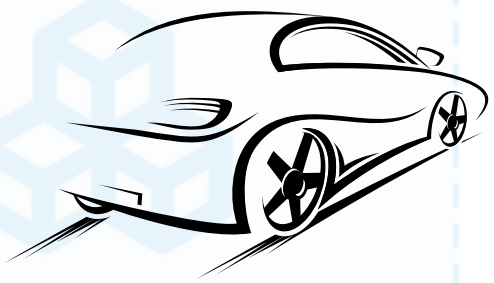
Use Cases of

# 10 LLMs IN AUTOMOTIVE INDUSTRY

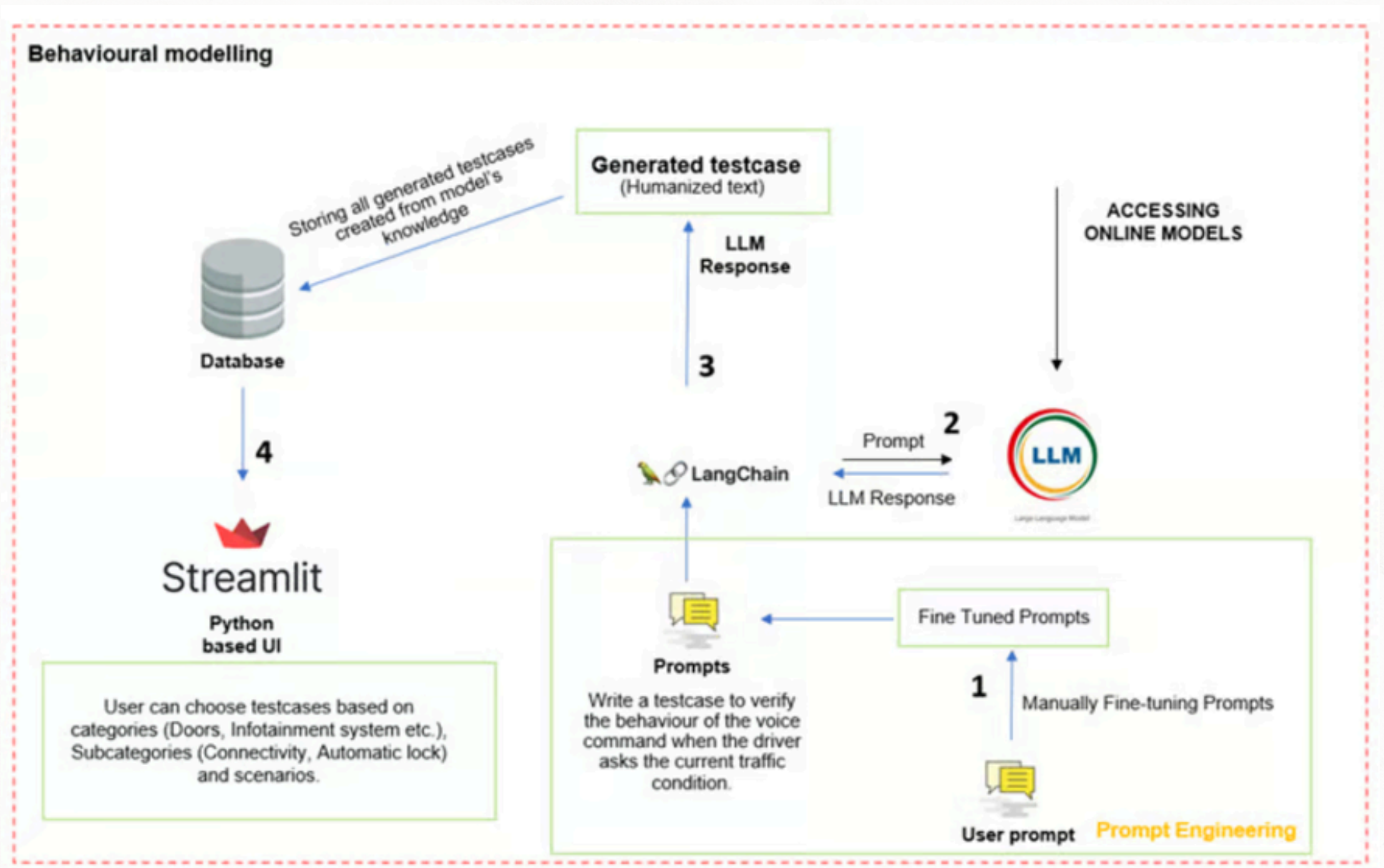


Bhavishya Pandit

# 1. Human Behavior Modelling

**TATA ELXSI** has applied **GenAI** to model human behavior and interactions with vehicle electronic systems.

This approach creates realistic test scenarios that don't rely on specific vehicle hardware or software. Large Language Models (LLMs) play a key role here, as their innate understanding of human behavior eliminates the need for additional pretraining. This innovation helps refine automotive systems with greater accuracy and efficiency.




