

Navigation System for Blind Using QR Code

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Abstract - Eyes is the main organ of the visual system, it gets images seen by the person and turns them into an electrical signal which is carried along the optic nerve to the brain. Once the signal reaches the visual cortex, it is "translated" by the brain, to create the image so the person can interpret the environment. But for some people they can't able to visualize the image by seeing only, for that they need to touch. Nowadays technology advancement is trying to improve life of such visually impaired people. In this research, we propose a mobile based application that identifies object using Smartphone camera by scanning QR code. We use Smartphone camera for scanning of the QR code and make run the dataset on the Android-based Smartphone. The result of this research is an android application that can identify objects and produce a sound output of the object name.

Keywords: assistive technology, assistive application, objects identification, visually impaired, path finding.

I. INTRODUCTION

One of the most significant rehabilitation steps for people who have recently become blind or have low vision, is for such people to regain their ability to navigate and react to their immediate environment independently and therefore to feel that they are in control again. This is what motivated the authors to develop a system using both line-of-sight and non-line-of-sight technologies to give the user both passive and active feedback about their position.

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 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.

II. DESIGN AND ARCHITECTURE

The proposed system uses Node MCU ESP8266 as its brain. As we can see in fig 1, the system is using the QR code for storing the information about the location or the type of object on which it'll be placed. The QR code will be decoded using a mobile camera that information will be sent to the microcontroller. The ultrasonic ECHO sensor will detect the obstacle in real-time and will send the data to the microcontroller. There the information will be processed in the microcontroller, from both the ultrasonic sensor and from the GPS module. The microcontroller will then send the signal to enable the buzzer or speaker module to provide the audio feedback via speakers or buzzer. The obstacle detection and buzzer or speaker can work parallelly or independently.

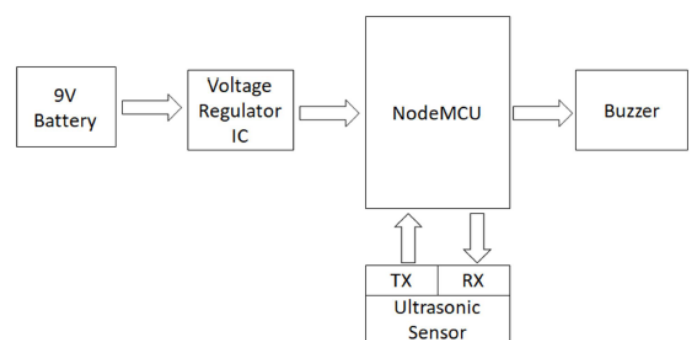


Figure 1: Block Diagram of the System

III. SYSTEM COMPONENTS

2.1 Node MCU ESP8266

Node MCU is a low-cost open source IOT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added. Node MCU is an open source firmware for

which open source prototyping board designs are available. The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IOT applications.

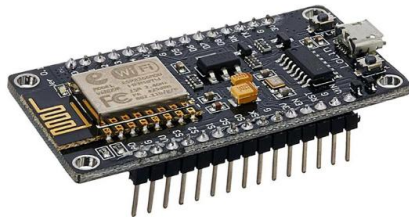


Figure 2: Node MCU ESP8266 Board

2.2 Ultrasonic Sensor

This "ECHO" Ultrasonic Distance Sensor from Rhydolabz is an amazing product that provides very short (2CM) to long range (4M) detection and ranging. The sensor provides precise, stable non-contact distance measurements from 2cm to 4 meters with very high accuracy. Its compact size, higher range and easy usability make it a handy sensor for distance measurement and mapping. The board can easily be interfaced to microcontrollers where the triggering and measurement can be done using one I/O pin. The sensor transmits an ultrasonic wave and produces an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated. Equation 1 is used to calculate distance by ultrasonic sensor.



Figure 3: Ultrasonic Sensor

$$D = 1/2 \times T \times C \text{ -----Equation 1}$$

Where D = Distance, T = Time & C = Speed of sound ~ 343m/s

Features:

Supply Voltage: 5V DC

Supply Current: 15mA

Modulation Frequency: 40 KHz

Output: 0-5V (output high when obstacle in range)

Distance: 2 cm – 4 m

2.3 Buzzer

A 5V Buzzer or a speaker is used to generate the sound when some object or obstacle comes in the path of visually impaired person. Speaker is used to know the object/obstacle when scanned using QR code.



