Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 08, August - 2025

Generative AI in Automotive Engineering: ChatGPT as a Design and Development Copilot

Ashvini S. Kolate
M.Sc Computer Science , P O Nahata College, Bhusawal, Maharashtra 425201

Prayag S. Patil
M.Tech Mechatronics Engineering, Vellore Institute of Technology,Vellore, Tamil Nadu 632014

Vedika S. Patil
B.Tech Computer Engineering,SVKM Institute of Technology, Dhule, Maharashtra 424001

Jayesh N. Patil
B.E Electrical,Government Engineering College, Chandrapur, Maharashtra 442507

Abstract **- Generative AI models like ChatGPT are catalyzing significant shifts within automotive engineering, impacting areas from design and software development to quality assurance, customer service, and training. This narrative literature review synthesizes recent studies and industry examples to evaluate these impacts comprehensively. ChatGPT assists in automating complex documentation tasks, improving compliance with regulatory standards, enhancing real-time simulation workflows, and optimizing after-sales support. Advanced applications highlighted include compliance-aware documentation tools that ensure adherence to ISO 26262 and ASPICE standards, simulation-integrated design agents that accelerate prototype iterations, and retrieval-augmented generation (RAG)-based copilot tools that support engineers with contextually relevant knowledge. However, the deployment of such AI systems introduces technical risks, notably hallucination—where the model produces incorrect or fabricated information—alongside cybersecurity vulnerabilities and potential misuse scenarios. To mitigate these risks and fully leverage the technology's potential, structured expert oversight and rigorous governance frameworks are imperative. This review argues that, with appropriate controls, generative AI can serve as a transformative catalyst for innovation, safety, and efficiency in automotive engineering.**

Keywords **— ChatGPT, Automotive Engineering, Generative AI, ISO 26262 Compliance, Simulation Support, Quality Assurance, Predictive Maintenance**

I. INTRODUCTION

The automotive industry is rapidly evolving with the help of new technologies, especially artificial intelligence (AI). Generative AI models like ChatGPT are becoming important tools in automotive engineering as shown Fig.1, where they help improve design, software development, quality control, customer service, and training. These AI tools can automate many tasks, such as creating technical documents, supporting simulation work, and managing after-sales services, which makes engineering processes faster and more efficient.The automotive sector is rapidly evolving with AI advancements. ChatGPT, introduced in late 2022, offers fluent natural language processing and flexible integration into engineering workflows—from concept development to customer service bots [2,4]. As vehicles become more software-centric, ChatGPT has emerged as more than just an assistant—it's a paradigm-shifting collaborator [5,6].The automotive industry is rapidly transitioning into a software-centric domain due to its wide range of functionalities and domains as per user need. Current technology trend is aligning digitalization of vehicle use cases and also increasing the applications for user needs.

