ENG 4000

Sprint 7 Review

Automobiles Making Decisions (AMD 2)

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Sprint Review

This Sprint review will cover up all the work completed in the following work weeks:

1. Week of January 28th, 2019
2. Week of February 4th, 2019
3. Week of February 11th, 2019

For this sprint review Chris acted as the Scrum Master and Sean acted as the stakeholder. The Sprint review meeting was held on Feb 13th 2019 and each group member was allotted time to discuss the progress they had made toward their assigned sprint goals. The team discussed ways in which this final sprint could move the product towards completion and how the timetable was affecting the group.

During this sprint, we were able to complete the following:

1. Begin to develop an architecture for our program
2. Discuss our progress with our industry advisor
3. Develop preliminary functionality for our project
4. Advance our simulation to allow our code to directly run inside the simulation
5. Review our progress and refine our approach to success in upcoming events

Minimum Viable Product

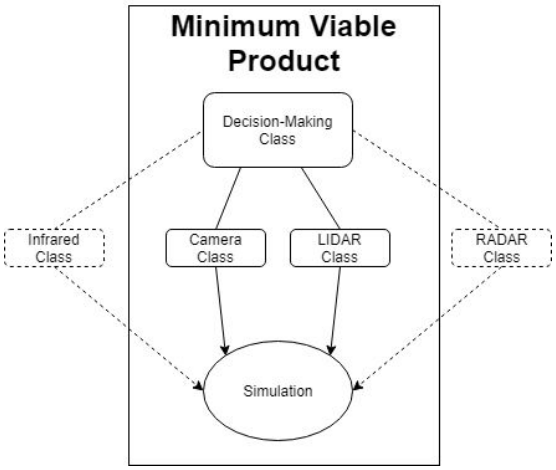

Figure 1 - MVP Architecture Outline

Simulated environment within a game engine.

The simulation (Figure 2) designed in sprint 6 has been slightly altered in purpose over this sprint. It is now possible for our algorithm to be run natively on the simulation platform

Figure 2 - Simulated environment within a game engine

The figure above shows preliminary work being completed in order to have a simulation environment that allows us to deploy and test our machine learning algorithm. Work is still under progress to incorporate different features of our MVP within the simulation.

Machine Learning and Computer Vision algorithm for analyzing number plates.

This initiative is led by Sean and Manmeet, with support from Chris in order to develop an algorithm that has the capabilities of detecting number plates from different regions and compute pixel information to determine how far/close the car is in view.

