

Fabricating The Electric Go Kart Considering The Aerodynamic Structure With Standard Dimensions

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Abstract

The increasing demand for eco-friendly and energy-efficient transportation systems has led to the development of electric vehicles as a sustainable alternative to conventional fuel-based vehicles. This project focuses on the fabrication and implementation of an electric go-kart considering aerodynamic structure and standard design dimensions to improve performance, efficiency, and stability. The work involves the design and fabrication of a lightweight chassis, along with the integration of essential components such as a Brushless DC (BLDC) motor, battery pack, motor controller, and power transmission system. Standard dimensions and safety considerations were followed during the fabrication process to ensure structural integrity and proper weight distribution. Special emphasis was given to aerodynamic design by incorporating streamlined body features to reduce air resistance and improve airflow characteristics.

The fabricated prototype was tested under real operating conditions to evaluate its performance in terms of speed, acceleration, energy consumption, and stability. The results obtained from experimental testing indicate that the go-kart operates efficiently with smooth power delivery and satisfactory performance. The aerodynamic considerations contributed to reduced drag and improved overall efficiency. This project demonstrates the practical implementation of electric vehicle technology combined with aerodynamic design principles. It provides valuable insights into fabrication techniques, system integration, and performance evaluation. The developed electric go-kart can serve as a foundation for further research and development in the field of sustainable and efficient transportation systems.

Keywords: Electric Go-Kart, Electric Vehicle (EV), Aerodynamics, Fabrication, BLDC Motor, Energy Efficiency, Vehicle Design, Drag Reduction, Lightweight Chassis, Sustainable Transportation.

1. Introduction:

The increasing demand for sustainable and energy-efficient transportation has encouraged the development of electric vehicles in various sectors, including small-scale mobility solutions such as go-karts. This project focuses on the fabrication and implementation of an electric go-kart while considering aerodynamic structure and standard design dimensions. The aim is to design a lightweight, efficient, and safe vehicle that demonstrates the practical application of mechanical engineering principles, including vehicle dynamics, aerodynamics, material selection, and electric propulsion systems.

Unlike conventional fuel-powered go-karts, electric go-karts offer advantages such as reduced emissions, low noise, minimal maintenance, and improved energy efficiency. Standard dimensions are followed to ensure driver safety, stability, and proper weight distribution. The chassis design, steering mechanism, braking system, and electric drive components are carefully selected and integrated to achieve reliable operation.

The outcome of this project provides practical knowledge in manufacturing techniques, electric vehicle technology, and aerodynamic design considerations. This study also highlights the importance of eco-friendly transportation solutions and demonstrates how engineering innovation can contribute to sustainable mobility.

2. Problem Definition:

The increasing demand for environmentally friendly and energy-efficient transportation has led to the development of electric vehicles as an alternative to conventional internal combustion engine-based systems. However, the performance of small electric vehicles such as go-karts is often limited by **high energy consumption, limited battery capacity, and lack of optimized design**. One of the key challenges in the development of an electric go-kart is the **integration of mechanical and electrical systems while maintaining efficiency, safety, and structural stability**. Therefore, it is essential to design and fabricate the go-kart according to **standard dimensions and engineering practices**. Another major issue is the **lack of aerodynamic consideration** in conventional go-kart designs. High aerodynamic drag and turbulent airflow increase resistance, resulting in reduced speed and

higher energy consumption. Additionally, there is a need for a practical approach that combines **fabrication techniques with aerodynamic design principles** to develop a reliable and efficient prototype. Therefore, the problem addressed in this project is to **fabricate and implement an electric go-kart using standard dimensions while incorporating aerodynamic features to reduce drag and improve performance**. This project seeks to bridge the gap between theoretical design and practical implementation by developing a functional, aerodynamically efficient electric go-kart suitable for educational and experimental purposes.

