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Smart Stick Using Ultrasonic Sensors for Visually Impaired

S. Prema[a], Jose Anand[b,1], P. Vanitha[c], Nirmala Devi K.[d], M. Mohamed Yaseen[e] and Rajeswari C.[f]

[a] *Associate Prof., Department of IT, Mahendra Engineering College, Namakkal*
[b] *Associate Prof., Department of ECE, KCG College of Technology, Chennai*
[c] *Assist. Prof., Department of EEE, Sri Muthukumaran Institute of Technology, Chennai*
[d] *Associate Prof., Department of ECE, KCG College of Technology, Chennai*
[e] *Assistant Prof., Department of ECE, KCG College of Technology, Chennai*
[f] *Assistant Prof., Department of CSE, Chennai Institute of Technology, Chennai*

Abstract. Tothe latest survey organized by the Times of India (ToI), currently, India is domestic to the globe's biggest variety of sightless human beings. Among the forty million human beings throughout the world were blind, from this above 15 million blinds are from India. Technology aspires to make our lives better. Just like smartphones, smart TVs, and smart automobiles, this survey advocated us to recommend an intelligent stick that uses ultrasonic sensors for the visually impaired. An impaired individual typically faces positive problems in their everyday lifestyles however with the development in an era we can help them to guide a less difficult lifestyle. We have proposed a sophisticated intelligent blind useful resource stick that enables visually challenged human beings to navigate with ease. Though comparable merchandise is to be had within the market, they're now no longer difficult and affordable. We have decreased the value without compromising with the elements of the smart cane as a substitute we've protected positive capabilities which can be mandatory.

Keywords. Raspberry Pi, Smart Stick, Ultrasonic Sensor, Visually Impaired

1. Introduction

Visualization is the crucial sense to the people who live in this universe. Blind humans usually want to assist while moving from one location to another location particularly while moving outdoors. Normally they require a stick to aid humans in their life. Thus it is important to provide ideas with innovation with the new technologies to develop a device that supports blind people [1]. Technologies are swiftly evolving, permitting humans to stay healthier and less complicated lives. Sightless humans are not able to perform their ordinary activities, which include taking walks in the streets or parks, traveling with pals, or performing a different routine errand. Thus, a clever cane is a stick that helps someone in taking walks accurately deprived of or worry of hitting every other individual or stable gadgets is planned as an option to this important subject.

[1],Jose Anand, Associate Professor, Department of ECE, KCG College of Technology, Chennai; E-mail: joseanandme@yahoo.co.in

This is an improvement on the conventional sightless cane because it performs as a partner for the sightless while taking walks by transmitting voice signals to the sightless thru an earphone linked with various kinds of voice call obstacles and additionally permits him to make a voice call to invite for help [2]. The article suggested a low-cost navigation support system much useful for visually challenged people. The proposed device is combined with a GPS unit to retrieve the longitude and latitude position of the blind person having the device and convey the information to the caretaker if required. The mobile app is developed and is given to the caretaker to identify the emergency contact at the earliest when the situation is catastrophic. The device uses a GPS unit, speaker or headphones, and Raspberry Pi. The concrete concept is to support an intelligent and efficient navigational unit and obstacle identification system for visually challenged people [3]. This is possible by conveying the person's surrounding environmental situations to the controller and conveying the environmental information to the caretaker who will act as a support system. The continuation of this article is articulated as trials. The second segment describes the associated work in the area to support the visually impaired people and the implementation of hardware devices for similar applications. Section 3 gives the proposed architecture and its explanation and section 4 shows the prototype developed and its details. Lastly, the conclusion is delivered in division 5.

