

IoT Based Smart Blind Stick with Navigation System

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Abstract

The greatest gift for appreciating nature is the eye. Blind persons have many challenges in their daily lives. People who are blind must rely on others to carry out their daily tasks. With the emergence of artificial intelligence, the internet of things, wireless sensor networks, and other innovations, information technology is revolutionizing every aspect of existence. The Internet of Things is a rapidly developing technology that connects people, machines, sensors, and everything else digitally for automation. The visually challenged can be assisted using an IoT-based smart blind stick that has a navigation system. A buzzer and ultrasonic sensor are built inside the smart stick to detect obstacles and sound a warning. Using a smart stick and a GSM module, registered numbers can receive critical notifications and GPS locations. This is an economical solution.

Keywords: *Raspberry Pi, Ultrasonic Sensors, Buzzer, Vibrator, GPS*

INTRODUCTION

The majority of information gathered from the outside world is processed by the brain primarily through the use of eyesight. As a result, visually impaired individuals experience difficulties in both their social and everyday lives. Blindness, often known as vision impairment, is a widespread ailment that impacts individuals globally. The valuable sense of vision is lost as a result of this illness. Millions of people suffer from vision impairments worldwide, and a large number of them are blind. Assistive technology was and will always be needed. For those who are blind or visually handicapped, there is a large selection of

navigation systems and aids available. It is really necessary for the blind person to distinguish objects.

About 253 million people worldwide suffer from vision impairment; of these, 217 million have moderate to severe impairment and 36 million are blind. According to WHO estimates, 81% of blind persons are 50 years of age or older. There will likely be an increase in the number of visually impaired persons in the future for a variety of reasons. Therefore, a reasonably priced device that enables blind individuals to walk comfortably and with ease is required. In order for blind individuals to employ a clever solution in their daily lives, one must be proposed. This idea suggests creating a smart blind stick to aid those who are blind or visually challenged.

There are many visually impaired people in our community; among them are millions of blind people and thousands of irrevocably blind people. Since vision is essential to practically every action we do, carrying out daily tasks can be challenging for those who are visually impaired. People who are blind or visually handicapped must rely on their memory to locate their possessions, and they may get agitated if something is periodically dropped or replaced. Without seeing, it is impossible to look for an object in an unfamiliar location.

The primary goal of this paper is to create a walking stick that will be extremely helpful to folks who are blind or visually impaired and frequently require assistance from others. By identifying the barriers, it enables the user to walk freely and autonomously. Several methods can be used to identify the difficulties. In the event that the blind person encounters an obstacle, the buzzer module will produce a sound that will alert him to its presence. The purely mechanical smart walking stick for the blind uses a straightforward method to identify impediments on the ground. This gadget is portable and light in weight. But because of its inherent size, its range is constrained. For blind people, it offers the best travel assistance. The blind are able to walk around on their own without assistance from others. The system's primary goal is to give blind people an effective navigational aid that allows them to see by giving them information about their environment and the items in it. A blind person can encounter fewer obstacles with the assistance of various technology. Generally speaking, these types of devices are known as assistive technology.

LITERATURE SURVEY

A literature analysis will go over the information that has been published in a specific topic; it could be as basic as an abstract of the sources, but it usually includes a directorial prototype and synthesizes and summarizes the information. The most important thing to remember while doing a literature review is to summarize, synthesize, and recapitulate the ideas and impact of other writers without adding anything new. Preserving the Authenticity of the Guidelines.

1. Arvind R. Tamboli's IOT-based smart stick for the blind that uses National Language Processing: It is predicated on enhancing the mobility of visually impaired individuals through the use of innovative technologies. Our research focuses on reducing navigation challenges for visually impaired people by detecting obstacles, pits, water, and position.

2. Md. Wahidur Rahman's Internet of Things-based Blind Person's Stick Create a prototype in which the blind person will receive the relevant message when the existing sensor detects an obstruction. This stick can also track the location of a blind person, detect holes in the pavement, detect water, and send a message to the person who is blind in the event of an accident.

3. A Perceptive Cane for Visually Impaired by Dabhade Yogita and Kher Chaitrali S. AnMake a proposal to create an intelligent gadget that, depending on how far away a barrier is from the user, will notify them when one arises. Here, the clever gadget not only sounds the alarm but also uses a server to track the user's location and notify family members of their current whereabouts.

