

PROJECT PROPOSAL

INTERCEPTOR 4.0

AUTONOMOUS LAW ENFORCEMENT VEHICLE

TEAM DELAMAIN

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1. INTRODUCTION

1.1 GOAL OF THE PROJECT



Team Delamain wants to build Interceptor 4.0, a level 4 autonomous law enforcement vehicle that patrols neighborhoods and when needed chases vehicles. The challenges Interceptor 4.0 will face are as follows: lane detection, object avoidance, GPS navigation, self-parking, specific vehicle tracking, and more. In addition it will need to follow the rules of law and during a pursuit should have the ability to ignore them while maintaining safety for its user and surroundings.

This autonomous vehicle would enable to increase the safety of law enforcement officers and people around them. It will be more reliable for chasing vehicles as no human will be able to run out from our AI. Officers will also be able to multitask in their Interceptor 4.0 while chasing a vehicle, enabling them to coordinate road blocks, spike strip, and more. In addition the Interceptor 4.0 will facilitate law enforcement agencies to have more coverage without having the need for more personal. Finally, Interceptor 4.0 could be equipped with a Grappler Police Bumper in order to safely stop the vehicle it is pursuing instead of using a dangerous pit maneuver.

1.2 LEVEL OF AUTONOMY

- **Level 4 of autonomy**
 - Highly automated car
 - Full self-driving under certain conditions
 - Equipped with a multitude of sensors
 - Camera, LIDAR, GPS
 - Optional: Radar, Semantic Camera



- **Target Market:**
 - Main: First Responders
 - Secondary: General Public (adapted)



1.3 DESCRIPTION

Base:

- Follow rules of law
- Lane detection & tracking
- Collision avoidance (object classification)
- Signs/Lights detection
- Intersections handling



3 Autonomous Scenarios:

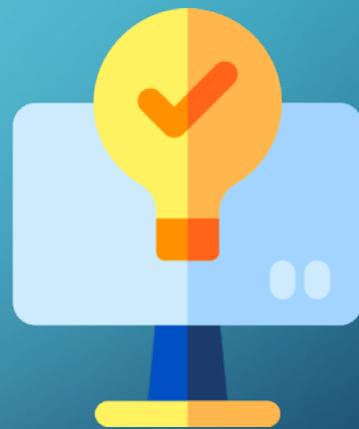
- GPS Navigation
- Car Chasing
- Self-Parking



2. RELATED WORK

2.1 INSPIRATION

- <https://github.com/JahodaPaul/autonomous-car-chase>
- <https://medium.com/xrpractices/autonomous-car-parking-using-ml-agents-d780a366fe46>
- <https://github.com/expectopatronm/platooning-demonstrator>
- <https://github.com/carla-simulator/imitation-learning>
- <https://thomasfermi.github.io/Algorithms-for-Automated-Driving/Introduction/intro.html>
- <https://github.com/Amin-Tgz/awesome-CARLA>
- <https://www.openbot.org/>
- <https://github.com/FoamoftheSea/mod6project>
- <https://medium.com/asap-report/training-a-neural-network-for-driving-an-autonomous-rc-car-3906db91f3e>
- <https://ai.googleblog.com/2019/01/soft-actor-critic-deep-reinforcement.html>
- <https://github.com/PacktPublishing/Hands-On-Intelligent-Agents-with-OpenAI-Gym/tree/master/ch7#2-carla-gym>
- <https://github.com/KaiChen1008/Sim-to-Real-Virtual-Guidance-for-Robot-Navigation>
- <https://www.mdpi.com/2504-446X/3/3/58/htm>
- <https://github.com/vignif/carla-parking>
- <https://policebumper.com/>



3. TEAM ORGANIZATION

3.1 TEAM MEMBERS AND ROLES

- Zhongheng (Heng) Li :
 - Object Detection + Chasing + Sim2real
- Nicolas Morant:
 - GPS Navigation + Self Parking
- Huayu (Jack) Tsu:
 - Lane Tracking + Intersection



