Smart Assistance for Visually Impaired People

[1] Dr.Shiva Sumanth Reddy,[2]Abhishek Adithya S K,[3]Anvitha Nairy,[4]Aparna A, [5]Rakshith J
[2,3,4,5]*UG Students, Department of Computer Science and Engineering*
[1]*Assistant. Professor, Department of Computer Science and Engineering*
[1,2,3,4,5]*Dayananda Sagar Academy of Technology and Management, Bangalore, Karnataka India*

Abstract*—Smart Blind Stick is a device designed to help guide the visually impaired people by detecting objects and give them the information in the form of speech.Thus, the smart stick comesas solution to help blind people to perform navigation and to do their walk easily and comfortably. With the normal stick, the detection of the obstacle is not done and the normal stick is not efficient for visually impaired people since it cannot detect obstacles completely.If they face any obstacle, they can sense it bythe Ultrasonic sensors, and also they can hear the guide directionsin the Bluetooth or headset. The camera module is used to detect the obstacle through an ultrasonic sensor that placed on the stick.The captured image is sent to the OCR to identify the type of the object and then it is convert it to voice command through the speaker or via Bluetooth connected with Raspberry pi. A Wet sensor is placed at the down of stick to measure the degree of water land soil moisture and Fire sensors are used to detect wet floor and fire and the buzzer is occurred.

Keywords—Smart stick, ultrasonic sensor, wet sensor, firesensor, buzzer, Raspberry pi.

I.INTRODUCTION

There are over 284 million people who are visually impaired and there are over 39 million people who are totally blind. Thelack of visual capabilities has limited these individuals from immediate surroundings which has potential safety concerns. The absence of visual capabilities significantly hampers their ability to fully perceive immediate surroundings, raising safety concerns and diminishing their overall quality of life as they depend on aids for mobility. Most of the people rely on white canes which helps them to scan the obstacles in their surroundings and for local navigation.

The primary objective of a smart blind cane is to detectobstacles in the user's path and assist in their avoidance. It uses sensors and technologies to detect and provide real-timefeedback about objects, walls, stairs, or other obstacles in the Environment. The smart blind cane seeks to enhance the safetyof visually impaired individuals by providing alerts or warnings about potential hazards. This can include detecting and signaling the presence of fire, dangerous substances, or otheremergency situations. The aim of this project is to propose aportable device, designed for visually impaired individuals toassist them with getting around. Smart stick recognizes the moisture content on the surface and intimate's blind person. Asof now, blind people use a wooden stick as a tool to analyze their surroundings while walking. Here, we develop a tool which can serve as a smart stick being more efficient and helpful than the conventional one.

II.LITERATURE SURVEY

In recent years, innovative advancements have revolutionized electronic canes, exemplified by the pioneering work of Sankari Subbiah [1]. Subbiah conceptualized and developed a cutting-edge smart cane, aiming to establish a robust navigation system for individuals with visual impairments. This groundbreaking device incorporates ultrasonic sensors, camera modules, a Navigation System Module, and a Raspberry Pi, enabling a comprehensive analysis of the user's surroundings. Additionally, the inclusion of a Speech Synthesizer/Voice Synthesizer System enhances user interaction by providing real-time auditory feedback. The integration of a GPS receiver ensures accurate location tracking,while a sophisticated Playback Unit further refines the user experience. Subbiah's creation not only enhances the safety of visually impaired individuals but also exemplifies the seamlessconvergence of state-of-the-art technologies in assistive devices.

Krishnakumar S [2] has ingeniously developed the Intelligent Walking Stick, a remarkable device integrating ultrasonic sensors, PIR sensors, and a Mega Arduino. The stickfeatures a water sensor capable of

detecting water levels above 0.5 cm, providing vital information to visually impaired users about potential obstacles. The stick emits voice warnings for various scenarios, such as the presence of humans or obstacles, utilizing buzzers for user feedback. An emergency alert systemis seamlessly incorporated, triggering voice warnings when obstacles are detected. Furthermore, an emergency button allows users to send location information to their relatives via Google Maps in case of urgency. Notably, the stick includes a remote to help visually impaired individuals locate a misplaced device. Krishnakumar S's Intelligent Walking Stick exemplifies a comprehensive and user-centric solution, significantly enhancing the safety and autonomy of visually impaired individuals.

