



**TEAM**



**TREME**

**SQUAD**

**Bangalore,  
Karnataka**

25<sup>th</sup> sept 2022

# Technical Specifications

## ENGINE

Displacement	149.2
Max. Torque	13.5 Nm @ 7000 rpm
Max. Power	11.64 KW @ 8500 rpm

## CHASSIS

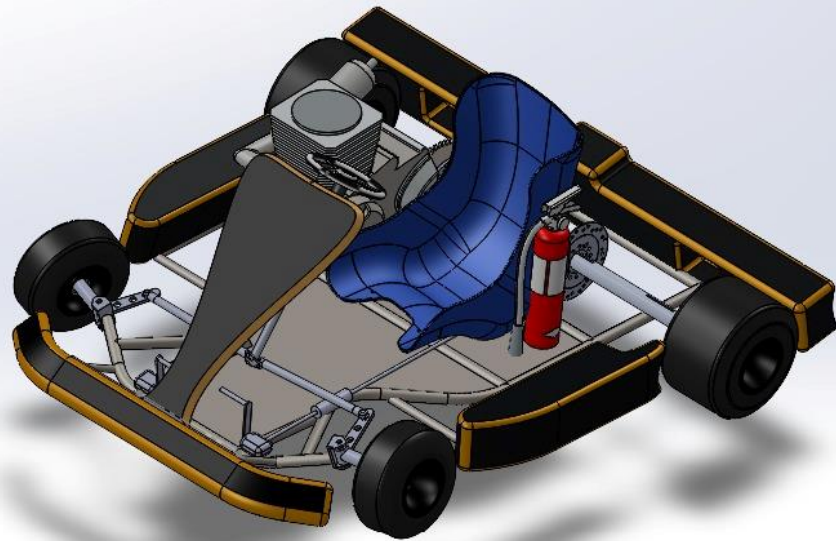
Type	Ladder
Weight	14.9 kg
Material	AISI 4130

## VEHICLE

Wheelbase	1020 mm
Front Track Width	960 mm
Rear Track Width	1040 mm
Total Weight	170 kg
Ground Clearance	35 mm

## TRANSMISSION

Gearbox	5 Speed
Type	Chain Drive
Top Speed	93.75 kmph
Acceleration	14.42ms <sup>-2</sup>



Iso-metric view of the kart

## STEERING

Ackerman angle	20.136 deg
Turning radius	2.1 m

## BRAKES

Type	Single hydraulic disc brake
Stopping distance	4.72 m

## WHEEL SIZE

Front	10 inches
Rear	11 inches

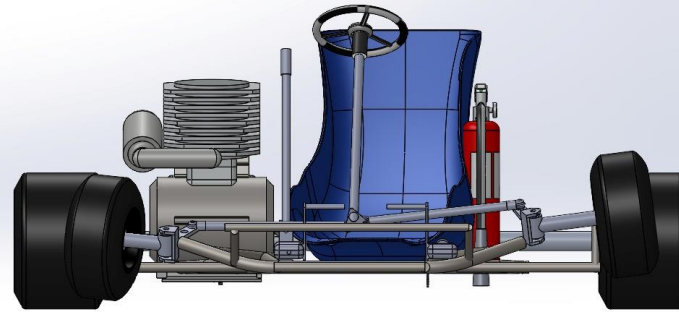
# Design Methodology

The following design methodology was followed during design:

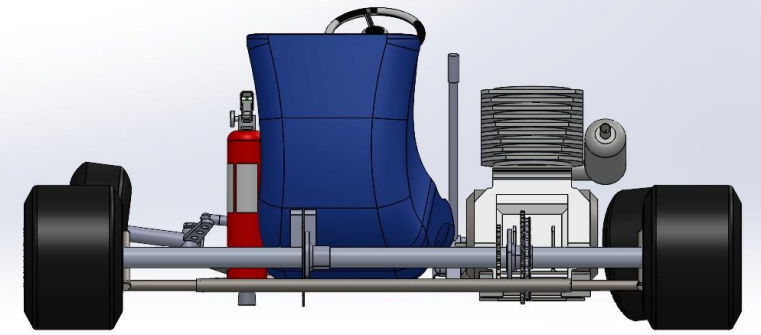
- Requirements(according to the Rulebook IKC-5)
- Drivers ergonomics
- Conceptual sketch
- Design calculations
- Designing
- Analysis
- Optimization
- Fabrication

