



F1/10 YELLOWTAILS

Autonomous Racing
For Everyone

Bowen Boyd, Hanyue Wang, Kyle Watson, and Jordan Wright

Faculty Mentor: Isaac Shaffer

Clients: Dr. Nghiem, Doan Nguyen

Introduction

Clients



Dr. Nghiem

- Assistant Professor
- Director of ICONS Lab



Doan Nguyen

- Graduate Research Assistant

What makes these cars run?

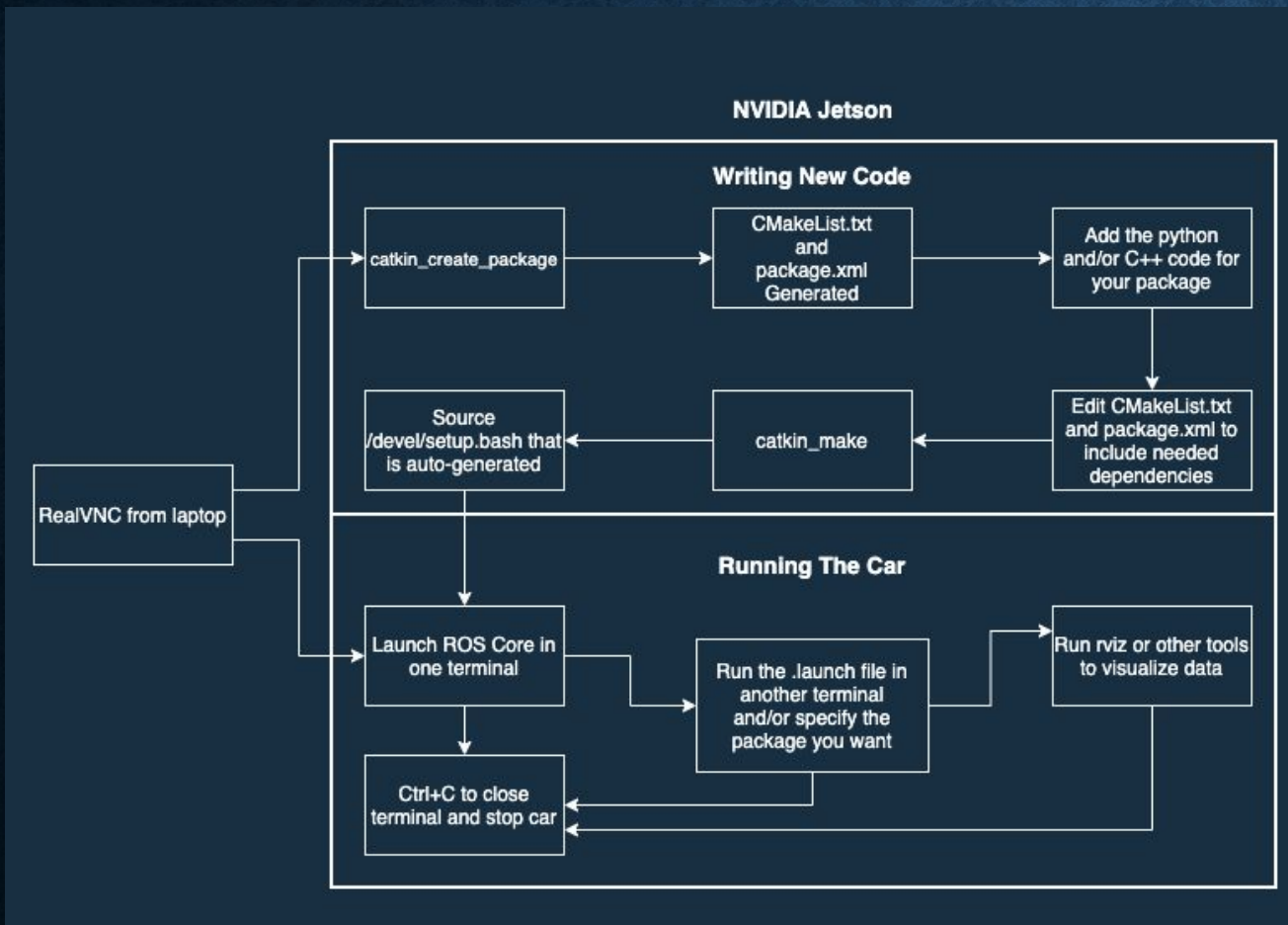
- NVIDIA Jetson / LiDar
- Robotic Operating System (ROS)



