Raspberry Pi Based Implementation of Wearable Smart Cap for Visually Impaired Person

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Abstract :- In our surrounding the Communication generally takes place through speech and text. The aim of this project is to provide an assistive technology to help the visually impaired person usage in disaster situations. The purpose of our paper is to develop a cap for blind which will guide them from their source to destination. The solution for smart Cap is to support visually Impaired person and it is cost effective wearable 'smart cap'. The Proposed system consists of web camera which is fitted into a cap, audio microphone, Raspberry pi, speaker for voice. The software's use in this project is Image processing. open cv, numpy, python. A OCR software is used for converting the details of the detected object (in text format) to speech output. This project is to provide an assistive technology to help the blind people or visually impaired navigate their way out of any potentially disastrous situation. Smart Cap easily navigate the paths and detect obstacles. Smart Cap" give blind people confidence to walk confidently on busy road. The main advantage of this project to use in critical condition. The system and its usage in disaster situations is an innovative, cost-effective solution specifically addressing the needs of visually impaired persons.

Index Terms – Raspberry Pi, web Camera, image processing, open cv, OCR etc.

1. INTRODUCTION

The technologies always try to make human life easier. The people who are visually Impaired they faces many difficulties during navigation. India is home to the largest number of visually impaired people in the world, about 40 million, which accounts for 20% of the world's blind population. Moreover, more than 90% of these people have little to no access to the necessary assistive technologies. Blindness can be occurring due to many reasons including disease, injury or other conditions that limit vision. In this paper, we design and implement a smart cap which helps the blind and the visually impaired people to navigate freely by experiencing their surroundings. The objective of this research study is to design an assistive wearable cap for the blind or visually impaired persons. The solution present is an assistive wearable 'Smart Cap' that helps people with visual impairment interact and navigate their way to safety by wearing a cap fitted with a camera, which interacts with a voice navigation system (Smart Cap). The aim purpose of our paper is to develop a cap for blind which will guide them from their source to destination. Smart cap is easy for who live alone. This solution is also support visually impaired people to navigate their way to safely and identify dangerous objects, fire and flood water scenarios after disaster.

1.1 Problem Statement

In most cases the visually impaired people have a problem they cannot navigate freely in an environment. The solution is to design an assistive wearable cap for the blind or visually impaired persons. The proposed solution presents in an assistive wearable 'Smart Cap' that helps people with visual impairment interact and navigate their way to safely by wearing a smart cap. This system is easy for those people who live alone. The aim purpose of our project is to develop a cap for blind which will guide them from their source to destination.

The organizational framework of this study divides the research work in the different sections. The Literature review is presented in section 2. Further, in section 3 shown Concept of Methodology is discussed and in section 4, Simulation Results work is shown. Conclusion and future work are presented by last sections 5.

2. LITERATURE SURVEY

For the blind, research on assistive technologies has traditionally been focused on three main areas: mobility assistance, information transmission, and computer access [4]. Mobility assistance focuses on navigation by scanning the user's immediate environment and conveying the gathered information back to the user via audio or tactile feedback. Information transmission aims at optical character recognition and information rendering from 2D and 3D scenes. Computer access-based solutions are Braille output terminals, voice synthesizers, and screen magnifiers. Over the years, a sundry of assistive devices have been developed, ranging from devices worn on the fingers, feet, and arms, to devices worn on the tongue, head, and waist [4]. As humans, we mostly rely on head motion to gather information from the environment. Hence, it is easy to deduce that head-mounted devices provide the freedom of motion for environment scanning, and thus, ease the process of gathering information. With the emergence of Android and iOS operating systems, several Android and iOS applications have been developed to support the visually impaired people to perform their daily tasks as well as aid them in navigation. Thus, Head-mounted devices (HMDs) along with Android and iOS apps, are the most popular type of assistive devices. An experimental analysis of a sign-based wayfinding system for the blind is proposed by Manduchi R. [5]. They use a camera cell phone to detect specific colour markers using specialized computer vision algorithms, to assist the blind person in navigation. A smart infrared microcontroller-based electronic travel aid (ETA) is presented by Amjed S. Al-Fahoum et al. [3] which makes use of infrared sensors to scan a predetermined area around the blind person, by emitting-reflecting infrared waves. The PIC microcontroller determines the direction and distance of the objects around the blind and alerts the user about the obstacle's shape, material, and direction. However, both these works are only useful for navigation purposes and do not incorporate the recent state-of-the-art deep learning techniques and cloud services to provide other essential and necessary features like face recognition, scene understanding and optical character recognition. Kavya. et al. [6] have developed an android app that exercises Google's cloud services. The chatbot-based app uses Google's Vision API for object detection, landmark recognition, and optical character recognition, and relies on Google's Dialogflow trained voice-based chatbot to interact with the user. The system proposed by A. Nishajith et al. [7] helps the blind to navigate independently using real-time object detection and identification. The project implements a Tensorflow object detection API (ssd_mobilenet_v1_coco model), on a Raspberry Pi. A Text to Speech Synthesiser (TTS) software called eSpeak is used for converting the details of the detected object from text to audio.

