Robot Parallel Motion Planning

Milestone 1

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Roadmap

Goal: Enable autonomous robot to navigate to a goal in an unknown environment using the power of the GPU

- Milestone 1 (11/18):
  - Simulation infrastructure
  - Understanding GMT*
- Milestone 2 (11/25):
  - Motion planning (GMT*)
- Milestone 3 (12/2):
  - Perception and localization
  - Optimizations
- Final Submission (12/8):
  - Presenstation
  - Performance analysis

What we did

Implemented:

Pipeline structure to implement CUDA kernels

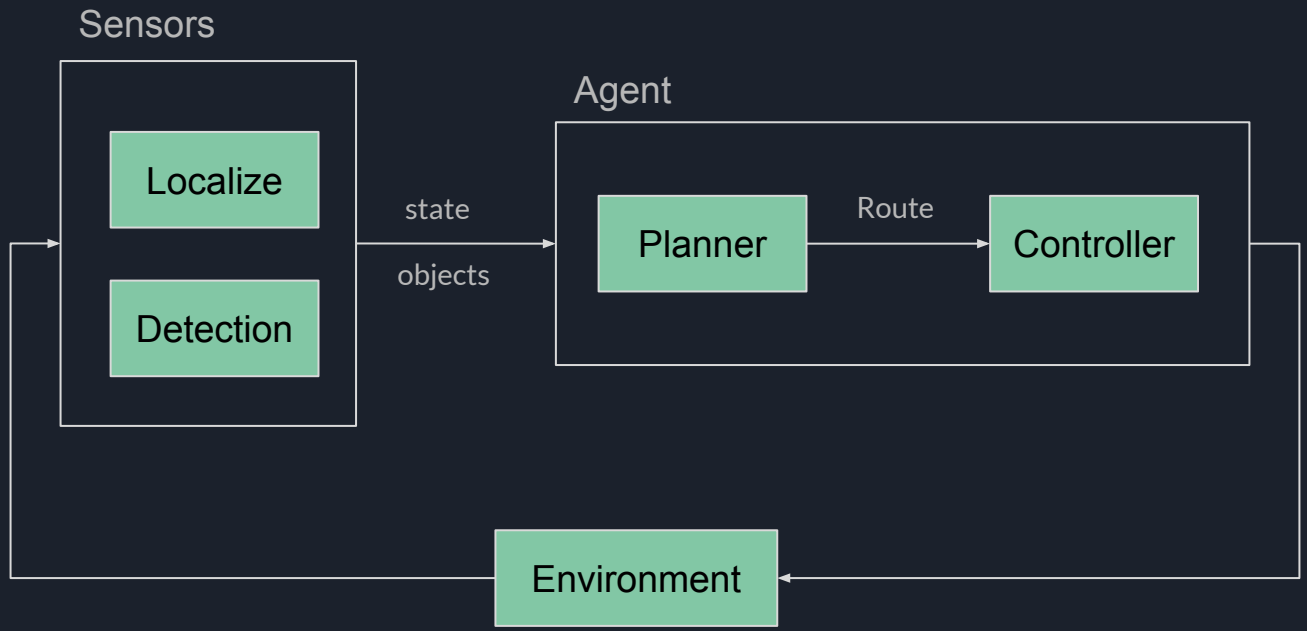
Various sensors on the car with processing

Test environment

Understood:

GMT* motion planning paper (mostly)

Pipeline


Sensors
Localize
Detection
state
objects
Agent
Planner
Route
Controller
Environment

Simulation Environment

- Debug route
- Spawn obstacles
  - Current implementation does not route around

Sensors

- Detection
  - Get obstacle depths
  - Data association
- Localization
  - Extended Kalman Filter

Sensors:

