DRIVAID

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Use Case

What will Drivaid do?

- Identify poor driving habits and notify driver
- Log and share the driving records
- Generate a driving report to score the driver based off of analyzed data

What problem area are you trying to improve?

- Many drivers never receive feedback on their driving
- Lack of driving data

Scope

- Identify driving infractions
- Maintain a log of driving data
- Capacity to share data with other users

ECE Areas:

- Software - data collection, analytics
- Signals - data sharing

Requirements - Infractions

Should be able to determine whether user:

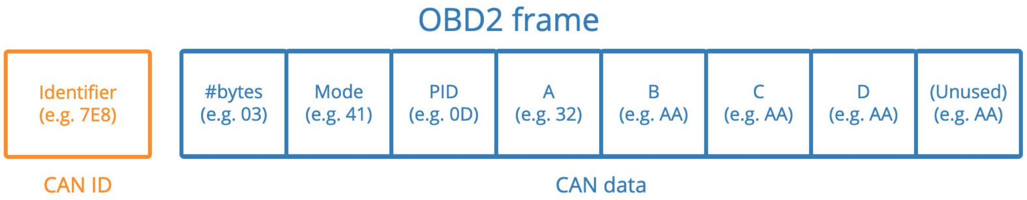
- Drives too fast in a given speed limit, drives too slow in a given speed limit
- Turns too fast/ turn radius is not ideal (90^{O} turns should be taken around 10mph)
- Seatbelt is not on
- Brakes too hard/accelerates too fast (below $-1.5 m/s^2$ or above $1.5 m/s^2$)
- Is not driving as economically efficient as possible or driving with high RPM

Requirements - Camera Storage

- We need a small, lightweight camera that can connect to a RaspPi and be mounted on the dashboard
- Video data must be compact enough to store in the cloud and retrievable by WebApp
- Should be at least 5 seconds of video data per infraction

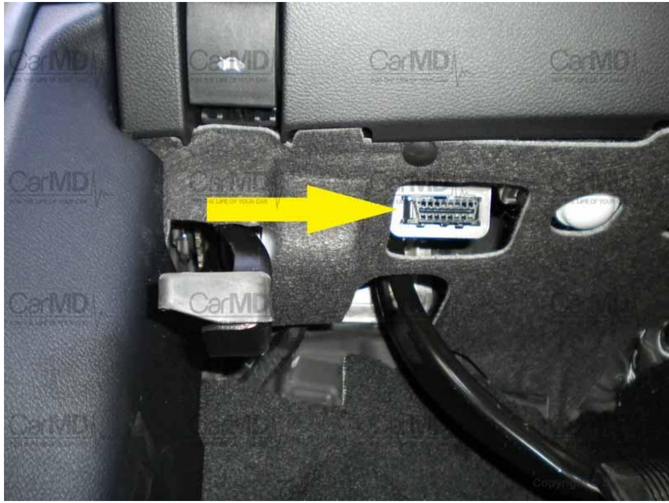
Requirements - Data Logging

- Must be able to accurately read and log data from the car’s OBD-II port
- Data must mirror real world conditions
- Before sending to web application, data must be in a web readable JSON format



OBD2 frame

Identifier (e.g. 7E8)	#bytes (e.g. 03)	Mode (e.g. 41)	PID (e.g. 0D)	A (e.g. 32)	B (e.g. AA)	C (e.g. AA)	D (e.g. AA)	(Unused) (e.g. AA)
CAN ID	CAN data							

