Supporting education of people with visual disabilities using braille codes and QR code technology

Apoyar la educación de personas con discapacidad visual usando códigos braille y tecnología de código QR

Apoiar a educação de pessoas com deficiência visual usando códigos braille e tecnologia de código qr

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Abstract

The purpose of this research is to find a new method for blind and visually impaired people to receive information using Braille codes with QR code technology in publications, which will enable them to use the Internet to obtain diverse information by voice. Information is provided for blind and visually impaired people. This article is one of several parts the researcher presents on methods using linear or binary QR code to provide information (audio books, audio articles, audio stories for children, etc.) for people who have visual impairments. Developing a curriculum for the blind and the visually impaired is a responsibility of governments and civil society organizations. The author believes that the visually impaired have the ability to develop, promote and become more active in their communities if resources for improving their living, education, and health are available to them.

Keywords: visual disabilities, blind, QR code, Braille, special education

Resumen

El objetivo de esta investigación es encontrar un nuevo método para que las personas ciegas y con discapacidad visual reciban información mediante códigos Braille con tecnología de códigos QR en publicaciones, lo que les permitirá utilizar Internet para obtener información diversa por voz. La información se proporciona para ciegos y deficientes visuales. Este artículo es una de varias partes que el investigador presenta sobre métodos que usan código QR lineal o binario para proporcionar información (audiolibros, artículos de audio, historias de audio para niños, etc.) para personas con impedimentos visuales. El desarrollo de un plan de estudios para ciegos y personas con discapacidad visual es responsabilidad de los gobiernos y las organizaciones de la sociedad civil. El autor cree que los discapacitados visuales tienen la capacidad de desarrollar, promover y ser más activos en sus comunidades si se dispone de recursos para mejorar su nivel de vida, educación y salud.

Palabras claves: Discapacidad visual, ciego, código QR, Braille, educación especial.

Resumo

O objetivo desta pesquisa é encontrar um novo método para pessoas cegas e com deficiência visual receberem informações através de códigos Braille com tecnologia de código QR em publicações, o que lhes permitirá usar a Internet para obter informações diversas por voz. A informação é fornecida para cegos e deficientes visuais. Este artigo é uma das várias partes que o pesquisador apresenta sobre métodos que usam código QR linear ou binário para fornecer informações (audiolivros, artigos de áudio, histórias em

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áudio para crianças, etc.) para pessoas com deficiência visual. O desenvolvimento de um currículo para cegos e deficientes visuais é de responsabilidade de governos e organizações da sociedade civil. O autor acredita que os deficientes visuais têm a capacidade de desenvolver, promover e ser mais ativos em suas comunidades se houver recursos disponíveis para melhorar o nível de vida, educação e saúde desse grupo.

Palavras-chave: Deficiência visual, cego, código QR, Braille, educação especial.

Introduction

The main aim of the research is to create a method to facilitate the accessibility of academic audio materials to people with visual disabilities using the Braille code in parallel with the QR code technology for access to audio materials on the Internet or the local server. The students with visual disabilities' access to the academic materials is real challenge. Therefore, the researcher proposes to provide academic materials in the form of audio materials on the Internet, to be accessible and easy, and so the researcher used two tools (Braille and QR code) to access to audio materials. It is clear to observers the number of possibilities enjoyed by many people with disabilities and the ways in which they are compatible with life and difficulties, whether in ways of preparing food, working in the market and home, or caring for their children, and these possibilities contribute positively to the enrichment of human civilization on the planet. I will focus the light in this article on the those who are blind or visually impaired, and I am guided by geniuses who provided humanity with great achievements, such as Helen Adams Keller [1] and Taha Hussein [2], as well as thousands of others who challenged their visual disability and provided great examples of the ability of the blind to achieve scientific creativity and humanity (Keller, 2002; Galal, 1993).

"Louis Braille's alphabet could be easily felt by the finger, and the arrangement of dots in different positions to represent individual letters and letter groupings gave the education of the blind an order and a stability it had not earlier possessed" (Mackenzie, 1953).

The United Nations approved the right to learn and facilitate access to science as one of the most important human rights; therefore, I chose this segment of the disadvantaged population to provide a way to facilitate their access to information using the Braille code known to most teachers of the blind, in addition to the information technology barcode. In addition to using Microsoft Visual Studio and the Internet, I intend to design a catalogue of guides for the visually impaired and the blind so that they can obtain information in the form of audio files from the Internet with the use of a computer or smart phone and with a dual barcode (QR code) reader. The QR code, "guides for the visually impaired and the blind so that they can obtain information in the form of audio files from the Internet with the use of a computer or smart phone and with a dual barcode (QR code) reader. The QR code, "the matrix barcodes" quick response code, is "a specific 2D barcode which carries information in the vertical direction as well as in the horizontal which enables the several hundred times the amount of data carried by ordinary barcodes (Vida et al, 2012). The code consists of black modules arranged in a square pattern on a white background to encode a text, URLs (uniform resource locator) to access web pages, or any other data. It can be defined in a small printout size and easily read with dedicated QR readers or with modern mobile, named smart phones, with camera and application for them" (Finžgar and Trebar, 2011). QR codes are used for many different purposes such as making purchases, accessing additional information in the web, giving out discount coupons, and interacting with social media.

