

Capstone Project

OBD-II Buddy

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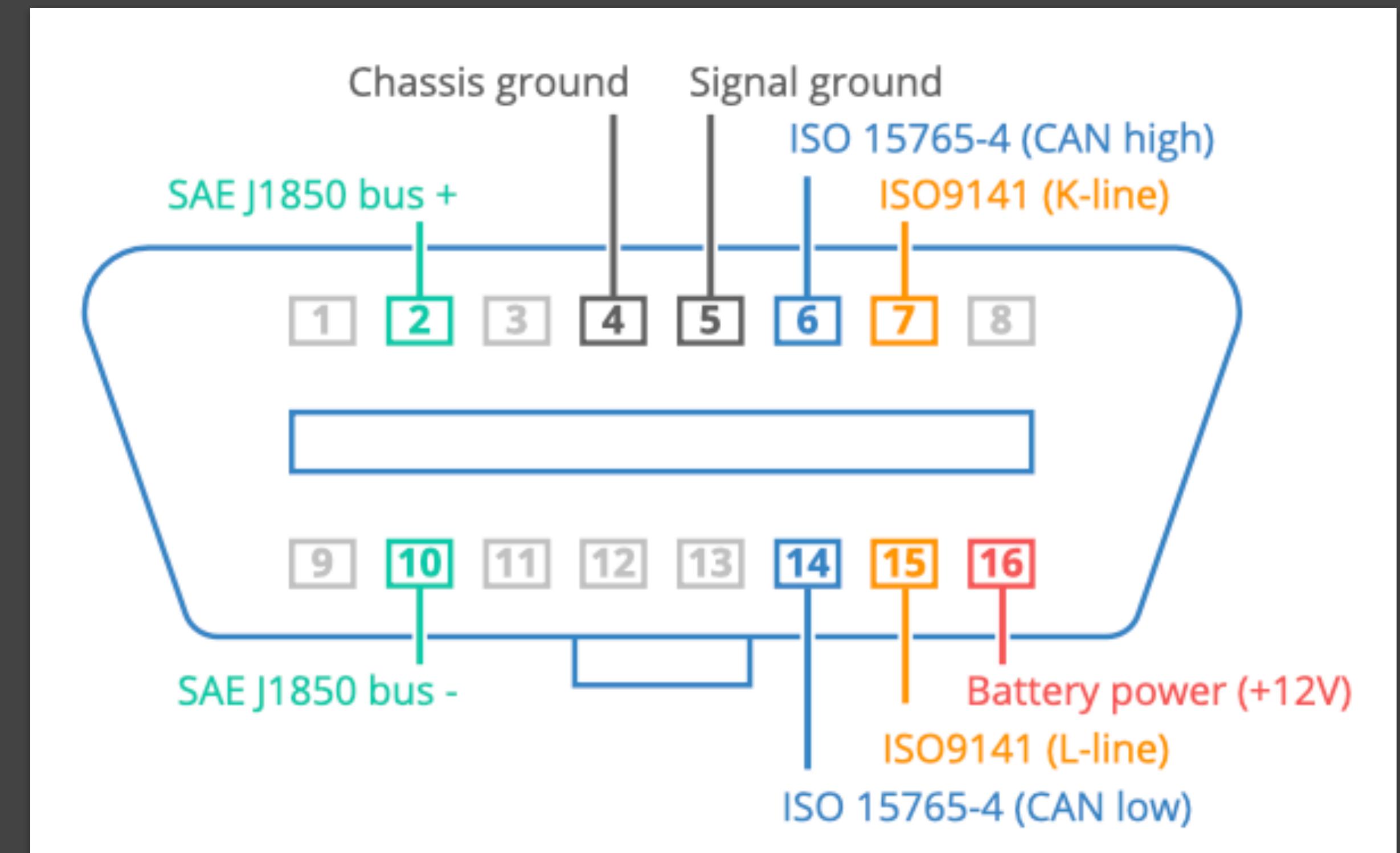
Date: 12/01/2023

Helpful Abbreviations

- On-Board Diagnostics - II (OBD-II)
- Controller Area Network (CAN)
- Electronic Control Unit (ECU)
- Parameter ID (PID)
- Bluetooth Low Energy (BLE)
- Core Bluetooth (CB)

OBD-II Protocols

- ISO 15765 (CAN bus)
- ISO14230-4 (KWP2000)
- ISO9141-2
- SAE J1850 (VPW)
- SAE J1850 (PWM)



ISO 15765-4 (CAN high)

ISO9141 (L-line)

Current Market Sample

Toyota TechStream



FIXD App and Sensor



Carly App and Sensor



Snap-On Solaris



Current Market Pricing

FIXD App and Sensor



\$ 128.99

Carly App and Sensor



\$ 195.11

Snap-On Solaris



\$ 3,485.00

Toyota TechStream



\$ 6,229.00

The prices of these tools vary, as they grow with capability.

