

IMPACT OF ARTIFICIAL INTELLIGENCE ON EV INDUSTRY AND PERCEPTUAL MAPPING IN INDIA

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Abstract

Introduction: Electric Vehicles are the upcoming largest share of the automotive industry. Adhering to sustainability and budget-friendly the E.V models are developing with every possible feature that would appeal to the world. In the Indian market, there are 12 Electric cars and 195 electric scooters circulated in different parts of India. **Objective:** The following research objectives were undertaken to understand the significance of A. I in the E.V industry, to understand the power of A. I in the ecosystem of E.V, to explore the methods of A. I used in E.V. **Methodology:** The Methodology Section provides the tools and techniques used in the research paper to investigate the research findings or solutions to the research problems. The researcher has used a secondary method for understanding the impact of Artificial Intelligence on the EV Industry. The researcher has taken information using secondary methods from different sources. **Results:** India's financial development is obvious for prosperous development due to various factors such as solid monetary extension, social change, rapid urbanisation, solid segment profits, and so on. India's advancement in the ease of carrying on with work records demonstrates the country's greater capacity to start and foster organisations.

Keywords: E.V, Electric Vehicle, Artificial Intelligence, Machine learning

1. INTRODUCTION

Today data is the biggest source of knowledge; humans cannot absorb the amount of Information present in today's world. Artificial Intelligence is the next level of Intelligence that makes things easier and can duplicate humans to a few extents. Electric Vehicles are the upcoming largest share of the automotive industry (Zhao et al., 2021). Adhering to sustainability and budget-friendly the E.V models are developing with every possible feature that would appeal to the world. In the Indian market, there are 12 Electric cars and 195 electric scooters circulated in different parts of India. The best part of these Electronic vehicles is that it is supported by A. I feature that makes an automatic driving experience and along with that it supports navigation systems and behaviour monitoring (Mithas et al., 2020). The algorithm of Artificial Intelligence in Electric vehicles provides real-time driving monitoring and provides optimization of the energy used, which would help for the extra driving range and give riders minimal panic attacks against the low battery.

1.1 Background

Machine Learning allows us to develop a cost-saving and time-saving approach to building a cost-effective and higher performance battery vehicle, the A. I am shaping up the future of battery-manufacturing vehicles. The study shows the recent market demand for E.V. The electronic vehicles are not only cost-effective but also environment-friendly and better alternatives for petrol and diesel-based automobiles. The A.I enables these Electronic vehicles to have smart features to monitor the real-time driving range. The smart grid charging and access points would appeal to a more target audience in the future (Chitra et al., 2020). The E.V models use V2G (Vehicle to a Grid), which is an additional income source for EV owners. This research paper highlights A. I used Electronic Vehicles in India. This article provides an analysis of Artificial Intelligence improving battery performance and changing efficiency and making it profitable for Manufacturers and Customers.

1.2 Literature Reviews

Khan et al., (2021)., suggests because of various factors like solid monetary extension, social change, quick urbanisation, solid segment profits, etc, India's financial development is obvious for prosperous development. India's advancement in the simplicity of carrying on with work records shows the country's more noteworthy capacity to begin and foster organisations. Atmanirbhar Bharat, or Self-dependent India, is a Make-in-India drive that supports youthful business people and conventional advancements like IoT, AI, and ML will be the vital elements in E-Mobility's future development, In both physically determined and driverless vehicles, AI and AI can assume a basic part. The vast majority of this will be coordinated with IoT and portable regulators and points of interaction. "Information dividing among gadgets, including vehicles, will turn into a reality, and information security will become basic," sooner rather than later. It mentioned the push on the possibilities of digitalization in India's automobile industry and its impact on the overall execution of the business. According to the review, digitization has had a significant impact on India's auto industry. Today, all strategic approaches are becoming digitalized, and when compared to home-grown car players, foreign players use cutting-edge innovation in their items. The acceptance of further developed innovation expands the auto item offer. It focuses on the quality of its products and after-sales service, which leads to client and brand trust among customers. According to Hemalatha et al., (2021) Counterfeit thinking (AI) is perhaps the most encouraging and persuading progression as of late, transforming people and altogether affecting essentially every part of the business world. While AI is accommodatingly and capriciously flourishing in all fields, the workforce isn't a special case for the standard. The main role of this examination is to research the effect that Artificial Intelligence (AI) is having on Human Resource chiefs' practices, especially on enlistment and choice in associations. The researcher focused on four AI capacities, in particular Natural Language Processing, Machine Vision, Automation, and Augmentation, and their effect on enlistment and decision interaction. The investigator gathered fundamental data on Chennai city from 141 IT labourers through an electronic audit. The expert moreover used helper data from outside sources (articles and reports) to show a piece of the disclosures about the impact of AI capacities on enrollment and assurance. According to the survey, the limits of

