FishSense

LOW POWER SYSTEM

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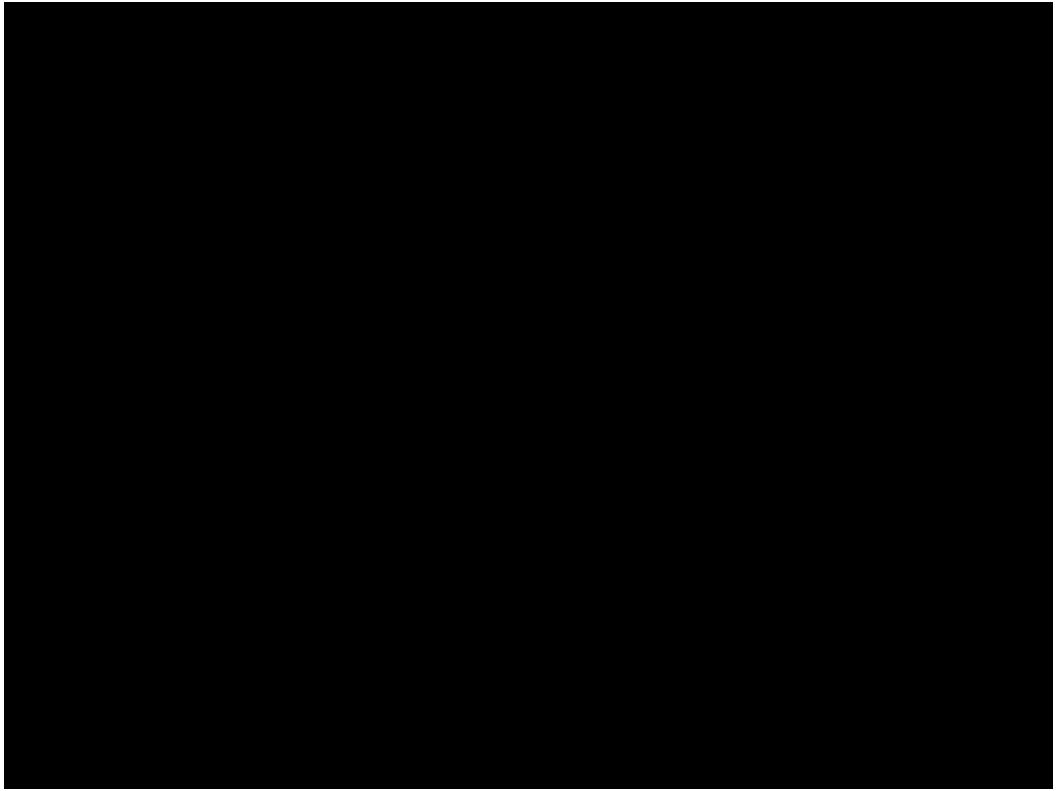
Overview

- FishSense aims to automate the detection and biomass estimation of fish
- Uses RGB and Depth cameras along with machine learning techniques



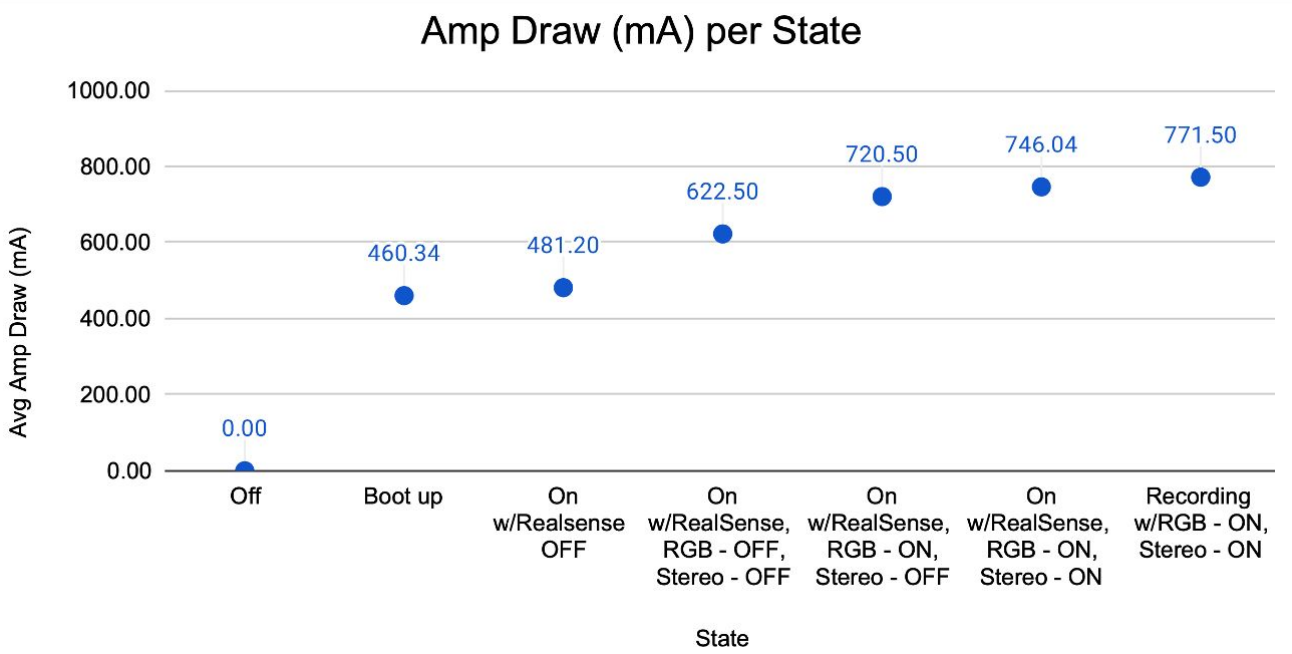
Overview - Problem

Need a solution for long term deployments

2-3 weeks Deployment window

Address issues of battery capacity

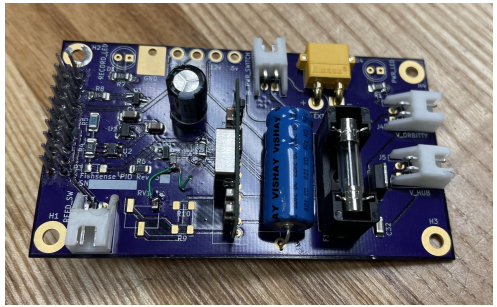
Benchmarking → Objective Update



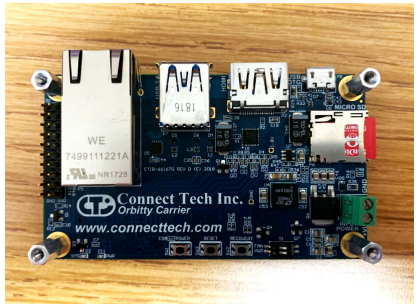
Target Avg Amp Draw: 10,400 mA hrs/336 hrs = **30.95 mA**