M.Adil Khan[3] introduces an innovative Android-based Portable Smart Cane, revolutionizing assistance for the visually impaired. Uniquely leveraging existing smartphone sensors like GPS, GSM, and accelerometer, the cane offers a cost-effective, energy-efficient, and lightweight solution. Easily attachable to any white cane, the device employs a buzzer and LED indications to alert users within a five-foot obstacle range. Notably, the Android application enhances userexperience with features like Shake to Start, Auto Connect, Add Contact, Call, SMS, and Emergency Message buttons. TheCall button initiates automatic calls to caretakers, while the SMS button sends predefined messages. The Emergency Message feature triggers a voice alert, providing comprehensive support. Designed for user-friendliness, portability, and energy efficiency, this fully-featured smart cane underscores Khan's commitment to empowering the visually impaired with cutting-edge technology.

In the realm of assistive technology, Shamim Ahmed's[4] Intelligent and Multi-functional Stick for Blind Individuals, utilizing IoT, stands out for its comprehensive features. The system integrates two Ultrasonic sensors—one for detecting obstacles and the other for identifying holes and stairs. When an obstruction or stair is detected, a Buzzer alerts the user. An Infrared sensor enhances environmental awareness, while a specialized water sensor distinguishes water from other obstacles. The system employs a 4-way remote signal, with components such as Arduino UNO, IR Sensor, Ultrasonic Sensor, Water Sensor, 4-Channel Wireless Remote, and Buzzer,to facilitate stick location. By pressing a button on the remote, the stick emits a distinctive tone for 5 seconds, aiding users in locating it. With additional features like GPS and GSM modules, the system ensures real-time communication of the user's coordinates to concerned family members, embodying a holistic approach to safety and autonomy for the visually impaired.

Lavanya Narayani T[5] introduces a groundbreaking Smart Cane design catering to visually impaired individuals, seamlessly integrating advanced technologies for heightened functionality. The design cleverly combines an Ultrasonic Sensor, Arduino Uno, and an ESP32 Camera Module with PIR sensor, ensuring a comprehensive approach to object and person detection. By utilizing these components in harmony, the smart cane achieves a refined level of precision in identifying obstacles. The ultrasonic sensor and ESP32 Camera module work synergistically, providing valuable data on distance and object response. In addition to these components, the inclusion of an SW-420 vibration module adds tactile feedback, enhancing the user experience. Lavanya Narayani T's innovative approach not only showcases the integration of cutting-edge technologies like ESP32 but also emphasizes the meticulous consideration of diverse modules for a well-rounded solution in aiding the visually impaired.

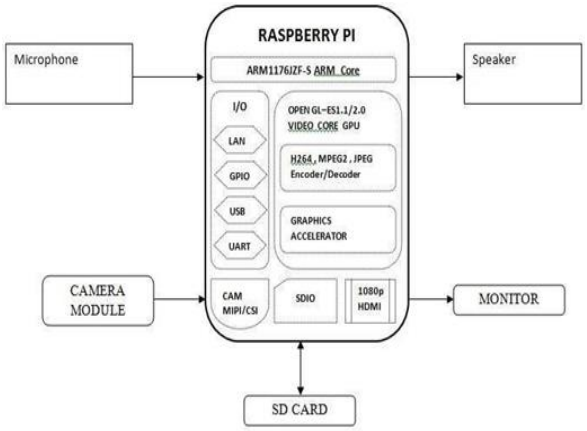
N. Loganathan [6] presents an innovative initiative, the Smart Stick for the Blind, aimed at enhancing the autonomy and safety of visually impaired individuals. This concept revolves around providing a self-reliant mobility solution, allowing the blind to navigate safely through their surroundings. The incorporation of ultrasonic sensors ensures obstacle detection, preventing potential injuries. Moreover, the addition of a radio frequency transmitter and receiver, along with a controller, establishes connectivity, enabling users to stay attuned to their environment. The inclusion of vibration features enhances feedback, contributing to an enriched user experience. This proposed smart stick, with keywords such as obstacles, ultrasonic sensor, radio frequency transmitter and receiver, controller, and vibration, serves as a foundation that can be further optimized by integrating additional sensors promising expanded utility and applications for the visually impaired.

