

Team D3: Theia



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What is Theia?

Pedestrians regularly use headphones, limiting their awareness of their surroundings

Our goal is to give these pedestrians information about what they do not see, enabling them to be more aware and reducing the risk of unexpected encounters and collisions

Theia is a piece of wearable technology that detects objects approaching from behind and alerts the user



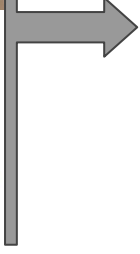
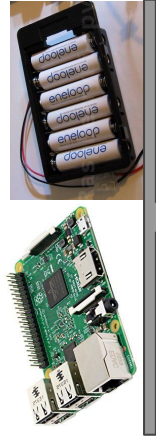


Solution Area

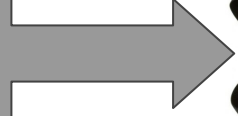
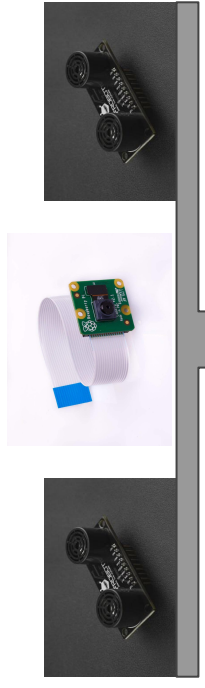
- » Detect approaching objects 8-10m away
- » Differentiate between pedestrians, bikers, and cars
- » Alert user within 5 seconds via headphones
- » Limited to daytime, clear weather conditions, objects coming from straight behind, and user traveling in a straight line



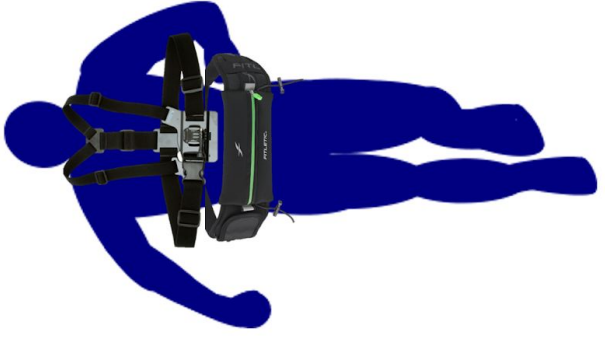
Theia Wearable



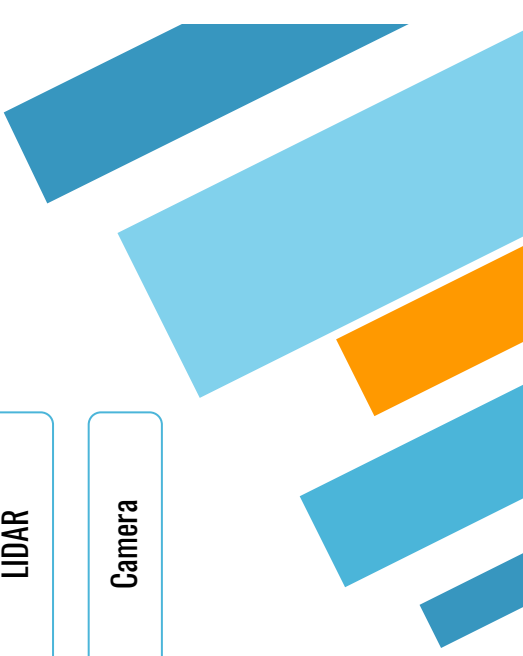
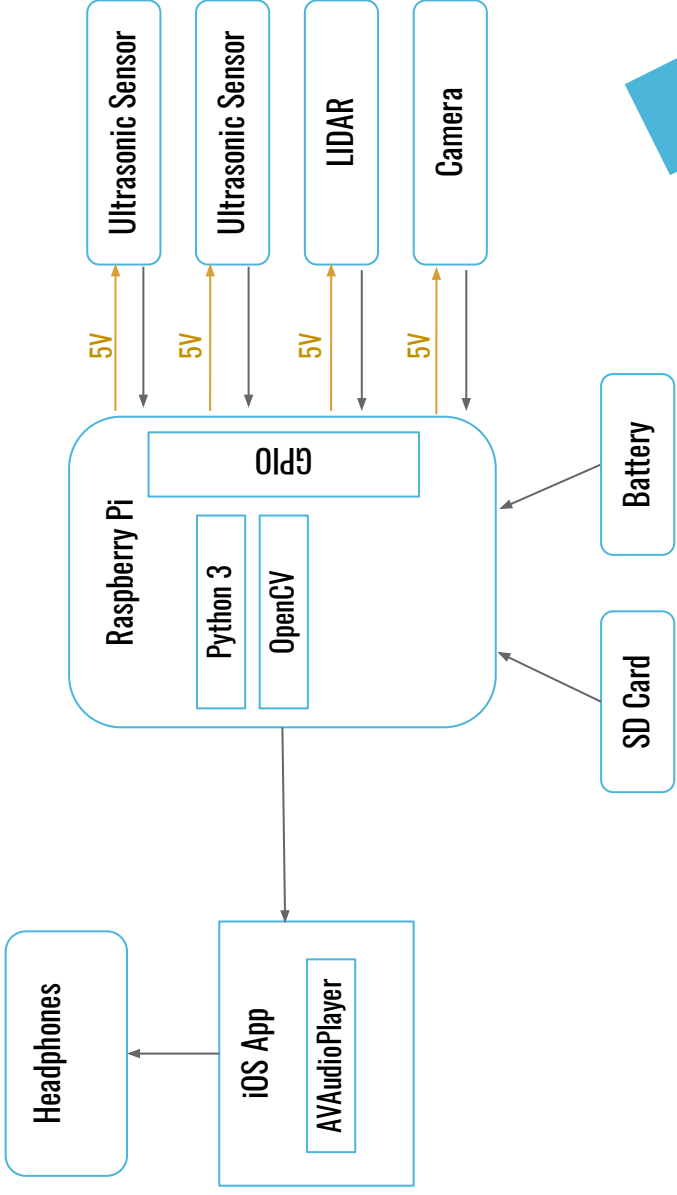
Max mass: 562 g



