

OBJECT IDENTIFICATION SYSTEM FOR VISUALLY IMPAIRED USING QR CODE

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ABSTRACT – This paper is an attempt towards generating a QR code and developing a scanning application to assist visually impaired in identifying various objects in their surroundings. The basis of this application is to make use of QR codes affixed to an object and then the same is scanned using a phone with a camera. The application contains a single button feature which scans the QR code. The UI of the application is designed in a user-friendly manner. The application then converts the QR code into characters. Then, with the help of text to speech engine, the application then generates a verbal description of the text, which is audible to the user. The application is useful in real-time interactions that enable the user to identify objects.

I. INTRODUCTION

Visual impairment, which is also known as vision impairment or loss of vision is a reduced ability to see, which cannot be usually fixed by usual means, such as eye glasses, contact lenses etc. The term blindness is used for complete or an almost complete loss of vision. Visual impairment may cause difficulties to people in terms of performing normal day to day activities such as driving, reading, etc.

The World Health Organization (WHO) estimates that 80% of visual impairment is either preventable or curable with treatment. As of 2015, there were 940 million people with some degree of vision loss. 246 million had low vision and 39 million were blind. The majority of people with poor vision reside in the developing countries and are over the age of 50 years. Visual impairment and/or blindness, have numerous costs that are economic in nature, both due to the high treatment cost and also due to the decreased ability to work.

Mobiles have become an integral part of our lives. The convenience provided by them has made our lives way easier now. One of the most important features of a mobile device is the integration of a camera feature with internet access, which enables us to seek information as and when we need. These days, the built-in digital cameras that are marketed as one of the main features of a smart phone and easy access to internet has been an enabler of sorts which has given a new dimension to information seeking.

Thinking about designing for the visually impaired seems like a daunting task, but one can make great progress by following accessibility best practices towards developing a useful mobile app experience.

The visually impaired people can further utilise the key benefits of the modern-day smartphones. In addition, the introduction of speech capabilities in smart phones such as text to speech engine by Google, that converts the displayed text to speech can help the visually impaired to easily communicate with the help of mobile devices.

The concept of utilising the key features of modern mobile phones with QR codes to assist visually impaired people in identifying objects looks very promising. Therefore, my proposed application is inexpensive and is readily available. A visually impaired person only requires an easily accessible smartphone that comes at an inexpensive price.

II. LITERATURE REVIEW

Visually impaired people undergo a lot of trouble as far as identifying objects is concerned. Braille system cannot be found easily everywhere, which is a challenge in itself as one must need to learn the language first. It is also not easy to deploy braille system everywhere. In this modern world, full of digital technologies and advancements, it is a learning step towards uncovering solutions to issues. A smartphone is the most basic technological devices when it comes to high-tech advancements that we are blessed with, that is easily reachable to the masses.

The visually impaired are at numerous disadvantages as they many a times lack the reliable set of information that can help them to avoid obstacles in their path. Object identification systems that were or are previously developed make use of expensive equipment which many a times is not readily and easily available and affordable by the common visually impaired community. The object identification systems available are either not user friendly or are very complicated to use.

To overcome the above issues, I created an application where a QR Code can be scanned in the visually impaired person's phone which can convert the QR Code from text to speech. This can significantly help reduce their difficulties and help make their lives easier, thereby enabling them to become self-dependent.

The application is developed on the basis of utilising QR codes that are attached to the object and scanned using a smartphone with the installed application. The application then converts the QR code into characters. Then, with the help of text to speech engine, the application then generates a verbal description of the text, which is audible to the user. My proposed application is useful in real-time interactions that enable the user to identify objects.

III. METHOD OF STUDY

Following in the footsteps of renowned and well-known researchers, I opted for a research methodology, which used trial and error-based data collection technique. Comprehensive tests were performed by me in various surroundings. This study was carried out at Maharaja Agrasen Institute of Technology, Guru Gobind Singh Indraprastha University, New Delhi.

An android application was created with user friendly user-interface for the research. The application contains a single button to scan. On opening the application, the visually impaired can press anywhere on the screen to launch the QR code scanner. Then the person will have to move the smartphone around a little, and subsequently the QR Code will automatically get scanned very quickly and the text to speech feature will then automatically get activated. Once the person taps the screen again, the scanning mode gets activated again. A thin button of 'QR Code generation' is available at the top of screen. This can be used to create new QR codes as per requirement.

IV. RELATED WORK

The use of QR codes in the context of solving problems for the visually impaired hasn't gained much popularity as compared to other fields of study. In this research work, I have developed an application that makes use of QR code scanner smartphones to help the visually impaired in identifying objects.

