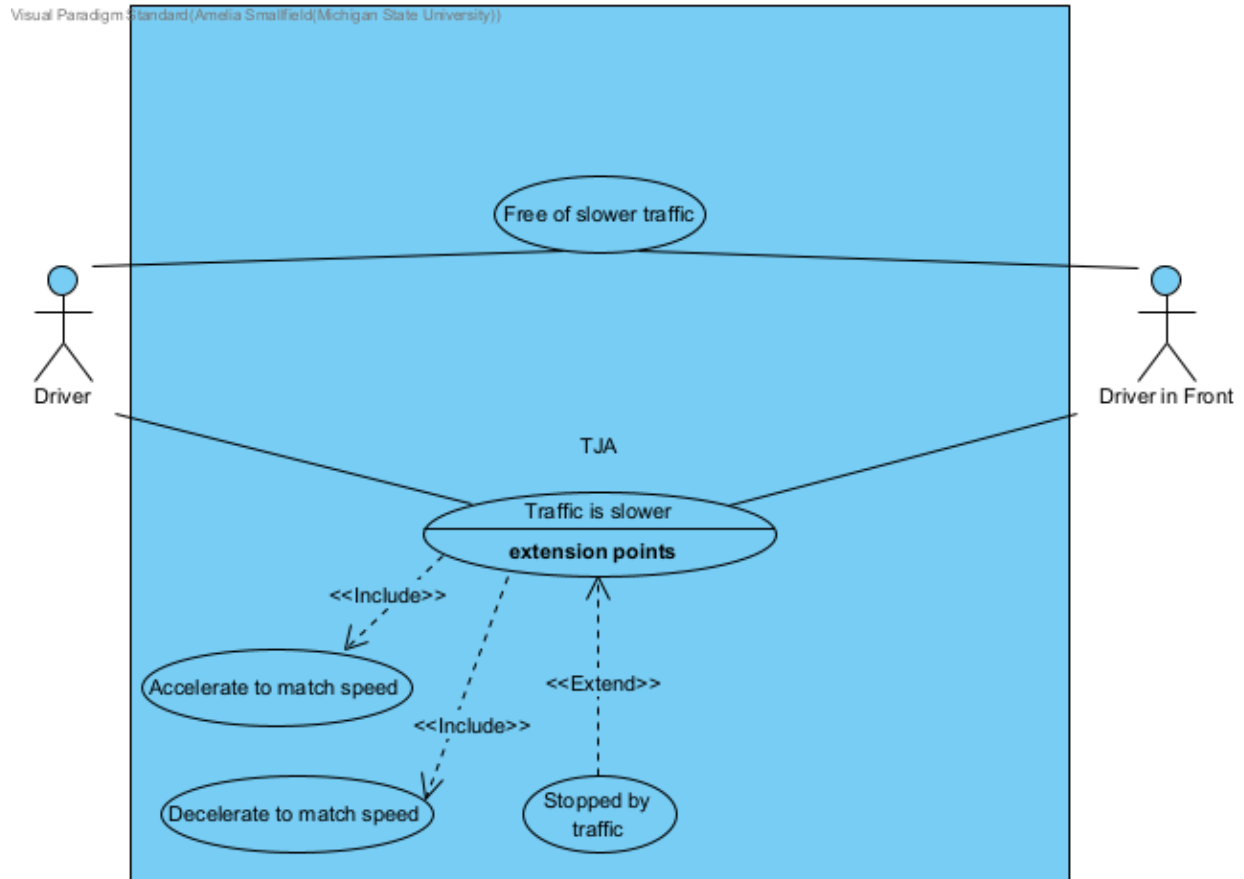


CSE 435 Software Engineering - Intermediate Project Assignment

1. Use Case Diagram:



Use case description:

Use Case:	Driver is stopped by traffic
Actors:	Driver, Driver in Front
Description	Completely stop behind traffic, resume following on the Driver in Front's acceleration and maintain following distance
Type:	Primary (essential)
Includes:	N/A*