2. Related Works

This segment begins with the analysis of preceding readings that produces the implementation of a guidance system provided for visually challenged people and articles with similar hardware applications. A device in the form of a stick with 0.5 inch PVC pipe to identify objects for the visually challenged using HC-SR04 ultrasonic sensor and Arduino board consisting of ATMEGA328 controller to track the substances at least a distance of 7 centimeters with audio yield was designed and developed [4]. A similar kind of device for the identification of the same is represented in [5] and controller-based implementation for traffic management [6]. An innovative design and development of a clever cane for hindrance identification and triangulation purpose for blind people were implemented using a microcontroller [7]. In the same way, controllers with other sensor arrangements are used for applications such as irrigation [8] and medical analysis [9], [10], [11]. A smart walking aid stick using an electronic technique to support the blind people using a PIC microcontroller-based hardware device consisting of proximity sensors, sonar sensor, water sensor, distance measurement sensor with micro pager motor is developed to assist the identification of objects in front of the visually disabled people is a low cost, less power consumption device kept in the form of a stick [12]. An economic smart cane was proposed to identify the obstacles to help the blind people as a carefree navigation system that detects the obstacles using ATMega328PU microcontroller and ultrasonic, and audio modules and also with a vibration motor unit and headphones. The device will provide haptic feedback on the usage of shaking and audio information. The smart cane can detect potholes on road downfalls, etc., [13]. An intelligent device to assist the blind people using RFID technology in the form of a walking stick for blind people is proposed to assist the visually impaired providing a voice output on the identification of any objects nearby the person holding the stick. The stick also uses infrared sensing technology with proximity sensors and an android device. The whole unit is connected

to any android phone using Bluetooth connectivity. The device will also send information about the person to the family members to get notifications about the location of the person [14]. A smart electronic stick was developed for blind people with artificial vision, object identifying, and conveying messages if required. The system was developed using ultrasonic sensors to manipulate the distance of the sightless individual to attendant the needed in the direction of the existing route. An alert is provided using a beep sound from a buzzer and the correct location is determined using GPS and GSM facility [15]. A multidimensional strolling resource for blind people with the usage of ultrasonic sensor units with voice steerage is proposed to carry out a group of functions and to identify the optimal path for visually impaired people. The concert and capability are advanced through the addition of an alert system, and voice assistance through the headset. The system is designed with an ISD 2590 audio report/playback chip, a controller using PIC16F887, ultrasonic modules, regulation circuits, and speaker units. The voice recording indicators the consumer of the occurrence and route of the impediment(s). The model of the visually weakened resource is capable of coming across limitations in all instructions of the consumer. The overall presentation of the cane in perceiving is low for distance, that is, can only able to cover a distance of 1 meter [16]. A microcontroller-based mobile device for blind people is suggested in the form of a stick consisting of an AT89C52 controller for computation and transferring information to alarm the device. The device design is programmed with reliability and able to examine good accuracy and is compared with previous works. The mobility of various resources is reasonable, dependable, and smooth to function. This minimizes strain on humans supporting the sightless and offers consolation to the sightless for the duration of strolling [17]. A sensor module-based smart stick is proposed for visually impaired people with a layout to expand software for blind humans to come across the device in multiple options in identifying the routes and manholes on the floor which is uncomfortable to the walker. The sensor arrangements protect from collision and the device can guide the person in all directions. A sensor module is located at the lowest portion of the cane also to identify depths on the floor. The device is capable of voice alerts and playing voices [18]. When the sensed data from the sensor device is obtained, the same to be conveyed to the destination for further processing during an emergency circumstance for this various routing algorithms are used to find the optimal path in the networks [19]-[23], and the same information can also be reached and stored through a cloud environment for the future purpose [24]. A system that ensures visual aid for blind humans in front of them while walking using a navigation system is provided. The intelligent electronic stick identifies the stick if it is lost or misplaced by the use of GPS inside the kit. [25]. A smart system for visually impaired people with different circumstances in moving around without human support is proposed with a wireless RF module that produces a unique sound for giving alerts [26].

3. Methods and Materials

To enhance the capacity of individuals who are sightless or have vast visible injuries to autonomously admittance, apprehend, and discover unexpected indoor and outside circumstances, we advise a brand new framework the use of a digicam to discover and apprehend the signs, textual content, and limitations to provide voice signal as output. Our consciousness is on improving the abilities of sightless humans by offering them

an answer so that the statistics are applied to them in the shape of voice information. The followingillustration in figure 1 shows the suggested device.

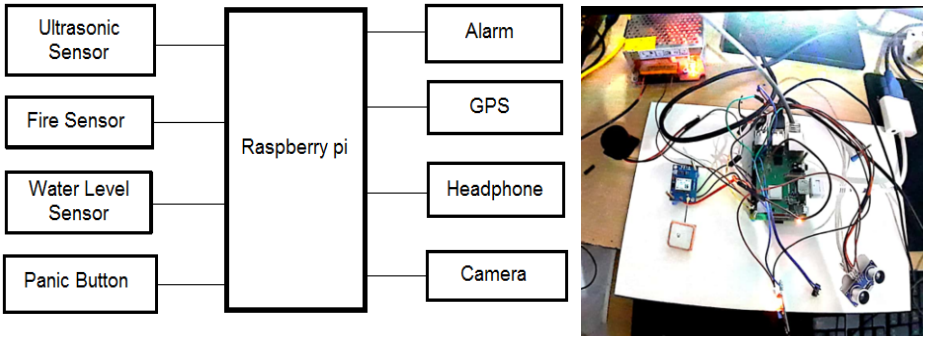

Figure 1. Block Diagram and Assembled Hardware.

