SUMO Traffic Simulation MIDTERM PROJECT REPORT

Team Members:
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The Project

Description:

Creating a Traffic simulation using traffic flow data collected from a real-world intersection that compares its effectiveness against a round-a-bout created in the same space to see which optimizes traffic flow better.

Objectives:

1. Determine an "optimum" traffic structure for directing vehicles in a high-volume intersection

2. Find an "optimum" stop light conditions for this intersection given our simulation.

Background

According to Federal Highway Administration:
Traffic light and roundabout are a safety concern for the environment, economy and pedestrians.
Constant development of roads:

- New road are being constructed
- Existing roads are being modified

There have been many other research papers and models done especially by the National Highway Traffic Safety Association.

According to WSDOT, roundabout reduced..

- Crashes: 75%
- Pedestrian Collisions: 40%
- Fatality Collisions: 90%
- Overall collisions: 37%

Project Plan

- Gather pre-existing traffic data
- Two Simulations in SUMO (each run using pre-existing traffic data)
  - Four-way traffic control
  - Round-a-bout
- Result Analysis
  - Collect multiple simulation data
  - Compare results

Expected Data

- Avg # of cars at given lane
- Avg wait time at a light
- Avg vehicle velocity
- Avg vehicles passing through the intersection per unit time frame

Data

Turning Movement Data

Start Time	YANCEYVILLE RD Southbound						LEES CHAPEL RD Westbound						YANCEYVILLE ST Northbound						LEES CHAPEL RD Eastbound						Int. Total
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	
7:00 AM	25	72	4	0	2	101	8	80	4	0	2	92	6	36	14	0	2	56	30	66	16	0	2	112	361
7:15 AM	73	124	18	0	1	215	8	73	10	0	0	91	8	27	22	0	0	57	26	85	40	0	0	151	514
7:30 AM	61	138	16	0	3	215	13	128	22	0	0	163	10	56	29	0	1	95	37	88	40	0	1	165	638
7:45 AM	60	135	17	0	8	212	20	111	15	0	0	146	5	49	25	0	0	79	37	110	48	0	0	195	632
Hourly Total	219	469	55	0	14	743	49	392	51	0	2	492	29	168	90	0	3	287	130	349	144	0	3	623	2145
8:00 AM	56	103	21	0	2	180	28	107	11	0	0	146	6	45	30	0	0	81	28	75	72	0	0	175	582
8:15 AM	55	103	22	0	1	180	10	93	7	0	0	110	7	35	26	0	0	68	26	65	31	0	0	122	480
8:30 AM	36	62	7	0	1	105	9	104	15	0	0	128	4	22	20	0	0	46	29	46	15	0	0	90	369
8:45 AM	22	62	7	0	0	91	6	87	10	0	0	103	6	28	23	0	0	57	28	65	18	0	0	111	362
Hourly Total	169	330	57	0	4	556	53	391	43	0	0	487	23	130	99	0	0	252	111	251	136	0	0	498	1793
9:00 AM	35	52	3	0	0	90	4	79	5	0	0	88	8	17	17	0	1	42	22	48	11	0	0	81	301
9:15 AM	27	41	6	0	0	74	4	56	4	0	1	64	12	15	17	0	5	44	21	54	11	0	3	86	268
9:30 AM	26	42	4	0	0	72	2	62	11	0	0	75	8	8	25	0	1	41	27	46	15	0	0	88	276
9:45 AM	20	27	7	0	3	54	1	55	4	0	0	60	9	16	16	0	0	41	29	60	10	0	0	99	254
Hourly Total	108	162	20	0	3	290	11	252	24	0	1	287	37	56	75	0	7	168	99	208	47	0	3	354	1099
10:00 AM	22	28	6	0	0	56	2	60	7	0	1	69	5	14	13	0	0	32	21	56	11	0	0	88	245
10:15 AM	13	23	2	0	0	38	4	65	8	0	0	77	9	21	26	0	1	56	34	49	12	0	0	95	266
10:30 AM	17	38	3	0	0	58	3	41	9	0	0	53	4	19	22	0	0	45	21	41	11	0	0	73	229
10:45 AM	21	23	2	0	0	46	8	52	12	0	0	72	8	18	21	0	1	47	24	64	13	0	2	101	266
Hourly Total	73	112	13	0	0	196	17	218	36	0	1	271	26	72	82	0	2	180	100	210	47	0	2	357	1006

