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Navigation Waist Belt For Visually Impaired Using Ultrasound

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ABSTRACT: Blind or visually impaired have to face many problems in their daily life. Many people are not born blind, but due to genetic condition lose their vision over time at a young age. In the United States, approximately 500,000 service dogs are helping people with a lack of vision. If we compare it with a total of 40 million people who require such help it becomes a common problem around the world. One major problem of visually impaired people is not having the satisfaction of enjoying a walk on their own or getting from point A to B without anyone to aid them. They either need to have a person or a service dog to assist them in their walk and activity. With our project, we aim at reducing the burden that this disability puts on our target user as well as the person or animal of assistance so that a simple task like navigating can be achieved without imposing any physical barriers. One major problem that our target user faces is some sudden obstacles in their path, we plan to eradicate this problem as well. To accomplish this task, we will provide our user with a special waist belt with ultrasonic sensors which monitor the users' surroundings and give haptic feedback pertaining to the distance of the obstacle from the user. A video capture camera will also be fitted that will detect the obstacle in real-time and if known, tell the user what they are facing. The user will be prompted Regularly when the sensors detect an elevation or an obstacle and the camera will try to identify the obstacle regularly as well.

KEYWORDS: NAVI; Computer Vision; Object recognition; Obstacle detection

I. INTRODUCTION

According to the World Health Organisation, an estimated 1 billion people suffer from a visual impairment of some kind. Out of those 1 billion: 88.4 million have moderate or severe distance vision impairment or blindness due to unaddressed refractive error, 94 million have a cataract, 7.7 million cases of glaucoma, 4.2 million cases of corneal opacities, diabetic retinopathy account to 3.9 million, and trachoma 2 million, as well as 826 million with near vision impairment caused by unaddressed presbyopia. The number of blink people was expected to be 76 million by 2020 in 2009. But that number has surpassed expectations and with the growth in population, it doesn't seem to be coming down anytime soon. Presently, many electronic aids are available. But they either are too hard to use, not reliable, or too expensive. A NAVI (Navigation Assistance for the Visually Impaired) Cane is an excellent example. But it requires the subject to use mechanical force to move it with them. The area of human error in such equipment is also great.

In this paper, we want to propose an effective Navigation system while keeping in mind the subjects comfort and keeping the expenses to a minimum. This system is bringing together Software object detection and feedback system and pairing it with reliable hardware that can sense obstacles so they can be avoided by the subject. Our objective is to create a contactless, intuitive, hands-free, and discreet wearable local navigation solution that allows users to sense both low- and high-hanging obstacles as well as physical boundaries in their immediate environment for local navigation.

1.1. Problem Statement:

Blind or visually impaired have to face many problems in their daily life. One of the major problems is not having the freedom of Traveling alone. They either need to have a person or service dog to assist them in their walk

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which is not always efficient. Solving this issue can help millions of people to interact with their surroundings and walk without the fear of an accident.

This project implements ultrasonic sensors with an Arduino processor and a camera sensor to not only detect, but also identify obstacles in front of the user.

II. RELATED WORK

There are several electronic travel aids (ETA) are available for visually impaired and blind people. Some of these aids are sonic pathfinder, Mowat-Sensor, Guide-Cane [4], and NAVI [3]. These systems are quite bulky and involve a physical interface with the subject. Even though there is an abundance of these systems, they are seldomly used. Due to this the user acceptability of such systems must be assessed. In [2], the work presents electronic navigation system for visually impaired and blind people. This system understands obstacles around the subject up to 500 cm in front, left and right direction using a network of ultrasonic sensors. It also uses speech feedback to alert the user of detected obstacle and distance. Their study of previous works described already existing systems such as theirs. The main objective of their work was so their system can be less bulky. They used an ultrasonic sensor pair on wearable spectacles. A distance formula is used which uses EPWHT (echo pulse width high time) to calculate the distance between the object and the subject. Their setbacks included failure to recognize obstacles and color.

In [1] the work uses more recent technology and seems very capable. The work author states, "ALVU (Array of Lidars and Vibrotactile Units), a contactless, intuitive, hands-free, and discreet wearable device that allows visually impaired users to detect low- and high-hanging obstacles as well as physical boundaries in their immediate environment." Two belts are used in this work. ALVU sports a feedback sensor belt with Haptic straps and Haptic feedback will be given to the user. The sensor belt sports 7 sensors that detect obstacles in all directions. If the right sensor detects an obstacle, the right haptic feedback motor starts to vibrate. This paper gives us tricks on ideal placement of a sensor belt and also calibration if multiple sensors are used. This paper also gives us an idea of downward pointing sensors that hint the subject of elevation in the environment.