Extends:	Driver is slowed by traffic
Cross-refs:	7
Use cases:	N/A*

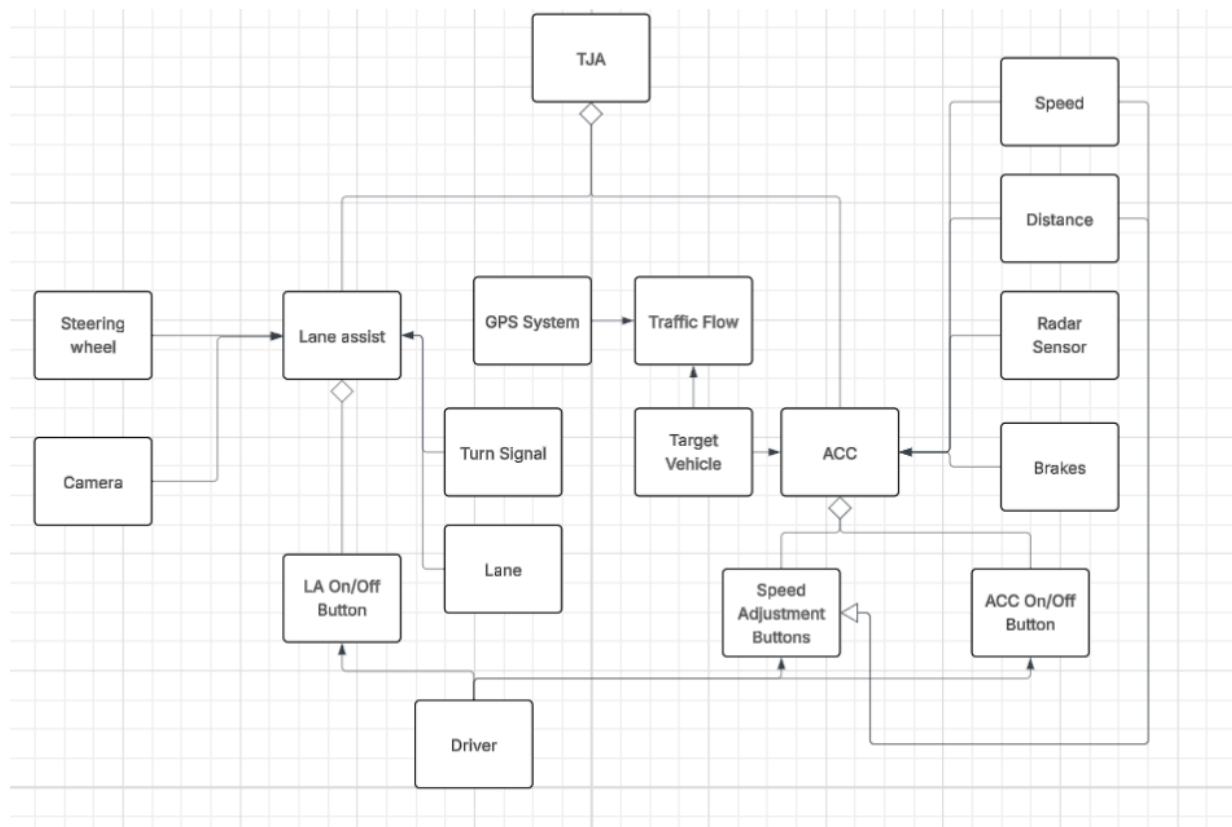
Use Case:	Driver is slowed by traffic
Actors:	Driver, Driver in Front
Description	Accelerate or decelerate with Driver in Front's movement in order to maintain constant following distance behind Driver in Front
Type:	Primary (essential)
Includes:	Accelerate to match speed, Decelerate to match speed
Extends:	N/A*
Cross-refs:	7
Use cases:	N/A*

Use Case:	Driver is free of traffic in front
Actors:	Driver, Driver in Front
Description	Maintain set cruise speed
Type:	Primary (essential)
Includes:	N/A*
Extends:	N/A*
Cross-refs:	7
Use cases:	N/A*

Use Case:	Accelerate to match speed
Actors:	Driver
Description	Engage the engine to match a speed faster than the speed the car is currently moving
Type:	Primary (essential)
Includes:	N/A*
Extends:	N/A*
Cross-refs:	7
Use cases:	N/A*

Use Case:	Decelerate to match speed
Actors:	Driver
Description	Engage the braking system to match a speed slower than the speed the car is currently moving
Type:	Primary (essential)
Includes:	N/A*
Extends:	N/A*
Cross-refs:	7
Use cases:	N/A*

2. Domain Model:



CLASS			
	Description (responsibilities)	Holds information about the vehicle in front of the Driver	
	Export control (public: yes/no)	yes	
	Relationships	Associations	Traffic Flow, ACC
		Aggregations	
		Generalization	
	List of attributes and their primitive types		Position, speed

**Target
Vehicle**

	List of operations (include parameters and results)		
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CLASS			
Driver	Description (responsibilities)	Handles input from Driver to car	
	Export control (public: yes/no)	yes	
	Relationships	Associations	LA On/Off, Speed Adjustment Buttons, ACC On/Off
		Aggregations	
		Generalization	
	List of attributes and their primitive types		position
	List of operations (include parameters and results)		IncreaseSpeed(int amount):void, DecreaseSpeed(int amount), ToggleACC():void, Toggle LA():void

