Guidance Through Ultrasonic Technology for the Visually Impaired

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Abstract: The primary goal of the publication is to inform those who are blind. Details that include the blind person's precise location, where they are standing, and whether there are any obstacles in the area. Our goal is to create an intelligent system that functions well in outdoor as well as indoor environments. A person must be able to discern whether or not there is an obstacle in front of him when they are walking. The visually challenged individual can move freely and without any limitations due to the existing equipment. If the visually impaired person encounters a barrier, it might sound an alarm for him.

Keywords: Ultrasonic, microcontroller, Ardino - UNO

1. INTRODUCTION:

The WHO estimates that 39 million people worldwide are blind. A human being is incapable of functioning without any senses. Around the world, blind people struggle to go about their daily lives with ease because one of our primary senses is vision. Dimensions, colour, and distance are all crucial components in comprehending the physical aspects of the universe. People who are blind or visually impaired have used conventional techniques for navigating spaces and finding their way for ages. Dogs, walkers, and canes are a few examples of devices that make it easier for the blind to operate. Each of these approaches has numerous drawbacks.

Since its creation, navigational assistance has been a ground-breaking technological advancement. Providing a smooth approach to path guiding based on an efficient comprehension of the surroundings is the main goal of this kind of assistance. In its most basic form, the end user anticipates that this help will give him information about the items in his environment along the predetermined path to his destination. This brings us to the need for creating a practical solution that makes it easy for a disabled person to

employ navigational help. The main goal of the suggested solution is to offer an innovative haptic feedback and Sound Navigation and Ranging (SONAR)-based indoor navigating help system. Ultrasonic transducers are used to implement SONAR, and haptic feedback is offered for motion vibrations.[2]. Being blind is the state of not being able to see objects because of neurological or physiological issues.

Partial blindness is the absence of integration in the optic nerve's growth, or the visual centre of the eye, whereas total blindness is the complete absence of the ability to perceive visual light. Imagine entering a strange location. To go to the destination, one must ask for directions. Nevertheless, what happens if the individual is blind? To go where they're going, a person must entirely rely on others. Generally speaking, a vision impaired person's best partner is a white cane. However, this cane is frequently useless. An individual with visual impairment may become disorientedin unfamiliar surroundings. So this restricts their mobility. This makes them dependent on others. The use of criticallife skills is the most important component that impacts an individual's mobility,

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regardless of the instrument utilised. NLP, which stands for "no light perception," is the clinical code for total blindness, which is the entire absence of form and visual light perception. Severe visual impairment with residual eyesight is commonly referred to as blindness. The only senses left to those who are said to have just light perception are the capacity to distinguish between light and dark, as well as the overall direction of a light source. The system's development has made use of both software and hardware implementations.

Objective:

- To build an aviation device for the blind using ultrasonic

- Feedback through haptic and sound.

- Modular and easy to wear sensors.

- An additional aid for the blind

II.METHODOLOGY:

Biomechatronic:

The word "bionics" combines the electronics thenics with the prefix "bio," which means life. Mechanical systems that behave like live things or portions of living things are studied in the field of bionics. The discipline is officially called biomechatronics, an applied multidisciplinary science that aims to combine biological organisms like human muscles, bones, and neurological systems with mechanical components and technologies

Ultrasonic Technology:

Digital data is transmitted using sound waves. To identify objects, it makes use of high frequency sound waves. By reflecting off of the object, the sound waves or pulses measure the separation between them.

Examples: Bats have evolved a natural ability to employ this technology for night time navigation and prey acquisition. The car's reverse parking sensors make use of the same technique to comprehend objects behind them.

Working / Component:

The mechanism of the device is based on echolocation. Waves from the ultrasonic sensor are reflected back by surrounding objects. Four sensors can be attached to the Arduino Unoboard, which is the primary computer. Depending on the user, each sensor can be fastened to clothing such as a jacket and cap. The computer registers the reflected ultrasonic waves and sends them to the feedback module. Both haptic and audio feedback are possible. A simple vibrating motor can be attached for haptic feedback, and a buzzer can be installed for aural feedback. After A 10-uS pulse is sent through the trigger when the HC SR04 and Arduino are connected. As a result, eight 40 KHz pulses are produced and relayed over the sensor's TX. When the initial ultrasonic burst returns to the sensor, the RX recognizes it and sends it to the Arduino via the ECHO pin. Using an ultrasonic library, the Arduino has a function to to determine the ToF and the distance from the ToF value. [6]

Design Consideration:

The product should meet all the considerations follows:

- Should be easy and convenient to use

- The device should determine all obstacles from large to small

- The feedback provided should be easily registered by the person

- It should be able to determine the distance of the

- object(no of beeps per minute)

- The gadget ought to take into account a person's measurements and entire body.

