quantiphi

Solving What Matters

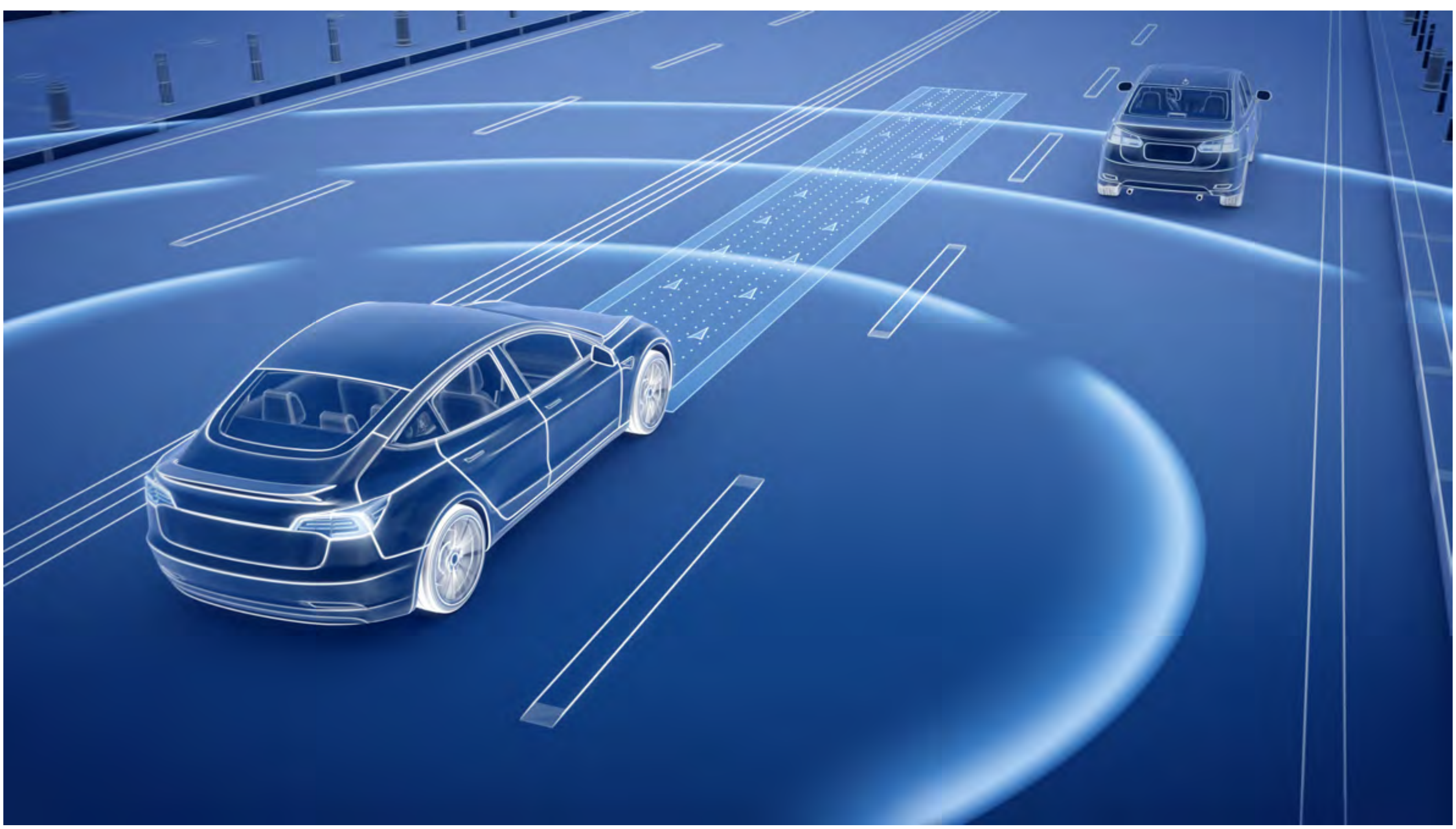
PREPARE FOR TIMELY CAR REPAIRS WITH

FIRST NOTIFICATION OF FAILURE PARTS

01 Overview of the **Aftersales Journey**

Aftersales forms a critical aspect of the business model of Original Equipment Manufacturers (OEMs). OEMs boost revenue from sales of spare parts and vehicle services via their affiliated workshops. The sustained engagement with customers after the sale helps build stronger relationships and aligns the sales of newer vehicle models for the future.

However, the aftersales market is seeing a massive overhaul due to several important trends. First, connectivity features in today's vehicles enable remote access to the OEM. This makes it easier for owners and drivers to plan maintenance and repair work, and also means that vehicle software can be updated over the air to enable remote repairs and new services. Second, connected features are redefining how OEMs and their customers stay in touch via new communication channels such as the car's human–machine interface (HMI). Connected technologies also provide fresh insight into driving trends, which helps OEMs deliver effective maintenance service.



