Visual Disability

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Abstract: *visually impaired individuals encounter severe challenges in identifying objects and preventing obstacles while moving. This paper proposes a low-cost real-time assistive system based on raspberry pi, pi camera, and ultrasonic sensors to assist the blind in safe mobility. The proposed system identifies objects and obstacles around the visually impaired person and translates this data into voice messages using text-to- speech functionality. The proposed system translates visual data into audio feedback, thus offering artificial vision to visually impaired individuals. The proposed system is compact, user-friendly, and suitable for real- time indoor and outdoor applications.*
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Keywords: raspberry pi, object detection, ultrasonic sensor, pi camera, voice assistance, visually impaired

I. INTRODUCTION

Visual impairment is a serious health concern across the world, affecting millions of people. According to the world health organization, visually impaired people experience difficulties in mobility, object recognition, and independent navigation. Conventional assistive devices like white canes and guide dogs are of little help, as they are not capable of recognizing object types or providing detailed information about the environment.

Recent advances in embedded systems, computer vision, and artificial intelligence have made it possible to develop smart assistive systems. By using low-cost hardware like raspberry pi and image processing algorithms, it is possible to develop systems that can translate visual data into audio feedback. The proposed project describes an object detection and voice alert system based on raspberry pi that can help visually impaired people by detecting obstacles and alerting them with voice output.

II. PROBLEM STATEMENT

The visually impaired have difficulties in detecting obstacles and identifying objects around them in real-time. This has led to accidents, injuries, and a high level of dependence on others for mobility. Current assistive technology systems are costly, large, power-hungry, or only capable of simple obstacle detection without object identification.

There is, therefore, a great need for a compact, cost-effective, and efficient assistive system capable of accurate object and obstacle detection with real-time voice output. The aim is to improve independent mobility and decrease dependence on human assistance.

III. OBJECTIVES

The Primary Goals of the Proposed System Are:

1) To identify objects and obstacles in real-time using a camera and sensors
2) To decode the captured visual information into significant audio messages
3) To help the visually impaired navigate independently and safely
4) To develop an inexpensive, portable, and user-friendly assistive system
5) To reduce reliance on others and boost confidence while moving around

IV. LITERATURE REVIEW

Different assistive systems for the visually impaired have been proposed in previous studies. Smart sticks equipped with infrared and ultrasonic sensors can sense nearby objects but cannot identify them. Systems based on RGB-D sensors have improved depth sensing capabilities but are costly and consume high power. Smartphone applications are flexible but highly dependent on camera resolution and internet connectivity.

Deep learning algorithms like fast R-CNN have greatly improved the accuracy of object detection but are highly dependent on optimized hardware and computing power. The proposed system will address these issues by integrating ultrasonic technology with camera-based object detection through raspberry pi.

V. PROPOSED METHODOLOGY

The proposed system uses raspberry pi as the central processing unit. A pi camera captures real-time images of the surroundings, while an ultrasonic sensor measures the distance of nearby obstacles. Opencv is used to process captured images and detect objects.

Once an object or obstacle is detected, python-based text-to-speech technology converts the detected information into voice messages. These messages are delivered to the user through earphones, allowing the visually impaired person to understand the environment without visual input.

VI. SYSTEM ARCHITECTURE

The system architecture is a combination of hardware and software components:

1) Raspberry Pi for processing
2) Pi Camera for image acquisition
3) Ultrasonic sensor for distance measurement
4) Earphones for audio feedback
5) Python, opencv, and TTS engine for processing

