Final Project: Team2

Team 2 Members: Andrew Nguyen(ECE), Daphne Chen(ECE), Rodolfo Gonzalez(MAE), Jose Castillo (BENG)

UC San Diego

JACOBS SCHOOL OF ENGINEERING

What was promised

Must Haves

- Pedestrian avoidance

based on oakd detection, running on gps lap

Nice to haves

- Make GPS run in ROS2 instead of donkey environment

UC San Diego
JACOBS SCHOOL OF ENGINEERING

What we actually done

- Make GPS run in ROS2 instead of donkey environment
- Have pedestrian detection working on the camera and determine going left or right
- Coded ublox gps node from scratch to work with the existing files on ROS2
- Didn't get to finish combining gps and detection logic together, one of the dependency was broken...

source: ucsd_robocar2 / ucsd_robocar_hub2 · GitLab

UC San Diego
JACOBS SCHOOL OF ENGINEERING

ROS2

```
Docker_Container@ucsdrobocar-148-02:/home/projects/ros2_ws/src/ucsd_robocar_hub2(master)$ ls
README.md     log                        ucsd_robocar_basics2_pkg          ucsd_robocar_nav2_pkg     ucsd_ros2_logos.png
core          oakd_ros2                  ucsd_robocar_control2_pkg         ucsd_robocar_path2_pkg
docker_setup  ucsd_robocar_actuator2_pkg  ucsd_robocar_lane_detection2_pkg  ucsd_robocar_sensor2_pkg
```

1. **Bag Processing Node**
   >>ucsd_robocar_path2_pkg #converts gps data to a csv file
   scripts
   gps_parser.py
   - Reads recorded **GPS data** from a `.mcap` bag file and converts it into a CSV.

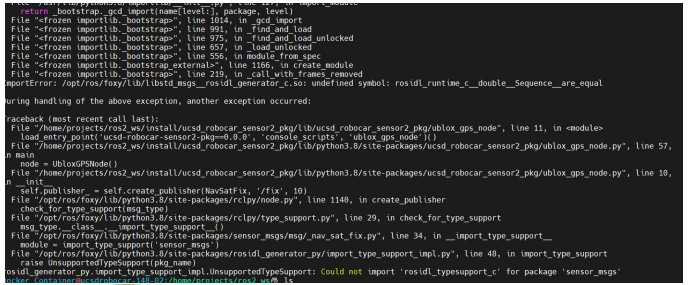
2. **Path Provider (`gps_path_provider_node`)**
   >>ucsd_robocar_path2_pkg #provides the path
   ucsd_robocar_path2_pkg
   gps_path_provider_node.py *
   - Reads the **CSV file and publishes a trajectory** to `/gps_trajectory`.
3. **Error Calculation (`gps_error_node`)**
   >>ucsd_robocar_path2_pkg
   launch
   gps_nav_launch.launch.py
   >>ucsd_robocar_path2_pkg
   ucsd_robocar_path2_pkg
   gps_error_node.py
   - Compares the car's **actual GPS position** (`/fix`) with the **desired path** (`/gps_trajectory`).
   - Computes **lateral, longitudinal, and heading errors** and publishes them to `/error`.
4. **PID Controller (`pid_gps_node`)**
   >>ucsd_robocar_control2_pkg
   ucsd_robocar_control2_pkg
   pid_gps_node.py