Five stages in the after sales customer journey

STAGE 01
Insight for a proactive relationship

STAGE 02
Transparency at booking

STAGE 03
Service experience

STAGE 04
Anticipating and managing the out-of-the-ordinary

STAGE 05
After- aftersales

71% of respondents in a recent survey stated that they want a detailed estimate of costs before they book a service appointment at a workshop. It stands to reason that providing a full break-down of service duration and costs upfront would greatly improve the chances of customers booking with an OEM over an Independent Automotive Aftermarket (IAM).

The constant stream of a vehicle's diagnostic and usage data enables OEMs to provide accurate cost estimates for a service, based on their knowledge of how and where the car has been used, and the wear and tear of its parts. The accessibility to key data in advance also enables OEMs to estimate the duration that the vehicle will need to spend at the workshop. Further, OEMs can ensure workshops have the right parts in stock before the vehicle arrives for its service, reducing the total time to service.

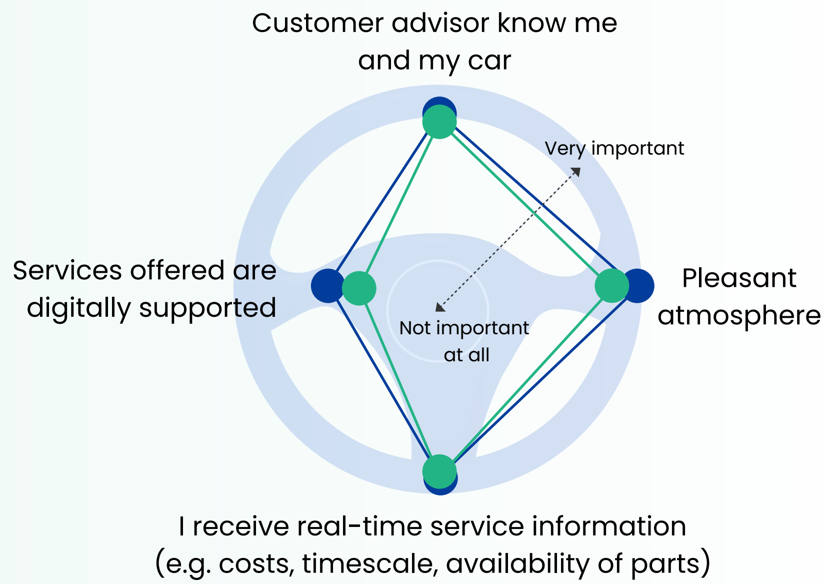
Today, customer experience is an integral aspect of the service industry. To this end, OEMs must increase investment in the physical environment of workshops and their customer-centric retail processes. OEMs must also recruit well-informed service advisors to receive customers and access their details. **62% of respondents** say this is the most important part of the experience.

02 Connectivity facilitates better service

Customers of authorized workshops are more likely to expect to be attended in a pleasant atmosphere than those of independent workshops

