



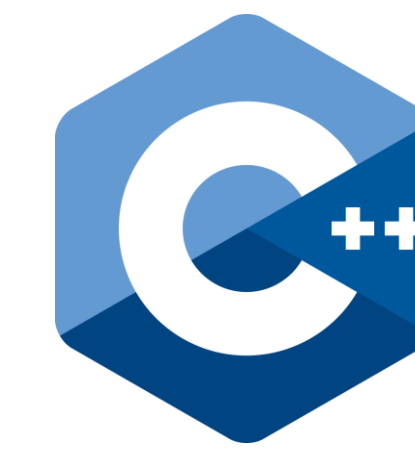
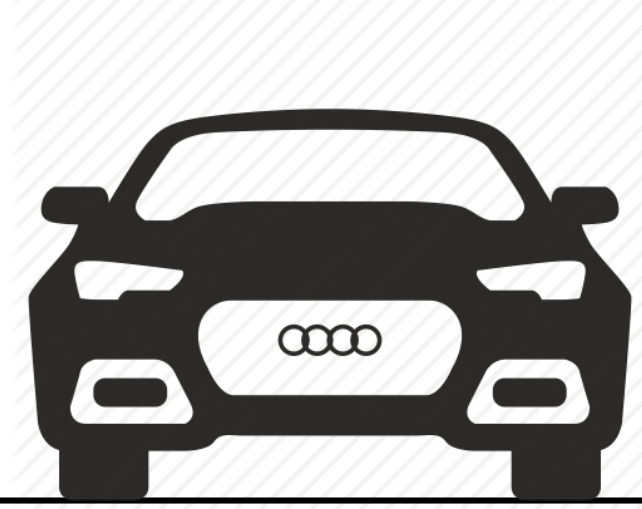
Senior Project, 2018, Fall

A Simulation Platform for Autonomous Research and System Evaluation (SPARSEv1.0)

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Problem

AI research for autonomous systems requires the collection of large, annotated datasets of real-world scenarios, especially for edge case events. It is difficult to collect enough data for these edge cases in the real world, since edge cases, by definition, are rare.

Solution

- ❖ The Unreal Game Engine provides the perfect environment to simulate realistic driving situations in real-time with minimal costs and with no safety risks.
- ❖ In a simulated environment edge cases can be easily tested repeatedly, accruing the large datasets needed to train an autonomous system.

Current Systems

There are other platforms that provide some of this functionality, such as OpenAI's gym, CARLA, or Microsoft's AirSim. However, these systems have a number of issues, such as a lack of realism, real-time simulation speed, custom sensor configurability, and readily usable APIs.

