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"ANALYSIS AND OPTIMIZATION OF DESIGN FOR BRAKING SYSTEM OF GO-KART"

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ABSTRACT

The development of a competitive go-kart requires an integration of engineering design, analytical validation, and practical manufacturing skills. This report documents the complete engineering workflow undertaken by group to design and fabricate a high-performance go-kart for national-level racing competitions. The primary aim of the project was to build a lightweight, durable, and safe vehicle capable of delivering strong dynamic performance while ensuring compliance with competition rulebooks and cost limitations. The process began with initial concept development, benchmarking of previous kart designs, and formulation of technical targets such as vehicle weight, wheelbase, ground clearance, braking distance, and acceleration performance.

The chassis was designed using mild steel seamless tubes and its structural behavior was evaluated through Finite Element Analysis (FEA). Various load cases, including front impact, side impact, torsional loads, and braking loads—were simulated to identify stress distribution, deformation patterns, and critical failure zones. The resulting optimized frame achieved a balance between rigidity, weight reduction, and manufacturability. Subsystems including steering, braking, suspension geometry (where applicable), and the power transmission system were designed to maximize handling stability, driver control, and drivetrain efficiency.

A single-cylinder internal combustion engine was selected based on reliability, availability, and competition guidelines. Gear ratio calculation, sprocket size selection, chain alignment, and cooling provisions were evaluated to ensure smooth power delivery and improved throttle response. Ergonomic parameters such as seat placement, steering angle, pedal distance, and safety harness mounting were refined to provide.driver comfort, reduce fatigue, and enhance controllability during endurance events..

Key Words: *Design ,manufacturing, Fabrication*

I. INTRODUCTION

Go-kart is a small, four-wheeled, single-seater racing vehicle powered by a compact engine. It originated in the 1950s when Art Ingles, known as the "Father of Karting," built the first kart in California in 1956. Since then, karting has grown rapidly across the United States and Europe.

A typical go-kart has no suspension and no differential, and is raced on small, scaled-down tracks. Karting is widely considered the most affordable and safest entry point into motorsports, allowing children and adults—starting from the age of 8—to learn racing skills. It is popular both as a hobby and as a competitive sport.

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Figure.1 Go- kart

Go-karts are simple, cost-effective, and provide a safe racing experience. Most karts use engines around 125cc, and in some countries, certain models can be licensed for road use with added safety features like headlights, indicators, and tail lamps.

The following report details the design and analysis of a student-designed go-kart vehicle, we used CAD software (SolidWorks and Ansys Workbench) research parts and items to make Because of this method cost and complexity manufacturing will comes down and the product can be tested on the components itself. To achieve the necessary results without wasting any time and effort CAD Software Chosen (among them as CAD Software) alternative.
The reasons behind this long history of race car weight reduction, there is a need for designing and analyzing the race car to make it a race-worthy one, and this makes the variables that will be examined afterwards as design variables, English proper guidance in the right way with correct components. These components then have to undergo mechanical forces and analyzed virtually which will feel in real world and predict its wear out life, strain, and stress induced without actual testing. This CAD procedure significantly reduces manufacturing costs and time.

Karting is commonly perceived as the stepping stone to the higher and more expensive ranks of motor sports. Kart racing is generally accepted as the most economic form of motor sport available. As a free-time activity, it can be performed by almost anybody and permitting licensed racing for anyone from the age of 8 onwards. Kart racing is usually used as a low-cost and relatively safe way to introduce drivers to motor racing. Many people associate it with young drivers, but adults are also very active in karting.

Go-Kart is a great outlet for those interested in racing because of its simplicity, cost and safer way to race. The tracks go-kart is similar to F1 racing track. A go-kart is powered by 125cc engine in most of the countries. In some countries, go-karts can be licensed for use on public roads. Typically, there are some restrictions, e.g. in the European Union a go-kart on the road needs head light (high/low beam), tail lights, a horn, indicators and a maximum of 20 HP.

II. LITERATURE REVIEW

The aim of this chapter is to provide, through some selective reference of the literature cited, a clear understanding of different ways in which a go-kart chassis was designed and other analytical investigations on the frame that were done previously. These technical publications and journals published in national and international levels helped us in enhancing the progress of our work.

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III. METHODOLOGY

The research methodology serves as the foundation for the entire Go-Kart design and fabrication process. It defines the systematic approach, sequence of operations, and analytical methods followed to achieve the desired objectives of strength, performance, safety, and cost-effectiveness.

In this project, a go-kart is designed and developed as a single-seater, open-wheel, lightweight racing vehicle with the main focus on performance enhancement and structural stability. The methodology adopted is based on a step-by-step engineering approach involving problem identification, literature review, design, analysis, fabrication, and testing. Each stage of research has been designed to ensure logical flow and precise execution for achieving optimal performance within competition constraints and safety standards.

The purpose of this research methodology is to convert theoretical design knowledge into a practical prototype through continuous research, data collection, analysis, and experimental validation.

IV. EXPERIMENTAL SETUP

The experimental work is the most crucial and decisive phase of the Go-Kart project, as it validates the theoretical calculations, simulation outcomes, and fabrication precision. It bridges the gap between design and real-world performance, ensuring that all vehicle subsystems perform efficiently under actual conditions.

This chapter outlines the detailed experimental testing conducted on the fabricated Go-Kart to assess its performance, handling, safety, and endurance parameters. The testing was performed in two stages — static testing and dynamic testing — to verify that the design meets the competition requirements and safety standards.

Both tests were carried out using various instruments, measuring tools, and controlled conditions. The data collected was analyzed and compared with the theoretical and simulation results obtained from SolidWorks and ANSYS Workbench, thereby verifying the accuracy of design assumptions and material selections.

V. RESULT ANALYSIS

After completing all tests, the collected experimental data were compared with simulation and theoretical values to validate the design.

Table Result Analysis

Parameter	Simulation Result	Experimental Result	Deviation (%)	Remarks
Maximum Stress (MPa)	182	175	3.8	Within safe limit
Maximum Deflection (mm)	2.1	1.8	14.2	Good agreement
Acceleration (0–40 km/h)	6.0 sec	5.8 sec	3.3	Excellent
Braking Distance (m)	4.0	3.5	12.5	Improved
Turning Radius (m)	2.1	2.0	4.7	Stable handling

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VI. CONCLUSION

The work is explained in such a way that everyone can easily understand and can follow the report. The steps to do the work are explained for all the objectives performed in this paper.

The calculation is done to get the best values of wheelbase and track width so this has helped us in designing a go-kart frame or chassis. The scope of the study is achieved in the design section where the design is in such a way that it is very compact and also gives a good advantage over your opponent's in real-world conditions. The design part is done in SolidWorks and ANSYS has been used to carry out the analysis. The analysis has been carried out to evaluate, create and modify the best vehicle design to achieve its set of goals.

The main goal was to reduce the track width at the rear to improve the performance of the vehicle. The overall design is carried out to make the vehicle light-weighted without sacrificing performance. After following all these sets of goals one can achieve their compact design. Basic consideration: The frame should contain fewer members to reduce the weight, the number of welds, and cost, Material selection should be done properly by considering the cost and its properties. Design the frame with less number of bends if there are more bends we have to give more support. The design of the chassis is so special that we have decreased the track width This helps one to move swiftly during autocross, skid pad, and many more hurdles easily. So this consideration has been taken to make the vehicle more compact. The aim was to design a compact frame that can handle well in real-world conditions.

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