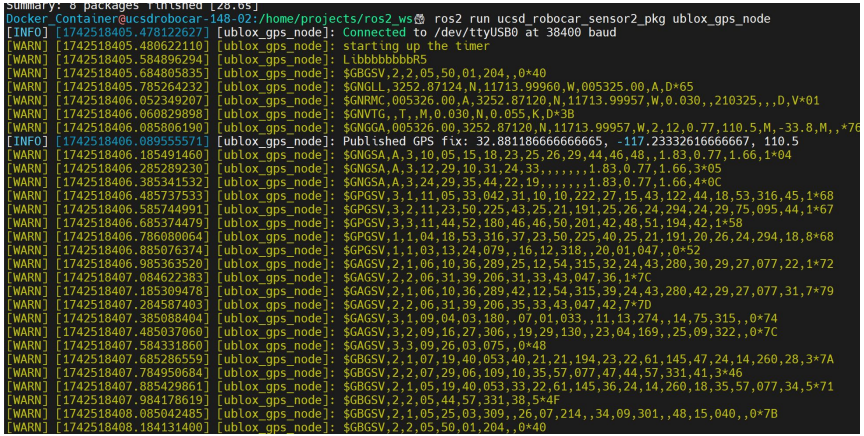
   >>ucsd_robocar_control2_pkg
   ucsd_robocar_control2_pkg
   pid_gps_calibration_node.py
   - Reads tracking errors from `/error`.
   - Computes **steering and speed corrections**.
   - Publishes **movement commands** to `/drive`

UC San Diego
JACOBS SCHOOL OF ENGINEERING

Problems

- This happened at the last minute, we solved it by reinstalling ROS2(sudo apt upgrade)