- Obstacle Characterization: It is necessary to divide obstacles into smaller groups based on their kinds in order to identify them. Therefore, barriers can be divided into the following categories from the perspective of a blind person:

1. Head level obstacles

2. Chest level obstacles

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3. Foot level obstacles

• Obstacles where the upper portion is at waist level butthe lower portion is farther away.

• Obstacles when the lower portion is closer than the upperportion [5].

Components require for the project:

• Arduino board (Computer)

• Ultrasonic sensor HC-SRO4

• Twelve-volt battery pack

• Simple DC Vibrating motor

• Buzzer

• Male & Female header pin

• Shouldering wire

• Jumper cables

Ultrasonor Sensor HC-SRO4

HC-SRO4 module includes a transmitter, receiver, and the controlled circuit. The sensor provides 2 cm to 4 cm range.

Every sensor contains four pins.

• VCC–Power

• Trig-Trigger

• Echo-Receive

• GND-Ground

The measuring angle is 15 degrees. Operates on voltage 5-volt DC and current of 15 ma.

Arduino based (Computer):

• An open-source microcontroller board that is inexpensive and simple to programme that can be included into a range of electronics.

• This board has the ability to control relays, LEDs, servos, and motors as an output. It may be linked with other Arduino boards, Arduino shields, and Raspberry Pis.

• AVR microcontroller AVR328UE, 6 analogue input pins, and 14 digital I/O pins, 6 of which are utilised for PWM output are all features of the Arduino UNO.

• The board has a USB interface, meaning that it can be connected to a computer using a USB cable, and it can be programmed using the Arduino IDE (Integrated Development Environment) software.

• SRM is 2 KB, and the board contains 32 KB of flash memory. The necessary voltage falls between 6 and 20 volts.

Arduino UNO components:

• The board's CPU, the ATmega328, is where the programme is kept.

• Groundpin

• Pulse width modulation, or PWM. There are 6 PWM pins on the PCB. PWM allows us to adjust the LED brightness, DC motor speed, and servo motor speed.

• There are 14 digital I/O pins on the board that can be used to connect external electronic components.

• AREF=Analog reference pin

• Press the reset button. The whole code stored into the board is reset by pressing this button.

• USB interface Arduino program is loaded on to the board by USB

• The board is powered by the DC power jack

• Power LED

• MicroSD card

• 3.3 Volt pin

• 5 Volt pin

• VIN: The input voltage that is applied to the board

• Voltage regulator

• SPI = Serial peripheral interface

• TX/RX = TX is a transmit pin to transmit date and RX is a receive pin to receive data.

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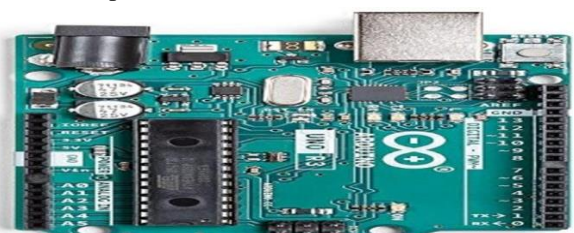
Language and program

Arduino code is written in C++ with an addition of special methods and functions. When you create a sketch (name given to Arduino code files) it is processed and compiled to machine language.

Arduino IDE

The Arduino integrated development environment is the main text editing program used for Arduino programming. It is where you will be typing up your code before uploading itto the board you want to program.

Design

The cap module.

The primary sensor is attached to the tip of the cap.

