eScanor

Interfacing & Data Communication
Final Report

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Abstract

This project is to prove that Raspberry Pi is very useful for our daily life; our project which is called eScanor is a device that can read and speak from a text using a little amount of budget that can be useful.

This report will discuss about purpose of this device, how it works, and how to make the device.

Background

Raspberry Pi is device that can do a lot of things by the user, this device is like a computer but it's half the size maybe even smaller some called it mini pc. Raspberry Pi is a device that comes from a British company called Raspberry Foundation, this thing is very cheap because it can assist many people around the world for computing education and comes with a lot of different versions, and has many attributes that can help more like the Raspberry Camera or the Raspberry Zero. Raspberry Pi has also what it's called GPIO pins to help the user to do some physical computation.

Raspberry Camera is dedicated digital that can capture image for Raspberry Pi devices we used this device to take a snap shoot so that the image will be converted to a text by using OCR.

OCR or Optical Character Recognition is the electronic or mechanical conversion of images of typed, handwritten or printed text into a machine-encoded text, whether from a scanned document, a photo of a document or from subtitle text superimposed on an image. After the conversion from an image to a text, the text will be spoken by using the TTS or Text To Speech tesseract library from python.

The name eScanor is an abbreviation of electric scan OCR, because it can scan and do a conversion that is using OCR. And the name Escanor is from a character of the anime called Seven Deadly Sins or Nanatsu no Taizai.

Purpose

The main purpose of this device is to assist the visually impaired that didn't facilitated a Braille text or the blind person who hasn't able to read Braille text, because this device is designed to be very simple to use just by the touch of a button the device will read the text.

The device also can be for everyone for example you want to read the newspaper but you haven't made your coffee yet, just use this device to read it while you making your coffee and your breakfast. And maybe for the children who want to read the bedtime stories.

Design

We mainly use stuff from our house, because we want to create a device with a minimum budget, the one thing that we bought is the Raspberry Camera.

The device is designed like a little desk lamp, the Raspberry Pi 3 is being taped on a standing ruler, the ruler can stand because we put two boxes taped around to hold the ruler, above the ruler we taped a cardboard and the Raspberry Camera, the Raspberry camera is positioned above as in a light bulb in a desk lamp and the dedicated cable connects to the Raspberry Pi, the cable is short that's why the Raspberry Pi is on the ruler stand. The speaker is on top of the boxes also the audio jack is connected to Raspberry Pi, also next to the speaker there's the button on the ¼ breadboard and connected by jumper wires to the GPIO pins.
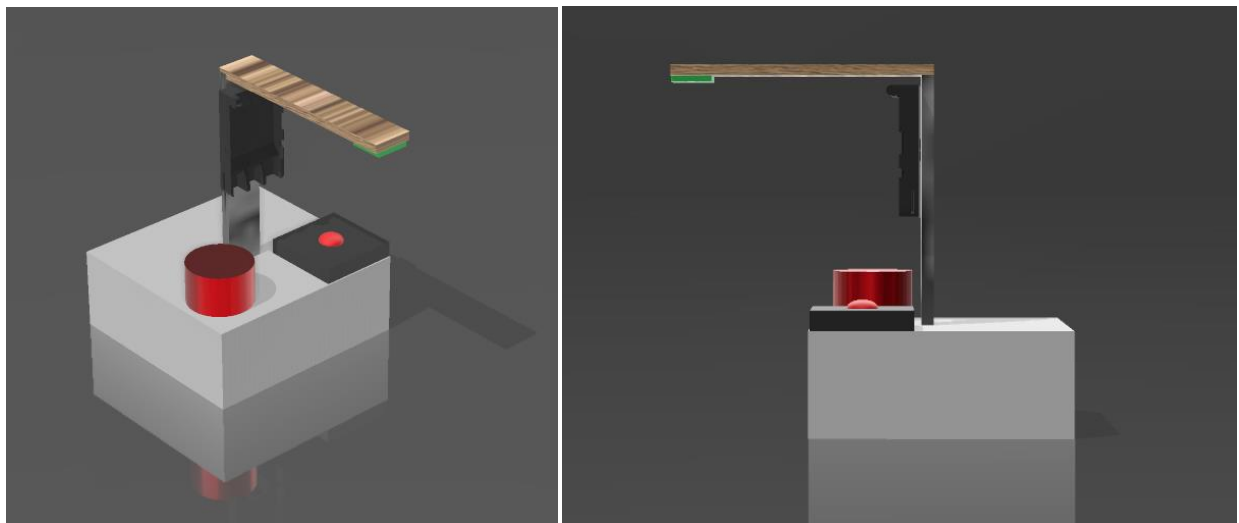
Isometric view