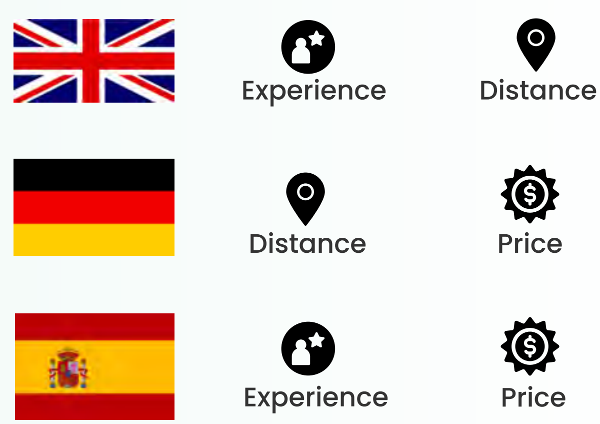
Automated workshop

Independent workshop



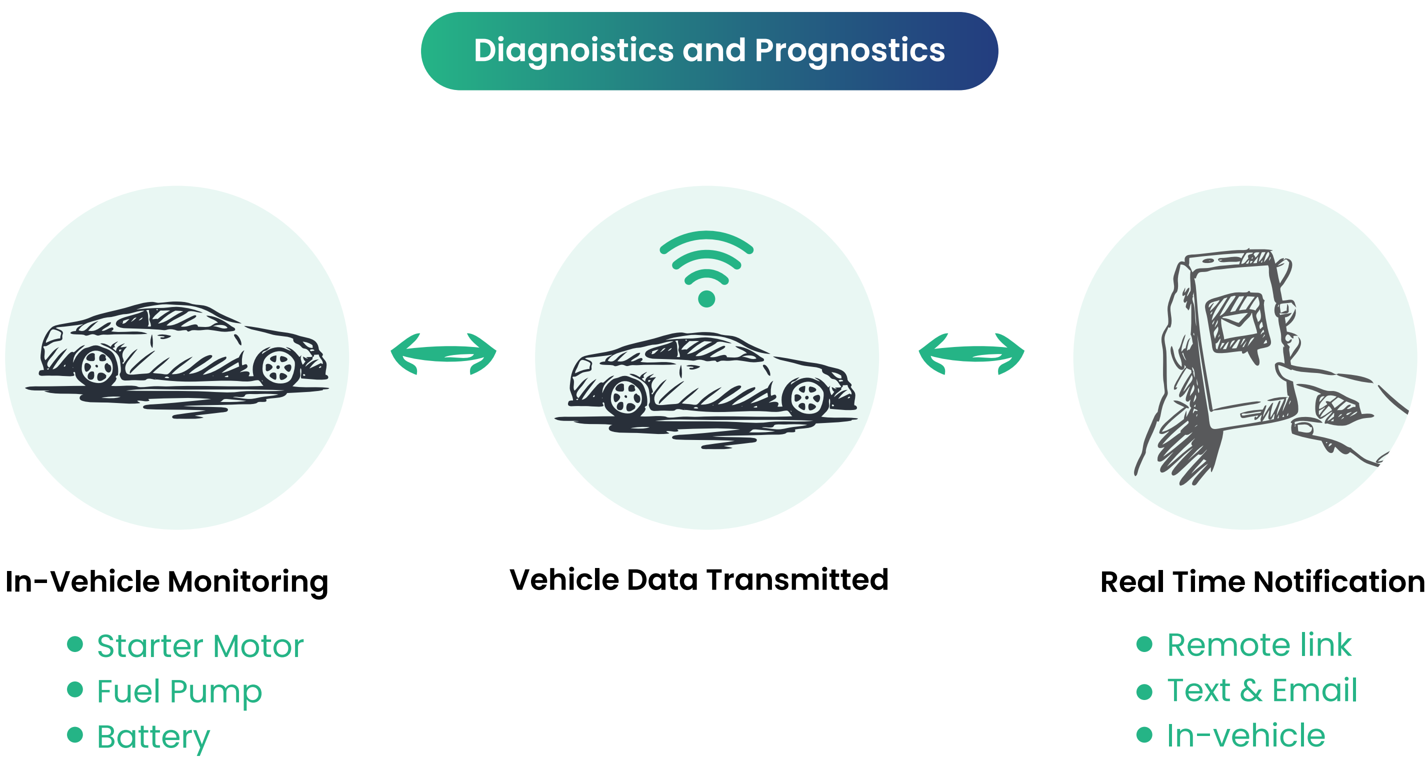
Generally customers reported having a pleasant experience with their last visit to the workshop, although they would prefer more digital support

On selecting a workshop, service experience is an important criterion for the customer. In Germany and Spain however, price is more important. Distant is also a key factor. In the UK, customers are less price sensitive



OEMs use connected car capabilities to be fully prepared for their customers' customized needs. For example, today's connected vehicles can predict maintenance requirements for parts that are at risk of decline by providing monthly health reports and remote diagnostics. Non-routine maintenance that requires essential repairs can be administered in a timely manner through vehicle alerts to the driver. Spurred by the alters, the driver can run diagnostic scans and forward the results to the workshop which enables them to be prepared for the vehicle when it arrives. Drawing on real-time diagnostics, OEMs can offer the driver faster support.

By extension, OEMs offer the driver faster and better support in the event of a breakdown, by drawing on real-time diagnostics as well as recent workshop and customer data. Remote diagnostics data automatically feeds into the ordering process for the required spare parts. It also



The dawn of the era of connected cars has implications for all stakeholders in the aftersales ecosystem. Connectivity drives the central combination of customer data with vehicle data and provides the ideal setting to enhance customer experience. Individual (offline) aftersales touchpoints are enhanced by newer digital touchpoints and integrated into one seamless customer journey which provides freedom to the customer to freely switch between offline and online touchpoints. In short, a consistent digitally enhanced service journey is an element stepping stone to delivering modern premium service for all customer touchpoints.

03 Case Study: **First Notification of Failure parts**

About The Client

The client is one of the three big automobile manufacturers based out of Detroit, known for its continuous development and innovation in technology, design, and engineering. The client is best known as the first auto manufacturer to automate production with an assembly line and deliver a vehicle for the mass market.

