QR For Blind People

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***ABSTRACT*—**In this paper a QR code generation and scanning system is created to help visually impaired and blind people identify various objects in the environment and to navigate in various places such as university buildings or hospitals. This system is based on the idea of utilising QR codes (two-dimensional barcode) affixed to an object and scanned using a camera phone. The phone is equipped with a single button application to scan the QR code. The reader decodes the barcode to a string of text and fetches an audio file using text to speech engine that contains a verbal description of the object or gives directions for navigation. This system is expected to be useful in real-time interactions with different environment and to navigate within unfamiliar surroundings in a building or in finding objects or prevent any hazardous situations.

***Keywords*—**QR Code, Visually Impaired, navigate

I. INTRODUCTION

Blindness is the condition in which a person is lacking visual perception as a result underlying physiological or neurological factors. Various factors have been developed to describe the extent of vision loss and define blindness. Total blindness is the complete absence of visual light perception and is clinically regarded as NLP, an abbreviation for "no light perception". Blindness is often used to describe severe visual impairment with residual vision. Those described as having only light perception have no more sight than the ability to distinguish light from dark or the general direction of any light source.

Unlike any other physical challenge, the blind or visually impaired people are the people who face a lot
of loss and difficulties in their daily life. So various methods have been followed and proposed by many scientists across the globe. These methods were studied carefully. Several methods were followed both technically and non-technically to work on the mobility of the blind and visually impaired people. These methods are being practiced since the history of mankind either technically or non technically.

Mobiles have become a crucial part of our lives. The convenience provided by them has made our lives way more easier than they were before. One of the most important features of a modern day cellular device is the integration of a camera module and the internet access enabling us to seek information whenever we need it with ease.

Nowadays, the built-in digital cameras found in smart phones and the easy access to internet can be used 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 convert the text to speech format of the application for easy understanding of the blind people.

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

The idea of utilising the capabilities of modern mobile phones with QR codes to assist visually impaired people identify objects in the environment is very promising. Therefore, our proposed system uses inexpensive and easily accessible smartphones used by the visually impaired, instead of using expensive assistive technologies to identify objects tagged with QR based code. A visually impaired man only requires a smartphone which is easily accessible and used by all and comes at a very inexpensive price as well.

II. LITERATURE REVIEW

Blind people undergo a lot of trouble when it comes to navigating around places. Braille system cannot be found easily everywhere. It is also not easy to deploy braille system in all places in our surroundings. In this modern digital world, it is a stepping stone to solve issues using our high technology advancements. A smartphone is the most basic one when it comes to high-tech that is easily reachable to the masses.

The visually impaired are at a considerable disadvantage as they often lack the viable information for avoiding obstacles or hazards in their path. They have very little information on self-velocity, objects and direction which is a necessity while travelling around at places. Previously developed navigation systems use expensive equipment which is often not affordable by the common blind community. The navigation systems available are not user friendly and are very complicated to operate.

To overcome the above issues, we created an application where a QR Code can be scanned in the blind person's phone which can convert the QR Code from text to speech so they know what and where the products/items/ways are. This can significantly help reduce their difficulties at unfamiliar surroundings to easily find the way.

The system is based on the concepts of utilising QR codes fixed to an object and scanned using a smartphone equipped with a QR reader software. The reader decodes the barcode to a string of text and then fetches an audio file using the text to speech engine to generate a verbal description of the object. Our proposed system is expected to be useful in real-time interaction with various environments and objects While navigating, the QR Code can be scanned from pillars or doors to help get directions or information about the room being entered such as principal's office.etc.

III. METHOD OF STUDY

Walking over the footsteps of researchers, we opted for the research, which used trial based data collection technique. Comprehensive and befitting tests were performed in varied backgrounds and surroundings. This study was carried out at Bhagwan Parshuram Institute of Technology, Guru Gobind Singh Indraprastha University, New Delhi.

A simple user friendly android application was created for the same. The application consists of a single button. Once the application is opened, the visually impaired can tap at any place on the screen to activate the QR code scanner. While moving the mobile phone around, the QR Code is automatically scanned at a fast speed and the text to speech feature is automatically activated. Once the screen is tapped again, the application again enters into the scanning mode. On top of the screen, a very thin bar of 'QR Code generation' in the form of a button is created. This is used to create various QR Codes as per the needs of the objects or the environment.

IV. RELATED WORK

The use of barcodes in the context of visual disabilities has not gained much momentum compared to other research fields to help aid the blind people. In this research, we have put forth a system that utilizes barcode systems and mobile phones for helping the VI and blind in navigation or object identification. Tatsumi et. al [2] used 1D barcode and RFID tags attached to objects for building an information covered area for the visually impaired in the college campus. They studied two scenarios where they applied their system. The first scenario was about receiving voice access to announce on the bulletin board by scanning barcode using a PDA equipped with barcode scanner. The second scenario 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 visitor (blind student) can read the message and can leave his own message for the teacher when the teacher returns back. Tatsumi et al. system proved efficient for information for the visually impaired. Similar systems for object identification can be found in [3] and [4]. In [3] Iannizzotto et al. made use of wearable computer system and 1D barcode for objects identification. Similarly, Ebrahim et al. [4] used portable camera along with a computing device using 2D barcodes. Coughlan et al. [5] portrayed a camera cell phone-based navigation system that permits a visually impaired user to search and read signs marked barcodes. In their solution, 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 work we can conclude that our proposed system differs from the other ones in two ways: the hardware used and the operational software. Our proposed system relies on the existence of any 3G mobile phone (hardware) that can install an application, compared to the previous systems that either required proprietary software or used some dedicated hardware device.