**Flow diagram of Behavioral Modelling**

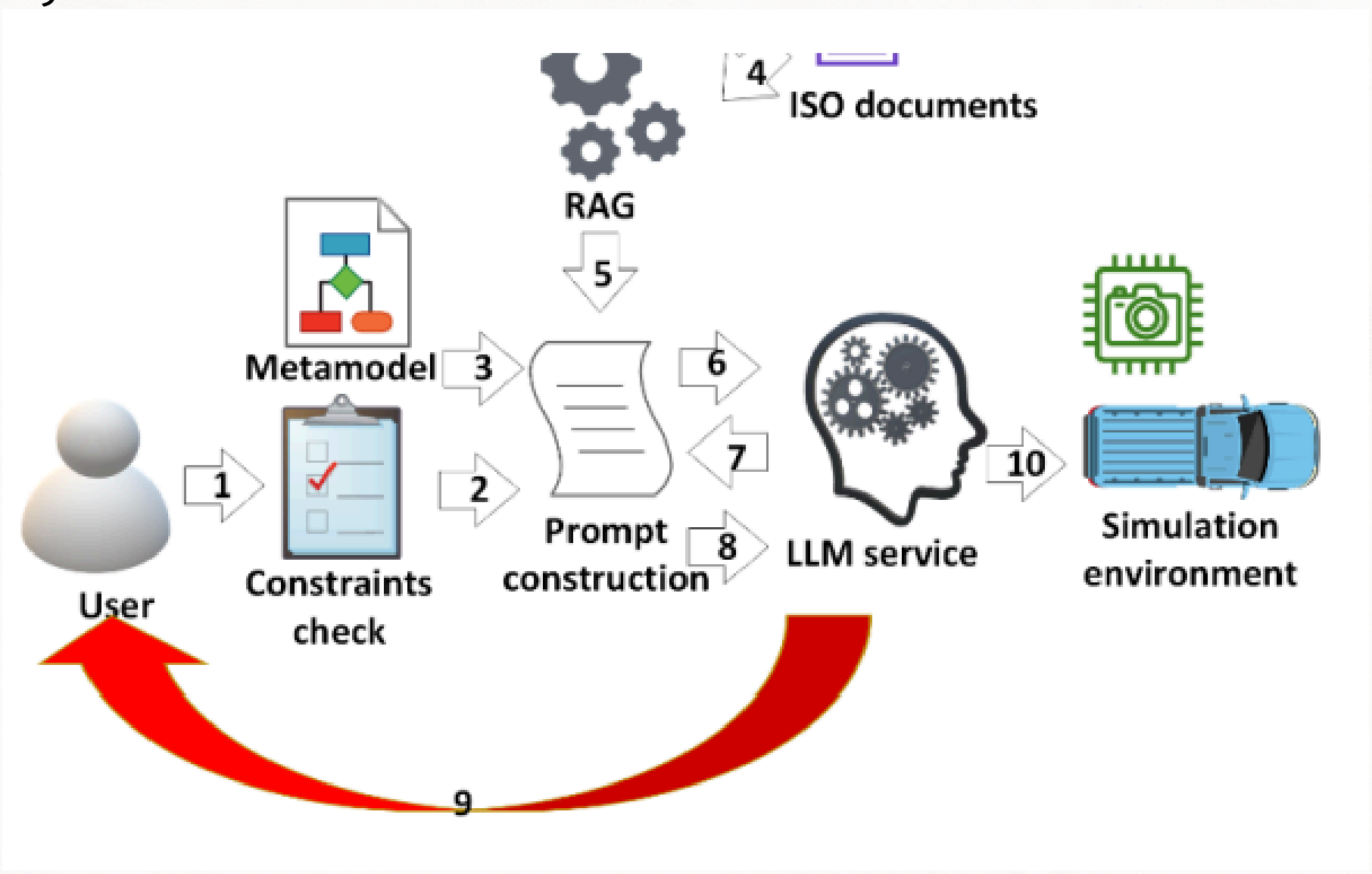
source: tata elxsi

# 2. DESIGNING

One study examines the use of Large Language Models (LLMs) integrated with Retrieval-Augmented Generation (RAG) to improve design and software development in the automotive industry. Two case studies were presented:

1. **Compliance Chatbot:** Provides accurate, context-aware responses for standardization and regulatory compliance.
2. **Design Copilot:** Enhances design workflows with precise suggestions.

Four LLMs—**GPT-4, LLAMA3, Mistral, and Mixtral**—were evaluated for answering accuracy and execution time. GPT-4 demonstrated superior performance, while LLAMA3 and Mistral were noted for their potential in local deployment, addressing data privacy concerns.



