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Project Title: SMART SHOPPING ASSISTANT FOR VISUALLY IMPAIRED PERSONS USING RASPBERRY PI

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ABSTRACT

There are all-around more than 315 million people who are visually impaired in the world and the number is increasing as the generation ages. Here the work is carried to make the life of visually impaired/ blind people easy and independent. A camera-based gadget is used here which scans any type of Barcode and QR_code behind the commodity and read the detailed description of the commodity with the help of ID or unique number saved in the codes using the raspberry pi 4 microcontroller. It is very difficult for the visually impaired/ blind people to get the details of the packaged goods to compare. The device/gadget proposed here will be very beneficial for these people in this regard and hence will help them in taking the decisions of either purchasing a commodity or not. The proposed offline smart gadget can be used in different places like shops, shopping malls, Book stores and pharmacy stores, etc. This has been tested that through the device proposed in the research work, people are able to identify labeled and unlabeled commodities of their daily life use.

LITERATURE REVIEW

Many researchers worked to make the visually impaired and blind people's life easy. Research has been carried out in various fields like Reading documents, Home automation, and personal assistant. The main objective of the previous research was to recognize the characters and read the typed, printed and handwritten text using the open CV-library and python programming language using the Raspberry pi. Here Raspberry Pi model 3B microcontroller is used for optical character-based book readers to make the reading easy and comfortable. Another work aimed to develop an ETA (Electronic Travelling Aid) kit to detect or know about the obstacle-free pathway. The objective was to provide a voice playback oriented navigation, object detection, and real-time positioning using the GPS module. Here destination's name was to be given as input by the person and the current location of the user could be received by GPS module and then it could give the output as the directions to the destination in voice playback. Another work was smart text reader from the captured images using optical character recognizer and text to speech synthesizer. A raspberry pi 3 processor was used for smart reading devices which made blind/visually impaired person's life easy and reliable and this could help them to be educated and independent from others. In another label reading work, ADA boost algorithm is used in Raspberry Pi for reading the labels of the products or package goods and help to take decision about purchasing goods. The work was just like a virtual eye or second eye for those persons who cannot see properly or blind. A mini camera is used in another research work to become a helping hand of the visually impaired persons (VIP) which could be used in purchasing products with their own choice and perhaps claimed to make them confident.

Proposed System:

In a previous work, a laser scanner is used which is not much efficient for reading and decoding Barcodes and QR codes and is not able to read the description of any product in real-time. Here a real-time camera-based barcodes and QR codes decoder and description reader is used which is more efficient and fast in processing than previously suggested. This assistant works in real-time which creates a greater level of confidence in visually impaired persons. Here the code to be decoded needs to be put in front of the focus range of the camera. A buzzer is connected which

will generate a loud beep signal/sound. This will indicate the successful capturing of the desired code from the real-time video streaming. The captured image will be sent to the Raspberry Pi 4. The text to speech synthesizer will separate the stored described data in code and after processing then OCR will recognize the data. Finally, Raspberry Pi 4 will convert the text into speech and play that through a 3.5mm audio jack of Raspberry Pi 4.

Software Requirements of the Proposed System:

A. **Operating system:** Raspberry Pi Raspbian Os (Linux Debian Based)
B. **Language:** Python 3.8
C. **Platform:** Imutil, OpenCV(Linux-Library)
D. **Libraries:** Python ZBar, TTS Engine, OCR Engine

1. Hardware Requirements of the Proposed System:

i. Raspberry Pi 4 computer Model B 2GB RAM :

Release Date	- 24 JUNE 2019
Hardware Platform	- Linux
Product Dimensions	- 3.7*3*1.1 inches
System on Chip Type	-Broadcom BCM2711
Core Type	- Cortex-A72(ARM v8) 64 Bit
CPU Clock	- 1.5 GHz
RAM	- 2 GB
USB	- 2*USB 3.0 + 2*USB 2.0
Ethernet	- Gigabit
HDMI Ports	- 2*micro HDMI
Analog Video Out	- Shared with Audio Jack
Analog Audio Out	- 3.5mm Jack

GPIO	- 40 Pins
SD/ MMC	- Micro SD
Wi-Fi	- 2.4 GHz and 5GHz 802.11 b/g/n/ac
Bluetooth	- 5.0
Item Height	- 3.37 in (85.6 mm)
Item Width	- 2.22 in (56.5 mm)
Item Depth	- 0.43307 in (11 mm)
Power Rating	- 800 mA @ 5V
Power over Ethernet	- With PoE Hat

5V Raspberry Pi based High sound Buzzer:

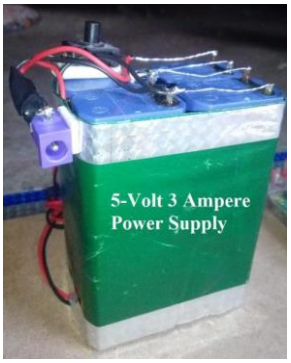
It is a small printed circuit board mountable 5-Volt 3-Amp active Electromagnetic high sound buzzer. This buzzer operates on 5-Volt power supply, which generates a high sound audio tone by using a coil element. This is a small 12 mm round speaker in diameter which operates around the audible 2 kHz range. This is a great device to connect or add audio feedback to the electronic desired designs.

