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SEPTEMBER 2024

Find out how COMPREDICT's
Virtual Sensor Technology is

Transforming Durability Testing



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technology and comprehensive
vehicle data insights.

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VIRTUAL SENSORS CROSS CONTINENTS

Purely software-based virtual sensors can deliver invaluable insights that are otherwise difficult or costly to obtain in R&D and applied applications

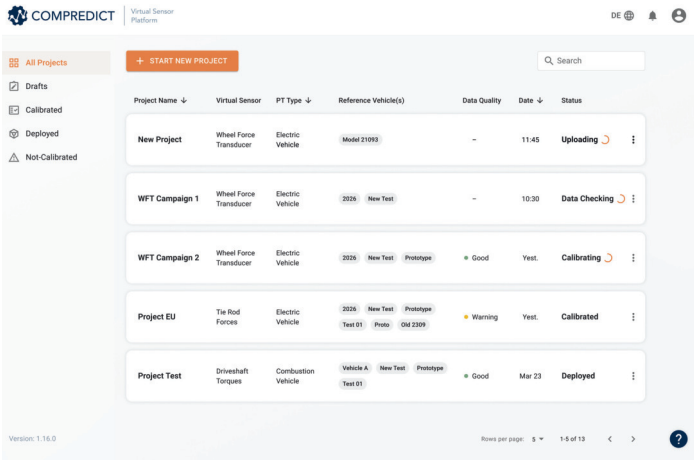
When a European OEM set out to plan an extensive evaluation campaign across a wide variety of driving conditions, it spelled out the need for detailed insights on all the forces and torques acting on each wheel of its test vehicle fleet. Yet it was clear that mounting wheel force transducers (WFTs) as hardware sensors was not an option for the campaign, which was due to cover more than 100,000km on open roads across another continent.

Virtual sensor specialist Compredict rose to the challenge and delivered a cost-effective solution that does not require adding sensor hardware to the fleet abroad yet still gives the R&D team in Europe the relevant WFT insights for all five test vehicles instantly.

The solution works off readily available CANbus data. Fifteen signals from the bus with a main sampling frequency of 50Hz are acquired and serve as input to a virtual WFT that delivers all required outputs with high precision.

"Our virtual sensor platform is delivered as an SaaS solution," says Rafael Fietzek, CTO, Compredict. "Customers can easily upload reference data, calibrate a virtual sensor, connect their test vehicles and deploy instantly via the cloud. We take away the burden of building custom machine learning pipelines and compute infrastructure. Still the customer stays in control."

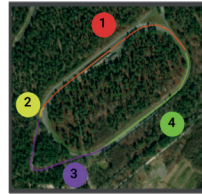
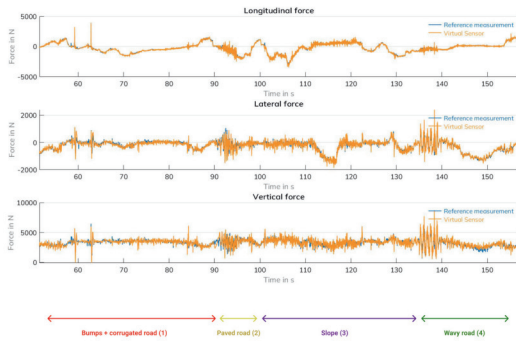
Ground truth data was acquired via a measurement campaign at a test track in Europe. Using a vehicle that was identical to the test fleet but equipped with a set of Kistler RoadDyn wheel force transducers, about four hours of reference data was recorded across the full variety of driving maneuvers and with various mass



ABOVE: Compredict's virtual sensor platform serves as a user interface for engineers to oversee and manage all virtual sensor projects within their organization

RIGHT: Open-road wheel force transducer measurement campaigns are possible with Compredict's virtual sensor technology





Test Track Overview

LEFT: Virtual sensor outputs for a wheel force transducer provide accurate measurements of longitudinal, lateral and vertical forces across various road conditions

configurations. Specific attention was paid to corrugated road surfaces, bumps and slopes.

