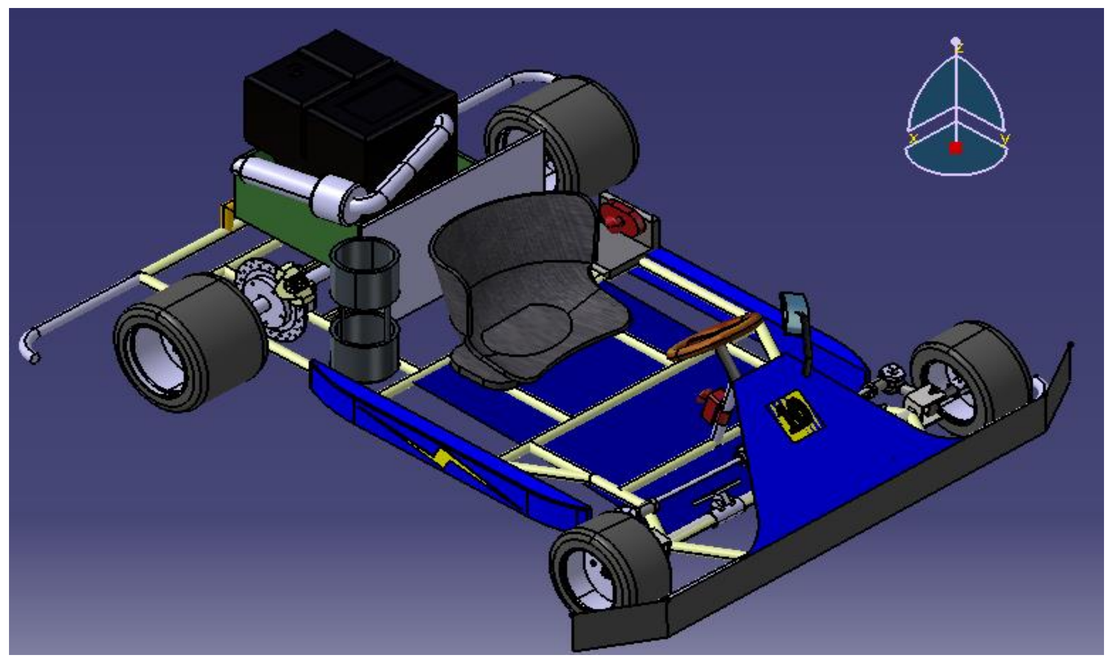
EMPOWER UVCE

UNIVERSITY VISVESVARAYA COLLEGE OF ENGINEERING

K R CIRCLE, BANGALORE-01

TEAM ID- 20152893



TECHNICAL SPECIFICATIONS

Wheel base = 46inches =1168.4mm

Front track width = 38 inches = 965.2 mm

Rear track width = 42 inches=1066.8 mm

Type of engine: 7.5 N-m, 3.5 BHP, 3600 rpm

Steering Geometry: Ackermann Geometry

Brake system: Disc brake (Petal disc)

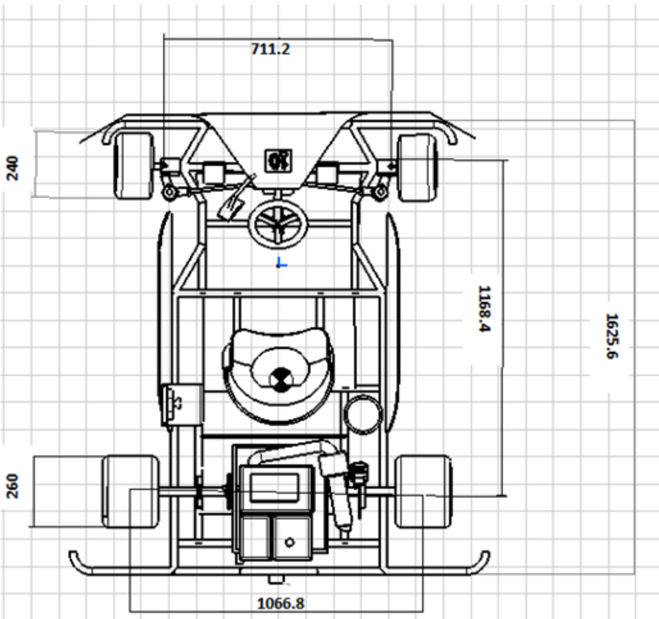
Type of transmission unit: Direct link chain drive.

Vehicle overall length = 64 inches =1626 mm

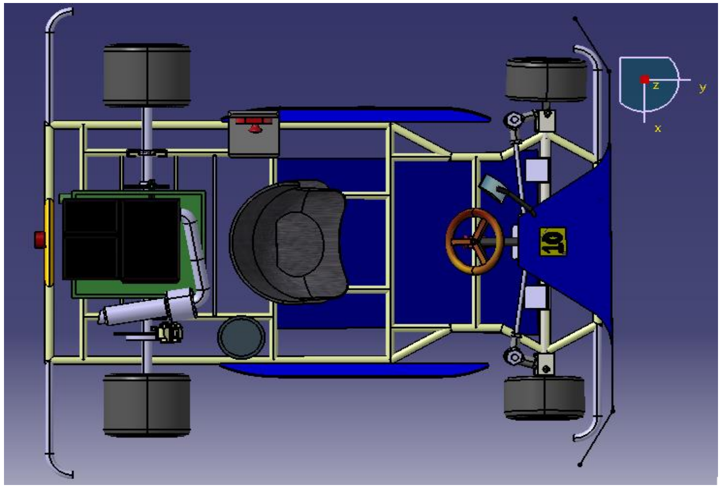
Mass of vehicle = 140 kg

Centre of gravity : (682.98 mm, 381 mm, 196.85 mm)

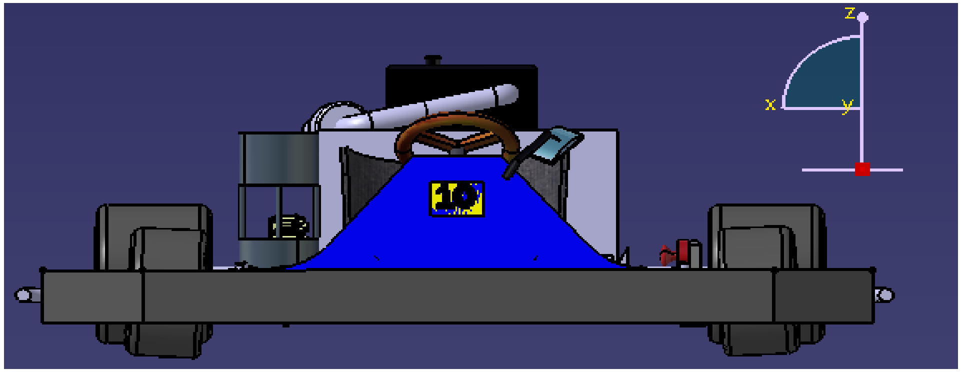
Ground clearance is minimum 25.4 mm.