Max mass: 163 g

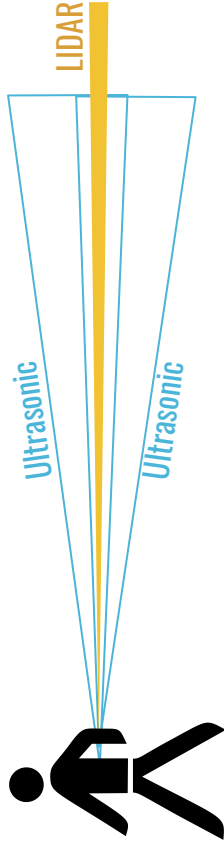


Block Diagram



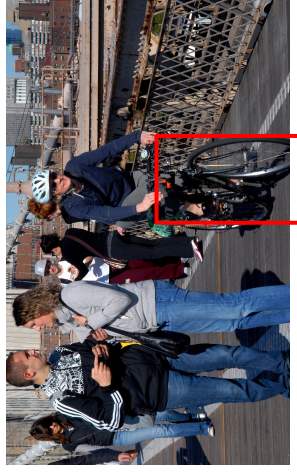
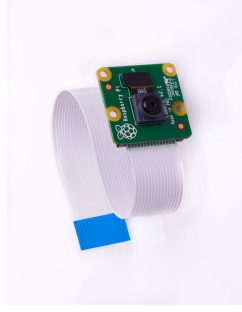
Ultrasonic & LIDAR Sensors

- » Off the shelf sensors: 2 URM37 V5.0 Ultrasonic Sensors and 1 TFMini Micro LiDAR Sensor
- » Interface with Raspberry Pi
- » Look at sensors in conjunction to minimize noise



Camera & Object Recognition

- » Use OpenCV to extract features from image
- » Use k-Nearest Neighbors algorithm to pick most likely object based on features
- » Training data from internet



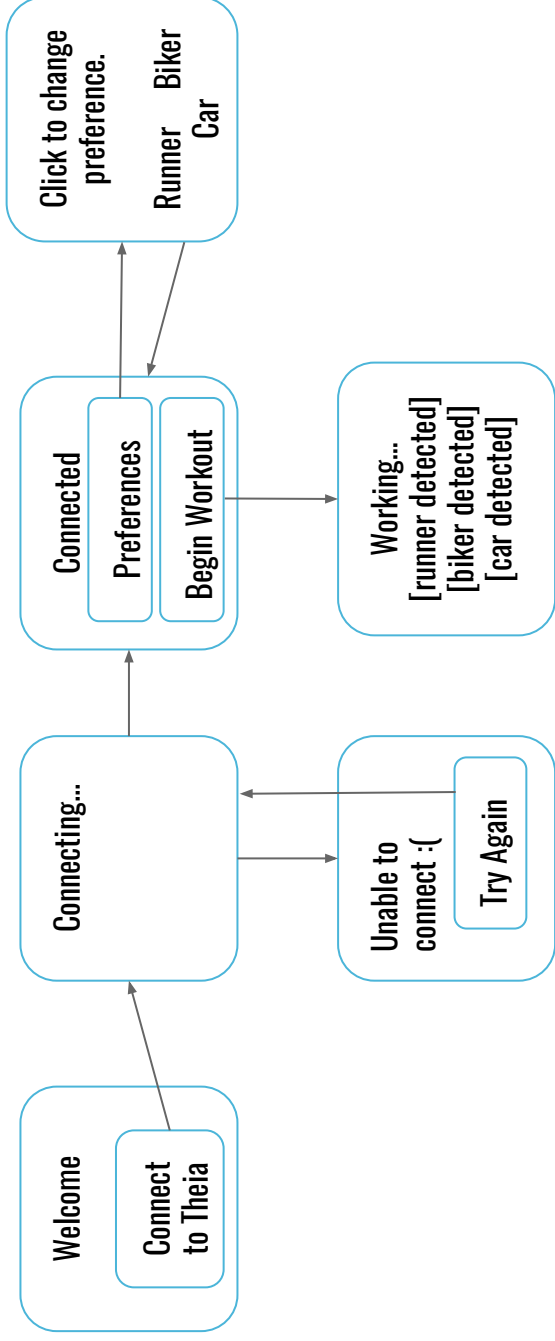


iOS Application

- » Connect to Raspberry Pi via Bluetooth and turn on wearable/set preferences
- » Listen for information from wearable
- » Communicate information to user's headphones
- » Pause for 3 seconds before next alerting user



