



# *The car as a sensor: Vetuda*



Vetuda Whitepaper

Beijer Automotive BV

© 2017

## ***Content***

Introduction	3
The source of Vetuda: sensors	3
Examples	4
Who benefits from Vetuda?	5
How do the data from that many cars get on the Vetuda platform?	6
“What’s in it for me?”	6
What is required for the unlocking of data?	6
How does the Vetuda-platform function?	7
How is the privacy of the vehicle data guaranteed?	8
In the end	8

## ***Introduction***

“The car as a sensor”. We encounter this term more and more in the media. Understandable, because there is a treasure trove of information ready to be taken. A treasure trove of information in the form of millions of cars on our roads that can tell a lot with their vehicle sensor data, about for instance actual weather conditions, road conditions, traffic situations and security- and environment aspects. This way, the combination of vehicle sensor data with other data sources can lead to serious savings in the costs of infrastructural traffic facilities. Worldwide there are experiments with the use of vehicle sensor data or Probe Vehicle Data as it’s often called, but in the Netherlands, we have already passed that phase and it’s already operational: we have Vetuda. How Vetuda works and what we can do with it, we would like to clarify for you. In this document, we try to do that by a couple of easy examples and evocative applications.

## ***The source of Vetuda: sensors***

The modern car is full of sensors. All of these sensors measure a value and send that out via the Controller Area Network (the so-called CAN-bus) of the car. Values that the car needs itself. There is for example a sensor in the car that measures the outside temperature. This value is shown on the info-display of the car to inform the driver about the outside temperature. Also, the switch to serve the fog lights is a sensor. The Body Computer of the car namely, wants to know when the switch is served, so it can activate the fog lights if that is required. These are only two of the sometimes hundreds of sensors that can be present in a modern car. The car needs all this information from the sensors, but... can we maybe do more with this information? Yes, we can! A lot of vehicle sensor data from a car can be well used with other applications. Some of these are obvious, but there are others that you would not be able to think of quickly. Perhaps, there are applications that we haven’t thought of yet as well.

## Examples

For which application can vehicle sensor data be interesting? To get a proper image of that, we give a few examples of sensors below, the value they represent and the application areas they could be / are deployed.

**Sensor in the car: *temperature sensor***

**Value: *outside temperature***

**Application areas: *weather forecast, ice control measures***

Imagine that you can read out the value of the outside temperature sensor from all the cars on the road, actual and continuous, and that the GPS coordinates with every measurement value are known as well. If you project that combination on a map, a very detailed image of the actual temperature in a certain area or carriageway appears, accurate to a few meters. Imagine the average temperature to be around the freezing point, this enables you to see on which parts of the road the temperature is beneath zero (for example next to a forest or below a viaduct), and where the temperature is above zero (for example next to an open field). This is exceptionally interesting information for road authorities and climatologists.

**Sensor in the car: *wiper switch***

**Value: *activity windscreen wiper (interval, slow, fast)***

**Application areas: *weather forecast, ice control measures***

What if you know when the windscreen wipers from all cars on the road are active, actual and continuous. Then you know exactly where it's raining and also when it stops raining. But not only that: The switch has multiple positions (interval, slow, fast), so also the extent that it's raining is known. Accordingly, you can accurately picture rainfall and use that input for traffic information and meteorological services.

**Sensor in the car: *steering wheel***

**Value: *turning angle***

**Application areas: *alertness drivers, ice control measures***

Imagine that you could monitor, on every road, where there are one or more cars that make sudden steering movements. If this concerns only one car, there could be a reduced alertness of the driver, through for example health problems or distraction such as the use of a smartphone. If it concerns more cars, there could be an obstacle on the road that drivers try to escape. Traffic information services can send an alert via the radio or on the matrix displays above the roads if necessary, and potentially necessary assistance services can be deployed.

**Sensor in the car: wheel sensors**

**Value: rotation speed**

**Application areas: road conditions**

If you can detect unexpected speed changes from one or more wheels from all cars on the road, you can possibly say something about the condition of the road surface. A pothole in the road could be traced this way. Road authorities can react rapidly with this information and remove a potential obstacle or plan a road surface repair and guide targeted maintenance on the road network.

These are merely a few examples, because what to think of vehicle sensor data such as the mileage, the use of seatbelts, seat contacts (number of passengers), direction indicators, vehicle speed, nominal speed, fuel consumption, etcetera. An enormous amount of data that, if processed the right way, could be of a priceless value.

