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Email ID: [editor@ijmm.net](mailto:editor@ijmm.net) , [ijmm.editor9@gmail.com](mailto:ijmm.editor9@gmail.com)

## Smart AI Blind Stick with Voice Feedback

<sup>1</sup>M. Ramya,<sup>2</sup>Sreepathi Arun Kumar,<sup>3</sup>Nukala Maheshwar Reddy,<sup>4</sup>Midde Aditya,<sup>5</sup>Varalu Shiva Shankar,

<sup>1</sup>Assistant Professor, Department of ECE, Narsimha Reddy Engineering Collage, Maisammaguda(V), Kompally, Telangana.

<sup>2,3,4,5</sup> Student, Department of ECE, Narsimha Reddy Engineering Collage, Maisammaguda(V), Kompally, Telangana.

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**Abstract-** The idea behind the "smart stick" is to provide the visually handicapped access to intelligent technological aids. Walking along the street, those with limited vision or no vision at all have a hard time seeing potential hazards. According to the developers, the system can detect objects, water, fire, and artificial vision using the Arduino UNO and Voice Module. They also claim to provide real-time assistance. Providing the visually impaired with well-founded help is the major objective of our mission. Moving from one place to another is the exclusive emphasis of current gadgets for the sight impaired. With this aid, people who are blind or have low vision can do many of the same tasks that sighted people do. Those who are unable to move about on their own due to vision impairments are the primary focus of our study. The technology is voice-activated and uses ultrasonic sensors for data collection. Our system's overarching objective is to help the visually impaired find their way around and avoid obstacles in an efficient and economical manner via the provision of scenario-based information on both static and moving objects. Making them feel and enabling them to walk on their own are the main goals. Buzzwords: RF module, voice module, ultrasonic sensors, Arduino UNO

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### 1. INTRODUCTION

Even with good eyesight, a visually impaired individual has trouble perceiving fine details. A horizontal field of vision with both eyes open for someone with 6/60 vision is less than 20 degrees. People with this condition are said to be blind. Going from one spot to another might be difficult for the visually impaired since physical movement can make it harder to see what's ahead of them. When it comes to getting about and making ends meet, they depend on their relatives. They avoid people and social gatherings because of how agile they are. The RF module, water sensor, voice module, and ultrasonic sensor are all part of the suggested machine. The stick uses an ultrasonic sensor to determine the distance between the objects and the smart on-foot stick. This apparatus employs ultrasonic sensors to traverse barriers by use of ultrasonic waves. The sensor communicates with the microcontroller by picking up on the limits and sending the data it has collected. In order to determine whether the obstacle is almost too great for the user, the microcontroller analyses the data. The circuit is ineffective if the obstacle isn't in close proximity to the microcontroller at all times. The microcontroller will signal a buzzer if the obstacle is almost too great. There are a lot of accessible products on the market for those who are visually impaired, but our device

has several benefits, including being inexpensive, simple to use, and portable.

### LITERATURE REVIEW

In their article published in May [2020], Prutha G et al. present a cane that enables visually impaired individuals to navigate independently. In order to keep an eye on the stick, we utilize Raspberry Pi and Arduino. Three sets of ultrasonic sensors can identify obstacles up to 15 cm away, while water sensors can identify pools of water. Connectors for the sensors are on the stick. When the stick senses an obstacle, it may use a dc motor to determine whether to go forward, backward, left, or right. Buzzers and vibrations will notify users. Others will be able to see the stick with the flashlight attached, so he may pass. A finger ring is supplied for navigation using GPS. Thanks to its quick responsiveness and minimal power consumption, the user may simply maintain it. Assisting the sight handicapped in traveling independently is the primary goal. In a study conducted by M. Narendran<sup>1</sup> et al. in January 2018, researchers from various disciplines, including computer science, electronics engineering, and health science, came up with a new invention called the "third eye for the blind." This invention uses ultrasonic waves to detect nearby obstacles and alerts

