Engineering Release Review

Smart Trip Planning
02/21/2021
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Single Objective

 Design and develop an application that routes economical trips for users by retrieving the cheapest gas price within the predicted vehicle range.





Value Proposition

The real-world problem we are trying to solve is minimizing our users cost of gas in order to maximize money that could be spent elsewhere.

High Level Background

Input:

- Ending location
- Bluetooth Connection to ELM 327 chip

Calculations:

- Route to take
- Current MPG (via MAF)
- Distance until empty
- Gas station location and their respective prices

Output:

- Where to stop for gas
- Current GPS location

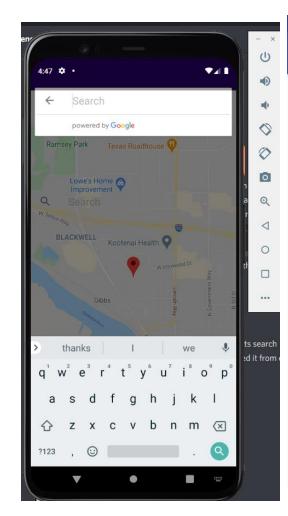






Requirements

- The Application
 - Functioning Map / Directions
 - Local Gas Stations & Prices
 - Obtain car fuel information
 - Gas consumption predictions
 - Fuel monitoring and alerts
 - Provide optimal gas station recommendations
- The estimations must be more accurate than range predictions already in cars



* 🏵 🛜 Чৣ 📶 80% 🗖 9:19 AM **OBD-Reader** OBD data :: Vehicle Speed: 0 km/h Engine RPM: 1687 Engine Runtime: 00:02:31hh:mm:ss Trouble Codes: C0300 Idling Fuel Consumtion: 0.01691305 Litre Driving Fuel Consumtion: 0.0 Litre Instant Fuel Consumtion: 0.0 L/100km driving maf: 0.0 g/s idle maf: 85.895546 g/s Fuel Type: 14.7 Rapid Acceleration Times: 0 Rapid Decleration Times: 0 Max Rpm: 1719 Max Speed: 0 km/h Driving Duration: 0.0 minute Idle Duration: 0.32515 minute Distance since codes cleared: 4161km Distance traveled with MIL on: 0km Intake Manifold Pressure: 33.0 kpa Air Intake Temperature: 286.15 C Fuel Consumption Rate: null L/h Fuel Level: 84.3% Fuel Pressure: null Engine Fuel Rate: null

Engine Coolant Temperature: 41C

Engine Load: 30.6%
Engine oil temperature: 26C
Barometric Pressure: 93kPa
Air/Fuel Ratio: 14.75:1 AFR
Wideband Air/Fuel Ratio: 14.74:1 AFR

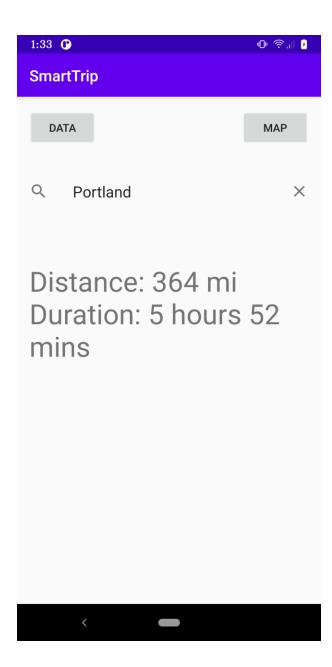
Absolute load: 22.0%

Overview of Key attributes

- User friendly GUI
- Precise Data
- Correct location suggestions
- On route suggestions
- Accurate directions

Technical Key Attribute: Fuel Consumption Calculation Via MAF

```
//Fuel Consumption calculation
//#TODO One thing we need to consider is the fuel percentage level, I cant seem to find function call to get that.
int mileZero = Integer.parseInt(tripRecord.getmDistanceTraveledAfterCodesCleared()); //get the mileage and turn it into an integer
while(true) {
   instantFuelConsumption.add(tripRecord.getmInsFuelConsumption()); //add current fuel usage into the list
       averageVarInstant = averageFunc((instantFuelConsumption)); //get the average of the instantaneous fuel consumption
       averageVarLongTerm = averageFunc(longTermFuelConsumption); //average the long term fuel consumption
       milesUntilEmpty = totalTankSize / averageVarLongTerm; //get a more accurate miles until empty by the average #TODO need to take total tank size and * fuel percentage
   else if(Integer.parseInt(tripRecord.getmDistanceTraveledAfterCodesCleared()) == mileZero+numberOfFuelCalculations && numberOfFuelCalculations <= 5){ //check to see if we h
        averageVarInstant = averageFunc(instantFuelConsumption); //average this list
       milesUntilEmpty = totalTankSize / averageVarInstant; //this will give us an estimate of how many miles we have until we are empty #TODO need to take total tank size as
```



