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DESIGN OF ELECTRIC GO-KART WITH SUSPENSION AND POWER REGENERATION THROUGH ALTERNATOR

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Abstract - *Generally, the main objective is to design and fabricate the electric go-kart with specially designed double wishbone suspension system, the design includes 40*40mm square cross-section hollow tube for the construction of chassis and 30*30mm square cross-section hollow tube for double wishbone arms, electric motor and battery of 48v are used to run the go-kart. The double wishbone suspension used in Go-kart which improve comfort and help the Go-kart to drive in city as well as rough road. Also assembling a new alternator which charge the battery while the Go-kart is running which helps to increase the distance travelled by the Go-kart. Main focus is to design the double wishbone suspension for the Go-kart.*

Key Words: Double wishbone suspension system, electric motor, 48V battery, speed controller, throttle

1. INTRODUCTION

By explanation of "International Karting Commission Federation International Automobile (CIK-FIA)", the kart is explained as the ground vehicle with or without a bodywork, with 4 neutral wheels in contact with the land, two of which control the steering when the other two transmit the power from motor to the wheels. Go-kart is a simple 4-wheeler, have low CC engine, one Seated racing car used mainly in "United States". They were initially design in the 1950, after the war period by airmen just a way to drive spare free time. Go-Kart are racing vehicle having small floor clearance and can be used on only level racing circuits.[2] The design process of this one-person Go-kart are iterative and based upon some engineering operation.

This electric Go-kart is design and fabricate with specially designed double wishbone suspension system, the design includes 40*40mm square cross-section hollow tube for the construction of chassis and 30*30mm square cross-section hollow tube for double wishbone arms, electric motor and battery of 48v are used to run the go- kart. The double wishbone suspension used in Go-kart which improve comfort and help the Go-kart to drive in city as well as rough road. Which can be use other than city such as villages, it is effective during turning and crossing speed breaker.[4] Also assembling a new alternator which charge the battery while the Go-kart is running which helps to increase the distance travelled by the Go-kart. Main focus is to design the double wishbone suspension for the Go-kart. Designing works are done to fulfil the best standardized as well as optimized design possible to encounter international standards. Apart from performance, purchaser needs the serviceability, endurance capacity and economical are to be kept in discuss which we turn to know through the market and internet investigation and analysis for go-kart vehicles.[5]

1.1 Why to Use double wishbone suspension in go kart

- It offers better traction with road surface and more stable on or off road.
- Improve the stability of the go-kart.
- It can also be used in off road conditions.
- Improve performance of the vehicle.

The double wishbone suspension improve the stability and handling performance.

After considering the above factors we come on the decision to select double wishbone suspension for this project. After selection of double wishbone suspension the design of the entire go-kart and every part of suspension is made in CAD software solidworks.

2. PROBLEM IDENTIFICATION

Go-kart are made for racing and entertainment purpose to be ride on flat surface or race track. Also as it is used for racing purpose so they used high power compact engine. The problem is this karts are not mean to use in city or bad road as they doesn't have suspension and as they are not environment friendly. Making Go-kart budget friendly by using electrical drive trail system like electric motor and battery. The Go-kart absorbs all road shocks and drive directly can get shocks because there are no suspension in it. Problem is to design a suspension system for Go-kart.

3. SUMMARY

The main objective is to design and fabricate the entire double Wishbone suspension system in electric go kart, as it is very useful to the person to control the go kart and provide better handling and comfort to the driver.
The control over the go-kart gets better by installing double wishbone suspension system. The go kart is electrically driven by battery of 48V which have enough torque in it to handle the weight of go-kart and person and also luggage or other goods which the person carries with them. The speed also calculated which shows the accurate speed to be given by the go-kart at maximum R.P.M. The alternator is also installed because there is no automatic charging facility in go-kart by adding the alternator the average distance travelled by the go-kart is increased. Design and fabrication of electric go kart with suspension which shows that electric karts can be made for educational, research purpose and publically. All the design work of electric go kart with suspension is easy and affordable. It can be the demand of next generation as a source of clean environment. This shows the knowledge of manufacturing electric go kart with low budget with a good Speed up to 60KMPH.In this kart adding suspension system provide the vehicle act as a safety member by giving all the control over the go kart while turn and rough roads if also provides cushioning against bumps or irregularities present on the road surface.

4. WORKING METHODOLOGY

First of all the 2D sketch design is made on paper with all specification and all the measurements, then using CAD software solidworks the 3D models of all the parts of Go-kart is made in it by using different commands such as extrude, revolve, extrude cut, revolve cut, shell command etc. after completion of 3D model all the parts bring to the assembly section and each parts are assembled in it.

The different parts designed in solidworks are:

- Chassis
- Coil spring and damper
- Upper wishbone arm left and right side
- Lower wishbone arm left and right side
- Hub plate
- Mid support frame
- Axle

Arrangements of all electrical components are made purchased online and all mild steel material for the fabrication of Go-kart are arranged from local hardware stores, cutting welding and paint job of all components and parts are done in college workshop. The model was then modified and retested for the final design. The design strategy of the car is iterative and is predicated on numerous engineering and reverse engineering processes depending upon the availability, value and different such components.