AI progresses like NLP, Machine Vision, Automation, and Augmentation through and influence the Recruitment and Selection Process, with possibly sure outcomes like time and cost save reserves, precision, tendency clearing, decreased liability, extended capability, and contender experience. Well-known EV models, for example, the Tesla Model S 100D have a normal scope of 355 miles, the Hyundai Kona has a normal scope of 198 miles, and the MG ZS EV has a normal scope of 214 miles. Besides range nervousness, charging time is additionally a wellspring of concern (Rigas et al., 2014). A Tesla station, for instance, requires 75 minutes to completely charge. The lithium-particle batteries utilised in EVs don't charge as fast as polymer batteries. To keep away from harm to the battery pack, battery engineers should test a wide scope of charging strategies to figure out which ones work best.

In the Research Paper of Ernst et al., (2019) they discussed, an overarching wave of innovation, fuelled by advancements in artificial intelligence (AI), has triggered widespread anxiety about unemployment and a growing income gap. This paper examines the purposes of these fears and offers a unique interpretation of AI and differentiates it from the past. According to the paper, there is the possibility of massive increments of inefficiency, including for non-industrial nations, because of the incomprehensibly reduced capital requirements demonstrated by some applications, as well as the ability to measure progress among the low gifted. Besides, for the advantages of AI-based innovative advancement to be extensively shared, dangers, for example, further expansions in imbalance should be tended to also. Abilities strategies are basic but inadequate. A new type of advanced economy regulation is also expected to prevent further market fixing, guarantee legitimate data protection and information assurance, and facilitate the sharing of benefits of development through benefit-sharing, (computerised) capital tax assessment, and a decrease in working hours. AI offers opportunities and risks, but policymakers and social partners must consider the unique characteristics of these new technologies.

The research paper of Reddy et al., (2020) focuses in light of the increase in fuel prices and the damaging effects of conventional gas motors on the environment. The auto industry is gradually switching to electrically controlled vehicles, rather than the traditional old fuel ignition motors. The report compares a conventional motor vehicle with an electric vehicle and examines the benefits and limitations of using electric vehicles. Further, the sun-powered charging idea has been integrated into electric vehicles, enabling environmentally friendly power charging. By utilising an electric vehicle as an alternative, this technique not only saves the environment, but it also reduces everyday working expenses. According to the views of Shelake et al., (2022), Environmental pollution and global warming have drawn increased attention to environmental protection in recent years. This has resulted in increased research focus on renewable energy sources such as solar and wind energy, as well as cutting-edge technologies such as electric vehicles. The transportation sector consumes approximately 18% of the total energy consumption in India. Over the last few years, there has been an increase in the Indian market for electric vehicles. However, the rate of growth has been slow; policy support has not been sufficient to fully realise the potential of the electricity market. Gas-powered vehicles continue to sell better than EVs. A number of advantages of electric vehicles is similar to those of natural cordial, including their non-contaminating nature, low operating

costs, and reduction in dependence on conventional fuel. Exorbitant costs, a complex charging infrastructure, and a limited range are just a few of the major issues with electric vehicles. When environmentally friendly power sources are unavailable, the advancement of new innovations in the EV sector provides an additional power source. Electric vehicles, according to industry leaders, will be the best option for the Indian public in terms of fostering a prosperous future. Ahmed et al., (2021) discuss the electricity of transportation is being heralded as a solution to reducing global ozone-depleting substance emissions and reliance on inefficient energy sources. Since around 2011, annual sales of electric vehicles (EVs) have increased, with 2.1 million EVs sold globally in 2019. This increase in sales is primarily due to ongoing improvements in the cost and execution of business EVs, expanded shopper EV options, and increased environmental consciousness. Regardless of the optimistic outlook, EVs face critical challenges that stymie their rapid and widespread adoption, such as limited driving range, long charging times, and a lack of adequate charging infrastructure. It discusses the recent advances in electric vehicles and related infrastructure, mainly in the area of artificial intelligence (AI), which makes EVs an attractive option for consumers. Analyzing and reviewing the use of AI to improve EVs, facilitate EV charging stations, and integrate EVs with smart grids. Next, the authors discuss future trends and prospects for this area.