3. Objectives of the Project

The primary objective of this project is to **fabricate and implement an electric go-kart prototype** by incorporating aerodynamic design features and maintaining standard dimensions to achieve improved performance, efficiency, and safety.

The specific objectives of the project are as follows:

- To design and fabricate a functional electric go-kart chassis using standard dimensions and suitable materials.
- To ensure structural strength, stability, and safety of the chassis under operating conditions.
- To select and integrate key components such as BLDC motor, battery, controller, and transmission system.
- To develop an efficient power transmission system using chain and sprocket mechanism.
- To incorporate aerodynamic features such as streamlined body structure and reduced frontal area to minimize air resistance.
- To implement proper weight distribution for improved balance and handling.

4. Research Methodology

The research methodology adopted in this project involves a systematic approach for the design, fabrication, implementation, and performance evaluation of an electric go-kart with aerodynamic considerations. The methodology integrates theoretical design principles with practical fabrication and testing.

1. Literature Review

A detailed review of existing research papers, journals, and technical resources related to:

- Electric vehicles and go-kart design
- Aerodynamics and drag reduction techniques

2. Conceptual Design

A conceptual layout of the go-kart was developed considering:

- Chassis geometry and standard dimensions
- Placement of motor, battery, and controller
- Driver seating and ergonomics
- Aerodynamic structure (streamlined design, reduced frontal area)

3. Design Calculations

Basic design calculations were performed to determine:

- Motor power requirements
- Torque and speed
- Gear ratio
- Load conditions

4. Component Selection

Appropriate components were selected based on design requirements:

- Motor: BLDC motor for high efficiency
- Battery: Lithium-ion battery for energy storage
- Controller: Speed control and power regulation
- Transmission: Chain and sprocket system

5. Fabrication of Chassis

- Mild steel pipes were cut according to design dimensions.
- Welding was performed to assemble the chassis frame.
- Grinding and finishing were carried out for safety and aesthetics.

6. Assembly and Implementation

- All components were mounted on the chassis.
- Electrical wiring and connections were completed.
- Steering, braking, and wheel systems were installed.

7. Performance Testing

The fabricated go-kart was tested under real operating conditions to evaluate:

- Speed and acceleration
- Battery performance (voltage and current)
- Stability and handling
- Braking efficiency

8. Aerodynamic Evaluation

- The effect of aerodynamic structure was analyzed based on vehicle performance.
- Observations were made regarding airflow behavior, stability, and resistance.

5. OBSERVATION

Parameter	Observed Value	Performance Remarks
Initial Acceleration (0–20 m)	~5–6 seconds	Good starting torque due to 2.8:1 gear ratio
Top Speed	~45–50 km/h	Limited by motor RPM and controller
Braking Distance	~3–4 meters	Disc / hydraulic brakes effective
Battery Voltage Sag	~2–3 V	Observed during full throttle
Motor Temperature	~50–55 °C	Safe for continuous operation

Properties (AISI 1018):

- Tensile strength (ultimate): 440MPa
- Tensile strength (yield): 370MPa
- Modulus of elasticity: 205GPa
- Bulk modulus: 140GPa

$$F_{total}=3353.6$$

Torque Required at Wheel

$$T_{Wheel}= F_{total} \times r$$

$$T_{Wheel}=353.60 \times 0.1397$$

$$T_{Wheel}=49.39Nm$$

Ergonomics

SR.NO.	Parameter	Value
1.	Vehicle length	72 Inch
2.	Vehicle Width	44 Inch
3.	Wheel Base	1054.1 mm
4.	Chassis material	AISI 1018
5.	Tube Dimensions	OD:25.4 mm ID 23.4 mm
6.	Chassis Weight	8.84 Kg
7.	Total Vehicle Weight (approx.)	150 Kg
8.	Ground Clearance	2 In
9.	Battery	12 V (Qty 4)
10.	Max. Speed	
11.	Acceleration (Avg)	3.454 m/s ²
12.	Brake	Disc
13.	Steering	Pitman
14.	Tyre	Slick Tyres
15.	Diameter of the tyre	Front: 254 mm Rear: 279.4 mm

