The Third Eye – An Assistive Technology for the Blind Visually Impaired Individuals

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ABSTRACT

The Third Eye device uses the power of artificial vision (Image Processing) and machine learning by incorporating pioneering technology into a wearable platform which improves the lives of individuals who are blind, visually impaired, and have reading difficulties. This consist of a small camera that can be clipped on to the person's spectacles and which is connected to a small speaker device. It assists visually impaired and blind people in their day-to-day activities. It can read any printed or digital text, including the morning paper, text messages, and even the computer screen at their office. It can recognize the faces of their friends and family. It can help one identify products, which allows people who are blind or visually impaired to identify objects in front of them so that they need not require assistance from anyone else.

Assistive technology for blind and visually impaired people includes assistive, adaptive, and rehabilitative devices that promote greater independence. It does so by helping people to perform tasks that they have difficulty performing. It helps with such tasks, mainly activities involving reading. This is not technology for the blind that enables seeing but rather technology that allows the user to be able to read texts without asking others for help. The device recognizes any text from any surface and relays the information to the user via a small speaker.

This allows the user to be able to read work emails, medicine labels, and more all on their own. For people who are visually impaired, this kind of technology for the blind makes the ability to walk independently much easier.

Keywords: - *Arduino UNO, Ultrasonic sensor, Vibration motor, Buzzer.*

I. INTRODUCTION

Since running the daily life of blind people is very difficult, this project helps them run their life as usual. They can make this project as a gadget or a device in their hands that detects the obstacle. This project is more efficient than the existing system with a cheaper and more accurate one. Here we are using an Arduino board to perform this operation, and making life a normal one for blind people may be a very worthwhile project for them. By making this as a gadget or a device in their hand, they can easily judge an object on their own by knowing the buzzer sound. The system uses ultrasonic sensors as a wide range of fields to detect an object with its higher detection range. According to WHO, 39 million people are estimated as blind worldwide. They are suffering a lot of hardship in their daily life. The affected ones have been using the traditional white cane for many years, which, although practical, still has a lot of disadvantages. Another way is, having a pet animal such as a dog, but it is expensive. In this proposed system, we developed a cheap, more efficient way to help visually impaired people navigate with greater comfort, speed, and confidence.
This can help us to get a cheaper and more accurate one

II. LITERATURE REVIEW

To make the system more effective, there are several systems related to the development of projects related to the blind. This literature review has helped us overcome several design and software improvements. Describes a better navigation tool for the visually impaired. The smart stick could be a device that avoids various obstacles in the way. Blind people cannot exercise every day, walk on the street, spend time with colleagues or family members, or perform daily activities. Therefore, the plan can help individuals to participate to confirm the willingness to solve this important issue.to be safe without having the excitement in his head that someone or something might meet him on his way. A smart cane: Visually impaired walking stick that can detect knee-high obstacles and provide better GPS navigation for the user. The sensors are mounted on the holding place of the user . A wearable ultrasonic obstacle sensor to assist the blind and visually impaired develops a method of developing electronic gloves that enable deaf and blind people to easily interact. They used sign language to communicate with others, but it is very difficult to use and understand this sign language because it contains around 6000 gestures. The model uses 26 hand gestures to convey the alphabet and another 10 more gestures to convey the numbers.

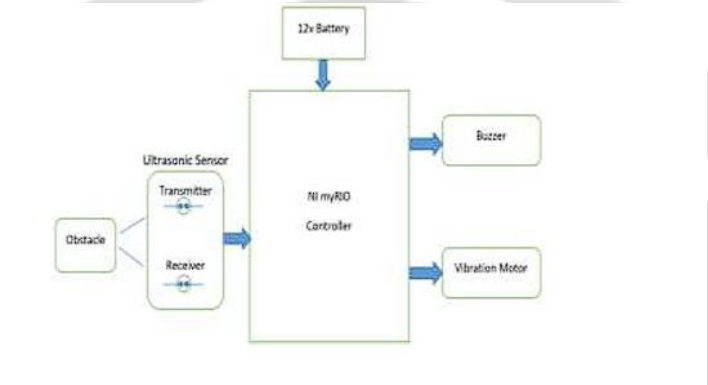
This will help the deaf people to connect with others by waving their hand and writing text on the Liquid Crystal Display (LCD) screen. The text becomes language so that the blind can listen and communicate.

