

# Final Project: Team2

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# 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



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# 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](#)



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# ROS2

```
Docker_Container@ucsdrobotcar-148-02:/home/projects/ros2_ws/src/ucsd_robotcar_hub2(master) ls
README.md      log            ucsd_robotcar_basics2_pkg    ucsd_robotcar_nav2_pkg      ucsd_ros2_logos.png
core           oakd_ros2      ucsd_robotcar_control2_pkg    ucsd_robotcar_path2_pkg
docker_setup    ucsd_robotcar_actuator2_pkg  ucsd_robotcar_lane_detection2_pkg  ucsd_robotcar_sensor2_pkg
```

## 1. Bag Processing Node

- ```
>>ucsd_robotcar_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.



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## 2. Path Provider (gps\_path\_provider\_node)

- ```
>>ucsd_robotcar_path2_pkg #provides the path
ucsd_robotcar_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_robotcar_path2_pkg
launch
gps_nav_launch.launch.py
>>ucsd_robotcar_path2_pkg
ucsd_robotcar_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_robotcar_control2_pkg
ucsd_robotcar_control2_pkg
pid_gps_node.py

>>ucsd_robotcar_control2_pkg
ucsd_robotcar_control2_pkg
pid_gps_calibration_node.py
```
- Reads tracking errors from /error.
  - Computes steering and speed corrections.
  - Publishes movement commands to /drive

# Problems

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

```
return bootstrap_gcd_import(level, package, level)
File <frozen importlib._bootstrap> line 1014, in gcd_import
File <frozen importlib._bootstrap> line 991, in find_and_load
File <frozen importlib._bootstrap> line 972, in find_and_load_unlocked
File <frozen importlib._bootstrap> line 857, in load_unlocked
File <frozen importlib._bootstrap> line 556, in module_from_spec
File <frozen importlib._bootstrap.external> line 1166, in create_module
File <frozen importlib._bootstrap> line 219, in call_with_frames_removed
ImportError: /opt/ros/foxy/lib/libd_msgs__rosidl_generator_c.so: undefined symbol: rosidl_runtime_c_double_sequence_are_equal
During handling of the above exception, another exception occurred:

Traceback (most recent call last):
  File /home/projects/ros2_ws/install/ucsd_robotar_sensor2_pkg/lib/ucsd_robotar_sensor2_pkg/ublox_gps_node.py, line 11, in <module>
    load_entry_point('ucsd-robotar-sensor2-pkg==0.0.0', 'console_scripts', 'ublox_gps_node')()
  File /home/projects/ros2_ws/install/ucsd_robotar_sensor2_pkg/lib/python3.8/site-packages/ucsd_robotar_sensor2_pkg/ublox_gps_node.py, line 57,
  in main
    mode = UblodGPSMode()
  File /home/projects/ros2_ws/install/ucsd_robotar_sensor2_pkg/lib/python3.8/site-packages/ucsd_robotar_sensor2_pkg/ublox_gps_node.py, line 10,
  in __init__
    self.publisher = self.create_publisher(NavSatFix, '/fix', 10)
  File /opt/ros/foxy/lib/python3.8/site-packages/rcipy/type_support.py, line 1148, in create_publisher
    check_for_type_support(type)
  File /opt/ros/foxy/lib/python3.8/site-packages/rcipy/type_support.py, line 29, in check_for_type_support
    msg_type_class = import_type_support()
  File /opt/ros/foxy/lib/python3.8/site-packages/sensor_msgs/msg/_nav_sat_fix.py, line 34, in __import_type_support__
  File /opt/ros/foxy/lib/python3.8/site-packages/rosidl_generator_py/import_type_support_impl.py, line 48, in __import_type_support__
    raise ImportError(f'package {pkg_name}
ImportError: cannot import name 'rosidl_runtime_c_double_sequence_are_equal' from 'rosidl_runtime_c' package 'sensor_msgs'
```