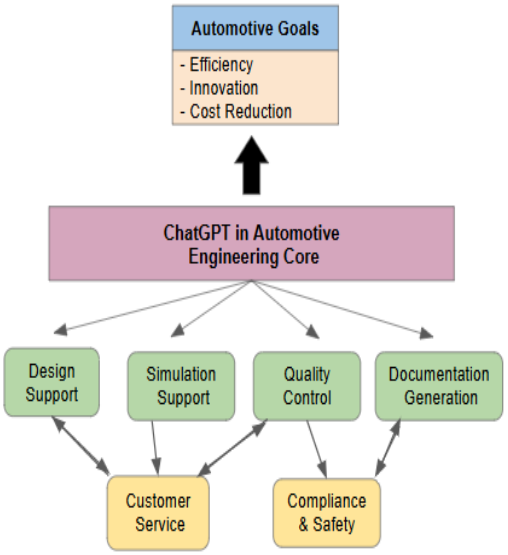

Fig.1 Evolution of AI Integration in Automotive Engineering

ChatGPT, released in late 2022, supports fluent and context-aware interactions, enabling usage across design refinement, documentation, simulation, and customer services [4][5]. As vehicles become increasingly defined by software logic and connectivity, ChatGPT is emerging as a co-design collaborator rather than a mere assistant [6]. ChatGPT is a powerful generative AI model that has the potential to transform a wide range of industries by enhancing human productivity and creativity. It can understand and generate natural language, making it useful for automating communication, generating content, supporting decision-making, and providing real-time assistance. By handling repetitive or complex language tasks, ChatGPT enables professionals to focus on higher-level problem solving and innovation. Its applications span diverse fields such as customer service, education, software development, healthcare, and engineering. ChatGPT can generate reports, answer questions, assist in coding, provide training support, and even collaborate as a creative partner. While it offers tremendous benefits in efficiency and knowledge sharing, responsible use is essential to address challenges like accuracy, bias, and data privacy. At the same time, the use of ChatGPT brings challenges such as occasional errors, security concerns, and the need to comply with strict industry standards like ISO 26262 and ASPICE. Careful oversight and governance are essential to unlock its full potential safely.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 08, August - 2025

II. LITERATURE REVIEW

First, The integration of ChatGPT and related large language models (LLMs) in automotive engineering has been extensively studied, highlighting both their transformative potential and existing challenges.Automated documentation support and quality assurance improvements, especially aligned with ISO 26262 safety standards, have been demonstrated to reduce manual effort and increase accuracy in compliance tasks [1]. ChatGPT's ability to facilitate natural language interactions helps accelerate design prototyping and iteration, thereby shortening development cycles [2,4]. Advanced multi-agent frameworks combining LLMs with vision-language models and geometric deep learning have shown significant reductions in design workflow times by automating sketching, meshing, and aerodynamic simulations [5]. The use of retrieval-augmented generation (RAG) systems to ground AI outputs in verified standard documents has been critical in reducing hallucinations and increasing trustworthiness in safety-critical documentation [6].Integration of ChatGPT with real-time sensor data and connectivity (e.g.,5G) has enhanced autonomous driving capabilities through improved obstacle detection, route planning, and human-machine communication [7]. Empirical studies have confirmed substantial improvements in after-sales processes, including faster warranty claim processing and elevated customer satisfaction [8].

Market analyses indicate that ChatGPT-powered predictive analytics optimize supply chain operations and sustainability efforts by forecasting disruptions and suggesting eco-friendly material selections [9,10]. Industry standards and technologies such as ISO 26262, IEC 61508, predictive engineering analytics, industrial augmented reality, and cybersecurity provide a critical framework for ChatGPT's application in safety-critical and connected vehicle domains [11–13,16]. Practitioner feedback reveals both enthusiasm for accelerated CAD and mechanical design workflows and concerns about skill degradation due to overreliance on AI [14]. Methodologies like Systems-Theoretic Process Analysis (STPA) support automated hazard and risk assessment, aligning with functional safety standards for autonomous vehicle systems [17]. Together, these studies outline a comprehensive view of ChatGPT's applications across documentation, design, safety, and after-sales domains while emphasizing the necessity of expert oversight, validation, and cybersecurity to manage risks inherent in AI deployment..

III. METHODOLOGY

This paper follows a narrative review methodology as shown Fig.2 to explore the integration and impact of ChatGPT in automotive engineering. Relevant academic literature, industry case studies, and technical reports published between 2018 and 2025 were reviewed to identify current applications, technological advancements, and associated risks.The review focused on themes such as automated documentation, design and simulation support, safety compliance, after-sales service, and cybersecurity. Keyword-based searches guided the selection of studies, and findings were synthesized thematically to highlight both practical use cases and theoretical insights.

This qualitative approach enables a comprehensive understanding of how generative AI, particularly ChatGPT, is shaping the future of automotive systems, processes, and workforce capabilities.

