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IOT & AI FOR AUTOMOTIVE

AND HOW AN AIOT PLATFORM CAN HELP

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THE BASELINE

Leveraging Big Data and AI approaches for process automation, predictive maintenance, and anomaly detection are at the forefront of R&D efforts in the automotive industry. Yet these are only part of the picture. Driving true optimisation in the long term requires the combination of the Internet of Things (IoT), Big Data, and Artificial Intelligence strategies. Once these three components — IoT, Big Data, and AI — are sufficiently addressed across the value chain, automotive companies can make full use of AI and machine learning (ML) in a sustainable manner.

The adoption of AI and machine learning techniques combined with IoT technologies allows automotive companies to optimise their fleets, determine the conditions that impact performance, and improve passenger experience & safety, automating as much as possible along the way.

Mobile AIoT is on the rise, too. The more connected IoT devices that can track and analyse vehicle movement and the conditions under which anomalous behavior occurs, the better will automotive companies be able to understand how and where to optimise for maximum impact.

04

Why does this matter?

+ THE AVERAGE AUTOMOTIVE MANUFACTURER DEALS WITH SOME 800 HOURS OF DOWNTIME ANNUALLY

+ THE AUTOMOTIVE SUPPLY CHAIN IS DECADES OLD AND HIGHLY FRAGMENTED

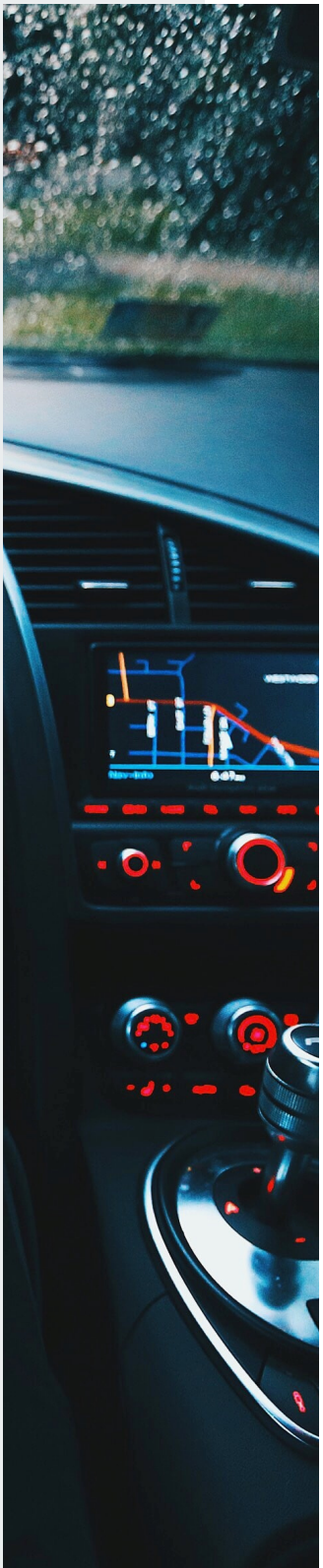
At the same time, demand for automotive products continues to be high.

+CONNECTED CAR SHIPMENTS ARE EXPECTED TO RISE TO OVER 77 MILLION BY 2025

+SELF-DRIVING TECHNOLOGY WILL BE THE BIGGEST DRIVER FOR AI ADOPTION, PRESENTING A $556 BILLION OPPORTUNITY BY 2026

+OVER 14 MILLION SEMI- OR FULLY AUTONOMOUS VEHICLES WILL BE ON THE ROADS BY 2025

COMBINING IOT & AI ON A SINGLE PLATFORM



So how does it work? To utilise the combined powers of IoT & AI, connect your vehicles and related assets to a single platform. This is how you begin to generate insights in real-time and near real-time. Once your vehicles are connected, extract and load data to the platform for further analysis. Right on the platform, you combine data coming from multiple disparate sources and consolidate it for insight generation. Here are the steps:

- **Cleanse and transform the data** coming from vehicles in real-time or near real-time.
- **Build machine learning algorithms.** Once you have high-quality data, you can start building your ML models.
- **Get ready for insight generation.** Get started with data mining for greater insight and visualise the insights in customisable dashboards.
- **Deploy.** Taking the generated insights, you build IoT apps to deploy to production. These can be distributed across various car fleets at the click of a button.
- **Monitor & update**. IoT & AI platforms allow you to establish iterative processes to continuously monitor assets and performance parameters so you can adjust to changing conditions and roll out updates instantly.

