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Intelligent stick for blind friends

Abstract

Eyes are one of the most precious blessings of nature. Blind friends face a lot of difficulty in doing normal life activities. A lot of work has been done to ease blind people so that they can complete their tasks by themselves and not be able to depend on other people. Keeping this motivation in mind, in this article, we have proposed and developed a intelligent blind stick which uses sensors and microprocessor to help blind friends in walking.

Keywords: blind friends, artificial intelligence, blind stick, path

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Uruba Ali, Hoorain Javed, Rekham Khan, Fouzia Jabeen, Noreen Akbar

Department of Computer Science, Shaheed Benazir Bhutto Women University, Pakistan

Correspondence: Fouzia Jabeen, Department of Computer Science, Shaheed Benazir Bhutto Women University, Pakistan, Email fouzia.jabeen@sbbwu.edu.pk

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Introduction

Now days through technology we can develop equipments that can ease peoples' lives. The use of technology in facilitating blind people is one of the important research areas which need exploration.[1] It is unsafe for blind people to walk freely out doors or in areas to which they are not familiar. It is need of the day and responsibility of researchers to use technology so that blind people should not rely on simple blind sticks. In this time of technology, with "internet of things" and "artificial intelligence" it is possible to make blind people life much easier and safer.[2] We proposed a design of blind stick which is based on artificial intelligent (AI)[3] which can sense the obstacles in different directions. It helps the user to select the path free of any obstacle. The directions about right path are given via audio voice. Blind sticks have been designed earlier which can detect obstacles coming in front of blind people's way, but they were not designed to tell the size of obstacle or distance from obstacle.[4,5] The direction of our research effort is to keep blind friend informed about the size and distance from obstacle that is it is near or far. Based on this information recommendation about directions in a path to follow are given. Intelligent blind stick facilitates blind friends' lives and gives them protection.

AI based blind stick is an innovative stick designed for visually disabled people in order to provide them improved navigation and helping them in making smart decisions about the selection of path that has no obstacle till a certain distance. Our search space involves searching a best suited path for a blind friend by using three ultrasonic sensors from front, left and right that will search the best path which does not have an obstacle at a certain distance. These sensors sense the obstacles through ultrasonic waves and direct blind friend to the direction that is clear of any obstruction to a certain distance. The knowledge is acquired through three sensors that senses the distance of obstacle. This sensor feedback is compiled and through audio facility communicated to blind person which I is then used for decision making in selecting the path having no obstruction. The research paper is organized in 5 Sections. In Section 2 we have covered the related work. Section 3 is about the methodology of our proposed work. Section 4 briefly explains the results and lastly we end up with conclusion in Section 5.

Related work

Many researchers have explored this area of research and significant work is done for blind friends. Many ultrasonic blind sticks have been made to facilitate blind friends but they are not intelligent. They have used buzzers and alarms for warning the blind friends but they do not direct them to choose the safe direction.[6] NAVBELT and GUIDCANE[7] are two robotics-based technologies that are used for obstacle avoidance for guiding blind friends. NAVBELT is a belt which contain array of ultrasonic sensors it basically guides the blind friend through stereo earphones about the direction through which they walk easily. It sends acoustic signals to user but it doesn't help in fast walking because user cannot understand guidance signals in time. GUIDCANE uses[7] the same robotics technology but it guides the user through a wheel attached at the end of cane; when it detects an obstacle its wheel move in opposite direction and the user feels the movement and walk fast with it. In Ultrasonic Blind Walking Stick,[8] ultrasonic sensor is used to sense the obstacle (if there is any). The signal is then send to microcontroller to operate a buzzer. There is one more advantage of this system. Sometimes when the blind loses their sticks or forgot where they have put it, they can find it by using the wireless remote. Wearable obstacle avoidance[9] for blind has been created to ease blind people. Two ultrasonic sensors are attached on the glasses which send the direction and the size of obstacle through stereo audible sound via headphones. This helps user in walking.

Methodology

We have designed an artificially intelligent blind stick that can detect the obstacle through ultrasonic sensor and inform the blind friend about it. Three ultrasonic sensors measures the distance of obstacle from left side, right side and front and through speech feature it directs the blind friend to make intelligent decisions for selecting a right direction that has no obstacle somewhere near. The methodology is shown in Figure 1.There are two main components. First are the sensing component and the other one is AI based decision making component.

Sensing obstacles

The purpose of this component is to sense the obstacles for which three ultrasonic sensors are used on the stick from front, left and right directions. The detection is done by calculating the time in which the ultrasonic wave returns back by reflecting from an obstacle from each direction. The direction from which the wave returns in maximum time is the clear path. The sensors are programmed using Arduino UNO processor and Arduino IDE. The connections are made between

ultrasonic sensors and Arduino using jumper wires and PINS of Arduino and sensors. Arduino IDE is the platform for programming Arduino.

