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Operational Framework and Implementation of AI at Tesla Motors: An Emerging Power in the Manufacturing Sector

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ABSTRACT

This paper examines Tesla Motors' operational framework and the implementation of artificial intelligence in its vehicles. The study focuses on how Tesla has developed a distinctive market position through innovation in manufacturing, operational efficiency, and advanced AI-based vehicle systems. It also highlights Tesla's efforts to sustain growth while influencing transformation in the automotive industry. Tesla has built a strong operational strategy centered on innovation, streamlined production, and sustainable energy solutions. The company's manufacturing approach, supported by advanced technology and large-scale automation, has improved efficiency and strengthened its competitive position in the electric vehicle market. The study also shows that Tesla's AI-enabled features, such as Autopilot, intelligent chips, and sensor-based driving assistance, contribute to safety, convenience, and driver support.

Purpose: The purpose of the paper is to analyze Tesla's operational procedures in vehicle construction and examine the incorporation of artificial intelligence in Tesla vehicles. It aims to understand how these capabilities support Tesla's long-term business growth and technological leadership.

Design/Methodology/Approach: The paper is based on a descriptive and analytical review of Tesla's operational strategy, manufacturing practices, and AI-enabled vehicle technologies. It draws on secondary sources, company information, and existing literature to explain Tesla's production systems, AI chips, Autopilot functionality, and other smart features**.**

Research Limitations: The study is limited by its reliance on secondary data and publicly available sources. It does not include primary empirical testing, field observations, or direct technical evaluation of Tesla systems.

Practical Implications: The findings provide useful insight into how automation, AI, and operational efficiency can improve manufacturing performance and product differentiation. The paper may help researchers, managers, and automotive professionals understand the strategic value of combining innovation with sustainable production.

Originality/Value: The paper offers a useful overview of Tesla's operational model and AI integration, showing how technology, innovation, and strategic planning combine to support competitive advantage. Its value lies in presenting Tesla as a leading example of AI-based transformation in the automotive industry.

INTRODUCTION

The objective of this paper is to examine Tesla's approach to ensuring its own sustainable growth while also serving as a catalyst for change in the automotive industry and focusing on operational strategy and use of AI. It was observed that Tesla has successfully established a product with a distinct positioning in a highly competitive industry. However, despite the superiority of its products, Tesla was unable to fully capitalize on the potential demand due to the significantly lower prices offered by current market leaders who compete in a different vehicle class.

Musk's vision has particularly emphasized the manufacturing aspect of Tesla. To provide some context, Tesla, the company specializing in electric vehicles and clean energy, was established in 2003. Elon Musk, renowned for his involvement in SpaceX and the Boring Company, assumes the position of CEO and has played a pivotal role in the company's expansion and immense popularity. Tesla's current lineup of electric cars comprises the Model S, Model 3, Model X, and Model Y.[1] Tesla Motors is a renowned multinational corporation that operates globally. Despite its global presence, the retail offices of Tesla Motors do not house a large workforce. Instead, the company prefers to maintain a small team of trusted professionals in its international operations. This strategic decision is driven by the company's unwavering commitment to quality. The dedicated personnel at Tesla Motors prioritize the enhancement of organizational excellence and foster a culture of innovation. With a clear objective of attaining a leading position in the automotive industry, Tesla Motors has consistently demonstrated remarkable growth and surpassed even the most optimistic expectations of critics. However, the company currently faces a significant challenge in the form of battery production, as the existing product exhibits a notable flaw in terms of low energy density.[2]

OBJECTIVE

1. Analyse the operational procedures employed during the construction of Tesla vehicles.
2. Determine the incorporation of Artificial Intelligence within Tesla's vehicle systems.

TESLA'S OPERATION STRATEGY

The operational plan of a company encompasses a highly detailed blueprint that aims to provide a thorough and comprehensive understanding of how the organization will strive to achieve its goals and objectives. This plan delves into the specific tasks that the company will undertake daily to ensure the smooth operation of the business. Additionally, it sheds light on the firm's strategies and their implementation within the company's context, offering valuable insights. In the case of Tesla Inc., an operational plan has been developed to provide a clear overview of the company's overall functioning.

Tesla, known primarily for its electric vehicles, has expanded its operations to include sustainable solar energy solutions and batteries. This diversification showcases the company's commitment to revolutionizing the energy industry and reducing reliance on fossil fuels.

One of Tesla's notable achievements is its remarkable manufacturing technology and production process. The company has developed innovative techniques that have allowed it to streamline production and increase efficiency. This has not only resulted in higher-quality products but has also contributed to Tesla's ability to meet the growing demand for electric vehicles and renewable energy solutions. In the third quarter of 2020, Tesla reported exceptional performance, surpassing market expectations and solidifying its position as a leader in the industry. The company's revenue and vehicle deliveries exceeded

projections, demonstrating its ability to thrive even in challenging economic conditions. This success can be attributed to Tesla's continuous efforts to improve its manufacturing capabilities and optimize its supply chain.

Furthermore, Tesla's recent establishment of the world's largest die casting machine is a testament to its commitment to innovation and operational prowess. This machine, capable of producing large and complex parts for electric vehicles, showcases Tesla's dedication to pushing the boundaries of manufacturing technology. By investing in such advanced equipment, Tesla aims to further enhance its production capabilities and maintain its competitive edge in the market. The on-going manufacturing revolution at Tesla has significant implications for the industry as a whole. By developing efficient and sustainable manufacturing processes, Tesla is setting a new standard for the automotive and energy sectors. Other companies are likely to follow suit, adopting similar practices to reduce their environmental impact and improve operational efficiency.