Even the most capable of these tools would only be necessary for a professional mechanic or dealership.

These high-priced proprietary diagnostic tools reveal the need for a cost-effective alternative for today's consumer.

OBD-II

Buddy

OBD-II Buddy Functionality

Sensor Data:

- Engine Load
- Engine Coolant Temperature
- Engine Speed
- Vehicle Speed
- Intake Air Temperature
- Mass Air Flow Rate
- Throttle Position
- Battery Voltage

Diagnostic Trouble Codes:

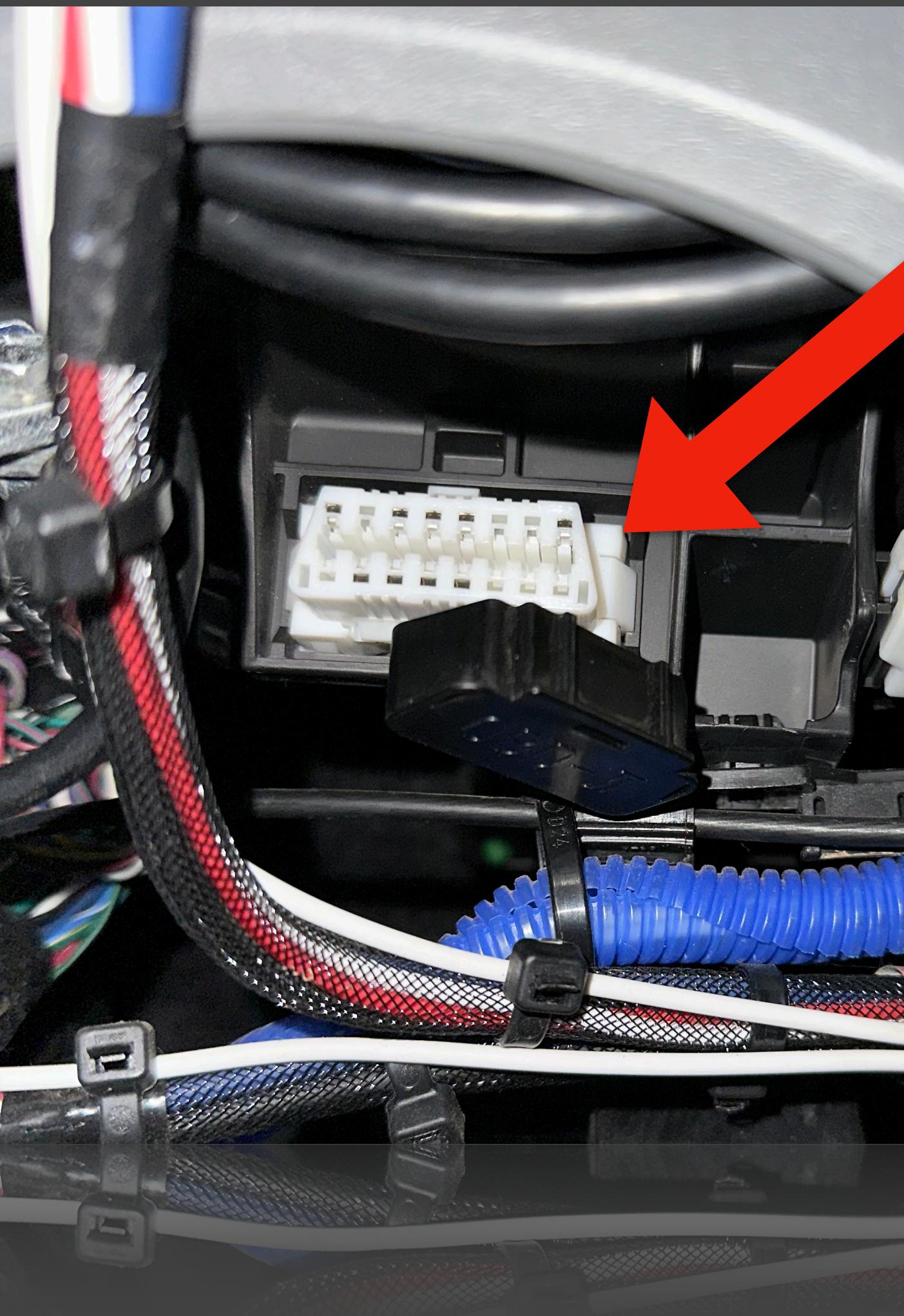
- Show Stored DTCs
- Clear DTCs

Vehicle Info:

