International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 4 Volume No.6 July – 2022
DOI:10.46647/ijetms.2022.v06i04.0016 ISSN: 2581-4621

Design and Development of Wearable Eye for the Visually Impaired

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Abstract:
The wearable eye for the blind or visually impaired persons is a technological advancement, which is aided by multidisciplinary courses like software engineering and hardware design. It aids the visually impaired to explore their surroundings as quickly as possible and assuresthem safety by sensing nearby deterrents with the use of ultrasonic waves and alerting them with a beeping sound and audio support. It also incorporates face recognition for identifying known people through a voice message when they appear before the visually impaired person. For a long time, the white stick, despite its power, still possesses a significantamount of weakness. This limitation is overcome by the design and development ofthis wearable innovation. The wearable eye deviceuses a little computer, the Raspberry Pi 4 module, ultrasonic sensors and a Raspberry Pi camera.
Keywords — **Wearable device, visually impaired, face recognition, Raspberry Pi.**

I. INTRODUCTION

As per the World Health Organization (WHO),there are about 2.2billion people around the world, who suffer from visual impairments.Unfortunately, emerging countries account for more than 90% of those who are blind. This project focuseson the subject of assistive technologies for visually challengedpersons in order to create an audio environment for the blind. It translates the sensor input and visual input captured through a camera into alternative rendering modes suitable for blind users usingimage processing.Auditory and haptic modalities can also be used in addition to this to create an immersive experience.The device can perform three tasks: face recognition, obstacle detection and alerting through SMS when panic button is pressed. This project can be a boon to the visually impaired people since this application can make daily tasks easier for them.

The face recognition system maps the facial featuresof the person in the image using Artificial Intelligence and compares the image with the images in the database of known person. The final step of picture processing is quite close to that of a person. Face recognition is the most common type of image recognition solution.The system must first recognize the face, and then determine whether or not it belongs to the faces in the database. In the training approach,we give the neural network a large number of labeled photos in order to train it to distinguish between objects.
Ultrasonic and infrared sensors are used to detect obstructions in the path of the blind person. Vision system disorders can cause visual impairment or blindness which can prevent people from doing routine things like walkingoutdoors or working in their office or workplace. With this device, one can be assured about not colliding with any obstruction in the user's path.
The construction of a portable artificial intelligence-based navigation system for visually impaired people is proposed in this project to aid in their daily mobility. Our proposed project harnesses the maximum capabilities of the Raspberry Pi microprocessor which has an inbuilt graphic card. The project uses various sensors such as IR Sensors, Sonar Sensors, and a Camera module which helps the system to gather the required data. The text-to-speech module is used to communicate with the user.

II. METHODOLOGY

The system is built using a Raspberry Pi microprocessor, Raspberry Pi camera module, ultrasonic and infrared sensors, voice processor, 12-volt relay with relay driver, headphones, 5-volt voltage regulator, and a 12-volt battery. Figure 1 shows the block diagram of the wearable eye.

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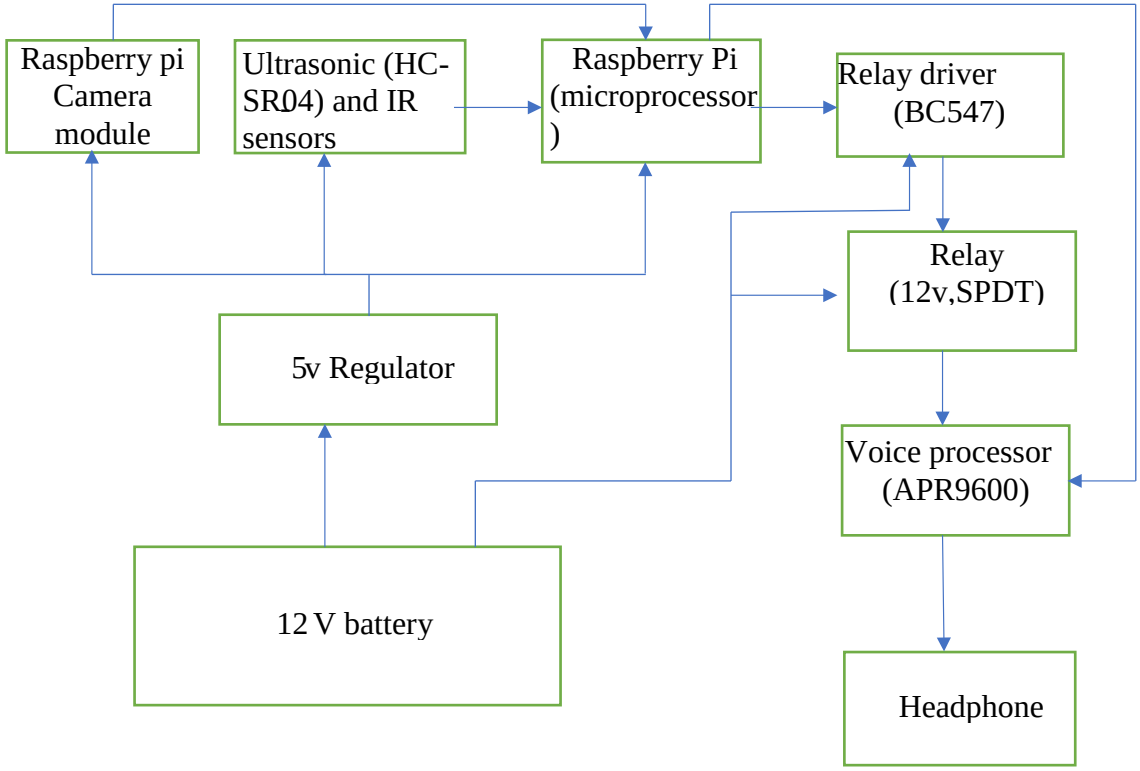

