2nd International Conference on Current Research Trends in Engineering and Technology
© 2018 IJSRSET | Volume 4 | Issue 5 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

AI based Assistive Wearable Device for Visually Impaired using Android Application

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ABSTRACT

This system harnesses the power of Artificial Intelligence to provide vision by incorporating technology into a wearable device which improves the lives of individuals who are visually impaired. This device is useful in reading text materials, identifying different objects, facial expression detection, currency denomination and help user to locate their geographical location. User can operate whole system using only voice commands. This Device is based on our previous project which helps visibly impaired people to get auditory output to help its user to perceive their surroundings. This system has been redesigned to achieve more efficiency, feasibility and ease of use to its users.

Keywords: Wearable technology, Artificial Intelligence, Android Application, IP Camera, Visually Impaired, Object Detection, Text Detection, Face Detection, Currency Denomination, GPS and Speech Recognition.

I. INTRODUCTION

This paper is about the system designed to provide an assistance related to visual information in auditory form to visually impaired individuals or other users having vision related problems. Using cloud based artificial intelligence services user can identify objects around them [4]. This system is designed in such a way that user can operate it using voice commands. User of this system can identify objects [1], read textual materials [2][3], identify facial expressions of other individuals, denominate currencies of different countries and know their current geographical location. So, visually impaired individuals can perceive the experience of sighted individuals using this system.

To identify an object, system captures an image of that specific object [1]. This captured image is sent to the cloud based artificial intelligence services which helps to detect objects and generate outputs in form of an audio. In case of an object recognized to be as a textual material, user can give further voice commands to system and can receive text information in form of an audio [2][3]. In case of an object recognized to be as a currency note, user can give further voice commands to system and can be acknowledged about the value of that specific currency note. User can also give voice commands to system and can recognize the facial expressions of the desired individuals. System can acknowledge its user about their current geographical location around the globe as per voice command of user.

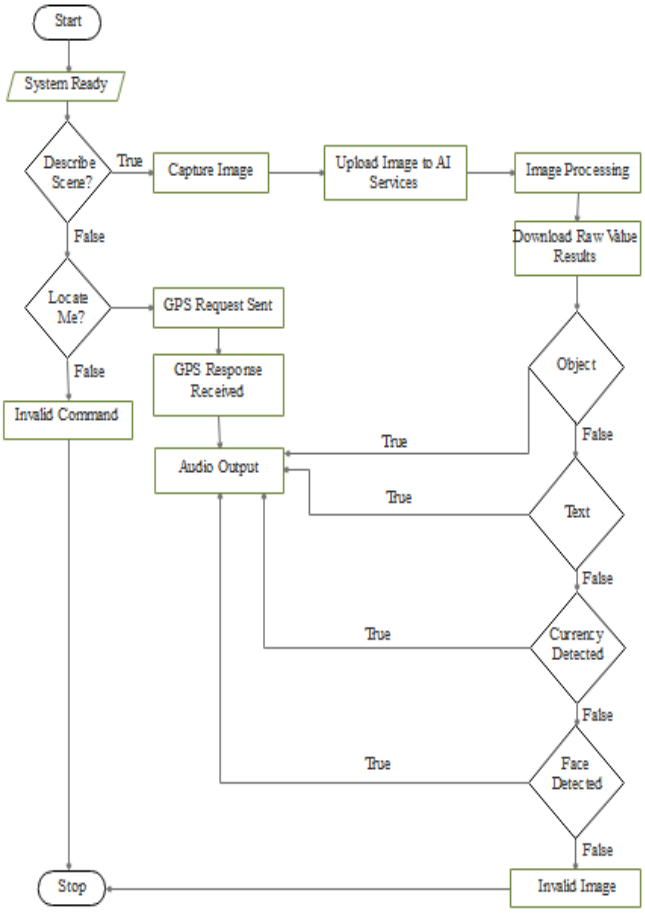

Figure 1: System Flow

An Internet protocol camera is used to capture images of specific objects to use it as input to perform further process. In this further process image is uploaded by an android application installed in smart phone of user to a cloud based artificial intelligence service provider to generate raw values relevant to the real-world objects. This raw value is filtered by an android application installed in smart phone of user and generates its output in form of audio [6].

Using only Internet protocol camera, an android application and a cloud based artificial intelligence services, system becomes more feasible to its users.