Objectives:

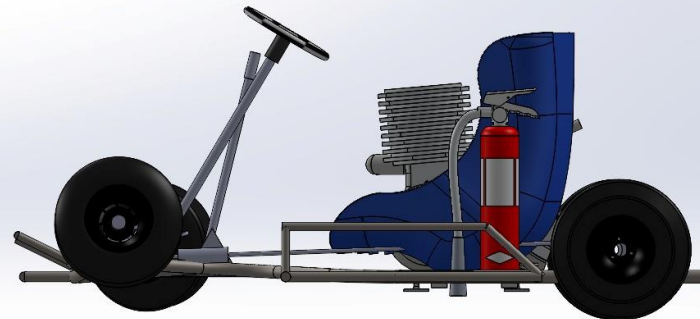
- Easy operation.
- Lightweight and compact.
- Low cost.
- Ease of manufacturing.
- Optimum Braking
- Effortless Steering
- Aesthetically Pleasing



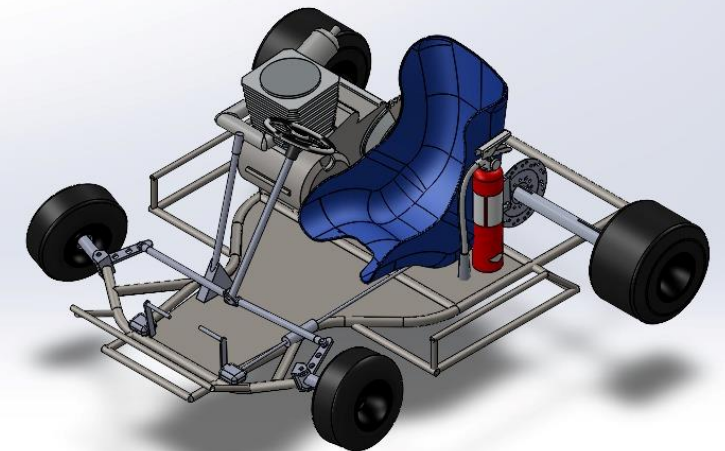
Front view



Rear view



Side view



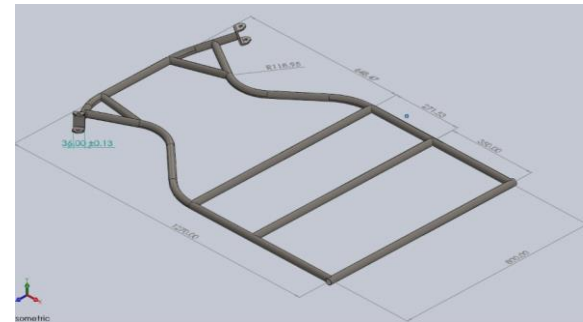
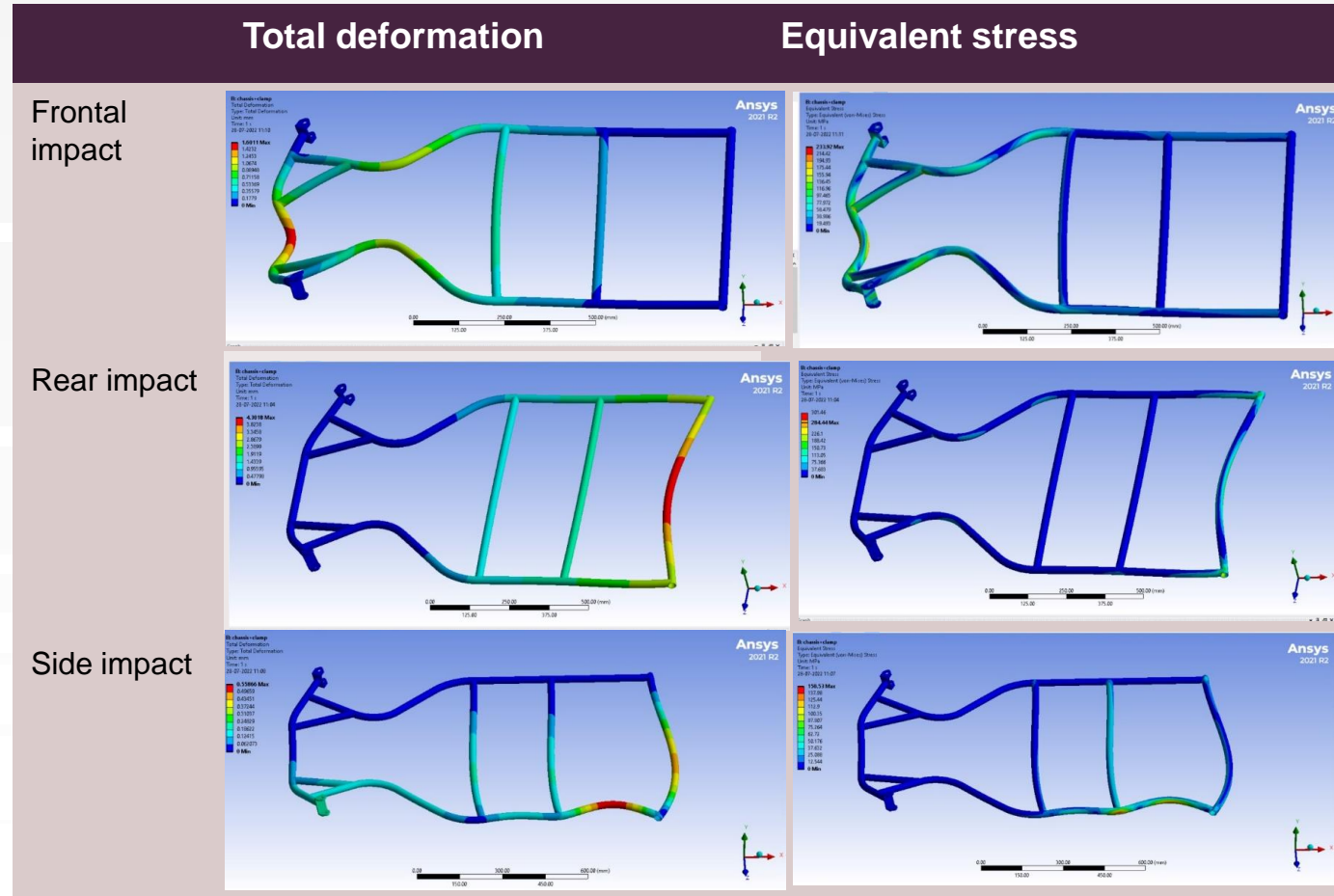
Isometric view

# Finite Method Analysis

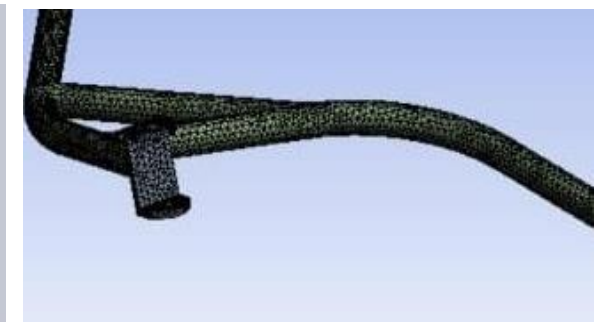
Element type	Tetrahedron
Element size	5mm
No. Of nodes	245885
No. Of elements	123460
Skewness	0.59695
Aspect ratio	3.1744

FRAME MATERIAL PROPERTIES	
Material	AISI 4130
Material Cross Section	25.4*1.6 mm
Ultimate Tensile Strength	560 Mpa
Yield Tensile Strength	435-979 Mpa
Shear Modulus	80GPa
Density	7,85 g/cc

	load	Deformation	Max. Stress	FOS
Frontal impact	2943 N	4.3018 mm	284.44 MPa	1.617
Rear impact	7375.05 N	1.605 mm	234.09 MPa	1.965
Side impact	5880 N	0.5586 mm	150.53 MPa	3.055



