Vision Impaired Lap Swim Aid

Advisor/Client: Leland Harker | sdmay20-05:

Team: Carson Kniep, Paden Uphold, Nathan Mortenson, Timothy Steward, Conor Albinger, and Jake Sieverding

Problem Statement

Vision impaired swimmers need a spotter at both ends of the pool to alert them when to turn around.

Microcontroller Boxes

Processes signal from camera with Raspberry Pi, sends serial data to Arduino. Process data and send audio signal with a FM Transmitter to the headphones warning the user when they reach the end.

Headphones

Receives radio signal from the control box and warns user that they are near the edge with sound in their ears. Otherwise, the FM Transmitter is sending a silent signal. The Uwater K7's are shown below in the design.

Solution

Our product will send an audio signal to wireless headphones that the vision impaired swimmer will wear while lap swimming.

Functional Requirements

- Waterproof to protect hardware
- Sensor always detects swimmer
- User friendly
- Headphones sends signal before swimmer hits the wall

Test Strategy

- Test sensors to find what works best
  - Tested different IR and Sonar sensors
  - Found computer vision with code works best
- Test headphone in water to test signal

Considerations

- ISU swim coach for questions and advise
- Brandon Schellhorn from Heartland AEA for advice on how vision impaired swimmer set up in the pool
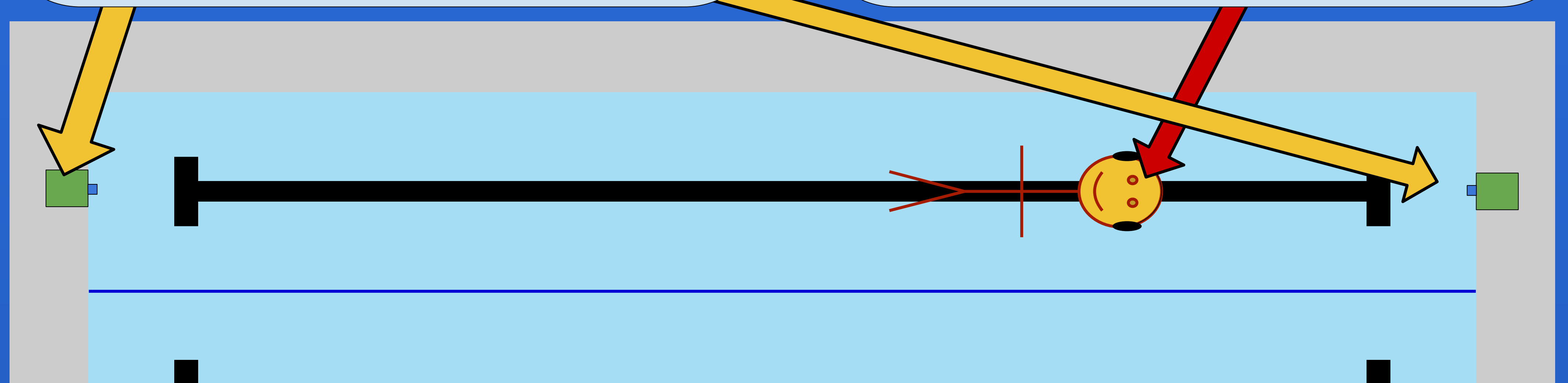
Engineering Standards and Design Practices

- IEEE Standard for Floating-Point Arithmetic (IEEE 754) in our computer vision computations
- Recommended Standard 232 (RS-232) for serial communication between the Arduino and Raspberry Pi