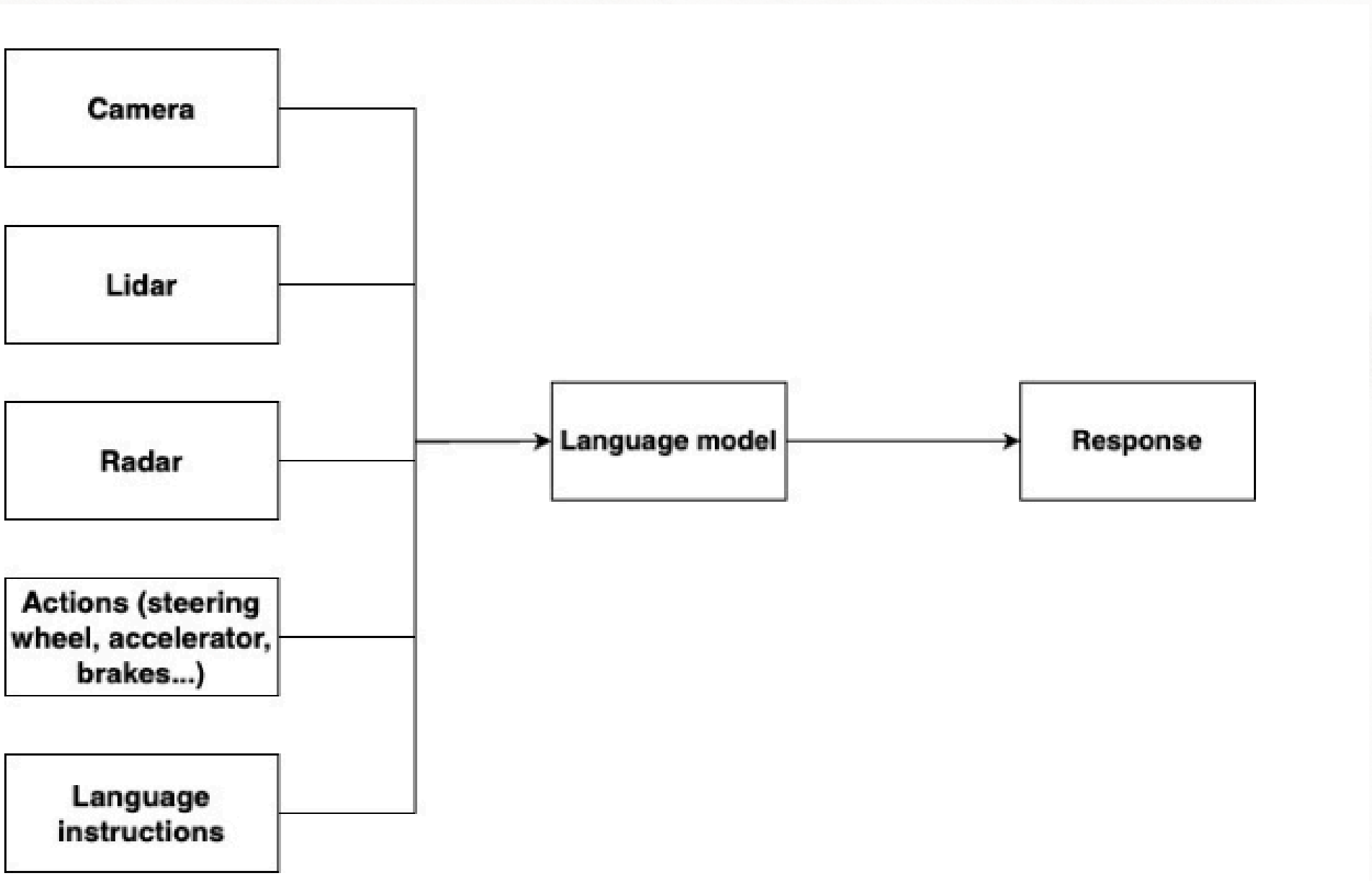
# 3. AUTONOMOUS VEHICLES

LLMs in **ADAS** and Autonomous Vehicles

- **Vision Language Models (VLMs)** combine text and visual data, enabling tasks like image classification, text-to-image retrieval, and visual question answering.

- In autonomous vehicles, VLMs enhance ADAS by interpreting camera data to provide real-time feedback.