High Resolution USB Camera:

A camera is used for capturing images & video recording or streaming in real-time, through a computer device to a computer network, such as the Internet. Webcam is typically a small device or camera set up on the monitor and used for performing various tasks to make tasks easy and efficient. Here camera for real-time streaming of the video is used.

5-Volt 3-Amp Power Supply:

Power supply module is an electrical device operates on 5-Volt and gives the 3-Amp current to this connected electronic device. This device can be charged many times through the electricity and it stores the energy through electrochemical reaction. It provides power supply whenever needed. Here 5-Volt operated a long lasting battery is used.



DESIGN AND IMPLEMENTATION

Image Capturing from Real-Time Video:

Using the various methods' library in the program/script from real-time streaming camera video, images can be captured. In OpenCV which is an open-source computer vision software library, VideoCapture() or VideoStream() method is used for capturing and creating images from the live stream of the camera as shown in Figure 7.1.

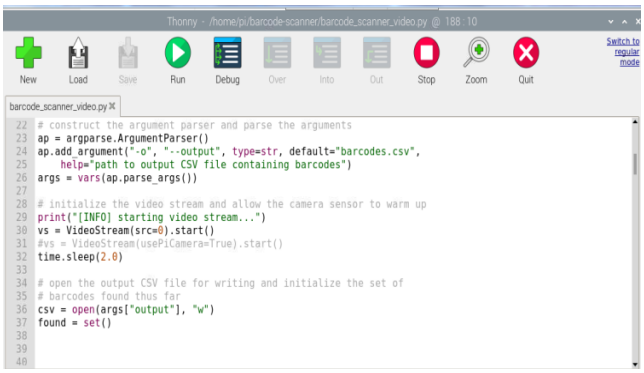


Figure 7.1: Capturing Image from Real-Time Video Snapshot

Pre-Processing:

Pre-processing involves the improvement of image data and the removal of the unwanted distortions from the image data. The pre-processing step includes mainly four categories within itself and in that categories, the first step deals with pixel brightness transformation, the second step involves geometric transformation, the third step uses the local neighborhood of the processed pixels and the fourth step describes the image restoration after acquiring entire knowledge about image. This work involves various pre-processing features of OpenCV's imutils library like changing colorspaces, Image thresholding, geometric transformations, etc as shown in Fig. 4.3

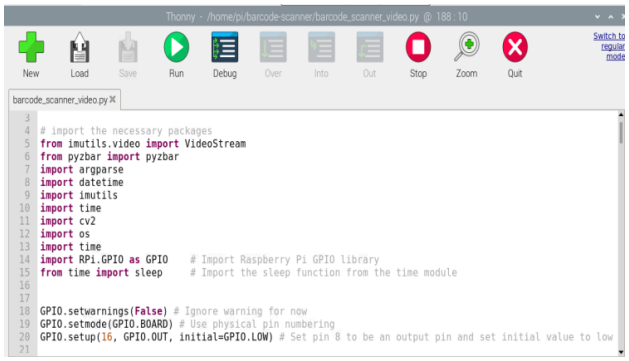


Figure 7.2: Pre-Processing Library Snapshot

Image to Text Converter:

In the step of image to text conversion, optical character recognizer (OCR) is used which helps in using various tools or methods for extracting the data from the image file of the Barcodes & QR codes. Live streaming is done using a camera and then using tools of image to text conversion image file can be converted into a text file as illustrated through Figure 7.3. Optical character recognizer is used in pattern matching, computer vision, and various field of artificial intelligence.

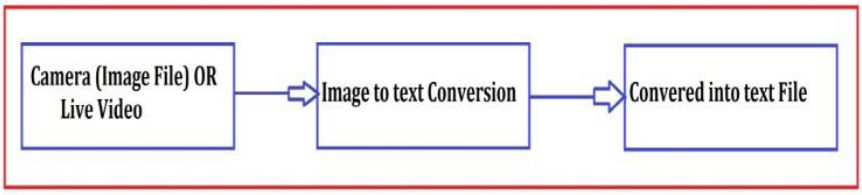


Figure 7.3: Image to Text Converter

Barcodes & Qrcodes Decoder:

In this step different types of one-dimensional and two-dimensional barcodes can be decoded by using the python ZBar library as shown in figure 7.4. Python ZBar library is used with OpenCV for barcodes and QR codes scan and decode both. This library is supported by both python 2 and python 3. Here version 3.8 of pythonprogramming is used which is the latest version of python programming IDLE.