The images and sensor data are processed in real-time to detect objects and produce corresponding voice alerts. The system architecture provides a fast response and works well in both indoor and outdoor settings.
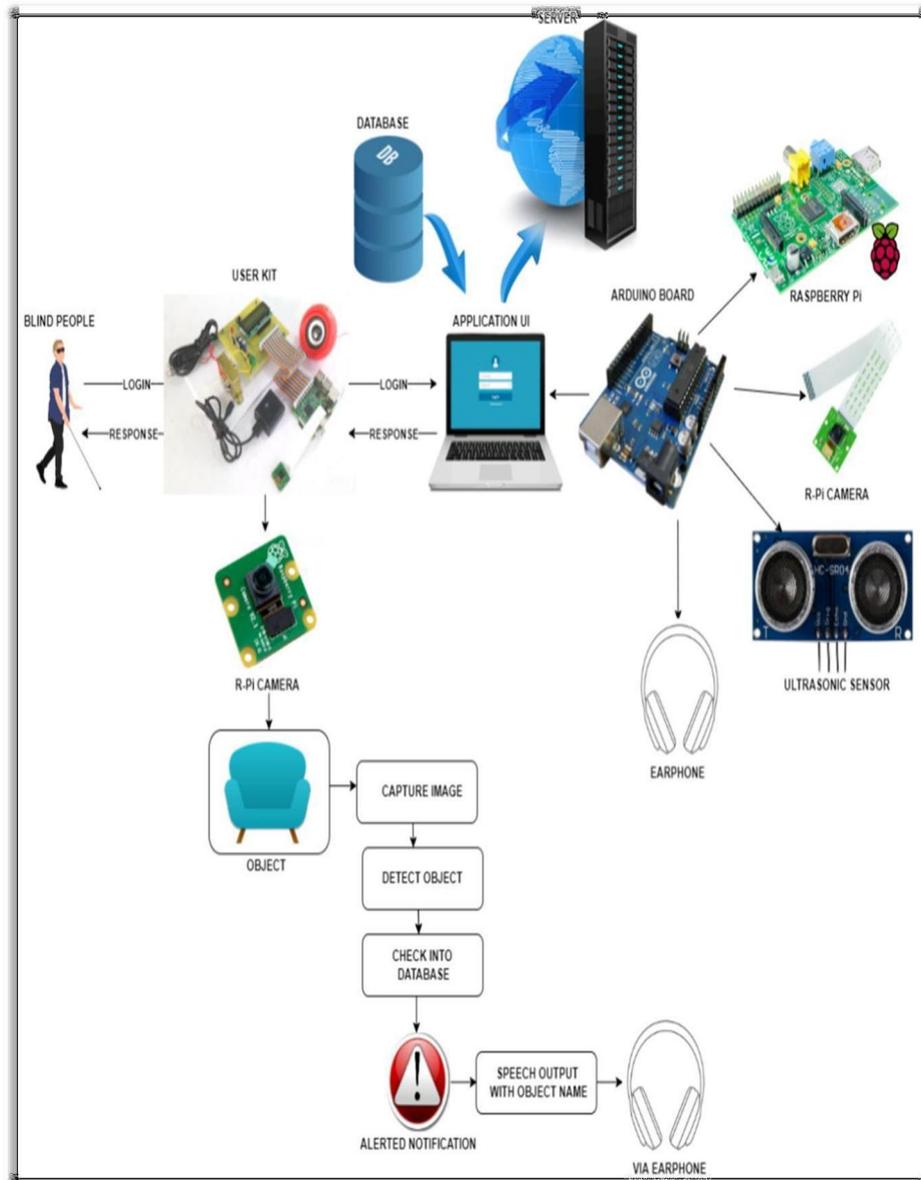
Fig: System Architecture

VII. HARDWARE & SOFTWARE REQUIREMENTS

Hardware requirements

1) Raspberry pi for computation and control
2) Pi camera for capturing live images
3) Ultrasonic sensor for obstacle detection
4) Earphones for voice output

Software requirements

1) Python programming language
2) Opencv library for image processing
3) Linux operating system

VIII. ADVANTAGES

1) Low-cost and portable design
2) Real-time object and obstacle detection
3) Easy to operate and user friendly
4) Enhances independence and confidence of blind users
5) Suitable for both indoor and outdoor navigation

IX. FUTURE SCOPE

Future enhancements may involve the incorporation of deep learning algorithms for better accuracy in object recognition. Gps navigation can be incorporated for outdoor navigation. Support for mobile applications and vibration feedback can be added for better usability and safety. Advanced ai algorithms can also be used for understanding the scene and navigation.

X. CONCLUSION

This project offers a trustworthy and affordable assistive system for the visually impaired using raspberry pi, pi camera, and ultrasonic sensors. Through the translation of visual information into audio feedback, the system offers artificial vision and improves independent mobility. The proposed system is efficient, effective, and has the potential to improve the lives of visually impaired individuals.

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REFERENCES

[1]. Ayat A. Nada, "Assistive Infrared Sensor Based Smart Stick for Blind People," Department of Computers and Systems, Electronics Research Institute, Giza, Egypt.

[2]. Arnesh Sen, Kaustav Sen, Jayoti Das, "Ultrasonic Blind Stick for Completely Blind People to Avoid Any Kind of Obstacles," Department of Physics, Jadavpur University, Kolkata, India.

[3]. S. Innet and N. Ritnoom, "An Application of Infrared Sensors for Electronic White Stick," University of the Thai Chamber of Commerce, Thailand.

[4]. Sharang Sharma, Manind Gupta, Amit Kumar, Meenakshi Tripathi, Manoj Singh Gaur, "Multiple Distance Sensors Based Smart Stick for Visually Impaired People," 2017.

[5]. Aladrén, G. López-Nicolás, Luis Puig, Josechu J. Guerrero, "Navigation Assistance for the Visually Impaired Using RGB-D Sensor with Range Expansion," IEEE Systems Journal, 2014.

[6]. Jinqiang Bai, Shiguo Lian, Zhaoxiang Liu, Kai Wang, Dijun Liu, "Smart Guiding Glasses for Visually Impaired People in Indoor Environment," IEEE Transactions on Consumer Electronics, Vol. 63, No. 3, August 2017, pp. 258–266.