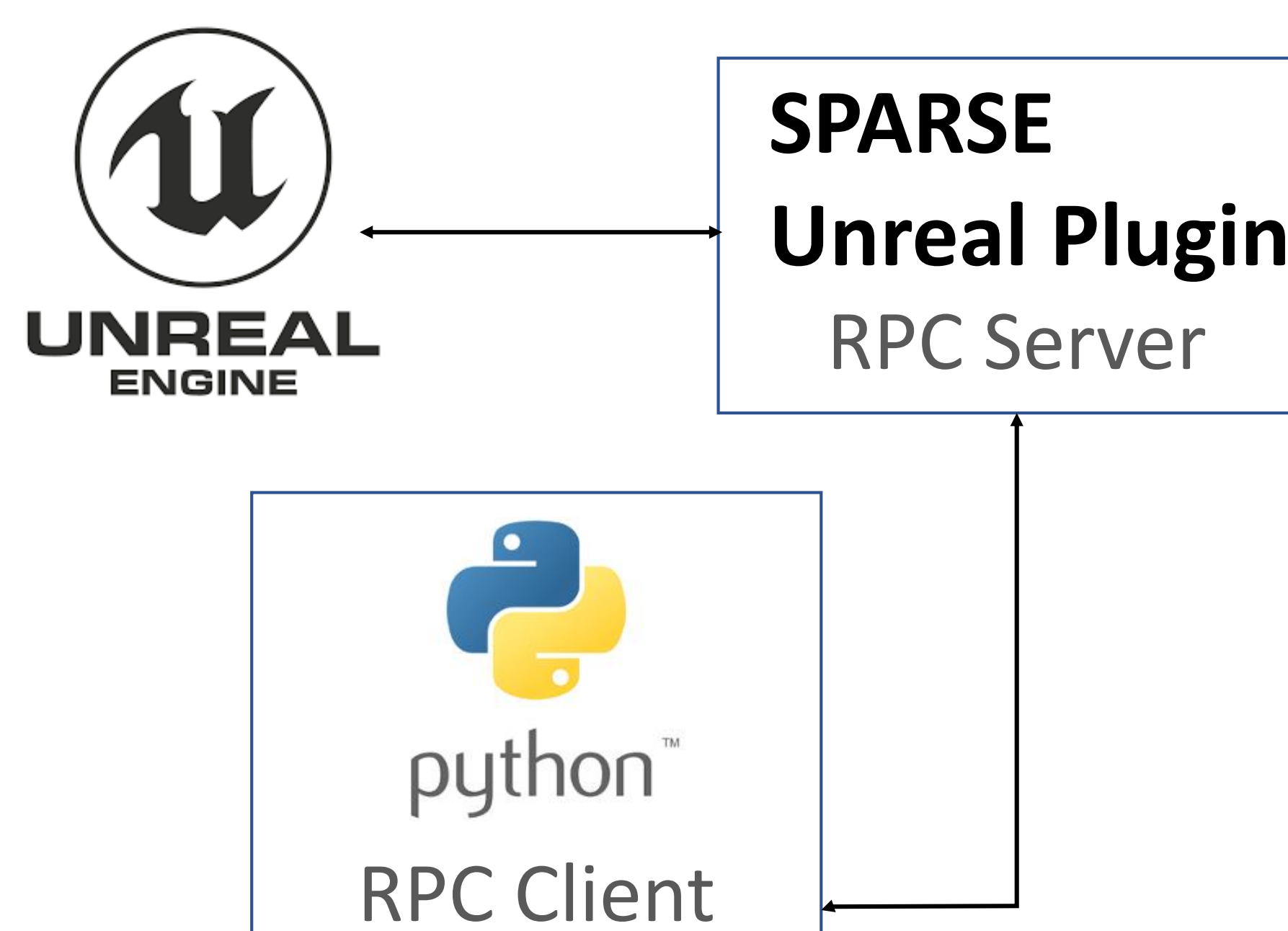
Requirements

Design a realistic autonomous AI simulator that addresses the shortcomings of current systems.

Include:

- ❖ A realistic environment and vehicle.
- ❖ Real-time simulation speed.
- ❖ Programmatic input from a python client.

System Design



Implementation

- ❖ We started with Unreal's C++ Vehicle Template .
- ❖ To control the Unreal simulation from a python client we added an RPC library called "rpclib".
- ❖ In the RPC server we bound different functions from the Unreal vehicle pawn so they could be called from the client.
- ❖ We then created 3 cameras to record the visual data from the Vehicles perspective.
- ❖ We optimized and added assets for the vehicle and for the environment.