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the user through buzzer sound or vibration, allowing them to navigate with confidence and speed. Blinds equipped with this wearable technology will soon be on the market. The fact that it will be inexpensive is the device's main selling point. A board like the Arduino Pro Mini 328-MHz 15/16 MHz is an example of wearable tech. A set of ultrasonic sensors will be installed on this. People who are visually impaired may be able to traverse their environments and recognize nearby objects with the aid of the sensor. When the sensor detects an item, it will sound an alarm or vibrate to let the user know. This is fully automated and will greatly assist the visually impaired on their travels. June [2020], Mohamed Dhiaeddine Messaoudi et al. People with vision impairments may navigate more simply and safely with the help of this "Smart Cane" technology. At now, the three main choices for the visually impaired are using a white cane, utilizing technological assistance, and having a guide dog. Using a range of technological resources to discover an ingenious solution to the problem and make customers' life simpler is the proposed approach in this article. The main objective of the created system is to make interior navigation easier by using cloud computing and wireless scanners from the Internet of Things (IoT). The creation of the Smart Cane will be able to fulfill its purpose by integrating many hardware and software technologies. A Smart Cane is one such option that might help the sight impaired get from one spot to another more easily. It gives them a means of interacting with nature that they may use for communication. A device with a microcontroller system and an ultrasonic sensor integrated into a walking stick is suggested by Saurav Mohapatra et al. in May of 2018. One way to detect obstacles is with the use of an ultrasonic sensor, which uses ultrasonic waves. A sensor will communicate with the microcontroller whenever it detects an obstacle. Once the data has been processed, the microcontroller determines whether the blockage is near enough. The circuit won't work if the barrier is too far away. When a barrier is going to be encountered, the microcontroller notifies the visually impaired person. The electronic "Save Our Souls" (e-SOS) system is also something we want to include. If a blind person is having problems navigating and needs to make a video call to a family member, they may hit the e-SOS distress call button on the stick. The video is streamed from an Android-powered mobile device. Additionally, the blind person's relatives may get updates on his whereabouts using the android app. In this manner, a family member may use the Android mobile app to lead a blind person down the

journey. S. Munirathnam et al., Apr. [2018], The primary objective of the article is to facilitate communication for visually impaired individuals. Its ingenious design allows it to serve its purpose both inside and out. The present visual impairment route planning tool is primarily concerned with getting from one place to another. This project centered on creating an easy-to-use device that allows those with vision impairments to travel on their own. The intended users of the suggested device are those who are blind or have limited vision. People who are visually impaired may now walk with the same assurance and ease thanks to this device. It also has a moisture sensor to keep you from falling into water and ultrasonic sensors to alert you to obstructions in your path. Using LDR, it may even divert the attention of visually impaired individuals away from the outside in any lighting condition. The client may be continuously monitored using it. The whole thing is meant to be compact and worn on a white stick. An intelligent walking stick called Assistant may aid the visually impaired in recognizing obstacles and providing them with the necessary support to achieve their objective (Akhilesh Krishnan et al., 2016). The assistant's functionality is supported by a navigation system, image processing, and echolocation technology. The visually impaired may find assistance and an improved quality of life with the support of an assistant. Finding better solutions to help the visually impaired is a hot topic of research and development. There are a lot of systems and walking sticks that can assist you go about both inside and outside, but none of them can drive itself, detect objects, or sound an alert. Ultrasonic sensors allow Assist to detect things by echoing sound signals. By capturing images with the camera while driving, the image sensor can detect and guide the driver to their destination using the Global Positioning System (GPS) and maps provided by the smartphone app.

