Vol-08 Issue 04, April -2024 ISSN: 2456-9348
Impact Factor: 7.936

iJETRM
International Journal of Engineering Technology Research & Management

PERFORMNACE EVALUTION OF EV GO-KART

Dr. B. Vijaya Kumar[1], Ch. Srinivasa Rao[2], G. Chandrashekar[3], M. Sai Krishna[4], P. Gajanan[5].
[1]HOD, Department of Mechanical Engineering, GNIT, Hyderabad, Telangana.
[2,3,4,5] UG Scholars Department of Mechanical Engineering, GNIT, Hyderabad, Telangana.

ABSTRACT
This document evaluates the performance of an electric (EV) go-kart. The evaluation considers various metrics including acceleration, top speed, handling, energy efficiency, and factors influencing these metrics, such as motor power, battery capacity, and chassis design, torque, regenerative braking, and weight distribution. The motor power andtorque determine the go-kart's ability to generate speed and acceleration. Battery capacity affects the range and duration of playtime. Regenerative braking helps in recovering energy while braking, enhancing the overall efficiency. Weight distribution affects the balance and stability of the go-kart. By considering all these factors, we can have a comprehensive understanding of the performance capabilities of EV go-karts.

Keywords:
Electric Vehicle (EV), Go-Kart, Performance Evaluation, Acceleration, Top Speed, Handling, Energy Efficiency, Motor Power, Battery Capacity.

INTRODUCTION

LITERATURE SURVEY

Dr. B. Vijaya Kumar [1]: Dr. B. Vijaya Kumar is currently engaged in the development of a composite material body panel for an electric go-kart, with a focus on improving performance and exploring advancements in race car design through the utilization of lightweight composite materials.

Morisho Penesenga [2]: This project involves the design and analysis of an electric motor-powered kart, with the primary objectives of reducing reliance on fossil fuel-powered vehicles and contributing to the growing electric vehicle industry. The project aims to design a robust electric go-kart capable of supporting increased weight while providing optimal features at an affordable cost.

Chirag patel [3]: In their work they examined around the plan and improvement of working show of fetchedcompelling electric go-kart. Fundamental objective behind planning and manufacturing the electric go -kart is to form itaccessible in cheap cost, making it basic in working for indeed nonprofessional drivers, expanding is quality so that it can support more weight and providing it with all the most excellent accessible offices in lower fetched.

Shaik Himam Saheb [4]: This paper concentrates on explaining the design and engineering aspects of making a Go Kart for student karting championship 2015. This report explains objectives, assumptions and calculations made in designing a Go Kart. The team's main goal is to develop a secure and operational vehicle with a sturdy and torsion-resistant frame. The design is selected to ensure ease of fabrication in all aspects.

Garcia [5]: The author of "Comparative Study of Electric and Combustion Engine Go-Karts". This research compares the performance of electric and combustion engine go-karts, considering factors such as acceleration, handling, and maintenance requirements.

Abhinay Nilawar [6]: A go-kart typically lacks suspension and a differential, and it's commonly used on scaled-down tracks for racing or recreational purposes. Karting is often seen as a starting point for aspiring racers, providing valuable experience in developing reflexes, precision car control, and decision-making skills. It's considered a cost-effective form of motorsport and serves as a foundation for higher levels of racing, helping drivers understand key parameters for

improving competitiveness. Both young enthusiasts and adults participate in karting, making it a versatile activity enjoyed by many.

Sandeep Kumar [7]: This study investigates how different battery types affect the acceleration, top speed, and overall range of electric go-karts. It highlights the importance of advanced battery technologies for improved performance. Battery management systems can enhance the lifespan and overall performance of EV go-kart batteries. It emphasizes the importance of proper battery maintenance and monitoring.

Anjul Chauhan [8]: Anjul Chauhan's paper focuses on elucidating the considerations involved in designing a chassis for a go-kart. It discusses the methodology and essential factors required for chassis design using CAD software. The paper conducts a series of analyses, including FMEA and Impact Analysis, to evaluate the structural rigidity of the chassis against various potential scenarios it may encounter during operation.

Mohanapriya [9]: Mohanapriya's study presents an approach to optimizing go-kart chassis design, vehicle dynamics calculation, Li-ion battery capacity analysis, and electric motor selection to achieve optimized vehicle performance. Utilizing CAD/FEA software, the study implements an original chassis design and conducts analyses to optimize chassis rigidity, evaluate tube joint stability, and assess vehicle dynamics under different driving conditions, with the aim of ensuring safety and performance.