PROBLEM STATEMENT

- Traveling from one location to another is extremely difficult for blind individuals. We have a good chance of seeing them if we see that they require assistance from others in order to walk.
- Their everyday lives are more difficult for them. With the help of this blind stick, one can walk with greater assurance.
- This stick uses a buzzer to alert the user when it detects an object in front of them.

- In order for the person to walk fearlessly. This gadget will be the most effective way to go through their problems.

OBJECTIVES

Basically, we divide this work into four objectives

- To employ three ultrasonic sensors—LEFT, RIGHT, and FRONT—around the stick to identify obstacles surrounding the user. By using echo, this sensor is able to determine the obstacle's distances.
- To use a moisture sensor on a street to find water on the surface. The moisture sensor transmits data to the controller when it comes into contact with water. The controller then notifies the Android application, which notifies the user via voice alert.
- Using GSM, our stick can locate the disabled individual. We gave the stick a button. By pressing the button, the blind person can use the GPRS module to send a message to their family members in the event of an emergency or mishap.

METHODOLOGY

The Raspberry Pi, a tiny computer-like processing device, is used in this system. When walking on the street, blind and visually impaired people have trouble identifying impediments. The Raspberry Pi is used in the system to offer object detection. Ultrasonic sensors, a panic button, a GPS module, a buzzer, an LDR sensor, a water sensor, and a vibrator make up the system. The total system's goal is to enable blind people to walk freely by offering them an affordable, effective navigation and obstacle detection tool.

The obstacle (if any) in this system is detected using ultrasonic sensors. The sensors have a threshold limit set, and if an impediment is detected within that range, a buzzer and beep sound will sound. To make them easier to distinguish, water that has been identified and obstacles that have been found are highlighted with distinct beep patterns and vibrations. The sounds produced by the ultrasonic sensors are inaudible to human ears since they are produced at frequencies that are in the ultrasonic spectrum (>20 kHz). After striking the obstruction, the sound waves return to the detectors.

Whereas the ultrasonic sensor is utilized to identify barriers on the sides, it is employed to identify objects or obstructions in front. Following data collection, computations are made

using the formula. The conditions are examined after the obstacle's distance has been determined. Next, a raspberry pi is signaled to turn on a buzzer. The raspberry pi controls the buzzer and uses a sensor to determine how far away the obstacle is. For vibrating sensation, the buzzer and vibrator are also connected in parallel. An environmental feedback is provided via the light sensor. In other words, it lets the user know if it's daytime or nighttime and if a certain location is light or dark. If there are any puddles, the water sensor is used to find them. The raspberry pi receives all of these signals after which it sends a signal to the buzzer, alerting the user.

