular in marketing and e-commerce.

4.2. QR CODE IN AUGMENTED REALITY

QR codes contain data that can be read by the camera of the mobile phone. Once these data are read from the phone, the user is often reference to a website where he can consider some special content that should be important or interesting to him. This website may prompt him to download a program to his phone, or just to give him useful information.

Problem for people is that QR codes are a combination of opaque squares. There is no way to see with naked eyes what is behind the code, who created it and what it can cause when it is read. (7)

5. STEPS FOR PROPERLY AND SUCCESSFUL USE OF QR CODE IN MARKETING

1) QR codes should be easily detectable. They may be a different color, surrounded by a frame or text that attracts attention.(8)

2) QR codes require instructions. It is advisable to add a description that tells people what to do with QR. This can be done by simply include text (eg "Scan QR code with your smart phone") or by adding an image that shows smartphone pointing to the QR code and charge website.(8)

3) QR code must be large enough and easy to scan.(8) However, no one knows for sure what kind of devices users have. If the slot with QR codes is too small, it would hamper mobile devices with older cameras in reading contours due to the lack of autofocus or poor resolution, or the placement of posters at a height difficult to scan. Handy size has to be at least 3x3 cm, depending again on the devices that scan code (scanning process itself takes time). It is therefore desirable that it should not be on billboards and advertisements located near roads, because the scan would cause an accident.

4) An essential part of the marketing strategy is the audience, the target group of customers that the company wants to attract. If the product using this technology is aimed at a user group that does not have mobile devices able to read the code, the entire campaign would have suffered a setback. It is therefore desirable campaign to be directed to consumer groups.

5) One of the main applications of these QR codes is their connection to the web, but because of the scanning by mobile devices is desirable these sites to be "lightened", so as not to put unnecessary strain on them.

6) The use of QR codes is universal. It can be used in marketing, mobile commerce, entertainment, even the FBI uses it as additional information about the most wanted terrorists. Scanning the QR code takes time and effort. So the final result is well worth it. Information that presents QR codes should be concise, to complement that one placed on the brochure to present it in an interactive way or make it easier to rationalize.

7) QR code can track visits through it. As a digital instrument QR codes can be very useful and convenient for the collection of follow-up information from the campaign, or just to draw some statistics. There are plenty of appropriate

programs for generating the code, decoding and tracking.

8) The long URL addresses are an obstacle. They are difficulties to generate and scan the codes. Service Bit.ly (www.bitly.com) applies for shortening the URL.

6. EXPERIMENT TO CAPTURE THE SENTIMENT OF USING QR CODES IN STARA ZAGORA

In order to test this new technology and the application of the QR Codes in Bulgaria, it has been conducted a blitz poll in the city of Stara Zagora. Cards that were created contained a QR code with generated greeting for Valentine's Day. (9) Participants in the random sample were aged 10 to 30 years. Everyone of them has their own smartphone.

Figure 5. Card for Valentine's Day with a message: "EVERY DAY IS SPECIAL THANKS TO YOU"

Connecting the emotion and excitement of this celebration of the younger generation with the election of new technologies for communication and aim to get an idea of how they are perceived by the use of the QR code. QR codes are not only invented to refer to "quick reply" but also instructions for their use are fast and catchy. Young people need to be flexible when it comes to implement new technological methods and devices. 42 people were involved into the experiment. About 30.95 % of the respondents don't know the real opportunities available on their mobile devices, 83.33% are motivated to learn about the implementation of QR code and only 16.67% refuse to continue to participate in the experiment. About 83.33% answered positively whether they have an interest in applying the QR code to greet their love partners in a new interesting way. 18, 81% of respondents who are aged over 18 valued QR codes as a creative approach in marketing.
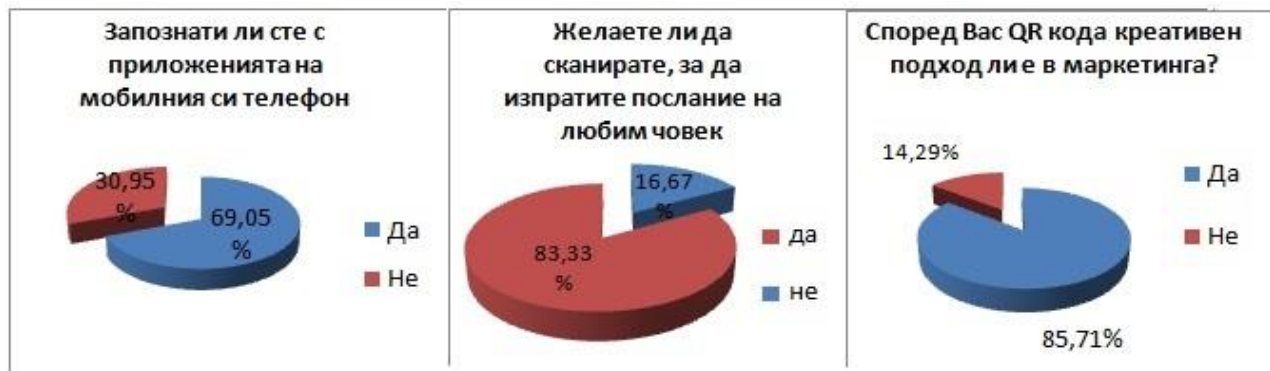

Figure 6. Quick Survey

This experiment does not claim to represent a large and accurate sample reporting the level of use of QR codes, but rather seeks to establish the possible attitudes for implementing this easy and affordable technology.