1.3 Research Gap

Electric vehicles are available in the Indian Markets with high demand in recent years. The hike in petrol and diesel rates has increased the market shift from petrol-based and diesel-based automobiles to Electronic vehicles that are less expensive and environmentally friendly. The researcher adhered to identifying the role of Artificial Intelligence in enhancing the E.V models and how these attract more customers to stick to Electronic vehicles. Electronic vehicles are the revolutionary actions that make sustainability and technology go hand in hand to provide the customer better experience, here the researcher acknowledging the growing demand of Electronic Vehicles in the Indian market, choose the following research topic. As this area of research has limited resources and research, the researcher is bound by this topic to provide the readers with a general idea of Artificial Intelligence helping the growth of Electronic vehicles in the Indian Market. The paper would provide transparent views of battery performance and charging efficiencies of the Electric vehicle and role of machine learning helping the E.V model to be user-friendly and profitable for the business owners.

1.4 Research Question

1. What are the artificial intelligence (AI) methods used within electric vehicles?
2. How are Electric Vehicles Using A.I, results to Enhance Battery Performance and Charging Efficiency?

1.5 Importance of the Study

Every 5 in 30 people in India own an Electronic Vehicle (Khurana et al., 2020). More than 2500 vehicles have already been launched in the Indian Market. This study would provide a comprehensive understanding of the Artificial Intelligence or Machine Learning model used in

the E.V models and how this E.V stand unique in the market with the help of automation by A.I. Both Artificial Intelligence and Electronic Vehicles are the budding future of India. Therefore this study would provide the benefit and look at the method or technique of A. I used it in Electric Vehicles.

1.6 Research Objectives

The following research objectives are undertaken-

- To understand the significance of A. I in the E.V industry.
- To understand the power of A. I in the ecosystem of E.V.
- To explore the methods of A. I used in E.V.

1.7 Scope And Limitation

The scope of the paper would provide the use of Artificial Intelligence in Electric Vehicles. Here the researchers have understood the importance of Electronic Vehicles in today's market and focused on Machine learning enhancement for battery manufacturing vehicles. The paper would provide V2C business models ideas to the readers and highlights the best features added in the E.V with the help of Artificial Intelligence. This paper would also suggest the future of E.V in the Indian Market. The researcher follows the ethical standards of research guidelines and gathers information through Secondary sources, as it would be practically impossible to conduct primary research, as many E.V Manufacturers are from abroad. The limitations of this paper would be the accuracy of the information gathered and the results found in the study would be based on the research findings only. Therefore it cannot be used for generalisation or interpretation. However, it would enrich the knowledge of the readers and can be used for future reference studies.

2. RESEARCH METHODOLOGY

The Methodology Section provides the tools and techniques used in the research paper to investigate the research findings or solutions to the research problems. The researcher has used a secondary method for understanding the impact of Artificial Intelligence on the EV Industry. The researcher has taken information using secondary methods from different sources.

2.1 Research Method & Design

The Researcher has used the Qualitative method in the study. The necessary data for this study will be collected through research of all the relevant articles related to the research question. The researcher uses a descriptive design and explanatory research design to highlight the measure findings.

2.2 Research Approach

The research approach is the blueprint of research methodology and design. The research approach includes a collection of assumptions that guide the research to meet the requirement of the research and show a direction to the research. Here, based on the requirements of the

research problems, the researcher has undertaken a qualitative and secondary analysis to discuss in detail the impact of Artificial intelligence on the EV industry in India.

3. ANALYSIS OF STUDY

What are the artificial intelligence (AI) methods used within electric vehicles?

Electric vehicles are revolutionising transportation, and this one-of-a-kind book brings together the numerous areas that participate in the study that makes them feasible, ensuring that the reader is well-versed in all of the basic research and technology that are driving the transformation (Miao et al.,2019). The unparalleled choice to safeguard the globe from the nursery impact and other ecological difficulties is to foster an outflow-free portability framework. This conviction has brought about a gigantic expansion popular for electric vehicles (EV) and mixture electric vehicles (HEV), the two of which are supposed to have a splendid future as per the European Commission's Horizon 2020 points. This handbook orders studies in the EV/HEV field, as well as the lead role of strong proficiency approaches, joined with AI technology. This is achieved by gathering the consequences of various explorations for the EV/HEV idea in the electrical, gadgets, innovation, and designing fields. The book features the issue in the EV/HEV industry and gives functional cures that utilise the best AI draws near, to fill in as middle for information on such logical examinations. Since the promotion of EVs/HEVs inside the industry is yet a significant undertaking of value and productivity, those are the main two compromises that need to be investigated in addition to finding the best answer. Thus, the focal point of this book is on the