Metha islameka [10]: Metha Islameka's chapter describes the energy conversion and balance processes in battery electric vehicles, essential for investigating energy consumption and determining battery capacity as primary energy storage. The chapter discusses mechanical and electrical power flows in the vehicle and explains driving cycles as speed versus time curves used in driving tests or simulations to estimate energy requirements. Various driving cycle standards are introduced, including worldwide standards, country-specific standards, and direct measurement techniques, comprehensively exploring energy consumption in battery electric vehicles.

Kanaad Bhardwaj [11]: Kanaad Bhardwaj's paper presents an electric propulsion system specifically designed to meet the performance requirements for go-kart applications. The analysis primarily focuses on reducing weight. The traditional internal combustion engine power unit is replaced with an electric DC motor powered by rechargeable batteries. This modern approach replaces the engine with a combination of motor, batteries, and controller. Modeling is conducted using 3D software such as BLENDER & FUSION 360 to calculate stress and strain on the go-kart. The paper aims to facilitate the design and production of electric go-karts.

Wang [12]: The author of Optimization of Powertrain Components for Electric Go-Karts" by Patel and Wang. Focuses on the optimization of powertrain components, including motor, controller, and battery, to enhance the performance and efficiency of electric go-karts.

James Larminie[13]: This study investigates how advancements in battery technology, such as higher energy density and faster charging capabilities, impact the performance, range, and overall efficiency of EV go-karts. It highlights the potential benefits of future battery innovations.

Ravindra Laxman Gaikwad[14]: This study investigates how temperature variations impact the performance, efficiency, and range of EV go-karts. It highlights the importance of thermal management systems for consistent performance.

G. Babukan [15]: The authors conducted finite element analysis to simulate disc brake stresses under various conditions, including braking torque and bolt preload. The aim is to evaluate the strength of the disc brake design and enhance its performance through optimization. The model includes both ventilated disc brake and hub, using 3D tetrahedral elements for modeling. Cast iron is chosen for both components. Bolts are modeled with rigid body and beam elements. A shell coat is applied to transmit braking torque. This analysis offers insights into disc brake performance and durability, aiding in design optimization for safety and efficiency.

Dr. Gregoire P. P. T. Bourassa [16]: Dr. Gregoire P. P. T. Bourassa's specialization in the mechanical design of racing vehicles positions him as a leading authority in the field. His research often encompasses in-depth analysis and optimization of go-kart steering systems to achieve optimal performance and handling characteristics. Dr. Bourassa's expertise enables him to address various aspects of steering system design, including geometry, materials, and mechanical components, with the aim of enhancing overall performance on the track. His contributions to the literature on go-kart steering systems provide valuable insights for engineers, designers, and racing enthusiasts seeking to improve the agility, responsiveness, and control of their vehicles.

iJETRM
International Journal of Engineering Technology Research & Management

Anne Naveen babu [17]: Anne Naveen Babu's work focuses on ensuring automobile safety and optimizing speed reduction and stopping mechanisms. Efficient operation is crucial to prevent mechanical, thermal, vibrational, or fatigue failures. While cable-operated disc brake systems are reliable in racing, they face challenges in mass reduction for high-performance vehicles. Optimizing these systems involves mitigating mechanical failures to enhance performance.

A. A. Faieza[18]: This paper on the design, fabrication, and testing of a student competition-based racing car. The competition aims to foster student participation and showcase their practical skills in developing a miniature race car. The design adheres to the specifications set by the organizer, Universiti Teknikal Malaysia (UTeM) Formula Varsity Car, 2008. Utilizing the CATIA solid modeling system, the car is fabricated in a laboratory within the mechanical and manufacturing engineering department at Universiti Putra Malaysia. The car undergoes performance testing, including static and track tests, to evaluate its capabilities.

Mr. Ashraf Shaik [19]: The values calculated may differ practically due to steering linkages error or due to improper steering geometry Mr. Ashraf Shaik discusses the steering system of go-karts, noting that while manual mechanical linkages are simple and commonly used in lightweight vehicles, they are not suitable for heavy-weight ones due to potential errors in steering linkages or improper geometry.

Aditya Pawar [20]: This paper aims to enhance the steering system of go-karts for improved responsiveness and control. Drawing from practical experience in manufacturing three steering systems for national level competitions, the paper provides comprehensive coverage of professional go-kart steering concepts, including theory, formulas, calculations, diagrams, and simulation results to aid in individual assembly and understanding.