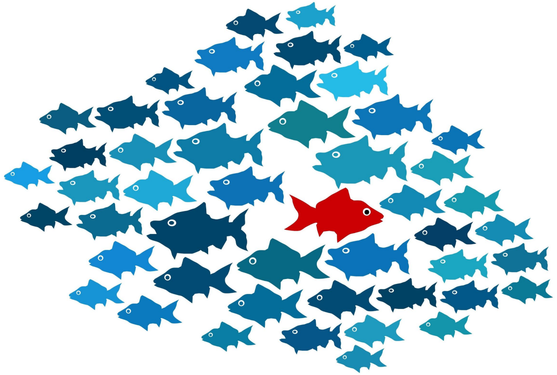


Requirements - Web Application

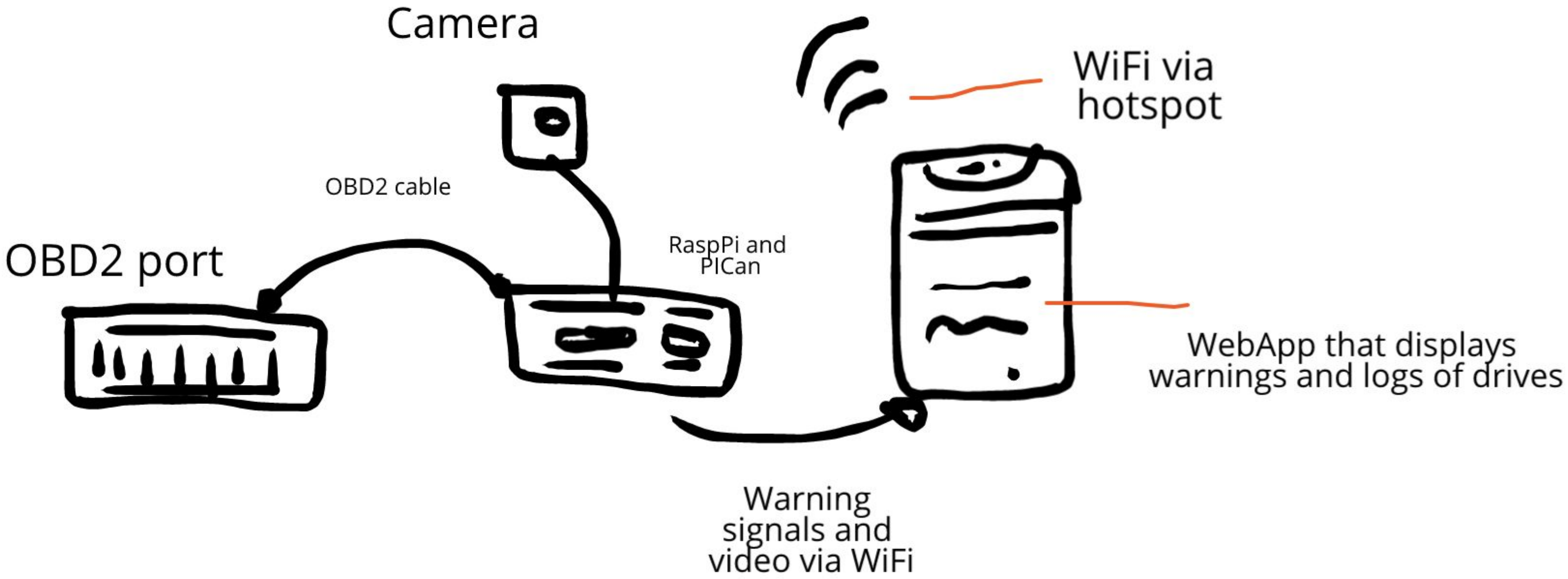
Features	Driver	Driving School / Insurance Company / Transportation Company
Login	Yes	Yes
View Individual Driver Graphs and Scores	Yes	Yes
Change Settings	Yes	No
Real Time Infraction Notification	Yes	No
View Group Data	No	Yes

Technical Challenges

- Getting the right amount of video during an infraction and correlating video data with acceleration, velocity
- Determining exactly when an infraction starts and ends (e.g.. if a user is going too fast for 15 minutes, is that whole 15 minutes an infraction?)
- If necessary: handling anomaly/nonsensical data from the OBD-II port
- Minimizing the time between web-app display of infraction and when infraction takes place



Solution Approach - Visualization



Camera

OBD2 cable

OBD2 port

RaspPi and PICan

WiFi via hotspot

WebApp that displays warnings and logs of drives

Warning signals and video via WiFi

Solution Approach

Software

- Phone acts as a Wifi Hotspot and video data is sent over Wifi

- Web app displays warnings to driver when infractions incur

- On back end, videos are stored on AWS (S3 Standard price point)

-From CANbus, we can receive data about:

- Velocity
- RPM
- Seat belts
- Steering wheel angle

Hardware

- 360p 30fps camera is mounted to dash
  - Low resolution and low sampling keep backend storage costs down
- Raspberry Pi receives video data and OBD-II data
  - Raspberry Pi 4 4GB of RAM
- Lithium ion battery 2000mAh
  - Can keep RaspberryPi running for 1 hour (assuming 5V, 2A)
  - Can also be used as backup for cigarette lighter plug in car

Solution Approach - Alternatives

Other ideas we have considered:

- Foxwell ELM327 CAN to Bluetooth device
  - Makes project too simplistic and is not as reliable as a hardware cable and PICan
- Cellular connection instead of WiFi hotspot
  - Adds extra cost, video quality and latency suffers
- Single photos instead of video stream
  - From a user perspective, not very informative

