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Wearable Technology for Visually Impaired People using Raspberry-Pi

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ABSTRACT

Fundamentally, unmistakably impeded individuals are the individuals who are halfway or completely visually impaired. To improve sight of the noticeably debilitated individual, they need to counsel eye's specialist. Causes for noticeable disability are many. Keeping in mind the end goal to defeat them or improve sight of a patient, there are bounty restorative systems. Corneal transplant, LASIK, and implantable focal points. This all systems need certain criteria to be satisfied to play out this therapeutic technique on patients. Numerous gadgets or custom guides have been produced for various sorts of people groups, so they might upgrade their sight. Be that as it may, sadly not all unmistakably impeded individuals can bear the cost of or fit in certain fundamental criteria of medicinal methodology or custom improvement helps. Raspberry Pi assists to recognize text, describe an object and provide speech synthesis, all together works on voice commands as well as on console interface Using cloud based Artificial Intelligence services. This device provides auditory output assisting the challenged to perceive their surroundings like a normal being.

Keywords : Visually Impaired, Raspberry-Pi, Text Recognition, Object Recognition, Facial Detection, Voice Command, Speech Synthesis, Python

I. INTRODUCTION

This paper describes about the framework intended to aid the challenged in auditory outputs [8]. Utilizing cloud based computerized reasoning administration user can perceive the environment around them. This framework is outlined such that client can work it utilizing voice commands [4][5]. Client of this framework can distinguish objects, read literary materials, recognize outward appearances of different people, designate monetary forms of various nations and know their current geological area. Thus, outwardly weakened people can see the experience of located people utilizing this framework.

To perceive an object, system captures an image with the help of the camera, which is connected to the raspberry-pi system. The Raspberry-Pi is a small single-board computer developed to promote the teaching of basic computer science in schools and in developing countries. The camera i.e. pi cam is connected to this computer which stores the image as well as processes using the cloud libraries to describe the image captured by the camera [2][3]. The description of the image is the output, which is in the form of audio. In case if text recognized in the image the user can verbally command to provide the literary part in the image, which again gives an auditory

output. User can perceive the facial expressions as well as body structure of a person [1][4].

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The pi camera, which is attached to the Raspberry-Pi captures an image which is the input for the further process. In the processing of this image it is uploaded by the Raspberry-Pi system to a cloud based artificial intelligence service provider to generate raw values relevant to the real-world objects. This raw value is in the form of a descriptive text, which is then synthesized to speech for auditory output.

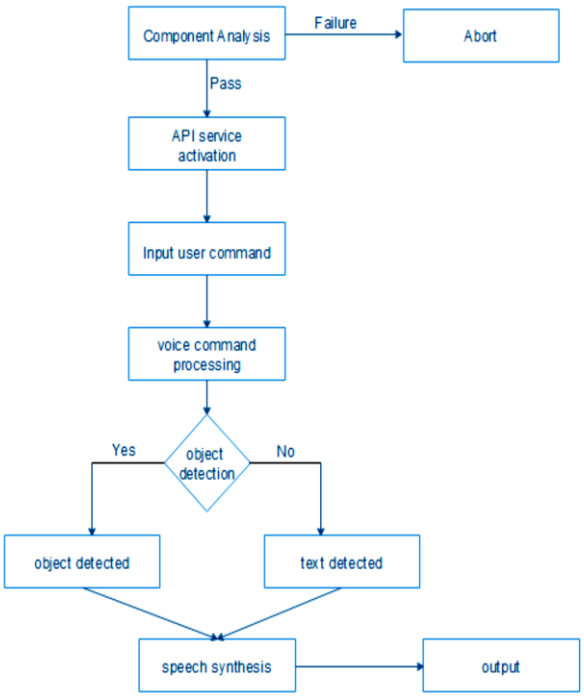

Figure 1: System Flow

II. METHODS AND MATERIAL

In this system third party cloud based artificial intelligence services are used to identify objects, text information and facial expressions. A lightweight Linux based OS is installed on the Raspberry-Pi system. A pi camera attached to Raspberry-Pi is used to capture input images for cloud based artificial intelligence services [2][3]. A USB wireless router is connected to the Raspberry-Pi to provides Internet connection for cloud computing. A lithium-ion 4000Mah rechargeable power backup, powers up the Raspberry-Pi and provides portability to the system. A USB microphone for the voice commands for desired tasks [5][7][8]. Hearing aids for the auditory outputs.

Raspbian OS is installed on the Raspberry-Pi computing system. This is considered as the main module, which handles the requests of the user to perform desired tasks. A single task can contain series of operations, which will be performed and handle by this main module. This module will maintain the system and manage the memory space utilization.

