Collaborative Control of Autonomous Cars

Team Members:
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Faculty Advisor:
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Client:
Tom Eskridge, affil. Florida Institute of Technology

Progress Matrix

Task	Completion	John	Brennan	Isaya	To Do
Learn CARLA software	100%	40%	40%	20%	None
Learn CARLA programming	80%	40%	40%	20%	Figure out why some programs increase the tick rate
“Hello world” programs	80%	30%	40%	30%	Continue making “hello world” programs for other functions
Program dashboard display	80%	90%	5%	5%	Allow dashboard to run at same time as other API programs, make dashboard appear in CARLA window (may not be necessary)
Program dashboard light	20%	25%	60%	15%	Make brake lights function during autopilot, add dashboard light, hook dashboard light to brake action
Analysis of autopilot	30%	10%	40%	50%	Analyze program that determines autopilot actions

Tasks Accomplished

Learn CARLA software:

Our first task was learning CARLA and getting it to work on our computers. This task was more difficult than we thought it would be due to compatibility issues. Multiple of our computers failed to run CARLA because it did not have a version available for those computers. Alternative computers were generally unable to run CARLA due to insufficient memory to meet CARLA's requirements. Despite this, we were able to get CARLA running on multiple computers and begin coding with it. The computer in the simulation lab has also been made available for development use. Aside from the initial difficulty, this task proceeded without trouble.

Learn CARLA programming:

Our second task was learning how to run and modify programs for CARLA. With the first step complete, this step has proceeded mostly without issue. However, we've encountered a single issue we have yet to determine the origin of. Certain programs, when run in CARLA, cause CARLA's simulation speed to increase. This makes manual control more difficult, which affects our results. We still need to figure out why this is the case.

"Hello world" programs:

Each member of the team has been working on their own individual hello world programs as part of initial work on other tasks. So far, hello world style programs for brake lights and a speedometer have been created and tested. Continued testing through these programs is ongoing, primarily as it relates to UI interactions that will later be necessary for dashboard implementation.

Program dashboard display:

Progress on this task was delayed due to the unexpected difficulties encountered with the first task. However, a basic dashboard has been created that displays a speedometer, rpm gauge, fuel tank level, and indicator lights. Testing has confirmed it runs successfully in a separate window; however, interaction with other programs, which is required for displaying relevant information, requires additional programming. Work on this is ongoing.

Program dashboard light:

This task was originally part of the task of programming the rest of the dashboard display. However, the requirements and work ended up being different enough that it was split off from the display itself. This task naturally requires the dashboard display to be complete, but aside from that it also requires analysis of the autopilot (see below for elaboration) and a trigger based

on when the brakes are activated. Work on this has thus far been divided between implementation of the dashboard and analysis of the autopilot.

Analysis of autopilot:

This task was not on our original task matrix for this milestone, but we started on it as part of our work for other tasks, as well as work in preparation for our next milestone. In order to synchronize our dashboard's brake light with the other brake lights, we had to know how the brake lights were activated. In doing this, we discovered that the brake lights weren't working properly during autopilot; they wouldn't turn on when the autonomous agent activated the brakes. As such, we've started analyzing the autopilot to figure out how we can activate the brake lights while the autopilot is active. (The brake lights activate as expected during manual control.) We've succeeded at this for the program with exclusively autonomous control, but we need it to work when either autonomous or manual control is possible for the purposes of our project.

Member Contributions

John Vitali:

John began writing the software to implement the dashboard interface for the CARLA program. He took lead in this task because originally, the team thought they would have to implement the dashboard through Unreal Engine 4. After looking deeper into it, the Unreal Files were unable to be edited, so he began writing the code in Python with pygame. Along with this, he completed the basic tasks: learn CARLA, program basic hello world programs, and he worked on trying to figure out why some python programs increase the game tickrate.

Brennan Pike:

Brennan took point in the braking system. He was in charge of adding brake lights to the cars, and eventually adding a brake light on the dashboard. He began with the simplest task, adding the brake light to the autopilot feature. The team noticed that when driving with manual controls, the brake lights would illuminate. However, when the user decided to turn on the autopilot function, the brake lights would not illuminate when the car was automatically braking. So, he began adding the brake lights to the autopilot function. Work on this is ongoing.

Isaya Danice:

Isaya was in charge of learning the autopilot functions. The purpose of the project is to determine how a human and autonomous driving car can communicate with each other. In order to do that, the team must understand how the autopilot in CARLA works, and more importantly, why it does the things it does. Isaya has begun reading through the entire autopilot program and will report back to the team his findings.

Plan for Next Milestone

Task	John	Brennan	Isaya
Implement/test/demo dashboard	Implementation/ testing (90%)	Testing/demo (5%)	Implementation/demo (5%)
Implement/test/demo brake lights	Test/demo (25%)	Implementation/ testing (60%)	Testing (15%)
Implement/test/demo autopilot system	Testing/demo (10%)	Testing/ Implementation (40%)	Implementation/ testing (50%)
Implement/test/demo autopilot & user inputs combined	Implement/test/demo (30%)	Implement/test/demo (40%)	Implement/test/demo (30%)

Discussion

Unfortunately, the team was unable to complete some of the tasks to their full extent, so the team will be finishing up the small percentage of items to do left for those tasks as part of the next milestone. Along with that, the team will begin to implement the user input and autopilot at the same time. In the beginning, if the human decides to turn 90 degrees to the right, and the autopilot wants to go straight, say at 0 degrees, the car will turn at 45 degrees to the right. An exact middle ground between the two inputs. In the beginning, it is okay if the car goes into a wall, sidewalk, or any other obstacle. The team will make the autopilot "smarter" as time goes on.

Dates of Meetings with Client

August 29, 2023 - Initial meeting
September 5, 2023 - Second meeting to confirm milestones and obtain signature on Project Plan.
September 19, 2023 - Third meeting to follow up with any issues, mainly gain access to the lab after hours.
September 26, 2023 - Fourth meeting to show what has been completed so far.

Faculty Advisor Feedback on each Task:

Learn CARLA software:

Good effort to get CARLA running and in both manual and automated modes.

Learn CARLA programming:

Using other existing code as a basis to develop your own may illuminate some issues that could address things like the clock rate increases.

Faculty Advisor Signature: _____ Date: ___10-02-2023___

Evaluation by Faculty Advisor

- Faculty Advisor: detach this page and return to Dr. Chan or email scores.
- Score (0-10) for each member: circle a score (or circle two adjacent scores for .25 or write down a real number between 0 and 10)

John Vitali	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Brennan Pike	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Isaya Danice	0	1	2	3	4	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10

Faculty Advisor Signature: _____ Date: _____