Data Collection and Description

May 14, 2024

1 Data collection

Three types of data are collected using the logger devices:

1. The OBD-II logger logs the vehicle/engine performance variables and sends them wirelessly to the OBD Fusion app on the tablet.

2. The OBD Fusion app logs the GPS and IMU (accelerometer, gyroscope, magnetometer) data and adds it to the dataset. It also performs some calculations and generates a few new variables based on OBD readings.

3. The PEMS (Portable Emissions Measurement System) measures emissions concentrations every second and sends it via Bluetooth to the laptop (parSync software).

Note that the sensors are set to log variables at 1Hz frequency (one measurement per second).

OBD output: The CSV files generated by the OBD Fusion app include second-by-second recordings. Within the app, we configured a diverse set of vehicle and engine variables for logging. However, it's worth noting that not all vehicles report the complete range of variables. As a result, the column headers (variable names) in the generated files may vary between tests conducted on different vehicles.

PEMS output: The CSV files generated by the PEMS unit include second-by-second recordings as well.

2 Description of the original variables

Table 1 presents the description of the original variables generated by OBD and PEMS units.

Table 1: Description of the original variables.

Variable	Description	Unit	Source
DateTime	Date and time		App
Latitude	GPS latitude	deg	GPS
Longitude	GPS longitude	deg	GPS
Altitude	GPS altitude	m	GPS
GPS Speed	Vehicle speed based on distance calculated using GPS coordinates	km/h	GPS
Engine RPM	Rate of engine revelations in unit of time	RPM	OBD
Vehicle speed	Wheel speed reported by ECU	km/h	OBD
Acceleration	Calculated acceleration based on speed	m/s^2	App
Fuel rate	Fuel consumption rate	l/hr	App
Intake air temperature	Temperature of the air entering cylinders through the intake manifold	C	OBD
Intake manifold absolute pressure	Pressure of intake air which is used by MAP sensor to define proper air and fuel quantities required for ignition in cylinders	kPa	OBD

Table 1 continued from previous page

Mass air flow rate	Mass rate of air entering cylinders through the intake manifold	g/s	OBD
Barometric pressure	Ambient air pressure	kPa	OBD
Fuel/Air commanded equivalence ratio	Also called "Phi" (= 1 / lambda). Equal to current fuel-to-air mixture ratio over stoichiometric fuel-to-air mixture ratio	-	OBD
Ambient air temperature	Temperature of the air entering the cylinders	C	OBD
DateTime	Date and time	-	PEMS
Bag#	Different testing stages (Zeroing, 0, 1, ...)	-	PEMS
CO2	Carbon dioxide (GHG) concentration measurement (V is the analog electrical measurement of NDIR CO2 sensor)	V, Vraw, ppm	PEMS
Temperature	Internal PEMS temperature (V is the analog electrical measurement of thermometer)	Vraw, C	PEMS