#### **METHODOLOGY:**

Here we present a smart blind stick that makes use of cutting-edge technology to make navigation easier for those who are visually impaired. The roller blind has a water sensor and an ultrasonic sensor built right in. In order to identify potential hazards, our invention first employs ultrasonic sensors that send out ultrasonic waves. The Arduino Uno receives alerts from the sensor whenever it detects obstructions. The data is processed by Arduino Uno, which determines whether the obstruction is near enough. The circuit will not work unless the obstacle is right there in front of it. The Uno will provide a verbal warning if it

detects an impediment in its vicinity. Additionally, it can identify whether there is water present and can alert the visually impaired individual using a distinct tone. There is a vibration sensor included inside the wand as well. The Arduino uno can detect when an obstruction is close by and will vibrate to let you know. A water sensor can detect the presence of water. Seeing the level of illumination in a room is another useful function for the visually impaired. The technology now includes an additional capability that may assist blind persons in finding their cane if they misplace it. To locate a lost stick, a wireless RF-based remote control is used.

**PROPOSED METHOD**

An revolutionary cane, the blind stick helps the vision handicapped navigate more easily. To help the vision handicapped go about, we have developed a state-of-the-art blind stick. The roller blind incorporates a variety of sensors, including an ultrasonic, fire, and water detector. Using ultrasonic sensors to identify impending obstacles is the first step of our suggested technology. To alert the microcontroller, the sensor sends a signal whenever it detects an obstruction. After that, the microcontroller determines whether the barrier is near enough by processing the data. In the absence of an obvious impediment, the circuit will not activate. There will be an alert from the microcontroller if there is an impediment in the vicinity. When it senses water, it notifies the blind and triggers an additional warning. It is often installed with other mechanical and physical components to form a whole gadget.

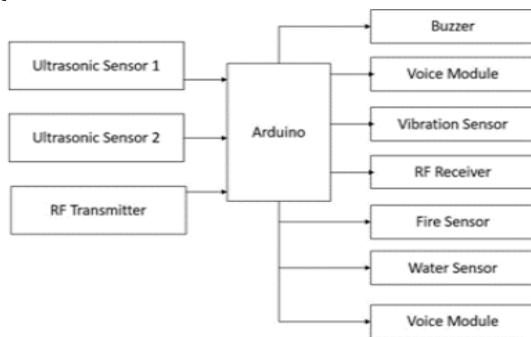


FIG.2. Block diagram

**A. OBSTACLE DETECTION PROCESS**

Identifying potential roadblocks An ultrasonic sensor lies at the heart of Tulo, allowing it to identify potential obstructions up to 70 cm away. When the resistance gets too near to the stick, it sends a signal to the Arduino, which may then act accordingly. For haptic feedback, there's a vibration motor, and for

aural feedback, there's a piezo summation. Figure 2 is a schematic representation of a feedback-enabled obstacle detection implementation. This procedure makes use of two detection systems. The first is an above-the-knee system that uses an ultrasonic sensor mounted on a pole about 80 cm from the ground to identify potential obstacles. The second method involves sticking an ultrasonic sensor approximately 15 cm above the ground as part of the below-the-knee obstacle detection system. At least 20 centimeters in height are detected by it.

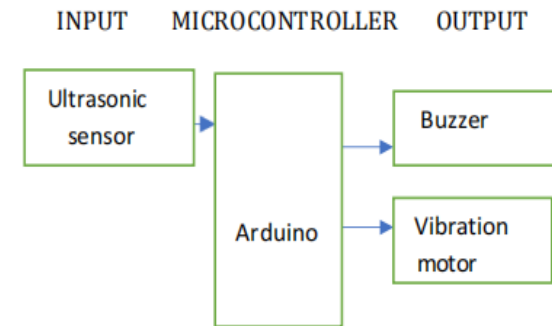


Fig.3: Obstacle Detection with Feedback

**B. WATER DETECTION PROCESS**

To identify the presence of water or dirt, a raindrop sensor is attached to the rod's base. The user is notified both aurally and tactilely whenever the sensor picks up on the presence of water. Volumetric water content was determined using soil moisture sensors by utilizing some other soil characteristic as a surrogate for moisture content. This property may be electrical resistivity, dielectric constant, or interaction with neutrons. Because soil moisture might vary depending on factors such soil type, temperature, and electrical conductivity, it is important to calibrate the relationship between the measured values and soil moisture.