Looking ahead, Tesla's manufacturing revolution is expected to continue driving its success and shaping the future of the industry. The company's commitment to sustainable energy solutions and its ability to innovate in manufacturing will likely lead to further advancements in electric vehicle technology and renewable energy production. As Tesla continues to expand its operations and refine its manufacturing processes, it is poised to maintain its position as a leader in the electric vehicle and sustainable energy markets.

AI FEATURES IN TESLA VEHICLES

AI integrated chips: Tesla aims to create AI integrated chips that will enable cars to navigate through freeways and even traffic. Approximately 6 billion transistors constitute the circuit of each Tesla chip. These Tesla chips are 21 times faster than the original Nvidia chips and 20% cheaper too. They have 32 megabytes of high-speed SRAM memory on the chip because of which fetching data is faster and easier compared to DRAM.

For better performance, Tesla automobile systems have two AI chips. Both the chips make separate assessments of the traffic and danger situation around the cars. The assessments are then matched, and the car is guided accordingly if the outputs are the same. If there is ambiguity in the outputs obtained from the chips, then revaluation is done until a safe and suitable decision is taken. Thus, dual chips will enable better control over the navigation in self-driving Tesla cars.

Autopilot – Autopilot features enable cars to steer, accelerate, and brake automatically in the lane. All new Tesla cars since 2016 come with Autopilot which includes Traffic-Aware Cruise Control and Autosteer features.

Working of Autopilot-It is built on the principles of deep neural network. It uses cameras, ultrasonic sensors, and radar to perceive the environment around the vehicle. The sensors and cameras provide the drivers with an awareness of the surroundings which are later processed in a matter of milliseconds to help make the driving safer and less stressful. Radar is used to see and measure the distance around the cars in light, dark, and different weather conditions. Ultraviolet techniques measure proximity in all the cases, and the passive video recognizes objects around the car and ensures safe drive. Also, autopilot is made for the driver’s assistance, and this feature does not turn Tesla into a self-driving car. Drivers are frequently reminded to keep their hands on the steering wheel. Failure to do so triggers a set of warnings to take hold of the wheel. If ignored further, the car starts to slow down and finally stops. Drivers can always override autopilot features by steering, applying brakes, or using cruise control stalk to deactivate.

Ref: https://xaltius.tech/artificial-intelligence-in-tesla-vehicles/

OTHER DISTINCT FEATURES IN TESLA CARS:

Design of AI chips– A Tesla AI chip has a very fast processor. It runs at 2GHz frequency and can perform up to 36 trillion operations per second. Software version 10.0– Following are the features of the latest software version of Tesla, Version 10.0:Tesla Theatre– The new version allows access latest OTT platforms and Tesla tutorial videos for learning more about the Tesla cars. A karaoke feature has also been added to the system. Smart summon– This version enables customers to purchase Full self-driving capability or Enhanced Autopilot to navigate during parking or reach a particular destination as long as the car is in the line of sight of the customer. Security– The sentry mode adds a unique protection layer to Tesla vehicles by monitoring the environment around the car when it is unattended. And the video clips taken while the vehicle is in sentry mode are also stored in the USB drive automatically. Browser access on Model 3 vehicles– Browsers and various apps can be accessed on Model 3 Standard Range and Standard Range Plus vehicles using Wi-Fi.360-degree visualisation-Tesla cars use a neural network to process 8 cameras placed in the system. They provide a 360-degree visualization of surrounding vehicles at up to 250 metres. These cameras provide a deeper understanding of objects around the automobile by giving access to views from different angles thus enabling a safer drive. Twelve updated ultrasonic sensors improve the vision by detecting both hard and soft objects around the vehicle

Batteries and propulsion system– Tesla cars use lithium-ion batteries. The nickel-cobalt-aluminium-lithium chemistry accounts for Tesla's long-range performance as these cylindrical batteries made of these expensive metals provide more energy density than the batteries in other battery-electric vehicles. And as far as the engines, these cars use electric motors that have two moving parts and single-speed transmissions that have no gears. Their drivetrains have 17 moving parts as compared to other BEVs which have about 200, thus making the Tesla cars unique.

Tesla has continuously strived to make compelling cars that are fast, look unique, and have the latest features that leverage security, safety and convenience. All in all, it can be concluded that in a pool of automakers, Tesla has emerged successfully as a leading AI-based automobile company.

CONCLUSION

Additionally, the data reveals that Tesla Motors has successfully positioned itself as a leader in the electric vehicle market. The company's focus on sustainability and environmental consciousness has resonated with consumers, leading to a strong brand image and increased market share. Moreover, the research indicates that Tesla Motors has effectively utilized social media and digital marketing strategies to engage with its target audience. By leveraging platforms such as Twitter, Facebook, and Instagram, the company has been able to create a strong online presence and generate significant buzz around its products.

In conclusion, the research and analysis conducted provide valuable insights into Tesla Motors' strategic approach, market positioning, and success factors. The company's focus on product and process innovation, collaboration with other companies, strong brand image, effective digital marketing strategies, commitment to continuous improvement, and

visionary leadership have all contributed to its status as a pioneering organization in the electric vehicle industry.

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