- Vehicle Identification Number
- Calibration ID
- OBD-II Protocol
- ECU Name
- Fuel Type

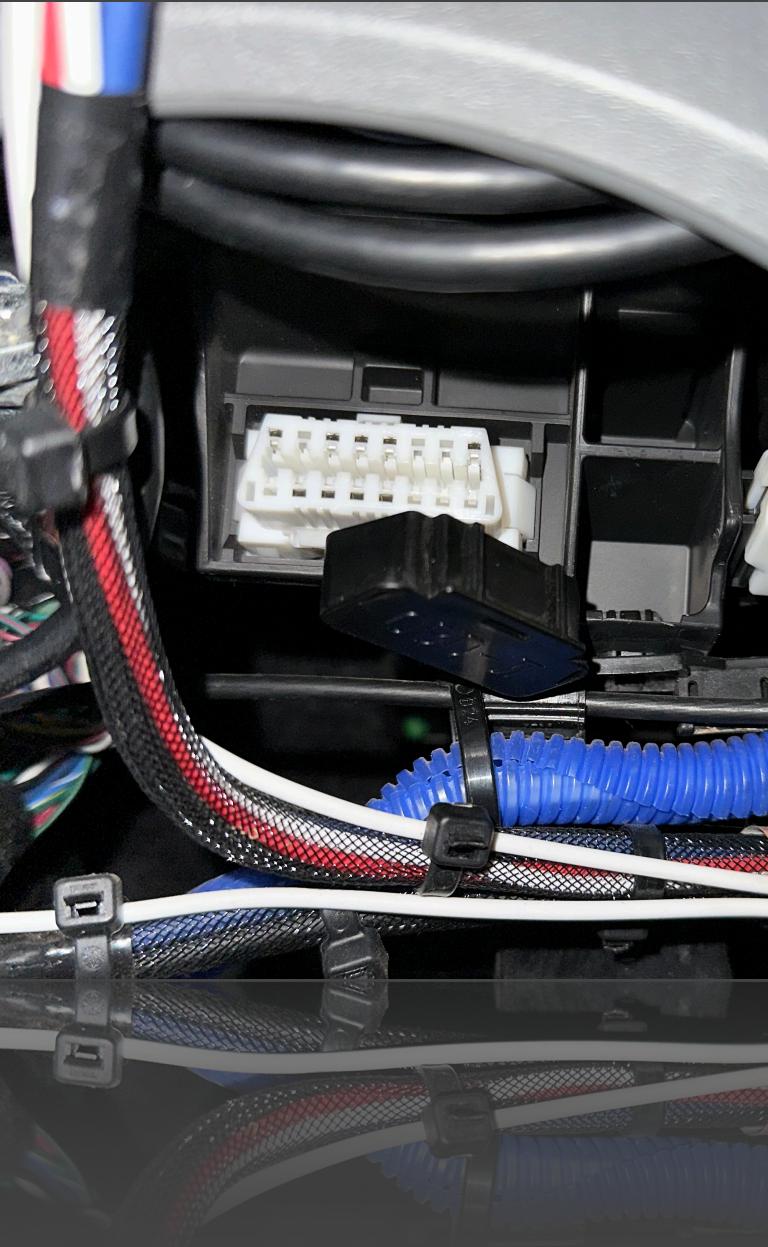
OBD-II Buddy Implementation

- Connect Bluetooth BLE device to OBD-II port



OBD-II Buddy Implementation

- Connect Bluetooth BLE device to OBD-II port



Connect to BLE device in OBD-II Buddy

This is achieved using Apple's Core Bluetooth framework:

- App establishes CentralManager
- CentralManager scans for nearby Bluetooth Peripherals
- CBPeripheralDelegate() determines Services offered by Peripherals
- CBPeripheral() detects Characteristics for a Peripheral's Services
- Once a Characteristic is selected, communication is passed through the Characteristic(s) by the CentralManager

OBD-II Buddy Implementation

- Connect Bluetooth BLE device to OBD-II port
- Connect to BLE device in OBD-II Buddy



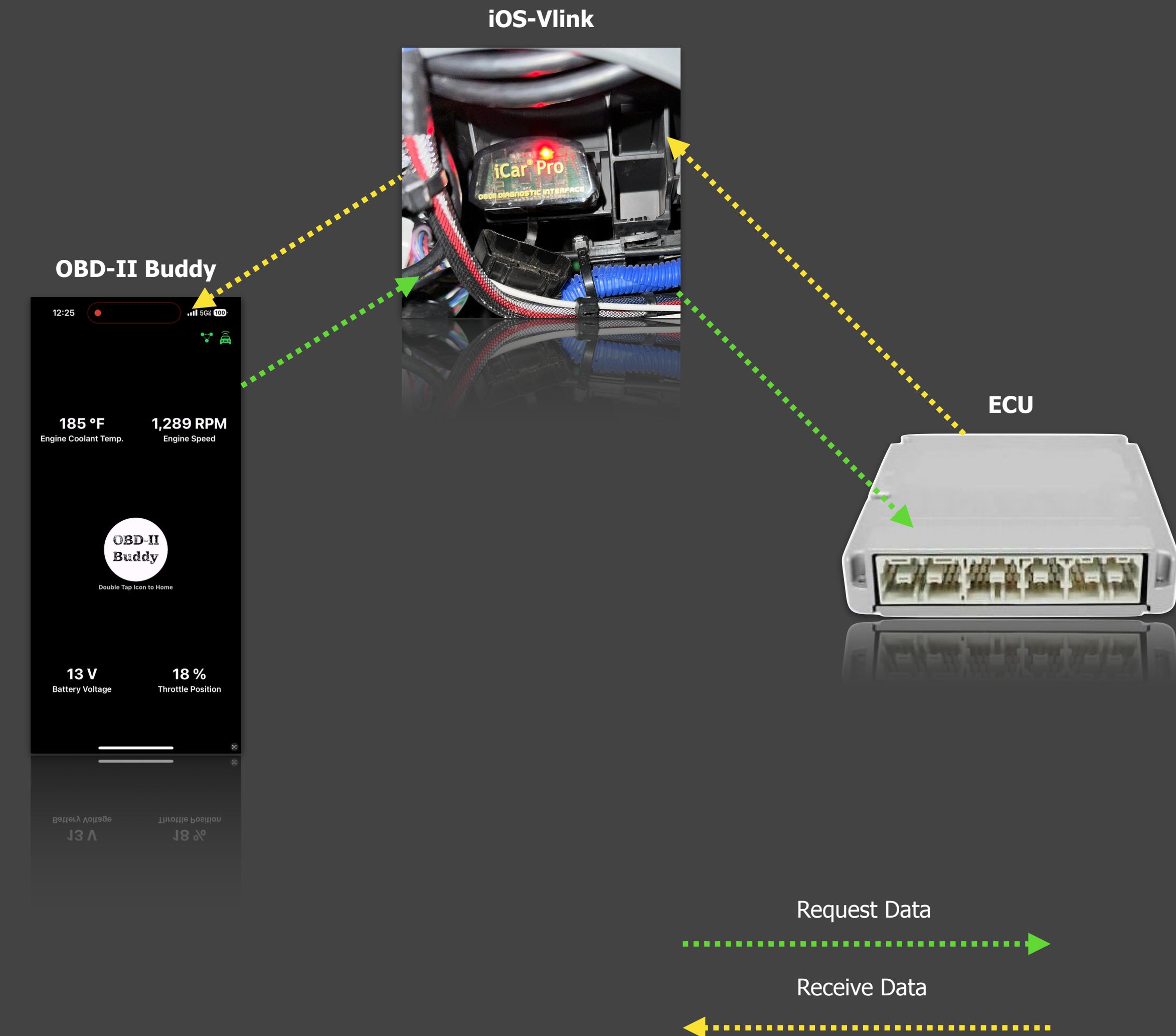
Request and receive data in OBD-II Buddy

This is achieved using the Bluetooth BLE device:

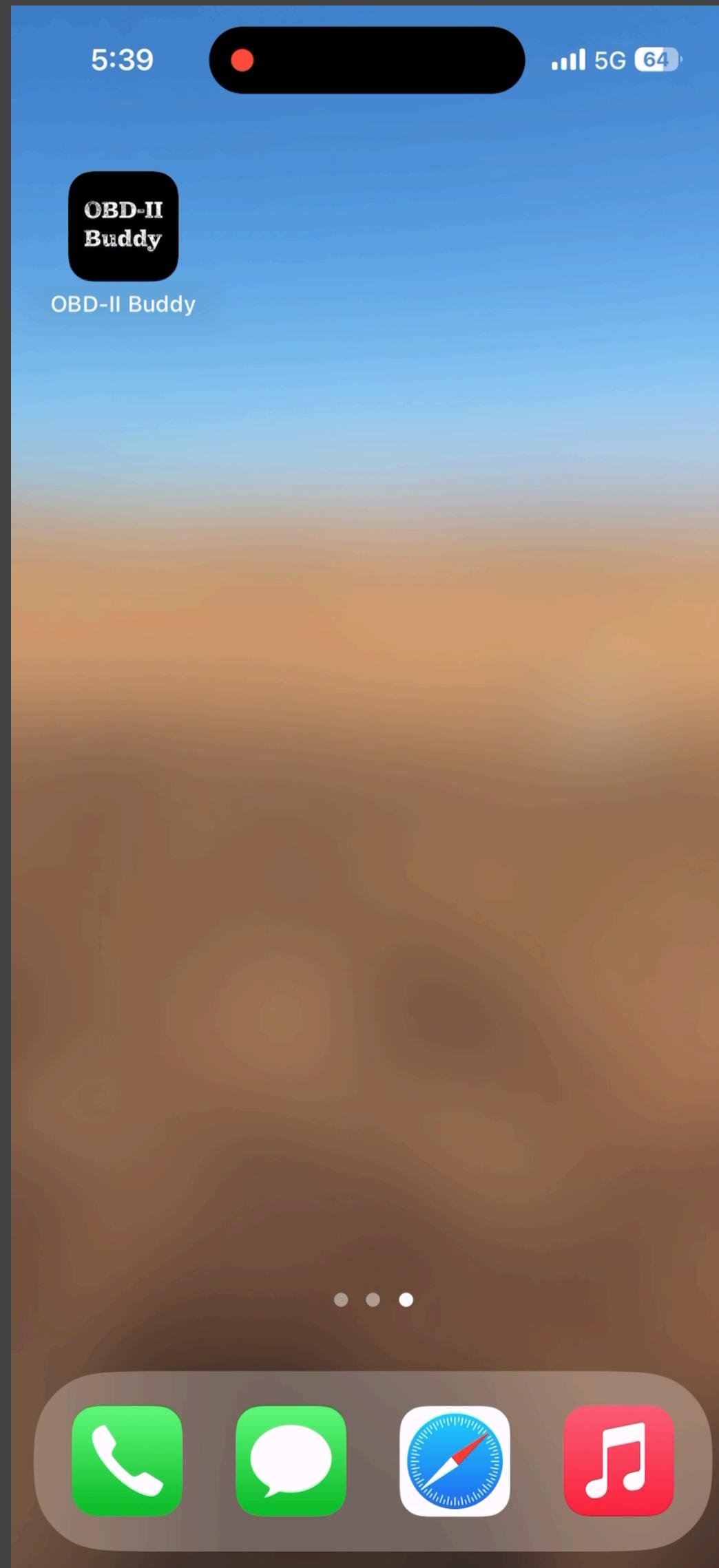
- BLE device receives an encoded hex request from OBD-II Buddy
- Passes data to ECU through OBD-II port into the CAN Bus
- ECU receives request from BLE device
- ECU passes response data back to BLE device
- BLE device passes the ECU encoded hex response back to OBD-II Buddy

