

Use Case / Application



Older and non-luxury cars do not have access to some safety features that exist today

AutoAlert bridges the gap with an affordable solution via dash cam that detects traffic lights and obstacles



Quantitative Design Requirements (1)

Light Chime Alert

We need a camera that will be able to see the traffic light in front of the user.

Users need to hear an alert when the light goes from red to green within 2 seconds to have enough reaction time.

Lane Detection

We need a wide-angle camera that can detect multiple lanes of the road.

We need to be able to detect the car's position to determine the correct traffic light for the car.

Quantitative Design Requirements (2)

Forward Collision Alert

We need a sensor that can see through glass as far as 50m.

Users need 50m to react and break fast enough to come to a complete stop at 40mph. We switched from LiDAR to radar to detect past glass.

Forward Car Departure Alert

We need a sensor that can detect a 10ft change in distance between 20-25ft away.

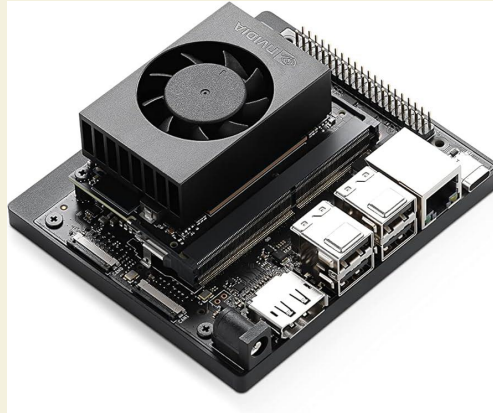
We need to be able to detect when the car in front of us has moved forward 10ft while we are stationary.