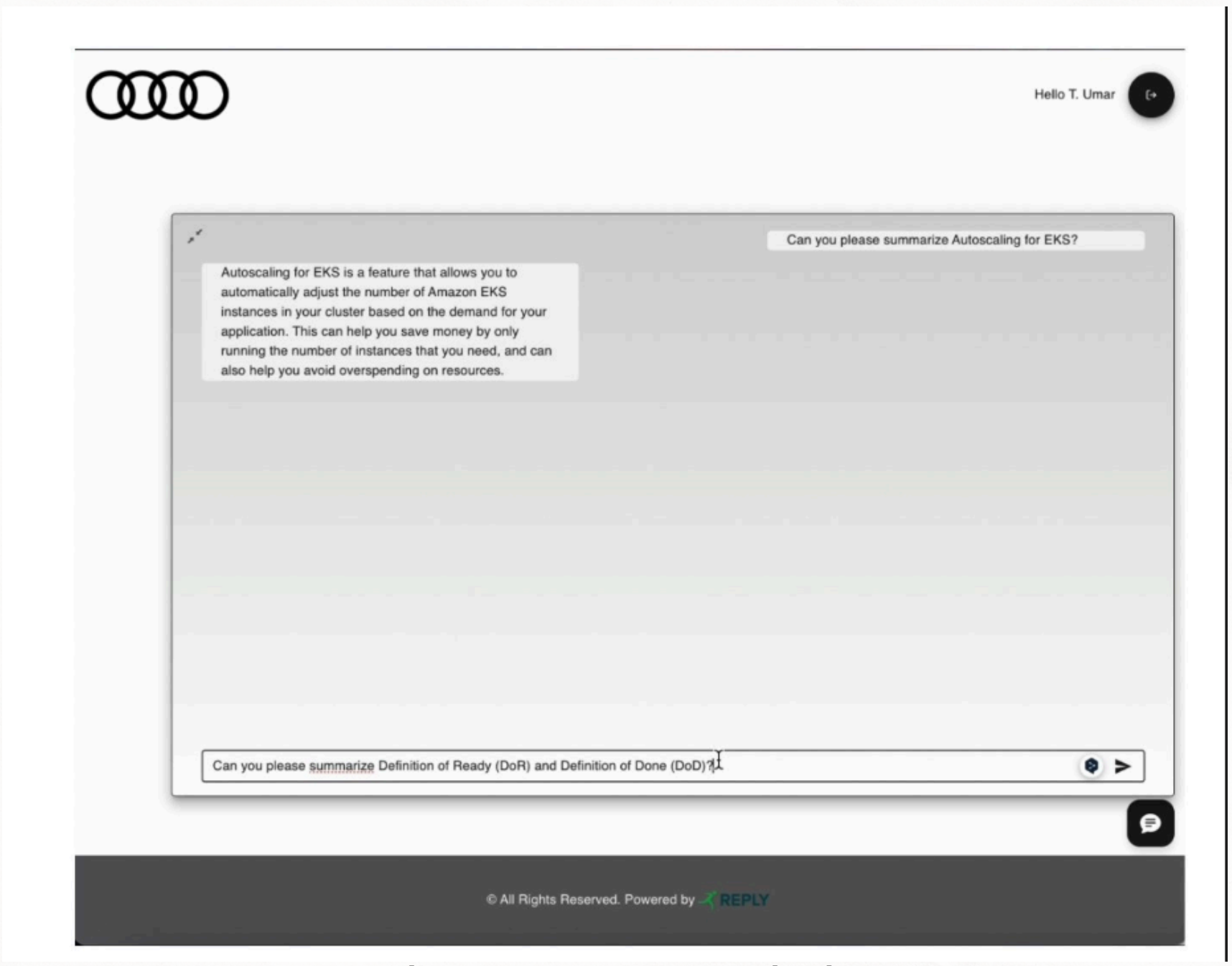
- For example, if a driver looks left, the front-facing camera could detect a child crossing the street and alert the driver, improving safety.



# 4. Customer Service

**Audi** and **Reply** partnered with Amazon Web Services (AWS) to enhance their enterprise search experience through a Generative AI chatbot.

By leveraging **Retrieval Augmented Generation (RAG)**, they integrated key AWS services such as Amazon SageMaker and Amazon OpenSearch Service, improving the speed and accuracy of search processes. Additional AWS tools, including Amazon S3, AWS Lambda, Amazon CloudFront, Amazon API Gateway, and Amazon Cognito, were used to support and optimize the system. This collaboration demonstrated how the combination of advanced AI and cloud technologies can drive innovation and efficiency in enterprise solutions.




**Audi Customer Support Chatbot**

source: audi

# 5. BMW's LLM based Car Expert

**BMW**, a leading German car manufacturer has long utilized artificial intelligence for speech processing through its **Intelligent Personal Assistant**.