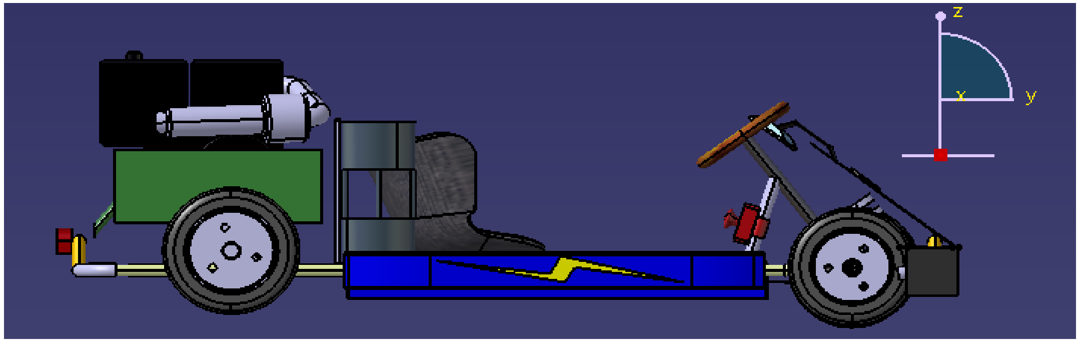
Vehicle drawing & dimensions



Top view



Front view

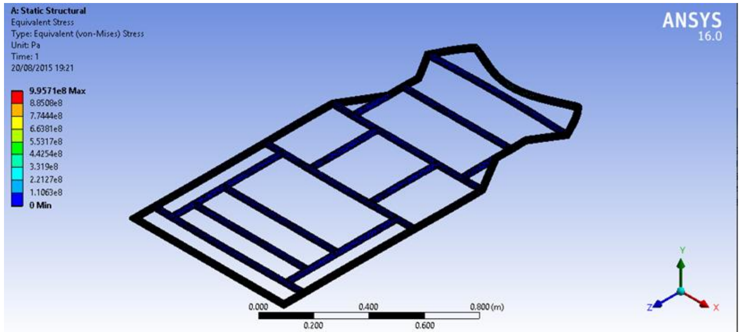


Side view

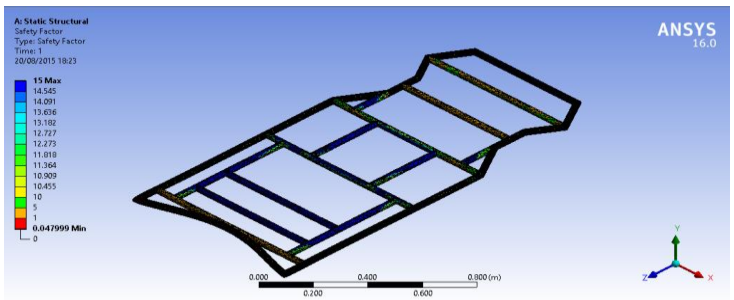
CHASSIS

The following are the pictures of simulation test results conducted on the frame.

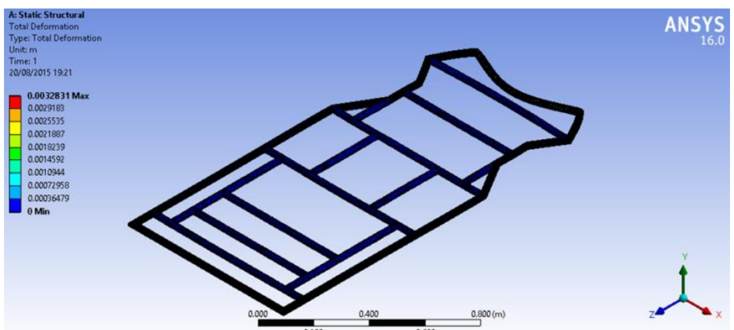
Von-Mises Stresses : Maximum and minimum stresses acting on the frame are found using Ansys software and are shown below.



The factor of safety is found to be optimum and is obtained as follows.



Displacement of chassis under loading conditions.



Design methodology

Step1 : Longitudinal loading is calculated using formula shown below:

$$R_f = Mg\{l-a\} - Mh(\frac{dv}{dt})/l$$

On this grounds, R_f is found to be 382.2N.

From this distribution of total weight on chassis is 42% front and 58% rear. This obeys 97.6 % of optimum chassis design rule.

Wheelbase of 46 inches =1168.4 mm is chosen.

Step2 : Rear track width is calculated using the formula

$$V^2 * 2h = g * T * R$$

Hence rear track width is 42 inches=1066.8 mm. Front track width must be minimum of 80%of wheelbase . Hence front track width is 38 inches=965.2 mm

Initial considerations:

Mass = 140kg.

Velocity = 40kmph = 11.11m/s.

Material used : Mild steel

Impact force = 8kN ,is found using formula.

$$m * \frac{v^2}{2} = F * d$$

Distance between driver and front wheel=32 inches = 812.8 mm

Acceleration=1.678 m/s^2 and is found using

Power P = 3.5 BHP = 2611 W =force*velocity.

But force=mass*acceleration. Thus acceleration is found to be 1.678m/s^2.