3. METHODOLOGY

A. Existing System

Nowadays blind people are not come out because of their blindness problem. So there are some techniques to solve their problems by the help of smart cap. So in smart cap there is one cap for blind people to wear and go out comfortably. So basically these cap navigate the blind people for crossing the road, detect the object whatever in front of blind person. So in these project we are going use some hardware and software tools used

B. Proposed System

The proposed system consists of a Raspberry Pi-3 processor which is loaded with open cv, numpy, OCR, speech recognition. The system and its usage in disaster situations it is cost-effective solution specifically addressing the needs of visually impaired persons. The proposed solution presents in an assistive wearable 'Smart Cap' that helps people with blind people interact and navigate their way to safely by wearing a smart cap. In this system here we store some pictures or images in .cvs file format in SD card. The system has a simple architecture that transforms the visual information captured using a camera to voice information using Raspberry Pi. The input device like mic and camera module. This camera module take input from user while output devices like speaker gives the audio output to the user. This system is Easy for those people who live alone. Also Smart Cap easily navigate the paths and detect obstacles. Smart cap boosts Confidence of user to walk on the busy roads. Smart cap converts text to speech, thus making user to understand the what is front of them. The system and its usage in disaster situations is an innovative, cost-effective solution specifically addressing the needs of visually impaired persons.

C. Block Diagram

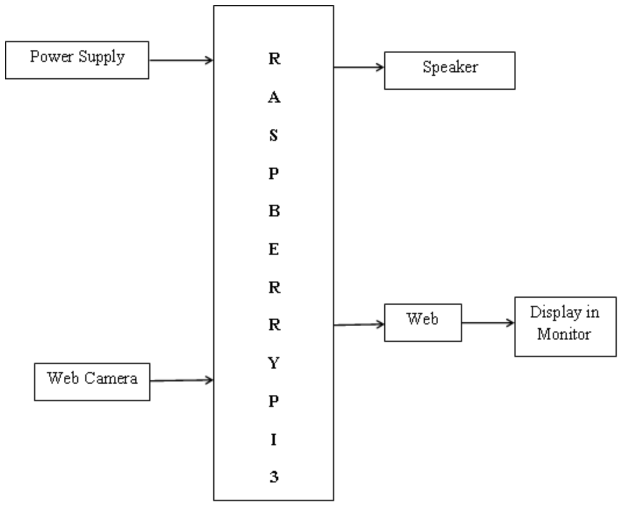


Fig.1: Block Diagram

The basic block diagram given in Figure 1. This give us an overview of the proposed system. The system has a simple architecture that transforms the visual information captured using a camera to voice information using Raspberry Pi. The block diagram of the system consists of various input and output devices. The input device like mic and camera module. A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet. Webcams can be used as security cameras. This camera module take input from user while output devices like speaker gives the audio output to the user. The system has a simple architecture that transforms the visual information captured using a camera to voice information using Raspberry Pi. The Raspberry Pi-3 processor which is loaded with open cv, numpy, OCR, speech recognition. The system helps the visually impaired people to navigate independently using real time object detection and identification. The proposed system consists of a Raspberry Pi-3 processor which is loaded with open cv, numpy, OCR, speech recognition.

D. Hardware Used

1. Raspberry Pi

Raspberry pi is a small chip of single board computer. There are various model of raspberry available in the market i.e. the Raspberry Pi1 Model B, Raspberry Pi1 Model B+, Raspberry pi2, Raspberry Pi3 Model B. These all are differ in memory capacity and hardware features like Raspberry pi3 has inbuilt Bluetooth and Wi-Fi modules whereas in previous versions these modules were not available .It has 1.2 GHz 64-bit quad core ARMv8 CPU with 1 GB of RAM as displayed in the Fig.2.

Fig.2: Raspberry Pi Controller

2. Web Camera

Web Camera is used to take the continuous images to get the traffic signs and signals from the real world that looks like in Fig.3. According to the images available through the camera we can send these images to the raspberry pi to perform car’s control action.

Fig.3: Web Camera

3. Speaker

Speakers are one of the most common output devices used with computer systems and the most common look like Fig.4. Some speakers are designed to work specifically with computers, while others can be hooked up to any type of sound system. Regardless of their design, the purpose of speakers is to produce audio output that can be heard by the listener.

Fig.4: Speaker

E. Software used

1. Python software

Python is a high level programming language used widely in industries and research work. Different versions of python IDLE is available for programming the python language.