In [3], the work has used one of the simpler approach and is the basis in our project. A basic NAVI (Navigation Assistance for the visually impaired) system is made up of a processing unit, an RGB sensor, and an ultrasonic sensor. They have chosen shoes to install these devices on. This paper has used feedback in the form of sound which we are planning to incorporate in order to make an economically viable system while keeping the main objective intact. The only problem we found in this paper was that using shoes gave lesser results, hence we plan on avoiding that.

In [4], the work uses a cane as the object for modification. Installing 3 ultrasonic sensors, a battery and switch, a play and record chip going to speakers and vibrational feedback. We feel this will make the cane fragile and rather bulky as well. The cane if not held properly can also give skewered results. But the research gives us an idea on a possible play and record system so that outside speech is not ignored when the subject wears earphones for sound feedback. Using multiple ultrasonic sensors may also help in accuracy of the system.

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III. PROPOSED SYSTEM

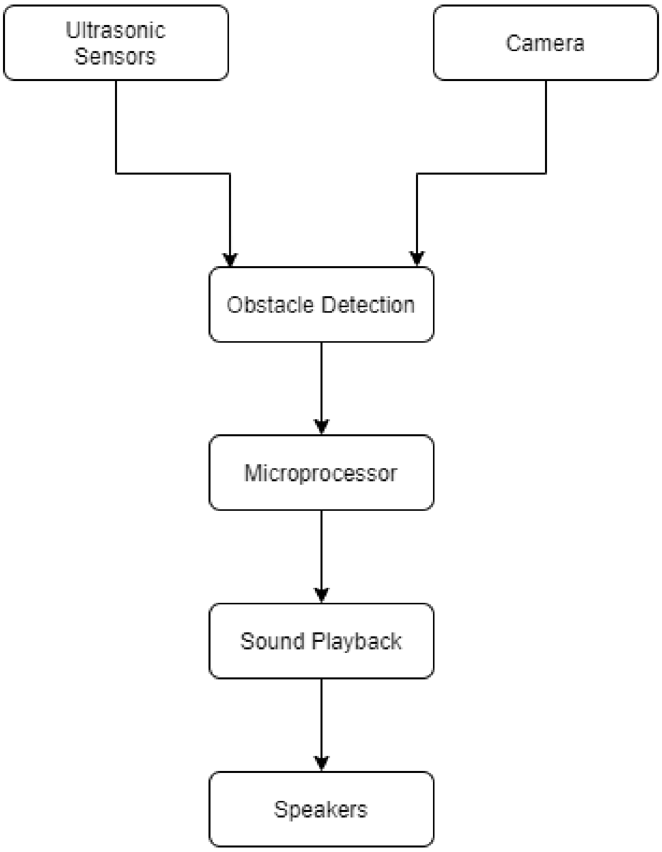

Fig.1. System Architecture

Flow Chart Explanation

In this system, Ultrasonic sensors are the obstacle detector and the Camera is the obstacle Identifier. Both of them work as input devices. The sensed input data is given to the microprocessor and according to the algorithm, it sends comments in the form of voice assist to alert our subject. The alert messages will be pre-recorded and according to the situation, the appropriate message will be played. The relative distance will be updated in real time and conveyed to the subject in the form of audio blips. The frequency of the blips will signify the distance of the obstacle from the subject. If the intensity/frequency of the blips is high, the subject will understand that the obstacle is in their immediate surrounding, else the obstacle is relatively far away. The subject will have to use the system for a while in order to get used to the distance alerts.

Alert Function

Apart from the base system, we have also implemented an alert function for the safety and well-being of the user. Upon initial start of the system, the user is prompted to add the details of their guardian or friend. They can take the help of someone to add the details in. This function will send a message to the added details when triggered. The message is for letting the recipients know that the user is in danger and is in need of help. The function also automatically shares the user's location via the map API. The system triggers this function when the user says the word 'danger'. The system keeps checking for prompts by the user.

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Fig.2. Ultrasonic sensor

Fig.3. Camera Sensor

- Ultrasonic sensors are used for obstacle detection and calculation of its estimated distance from the visually impaired person. Ultrasonic sensors are used in pairs as transceivers. One device which emits sound waves is called a transmitter and the other that receives the echo is known as the receiver.
- Ultrasonic sensors have been placed in several locations in previous projects. We think that the best possible position for them to be placed is at waist level so it can detect lower obstacles as well.
- Since visually impaired people have more efficient hearing, the proposed system is focused on alerting the user through voice and sound response.
- If the camera sensor recognizes the obstacle, it will let the subject know what it is.
- If the ultrasonic sensors pick up an obstacle, the camera sensor will try to determine its identity. If the identity is unknown or if the obstacle is a wall, the system will refer to the obstacle as an unknown entity.
- To connect the system via WIFI to the internet, we have used nodemcu.