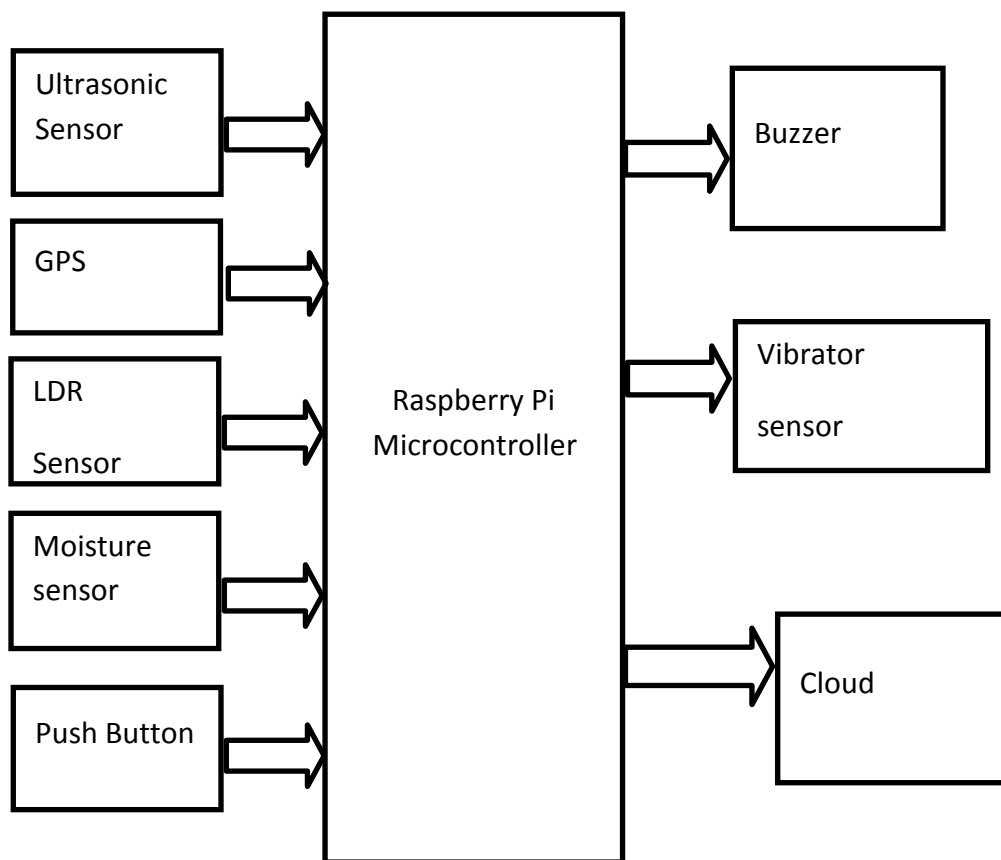


Fig 1: Block diagram of a Smart Blind Helping Stick

WORKING OF PROPOSEDSYSTEM

The Raspberry Pi, which manages the other parts of the system, is the central component. We have the two ultrasonic sensors available. Two ultrasonic sensors are positioned above and below the middle of the stick, one at the bottom. The buzzer and vibration motor will turn on when any items or obstacles are detected by the ultrasonic sensors within a 50cm radius. Furthermore, we have a GPS modem that tracks the whereabouts of blind individuals.

When the panic button on the stick is pressed in an emergency, the signal from the button reaches the Raspberry Pi, which uses the GPS modem to determine its location and transmits the location along with an emergency message to all of the system's saved numbers.

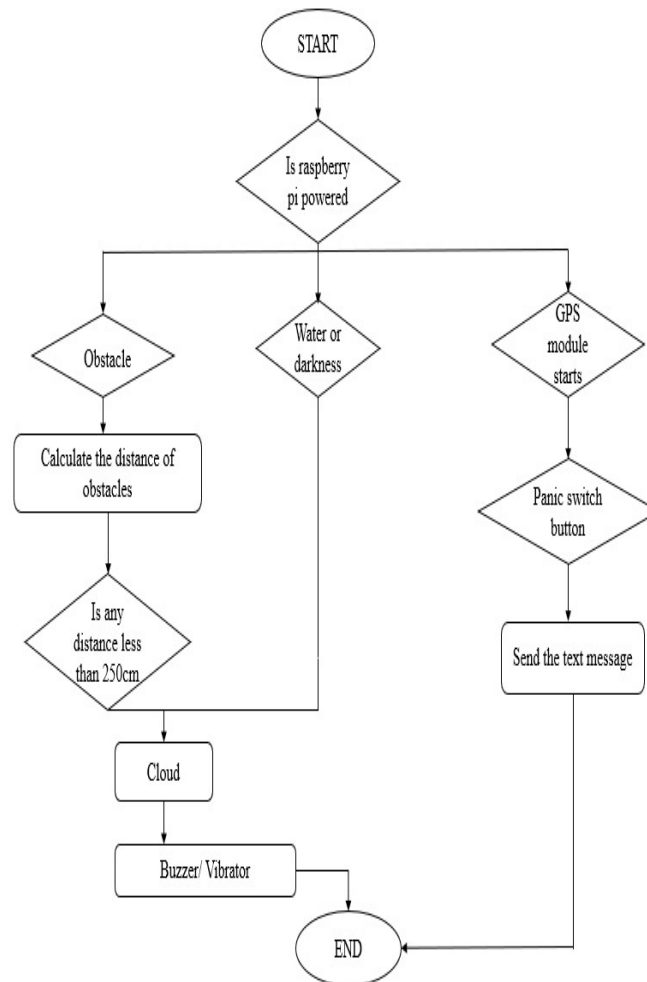


Fig 2: Flow chart for the proposed system

SYSTEM IMPLEMENTATION AND EXECUTION

This is an intelligent walking stick with a GPS module and an obstacle detective sensor built in, powered by a Raspberry Pi. There are two steps in the system execution process. The obstacle detection portion is one, and the position information portion is the other. The entire system is initialized and activated when the Raspberry Pi is powered on. The smart walking stick had a vibration motor, LDR, buzzer, GPS module, vibration motor, water sensor, vibration motor, and Raspberry Pi mounted on it. The Raspberry Pi is linked to the ultrasonic sensor in this project. The barrier has been spotted if the echo wave is received. Subsequently,

the sensor transmits the information to the Raspberry Pi, enabling it to calculate the object's distance by measuring the interval between the transmitted and received signals. The Raspberry Pi coding sets the threshold settings based on user convenience in order to alert those with visual impairments to potential hazards. The threshold value, which can be adjusted for user convenience, is a predetermined range of distances within which an obstruction can be identified. Subsequently, the Raspberry Pi's written code compares the calculated distances to the threshold value; if the calculated distances are less than or equal to the threshold value, the Raspberry Pi triggers the buzzer and vibration motor.

