A

Project Report

ON

"Electric Car"

Submitted to Department of Mechanical Engineering in partial fulfillment of the requirements of the award of the Degree

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

2017-2021

Submitted By:

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Under the Guidance of Mr. Devesh Bora

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DEPARTMENT OF MECHANICAL ENGINEERING

GRAPHIC ERA HILL UNIVERSITY BHIMTAL CAMPUS

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DISTRICT –NANITAL -263136

2020-2021

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CERTIFICATE

This is to certify that the project report entitled, "Electric Car" is submitted by batch of “2017-2021”. Is required in partial fulfillment for the award of Bachelor of Technology Degree in Mechanical Engineering. The matter embodies original work done by them under my supervision.

PROJECT MENTOR / GUIDE

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GEHU BHIMTAL

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DECLARATION

We hereby declare that the Project Report entitled "Electric Car" Submitted for the Bachelor of Technology Degree is our original work and the project report has not copied from any degree, associate fellowship or other similar titles.

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We are very pleased with all the faculty members and staff of Mechanical Engineering Department, Graphic Era Hill University, Bhimtal, for their consistent encouragement.

Last but not least it was the hard work and dedication of the students who made it a successful project.

ABSTRACT

Generally, the main objective is to design and fabricate the electric car 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 batteries of 48V are used to run the electric car. The double wishbone suspension used in the electric car which improves comfort and helps the electric car to drive in city as well as on rough terrain, also adding a new alternator which charges the battery while the electric car is running which helps to increase the distance travelled by the electric car. Main focus is to design the double wishbone suspension for the electric car. Overall Use of Double wishbone suspension system, electric motor, 48V battery, speed controller, throttle.

INTRODUCTION

The world's car usage is booming. Cars are Polluting the world's cities, dumping increasing amounts of Carbon dioxide and other climate-altering greenhouse gasses into the atmosphere, and consuming vast quantities of petroleum. The alarming reality is that the automobile usage is growing at a much faster rate than the human population, with saturation nowhere in sight. If present trends continue, over 5 billion vehicles could be in operation by the year 2050, exceeding 20 cars per 100 people. Even then, world car ownership rates would fall far short of current world rates of 70 cars per 100 people.

Electric Propulsion Trends

Electric vehicles cost more and perform worse than their gasoline counterparts. This is mainly because gasoline cars have benefited from a century of intensive development; electric cars have been virtually ignored for over seventy-five years even today, gasoline cars profit from billions of dollars of research every year while electric vehicles receive a tiny fraction of that.

Environmental Benefits

The primary premise for government support of electric vehicles has been air quality. The sole legal justification for the EV mandate is controlling the pollution. Electric vehicles will not disappoint on this count. But air quality alone is not sufficient justification to mandate electric vehicles. The single biggest advantage of electric vehicles is that the electric power is produced in a centralized location where the pollution can be better monitored and controlled.

PROBLEM IDENTIFICATION

Go-karts 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 use high power compact engine. The problem is these karts are not meant to be used in city or bad road as they don't have suspension and as they are not environment friendly. Making a Go-kart economical by using electrical drive train system like electric motor and batteries is our main objective. The Go-kart absorbs all road shocks and drive directly can get shocks because there are no suspensions in it. Problem is to design a suspension system for Go-kart. This was the main skeleton for the fabrication of our electric car.