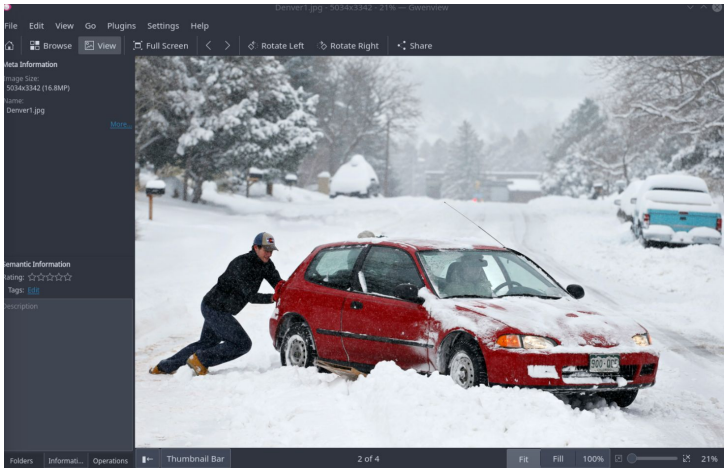

Figure 3 - Number Plate Detection Algorithm test image 1

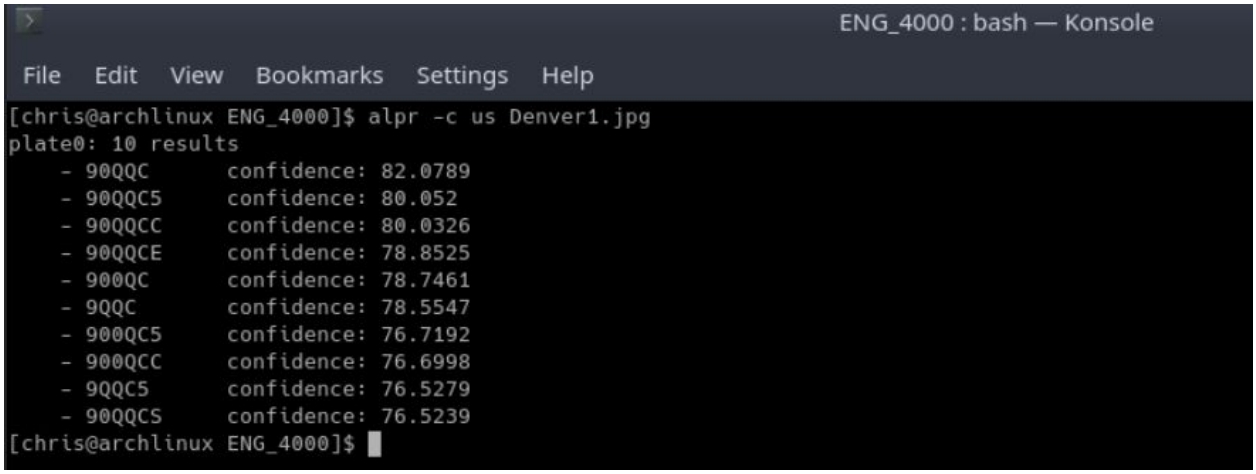

Figure 4 - Number Plate Detection Algorithm Preliminary results

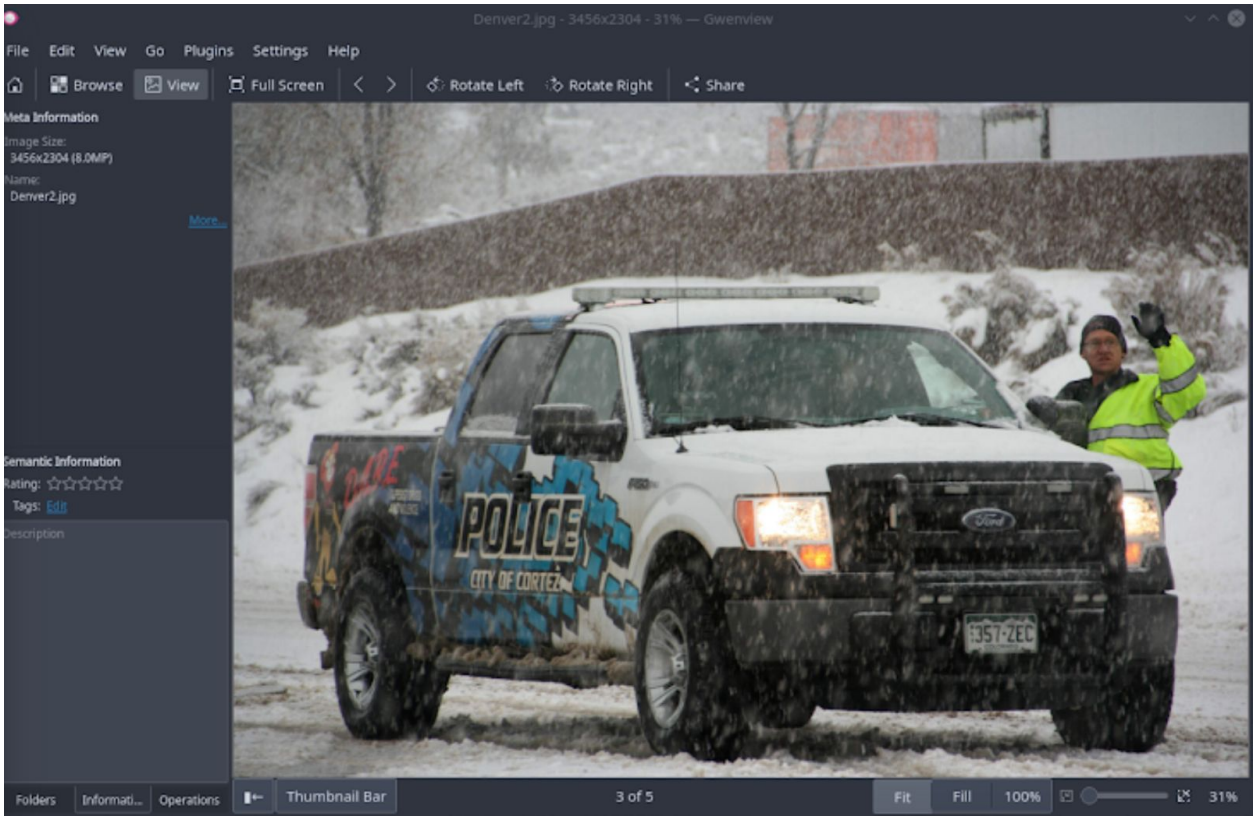

Figure 5 - Number Plate Detection Algorithm Test Image 2

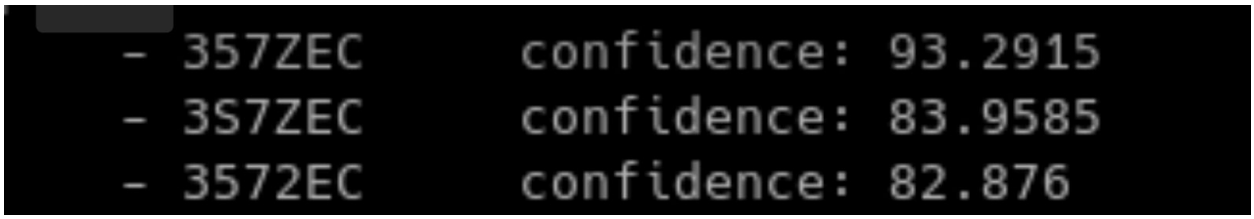

Figure 6 - Number Plate Detection Algorithm Preliminary results for Test Image 2

The preliminary algorithm requires more work in order to improve its overall accuracy and then build upon it to analyze image pixels to compute distance. Work is currently under progress.

Challenges

Sprint 7 was significantly shorter than Sprint 6 and the timing was a little bit inconvenient with midterms happening this during this sprint. It would have been nice to utilize the reading week to develop our project further, but we had to make do with the time we had. Aside from product direction, workload management has been the most consistent challenge we have faced during this project. It is an unfortunate part of having other commitments outside of the project but we

have gotten better at sharing the workload on tasks assigned to individual members in order to complete important tasks. In the past we might have not completed any tasks while midterms were happening but the lessons we have learned from past sprints allowed us to adjust our workload assignment during the sprint.