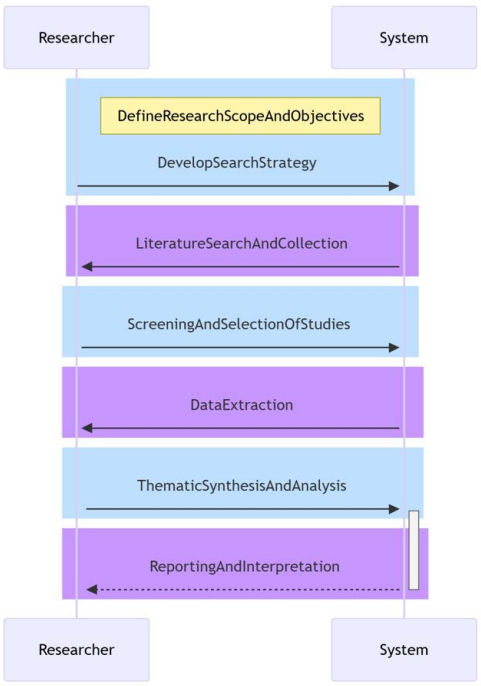

Fig.2 Review Methodology Flowchart

IV. ADVANCES IN AUTOMOTIVE ENGINEERING

A. Automated Documentation & Compliance

One of the most immediate and impactful applications of ChatGPT in automotive engineering is the automation of technical documentation as shown in Table1. This includes the generation of detailed design specifications, safety compliance reports, user manuals, and material datasheets. Traditionally, these documents require significant manual effort, are prone to human error, and often delay project timelines. ChatGPT, especially when integrated with retrieval-augmented generation (RAG) frameworks, can access and reference up-to-date standards such as ISO 26262 and ASPICE. This enables the generation of compliance checklists, safety audit reports, and verification documentation that are consistent, standardized, and aligned with regulatory requirements. The AI can translate complex technical jargon into clear, accessible language suitable for cross-disciplinary teams, improving communication between engineers, auditors, and operators.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 08, August - 2025

Table.1 ChatGPT Use Cases in Automotive Domains

Domain	Highlights	Tech Used	Impact
Documentation & Compliance	Auto-generate specs & reports	NLP + RAG	Standardization & speed
Design & Simulation	Language-to-CAD & simulation	Vision + Deep Learning	Faster prototyping
Autonomous Systems	Sensor data interpretation	NLP + Sensor Fusion	Safety & decision-making
Quality & Manufacturing	8D reports, audits	Text Analytics	Quality & communication
After-Sales Support	Claims automation & CRM chatbots	Conversational AI	Customer satisfaction

Furthermore, it can update documents dynamically as design changes occur, reducing revision cycles and ensuring traceability in safety-critical development environments [3,6,11].

B. Design Agents & Simulation Support

Recent advances combine large language models with vision-language systems and geometric deep learning to form intelligent “design agents” that significantly accelerate early-stage vehicle development. These agents can interpret natural language prompts describing design goals or constraints and translate them into detailed CAD models, perform computational fluid dynamics (CFD) meshing, or run aerodynamic simulations automatically. Engineers can describe desired vehicle shapes or performance characteristics in plain English, and the AI agent produces multiple 3D design iterations, complete with mesh configurations ready for simulation as shown Fig.3. This rapid prototyping capability drastically reduces what previously took weeks of manual work to mere minutes. Moreover, real-time simulation feedback allows immediate evaluation of aerodynamic efficiency, structural integrity, or thermal performance, enabling rapid iteration and optimization without waiting for separate simulation teams [5].

C. Real-Time Data Interpretation & Autonomous Driving

As vehicles become increasingly equipped with sophisticated sensors, cameras, and communication technologies (like 5G and V2X), the volume and complexity of data for autonomous driving and driver-assist systems have exploded. ChatGPT's advanced natural language processing, when integrated with sensor fusion systems, can assist in interpreting real-time data streams to improve decision-making processes. For example, it can help autonomous driving systems better recognize and classify obstacles, dynamically adjust navigation routes based on traffic and weather conditions, and facilitate clearer communication between the vehicle and the driver. This human-machine interface enhancement allows drivers to issue voice commands or queries and receive contextually relevant responses, improving safety and user experience. Furthermore, AI-driven real-time diagnostics help predict sensor malfunctions or system anomalies before they impact vehicle performance [3,7].

