KSCST STUDENT PROJECT SYNOPSIS

Project Proposal Reference No: **46S_BE_1545**

Project Proposal Title: **DEVICE TO AID THE VISUALLY IMPAIRED PEOPLE (USING ULTRASONIC SENSORS AND MACHINE LEARNING)**

College: **Sri Venkateshwara College of Engineering, Bengaluru**

Branch: **Department of INFORMATION SCIENCE AND ENGINEERING**

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INTRODUCTION:

Visually impaired individuals often face significant challenges when traveling independently, as they lack the support of others. Existing assistive devices often fail to meet their requirements in terms of affordability and level of assistance. Therefore, our project aims to introduce a new design for a wearable device that can provide multifunctional assistance while maintaining a low overall cost. The primary objective of this device is to detect obstacles and potential dangers in front of the user, promptly reporting them. It incorporates ultrasonic sensors capable of detecting obstacles within a predetermined range in all directions. Once an obstacle is detected, the device activates output devices, generating audio signals and vibrations to alert the user. To enhance obstacle detection capabilities and provide efficient assistance, we employ Machine Learning techniques. These algorithms aid in identifying obstacles and deliver real-time voice assistance to the user.

Additionally, our mobile application provides real-time updates on public transportation, object detection, currency recognition, and other relevant information to aid navigation. Furthermore, this device holds promise in assisting the elderly population, as their vision tends to deteriorate over time. By addressing the challenges faced by visually impaired individuals, our project seeks to improve their safety, independence, and overall quality of life. With the potential to revolutionize the way visually impaired individuals navigate their surroundings, our project strives to bridge the gap between technological advancements and the specific needs of this user group. By addressing the limitations of existing devices in terms of cost and functionality, our project aims to empower users with greater independence and confidence during their daily activities.

OBJECTIVES

- Develop a device that can detect obstacles or any potential danger in front of the user and promptly report them.
- Incorporate ultrasonic sensors to accurately detect obstacles within a predetermined range in all directions.
- Activate output devices to generate audio signals and vibrations that alert the user when an obstacle is detected.
- Utilize Machine Learning techniques to assist in identifying obstacles and provide voice assistance to the user.
- Provide important features like currency detection, remainders & text to speech to assist the user in their daily activities using a mobile application.
- Extend the usability of the device to assist the elderly population, whose vision tends to deteriorate over time.

By achieving these objectives, our project seeks to enhance the safety and independence of visually impaired individuals, while also considering the specific needs of the elderly. The integration of ultrasonic sensors, Machine Learning algorithms, and a comprehensive mobile application creates a versatile and user-centric solution that addresses the limitations of existing assistive devices.

METHODOLOGY

Our methodology involves a combination of software development, machine learning, and hardware integration to create a comprehensive solution for visually impaired individuals. Here are the key steps and methods we will be implementing:

Mobile Application Development: The development of a mobile application that serves as the user interface for various features. This application is developed using relevant programming languages and frameworks, integrating Google voice assistant and maps APIs.

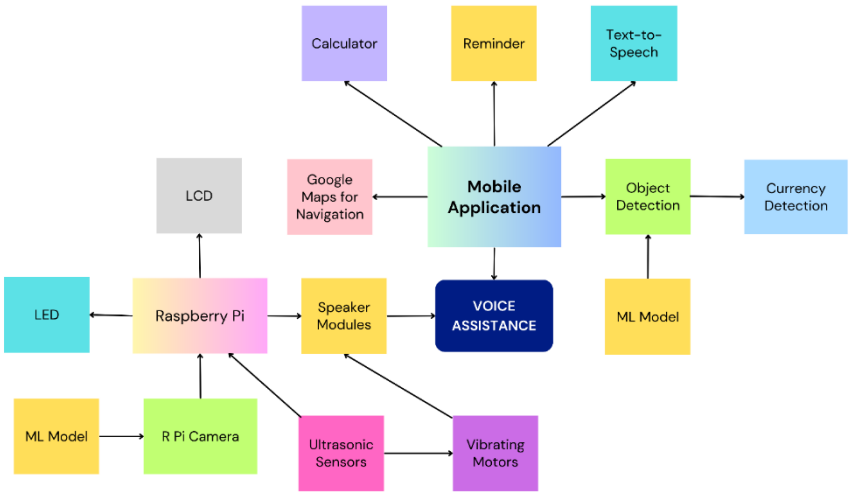
Voice-Activated Destination Guidance: The application will process the user's input and provide audio instructions for navigation, leveraging the maps API to guide the user along the optimal route.

Object Detection using YOLOv5: To detect obstacles and potential dangers in real-time, we have trained the YOLOv5 real-time object detection algorithm.

Hardware Integration: The hardware components required for the wearable device will be integrated into a Raspberry Pi. This compact and portable setup will serve as the core of the device, housing the necessary components.

Testing and Iteration: We will conduct rigorous testing of the wearable device at various stages of development. This includes testing the accuracy and efficiency of the object detection algorithm, evaluating the responsiveness of the audio signals and vibrations.

By following this methodology, we aim to create a robust and user-friendly wearable device that addresses the specific challenges faced by visually impaired individuals.



RESULT AND CONCLUSION

The proposed solution utilizes ultrasonic sensors, vibrating motors, as well as YOLOv5 algorithmic models, which could empower people with visual impairments to travel on their own in a secure and safe manner. By detecting obstacles, issuing auditory instructions, and allowing communication with guardians in case of emergencies, the system provides a complete solution for visually impaired individuals to navigate their environment without depending on others. The results of the machine learning model for detecting potholes, staircases and other common objects were highly promising. The model achieved a high accuracy rate of over 95% in accurately identifying these obstacles. The precision and recall values were also satisfactory, indicating that the model had a good balance between correctly detecting the obstacles and minimizing false positives or false negatives. The device's application of the machine learning model for detecting potholes and staircases in real-time scenarios proved effective and efficient. By leveraging the power of computer vision and machine learning, visually impaired individuals can now be alerted to the presence of these potential hazards, enabling them to navigate their surroundings safely and with greater confidence.

SCOPE FOR FUTURE WORK

While our project aims to address the challenges faced by visually impaired individuals and provide a comprehensive solution, there is still significant scope for future work and enhancements. Some potential areas for further development include:

Enhanced Obstacle Detection: Improve obstacle detection algorithms using advanced machine learning techniques like deep neural networks for better object recognition and classification.

Advanced Navigation Features: Integrate indoor mapping, and real-time updates on hazards, road conditions, and construction sites into the mobile application.

Integration with Smart Home Technology: Extend the wearable device's functionality to integrate with smart home technology, providing additional support for visually impaired individuals.

Collaborative Obstacle Mapping: Implementing a collaborative obstacle mapping system can help create a crowdsourced database of obstacles and hazards. Users can contribute information about obstacles they encounter, which can be shared with other users in real-time.