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A REVIEW PAPER ON ELECTRIC GO-KART

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Abstract - Go-Kart is a racing vehicle having very low ground clearance and can be work on only flat racing circuits. This paper concentrates on explaining the engineering behind designing of a safe, rigid and torsional free frame, well-mounted power train along with braking and steering system. We approached our design by considering all possible alternatives for a system and modelling them in SOLIDWORKS. The design process of the vehicle is iterative and is based on various engineering and reverse engineering processes depending upon the availability, cost and other such factors. The design objectives, set out to be achieved were four simple goals applied to every component of the vehicle: durable, Safety & ergonomics, lightweight and high performance. All the parameters like Reliability, safety, Cost, Performance, aesthetics, ergonomics, Standard dimensions & material were also taken in consideration on the same time. Also, while designing every individual part DFMEA and DVP has been done which improved our quality standard, factor of safety and other safety parameters also. The designed go-kart is able to withstand against any adverse condition on road as each component is designed specifically considering all types of failures and safety issues.
This study focuses on the design and implementation of electrical powertrain of an E-kart that will be used in Student Motorsport Racing competitions. This work mainly focuses on the design and implementation of electrical powertrain using high density of Lithium-Ion Battery Technology. The kart is built keeping in mind all the safety concerns that are involved in building an EV. The aim of study is the preliminary sizing of the main components of electrical powertrain for satisfying the performance requirements in the event and be the best in terms of performance, reliability and safety. The study shows the optimal design procedure on basis of fixed racetrack identifying the speed profile, output mechanical power to the wheel, considering all the resistive forces experienced by the kart and energy required to sufficiently run the kart throughout the series of dynamic events in the competition

Key Words: Electric, Powertrain, Lithium-ion, Electric kart, Solid works, Ansys, FEA.

1.INTRODUCTION

Go-Karts come in all shapes and forms, from motor less models to high-powdered racing machines, some, likes super karts, being able to beat racing cars on long circuits. Electric propulsions systems for competition racing karts have not yet reached the point in their development cycle where by a recognized technical formula has been achieved for their introduction into sanctioned competitive electric kart racing.

The design is mainly focused on the following objectives: Safety, Serviceability, Strength, Ruggedness, cost, durable, lightweight, high performance, ergonomics, and aesthetics.

1.1 Components

The integration of a Go-Kart involves fitting together separate parts to form a monologue body or units and mounting these onto a frame, the chassis. A Go-Kart chassis basically comprises the following,

1. Body shell: forms the skeleton of the vehicle.

2. Motor: a machine, especially one powered by electricity or internal combustion, that supplies motive power for a vehicle or for another device with moving parts.

3. Transmission system: aids in transferring the drive from the engine to the wheels. Its main components are the clutch, gearbox, final drive, and differential.

4. Suspension system: used to connect the wheels to the body or chassis frame.

5. Steering system

6. Brakes

7. Electrical equipment

8. Roll Hoop, Floor sheet, Go-Kart wheels, seat, etc.

2. LITERATURE SURVEY

Eli Davis, in his paper he discussed about the design considerations and specifications of building a personal battery-powered go-kart that includes designing and building a custom brushless DC motor for use in the drivetrain.

Prof. Ambeprasad Kushwaha1, Prof. Avinash Chavan Tapeshwar, A. Das, Shubham S. Kenjale, Jay A. Patel, Pradeep R. Prajapati, In their work they studied about the design and development of working model of cost effective electric go-kart. Main objective behind designing and fabricating the electric go -kart is to make it available in cheap price, making it simple in working for even nonprofessional drivers, increasing is strength so that it can sustain more weight and providing it with all the best available facilities in lower cost.

Włodzimierz Gołębiowski, in his study he discussed about the role of electric vehicles in the motorsport like F1 and Go-karting. Current technology enables to construct e-Karts for children's and juniors` categories. In this paper concept of the construction of e-Kart uses advantages of electric motors which are presented. The proposed construction concept assumes the introduction of an in-dependent wheel drive of the rear axle allowing the so-called torque vectoring.

Harald Neudorfe, in this study he compared the types of propulsions of electro and hybride vehicles basically 3 different motors are used: induction machine (IM), permanent synchronous machine (PM) or switched reluctance machine (SR). To analyse and compare these types of machines three electrically powered go-karts were buildt at Daimler Chrysler AG Stuttgart plant 10. These e-go-karts have the same configuration regarding batteries, power inverter, gearbox and mechanical parts.

Manh-Kien Tran , Mobaderin Akinsanya , Satyam Panchal, Roydon Fraser and Michael Fowler, In ''Design of a Hybrid Electric Vehicle Powertrain for Performance Optimization Considering Various Powertrain Components and Configurations", examined various powertrain configurations and components to design a hybrid powertrain that can satisfy the performance criteria given by the EcoCAR Mobility Challenge competition. These criteria include acceleration, braking, driving range, fuel economy, and emissions. They designed a hybrid powertrain consisting of a 2.5 L engine from General Motors, a 150 kW electric motor with a 133 kW battery pack.

