# Troubleshooting and Its Solutions in Designing of a Smart Go Kart

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**Abstract**
The Provoc'ar is a Spanish word meaning Spark. Hence, our idea began with a spark in our mind to design such a vehicle which would have all the qualities of an ideal Go Kart. The beginning of this project started with a simple 109cc, 8 BHP, 4 – Stroke Engine, and sooner our dream turned into reality. We know that competition is a major factor in modern life. There are too many competitions and errors in these. In all these competition persons have conflicting interest, and everyone tries to maximize his gains and minimize losses and errors. So we have a mathematical tool which can be used to analyze these errors named as Operation Research.

**Keywords**
Designing, Provoc'ar, Go Kart, Game Theory, Operational Research, Steering system

## I. Introduction

The main purpose was to develop a vehicle that has similar driving characteristics to an usual passenger car. Design and fabrication of the Go-kart focuses on developing a simple, lightweight and easily operated vehicle. Aspects of ergonomics, safety, ease of manufacture, and reliability are incorporated into the design specifications. Analyses are conducted on all major components to optimize strength and rigidity, improve vehicle performance, and to reduce complexity and manufacturing costs. This coupled with appropriate research, to create a new chassis and suspension system that possesses improved performance and features. This is done by carrying static and dynamic analysis from theoretical knowledge and analytical methods.

A game is any decision problem where the outcome depends on the actions of more than one agent, as well as perhaps on other facts about the world. Game Theory is the study of what rational agents do in such situations. Games are an interesting enough class of decision problems that they are worthy of attention because of their practical significance, even if they don't obviously form a natural kind. Problems faced in using optimized product have been solved using Game Theory (Operational Research).

## II. Specifications

In this paper description of the making of Go Kart is given which had undergone many steps. The Go kart have been made according to the following specifications:

### A. Chassis

Rectangular construction, MILD STEEL Square Tube 1.5"*1.5"*240" 16 Gauge, Angular Mild Steel Rod 1"*1"*27", Mild Steel Square Tube 1.15"*1.15"*27" 16 Gauge, Mild Steel Square Tube 0.75"*0.75"*216" 18 Gauge, Mild Steel Plate 36"*36"*0.25", Mild Steel Plate 24"*24"*3/8".

Chassis has been constructed while keeping in mind its strength, less weight and safety of the driver.

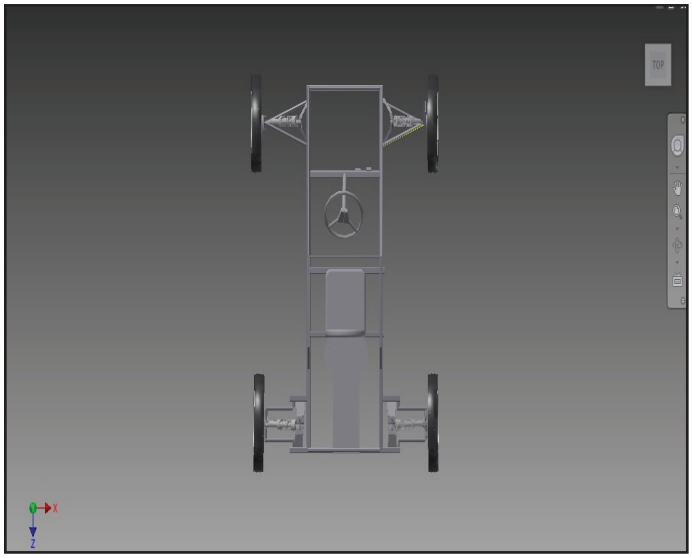

Fig. 1: Top View of Design of Go Kart

### B. Tyres

3.5-10 MRF Nylogrip Tyres, 4
Tyres Diameter 16 (TVS Kinetic Tyres)
Tyres were specially selected to bear the whole weight, grasp firm grip and at the same time maintain required Ground Clearance.

### C. Kart Specifications

Total length = 84", Total width = 56",
Total height = 51", Wheel base = 65",
Track (front) = 52", Track (rear) = 54",
Ground clearance = 7", Kart weight = 148 kg.

### D. Engine

109cc, 8 BHP, 4 Stroke, Single Cylinder, Honda Activa Engine, Engine weight =55kg.

### E. Axle

Single Axle Drive
Right Back Tyre is connected to the shaft of Engine through Cross Assembly (u-shaped joint which transmits motion).

### F. Braking

Drum Brakes of the Engine itself are used, which brakes the same tyre driven by the axle.

### G. Suspension

Used to allow the relative motion to absorb shocks and provide comfort to rider.
Bajaj Discover Suspension used.

### H. Steering

Maruti Suzuki Rack and Pinion Steering Arrangement, Cut to specific length as required as per Front Track.

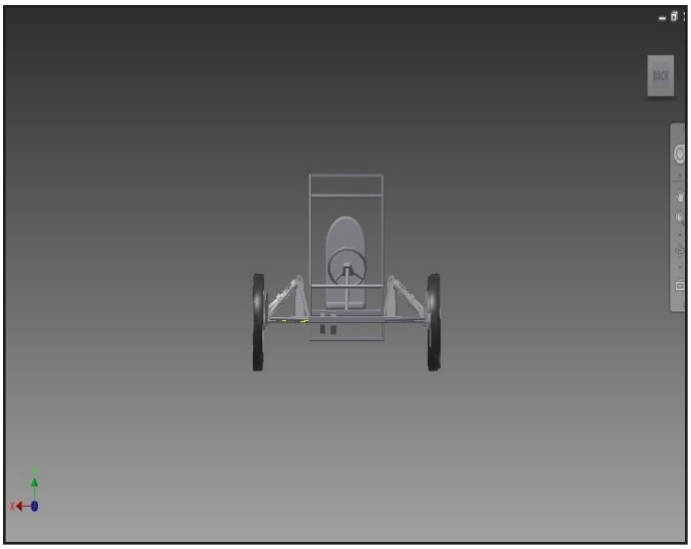

Fig. 2: Front View of Design of Go Kart

### I. Electricals

Battery: 12 volts
Self Start: Same of the Engine
Head Lamps: 2 Head Lamps above the roll bars have been used
Horn: 72 Decibels

### J. Safety

Roll Bars have been used for the safety of Driver in case of accident and collision.
Safety Belts and Helmet are provided.
Fire Extinguisher is handy.
Safe distance between Petrol Tank, Battery and Engine. Kill Switch in the form of Key is provided which Shuts down all the wiring.