Tatsumi et. al used 1D barcode and RFID tags that were attached to objects for creating an information covered area for people that are visually impaired in the college campus. There were two test cases where their systems were applied. The first test case comprised of receiving voice access to announce on the bulletin board by scanning barcode using a PDA equipped with barcode scanner. The second test case was studied by using a PDA equipped with an RFID unit to structure a messaging system between students and teachers. In this part, an RFID tag is attached to a laboratory door that keeps a message from a teacher, such as, where he left for and when he will be back again. A visually impaired person can read the message and can leave his own desired message for the teacher when the teacher comes back. Tatsumi et al. system proved an efficient means of information for the visually impaired.

Iannizzotto et al. made use of wearable computer system and 1D barcode for objects identification. Similarly, Ebrahim et al. used portable camera along with a computing device using 2D barcodes. Coughlan et al. portrayed a camera cell phone-based navigation system that permits a visually impaired person to search and read signs marked barcodes. In this method of study, they placed a distinctive color target pattern on a sign that quickly guided the system to an adjacent barcode, which led their system to read using an algorithm which is robust to poor resolution and lighting. Preliminary experiments using blind subjects confirm the feasibility of the system.

From the previous works of study, I concluded that my proposed application differs from the other ones in a couple of ways:

1. The hardware (android smartphone) used and the operating system.
2. My proposed application relies on the existence of any android smartphone that can install my application, compared to the previous systems that either required some sort of specialized paid and proprietary software or used some dedicated hardware device.

V. OVERVIEW OF QR CODES

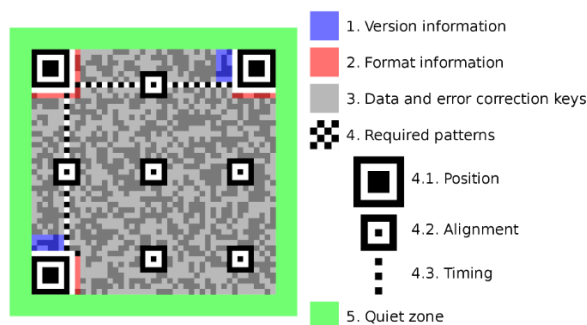
QR code, the abbreviated form of Quick Response code is a trademark that was first designed in 1994. A barcode is a machine-readable label that contains information about the object to which it is attached.

The Quick Response system became popular due to its fast readability and greater storage capacity compared to standard UPC barcodes. Applications for which QR codes are widely used include product tracking, item identification, time tracking, document management, and general marketing, amongst others.



A pictorial representation of a QR code is given above for reference. The diagram depicts black squares on a white background arranged in a square grid, which can be read and appropriately interpreted by an imaging device, like a camera. The horizontal and vertical components of the image then help to extract data from present patterns.

The representation of a QR Code can be understood by the following image. The below image highlights the functional elements of a QR code.



VI. PROPOSED WORK

The research and study for my project showed me that development of an Android Application was a prerequisite that generates and scans QR code and helps visually impaired people in various tasks like identifying various objects or items in supermarkets, house; help them in identifying the ingredients of packaged foods or any other details regarding the items. This is done by making use of QR codes; when the QR code is scanned, the retrieved text is converted to speech.

Workflow:

Step 1: QR code Generation.

Step 2: QR code Scanning.

Step 3: Text to speech conversion.

VII. IMPLEMENTATION

My project is implemented in two parts:

1. Generation
2. Scanning.

My project is developed using the IDE- Android Studio and some APIs to make this project a reality.

Steps for implementing QR code Generation:

Step 1: Open App level gradle file

Step 2: Import the library and click 'sync now'.

```
implementation 'com.airbnb.android:lottie:2.5.0'
implementation 'com.google.zxing:core:3.3.0'
```

Step 3: Open the Manifest file and add the following permissions. This permission is required to save QR Code to file system.

```
<uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE" />
```

Step 4: Open the MainActivity.java file and add the following line of code. Here, 'data' is an input to be converted to QR Code.

```
public void generateQrcode(View v) {
    data = txtData.getText().toString();
    if (data.length() > 20) {
        createQRImage(data);
    } else {
        Toast.makeText(getApplicationContext(),
            text: "Please enter data",
            Toast.LENGTH_SHORT).show();
    }
}
```