### **Who benefits from Vetuda?**

- Among others **road authorities**, both on national level as provinces and municipalities, are enthusiastic about Vetuda, because they receive a lot of actual information about traffic flows and the driving behavior of the road users. It could result in significant savings in expenses on infrastructural traffic facilities. A lot of brake actions on a specific road part could for example be a reason for an observation at location, that could lead to people striking safety enhancing measures. But man would also want to know for example where there are agricultural vehicles on the road: in general, slow driving traffic that might leave dirt on the road, mainly during harvest time. This information road authorities can feedback to the **road users** that can profit from all of this as well.
- Both national as regional operating **road builders** benefit from Vetuda as an alternative for expensive facilities to monitor road conditions.
- Actual alerts about fog, temperature, rainfall and environment factors on a local level are valuable for **de-icing operators**. They can directly feedback this information to the spreaders and to the **road users** via the traffic information and the matrix displays above the road.
- **Meteorological institutes** can, thanks to the growth of the amount of measuring points (cars) that they have at their disposal, refine their calculations and predictions even more. That does not only lead to a higher coverage and so a more accurate measurement value, but it also significantly saves in the purchase of expensive measuring stations.
- You might not think of it immediately, but the **agricultural sector** has a lot of interest in Probe Vehicle Data from cars as well. There, they are mainly interested in all climatic related parameters such as windscreen- and fog light activity. The more accurate the weather predictions are, the better they can apply precision agriculture and enlarge their yield.

## ***How do the data from that many cars get on the Vetuda platform?***

The engineers from Beijer Automotive, the makers of Vetuda, have performed measurements on practically every European car model for the last 20 years. Car manufacturers each handle their own CAN-protocols and even per type, model and engine variation there are differences. But Beijer has researched all these cars already and translated all those different 'CAN-languages' to one legible format. The Probe Vehicle Data from all those car models are retrievable in the Vetuda-database. A treasure trove of information your application might benefit from as well. The engineers haven't only measured and analyzed cars, but motorcycles and agricultural vehicles as well.

After a vehicle has been measured, there is a complex analysis- and translation process where a blueprint is recorded for every model. From that moment, all vehicles from the same model are 'Vetuda-compatible'.

### ***"What's in it for me?"***

But how do all these data from all these cars get on the Vetuda platform, whilst we have only measured one car from every model? Well, many cars on the road network have already been provided with a connected after-market system in a way. That could be a telematics system, accident-analysis equipment or for example a taximeter. By making agreements about the supply of these data from after-market systems with telematics manufacturers, government agencies and taxi companies, in short system suppliers, right now, a win-win situation appears. Part of the yields from Vetuda, such as for instance generated alerts and traffic information, namely goes to the system suppliers, and finally also to the driver since they can use beneficial services. Meanwhile, good cooperation's with several system suppliers arose and we are more than willing to talk to other parties.

### ***What is required for the unlocking of data?***

In practice, it simply comes down to adding some 'Beijer-technology' to the after-market system. So, there is no additional equipment necessary, since already existing systems are being used such as black boxes, Track&Trace, taximeters, etc. that are being expanded with extra interpretation knowledge to read additional data from the CAN-network of the vehicle. With the focus on the admissible- and safe reading, because here nothing's written on the network, which is necessary with OBD-like applications to retrieve data from the vehicle. The used method has been tested for dozens of years and is in line with the European guideline Electromagnetic Compatibility (EMC).

The number of vehicles that contribute to the Vetuda-platform is growing, with as a result a higher coverage and so a more accurate measuring value. And that's how the car becomes a sensor.



## ***How is the privacy of the vehicle data guaranteed?***

To collect and manage all data in a reliable and safe way, Beijer has launched the Vetuda-database and web server environment on the Microsoft Azure platform. As “market leader in the field of ‘customer advocacy’ and privacy protection”, and “cloud provider with the most certifications” the choice of Microsoft as manager was obvious. Before the vehicle data is being send to Vetuda, vehicle- and personal information are deleted. The question if and “how the privacy of the vehicle sensor data is guaranteed” is simply not relevant. Vehicle- and personal data are namely not used in Vetuda applications. That is also why we say ‘vehicle sensor data’ and nothing more than that. So solely information from the sensors that tell something about the use of for instance wipers, fog lights, steering direction, etc. Vetuda only uses measuring data without an ID, license plate or name and only with the client being aware. This assures that it is impossible to retrace from the Vetuda data, which vehicle the data was coming from or who the driver or co-drivers were. Solely a signal id, signal name, time, location and value/status of a specific signal are being saved as shown in the example below.

<i>SignalId</i>	<i>SignalName</i>	<i>Time</i>	<i>Location</i>	<i>Value</i>
191	Speed	28-08-2016 11:23	52.366667, 4.90000	34,6
141	Odometer	03-09-2016 23:55	51.604351, 5.440481	18247
191	Speed	31-12-2016 13:35	46.636837, 8.5779829	80,5
13	Ambient Air Temperature	18-01-2017 11:23	48.861944, 2.360833	-2

## ***In the end***

Are you interested in Vetuda after reading this information, or do you have any questions? Don't hesitate to contact us. Maybe you deliver systems that could be a source for this (anonymous) data as well, or you've been inspired for a new Vetuda-application. Also in that case, we are more than willing to exchange thoughts with you.