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EMPOWERING THE BLIND

An IoT Based Assistive Device for Visually Impaired

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Abstract : The development of navigation devices that guide blind peoples indoors and outdoors has remained a challenge for decades. The purpose of this paper is to provide developers with an updated, holistic view of this research, so that they can exploit its multidisciplinary aspects. A brief history of previous solutions will be presented in this paper, ranging from the first "Electronic Travel Aids" to the latest systems based on artificial vision. A number of technological achievements are highlighted as they could support future feasible designs in the future. Following this, smart phones and wearable devices with cameras will be suggested as potentially viable options for supporting state-of-art computer vision solutions, enabling positioning and monitoring of the user's surroundings. By utilizing remote resources, such as cloud computing or urban infrastructures, these functionalities could be further enhanced.

KEYWORDS: Assisting system; Navigating system; Visually impaired; Situation awareness.

INTRODUCTION

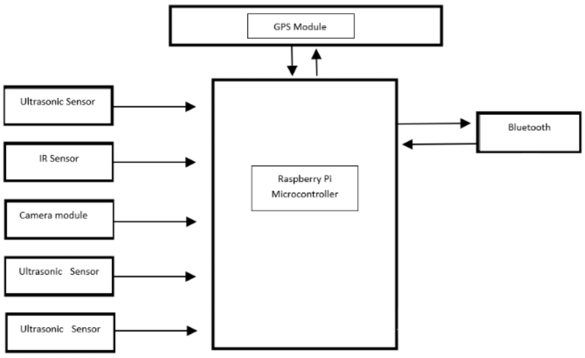
In 2021, It was reported that globally there are 43 million people living with blindness and 295 people living with severe visual impairment. This impairment affects them in everyday tasks and they undergo some difficulties when moving through an unknown environment. Generally, a normal human being depends on their vision to recognize objects present in their surrounding and to know their position and directions in the environment. The lack of vision heavily affects the performance of tasks such as mobility, way finding, and orientation. Basically, the purpose of the navigation system is to help the visually impaired people to get into the desired destination point and to alert them on any obstacles. The researchers are still working in this field to find efficient and cost-effective solution for both indoor and outdoor guidance of visually impaired people. Nevertheless, recent years have seen unprecedented scientific and technological progress, and new tools are now at our disposal to address this challenge.

• EXISTING SYSTEM AND PROPOSED WORK:

The previous work of this paper include guiding the blind and visually impaired people using ultrasonic sensor, gesture sensor and IR sensor for obstacle detection and raspberry pi for processing and voice module for giving instructions. But in this system, no camera module is installed to find people , text or currency in front of them. The sensors in the system detect the obstacle. But the module was not covering the large area. The IOT based white cane system is very useful for monitoring the patient's conditions continuously and recording the data about the patients and sending those data to the receiver end i.e. the blind people. General cameras (or mobile phone cameras), depth cameras, radio frequency identification (RFID), Bluetooth beacons, ultrasonic sensors, infrared sensors, etc. are some of the common sensing inputs utilised in ETAs. Contemporary smart phones have cameras that can produce high-quality, compact photos. However, a typical smart phones camera's fundamental drawback is that it lacks depth information, making it impossible for such systems to calculate the distance between a person and an obstacle. Typically, during navigation, general camera images are processed to only identify impediments up front.

BLOCK DIAGRAM

This block diagram layout demonstrates the connections between sensors and the Raspberry Pi Microcontroller while also showing how to link the GPS Module using programmes. By examining the workings of the sensors and software, connectivity is achieved. With the use of jumper wires, this diagram shows the subsequent clear connectivity of the sensors.



COMPONENTS USED:

- Raspberry Pi – 3 Model B
- Ultrasonic Sensor – HC-SRO4
- IR Sensor – Motion Detection
- Camera module – 5MP
- GPS Module – L80-39
- Bluetooth Module – HC06

THINGSPEAK IOT – PLATFORM

ThingSpeak is free, open-source software that lets people talk with internet-connected gadgets. It was created in Ruby. By giving an API to both the devices and social network websites, it makes data access, retrieval, and logging easier. It is an IOT analytics platform that gathers and transforms unprocessed data into information that can be diagnosed. Through channels, it is possible to determine the sensor values. IOT allows for the computation and integration of numerous channels.

OUR PROPOSED SYSTEM

Feedback system:

In a navigation system, audio feedback is typically provided through speakers or earphones. The user is disrupted by audio feedback when it is overloaded with information, and it can be frustrating when the user ignores environmental sounds because of auditory cues. In order to somewhat reduce this problem, many navigation systems incorporate bone conduction headphones. The headset enables sound to get to the inner ear, allowing the user to hear the audio signal without having their ear canals blocked. The vibration pattern can be used to provide specific direction cues. However, because it occasionally causes user confusion or requires extra time to decode the significance of the vibration pattern in real-time, it is not as helpful or comfortable for the users.

Camera system:

This system has two vision cameras that take pictures of the surrounding three-dimensional environment at the user's request It then transforms those images into the spoken descriptions that correlate to them, which it uses to initiate verbal dialogue with the user.

Visual system:

Vision-based navigation, also known as optical navigation, employs optical sensors, such as different kinds of cameras, and computer vision algorithms to extract visual characteristics from the surrounding environment. The system makes an effort to identify impediments using visual cues, and it then directs the user to move safely by providing avoidance instructions. In the literature, several visual imagery-based tools and technologies have been tried to be incorporated into navigation system designs.

