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Design and Fabrication of a Quick Assembly Modular EV Gokart

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Abstract: ***This paper presents the design and development of a modular electric go-kart with quick assembly and disassembly features. The go-kart uses an AISI 4130 steel tubular chassis, mild steel body panel frames, and lightweight fiberglass panels to ensure structural strength, safety, and ease of maintenance. Quick-release mechanisms are integrated for the steering, battery, and body panels, allowing rapid removal and installation of components. The modular design improves maintainability, supports future upgrades, and enhances overall performance and safety in racing conditions.***

Keywords: Modular EV Go-Kart, Quick-Release Mechanism, Chassis Design, Fiberglass Body Panels, PMSM Motor, Assembly/Disassembly

I. INTRODUCTION

Electric vehicles (EVs) are becoming increasingly popular in motorsports due to their efficiency, low maintenance, and environmental benefits. Traditional go-karts often face challenges in assembly, maintenance, and repairs because components are fixed and difficult to detach. This can lead to longer downtime, especially during competitive racing or testing.The objective of this project is to design and develop a **modular EV go-kart** with quick-release mechanisms that enable easy assembly and disassembly of components such as the chassis, body panels, battery, and steering system. The modular design allows for rapid maintenance, efficient part replacement, and safe handling of hazards, without compromising the structural integrity or performance of the vehicle.The project integrates **lightweight materials**, such as AISI 4130 steel for the chassis and fiberglass for the body panels, with careful CAD modeling and structural analysis to ensure strength, rigidity, and optimal weight distribution. Quick-release systems for the battery, steering, and body sections provide enhanced operational efficiency, making the go-kart adaptable for future upgrades and competitive environments.

II. LITERATURE SURVEY

1) Mihalić et al. (2020) presented a systematic approach to designing a go-kart chassis using CAD and FEA. They optimized beam elements and critical joints to assess stability and suggested thicker tubes or larger diameters for improved safety factors. Vehicle dynamics calculations were performed to evaluate braking and collision stresses.

2) Jenny and Abdallah emphasized creating a lightweight, structurally sound EV go-kart for beginner users. They performed static and dynamic analyses to ensure the chassis could handle loads without excessive material use, balancing performance and cost.

3) Tharun Reddy et al. described the full design and fabrication process, including chassis, steering, braking, and electrical powertrain integration. They highlighted the importance of strong materials and FEA validation, while using locally available resources to reduce costs.

4) Shelke et al. designed a rigid, torsion-free chassis using AISI 4130 steel and validated it through FEA. Their work also focused on ergonomic driver placement, optimized powertrain mounting, and manufacturing simplicity.

5) Omar et al. simulated an EV powertrain using a 72VPMSM motor with NMC batteries. Their scaled-down model tests ensured thermal and electrical stability, showing reliable performance for 30 minutes at full power.

6) Abhijith et al. focused on designing a cost-effective electric go-kart while maintaining structural strength. They emphasized minimizing material cost without compromising safety or durability.

III. DESIGN AND DEVELOPMENT

The entire document should be in Times New Roman or Times font. Type 3 fonts must not be used. Other font types may be used if needed for special purposes.The core focus of this project was to design a modular EV go-kart with efficient quick-removal mechanisms, enabling rapid assembly and disassembly for maintenance, safety, and competitive scenarios. The chassis was constructed using AISI 4130 steel, 1-inch diameter, 2 mm thickness, providing strength while maintaining light weight.

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The body panel frames were fabricated from mild steel, 1-inch diameter, 1.6 mm thickness, designed to support fiberglass body panels, which were molded using thermocoal and resin to achieve aerodynamic shapes and lightweight structures.