Use an external, extreme low power STM32 board as a clock to control power to main system

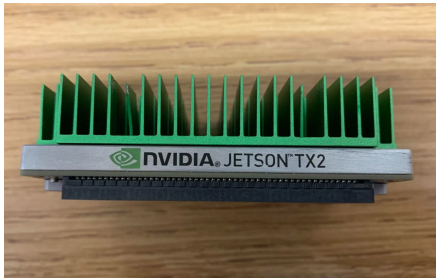
Project Architecture - Original



Power IO

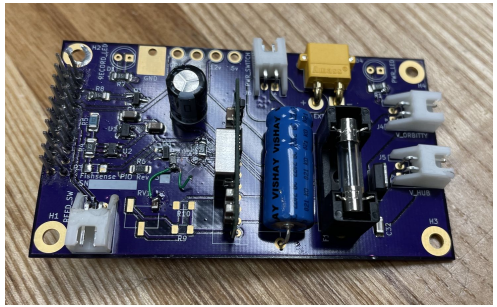


Orbitty

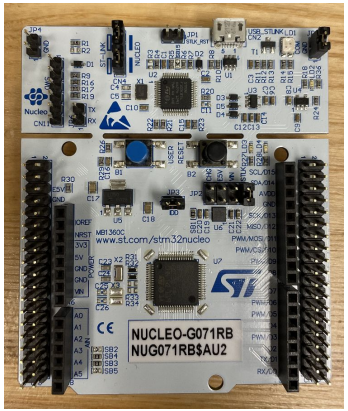


Jetson

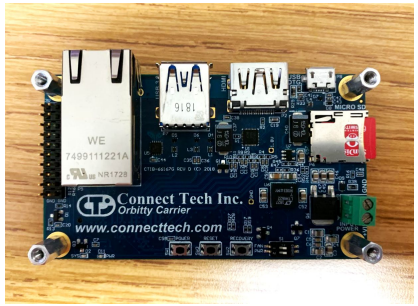
Project Architecture - Proposed



Power IO



STM32



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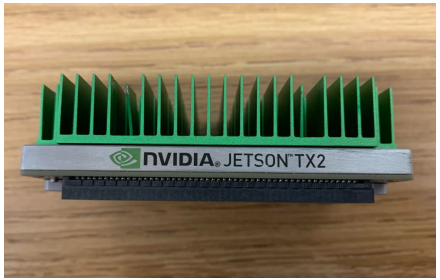
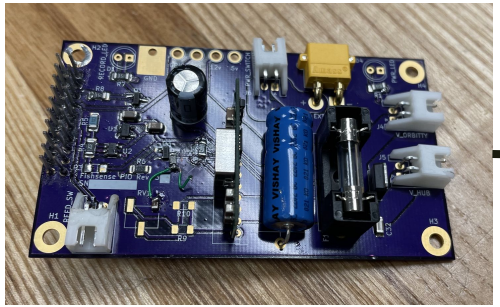
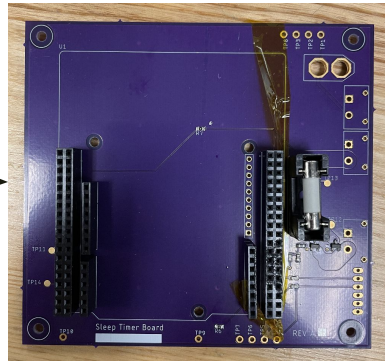


Jetson

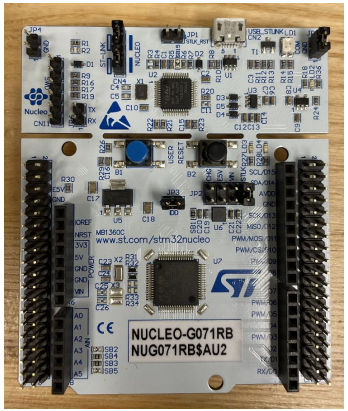
Project Architecture - Updated



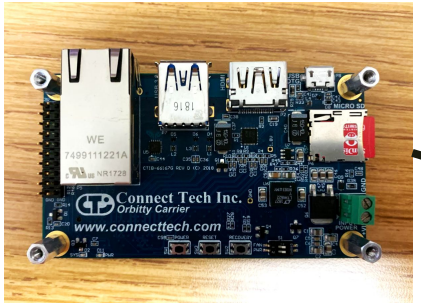
Power IO



Sleep Timer Board



STM32



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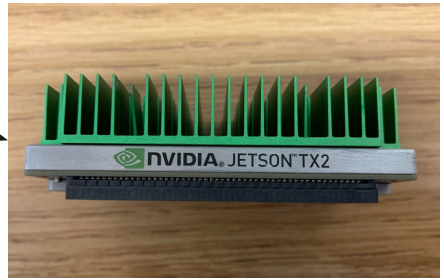


Jetson

STM Firmware

STM32

Sleep Timer Board

Power IO

GPIO pin 1

Orbitty Carrier

Nvidia Jetson TX2

main.c

HAL_init()

GPIO_init()