Clients Goals

- Flagstaff's F1/10 Robo-Racing Project

Problem Statement



1. Overly Complicated

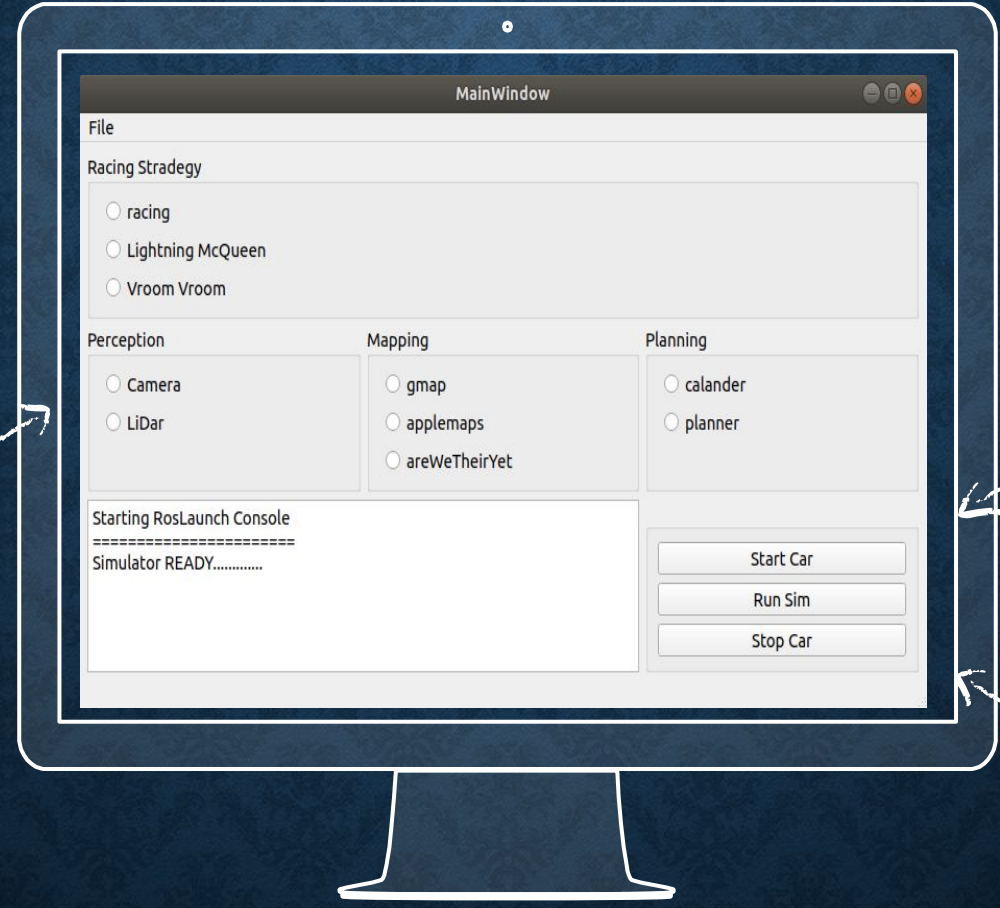
2. Disconnected Configuration

3. No emergency Stop

Solutions Overview

An Interactable System
For High School Students!