Figure 4: 5V DC Buzzer

IV. FLOWCHART

Steps of Algorithm:

- Step 1: System starts as the battery starts power supply.
- Step 2: ESP8266 will initiate the camera for scanning of QR code.
- Step 3: As image is captured from camera it will check for QR code, if YES it will go to next step.
- Step 4: The QR code will be then decoded using react library.
- Step 5: After decoding text in QR code it will be converted to speech.
- Step 6: That converted speech will be then given through buzzer/speaker.

The QR code works in the following loop as shown in the fig. 5 below.

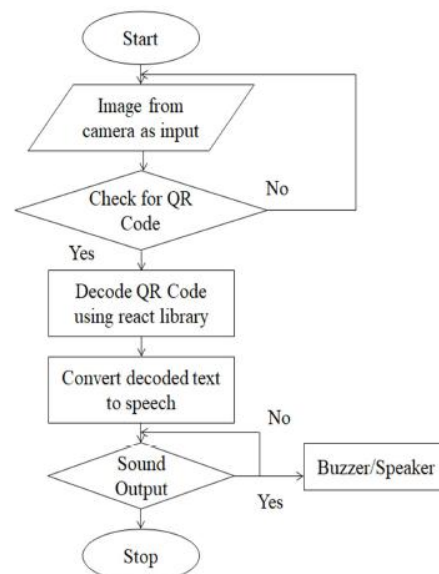


Figure 5: Flowchart of Working of QR Code

4.1 QR Code

QR code is meant by Quick Response code (or two dimensional barcode). It is the same as the barcode. QR code contains the information in encoded form and can be seen using a QR code scanner. The QR codes are faster to detect and the data is safe with them. The QR codes are basically a matrix of random black and white squares. They provide information to any user using them. And hence we are using this in our proposed system, to store the information about the location.



Figure 6: QR Code

V. RESULTS AND DISCUSSIONS

The system detects the presence of obstacle coming in the path of the visually impaired person and buzzer/speaker gives the output.

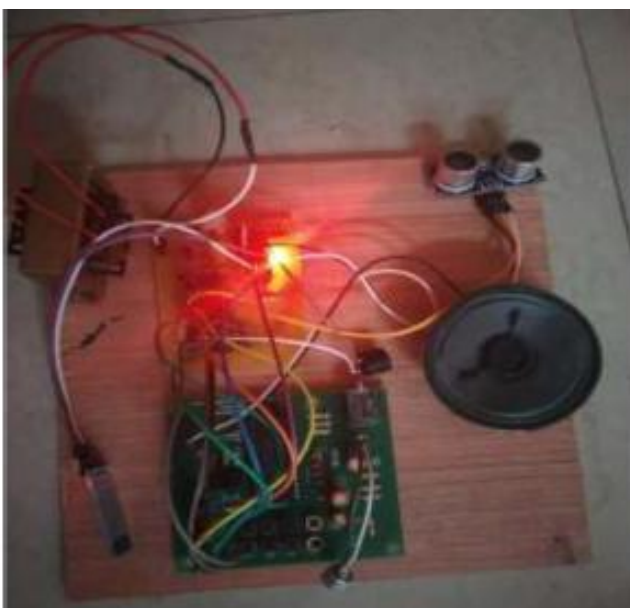


Figure 7: Implemented System



Figure 8: QR Code detection using Smart Phone Camera

In the future, there are many possibilities to improve this presented system. The system can be made wearable using high-performance processors which will also be having minimal size. For QR Code detection, an embedded micro camera can be used. And the obstacle detection can also be provided using micro transducers. All together implemented as one system on a single platform.

VI. CONCLUSION

This paper proposes the design and architecture of an innovative navigation tool using Node MCU microcontroller and ultrasonic sensor. A simple, affordable, easy to use, customizable electronic guidance system is proposed to help blinds and visually impaired people. With the mentioned features, this navigation system can help visually impaired person in finding their way independently.

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