NEXUS 4

SMART SPECS

FOR VISUALLY IMPAIRED PEOPLE

Ishan Jiji George
Jishin Bijumon
Jeny Joseph
Manuel James

INDEX

Introduction

Smart Specs for the Blind are an assistive device that employs image detection and signal processing to analyze the user's surroundings. They provide real-time audio feedback, informing visually impaired individuals about obstacles and environmental features. This technology enables users to navigate confidently and safely, both indoors and outdoors, fostering greater independence. By translating visual data into auditory cues, Smart Specs offer a practical and innovative solution to enhance mobility and accessibility for the visually impaired.

Project Overview

The aim of this project is to create Smart Specs, a compact, wearable device integrating the ESP32 microcontroller, booster module, charging module, audio amplifier, and audio output. These smart glasses are designed to enhance accessibility, communication, and entertainment through features like wireless connectivity, efficient power management, and high-quality audio feedback.

Literature Survey

- The paper “*An IoT-based Vision Alert for Blind Using Interdisciplinary Approaches*” explores an IoT-based system that assists visually impaired individuals by integrating various technologies such as computer vision, sensors, and real-time data processing.The research highlights interdisciplinary approaches, likely combining image processing with audio/haptic feedback.

- The paper "*Smart Navigation for Visually Impaired People using Artificial Intelligence*" by Rajvardhan Shendge, Aditya Patil, and Siddhi Kadu focuses on assistive technology for visually impaired individuals. It introduces a system that uses live object recognition to help users navigate their surroundings independently

- The paper “*Obstacle Detection for Visually Impaired Using Computer Vision”* explores how computer vision can be applied to assist visually impaired individuals by detecting obstacles and providing real-time feedback. This is highly relevant because it shares common goal of enhancing navigation and awareness for visually impaired users.

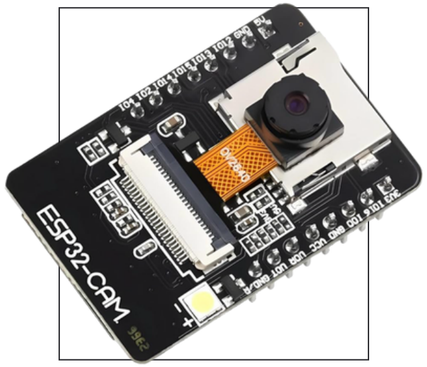
- The paper "*Smart Blind Glasses Using OpenCV Python*" by B.S.S.V. Ramesh Babu and colleagues focuses on developing assistive smart glasses for visually impaired individuals using OpenCV and Python. It utilizes OpenCV for tasks like object detection and text recognition. You can incorporate similar techniques in your smart specs to provide real-time assistance, such as identifying objects or reading text aloud.

- The paper "*AI Enhanced Arduino Based Customized Smart Glasses for Blind People Integrated with Speech Synthesis*" by Y. Rajesh and colleagues explores the development of smart glasses for visually impaired individuals using AI and Arduino technology

METHODOLOGY

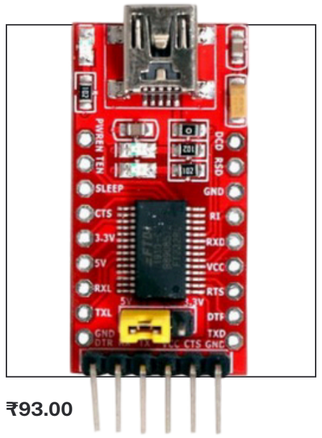
- The Smart Specs for the Blind comprise hardware components such as the ESP32 microcontroller, camera module, FTDI module, display output system, and power source.
- The software employs OpenCV for image processing. The data processing involves capturing images, analyzing them through a pre-trained model, and converting the results into voice feedback, thus assisting visually impaired users in navigating their environment safely.