(Source:https://www.google.com/imgres?imgurl=https://autonexa.com/storage/uploads/2021/11/ather-grid-charging-network-studio-shot-6587_1637565722.jpg&imgrefurl=https://autonexa.com/bounce-to-launch-its-first-consumer-electric-scooter-on-2-december&tbnid=e_qyb80-0x_WtM&vet=1&docid=NYqF8mLse8uoXM&w=1280&h=864&itg=1&hl=en-IN&source=sh/x/im)

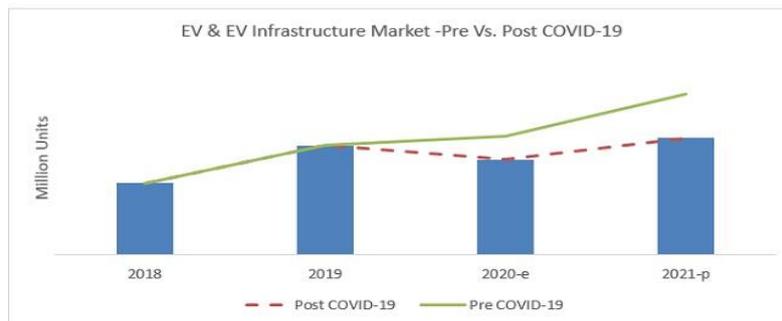
The union of different advancements utilised in EVs/HEVs. It likewise goes about as a significant reliable asset for multidisciplinary scientists and industry groups, as all nations will step by step move from ordinary interior combustion (IC) motor-based autos to EVs/HEVs before long. Batteries' endurance is a vital thought in every single component of a vehicle's life. The battery represents 25% of the complete expense of an electric vehicle, and nothing is

more essential than helping battery duration concerning EV headways. Man-made brain power has assisted dreams with working out as expected, for example, charging an electric vehicle in the time it takes to stop at a gas station, and it might likewise help work on different parts of battery innovation. The battery market as a whole is continuously growing in size. The Tesla S 100D, for example, has a range of 355 miles, the Hyundai Kona has a range of 198 miles, and the MG ZS EV has a range of 214 miles, but neither of those can be fully charged within an hour (Wei et al., 2021). For example, EVs will take 75 minutes to reach full charge at a Tesla fast-charging- charging station, while Indian participants in the EV market will need dozens of hours. Computerised reasoning is analysing battery utilisation, top off data, and building an arithmetical model to optimise fast-charging capacity without compromising vehicle life length, which is getting better endurance of the battery and life cycle of the board, including driving reach and charging time, as well as vehicle life range. It can likewise help speed up battery field research by speeding up the quest for further developed materials and testing," "Computerised reasoning is contributing significantly to the absolute battery upkeep in hardware," said the Founder Of teachers, when getting some information about the utilisation of AI in electric vehicles. It has been around for some time in cell phones, where AI assists with raising the charge of a battery, limiting the time it takes to charge, and broadening the battery's duration. For instance, AI screens the battery's temperatures and answers with security measures in case of overheating, and so on. It's likewise assisting with expanding the energy proficiency of electric vehicles."

How are Electric Vehicles Using A.I, results to Enhance Battery Performance and Charging Efficiency?

Whenever questioned concerning the work of AI in electric vehicles, the Founder of teachers expressed, "Computer-based intelligence is contributing altogether in the whole battery of the executives in gadgets." AI has been utilised in smart phones for quite a while to assist with raising the charge of a battery, lessen charging time, and increment the battery's duration. For instance, AI checks the hotness of the battery and avoids the potential risk of assuming it overheats, for example. It additionally helps electric vehicle performance (Elkasrawy et al.2020). The battery represents 25% of an EV's all-out cost, with materials representing half of that. Battery analysts can utilise computerised reasoning to accelerate the examination and testing of a wide exhibit of new material syntheses that could be utilised in batteries. Accordingly, leap forwards in study and development are happening at an extraordinary rate. In certain conditions, disclosures that would have taken more time to make are currently attainable in a little while. "To convey a maintainable and affordable power supply in the setting of steadily expanding buyer interest, current power networks should be more astute." The smart grid (SG) is a modernised form of the more seasoned power lattice that is acquiring fame as reconnaissance gear improves and power utilisation rises. Control focuses, transmission organisations, and substations are all essential for this organisation. The SG is a minimal expense appropriated power line status observing framework that accommodates a two-way progression of force and information among customers and power age suppliers, further developing power conveyance execution and exactness.

