January-February 2020
ISSN: 0193-4120 Page No. 10985 - 10988

Aiding Navigation for Visually Impaired Persons

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Abstract:
Individuals with visual impairment have trouble navigating, as they often lack the knowledge they need to overcome obstacles and hazards in their path. Software has been developed to identify obstacles using ultrasonic sensor-based visual navigation and a USB camera to help blind people to survive safely. The proposed system detects the obstacles to warn the blind persons and avoid the accidents by sending the audio feedback by using the Arduino. Furthermore, a USB camera is attached to a raspberry to capture the persons in front of them, in particular to locate a human being in the sense of this research to determine the properties of the obstacle. Identification of human presence in the cloth fabric is based on facial recognition and texture checking. The proposed system also allows the visually impaired to read books without third party assistance.

Keywords**:** Arduino, Raspberry pi 3, Ultrasonic Sensors, Camera Module, Headphone.

1. Introduction

Disabled or elderly people have drawn interest of public. Now there are lot of scopes of it including slopes instead of stairs, handrails, elevators, paving stones etc. Nevertheless, improvements or scopes are used in some places and personally, living in most areas is still difficult for the disabled. These people have a great deal of trouble getting knowledge about the environment. In reality, barriers that are not dangerous to average people and sometimes the barriers may dangerous to them. While using stick to gain this message, they often find it difficult to walk around in most areas and not to cover the whole area as well. There have been a lot of studies in developing a system that helps the blind. The research discussed here is about using new technologies to boost the autonomy of people with visual impairment. The emphasis is on finding obstacles to the visually impaired people to that navigation issues.

Since complex objects create noise when traveling, blind people improve listening ability to locate them. Furthermore, when the matter decides exactly where an a nimate object is, it's limited to its sense of touch. A stick cane or cane for walking is the preferred way to navigate the visionless person. The walking stick is used by many people and this device is used to detect the immovable obstacles, surfaces that are not even and holes on the ground through direct input from the contact force. This system is lightweight, compact but limited in range, and is not suitable for barrier protection near the head area. The guide dogs are one of the best options to help the Blind with the travel assistance.

The travel aids are of different types that are available to help the blind persons through the advancement of the modern technology. They are otherwise known as ETAs. Sonic Pathfinder4, Mowat-Sensor5 and Guide Cane6; they do have directionality are

January-February 2020
ISSN: 0193-4120 Page No. 10985 - 10988

the some of the travel aids, however. Sonic Guide7, NavBelt8, and other 9, 10 ETA devices, however, have broad directionality, and can simultaneously search for multiple obstacles. The generation of the ultrasonic sensors and some of the laser light beams will lead to the development of these devices. The reflected waves from the obstacles through the ultrasonic sensor is observed by the system, sometimes it may give the wrong result of the obstacle, the wrong information may lead to the accidents of the blind persons, the long white cane is not used by the people that much because it may give the wrong results. Accordingly recent research efforts aim to create a system in which the digital camera acts as the vision sensor.

Some of them are: VOICe11, NAVI12, SVETA13, CASBLIP14; The image is recorded in voice with one video camera is on the headgear and for the sound generation the image that was captured is scanned from left to right. Similar work was done in NAVI, where the processed image captured is converted into stereo sound is directly proportional to the pixel orientation. Inside SVETA an enhanced matching area is conducted transformed images to measure depth of the image. The sonification method is used to transform a stereo musical sound into the picture of difference.

In CAPSBLIP the target is determined by sensors and stereo vision. On top of that, guidance using GPS. The FPGA applies this technology. The most of the blind consumers accept the devices which are in low cost control easiness. So devices for portability with ETA should be lightweight and compact in size. This device is easily controllable by the blind persons because the panels and buttons are not seen by the blind persons. This device is low cost and easily controllable and it can be easily used by the common people. In the proposed system, e-Box is used as a processing unit in light of all these parameters. Processing of ETA devices is carried out on that embedded system. This manages every module in which the user navigates. A system prototype is built to check the ETA device on blindfolded individuals, where the USB camera used here is mounted and ultrasonic sensors are also used to detect the obstacles. In a pocket the user places the circuit sensor unit and the 2300TM e-box. The device is checked by the blindfolded persons. There are about 314 million visually impaired persons and the blind people are about 45 million. Visually impaired people are about 87% out of these the Indians are about 15 million. Some jobs or circumstances have physical limitations which they sometimes find difficult to overcome. The problems are related to the lack of competence these are helpful in avoiding the obstacles. These difficulties can be solved by the strengthening and acknowledging the people sense.

