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VISUALLY IMPAIRED PEOPLE COMMUNICATION USING RASPBERRY PI AND MINI LIDAR

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Abstract - *Obstacle detection and warning can improve the camera as well as the safety of visually impaired and deaf people especially in unfamiliar environments. For this, firstly, obstacles are detected and localized and then the information of the obstacles will be sent to the visually impaired and deaf people by using different modalities such as voice, vibration. The main objective of this project is to develop an application for blind people to detect objects in various* directions

Keywords: Raspberry Pi, Mini Lidar, Ultrasonic Sensor, Vibration Motor, Open CV.

1. INTRODUCTION

Blindness is a state of lacking visual perception due to neurological or physiological factors. Partial blindness represents the lack of integration in the growth of the optic visual or nerve center of the eye, and total blindness is the full absence of the visual light perception. In this paper, we present an assistive system for a visually impaired people-based cameras.

This system consists of two main components. The first part aims at capturing the environment by using a camera and analyzing it, while in the second component when there is an obstacle to the right of the user; he or she feels strong frequent pulses on the right side through the haptic strap.

2. .LITERATURE SURVEY

We categorized the techniques for assisting visually impaired people into four different groups based on the methods used for mobility and obstacle recognition tasks. MESHRAM et al.: ASTUTE ASSISTIVE DEVICE FOR MOBILITY AND OBJECT RECOGNITION FOR VISUALLY IMPAIRED PEOPLE 451 A. Range-Based Techniques The C-5 laser cane [16] emits infrared pulses that are reflected by objects in front of it and are detected by a photodetector. The distance of the obstacle can be calculated based on the angle made by the reflected pulse. The Ultracane [28] was a step forward in assistive technology. It detects objects in front of and at shoulder or head height of the user. It informs the user about detected obstacles through tactile feedback. The GuideCane [27] is a robotic cane that has a passive wheel at the bottom. The wheel is useful during its regular operation but it adds extra weight to the cane. It cannot detect overhanging obstacles or sidewalk borders. The technique by Ando et al. [2] and the EMC [3] use tactile and audio feedback mechanisms to warn users about obstacles detected in the surrounding environment. The device is limited to detecting only floor-level and knee-level obstacles. In addition, the performance of the EMC in detecting obstacles is hindered whenever it is slanted or used diagonally. Echolocation [12] is a portable cane. It detects head-level obstacles and notifies the user through an audio feedback mechanism. However, it is a costly device and does not detect slippery floors.

Haptic and Wearable Computing Technologies Katzschmann et al. [14] proposed a wearable system that is capable of detecting scaffold obstacles. It uses infrared light to measure the distance from the user to the surrounding obstacles. Ando et al. [1] proposed a multisensor system to assist visually impaired people in performing urban mobility tasks. Flores et al. [10] presented a vibrotactile belt system for guiding blind walkers. It uses an external localization system instead of GPS-based navigation to measure the position and orientation of the user. In the study by O'Modhrain et al. [21], all the researchers are visually impaired and they presented important issues to the designers of media for blind users. The study considers the impact of human factors on the effectiveness of tactile, vibrotactile, and haptic methods of rendering maps and graphs. Park et al. [22] proposed an assistive robotic system using a novel haptic exploration framework for real-time remote exploration. In particular, it aims to help visually impaired people explore public places such as art galleries and museums. The information acquired by the system is provided using a forced feedback platform that gives a real-time 3-D haptic rendering of the item. The CyARM [13], sonic torch [15], and kaspa systems [6], [7] are handheld devices that use echolocation to detect obstacles. These systems require the user's constant conscious effort

to actively scan the surrounding environment. The NavBelt [26] is a portable, wearable assistive system that has embedded ultrasonic sensors. It requires users to make a conscious effort to comprehend the audio cues. The NavGuide [23] is a wearable device that detects obstacles up to the knee level in the front, left, and right directions. to actively scan the surrounding environment. The NavBelt [26] is a portable, wearable assistive system that has embedded ultrasonic sensors. It requires users to make a conscious effort to comprehend the audio cues. The NavGuide [23] is a wearable device that detects obstacles up to the knee level in the front, left, and right directions.