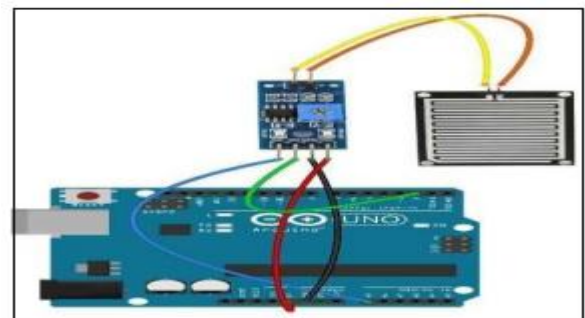


Fig.4: Water detection

**C. RF REMOTE**

In case the user loses the stick, the receiver portion of the RF remote—which also has a buzzer and a vibration motor—will assist in locating it. While infrared communication requires a direct line of sight between the two devices, radio frequency communication offers a number of benefits. Radio frequency (RF) transmission has a far larger range than infrared (IR) communication. In this case, a wireless transmitter and receiver system is built using RF modules, namely an RF transmitter and an RF receiver. In Figure, we can see the RF transmitter illustration. 4. You'll need two little circuits to do this. Attached to the blind stick will be the receiver circuit. One is a circuit that will be used to broadcast signals in order to locate the stick; this is a remote RF transmitter. Wireless data transfer uses Amplitude Shift Keying Modulation to alter the 433 MHz radio frequency transmissions. We use an IC HT12E encoder and an IC HT12D decoder to accomplish the transmitter and reception operations.

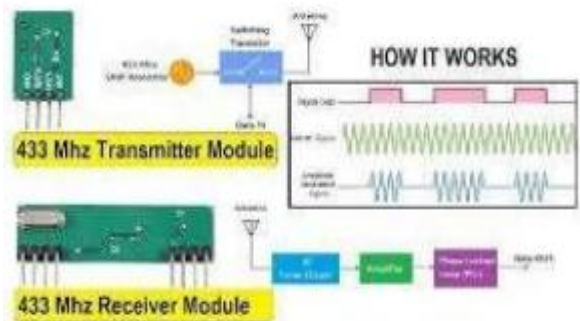


Fig.5: RF module

**D.VOICE MODULE**

Indoors and out, the gadget performs well. The image-derived text may be transformed into spoken language using Natural Language Processing techniques. Notifications concerning obstacles are sent to the user by vibrations and audible sounds. People with vision impairments may benefit from this module's ability to alert them to approaching danger.

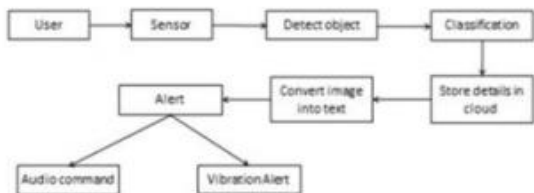


Fig 6.Voice Module Synthesis

**APR9600 VOICE MODULE:**

Using flash analogue storage, the APR9600 is a high-performance, low-cost audio record/play IC. The audio files remain accessible even after disconnecting the module's power source. The audio that has been replayed is of high quality and has little ambient noise. With a sampling rate of 4.2 kHz, you can record and play back audio between 20 Hz and 2.1 kHz for 60 seconds. Changing the oscillation resistor, however, allows for a sampling rate of up to 8.0 kHz. The whole length of the audio recording has been reduced to 32 seconds. From 32 seconds to 60 seconds is the total time of the sound recording that may be adjusted by adjusting the value of a single resistor. The integrated circuit is capable of operating in two modes: serial and parallel. When using serial access mode, audio may be recorded in 256 separate portions. In parallel access mode, audio may be recorded in 2, 4, or 8 segments. One easy method to operate the IC is via push-button keys. The integrated circuit may also be controlled by other digital circuits, such as computers and microcontrollers. The supply voltage range for the APR9600, which comes in a 28-pin DIP package, is 4.5 to 6.5 volts. Both the recording and playback processes use 25 mA of current. In standby mode, the current drops to 1 Ma.