Residential incidents are usually caused by inadequate signaling or disaster, as well as some related causes such as phones, poles, postboxes. If we can rely on our own instincts, roaming through unfamiliar area it will becomes a real challenge. Since complex objects usually create noise during travel, blind people improve their sense of hearing to distinguish them from each other. Since complex obstacles cause noise during travel, blind or visually impaired people develop their sense to hear the sounds. But when the matter determines precisely where an inanimate object is, it's limited to its sense of touch.

2. Existing System

People with visual impairments have trouble communicating and sensing their surroundings. They have little contact with the environment. Physical movement is a problem for visually impaired people, as identifying objects that appear before them can become difficult and they cannot move from one position to another. They are dependent on mobility and financial support from their families. In the past, different systems with limitations are constructed without a solid understanding of the non-visual perception. Scientists have spent decades creating an intelligent and adaptive stick to support and warn visually impaired people from obstacles and provide knowledge about where they are. Research on new devices has been conducted over the last few decades to develop a good and reliable program to detect obstacles and alert visually impaired people in areas of risk. Current patents and emerging inventions are Smart Canes with detection of obstacles, Sonar vision glasses with detection of obstacles, and GPS navigation devices providing directions. There are some tools, such as head mounted sonic guide (1974) and KASPA system for supporting the blind. Researcher created a device that uses Microsoft cane sensor to acquire Depth data. The designed smart walking stick is specifically used to detect the obstacles and helps the blind to move easily. The audio warnings help the user safely and help to reduce the accidents significantly. It also provides an automatic voice-activated switch to assist them in private space.

This program provides a model for providing blind people with smart electronic assistance, in both public and private spaces. The smart walking stick is used to test the distance between the objects by using the ultrasonic sensor. If any objects or obstacles appear within an ultrasonic sensor's range, the head phone will say the name of the obstacle in front of the stick. The smart walking stick is a simple, purely mechanical instrument for detecting obstacles on the ground. This system is lightweight and compact. But despite its own scale, its range. Most jobs or circumstances have physical limitations that they sometimes find impossible to resolve. These difficulties are related to expertise which would help them to avoid obstacles. It provides the person with the best travel assistance. The blind person will travel from one position to another independently, without the assistance of the others. The system's objective is to give the blind people with an active travel aid that gives them a vision by giving the information about the surroundings.

January-February 2020
ISSN: 0193-4120 Page No. 10985 - 10988

3. Proposed System

The existing system developed was used to detect the obstacles and the system that was proposed is used to detect the people before them. The hardware components are given below.

The entire scheme is introduced using the cost-effective components and easier to carry. Every unit in the network takes on a particular job.

A proposed ETA has been suggested to the people to wear it while travelling it will be surely helpful. The device is tested by the blindfolded persons to check the results. Using this device, the blind persons can navigate independently without the help of the others and they can move safely. The proposed aid is easily acceptable by the users because they are light weight, easy to carry and cost effective. These things are considered in to account and the development of our proposed system is done. The user must wear a headset to hear the audio feedback from Arduino. The user can easily carry the device and navigate to any place where ever they want.

Raspberry PI 3b+

The CM3 + contains a Raspberry Pi 3B+ BCM2837B0 processor, 1Gbyte LPDDR2 RAM and eMMC Flash. Actually, the CM3 + is available in 4 versions, CM3+/8 GB, CM3+/16 GB, CM3+/32 GB, and CM3 + Lite, with 8, 16, and 32 Gigabytes of eMMC Flash or no eMMC Flash. Except that the eMMC Flash is not equipped, the CM3 + Lite software is the same as CM3 +, and the SD / eMMC interface pins are accessible for the consumer to connect their own computer. Remember that the CM3 + is electrically similar and is physically identical to the legacy CM3 products except for higher CPU z-height.

Power Supply

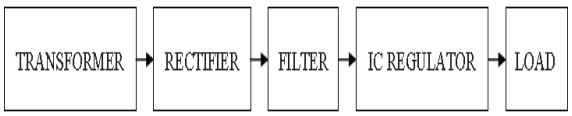

Figure 1: Block diagram of the power supply

The transformer is wired to the ac voltage, normally 220V rms that increases the voltage to the proper dc output level. A full-wave rectified output that produced from the diode rectifier passed through the simple condenser that produced the filtered output. The resulting voltage that differs from the ac or the repel voltage. When the dc voltage is different, the controller circuit removes the ripples and maintains the same dc value. The voltage regulation is done by the one of the renowned voltage regulator IC units. Figure 1 shows the block diagram of power supply.