Solution Approach

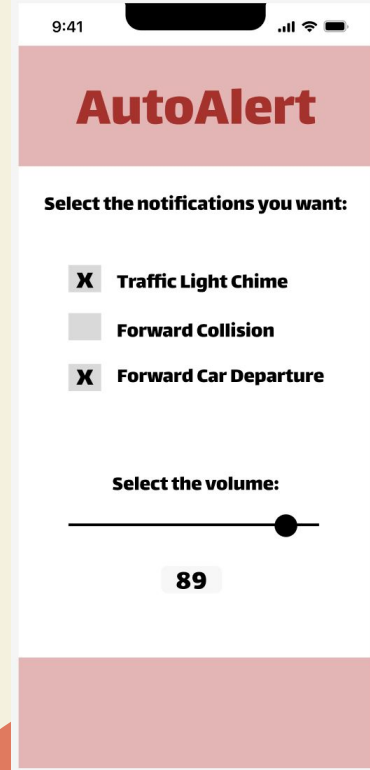
Step 1



Step 2



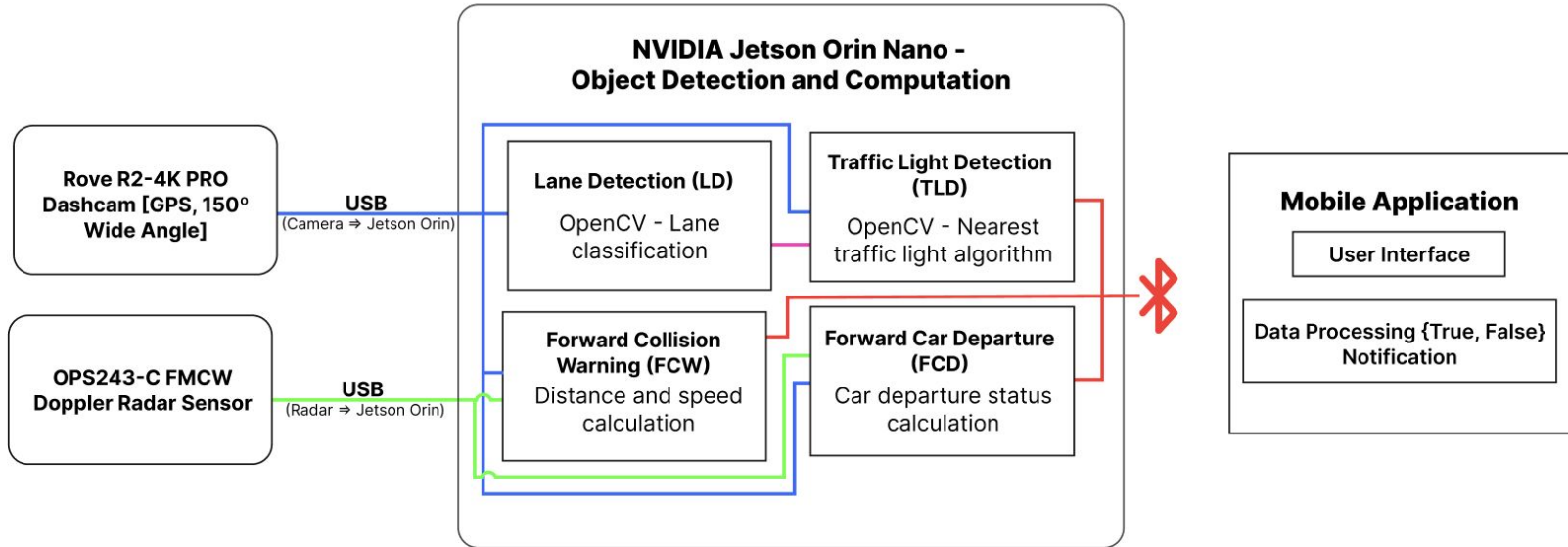
Step 3



Implementation Plan

	Component	Use
Buying	Rove R2-4K Dashcam (\$160)	Gather video/image data for processing
	OPS243-C FMCW and Doppler Radar Sensor (\$240)	Gather distance/speed data about forward objects
Designing	Lane Detection	Identify lane position of vehicle
	Traffic Light Detection	Detect transition from red to green light
	Forward Collision Warning	Detect when vehicle inside “collision” range
	Forward Car Departure	Detect when forward vehicle has left
Utilizing	NVIDIA Jetson Orin Nano, SDK Manager	Run OpenCV and other processes
	OpenCV	Image Processing Library
	Radar API	Access Data from Radar

Block Diagram



KEY:

hardware

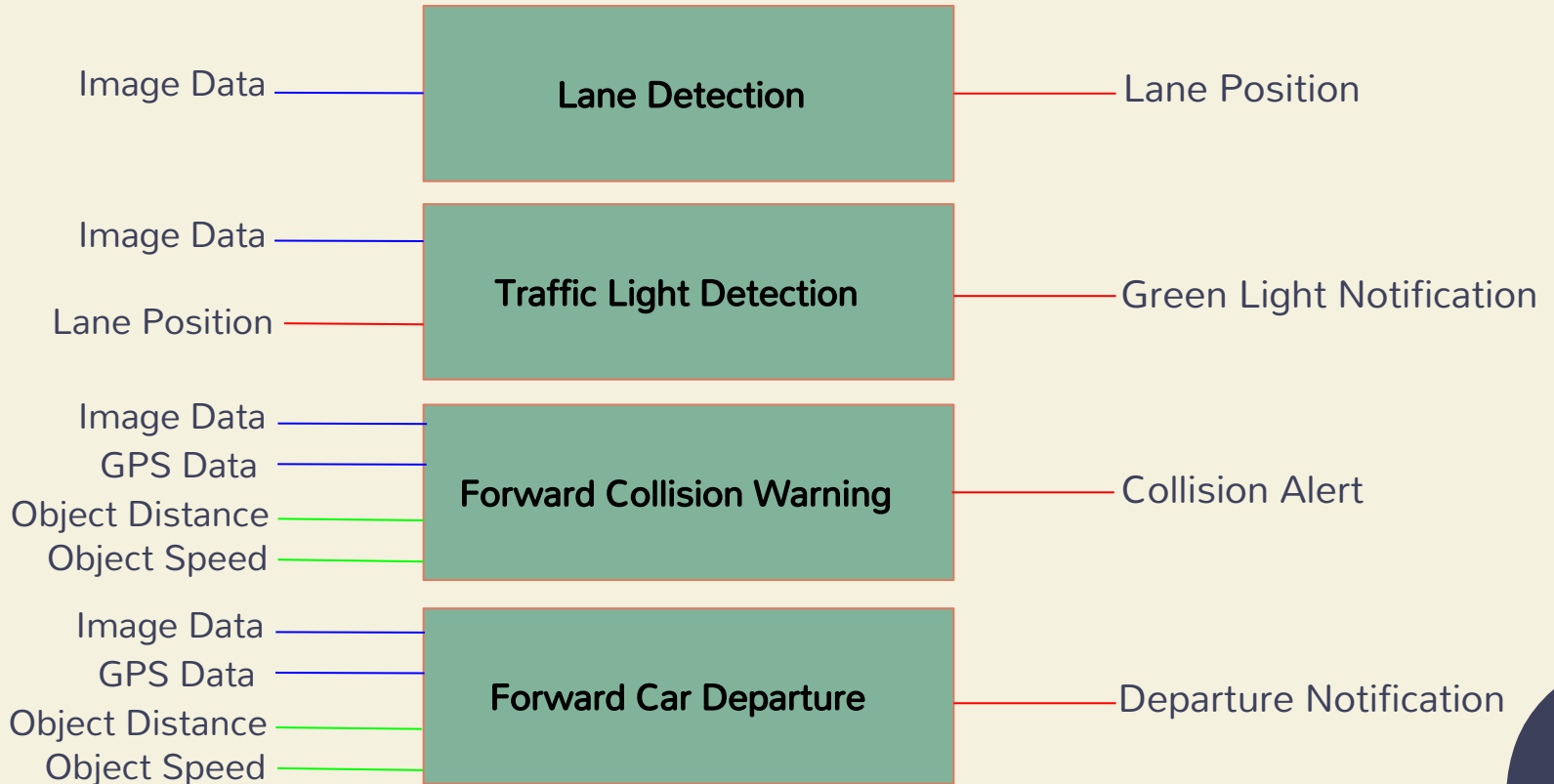
software

Data input (hardware ⇒ software)