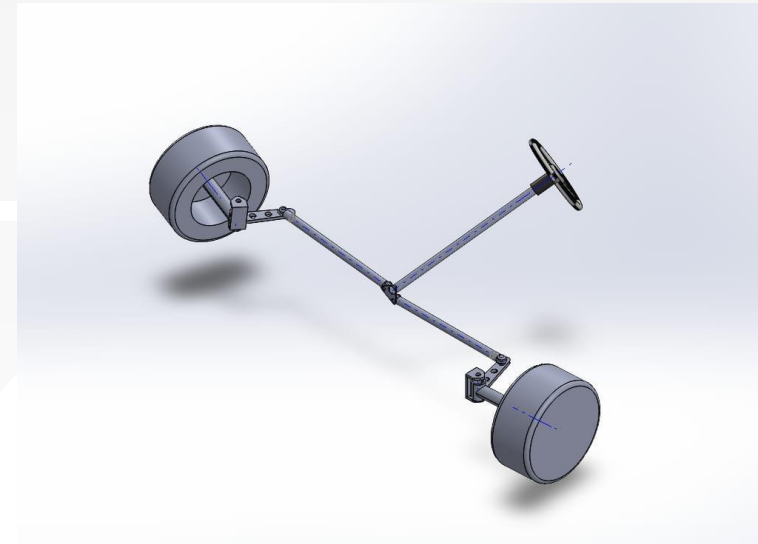
analysis model



meshed model

# Steering System

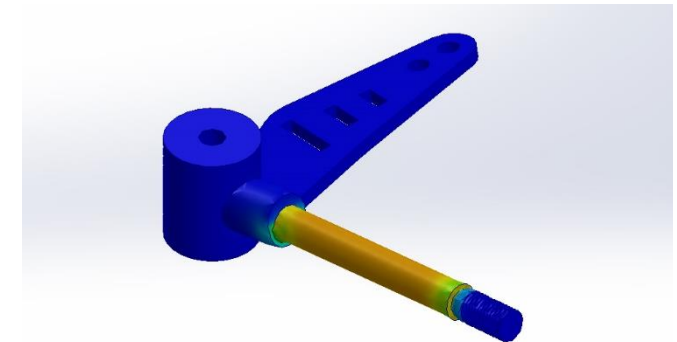
PARAMETER	VALUE
Mechanism	Ackerman geometry
Steering Ratio	1:1
Max turning radius	2.44 m
Turning radius	2.101 m
Min turning radius	1.779 m
Tie-rod length	716 mm
Scrub Radius	7.7 cm
Camber	0 deg
Caster	8 deg
Kingpin inclination	10 deg
Inside steer angle	35 deg
Outer steer Angle	24.7 deg
Steering effort	38.64 N
Ackermann angle	20.136 deg
Ackermann percentage	100 % theoretically 99.7 % practical
Self aligning torque	0.993 Nm



