

An AI based car preventative maintenance solution brought to you by:

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Problem/Motivation



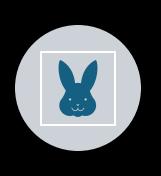
Cars are convenient until something breaks and you're left stranded or stressed



Solutions often exist, but it would've been nice to catch the issue earlier, before the damage or cost escalated.



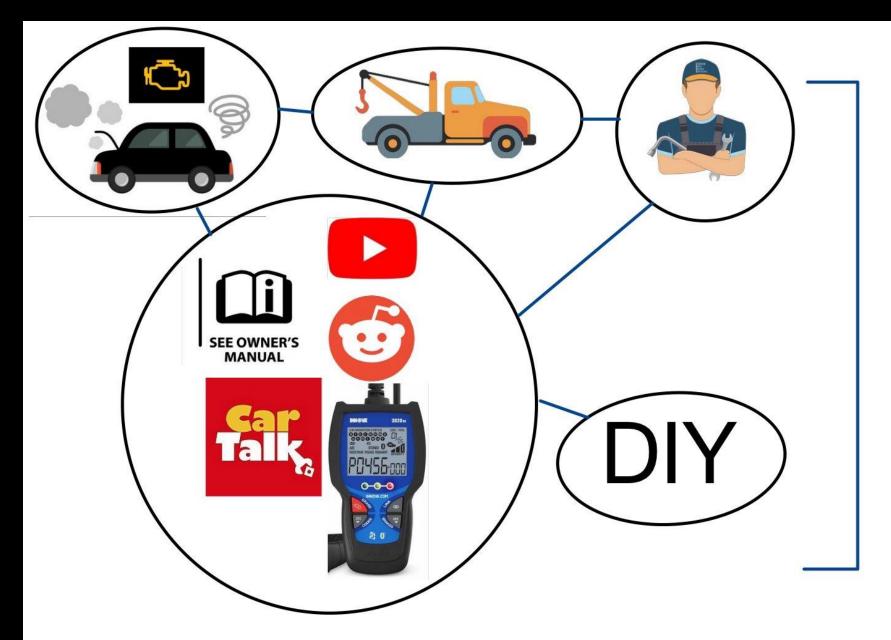
When the check engine light comes on, most people have no idea what it means



Drivers are forced down internet rabbit holes, or they leave it all up to a mechanic — risking overcharges or unnecessary repairs.



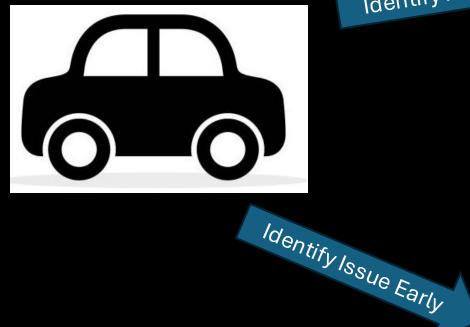
This creates frustration, confusion, and unnecessary costs for car owners.







Our Vision

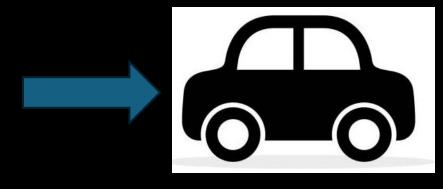




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How can we make it easier?

