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SMART ASSISTIVE DEVICE FOR VISUALLY IMPAIRED

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Abstract - *This paper aims to create a device for visually impaired people which will be efficient as well as cost-effective. Visually impaired person struggles every day in performing actions that can be simple as moving from one end to another without knocking against obstacles or falling down. This device includes haptic and audio feedback options depending on the indoor and outdoor purpose. A Smart Phone app is used to navigate the individual in the outdoor using voice commands. The device is portable and the purpose of its usage is to warn the user when objects are present on the walking path so collision can be avoided. Distance measurements between the user and obstacles are performed using ultrasonic echolocation and the data provided by the ultrasonic sensor is processed by Arduino uno, which also handles the feedback part.*

Key Words: Smartphone, Arduino Uno, Ultrasonic sensor, haptic and audio feedback.

1. INTRODUCTION

In past years, several electronic aid devices, called electronic travel aids (ETA), were introduced as a substitute for the white cane. Different implementation approaches combine various types of sensors, cameras or feedback channels. They all aim to improve the mobility of visually impaired individuals

One such device is "A 2D Vibration Array as an Assistive Device for Visually Impaired," where a wearable navigation device is presented. A 2D vibrator array attached to the user's chest is linked to a portable computer and provides tactile feedback based on the images captured by two miniature cameras.

Another device is one with the haptic feedback is described in "A Haptic Solution to Assist Visually Impaired in Mobility Tasks". Authors started with the user is aware of the cane inclination and hence of the obstacle place. The two ultrasonic sensors are placed on a short cane and the user can detect the obstacle position by moving the cane left to right and vice versa while walking .One of the most used ways to determine the distance and direction of an object is by means of ultrasound reflections is called ultrasonic echolocation.

The same principle was exploited in "A necklace sonar with adjustable scope range for assisting the visually impaired". Here the authors developed a portable device that features a rechargeable polymer lithium battery, a potentiometer to adjust the range and sensitivity, an ultrasonic sensor and a MCU.

Alongside mobility, visually impaired individuals deserve an enhanced access to some sort of information that for other individuals is straightforwardly reachable (such as books or newspapers). The standard writing system used by blind and visually impaired people is the Braille alphabet. A solution to convert digitally stored text into Braille using solenoids "Low Cost E-Book Reading Device for Blind People" where a SD card is used to store text files. The characters are converted one by one on a display unit in Braille format using six solenoids to represent the letter in a format effortlessly interpretable by the user.

2. LITERATURE REVIEW

Environment Sniffing Smart Portable Assistive Device For Visually Impaired Individuals; [1] This paper aims to create a device for visually impaired people which will be efficient as well as cost-effective. Visually impaired person struggle every day in performing actions that can be simple as moving from one end to another without knocking against obstacles or falling down. The population of India has reached120 Cr. of those 8.90 Cr. people are visually impaired. 90%of those cannot travel independently. Recent survey source India is now becoming the world's large number of blind people. Our Proposed system guide a blind person from upcoming obstacles, Staircase detection and provide a traffic alert system.

Assistive Infrared Sensor Based Smart Stick for Blind People;[2] Blind people need some aid to feel safe while moving. Smart stick comes as a proposed solution to improve the mobility of both blind and visually impaired people. Stick solution use different technologies like ultrasonic, infrared and laser but they still have drawbacks. In this paper we propose, light weight, cheap, user friendly, fast response and low power consumption, smart stick based on infrared technology. A pair of infrared sensors can detect stair-cases and other obstacles presence in the user path, within a range of two meters. The experimental results

achieve good accuracy and the stick is able to detect all of obstacles.

Sound and Touch based Smart Cane: Better Walking Experience for Visually Challenged;[3] Moving with the help of a white cane is an elusive task for the visually challenged unless they create a mental route map with recognizable reference elements. The smart cane is intended to provide the visually challenged a better walking experience. The design is incorporated with Bluetooth enabled Obstacle detection module, supported with heat detection and haptic modules. The ultrasonic range finders help in detecting obstacles. The distance between the obstacle and the user is sent to an Android device via Bluetooth. The user gets voice alerts about the distance through Bluetooth headset. Haptics module is included to warn the user of moving obstacles with the help of vibratory motors. This research work explains about the setup we used for the implementation, design details and experimental results of the measured parameters.

Voice-Controlled Smart Assistive Device for Visually impaired individuals;[4] This paper presents the modeling, implementation and testing of an experimental microcontroller (MCU) based smart assistive system which can be used by the visually impaired or blind people. This device includes haptic and audio feedback options from which the user can select. A Smart Phone can be used to control the device using predefined voice commands and Bluetooth connectivity. The device is portable and the purpose of its usage is to warn the user when objects are present on the walking path so collision can be avoided. Distance measurements, between the user and possible obstacles, are performed using ultrasonic echolocation and the data provided by the ultrasonic sensor is processed by a microcontroller, which also handles the feedback part.

3. METHODOLOGY

The challenge faced by blind persons is facing obstacles. To solve this problem, our system provides the functionality by using ultrasonic sensor to avoid the incoming obstacles. The ultrasonic sensor is used to measure the distance of target object. It uses electrical-mechanical energy transformation to measure the distance. The ultrasonic sensor consists of transmitter and receiver which are embedded together as a single unit. Ultrasonic Sensor is fixed at the center of Belt. It is used to detect the obstacles. The ultrasonic sensor range was software-limited to 30.