- Camera
- Segment Sensor
- Depth Camera
- GPS Sensor

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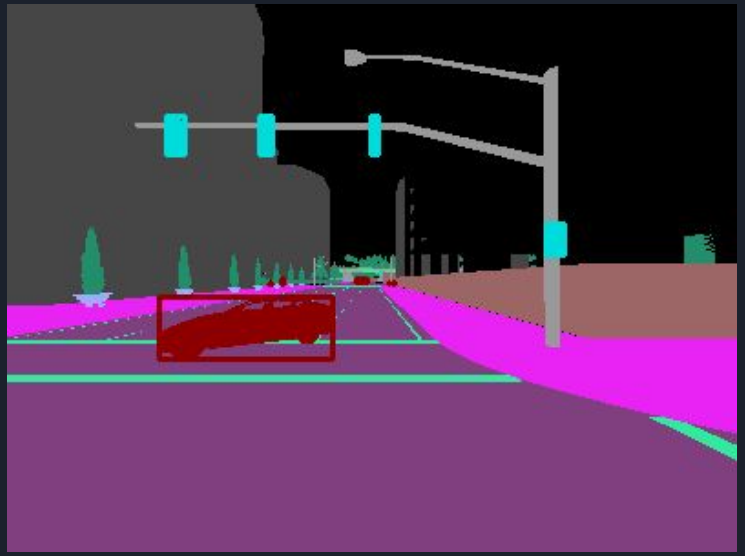
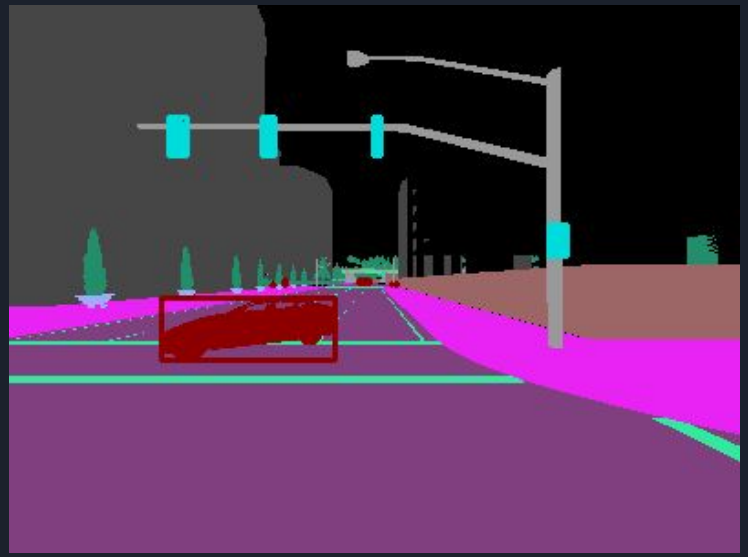
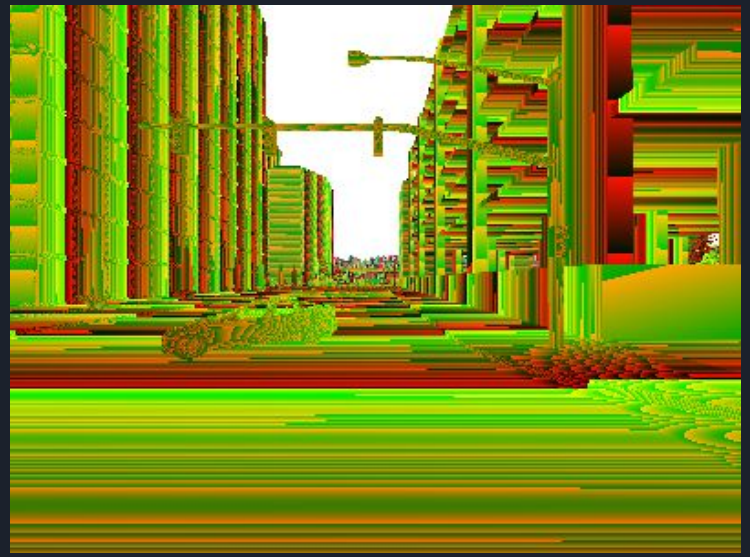