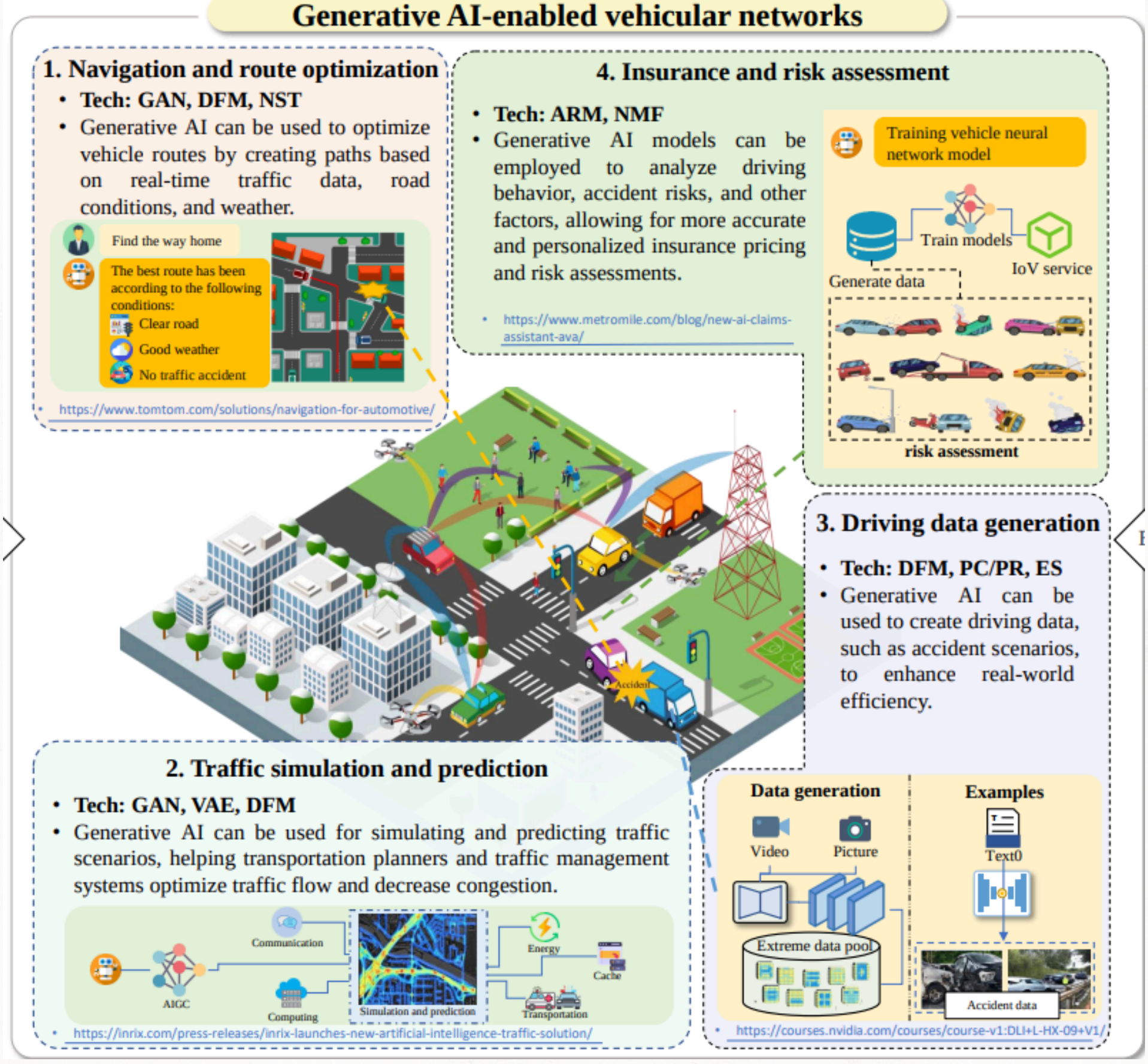
BMW recently announced integration of LLMs to it. BMW's Intelligent Personal Intelligent now comes with **Amazon Alexa's** to give drivers all the insights about their car as well controls like changing drive models, infotainment controls etc.


source: bmw

# 6. Gen AI in Vehicular Networks

Vehicular Networks when integrated with Gen AI can help in optimising costs and reduce risks.

A research paper titled - **“Generative AI-enabled Vehicular Networks”** talks about 4 ways how Gen AI can help in building a better driving environment.



# 7. Road Safety

Managing the diverse Big Data from transportation infrastructures, including traffic flows and sensor data, is complex due to the combination of textual and numerical information. Traditional methods struggle to effectively analyze and interpret this data.

The solution lies in the introduction of **BERT4ITS**, a deep learning framework leveraging BERT's capabilities. It improves traffic prediction, accelerates incident detection, and enhances decision-making, offering a smarter, safer approach to **Intelligent Transportation Systems (ITS)**.

Similarly, **BERT-ITS** efficiently identifies traffic incidents like accidents and blockages, outperforming traditional methods.