For mild steel welded material,

Yield strength = 465 MPa

Ultimate tensile strength = 700-850 MPa

Thus Factor of safety is calculated using formula

$$FOS = \frac{Ultimate\ stress}{Working\ stress}$$

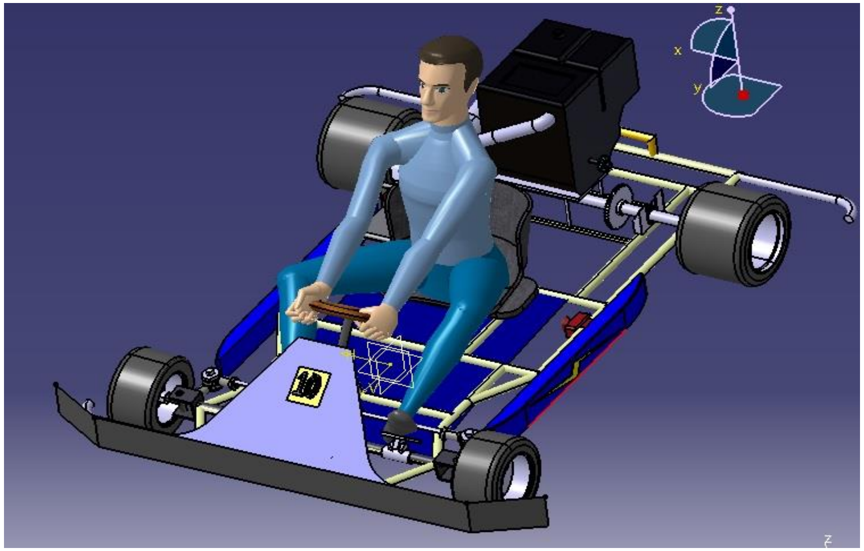
Here working stress is found out using the formula σ=F/A, which is found to be 138.552MPa.

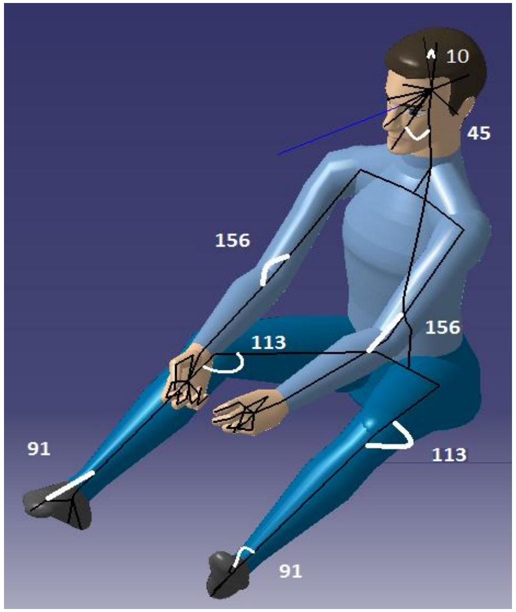
Hence the Factor of safety is calculated by above formula and is found to be

FOS=2.5

Go-kart Ergonomic

- The comfort of the driver in the driver seat of the go kart is explained by the ergonomics of the go kart.
- Steering wheel height and length from horizontal was taken by making the driver sit in a full scale drawing of the chassis on the floor.
- Dummy axle is given not only to provide support for steering column, but also to give pedals for driver's comfort.
- Tie rods are given below the horizontal level and also above the chassis. Tie rods above chassis ensure driver's safety and tie rods below the horizontal level ensures optimal leg space for the driver.
- All components are minimum 3 inches away from driver during static and dynamic conditions.





Posture of Driver

ENGINE AND POWERTRAIN

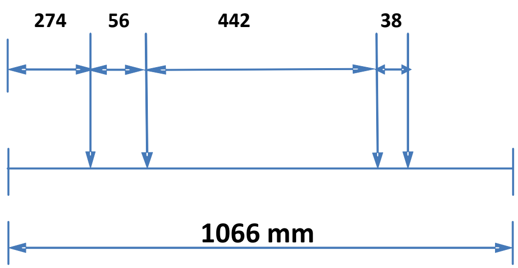
The power train of go-kart consists of a Briggs and Stratton 550 series engine, whose power is transmitted through a chain drive mechanism.

The engine will be provided by ISNEE. The engine position is longitudinal with respect to the go-kart chassis, and is in-line with the central axis of the chassis. A stock exhaust is being used as the exhaust for the go-kart.

The rear axle is made of C40 steel. Its diameter is 27mm and length is 1066.8mm. Bearings used are SKF roller bearing RNU 204.

We are using a chain transmission with a pitch of 9.525mm.

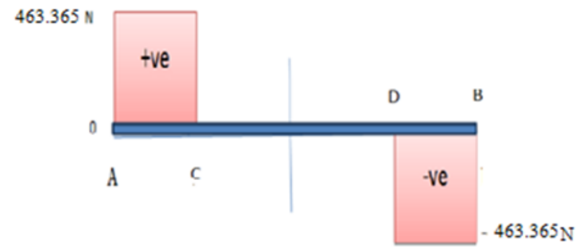
The point of action of forces acting on the shaft are given below :



The reaction diagram of the shaft is given below :

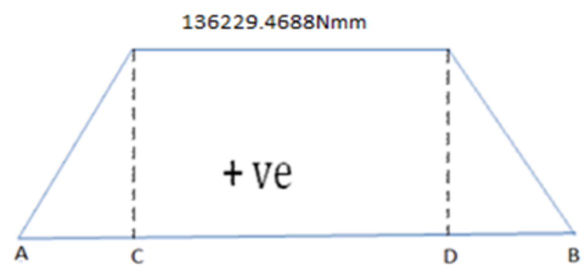
The loads at each of the bearings C and D are 47.234kg each.

SHEAR FORCE DIAGRAM OF SHAFT:



The shaft is subjected to a shear force of 463.36N.

BENDING MOMENT DIAGRAM OF SHAFT:



The maximum bending moment to which the shaft is subjected is 136299.4688 N-mm.

According to maximum shear stress theory a safe diameter for the shaft can be calculated using the formula:

$$D= ((16/\pi\tau_{ed})((K_b M_b)^2 +(K_t M_t)^2)^{1/2})^{1/3}$$

We have taken the diameter of the shaft to be 27mm.