Samarpan Farmer [21]: This paper describes the go-kart as a small, lightweight 4-wheeled vehicle commonly used in motorsports and recreational activities. The primary role of the go-kart chassis is to support the vehicle's weight, maintain structural integrity, and provide flexibility during maneuvers. The chassis design considers weight, safety, cost, and fabrication criteria, with AISI 4130 tubes chosen for fabrication. The chassis is modeled in Solidworks CAD software, and FEA analysis is conducted to simulate front and side impacts. The design is optimized for safety, with evaluations based on factors such as factor of safety, stresses, and deformation.

Brown [22]: The author of Effect of Track Surface and Conditions on Electric Go-Kart Performance" by Brown and Johnson. Studies the influence of track surface characteristics, such as grip level and roughness, as well as environmental conditions, such as temperature and humidity, on the performance and lap times of electric go- karts.

M Sindhukavi [23]: This review focuses on the impact of suspension systems on the ride comfort, handling, andoverall performance of EV go-karts. It discusses different suspension setups and their effects on vehicle dynamics.

SN Chandan [24]: This paper focuses on the design and analysis of a race car, with particular attention to insights into the design process. The car is modeled to accommodate a 95th percentile male within the cockpit of the chassis. Special consideration is given to protecting the car and minimizing stresses while maintaining optimal performance, especially during high-speed travel.

Wei He [25]: This review focuses on drivetrain technology has gained significant attention in recent years due to its potential to reduce greenhouse gas emissions and dependence on fossil fuels. EV drivetrains consist of various components that work together to provide efficient and sustainable propulsion. This literature review aims to explore the key aspects of EV drivetrain technology, including the types of drivetrains used, the role of electric motors, power electronics, battery technology, and regenerative braking.

CONCLUSION

A performance evaluation of an EV go-kart offers valuable insights into its strengths and weaknesses across various metrics. These include acceleration, top speed, efficiency, handling, and range. The evaluation's conclusion should summarize the go-kart's overall performance and suitability for its intended use. It can recommend improvements or highlight areas of competency, like exceptional efficiency or superior handling. This information is crucial for optimizing the go-kart's design for competitive racing or recreational enjoyment.

iJETRM
International Journal of Engineering Technology Research & Management

ACKNOWLEDGEMENT

We would like to extend our sincere gratitude to GURUNANAK INSTITUTE OF TECHNOLOGY for their invaluable support and resources, which have been instrumental in the successful completion of our project. We sincerely appreciate Dr. S. SREENATHA REDDY, Principal and the management of the Guru Nanak Institute of Technology for providing us the best amenities which enabled us to complete our project in the stipulated time. We express our genuine gratitude to Dr. RISHI SAYAL, Associate director, for providing excellent lab facility, for smooth completion of project and we are thankful for your support. We extend our deep sense of graduate to Dr. B. VIJAYA KUMAR, Professor & Head of the Mechanical Department for his masterly supervision and valuable suggestions for the successful completion of our project. We owe our immense thanks DR. B. Vijaya Kumar our projectguide, Assistant Professor in Department of mechanical Engineering, Guru Nanak Institute of technology for the sustained interest, constructive criticism, and constant encouragement at every stage of this Endeavour. Finally, yet importantly, we are very thankful to our parents, friends, and other faculty of Mechanical Engineering Department for their constant support in completion of this project.

REFERENCES

[1] Dr. B. Vijaya kumar "Design and Fabrication of Composite Material Body Parts for EV Go-Kart" IJAEM, Volume 5, Issue 3 March 2023, pp: 1895-1913www.ijaem.net ISSN: 2395-5252.

[2] Morisho Penesenga, Jenny Bahram Abdallah "Design and Fabrication of an Electric go-kart" Apr 2023 DOI: 10.13140/RG.2.2.17241.90723

[3] Chirag Patel, Dhyaneshkumar Patel, Jatin Patel, and Dhruvil Patel authored a paper titled "Electric Go-Kart Design Optimization forImproved Performance" under the Department of Mechanical Engineering, PD Patel Institute of Technology, Gujarat, India.

