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A Distinguish Approach to Design a Smart Stick for Visually Impaired People

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ABSTRACT: Blind individuals often face challenges in their daily lives due to their disabilities. To address these difficulties, innovative technology has been integrated into traditional walking sticks, creating a "Smart Stick" with various functionalities. This enhanced walking stick includes features such as an audible beacon for locating the stick when misplaced, obstacle detection through vibration sensors. The stick is loaded with ultrasonic sensor to capture images of obstacle, which are then analyzed by a microcontroller to provide voice commands through a speaker. This enables blind individuals to identify objects in their path, seek assistance if a person is detected, or navigate around larger obstacles like cars. Additionally, GPS integration helps them determine theirprecise location. The Smart Stick is an innovative assistive device designed for blind people to enhance their mobility and independence. It integrates cutting-edge technology such as sensors, GPS, and artificial intelligence to detect obstacles, provide navigation guidance, and offer environmental information. This compact and portable device aims to improve the life for the visually impaired by assisting them in safely navigating their surroundings and accessing critical information. This device incorporates advanced sensors and technologyto detect obstacles, provide real- time feedback through audio or haptic cues, and offer navigation assistance via GPS integration. It aims to empower the visually impaired by enabling them to guide abouttheir surroundings more confidently andefficiently while promoting greater autonomyin their daily lives.

KEYWORDS: Blind people, walking stick, obstacle detection, ultrasonic sensors.

I. INTRODUCTION

It is an IOT-based smart blind stick with a location proving system using ESP32,GPS module, ultrasonic sensor, vibration motor, and buzzer is a device that helps visually impaired people direct then about their surroundings safely and independently. It uses a variety of sensors and technologies to detect obstacles, identify landmarks, and provide the user with actual feedback. TheESP32 is a microcontroller that is well-suited for IOT applications. It is powerful, energy- efficient, and it has many connectivity options, Which including Wi- Fi, Bluetooth, and GPS. The GPS module allows the stick totrack the location of that person and provide them with directions.

II. LITERATURE SURVEY

This stick is intended for the visually impairedfor improvement in there movement while moving around. A smart stick designed in such a way that it can identify all obstacles in the way using a multiple sensors, ultrasonic sensor, RF module and GSM module is used init and transmit it as a vibration to guide the user about obstacles on the way The paper might detail how the smart cane functions. This could include the camera's role in detecting obstacles, recognizing objects, providing navigation assistance, and enhancing the user's situational awareness. Discussion on the user experience is likely included, addressing aspects such as ease of use, ergonomics, and how effectively the device meets the specific needs of blind individuals. Given the focus on artificial intelligence in the title, the paper may explainhow AI algorithms are used in conjunctionwith the camera module to provide advanced features like object recognition or scene analysis[1].

Blind cane called I Walk has an integrated water sensor in it which activates the alarm if it detects water around it. This system has a wireless RF remote which controlthat emits voice. when it is pressed, which helps in locating the rod. The

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paper likely presents a technological innovation or solution designed to assist individuals who are blind or visually impaired. While the provided citation does not include the full details of the paper, a"Smart Stick" suggests a device or system intended to enhance the mobility and independence of blind and visually impaired people. Such devices often incorporatesensors, navigation aids, and connectivity features to help users navigate their surroundings safely[2].

This model consists of GPS and GSM which sends SMS any time oneneeds help. It uses an ultrasonic sensor for finding obstacles and an infrared sensor for detecting level of water. The paper may conclude with summary of its findings, potential future developments and impact of such technology on the lives of visually impaired individuals.
Unfortunately, the provided citation does not offer specific details from the paper, so this summary is based on typical content that mightbe found in a paper discussing a smart stick forthe visually impaired. For more specific information or key points from the paper, you may need to access the full paper through the provided DOI (Digital Object Identifier) orprovide additional context or questions[3].

They have Designed an Arduino Nano based stick which detects objects using ultrasonicsensors and an android mobile app to help the blind people The paper could detail how the smart stick functions in various situations. Thismayinclude how it detects obstacles, provides navigation assistance, and interacts with the user. It may discuss the user experience and theusability of the smart stick. This could involveuser feedback, ergonomic considerations, and ease of operation. The paper might compare the smart stick to traditional white canes or other mobility aids, highlighting the advantages and improvements it offers[4].

Theybuild a model that can detect obstacles of distance 3m using infrared, ultrasonic and water sensors.So blind people can send their location to his/her family members using GPS location. The survey could detail how the smart stick operates in various scenarios. This may include obstacle detection and avoidance, navigation assistance, and providing real-time feedback to the user Discussion on the userexperience is essential, including ease of use, ergonomics, and how effectively the device meets the needs of blind individuals[5].