**2. Configuration
Window**



**1. Driver
System**

**3. Kill Switch
System**

Key Requirements

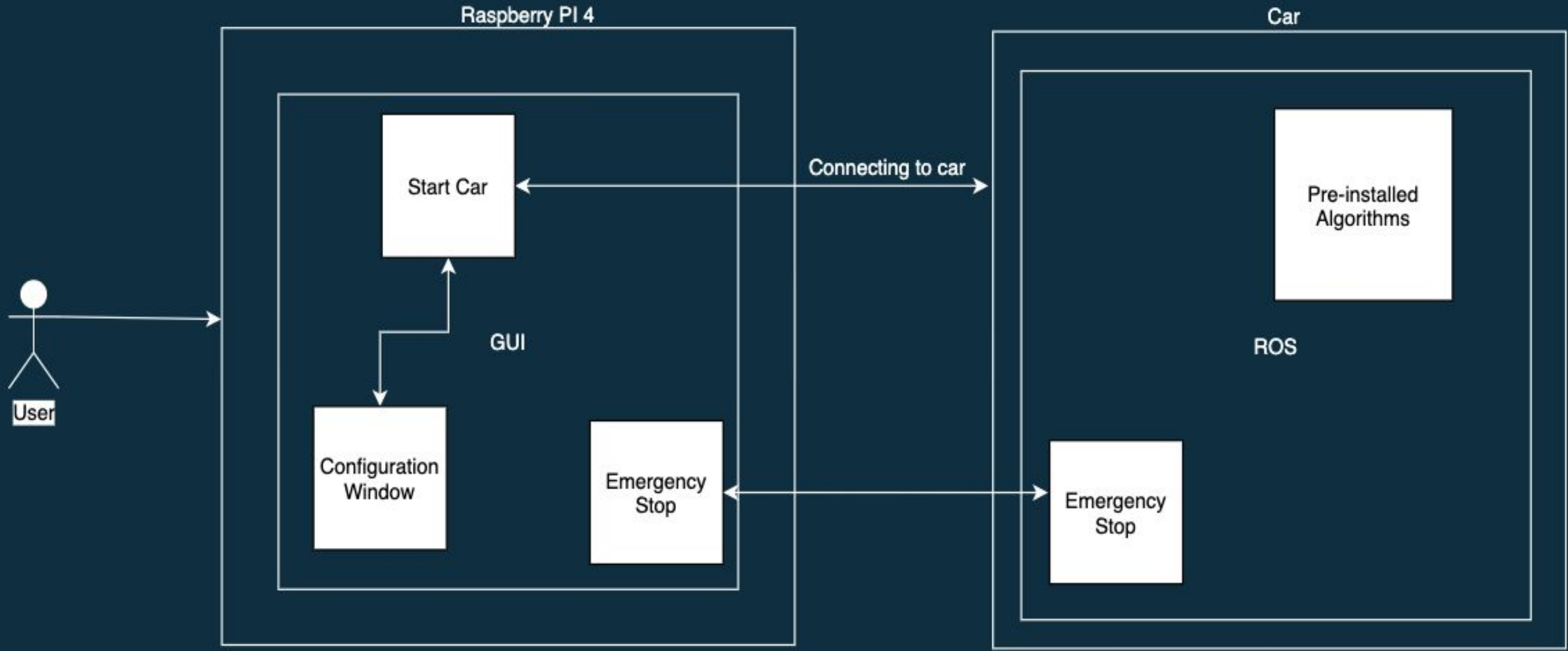
Functional

- Configuration System
- Communication Tool Kit
- Console
- Emergency Stop Button