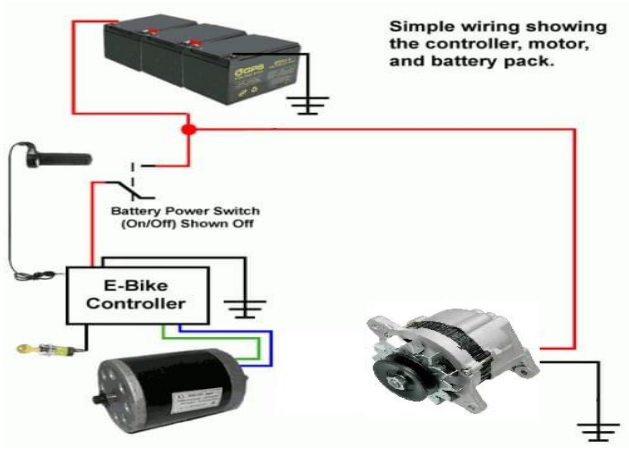

FIG-1 Line diagram

4.1 3D MODELING

The standardized dimensions for the components are found from some research paper and also are calculated. The design of Go-kart components are designed in CAD software solidworks. After designing every component are assembled by using assembly command in solidworks.

4.2 Material used are

Mild steel AISI 1005

Table-1: property of material[3]

Property	Mild steel
Composition(wt%)	C:0.14-0.2, Mn:0.-0.9, P:0.04,S:0.05,Fe:balance
Specific gravity($g.cm^{-3}$)	7.8
Melting point(^0C)	1523
Thermal conductivity ($W.m^{-1}.k^{-1}$)	51.9
Specific heat capacity($j.g^{-1}C^{-1}$)	0.472
Electricity resistivity	1.74
Hardness(HRB)	143
Tensile strength(Mpa)	475
Yield strength(Mpa)	275

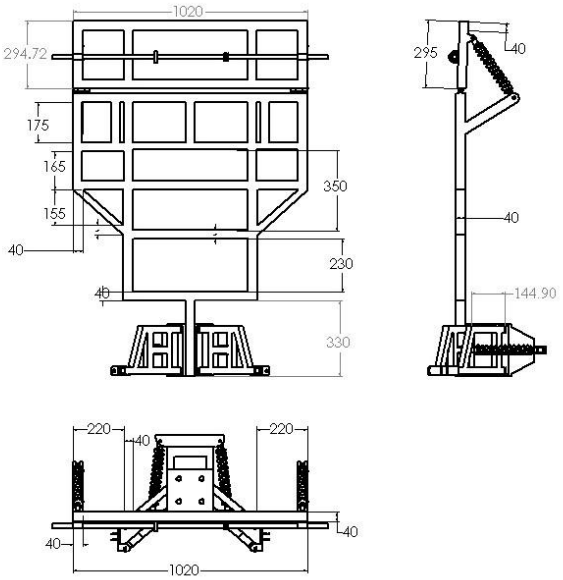

Fig-2: Sheet of go kart

Name	Dimension
Length Hollow square cross section	1600mm
Width of hollow square cross section	1020mm
Thickness of hollow square section in frame	40mm
Thickness of hollow square section used in wishbone	30mm