KEY COMPONENTS USED



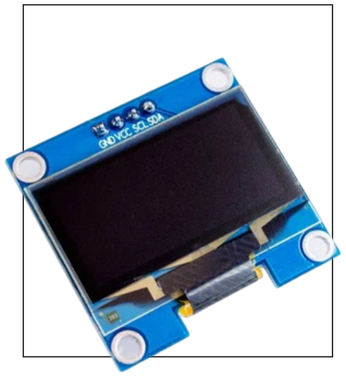
₹522.00

ESP-32 with CAM



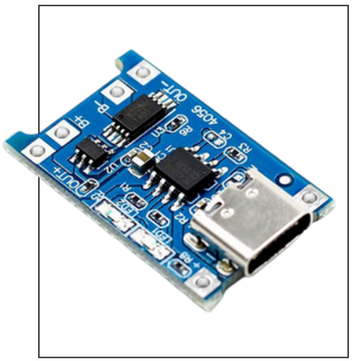
₹93.00

FTDI Module



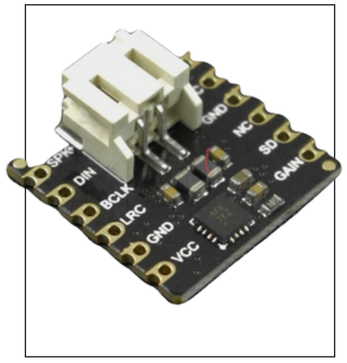
₹139.00

OLED Screen



₹150.00

TP4056 Module

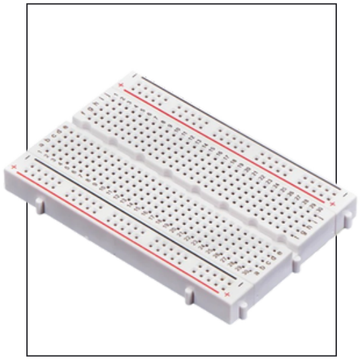


₹527.00

MAX98357 Amplifier

₹550.00

Lithium Ion Battery 3.7v



₹100.00

BreadBoard

₹150.00

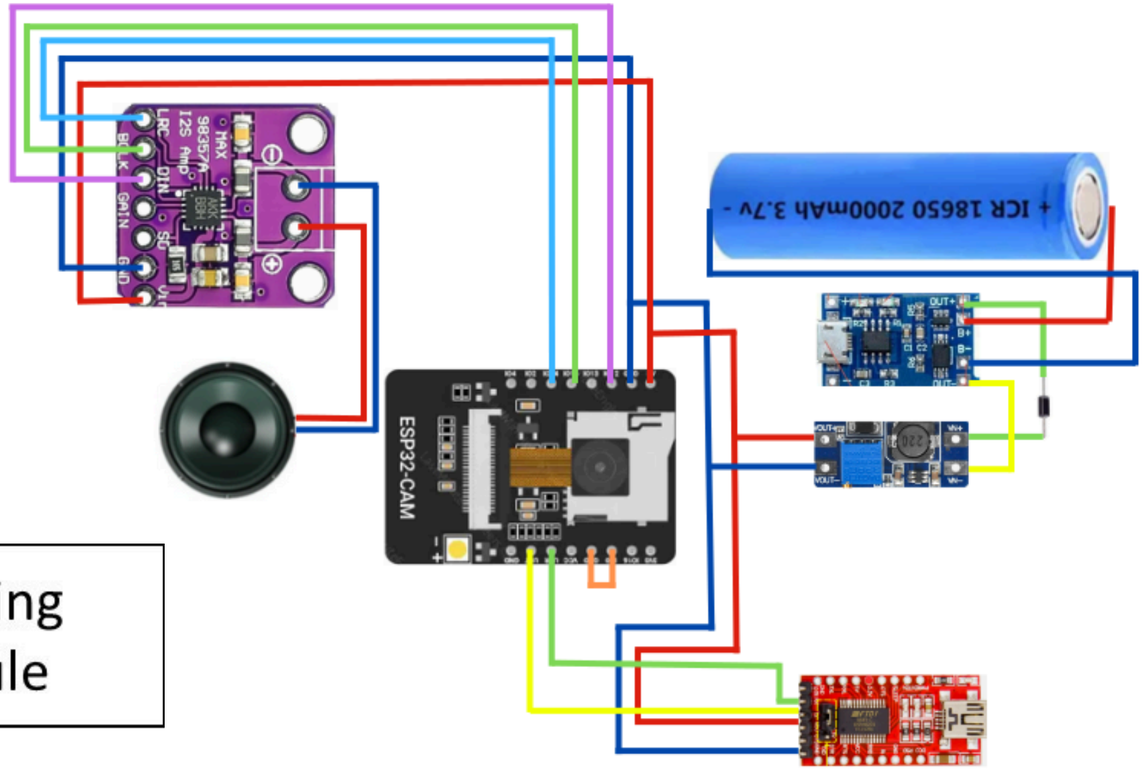