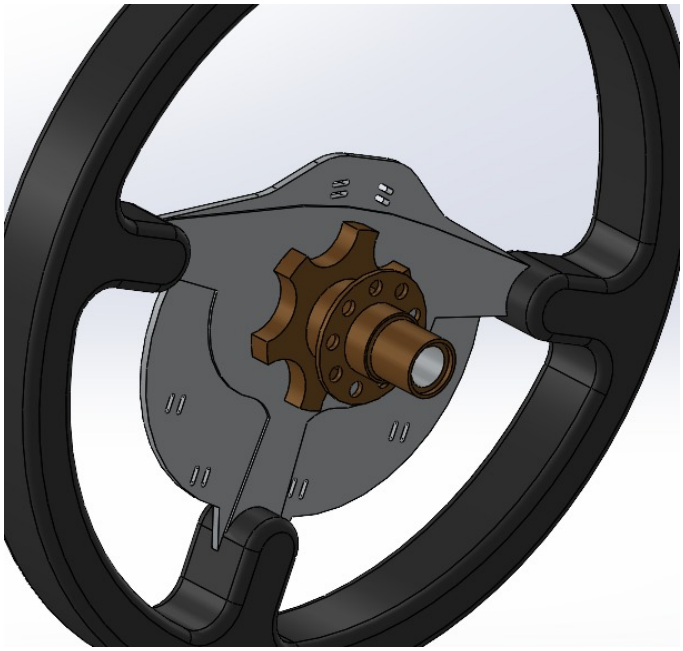


Fig.1 Example of an Quick removal Mechanism

Quick-removal mechanisms were implemented across the kart to enhance modularity and operational efficiency. The steering mechanism features a ball-lock system with splined rods, allowing fast detachment and reattachment. The battery system is mounted in an L-channel frame with a single bolt securing the top, enabling easy removal without compromising structural integrity. The front and rear sections utilize sliding pipe connections with intermediate mounts and bolts, ensuring rigidity while allowing rapid assembly/disassembly. Side panel bodywork is bolted to fixed frames, allowing safe and fast removal of only the hazardous or exposed components. All fasteners and locking mechanisms, including locknuts and washers, were selected for strength, reliability, and speed of operation.

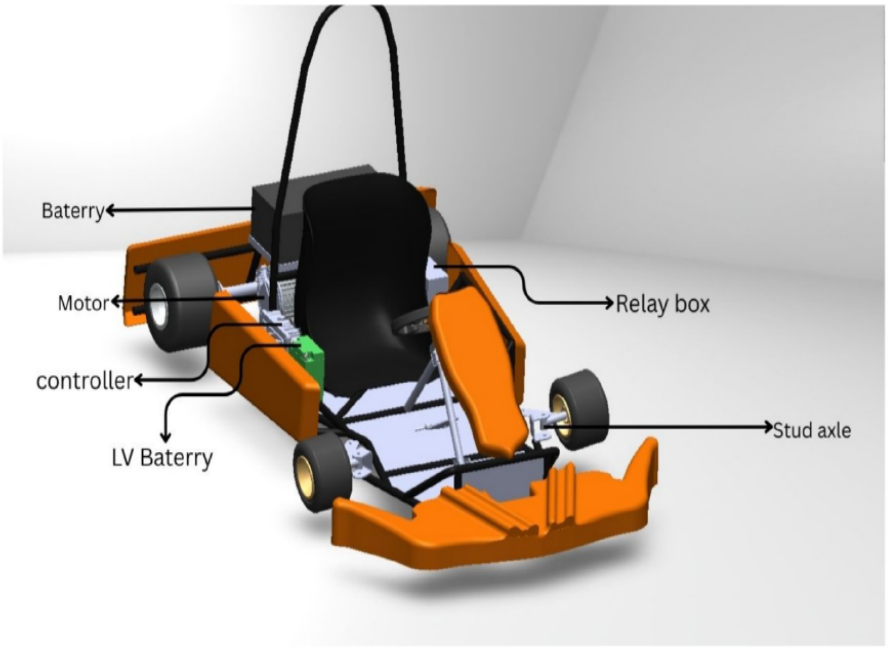


Fig.2 Full cad of Ev gokart

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IV. RESULTS

The proposed modular go-kart system demonstrates a significant improvement in assembly and maintenance efficiency compared to existing solutions. While traditional market karts require around 40 minutes for complete assembly or disassembly, the previous design reduced this time to approximately 6 minutes. Our proposed system further optimizes the process, achieving an average assembly and disassembly time of just 2.3 minutes. This reduction highlights the effectiveness of the quick-release mechanisms and modular design, making the vehicle highly practical for rapid maintenance and component replacement.