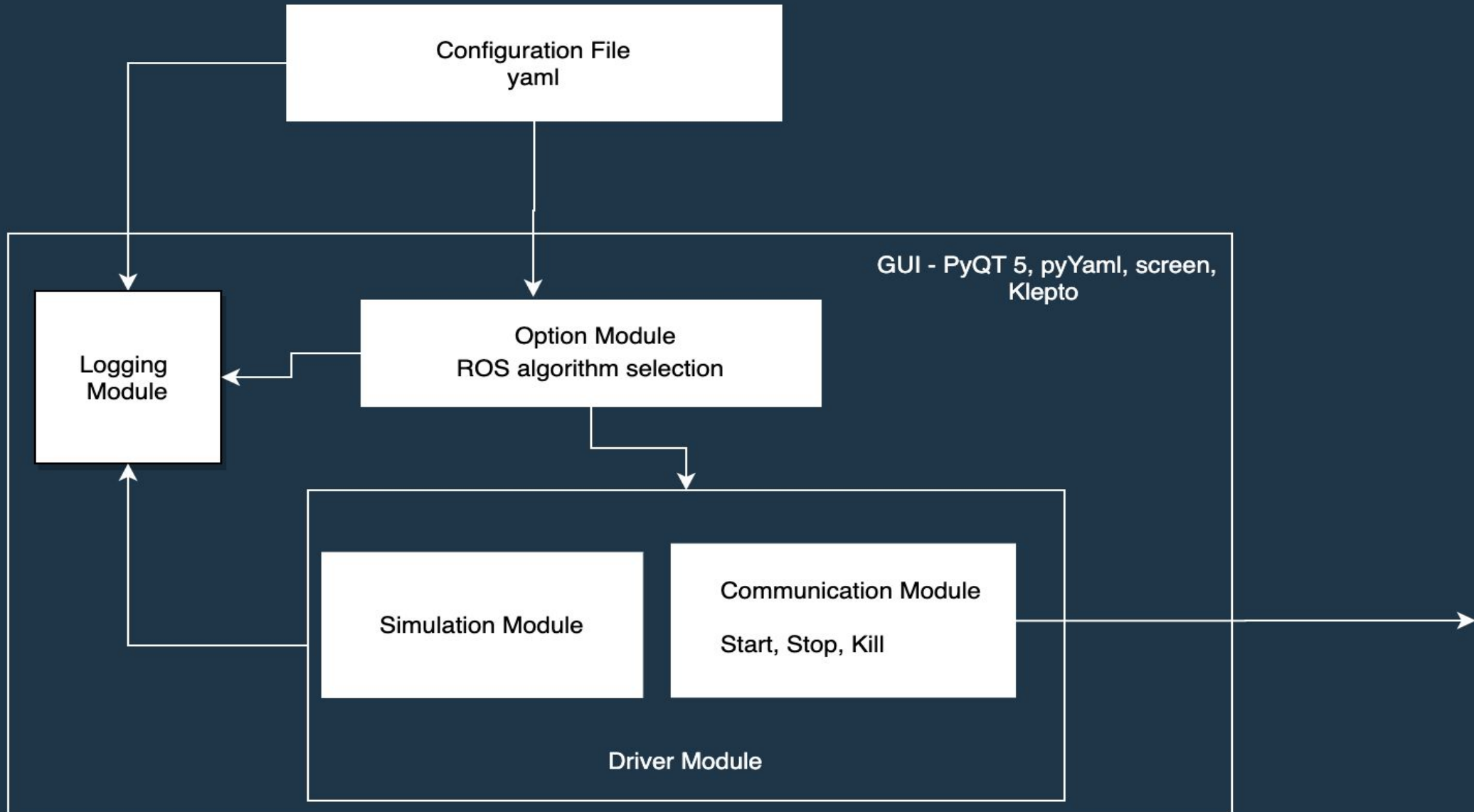
Environmental

- ROS
- Ubuntu
- NVIDIA Jetson
- Raspberry Pi

Implementation Overview



Architectural Software Overview



Options Module

```
# config.yaml
Version: 20200221 #used to kepp track of diffrent configs and relate to saved profiles

Racing Stradegy: #module name
  variable: strat #varname that gets passed in string
  choices: #list of buttons and thier values
    button0: #button value passed to the string
      title: Racing #title of the button in the GUI
      dependencies: #list of other choices that
        #button3 for exaple
    button1:
      title: Lightning McQueen
      dependencies:
    button2:
      title: Vroom Vroom
      dependencies:

Perception:
  variable: eyes
  choices:
    button3:
      title: Camera
    button4:
      title: LiDar

Mapping:
  variable: mapper
  choices:
    button5:
      title: gmap
    button6:
      title: applemaps
    button7:
      title: areWeTheirYet

Planning:
  variable: planner
  choices:
    button8:
      title: calander
    button9:
      title: planner
```



Racing Stradegy

- Racing
- Lightning McQueen
- Vroom Vroom

Perception	Mapping	Planning
<ul style="list-style-type: none"><input type="radio"/> Camera<input type="radio"/> LiDar	<ul style="list-style-type: none"><input type="radio"/> gmap<input type="radio"/> applemaps<input type="radio"/> areWeTheirYet	<ul style="list-style-type: none"><input type="radio"/> calander<input type="radio"/> planner