OBD-II Buddy Implementation

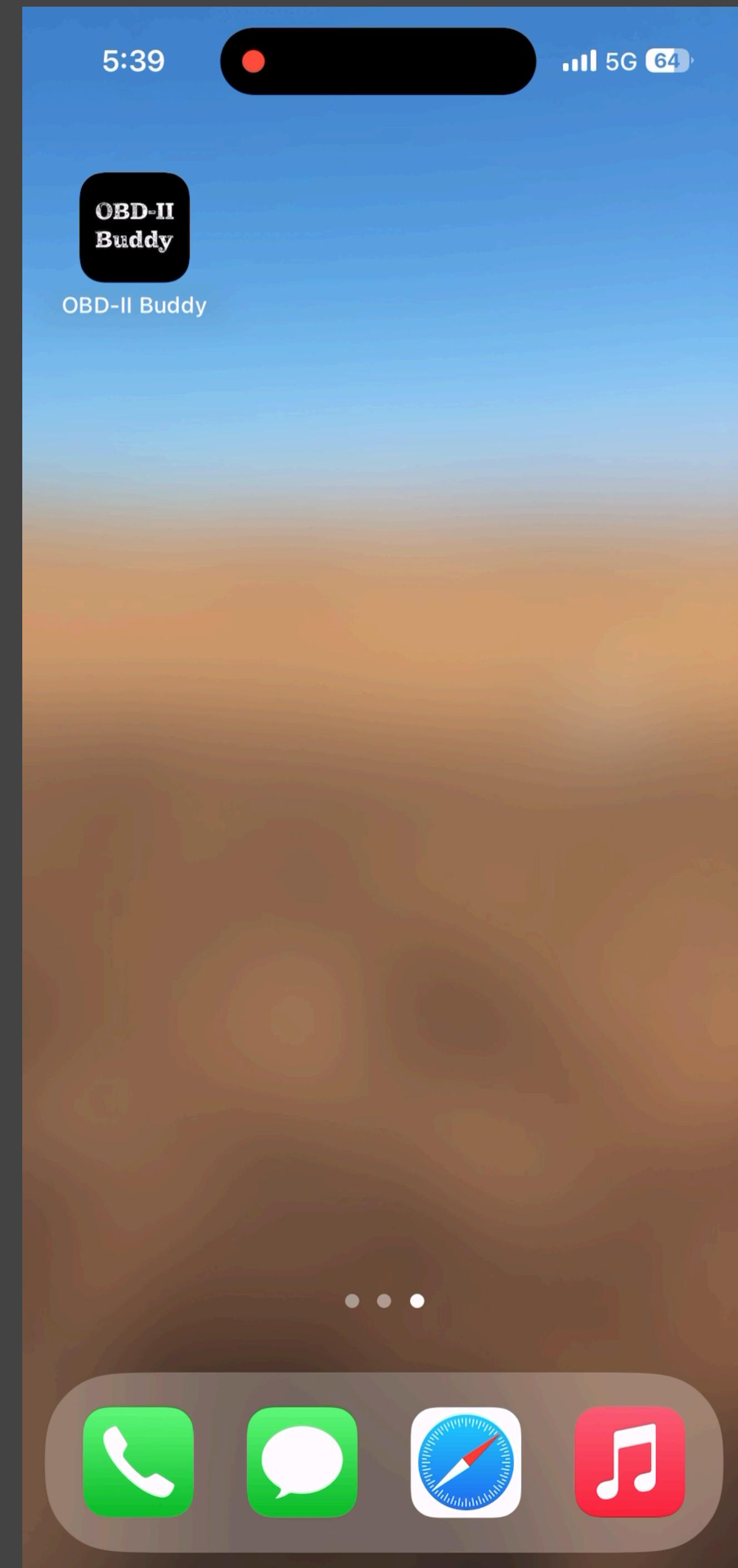
- Connect Bluetooth BLE device to OBD-II port
- Connect to BLE device in OBD-II Buddy
- Request and receive data from the ECU through the vehicle's CAN Bus