Operating/Test Environment

Lap swimming pool
Max length: 50m

Technical Constraints

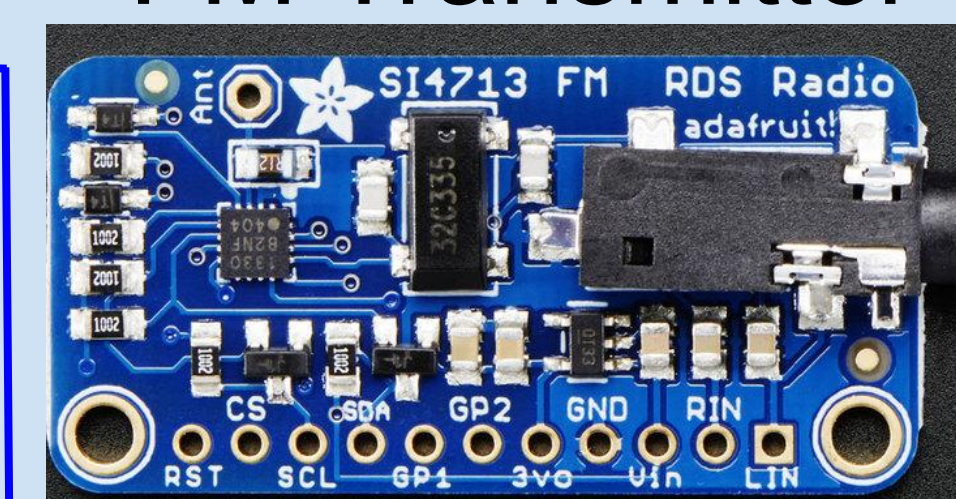