Screenshots

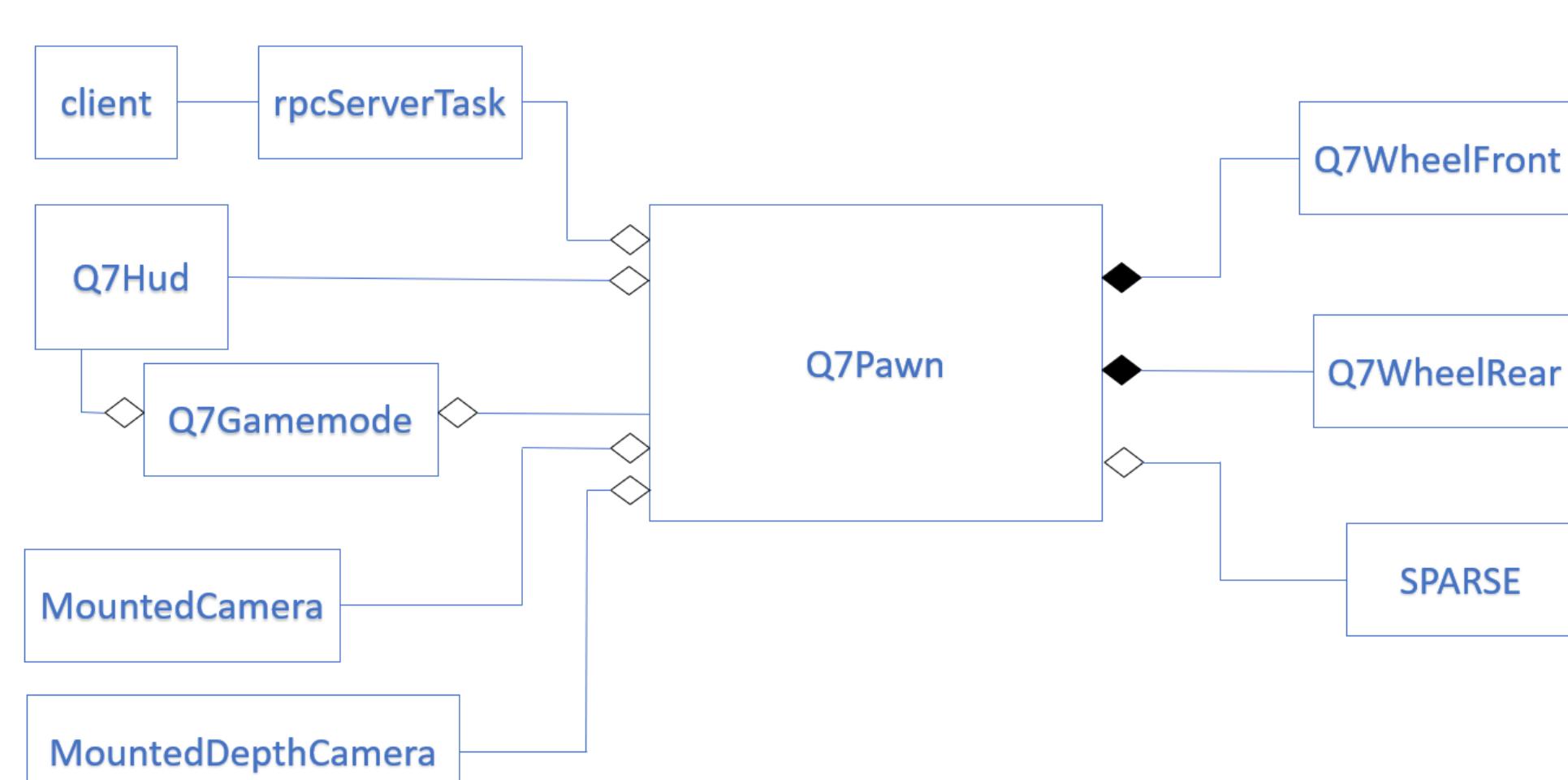


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To Reverse: 'reverse [0:1]'
To Steer: 'steer [-1:1]'
To Engage Handbrake: 'brakeon'
To Disengage Handbrake: 'brakeoff'
To Toggle Cameras: 'toggleFcameras'
To Re-Enter Controller Mode: 'Controller'
>>
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Left Camera Depth Camera Right Camera

Object Design



Future Work

- ❖ SPARSE requires a way to extract the visual data that Unreal Engine is rendering in real time. Possibly with with an RTSP server.
- ❖ Add more customizability to sensors.
- ❖ Further optimization.

Summary

This project is version 1.0 of a Simulation Platform for Autonomous Research and System Evaluation (SPARSE).

The platform provides a realistic driving simulation that can be used to test and develop an autonomous driving system with minimal costs and safety concerns.

Acknowledgements

The material presented in this poster is based upon the work done by Nicolas Gonzalez and Emmanuel Perez with support by Dr. Miguel Alonso. Special thanks to our mentor Dr. Miguel Alonso and Professor Masoud Sadjadi.