Technical Description

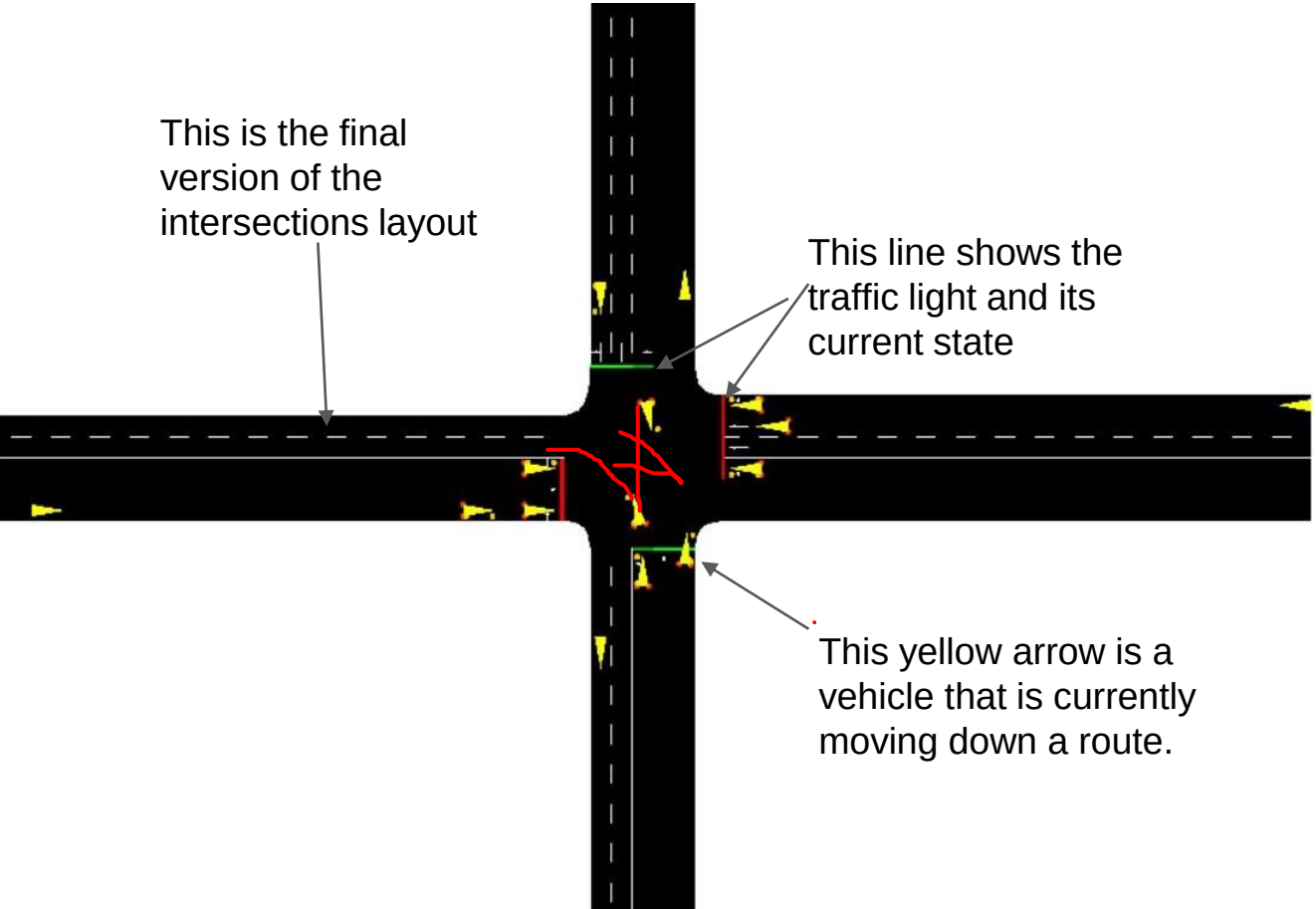
- Simulations construction tools
  - SUMO – click and place simulation editing interface that allows users to manipulate .xml files
    - Visual manipulation of routes, intersection
  - .xml files: Manipulate the SUMO environment through code
    - Python language
    - Ex: A program that spawn 20,000 vehicles
  - SUMO GUI : an environment to initiate the simulation
    - With controls such Play, pause, step forward

Accomplish Work

Accomplished Work:

- We have produced the four way intersection and the simulation on it for traffic flow.
- We have produced the prototype roundabout.
- We have found data for comparison.
- We have worked out what SUMO commands are required for data collection

Status


This is the final version of the intersections layout
This line shows the traffic light and its current state
This yellow arrow is a vehicle that is currently moving down a route.

Effort

Member	Activities	Hours
Alain	Traffic light timing	2
Matthew	Data collection	1
Dylan	Routes creation	1.5
Dylan	Road layout	4
Matthew	Road layout	6
Alain	Round-a-bout	2
	Construction (not finished)	
Matthew	SUMO set-up for team use	4
Dylan	Traffic Junction Creation	1
Dylan	Vehicle Spawning	2
Matthew	Vehicle Spawning	2

Lessons Learned

What Went Right:

- Data Gathering -> Simulation production – All tasks were completed without any alterations.

What Went Wrong:

- Layout creation (turning lanes/route placement) -> length and lane(turning) placement issues – these were challenges that halted our progression for a little bit, but we ultimately solved our problems.
- Nothing

What we would do differently:

- Complexity – adding unnessary complexity (Unusual intersection shape) created these "hiccups" that slowed progression
- Simplicity – using a simplier design, since this is our first using SUMO, would have saved a day of work. (Go big or go home though right?)

Expected Forthcoming Activities

Activities to do	How to do it	When
Collect data on four-way intersection	Though SUMO commands	By 4/6/2020
Create Final roundabout simulation	Through SUMO	By 4/10/2020
Collect Data on roundabout	Through SUMO commands	By 4/18/2020
Start Report & Presentation	Overleaf Latex & Google Slides	By 4/19/2020
Finish Report & Presentation	Overleaf Latex & Google Slides	BY 5/2/2020

References

[1] “Roundabout benefits,” WSDOT, 14-Sep-2018. [Online].
Available: https://www.wsdot.wa.gov/Safety/roundabouts/benefits.htm. [Accessed: 28-Jan-2020].

[2] ACS Engineers, “Roundabouts vs Traffic Lights,” ACS Engineers, 22-Aug-2016. [Online]. Available: https://www.acsengineers.com.au/2016/08/22/roundabouts-vs-traffic-lights/. [Accessed: 28-Jan-2020].

[3]“Intersection Safety - Safety: Federal Highway Administration,” Safety. [Online]. Available: https://safety.fhwa.dot.gov/intersection/innovative/roundabouts/. [Accessed: 28-Jan-2020].