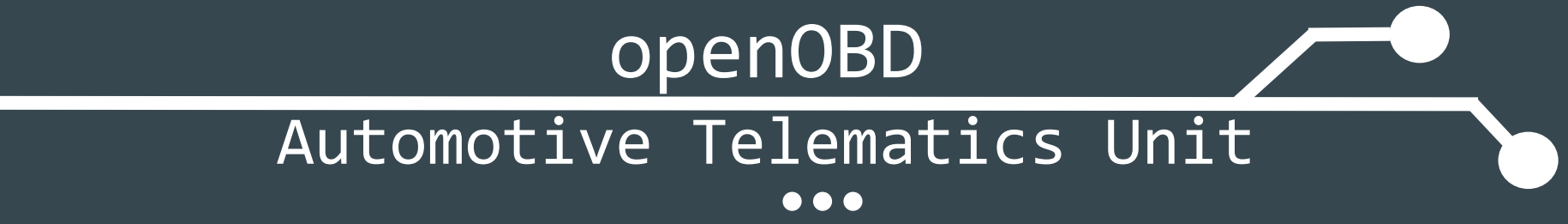
openOBD

Automotive Telematics Unit



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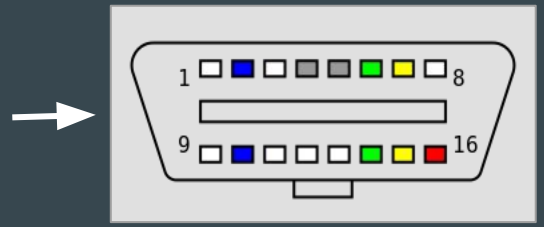
Project Goal

- Vehicle data acquisition through OBD-2 port
- Open source platform
- Easy integration of new hardware & software
- Modular software & hardware design
- More control over functions & features
- More customizable data from devices

What is OBD-2?

OBD-2 is a standard for vehicle self-diagnostic and reporting. (mandatory in U.S. since 1996)



It provides real time data communication in addition to a set of diagnostic trouble codes called PIDs (Parameterized IDs).

0A	1	Fuel pressure (gauge pressure)	0	765	kPa	$3A$
0B	1	Intake manifold absolute pressure	0	255	kPa	A
0C	2	Engine RPM	0	16,383.75	rpm	$\frac{256A+B}{4}$
0D	1	Vehicle speed	0	255	km/h	A
0E	1	Timing advance	-64	63.5	° before TDC	$\frac{A}{2}-64$
0F	1	Intake air temperature	-40	215	°C	$A-40$

What is CAN Bus?

CAN = Controller Area Network

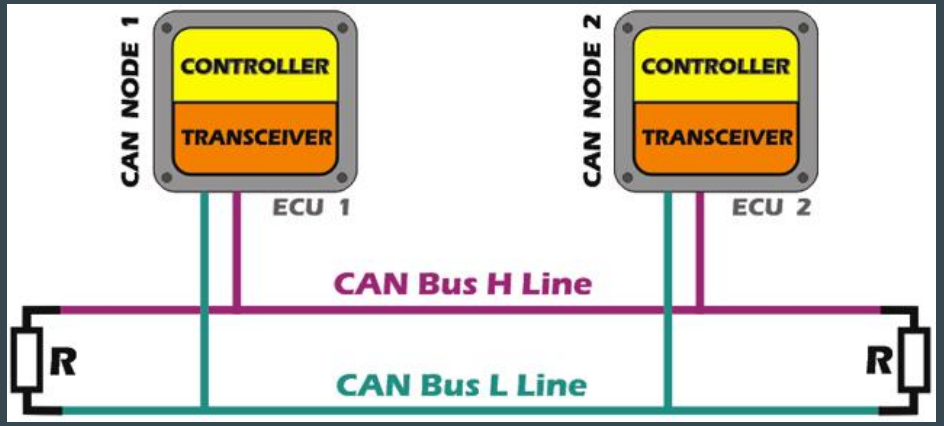
(found in most N. American cars ~2001 onward)

CANbus is composed of nodes connected to a bus.

It is a multi-master serial bus, i.e. there is no single centralized processing unit.

