Albatros

Continental Tire Pressure

Inhoudsopgave

1. Document data

1.1 Versions

Date	Versie	Opmerkingen
13-4-2022	0.1	Eerste Versie

1.2 References

Date	Versie	Remarks
api_public_documentation_final.pdf	1.0	ContiConnect Live via Api Description on how to upload tire pressure data to the conticonnect website.
CPC-3rd-Party-Connection_v0160.pdf	1.6	Description of the content of the sensor data. (Jörg Hanna)

1.3 Distribution list

Date	Versie	Remarks
	0.1	First version

1.4 Abbreviations

Datum	
CAN	Controller area network. (inside the vehicle)
CCU	Central Control Unit
CPC	Continental Pressure Check ™
TTM	Truck Tire Module
PGN	Parameter Group Number

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Project   Albatros
Subject   **ContinentalTirePressure**
Date   20-4-2022

2. Background

A number of vehicle has been equipped with tire pressure sensors by Continental.
Especially the electrical vehicles in Limburg Zuid.
These sensors are connected to a central device within the vehicle and this device is
connected to the Pilotfish Vehiclegateway. (via the vehicle's CAN bus)
The sensors communicate information like pressure and temperature, but also
'alarms', for instance when the pressure is dropping quickly or the pressure is below
a threshold.
The Vehiclegateway stores the collected data in an Azure Blob Storage.
Continental provides a website where the condition of all vehicles and tires is
monitored and managed.
This document is the description of the software to collect the data from the Azure
Blob Storage and deliver it to the Continental website.

3. Processing the data

3.1 Collecting the data

Every second this data is collected by the pilotfish, and written to a Azure Blob Storage about every 10 minutes in the form of a blobitem containing up to about 600 payloaditems.

Each payloaditem contains many messages containing information (PGN's) about one or more tires of the vehicle, each vehicle at most one time. Not every tire is represented in every payload.

Every payload contains all CAN data collected, during about one second. Beside the tiresensors information, more CAN data is found in the payload such as engine's rpm, fuel level, acceleration, breaking etc. For the rest of this document this data is ignored. But it may be used in the Datawarehouse.

3.2 Processing step 1, divide and conquer

Every blobitem is stored on the exact same location in the Azure Blob. This causes a performance issue when processing the data, since if nothing is done millions, if not billions of blobitems will be there without a clever selection criterium.

Therefore the first step in processing the blobitems is moving them to a subdirectory structure containing year/month/day/vehiclenumber. This step is performed by the BlobDistributerService.

This process is moving a blobitem like

```
arriva-nl/cloud-fms/9601_cloudfms1-2_20220412121845_2232834_1649766530215.json
```

to

```
arriva-nl/cloud-fms/2022/04/12/9601_cloudfms1-2_20220412121845_2232834_1649766530215.json
```

3.3 Processing step 2, update continental website

Completely independent of step 1, the content of the blobitems is processed.
The data is read and send to the continental backoffice website using an API.
For every blobitem, every payload is read, data is send to continental:

1. At least once every 10 minutes;
2. When any alarm value changes compared to the latest send data;
3. When the tire pressure changes by 10% or more compared to the latest send data;
4. When the temperature changes by 10% or more compared to the latest send data.

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4. Technical details

4.1 SAE J1939

The low level data structure confirms to the SAE J1939, the open standard for the Society of Automotive Engineers for Controller Area Network (CAN) bus data.

SAE J1930 describes messages put on the CAN, where every message is identified by a Parameter Group Number (PGN).
PGN's are identified by a 4 digit hexadecimal code or a decimal number. The important PGN's used by Continental are described in the document "CPC-3rd-Party-Connection_v0160.pdf" called PGN doc below.

The vehicles Central Control Unit (CCU) can be configured to put a selection of the PGN's on the CAN

[TBD : is this right? How to we to this?]

We need to combine the information in different PGN's to find out the vehiclenumber, SensorId, and the location of the sensor within the vehicle.
When a blobitem is analysed, and thus all payloads are analysed, we find that not all payload's contain all PGN's and if a payload contains certain PGN's they may or may not be present for all tires.

These are the used PGN's

PGN	Doc	Description	Identifiers / relational fields	Content
0xFF04	paragraph 4.9	CPC Graphical Position Main source for knowing what sensor has what id and is located where, and for relating the 3 PGN's below to each other	TireId TireLocation TTM-ID = SensorID	Graphical Position
0xFF02	Paragraph 4.8	TTM Data. Summary Alarms a little different from the 0xFEF4	TireId	TirePressure, temperature and alarm data.
0xFEF4	Paragraph 4.3	Tire Condition	TireLocation	Pressure Temperature and alarms.
0xFC42	Paragraph 4.4	Tire Condition 2	TireLocation	Pressure and Required pressure

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5. Data send to Continental

After being authorized (see doc "Conti Connect live via API")
the continental web api is able to receive the following data:

Master Data
Vehicle Activity Data
Sensor Activity Data

The M**aster Data** contains information per vehicle and the sensors belonging to that vehicle. Arriva sends new master data only when a change is found i.e. when a sensor is seen on another vehicle, or on another location at the same vehicle.

The **Vehicle Activity Data** contains the gps location of the vehicle (not used currently by Arriva)

The **Sensor Activity Data** contains the pressure, temperature etc per sensor.
See paragraph 3.3 for when new sensor activity data is send.

Vehicles cannot be created via the api but must be created on the continental website manually.

If data is send, via the api, about an unknown vehicle or an unknown sensor.
An error messages is returned.

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5.1 Possible error messages

This is a collection of error that can be received from the continental web api

URL: https://qa.c2tires.conti.de/sensorad/sensors/1855853017
content: {"errorCode":404,"errorMessage":"The sensor doesn't belong to the provider"}

URL: https://qa.c2tires.conti.de/vehiclead/gps/1111
content: 404 page not found

URL: https://qa.c2tires.conti.de/vehiclemd/vehicles/9601
content: {"errorCode":409,"errorMessage":"The sensorId: 1855848924 belongs to another fleet"}

URL: https://qa.c2tires.conti.de/vehiclead/gps/9608
content: {"errorCode":404,"errorMessage":"Vehicle not found in the system or doesn't belong to the provider"}

URL: https://qa.c2tires.conti.de/sensorad/sensors/1855953867
content: {"errorCode":404,"errorMessage":"The sensorID is not assigned to a vehicle"}

URL: https://qa.c2tires.conti.de/vehiclemd/vehicles/9611
content: {"errorCode":404,"errorMessage":"Vehicle for provided external vehicle ID doesn't exist."}