Blindstick is built with an ultrasonic sensor with thehelp of electronic sensor. It can send audio signal to the buzzer if it detects object is closeto the blind person. The paper might detail howthe smart walking stick operates. The ultrasonic sensors used in the stick detect the obstacles in front of the peoples which helps the blind persons while walking. This stick helps blind person easily walking anywhere without any fear. This includes its ability to detect obstacles, provide navigation guidance, and initiate emergency assistance through the SOS navigation system. Discussion on the user experience may be included, covering aspects like ease of use, comfort, and how effectively the device caters to the specific needs of blindindividuals. A significant portion of the papermay be dedicated to explaining the SOS navigation system integrated into the walking stick. This system likely allows the user to request help or alert authorities in emergency situations [6].

It has Designed walking stick with the help of the ultrasonic sensor which has buzzer and vibration motors which are activated when any of the obstacle's detected.The stick is also equipped with GPS and GSMto guide about the location of blind people. Considerations for user-friendliness, comfort, and accessibility for blind individuals are likely discussed. This could involve tactile feedback, voice commands, or other assistive features. The article may explore potential applications beyond navigation, such as emergency alerts or communication capabilities. To gain a comprehensive understanding of the author's work, including technical specifications, experimental results, and insights into the practical applications of the IOT-based band for blind individuals, it would be necessary to refer to the complete article[7].

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III. EXISTING SYSTEM

Many existing system are present like sticks which can guide blind people through touching or poking by guiding them to understand about distance of the obstacle in the path. Some of the alternative methods which can help blind people include smart belt, smart rings, smart canes etc., which detect the obstacle using ultrasonic sensor or laser sensor. The limitation of an existing system is as follow:

Smart sticks, often called "smart canes" or "smart white canes," are innovative devices designed to aid visually impaired individuals in safe and independent navigation. They leverage sensors, connectivity options, and feedback mechanisms to convey information about the surrounding environment. Key features include ultrasonic, laser, or infrared sensors for obstacle detection, GPS for navigation, haptic and auditory feedback, and connectivity to smartphones for enhanced functionality. These devices vary in cost and design, with some being collapsible and portable. Ongoing research and development aim to improve the technology, making smart sticks more effective and accessiblefor users.

- Not effective
- Expensive
- Limited features

Ultrasonic sensors are a common feature in smart sticks, emitting high-frequency sound waves to detect objects and obstacles in theuser's path by analyzing the reflections. Users are typically informed through auditory cues or vibration patterns.

IV. PROPOSED SYSTEM

This proposed system model consists of followingdetails which works according to the design of thestick.
Components:

Ultrasonic sensor: This ultrasonic sensor's measures distance by emitting sound waves at a specific frequency and timing. How long it takes for the waves to bounce back. This elapsed time helps determine the distance to a target object.

GSM-GPS module: The GPS-GSM module system includes a GPS module (NEO- 6m) and a GSM module (SIM 900A). The first tracks people's current location by obtaining GPS coordinates, and the second sends these coordinates to the relevant person. The system ensures the safety and assistance of visually impaired people by facilitating instant locationtracking and communication.

Buzzer and Vibration motor: Buzzer are the sound machine that is activated when abutton on the RF remote control is pressed, indicating that an object, such as a wand, has been placed in the wrong position. In contrast, the vibration motor (a mechanical device)vibrates when the humidity sensor blindly detects water. This product offers suggestions to alert users to certain situations: the buzzer sounds a warning of faulty products, while the vibration force tactically alerts users to the presence of water, making them safe and informed.

Switch: A switch is an electrical device usedto open or close the electrical circuit, thereby controlling the flow of electric current. Thepurpose of the described application is to save battery life by turning the joystick on and off when not in use.

Power supply: A 12V rechargeable lithium ion (Li-ion) battery is used as the power source of the controller in the body. This battery provides energy to all the sensors and component present in modules connected to it. Which assure the necessary power supply to thecomponents.

Alert Mechanism: The microcontroller analyzes the distance data from the ultrasonic sensors. When an obstacle is detected within a certain range, the smart blind stick triggers an alert mechanism. This alert can take various forms, such as vibration, sound, or haptic feedback, to notify the person about the presence of obstacle and proximity.

Bluetooth Connectivity: Connection ofsmart stick with user's mobile for safety isachieved through Bluetooth**.**

Amplifier: As signals received from ultrasonic sensors are too weak to hear or recognize, hence we are integrating

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amplifier inthe architecture for strengthening the signal.

Cane or handle: The physical component ofthe blind stick should be sturdy and comfortablefor the user to hold. We are attaching the sensors, microcontroller, and other componentsto the handle

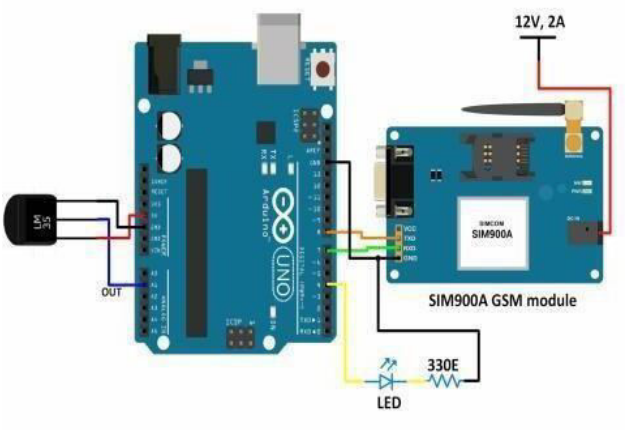

Fig4.1 Integration of Arduino Uno with GSMmodule.(Reference from Google)