The factor of safety is 4.444

Power transmission calculations:

The maximum speed of the engine is 3600 RPM
The pitch of the sprocket and chain setup is given by

$$P<=0.25(900/n_1)^{2/3}$$

We have a standard pitch of 9.525mm.

Z_1=Number of teeth on driving sprocket = 14
Z_2=Number of teeth on driven sprocket = 42

We have got the diameter of driving sprocket as

$D_1 = P/ \sin(180/Z_1)$
$D_1 = 4.29$ cm

Diameter of driven sprocket is

$D_2 = P / \sin(180/Z_2)$
$D_2 = 12.75$ cm

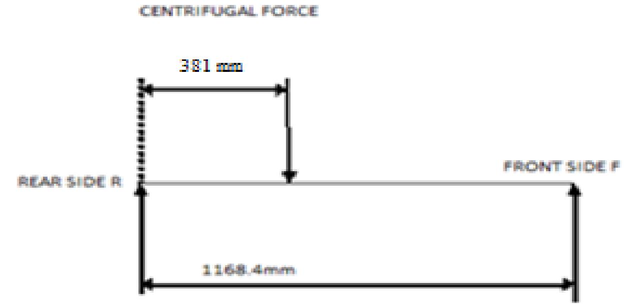
Bearing design:

As it's clear the radial load is the resultant load of braking and weight of the vehicle on bearing.

The net Radial load on the Bearing is WR= 812.40 N

When it comes to axial load, it is considered only when the vehicle takes a turn as the centrifugal force acts on the vehicle.

Here we considered the centrifugal force as the axial load on axles of the vehicle



Let us consider vehicle moving with velocity V=60 Km/hr and taking turn of radius R=14 m.
Then the centrifugal Force on the vehicle = $(MV^2)/R$
Centrifugal force =2777.77 N
Taking moment about R:
W (front) = 906.082 N
W (rear) = 1871.667 N
Therefore the total axial load on Rear Axle is

WA=1871.667 N

Axial Force on each Bearing is = 935.833 N.
The output speed of the Engine is n=1224.889rpm.
Let the life of Bearing is 8hrs / day

Then Life of the Bearing in revolutions=60*n*life = 134.125 million rev
Now the total Load on the bearing

P=XVWR+YWA

Values of X and Y are found from data handbook.

$(W_A/W_R) = 1.166$
$(W_A/C_O) = 0.1288$

Equivalent Load due to dynamic loading

$P = X*V*W_R + Y*W_A = 1815.645$ N

LIFE OF THE BEARING:

$L = (C/P)^{10/3} = 1065.66$ Million

$L>L_{REQUIRED}$

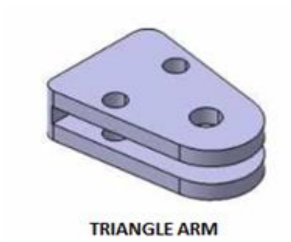
Therefore the bearing selected is suitable. The bearing is SKF roller bearing RNU 204.

Steering

The main aim is to design an optimized steering mechanism for a wheel base of 1168.4mm and front track width of 965.2mm with positive stops.

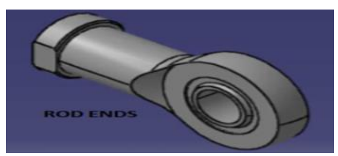
PARTS USED

1) **Steering Column**
2) **Axle with C- Brackets**
3) **Triangle Arm**
4) **Ball bearing**
5) **Tie rods**
6) **Kingpins**
7) **Rod Ends M20**



APPROXIMATIONS:

· **Caster Angle**: 6°
· **Camber Angle**: negative angle of 3°
· **Toe in/Toe out**: Since the vehicle speed is limited to 40 kmph, it is not necessary
· **Tyre Sensitivity**: The tyre Stiffness is approximately 55000 N/rad and 60000N/rad for the front and rear tyres respectively.



CALCULATED RESULTS FOR FINAL ASSEMBLY OF STEERING

Steering wheel height=330mm
Steering wheel horizontal distance from front axle=127mm
Therefore by Pythagoras theorem, Steering arm Length=353.59mm and Steering arm inclination=52^0

Ackerman's Ratio

Track width = 38"
Wheel base = 46"
w/l=38"/46"=0.826

Maximum Velocity of Turning: The limit for the speed at turn, so that the maximum centrifugal force is limited by toppling condition for a kart with c.g height 196.85 mm

V_{max} = 7.593 m/s = 27.33 kmph
Max lateral acceleration = 24.022 m/s^2

Steering Forces:

Estimation of king pin forces

Torque required at king pin for steering is given by

$T = W\mu \sqrt{(B^2/8 + E^2)}$

T = Kingpin torque in inch lbs.

W=Vehicle weight on the steered axle 140/ 2 kg = 70kg

μ = Coeff of friction b/w tire and road

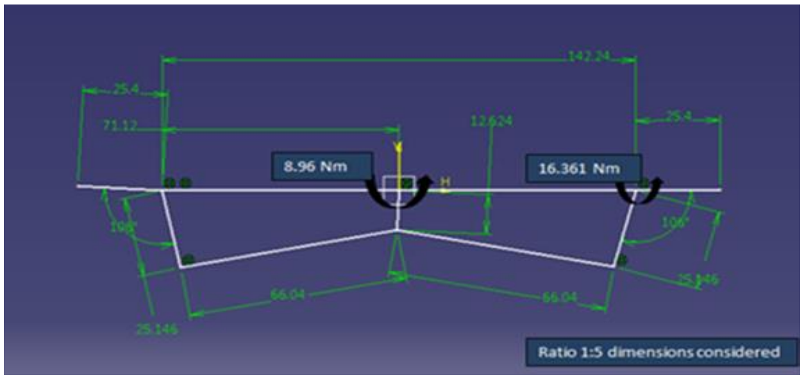
= 0.2 from graph for E/B= 0.846 N/m

B = Nominal width of tire = 130 mm =5.11 inch

E = Kingpin offset = 110mm = 4.33 inch

$T = 154.324 * .2 \sqrt{(5.11^2 / 8 + 4.33^2)}$

=144.81 lbs. inch = 16.361 N m



Forces on the King Pin Stub:

The king pin stub suffers higher bending moment due to lateral tyre forces trying to bend it towards the instantaneous centre. The kingpin stub can be considered as a separate entity to draw a free body diagram

the lateral force on the outer tyre can be taken as 0.5 of total front lateral force

Fl = 1965.7 / 2 = 982.85 N

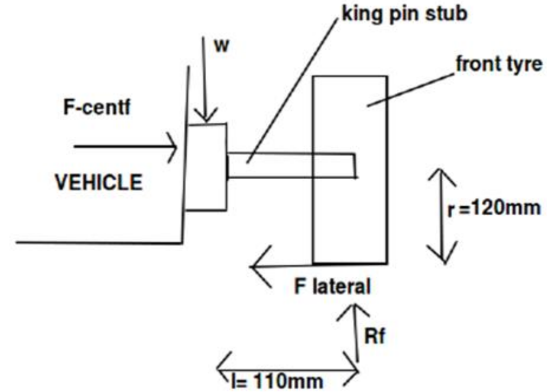
As shown in the drawing

F lateral = F centrifugal-front = 982.85 N

and front right reaction

Rf = w (weight of vehicle acting on the front right) = m*g * lr /l

=140*9.8 * 682.98 / 1168.4 = 801.992 N



Slip Angle and tyre forces:

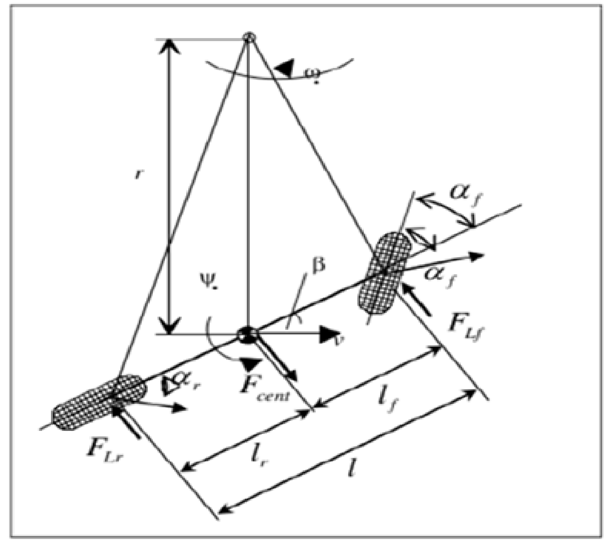


Fig. 3. Deflection of the rolling tire by a lateral cornering force F_a where, v : Vehicle velocity, ω : Vehicle angular velocity, r : radius of curve, ψ : Yaw angle, β : Side slip angle, δ : Steering angle, α : Tire slip angle, l : Wheel base

We have considered the simplified model of a bicycle to analyse the lateral forces acting on tyres and the slip angles.

Rear tyre slip angle= $\propto_r = 0.02328\ rad$

Front tyre slip angle= $\propto_f = 0.03574\ rad$

Steering angle = δ = 0.4992 rad = 28.607 °

Tyre Forces

Flf = Caf * αf = 55000 * 0.03279 = 1965.7 N

Flr = Car * αr = 60000 * 0.02543 = 1396.8 N

Brakes

Brake chosen for go-kart: Discover 125 st-front disc brake.
Type of disc: Pedal disc.
Main reasons for choosing petal disc brake:
1) Optimum disc diameter and it satisfies our need.
2) Proper heat dissipation i.e., better than the conventional round disc.
3) Due to 20% reduction in material, due to holes the disc becomes lighter.
Disadvantages of using petal disc:
A chain saw effect is produced on the brake pad, so eventually the brake pads will be worn off.

However, this occurs only after considerable usage and need not be worried about brake wear.
Disc diameter: 200mm.
Location of disc on the rear axle: 38mm right of the right bearing.
Length of cable/tube required: 1500mm approximately.
Calliper specifications depend on the disc as we will get specific callipers for a particular set of disc.
Mass of go-kart = 140 kg
Maximum speed of go-kart= 40km/h =11.11m/s

Desired braking time = 3.5 s

Deceleration = $\frac{\text{maximum speed}}{\text{braking time}}$ = -3.1746 m/s^2

Braking force= Mass*deceleration = 444.44kN

Braking torque = T_b =BF*$\frac{\text{tire radius}}{\text{tire to brake speed ratio}}$ = 57.77Nm

Master cylinder area = 1.227*10^{-4} m^2

Calliper base area = 4.91*10^{-4} m^2

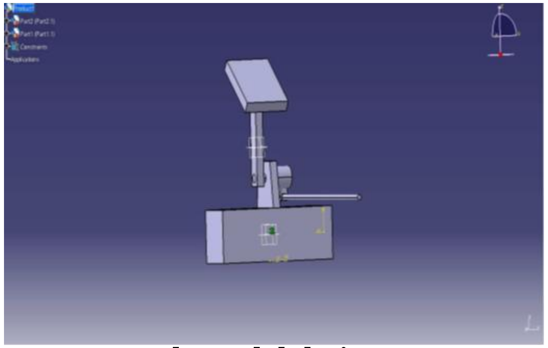
Actual clamp force = CF_a = BF*2*$\frac{\text{calliper base area}}{\text{Master cylinder area}}$ = 3556.969 N

Braking pressure = CF_a / Calliper base area = 7244.336kN/m^2

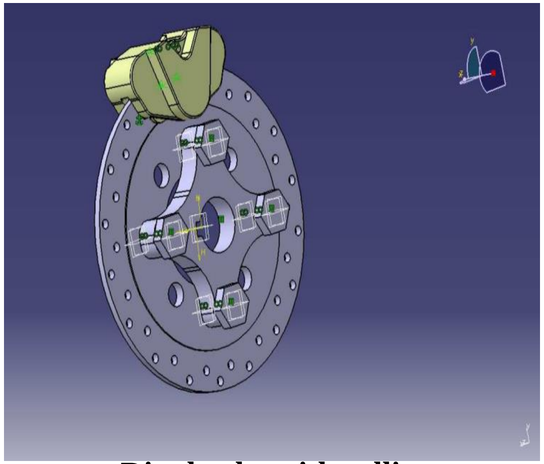
Average deceleration of entire stop

= $\frac{\text{max speed}}{(\text{max speed/deceleration} + 0.3g)}$ = -1.7245m/s^2