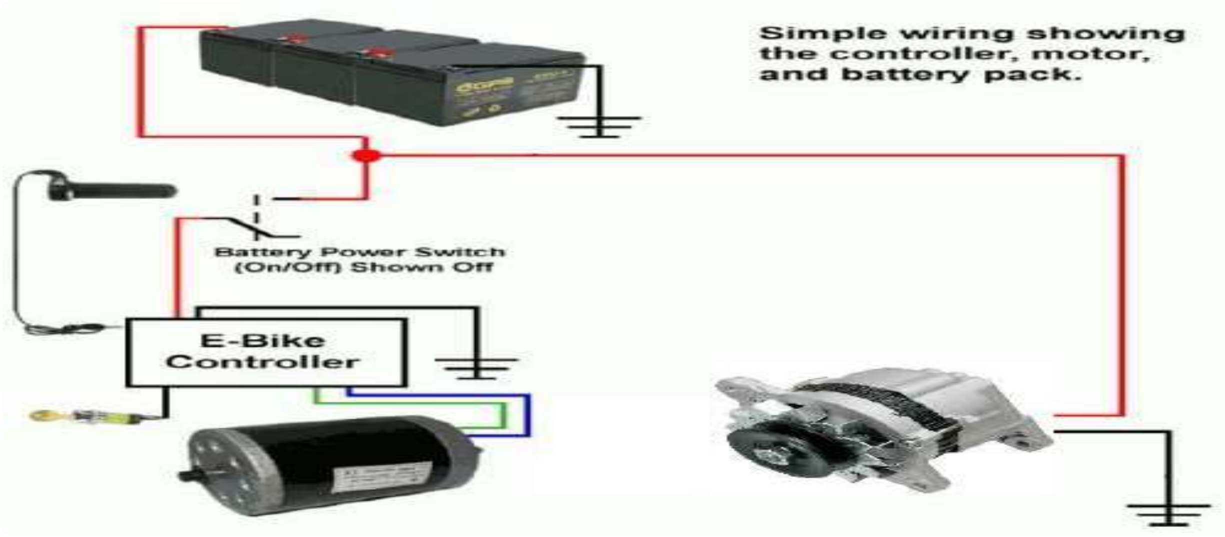
WORKING METHODOLOGY

First the 2D sketch design is made on paper with all specification and all the measurements, then using modeling software like solidworks the 3D models of all the parts of electric car are 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.



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.

Materials used are:

Table 1: Property of the material

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

DIFFERENT MATERIALS USED FOR CHASSIS MAKING

1 Steel: The main factors of selecting material specially for body is wide variety of characteristics such as thermal, chemical or mechanical resistance, ease of manufacture and durability. So if we want to choose a material with these characteristics, Steel is the first choice. There was many developments in irons and steels over the past couple decades that made the steel more light-weight, stronger, stiffer and improving other performance characteristics. Applications include not only vehicle bodies, but also engine, chassis, wheels and many other parts. Iron and steel form the critical elements of structure for the vast majority of vehicles, and are low-cost materials. The prime reason for using steel in the body structure is its inherent capability to absorb impact energy in a crash situation. The prime reason for using steel in the body structure is its inherent capability to absorb impact energy in a crash situation.

2 Aluminium: There are wide variety of aluminium usage in automotive powertrain, chassis and body structure. Use of aluminium can potentially reduce the weight of the vehicle body. Its low density and high specific energy absorption performance and good specific strength are its most important properties. Aluminium is also resistance to corrosion. But according to its low modulus of elasticity, it cannot substitute steel parts and therefore those parts need to be re-engineered to achieve the same mechanical strength, but still aluminium offers weight reduction. Recent developments have shown that up to 50% weight saving for the body in white (BIW) can be achieved by the substitution of steel by aluminum. This can result in a 20-30% total vehicle weight reduction. The cost of aluminium and price stability is its biggest obstacle for its application.

3 Magnesium: There are a wide variety of magnesium usage in automotive powertrain, chassis and body structure. The density of magnesium is about two-thirds the density of aluminum (1.8 g/cm3 for magnesium vs. 2.7 g/cm3) and close to the density of carbon fiber composites (1.6 g/cm3). Magnesium alloys are lighter than aluminum alloys but similar in strength depending on the alloys compared. Magnesium has limitations in handling high loads and finished components have lower ductility levels compared to aluminum or mild steel. While some magnesium alloy can have specific higher specific strength or strength-to-weight ratios compared to the mild or low carbon steels and aluminum, advanced high strength steels (AHSS) and aerospace aluminum alloys would have higher specific strengths.

