18-500: Project Proposal Presentation

# THEIA

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# Introduction

A piece of wearable technology for walkers and runners, attached to the back of a vest

Designed for people who like to run/walk with headphones

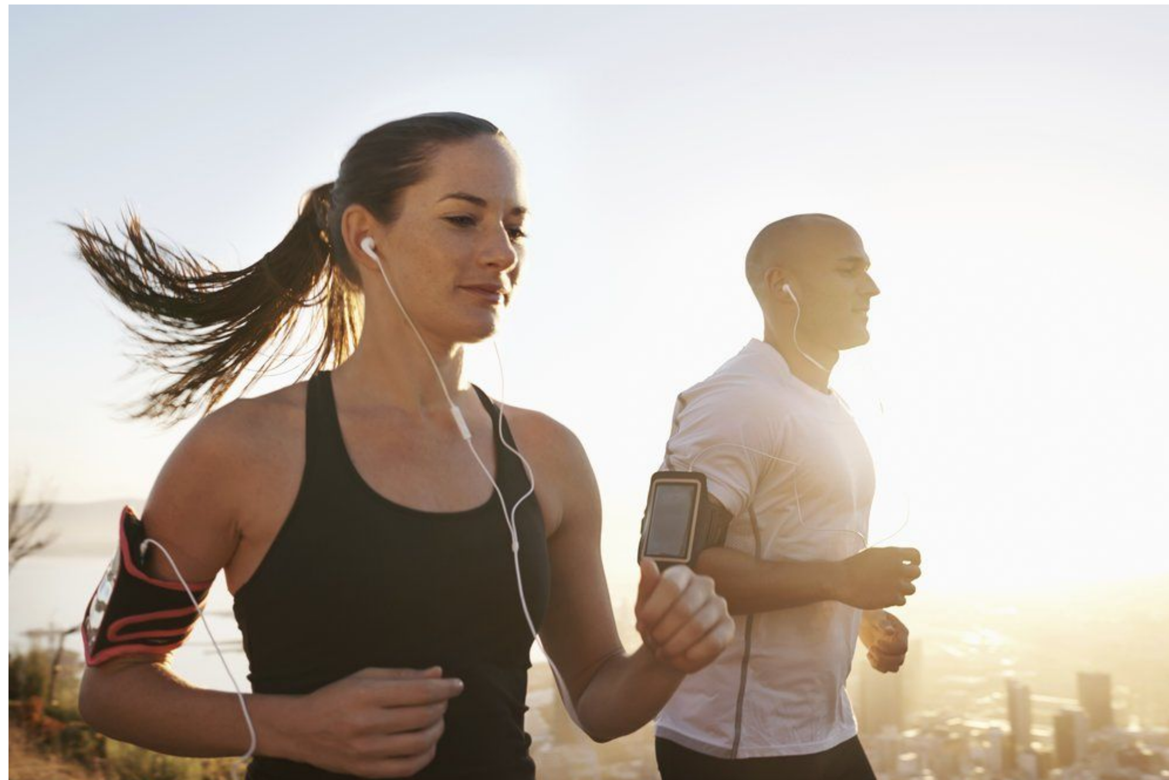
Acts as a “third eye” for a pedestrian on their back

# Use Cases

Allow pedestrians to safely listen to music and be aware of their surroundings

Informs user of cars, bikes, and other pedestrians approaching from behind through headphones

ECE Areas: Software Systems, Signals Processing



# Requirements

Distance: detect objects 8-10m away

Accuracy: >70% object recognition classification (Pedestrian, Car, Bike)