V. Overview of QR Codes

A QR code is the natural extension of a conventional barcode. A QR code can store around 100 times more information than what a barcode can and it can be scanned from any direction. The time taken to scan a QR code is less than a few seconds.

From a user's point of view, each code's appearance is unique and interesting which further increases the likelihood of engaging the customer in places where a QR code is deployed. The user just needs to use their smartphones to scan the specific QR code and read or interpret what the code represents. QR codes can only be read by machines, and not directly by humans.
The representation of a QR Code can be easily understood by the following image:

Fig 1: QR Code Architecture [9]

1- QUIET ZONE: It is am empty white border which can isolate the code from the other information that surrounds the code.

2- FINDER PATTERNS: These are large black and white squares in three corners of the code which can help distinguish a QR code from other codes like the Aztech code. Etc.

3- ALIGNMENT PATTERN: It helps in decoding the code even if it is distorted, i.e, printed on a curve or viewed at a different angle.

4- TIMING PATTERN: This pattern runs vertically and horizontally between three finder patterns and are made of alternate black and white squares. They help identify the data cells and help decipher if the code is damaged or distorted.

5- VERSION INFORMATION: The vision information lies near any two finder patterns to help identify which one is being used in that particular code.

6- DATA CELLS: These are the black and white squares which contain some of the actual data of the code. [10]

VI. Proposed Work

The research and study for our project showed us that we need to create an Android Application that generates and scans QR code and helps blind people in various tasks like navigating them through a retail store, home; help them identify the ingredients of packaged foods or any other packaged item. We do this with the help of QR codes; when the QR code is scanned, the retrieved text/content is converted to speech for blind people.

Workflow:

Step 1: QR code Generation.
Step 2: QR code Scanning.
Step 3: Text to speech conversion.

VII. Implementation

Our project implemented in two parts - Generation and Scanning. Our project uses Android Studio and some Android APIs to realize this project like - Zxing, Airbnb Lottie and a library based on Zxing for scanning by blikoon.

Steps for implementing QR code Generation :

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

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

Step 2: Open your Manifest file and add the following permissions. It is used to save QR Code to file system.

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

Step 3: Open your MainActivity.java file and add the following lines.
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(getBaseContext(),
                text: "Please enter data",
                Toast.LENGTH_SHORT).show();
    }
}
```

Step 4: Then, add the following lines to create 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 5: 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();
```

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

Steps for implementing QR code Scanning :

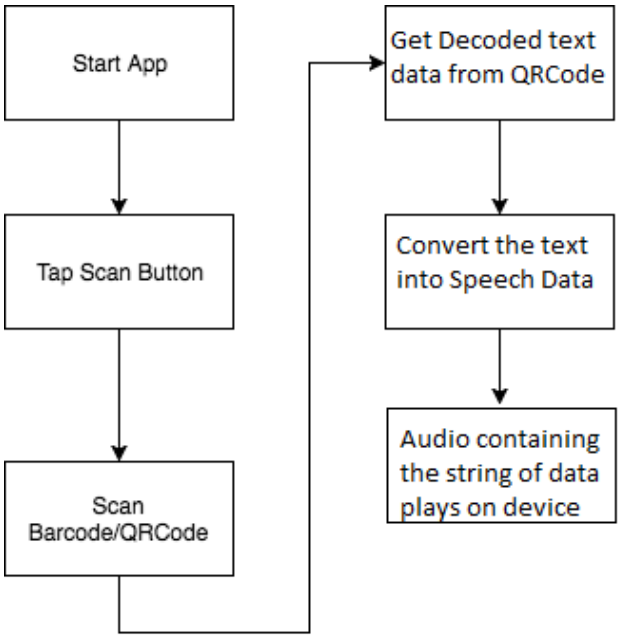

Figure 2: QR Code Scanning steps

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

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

This will make the library available for our project.

Step 2: Open your 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 your program, proclaim your request for Scanning QR code

```
if(requestCode = REQUEST_CODE_QR_SCAN)
{
    if(data=null)
        return;
    //Getting the passed result
    String result = data.getStringExtra( name: "com.blikoon.qrcodescanner.got_qr_scan_relult");
    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.

```
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 an audible form.

VIII. Conclusion and Future Scope

People widely use QR codes and barcodes to link physical objects to Web Links and text messages. Moreover, the recent interest in the use of visual tags in everyday life is a natural consequence of the technological advancement of modern day smartphones. Even though the system designed by us had great potential to help blind people easily access objects using mobile phones, the work presented in this paper can be considered as a stepping stone and many other issues can be resolved on the way. Efficient algorithms are to be investigated to speed-up the process of scanning QR based codes. In addition, we need to experiment with blind subjects to demonstrate the feasibility of using the system as a real-time aid.

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