Fig.7.Apr9600 voice module

**E.PIR SENSOR**

Whether it's a person or an animal, PIR sensors can detect motion. Humans are the source of infrared energy. As soon as a person walks within the PIR sensor's detecting range, the sensor's output goes up since it has detected these fluctuations in radiation. A passive infrared sensor is an electrical device that can detect objects' infrared light emissions. PIR sensors are mostly used in motion detectors. Additionally, it is used in security alarm systems and automated lighting. The picture below shows the standard pin layout of the PIR sensor. The pinouts are simple to understand. There are three pins on the PIR sensor.



Fig.8.PIR sensor

One example of a drain terminal is Pin1, which is connected to the positive supply of 5V DC. The source terminal of the device, which is Pin 2, is linked to the ground terminal with a resistor of either 100K or 47K. On the sensor, Pin 2 is the output pin. The measured infrared signal is sent to an amplifier via pin 2, while pin 3 of the sensor is grounded. How far the PIR sensor can see: Passive infrared detection is effective within an indoor range of 25 cm to 20 m. Inside curtain variants have a detection range of 25 cm to 20 m. Outdoor passive infrared sensors have a detection range of 10 to 150 meters. With an outdoor passive infrared curtain detector, the range is 10 to 150 meters.

**SENSORS WITH ORIENTATION**

For obstacle and pothole detection, the included stick makes use of the Ultrasonic Sensor HC SR-04. A device that detects objects in front of it by analyzing their sound waves is known as an ultrasonic sensor. It determines the distance by emitting a 40 Hz sound wave and then waiting for the corresponding stream to return. By measuring the time it takes for the sound wave to travel from its source to its destination, an ultrasonic sensor may determine how far away an impediment is. Since air travels at a speed of 344 meters per second and sound waves are believed to travel through air as well, we may get the total distance the sound wave traveled by multiplying the time it takes for the wave to return by 344. This teaches us that the distance from the barrier may be calculated by dividing the total length by two, as the wave's path to the obstacle was twice as long as its path to the ultrasonic sensor. It is shown how the ultrasonic sensor works in its most basic form.

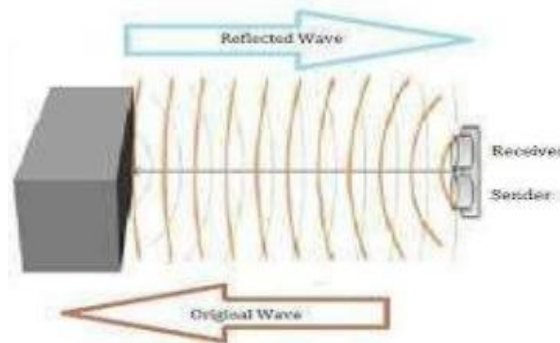


Fig.9: Ultrasonic Sensor

The HC-SR04 ultrasonic sensor module has a non-contact range of 2 cm to 400 cm. The module consists of the control circuit, an ultrasound receiver, and transmitters. The following are the basic principles: The first uses an input/output (IO) trigger for a signal with a minimum amplitude of 10 ms, while the second transmits eight 40 kHz waves in rapid succession to an ultrasonic sensor module, which then detects a return signal. (3) In the case of a high-level signal return, the period of high-output IO duration is the time between wave transmission and reception. Get the distance by dividing the sum of the high-level duration with the air speed of sound (344 m/s).