7. EXPERIMENTAL CAMPAIGN TO PROMOTE THE ACTIVITIES OF THE AGENCY FOR YOUTH AND STUDENT PROGRAMS "COOL TRAVEL"

Accounting a large proportion of young people expressed pleasure as a result of using QR codes was the main purpose for creating 4 different QR codes for "Cool Travel" agency - Stara Zagora.
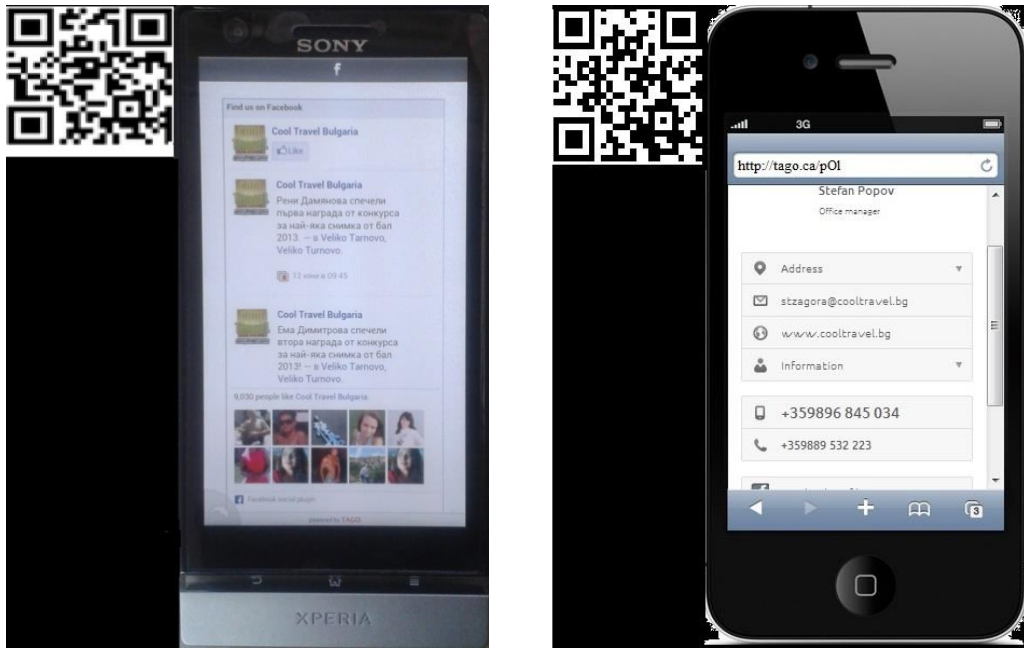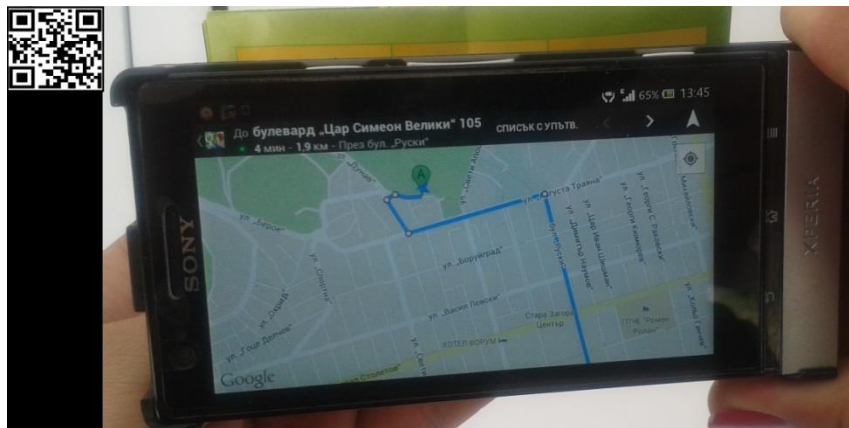
Figure 7. Facebook like content and Vcard content

Figure 8. Google Map content

Figure 9. Web site content

Participants in the experiment scan them. The aim was to observe which one of the contents generated in the QR codes was the most preferred.