Speed: <3 seconds

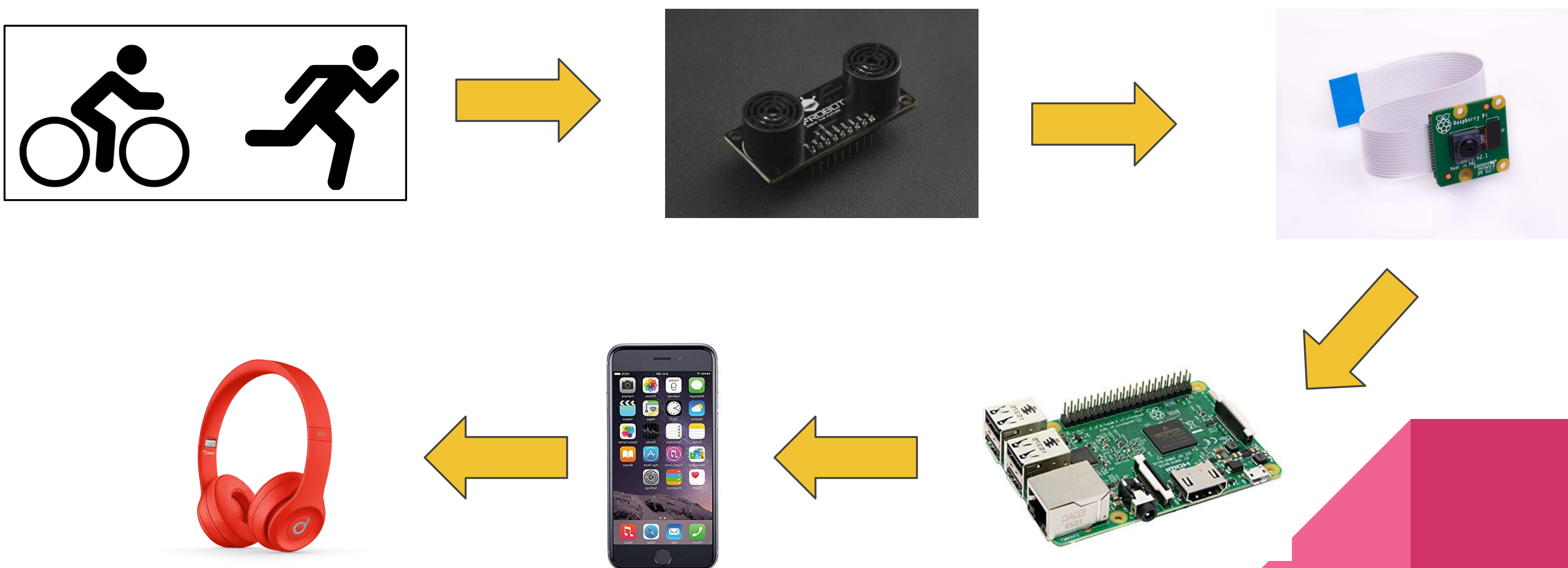
Weight: <300g

Power: Battery operated one use case

# Challenges

- Sensor capture quality/reliability
  - User’s movement impairs image quality
  - Sense objects 8-10m distance away without too much noise
- Minimizing latency
- Sustaining battery

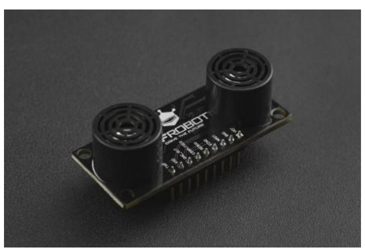
# Approach (Pipeline)



# Approach (Sensors)

Ultrasonic sensors trigger camera to reduce compute power

May switch to a Lidar approach if the ultrasonic sensors prove insufficient for our distance requirements



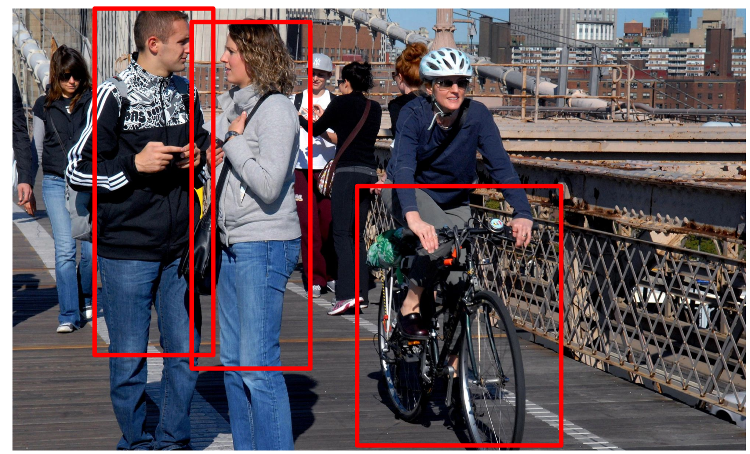
URM37 V5.0 Ultrasonic Sensor

LIDAR-Lite v3 Sensor

# Approach (Object Recognition)

Most likely will need to attempt several Object Recognition approaches to meet the latency and accuracy requirements.