Driver Module

Start / Stop Car

- Sends config to car and runs car
- Sends a message to car to stop



Start Simulator

- Runs functionality on the simulation



Logging Module

What logging looks like in **Log File**:

```
... logging to /home/bboyd/.ros/log/ecae6c56-4467-11ea-8026-000c293c857d/roslaunch-ubuntu-3661.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.
|2;/home/bboyd/R05WS/f110_ws/src/f110-fall2018-skeletons/simulator/f1_10_sim/race/launch/f1_tenth.launch
[1started roslaunch server http://ubuntu:34553/ [0m

SUMMARY
=====

PARAMETERS
* /gazebo/enable_ros_network: True
* /racecar/joint_state_controller/publish_rate: 50
* /racecar/joint_state_controller/type: joint_state_contr...
* /racecar/left_front_wheel_velocity_controller/joint: left_front_wheel...
* /racecar/left_front_wheel_velocity_controller/pid/d: 0.0
* /racecar/left_front_wheel_velocity_controller/pid/i: 0.0
* /racecar/left_front_wheel_velocity_controller/pid/i_clamp: 0.0
* /racecar/left_front_wheel_velocity_controller/pid/p: 0.5
* /racecar/left_front_wheel_velocity_controller/type: effort_controller...
* /racecar/left_rear_wheel_velocity_controller/joint: left_rear_wheel_j...
* /racecar/left_rear_wheel_velocity_controller/pid/d: 0.0
* /racecar/left_rear_wheel_velocity_controller/pid/i: 0.0
* /racecar/left_rear_wheel_velocity_controller/pid/i_clamp: 0.0
* /racecar/left_rear_wheel_velocity_controller/pid/p: 1.0
* /racecar/left_rear_wheel_velocity_controller/type: effort_controller...
* /racecar/left_steering_hinge_position_controller/joint: left_steering_hin...
* /racecar/left_steering_hinge_position_controller/pid/d: 0.5
* /racecar/left_steering_hinge_position_controller/pid/i: 0.0
* /racecar/left_steering_hinge_position_controller/pid/p: 10.0
* /racecar/left_steering_hinge_position_controller/type: effort_controller...
* /racecar/right_front_wheel_velocity_controller/joint: right_front_wheel...
* /racecar/right_front_wheel_velocity_controller/pid/d: 0.0
* /racecar/right_front_wheel_velocity_controller/pid/i: 0.0
* /racecar/right_front_wheel_velocity_controller/pid/i_clamp: 0.0
* /racecar/right_front_wheel_velocity_controller/pid/p: 0.5
* /racecar/right_front_wheel_velocity_controller/type: effort_controller...
* /racecar/right_rear_wheel_velocity_controller/joint: right_rear_wheel...
* /racecar/right_rear_wheel_velocity_controller/pid/d: 0.0
* /racecar/right_rear_wheel_velocity_controller/pid/i: 0.0
* /racecar/right_rear_wheel_velocity_controller/pid/i_clamp: 0.0
* /racecar/right_rear_wheel_velocity_controller/pid/p: 1.0
* /racecar/right_rear_wheel_velocity_controller/type: effort_controller...
```

What logging looks like in **GUI console**:

```
Starting RosLaunch Console
=====
Simulator READY.....
```