iOS Application UI Diagram





Validation

Detect objects 1-10m away with 90% accuracy

- » Unit testing: each sensor individually detects at least 85% of approaching objects

Differentiates car/biker/pedestrian with 50% accuracy

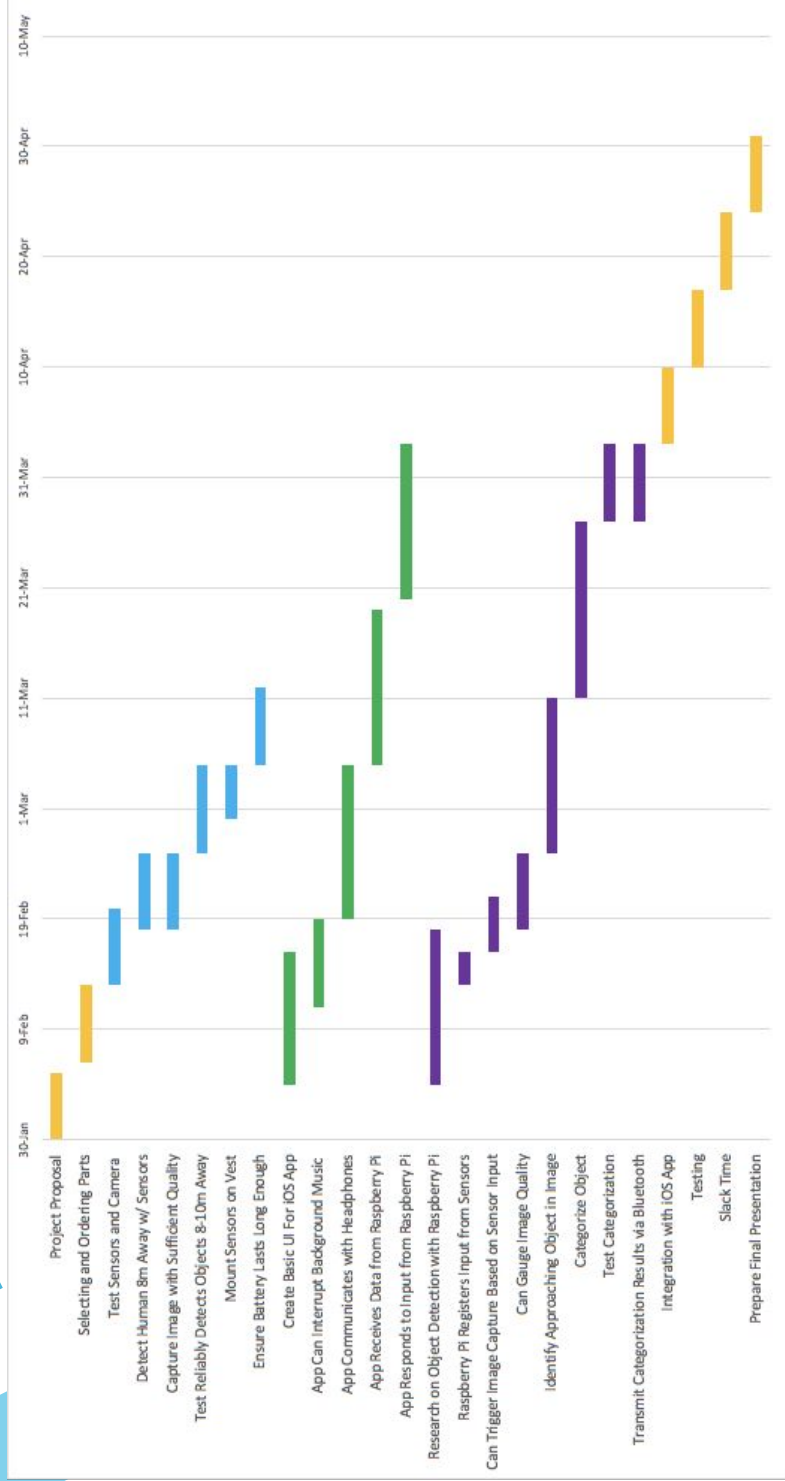
- » Training with images, then real world testing

While running, battery should last at least 45 minutes

Robust, user-friendly iOS app



Schedule



Will

Alli

Evan

Together