[4] Shaik Himam Saheb, Govardhana Reddy, Md Hameed "Design report of a go kart vehicle" International Journal of Engineering Applied Sciences and Technology 1 (9), 95-102, 2016

[5] Rakshith Shetty and Nishant Amin "Design and Development of an Electric Go-Kart". National Institute of Technology Karnataka, Surathkal, India. DOI: 10.1007/978-981-15-7633-8_31

[6] Abhinay Nilawar, Harmeet singh Nannade, Amey Pohankar, Nikhil Selokar "Design of Go-Kart "Maharashtra, India, IJFEAT, ISSN, 2321-8134, 2016

[7] Sandeep Kumar, Ali Keyhani, and Rakesh Kumar "Electric Vehicle Battery Modeling and Simulation" Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi, India. DOI: 10.1007/978-981-13-7978-3_2

[8] Anjul Chauhan.et.al, "Design and Analysis of Go-Kart", IJAME, Volume 3, No. 5, Sept 2016

[9] Mohanapriya "Design Optimization of a High-Performance Electric Go-Kart". Department of Mechanical Engineering, SRM Institute of Science and Technology, Tamil Nadu, India. DOI: 10.1007/978-981-10-7072-7_41

[10] Electric Vehicle Battery Modeling and Simulation by Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi, India. DOI: 10.1007/978-981-13-7978-3_2

[11] Kanaad Bhardwaj, Mahesh Kumawat, Abhinav Pamecha, Aryan Sharma, Hemant Choudhary, Dhruv Rana, Ajit Singh Gour, Atul Katara authored a paper titled " Design and Performance Evaluation of an Electric Go-Kart "IJARIIE-ISSN(O)-2395-4396 Vol-6 Issue-3 2020

[12] Practical Finite Element Analysis" by Nitin S Gokhale, Sanjay S Deshpande, Sanjeev V Bedekar, Anand N Thite published 2002 by Finite to Infinite.

[13] "Electric Vehicle Technology Explained" by James Larminie and John Lowry published by John Wiley and sons limited in 2012.

[14] Ravindra Laxman Gaikwad, Prathmesh Vishwas Waghmare, Lalit Daulatrao Deo, Akshay Mukesh Mutake, Matoshri College of Engg & Research Centre, Nashik, Maharashtra, (India) "DESIGN OF GO-KART VEHICLE SYSTEM", ISSN: 978-81-932074-7-5

[15] G. Babukanth "Transient Analysis of Disk Brake by using ANSYS Software" International Journal of Mechanical and industrial engineering,https://www.researchgate.net/publication/325719723_Strength

[16] "Design and Simulation of 4 Wheel Steering System" ISO 9001:2008 Certified International Journal of Engineering and Innovative Technology (JEIT) Volume 3, Issue 12, June 2014

[17] Sangeetha Krishnamoorthi L. Prabhu, MD Shadan, Harsh Raj, Nadeem Akram authored a paper titled "Design and analysis of electricGo-Kart. Mater. Today Proc. 2020, 45, 5997–6005.

https://doi.org/10.1016/j.matpr.2020.09.413
[18] A. A. Faieza, S.M. Sapuan, Ariffin, Baharudin and E. E. Supeni authored a paper titled "Design and fabrication of a student competition-based racing car". Sci. Res. Essays 2009, 4, 361–366.
[19] Osman Soylu, Mehmet, and Ismail Hakan Altas "Development of a Low-Cost Electric Go-Kart for Educational Purposes". Department of Mechatronics Engineering, Izmir Institute of Technology, Turkey.
DOI: 10.1109/ACCESS.2017.2787921
[20] Aditya Pawar and Ayush Deore, "Design and Analysis of a Professional Go Kart Steering System," International Journal for Scientific Research & Development, Vol. 7, Issue 04, 2019.
[21] Samarpan Farmer, Prakriti Prasad, Gurbaaz Singh Dhaliwal, Utkarsh Chadha "Design and analysis of a go-kart chassis" Jan 2023 AIP Conference Proceedings. DOI: 10.1063/5.0158558
[22] Xiaohui Han, Xiaoping Li, and Chenglin Yang "Performance Evaluation of an Electric Go-Kart". School of Automotive Engineering, Jiangsu University of Science and Technology, Jiangsu, China.
DOI: 10.1088/1757-899X/1031/1/012023
[23] M Sindhu Kavi, C Arun Kannan, S Sowmya "Design and fabrication of an upright for student formula car". International Journal of Research in Engineering, Science and Management 3 (8), 599-606, 2020
[24] SN Chandan, GM Sandeep, N Vinayaka "Design, analysis and optimization of race car chassis for its structural performance"International journal of engineering research and technology 5 (7), 361-367, 2016
[25] Wei He, Xiangyu Wang, and Meng Zhang "A Review of Electric Vehicle Drivetrain Technologies and Modeling Techniques". Key Laboratory of Advanced Vehicle Electronics of Ministry of Education, Changchun University of Science and Technology, Jilin, China. DOI: 10.1088/1757-899X/694/1/012003