RESULTS AND DISCUSSION

All of the devices are linked to the Raspberry Pi Zero, as seen in the figure. Here, the Raspberry Pi Zero is connected to an ultrasonic sensor, push button, vibrator, GPS module, buzzer, water sensor, and LDR sensor.

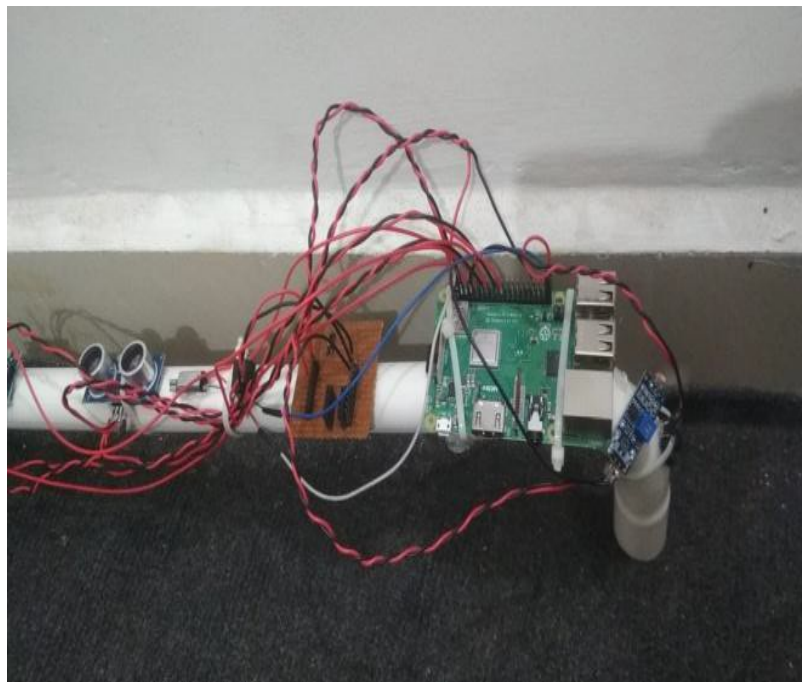
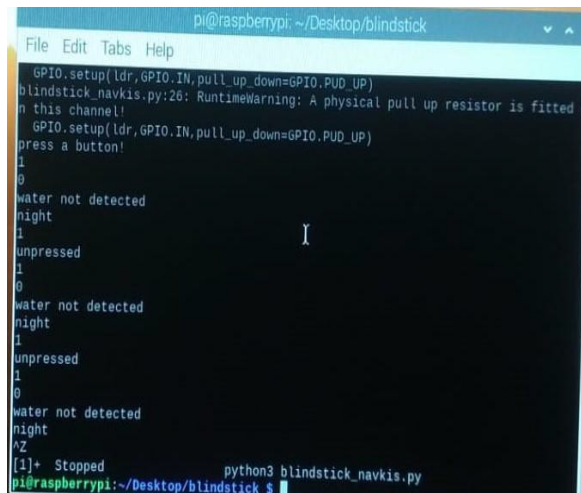


Fig.3: Snapshot of the model

The technology depicted in the following figure shows the distance, measured in centimeters, between the person and the object utilizing an ultrasonic sensor.



