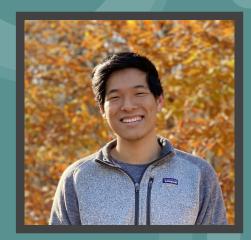
Team B7: Carma Design Review



Jananni Rathnagiri



Adriana Martinez



Evann Wu

Application Area

Drowsy and Distracted Driving

- Sleepy / Distracted Eyes
- Yawning

Applications

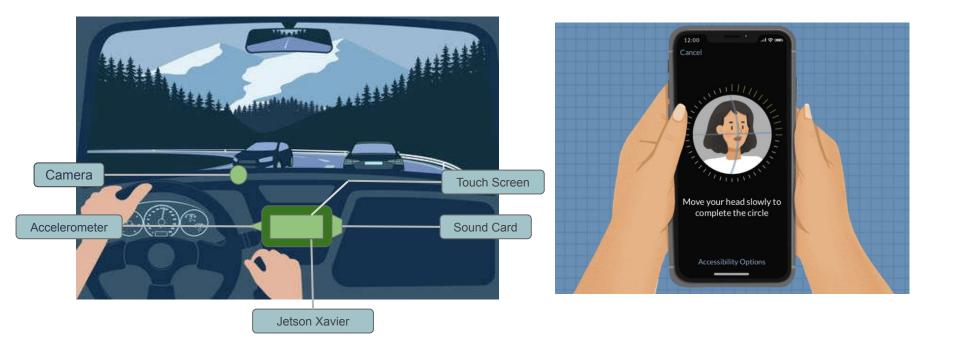
- Trucking industry
- Commercial use

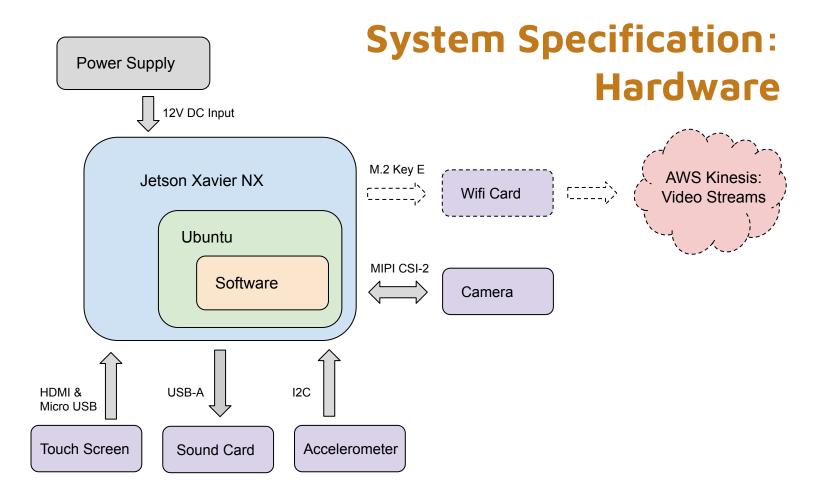
ECE Areas:

- Software
- Signals and Systems

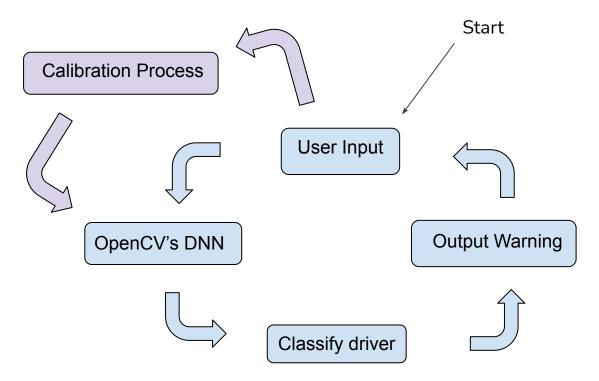


Solution Approach

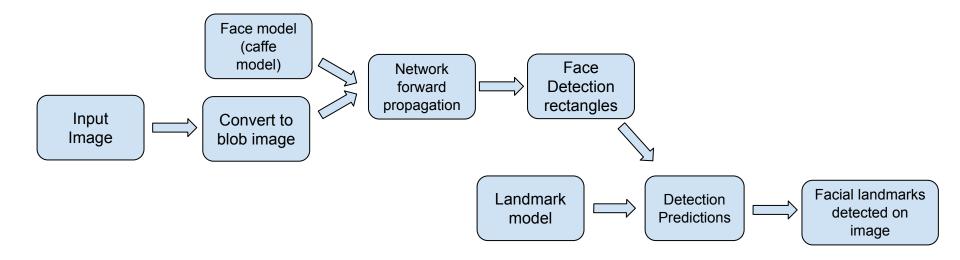




System Specification: General Software



System Specification: Deep Learning with OpenCV



Implementation Plan

Components to Download

- OpenCV
 - DNN Module
- TensorFlow

Components to Design/Implement

- 1. Following OpenCV deep learning tutorials from <u>PyImageSearch</u>
 - How to utilize OpenCV library for facial detection and eye tracking
- 2. Parallel GPU Processing
 - OpenCV's CUDA API in order to obtain desired frames per second

Components to Buy

- Jetson Xavier board (arrived)
- Jetson Kit includes Touch screen, camera and SD card (arrived)
- Car Power Adapter (for late stage testing)
- Wifi Card (back-up)
- Sound Card (back-up)
- Accelerometer (back-up)
- Total ~\$540

Components to Borrow

- Sound Card (claimed)
- Accelerometer (claimed)

Metrics and Validation: Driver

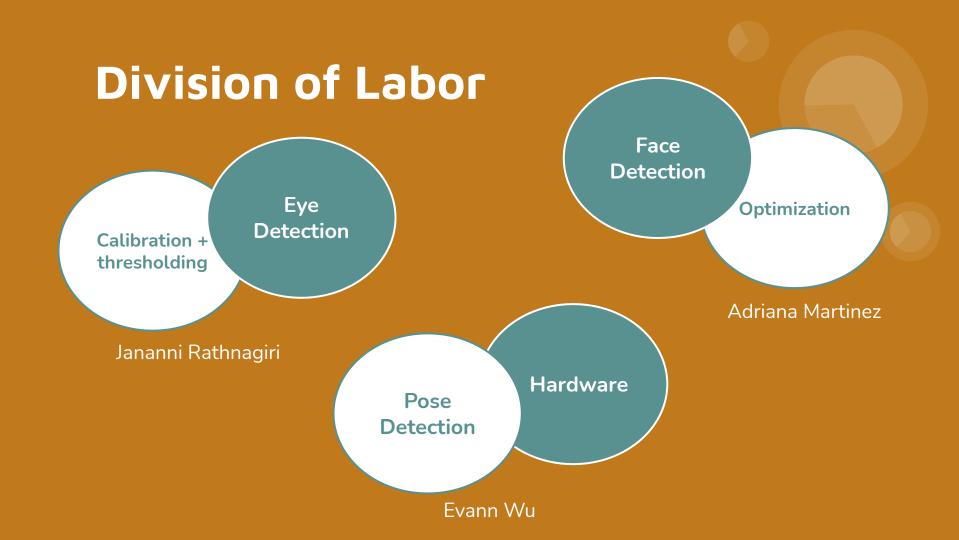
Requirements	Metrics	Test Plan	
Driver should never take eyes off the road for > 2 secs	Frontal view: Eyes looking away > 2 sec	Error rate False + False -	<10% <9% <1%
Driver should not fall asleep at the wheel	Frontal view: Frequency of blinking and/or length of blink increases by 0.25x norm	Error rate False + False -	<15% <13% <2%
Driver should not fall asleep at the wheel	Frontal view: detect yawning detect eyes closed	Error rate False + False -	<15% <13% <2%
Most fatal accident happen over 55 mph	Side view: turned > 2 secs while driving > 55 mph	Error rate False + False -	<35% <30% <5%

Metrics and Validation: Device

Requirements	Metrics	Test Plan
Driver should never take eyes off the road for > 2 secs so computation must be fast	Computation Time < 1000ms	Measure the time at start and end of computation
Driver should never take eyes off the road for > 2 secs so computation must be fast	>= 5 frame/sec (fps)	Run the program with a person looking at the camera for 60 seconds. Take the average frame rate
Total Device Accuracy	-	Accuracy of model against test suite >= 75%

Risks and Mitigation

Risks	Mitigation
Inadequate Board Performance (Low FPS)	Using AWS Kinesis for Faster Computation
Poor Frontal Face Detection or DNN GPU parallelization incompatibility	Switch to Dlib Algorithm
Xavier NX Board Malfunction	Use Jetson Nano (~\$100) + AWS
Accelerometer/Sound Card/Camera Failure	Purchase new parts using remaining budget
Unforeseen delays	10 days of slack



Carma Project Schedule

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