Problem Statement

- The client needed to improve their ability to identify early warning signals and predict required repairs through models leveraging a variety of inputs such as DTC codes (multi-level), vehicle repair history, warranty and other available data
- Solution to help service center personnel in maintaining and repairing vehicles in a quick and efficient manner
- Machine learning system that can predict and sort the possible root causes/failure parts based on the DTCs, vehicle input data, and customer feedback
- Interface to retrieve information from a knowledge base using NLP techniques from various manuals (possible causes, diagnostic tests, install/repair manuals)

Quantiphi's Solution

Quantiphi built a model that enables AI-guided diagnostics to recommend repairs and the likely repair parts for a set of vehicle components or a sub-system to provide proactive notice for possible failures. Once the likelihood of failure is estimated, the solution recommends the appropriate part(s) and processes needed to repair the vehicle and facilitates the delivery of the parts to the dealer ahead of a customer appointment.

Implementation model and flow

- Created a framework to incorporate inputs such as qualitative customer feedback and connected vehicle data into a prediction model to deliver efficient service visits with minimal downtime from issue notification to resolution

- Developed a Root Cause Prediction model to identify root causes along with priority order and NLP models to generate metadata and retrieve documents and manuals to help diagnose the quality issues accurately and in a timely manner (KG info)

Solution Approach

The project is divided into 2 major workstreams

Workstream 1

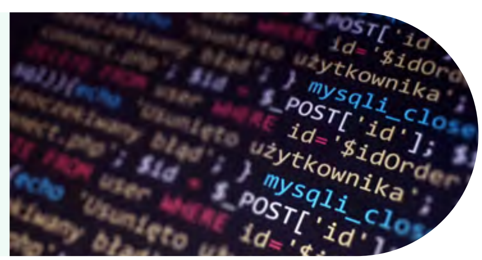
Creation of a multilabel multiclass classification model to classify multiple parts of the vehicle based on customer comments, DTC codes, and numerical data like mileage, RO date, etc.

Accomplishments

Successful Customer Technician text separation, and extracted keywords from text data using the RAKE Algorithm to be used as potential features.

Worked on multiple different modeling techniques to create features and insights which can be combined with current features, and worked on AutoML parts for initial model training

Created a custom script for feature engineering to scale features, removal of outliers, and creation of train and test data.



Worked on testing BERT embeddings that are both pre-trained and fine-tuned for the customer text feature, and trained a feed-forward neural net for the resulting data.

Analyzed frequency tables for numerical values, n-gram word analysis, keyword extraction using spaCy, and feature engineering on customer comments using fast-text embedding

Workstream 2

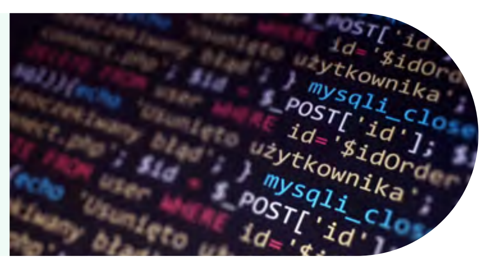
Created complex Knowledge Graphs that extract data from the workshop manuals in XML format and store them as a graph that can be queried anytime to reflect the data in the dashboard for seamless visualization.

Accomplishments

Created a condensed Knowledge Graph that established a relationship between the DTC code and the part numbers, via the Pin-Point Tests

Wrote reusable scripts to parse XMLs and generate both static and dynamic KGs, which are interactive in nature

Created a complex knowledge graph that extracts data from the workshop manuals and stores them as a graph for the linables section in XMLs



04 Appendix

What is a DTC Code?

A DTC, short for Diagnostic Trouble Code, is a code used to diagnose malfunctions in a vehicle or heavy equipment. While the malfunction indicator lamp (MIL)—also known as the check engine light—simply alerts drivers that there is an issue, a DTC identifies what and where the issue is. DTCs are also called engine vehicle fault codes and can be read with a scanner that plugs directly into the port of a vehicle.

The P0000 to P1000 are all EOBD Codes.

The first digit structure is as follows:

- Pxxxx for powertrain
- Bxxxx for body
- Cxxxx for chassis
- Uxxxx for future systems

Second digit structure is as follows:

- P0xxx Government required codes
- P1xxx Manufacturer codes for additional emission system function; not required but reported to the government

Third digit structure is as follows:

- Px1xx measurement of air and fuel
- Px2xx measurement of air and fuel
- Px3xx ignition system
- Px4xx additional emission control
- Px5xx speed and idle regulation
- Px6xx computer and output signals
- Px7xx transmission
- Px8xx transmission
- Px9xx control modules, input and output signals

The fourth and fifth digits designate the individual components and systems.