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.

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

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Hardware Components
- ESP32 microcontroller
  - 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

Printed Circuit Board
ESP32 MCU, BNO055 IMU, PowerBoost 500C, and ArduCam

Block Diagram