The Raspberry Pi is quite effective for this type of small tool. This turned into made viable through the equipped availability of less expensive and tiny processors for cellular gadgets. The Raspberry Pi digicam module is a nifty peripheral that helps you to place the tiny laptop to loads of sensible and innovative uses. To get the maximum out of the digital digicam's functionality, however, you want to have as a minimum a primary running understanding of Bash or Python scripting. The SKG13C has GPS to function with outstanding compassion, ultra-low energy, and less form factor. The small shape issue and coffee energy intake make the module clean to combine into a transportable tool like PNDs, cellular telephones, cameras, and automobile navigation systems. Ultrasonic transmitter emitted an ultrasonic wave in a single course and began out timing whilst it launched. Ultrasonic unfold in the air and could go back right now whilst it encountered boundaries on the way. At remaining, the ultrasonic receiver could prevent timing whilst it gets the meditated wave. The distance of the sensor from the goal item is calculated. Flame detector sensorsobserve the presence of a flame or fire. The detection distance is as much as one hundred cm. The Flame sensor can output virtual or analog signs. Level Sensors come across the extent of materials that flow, such as liquids, Slurries, granular materials, and powders. The substance to be unrushedisan interior field. The degree size isboth non-stop and factor values. Continuous degree sensors degree inside a distinctive variety and decide the precise quantity of substance in a sure location. While factor-degree sensors best suggest whether or not the substance is above or under the sensing factor. An alarm tool or device of alarm gadget offers an audible, visible, or different shape of alarm sign approximately trouble or condition. Alarm gadgets are regularly equipped with a siren. Connect TV display to Raspberry Pi using Audio Video (AV) or HDMI cable. Insert the SD card into its slot and switchat the energy delivery. When that occurs, get rid of the energy-deliver twine of the Raspberry Pi board once (preserving the display's energy delivery) after which re-plug it. Finally,the display comes.

4. Experimental Results

The hardware assembled and its testing is successfully done and the same is shown in figure 1. All the sensor modules are connected using the Raspberry Pi board with the

GPIO pins. It is observed that all the functions and operations mentioned in the previous section are verified. Figure 2 shows the proposed model by which the entire sensor modules and microcontrollers are integrated into the flexible, portable walking stick.Figure 2 shows the proposed compact and optimized stick in which all the hardware units are integrated. The ultrasonic sensor in the proposed stick senses objects at a particular distance and if obstacles are identified within the range, then this information to the blind person using headphones. This senses the occurrence of fire and liquid nearby with the fire sensor and water sensor respectively. The panic button is used to convey to the caretaker about the emergency.

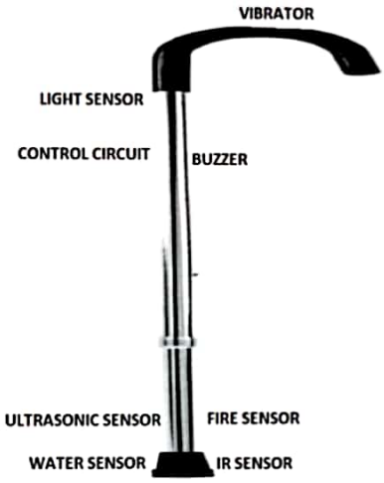

Figure 2. Walking Stick Model.

5. Conclusion

The proposed smart cane represents a fundamental medium for helping gadgets to assist the visually impaired. It provides an outcome in detecting the limitations mendacity in advance of the consumer at a distance of 4 meters, noticing both stairs and water pits. This hasa minimum cost, is dependable, portable, has low energy intake, and sturdy answer for navigation with a brief reaction period. Additional factors of this gadget are progressed thru Wi-Fi connectivity among the gadget mechanisms, growing the variety of the ultrasonic sensor, and enforcing an era for figuring out the velocity of drawing near limitations. In growing an authorizing answer, visually impaired and sightless humans in all growing nations have been on the pinnacle of our priorities.

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