Arduino UNO

The Arduino Uno is comes under the AT mega 328, a micro-controller module. The Arduino Uno has 14 digital input / output pins. From the 14 pins 6 of them are PWM inputs, 6 were analog inputs, 16 MHz crystal oscillator, a USB pin, a power jack to connect the computer, an ICSP header and a reset key to reset the microcontroller. It provides the user comfortable and the USB is used to connect the micro controller to the computer and the power jack is used to give the power to the microcontroller.

Ultrasonic Sensor

Parallax PING offers precise distance measurements from around 2 cm (0.8 inches) to 3 meters (3.3 yards). The PING sensor works by transmitting an echo pulses though it have the transducer as well as the receiver. The distance is calculated by sending the echo pulses that reaches the obstacle and the echo pulses are received by the receiver.

aPR33A Audio Processor

The aPR33A series and digital to analog converters (DACs) are efficient audio processors in combination with high-performance analog to digital audio converters (ADCs).The aPR33A series is a fully integrated system offering high efficiency and unprecedented integration with functions for analog input, digital processing and analog output. The aPR33A series integrates all the required features to perform challenging audio / voice applications. Integrated analog data converters and full suite of quality-enhancing features such as sample rate converter, high quality audio/video systems with lower bill of material costs can be implemented with the aPR33A series.

4. Results and Discussion

Detection of Obstacles

The Raspberry Pi 3 is a microcontroller which is used as the loop operation because same operation will be repeated. First step is to activate the ultrasonic sensor, that is used for the measurement of the distance from the user to the obstacle and alert a user. The Raspberry Pi 3 can store the signal begin to start and which time it will ends that is the Raspberry Pi 3 stores the start and end time of the signal. The distance is measured by the ultrasonic sensor and the distance also be stored in the computer. The number of ultrasonic sensor which is connected to the computer will repeat the same process. The Raspberry Pi 3 determines which sensors are working now and the results of the sensors can be stored in the computer and each ultrasonic sensor may have different results. If the output of the sensors is different and the audio will be played to the user. This is repeated once the switch is on and the detections of the obstacle will be calculated repeatedly and stops the loop when the switch is off.

Detection of Human

The main operation of the system is to help the blind persons to survive alone without the help of the others. The existing system will detect the obstacles and guide them to walk without the help of the dog or other humans. The detection is done by the ultrasonic sensor which

January-February 2020
ISSN: 0193-4120 Page No. 10985 - 10988

detects the obstacles nearby and guides them correctly. The ultrasonic sensor works with the help of the Arduino microcontroller. In the proposed system, additionally added the detection of the human face using the raspberry pi – 3 camera module; it detects the human in front of the blind persons. Our system will detect the human in front of them and give the voice over that is in front of them. The camera module will capture the persons in front of them and process the image to detect who is standing in front of them. If the captured image will be the known face and the headphones connected to the setup will give the voice over that whom is present in front of them. Otherwise the human in front of them is unknown then the voice over will like "Stranger is in front of you". This will give full security to the blind persons.

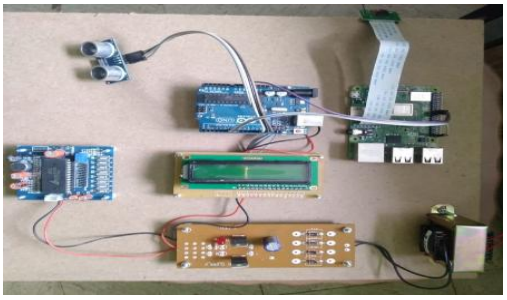

Figure 2: Hardware implementation of the Proposed Method

5. Conclusion

The proposed device can detect the obstacle with some distance using the ultrasonic sensor connected to the Arduino and the human presence is detected within 120 cm with the help of the camera in the Raspberry pi 3 which detect the human and find the persons in front of them and sends the audio feedback to the headset. This device helps the blind persons to come out of the room and navigate to the places where ever they want and to know the persons in front of them without the help of the others.

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