Supervisor Meeting Summaries

February 4th 2018, Tommy Sin

Our group reached out to Tommy Sin for an introductory meeting as he is our assigned industry advisor. We sent him our most recent sprint document and he reviewed it for us over the phone. Tommy gave us his thoughts about our topic, and some advice for how to assemble our next report. We kept the meeting brief because we had to introduce ourselves and our idea to him which took up a fair amount of time.

Scrum Record

Team Member	Task	**Week of 7th Jan**	
		Monday	**Thursday**
Yahya Ismail	Specify Sprint #	7	7
	What did you do previously?	Driving Simulation	LIDAR Simulation
	What Will you work on next?	LIDAR Simulation	LIDAR Simulation
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time
Chris Posca	Specify Sprint #	7	7
	What did you do previously?	Manually Calibrating Edge-Finding Algorithm	Build 'Owner' Class in C++
	What Will you work on next?	Build 'Owner' Class in C++	Build 'Owner' Class in C++
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time
Sean O'Brien	Specify Sprint #	7	7
	What did you do previously?	Manually Calibrating Edge-Finding Algorithm	Build 'Owner' Class in C++
	What will you work on next?	Build 'Owner' Class in C++	Build 'Owner' Class in C++
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time
Manmeet Singh	Specify Sprint #	7	7
	What did you do previously?	Rudimentary Car Decision Maker	Plate Detection Optimization

