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FUELMETRIX

Procedure for integration of Fuelmetrix tools into AVL-system

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Procedure for integration of Fuelmetrix tools into monitoring system

To add the function of fuel consumption monitoring into the monitoring system for transportation vehicles and immovable objects (AVL-system), both or either of Fuelmetrix tools – fuel level sensor LLS and/or fuel data processing server FPS – can be used.
The 3 steps listed below are required to make such integration complete. Any of Fuelmetrix tools can be replaced by a tool of your own.

- Step 1. Connection of LLS to on-board equipment
- Step 2. Integration of FPS into server component of AVL-system
- Step 3. Creation of a client reports system

STEP 1. Connection of fuel level sensor LLS to on-board equipment

To realize fuel monitoring function, in the first place, it is required to arrange for receiving data on the fuel level in the tank of the vehicle or immovable machine. Then fuel information should be transmitted to the server of the monitoring system.

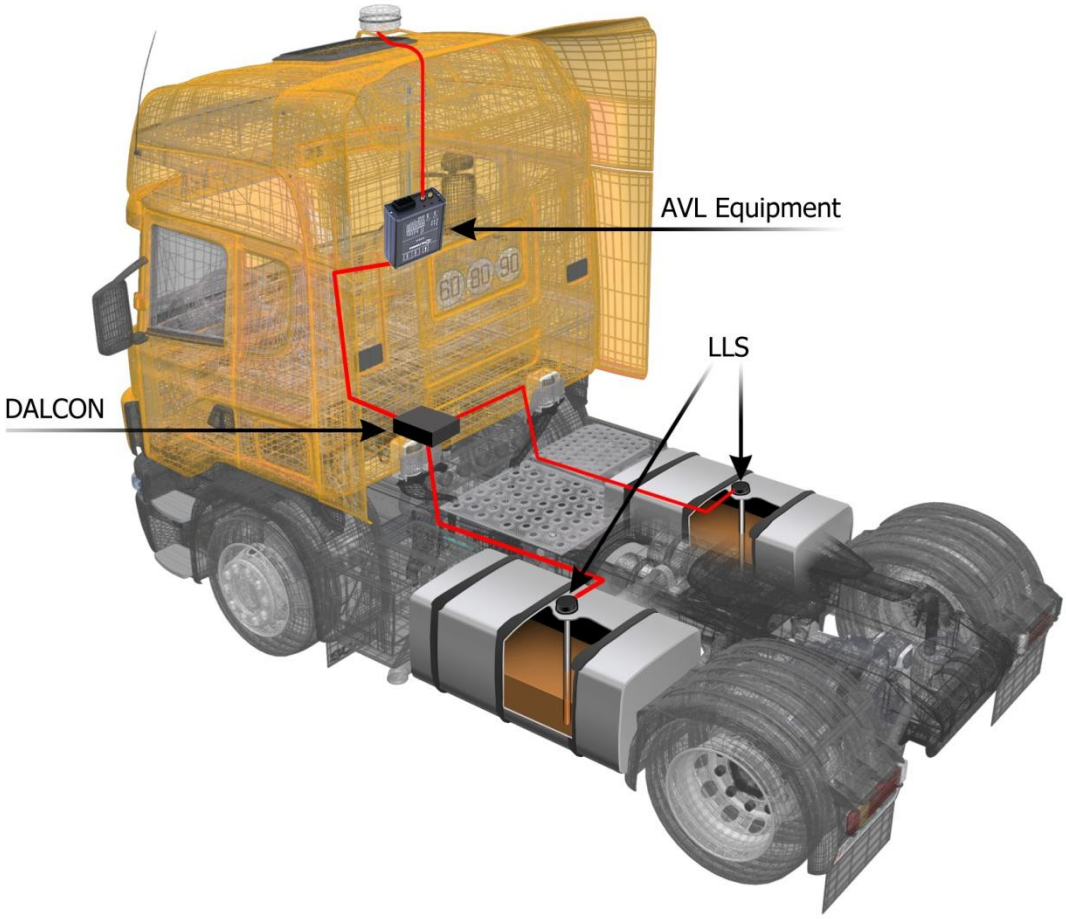
Fuel level data can be obtained with the help of a regular sensor, as well as with the help of various other fuel level sensors. A number of advantages of the fuel level sensor LLS allows to obtain the data in the most effective way.

Advantages of fuel level sensor LLS

- High precision, unreachable for float sensors and CAN bus
- Possibility to adapt the length in the field
- Galvanic isolator to operate from the battery when the frame is cut off
- Completely digital path to provide protection against noise and measurement errors
- Built-in compensation of temperature-related fuel volume changes
- Possibility to connect several sensors to increase precision in extreme conditions
- Protection against on-board overvoltage
- Connection through digital (RS 232/485) and analog interfaces (via Dalcon)

Generally, an on-board AVL-module has a free analog input or an unused port RS 232 or RS 485. One of these inputs should be used to receive information from fuel level sensor LLS and transmit it to the server.