### K. Ergonomics

Comfortable seat for driver,
Easy and Simple driver for the driver.
Vehicle can be utilised for simple day to day purpose of travelling to nearby destinations.

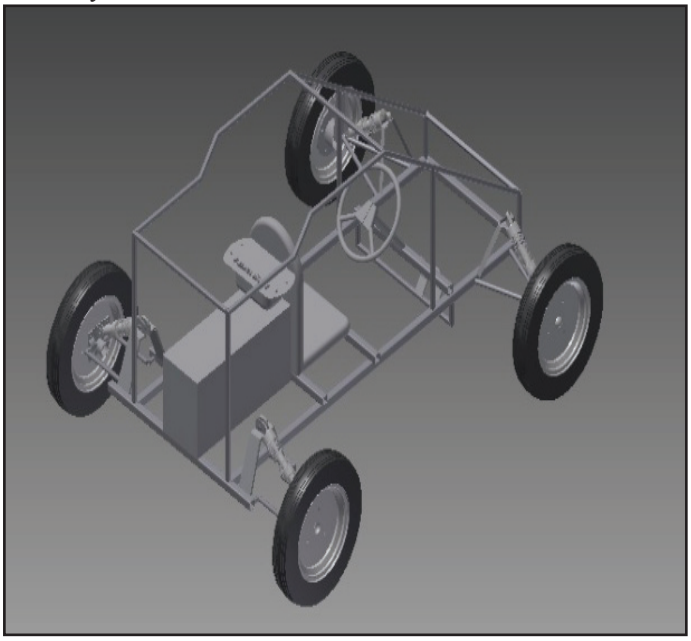

Fig. 3: Structural Design

### III. Bottleneck and its Solution

The function of the steering system is clearly to afford the driver directional control of the vehicle, and to provide this control with sufficient accuracy to choose the best course around corners, to avoid other vehicles and stationary obstructions. But one problem raised i.e. the handling of Go kart was not appropriate so work on the steering system to make it stable on road while driving is done. Application of different-different parts and objects to constrain the free motion of tyre has been worked upon when it loses the contact with rod due to pat-holes.
Having two options for improvement of the system i.e. either to apply a rigid rod to constrain the free motion of tire while going through pat-holes or second option is to apply a spring to constrain that motion. Both the options were analyzed practically and theoretically. One of these options has been finally opted after analyzing with probability of Accident before and after the manipulation with the help of Game Theory (Operational Research).

Fig. 4: Application of Spring

### IV. Analyzation

Pay off Matrix for the given situation before and after manipulation is analysed. Data is collected according to tests done per manipulations and without manipulations. Tests were done for 4 hours per day for 15 days. The values given are the mean accident reasons occurring per day.
Following is the payoff matrix formed by the data collected.

| | Without Rigid rod Manipulation | With Rigid rod Manipulation |
|---|---|---|
| Without Spring Manipulation | 10 | 5 |
| With Spring Manipulation | 2 | 3 |

Fig. 5: Payoff Matrix

Following is the bar graph representing Mean accident reason occurring per day with and without manipulation.

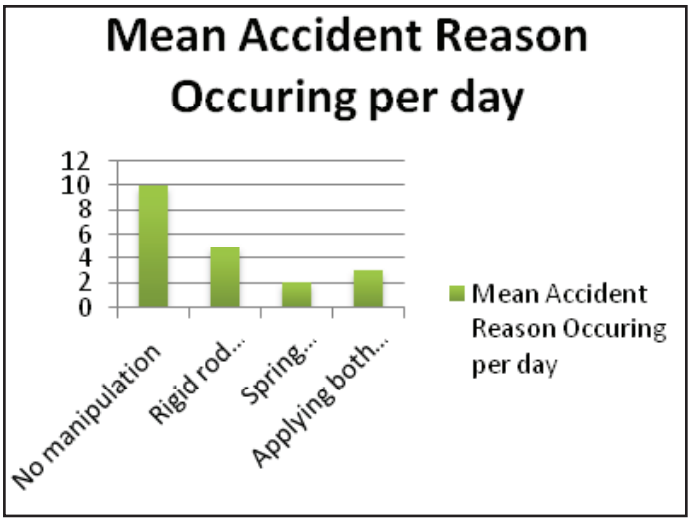


Fig. 6: Bar Graph representing Mean accident reason occurring per day

## V. Conclusion and Future Scope

According to results found by analyzation it's better to apply spring manipulation. Hence application of spring is done. Also, rigid rod was creating more problems according to tests done with and without manipulations.

The Kart is very feasible for day-to-day travel similar to motorbike. The Kart is much comfortable which supports the driver for easy riding. Mileage efficient vehicle in comparison with any other four wheelers. Very Less weight compared to a small car and comparable to a motorbike. It provides better safety than a two wheeler vehicle.

In future, further improvements can be done by using more powerful engine or tuned for first gear, differential can be used to transmit torque for rear wheels and automatic clutch can be used.

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