TABLE I

S.NO	SYSTEM	AVERAGE TIME ASM_DSM
1	MARKET KARTS	40MINS
2	PREVIOUS DESGIN	6MINS
3	PROPOSED SYSTEM	2.3MINS

V. CONCLUSIONS

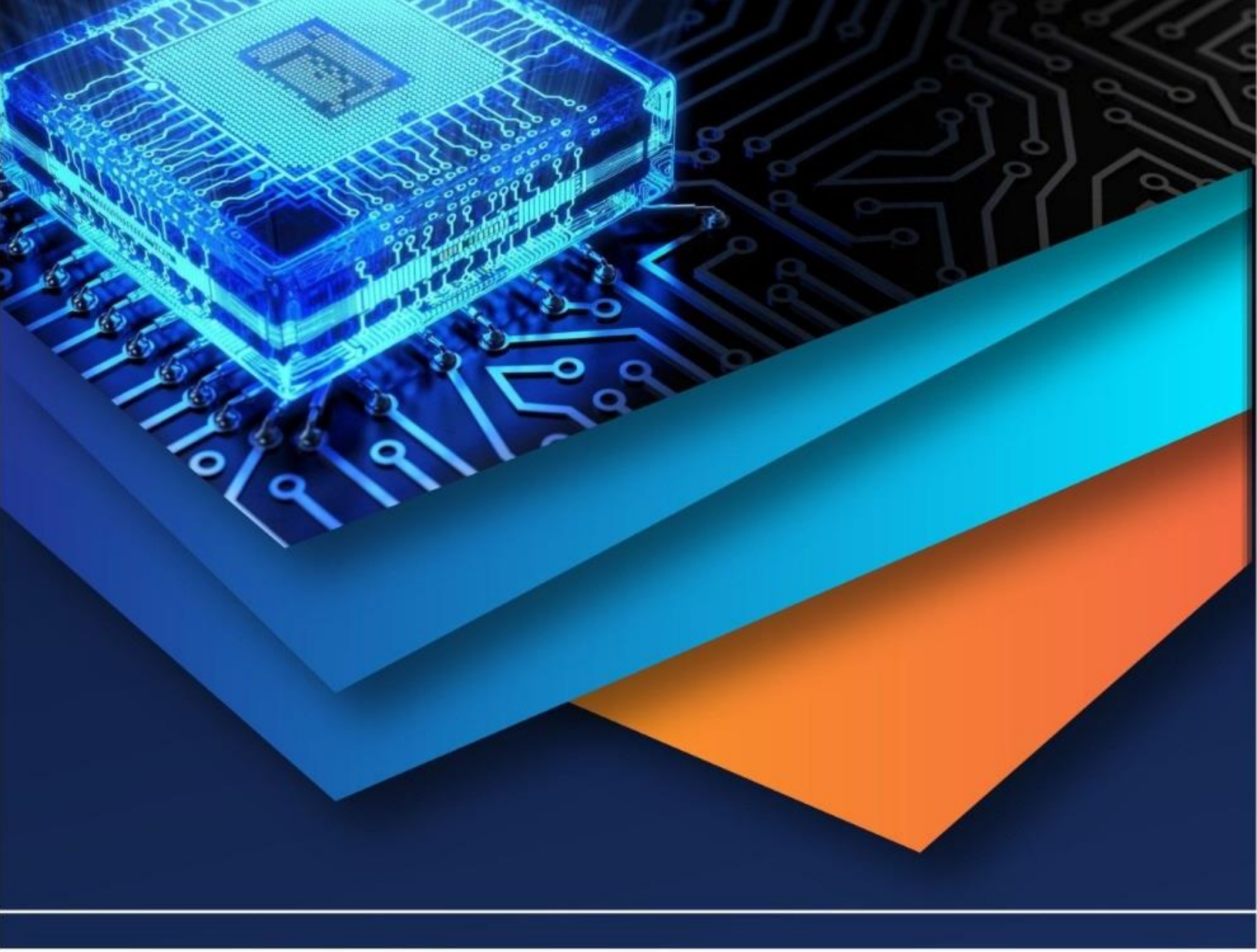
The design and development of the modular electric go-kart chassis successfully achieved a lightweight, strong, and easily maintainable structure. By incorporating quick-release mechanisms and optimizing the frame, assembly and disassembly times were significantly reduced compared to previous designs and commercial market karts. The proposed system demonstrates enhanced efficiency, structural integrity, and user-friendliness, making it suitable for educational purposes, small-scale racing, and practical applications in resource-constrained environments. Overall, this project highlights the effectiveness of combining CAD modeling, FEA analysis, and modular design principles in improving both performance and usability of electric go-karts.

VI. ACKNOWLEDGMENT

I would like to express my sincere gratitude to my mentors, colleagues, and team members for their guidance, support, and encouragement throughout this project. Special thanks to the faculty and technical staff who provided valuable insights and resources, enabling the successful design, development, and testing of the modular electric go-kart. Their expertise and assistance were instrumental in overcoming challenges and ensuring the completion of this work.

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