II. METHODS AND MATERIAL

In this prototype, third party cloud based artificial intelligence services are used to identify objects, text information, facial expressions and value of currency. An Internet protocol camera is used to capture input images for cloud based artificial intelligence services. This Internet protocol camera is connected to user's smartphone via wi-fi hotspot. An android application installed in user's smartphone handles all backend processes. A Microphone on internet protocol camera is used to receive all voice commands from user [8]. GPS chip on smartphone is used to acknowledge user's current geography location.

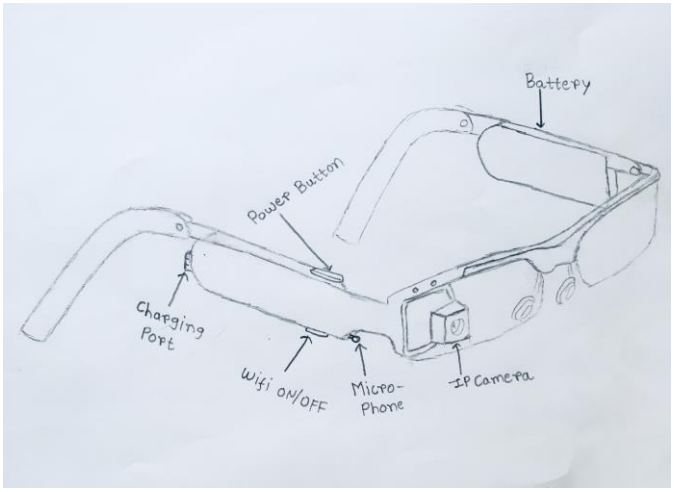

Figure 2: Prototype

Above figure represents a prototype concept of this systems internet protocol camera merged with spectacles. Merging internet protocol camera enables its user to use it as wearable technology.

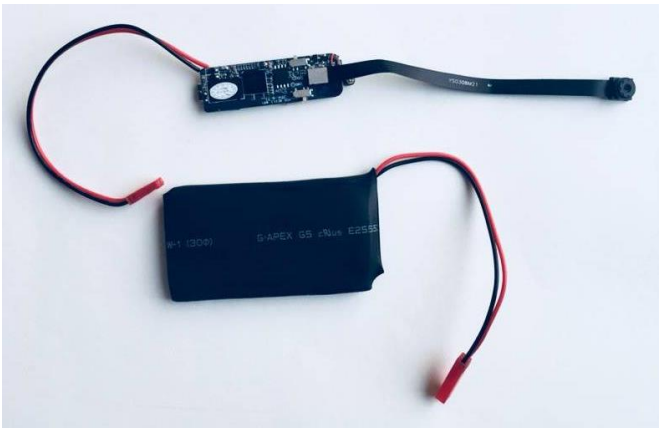

Figure 3: IP Camera and Battery

Above shows and circuit of an internet protocol camera. This internet protocol camera circuit board contains a wi-fi card, a microphone, a micro USB port, on-off switch for wi-fi hotspot, on-off switch for internet protocol camera. And a rechargeable lithium

polymer battery of 400Mah capacity supply a voltage of 3.7v. This internet protocol has a camera sensor of 5 megapixel of resolution. A smartphone can be connected to this internet protocol camera by its wi-fi card. Connection between smartphone and internet protocol camera is formed in peer to peer relationship by wi-fi tethering.

To make system detect any object user gives voice command "describe scene" [1]. This command captures an image from internet protocol camera. Image is uploaded to cloud based artificial intelligence service. Raw values are generated and downloaded by smartphone. Android application installed in smartphone filters all downloaded raw values to get more accurate output. This output is converted in form of audio by speech synthesizer.

When text material is detected by system, user can use further voice command "read text" to get text information in form of audio [2][3]. The system again uploads the same previously captured image to cloud based artificial intelligence service for optical character recognition. Raw values are generated and downloaded by android application installed on smartphone. Raw values are converted in form of audio by speech synthesizer.

When system detects input image as a face, user can use further voice command "read face" to read facial expressions of detected face [5]. The system again uploads the same previously captured image to cloud based artificial intelligence service for facial expression recognition. Raw values are generated and downloaded by android application installed on smartphone. Raw values are converted in form of audio by speech synthesizer.

When system detects input image as a currency, user can use further voice command "currency value" to calculate total value of detected currency [7]. The system again uploads the same previously captured image to cloud based artificial intelligence service for currency value calculation. Raw values are generated and downloaded by android application installed on smartphone. Raw values are converted in form of audio by speech synthesizer.