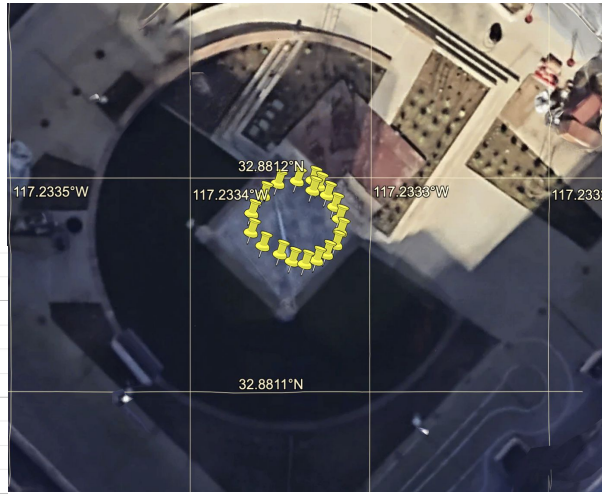


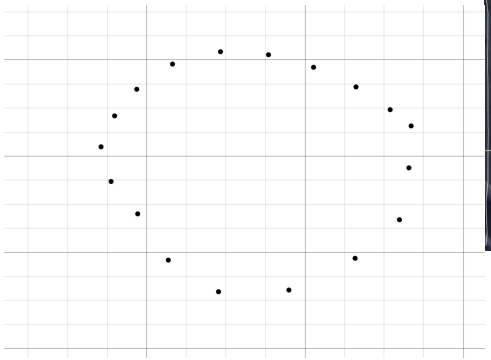


UC San Diego
JACOBS SCHOOL OF ENGINEERING

Video of gps working in EBU courtyard

https://youtube.com/shorts/zIVCutLHtOU





UC San Diego
JACOBS SCHOOL OF ENGINEERING

Oakd node detection


```
[INFO] [1742520236.626823755] [oakd_detection_node]: Updated Movement: LEFT
[INFO] [1742520237.477816675] [oakd_detection_node]: Published: foot (88.53%) - x_min: 109, y_min: 198, x_max: 517, y_max: 367; foot (83.06%) - x_
min: 462, y_min: 226, x_max: 1123, y_max: 437; foot (71.88%) - x_min: 466, y_min: 257, x_max: 781, y_max: 440 | Movement: LEFT
[INFO] [1742520238.393951103] [oakd_detection_node]: Published: foot (88.18%) - x_min: 109, y_min: 201, x_max: 518, y_max: 367; foot (85.06%) - x_
min: 463, y_min: 201, x_max: 1123, y_max: 437; foot (62.06%) - x_min: 467, y_min: 257, x_max: 781, y_max: 440 | Movement: LEFT
[INFO] [1742520238.626806674] [oakd_detection_node]: Updated Movement: LEFT
[INFO] [1742520239.388360766] [oakd_detection_node]: Published: foot (86.91%) - x_min: 396, y_min: 194, x_max: 1071, y_max: 445; foot (86.77%) - x
_min: 111, y_min: 208, x_max: 509, y_max: 371 | Movement: LEFT
[INFO] [1742520240.385731912] [oakd_detection_node]: Published: foot (90.62%) - x_min: 340, y_min: 201, x_max: 1029, y_max: 450; foot (64.79%) - x
_min: 111, y_min: 213, x_max: 455, y_max: 365 | Movement: LEFT
[INFO] [1742520240.627468738] [oakd_detection_node]: Updated Movement: LEFT
[INFO] [1742520240.899005529] [oakd_detection_node]: Published: foot (89.84%) - x_min: 54, y_min: 232, x_max: 841, y_max: 457 | Movement: LEFT
[INFO] [1742520241.235331464] [oakd_detection_node]: Published: foot (90.92%) - x_min: 0, y_min: 243, x_max: 806, y_max: 454 | Movement: LEFT
[INFO] [1742520241.828930281] [oakd_detection_node]: Published: foot (72.90%) - x_min: 3, y_min: 185, x_max: 511, y_max: 472 | Movement: LEFT
[INFO] [1742520242.165621637] [oakd_detection_node]: Published: foot (88.28%) - x_min: 128, y_min: 176, x_max: 668, y_max: 376; foot (77.25%) - x_
min: 0, y_min: 288, x_max: 291, y_max: 475 | Movement: LEFT
[INFO] [1742520242.626783234] [oakd_detection_node]: Updated Movement: LEFT
[INFO] [1742520242.668879895] [oakd_detection_node]: Published: foot (87.99%) - x_min: 122, y_min: 190, x_max: 669, y_max: 377; foot (79.20%) - x_
min: 0, y_min: 287, x_max: 232, y_max: 474 | Movement: LEFT
[INFO] [1742520243.086156703] [oakd_detection_node]: Published: foot (88.57%) - x_min: 127, y_min: 176, x_max: 668, y_max: 373 | Movement: LEFT
[INFO] [1742520243.585923499] [oakd_detection_node]: Published: foot (88.53%) - x_min: 128, y_min: 178, x_max: 670, y_max: 374 | Movement: LEFT
[INFO] [1742520244.161909965] [oakd_detection_node]: Published: foot (86.62%) - x_min: 69, y_min: 211, x_max: 849, y_max: 463 | Movement: LEFT
[INFO] [1742520244.626800392] [oakd_detection_node]: Updated Movement: RIGHT
[INFO] [1742520244.660062535] [oakd_detection_node]: Published: foot (86.62%) - x_min: 68, y_min: 212, x_max: 852, y_max: 463 | Movement: RIGHT
[INFO] [1742520244.998613966] [oakd_detection_node]: Published: foot (85.06%) - x_min: 69, y_min: 213, x_max: 853, y_max: 463 | Movement: RIGHT
[INFO] [1742520245.928279571] [oakd_detection_node]: Published: foot (87.70%) - x_min: 67, y_min: 210, x_max: 851, y_max: 463 | Movement: RIGHT
[INFO] [1742520246.860575538] [oakd_detection_node]: Published: foot (87.30%) - x_min: 65, y_min: 207, x_max: 850, y_max: 463 | Movement: NONE
[INFO] [1742520248.027049419] [oakd_detection_node]: Published: foot (87.21%) - x_min: 64, y_min: 210, x_max: 851, y_max: 463 | Movement: NONE
```

UC San Diego
JACOBS SCHOOL OF ENGINEERING

Conclusion

What Worked

- GPS sending data inside ROS2
- Oakd camera working in ROS2

What didn't work

- Combining the whole project together

We will update the documentation for GPS on ROS2 as a part of our final report on github!

Thank you for listening

UC San Diego
JACOBS SCHOOL OF ENGINEERING