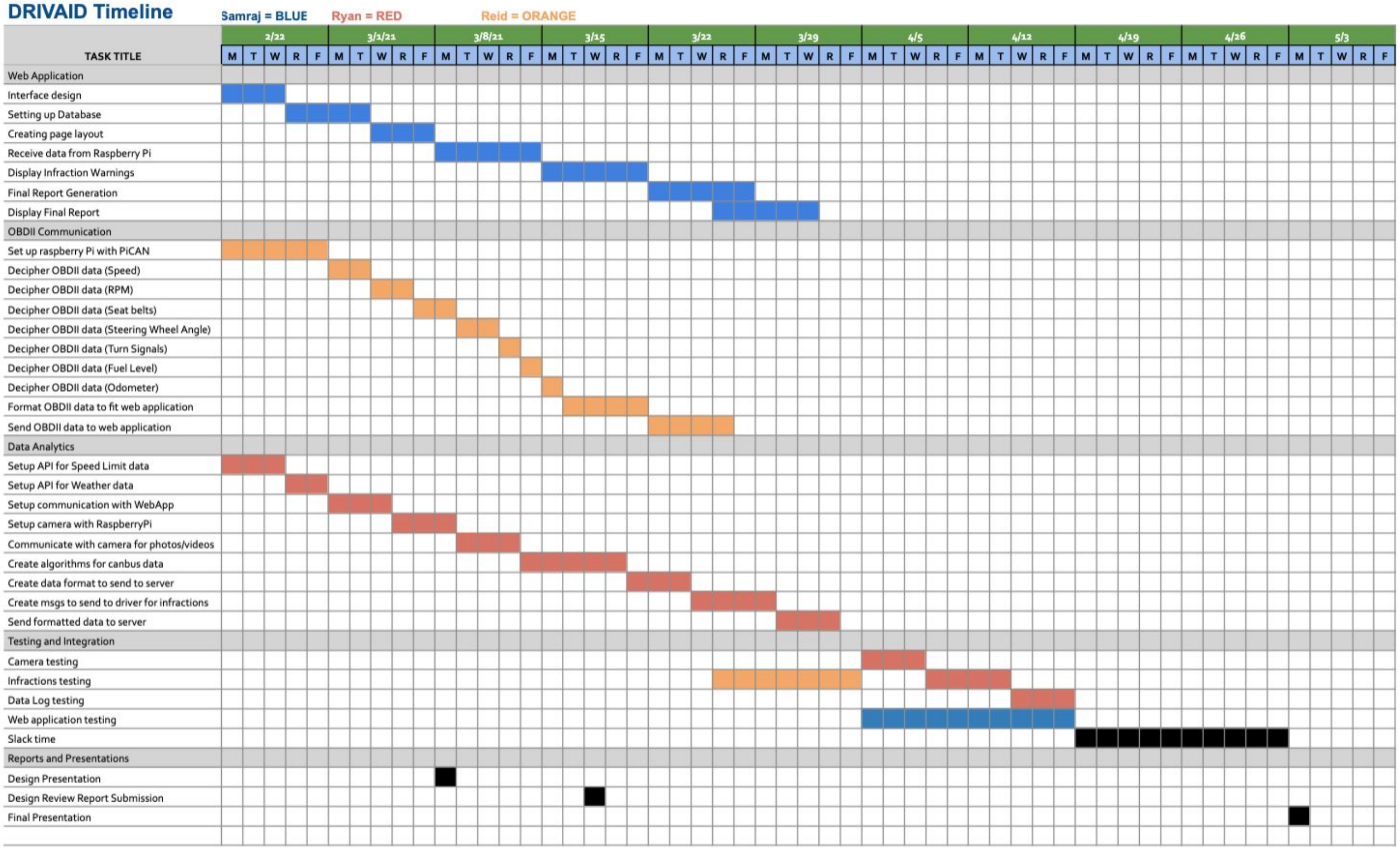
Testing, Verification and Metrics

Requirement	**Testing, Verification, and Metrics**
Infractions	● Controlled driving test, committing a known number of infractions and comparing to detected amount
Camera	● Script to make sure camera is functional by sending a test image for a fixed interval
Data Logging	● Verify all data is being sent and processed correctly between OBD-II and RPI ● Monitor data log to ensure connection and compare to commercial system
Web Application	● Unit testing and database testing with Selenium