	What will you work on next?	Plate Detection Optimization	Plate Detection Optimization
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time

Team Member	Task	**Week of 14th Jan**	
		Monday	**Thursday**
Yahya Ismail	Specify Sprint #	7	7
	What did you do previously?	LIDAR Simulation	LIDAR Simulation
	What Will you work on next?	LIDAR Simulation	LIDAR Simulation
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time
Chris Posca	Specify Sprint #	7	7
	What did you do previously?	Build 'Owner' Class in C++	Build 'Owner' Class in C++
	What Will you work on next?	Build 'Owner' Class in C++	Build 'Owner' Class in C++
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time
Sean O'Brien	Specify Sprint #	7	7
	What did you do previously?	Build 'Owner' Class in C++	Build 'Owner' Class in C++

	What will you work on next?	Build 'Owner' Class in C++	Build 'Owner' Class in C++
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time
Manmeet Singh	Specify Sprint #	7	7
	What did you do previously?	Plate Detection Optimization	Plate Detection Optimization
	What will you work on next?	Plate Detection Optimization	Plate Detection Optimization
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time

Team Member	Task	**Week of 21st Jan**	
		Monday	**Thursday**
Yahya Ismail	Specify Sprint #	7	7
	What did you do previously?	LIDAR Simulation	LIDAR Simulation
	What Will you work on next?	LIDAR Simulation	LIDAR Simulation
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time

Chris Posca	Specify Sprint #	7	7
	What did you do previously?	Build ‘Owner’ Class in C++	Build ‘Owner’ Class in C++
	What Will you work on next?	Build ‘Owner’ Class in C++	Build ‘Owner’ Class in C++
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time
Sean O’Brien	Specify Sprint #	7	7
	What did you do previously?	Build ‘Owner’ Class in C++	Build ‘Owner’ Class in C++
	What will you work on next?	Build ‘Owner’ Class in C++	Build ‘Owner’ Class in C++
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time
Manmeet Singh	Specify Sprint #	7	7
	What did you do previously?	Plate Detection Optimization	Plate Detection Optimization
	What will you work on next?	Plate Detection Optimization	Plate Detection Optimization
	Do you have any obstacles you need help with?	No	No
	Any Important Lesson learnt that you want to share with the team	None at this time	None at this time

Sprint 7 Retrospective

Overall, we feel sprint 7 was a successful sprint because we completed some development tasks and made encouraging progress on the more rigorous tasks. We feel we have set ourselves up well going into the reading week, and we are optimistic that we will have a minimum viable very soon. In this past sprint we completed work on

Distance Estimation

Image Acquisition and Delivery

Completing these two features of our program brings us a significant step closer to a minimum viable product. The plate distance software is integral to our design and it was satisfying to see it completed. The other task that was completed was the Image Acquisition and Delivery, which was not a stated objective last sprint but was also an essential task to complete. What it means is that we wrote software which our program will use to capture images in the simulation and provide those images to the C++ owner class.

We left some rather important tasks still to be completed over the reading week, which is not ideal but we have only really been working towards this version of the project for the past two sprints. What remains of the MVP is the simulation of the LIDAR data, the optimization of the plate acquisition software, and the owner class which will be the class that puts all of our other classes to work. These tasks are all underway already, so the reading week will be utilized to complete and test their functionality. The LIDAR simulation is very close to complete and the we have already tested a method to improve the performance of the plate acquisition software.

Regarding the two tasks on the backlog, we would really like to include them in the MVP, but we have so little time left that we will leave them on the backlog and complete the MVP first. When we finish the MVP during reading week, if time allows, we will move all group members on to one of the tasks at a time in order to try to get their functionality added. We are late enough into development that getting partway through a task will not be of any value to us, so once the MVP

is completed the group will meet and decide the best way to divide up on of the backlog tasks at a time.