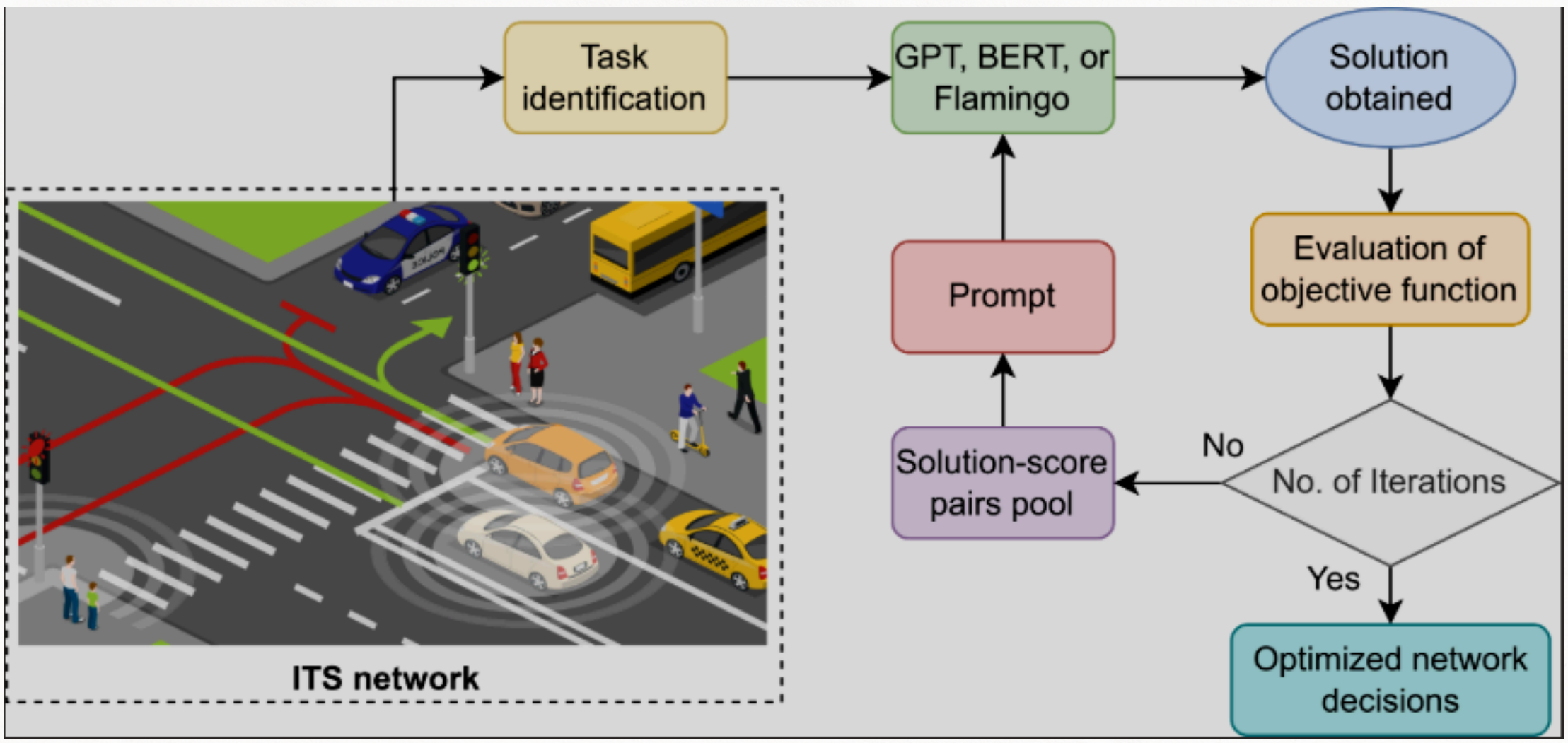
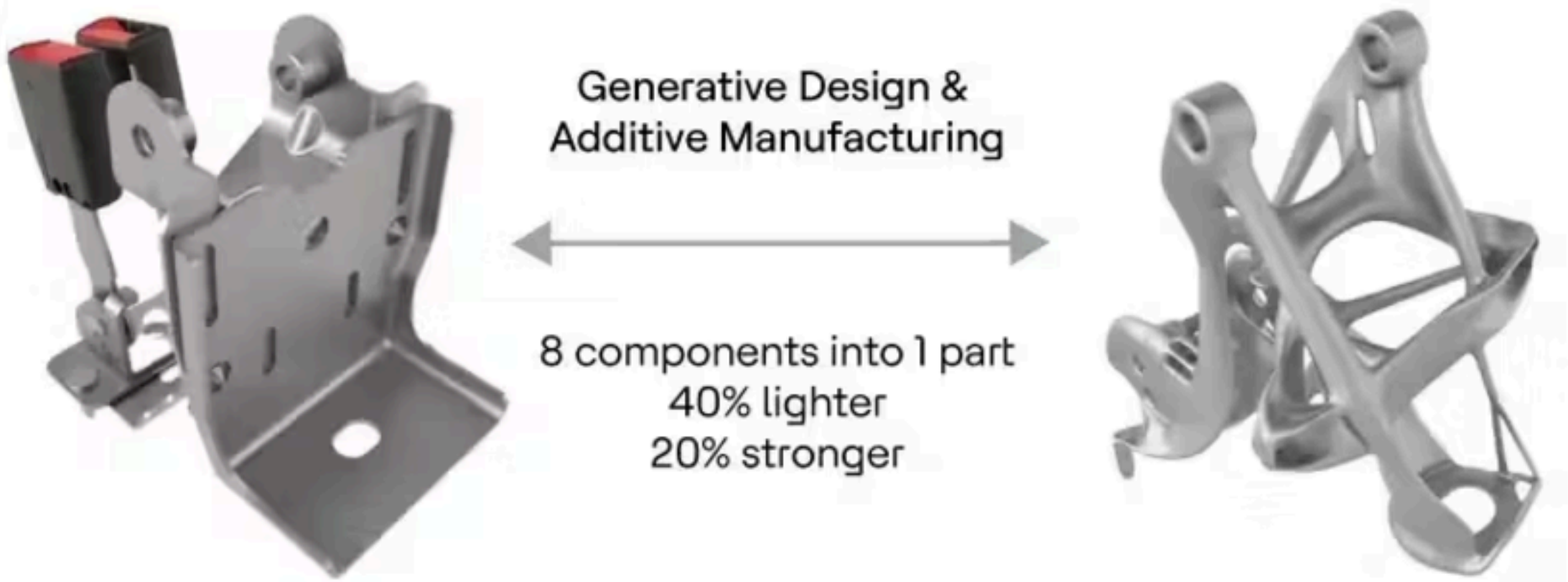