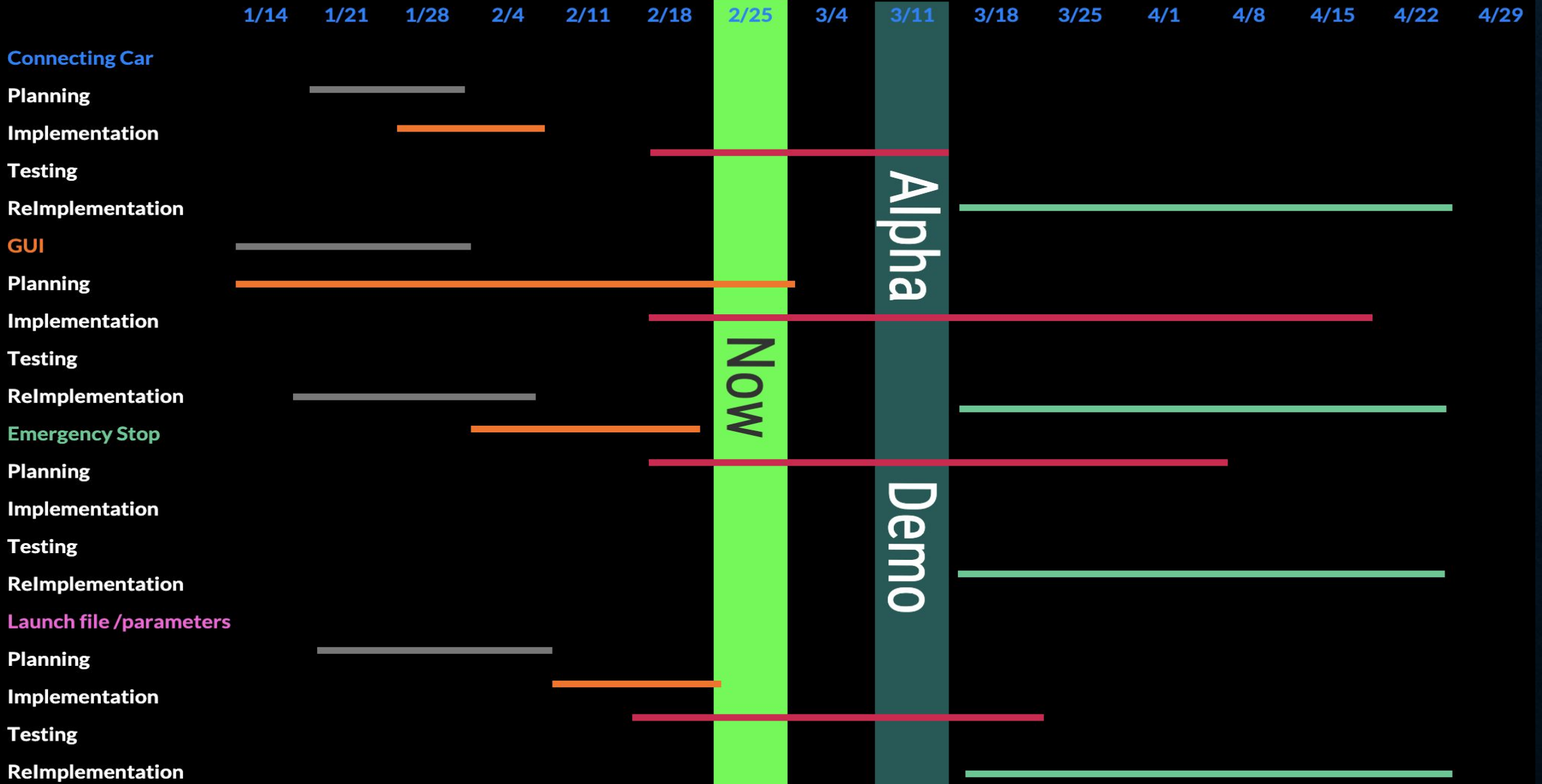

Challenges and Resolutions

1. *Testing without Car*
 - Creating a script to simulate connecting to car
2. *GUI Format*
 - Dynamically by Configuration File
3. *Saving Configuration Data*
 - Using Save button in file
4. *Using SSH to communicate and control car:*
 - Bash screen command



Schedule

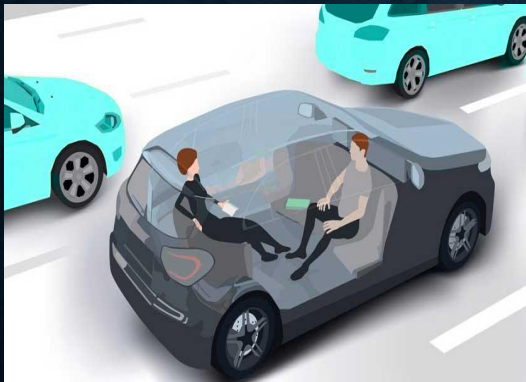
Spring 2020



Conclusion

Big Picture

- Self-driving cars are the future!



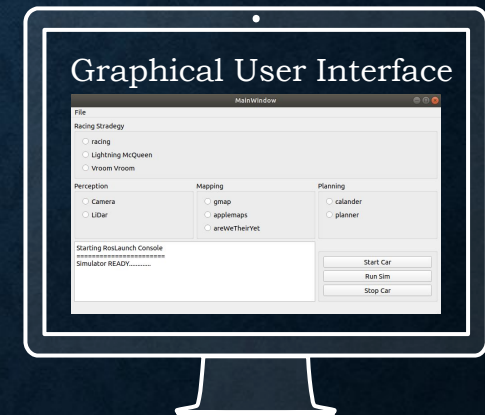
Problem

- Autonomous F1/10 program is currently inaccessible to HS students



Solution

- Graphical User Interface for Better Accessibility



Thank you!

For more information please visit our website:

<http://tiny.cc/yellowtails>

