



# 20 AI Use Cases in Automotive Engineering

*Presented by:*

**Pareekh Jain**

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# Summary: AI Use Cases Automotive Engineering



Design & Development	Manufacturing	Supply Chain	Aftermarket Services
<ul style="list-style-type: none"><li>▪ Generative design</li><li>▪ Design automation</li><li>▪ Simulation model</li><li>▪ Personalized design</li><li>▪ Autonomous driving</li></ul>	<ul style="list-style-type: none"><li>▪ Quality control</li><li>▪ Digital twin</li><li>▪ Production optimization</li><li>▪ Predictive maintenance</li><li>▪ Customized configuration</li></ul>	<ul style="list-style-type: none"><li>▪ Autonomous robots</li><li>▪ Demand forecasting</li><li>▪ Supply chain efficiency</li><li>▪ Risk management</li><li>▪ Sustainability</li></ul>	<ul style="list-style-type: none"><li>▪ Dealer management</li><li>▪ Experience management</li><li>▪ Voice recognition</li><li>▪ Safety management</li></ul>

## 1: Lightweight vehicle design

### Details

- Leveraging advanced AI-based generative design technology to rapidly explore different combinations of designs

### Examples

- General Motors is collaborating with Autodesk to leverage advanced AI-based generative design technology and 3D printing advancements to help lighten and transform future vehicles. ([Link](#))

## 2: Design automation

### Details

- Developing an AI algorithm that can recognize images and based on that it attempts to design cars.

### Examples

- Nissan has built a prototype AI that can recognize images and based on them it attempts to design cars.  
([Link](#))

## 3: Simulation model for verification and validation

### Details

- Machine learning-based method to reduce battery testing time including battery charge speed. It is helpful for battery development for electric vehicles.

### Examples

- Stanford and Toyota are collaborating to develop new machine learning methods for battery management in electric vehicles. ([Link](#))

## 4: AI application for autonomous driving

### Details

- Leveraging AI to generate camera images for simulation by using sensor data collected from self-driving vehicles.

### Examples

- Waymo is using AI to simulate autonomous vehicle camera data. ([Link](#))

## 5: Personalized product design

### Details

- Using AI system to learn about driver's habits and preferences to provide a better driving experience. For example, based on driving patterns and schedules, the AI system learns about temperature preferences, route etc..

### Examples

- The Toyota Concept-i leverages AI system that learns drivers' habits, preferences, and other factors to provide a better driving experience. ([Link](#))

## 6: Integrating AI in manufacturing

### Details

- Image recognition and processing technologies to improve the manufacturing productivity.

### Examples

- Volkswagen Group leverages computer vision for efficient manufacturing. ([Link](#))



## 7: AI application for quality inspection

### Details

- Developing automated vision system to create a 3D model of the car bodies to be inspected for dirt particles.

### Examples

- Ford installed automated vision systems to identify dirt particles in the paint jobs of various automobile types. ([Link](#))

## 8: AI application for quality inspection

### Details

- Usage of machine vision technology to identify defects. Many times, pseudo-defects arise in the form of small permitted variations, declaring them as defects. But this technology eliminates pseudo-defects, avoiding the extra loop of manual checks.

### Examples

- BMW is using machine vision technology for imaging-based automatic inspection and analysis of parts. ([Link](#))

## 16: AI application for quality inspection

### Details

- Leveraging deep learning to recognize and mark the finest cracks in sheet metal parts.

### Examples

- Audi is using machine learning to optimize quality inspections in the press shop. ([Link](#))

## 9: Digital twin for production line

### Details

- Digital twin technology to detect energy losses and identify areas where energy can be conserved, and improve the overall performance of production lines.

### Examples

- Ford uses digital twin technology to accurately detect energy losses in production line. ([Link](#))

## 10: Predictive maintenance

### Details

- Leveraging big data to analyze cases when unexpected equipment failures can occur and also to predict when maintenance is required.

