Team B4: Ride-ar

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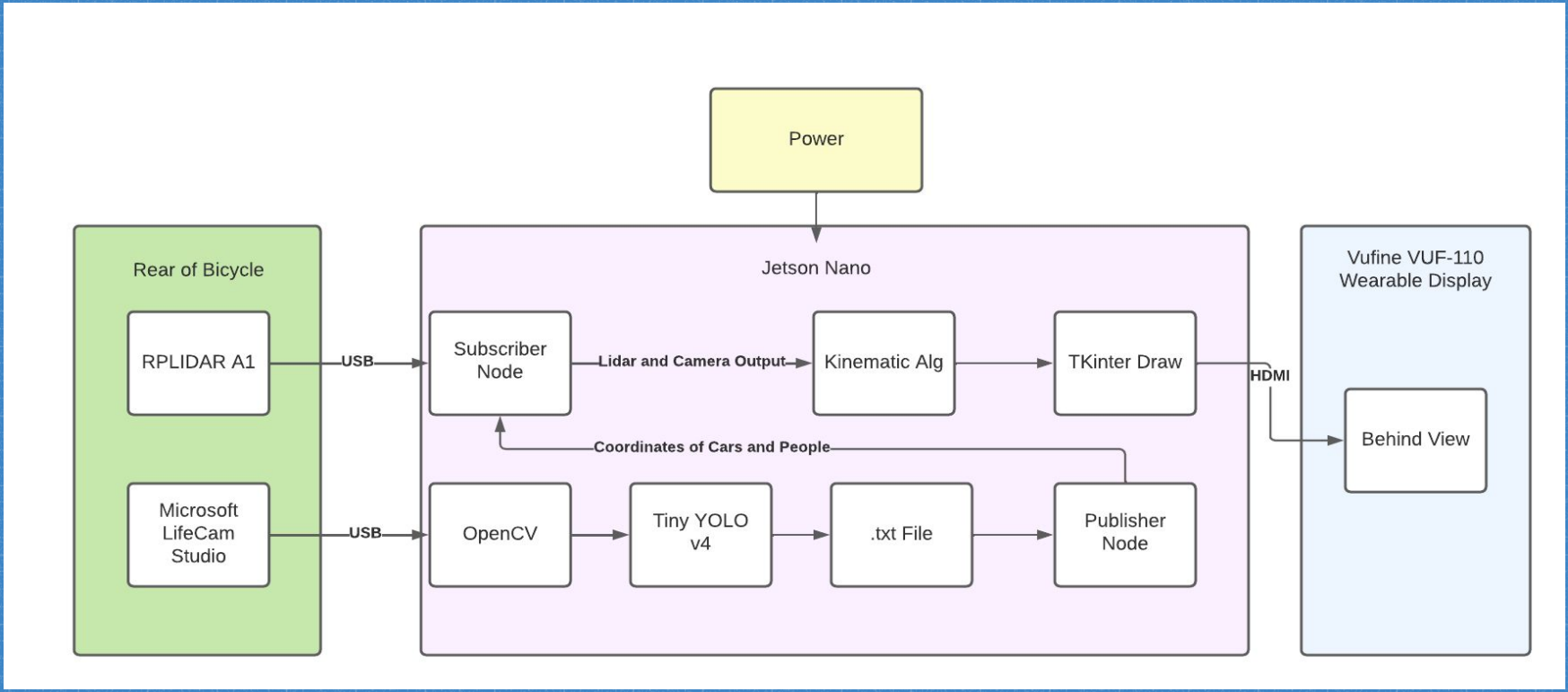
Use Case and Problem Statement

- Significant number of accidents happen with cyclists due to vehicle or human interference
- Over 40,000 bicycle accidents and 800 deaths occurred in the US in 2019
- Products available to help but accidents still arise

Solution Approach

- Improve biker situational awareness through two different sensors. Camera and Lidar.
- Use glasses with mini HUD to inform user

System Design



Complete Solution

- System is housed inside physical component that looks out and is connected to glasses running scripts to effectively detect cars and people and their position
- Cars are rather tricky to test so will try to test cut outs and showcase videos of outside testing.