To speak the language of a particular audience is one of the main quality of the true professionals in the field of marketing. Thus the study of the preferred information that students from Trakia University may receive by the use of QR codes is organized for this specific target group. Student audience is the main user of the company's products offering different student's programs for travelling and working abroad. Experimental campaign involved 53 people selected randomly. (10)
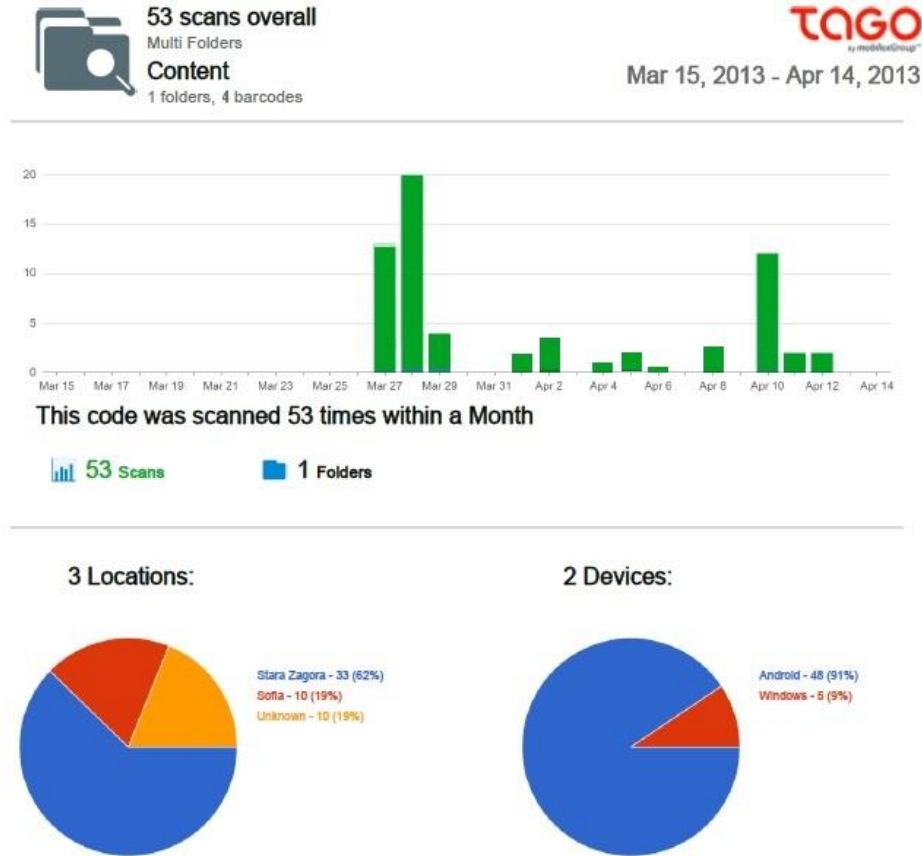

Figure 10. QR code statistic of "Cool Travel" campaign

Information generated in these QR codes construct diverse as space and volume trends in the perception of "Cool Travel" agency.

33.96% of respondents pointed as the most preferred **Facebook like** content generated in QR code.

Facebook allows feedback for customers interested in the company. They can share information and make comments regarding its quality. QR codes invite people to "like" and "follow" business quickly and easily requiring no effort and time to obtain information about a company and feedback about the things and services it proposes. This is an easy way this component to lay on the interest of other potential customers to search for information about the company.

Google map shows how to get to the address of the agency - it's the best and most accurate information about geolocation of a company. It represents a real call to action for those who are motivated to focus on the company's services. In this study 28.30% preferred this kind of content generated in QR code.

Web sites that provide quick access to concise information are preferred by 22.64%. These respondents hesitated whether they needed more information about the company or whether it was necessary at this point in their lives.

The **business card** of the manager earned the lowest rate - 15.09% of students indicated as

their favorite for obtaining information. They contact directly to the manager of the agency suggesting that still were not acquainted with the information from other QR code contents or require this information in more details and in direct connection.
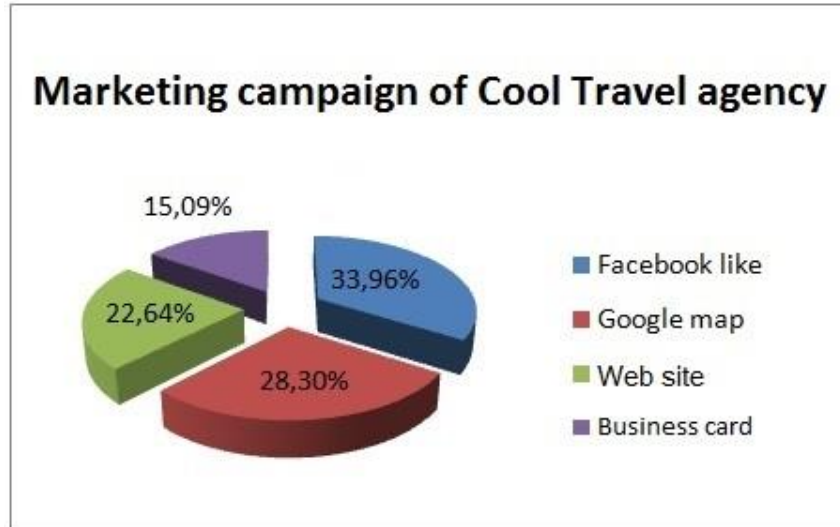

Figure 11. Marketing campaign of Cool Travel agency

8. CONCLUSIONS
The number of companies that use QR codes in their marketing strategy is constantly increasing. Using smartphones as a tool for scanning these codes enables reaching customers more quickly and efficiently. This approach helps them to make their choice in an exciting way and to buy the product or service easy and fast.

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