Each Node (or ECU, Electronic Control Unit) consists of:

- A Processing Unit / CPU (e.g. a microcontroller)
- A CAN Controller
- A CAN Transceiver



High-Level Design

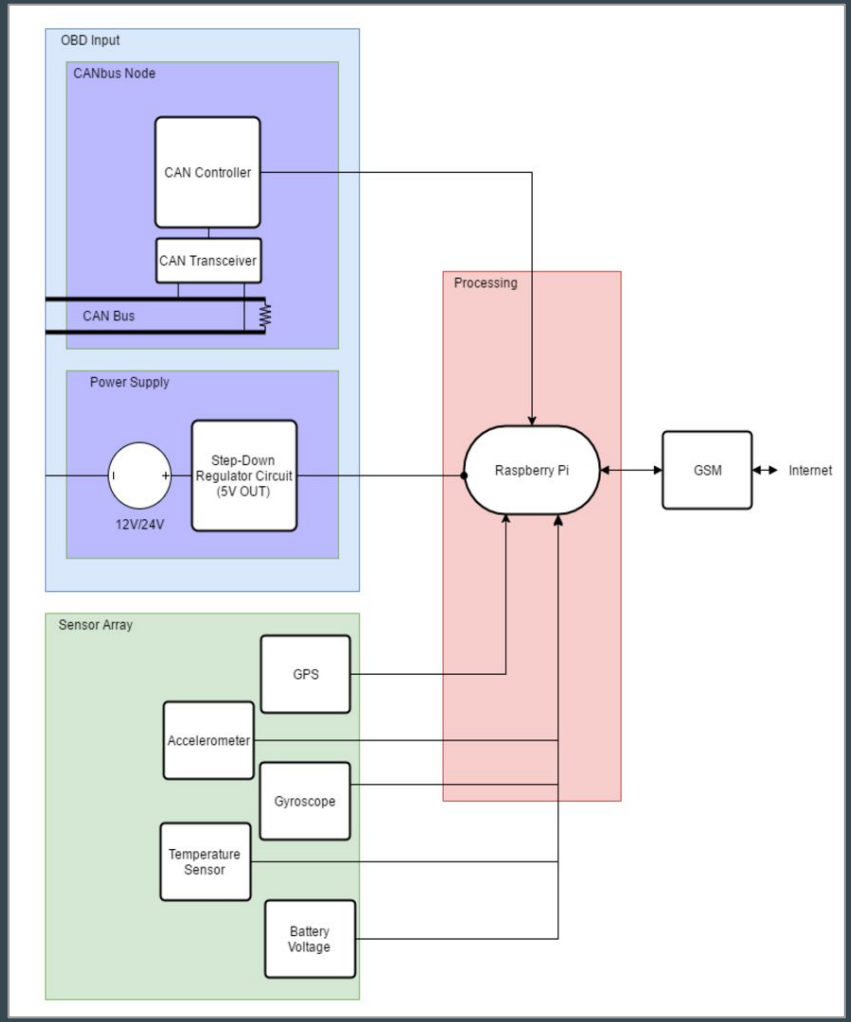
CPU: Raspberry Pi Zero
Communicates with all hardware

Power: Wide input switching buck converter
Provides power from OBD
Ignition on/off detection for low power mode

CAN: Controller implements CAN protocol
Transceiver translates signals to and from bus

Sensors: GPS+GSM module provides
GPS data and network connectivity;
IMU provides accel, gyro, temperature,
ADC for battery voltage

Code: Python Scripts read inputs,
Object/Interface-oriented framework



Hardware Design Choices

Raspberry Pi Zero:	Great online community Plenty of processing power for a small cost GPIO for hardware interface
Power Supply:	Reduces energy consumption. Less heat dissipated High Frequency, small footprint, wide input range
CAN:	Linux drivers + open source libraries available for controller Simple interfacing over SPI, 3.3V compatible
Sensors:	Simple interfacing over I2C (IMU module), Open Source libraries
Network/GPS:	SIM808 module combines 2 features; open documentation & simple implementation; smaller footprint