User can know their current geographical location by giving voice command "locate me". Android application installed on smartphone will use on chip GPS to send location request to satellite. GPS satellite respond back to android application with user's current geographical location [8].

III. INPUT AND RESULTS

Different images are captured by system to generate raw output values in JSON format from cloud based artificial intelligence services. Generated raw output values are converted into auditory form by android application.

A. Object Recognition

Input:

Figure 4: Object Image

Above image was captured by internet protocol camera and uploaded to a cloud based artificial intelligence service. And some generated raw values are "two square silver-coloured and gold-coloured watches".

Output:

{
"token": "32PfFByWThTFF5TAeGp20Q",
"status": "completed",
"name": "two square silver-coloured and gold-coloured watches"
}

B. Text Recognition

Input:

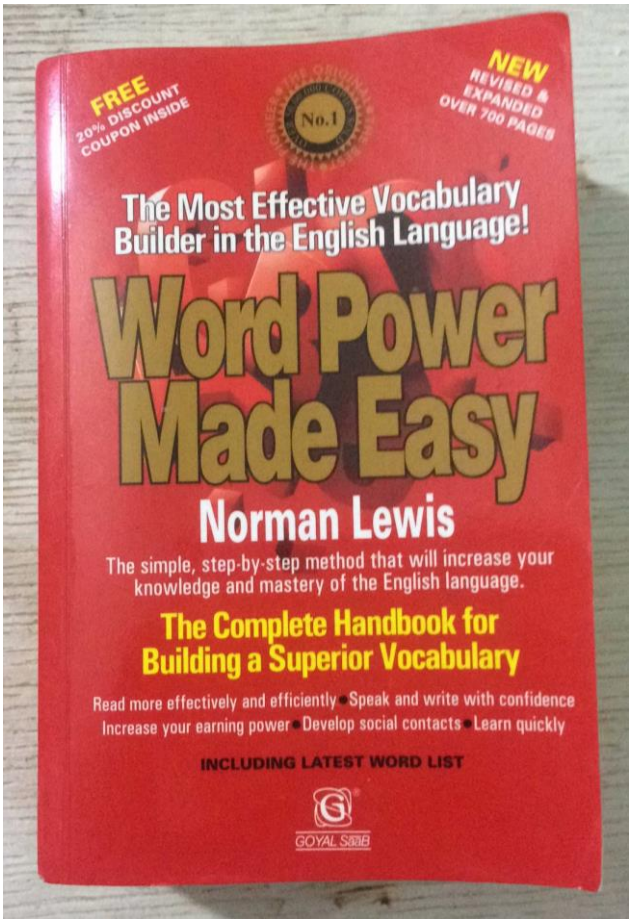

Figure 5: Text Recognition

Above captured image was uploaded to a cloud based artificial intelligence service, generated raw values are "Word Power Made Easy book by Norman Lewis".

Output:

{
"token": "sKh6oRXFkt5OMzNzQRFngw",
"status": "completed",
"name": "Word Power Made Easy book by Norman Lewis"
}

C. Currency Recognition

Input:

Figure 6: Currency Recognition

Above image of an Indian currency. Captured image was uploaded to cloud based artificial intelligence service, generated raw values are "2000 Indian rupee 3MG557863 banknote". Its result can also be used to denominated Indian currency.

Output:

{
"token": "9xenYt1hYDMCga5LQHW7ow",
"status": "completed",
"name": "2000 Indian rupee 3MG557863 banknote"
}

D. Facial Expression Recognition

Input:

Figure 7: Facial Expression Recognition

The cloud based artificial intelligence service generated raw values are “baby sticking out his tongue”.

Output:

{

"token": "GvIGmZnTaHGKh8YLZ9Bcpw",

"status": "completed",

"name": "baby sticking out his tongue"

}

IV. CONCLUSION

As observed in this paper, framework which can help outwardly impeded individual to see perspective of this present reality as a normal individual. This device lets an impaired person identify objects placed in front of the being, recognize the facial expression of a person in front of them, lets them read the texts audibly as well as it can denominate currencies. This device implemented as proposed, can prove that it serves to be an aid for challenged people. The device would help a visually challenged to fulfil their daily chores fluently as would a normal being. This device is more efficient, feasible and easy to use then the former design. Hence this wearable technology serves to be an assistive accessory for an outwardly impeded individual.

V. REFERENCES

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