V. METHODOLOGY

The proposed system described in Section IV consists of various components connected to an Arduino board through jumper wires. This systemoperates on a 9V/12V input voltage and offers several key features:

Obstacle Detection: The system employs two ultrasonic sensors, one near the bottom and another at 2/3 of the stick's length, to detect obstacles of different shapes and sizes.
Based on the sensor input, the algorithm determines the type of obstacle using a predefined logic and provides appropriate alerts to the user through the audio alert message's or vibration patterns via a speaker module or vibration motor.

Emergency Location Sharing: When the userpresses a button, the GPS module retrieves thatperson's location, which is given by GoogleMaps.
"I'm in danger; please find me here" and sent to the guardian to their designated contact numbers using the GSM module.

RF Remote Control: The system continuously monitors an RF receiver on the stick for signals from which an RF transmitter on a remote controller.

When the user presses a button on the remote control, it sends out a radio frequency signal that is detected by the joystick receiver. In response, the algorithm activates the alarm for ashort period of time to help the user position the joystick.

The system uses a well-defined algorithm thatcontinuously selects various sensors and followsspecific instructions to provide real-time data. Provide timely service and alerts for visuallyimpaired users. It includes trouble detection, humidity measurement, emergency communication and wand position recovery, thus improving user safety and mobility.

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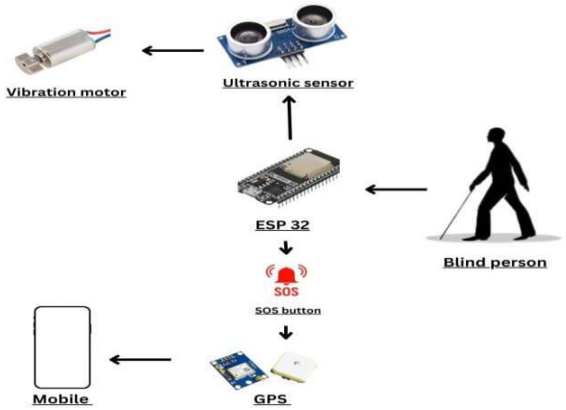

Fig 5.1:Architectural Diagram

Sr.no	Parameter	Smart stick available in Market	Smart stick Developed byour Team
1	Services	FoldableStick.	Ultrasonic sensor for object detection,GPSfor location
2	perks	Can accommodatein small place	Can be useful in any panic situation
3	Cost effective	4000	3000

VI. RESULT

The Smart Stick provides real-time alerts and feedback to the visually impaired user, ensuring obstacle awareness, moisture detection, and the ability to share their location in emergencies. The Bluetooth connectivity enhances safety through mobile phone integration. Ultrasonic sensors works on principle of echo, its reflection is different on each obstacle. Themeasurement cycle starts with microcontroller transmitting the 10µs high level pulse to the sensor trigger pin to start ranging, then sensor will send out ultrasonic signal with 40 kHz and450µs and then wait to capture the rising edge output by echo port from 150µs: 25ms, depending on measured distance. In case of no obstacle it waits 38ms before it restarts transmission. Ultrasonic distance sensoruses time of flight (TOF) to detect obstacle – theoutput is digital pulse which length is the time ittakes for the sound to reach the target and returnbefore the beep is heard. The device is accurate with detecting obstacle of up to 2m.

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Fig:6.1 Experimental setup of Smart Blind Stick

Distance(cm)	Time(ms) Sensor Data	Voltage(v)
6	0.3	0.40
20	1.14	0.53
30	1.75	0.58
40	2.32	0.66
50	2.89	0.76
100	5.8	1.20
400	23.30	3.96

Table: Distance Measurement by the UltrasonicSensor

VII. FUTURE SCOPE

This project is not completely ideal and have Chances for development:
It can have voice guidance to the stick to guide User in brief about object in front of it, it can Also introduce AI assistance in stick for help Of the user.

VIII. CONCLUSION

The IOT connectivity of the smart blind stick allows it to be integrated with other smart devices and services. For example, the user's location could be automatically shared with a smart home system to turn on lights or unlock doors as they approach. The smart blind stick could also be integrated with a navigation app to provide voice-guided directions. Overall,the

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IOT-based smart blind stick with location proving system is a technology that can improve the experience for visually impaired people.

It is affordable, easy to use, and provides a number of valuable features. The Smart Stick for blind individuals is a remarkable assistive tool that significantly enhances their daily lives. It incorporates advancedtechnologies like audible beacon, obstacle detection, and GPS integration to provide invaluable support. This innovation empowers blind individuals by improving their mobility, obstacle awareness, and overall independence, making their daily activities more manageableand secure.

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