INTERNET OF THINGS - IT23A31

PROJECT

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OBJECTIVE

Our project aims to create a smart wearable obstacle detection system using an ESP32-CAM microcontroller, ultrasonic sensor, and audio feedback. The system detects nearby obstacles and objects, using both ultrasonic sensing and real-time image analysis via the onboard camera. It provides auditory warnings and object identification to the user, with customizable voice alerts in multiple languages. This enhances situational awareness, safety, and independence, especially for visually impaired individuals

SHADOWSENSE

IOT INTEGRATED OBSTACLE DETECTION CAP FOR THE VISUALLY IMPAIRED
SMART NAVIGATION WITH AUDIO GUIDANCE

EXISTING SOLUTIONS FOR OBSTACLE DETECTION FOR THE VISUALLY IMPAIRED

- WeWalk Smart Cane – A smart walking stick that helps detect obstacles using sensors and gives voice instructions through a mobile app. It doesn't tell what the object is.
- OrCam MyEye – A small camera attached to glasses that can read text, recognize faces, and speak out what it sees. It's helpful but very expensive.
- UltraCane – A high-tech cane with sensors that vibrate when something is in the way. It helps avoid obstacles but doesn't say what they are.
- Envision Glasses – Smart glasses that can read text and recognize objects, people, and places, then describe them through audio. It's useful but costly.
- Seeing AI App – A free phone app that uses your phone's camera to read text, recognize people and objects, and speak out loud. You have to hold your phone and it needs the internet for some features.

PROPOSED SOLUTION: SMART CAP FOR THE VISUALLY IMPAIRED

An ultrasonic sensor on the cap checks if there's something in the way (up to 50 meters ahead).

If it finds something, it sends a signal to a small camera (ESP32-CAM) on the cap to take a picture.

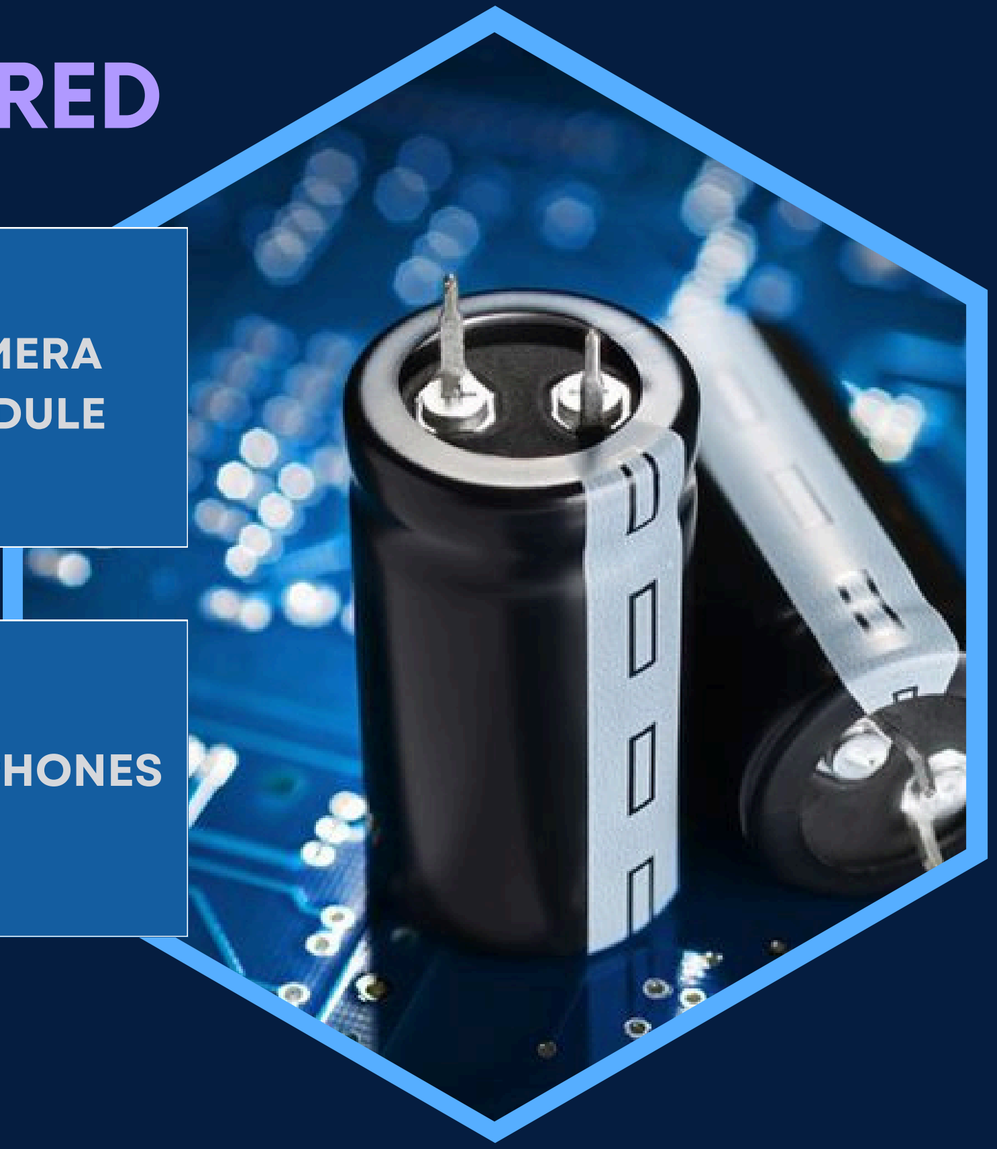
This picture is sent wirelessly to a laptop, where a smart AI model called YOLO (You Only Look Once) checks the picture and identifies the object — for example, a person, car, or table.

After that, the system plays a voice alert using a small audio player (DFPlayer Mini) and headphones, saying things like "Person ahead" or "Car in front," so the user knows what's there.

The whole system is wireless, small, and built into a wearable cap, making it easy to use without holding anything.

COMPONENTS REQUIRED

ULTRASONIC SENSOR	ESP32	CAMERA MODULE
DF PLAYER	BATTERY	HEADPHONES



CONCLUSION

The proposed smart cap presents an innovative and efficient assistive solution for visually impaired individuals, integrating real-time obstacle detection, object classification, and voice-based alerts into a compact wearable device. By leveraging the ESP32 microcontroller, ultrasonic sensing, wireless communication, and YOLO-based AI processing, the system offers a significant advancement over traditional aids by not only detecting obstacles but also identifying and communicating their nature to the user. Its hands-free design enhances user mobility and situational awareness, promoting greater independence and safety.
This solution demonstrates the potential of combining embedded systems and artificial intelligence in low-cost, practical applications. Future enhancements will focus on reducing processing latency, enabling on-device AI, and incorporating mobile app support for personalized user experiences.