For a vehicle with several fuel tanks or with large volume tanks, it is necessary to use several fuel level sensors. Information from several sensors is consolidated by a fuel level sensors concentrator - Dalcon.



DALCON advantages

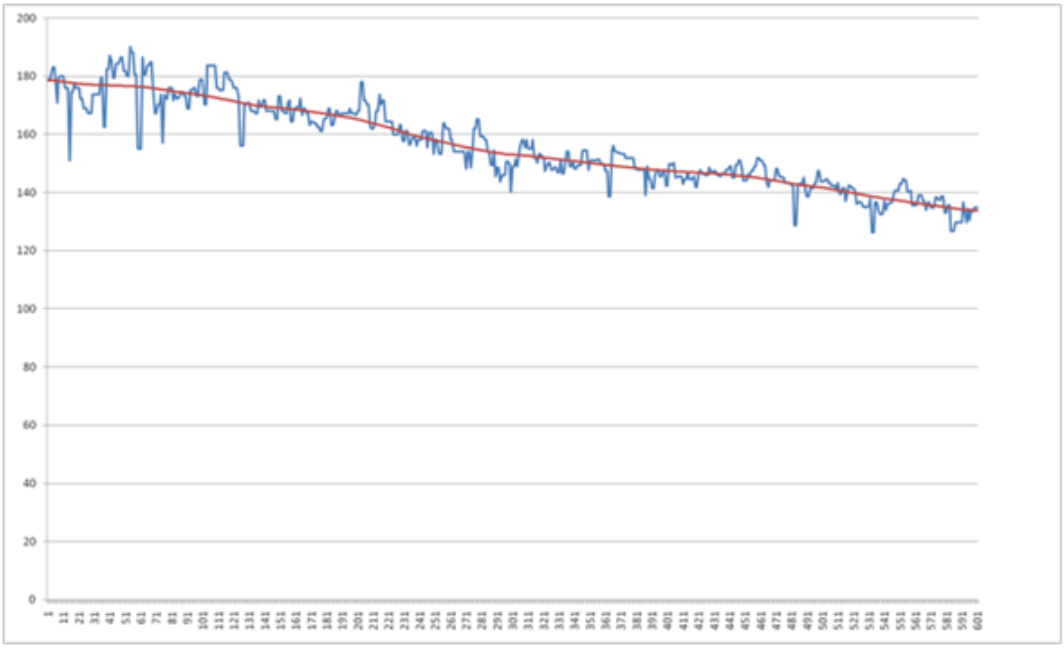
- Possibility to consolidate information from several LLS-sensors
- Identical protocols of Dalcon and LLS
- Built-in system of fuel level recalculation into the percentage of the total tank volume
- Protection system against the tank inclination
- Conversion of digital information about fuel volume into an analog signal

A sensor can be connected to on-board AVL-system equipment using digital protocols RS 232 and RS 485 or an analog signal with voltage from 0 to 5V via Dalcon. To eliminate noise and errors, it is recommended to use digital connection. In this case it is possible to receive information by 2 ways: sending a query to the LLS-sensor and reading the response or presetting the sensor so that it would periodically provide information and then transmit data from the sensor to the server as they come in.

Having accomplished all Step 1 activities, we obtained the possibility to read data on the fuel level in the tank of a vehicle or an immovable machine and send them to AVL-system server.

STEP 2. Integration of FPS into server component of AVL-system

Any monitoring system includes a parser installed at its input. The parser extracts information from incoming packet and includes it into the database. As a result of accomplishing Step 1 or other actions, information coming from on-board equipment via AVL-module now contains a new type of data – fuel level data. Therefore, it is necessary to modify the parser and "teach" it to extract fuel data.
"Raw" data received from fuel level sensors contain a high level of noise and resemble a cardiogram.
FIG. 2.