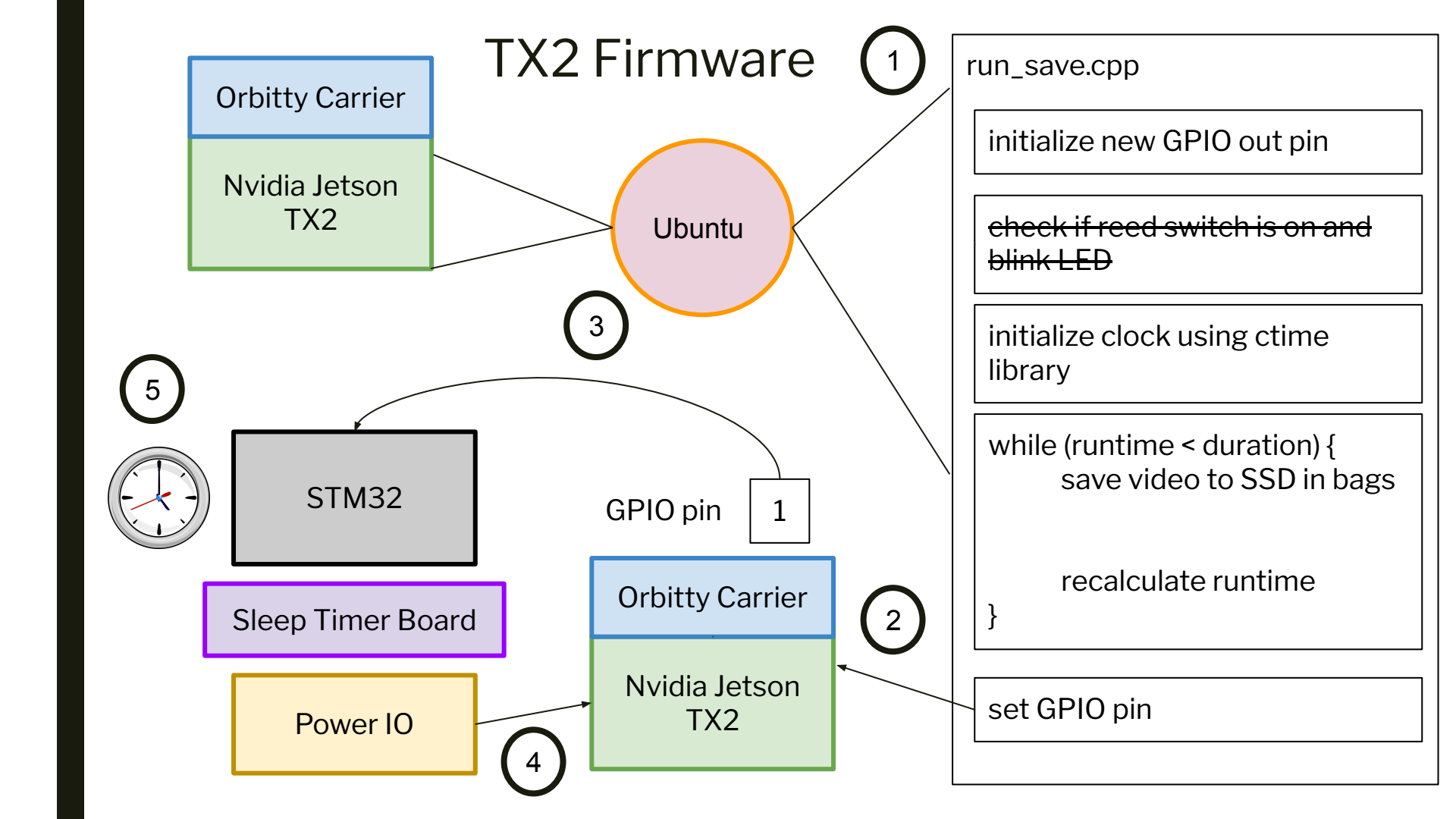
SystemClock_Config() - LSE 32.768 kHz

MX_RTC_Init()

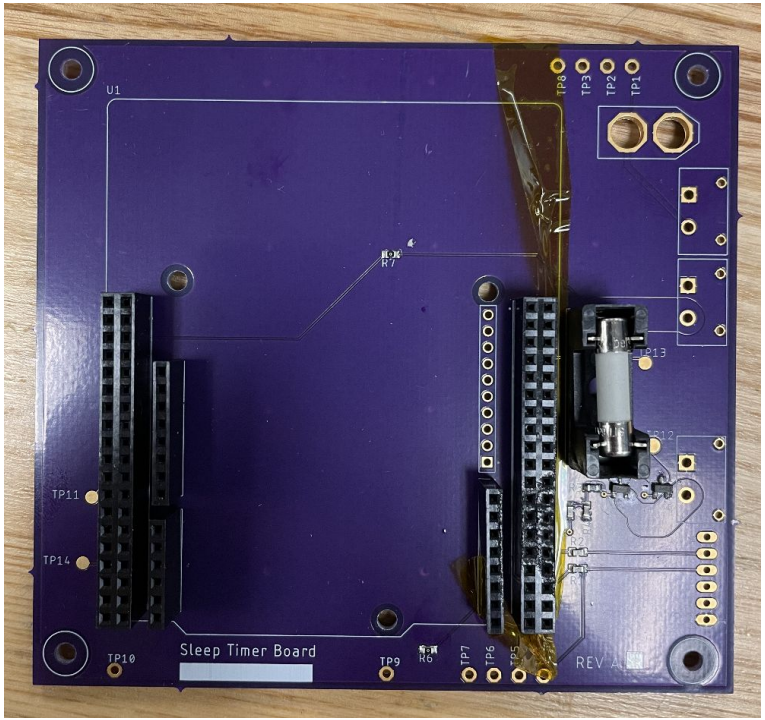
```
while (1):
        if tx2_pin 1→ 0:
            BSP_GPIO_Off(PIO);
            MX_RTC_Set_Alarm(tIme t);
```

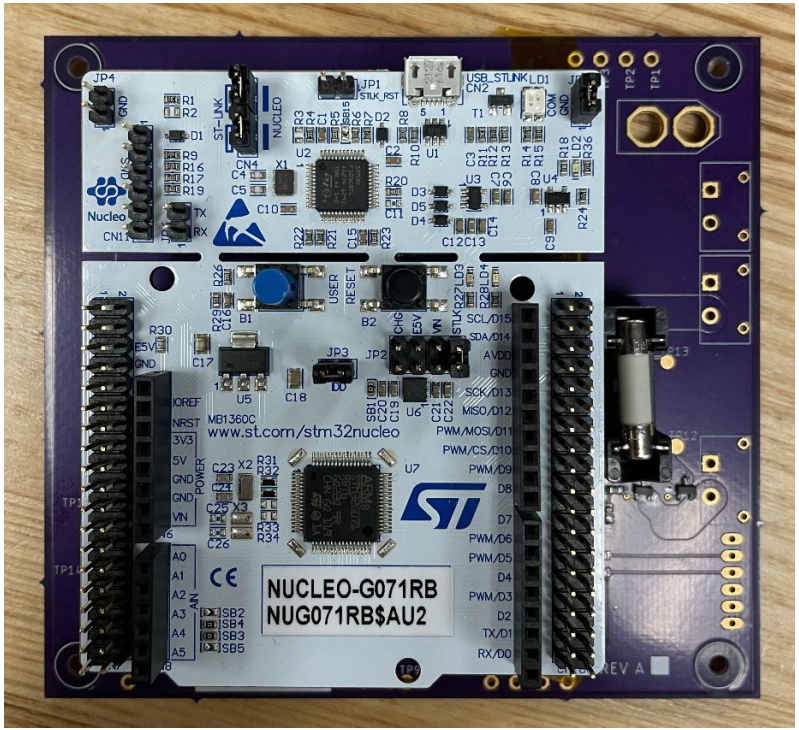
```
HAL_RTC_AlarmAEventCallback():
        BSP_GPIO_On(PIO);
```