### Examples

- Audi is following predictive maintenance applications for car manufacturing equipment. ([Link](#))

## 11: Production optimization

### Details

- Data-driven insights about production operations. Insights about actual manufacturing processes in real-time to improve and optimize our process and efficiency.

### Examples

- Caterpillar used a rapid IIoT deployment to gain data-based insights and optimize production at a components plant. ([Link](#))

## 12: AI application for quality inspection

### Details

- Leveraging image recognition technology to automate the quality inspection process including increasing the overall efficiency.

### Examples

- Ford used image recognition technology to detect wrinkles in seats. ([Link](#))

## 13: AI application in automotive paintshop

### Details

- Leveraging AI to increase the flexibility related to both the products and the paint processes. AI applications help to create flow for each specific customized car configuration instead of a dedicated sequence.

### Examples

- Lamborghini is using AI in its new paintshop in Sant'Agata Bolognese plant, in the north of Italy, specifically for its Urus Super SUV. ([Link](#))



## 14: Digital twin for manufacturing

### Details

- AI is used to simulate the production of the support structure for the vehicle components using different types of materials.

### Examples

- The BMW Group uses a component simulation based on AI methods for the production of the BMW iX cockpit. ([Link](#))

## 15: Automated quality inspection system

### Details

- Application of AI to recognize the patterns from a large data volume and compare it with the similar past patterns, suggesting the possible root-cause of the problem.

### Examples

- Mercedes-Benz deployed AI to find patterns and suggest remedies for quality-related incidents. ([Link](#))

## 17: AI application for logistics

### Details

- Autonomous robots that can identify different obstacles such as forklift trucks, tigger trains and people more quickly and select alternative routes. They can also learn from the environment and apply different responses to people and objects.

### Examples

- BMW and NVIDIA collaborated to develop AI-enabled smart transport robots (STRs) that optimises material flow and planning processes. ([Link](#))

## 18: Intelligent algorithm to assess supply chain risk

### Details

- Usage of intelligent algorithm to identify and analyze supplier-related news (flag instances like environmental pollution, human rights abuses and corruption) from publicly available media and social networks to indicate sustainability risk in the supply chain.

### Examples

- Porsche, Audi and Volkswagen use AI to minimize sustainability risks. ([Link](#))

## 19: Leveraging AI for supply chain and customer experience

### Details

- Precise sales planning has become of critical importance for achieving overall operational efficiency. So, AI model is developed to take into account different economic, social, and customer parameters for the planning.

### Examples

- Volkswagen is creating market forecasts with a multitude of variables including economic development, household income, customer preferences, model availability, and price. ([Link](#))



## 20: Leveraging AI for experience management

### Details

- Collecting data at dealership level for both employees and customers to understand about the experience management at the both ends. It also leverages AI tools across its social platform and other channels to understand the customer journey.

### Examples

- Volkswagen Australia uses AI to link customer and employee experience. ([Link](#))



## 21: After-market services & customer experience

### Details

- Using IoT, AI and machine learning technologies to track and analyze vehicle data and driver behavior to provide enhanced driving experience.

### Examples

- Tata Motors and Microsoft India collaborated to provide connected and personalized driving experiences for Indian customers. ([Link](#))



## 22: Applications of AI for detecting oversteering

### Details

- Gathering real-world data from a vehicle before, during, and after oversteering. Developing a machine learning algorithm model based on that test data and detecting oversteering automatically in real-life scenario.

### Examples

- BMW is exploring machine learning model to detecting oversteering. ([Link](#))



## 23: In-car voice-recognition systems

### Details

- Advanced machine learning and artificial intelligence model for voice recognition and in-car commands.

### Examples

- BMW and Microsoft collaborated to improve in-car voice recognition. ([Link](#))



# Thank you



## Pareekh Jain

Founder Pareekh Consulting &  
EIIRTrends.com, Bangalore

13<sup>th</sup> floor, M2 Block,  
Manyata Embassy Business Park, Bengaluru

E: [pareekh@pareekh.com](mailto:pareekh@pareekh.com)

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