Booster Module

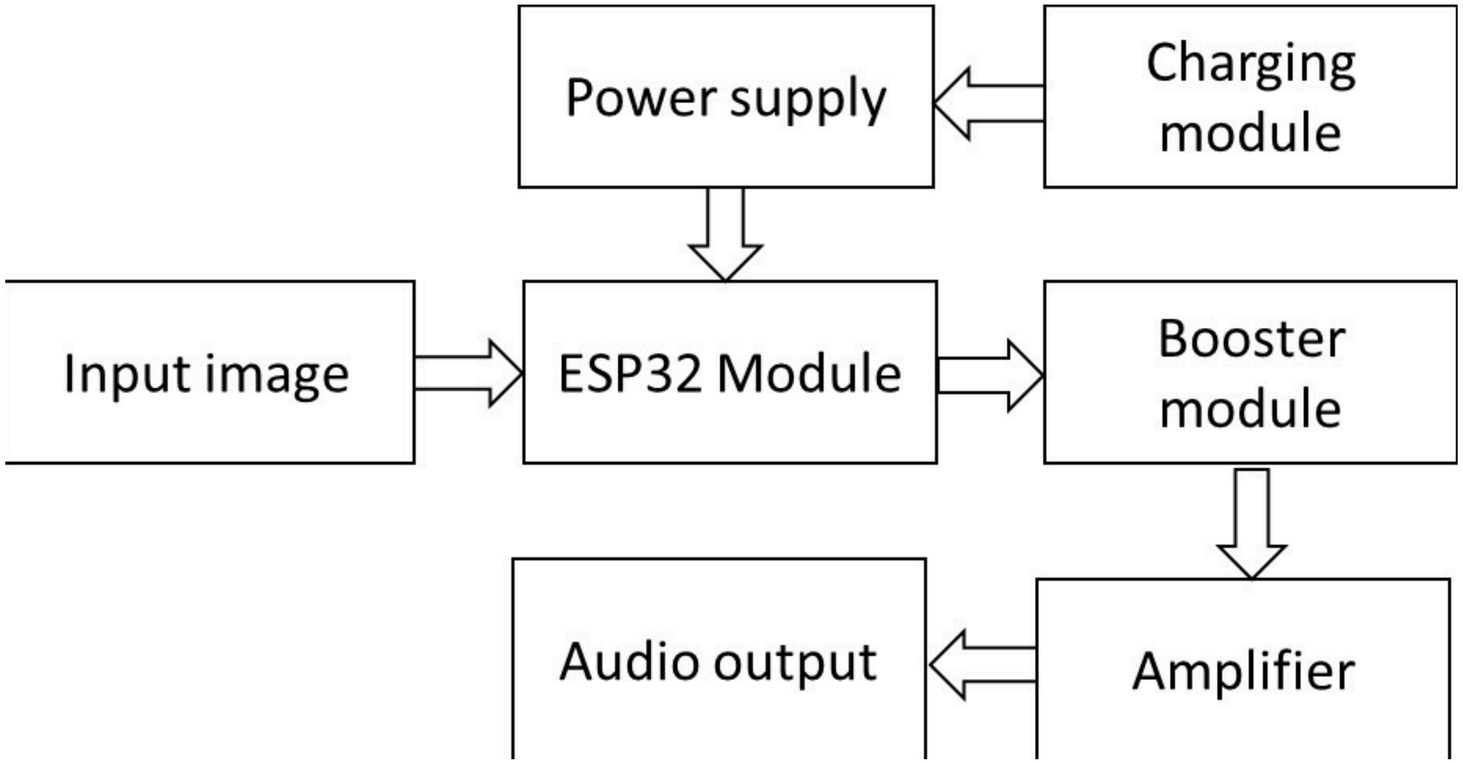
₹150.00

Speaker Module

BUDGET : ₹2000.00

BLOCK DIAGRAM





CIRCUIT DIAGRAM

WORKING

Image Capturing

- The ESP32-CAM module captures real time images through its built-in camera.
- The captured frames are processed using an Edge Impulse-trained machine learning model deployed on the ESP32-CAM.
- The model detects objects and assigns labels to recognized items.