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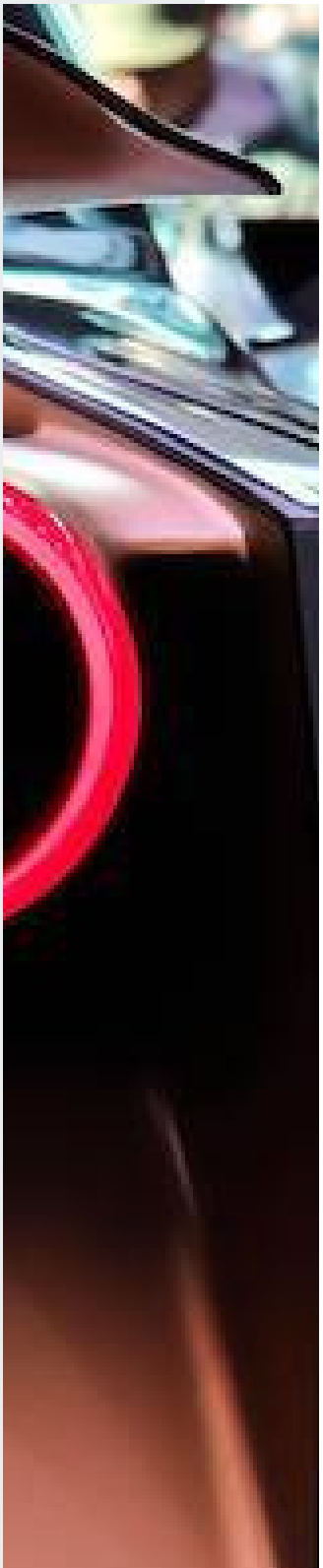
IOT & AI APPLICATION AREAS IN AUTOMOTIVE



IoT data analytics in automotive keep organisations on the cutting edge by streamlining and improving both vertical and horizontal processes. This involves process automation and keeping up with advances in lean manufacturing, optimising product design, addressing safety and performance concerns through anomaly detection, all the way to supply chain or sales, and, ultimately, innovative product development.

> *AIoT is a new force in automotive that makes everything leaner, at every stage, and is ultimately geared towards a better consumer experience.*

So what are the biggest impact areas for automotive? And where do the combined forces of IoT & AI, also known as AIoT, make all the difference?

Automation in car manufacturing

Machine learning and AI play a key role in optimising automated processes. This involves operational streamlining, shortening production cycles, and removing procedural steps that previously involved manual labor. Optimisation on the operative level makes it possible for automotive companies to focus their creative energies on Research & Development, strategy, and system improvements.

Predictive car maintenance

Custom machine learning is a typical application area for AIoT. Here ML algorithms allow for the timely detection of wear and tear. Predictive maintenance is not just that, however. Thanks to data visualisation dashboards that show the evolution of assets in real-time, robust AIoT platforms help you create the foundation for granular, highly customised alerting mechanisms, lifecycle monitoring, and the oversight of asset amortisation. This is not simply about predicting vehicle failures. It is about optimising asset lifecycles and conducting maintenance in a sustainable manner.

Anomaly detection

A special subcategory of predictive maintenance, anomaly detection helps you eliminate blind spots and investigate the underlying causes behind non-typical events. You detect, prioritise, and combat threats to the smooth operation of vehicles.