Stopping distance $= \frac{(\text{max speed})^{\wedge}2}{2g*\text{average deceleration}}$ = 3.6487m



Brake pedal design



Disc brake with calliper

Design Failure Mode and Effect Analysis

Sr.no	Components	Potential failure mode	Effect	SEV.	Potential Causes of failure	OCC.	Current Design	DET.	RPN	Action Taken	SEV	OCC	DET	RPN
1)	Brake	Brake failure	Risk of accident/vehicle damage	4	Damage in tandem cylinder	2	1 Master cylinder brake	4	32	Cylinder replace	2	2	4	16
2)	Hydraulic Hoses	Hydraulic hoses oil leakage	Brake failure	4	Excess pressure in the Hoses	3	Bajaj Discover 125ST	4	48	Hoses replace	2	3	4	24
3)	Weld joint in chassis	Weld Breakage	Breakage	5	Impact	1	TIG welding	5	25	Re-weld	3	1	5	15
4)	Tyre	Deflate	Inability to drive	3	Piercing by objects	3	Hosier tire	4	36	Replace	2	3	4	24
5)	Fuel Tank	Fuel Leakage	Engine stops	4	Damaged fuel pipe/joints	2	Standard size	4	32	Repair/Replace	2	2	4	16
6)	Accelerator wire	Wire break	Inability to accelerate	4	Excess use of acc. Wire	1	Piaggio rickshaw	4	16	Replace	2	1	4	8
7)	Engine	Over heating	Bad performance & ceasing of engine	4	No/Partially working radiator	3	Briggs and Stratton 550	5	60	Reduce usage	2	3	5	30
8)	Air filter	Irregularities present	Low performance of engine/ Stops	4	Low maintenance/Clogs due to dust	2	Air cooled	3	24	Replace tray	2	2	3	12
9)	Engine mounting	Mounting points	Excessive vibration / Noise	4	Loose mounting nut	3	High strength nut bolts	5	60	Washers used	2	3	5	30
10)	Shaft	Drive shaft failure	Lack of power transmission	4	Torsion via high power transmission	2	Modified drive shaft	5	40	Replace	2	2	5	20
11)	Tie rod	End of tie rod breaks	No steer	4	High impact forces	2	Standard cast iron	4	32	Replace	2	2	4	16
12)	Battery	Short circuit/ Discharge	Starter motor/Electrical components failure	1	Contact with water/ Over usage	4	Direct connections	5	20	Replace wires	1	4	5	20
13)	Exhaust	Corrosion of inner surface	Cracking sound/ Acidic mixtures formation	5	Condensation due to low temperature	2	Briggs and Stratton 550	2	20	Replace	3	2	2	12

Design Validation Plan

Team name: eMpower UVCE	College Name: University Visvesvaraya College of Engineering	DVP Creator: Pranav B Venkatesh	Supervisor incharge: Dr.H.C.Chittappa
Car Number: Not defined	Time Period of testing: 30-08-2015 to 14-09-2015	DVP Validation Approver: Paul Vizhian	Engineer: T Sreeharsha Varma
Vehicle Owner: eMpower UVCE	Vehicle Design: Go-Kart (127cc class)	Technical Asst. : Sharanabasavesh	Project Manager: Santhosh M N

Testing Data and Results							Planning Information						
Test No.	Test Name	Test Procedure	Acceptance Criteria	Expected Results	Test Status	Remarks	Test Stage	Target requirements	Test Location	Test Data verification	Start Date	End Date	Member Responsible
1	Braking Test	The vehicle is accelerated to the maximum speed and brakes are applied.	10 metres is the maximum distance	3.8 seconds, 5 meters	Test to be conducted	Design validated	2 stages, 2 trials taken and the average value was taken	Vehicle to brake in 10 m with minimum braking time	Jnana Bharathi Campus, Bangalore	Test data to be implemented to select Bajaj Discover 125 Brakes	30-08-2015	31-08-2015	Thrived M S
2	Steering Test	-Scale models built using metallic strips and fastened at key positions. -Turning radius measured for full lock.	Maximum T.R= 2.4 m	T.R = 2.25 m at 60° turn	Test to be conducted	Design validated	Single stage	Vehicle to manoeuvre in maximum 2.5 m radius portion of the track for skid-pad test	UVCE	Test data was verified by simulating on CATIA V5 R20 sketcher workbench	02-09-2015	03-09-2015	Pranav B V
3	Chassis Static Loading	Chassis model developed was simulated in Autodesk multiphysics and Solidworks	Minimum FOS= 2.5	Factor Of Safety = 2.5, Maximum deformation = 5mm at 8000N	Test performed	Design validated	Multiple stages	Chassis to have an overall factor of safety greater than 5	UVCE	Test data was verified with the von Mises stress plot of the chassis	10-06-2015	16-06-2015	Harish B S
4	Brake Light	The brakes are applied and it is checked for their functionality.	Brake Light Should glow when the brakes are applied	The lights should be functional	Test to be conducted	Design validated	Single stage	Immediate glow of lights when the brake is applied	UVCE	Test to be verified using certified brake lights	07-09-2015	07-09-2015	Sharanabasavesh
5	Brake failure system	-Brake lever end had a pad attached beneath that incorporated switches. -Brake is given zero spring force and allowed to touch the pad.	Engine cut-off	Brake failure mechanism was suitable for the requirements of go-kart	Test to be conducted	Reliable design, validation complete	Two stages- Installation and testing of mechanism	Brake failure switch to actuate when complete pressure falls on brake pedal.	Tested on a Bajaj discover 125 brake pedal	Verified with suitable calculations and modelling	12-09-2015	14-09-2015	Srustik

