Environment Awareness for Low-Vision Patients

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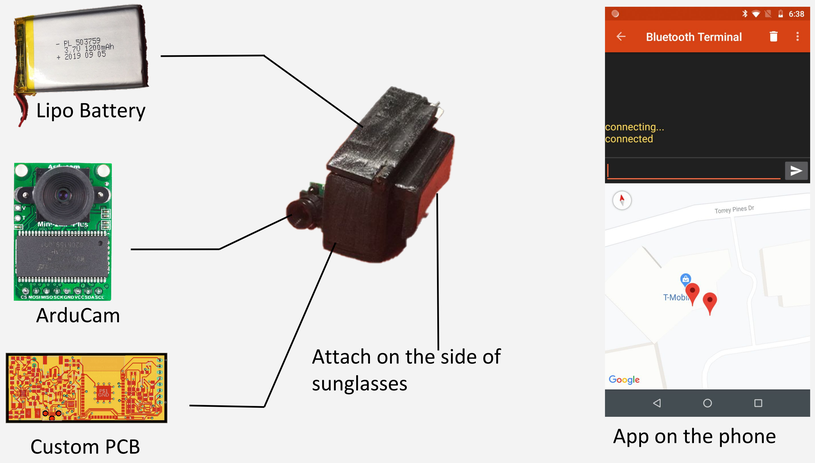
Background

Low vision patients face innate disadvantages when acclimating to their environment. To identify one's environment, one must understand both the global context (where they are in the world), and the local context (objects around them). Although patients can use GPS to understand their global context, they must rely on their senses and on people around them to understand their local context. IntelliSight aims to solve this problem by developing a pair of sunglasses that combines visual information from a camera, orientation information from an IMU, and location information using GPS to relay an immersive, in-depth understanding of the user's surroundings.

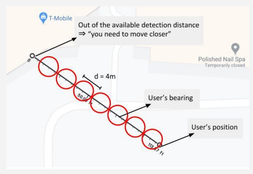
Overview

The smart sunglasses are equipped with an ESP32 MCU which collects data from the IMU sensor and camera and transmits it to an Android phone over Bluetooth. The phone then combines this information with the built-in GPS, and uses computer vision and maps information to identify the buildings and physical objects around the user. Lastly, the system relays this information to the user over voice. The user can interact with the system using head gestures such as nodding or shaking.

Final Product



Functionality



- The IMU detects the user's current bearing within the global coordinate system
- The app scams in increments of 4m along the user's bearing and find the closest landmark within 27m.

- The arduCAM sends a 320x240 image to the TensorFlow Lite classifier on Android
- The classifier can then dictate the probable objects above a certain threshold of likelihood
- Specific locations are possible with improved models

Hardware Components

ESP32 Feather Board

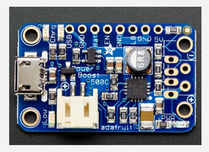
- Connects to phone via Bluetooth
- 240 MHz dual core microcontroller
- Onboard USB-to-Serial converter

BNO055 Inertial Measurement Unit

- Interface with ESP32 via I2C
- Collects user's orientation data
- Data used for gesture detection

ArduCam Mini 2MP

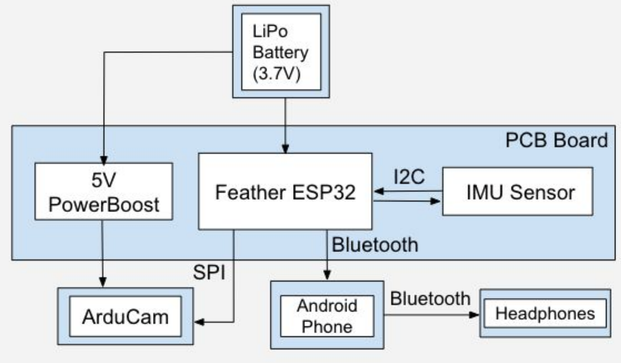
- Captures images of nearby objects
- Operating Voltage: 5 V, 70 mA
- Interface with ESP32 via SPI



PowerBoost 500 Charger

- Converts 3.7 V to 5 V
- Charges the LiPo Battery and
- Power the camera

Block Diagram



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