In the beginning, we identify the audio files that the visually impaired or the blind want to obtain. then, we upload them on the Internet, and have chosen as an example the world music Swan Lake of the great Tchaikovsky on the site YouTube.

Note: Audio books or audio lectures can be selected as desired.

Methods and Related Works

In this section, we review the error rate in several modern methods of access to materials on the Internet, and show the advantage in using our method in terms of ensuring access to audio materials required on the Internet without technology error using QR code.

-Audio-based Methods like Apple's VoiceOver with on mobile devices previous studies have shown that this method supports very low text entry rate. and In their evaluation of the system, Bonner et al. showed that participants were able to input text using No-Look Notes with 11% error and VoiceOver with 60% error.

-Typing- and Tapping-based Methods like BrailleTap maps inputs from the phone's physical keypad into dots in a Braille code. Guerreiro et al. showed that the error 6.55% with BrailleTap.
-Gesture-based Methods, for example, 8.43% error with EdgeBraille, users can enter a Braille

code by swiping their finger along a mobile device's edges, which contain areas that could be touched to input dots (Whiting, 2004).

-The software application. The first researcher designs a barcode-generating program (QR code) to convert Internet addresses to a binary code of type (QR code) and to design the QR code generator program. The researcher uses Microsoft Visual Studio as in the forms below (Li et al, 2017). Figure 1 shows the form of the barcode QR code generation program using Microsoft Visual Studio:
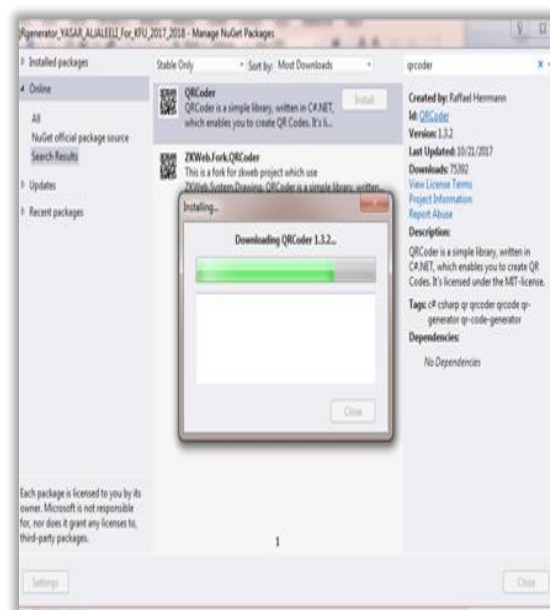

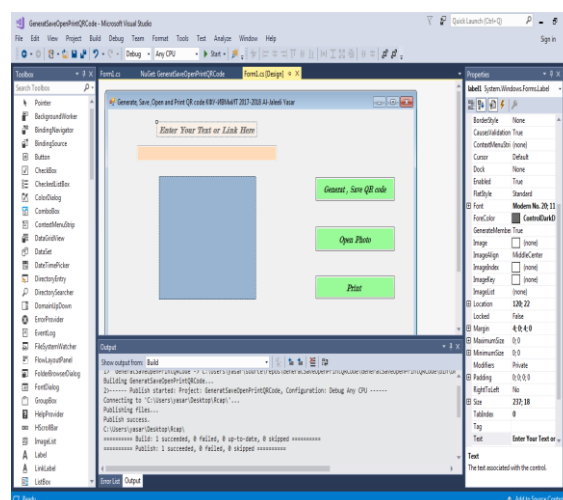Fig. 1. The form of the barcode QR code generation program using Microsoft Visual Studio

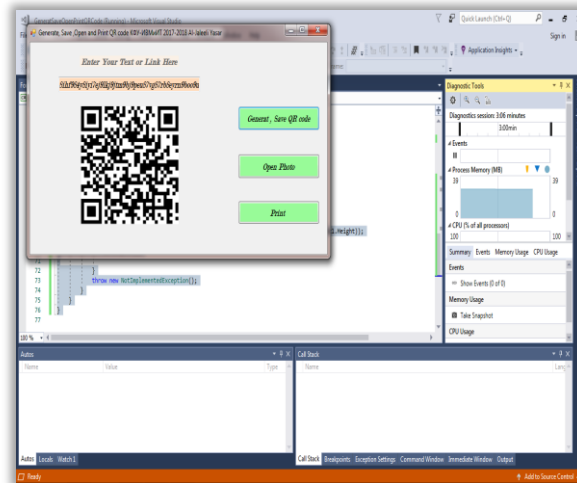Fig. 2. The link pasted from YouTube to generate and save barcodes