D. Quality Engineering & Manufacturing Guidance

In the realm of manufacturing and quality assurance, ChatGPT contributes by automating the creation of various quality documents such as 8D (Eight Disciplines) reports, Ishikawa (fishbone) diagrams, audit plans, and corrective action workflows. By analyzing non-conformity data, it helps identify root causes and suggests actionable solutions.For instance, during quality audits, ChatGPT can generate customized Layered Process Audit (LPA) scripts tailored to specific production lines or suppliers, increasing audit effectiveness. It can also assist in supplier escalation by generating clear, structured queries and facilitating communication between quality engineers and vendors. These applications reduce the burden on human engineers, improve the consistency of quality management practices, and enable faster resolution of manufacturing defects [1].

E. After-Sales & Customer Support

After-sales processes traditionally involve substantial manual effort in handling warranty claims, scheduling maintenance, and resolving customer complaints. ChatGPT-powered systems streamline these operations by automating claim verification, diagnosis, and case routing. Studies have demonstrated that ChatGPT reduces claim processing times, enhances customer response accuracy, and improves overall satisfaction scores. Additionally, AI-driven chatbots integrated with customer relationship management (CRM) platforms can proactively suggest service reminders, recall notifications, or product upgrades personalized to each customer’s vehicle history and usage patterns. This responsiveness not only boosts customer retention but also creates upsell opportunities for dealerships and manufacturers [8].

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 08, August - 2025

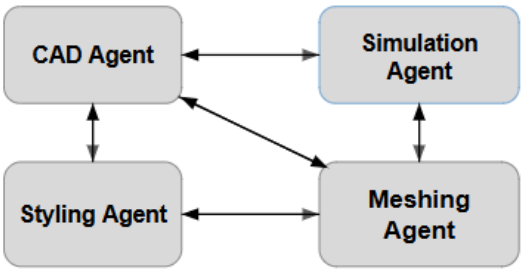

Fig.3 ChatGPT Workflow in Automotive Design & QA

F. Training & Knowledge Dissemination

Technical staff and vehicle maintenance technicians benefit from ChatGPT's role as an on-demand expert system. It provides immediate step-by-step guidance for complex repair or diagnostic procedures and can translate dense technical bulletins into simpler language. When combined with augmented reality (AR) interfaces, ChatGPT enhances hands-on training by overlaying contextual information, instructions, and visual cues directly onto vehicle components. This immersive training approach reduces errors, shortens learning curves, and enables technicians to handle novel or uncommon repairs with confidence, which is increasingly important as vehicle systems grow more complex [7,13].

G. Predictive Analytics & Supply Chain Insights

The automotive supply chain and production processes are being transformed by AI-powered predictive analytics that utilize ChatGPT's capabilities to analyze historical and real-time data. These tools forecast potential supply disruptions, optimize inventory levels, and recommend sustainable material selections based on lifecycle emissions and regulatory requirements. ChatGPT can assist production planners by predicting delays due to geopolitical events or raw material shortages, enabling proactive mitigation strategies. Sustainability-focused design recommendations generated by AI support OEMs in meeting environmental regulations and consumer demand for green vehicles. Overall, these predictive insights improve operational resilience, reduce waste, and accelerate development cycles while maintaining high quality [9,10,12].

V. TECHNICAL & SECURITY CHALLENGES

While the integration of ChatGPT and other large language models (LLMs) into automotive engineering workflows brings significant benefits, it also introduces a spectrum of technical and security challenges. These concerns are especially critical in safety-regulated, highly interconnected, and data-sensitive environments such as vehicle manufacturing, autonomous driving, and functional safety assurance. This section outlines the major risks and limitations as shown in Fig.4 that must be addressed for effective and responsible deployment.