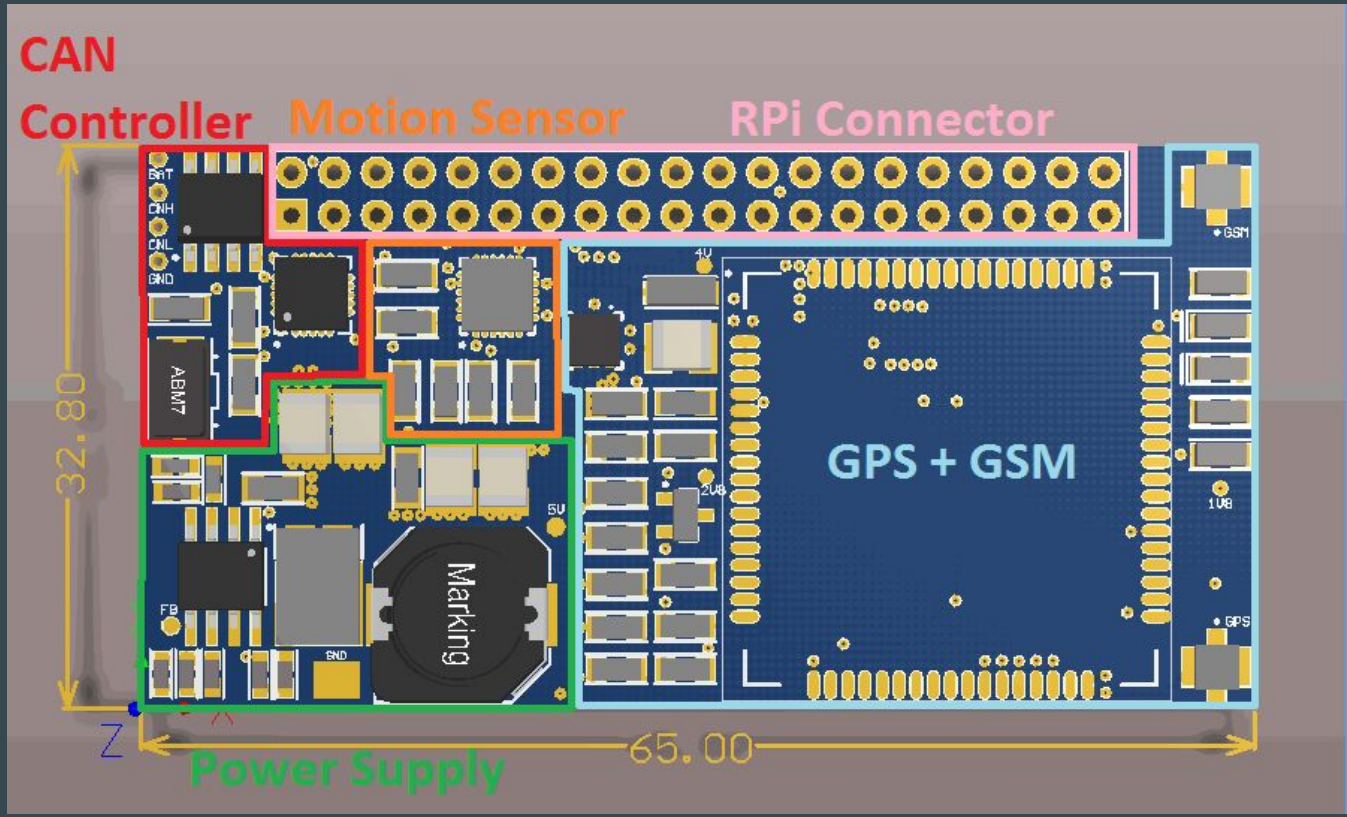
PCB (rev 1.0)

High density compact design.