User experience: connected cars

In-car marketplaces enable consumers to supplement the driving experience with services. These may range from personal retail therapy, wellness features, multimedia offerings that include both entertainment and safety improvements, plus a variety of comfort enhancements from within a vehicle's cockpit.

AIoT holds the potential to "push the boundaries of personalisation" and thoroughly transform the consumer experience. Features-on-demand will positively impact consumer convenience and pave the way towards a full multimedia experience while working towards optimal vehicle performance and safety. At the same time, connected cars are uncovering new business models for automotive companies.

Optimising the automotive supply chain

When IoT & AI are combined on a single platform, automotive companies can begin to leverage the full potential of their data efforts. And this includes supply chain optimisaton. Enterprises can simplify process flows, enhance collaboration to combat silos, and safeguard agility while making sure safety and accountability are still written large.

A collaboration platform to unify insights, explore all relevant data, and monitor process-critical activities from a single venue is a step towards process & security improvement and faster decision-making.

THE IOT & AI PROCESS FROM THE EDGE TO THE CLOUD

So how do IoT & AI work together and what processes do they account for?

The role of IoT in collecting car data

Again, the potentials harnessed by AI-powered systems are immense. To tap into these potentials, you need to first be able to read out data from your vehicles and machines. It is often the case that this data is siloed and hard to access. Yet collecting this data is the first crucial component in the process of building ML and AI. Using a hardware-agnostic IoT platform powered by container technology, today you can turn anything into an IoT edge device. It is possible to access any vehicle or machine to read out data from a variety of legacy systems and devices.

The role of collected IoT data in analytics

Once you have collected the vehicle data, it has to be cleansed, modelled, transformed, and turned into high-quality data that is readily available for long-term use. You can explore datasets coming from disparate IoT data sources. On the basis of the insights gained out of these, you build and deploy data solutions for further insights. In this way, an iterative cycle is formed.

When you connect your assets with the IoT & AI platform, you are continually receiving fresh IoT data from your fleets. You are using the data to improve on your data solutions. This is where you can get truly creative with IoT & AI, capturing more value from existing IoT infrastructures.

But to get there, you first need to collect IoT data from your fleets. Then you set up device management processes to safeguard the availability of that data. And you make sure that your fleets are connected to the IoT & AI platform whenever you need them to be.

Getting creative with IoT & AI

Once your fleets are connected and streaming data, you can start designing your own AI solutions and deploy them to production for more insight generation in near real-time. You create and automate workflows to assist you in getting on top of your data, monitor your fleets to prevent unwanted behavior, update your ML models over the air, and collaborate with peers across the globe to enhance your existing solutions.

Possible AI development scenarios may involve customised data collection apps (that is, machine learning models packaged as IoT apps), anomaly detection, maintenance notification, or event recognition applications that are rolled out directly to the IoT edge. And again, using the data from vehicles at the IoT edge, you continually improve on the apps and release updates in short iterative cycles.

APPLICATION SCENARIOS BY DIVISION

Car manufacturers can utilise IoT & AI in just about any aspect of their operations where IoT data analytics leads to more automation and higher efficiencies.

Research and Development

The confluence between IoT & AI is bound to breathe fresh life into R&D initiatives, rejuvenating R&D projects and making it possible to fully unfold their potential. IoT & AI will also help predict the success rates of different initiatives and better estimate the time and resources needed for completion. This way, automotive companies can remain on the cutting edge while saving money. Identifying and focusing on high-potential high-feasibility initiatives is where AI can supplement IoT in creative and unconventional ways.

Manufacturing

AI-driven systems help car manufacturers to create and oversee workflows with more efficiency. Further, they enable the timely identification of defective car parts, produced both in-house or coming from external suppliers, before they are installed in vehicles and headed for the road.

The combination of IoT & AI (AIoT) also provides the basis for stress measurement and deformation identification techniques, the development of safety concepts, and predictive maintenance use cases.