Gantt chart

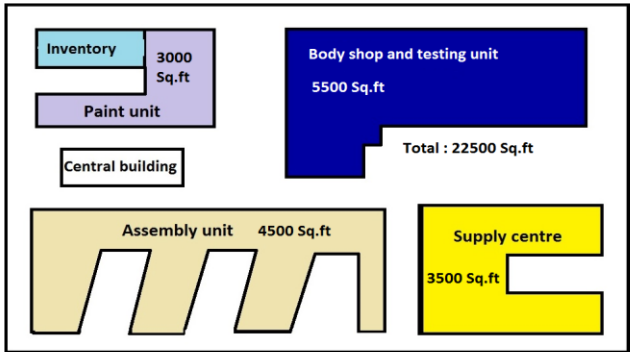
Pre PFR				
Sr no	**Date**	**Process carried out**	**Tool used**	**Member responsible**
1	18-02-2015	Team selection exam	Aptitude test	/
2	25-02-2015	Selection list announced	/	/
3	28-02-2015	Team formation	/	Santhosh M.N
4	05-03-2015	Registration of the team	/	Santhosh M.N
5	10-03-2015	Analysing of problems	Brain storming	Team
6	20-02-2015	Design of preliminary chassis	Catia	Harish
7	23-03-2015	Design of steering	Catia	Sneha
8	28-03-2015	Analysis of transmission systems	Kirpal Singh	Harsha
9	10-05-2015	Final design of chassis	Catia	Harish
10	15-05-2015	Announcement of engine specifications	/	/
11	16-05-2015	Start of transmission system	Catia	Sharan
12	20-05-2015	Finished steering and brake design	Catia	Sneha, Thrived
13	27-05-2015	Analysis of chassis	Ansys & solid works	Srustik, Harish
14	10-06-2015	Conclusion of final design	/	Santhosh M.N
15	15-06-2015	Market survey started	Networking	Swapnil
16	26-06-2015	B-plan	Internet/Consulting	Pranav
17	04-Jul	Cost report, Dfmea and Gantt chart	MS-excel	Pranav
18	20-07-2015	Final PPT and PDF reports	MS-PPT and PDF	Team

Post PFR				
Sr No	**Days**	**Process carried out**	**Tools used**	**Member responsible**
1	Day 1-2	Sketching of mock model	Engineering drawing	Srustik
2	Day 3	Cutting and filling	Hack saw,filer	Swapnil
3	Day 4-6	Making fixtures	Drilling machines	Vignesh
4	Day 7-8	Fixing	Joints	Darshan
5	Day 8-9	Checking dimensions and angles	Measuring instrument	Santhosh M.N
6	Day 10-11	Preparation of parts for steering	/	Sneha
7	Day 12-13	Assembling of steering	Joints & fixtures	Pranav
8	Day 14-15	Assembling of chassis	Welding	Harish
9	Day 16	Joining of Steering and chassis	Pins	Niraj
10	Day 17-19	Preparation of rear shaft	Turning	Keshav
11	Day 19	Assembly of Break & bearing on rear shaft	Joints	Thrived
12	Day 20	Assembly of rear shaft to chassis	Fixtures	Harish
13	Day 21-24	Mounting of transmission system and engine	Fixtures	Harsha
14	Day 25-26	Assembling of tyres	Joints	Harshith
15	Day 26-27	Lining of electrical wirings	Soldering	Sharan
16	Day 28-30	Fixing of electrical lcomponents	Bolts	Yash
17	Day 31-33	Testing of the kart	Track	Pranav
18	Day 34-35	Fine-tuning of the Kart	/	Harsha

BUSINESS PLAN

Mind Your Track Inc.

Infrastructure:



Cells/Department

Manufacturing Department: Assembly department, Welding, Cutting, Grinding requires 1 employee with Solidworks software skills, 3 employees with of basic workshop skills.

Marketing Department: Advertisement department, Information department requires Marketing department : 2 employees holding Engineering and MBA degrees with wide range connections. Under them 4 employees will be at dispose for different purposes.

Technical Department: Analysis department, Design department, Testing department requires 2 employees, 2 employee with CAD/Analysis software knowledge and with engineering knowledge Failure of materials for practical testing. Minimum work force of 14 employees are required.

Machinery Analysis

Machinery/Instruments	Qty	Per Machinery cost	Total cost (₹)
CNC machines	1	9,45,000/-(Alibaba)	9,45,000/-
Engine testing rig	1	3,50,000/-(Indiamart)	3,50,000/-
Welding equipment	3	46,828/-(Amazon)	1,40,484
Painting equipment	3	1,499/-(Amazon)	4,497
Assembly Kit	2	36,078/-(Industrybuying)	72,156
Structural testing machine	1	1,83,000/-(Alibaba)(Ultrasonic radar)	1,83,000
Total estimate for machinery(₹)			**16,95,137/-**

Production process	Supplies (Beams , bolts, tyres etc.)	Manufacturing parts	Testing parts	Assembly and painting	Quality checking	Road test	Total (Hours)
Time invested (Hour)	240	48	24	96	24	5	**437**

Total time required for production of one Go-kart is highly dependent on supply time and Assembly of parts hence to increase the sales rate we will concentrate our work force on marketing and manufacturing departments.

Company Financing

Projected Start-up cost	Amount
Initial lease payments and registration	29,607/-
Working Capital	10,00,000/-
Estate for manufacturing	25,00,000/-
Security deposit	15,000/-
Opening Supplies including furniture, fixtures and equipment	7,00,000+16,95,137/-
Company Vehicle and lease deposits	65,000/-
Marketing Budget	45,000/-
Total Start-up Cost	**64,54,744/-**

Product and service overview: Primary revenue stream for the business will come from the ongoing usage of the company's Go karts. Inventory will hold approximately 15 Go karts with safety precautions enforced. Secondary revenue stream for the business will come from the sale of food , concessions, event hosting services and production sales.