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Fig.4. Nodemcu

IV. PSEUDO CODE

Step 1: Start

Step 2: Ultrasonic sensor is turned on and keeps on monitoring for obstacles.

Step 3: Check if user says the word 'danger'

If ('danger' == true)

run the alert function

end

Step 3: Check if obstacle is detected

if (Obstacle detected)

send sound blips to the user according to the distance of the obstacle

else

go to step 3

end

Step 4: Check if obstacle is identifiable

If (Obstacle identified)

play the alert message for the identified obstacle

else

play default obstacle detected message

end

Step 5: Go to step 3.

Step 6: End

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V. RESULTS

We have trained the object detection module to detect objects in real time right after the ultrasonic sensor detects the said obstacle or object in front of the user. The object-detection is done by using TensorFlow.JS.

The alert system has also shown good results with little to no error in voice recognition.

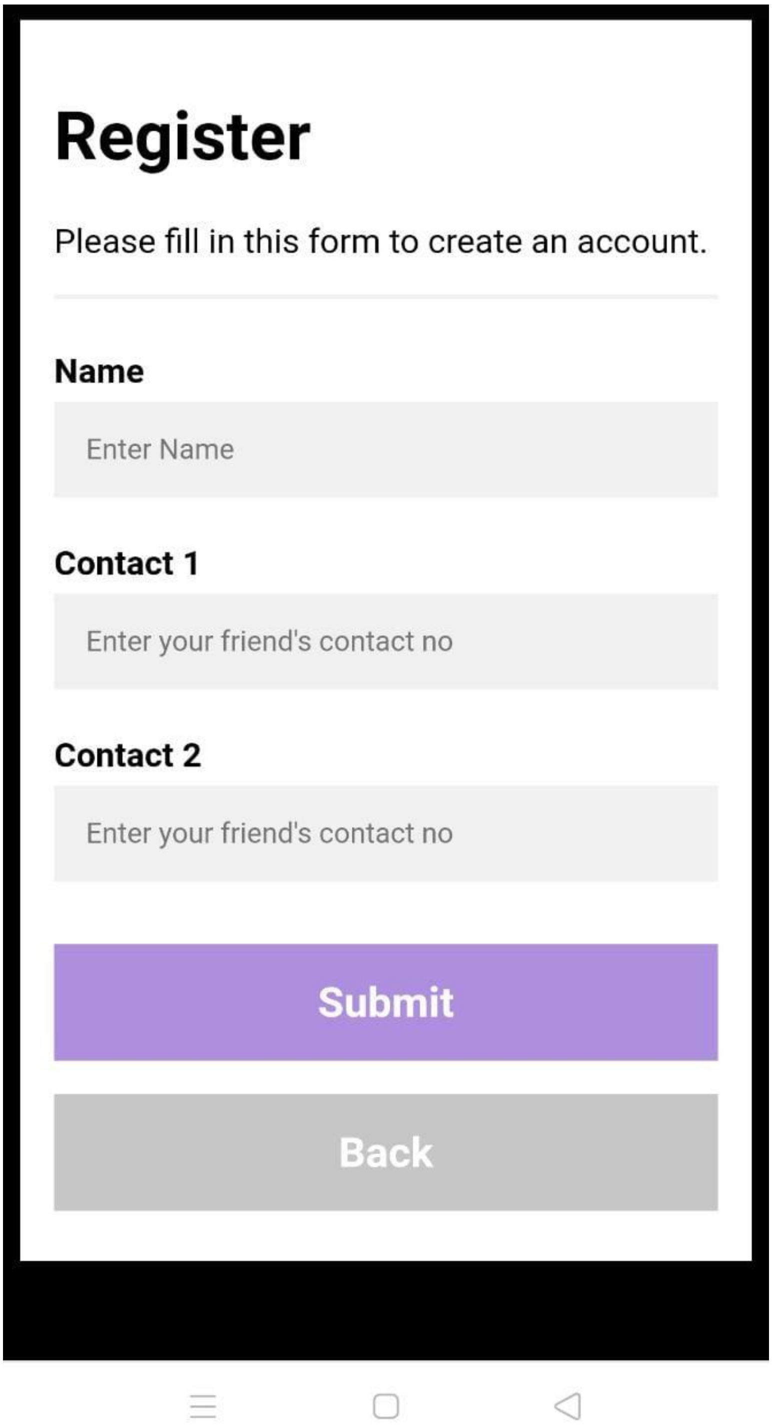

Fig.5. Registration Page

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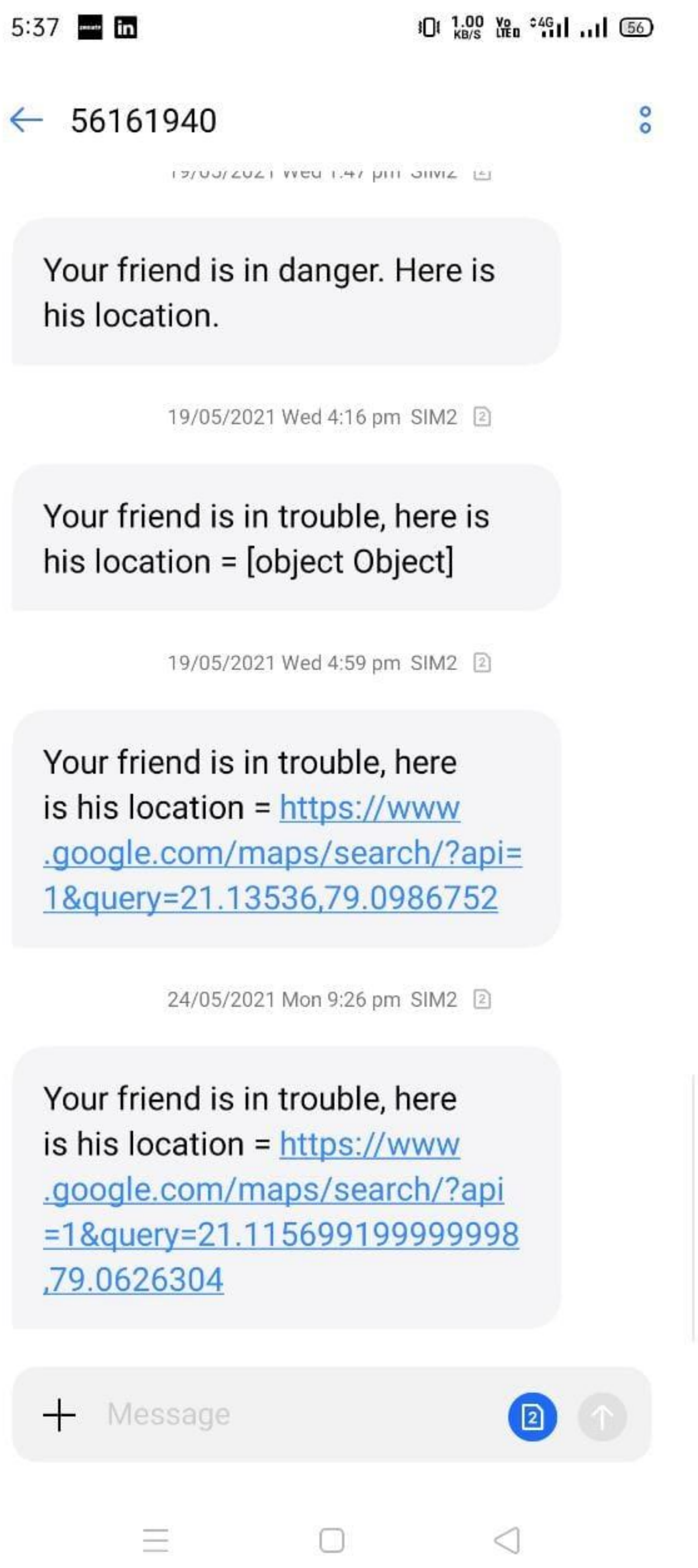

Fig.6. Alert System

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VI. CONCLUSION AND FUTURE SCOPE