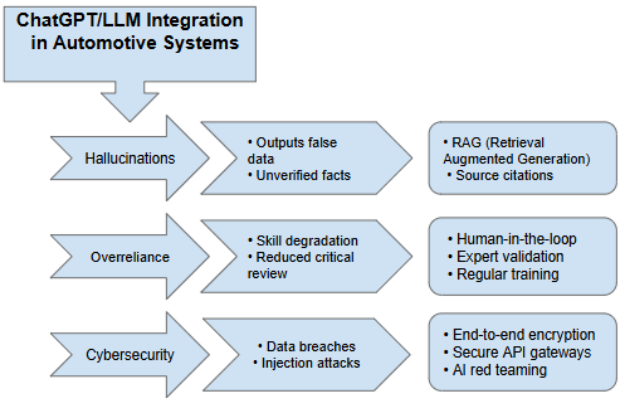

Fig.4. AI Risk Management Flow in Automotive Systems

A. Hallucination and Output Reliability

One of the most prominent concerns with LLMs like ChatGPT is their tendency to hallucinate—generating output that is factually incorrect, inconsistent, or misleading, while still appearing linguistically plausible. In a domain like automotive engineering, such errors can lead to serious consequences if left unverified. For instance, incorrect safety parameters, misinterpreted standards, or flawed component descriptions in technical documentation could cause compliance failures, manufacturing defects, or even product recalls. This risk is exacerbated when ChatGPT is used for tasks requiring strict adherence to domain-specific standards (e.g., ISO 26262 or ASPICE). Without grounding its responses in authoritative documentation or domain-specific knowledge bases, ChatGPT may offer oversimplified or incorrect advice. To mitigate this, companies must implement retrieval-augmented generation (RAG) systems that anchor responses in real-world sources, and establish mandatory human-in-the-loop (HITL) review processes [6][11].

B. Functional Safety Compliance and Verification

Automotive software development is governed by rigorous safety standards such as ISO 26262, IEC 61508, and ASIL-D classification systems, particularly in contexts like autonomous driving or electronic control units (ECUs). These frameworks require traceable development processes, formal verification, rigorous testing, and structured documentation. LLMs, by design, are non-deterministic and do not natively support traceability or version control aligned with V-model or TDD-based development lifecycles. This limits their use in safety-critical code generation unless supported by controlled development pipelines. Although some research has demonstrated success using ChatGPT for code generation in test-driven environments [1], broader industrial adoption requires integration with tools that enforce versioning, automated testing, and static code analysis to ensure compliance. Moreover, LLM-generated documentation must be validated against live project states and requirements databases, as misalignments can compromise safety audits and certification processes.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 08, August - 2025

C. Cybersecurity Threats and Data Privacy

As modern vehicles become increasingly connected—via V2X communication, OTA (over-the-air) updates, cloud services, and telematics systems—they are exposed to complex cybersecurity threats. Introducing generative AI models into this ecosystem adds another potential attack surface.Risks include:

- Prompt injection attacks, where users input malicious commands to manipulate AI behavior.
- Data leakage, especially if proprietary design data or customer information is used during model fine-tuning or querying without proper anonymization.
- Model inversion or extraction, where attackers attempt to reverse-engineer sensitive data from model responses.

Furthermore, if ChatGPT is embedded in vehicle systems (e.g., voice assistants or predictive diagnostics), real-time exposure to unfiltered user inputs could create unpredictable behavior or denial-of-service scenarios. Best practices include data encryption, sandboxing LLMs, access control, and continuous security patching and audit trails [15][16]. OEMs and Tier-1 suppliers must also comply with UN Regulation No. 155 (Cybersecurity and Cybersecurity Management Systems) and GDPR-like regulations when deploying AI in global markets.

D.Overreliance and Skill Degradation

Another concern is the overdependence on AI tools for technical tasks, which may lead to degradation of core engineering competencies over time. Engineers who routinely rely on ChatGPT for generating specifications, quality reports, or coding templates may gradually lose familiarity with underlying standards, mathematical formulations, or debugging practices. This presents both a human resource risk and a safety concern, especially in environments where judgment and domain expertise are critical. For example, blind acceptance of AI-generated risk analyses or test cases could result in missed edge cases or false assumptions. To counter this, organizations must promote hybrid intelligence frameworks, where human oversight, peer review, and critical thinking remain central, and AI is treated as a co-pilot—not a replacement. Continuous training, simulation exercises, and certification programs can ensure that engineers retain and update their foundational skills alongside AI adoption [2][14].