**SPECIFICATION:**

COMPONENT	WORKING CURRENT	WORKING VOLTAGE	RANGE
ULTRASONIC SENSOR (HC SR04)	15mA	3.5V-5V	2cm-450cm
RF MODULE	3.5mA	3V-6V	300m
BUZZER	<32mA	4V-8V	10cm(85dB)
VIBRATION SENSOR SW-420	11.9mA	3V-5V	
FIRE SENSOR	20mA	3V-5V	760nm -1100nm
WATER SENSOR	<20mA	3V-5V	40mm*16mm
ARDUINO	20mA-40mA	5V	

Table 2:Specification

**A. ULTRASONIC SENSORS VS IR SENSOR**

The sensor we end up selecting will be based on its intended purpose. Among infrared sensors' drawbacks is its lack of sensitivity to daylight-induced impediments, such as intrusion. It could be somewhat challenging to use IR sensors for applications outside or in low light inside. Since ultrasonic sensors rely on sound waves to operate, its ability to identify obstacles is less affected by a variety of factors. The stick has to work

in both bright and dark environments for our form to be accurate, so we figured an ultrasonic sensor would be the best bet. There are a number of ways in which ultrasonic sensors excel above their infrared (IR) and photoelectric (PIR) counterparts. a) Unlike cameras, which have trouble taking clear pictures at night and whose IR sensors are affected by sunlight, ultrasonic sensors can detect in both bright light and complete darkness. b) Environmental factors such as luminosity, dust, smoke, mist, etc. do not affect it. c) It may be more effective with certain kinds of obstructions, including tiles, wood, plastic, or sponges.

Parameter	HC SR - 04	HY SRF - 05
Working Voltage	3.3 to 5 Volt	5 Volt
Static Current	< 2mA	< 2mA
Sensor Angle	<15 degrees	<15degrees
Detection Distance	2cm to 4m	2cm to 4m
Pin Number	4	5
Pins	VCC, trig, echo, GND	VCC, trig, echo, GND, OUT
Precision	3mm	2mm

**Table 1:Comparison between sensors**

## RESULTS AND DISCUSSION

The idea begins with the use of ultrasonic sensors to detect potential obstacles. As soon as the sensor identifies an obstruction, it sends a signal to the microcontroller. After that, the microcontroller checks to see whether the obstacle is near enough by processing the data. There will be no impact from the circuit if the blockage is not there right away. When the barrier is cleared, the microcontroller triggers the buzzer to go off. In addition, when it senses water, it alerts the visually impaired by the sound of a unique buzzer. Along with other physical and mechanical parts, it forms an integral part of a larger apparatus. There are a number of everyday items that rely on embedded systems for control. Eleven percent of all microprocessors manufactured today are components for embedded systems. Compared to general-purpose alternatives, it has a cheap cost per unit, is tiny, has a rugged operating range, and uses little power. This results in reduced processing power, which in turn makes programming and interfacing with them much more difficult. On the other hand, by integrating intelligence mechanisms into the hardware, utilizing any pre-existing sensors, and establishing a network of embedded units, it becomes feasible to achieve optimal resource management at both the unit and network levels, all while providing enhanced capabilities that surpass what is currently available.

## CONCLUSION

This study describes the development of an intelligent assistive device that may help the visually impaired and the blind navigate common obstacles such as holes, water, and stairs with more ease and safety. The existing solution may serve as a user-friendly roadmap for them. The system's potential to be an affordable solution for the world's millions of visually handicapped is one of its main advantages. Both the knees below and the knees above obstacle detection include tactile and auditory feedback. It has a minimum height requirement of 20 cm to identify obstacles. It has a range of 70 cm and can identify obstacles like stairs. The fact that the transmitter's switch may be pressed from around 300 meters away makes it possible to recover a lost stick, which is a nice perk. One of its limitations is that it needs training for the operator and has a range of 30 cm for pothole identification.

## FUTURE WORK

Improving object recognition's ability to detect and identify things in difficult environmental settings will be the primary focus of our future effort. There will also be an effort to increase the device's charging capacity. More picture databases will enhance object identification. Improved algorithms for the device's navigation might be implemented via the use of dynamic picture recognition.

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