- OpenCV with Python
- Machine Learning Algorithms
  - k-NN or SVM
  - Deep Learning



# Approach (iOS Application)

Set up and handle bluetooth communication with Raspberry Pi

Communicate with headphones and potentially other wearables (i.e. watch)

Allow user to set their preferences for the wearable

Theia iOS

# Testing, Verification, and Metrics

Test if device matches our requirements

Controlled testing:

- Testing accuracy, latency, and distance
- Perform series of experiments with varying approaching objects, speed, and distance, and movement of user

Real world testing:

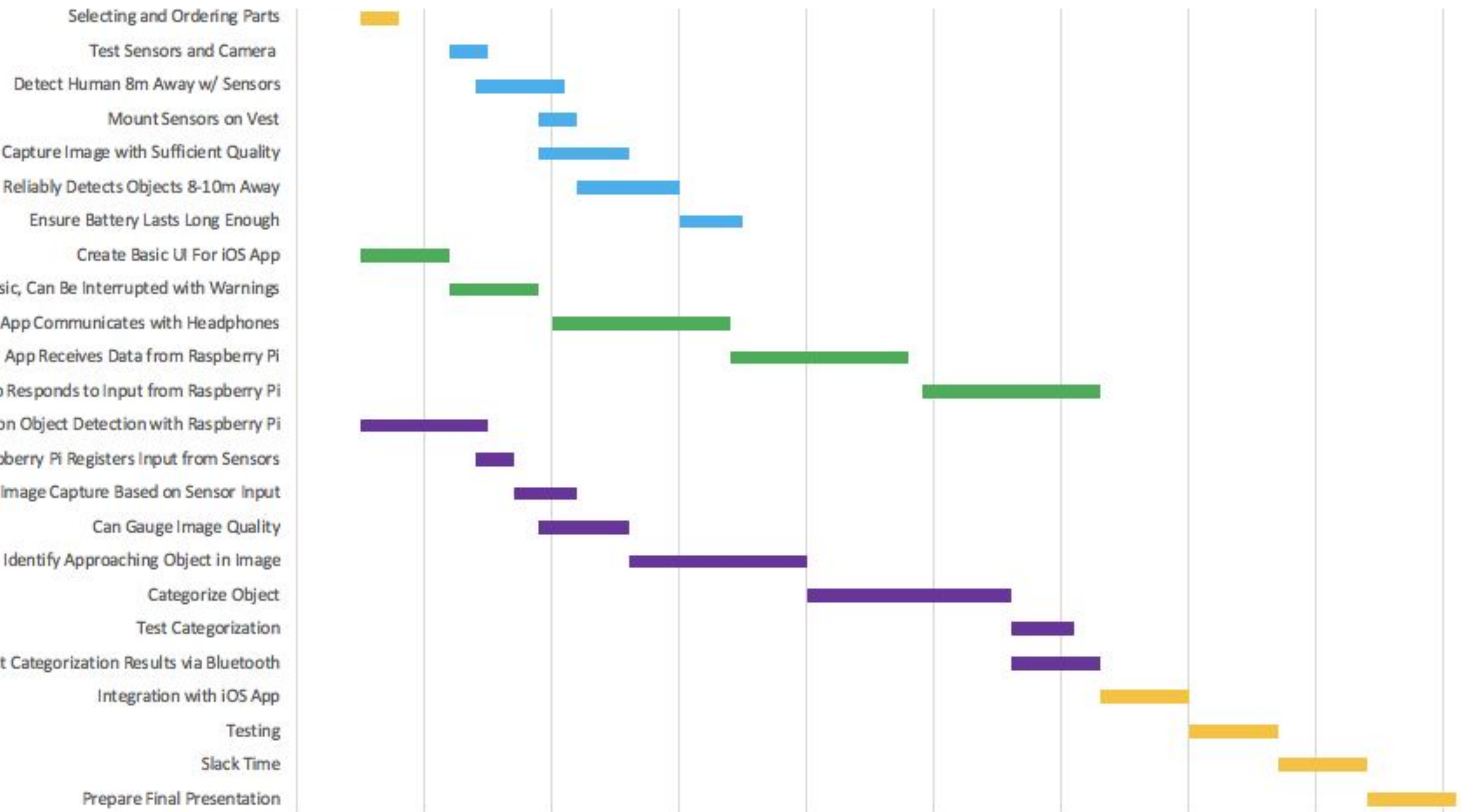
- Testing battery life and accuracy

# Division of Labor

Will Mitchell
- Wearable construction, Raspberry Pi interfacing

Evan Compton
- Object recognition classification

Alli Scibisz
- iOS application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Test Sensors and Camera
Detect Human 8m Away w/ Sensors
Mount Sensors on Vest
Capture Image with Sufficient Quality
Reliably Detects Objects 8-10m Away
Ensure Battery Lasts Long Enough
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sic, Can Be Interrupted with Warnings
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App Receives Data from Raspberry Pi
Responds to Input from Raspberry Pi
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berry Pi Registers Input from Sensors
Image Capture Based on Sensor Input
Can Gauge Image Quality
Identify Approaching Object in Image
Categorize Object
Test Categorization
t Categorization Results via Bluetooth
Integration with iOS App
Testing
Slack Time
Prepare Final Presentation