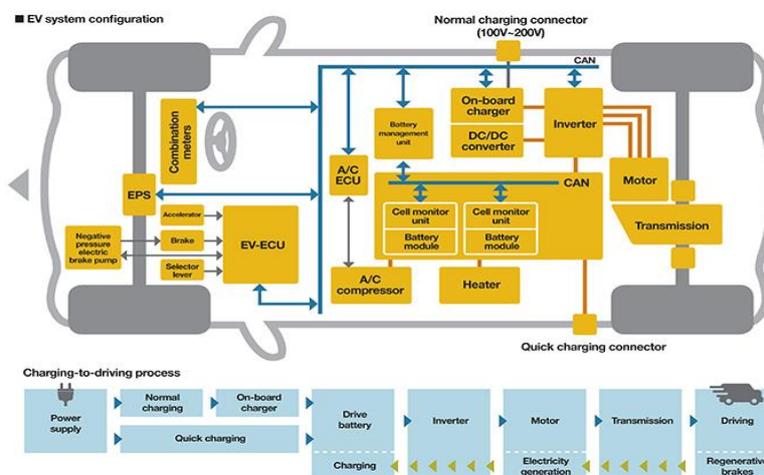
COVID-19 Impact on EV & EV Infrastructure Market (Pre Vs. Post COVID-19 Analysis)



Source: Press Release, Investor Relation Presentation, Annual Report, Expert Interview, and MarketsandMarkets Analysis

(Source: <https://www.marketsandmarkets.com/Market-Reports/covid-19-impact-on-electric-vehicle-market-181970499.html>)

The high-level metering foundation (AMI) shows that the energy supply is not just reliable and secure but likewise practical throughout the framework, by using this two-way correspondence. As far as innovation, the savvy lattice is a state-of-the-art arrangement that utilises an exclusive advanced stage to convey state-of-the-art detecting, signal handling, transmission, and registering capacities. The construction of the technological framework for a power grid that integrates power correspondence and PC control, along with sophisticated measurement and distributing automated, can turn into a major enhancement in grid dependability and capacities. Moreover, the power grid tracks each piece of evidence in the energy supply cycle's network, allowing for true-time monitoring and control of energy services such as cost, output, and usage. As a result, energy services can accomplish effective load balancing and reliable power transfer. As a result of creative specific item options, smart grids give greater independent preventive actions and increased performance. Visual technologies and user experience technologies could be used to take authority. A vehicle-to-grid (V2G) network environment is depicted. To direct the conveyed control framework, the V2G assistant help framework utilises administration arranged innovation, ideal control, and composed control hypothesis.

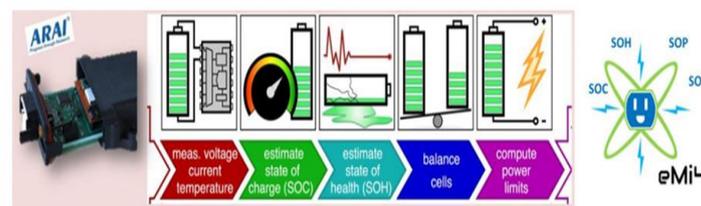


(Source:<https://www.st.com/en/applications/electro-mobility/automotive-battery-management-system-bms.html>)

The particular utilisation of administration situated innovation depends on the constant working condition of the power matrix and the genuine charging request of EV shoppers. Most experts on the matter would agree, the method can accelerate all steps of the batteries improvement cycle, including player science to estimate and frame assurance to better materials and creation frameworks (Bhatti et al., 2021) This has repercussions for charging electric vehicles, yet in addition to different types of energy stockpiling, for example, sun-based and wind power. a co-author of the paper and a researcher at the Toyota Research Institute, commented, "This is a new way of performing battery production." "Collect data which we can share with a huge number of individuals in academic circles and the industrial sector and that is constantly analysed allows you to innovate much more quickly."The researchers plan to make the computational modelling and data gathering method used in the work openly accessible to prospective battery experts. The ability of a sophisticated Computers or Computer automaton to accomplish functions that are commonly associated with sentient beings. The term applies as frequently as required to the task of developing methodologies with human-like mental repetitions, such as the capacity to comprehend, develop initiatives, sum up, or gain from prior experience. The use of artificial intelligence (AI) in automotive production assists automobile manufacturers in lowering assembly expenditures while also providing a more secure and effective manufacturing line ground. Improperities in products can be easily identified using advances such as computer vision. For item experimentation and re-enactment, ML estimates can be used. Carmakers are currently collaborating with a variety of programming organisations to create enticing and personalised client encounters.