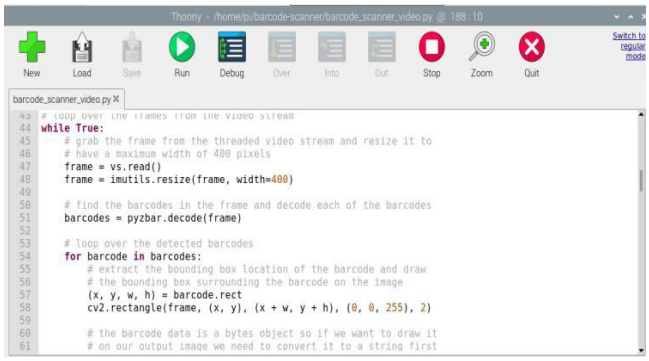


Figure 7.4: Library for different codes decoder

Text To Speech Converter:

In the Text to speech converter step, firstly extracted text file will convert into the audio file using the speech synthesizer that is called Text to speech engine (TTS Engine) as shown in figure 7.5. This TTS Engine is capable of converting text files into speech files using predefined libraries. This research work involves the festival TTS Engine for converting text to speech files.

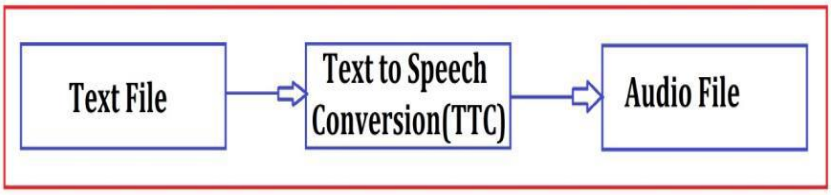


Figure 7.5:Text to Speech Converter

Architecture of the Proposed System:

The actual hardware setup is shown through the real picture as in Figure 8.1.

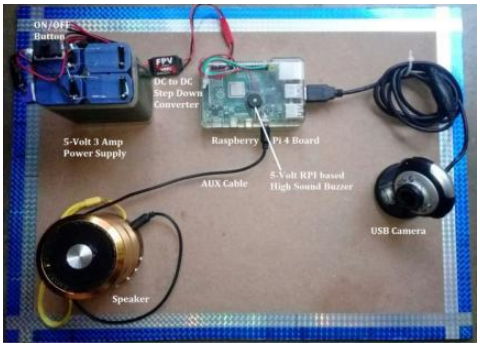


Figure 8.1: Hardware Setup of Proposed System

The architecture of the proposed system is illustrated through the block diagram as in Figure 8.2.

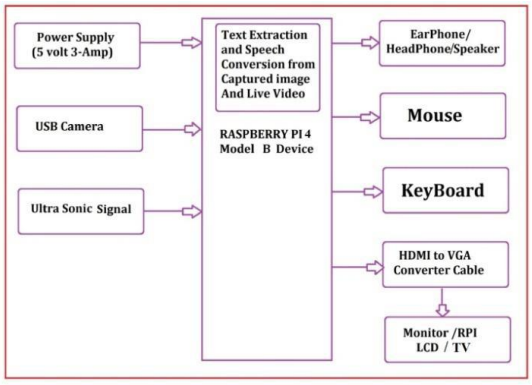


Figure 8.1: System Architecture Diagram

TESTING:

Here we have tested approximately all types of one dimensional and two dimensional codes and some of them codes we have attached here.

Figure 9: Some Codes

Results:

Here different test cases of different types of one-dimensional and two-dimensional codes have been tested as shown in Figure 10.

Figure 10: Results of Tested Codes

CONCLUSION

A real-time gadget for visually impaired persons (VIP) is successfully implemented. This research work presents an influential arrangement for blind and visually impaired persons. The proposed work has an elementary architecture that is to be used for visually impaired, hence responsibility to make it very easy & reliable. The main feature of the gadget is that it may detect codes from any angle and it is found to be able to detect any defected or incomplete barcode up to 30% defected or blur. This is an offline gadget that does not require internet connection and capable of describing the description of the commodity. This device found to be effective even during low light vision. This also saves time in conversions and provides output quickly. This smart gadget is useful for the blind/ low vision & visually impaired persons and does not require literacy.

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