Table-2: size of cross section

4.3 FINAL ASSEMBLY

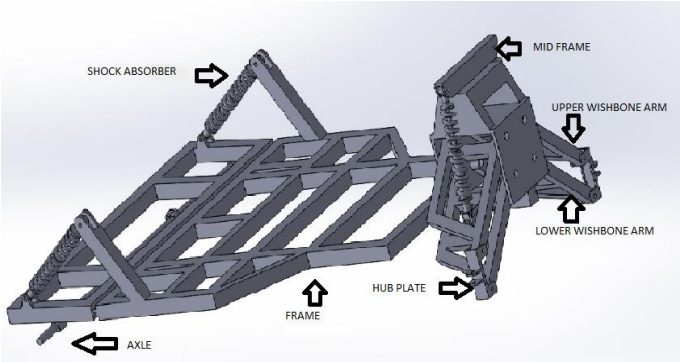

Fig-2: Final assembly

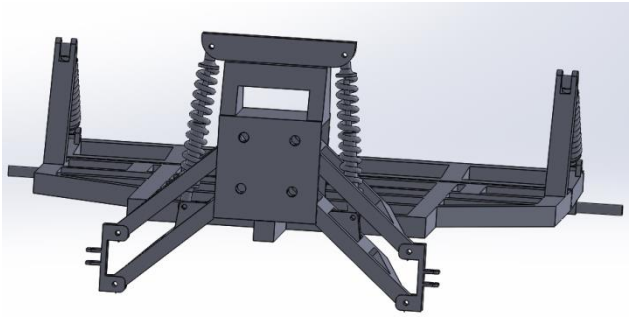

Fig-3: front view of go-kart

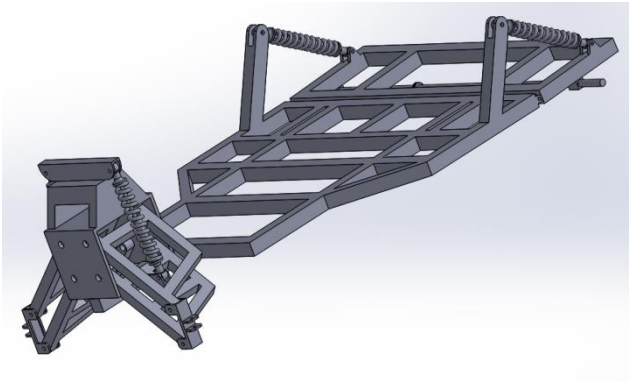

Fig-4: side view of go kart

5. MAIN COMPONANTS

5.1 Electric motor

The motor we used in this electric go kart is 48 volt 1000 watt electric go kart motor with mounting base. Motor speed is 3000 rpm highly effective four brush permanent magnet electrical motor design with 100% ball-bearing development. 24" long energy leads. Shaft rotation reversible by reversing power leads. Consists of a manufacturing unit put in 11 tooth sprocket for 8mm chain. Different size sprockets can be found for this motor. Motor shaft starts at 12mm OD and is stepped right down to 10mm OD with two flat spots which might be 8.5mm aside where the sprocket mounts, previous the sprocket is an 8mm left hand threaded submit for the nut and washer which holds the sprocket in place.

Dimensions: 4-1/4" wide x 6" long excluding shaft, 7" long including shaft. Mounting bracket measures 4-3/4" x 2-7/8" and has 4 holes that are spaced 4" x 2-1/4" apart. Weight of motor is 11 lbs. means approx. 5 kg.

5.2 SPEED CALCULATION [1]

Gear ratio = zg/zp = 42/11 =3.818:1.0

Speed = Tyre radius * Rotational velocity/168*Gear ratio
=8* 3000/ 168* 3.818
=37416.0 Mph
Speed in kmph will be:
Kmph = mph* 1.609344
=37.416*1.609344
=60.21Kmph

5.3 BATTERY

An electrochemical power source or battery is a tool which allows the energy liberated in a chemical reaction to be transformed immediately into electrical energy Batteries fulfill two major features, first they're moveable supply of electrical energy and second they're used to store the electrical energy Within the apply the words cell and battery mean closed electrochemical energy sources. The first cell or battery is a system whose helpful life is ended as soon as its reactants have been consumed by the discharge process. However the secondary battery is able to being charged or recharged when its reactants have been used up. The spontaneous electrochemical reaction may be reversed by passing current through the cell in the other way to that of cell discharge. It means the secondary battery is likely to be considered as an electrochemical energy storage unit. A cell could also be characterized by way of, Available capacity, obtainable power and the facility it may deliver.

5.4 CALCULATION[1]

Charging time of battery
=battery amph / charging current
=Ah / A
Charging current should be 10% of the ah rating of battery
Therefore,
Ah = 32 Ah
Charging current for 32 ah battery
=32*10/100
=3.2 A
Charging time of battery
=32/3.2 = 10 hrs. (Ideal case)

Practical Case

40% of losses occurs,
32*40/100 =12.8
32+12.8 = 44.8 Ah
Charging time of battery
= 44.8/3.2 = 14 hrs

Discharge time:
Battery Ah*Battery volt/Applied volt
=32*48/1000
=1.536 hrs
Considering loss (max)
=1.536*40/100
=0.6144hrs = 61 min

6. ADVANTAGE

- It will give higher comfort to the passengers.
- It reduces rate of accidents resulting from skidding.
- The vehicle will likely be helpful on highways as well as on off roads.
- Good directional as well as dynamic stability.
- Enhance efficiency of car.
- Driver is safe whereas taking sharp turn on the street trigger risk of skidding or falling of Go-kart is nearly negligible.

7. LIMITATION

- The complete weight of the automobile will increase.
- energy consumption will increase.
- As a result of improve within the elements throughout the suspension ,it takes for much longer to service is heavier than an equal Macpherson design.
- Weight shifting whereas turning is required.

8. APPLICATION

- It could be utilized in rainy seasons.
- Suitable for handicapped folks.
- It can be applied in four wheeler and likewise three wheeler
- It permits extra control over the movement of the wheel.

9. CONCLUSIONS

Design of electric go kart is made in this research. Designing of electric go kart with suspension is made in this research which shows that electric karts can be made for educational, research purpose and publically. All the design work of electric go kart with suspension is easy and affordable. It can be the demand of next generation as a source of clean environment. This research shows the knowledge of manufacture a electric go kart with low budget with a good speed up to 60 kmph. In this kart adding suspension system provide the vehicle act as a safety member by giving all the

go kart while turn and rough roads if also provides cushioning against bumps or irregularities present on the road surface. Assembling a alternator which charge the battery while the Go-kart is running which helps to increase the distance travelled by the Go-kart.

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