Revenue resource			Total	Annual
Customers for Go-Karting	30 (Weekdays) X150/-	50 (Weekend) X175/-	40000/- (Week)	20,80,000/-
Food Facilitating revenue	Land and customers provided		30,000/- (Monthly)	3,60,000/-
Special event revenue	Birthday parties,competition etc		40,000/-(Monthly)	4,80,000/-
Go-kart production sales	1,40,000/- (per Kart)	15 Karts (Target yearly)	59259/- (per kart profit)	8,88,885/-
Annual turnover expected				38,08,885/-

Marketing Objectives:

1) Develop an online presence by developing a website.
2) Implement a local campaign with company's targeted.

Marketing Strategies:

Management intends on using a number of advertising and marketing channels to promote traffic with Mind Your Track. <u>The company primarily intends to raise awareness of the retailed location among the targeted young adolescents and adult demographic.</u>

Cost Report

Individual part	Individual cost(₹)	Shortlisted companies for parts	Number required	Total cost (₹)
King pin	800	Shello Automobiles	2	1600
Pedal	400	Shello Automobiles, Pavitra toolings	2	800
Disc break set	3500	Shello Automobiles, Pavitra tooling's	1	3500
Rod ends	250/set	Shello Automobiles	3	750
Tie rods	600/set	Shello Automobiles	4	2400
Foot rest	1200	Shello Automobiles, Pavitra tooling's	2	2400
Steering column	2500	Shello Automobiles	1	2500
Ball bearing	200	Shello Automobiles, Pavitra toolings	4	800
Engine and Fuel tank	15000	Provided (Briggs and stratton 550)	1	15000
Chassis + Welding	4800+4320	Sicagen, Salem steel suppliers	1	9120
Tyres	4/set	Dunlop(imported)	4	7832
Transmission/Sprocket	4000	Manufactured+Shello Automobiles	2+Chain	4000
Steering column(Adjustable)	1000	Manufactured	1	1000
Roller Bearings	1500	Shello Automobiles	2, 6 ,2	9600
Hard plastic sheet (2 kg)	260/kg	Shello Automobiles	2kg	520
MECHNICAL COMPONENTS TOTAL				**₹ 61822**

Individual part	Individual cost(₹)	Shortlisted companies for parts	No.req	Total cost (₹)
Helmet- Snell K2000, 2005, 2010 – SFI31.2A	3200	Shello Automobiles	1	3200
Fire suit	4500	Shello Automobiles	1	4500
Balaclava	200	Shello Automobiles	1	200
Neck support- 〖360〗^°(SFI rated)	200	Shello Automobiles	1	200
Fire extinguisher	500	Shello Automobiles	3	1500
Fire resistant shoes	3000	Shello Automobiles	1 Set	3000
Foam rubber padding	450	Shello Automobiles	1	450
Engine Fire wall	0.5x1 m.sq	Shello Automobiles	0.1575m.sq	100(with spare)
SAFETY COMPONENT TOTAL				**₹ 13150**

Individual part	Individual cost(₹)	Shortlisted companies for parts	No.req	Total cost (₹)
5 AH lead- acid battery	2700	Shello Automobiles	1	2700
Copper wire	25/m	Any local electrical shop	15m	375
Brake lights	990	Shello Automobiles	1 Set	990
Push switches	250	Shello Automobiles	3	750
Arduino board	549	Amazon	1	549
Hall effect sensor	35	Amazon	1	35
Alcohol sensor(MQ3)	370	Amazon	1	370
ELECTRICAL COMPONENT TOTAL				**₹ 5769**

COMPONENTS FOR GO-KART	COST (₹)
Mechanical parts	**61822**
Safety products	**13150**
Electrical components	**5769**
TOTAL COST	**₹ 80741**

Most efficient buy which is available locally by the following companies	
1) Shello Automobiles	**#36, 2nd cross, Journalist Colony, B'lore - 560002 Phone: 080 26708892/080 26801379**
2) Sicagen	**Shaukat building, PO box 6682, Silver jubilee park road, B'lore - 560002 Phone : 8041695042/ 080 22221448**
3) Dunlop	**# 512 MTH Road, Ambattur, Chennai - 600053 Phone : +91 4426248744**
4) Amazon	**www.amazon.in**

College level manufacturing and design facilities.

Forging equipment

Milling machine

Engine Lathe

Arc welding equipment

Workplace

- We have certain equipment at our college which we used to fabricate the go-kart. Certain operations which couldn’t be performed at the college will be done at a workshop in the Peenya industrial area.

- Our college is well equipped with lathes, electric hack saw, welding equipment's .

- Manufacturing of rod ends, tie rods and other parts are done by different dealer.

INNOVATION REPORT

We have the following innovative ideas being implemented in our go-kart.

Arduino Board: It works as a microprocessor with analogue /digital I /p &O/p pins to connect with the sensors. Also needed – Battery, wires.

1. **Hall effect Sensor/Economy indicator:** A magnet when comes close to the sensor it detects the magnet which is placed on the shaft. The sensor is connected to a digital rpm indicator.
   - The light glows green in the highest efficiency region (2500 – 2700 rpm).
   - The light glows red in the highest power region (3400 – 3700 rpm).

This helps the driver to choose the mode at which he/she wants to race.

2. **Alcohol Sensor:** A sensor is placed at the center of the steering wheel connected to the programmed arduino board. The sensor is a stable and sensitive, which can detect ammonia, alcohol, smoke, nitrogen di-oxide, etc. The vehicle stops giving an alarm when the alcohol is detected.
3. **Steering rake and reach adjustment:** We are using an adjustable steering column, for the comfort of the driver.

CONCLUSION

After finishing the designing of the Go kart project we conclude that the Designing process in theory might look Intuitive and Exciting as it is but it as much equally requires Structured Planning, Movement & Brainstorming.

A lot of in depth understanding of concepts is needed and one should also be exposed to Industry Design Practices and Standards. There should be a sense of responsibility in choosing parts considering safety because our main aim is to build a Go-kart to overcome causalities.

We were flooded with ideas and concepts, but it took us in depth knowledge & understanding to settle on best design. Market Availability & Innovative ideas were cleverly matched up to get the best of both the worlds.

This is the dream of our team eMpower UVCE. We at eMpower UVCE are envisioned to empower the automobile industry and the world at large to create better citizens for the future and help and empower the humanity!