3. SYSTEM OVER VIEW:

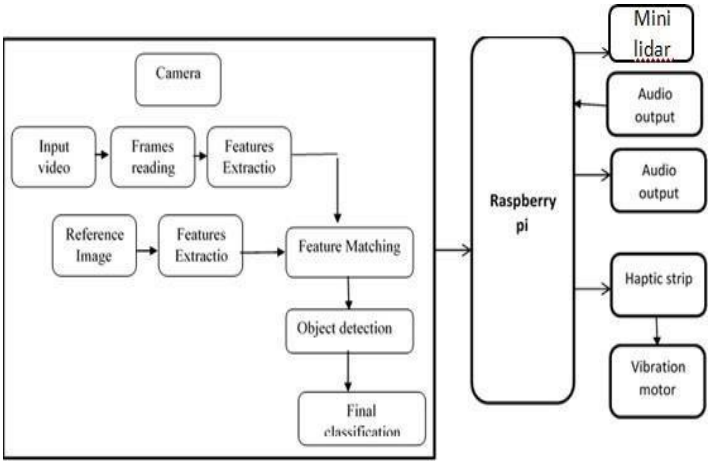


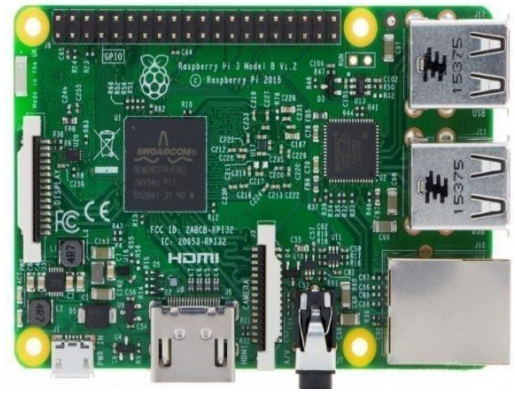
Fig-1: Block diagram of visually impaired people communication

Working:

The blind person taking a video of the path where he or she was walking the application will give voice message to that blind and deaf person and it will help to that person for identifying he's path. The object gets detected by the key matching technique which is used in the algorithm. And match that object with the database images to confirm the obstacle that comes into the way. When an object is matched with database objects the application gives the voice instruction by using the Speech synthesizer. The output comes from the haptic strip. Shorter distances to obstacles are relayed by increased pulse rates with higher vibration strength.

4. DESIGN AND IMPLEMENTATION SETUP

Raspberry Pi 3:



Raspberry Pi is a small board Computer. Raspberry pi is a Controller and Controlled by all sensors. The heart of the Raspberry Pi is a Broad Com System on Chip (SOC), which includes

ARM Compatible CPU and on Chip graphic processing unit. All the all Sensor interfacing into Raspberry Pi and the Raspberry Pi is used for controlling all sensors.

The Raspberry Pi 3 model is the third generation Raspberry Pi. This power credit card-size board computer can be used for many applications and supersedes the original Raspberry Pi model and Raspberry Pi 2, maintaining the popular board format. The Raspberry Pi 3 model brings a more powerful processor, 10x faster than the first- generation raspberry pi. Additionally, it adds the wireless LAN and Bluetooth connectivity making it the ideal solution for power- connected design.

4.1 CAMERA:

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 are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware. Webcams can be used during a video chat session

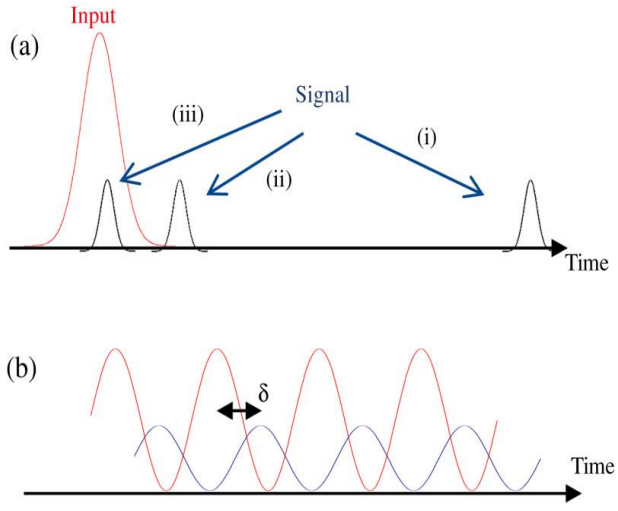
involving two or more people, with conversations that include live audio and video.

The Webcam software enables users to record a video or stream the video on the Internet. As video streaming over the Internet requires a lot of bandwidths, such streams usually use compressed formats

4.2 LIDAR:

LIDAR-Light Detection and Ranging—is a remote sensing method used to examine the surface of the Earth. A lidar is a laser range measurement device. The name is a combination of the terms Light and RADAR and not, as commonly suggested, an acronym derived in a manner similar to its forerunner, "Radio Detection and Ranging"

The **RPLIDAR A2 180° Laser Scanner** is the next generation of 180-degree 2D lidars. The RPLIDAR A2 adopts a low-cost laser triangulation measurement system developed by SLAMTEC, and therefore has an excellent performance in all kinds of indoor environments and outdoor environments without direct sunlight exposure.The typical scanning frequency of the RPLIDAR A2 Laser Scanner is 10hz (600rpm). Under this condition, the resolution will be 0.9°. And the actual scanning frequency can be freely adjusted within the 5-15 Hz range according to the requirements of users.