The customer uploaded ground truth data to the Compredict SaaS platform, where engineers could then calibrate the virtual sensors of their choice using a self-service approach. Once calibrated and deployed via the platform, the durability engineers could access and analyze all required WFT signals from their test fleet without shipping, installing and maintaining sensor hardware across continents.

"With this technology, we access force and torque data from multiple development vehicles – all without the burden of additional hardware,"

Need to know

- » Virtual sensors enhance physics-based approaches with signal processing and AI
- » They simulate the behavior of hardware sensors and use readily available data.
- » Use cases range from enhanced R&D insights to replacement of hardware in series application

says the OEM's director of test and reliability in charge of this open-road measurement campaign. "The platform enables us to quickly integrate virtual sensors and analyze all outputs, setting a new pace for efficiency in engineering processes."

Other virtual sensors on the Compredict platform include tie rod forces and driveshaft torques, and the portfolio for R&D applications continues to expand. Fietzek highlights an increasing appetite for series application of the technology: "Many OEMs strive to make their series vehicles as smart as R&D vehicles when it comes to assessing chassis loads under real-world conditions. Heavy BEVs make this ever more relevant."

The young company's ambitions do not stop there. As more powerful compute becomes available in the upcoming vehicle generations, virtual sensors can readily replace certain hardware sensors. Emerging use cases range from headlight leveling to tire pressure.

The CTO adds, "Virtual sensors can add instant value to R&D and testing today. Engineers have been quick to grasp the benefits of low costs while leveraging the full potential of their fleet's data. Looking to the near future, we believe this technology has a market that is orders of magnitude bigger than R&D. We see virtual sensors as an essential layer in the emerging SDV stack."

Although the benefits of virtual sensor technologies have been proved for various use cases in the

automotive industry, and their accuracy is trusted, broad adoption has been held back mainly by two limiting factors: insufficient onboard compute capacity and legacy software stacks. The latter cannot provide the means for efficient deployment and management of machine learning algorithms and applications independently from underlying hardware. The move to SDVs will fundamentally change this. The next generation of E/E architecture is evolving toward centralization, with computing power and memory that can easily accommodate various virtual sensor use cases. Upcoming vehicle operating system and middleware stacks promise to take away the burden of feeding vehicle data at scale to advanced algorithms, managing connectivity, updates, privacy and cybersecurity. Compredict is all set to use

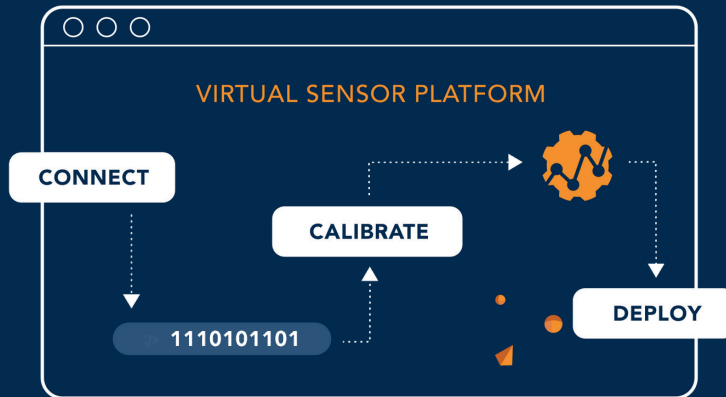
these tailwinds to grow its presence outside of R&D. The company aims to scale automotive virtual sensors that replace hardware, and thereby reduce the bill of materials, add advanced features such as real-time tire and brake wear measurement, and enable car-centric apps for after-sales and digital business use cases. "We bring a unique blend of expertise in automotive engineering, data science and SaaS development to the table," says Fietzek. "This allows us to bring exciting new capabilities to the market and deliver value quickly."

A recent investment of Toyota's growth fund, Woven Capital, in Compredict underpins this claim. <





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