Fig. 1 Block diagram of the Wearable Eye

The 12 volt battery provides DC supply to the voltage regulator which converts 12 volts to 5 volts DC. This 5 volts is used to power the Raspberry Pi microprocessor, Raspberry Pi camera module, ultrasonic sensor, and infrared sensor. The ultrasonic sensor producesthe ultrasonic sound of 48 kHz frequency with the help of an oscillator. The transmitter sendsa signal into the surrounding air and if it encounters any object within 4 meters in front of it, the signal hits the object and returns back to the receiver.Thus, the presence of an object in front of the visually impaired person is detected using the ultrasonic sensor. Since the signal received is very weak, it is strengthened using a PIC microcontroller using the pulse width modulation (PWM) method.The amplified signal is input to the SPDT relaythrough the relay driver. The voice processor unit receives the relay output and gives out the audio output in the form of a voice message. The Raspberry Pi camera captures the image and sends it to the microcontroller for face detection. If a face is detected, it is compared with the images stored in the database. If there is a match, the relay operates, and the voice processor which causes the speaker to output an audio message that the person is in front of the visually impaired person.

This project proposes the design of a portable Artificial Intelligence-based guidance system for the visually challenged, which helps in their day-to-day mobility. The project called the Third eye provides the visually impaired community with a new way to visualize the world by giving necessary input about their surroundings. The whole system is controlled by Raspberry Pi Microprocess

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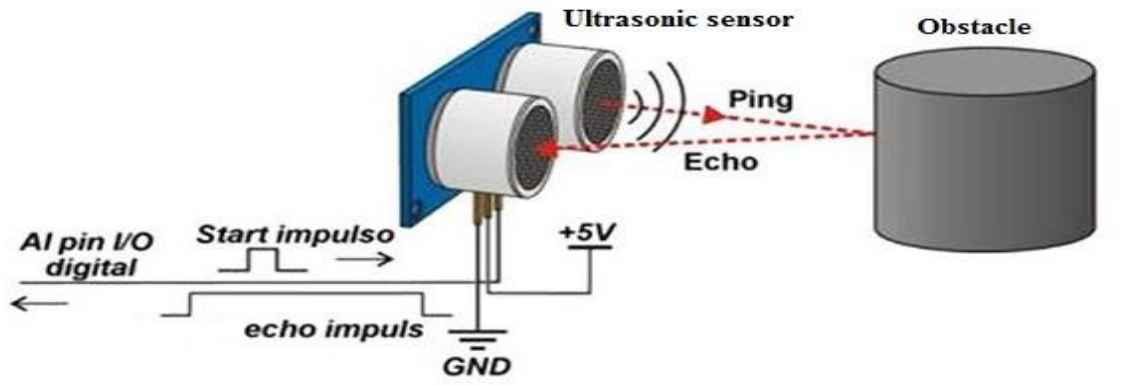

Fig 2: Object Detection using Ultrasonic sensor

The system's beating heart is Python. The system's programming allows the Raspberry Pi microcontroller to communicate with all the sensors. The gathered data is subsequently processed and turned into information. Obstacles are picked up by the IR sensor at lower levels, and the ultrasonic sensor periodically gathers information about their distance. The camera module is crucial since it captures the images that are later analyzed using image processing to recognize and identify the individual. The speech processor (APR9600) processes and transmits all the acquired data before delivering the voice message to the user through a speaker or headphones.