4 E Glass Epoxy fiber : Glass has been the predominant fiber for many civil engineering applications because of an economical balance of cost and specific strength properties. Glass fibers are commercially available in E-Glass formulation (for electrical grade), the most widely used general-purpose form of composite reinforcement, high strength S-2® glass and ECR glass (a modified E Glass which provides improved acid resistance).

Various loads acting on the Chassis frame

The loads acting on the chassis frame are as follows:

1. Stationary loads namely the loads of permanent attachment like all the parts of the chassis, body etc.

2. Short duration loads while turning, braking etc.

3. Momentary loads while quick acceleration, sudden braking etc.

4. Loads applied while crossing roads of irregular and uneven surfaces

5. Loads caused by sudden accidents, head on collusions etc.

6. Loads caused by irregular and overloading of vehicle.

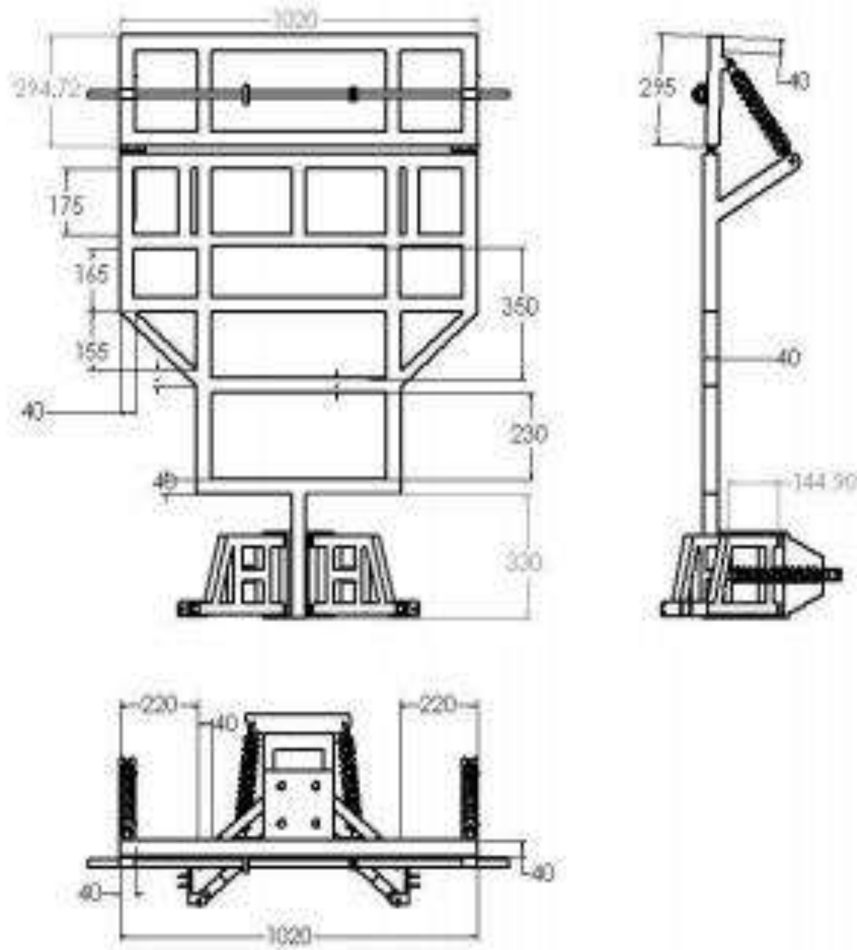


Figure : Sheet Of Electric Car