Video

Testing Plans

- Metrics to Test
  - Latency of end-to-end system (<0.3ms)
  - Detection accuracy people and cars at different positions/ranges from the system (<5%)
- Other Requirements
  - LIDAR detect car within 12m
  - Object recognition detect car within 30m (<10% error rate)

Testing Plans

- Difficult to test with real cars in current environment
  - Testing mainly using people as a proof of concept
  - Going to use pictures of cars in place of real cars

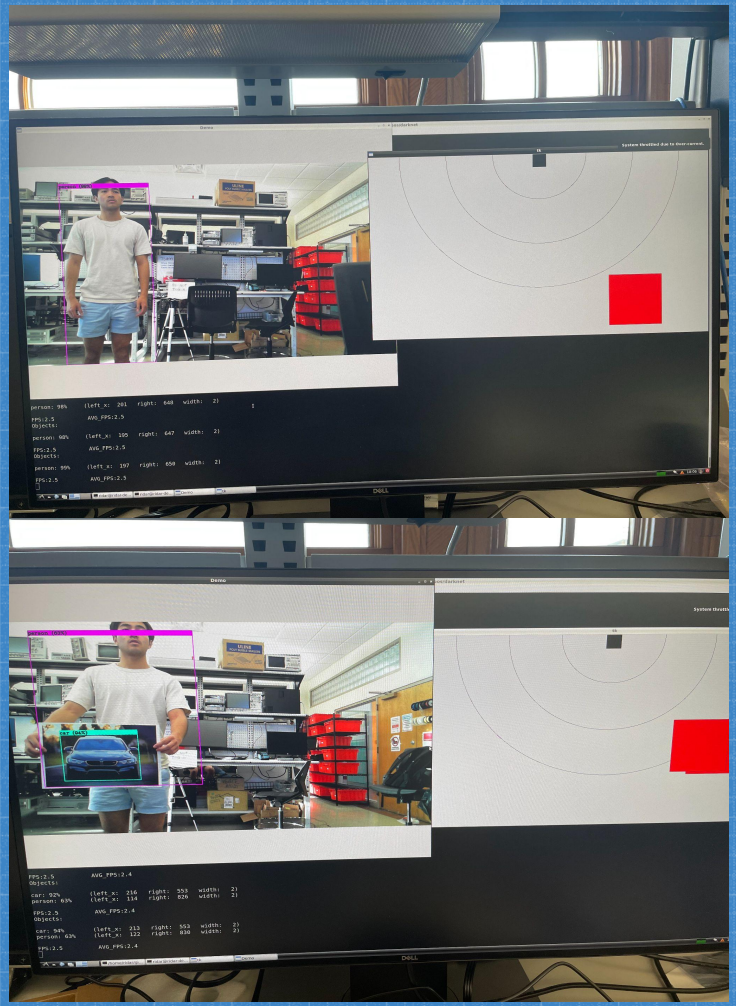
Results

Average Accuracy:

Cars	Persons
82%	98%

Average Latency:

Tiny-Yolov4	GUI display
0.4s	0.03s



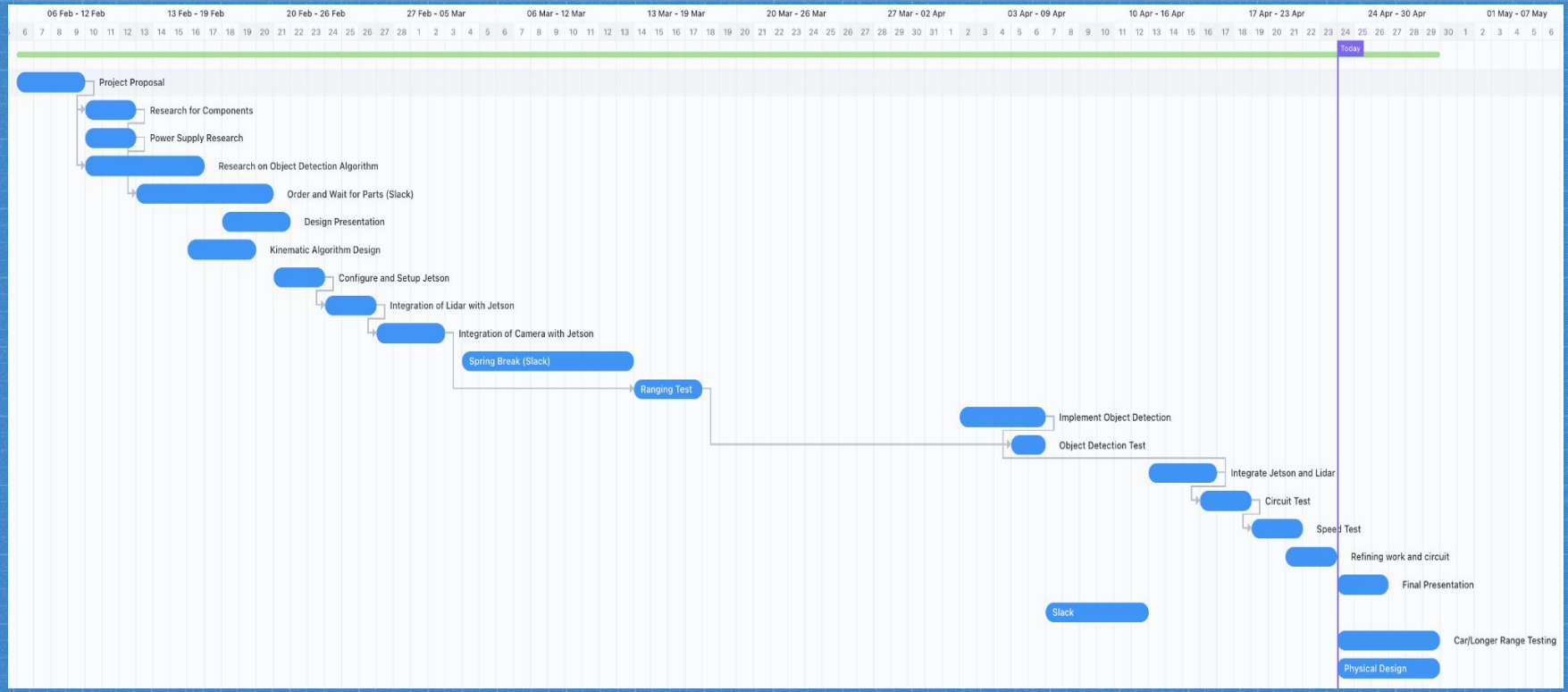
Trade-offs

- Decided to use one Jetson Nano instead of two as the Lidar processing isn’t as intensive as initially anticipated.
- Decided to use darknet Yolov4 as it has better accuracy and speed results than Yolov3. Tiny-Yolov4 mAP(mean average precision) is 40.2% compared to Tiny-Yolov3 which is 33.1%.
  - Tiny version of Yolov4 as it was the most lightweight and could run fairly well on the Jetson Nano along with ROS.

Lessons Learned

- Integration takes time
- Account for bugs and errors
- If something not working, look to pivot

Schedule


06 Feb - 12 Feb
13 Feb - 19 Feb
20 Feb - 26 Feb
27 Feb - 05 Mar
06 Mar - 12 Mar
13 Mar - 19 Mar
20 Mar - 26 Mar
27 Mar - 02 Apr
03 Apr - 09 Apr
10 Apr - 16 Apr
17 Apr - 23 Apr
24 Apr - 30 Apr
01 May - 07 May
Today
Project Proposal
Research for Components
Power Supply Research
Research on Object Detection Algorithm
Order and Wait for Parts (Slack)
Design Presentation
Kinematic Algorithm Design
Configure and Setup Jetson
Integration of Lidar with Jetson
Integration of Camera with Jetson
Spring Break (Slack)
Ranging Test
Implement Object Detection
Object Detection Test
Integrate Jetson and Lidar
Circuit Test
Speed Test
Refining work and circuit
Final Presentation
Slack
Car/Longer Range Testing
Physical Design