Side view

Raspberry Camera

Raspberry Pi 3B

Button, breadboard and jumper wires
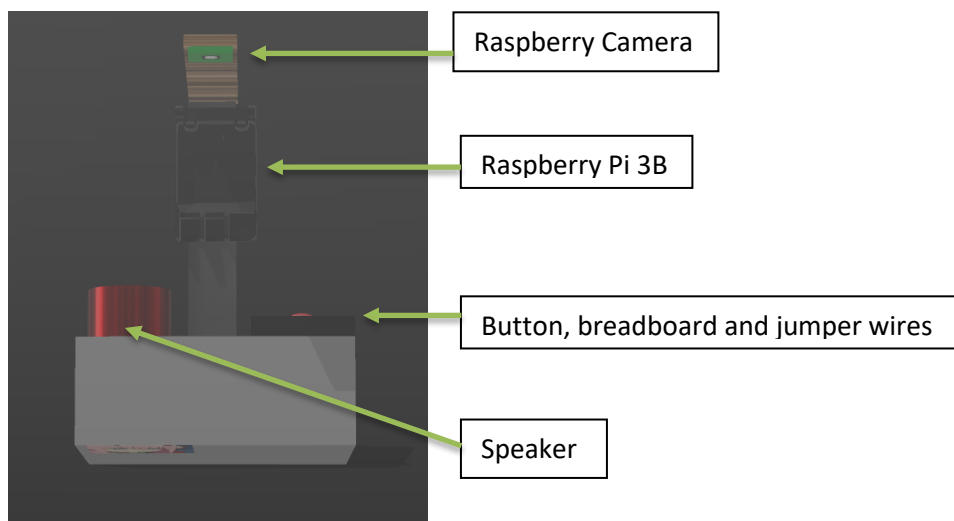
Speaker

Front view

Components:

1. Raspberry Pi 3B
2. Raspberry Camera 5MP
3. Jumper wires
4. ¼ breadboard
5. Button
6. Speaker and the aux cable
7. Cardboard
8. Ruler
9. Tape

Discussion

The pseudocode for the main program goes like this:

```
Import necessary modules

Set GPIO mode to BCM
Setup GPIO Button as Input and configure volume
Speak to user "Ok, ready to scan…" # lets user know

While True:
        If BTN input == LOW: # pressed
                getData()
                stopTTS()
                speak to user "Ok, ready to scan"

If keyboardInterrupt:
        Exiting()

Clean up GPIO #reset GPIO state
```

To put it simply, first we import modules then set the button that connected to GPIO pins act as a starting point and will speak "ready to scan", next the Raspberry camera will take a picture of the paper then the OCR will convert the image that was taken to a txt file, the TTS will read the txt file with the volume that's already been set above before the loop, after the txt file has been read out the TTS will stop and do a cleanup so that the Raspberry won't store unnecessary file that was already being read and if the user interrupt then the program is done and will exit the program automatically stopping all activities