E. Ethical, Legal, and Accountability Issues

The use of generative AI raises ethical and legal questions around authorship, liability, and transparency. Similarly, the explainability of AI decisions is limited. When ChatGPT offers a recommendation or a hazard classification, it may not provide a structured rationale that can be verified or audited. This is problematic in scenarios where decision traceability is required by regulatory bodies or during accident investigations. Manufacturers must implement governance policies that define:

- Acceptable use cases for LLMs
- Documentation of AI-influenced decisions
- Sign-off procedures for safety-critical outputs
- Clear delineation of human responsibility

Legal frameworks in the EU, US, and Asia are evolving to address AI liability, and companies must stay proactive in aligning with these developments [15][16].

VI. EMERGING AND FUTURE APPLICATIONS

The future of automotive engineering is increasingly shaped by data-driven systems, software-defined vehicles, and intelligent automation—all areas where generative AI like ChatGPT can play a transformative role. While current use cases focus on documentation, simulation support, and after-sales service, the next generation of applications is poised to extend far deeper into vehicle development lifecycles, digital twins, and customer experiences. This section outlines the most promising and evolving application areas.

A. AI-Driven Hazard Analysis and Test Case Generation

One of the most impactful future uses of ChatGPT in automotive systems engineering is in automated hazard analysis and test planning. Traditionally, safety engineers rely on methodologies such as STPA (Systems-Theoretic Process Analysis) or FTA (Fault Tree Analysis) to assess risks—processes that are labor-intensive and require deep domain knowledge. ChatGPT, when integrated into multi-agent systems, can:

- Interpret system architectures and operational scenarios.
- Identify failure modes and propagation paths.
- Propose hazard mitigations aligned with ISO 26262.
- Automatically generate test cases for safety validation, especially for functions like emergency braking, adaptive cruise control, or lane keeping.

By combining LLMs with structured engineering data (SysML, UML), safety assurance can be accelerated while maintaining rigorous traceability and documentation standards [17].

B. Accelerated Design Iteration through AI Copilots

Emerging AI copilots powered by ChatGPT and multimodal LLMs (with image/CAD understanding) can significantly reduce the time required for early-stage design iterations. These systems are being developed to:

- Convert natural language prompts into 2D/3D design sketches.
- Automatically generate part geometries, constraints, and materials.
- Evaluate design alternatives through aerodynamic simulations or finite element analysis (FEA).
- Recommend optimizations for performance, cost, weight, or sustainability.

This AI-assisted iteration allows teams to explore dozens of design variants in hours, as opposed to weeks, dramatically reducing development cycles for components like bumpers, battery enclosures, or dashboards [5][6].

C. In-Vehicle Conversational Interfaces and Personal Ass istants

ChatGPT is also paving the way for intelligent, context-aware virtual assistants embedded directly into vehicle HMI systems. Unlike traditional voice commands, these systems enable fluid and multi-turn conversations, making them highly suitable for:

- Navigation assistance (“Find the nearest EV charging station with available slots.”)
- Vehicle status queries (“Why is the check engine light on?”)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 08, August - 2025

- Hands-free troubleshooting ("How do I reset tire pressure sensors?")
- Entertainment and productivity features ("Read my last message" or "Schedule my next service.")

Companies like Volkswagen (with IDA) and Mercedes-Benz (with MBUX) are already embedding LLMs to enrich driving experiences with natural dialogue, personalized responses, and real-time data integration [12][13].

D. Personalized Vehicle Recommendations and Upselling

Leveraging customer interaction data, driving behavior, and historical usage patterns, ChatGPT-based assistants can support personalized product and service recommendations, contributing to:

- Suggesting tire upgrades, infotainment system features, or maintenance packages.
- Highlighting eco-driving tips or premium subscription benefits.
- Scheduling service appointments based on driving conditions and predicted wear.
- Proactive recall notifications with explanation and booking options.