Technical Key Attribute: Navigation Via Google Maps API

- Search
 - Leg
 - Distance
 - Duration
- Waypoints

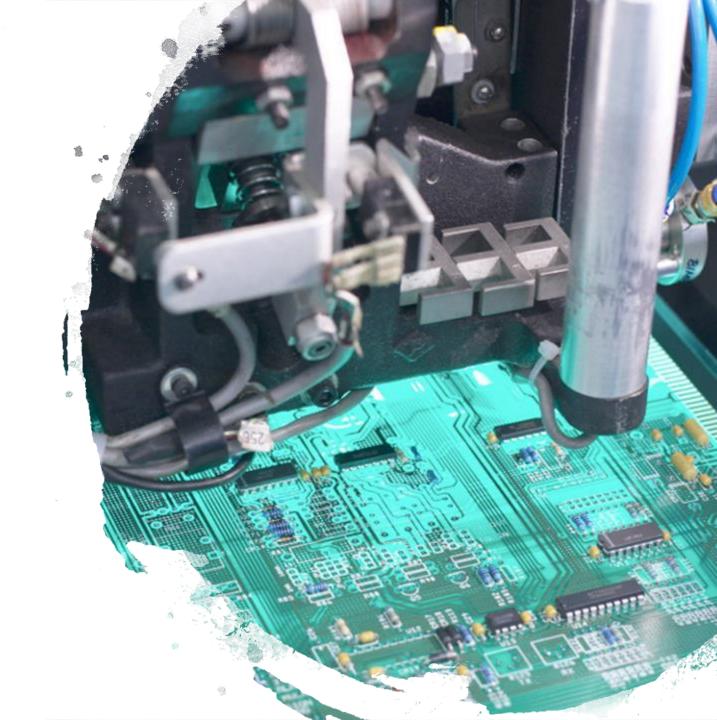
```
total duration 5 hours 52 mins
total distance 364 mi
single leg distance 0.7 mi
single leg distance 7.4 mi
single leg distance 417 ft
single leg distance 2.4 mi
```

Bill of Materials

Capstone Project Bud		Shring				-									
Project:	Smart Trip														
Last Updated	2/5/2021														
				2020-	2021							It	tem		
Expense Items	Sept	Oct	Nov	Dec	Jan		-eb	M	ar	-	Apr	Te	otal		
Equipment/Tools:															
Car												\$	-		
Gas												\$	-		
Travel:															
Test drives						\$	5	\$	10	\$	10	\$	25		
												\$	-		
							I					\$	-		
Supplies / Parts / Services:							I								
ELM327 Chip x3	\$ 20											\$	20	Cl	hip:
OBD2 port splitter		\$ 15										\$	15		
												\$	-		
												\$	-		
												\$	-		
												\$	-		
												\$	-		
												\$	-		
												\$	-	Ex	xpense
														\$ 60 Su	ubtotal

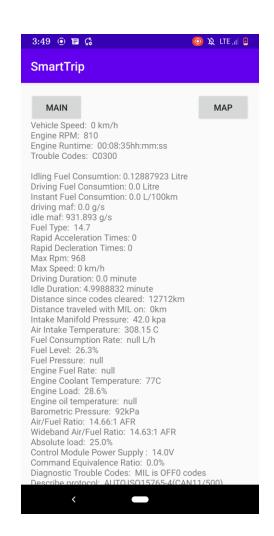
Manufacturing Plan

- We don't have anything needed to be manufacture
- All sections of the project are still being developed at various rates
- All components needed were bought from amazon (ELM327 chip)
- Approximately \$10 to purchase



Validation Approach

RPM
Fuel Consumption
MAF
Intake Manifold Pressure
Engine Load





Smart Trip App

OBD Reader

Validation Approach cont. (More Tests)







FUEL USE



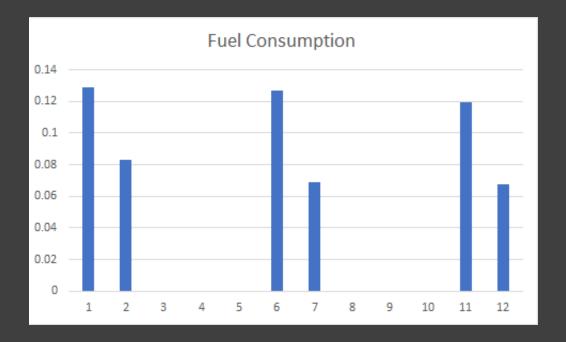
REACHABLE GAS STATIONS

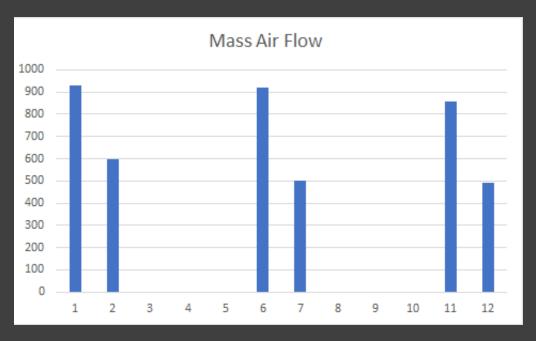


OFFLINE ROUTES

Air conditioning test

- Left side: On
- Right side: Off





Why we do not need weight

Mass Air Flow

Air On

idle maf: 855.6973 g/s

Air Off

idle maf: 490.3312 g/s

MAF is comprehensive

Schedule

In Progress

- Searching along route
- Fuel estimation

Later

- Add waypoint
- Estimate costs

Schedule

Budget

ELM 327 chip

Google APi

- Directions
- Places
- Maps

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Google Maps Costs

Routes

APIs in Routes include: Directions API; Distance Matrix API; and Roads API.