TX2 Firmware

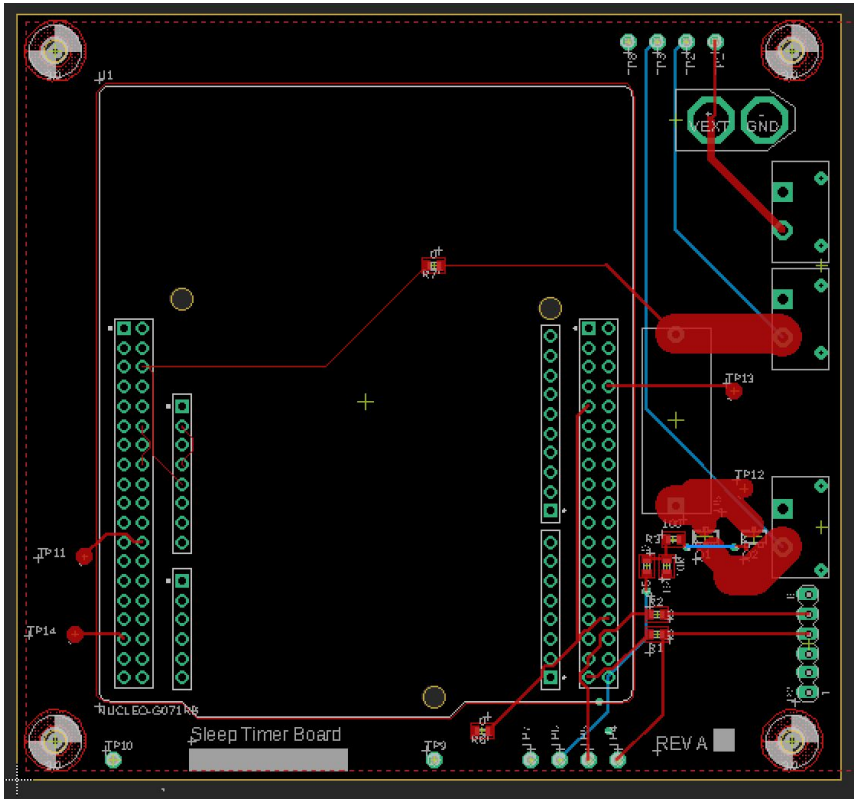


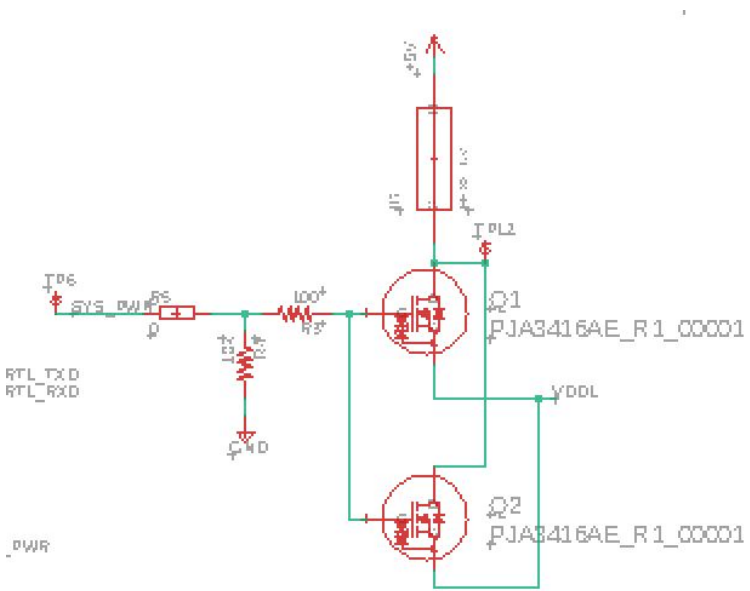
Project Objective - Integration





Project Objective - Integration





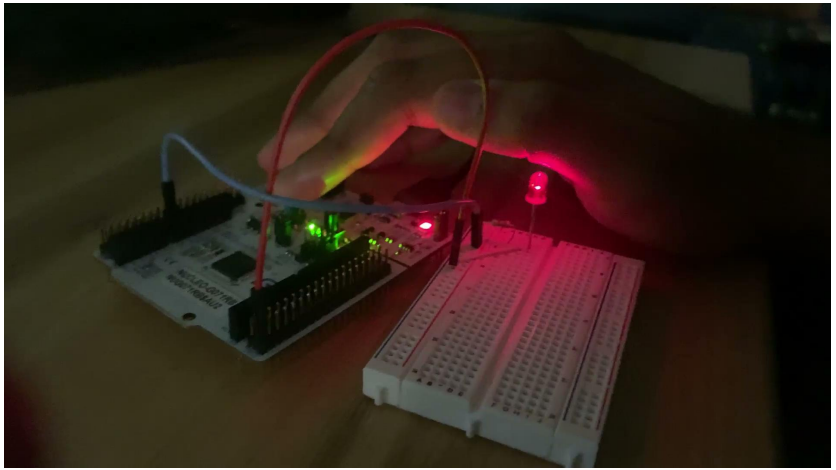
Conclusion

Progress

- Code on TX2 and STM are done
- STM and TX2 testing done
- Integration attempted, MOSFET problem found using scope

Next: Integration

- Replacement sleep timer board to complete integration
- Integration testing and benchmarking