```
Summary: 0 packages (1 installed, 0 to install)
Docker Container@ucsdrobotar-148-02:/home/projects/ros2_ws$ ros2 run ucsd_robotar_sensor2_pkg ublox_gps_node
[INFO] [1742518405.478122627] [ublox_gps_node]: Connected to /dev/ttyUSB0 at 38400 baud
[WARN] [1742518405.480622110] [ublox_gps_node]: starting up the timer
[WARN] [1742518405.584896294] [ublox_gps_node]: LibbbbbbbBRS
[WARN] [1742518405.684805835] [ublox_gps_node]: $GBGSV,2,2,05,50,01,204,,0*40
[WARN] [1742518405.785264232] [ublox_gps_node]: $GNGLL,3252.67124,N,11713.99960,W,0.05325,0.0,A,D*65
[WARN] [1742518406.052349207] [ublox_gps_node]: $GNRMC,0.05326,0.0,A,3252.87120,N,11713.99957,W,0.030,,210325,,,D,V*01
[WARN] [1742518406.060829898] [ublox_gps_node]: $GNVTG,T,M,0.030,N,0.055,K,D*38
[WARN] [1742518406.085086190] [ublox_gps_node]: $GNGGA,0.05326,0.0,3252.87120,N,11713.99957,W,2.12,0.77,110.5,M,-33.8,M,,*7E
[INFO] [1742518406.089555571] [ublox_gps_node]: Published GPS fix: 32.881186666666665, -117.23332616666667, 110.5
[WARN] [1742518406.185491460] [ublox_gps_node]: $GNGSA,A,3,10,05,15,18,23,25,26,29,44,46,48,,1.83,0.77,1.66,1*04
[WARN] [1742518406.285289230] [ublox_gps_node]: $GNGSA,A,3,12,29,10,31,24,33,,,,,1.83,0.77,1.66,3*05
[WARN] [1742518406.385341532] [ublox_gps_node]: $GNGSA,A,3,24,29,35,44,22,19,,,,,1.83,0.77,1.66,4*0C
[WARN] [1742518406.485737535] [ublox_gps_node]: $GPGSV,3,1,11,05,33,042,31,10,10,222,27,15,43,122,44,18,53,316,45,1*68
[WARN] [1742518406.585744991] [ublox_gps_node]: $GPGSV,3,2,11,23,50,225,43,25,21,191,25,26,24,294,24,29,75,095,44,1*67
[WARN] [1742518406.685374479] [ublox_gps_node]: $GPGSV,3,3,11,44,52,180,46,46,50,201,42,48,51,194,42,1*58
[WARN] [1742518406.786080064] [ublox_gps_node]: $GPGSV,1,1,04,18,53,316,37,23,50,225,40,25,21,191,20,26,24,294,18,8*68
[WARN] [1742518406.885076374] [ublox_gps_node]: $GPGSV,1,1,03,13,24,079,,16,12,318,,20,01,047,,0*52
[WARN] [1742518406.985363520] [ublox_gps_node]: $GAGSV,2,1,06,10,36,289,25,12,54,315,32,24,43,280,30,29,27,077,22,1*72
[WARN] [1742518407.084622383] [ublox_gps_node]: $GAGSV,2,2,06,31,39,206,31,33,43,047,36,1*7C
[WARN] [1742518407.185309478] [ublox_gps_node]: $GAGSV,2,1,06,10,36,289,42,12,54,315,39,24,43,280,42,29,27,077,31,7*79
[WARN] [1742518407.285487403] [ublox_gps_node]: $GAGSV,2,2,06,31,39,206,35,33,43,047,42,7*7D
[WARN] [1742518407.385088404] [ublox_gps_node]: $GAGSV,3,1,09,04,03,180,,07,01,033,,11,13,274,,14,75,315,,0*74
[WARN] [1742518407.485037060] [ublox_gps_node]: $GAGSV,3,2,09,16,27,306,,19,29,130,,23,04,169,,25,09,122,,0*7C
[WARN] [1742518407.584331860] [ublox_gps_node]: $GAGSV,3,3,09,26,03,075,,0*48
[WARN] [1742518407.685286559] [ublox_gps_node]: $GBGSV,2,1,07,19,40,053,40,21,21,194,23,22,61,145,47,24,14,260,28,3*7A
[WARN] [1742518407.784950604] [ublox_gps_node]: $GBGSV,2,2,07,19,40,053,40,10,35,57,077,47,44,57,331,41,3*46
[WARN] [1742518407.885429861] [ublox_gps_node]: $GBGSV,2,1,05,19,40,053,33,42,61,145,36,24,14,260,18,35,57,077,34,5*71
[WARN] [1742518407.984178619] [ublox_gps_node]: $GBGSV,2,2,05,44,57,331,38,5*4F
[WARN] [1742518408.085042485] [ublox_gps_node]: $GBGSV,2,1,05,25,03,309,,26,07,214,,34,09,301,,48,15,040,,0*78
[WARN] [1742518408.184131400] [ublox_gps_node]: $GBGSV,2,2,05,50,01,204,,0*40
```



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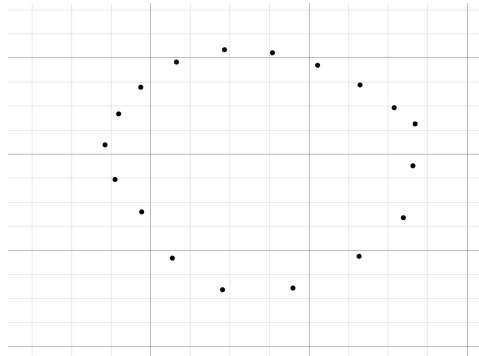
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# Video of gps working in EBU courtyard

<https://youtube.com/shorts/zlVCutLHtoU>



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# 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] [1742520244.626808392] [oakd_detection_node]: Updated Movement: RIGHT
[INFO] [1742520244.660862535] [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
```



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# 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!

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# Thank you for listening



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