Emma Arfa Grunditz, in his study ''BEV Powertrain Component Sizing With Respect to Performance, Energy Consumption and Driving Patterns'', she assessed typical vehicle usage on different road types and also to study the implication on vehicle energy consumption due to the drive cycle's characteristics. For this evaluation, three reference vehicles were designed after different set performance requirements, with data on 17 existing BEVs as a frame of reference. An available traction motor, power electronic module and battery cell were utilized, where the motor was scaled by active length. Finally, the consequence of downsizing the electric drive system in terms of energy consumption and performance was also studied.

Mark Allison, Bryan Bidwell, Stuart Hopson, Jackson Smith, Carlos Streegan, and Dominic, Villa, in their work " Formula electric : powertrain ", worked on design and manufacturing of powertrain for an electric racecar according to the rules prescribed by the SAE international Formula Electric Competition.

Lal K., 2016, Go-kart is one of the famous vehicles consisting of small size tires, an engine, chassis, and single seat. All the materials used in manufacturing go-kart are lightweight, durable, and strong. No suspension system is involved in go-kart which makes it easy to operate. Other vehicles have a large clearance from the ground. But in the case of go-karts, a small clearance is left from the ground. Thus flat tracks are used to run go-karts on the roads. It was first time developed in the 1950s in the United States by Art Ingles. It was initially developed for racing purposes. In the 1960s and 1970s, it became popular in India, Europe, and United States. Now it is modified in various sizes and different technologies are used and used for many other purposes.

Pattenshett SV., 2016, There are five major components in a go-kart. These include chassis, engine, steering system, braking system, and control systems. Chassis is the part in which all other components are fixed and mounted. So chassis must be designed in such a way that it has sufficient stability and structural rigidness.

Mitchell S. et al., 2017, The steering system consists of components, which form a mechanical arrangement. This arrangement ensures that the front wheels of the go-karts are moving in the right direction as they receive a command from the steering. The most common system used in go-karts is the rack and pinion system.

Kelkar K. et al. suggested that as the suspension is not used in go-karts, so series of tests should be conducted to verify that no harmful stresses would be generated which affect the performance of the vehicle (Kelkar K., 2017)

Harshil et al. studied the aerodynamic behavior of the vehicle. They examined that body of the vehicle should be designed on the principles of aerodynamics and the engine must be chosen wisely. The speed of the vehicle can be sufficiently increased by following the above two points. As the speed is concerned, the braking system should be wisely chosen which is compatible with to speed of the vehicle (Harshil et al., 2015).

Hajare K. et al. studied the design of the chassis with many design and analysis software. They used FUSION 360. They developed a design and made an analysis. Their results showed that the chassis had enough strength and stability and it can withstand stresses and impact loads (Hajare K. et al.).

Mitchell et al. studied go-karts. He showed that the base of the vehicle is the center distance between the front and rear wheels. He proved that if the base of the vehicle is large then it has more stability and reliability. He also showed that different types of designs for the go-karts have different criteria to check the stability of the vehicles. He concluded that research and study on go-karts should not be stopped as the designs must be updated with time (Mitchell et al., 2017).

American Art Ingels is generally accepted to be the father of karting. A veteran hot rodder and a race car builder at Kurtis Kraft, he built the first kart in Southern California in 1956. Instantly popular, Karting rapidly spread to other countries, and currently has a large following in Europe. The first kart manufacturer was an American company, Go Kart Manufacturing Co. (1958). In 1959, McCulloch was the first company to produce engines for karts. Its first engine, the McCulloch MC-10, was an adapted chainsaw two-stroke engine. Later, in the 1960s, motorcycle engines were also adapted for kart use, before dedicated manufacturers, especially in Italy (IAME), started to build engines for the sport.

"A FUTURE FOR SOLID STATE BATTERIES" by J. Janek, Wolfgang G. Zeier, Solid-state batteries have recently attracted great interest as potentially safe and stable high-energy storage systems. However, key issues remain unsolved, hindering full-scale commercialization.

D. Karale, S. Thakre, M. Deshmukh "DESIGN AND ANALYSIS OF ELECTRIC VEHICLE", The EV's chassis was designed and developed based on assumptions about the vehicle's gross weight for carrying a suitable size of sprayer attachment, taking into account the agronomical requirements of the field crops available in the region, and validated using the Finite Element Method (FEM) with ANSYS software.

Prof. Nirmal Chohaun, The goal of this report is to design and build a working model of an electric go-kart. The go-design kart's and construction are basic enough that even nonprofessional drivers can run it. The design is based on the vehicle's great strength, which allows it to carry more weight and deliver the best services at a low cost.

3.ACKNOWLEDGEMENT

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