SKU	\$200 monthly credit Equivalent free usage	Monthly volume range (Price per thousand)				
		0-100,000	100,001-500,000	500,001+		
Directions	Up to 40,000 calls	\$5.00	\$4.00			
Directions Advanced	Up to 20,000 calls	\$10.00	\$8.00			
Distance Matrix	Up to 40,000 elements	\$5.00	\$4.00	CONTACT SALES		
Distance Matrix Advanced	Up to 20,000 elements	\$10.00	\$8.00	for volume discounts.		
Roads - Route Traveled	Up to 20,000 calls	\$10.00	\$8.00			
Roads - Nearest Road	Up to 20,000 calls	\$10.00	\$8.00			
Roads - Speed Limits	Up to 2,000 elements	\$20.00	\$16.00			

Maps

APIs in Maps include: Maps SDK for Android; Maps SDK for iOS; Maps JavaScript API; Maps Static API; Street View API; Maps Embed API; and Maps URLs.

SKU	\$200 monthly credit Equivalent free usage	Monthly volume range (Price per thousand)					
		0-100,000	100,001-500,000	500,001+			
Mobile Native Static Maps	Unlimited loads	\$0.00	\$0.00				
Mobile Native Dynamic Maps	Unlimited loads	\$0.00	\$0.00				
Embed	Unlimited loads	\$0.00	\$0.00				
Static Maps	Up to 100,000 loads	\$2.00	\$1.60	CONTACT SALES			
Dynamic Maps	Up to 28,000 loads	\$7.00	\$5.60	for volume discounts.			
Local Context Map beta	Requires enabling Dynamic Maps	\$0.00 during beta	\$0.00 during beta				
Static Street View	Up to 28,000 panos	\$7.00	\$5.60				
Dynamic Street View	Up to 14,000 panos	\$14.00	\$11.20				

Potential Risks and solutions



Broken MAF sensor



Compare consumption estimations to actual fuel level change

Risks and Solutions



Phone loses service



Downloaded route options

Risks and Solutions



No fuel stops found



Alert the user and backtrack

Vehicle Speed: 0 km/h Engine RPM: 787

Engine Runtime: 00:18:22hh:mm:ss

Trouble Codes: C0300

Idling Fuel Consumtion: 0.119508795 Litre

Driving Fuel Consumtion: 0.0 Litre Instant Fuel Consumtion: 0.0 L/100km

driving maf: 0.0 g/s idle maf: 855.6973 g/s

Fuel Type: 14.7

Rapid Acceleration Times: 0 Rapid Decleration Times: 0

Max Rpm: 870 Max Speed: 0 km/h

Driving Duration: 0.0 minute Idle Duration: 5.022567 minute

Distance since codes cleared: 12712km Distance traveled with MIL on: 0km Intake Manifold Pressure: 41.0 kpa Air Intake Temperature: 327.15 C Fuel Consumption Rate: null L/h

Fuel Level: 26.3% Fuel Pressure: null Engine Fuel Rate: null

Engine Coolant Temperature: 91C

Engine Load: 26.7%

Engine oil temperature: null Barometric Pressure: 92kPa Air/Fuel Ratio: 14.65:1 AFR

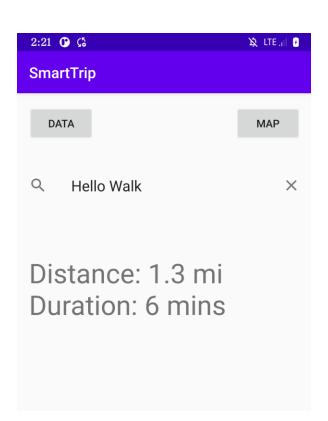
Wideband Air/Fuel Ratio: 14.65:1 AFR

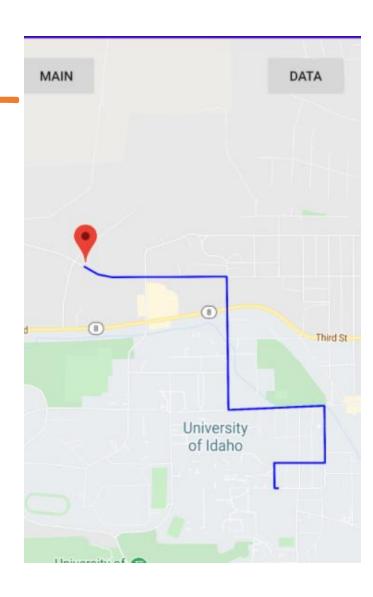
Absolute load: 22.0%

Control Module Power Supply: 13.0V Command Equivalence Ratio: 0.0%

Diagnostic Trouble Codes: MIL is OFF0 codes

Prototype







Questions?