III. PROPOSED WORK

The purpose of the project is to develop a product that is useful for blind people and people who often rely on others. Visually impaired people move around and learn about nearby objects by using the portable armband holder emit ultrasound, buzz when obstacles are detected.

The aim of the project is therefore to develop a cost-effective and efficient way to navigate more comfortably, faster and safer. The main disadvantage is consumption a lot of time and effort. Figure 1 shows the block diagram of the current system, since the blind person want to know that there is a hurdle in front of them, an ultrasonic sensor is used to detect the obstacle.

This a detection device works according to the SONAR principle (Sound Navigation and Ranging). Innovative wearable technology with NI myRIO Sends a high-frequency ultrasound signal every 10 μs. This signal hits the obstacle and reflect.



During this period, the echo signal rises from the echo pin of the ultrasonic sensor, which is connected to the NI myRIO. The controller used here is NI myRIO, a Xilinx FPGA (Field Programmable Gate Array) and a dual-core ARM (Advanced RISC Machine) Controller Cortex Processor - A9, which is used to evaluate the distance in centimeters through the received duration echo pulse.

IV. METHODOLOGY

The third Eye's camera device clips on to a user's eyeglasses. It is connected via a Bluetooth to a small computer that fits in a pocket. The interface is minimal: the caretaker of the blind user uses the website application to register, and upload faces of individuals whose faces are to be recognized by the device. The uploaded photos get stored on to the database where the system is trained to recognize the faces. So, after training as the person comes in front of the camera frame the system detects the face and spell out the corresponding names.

By default, the camera opens as soon as the application is launched, and the camera remains working until the application is closed. The camera captures and sends the live sessions of video segmented images in front of the user to the server, where the image gets processed, and objects are classified using deep learning algorithms.

The corresponding image label is sent as voice output back to the mobile application and the user gets to know about the objects in front of them. Next for the voice assistance the user needs to hold the volume down button for 3 seconds of time and the voice assistance module gets activated and the user can now give voice inputs by saying the voice commands followed by "okay".

The application processes the voice command, and the corresponding voice output is given to the user. Whenever the user gets lost somewhere or when they are indeed of help, the user can ask for help through voice commands simply by activating the voice assistance module and speak out the message that needs to be sent followed by "help okay" command. The message is sent to the caretaker's registered mobile number.

The caretaker can then locate the user/blind through the web portal. For reading the printed text, the OCR (Optical Character Recognition) module needs to be activated, which can be done in the same way through voice command – "OCR okay", then the camera gets opened and reads the printed text through camera and spells out the sentences or words that get captured in the camera frame. To get best results the printed text needs to be kept steady.

Following are the applications or features of the Third Eye Device:

*Reading: The device converts printed text to speech. One can read most digital text, such as that on a television or computer. It reads printed text, such as books, newspapers, food labels, restaurant menus, and even street signs.

*Identifying people: The device identifies known faces. Basically, you take an image of the face you want to be able to recognize and add a name. The device will then announce the name of that person once they enter the camera's view.

*Recognition of specific objects: In a similar way to the face recognition, there is a feature to recognize objects around the user e.g table, chair, books etc.

*Voice over assistant: This device helps the user to know about the time, making a phone call, current location, weather details by giving the voice as input.
The system responds to user's voice input and give voice output through speakers.

1. OCR (Optical Character Recognition)

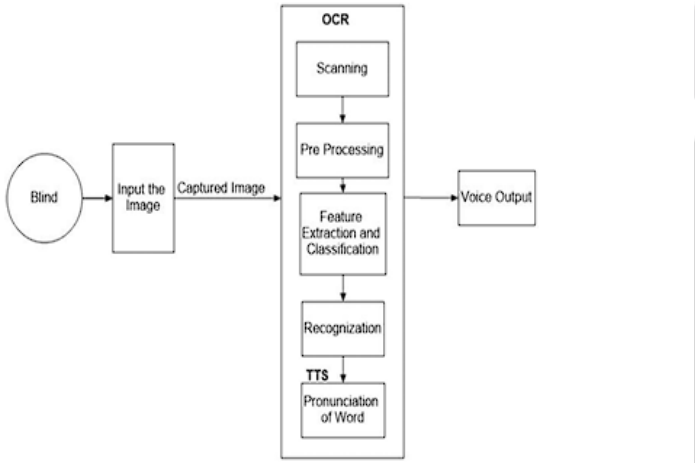


Figure 1- Block Diagram of OCR Module

This module provides a full alphanumeric recognition of printed or handwritten characters at electronic speed by simply scanning the images. Forms containing characters images can be scanned through camera and then recognition engine of the OCR system interpret the images and turn images of handwritten or printed characters into ASCII data.