Fig. 3. The barcode form after the generation process

-The software code. using System;

using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Drawing.Imaging;
using System.Drawing.Printing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;

namespace GeneratSaveOpenPrintQRCode
{
    public partial class Form1 : Form
    {
        public Form1()
        {
            InitializeComponent();
        }

        private void Form1_Load(object sender, EventArgs e)
        {

        }

        private void button1_Click(object sender, EventArgs e)
        {
            using (SaveFileDialog sfd = new SaveFileDialog() { Filter = "JPEG|*.jpg", ValidateNames = true })
            {
                if (sfd.ShowDialog() == DialogResult.OK)
                {
                    MessagingToolkit.QRCode.Codec.QRCodeEncoder   encoder   =   new
MessagingToolkit.QRCode.Codec.QRCodeEncoder();
                    encoder.QRCodeScale = 8;
                    Bitmap bmp = encoder.Encode(textBox1.Text);
                    pictureBox1.Image = bmp;
                    bmp.Save(sfd.FileName, ImageFormat.Jpeg);
```

```
                }
            }
        }

    private void button2_Click(object sender, EventArgs e)
    {
        using (OpenFileDialog ofd = new OpenFileDialog() { Filter = "JPEG|*jpg", ValidateNames = true
})
        {
            if (ofd.ShowDialog() == DialogResult.OK)
                pictureBox1.Image = Image.FromFile(ofd.FileName);

        }
    }

    private void button3_Click(object sender, EventArgs e)
    {
        PrintDialog pd = new PrintDialog();
        PrintDocument doc = new PrintDocument();
        doc.PrintPage += Doc_PrintPage;
        pd.Document = doc;
        if (pd.ShowDialog() == DialogResult.OK)
            doc.Print();

    }

    private void Doc_PrintPage(object sender, PrintPageEventArgs e)
    {
        {
            Bitmap bm = new Bitmap(pictureBox1.Width, pictureBox1.Height);
            pictureBox1.DrawToBitmap(bm,        new        Rectangle(0,       0,       pictureBox1.Width,
pictureBox1.Height));
            e.Graphics.DrawImage(bm, 0, 0);
            bm.Dispose();

        }
        throw new NotImplementedException();
    }
  }
}
```

It is also possible to generate (QR-Code) using Google applications that are free on the Internet (if Internet service is available). "At the time of choosing a QR code generator for the project, the choice lay between selecting Denso Wave's generic 2D barcode, which could be generated by a variety of free web programs and was supported by Google" and a separate program by Microsoft (Halvorsen, 2006).

The contribution of the authors is finding a way to access the content results without mistakes by combining the tools (Braille + QR code) in a unique and guaranteed way to access the audio materials are preloaded on the Internet, which is characterized by the method that other user to reach the goal set by the educational programs without making mistakes that you find found in other ways.

After we obtain the barcode QR code, we print it on the page in Braille code, which can be read by visually impaired people with their fingers. We wrote the Braille code for the below example, and we typed the bar code for the Swan Lake global music in 2-dimensional Braille code to allow the blind to find the bar, which needs to be read using the bar code scanner binary code that connects to a computer; now, the visually impaired have the ability to hear Swan Lake using

this application. The process is the same when a visually impaired person wants to listen to audio books or children's stories on YouTube or other web sites. See the example in Figure 5:

Fig. 4. Example 1

A second example is shown in Figure 5:

Fig.5. Example 2

In the second example, the researcher used the book title (Hicks and Sinkinson. (2011). The visually impaired can listen to this book for more than 3 hours. The researcher used Braille code in English for use in the U.S.A. to design the example paper that can be seen above (Machiavelli, 2002). It is necessary to train visually impaired people in a sufficient and effective manner to use both the barcode readers and the method of locating the QR code on the page, which is surrounded by Braille code to determine the orientation accurately and to guide the barcode readers in the right direction.

Conclusion

The use of this method in the education of the visually impaired provides many positive aspects, the most important of which is the availability of thousands of audio materials and make them available to students in the form of audio materials to listen to them at any time and the

provision of thousands of dollars required to print textbooks through Braille alone, The method is cost-effective economically, it does not need the imaginary amounts of 5000 - 10000 Euros owned by the majority of visually impaired, especially in poor countries.

The use of this method ensures that it handles all local languages without error of access. The audio material that we reach using QR code is specially produced in the target language, while there is an error rate when using other methods such as (Text-To-Speech) TTS Especially with the lack of support for many local languages in technology TTS.

QR codes are easy to generate and can store much more information (maximum 7,089 character) than barcode. As QR codes are resistant to dirty and damage, data in QR codes can be restored even if the symbol is partly damaged or dirty. Further, they support high-speed reading from 360-degree directions (Maurel, 2012).

Acknowledgements

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