4. SOFTWARE AND DEVELOPING TOOLS

4.1 SOFTWARE



GitHub



4.2 LAPTOP/DESKTOP SETUP

□ Desktop computers

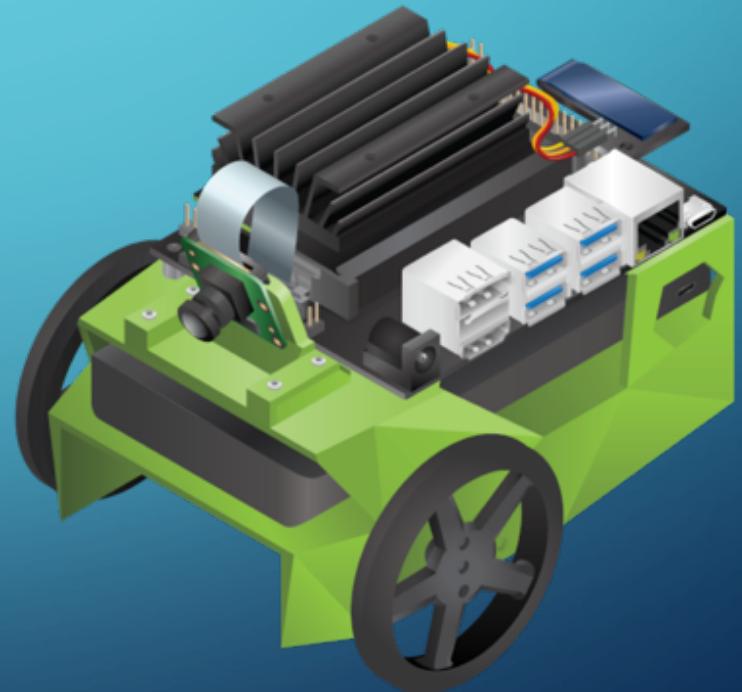
□ Recommended requirements:

- Intel i7/i9 gen. 9th - 11th or AMD Ryzen 7/9
- +16 GB RAM memory
- NVIDIA RTX 2070 or higher
- Windows or Ubuntu



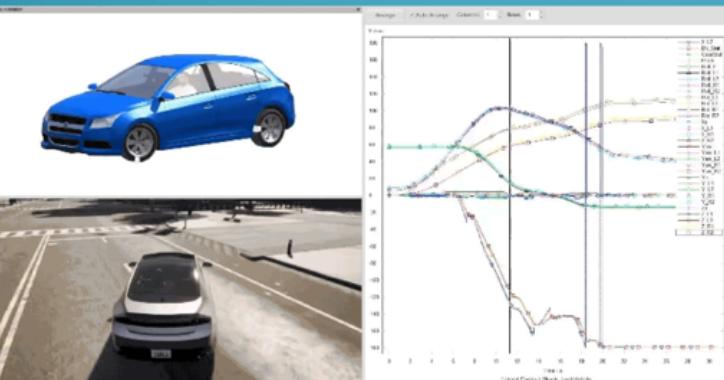
4.3 HARDWARE NEEDED (BONUS PHASE)

- ❑ Bonus Phase for Sim2Real:
 - ❑ JetBot AI Robot Kit
 - ❑ Including NVIDIA Jetson Nano



4.4 SIMULATOR NEEDED

- CARLA Simulator (<https://carla.org/>)



5. LIST OF MILESTONES

5.1 OUTLINE AND SCHEDULE



Week	Date	Milestone
3	8-Feb	Setting up our desktops and installing CARLA simulator
4	15-Feb	Testing Carla simulator's features and functionalities
5	22-Feb	Writing project proposal
6	1-Mar	Project proposal submission (28-Feb)
7	8-Mar	Phase 1: Lane Tracking; GPS Navigation; Object Detection - Demo
8	15-Mar	Phase 1 features - Finalized
9	22-Mar	Phase 2: Intersection; Self-Parking; Vehicle-reID - Demo
10	29-Mar	Phase 2: features - Finalized
11	5-Apr	Phase 3: Integration - Planning
12	12-Apr	Phase 3: Integration - Demo
13	19-Apr	Phase 3: Integration - Finalized
14	26-Apr	Presentation preparation + Bonus phase
15	3-May	Project submission and presentation

5.2 PHASES

Enable Baseline in CARLA Simulator

Tasks:

- Lane Tracking
- GPS Navigation
- Object Detection

PHASE 1

PHASE 2

Integration

Tasks:

- Fuse all scenarios from phase 1 & 2

PHASE 3

BONUS PHASE

Self-Driving Capability Enhancements

Tasks:

- Intersection Handling
- Self-Parking
- Vehicle Reidentification

Deploy to JetBot

Tasks:

- Test car start, stop and car chasing in JetBot
- Enable continuously generate real world dataset

6. TEAM MEETING SCHEDULE

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More meetings will be added as needed throughout the semester.



INTERCEPTOR 4.0
COMING SOON
TEAM DELAMAIN