2. Open CV

It stands for Open Source Computer Vision.It has a library of programming function mainly for real time computer visions. It has over more than 2500 optimize algorithms for set of classical algorithm as well as for the state of art algorithms in the computer visions. It is basically used for image processing in which in the present study it is used for the face detection, object detections, image recognition, traces and also for other functions.

3.OCR

OCR stands for "Optical Character Recognition." It is a technology that recognizes text within a digital image. It is commonly used to recognize text in scanned documents and images. OCR software can be used to convert a physical paper document, or an image into an accessible electronic version with text.

4. EXPERIMENTAL RESULTS

Smart Cap for Visually Impaired People using Raspberry Pi consists of a Raspberry Pi-3 processor which is loaded with open cv, numpy, OCR, speech recognition. The system and its usage in disaster situations it is cost-effective solution specifically addressing the needs of visually impaired persons.

Fig.5: Hardware setup

Figure 5 shows the hardware setup for smart cap it consist of Raspberry pi controller, camera and speaker.

Fig 6. Object detection

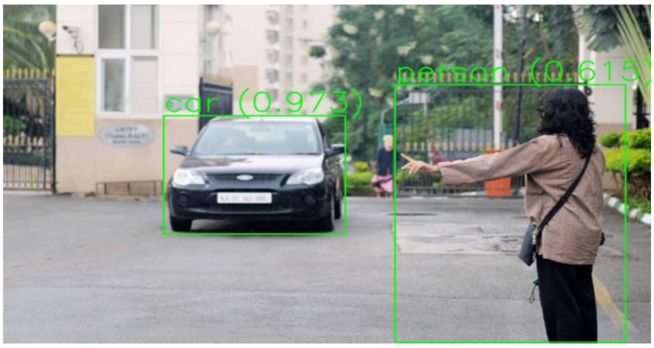
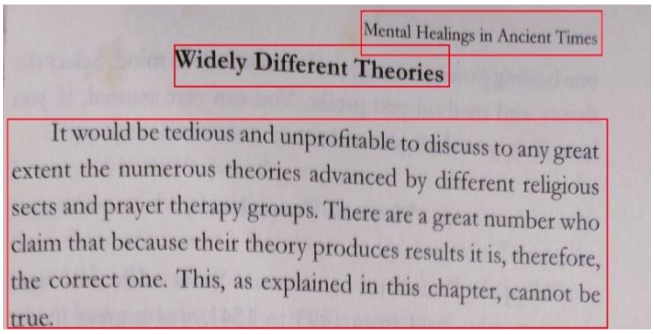


Fig.7: Object Detection

In this above figure 6 & 7. Shows that object is captured by camera. After that object save it to captured frame folder in SD card and object detection is performed on that frame.



Mental Healings in Ancient Times

Widely Different Theories

It would be tedious and unprofitable to discuss to any great extent the numerous theories advanced by different religious sects and prayer therapy groups. There are a great number who claim that because their theory produces results it is, therefore, the correct one. This, as explained in this chapter, cannot be true.

Fig.8: Text recognition OCR Output

Fig.9: Text recognition

In this above figure 6 & 7. Shows that Text Recognition by the OCR.

Fig.10: Person detection

Figure 10 shows the face detection is the captured frame and it detects the person whose data is stored in our database then it frames of the sentence which speaks the name of that person it can see. e.g. I can see Mr. x here.

5. CONCLUSION

The implementation of the proposed system “Smart Cap for Blind People” has various benefits for the users. The system has a simple architecture that transforms the visual information captured using a camera to voice information using Raspberry Pi. The system consists of a Raspberry Pi-3 processor which is loaded with open cv, numpy, OCR, speech recognition. It is an open source software library for numerical computation using data flow graphs. The proposed system is cheap and configurable. The device is a real-time system that monitors the environment and provides audio information about the environment making his/her navigation safe and secure. The object detection is developed to count the number of objects in a scene. The number of objects can be increased by training the model by ourselves. Face detection is also incorporated so that the blind person can easily identify his/her family members and friends. In this system here we store some pictures or images in .cvs file format in SD card. So by the help of these blind people know which object in front of them or else when he or she go out the smart cap can navigate the direction. Smart cap converts text to speech, thus making user to understand the what is front of them. OpenCV develop real-time computer vision applications. It mainly focuses on image processing, video capture and analysis including features like face detection and object detection.

Future Scope

The future work of the Smart Cap presented in this study can take multiple directions. To begin with, the addition of more robust hardware support like GPUs will not only improve the device’s response time but also pave the way for the inclusion of faster and more accurate deep learning models. OCR can be coupled with Document Image Analysis (DIA) for getting more optimal results. The system’s audio interface can be enhanced by providing multilingual support so that the user can operate the smart cap in his or her native language. Finally, real-time object detection can be achieved by adding proximity sensors.

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