4. RESULTS

Artificial intelligence is assuming a significant part in the EV business, with applications, for example, independent driving, client conduct checking, and brilliant route frameworks. It may very well be utilised for wellbeing applications, for example, prescient gear support, driver conduct checking, and vehicle security. Different organisations utilise Artificial Intelligence in their vehicles; a utilisation it to supplant current transportation frameworks with self-driving administrations, while others use it to further develop the battery force of their EVs. "In EV stanza, there will generally be an endeavour by the business to accomplish productivity on a few things," he said of the extent of AI in the EV business.



(Source:<https://www.araiindia.com/services/technology-and-products/electric-vehicle-battery-management-system>)

Artificial intelligence is assuming a significant part in the EV business, with applications, for example, independent driving, client conduct checking, and brilliant route frameworks. It may very well be utilised for wellbeing applications, for example, prescient gear support, driver conduct checking, and vehicle security (Sanguesa et al., 2021). Different organisations utilise Artificial Intelligence in their vehicles; a utilisation it to supplant current transportation frameworks with self-driving administrations, while others use it to further develop the battery force of their EVs. "In EV stanza, there will generally be an endeavour by the business to accomplish productivity on a few things," he said of the extent of AI in the EV business. This can be attributed to rising working-class wages and a more youthful population development rate. By 2030, India is expected to be the world leader in shared versatility, creating more opportunities for electric and self-driving vehicles.

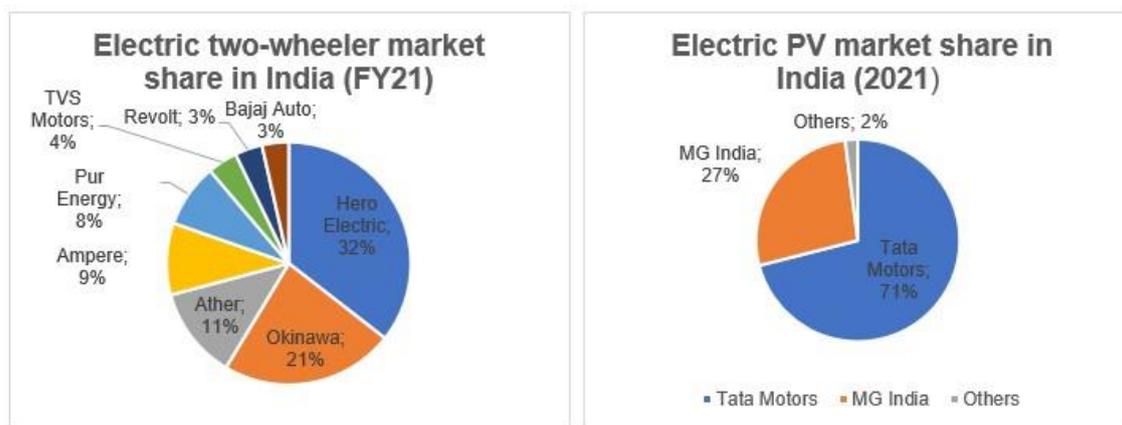
India's financial development is obvious for prosperous development due to various factors such as solid monetary extension, social change, rapid urbanisation, solid segment profits, and so on. India's advancement in the ease of carrying on with work records demonstrates the country's greater capacity to start and foster organizations. Atmanirbhar Bharat, or Self-sufficient India, is a Make-in-India initiative that encourages both young and traditional entrepreneurs. IoT, AI, and ML advancements will be critical components in the future development of E-Mobility. AI and AI can play a basic role in both physically determined and driverless vehicles (Li et al., 2018). The vast majority of this will be coordinated with IoT and

portable regulators and interaction points. "Information sharing among devices, including vehicles will become a reality, and information security will improve."