The primary sensor is the first one to detect upcoming objects as it is high up from the ground level.
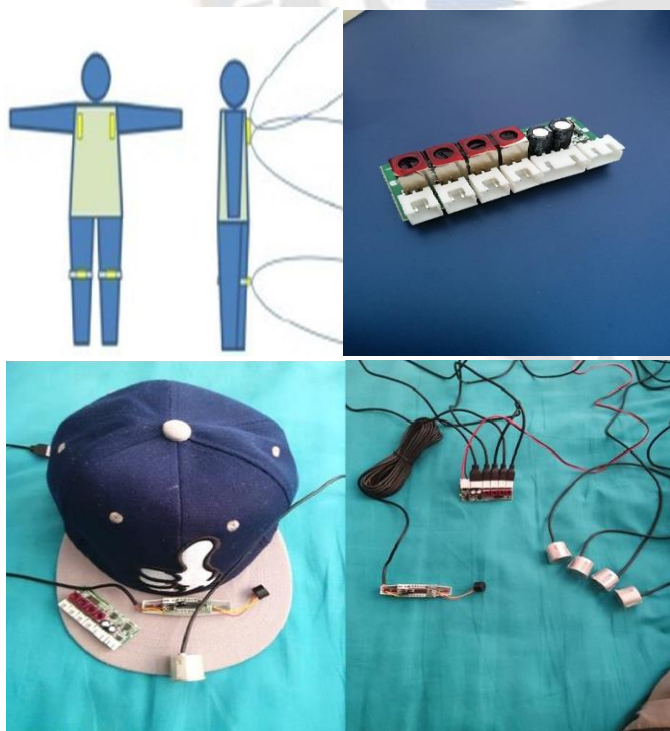
The cap module is the main gear where the micro-computer and feedback sensor exists.

Rotation of the head allows for 180 degree of coverage for obstacles.

Sensorno: 1 is attached primarily to the device.

Rest we have three sensors that can be attached to the Arduino board. Sensor no: 2, 3 and 4 can be attached as per the requirement of the person.

Example: -

Sensor number 2, 3 can be attached to a jacket or can be worn on the arms in form of a band.

Sensor number 4 can be attached to the belt for lower the waist object detection.

Sensor number 2, 3 can be attached to the thighs of a person for lower detection of an object.

This allows freedom for the person to detect the area of obstacles as per the need and requirement of the visually impaired.

Circuit Representation:
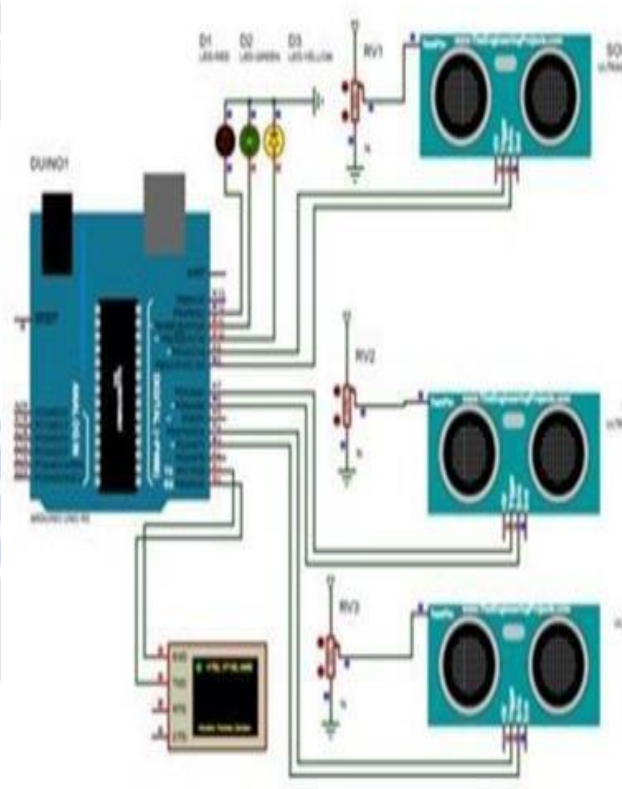
CONCLUSION

Therefore, this research suggested the architecture and design of a novel Virtual Eye for blind individuals that are based on Arduino. It is suggested that the blind and visually impaired get helpful assistance and support from anelectronic guidance system that is straightforward, affordable, effective, portable, easily adaptable, and easy to use, among many other incredible features and benefits. The system's capacity to identify the source and distance of things that may meet blind people will make it effective and exceptional. Regardless of their height or depth, obstacles can be scanned and detected by it in the blind person's left, right, and front zones. If the suggested design is built with the highest level of accuracy, the blind will be able to navigate around without assistance.

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FUTURE SCOPE:

The suggested gadget is limited to inside use and only assists with full navigation. The unpredictability of an outside setting renders the gadget ineffective for its intended use. There is much room for improvement, and the device's capability can be expanded to achieve its performance objective in a dynamic outdoor setting. Real-time object tracking with ToF cameras and their processing can enable this. The procedure will entail recognizing their movements, projecting the next action, and providing the user with feedback in line with that prediction. High-speed sensors and real-time digital image processing are involved in this. In an outdoor setting, a gadget with this kind of technology can easily help anyone in need. Finally, Polyethylene Terephthalate (PET) can be used in the manufacturing process of the sheet metal device to improve handling convenience, durability, and insulation.

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