The image-processing task starts when the user provides a voice command to capture the image. The captured image is uploaded by the Raspberry-Pi system to a cloud based artificial intelligence service provider to generate raw values relevant to the real-world objects [4][5]. This raw value is in the form of a descriptive text i.e. JSON, which is then synthesized to speech for auditory output [6].

Active internet connection is provided to the Raspberry-Pi system using an USB wireless router which is connected physically to the system. Internet is required for uploading the raw data for computing with the cloud libraries.

Now, when the image contains literary content, user can command further to perceive the text in auditory format. It helps the user to read printed textual materials [1]. This module will be activated whenever the system will detect any textual contents in images file. This module will use Google natural language API to generate text data. This module will download those raw data in JSON format. And will convert it to a text-to-speech module and play it to hearing aids of the user [6].

To get the output in the form of audio, the description of the image, which is in the textual form, is synthesized into speech i.e. auditory format. This audible output aids the user to read the text with the use of this assistive gadget [1] [8].

The user can get the description of desired sight at any point of time, can be done by giving command to the Raspberry-Pi system. The input commands are given using an USB condenser microphone accessory, which is connected to the Raspberry-Pi system. To save power consumption this module is activated by the user when the physical button is pressed which is attached to the system [4]. The USB microphone records the voice commands from a user and feed it to Google speech API. This API service generates textual raw data. This raw data is used to analyze the command from a user and helps system to decide which task is to be performed [4].

The output, which is in the form of audio, is provided to the user using the hearing aids. This hearing aid is connected to the Raspberry-Pi system. The user can listen to the description of the desired sight with the help of this aid.

The whole system is powered using a lithium-ion rechargeable power backup. The system can also be powered with the help of electricity using a micro USB port charging adapter but would result in an immobile device, which is contradictory to the proposed purpose. So this power backup can power the system and make the system a mobile device [7].

Figure 2: Hardware Parts

III. INPUT AND OUTPUTS

Different images were captured by system to generate output from cloud based artificial intelligence services. The output below presented in JSON format.

A. Object Recognition

Input:

Figure 3: Object Recognition

Output:

TABLE I
OBJECT DETECTION

Sr. No.	Probabilities		
	Label	Score (%)	Topicality (%)
1	Laptop	88.74	88.74
2	Technology	82.68	82.68
3	Electronic Device	80.07	80.07

B. Facial Detection

Input:

Figure 4: Facial Detection

Output:

TABLE 2
FACIAL DETECTION

Sr. No.	Probabilities		
	Label	Score (%)	Topicality (%)
1	Face	88.74	88.74
2	Skin	96.63	96.63
3	Eyebrow	95.05	95.05
4	Person	93.23	93.23

C. Text Recognition

Input:

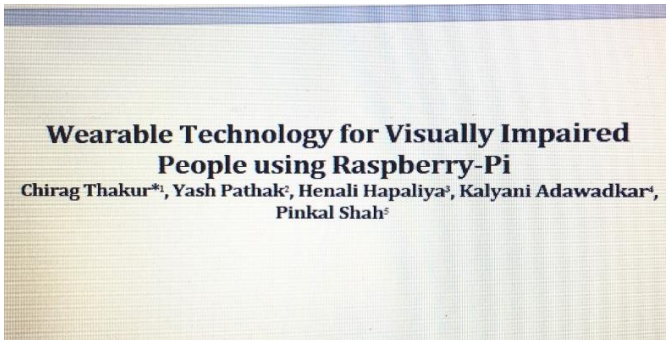

Figure 5 : Text Detection

Output:

TABLE 3
TEXT RECOGNITION

Sr. No.	Label
1	WearableTechnologyfor VisuallyImpaired
2	PeopleusingRaspberry-PiChiragThakur*i,YashPathak',HenaliHapaliya,KalyaniAdawadkar,
3	PinkalShah

IV.CONCLUSION

As paper states, this device can help visually challenged being to see present reality as a typical person. This gadget gives a weakened individual a chance to distinguish objects around them, perceive the outward appearance and expressions of a person before them, a chance to perceive the writings perceptibly. This device can turn out to be a guide for tested individuals. The gadget would cause an outwardly tested to satisfy their everyday tasks fluently as would a typical being. This gadget as proposed fulfils a lot of requirements such as ease of accessibility, audibly commands and output, object and colour description in an image, text reading also recognizing facial expressions. Altogether, this device as witnessed has proved to be assistive and convenient to use for visually impeded being. Consequently, this wearable innovation serves to be an assistive adornment for an ostensibly obstructed person.

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