Ultrasonic Sensor: The ultrasonic sensor works on the sonar technology which will work on the ultrasonic sound waves. The device that can measure the distance to an object using ultrasonic sound waves. The sensor emits a soundwave at a specific frequency and waits for it to bounce back from the object. By counting the time it takes for the sound from the sonar sensor to reach the object and then calculating the distance between them, it can figure out how far away the object is. However, the sonar sensor might not be able to detect some objects. This could be because the wave might not bounce back properly to the sensor, and it could travel somewhere else. The sonar sensor will not be able to accurately predict the distance in this situation.

Relay (12V SPDT) :

Basically, the relay is an electronic switch,

In this project, we are going to use it as a switch for the voice processor to give a voice message to the user. We are using SPDT relay (single pole double through) means single input and double output which can control two electric circuits

The relay is having 5 pins namely

Coil, Coil, NO, NC and COM

Infrared Sensor: IR sensors are miniature microchips having a photocell that may either emit or receive infrared light, or do both in some circumstances. They are used to identify distant objects, which can be anything, including televisions. There is a matching IR led inside any IR emitting device, which produces IR pulses to notify the other device what action to take. Because human eyes cannot see infrared light, testing IR sensors require more work. IR sensors only detect infrared

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radiation and cannot detect visible light. The IR sensor's demodulator searches for modulated IR signals at 38 kHz. Normal IR will not be detected; instead, it must blink at a frequency of 38 kHz.

Raspberry Pi: The Raspberry Pi is a small, inexpensive computer that you can take anywhere. It supports a variety of programming languages such as Python, Java, and Scratch. You can perform all the tasks that your desktop computer can do. In this study, we are using the python programming language it is used for image processing to identify people.
Furthermore, the Raspberry Pi features a feature that is not available on normal desktop PCs. It is able to communicate with the outside world. It's been utilized in a wide range of projects, from musical instruments to weather stations. It's also been used to make tweeting birdhouses equipped with infrared cameras.

Voice processor (APR9600): The APR9600 is a low-cost, high-performance sound record/replay IC that uses flash analog storage. Even after the module's power supply is withdrawn, the recorded sound is preserved. The re-played sound is of excellent quality and has a low noise level. For a 60-minute period, the sampling rate in the second recording period is 4.2 kHz, resulting in a 20Hz to 2.1 kHz sound recording/replay bandwidth. A sampling rate of up to 8.0 kHz can be reached by altering an oscillation resistor.The overall length of the sound recording is now 32 seconds.

III. ADVANTAGES

- Glasses can take pictures through the camera (Raspberry pi camera module)
- Interpret images and identify objects in images through computer vision and pattern recognition systems
- You can calculate the distance between a person and an object
- Converts information via headphones into a voice that can be understood by the visually impaired
- Notify if very close to the object
- In case of emergency, it will send an SMS to the user’s family

IV. EXPECTED OUTCOMES

- Implementing a distance measurement sensor for the measurement of the distance between the user and object.
- It will indicate whenever there is an obstacle in front of the user up to 4 meters through the voice message.
- It will detect the face and gives a voice message to the user (name of the person)
- Panic button will send the SMS to the user’s family member if the user is in an emergency

REFERENCES

1."Project.Prakash". https://nei.nih.gov/news/scienceadvances/discovery/project_prakash.
2.Rohit Sheth, Surabhi Rajandekar, ShalakaLaddha and Rahul Chaudhari (2014). American Journal of Engineering
3.G.Gayathri, M.Vishnupriya, R.Nandhini, Ms.M.Banupriya (2014, March). International Journal of Engineering And Computer Science. [Online]. 03(03), pp-4057-4061.
Available:http://ijecs.in/issue/v3-i3/8%20ijecs. Pdf
4.Sarah Griffiths and Fiona Macrae. (2014, June). Smart glasses for the BLIND: Display turns the world into outlines to help people with a poor vision 'see' obstacles And faces.

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5.Steve (2010, Dec). HALO-Haptic Feedback System for Blind/Visually-Impaired.
6.Zhou, X., Ylao, C., Wen, H., Wang, Y., Zhou, S., He, W., & Liang, J. (2017). EAST: an efficient and accurate scene text detector. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 5551-5560)