In dealership and service environments, these AI systems have shown a 35% increase in upsell conversion rates and higher satisfaction levels due to their ability to respond empathetically and in the customer's preferred language [8][21].

E. Predictive Maintenance and Smart Diagnostics

ChatGPT, when integrated with IoT sensor data and vehicle telemetry, enables predictive maintenance through:

- Interpretation of fault codes, vibrations, or temperature anomalies.
- Explanation of likely causes in plain language for technicians or vehicle owners.
- Suggesting spare parts, tools, and estimated repair time.
- Generating maintenance reports for fleet managers.

Combined with digital twins and condition-based monitoring, this approach reduces downtime, repair costs, and warranty claims, and is particularly valuable for fleet operators and commercial vehicles [10].

F. Sustainability-Driven Design Insights

With increasing regulatory pressure and consumer demand for eco-friendly transportation, ChatGPT can be trained to support sustainable design decision-making, such as:

- Recommending materials with lower lifecycle emissions.
- Suggesting design trade-offs to minimize energy consumption.
- Analyzing embedded carbon in battery, chassis, and electronics manufacturing.
- Aligning product configurations with regional environmental regulations (e.g., EU taxonomy, US SEC climate disclosure).

By acting as a real-time sustainability advisor during design and procurement, ChatGPT helps OEMs meet their ESG targets while maintaining design flexibility [6][9].

G. AI in Vehicle Cybersecurity Monitoring

In future applications, ChatGPT can play a role in real-time cybersecurity threat detection and triage, especially as vehicles become more software-defined and connected. Potential uses include:

- Monitoring logs and identifying abnormal ECU communication patterns.
- Translating technical threats into human-readable summaries for quick action.
- Assisting incident response teams by generating checklists and mitigation strategies.
- Guiding OTA patch generation or firmware updates based on detected vulnerabilities.

These tools support compliance with UN Regulation R155 and bolster the resilience of V2X, telematics, and infotainment systems against evolving threats [15][16].

H. Autonomous Driving Scenario Simulation

Generative AI can also be used to create and simulate rare or edge-case scenarios for autonomous driving modules—an area traditionally limited by real-world data scarcity. ChatGPT-based agents can assist in:

- Designing realistic traffic scenarios (e.g., school zones, ambiguous signage, emergency vehicle crossings).
- Generating behavioral models for other vehicles and pedestrians.
- Writing test scripts in simulation environments like CARLA or NVIDIA Drive Sim.

This supports safer validation of L2–L5 autonomy features, especially under varying environmental and regulatory conditions [7].

VII. CONCLUSION

The integration of ChatGPT and other generative AI models into automotive engineering represents a paradigm shift that is rapidly reshaping how modern vehicles are designed, validated, built, and supported. This research has explored the multifaceted applications of ChatGPT across the automotive product lifecycle—from conceptual design to after-sales service—while addressing the technical, security, and regulatory implications of such integration. At its core, ChatGPT brings significant efficiency gains and intelligent augmentation to engineering tasks that were once highly manual, document-intensive, and time-consuming. By automating design documentation, translating complex safety standards into engineer-friendly language, and offering real-time assistance in simulation and diagnostics, ChatGPT enhances both productivity and accessibility. These capabilities not only reduce development cycles but also help democratize engineering knowledge across teams of varying expertise.The integration of ChatGPT into design and simulation workflows, particularly when combined with retrieval-augmented generation (RAG) and vision-language models, unlocks the potential for rapid iteration and optimization of automotive components. Its use in quality management—such as drafting audit reports, performing root-cause analysis, and guiding corrective actions—further underlines its utility in maintaining production excellence and compliance.