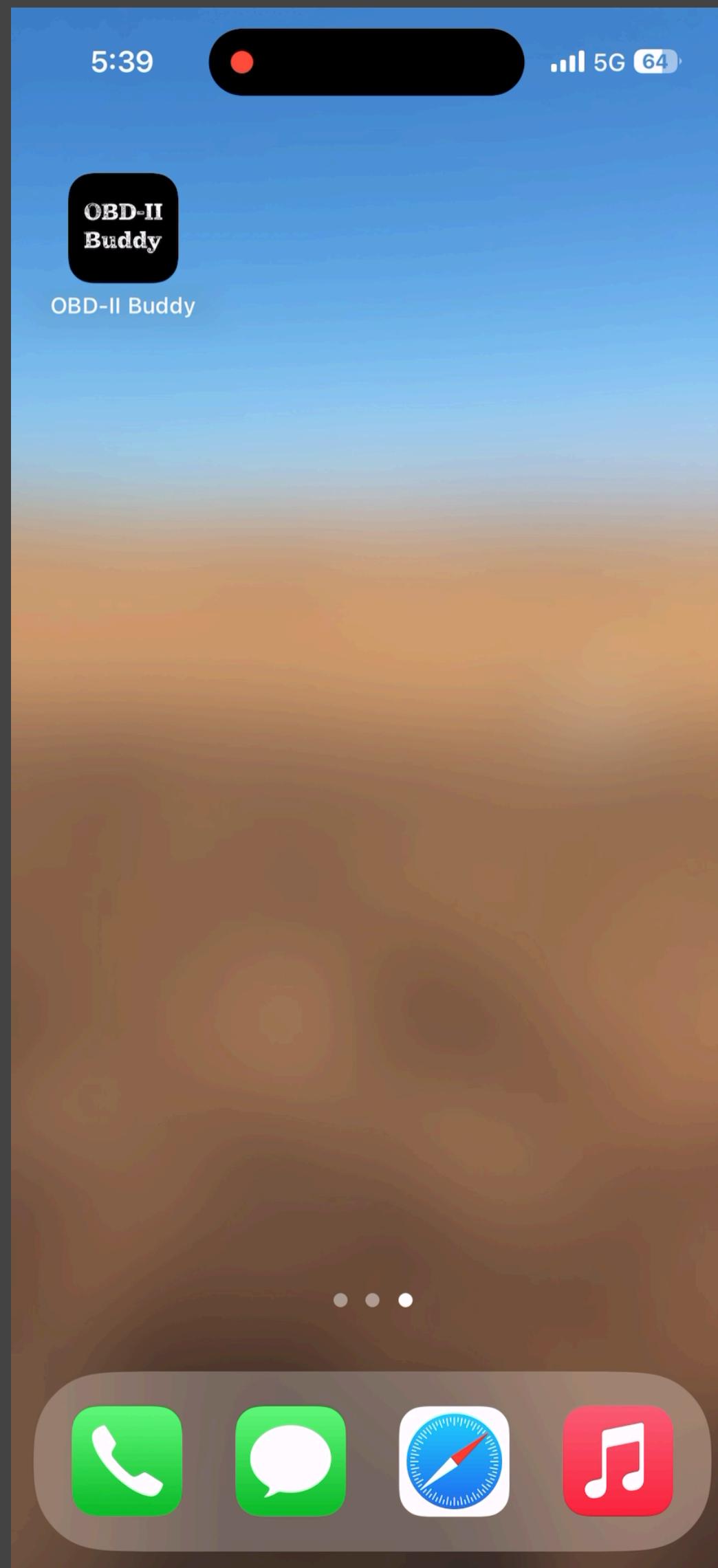
OBD-II Buddy



iPhone (Light Mode)



OBD-II Buddy



iPad (Dark Mode)



Testing

- Conducted systems testing for all functionalities of the application.
- Conducted user testing for all functionalities of the application.
- Vehicle application testing:

Fully Operational	Partially Operational	Non-Operational
2016 Toyota Tacoma	2016 Nissan Rogue	2012 Honda Civic
2014 Toyota Tacoma (x2)	2011 KIA Soul	
2011 Toyota RAV 4		
2011 Toyota 4Runner		

Challenges

- Learning Swift and SwiftUI
- Implementing Core Bluetooth
- Parsing return data

Future Enhancements

- Save user preference data to iCloud
- Add PIDs and manufacturer specific PIDs
- Data parsing support for other manufacturers
- Refactor application to run on macOS
- Publish OBD-II Buddy to the App Store

Questions?

Resources

Slide 3: <https://www.csselectronics.com/pages/obd2-explained-simple-intro>

Slide 4 & 5: <https://www.snapon.com/EN/US/Diagnostics/Products/SOLUS-Legend>

Slide 4 & 5: <https://www.fixd.com/>

Slide 4 & 5: <https://www.mycarly.com/>

Slide 4 & 5: https://techinfo.toyota.com/techInfoPortal/appmanager/t3/ti?_pageLabel=ti_vehicle_reprog&_nfpb=true

Slide 13: <https://www.toyotapartsdeal.com/oem/toyota~computer~engine~control~89661-04690.html>