Lane detection for TLD

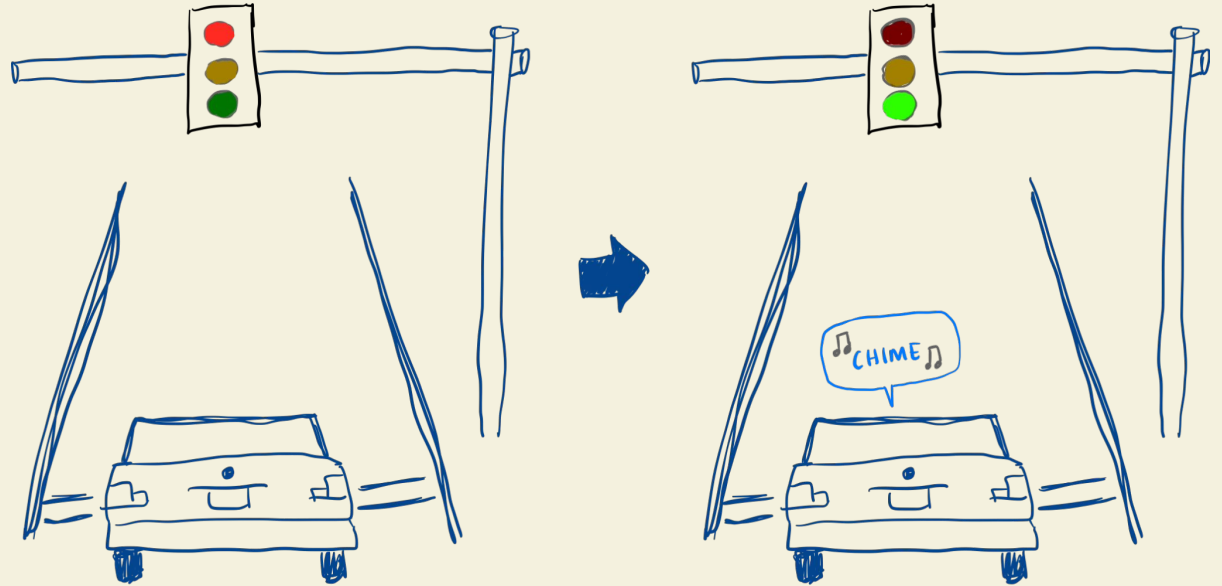
Bluetooth from Jetson Orin to mobile application

System Specification - Software



Test, Verification, and Validation

We will test our lane detection, light chime alert, and forward car departure features both while driving in Pittsburgh and with RC cars.



Light chime alert testing example

Test, Verification, and Validation

	Testing Method	Testing Locations	Measurement	Demo
Lane Detection	3 testing situations: (1) Lane on left, (2) lane on right, (3) lanes on both sides Edge cases: (1) Switching lanes, (2) bad roads	3 locations: Fifth Ave, Washington Boulevard, RIDC Park	Per testing situation: Sample product output every 15 seconds for 10 minutes.	Place RC car in differently marked lanes and demonstrate product output is correct.
Traffic Light Detection	3 testing situations: Drive past at least 20 left turn, straight, and right turn traffic lights each.	Forbes Ave + Fifth Ave	Per location: Sample product output after red lights turn green.	Place RC car in front of simulated traffic light and demonstrate product output is correct.

Test, Verification, and Validation

	Testing Method	Testing Locations	Measurement	Demo
Forward Collision Warning	Unit testing only	N/A	Mathematical calculations	Display mathematical calculations based on simulation.
Forward Car Departure	2 testing situations : (1) Stand still with camera and have car in front drive away (2) Move with camera and have car in front drive away.	Parking lots + Fifth Ave	Per car departure: Detect 20-35 ft distance, measuring the time it takes for notification to go off. After 2s is fail. Take percentage passes / failures.	Place one RC car in front of another and demonstrate correct notification speeds when front RC car drives away.

Project Management

Owner	Week 7							Week 8						
	Sun 10/6	Mon 10/7	Tue 10/8	Wed 10/9	Thu 10/10	Fri 10/11	Sat 10/12	Sun 10/20	Mon 10/21	Tue 10/22	Wed 10/23	Thu 10/24	Fri 10/25	Sat 10/26
Eunice Lee	Rest	Equipment procurement					Rest	Rest	Video + radar processing	Lane detection			Testing	Rest
Ankit Lenka										Leaving car detection				
Emily Szabo														
Owner	Week 9							Week 10						
	Sun 10/27	Mon 10/28	Tue 10/29	Wed 10/30	Thu 10/31	Fri 11/1	Sat 11/2	Sun 11/3	Mon 11/4	Tue 11/5	Wed 11/6	Thu 11/7	Fri 11/8	Sat 11/9
Eunice Lee	Rest	Traffic light detection				Testing	Rest	Rest	Mobile app development			Testing	Rest	
Ankit Lenka		Forward collision detection							Bluetooth connection between hardware + software					
Emily Szabo						Mobile app development								