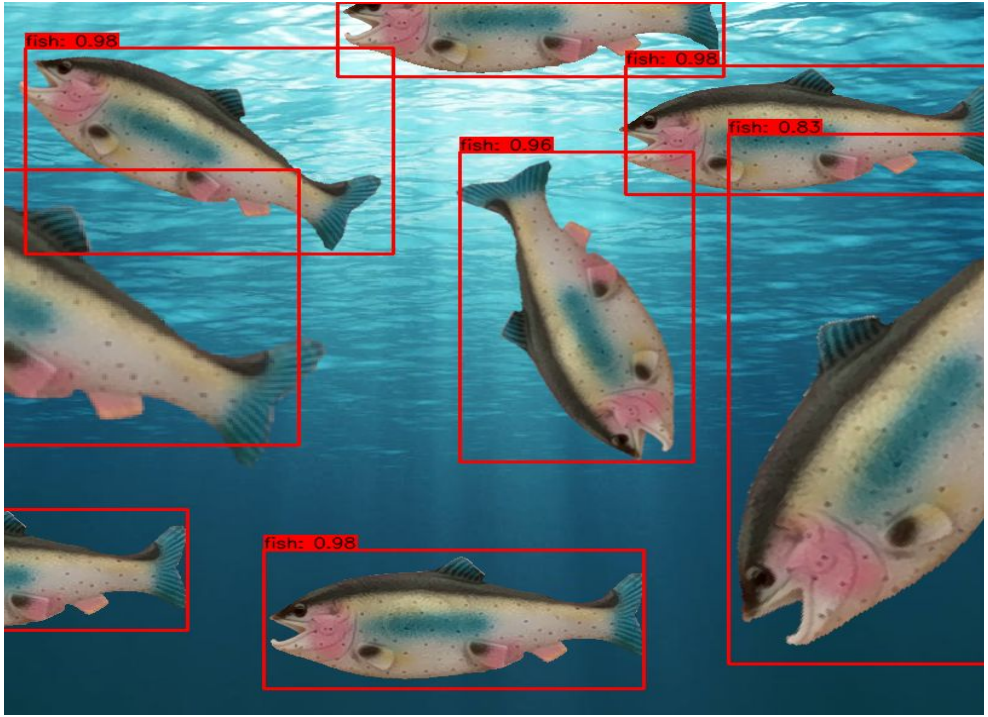
FishSense

Oral Project Update

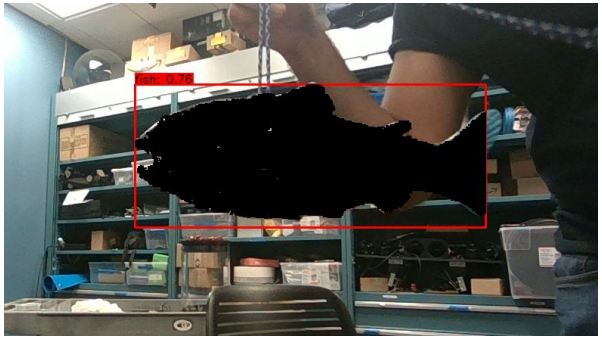
ML Team: Cameron Nazemi & Aarushi Sehgal

ML Overview

Our Target: Accurate Fish detection inside water ***and*** outside water on any flat surface.



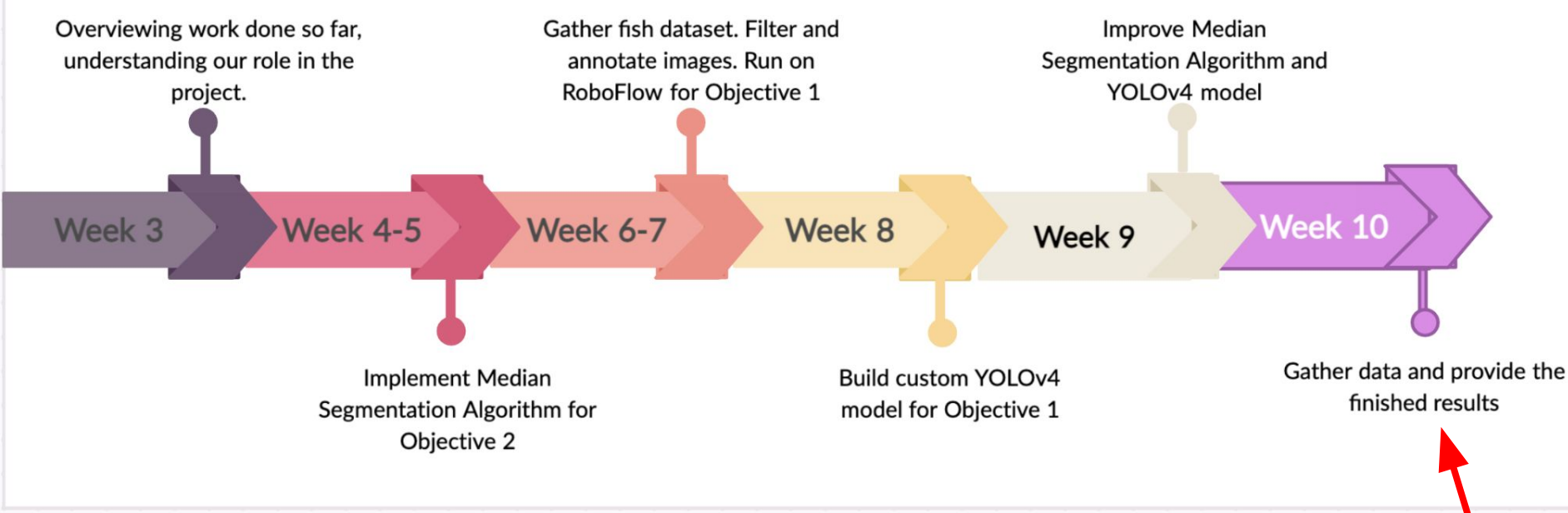
ML Overview



Fish detection outside water on any flat surface.