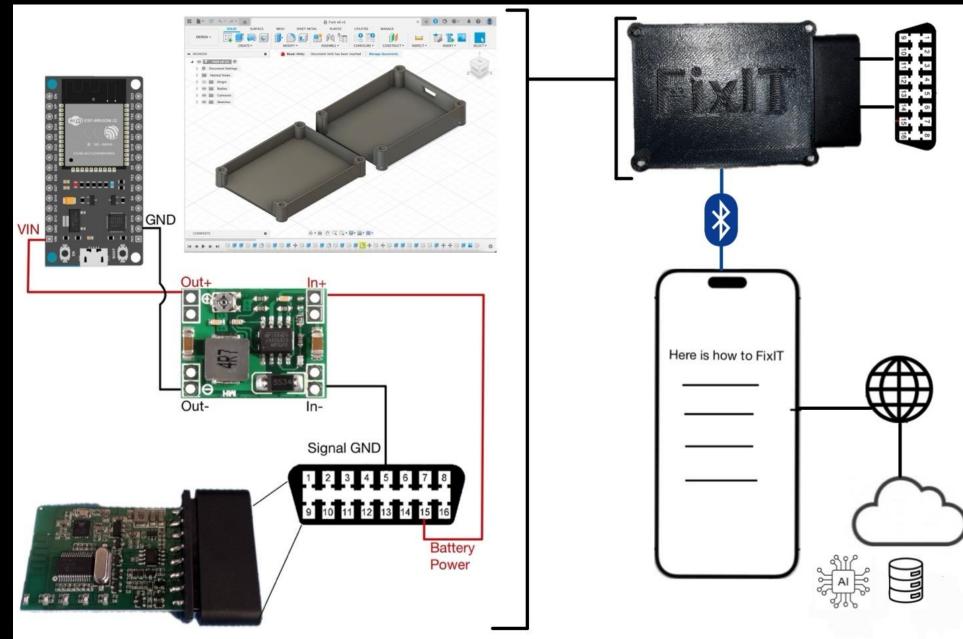


Proposed Solution: An AI based OBD-II that will tell you what's wrong and how to:

Fix T

Prototype/Design

Design Overview



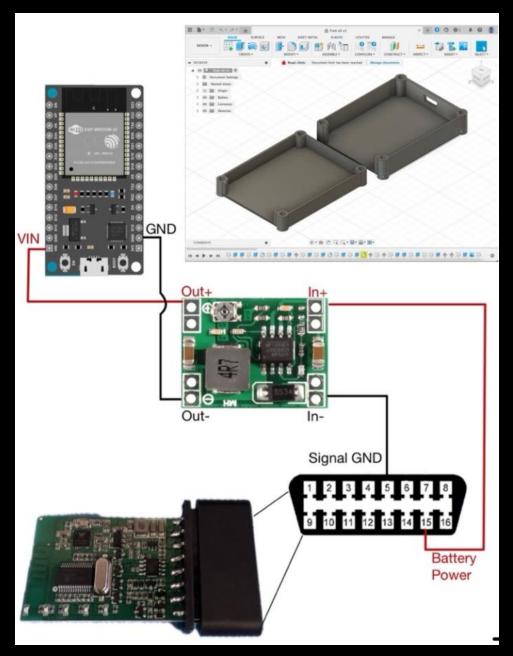
Hardware

• ESP32 Microcontroller

- Powered by OBD-II pins 15(+) and 5 (-)
- Buck converter to step down voltage 12V to 5V
- Connects to ELM327 via Wi-Fi
- Transmits BLE signal to smartphone

• ELM327

- Connects to car and transmits CAN data via Wi-Fi
- ECUSIM-2000
 - Used to simulate a vehicle
- Custom 3D printed casing
 - Logo
 - Debug Port



Software

Embedded

- .ino file built and compiled on ESP32
- ELMduino library
- Decipher DTCs and other data from the car (ex: temp)
- Send chunked JSON packets to frontend

Frontend

- React Native
- TypeScript
- AsyncStorage for local data persistence
- BLE connection manager (react-nativeble-plx)
- OpenAl service integration