Vanitha Kunta[7] introduces a versatile Multi-Functional Blind Stick, designed to empower visually

impaired individualsin navigating diverse terrains. This innovative stick incorporates Ultrasonic and Infrared sensors, an RF module, and a GPS-GSM module to not only assist in obstacle detectionbut also relay the user's location in emergencies. Enhancementsinclude the integration of a Buzzer and Vibration Motor for tactile feedback, a Push Button for user control, and a Speaker for informative alerts. The stick's adaptability is further improved with a microcontroller, Arduino Uno, and a 12 volts(V) rechargeable Li-ion battery. Vanitha envisions additional advancements by incorporating high-performing sensors and utilizing materials like carbon fiber for a lightweight and flexible design, reflecting a commitment to continual improvement in aiding the visually impaired community.

T S. Aravinth[8] introduces an innovative WiFi and Bluetooth-based Smart Stick, aiming to significantly enhance the mobility of blind individuals. The smart stick is meticulously designed to cater to a myriad of applications, utilizing cutting-edge components such as an Ultrasonic Sensor,Raspberry Pi, Vibration Motor, Buzzer, RF Module Transmitter, USB Camera, and GPS. This comprehensive design ensures a multifunctional approach to guide blind people effectively. The incorporation of WiFi and Bluetooth technologies adds to the stick's versatility, providing ease of use and addressing the daily challenges faced by the visually impaired. By combining these advanced components, the smart stick emerges as a valuable tool, showcasing the commitment to leveraging technology for the betterment of the blind community's daily lives.

III.PROPOSED SYSTEM



System design is the process of defining the architecture, components, modules, interfaces and data for a system to satisfy specified requirements. System design is one of the most important phases of software development process. the purpose of the design is to plan the solution of a problem specified by the requirement documentation. In other words the first step in solution is the design of the project. The design of the system is perhaps the most critical factor affecting the quality of the software. The objective of the design phase is to produce overall design of the software. It aims to figure out the modules that should be in the system to fulfil all the system requirements in efficient manner. The design will contain the specification of all modules, their interaction with other modules and the desired output from each module.

A. Methodology

Methodology refers to the systematic approach and set of procedures used to conduct research or carry out a project. It outlines the steps, tools, and techniques employed to achieve the objectives of the study or project. The main steps are:

Assembly of the hardware components according to the experimental setup: involves the process of physically connecting and configuring the various hardware components required for the smart blind cane project This step includes tasks such as integrating sensors like ultrasonic and establishing the necessary wiring connections.

Developing the Software part for each module: involves creating the necessary software components and programminglogic to enable the functionalities of each module within the smart blind cane project.

Testing and Improving the Code for Optimization: involves evaluating the software code developed for the smart blind caneproject through rigorous testing and making necessary improvements to optimize its performance.

Linking the User Interface with the respective modules: involves integrating and establishing a connection between thecorresponding software modules and the smart blind cane project.

Mounting the Device onto the sticks: involves securely attaching the smart blind cane device onto the handle or shaft ofthe traditional white cane. This step ensures that the smart blind cane remains stable and functional during use while maintaining the familiar form factor and ergonomics of a standard cane.