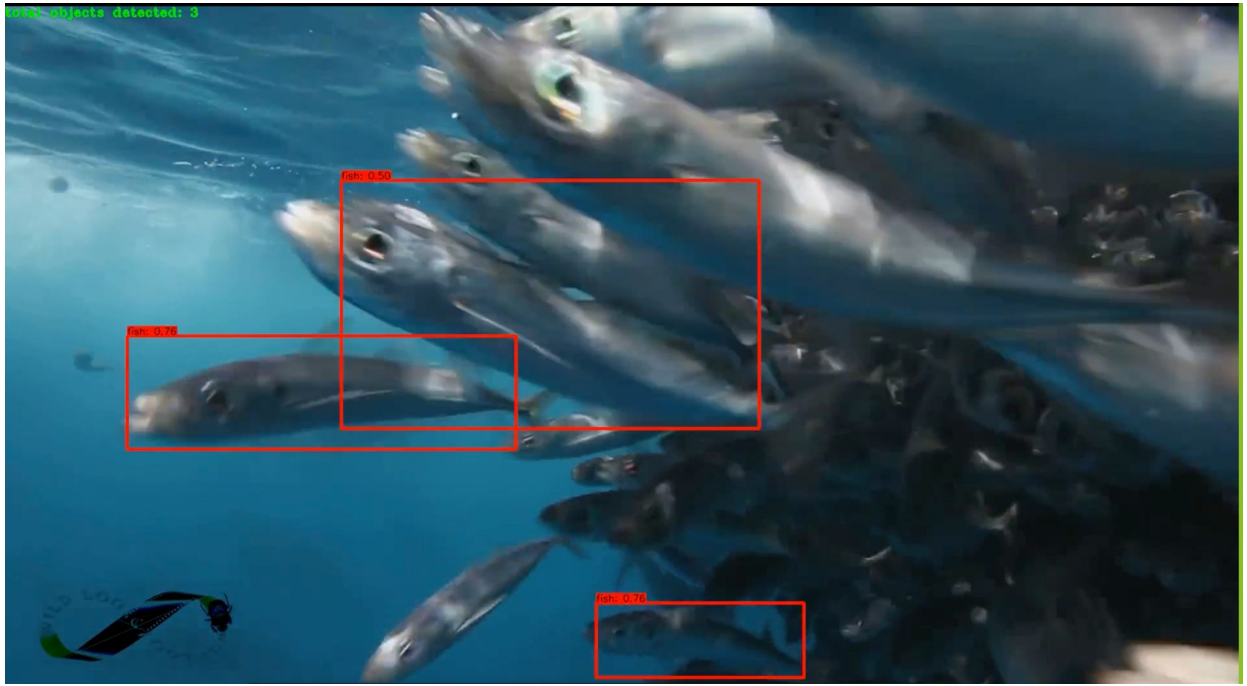
Use depth data from Intel RealSense camera to get more accurate fish detection

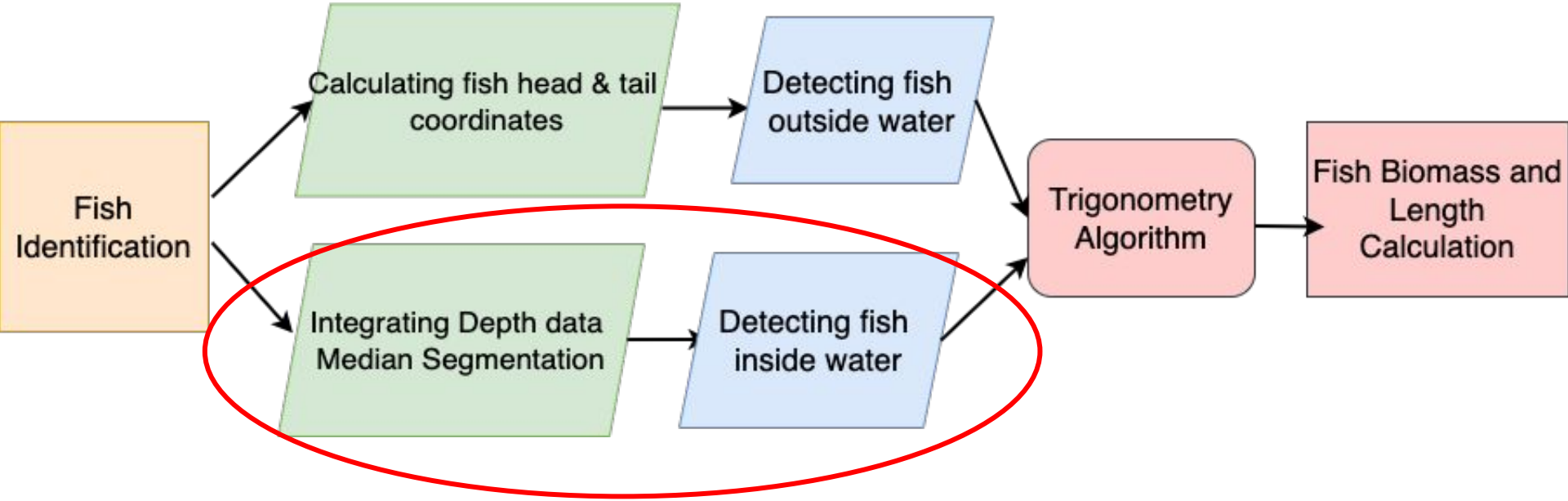
FishSense ML Timeline



Objective 1

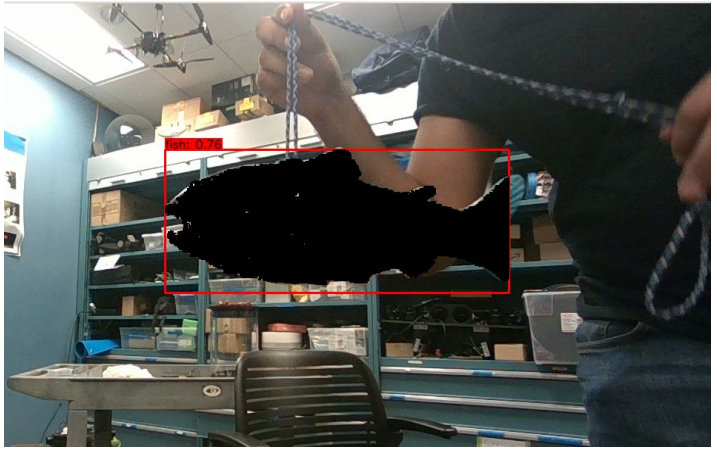
Use depth data to get more accurate fish detection inside water




Fish Identification
Calculating fish head & tail coordinates
Detecting fish outside water
Integrating Depth data Median Segmentation
Detecting fish inside water
Trigonometry Algorithm
Fish Biomass and Length Calculation

Progress and Achievements

- Revisited and modified Median Segmentation for detection outside water.
- Objective 1 almost complete and we have written the code for finding fish length using Median Segmentation.