Distance measurement can be done in a multiple ways but there are two principal ones used. One measures the time of flight of a laser pulse while the other uses the angle of deflection of the laser beam.

Time of flight measurement

You're familiar with how basic radar and sonar works out a pulse and measure the time it takes to receive the return signal. The time divided by the speed of light or sound gives you the distance the signal traveled out and back. Divide that by two to get the distance to the object. That's a time of flight (ToF) measurement.

4.3 Raspberry pi software:

This chapter introduces the devices and software which are used in this bachelor's thesis. The chapter also contains a short introduction to the Linux operating system which is used in this thesis.

Linux:

Linux is a free open-source operating system and it belongs to the Unix operating systems. Actually

Linux means the kernel which is the heart of the operating system and handles the communication between the user and hardware.

Normally ,Linux is used to refer to the whole Linux distribution. (Upton, E. & Halfacree, G. 2012, 28.) Linux distribution is a collection of software based on the Linux Kernel. It consists of the GNU project's components and applications. Because Linux is an open-source project, anyone can modify and distribute it. That is the reason why there are many variations of Linux distributions. The most popular distributions are Ubuntu, Red Hat Linux, Debian GNU/Linux ,and SuSe Linux. (Kuutti, W. &Rantala, A. 2007,

2.)

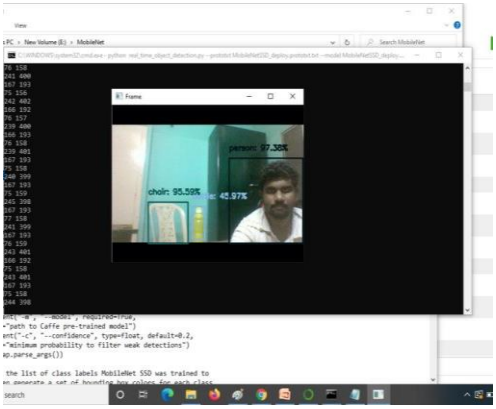
Python Platform for Raspberry Pi:

Python is a flexible and powerful programming language easy to learn and follow. The clear syntax of Python makes it a valuable tool for users who want to learn programming. This is one of the reasons why it is recommended by the Raspberry Pi Foundation. Python is published under an open-source license and it is available for different operating systems. Python runs on Linux, OS X and Windows computer systems. (Upton, E. & Halfacree, G. 2012, 152.) Cross-platform support guarantees that the programs which are written in Python are also compatible in other platforms. There are few exceptions where the programs are not compatible. For instance, when the Python is addressed to use the specific hardware such like Raspberry Pi's GPIO. (Upton, E. & Halfacree, G. 2012, 152.)

IMAGE PROCESSING USING OPENCV IN PYTHON

Image processing is the process of manipulating pixel data in order to make it suitable for computer vision applications or to make it suitable to present it to humans. For example, changing brightness or contrast is an image processing task which makes the image visually pleasing for humans or suitable for further processing for a certain computer vision application

5. RESULT:



5.1 SOFTWARE OUTPUT:

5.2 HARDWARE OUTLOOK:

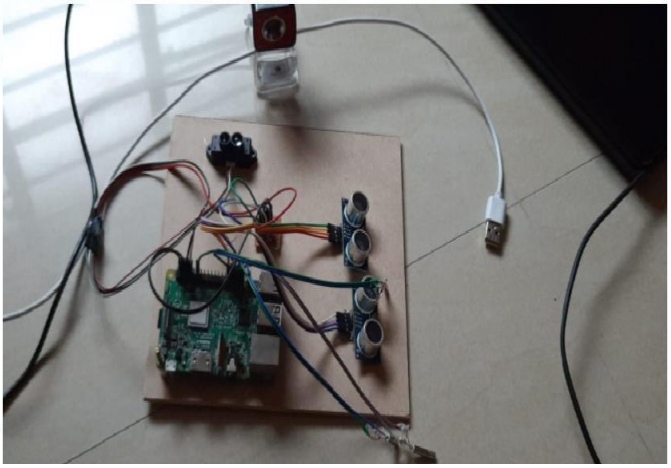


Fig-: hardware outlook

6. CONCLUSION:

In this paper, we have used the functions of OpenCV It is free for both commercial and non- commercial use. Therefore, you can use the OpenCV library even for your commercial applications. It is a library mainly aimed at real- time processing. Now it has several hundreds of inbuilt functions which implement image processing and computer vision algorithms which make developing advanced computer vision applications easy and efficient

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