Design and Manufacturing of Electric Kart Using PVC Material

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Abstract-A go kart is small four wheeled vehicle. Go kart, by definition has no suspension and no differential. They are usually raced on scaled down tracks, but are sometimes driven as entertainment or as a hobby by nonprofessional's. Karting is commonly perceived as a stepping stone to the higher and more expensive ranks of motor sports. Go-karting is a growing segment in a automobile sector. In order to control air pollution through this growing segment, this paper aims towards designing of an electric kart, which is environment friendly as it causes no pollution. The electric kart is motor and battery operated the designed aimed towards light weight and highly stable vehicle in order to maximize the power to weight ratio. Reliability, durability, safety and comfort were the key factors which kept in mind while fabrication of electric kart.

Keyword: PVC material for chassis, light weight, low cost.

I. INTRODUCTION

Go-karting originated in early 1950's in America and instantly became popular, which lead to rapid spreading in other countries. Since then go-karts used 2-stroke & 4-stroke air-cooled engines which are operated on gasoline. Sometimes motor cycle engines are also used as a power unit in go karts. The use of fossil fuels in go-karts not only adds to air pollution but also leads to fast depletion of fossil fuels due to their excessive use and limited stocks[1-2]. The engines used have bad exhaust systems and are not even fully optimized to decrease the emissions. Some go-kart engines even give out more emissions than a passenger car. In order to tackle all these issues and keep our environment pollution free and healthy, there is an urgent need to explore alternatives to fossil fuels. Numerous efforts are being put forward to power the vehicles through hydrogen, bio-diesel, ethanol, methanol, CNG, solar power, batteries etc. [3-6].

In order to explore opportunities with an electric kart, we aimed to design a motor and battery operated kart. The major difference between an electric kart and a go-kart is only of the power source. The static and dynamic behaviours of the go-karts were studied in order to eliminate the other existing problems in a go-kart. The designs were iterated continuously in order to maximize the performance. All the subsystems designed had separate design considerations. The overall vehicle was light in weight, highly stable and eliminated most of the current issues with a go-kart [7-8]. The kart could pass through all the static and dynamic tests put forward in order to prove its excellence.

II. METHODOLOGY

We approached our design by considering all possible alternatives for a system and modelling them in AUTODESK INVENTOR. The model was then modified and retested for the final design. 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 three simple goals applied to every component of the vehicle: durable, light-weight and high performance, to optimize the design by avoiding over designing, which would also help in reducing the cost, with this we had a view of our kart. This started our goal and we set up some parameters for our work.

The following methodology was used in design:

- Material selection
- Frame design
- Steering system design
- Fabrication of Chassis
- Fabrication of Parts to Chassis
- Driving and Testing.

The actual PVC design of the chassis is shown on fig. 1 below

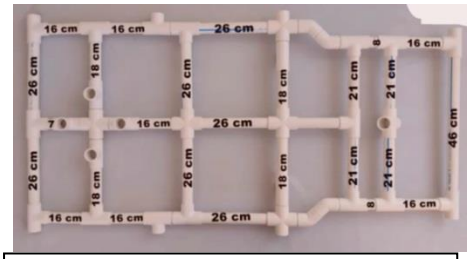

Fig.1 Design of Chassis

III. DESIGN

TABLE 1 Physical Property Of Chassis

Mass	10.546 kg
Area	3158730 mm^2
Volume	7532850 mm^2
Center of gravity	X=1276.71 mm Y=-1783.96 mm Z=287.335 mm

TABLE 2 Property Of PVC Material

Name	PVC Piping	
General	Mass density	1.4 g/cm^3
	Yield strength	46.53 MPa
	Ultimate tensile strength	52.36 MPa
Stress	Young's modulus	3.4 GPa
	Poisons ratio	0.4 ul
	Shear modulus	1.21429 GPa
	Melting temperature	100-160 degree Celsius

TABLE 3 Operating Conditions

Load type	Force
Magnitude	15.000 N
Vector X	-15.00 N
Vector Y	0.000 N
Vector Z	0.000 N

- Material selected is PVC which reduces the weight.
- Starting torque is reduced due to light weight.
- Life span is increased.
- Ackermann's steering mechanism will be used to provide easy manoeuvring with quick response.

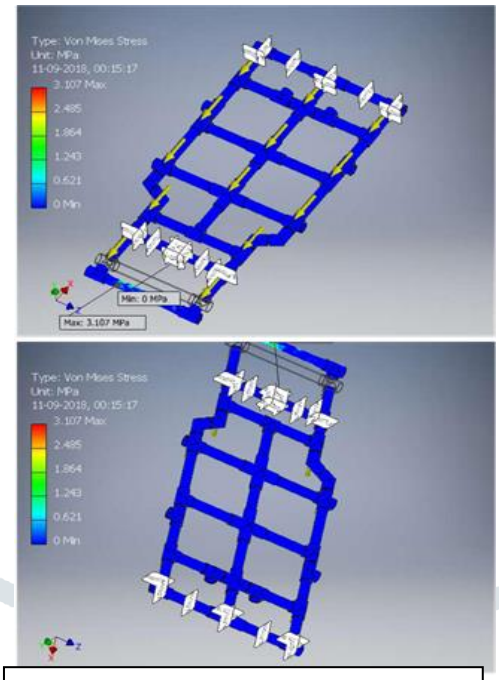

Fig. 2 stress analysis

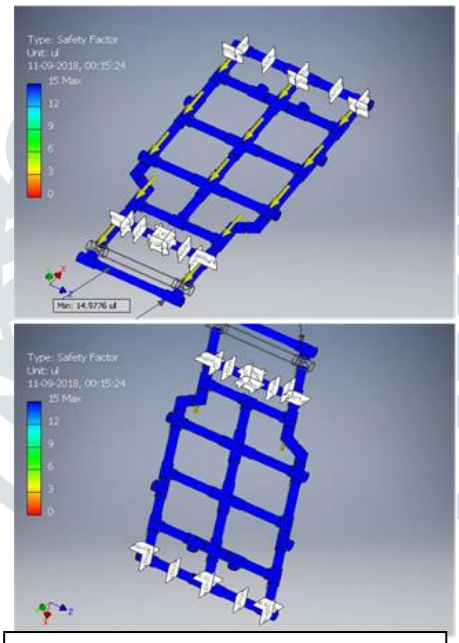

Fig. 3 safety factor

IV. RESULT

TABLE 4 Result Summary Of Chassis

Name	Minimum	Maximum
Volume	7533000 mm^3	
Mass	10.5462 kg	
Principal stress	-1.66825 MPa	3.29399 MPa
Displacement	0 mm	2644.43 mm
Safety factor	14.9776 ul	15 ul

The principal stress, displacement and safety factor are all within the safe limits as shown in fig.2 and fig. 3 and also the applied on the chassis does not fail and is safe for use.

V. CONCLUSION

In this research study we conclude that the PVC (polyvinyl chloride) material used for the manufacturing of chassis can easily sustain the load up to 100kgs. Tremendous reduction in the weight of the go-kart is achieved by the use of PVC material. In this paper, a complete overview is given about the design and fabrication of go kart which is to be made. The following references focus on specific aspects such as high reliability, compact design, use of electric energy and effortless steering.

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