And the flow chart of the program will be shown below:

```
                    ┌─────────────┐
                    │    START    │
                    └──────┬──────┘
                           │
                    ┌──────▼──────┐
                    │Import modules│
                    │ Set BCM mode │
                    │Configure Volume│
                    └──────┬──────┘
                           │
                   ╱───────▼───────╲
                  │ Set BTN1 as GPIO.IN│
                  │ then Speak to USER │
                  │   "Ok ready!"      │
                   ╲───────┬───────╱
                           │
                      ◇────▼────◇
                     ╱ while True: ╲
                      ◇─────┬────◇
                            │
                      ◇─────▼──────◇
                     ╱ if BTN1 ==    ╲─── False
                    ╲  GPIO.LOW      ╱
                      ◇─────┬──────◇
                            │ True
                    ┌───────▼───────┐
                    │ Built in Camera│
                    │ turns on and   │
                    │ takes a picture│
                    └───────┬───────┘
                            │
                    ┌───────▼───────┐
                    │ Tesseract OCR  │
                    │ conversion in  │
                    │ process.       │
                    │ Generate a txt │
                    │ file.          │
                    └───────┬───────┘
                            │
                    ┌───────▼───────┐
                    │   playTTS()    │
                    └───────┬───────┘
                            │
                    ┌───────▼───────┐
                    │  CleanupTTS()  │
                    └───────┬───────┘
                            │
                    ┌───────▼───────┐
                    │   StopTTS()    │
                    │  Speak to USER │
                    │   "Ok Ready"   │
                    └───────┬───────┘
                            │
                      ◇─────▼──────◇
                     ╱ if keyboard   ╲─── False
                    ╲  Interrupt     ╱
                      ◇─────┬──────◇
                            │ True
                    ┌───────▼───────┐
                    │ Cleanup GPIO   │
                    └───────┬───────┘
                            │
                    ┌───────▼───────┐
                    │     STOP       │
                    └───────────────┘
```

4
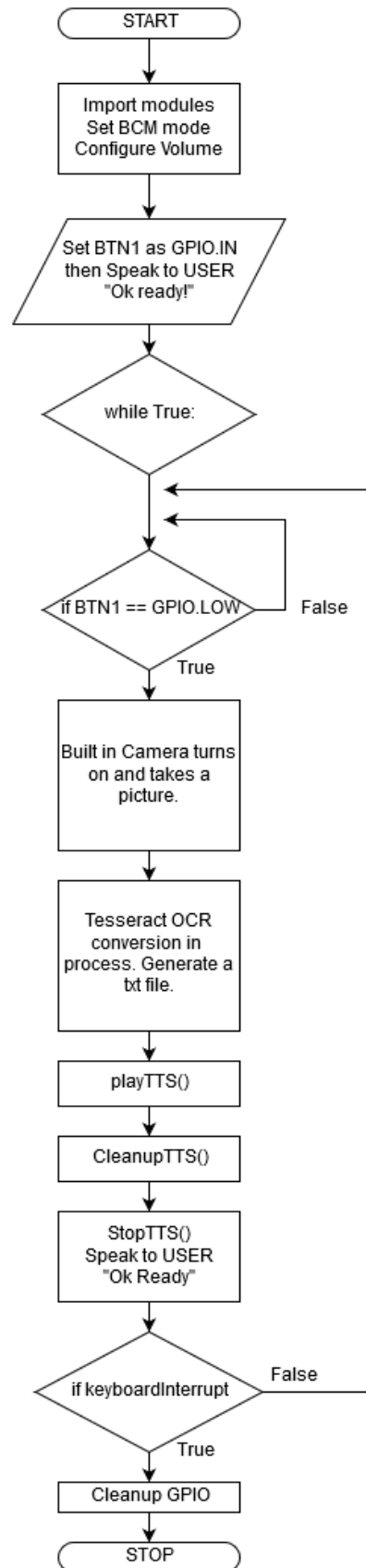
Advantage

Easy to use, only by pushing a button the device will do the job.

No internet connection needed, this is an offline device like an office printer so you don't bother activates the device from a phone. If we were to implement this idea to our device it would be more difficult and complex.

Disadvantage

Low lighting, due to the Raspberry camera only 5MP, the conversion carried by the OCR become less accurate.

The design flaw, we use a tape to make them stick together it may not long last and the cardboard that holds the Raspberry Camera little bit unsteady.

Conclusion

eScanor is a device to read a physical paper based text then speaks the OCR converted text to help the target audience (for blind people), using mainly from scraps and Raspberry Pi as the brain of the device and using python as the programming language supported by tesseract OCR library and TTS to do the task.

References

1. Raspberry Pi, "https://opensource.com/resources/raspberry-pi", November 2nd 2019
2. OCR, "https://www.abbyy.com/en-us/finereader/what-is-ocr/", November 2nd 2019
3. Python import modules, "http://thomas-cokelaer.info/tutorials/python/module_os.html", November 18th 2019