**Illustration of traffic network, control, optimization, and management using LLMs.**

# 8. Product Design & Development

According to a report by **McKinsey**, companies implementing AI in product design can achieve a **10% to 30%** improvement in engineering efficiency.

**General Motors (GM)** partnered with **Autodesk** to use generative design software in vehicle development. This approach allowed GM to create components that are **40%** lighter and **20%** stronger than traditional parts, improving both performance and efficiency.



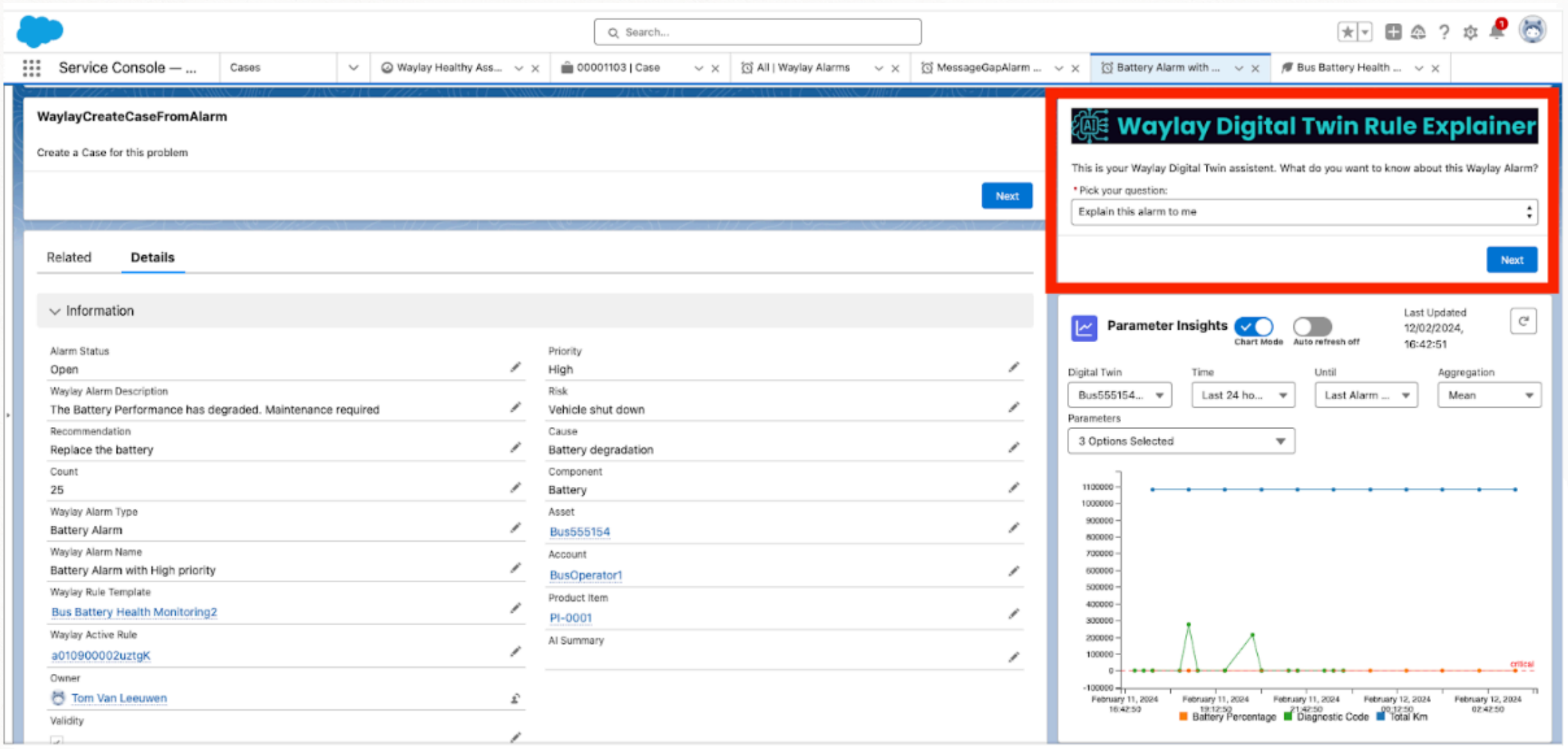

**Buoy App**

# 9. Maintenance

Traditional predictive maintenance systems face challenges in delivering clear, human-readable, and multilingual explanations for alarms, making it difficult for operators to efficiently understand and address the issues.