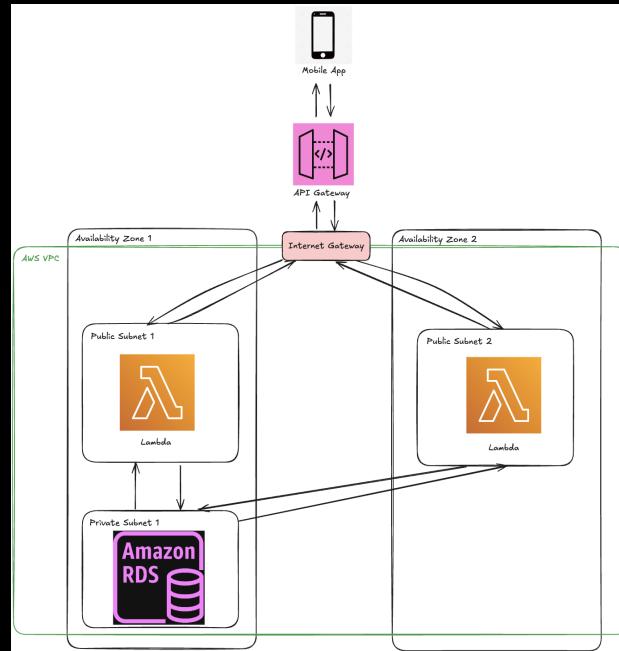
Backend

 (Python) endpoints to serve API requests, returned in JSON

- Flask library
- Bruno for API testing
- PostgreSQL database to store user data

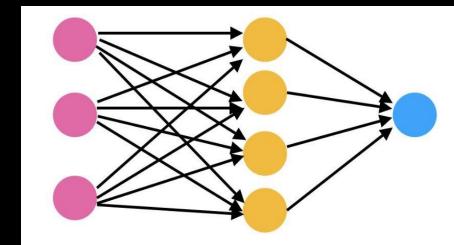
Cloud Infrastructure

- API gateway: API hosting
- AWS VPC
 - Internet Gateway
 Availability Zones
 Subnets
- Lambda: Compute
- RDS: Database
- Terraform: Infrastructure as Code
- Cloudwatch: Logging





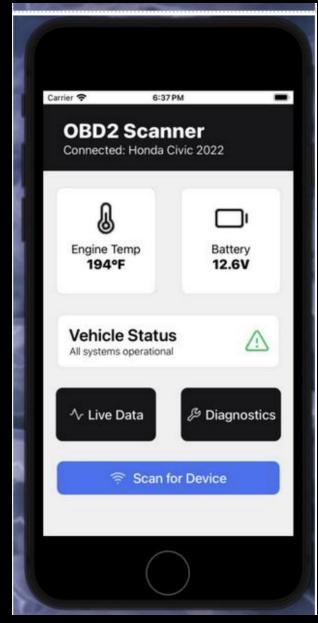
- Original Plan: make our own ML Model
 - \circ Multi-Label Classification
 - \circ Not enough data
 - \odot Potentially not enough compute
 - \odot Opted to use an LLM instead
- On-phone model vs just calling an API
 - On-phone is not feasible due to hardware constraints
- Pre-prompting



Design roadmaps

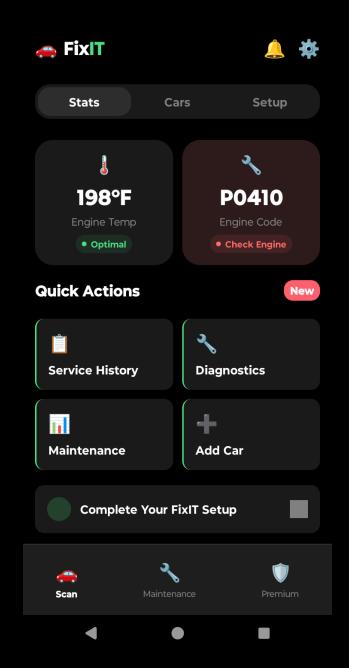
First Semester Design & early development





Results: Final Design





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* Repairs

1. Repair or replace the second cylinder due to misfire (DTC P0302). 2. Check and fix any issues causing the check engine light to be on. 3. No other critical repairs needed.

1 **Cost Estimates**

Normal

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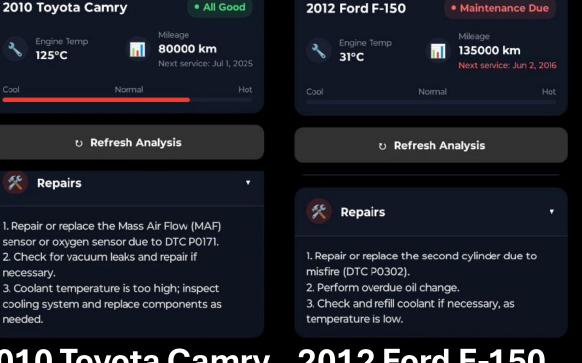
DTC P0302 indicates a cylinder 2 misfire. Repair costs can range from \$100-\$300 for spark plug or ignition coil replacement, to \$500-\$800 for fuel injector replacement. Check engine light is on, likely due to this issue. Coolant temperature is normal. No maintenance service needed as status is good.

Testing

- Ran multiple outputs testing different codes and cars
- Tweaked engine temperature (using ECUSIM) and tested AI response
- Used physical car with known issue







2010 Toyota Camry DTC code: P0171

2012 Ford F-150 DTC code: P0302

Demo

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Future work?

- Entrepreneurship?
 - \circ Maybe
 - $\odot \operatorname{\mathsf{More}}$ research and market analysis
 - \circ Sell idea or continue making our own
- Transition to open-source models we can fine tune or use RAG

 Ex: Ollama large parameter models trained with various data for specific vehicles

The **Fix** team thanks you for your time!

Questions?