The sensor cannot measure the distance to an object that:
i) is more than 30 cm away,
ii) is too small to reflect an adequate sound level and
iii) has the reflective surface at a shallow angle so the sound will not reflect back to the receiver module

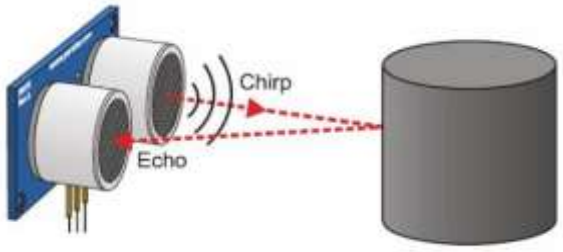

Fig - 1 working of an ultrasonic sensor

This assistive device consists of two parts, one which helps the visually impaired to avoid obstacles with the help of ultrasonic sensor and the other which is used for navigation purpose using google map. The proposed system uses Arduino Mega which is programmed to identify the obstacle within distance.

The ultrasonic sensor uses the echo signal for the obstacle to identify the distance and this is processed using arduino, then haptic feedback is obtained via small motor. The device is powered using lithium ion battery pack. which is responsible for measurements processing, feedback and user interface interaction. In order to start the measurement procedures, the HCSR04 needs a trigger input of 10 µs. Once the trigger transmitting a cycle of 8 bursts at 40 kHz and waits for the reflected signal to return to its receiving terminal.

The device can provide both acoustic and tactile feedback to inform the user if there is an obstacle in his walking path. The MCU outputs a Pulse Width Modulated (PWM) signal at one of its I/O pins and the duty cycle is directly responsible for the intensity of the feedback signal. The device is powered by a lithium-ion battery that can provide an output voltage of 9 V.

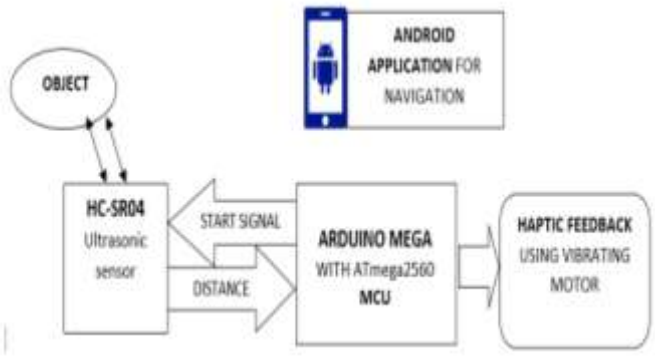

Fig - 2 Block Diagram

It is easy for the user to scan the entire surrounding environment by moving his hand in different positions. The user is always aware of the position of his hand to his body and can easily identify the direction of the obstacle. Before starting navigating unaccompanied it is needed that the visually impaired individual to be guided in front of a

obstacles by someone else in order to get used with the tactile signals according to the distance to the obstacle.

The second part of the assistive device includes an android application, which uses voice command from the visually impaired for the navigation. This application works with the help of Google Maps. The application is developed using android studio build AI-171.4443003.

4 EXPERIMENTAL RESULT

For the proposed device we have focused our tests on the accuracy of the measurements and the ability of visually impaired individuals to keep away from obstacles in a controlled environment. We verified if the feedback modes can work all together and calibrated the intensity of the feedback signals such that they have the same magnitude in both modes. The device was tested in indoor conditions. It can be used in outdoor because it is waterproof and the maximum detection range is limited to 30 cm.

The tests were performed on 5 blindfolded individuals in various environmental situations. All the individuals were able to navigate in the environment and avoid the obstacles. The most accurate results were obtained with flat surfaces as obstacles at an angle of maximum 30° from horizontal. Surfaces with irregular shapes can reflect the signals in the vicinity of the ultrasonic sensor and the results of the measurement can be wrong. This shortcoming can be suppressed by moving the hand both in the horizontal and vertical planes.

Fig - 3 Proposed design

5. CONCLUSION

With the increase in difficulties faced by the blind people in their daily life leads to loss self-confidence of these people. They feel difficulty for finding the distance of the obstacle, presence of the humans, detecting the stairs, all these problems could be solved by using our proposed system. The prototype version of a smart assistive system which can be used by the visually impaired or blind people. The device helps visually impaired individuals to avoid collisions with obstacles present on the path. This has been inspired from existing systems which are used by visually impaired and blind individuals on a daily basis. Inclusion of a Smartphone capable of navigating the device offers a great base for further development. The location of the user can be provided using the GPS function of the smart phone.

REFERENCES

[1]Piyush Patil, Akshay Sonawane, "Environment Sniffing Smart Portable Assistive Device For Visually Impaired Individuals" 2017 International Conference on Trends in Electronics and Informatics (ICEI)

[2]Ayat A. Nada, Mahmoud A. Fakhr, Ahmed F. Seddik "Assistive infrared sensor based smart stick for blind people" 2015 Science and Information Conference (SAI)

[3]Rajesh Kannan, Megalingam, Aparna Nambissan, Anu Thambi, Anjali Gopinath, Megha Nandakumar "Sound and Touch based Smart Cane: Better Walking Experience for Visually Challenged" 2014 IEEE Canada International Humanitarian Technology Conference - (IHTC)

[4]D. Munteanu, R. Ionel "Voice-Controlled Smart Assistive Device for Visually impaired individuals" 2016 12th IEEE International Symposium on Electronics and Telecommunications (ISETC)

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