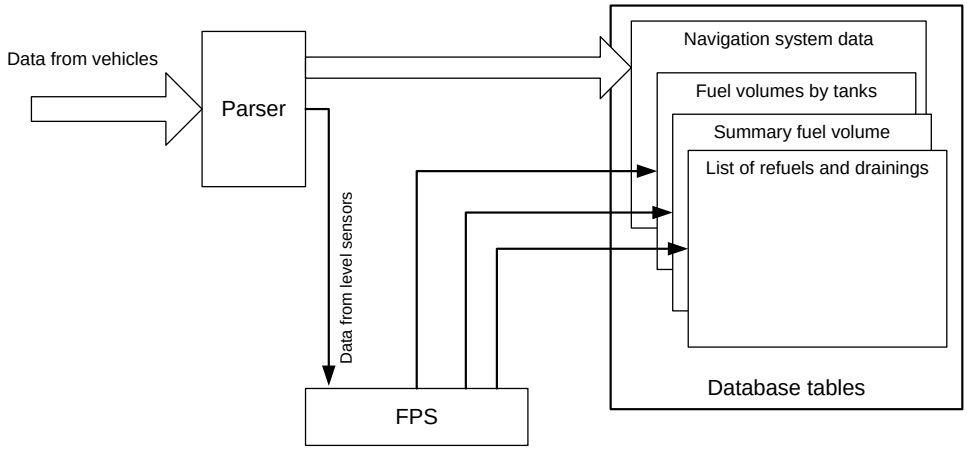


It is required to filter the received data to exclude random spikes, smooth them, detect refuels and drains, determine their values and then save all the results in database tables.
To perform the first group of tasks (from filtration to determination of refuel/drain volumes), it is necessary to develop and use special data processing algorithms. Fuelmetrix has a ready-to-use tool which serves this purpose – fuel data processing server FPS.
To save the results of fuel data processing on AVL-system server, it is required to add fields into the database. Additional fields are needed to store new information – filtered and smoothed fuel level, parameters of detected refuels and drains (start/end time and date, volume).

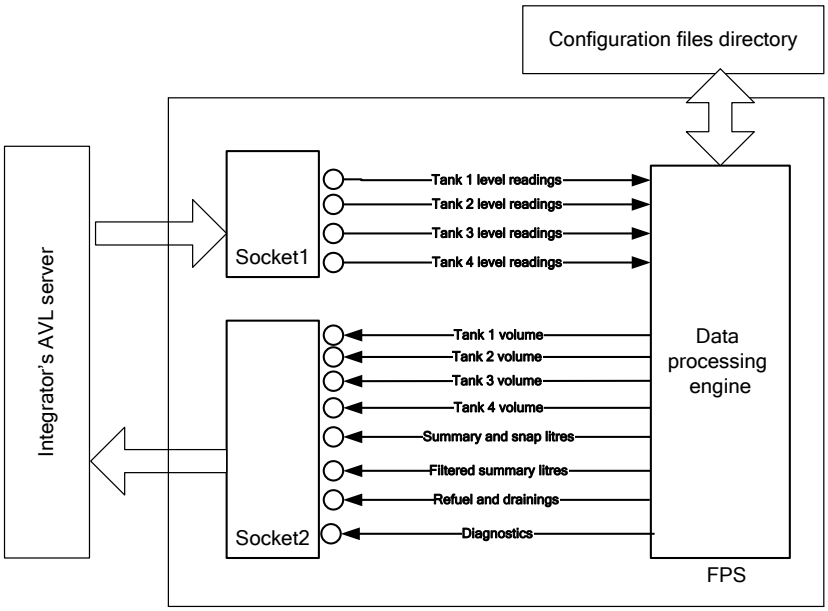
FPS advantages

- Operates with any operating system
- Operates with any client type ("thick" and "thin")
- Processes data from any fuel level sensor
- Does not require administration or maintenance in the process of operation
- Contains Algorithm for fuel data smoothing and refuel/drain detection - Fuelmetrix
- Supports up to 4 sensors per vehicle and 10 configurations of tanks and sensors
- High performance – up to 12 thousand sensors on one FPS

The method of FPS connection to AVL-system server is shown in Fig. 2.



AVL-system server connects to FPS via 2 sockets. One of them is used by AVL-server to send data, the other – to receive. A list of sent and received data is given in Figure 4. Data processing engine supports up to 4 sensors per vehicle. At the same time, 10 configuration versions for tanks and sensors are possible on one vehicle, ranging from 4 sensors in 4 different tanks up to 4 sensors in one tank, for example, on a marine vehicle in order to precisely determine the fuel level of a rolling object. FPS server settings are performed by placing files with vehicle and tank parameters in a dedicated directory.



Step 2 is completed. AVL-system receives “raw” fuel level data, processes them and saves ready-to-be-analyzed information in the database.

STEP 3. Creation of a client reports system

Based on fuel information processed by FPS server, there are added reports related to fuel and refuels. For example, reports on the actual fuel volume in the tanks of a moving or immovable object, fuel consumption per kilometer or motor-hour, haulage or power generation per one liter of fuel. Precise data on the time and volumes of refuel/drains help analyze fuel metering information and map the events. Once fuel consumption reports have been added to client's monitoring system software, Step 3 ends. The process of integration of Fuelmetrix tools into AVL-system is successfully completed.