Object Detection and Conversion

- Once an object is detected, the ESP32 microcontroller converts the label into a digital signal (text representation of the detected object) and the digital text is processed into an audio signal .

- The generated audio signal is amplified using a amplifier(MAX98306) to ensure clear sound output.

Power Management

- A rechargeable battery (2000mah 3.7V) powers the ESP32-CAM, amplifier, and speaker to ensure portability and continuous operation.

Speaker Output

- The amplified audio is fed into a small speaker (3Ω,5V) mounted on the smart specs.
- The user hears the spoken name of the detected object, helping them recognize their surroundings.

Testing & Debugging

- Test object detection efficiency in different lighting conditions. Check audio supplies. Optimize power consumption for extended battery life.

TIMELINE

WEEK0

selected the team member’s for mini project and discussed on new innovations that we can change in the society

WEEK1

find out that we can help the blind persons and hence we found out on our project for them .
Initial plan is to make a sensitive blind stick for visually impaired people.Hence,
we researched detailed on our topic.

WEEK2

we make review 0 infront of Agi sir and Theresa miss and they suggest to refer Dr. abubaker sir for more reference. under his guidance we make change in our plan from blind stick to blind specs,due to its wide applications.

WEEK3

After detailed searches and references we finalize our topics and ordered our components
also we submit our plan for YIP idea submission as NEXUS 4

WEEK4

waiting for our components to be delivered.
From week 4 ,we started preparing paper presentation.

TIMELINE

WEEK5

the components we placed order are delivered and started assembling and collected all the information for paper presentation

WEEK6

we made our review 1 and suggested for applying for patent application but planned it for next year as we required a detailed research on our topic.

WEEK7

we selected sustainable development goals such as,
1.Good Health and Well being.
2. Reduce inequality.
as per the suggestion for our project from Agi sir.

WEEK8

we try fixing some components and we try to troubleshoot our coding error, but not able to correct it.

WEEK9

Due to the continuous error occuring on coding,we tried rewiring our circuit.Later ,we found that due to driver issue,the code was not able to read in ESP32 module and we seek help from abubekar sir and suggested to get a new FTDI module.

TIMELINE

WEEK10

By the time ,we completed our paper work and submited to theresa miss for checking plagarism and we tried trouble shooting the error in all possible ways and finally we ended up with the conclusion for taking another ESP 32 module.

WEEK11

we got our plagarism checking result,which was 11% of plagarism and modified the paper report and uploaded it again.

EXPECTED IMPACT & BENEFITS

Improved Awareness
Helps users detect and recognize objects in their surroundings.

Obstacle Avoidance
Alerts users about nearby obstacles, preventing accidents.

Real-Time Feedback
Provides instant audio or vibration alerts for detected objects.

Lightweight & Wearable
Ensures ease of use for daily activities.

Affordable Assistive Solution
Cost-effective compared to high-end smart glasses.

Scalable for Future Upgrades
Can integrate AI, Braille translation, and GPS in later versions.

CONCLUSION

In conclusion, the ongoing development of Smart Specs for the Blind using the ESP32 module demonstrates significant progress in creating an accessible and efficient assistive device. By integrating the ESP32 microcontroller with image processing and sensor-based technologies, the project aims to offer real-time audio feedback, ensuring safe and independent navigation for visually impaired users.

FUTURE SCOPE

Raspberry Pi Integration

Enhances processing power, enabling real-time object detection, facial recognition, and OCR-based text reading.

Enhanced Object Detection

Uses YOLO, Edge Impulse, and cloud-based AI for better accuracy and real-time scene understanding.

Braille-to-Audio Translation

Converts Braille text into speech using OCR and multi-language text-to-speech (TTS).

GPS Navigation Support

Provides voice-guided directions, obstacle alerts, and emergency SOS features for outdoor mobility.

References

Youtube Channels

https://www.youtube.com/watch?v=A1SPJSVra9I

https://www.youtube.com/watch?v=NcJRb40dYc40

https://youtu.be/bZIKVaD3dRk

Websites

https://github.com/TareDevarsh/distance_fromcamera/blob/master/dist_measure.py

https://how2electronics.com/esp32-cam-based-object-detection-identification-with-opencv/

Thank you!

ANY QUERIES!!!