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

FINAL ASSEMBLY

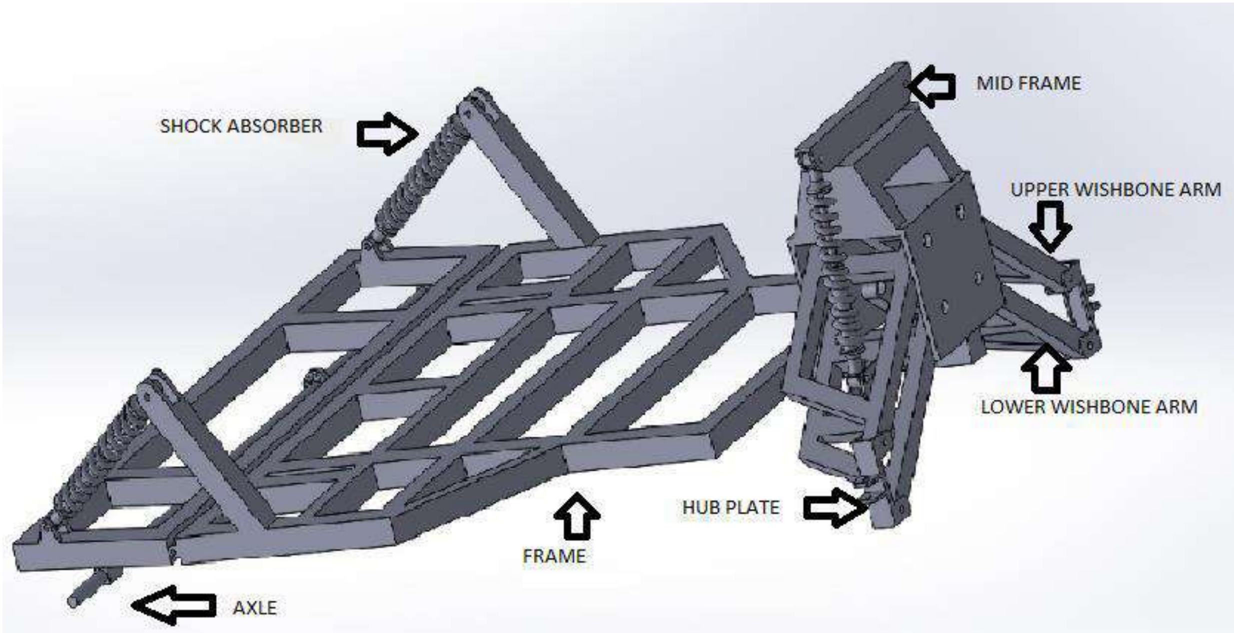


Figure: Final Assembly

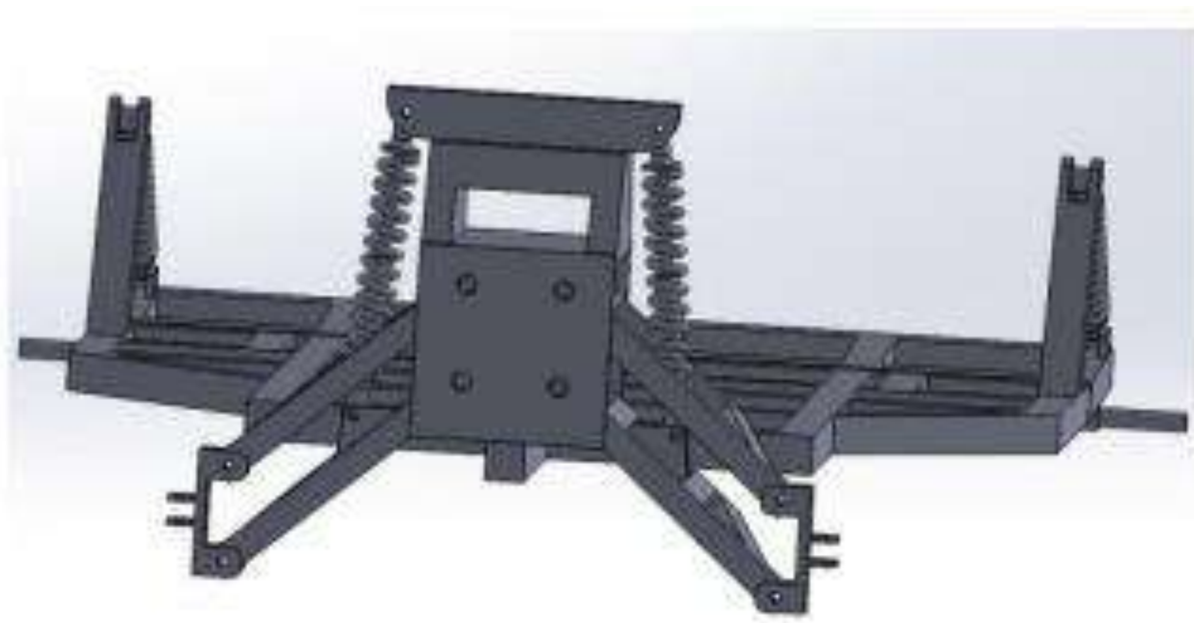


Figure: Front View of Go Kart

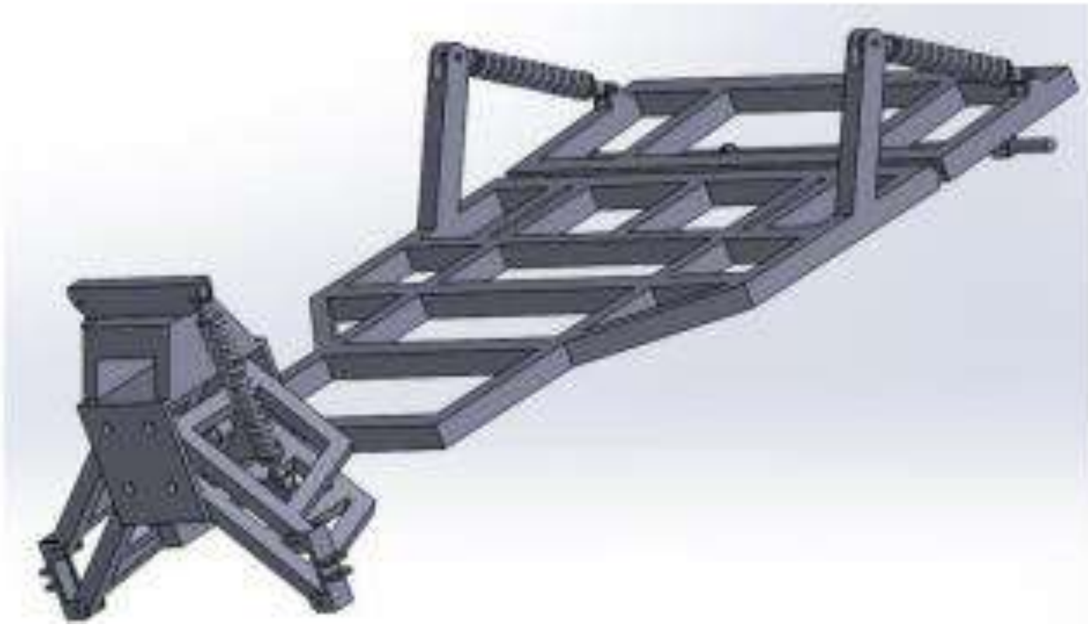


Figure: Side View of Go Kart

MAIN COMPONANTS

MOTOR:

An **electric motor** is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied on the motor's shaft. Electric motors can be powered by direct current (DC) sources, such as from batteries, or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. An electric generator is mechanically identical to an electric motor, but operates with a reversed flow of power, converting mechanical energy into electrical energy.

Electric motors may be classified by considerations such as power source type, internal construction, application and type of motion output. In addition to AC versus DC types, motors may be brushed or brushless, may be of various phase (see single-phase, two-phase, or three-phase), and may be either air-cooled or liquid-cooled. General-purpose motors with standard dimensions and characteristics provide convenient mechanical power for industrial use. The largest electric motors are used for ship propulsion, pipeline compression and pumped-storage applications with ratings reaching 100 megawatts. Electric motors are found in industrial fans, blowers and pumps, machine tools, household appliances, power tools and disk drives. Small motors may be found in electric watches. In certain applications, such as in regenerative braking with traction motors, electric motors can be used in reverse as generators to recover energy that might otherwise be lost as heat and friction. Electric motors produce linear or rotary force (torque) intended to propel some external mechanism, such as a fan or an elevator. An electric motor is generally designed for continuous rotation, or for linear movement over a significant distance compared to its size. Magnetic solenoids are also transducers that convert electrical power to mechanical motion, but can produce motion over only a limited distance.