AI based decision making component

The data acquired from sensors is transferred to this component which helps in intelligent decision making. It works as if the time of detection of reflected ultrasonic wave is maximum for a right sensor, a condition for the right sensor will become true and an audio message will be played "move to right side". The same will go for other two directions as well. SD card module, mini speaker and USB micro SD card reader are used for the purpose of speech. The audio file is fed into the SD card which in turn is inserted into SD card module. SD card module is connected to the Arduino UNO processor through the PIN connections. Distance of reflection from each ultrasonic sensor is represented with n1, n2 and n2. The prototype of the proposed approach is shown in Figure 2.

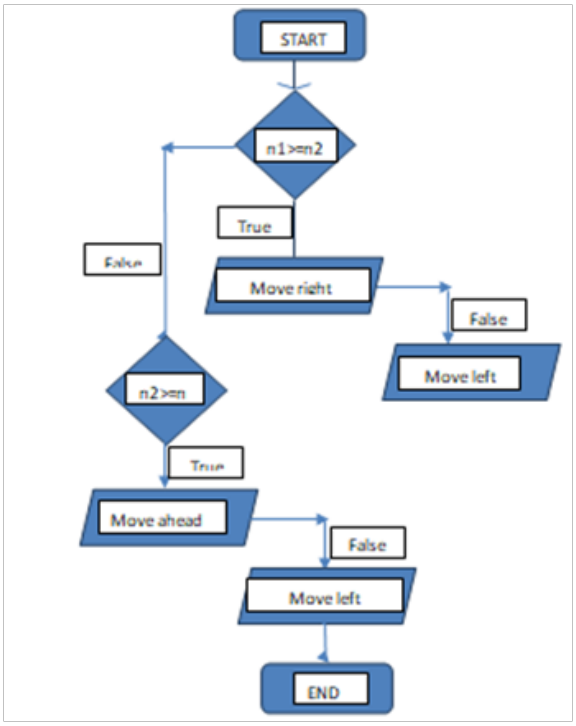

Figure 1 Methodology.

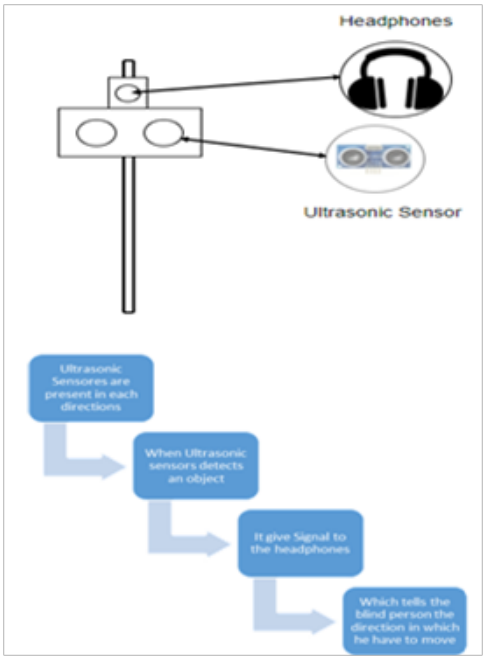

Figure 2 Prototype of intelligence stick for blind friends.

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Results

This AI based blind stick uses the features of ultrasonic sensors and makes it artificially intelligent by adding the decision-making feature in it to select the most suitable path intelligently. The stick was tested on 10 male and 10 female blind friends. The results were successful. The speech feature is clear enough to give accurate directions. There was no delay or inaccuracy in voice recommendations. Hence it did path selection and decision making for the blind friends successfully and directed them at each point of their walk to move either right, left or go straight; based on results of distance from obstacles in all three directions. The most interesting observation was that the stick proves to be affordable for them as well. Comparative analysis of characteristics exhibited by our approach and state-of-the-art approaches are tabulated in Table 1. We have stereo audible sound via headphones through which the blind friend will heard about the best path for walk and will inform the blind person about the direction. It will help in walking like a normal person. Ultrasonic sensor is used to detect the obstacle from different directions. Ultrasonic sensor make the stick act intelligently and enables to select best path which having no obstruction.

Table 1 Comparative analysis of characteristics of our approach and state of approaches

Approaches	Characteristics				
	Stereo audible sound via headphones	**Ultrasonic sensors for obstacle detection**	**Give direction to blind friends for walking**	**Help in walk like normal person's walking speed and confidence**	**Intelligently select path that has no obstacle in it**
Our approach Intelligent stick for blind friends	✓	✓	✓	✓	✓
State of approaches NAVBELT[2]	✓	✓	✓	x	x
GUIDCANE[2]	✓	✓	✓	✓	✓
Ultrasonic Blind Walking Stick[3]	x	✓	✓	x	x
Wearable obstacle avoidance[4]	✓	✓	✓	x	✓
Ultrasonic stick with alarm[1]	x	✓	x	x	x

Conclusion

AI based intelligent blind stick design is proposed in this work. It helps blind people in choosing right direction of movement and helps in navigation. It directs the blind person to choose a path that has no obstacle in their way. Three sensors installed in front, right and left side of the stick detects any near obstacles and selects the path that has no hindrance somewhere near comparatively. This information is given to the blind person through a speech feature which successfully informs the blind person to follow obstacle free path.

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Conflict of authors

None.

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