B. System Requirements

HARDWARE

ARM11 Raspberry Pi board:Pi is a credit-card sized computerthat connects to a computer monitor or TV and uses input devices like keyboard and mouse.

Ultrasonic Sensor: These are the devices that generates or senseultrasound energy. They can be divided into broad 3 categories: transmitters, receivers, transceivers.

Wet Sensor: These sensors detect the presence of water and when locations where water should not present.

Fire Sensors: These sensors are designed to detect and respond to the presence of flame or fire, allowing flame detection.

Camera: An image sensor integrated with lens, control electronics and an interfaces like CSI, Ethernet etc.

SOFTWARE

Python: Python Tesseract is an optical character recognition (OCR) engine for various OS. Tesseract OCR is the process of electronically extracting1text from images and1reusing it in a variety of ways1such as document1editing, 1free-text1searches Open CV: It is a library of programming1functions mainly aimed at real-time1computer vision. It is developed by Intel research center and subsequently supported by1Willow Garageand now maintained by itseez.

IV.OUTCOMES AND APPLICATIONS

Smart Cane enables the blind user to:

Function independently. Detect obstacles within a given range and avoid the said obstacle. It guides the user to the respective destination. Alert blind people about dig.

V.CONCLUSION

The blind stick gives the result for all 3600 from the position ofthe smart walking stick. So, this system provides overall support for the blind society in guiding. The broad beam angle ultrasonic sensors help in wide range obstacle detection. The main aim of this system is to act as a secure guard and helps the blind to be aware of their surroundings. Future work includes addition of GPS system helps in locating the exact position of the blind person which helps their guardians to find them and provides a great guide. It is necessary that visually impaired people get access to an efficient and comfortable object in order to live their daily life comfortably. In a developing country likeIndia, there is a need for a cost-effective solution so that most of the people can have an effective product as proposed in this paper. The project Smart Stick for Blind Using Raspberry Pi is designed to create a system using Ultrasonic sensors, wet sensors, fire sensors and providing Voice command through headphone or speaker to the blind people.

REFERENCE

[1] Sankari Subbiah, Ramya.S, Parvathy Krishna.G, Senthil Nayagam- SMART CANE FOR VISUALLY IMPAIRED BASED ON IOT,3rd International Conference on Computing and Communication Technologies ICCCT 2019.

[2] Krishnakumar.S, Bethanney Janney J,Umashankar. G- IntelligentWalking Stick with Static and Dynamic Obstacle Detection Technology for Visually Challenged People,2021 Seventh International conference on Bio Signals, Images, and Instrumentation (ICBSII) | ©2021 IEEE.

[3] M. Adil Khan, Kashif Nisar,Sana Nisar,BS Chowdhry,021 International Conference on Artificial Intelligence and Smart Systems (ICAIS) | ©2021 IEEE.

[4] Shamim Ahmed, Md. Munam Shaharier, Srijan Roy, Anika Akhtar Lima, Milon Biswas- An Intelligent and Multi-functional Stick for Blind People Using IoT 2022 Seventh International conference on Bio Signals, Images, and Instrumentation (ICBSII) | ©2022 IEEE.

[5] Lavanya Narayani.T, Sivapalanirajan. M, Keerthika. B,Ananthi. M, Arunarani. M-Design of Smart Cane with integrated camera module for visually impaired people,021 International Conference on Artificial Intelligence and Smart Systems (ICAIS) | ©2021 IEEE.

[6] N.Loganathan- Smart Stick For Blind People, 2020 International Conference on Intelligent Sustainable Systems (ICISS)|©2020 IEEE.

[7] Vanitha Kunta,Charitha Tuniki,U. Sairam Multi-Functional Blind Stick for Visually Impaired People,Fifth International Conference on

Communication and Electronics Systems (ICCES 2020)IEEE.

[8] T.S. Aravinth- WiFi and Bluetooth based Smart Stick for Guiding Blind People,020 3rd International Conference on Intelligent Sustainable Systems (ICISS) |©2020 IEEE.