CLASS			
Speed Adjustment Buttons	Description (responsibilities)	Adjust the set speed of the ACC	
	Export control (public: yes/no)	yes	
	Relationships	Associations	
		Aggregations	ACC
		Generalization	
	List of attributes and their primitive types		currentSpeed
	List of operations (include parameters and results)		

CLASS			
ACC	Description (responsibilities)	Applies set CC settings to TJA	
	Export control (public: yes/no)	yes	
	Relationships	Associations	Target Vehicle, Speed, Breaks, Distance, Radar Sensor
		Aggregations	TJA
		Generalization	
	List of attributes and their primitive types		
	List of operations (include parameters and results)		

CLASS			
Steering Wheel	Description (responsibilities)	Control steering	House buttons for TJA
	Export control (public: yes/no)	yes	
	Relationships	Associations	Lane assist
		Aggregations	
		Generalization	
	List of attributes and their primitive types		
	List of operations (include parameters and results)		

CLASS			
Camera	Description (responsibilities)	Detects lane lines	Sends information to Lane assist
	Export control (public: yes/no)	yes	
	Relationships	Associations	Lane assist
		Aggregations	
		Generalization	
	List of attributes and their primitive types		
	List of operations (include parameters and results)		

CLASS			
Lane assist	Description (responsibilities)	Center the car in a lane	
	Export control (public: yes/no)	yes	
	Relationships	Associations	Steering wheel, camera, turn signal, and lane
		Aggregations	LA On/Off Button
		Generalization	
	List of attributes and their primitive types		
	List of operations (include parameters and results)		

CLASS			
Turn Signal	Description (responsibilities)	Indicates the car is turning	Will temporarily turn off Lane Assist
	Export control (public: yes/no)	yes	
	Relationships	Associations	Lane Assist
		Aggregations	
		Generalization	
	List of attributes and their primitive types		
	List of operations (include parameters and results)		

CLASS			
TJA	Description (responsibilities)	Allow the driver to use lane assist and ACC	
	Export control (public: yes/no)	yes	
	Relationships	Associations	
		Aggregations	Lane Assist, ACC
		Generalization	
	List of attributes and their primitive types		
	List of operations (include parameters and results)		

CLASS			
Speed	Description (responsibilities)		Represents vehicle velocity and manages acceleration and deceleration commands.
	Export control (public: yes/no)		yes
	Relationships	Associations	ACC
		Aggregations	ACC
		Generalization	None
	List of attributes and their primitive types		currentSpeed : float setSpeed : float maxSpeed : float minSpeed : float
	List of operations (include parameters and		setSpeed(value : float) : void adjustSpeed(delta : float) : void

	results)		maintainSetSpeed() : void
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CLASS			
Distance	Description (responsibilities)		Calculate and maintain distance between driver and target vehicle.
	Export control (public: yes/no)		yes
	Relationships	Associations	ACC and Target Vehicle
		Aggregations	ACC
		Generalization	None
	List of attributes and their primitive types		currentDistance: float safeDistance: float closingSpeed: float
	List of operations (include parameters and results)		updateDistance(sensorData: float): void isSafeDistance(): bool adjustFollowingDistance(targetSpeed: float): void getClosingSpeed(): float

CLASS			
Radar Sensor	Description (responsibilities)		Detection of surrounding vehicles and other objects. Measures distance and speed.
	Export control (public: yes/no)		yes
	Relationships	Associations	ACC
		Aggregations	ACC
		Generalization	None
	List of attributes and their primitive types		detectedObjects: list objectRange: float objectAccuracy: float
	List of operations		measureDistance(target:

CLASS			
Brakes	Description (responsibilities)		Controls braking commands to decelerate and stop driver vehicle safely when needed.
	Export control (public: yes/no)		yes
	Relationships	Associations	ACC
		Aggregations	ACC
		Generalization	None
	List of attributes and their primitive types		isEngaged: bool responseTime: float brakeApply: float
	List of operations (include parameters and results)		applyBrakes(force: float): void releaseBrakes(): void brakeStatus(): bool automaticBrake(): void

CLASS			
GPS SYSTEM	Description (responsibilities)		Satellite navigation system that provides real life location of vehicle and complements sensor and camera to allow activation of system only on highways
	Export control		yes

	(public: yes/no)		
	Relationships	Associations	Traffic flow,TJA
		Aggregations	
		Generalization	
	List of attributes and their primitive types		x coordinate : real y coordinate : real Compass: String
	List of operations (include parameters and results)		On Highway(x,y,Compass) : True if the vehicle is currently on a highway. False if not.