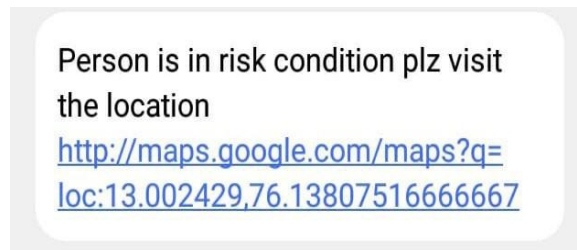
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pi@raspberrypi: ~/Desktop/blindstick
File Edit Tabs Help
GPIO.setup(ldr,GPIO.IN,pull_up_down=GPIO.PUD_UP)
blindstick_navkis.py:26: RuntimeWarning: A physical pull up resistor is fitted o
n this channel!
GPIO.setup(ldr,GPIO.IN,pull_up_down=GPIO.PUD_UP)
press a button!
1
0
water not detected
night
1
unpressed
1
0
water not detected
night
1
unpressed
1
0
water not detected
night
^Z
[1]+  Stopped                  python3 blindstick_navkis.py
pi@raspberrypi:~/Desktop/blindstick $

```

Fig.4: Distance values of ultrasonic sensor

These numbers represent the distances that people have to the object or obstruction that ultrasonic sensors have detected.



Pressing this button will let the person know whether he is experiencing terror or if he is missing the route. so that family members may see where the blind person is present with the use of these links, the message will be delivered to the Raspberry Pi, which will then transmit it to a mobile device.

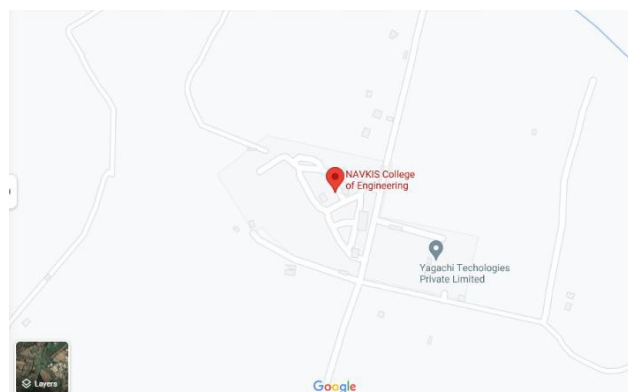


Fig.5: Screenshot of GPS location

Table 1: Ultrasonic sensor 1 test result

Sl. No	Distance(centi-meter)	Alert
1	243.5	ON
2	233.9	ON
3	355	OFF
4	248.45	ON
5	223.8	ON

Table 2: Water detection test result

Sl.no	No Water detected	Water detected
1	0v, The transistor is off	5v, The transistor is forward bias
2	0v, The transistor is off	5v, The transistor is forward bias

Table 3: Ultrasonic 2 sensor test result

Sl.no	Distance(centi- meter)	Alert
1	233	ON
2	100.8	ON
3	56.5	ON
4	355.89	OFF
5	196.2	ON

CONCLUSION AND FUTURE ENHANCEMENT

The goal of the "IoT Based Smart Blind Stick with Navigation System" paper is to develop a system that uses GPS modules, ultrasonic sensors, and a sound system to help blind people see. It would facilitate an individual with vision impairments to independently navigate a public setting. The suggested system makes an effort to fix the shortcomings of the old one. It seeks to provide solutions for the issues that blind people encounter on a daily basis. Additionally, safety precautions are taken by the system. People who are blind can profit greatly from the design of the Smart Stick for Blind, which uses GPS, vibrator, and buzzer output in addition to ultrasonic sensors, to enable independent mobility. The system's benefit is that it has the potential to be extremely inexpensive. The suggested pairing of GPS with Ultrasonic Sensor creates a real-time system that tracks the user's location and offers feedback, improving the security and safety of navigation. With the sound system that we

have, blind people may go about with ease. The Smart Stick for Blind prototype has the ability to recognize objects in front of the user. As a result, it can assist someone who is blind in navigating his surroundings.

The developed prototype will be a great help to the blind since it performs well in identifying obstacles that are paced at a distance in front of the user. Simultaneously, the emergency message and the global positioning system (GPS) can be connected to enable the recipient to know their exact location and the distance to their destination, which will be communicated to them via message instructions.

FUTURE ENHANCEMENT

There are numerous potential scopes that work with the stick. According to Google, GPS can also be used to determine the optimum and shortest route (Bing map based on real time locations). The GSM attachment can be useful for any future emergency casualty assistance. Additionally, it may have a unique configuration that links the walking stick to the wearers' Aadhar card, improving the way the government assists the physically impaired.

It may be improved even more by designing the printed circuit board (PCB Unit) with VLSI technology. The system becomes even more compact as a result. By using several sensor types, it can be further enhanced to have greater decision-making capabilities and, as a result, be used for a variety of applications. It attempts to address the issue that blind people deal with on a regular basis. The safety is also measured by the system.

The real GPS module that is used in cars can be added to the system to aid with simple navigation.

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