Steering system geometry



Steering knuckle

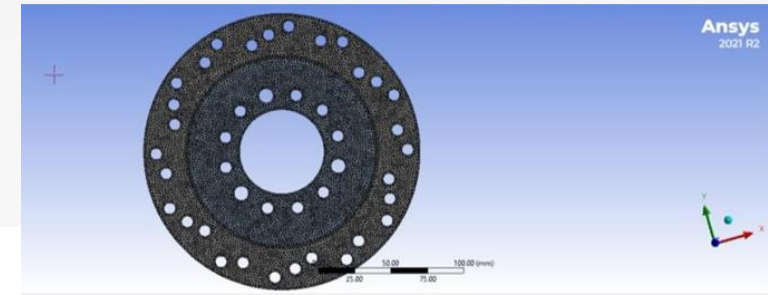


FEA model of knuckle

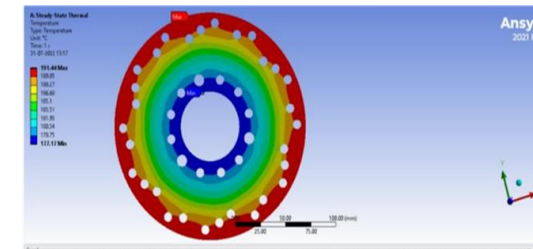


# Braking System

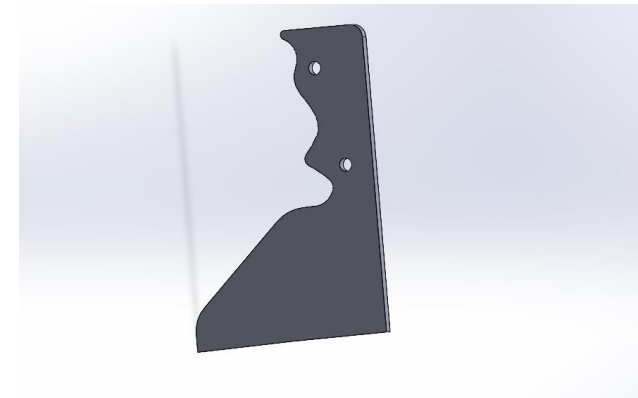
Brake type	Single disc floating caliper at rear axle
Diameter Of Disc	190 mm
Effective radius	85 mm
Master Cylinder Diameter	15.19 mm
Caliper Piston Diameter	27.44 mm
Pedal Ratio	5:1
Pedal force	220 N
Braking Force	2808.6 N
Braking Torque	238.73 Nm
Deceleration	16.52 m/s <sup>2</sup>
Velocity	12.5 m/s
Stopping Distance	4.72 m
Stopping Time	0.75 sec
Heat flux	1411442.6 W/m <sup>2</sup>



Disc model



Thermal analysis of disc



Caliper mount model



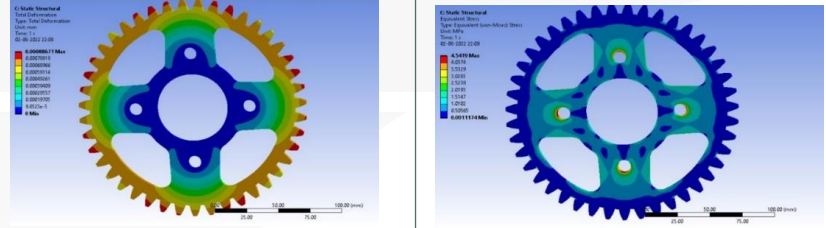
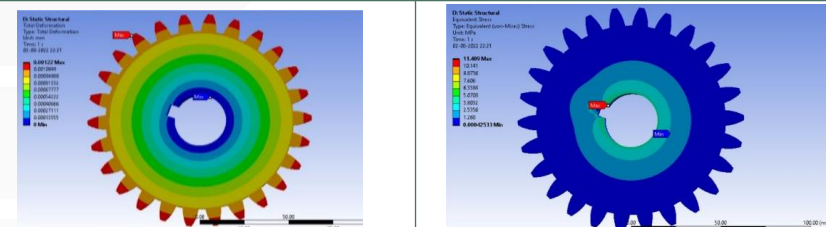
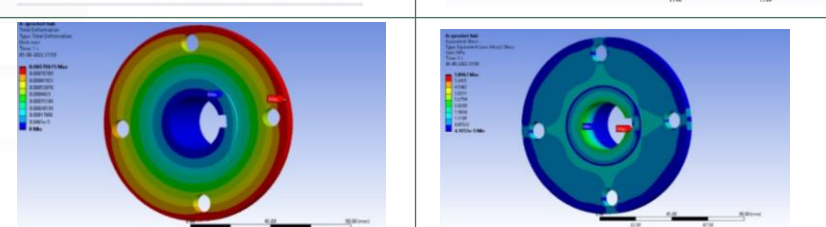
Braking system

# Power Transmission

PARAMETERS	VALUE
Pitch (chain)	13 mm
Sprocket Reduction	1.78(26 teeth) and 3.0714(43 teeth)
No. Of Teeth On Driven Sprocket	43 and 26
Rear Axle Diameter	30 mm
Speed	5 Speed
Acceleration	14.42ms <sup>-2</sup>