Supply chain operations

Supply chain data analytics have been around for a while. However, supplementing front-end AI systems with IoT technology can make all the difference when it comes to tapping into new data sources by analysing even larger and more diverse data sets, overseeing logistics on a grand scale, or managing risk. Using classic metrics such as delivery performance and the platform's collaborative features, automotive companies can achieve more transparency in their supply chain operations, identify typical scenarios for delivery failure, and begin to cooperate more with their suppliers towards a common goal.

"Eventually, every automotive company will have to reinvent itself as a data-driven company. And IoT & AI platforms are here to help."

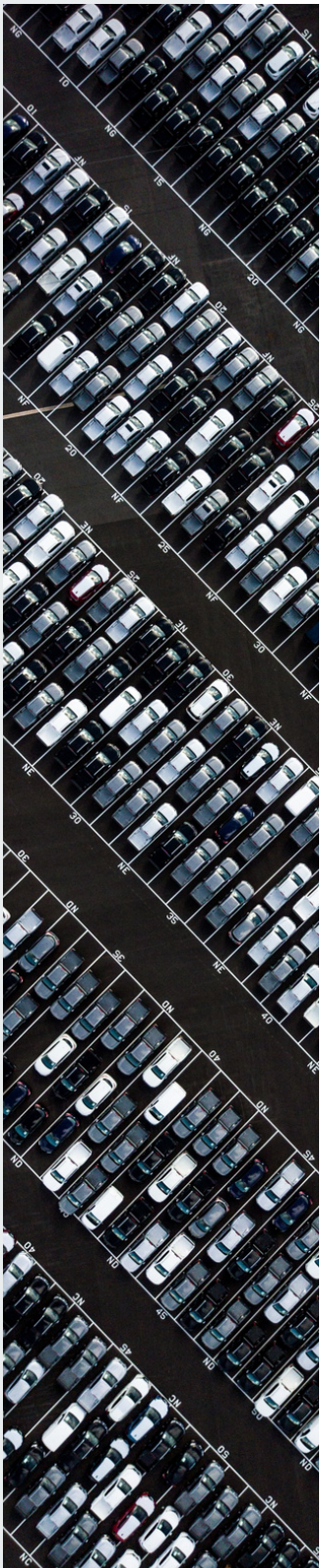
THE BENEFITS OF IOT & AI PLATFORMS FOR AUTOMOTIVE

The combined forces of IoT & AI are transforming and will continue to inspire innovation in just about every aspect of the automobile industry. Untapping those potentials and identifying revenue opportunities with IoT & AI can be the ultimate game-changer for automotive manufacturers, suppliers, and innovators.

The confluence of IoT & AI can optimise automotive production across the entire value chain, increase car safety, and drive customer loyalty. We all know about the possibilities opened up by autonomous and semi-autonomous driving, NLP-based in-vehicle speech recognition systems, computer vision, deep learning algorithms that improve navigation, or automaker AI solutions for car safety management such as object detection and course calculation. The possibilities are endless.

Innovative business models and revenue streams

IoT&AI-driven innovations can help you tap into new and unexpected revenue sources. And you can develop yet-unseen business models around digital products developed on a combined IoT & AI platform.



