Boston University
Electrical & Computer Engineering
EC463 Capstone Senior Design Project

Test Report

Visually Impaired AI Wearable

By

Team #32
Mimir

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Required Materials

Hardware:

- Raspberry Pi 5
- Raspberry Pi Camera
- LiDAR Camera
- Bluetooth Connected Speaker
- Battery Pack
- 3D Printed Enclosure
- Mini-sized USB Microphone

Software:

- Python
- OpenAI API
- DepthAI SDK
- Vosk Model Small Offline Speech Recognition
- Text-toSpeech Engine (pyttsx3)

Set Up

The equipment and setup are divided into 3 key components: the Raspberry Pi, the Software Pipeline, and the additional devices such as the battery terminals.

Raspberry Pi:

1. Flash Raspberry Pi OS (Lite or Desktop) onto microSD using Raspberry Pi Imager
2. Enable I2C, SPI, and Camera Interfaces via raspi-config
3. Attach OAK-D Lite to USB3 port
4. Pair Bluetooth speaker
5. Install all required libraries: depthai, vosk, openai, pyttsx3, opencv-python, numpy
6. Attach the battery pack to the 40-pin header stack

Voice Activation System:

1. Microphone input is monitored with Vosk
2. Recognize commands such as “track”, “analyze”, or “liquid” trigger specific locked-out functions
3. Run Ollama ContainerAudio feedback is disabled during active listening to avoid re-triggering voice input

Function Descriptions

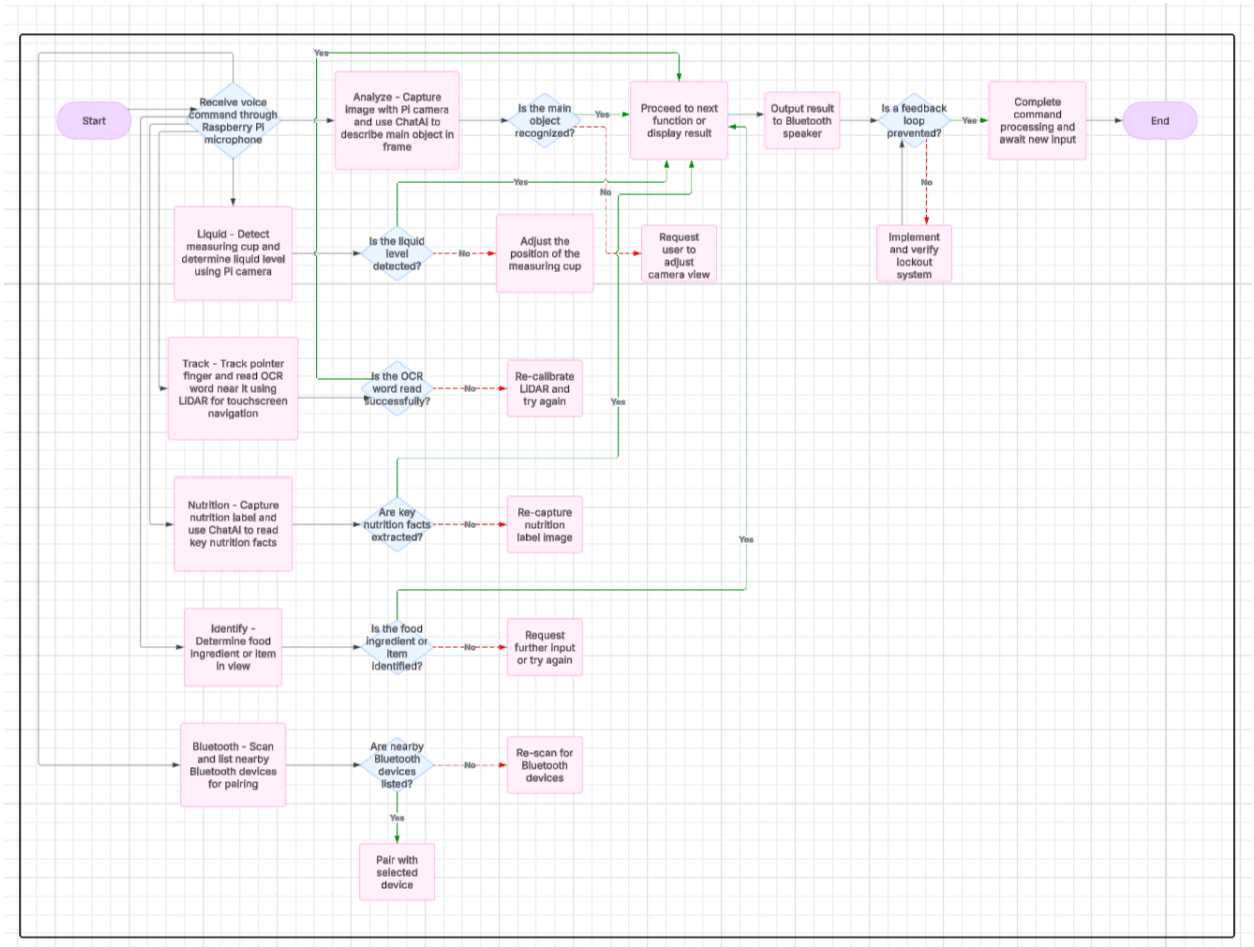
- Analyze - captures image using the pi camera and uses ChatAI to describe the main object in the frame
- Liquid - detects measuring cup and determines liquid level using the pi camera
- Track - Tracks pointer finger and reads OCR word near it (touchscreen navigation)
- Nutrition - captures nutrition label and uses ChatAI to read key nutrition facts

- Identify - determines the food ingredient or item in view
- Bluetooth - scans and lists nearby Bluetooth devices for pairing
- Echo - responds with “echo” for debugging and testing voice loop

Pre-testing Setup Procedure:

1. Each function is individually initialized using wake words
2. Pi logs which function is active and enters lockout mode for accurate function isolation

System Block Diagram:



Testing Procedure:

1. Initialize device
2. Speak function keyword
3. Perform function-specific execution
4. Voice unlock where system resumes idle state for next voice command

Measurable Criteria:

The criteria for successful running and output is as follows:

1. The Raspberry Pi should be able to capture an image, have it processed by OCR, and have the output converted to a wav file
2. The Pi should be able to capture an image and have it processed by LlaMa and have the output converted to a wav file
3. The LiDAR camera should accurately track the movement and position of one's hands.
4. The script will process the nearby words to the indWex fingertip and read it back to the user.

Score Sheet:

Command	**Successful**
Analyze	**Y**
Identify	**Y**
Liquid	**Y**
Bluetooth	**Y**
Nutrition	**Y**
Track	**Y**
Echo	**Y**