Utilizing QR Code and Mobile Phones for Blinds and Visually Impaired People

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Abstract. In this paper a barcode-based system to help the visually impaired and blind people identify objects in the environment is introduced. The system is based on the idea of utilizing QR codes (two-dimensional barcode) affixed to an object and scanned using a camera phone equipped with QR reader software. The reader decodes the barcode to a URL and directs the phone's browser to fetch an audio file from the Web that contains a verbal description of the object. Our proposed system is expected to be useful in real-time interaction with different environments and to further illustrate the potential of our work, two scenarios are presented.

1 Introduction

Cell phones are becoming an important aspect of our lives. The comfort and convenience they provide certainly made our lives much easier than ever before. Two brilliant features found in modern cell phones are: the integration of digital cameras and the ability to access the Internet anytime and anywhere, thus, enabling us to seek information when we need it.

Nowadays, the built-in digital camera found in cell phones and Internet access can be consolidated to provide a new dimension of information seeking. A user having a camera phone equipped with the correct reader software can scan a two-dimensional (2D) barcode and decode it to launch and redirect a phone's browser to an embedded URL or to resolve text embedded in the scanned barcode.

The benefit of such a feature in modern mobile phones can be further extended to include blind and Visually Impaired (VI) people. Also, with the introduction of speech technologies in cell phones such as the use of Nuance TALKS [1], which converts the displayed text on the mobile handset into speech, the blind and VI person can easily interact with the mobile handset as a sighted person do.

The idea of utilizing the capabilities of modern mobile phones with 2D barcodes to assist VI and blind people identify objects in the environment is very promising. Thus, our proposed system uses mobile phones, which are inexpensive, portable and nearly a ubiquitous mainstream consumer product widely used by blind people, not like some expensive assistive technologies, to verbally identify objects tagged with 2D barcodes.

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The remaining of the paper is structured as follows. We start by providing brief background information on 2D barcodes. Following this, we describe our proposed system of the particular camera-phone/2D barcode interaction system. The potential applications of our proposed system are then reported. Finally, we consider related work and present conclusions and future work.

2 A Brief Overview of 2D Barcode

Applications of 2D barcode technology have recently found a great growth with the spread of camera phones. 2D barcode technology was initially developed for product tagging, in Medicine, Press and many other fields [2].

2D barcodes were developed to overcome the information limitation in linear barcodes, i.e. one-dimension barcode. 2D barcode stores data along two dimensions and therefore is capable of containing much more information than one-dimensional (1D) barcode (Fig. 1) used in many products such as food and cosmetics. 2D barcode can hold a large amount of information and it is capable of handling all types of data, such as numeric and alphabetic characters, symbols, binary, and control codes.

Fig. 1. 2D barcode (left), 1D barcode (right)

Fig. 2. A tool box tagged with QR code [From Flickr[1]]

[1] http://flickr.com/photos/74845103@N00/2206455829/in/photostream/

There are many 2D barcode tagging systems available online among them are: Semacode URL tagging system [3], ShotCode [4], QR code [5], and BeeTagg [6], to name but a few.

Despite the wide variety of 2D barcode systems, the QR code was chosen for our proposed system for the following reasons: firstly, the QR reader works with any camera cell phone running the Symbian OS and it runs quickly and reliably on portable camera phones. Secondly, the QR reader is freely available, easy to install and the 2D barcode generator is widely available on the Web. Finally, QR Codes can store text or URLs that may link to websites or multimedia files (Fig. 2).

3 Proposed System

Although many systems for helping the VI and blinds with identification problems have been developed in the past few years, there is always a need for a system that utilizes and integrates available technologies for facilitating VI and blind people lives.

Fig 3. shows the configuration of the proposed system. The system consists of three components which are: 3G mobile phone equipped with QR reader and Nuance TALKS, a web server that host the audio files and an object tagged with a QR code.