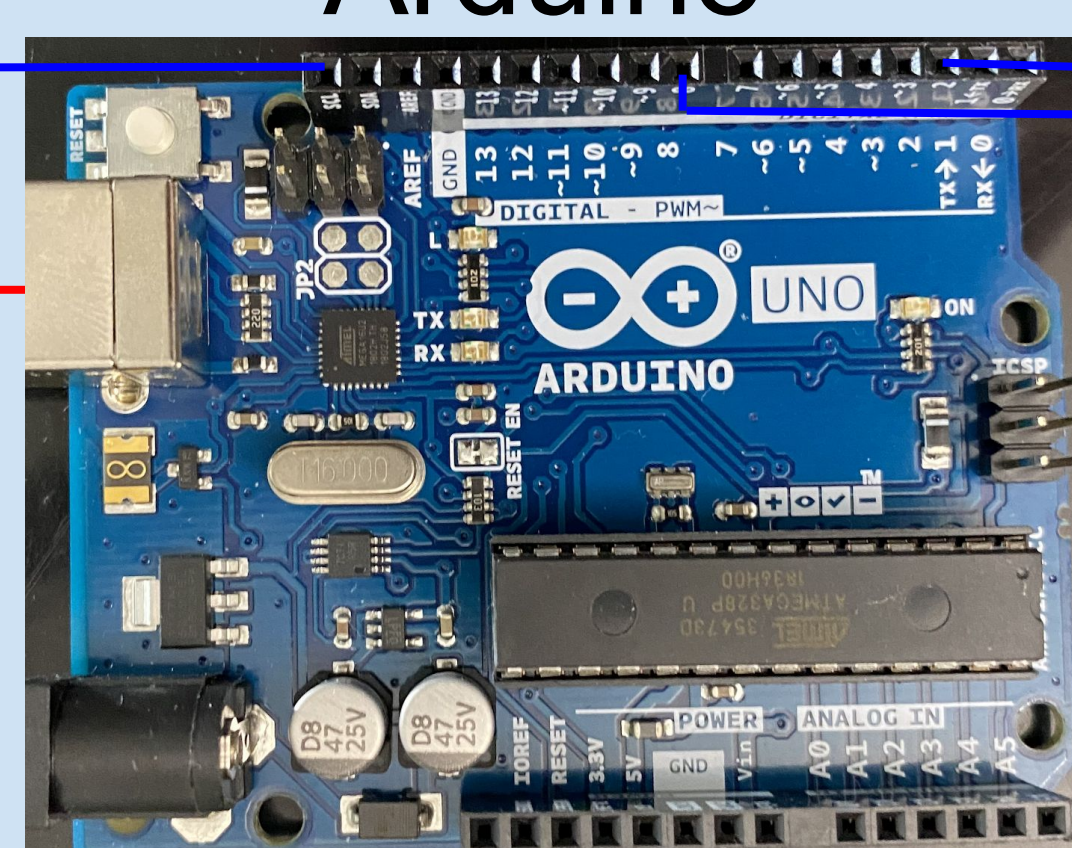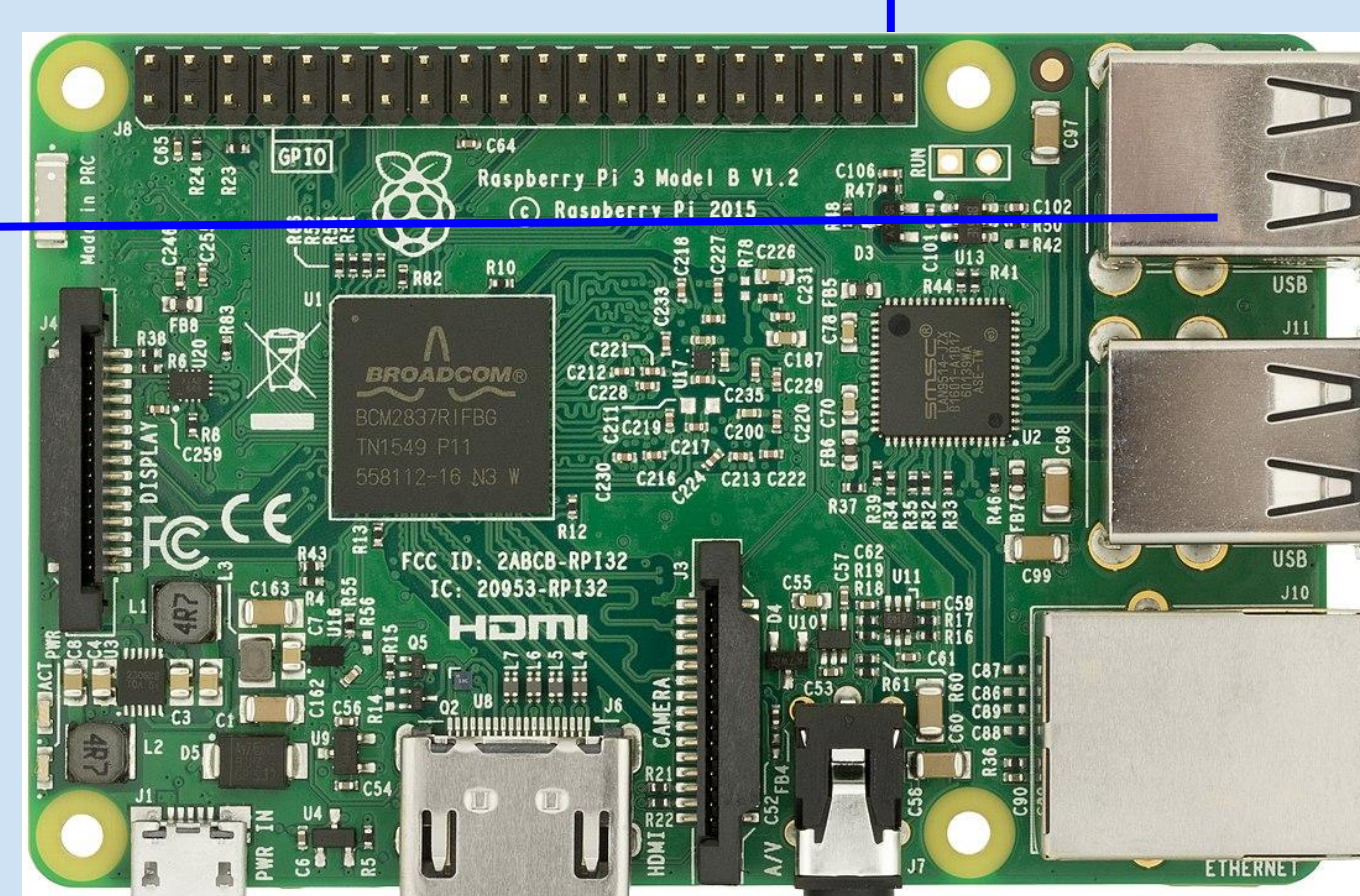