By implementing this project, we are providing various subjects with visual imparity the opportunity to safely walk around and commute without requiring them to be dependent on anyone else. That being said, the system can improve in various ways. We have already implemented map API for the alert system, in the future the API can be more useful by giving the user directions to his desired destination paving way for the most convenient outdoor travel experience for the visually impaired. For that the system would have to be more safety driven with added ultrasonic sensors for both directions as well as head-level safety.

REFERENCES

[1] R.Katzschmann, B. Araki, D.Rus “Safe Local Navigation for Visually Impaired Users with a Time-of-Flight and Haptic Feedback Device”, IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2018.

[2] S.S.Bhatlawande, J.Mukhoadyay, M.Mahadevappa, "Ultrasonic Spectacles and Waist-belt for Visually Impaired and Blind Person", IEEE Transactions on Biomedical Engineering, vol. 45, 2012.

[3] C.K.Lakde, Dr.P.S.Prasad, "Navigation System for Visually Impaired People", International Conference on Computation of Power, Energy, Information and Communication, 2015.

[4] N.Mahamud, R.K.Saha, R.B.Zafar, M.B.H.Bhuian, S.S.Sarwar, "Vibration and Voice Operated Navigation System for Visually Impaired Person", 3rd International Conference on Informatics, Electronics and Vision, 2014.

[5] “Blindness and Visual impairment: Global Facts” https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

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