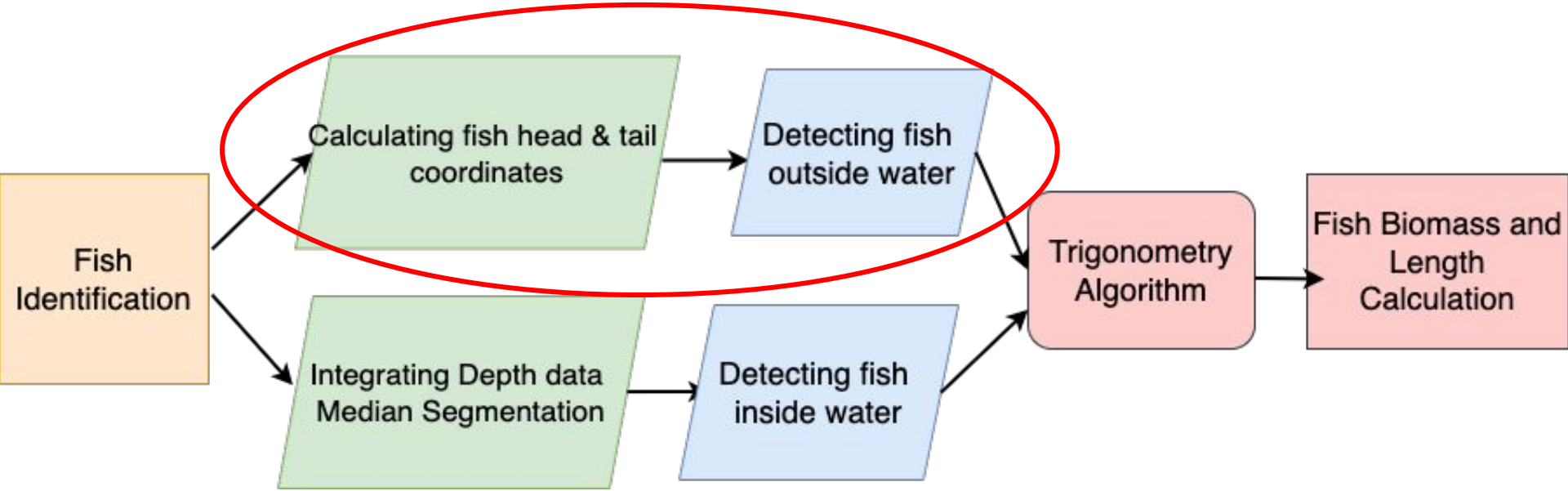
https://www.sciencedirect.com/science/article/abs/pii/S1537511019308761?via%3Dihub

Next Steps

- Run modified Median Segmentation code to obtain fish length.

Objective 2

Fish detection outside water on any flat surface
for automatic measurement


Fish Identification
Calculating fish head & tail coordinates
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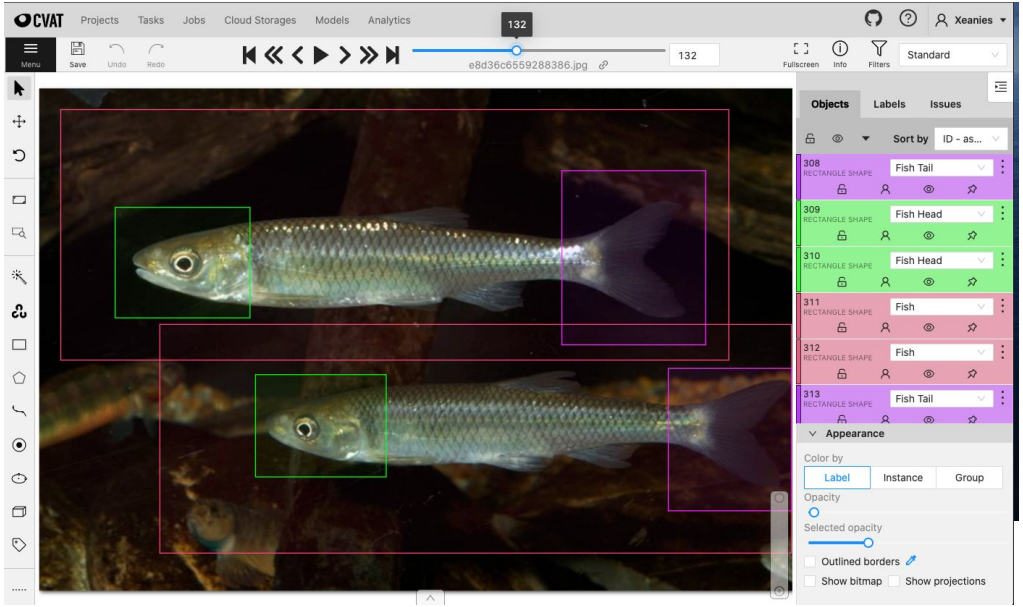
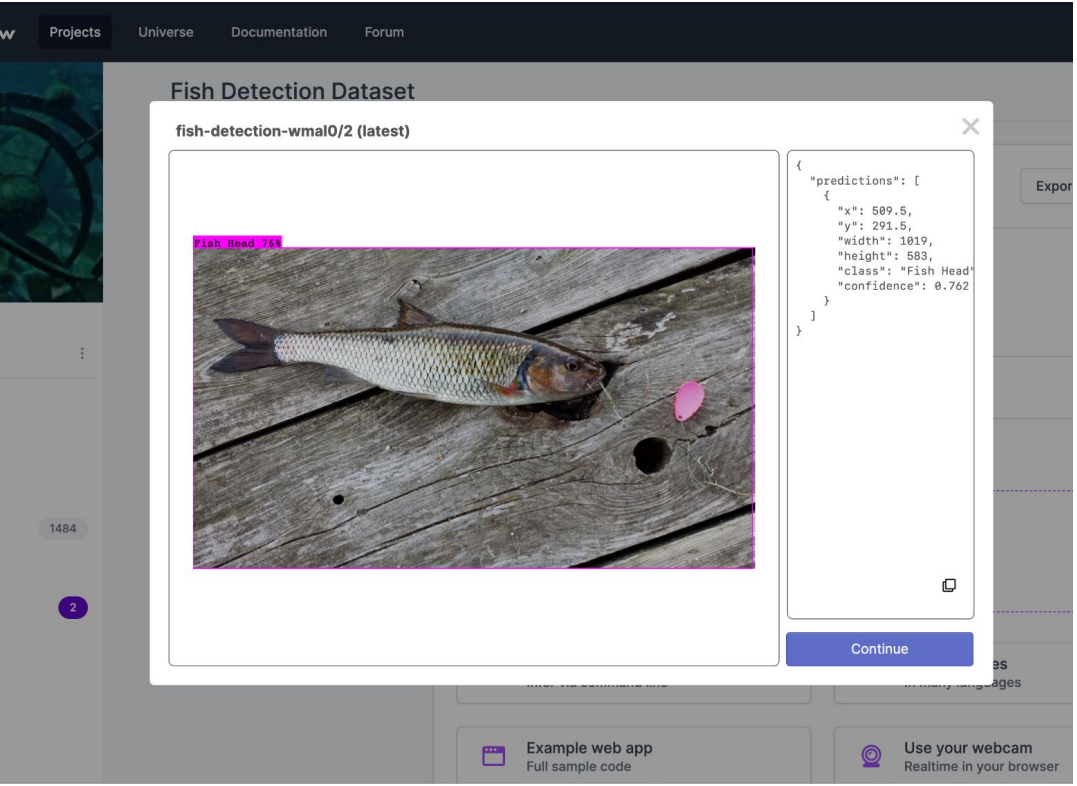
Trigonometry Algorithm
Fish Biomass and Length Calculation