Brake System

Parameter	Stunner
Max. Power	3000-4000 rpm
Max. Torque	25 – 35 Nm

Gear Ratio

Gear Ratio(G) Tells HON many times the motor rotator compared to the wheel

$$G=(N_{motor})/(N_{wheel}) \quad (N - r.p.m)$$

Wheel RPM

$$N_{wheel}=(V)/(2\pi r) \times 60$$

$$N_{wheel}=(11.1)/(2\pi \times 0.135) \times 60$$

$$N_{wheel}=785.164 \text{ r.p.m}$$

Motor RPM 3000 RPM

$$G=(3000)/(785.164)$$

$$G=3.82 \sim 4$$

$$G=4:1$$

Motor Torque Selection

Gear Ratio G=4 (assume)

$$\text{Efficiency}=\eta=0.9$$

$$T_{motor}=(T_{wheel})/(G \times \eta)$$

$$T_{motor}=(49.39)/(4 \times 0.9)$$

$$T_{motor}=13.719$$

$$w= 140kg$$

$$r=(0.1397m)$$

$$v= 40 \text{ Km/hr}$$

$$=11.1m/s$$

$$T=5 \text{ sec}$$

$$C_r=0.015$$

Force Calculate

Rolling Resistance Coefficient

$$C_r=(F_r)/(w \times g)$$

$$C_r=(20.60)/(140 \times 9.81)$$

$$C_r=0.015$$

Rolling Resistance Force

$$F_r= C_r \times w \times g$$

$$F_r=0.015 \times 140 \times 9.81$$

$$F_r=20.60N$$

Acceleration Force

$$F_a=(w \times v)/t$$

$$F_a=(140 \times 11.1)/5$$

$$F_a=333N$$

Total Force Required

$$F_{total}=f_r+f_a$$

$$F_{total}=20.60+333$$





Future Scope of the Project

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The present project on the fabrication and implementation of an electric go-kart with aerodynamic considerations demonstrates the feasibility of developing an efficient and eco-friendly small-scale electric vehicle. However, there are several areas where further improvements and advancements can be made to enhance performance, efficiency, and practical applicability.

1. Advanced Battery Technology

- Implementation of high-capacity lithium-ion batteries to increase driving range.
- Use of solid-state batteries for improved safety and energy density.
- Integration of fast-charging systems to reduce charging time.

2. Lightweight Materials

- Replacement of mild steel with aluminum alloys or composite materials to reduce weight.
- Use of carbon fiber components for improved strength-to-weight ratio.

3. Solar-Assisted Charging

- Installation of solar panels for auxiliary charging.
- This will enhance sustainability and reduce dependency on external power sources.

4. Real-Time Data Acquisition and Testing

- Use of sensors and data acquisition systems for real-time performance analysis.
- Comparison of experimental and theoretical data for better validation.

.Conclusion

The project titled “**Fabricating and Implementing the Electric Go-Kart Considering the Aerodynamic Structure with Standard Dimensions**” was successfully completed with the objective of developing a functional, efficient, and safe electric go-kart prototype. The study focused on combining proper fabrication techniques with aerodynamic design principles to improve overall vehicle performance. A lightweight and structurally strong chassis was designed and fabricated using standard dimensions to ensure stability, safety, and proper weight distribution. Key components such as the Brushless DC (BLDC) motor, battery, controller, and transmission system were carefully selected and integrated to achieve reliable operation and efficient power delivery. Special emphasis was placed on incorporating aerodynamic features in the design to reduce air resistance. The streamlined structure helped in improving airflow around the go-kart, resulting in reduced drag and enhanced performance. The fabricated prototype was tested under real operating conditions to evaluate parameters such as speed, acceleration, energy consumption, and handling characteristics. The experimental results indicated that the go-kart performed satisfactorily, with smooth operation, stable control, and efficient energy utilization. Minor variations between theoretical and experimental values were observed due to practical factors such as frictional losses and environmental conditions; however, these were within acceptable limits.