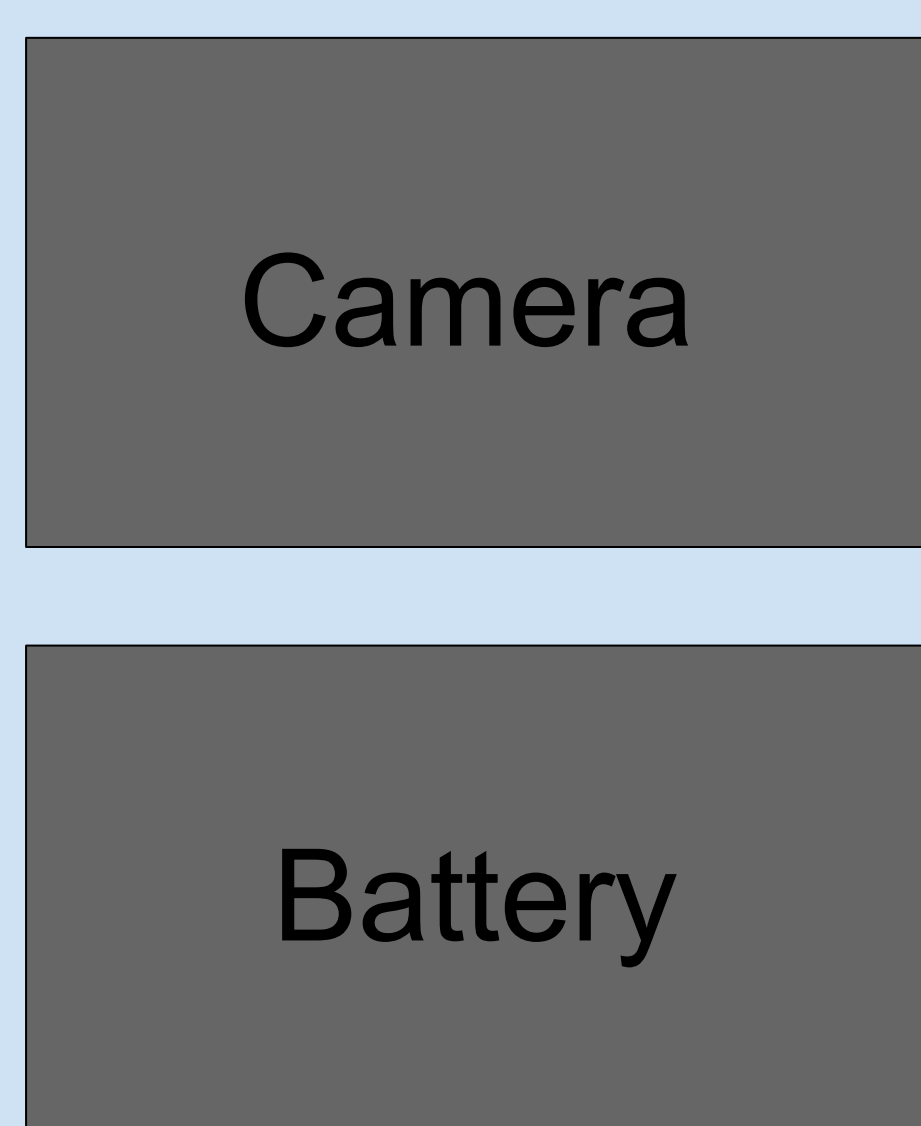- Deciding what work best between IR sensor, Sonar sensor, or Computer Vision