Brand Positioning of Electric Players in India

The Indian EV market is growing in fast pace as close to 0.32 million vehicles were sold in the year of 2021. The sales were increased by 168% YoY¹. The electric vehicle market growth in India is fuelled by the Paris agreement to reduce carbon emissions and improving the air quality.

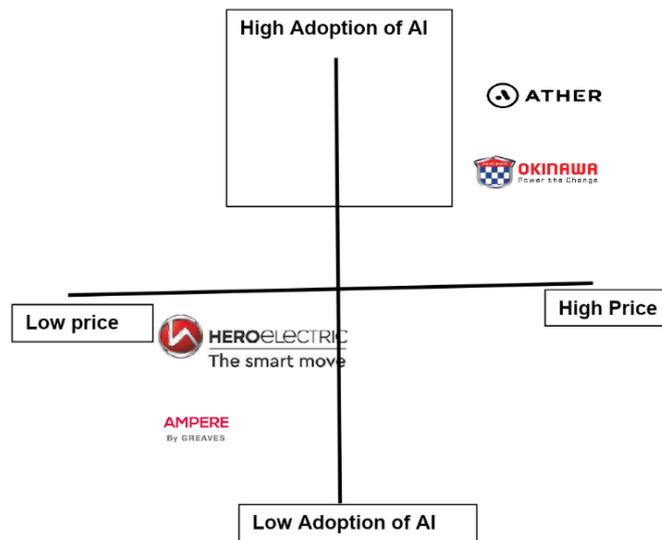
Indian electric vehicle market is dominated by three players Hero Electric, Okinawa, and Ather Energy. They hold 64% market share cumulatively. Hero Electric is the market leader in the EV market in India. The following figure explains the Electric two-wheeler and Electric Passenger vehicle market.



Source:<https://www.ibef.org/blogs/electric-vehicles-market-in-india#:~:text=According%20to%20EV%20volumes%2C%20overall,million%20vehicles%20on%20the%20road.>

The following section deals with the adoption of artificial intelligence by these companies and its positioning in the EV market. The perceptual map can be developed to explain the various position occupied by these EV brands in consumers' mind. There are two dimensions are used to develop this perceptual map. The price of the vehicle and the application of artificial intelligence in their vehicles are the two dimensions used to develop the perceptual map.

The Perceptual Mapping of Electric Vehicles Market



Source: Cardekho, gaadiwaadi, Rushlane and bikedheko

Many companies have started to include the features based on artificial intelligence. The market leader, the Hero electric is yet to adopt the AI in the mass scale. But Ather Scooters adopted AI into their electric vehicles. The scooter will be able to learn the personal riding behavior of riders and customizing torque, range, pickup according to their personal needs. The AI system will detect and automate the rider actions to augment overall ride experience. ADAS (Advanced Driver Assistance Systems²) is adopted in the Ather scooter. The system provide accurate and personalized estimates of distance that a rider can cover using the charge left in the vehicle, based on their riding patterns.

Okinawa also in the race followed by Ather in adopting AI. At Okinawa, Both IoT and AI got implemented into their flagship models, the i-Praise and Ridge+ through the Okinawa Eco App³. Through the app, the customers can have access to smart functions such as immobilizing their scooter remotely if it is ever stolen. So it is clear that high technologies like AI and IoT have been adopted by Indian firms gradually. In 2030, all electric scooters will be powered by AI and IoT.

5. CONCLUSION

The best part of these Electronic vehicles is that it is supported by A.I feature that makes an automatic driving experience and along with that it supports navigation systems and behaviour monitoring. The algorithm of Artificial Intelligence in Electric vehicles provides real-time

driving monitoring and provides optimization of the energy used, which would help for the extra driving range and give riders minimal panic attacks against the low battery. The smart grid charging and access points would appeal to a more target audience in the future. The E.V models use V2G (Vehicle to a Grid), which is an additional income source for EV owners. This research paper highlights A. I used Electronic Vehicles in India. Artificial intelligence is assuming a significant part in the EV business, with applications, for example, independent driving, client conduct checking, and brilliant route frameworks. It may very well be utilised for wellbeing applications, for example, prescient gear support, driver conduct checking, and vehicle security. India's financial development is obvious for prosperous development due to various factors such as solid monetary extension, social change, rapid urbanisation, solid segment profits, and so on. India's advancement in the ease of carrying on with work records demonstrates the country's greater capacity to start and foster organisations.

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