CLASS			
TRAFFIC FLOW	Description (responsibilities)		System that analyzes how vehicles around interact with each other and calculate closing distance with vehicle in front
	Export control (public: yes/no)		yes
	Relationships	Associations	GPS System, Target Vehicle
		Aggregations	
		Generalization	
	List of attributes and their primitive types		x coordinate : real y coordinate : real Compass: String
	List of operations (include parameters and results)		Closing Distance(sensor, front vehicle, speed) :Closing distance

CLASS			
LANE ASSIST ON/OFF	Description (responsibilities)		Control used to turn on and set lane assist. Also used to turn off the system. The button is located in the steering

			wheel.
	Export control (public: yes/no)		
	Relationships	Associations	Driver, Lane Assist
		Aggregations	Lane Assist
		Generalization	
	List of attributes and their primitive types		switch: int
	List of operations (include parameters and results)		Turn on(switch) :Activates Lane Assist and shows in the dashboard as a small icon on the right side.

CLASS			
ACC ON/OFF	Description (responsibilities)		Control used to turn on and set adaptive cruise control. Also used to turn off Lane Assist. The button is located in the steering wheel.
	Export control (public: yes/no)		
	Relationships	Associations	ACC, Driver
		Aggregations	ACC
		Generalization	
	List of attributes and their primitive types		switch: int
	List of operations (include parameters and results)		Turn on(switch) :Activates Adaptive Cruise Control and awaits for speed set up before its on

3. Requirements:

1. The driver will turn on the system by activating the ACC ON button
 - a. When the system is activated, the dashboard should indicate to the user that the system is on with an ACC ON icon

2. The system will by default will set the current speed as the maximum speed and have the maximum following distance set
 - a. The vehicle will not surpass the speed limit set by the driver at any time
3. The system shall allow the driver to deactivate Traffic Jam Assist by pressing the cancel/OK button on the steering wheel, or by braking.
 - a. Upon deactivation, the driver will have to be aware of traffic ahead.
4. The user can change the maximum speed and following distance with buttons on the steering wheel
5. The Traffic Jam Assist System shall only work if the driver is engaged. The system must only work if it detects contact in the steering wheel at all times.
 - a. If the driver is not engaged(not in contact with the steering wheel) the vehicle will alert the driver on the console until hands are in the steering wheel.
 - b. After one minute of disengagement the TJA will alert the driver and shut off.
6. If the vehicle has a front camera, when activated, TJA will keep the vehicle centered in the lane.
 - a. If the vehicle drifts to the side, the vehicle will alert the driver on the console and TJA will center the vehicle by manipulating the steering wheel.
 - b. TJA will not manipulate the vehicle if turning lights are on.
7. Completely stop behind target vehicle slowly in case traffic stopped
 - a. Break immediately an object is detected within the emergency braking zone
 - b. If car in front is only slowing down the car will slow down at the same speed
8. Start vehicle back up when stopped traffic resumes with the flow of traffic, at set speed and distance
9. Provide status on the overhead dash and enable/disable alerts for vehicles when TJA is active.

Global Invariant Requirements:

1. Pressing the ACC button will activate the ACC system
2. When TJA is enabled, the vehicle never surpasses the maximum speed set by the driver.
3. The system shall always deactivate when breaking and pressing the “OFF” button.
4. The system should not accelerate if the measured distance between the driver and vehicle ahead is below the selected following distance.
5. The driver inputs are primary, meaning they override any TJA controls and inputs.
6. Vehicle will maintain speed until another vehicle is detected
7. Forward looking radar will identify a target and determine closing rate
8. If the vehicle gets too close to the target in front of it, it will slow down and maintain a set distance

Questions for customer:

1. If the vehicle is driving at high speeds on the highway and the vehicle in front suddenly brakes what should TJA do?
2. If a collision on the highway is imminent what should the system do?
3. What happens if a vehicle's engine shuts you off, but the electronic system is still on? How should TJA behave?
4. What is the sensor set given to us and what if one of them (radar or sensor) fails? Will there be a fallback to other forms of sensors or will TJA just be deactivated?
5. What are, if any, legal specifications/regulations that are important and must be honored?
6. How close is too close?
7. What is the difference between the three distances?
8. How strong is the lane stay assistance, or could it be disabled/ how much input would end up overriding it?
9. How should the system respond if the sensors are obstructed?
10. What objects is it expected to detect, how should it respond to other objects?