Step 5: Then in the next step, add the following lines of code to generate QR Code and encode that into Bitmap Format.

```
Bitmap myBitmap;

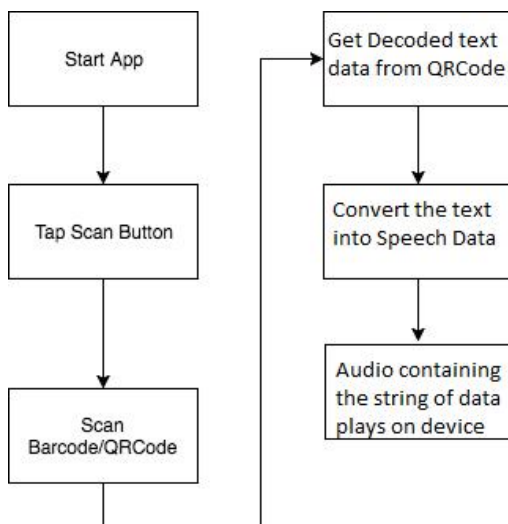
private void createQRImage(String data) {
    try {
        MultiFormatWriter multiFormatWriter = new MultiFormatWriter();
        try {
            BitMatrix bitMatrix = multiFormatWriter.encode(data,
                BarcodeFormat.QR_CODE.QR_CODE, width: 200, height: 200);
            BarcodeEncoder barcodeEncoder = new BarcodeEncoder();
            myBitmap = barcodeEncoder.createBitmap(bitMatrix);
            imgQRCODE.setImageBitmap(myBitmap);
        } catch (WriterException e) {
            e.printStackTrace();
        }
    } catch (Exception e) {
        e.printStackTrace();
    }
}
```

Step 6: Insert the following lines of code to share .jpeg image of QR code

```
Intent share = new Intent(Intent.ACTION_SEND);
share.setType("image/jpeg");
ByteArrayOutputStream bytes = new ByteArrayOutputStream();
myBitmap.compress(Bitmap.CompressFormat.JPEG, quality: 100, bytes);
String path = MediaStore.Images.Media.insertImage(getContentResolver(),
    myBitmap, title: "temp", description: null);
Uri imageUri = Uri.parse(path);
share.putExtra(Intent.EXTRA_STREAM, imageUri);
startActivity(Intent.createChooser(share, title: "Select"));
Snackbar.make(view, text: "Share QR Code", Snackbar.LENGTH_LONG)
    .setAction(text: "Action", listener: null)
    .show();
```

Finally the QR code is generated and ready to be shared.

Steps for implementing QR code Scanning:



The above figure describes the QR Code Scanning steps.

Step 1: Open App level gradle file and import the library and click 'sync now'.

```
dependencies {
    compile 'com.github.blikoon:QRCodeScanner:0.1.2'
}
```

This will make the library available for my project.

Step 2: Open the Manifest file and add the following permissions.

```
<uses-permission android:name="android.permission.CAMERA" />
<uses-permission android:name="android.permission.VIBRATE" />
```

It is used to access camera API of the system

Step 3: In the program, ask the user to allow permissions to scan the QR code.

```
if(requestCode == REQUEST_CODE_QR_SCAN)
{
    if(data==null)
        return;
    //Getting the passed result
    String result = data.getStringExtra( name: "com.blikoon.qrscanners.got_qr_scan_reult");
    Log.d(LOGTAG, msg: "Have scan result in your app activity :"+ result);
    AlertDialog alertDialog = new AlertDialog.Builder( context: MainActivity.this).create();
    alertDialog.setTitle("Scan result");
    alertDialog.setMessage(result);
}
```

Step 4: Text to speech conversion is then done.

```
t1 = new TextToSpeech( context: this, (status) → {
    if (status ≠ TextToSpeech.ERROR) {
        t1.setLanguage(Locale.UK);
    }
});
speakRead("Tap on Screen to Scan QR CODE");
```

'TextToSpeech' class is used to convert text into the audible form.

VIII. CONCLUSION AND FUTURE SCOPE

QR codes and barcodes are widely used that are linked to physical objects. The increase in the usage of visual tags in day to day life is by far one of the largest consequences of the technological advancements of the modern lives we live today. The application designed by me has great scope to help the visually impaired people in easily accessing information about objects using their or any other easily available smart phones. The idea presented in this research paper can be considered as a stepping stone to solving many other issues in numerous ways. New algorithms that are much faster and more efficient in scanning QR codes need to be developed. In addition to this, we need to conduct experiments with visually impaired people in demonstrating the feasibility and ease of using the application that can come to their aid in any real-time situation.

IX. REFERENCES

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