PARTS	MATERIAL
Sprocket	Mild Steel
Hub	Mild Steel
Rear Axel	Mild Steel
Engine Mounts	Aluminum and AISI 4130

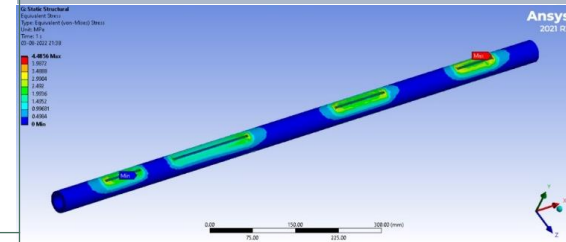
Total deformation	Equivalent stress
-------------------	-------------------

Sprocket 1 (43 teeth)	
Sprocket 2 (26 teeth)	
Sprocket hub (common)	

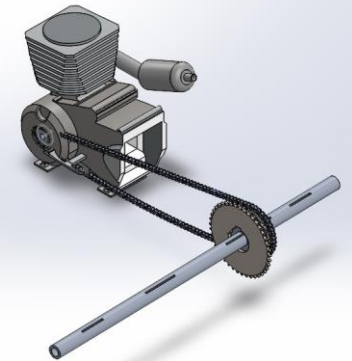
	Moment	Max. Deformation	Max. Stress
Sprocket 1	40KNmm	8.8*10 <sup>-4</sup> mm	4.54 MPa
Sprocket 2	40KNmm	1.22*10 <sup>-3</sup> mm	11.409 MPa
Sprocket hub	40KNmm	7.9615*10 <sup>-4</sup> mm	5.8967 MPa
Shaft	42KNmm	1.5319*10 <sup>-3</sup> mm	4.4856 MPa






Sprocket model



FEA model of shaft



Transmission system



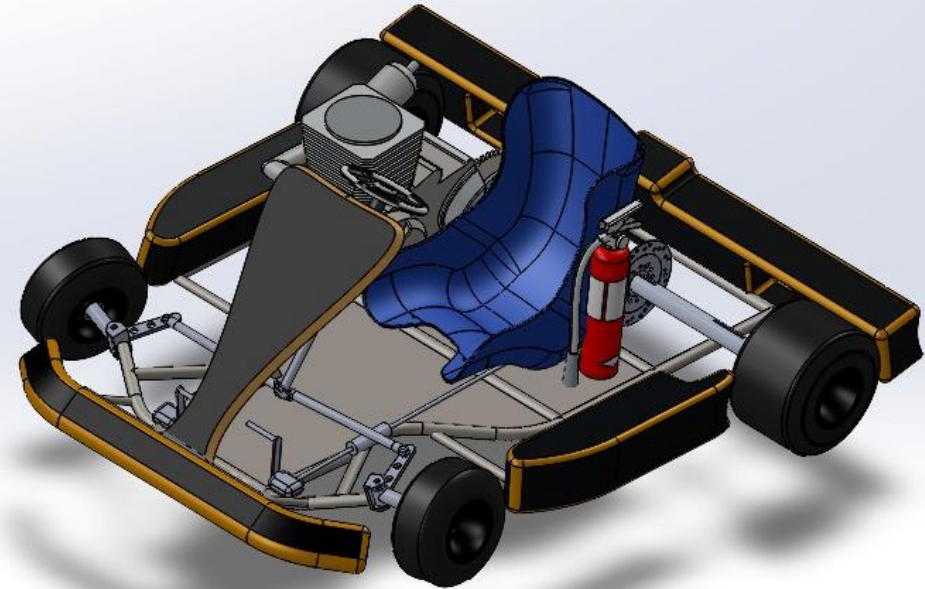
Manufacturing Process				
<div></div>	Process required	Facilities available	IN HOUSE	OUT HOUSE
			Flappy Clutch	Hubs
	Welding	Welding	Gear Lever	Sprockets
			Pedals	Engine
	Cutting	Cutting tool	Tie-Rods	Tires
	Drilling	Drilling tool	Engine Mounts	Brake Disc
			Steering System	Brake Caliper
	Grooving	Lathe machine	C-Clamp	Fuel Tank
			Chassis	Fairings
	Grinding	Shaping machine	Bumper Mounts	Seat
			Caliper Mounts	Bumpers
	Milling	-	Wheel and Sprocket hubs	Steering Wheels
	Shaping	-	Bearing Mounts	Master Cylinder
	Sanding	-		
Polishing	-			
Finishing	-			