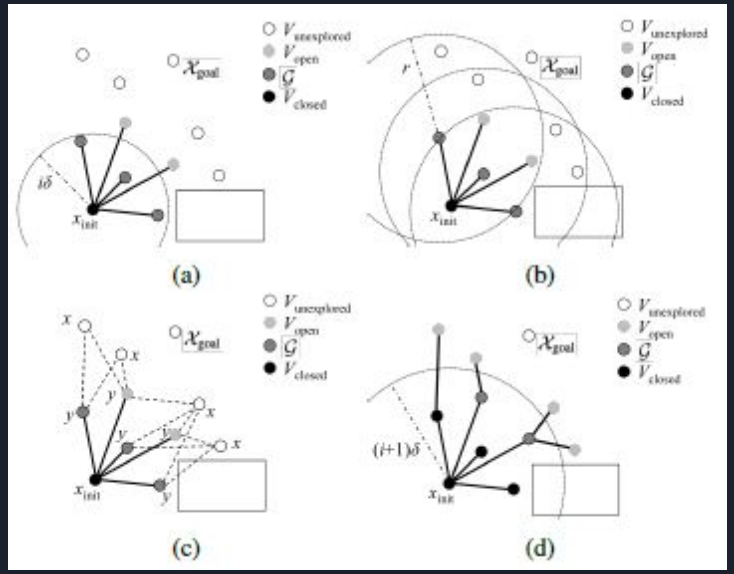
Sensors

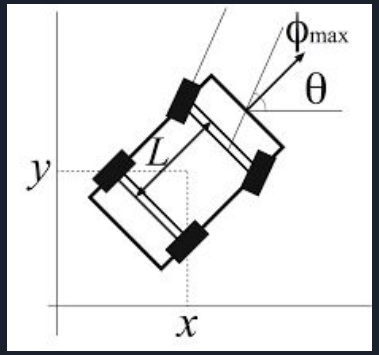


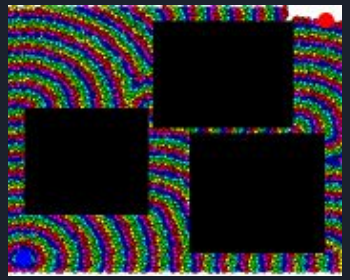


Agent

- GMT* planner
  - Sample state-space
  - Build tree
  - Avoid obstacles
- Controller
  - Using PID controller







Issues and Future Work

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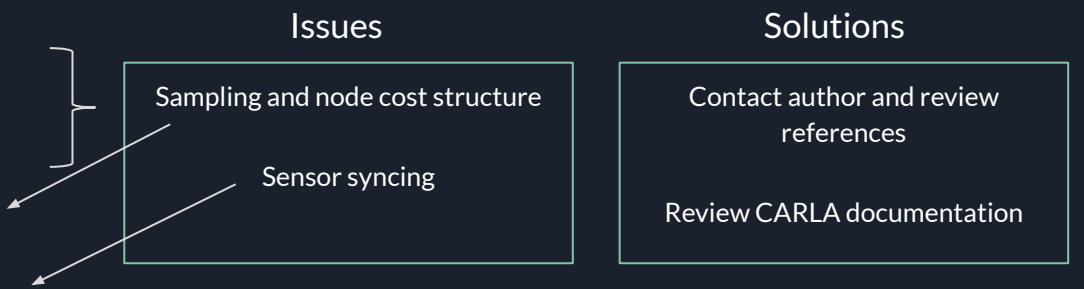

References

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   a. http://carla.org/
   b. https://carla.readthedocs.io/en/latest/
2. PyCuda
   a. https://documen.tician.de/pycuda/
   b. https://wiki.tiker.net/PyCuda
3. GMT*
   a. https://arxiv.org/pdf/1705.02403.pdf
4. FMT*
   a. https://arxiv.org/pdf/1306.3532.pdf

Q & A

Previous Work