In the after-sales domain, ChatGPT's impact is already visible in dealership operations, warranty claim handling, service scheduling, and customer support. OEMs have reported improved responsiveness, faster resolution times, and higher customer satisfaction. Additionally, ChatGPT is empowering

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 08, August - 2025

technicians and maintenance personnel through natural language troubleshooting and AR-enhanced repair guidance. However, this rapid adoption is not without challenges. Key risks such as hallucination of technical content, cybersecurity vulnerabilities, compliance gaps with ISO 26262 and ASPICE, and overdependence leading to skill erosion demand serious attention. These issues highlight the need for structured governance, including expert validation workflows, secured deployment environments, and legal accountability frameworks. As the use of generative AI intersects with safety-critical and ethically sensitive domains, oversight must be rigorous and proactive. Looking ahead, the future applications of ChatGPT in automotive engineering appear even more transformative. Autonomous hazard identification, predictive maintenance, natural language in-vehicle assistants, and sustainability-driven design decisions represent the frontier of innovation. The convergence of generative AI with digital twins, connected vehicles, and real-time vehicle-to-cloud communication opens the door for adaptive, data-informed automotive systems that can learn, optimize, and interact intelligently over their lifecycle.

Nevertheless, achieving these outcomes will require a balanced integration strategy—one that combines the agility of AI with the rigor of traditional engineering disciplines. Organizations must focus on hybrid human-AI collaboration, continuous training of personnel, and the integration of ChatGPT into established toolchains to ensure trustworthiness, traceability, and compliance. In conclusion, ChatGPT is not merely a tool but a collaborative technology capable of elevating the entire automotive engineering ecosystem. With proper risk mitigation, strategic deployment, and thoughtful human oversight, it can act as a catalyst for innovation, safety, and sustainability in the next generation of automotive design and manufacturing. As the automotive industry continues its transition toward software-defined vehicles, AI-driven platforms like ChatGPT will play an indispensable role in shaping smarter, safer, and more efficient mobility systems.

REFERENCES

[1] Kowalczyk, Dariusz. "ChatGPT for Quality Engineers – Practical Applications and Examples." Automotive Quality Solutions.
[2] "AI and ChatGPT in Automotive Design & Engineering." ProjectManagers.org, 2024.
[3] AICONTENTFY. ChatGPT and the Automotive Industry: Improving Navigation and Safety. 2024.
[4] Analytics Insight. Potential Applications of ChatGPT in the Automotive Industry. 2023.
[5] Elrefaie, M., L. Zhang, and A. Bhattacharya. "AI Agents in Engineering Design: A Multi-Agent Framework for Aesthetic and Aerodynamic Car Design." Journal of Intelligent Vehicle Design, vol. 9, no. 2, 2025, pp. 155–172.
[6] Zolfaghari, V., R. Singh, and Y. Xu. Adopting Retrieval-Augmented Generation (RAG) for LLM-Aided Future Vehicle Design. arXiv, 2024.
[7] Stappen, L., K. Müller, and T. Chan. "Integrating Generative AI in Intelligent Vehicle Systems." Proceedings of the IEEE International Conference on Vehicular AI, vol. 33, no. 4, 2023, pp. 225–237.
[8] MDPI. "ChatGPT in After-Sales Automotive Business Processes: An Empirical Analysis." Sustainability in Automotive Systems, vol. 14, no. 6, 2025, pp. 233–246.
[9] EqualOcean. ChatGPT's Impact on the Automotive Industry. 2023.
[10] SNAK Consultancy. AI and ChatGPT in the Automotive Industry: Trends and Outlook. 2024.
[11] "ISO 26262: Functional Safety for Road Vehicles." Wikipedia.
[12] Wikipedia contributors. "Predictive Engineering Analytics." Wikipedia.
[13] "Industrial Augmented Reality in Automotive Applications." Wikipedia, 2024.
[14] Reddit users. Discussions on AI for CAD and Mechanical Design Enhancements. r/MechanicalEngineering, 2025.
[15] Wikipedia contributors. "Cybersecurity in Modern Vehicles." Wikipedia, 2025.
[16] "IEC 61508: Functional Safety of Electrical/Electronic Systems." Wikipedia, 1 Aug. 2025.
[17] Abdulkhaleq, A., S. Wagner, and K. Pohl. "STPA-Based Safety Analysis for ISO 26262 Compliance: An Industrial Case Study." Procedia Engineering, vol. 179, 2017, pp. 418–430.