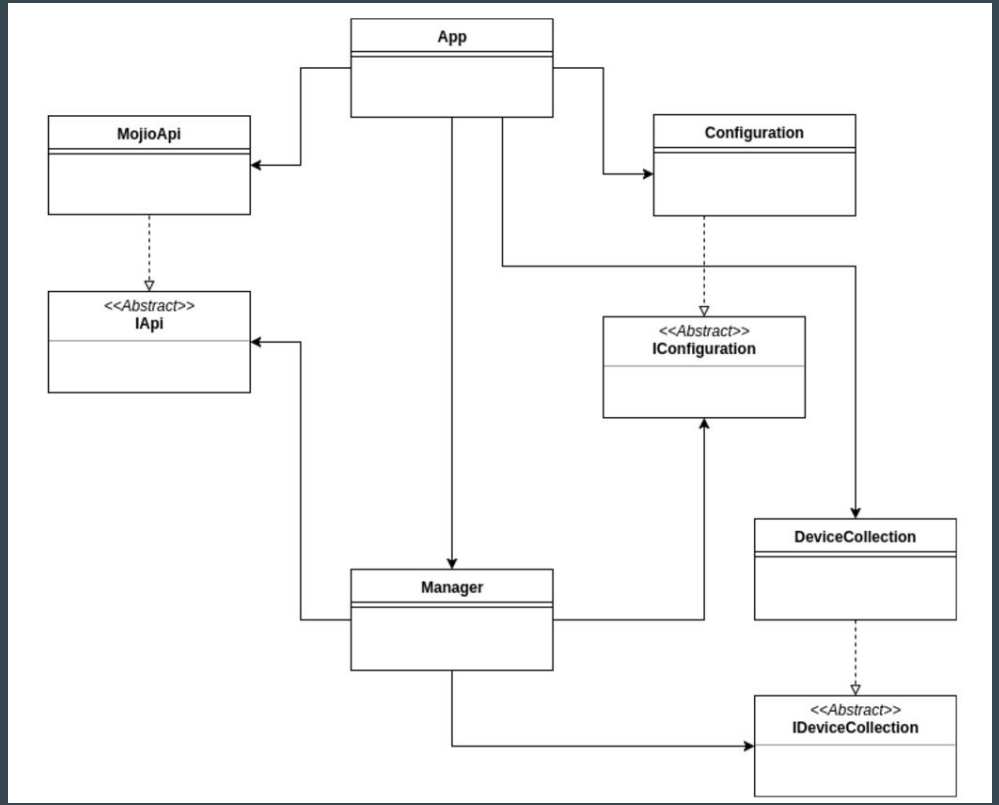
Only 3mm wider than Raspberry pi 0 footprint.

External antenna connections.

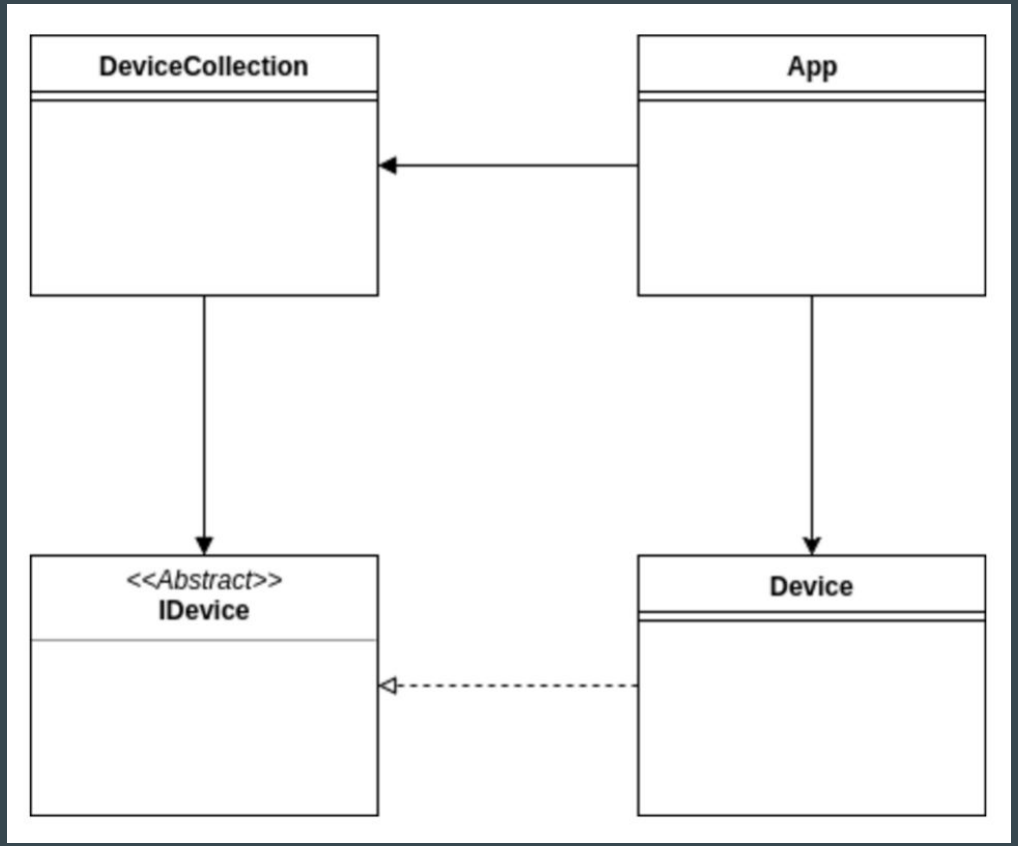
Sim card holder and ignition detection for low power mode



Software Design - Overview



Software Design - Devices



Software Testing - Example using a Mock Class