- Transmitting audio signal the entire distance of the pool
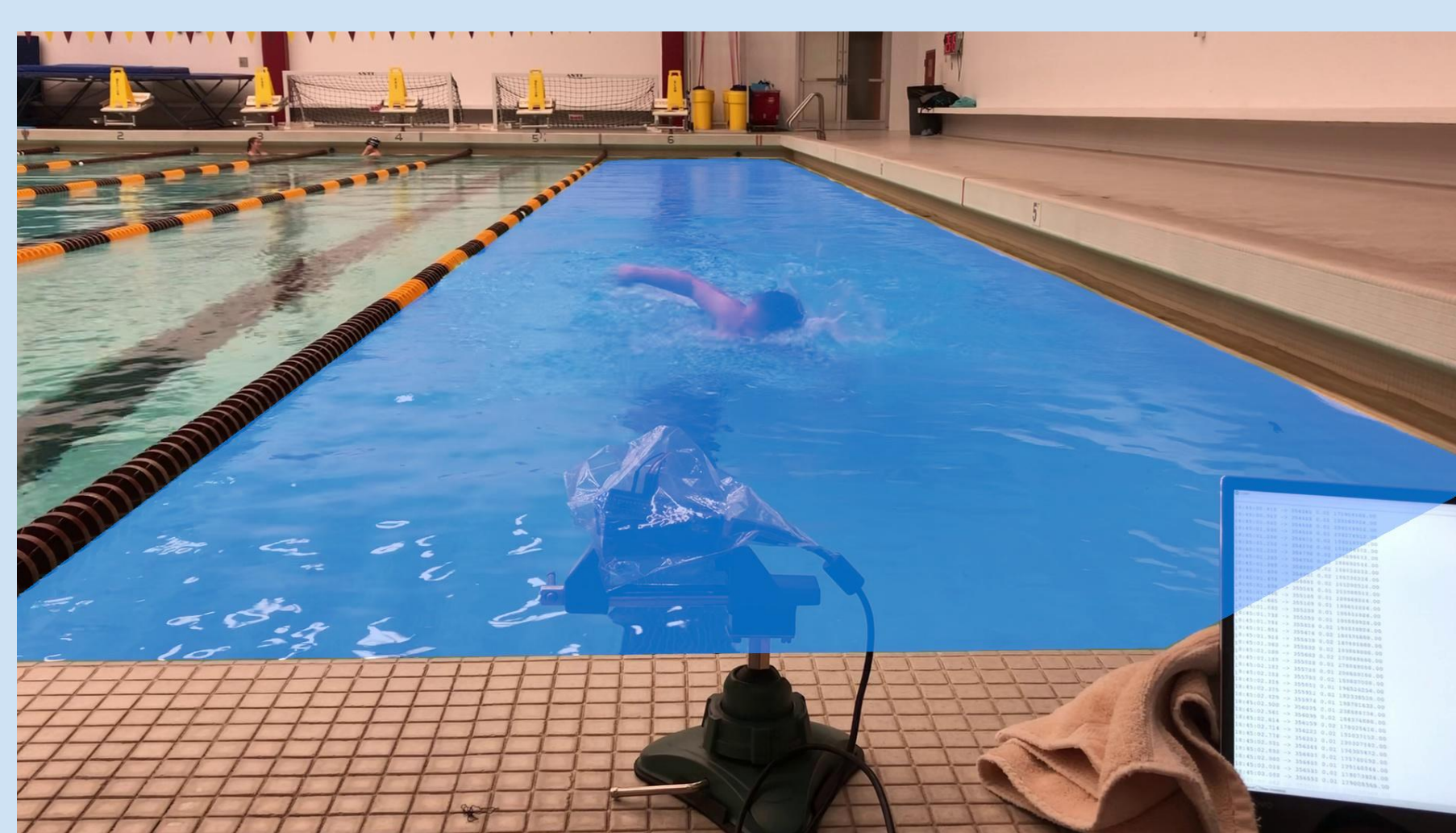