2. Web Application Module The caretaker can register and login through the web browser, where the he/she can perform tasks such as view the registered devices, track the users, manage the devices of blind, and upload images of persons whose face is to be recognized.

3. Object Detection Module The Object Recognition module provides a way to identify specific trained objects within the current image.
Here we have used a pre-trained model of COCO (Common Objects in Context) dataset for the purpose. It contains around 90 trained objects which can be correctly classified and labelled.

4. Face Recognition Module The facial recognition module is used to automatically identify people by their video images. It recognizes faces captured by camera by comparing their parameters with digital templates stored in a dedicated database and give voice outputs of names corresponding to the images.
In addition to automatic identification of people based on video images, the module enables users to add or remove entries from the reference database.

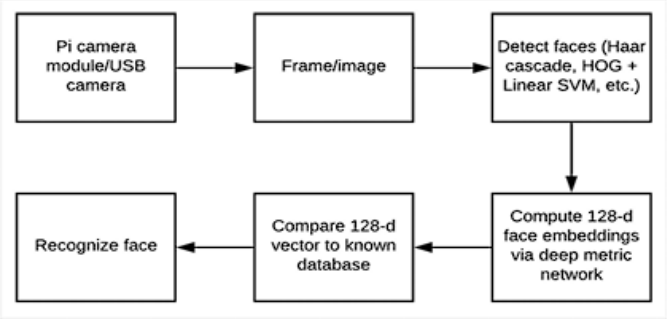


Figure 3 - Block Diagram of Face Recognition Module

5. Voice Assistance Module The device can hear and process voice input and voice-based assistance to the users. Such as, it helps the users do things like checking the current time, location and ask for help from caretakers through text messages.

V. ADVANTAGES AND DISADVANTAGE

Advantages:

1. Enhanced Mobility: It provides users with greater independence by helping them navigate their environment without the need for a traditional white cane.
2. Object Recognition: The system can detect obstacles and inform the user about their surroundings, potentially identifying the objects.
3. Audio Assistance: Some systems can read aloud e-books or provide audio feedback, which is beneficial for those who cannot read printed text.
4. Face Recognition: It can differentiate between known and unknown individuals, adding a layer of personal security and social interaction.

Disadvantages:

5. Training Required: Users may need extensive training to use the device effectively.
6. Electronic Interference: The technology might fail in crowded areas or where there are high volumes of electronic waves.
7. Portability: Some devices may not be easy to carry or could be cumbersome to wear for extended periods.
8. Cost: The price of the technology might be prohibitive for some users.

VI. RESULT

Third eye for the blind: An innovative wearable technology u, the ultrasonic sensor module (HC SR04), buzzer, vibrator motor and voltage regulator. The ultrasonic sensor module detects the obstacle. When people move forward, they point obstacles and send ultrasonic waves in the indicated direction.
The ultrasound module calculates the distance from the obstacle to the person and if the obstacle is not detected, i.e., if it is not within the distance as used in the program code, the user cannot feel any of the outputs.

The vibrator motor does not vibrate and the buzzer does not sound. If the gap between the user and the object is smaller when the object is detected, then the person can feel the output. When the module is within range obstacle can be detected, the vibrator motor vibrates and the buzzer sounds.

The length of time the buzzer sounds depends on the gap from the sensor and the obstacle, the delay is greater when the space is greater and less when the space is shorter. The buzzer sounds faster when the user is close to the obstacle.

VII. CONCLUSION

The third eye for the blind is a useful device that allows the blind to work freely. Its goal is to help blind people overcome vision loss by using other senses such as sound and touch.
A blend of an HCSR04 ultrasonic sensor is used as an input to calculate the obstacle distance. An efficient and accurate way of signaling the user about obstacle is by using vibration motor and a buzzer. Xilinx FPGA is used to process the duration received from the ultrasonic sensor and finally the output is received through two devices, buzzer and vibrator motor, to provide sound and touch.
In this way, a simple, inexpensive, efficient, easy to transport, configurable, easy to use electronic guidance system for constructive assistance for the blind is developed.

FUTURE SCOPE

In the future, the equipment can be improved as follows:

1. The size of the device may be reduced with MEMS controllers.
2. Object identification can be included.
3. Location tracker can be included.
4. The Haptic feedback can be improved with vibration.

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