Bluetooth system:

In this Guide system, a smart phone was utilised to communicate with Bluetooth-based beacons installed in various indoor areas that can help users by providing navigational guidance. The user interface and navigation modules of the suggested system might use some changes.

Ultrasonic sensor:

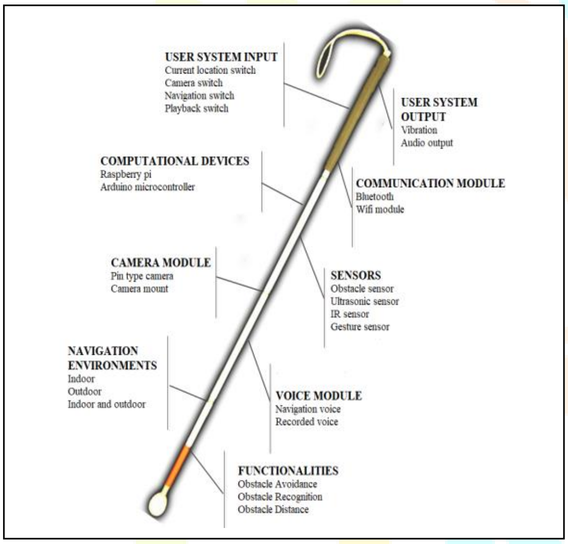
Following solutions based on visual (camera) technology, navigation systems based on ultrasonic sensors can be thought of as a common choice in the design. A few electronic boards, such the Raspberry Pi or Arduino, are required for the systems that this technology is recommended for a GPS module and ultrasonic proximity sensor-equipped blind stick with a programmable sensitivity.

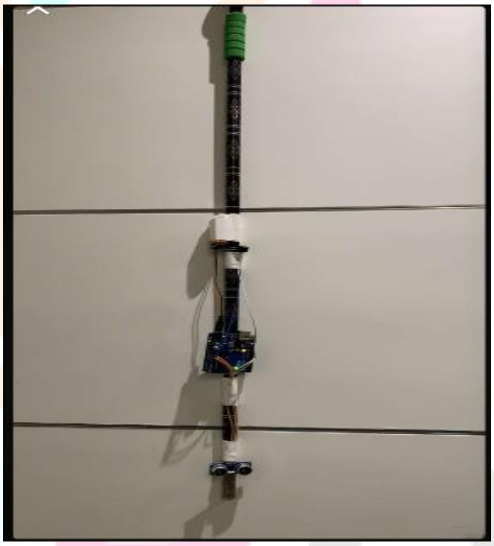
IR sensor:

Due to their lower cost and lower power consumption compared to ultrasonic sensors, IR sensors have also been tested in navigation system design. IR has also been used with other technologies, such Google Tango and Unity.

Smart phone based system:

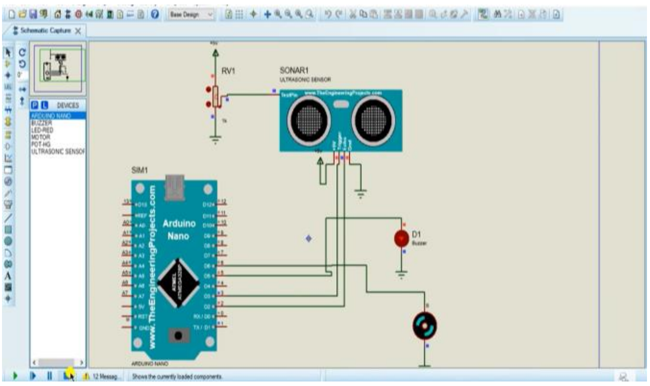
This was an in-door navigation system that gives turn-by-turn directions and prompt feedback when it detects a wrong orientation. Additionally, it offers details on several nearby areas of interest and landmarks. Users receive audible input from the system. By touching certain land-marks on the application that is installed on the mobile device, the target user can acquire navigation instructions to the desired destination. Near Field Communication (NFC) tags were used to mark the destination locations.





RESULTS & DISCUSSION

The four functions of an ETA are obstacle detection, obstacle avoidance, navigation, and localization. We have used these features in various combinations, such as localisation and obstacle avoidance. Technology can be utilised in a variety of ways to provide the needed functionality, such as tags for localisation and smart phones for obstacle detection and navigation. A number of solutions provide further features, such as the ability to estimate cane posture while also identifying obstacles using the Visual Range Odometry (VRO) approach. Adopting this strategy has the advantage of allowing smart phone access without holding the device. It is built with technologies to identify obstructions in the user's path and transmits the blind user's location via text messages using GPS.



FUTURE WORKS AND CONCLUSION

One of the most popular navigational aids for blind people is the white cane. The development of widely used current technology has created a variety of chances to increase the usefulness of the white cane. We have worked tirelessly to make technology-assisted white canes practical, dependable, and user-friendly in this aspect. In addition to the above we can consider, A user can explore the environment safely and effectively with the help of an ETA, which also identifies barriers and gives orientation, localisation, and signpost information. It cannot, however, fully adopt, replicate, or expand the advantages of the white cane. Its design must be user-centred, portable, trustworthy, reliable, lightweight, inexpensive, and less power-hungry with the least amount of training. Additionally, it should make use of cutting-edge technologies to augment or take the place of the white cane and allow the user to easily explore the surroundings. The proposed alternatives should not alter the use, weight, shape, security, assembly, or folding of the conventional white cane. There should be as little of a learning curve as feasible.

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