Cost reduction

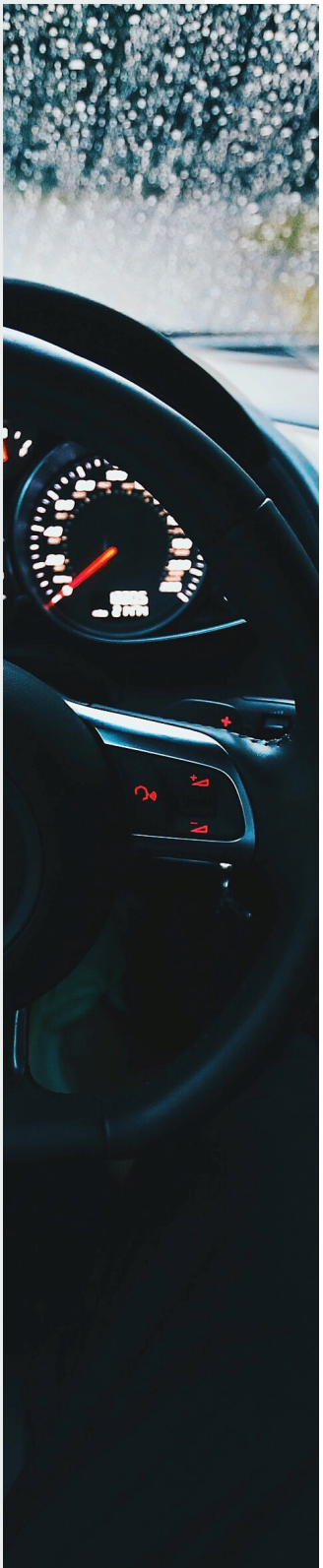
Supplementing IoT with AI means increased operational efficiency and revenue boosts in all areas of automotive. But often the untold story is that of all the cost cuts and savings that take place thanks to the implementation of combined IoT & AI solutions. This involves resource savings thanks to automation, operational streamlining, digital assistants, and more.

Risk reduction

Predictive maintenance, anomaly detection, smart object recognition and built-in AI-powered security systems play an increasingly crucial role in developing innovative models around vehicle safety. Implementing viable risk reduction scenarios is especially relevant in emerging areas such as autonomous or semi-autonomous driving. Across all these domains, IoT&AI-driven innovation is key in developing concepts for safer and stress-free driving.

Enhanced customer experience

Customised IoT&AI technology can help engage with customers in a sustainable way. You boost customer loyalty and create overwhelmingly positive customer experiences thanks to tailored digital services. Data-driven manufacturers are better equipped to develop customer retention solutions. You manage long-term relationships by identifying customer churn in advance and developing targeted offers to counteract unwanted developments.



USE CASE

COLLECTING IOT DATA FROM TEST VEHICLES TO IMPROVE SQUEAL DETECTION

Identifying brake squeal noises with Continental AG

Together with the HBS R&D division at Continental, Record Evolution has developed a pilot for identifying brake squeal noises using Big Data and AI approaches on IoT data collected from test vehicles.

Using the Record Evolution platform for end-to-end IoT development, Continental AG was able to implement IoT data collection strategies, Big Data analytics & AI solutions in mobile IoT scenarios. The goal was to improve Noise, Vibration and Harshness (NVH) measurements to better evaluate the circumstances under which brake squeal noise occurs.

The employed end-to-end process starts with data collection from test vehicles, transferring the data to an on-premises cloud environment, data processing in the cloud, and the creation of a database of structured and harmonised high-quality data.

The next steps are collaboration on the creation of diverse analytical insights into the data and the creation of a custom AI algorithm for edge devices to classify NVH events with high accuracy in near real-time.

To collect raw IoT data, we developed a measurement device based on Raspberry Pi and enhanced it with professional measuring electronics. Devices were installed in multiple test vehicles and were connected to the platform. With the help of the Record Evolution Reflasher, platform users can now easily add new vehicles to their test fleet with just a few clicks and so enrich the existing data pool.

Using the Record Evolution platform for IoT and AI, Continental AG has built a comprehensive system for IoT data collection and analysis. This system can serve as a foundation for the development of multiple use cases, such as apps for NVH detection and real-time NVH prediction based on the identification of patterns that arise prior to an NVH event.

KEY TAKEAWAYS

> Using a single IoT & AI platform, you consolidate the IoT assets and know-how within your organisation. Now you are ready to build your use cases and even develop your own products.

ABOUT RECORD EVOLUTION

IOT & AI PLATFORM

Record Evolution is the collaborative end-to-end IoT & AI platform that enables companies of all sizes to develop their own IoT products.

Built to facilitate the development and wide availability of artificial intelligence (AI) in an IoT context, the simple-to-use platform serves as an organisation-wide decentral hub for organising teams and conducting IoT projects, effectively providing broad AI enablement within any organisation.

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