Tasks and Division of Labor

- OBD-II reader and logging (REID)
  - Connecting to port with Raspberry Pi, reading, and logging data
- Camera (REID)
  - Connecting camera to Raspberry Pi and taking picture when infraction is detected
- Infraction Detection (RYAN/REID)
  - Implementing algorithms to detect infractions from the data on Raspberry Pi
- Web Application (SAMRAJ)
  - Creating a web interface to visualize infractions, warnings, and generate final report
  - Setting up a database to store information and multiple user accounts

Schedule



DRIVAID Timeline

Samraj = BLUE Ryan = RED Reid = ORANGE

	2/22					3/1/21					3/8/21					3/15					3/22					3/29					4/5					4/12					4/19					4/26					5/3				
TASK TITLE	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
Web Application																																																							
Interface design	🟦	🟦	🟦																																																					
Setting up Database				🟦	🟦	🟦	🟦																																																
Creating page layout								🟦	🟦	🟦																																													
Receive data from Raspberry Pi											🟦	🟦	🟦	🟦	🟦																																								
Display Infraction Warnings																🟦	🟦	🟦	🟦	🟦																																			
Final Report Generation																					🟦	🟦	🟦	🟦	🟦																														
Display Final Report																								🟦	🟦	🟦	🟦	🟦																											
OBDII Communication																																																							
Set up raspberry Pi with PiCAN	🟧	🟧	🟧	🟧	🟧																																																		
Decipher OBDII data (Speed)						🟧	🟧																																																
Decipher OBDII data (RPM)								🟧	🟧																																														
Decipher OBDII data (Seat belts)										🟧	🟧																																												
Decipher OBDII data (Steering Wheel Angle)												🟧	🟧																																								
Decipher OBDII data (Turn Signals)														🟧																																									
Decipher OBDII data (Fuel Level)															🟧																																								
Decipher OBDII data (Odometer)																🟧																																							
Format OBDII data to fit web application																	🟧	🟧	🟧	🟧																																			
Send OBDII data to web application																					🟧	🟧	🟧	🟧																															
Data Analytics																																																							
Setup API for Speed Limit data	🟥	🟥	🟥																																																				
Setup API for Weather data				🟥	🟥																																																		
Setup communication with WebApp						🟥	🟥	🟥																																															
Setup camera with RaspberryPi									🟥	🟥	🟥																																												
Communicate with camera for photos/videos												🟥	🟥	🟥																																							
Create algorithms for canbus data															🟥	🟥	🟥	🟥	🟥																																				
Create data format to send to server																				🟥	🟥	🟥																																	
Create msgs to send to driver for infractions																							🟥	🟥	🟥	🟥																													
Send formatted data to server																											🟥	🟥	🟥																										
Testing and Integration																																																							
Camera testing																															🟥	🟥	🟥																						
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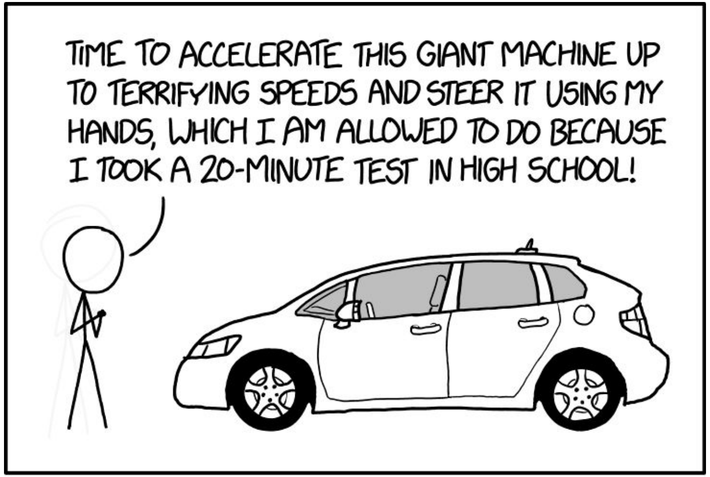
Design Presentation											⬛																																												
Design Review Report Submission																		⬛																																					
Final Presentation																																																			|⬛|			

Drivaid is looking to change the way we look at learning to drive. Are you in?


TIME TO ACCELERATE THIS GIANT MACHINE UP TO TERRIFYING SPEEDS AND STEER IT USING MY HANDS, WHICH I AM ALLOWED TO DO BECAUSE I TOOK A 20-MINUTE TEST IN HIGH SCHOOL!

DRIVING FREAKS ME OUT.