An LLM can can provide human-readable, multilingual answers to alarms explaining the conditions checked, the parameter values evaluated, and the recommended actions in a clear and actionable manner.

**Waylay** is one such company working for this exact use case.



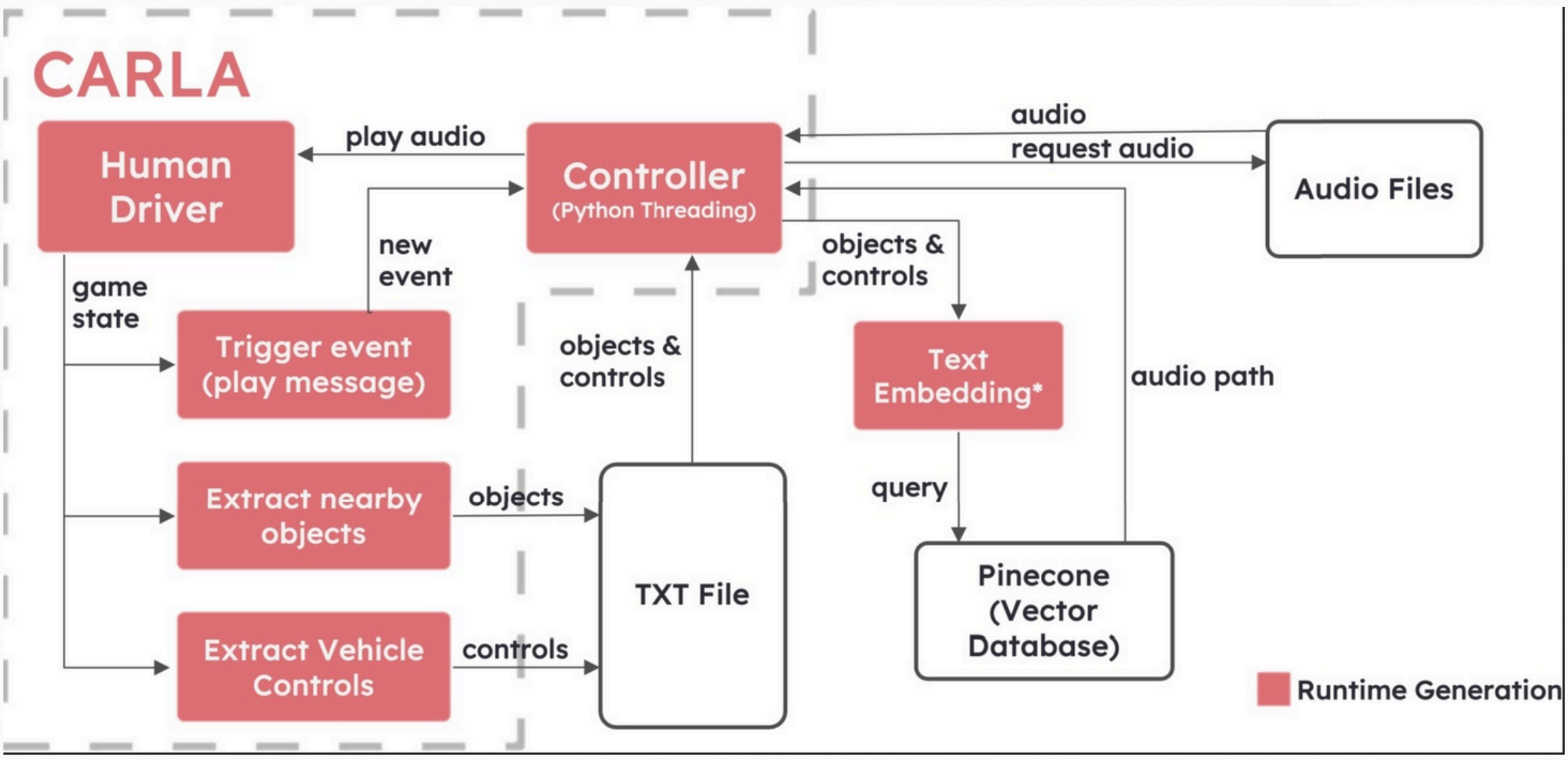

**Waylay Twin Assistant Built on Salesforce**

# 10. Drive Simulation

**CARLA** is an open-source driving simulator that enables the development and testing of autonomous driving systems.

It offers realistic simulations of traffic, weather, and road conditions, allowing developers to train AI models in a controlled environment.

With high-fidelity sensors like cameras and LIDAR, CARLA helps test and improve driving algorithms, particularly for detecting and addressing anomalies in driving scenarios.




**Real time driving simulation with LLM assistant**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