The developed electric go-kart serves as a practical model for understanding design, fabrication, and testing processes in mechanical and automotive engineering. In conclusion, this study provides a strong foundation for further advancements in electric vehicle design and highlights the potential for developing more efficient, sustainable, and high-performance transportation solutions.

REFERENCES

1. **Design and Manufacturing of Aerodynamic devices for Formula Student Car.** International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072.
2. **Design, Development and Fabrication of a Go-Kart.** International Journal of Advance Research and Innovation Vol. 6(2), Apr-Jun 2018, pp. 96-122 Doi: 10.51976/ijari.621815.
3. **Design and Manufacturing of Go-Kart.** IOSR Journal of Engineering (IOSR JEN) www.iosrjen.org ISSN (e): 2250-3021, ISSN (p): 2278-8719, || Special Issue || June-2019, || PP 49-55 ||.
4. **Design and Development of an Electric Go kart Prototype ‘E-Andalasian’ for Sustainable Campus Transportation.** And., Intl., J., Appl Sci., Eng., Tech, Vol 05, No 01, March 2025 e-ISSN: 2797-0442. Received: December 18, 2024, Revised: March 9, 2025, Accepted: March 24, 2025 <https://doi.org/10.25077/aijaset.v5i1.205>.
5. **Design and Fabrication of an Electric go-kart.** International Journal of Scientific and Research Publications (ISSN: 2250-3153) IJSRP Inc. www.ijsrp.org.
6. **Design and Manufacturing of EV Go-Kart.** International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 12 Issue IV Apr 2024- Available at www.ijraset.com.
7. **Design and Development of an Electric Go kart Prototype ‘E-Andalasian’ for Sustainable Campus Transportation.** AIJASET – Vol. 05, No. 01, March 2025. 86-94 <https://doi.org/10.25077/aijaset.v5i1.205>.
8. **Concept Design and Development of an Electric Go-Kart Chassis for Undergraduate Education in Vehicle Dynamics and Stress Applications.** Appl. Sci. 2023, 13, 11312. <https://doi.org/10.3390/app132011312> <https://www.mdpi.com/journal/applsci>.
9. **Concept Design and Development of an Electric Go-Kart Chassis for Undergraduate Education in Vehicle Dynamics and Stress Applications.** Appl. Sci. 2023, 13, 11312. <https://doi.org/10.3390/app132011312> <https://www.mdpi.com/journal/applsci>.
10. **Design and fabrication of a student competition based racing car** Scientific Research and Essay Vol. 4 (5) pp. 361-366, May, 2009 Available online at <http://www.academicjournals.org/SRE> ISSN 1992-2248 © 2009 Academic Journals.
11. **Design and analysis of electric Go-Kart.** <https://doi.org/10.1016/j.matpr.2020.09.413> 2214-7853/ 2020 Elsevier Ltd. All rights reserved. Selection and peer-review under responsibility of the scientific committee of the International Conference on Mechanical, Electronics and Computer Engineering 2020: Materials Science.
12. **DESIGN AND FABRICATION OF A GO-KART VEHICLE WITH IMPROVED SUSPENSION AND DYNAMICS.** PRABHUDATTA DAS 2010A4PS660G.
13. **Concept Design of a Battery for an Electric go-Kart.** Cranfield University 2023. All rights reserved. No part of this publication may be reproduced without the written permission of the copyright owner.
14. **MODELING, FABRICATION AND SIMULATION (USING AVL CRUISE SOFTWARE) OF ELECTRIC GO-KART.** Department of Mechanical Engineering PURWANCHAL CAMPUS Dharan, Nepal. APRIL, 2025.