Continued Development (Sprint) Plan

This section will take the place of the next sprint plan as this is the last sprint we are asked to formally document. Rather than filling out a plan for the next sprint we will lay out the final steps that need to be taken in order to complete the MVP in time for the test readiness review.

Product Features Monitoring

Feature Goal	Associated Sprint #	Duration		Story Points	Release Status
Simulation Environment Create road geography and markings, lighting and weather conditions for environment.	Sprint 6	Nov 29	Jan 15	High	Completed
Plate Recognition Implementation Implement OpenCV and OpenALPR libraries in C++, such that the plate recognition software is operational.	Sprint 6	Nov 29	Jan 15	High	Completed
LIDAR Simulation using Ray-Tracing Write script to simulate LIDAR and pass distance travelled by rays to master software.	Sprint 7	Feb 15	Mar 5	Medium	Underway
Sensor Accuracy Decision Making System Write class to make decisions about the accuracy of the sensors in the system.	Sprint 7	Feb 15	Mar 5	High	Underway

Distance Estimation Calculation Write class to parse JSON data to retrieve pixel dimensions of license plate. Then using the pixel dimensions and an estimation of the plate size to infer the plate's distance.	Sprint 7	Jan 29	Feb 22	High	Completed

Sprint Tasks Monitoring

Before TRR						
Priority	**Feature Goal**	**User Story**	**Success Criteria**	**Owner**	**Duration**	
High	**Build 'Owner' Class in C++** Write C++ class which will act as the monitor and decision maker for the individual sensor classes.	The software needs to make decisions about which sensors are providing good data and which should be temporarily ignored.	When the sensor classes are completed, and this class is accurately determining when there is an obstruction in the LIDAR's view.	**Chris and Sean**	Feb 15	Mar 5
Medium	**Plate Detection Optimization** Improve performance of plate detection by focusing the plate location and a small margin around it.	The computation speed of the plate detection is an order of magnitude faster when you provide an close-up of the plate.	When the software is (on its own) running in one tenth the time it would take to process the entire image. (We have produced better results than this manually cropping the image)	**Manmeet**	Feb 15	Mar 5

Medium	**LIDAR Simulation** Write Unity script for collecting information about the path of light rays.	The system is being designed to operate under conditions where light rays are obstructed by small objects.	This is considered successful when the simulation returns similar data to a LIDAR sensor.	**Yahya**	Feb 15	Mar 5

Sprint Backlog Tasks

Before TRR						
Priority	**Feature Goal**	**User Story**	**Success Criteria**	**Owner**	**Duration**	
	Infrared Sensor Class Write C++ class will be instantiated within the owner class to process Infrared Signal.	We want the sensor to work in the event of a storm where there are no vehicles ahead of the camera.	This is considered successful when the system can determine the accuracy of the LIDAR data without the camera or RADAR.	TBD	Feb 15	Mar 5
	RADAR Sensor Class Write C++ class that will be instantiated within the owner class to process radar signal.	We want the sensor to work in the event of a storm where there is little visibility.	This is considered successful when the system can successfully determine the accuracy of the LIDAR data without the camera.	TBD	Feb 15	Mar 5

Self-Evaluation

Criterion	Self-evaluation ranking	Justification
Sprint Review	Meeting Expectations	We reviewed some of the common mistakes we've made over the course of the many sprint reviews we have completed. From these we reflected how we could learn from these in order to make our final push to MVP as efficient as it can be. We also evaluated our performance in terms of work completed and work remaining. For this reason we feel we have met the expectations of a good retrospective.
Sprint Retrospective Plan	Meeting Expectations	We explained the significance of the work completed in this sprint, and we reflected on changes that we have made over the course of the sprints we have been running. We made an effort to demonstrate our growth over time and we feel like we have improved over the course of the sprints we have been running.
Sprint Plan	Meeting Expectations	We created a plan for the upcoming weeks even though there is no sprint 8 because we feel like it is beneficial to divide the workload and establish important tasks. We did not put an immense amount of detail into scheduling work because we felt that to be too inflexible for our outside commitments. For this reason we are leaving ourselves at meets expectations and not exceeds expectations.