Progress: Expanded Annotations



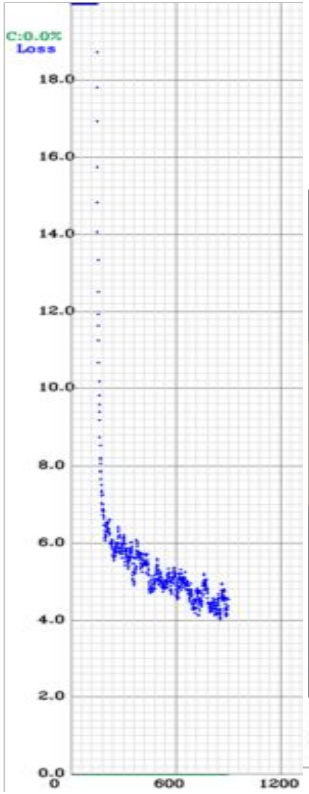
- Reanalyzed 900+ fish images.
  - Added annotations for fish head, tail, and body.
- Fish detection and length estimation outside water by extracting pixels marking head and tail of the fish.

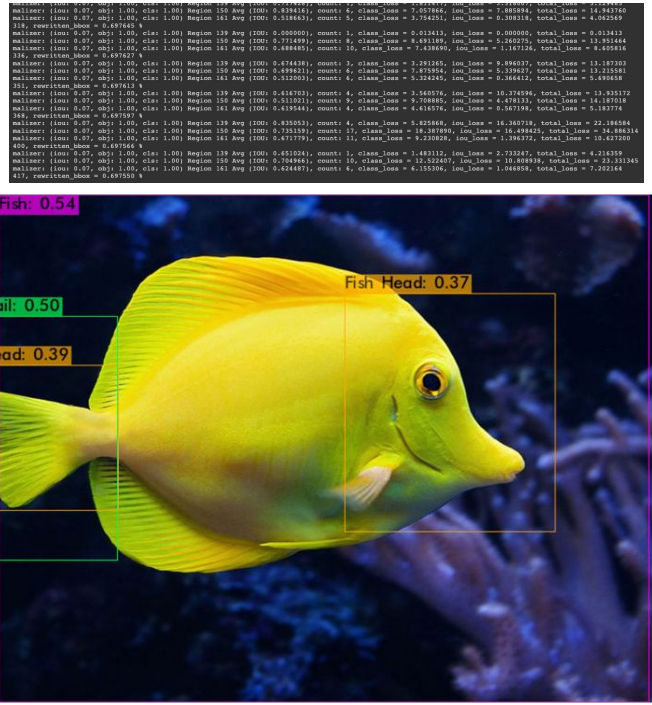
Progress: Trained Model with RoboFlow



- Uploaded our fish images and annotations to RoboFlow for training on the YOLO v5 model
- Unsatisfactory results, the model isn't accurate at detecting fish head, tail, or body.

Achievements: Trained Model with YOLOv4



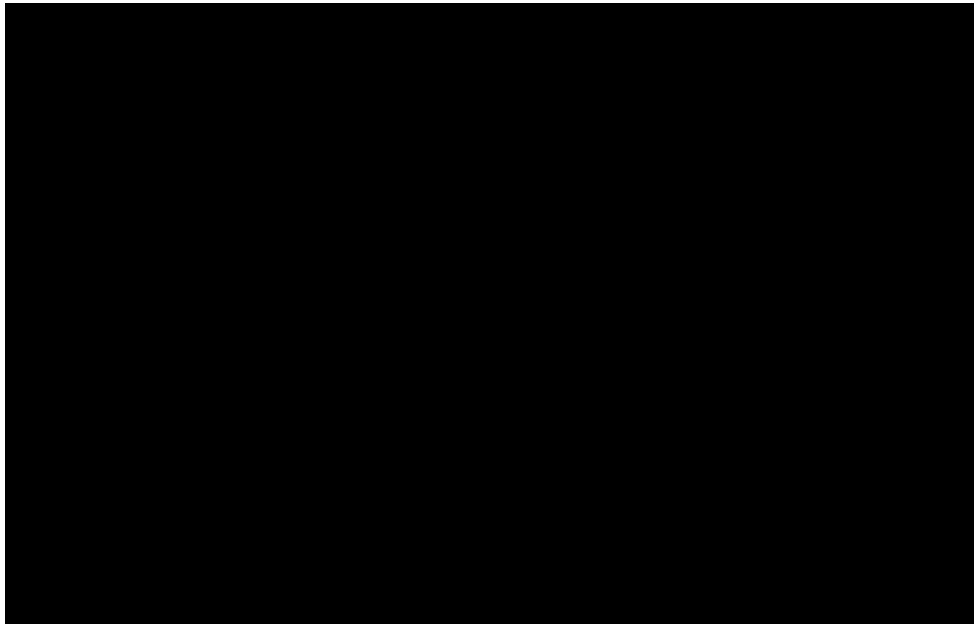


- Uploaded our fish images and annotations to train on a YOLOv4 model
- Achieved 80% accuracy for fish detection.

current avg loss = 4.5532 iteration = 900 approx. time left = 11.60 hours
Press 's' to save : chart.png Iteration number in cfg max_batches=6000

Next Steps

- Locate head and tail pixels using bounding box obtained from YOLOv4 model.
- Calculate length utilizing head and tail pixel information.



THANKS!

Does anyone have
any questions?

In Conclusion:

- Modified Median Segmentation for fish detection outside water.
- Training YOLOv4 model for fish head and tail detection.