8



## Part Weights

Sl.No	PART NAME	QTY	WEIGHT
1	AISI 4130 Pipes	m	14.9 kg
2	Welds	54	2 kg
3	Bodyworks	5	9 kg
4	Seat	1	1.5 kg
5	Pedal assembly	2	0.5 kg
6	Steering system	1	3 kg
7	Fuel Tank	1	4 kg
8	Exhaust	1	3.5 kg
9	Rear Axle	1	12 kg
10	Engine	1	36 kg
11	Wheel Assembly	4	8 kg
12	Brake Assembly	1	2 kg
13	Chain Drive	1	1.5 kg
14	Electricals	1	1.5 kg
15	Fire Extinguisher	1	1.5 kg
16	Floor Plate	1	2 kg
17	Brake Mount	1	1.5 kg
TOTAL WEIGHT			103.9 kg



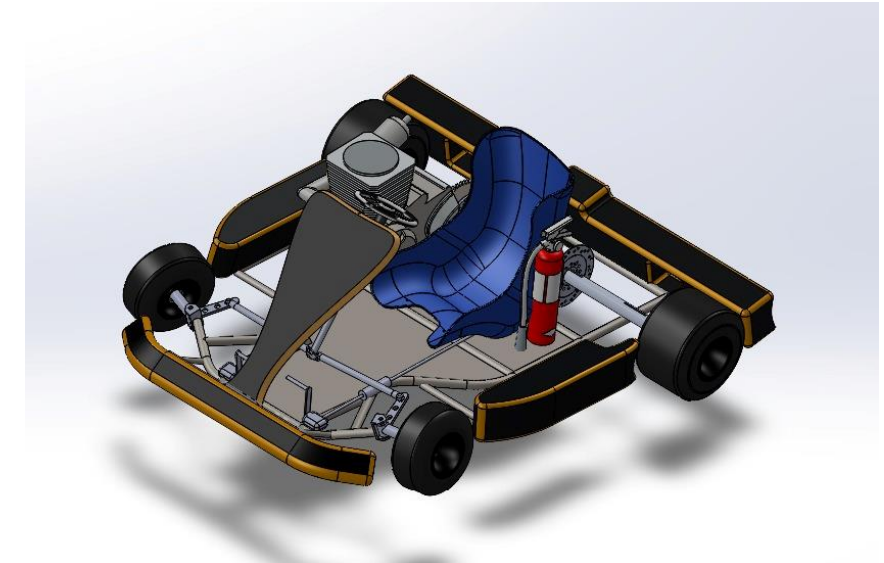
[illegible][illegible]

## Significant Changes

S.No	CHANGES	IKC 3	IKC 4	IKC 5
1	Engine	HONDA STUNNER	YAMAHA GLADIATOR	HERO HUNK
2	Chassis material	AISI 1018	AISI 4130	AISI 4130
3	Wheelbase	1180mm	1070mm	1020 mm
4	Front trackwidth	1020mm	940mm	960 mm
5	Rear trackwidth	1150mm	1000mm	1040 mm
6	Braking pedal ratio	4:1	5:1	5:1
7	Kerb weight	145 kg	102 kg	103.9 kg
8	Frame weight	20kg	15kg	14.9 kg
9	Kingpin inclination	0(deg)	2(deg)	10(deg)
10	Camber	-4(deg)	0(deg)	0(deg)
11	Caster	0(deg)	2(deg)	8(deg)
12	Clutch mounting	LEVER TYPE	FLAPPY CLUTCH	FLAPPY CLUTCH
13	Scrub radius	140mm	100mm	77 mm



IKC-4



IKC-5



# THANK YOU



Captain : Sunil Kumar S  
Email: [teamxtremesquad@gmail.com](mailto:teamxtremesquad@gmail.com)