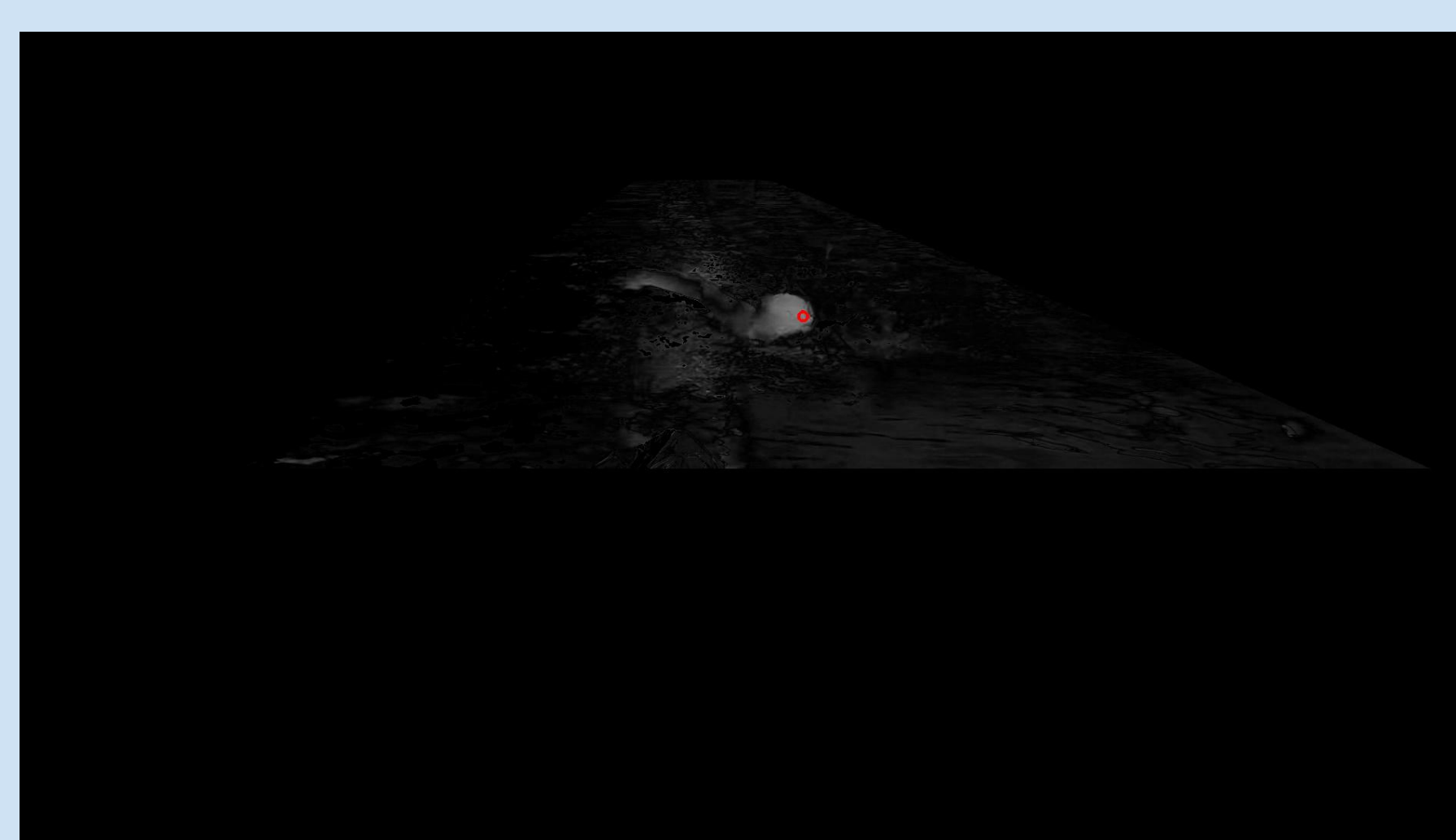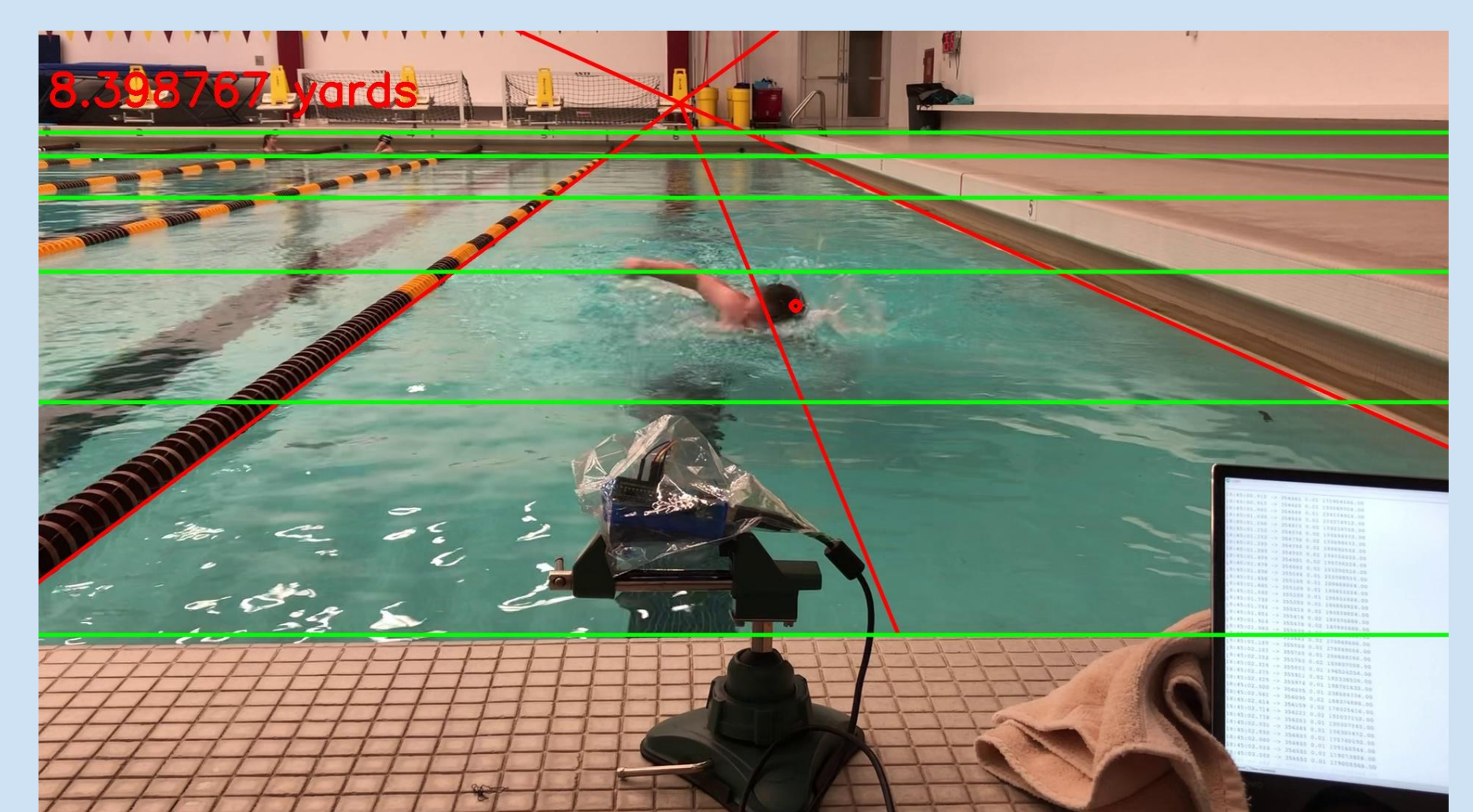Raspberry Pi   Arduino   FM Transmitter