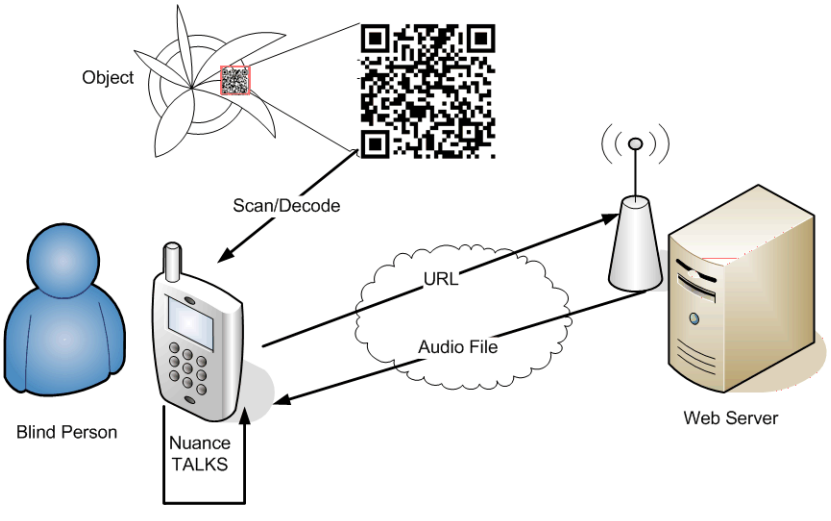

Fig. 3. Overview of the proposed system

The QR Code is affixed to the object that the blind person needs to know more information about and the barcode location is marked with a Braille seal for easy identification.

Once the blind person passes the camera phone over the QR code, the QR reader detects the barcode by providing the user with an appropriate audio feedback (i.e. a beep), thus, indicating the scanning of the 2D barcode. The reader then launches and redirects the phone's browser to the embedded URL, which fetches a pre-recorded

audio file describing the designated object. However, if the embedded information in the QR code was merely text, Nuance TALKS is invoked to read the text aloud.

4 Applications of the Proposed System

In this section we demonstrate two scenarios were our proposed system will be beneficial, namely: Museums and shopping.

Most objects in a museum are described with some information adjacent to it. Usually, it requires a guide or an operator to read the information content to the VI or blind visitor, thus, constituting a barrier for the VI and blind visitor to know about an object in case of the museum guide absence. However, with the use of QR codes to tag objects in the museum, the VI and blind visitors can point their mobile phones to objects tagged with QR codes so they can get more information about them.

Another similar scenario is the use of QR code with products. A product can be tagged with a QR code that contains information about it. When a VI shopper needs to buy a product (s)he points his/her camera phone to the QR code attached to the product to get more information about the item.

5 Related Works

The use of barcodes in general and 2D barcodes in particular in the field of visual disabilities has not gained much momentum compared to other research fields. In this section, we introduce a set of systems that utilizes barcode systems and/or mobile phones for helping the VI and blinds in navigation or object identification.

Tatsumi et. al [7] used 1D barcode and RFID tags attached to objects for building an information ensured area for the visually impaired in the college life. They presented two scenarios where they applied their system. The first scenario was about getting voice access to announcement on the bulletin board by scanning barcode using a PDA equipped with barcode scanner. The second scenario was by using a PDA equipped with an RFID unit to build a messaging system between students and teachers. In this scenario an RFID tag is attached to a laboratory door that keeps a message from a teacher, for example, where he left for (destination) and when he will be back again. A visitor (blind student) can read the message and can leave his own message to the teacher. Tatsumi et al. system proved effective for information ensuring for the visually impaired.

Similar systems for object identification can be found in [8] and [9]. In [8] Iannizzotto et al. used wearable computer system and 1D barcode for objects identification. Similarly, Ebrahim et al. [9] used portable camera with a computing device and 2D barcodes.

Coughlan et al. [10] demonstrated a camera cell phone-based wayfinding system that allows a visually impaired user to find and read signs marked with color targets and barcodes. In their solution they placed a distinctive color target pattern on a sign that quickly guides the system to an adjacent barcode, where their system read using an algorithm that is robust to poor resolution and lighting. Preliminary experiments with blind subjects confirm the feasibility of the system.

From the previous work we can find that our proposed system differs from the other ones in two aspects: the hardware required and the operational software. Our proposed system relies on the existing of any 3G mobile phone (hardware) that can install QR reader (software), where as the previous systems either required proprietary software or used some dedicated hardware device.

6 Conclusion and Future Work

2D barcodes are widely used by sighted people to link physical objects to URLs or descriptive text. Moreover, the recent interest in the use of visual tags in every day life is a natural consequence of the technological advances found in modern mobile phones.

Although our proposed system has the potential to make objects more accessible to blind and visually impaired people using mobile phones, the work presented in this paper should be considered as a first exploratory step and there are many issues that need to be resolved along the way. Efficient compression algorithms must be investigated to speedup the delivery of large audio files over 3G networks. Also, we need to experiment with blind subjects to demonstrate the feasibility of using the system as a real-time aid.

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