Camera

Battery

Radio Module

Signal —
Power —

On the User:

UWATER K7
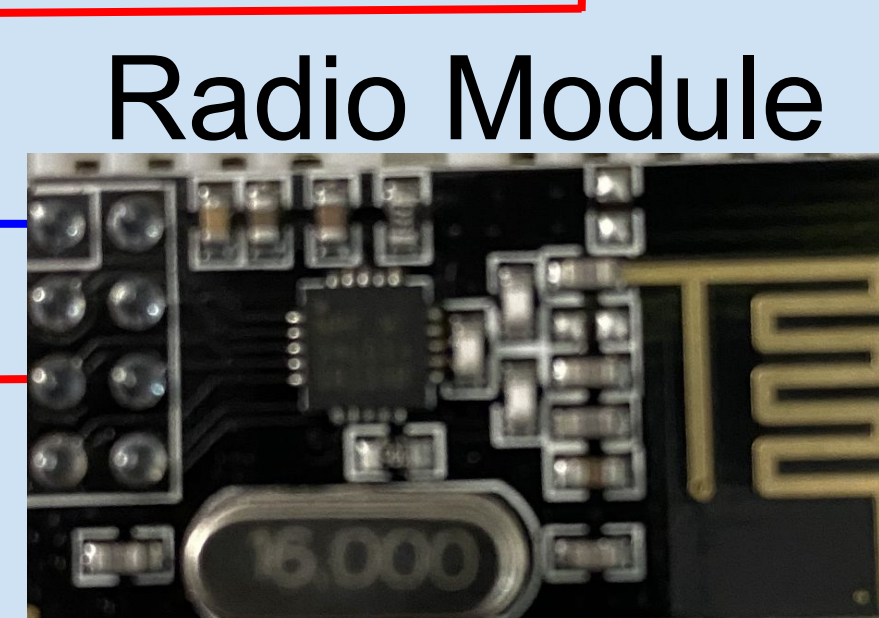
Detect Lane

Detect Swimmer

Calculate Distance