Electric motors are much more efficient than the other prime mover used in industry and transportation, the internal combustion engine (ICE); electric motors are typically over 95% efficient while ICEs are well below 50%. They are also lightweight, physically smaller, are mechanically simpler and cheaper to build, can provide instant and consistent torque at any speed, can run on electricity generated by renewable sources and do not exhaust carbon into the atmosphere. For these reasons electric motors are replacing internal combustion in transportation and industry, although their use in vehicles is currently limited by the high cost and weight of batteries that can give sufficient range between charges.

Types of Motors

1. AC Motors: An **AC motor** is an **electric motor** driven by an **alternating current** (**AC**). The **AC motor** commonly consists of two basic parts, an outside stator having coils supplied with **alternating current** to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field.
2. DC Motors: A DC Motor whose poles are made of Permanent Magnets is known as **Permanent Magnet DC (PMDC) Motor**. The magnets are radially magnetized and are mounted on the inner periphery of the cylindrical steel stator. The stator of the motor serves as a return path for the magnetic flux. The rotor has a DC armature, with commutator segments and brushes.

COMPONENTS OF MOTORS:

1. **Rotor:** In an electric motor, the moving part is the rotor, which turns the shaft to deliver the mechanical power. The rotor usually has conductors laid into it that carry currents, which the magnetic field of the stator exerts force on to turn the shaft. Alternatively, some rotors carry permanent magnets, and the stator holds the conductors. There must be an air gap between the stator and rotor so it can turn. The width of the gap has a significant effect on the motor's electrical characteristics. It is generally made as small as possible, as a large gap has a strong negative effect on performance. It is the main source of the low power factor at which motors operate. The magnetizing current increases and the power factor decreases with the air gap, so narrow gaps are better. Very small gaps may pose mechanical problems in addition to noise and losses.
2. **Bearings:** The rotor is supported by bearings, which allow the rotor to turn on its axis. The bearings are in turn supported by the motor housing. The motor shaft extends through the bearings to the outside of the motor, where the load is applied. Because the forces of the load are exerted beyond the outermost bearing, the load is said to be overhung.
3. **Stator:** The stator is the stationary part of the motor's electromagnetic circuit surrounding the rotor, and usually consists of the field magnets, which are either electromagnets consisting of wire windings around a ferromagnetic iron core or permanent magnets. It creates a magnetic field which passes through the rotor armature, exerting force on the windings. The stator core is made up of many thin metal sheets which are insulated from each other, called laminations. Laminations are used to reduce energy losses that would result if a solid core were used. Resin-packed motors, used in washing machines and air conditioners, use the damping properties of resin (plastic) to reduce noise and vibration. These motors completely encapsulate the stator in plastic.
4. **Windings:** Windings are wires that are laid in coils, usually wrapped around a laminated soft iron magnetic core so as to form magnetic poles when energized with current. Electric machines come in two basic magnetic pole configurations: salient- and non-salient-pole configurations. In the salient-pole machine the ferromagnetic cores on the rotor and stator have projections called poles facing each other, with a wire winding around each pole below the pole face, which become north or south poles of the magnetic field when current flows through the wire. In the non-salient-pole, or distributed field, or round-rotor, machine, the ferromagnetic core does not have projecting poles but is a smooth cylinder, with the windings distributed evenly in slots about the circumference. The alternating current in the windings creates poles in the core which rotate continuously. A shaded-pole motor has a winding around part of the pole that delays the phase of the magnetic field for that pole. Some motors have conductors that consist of thicker metal, such as bars or sheets of metal, usually copper, alternatively aluminium. These are usually powered by electromagnetic induction.

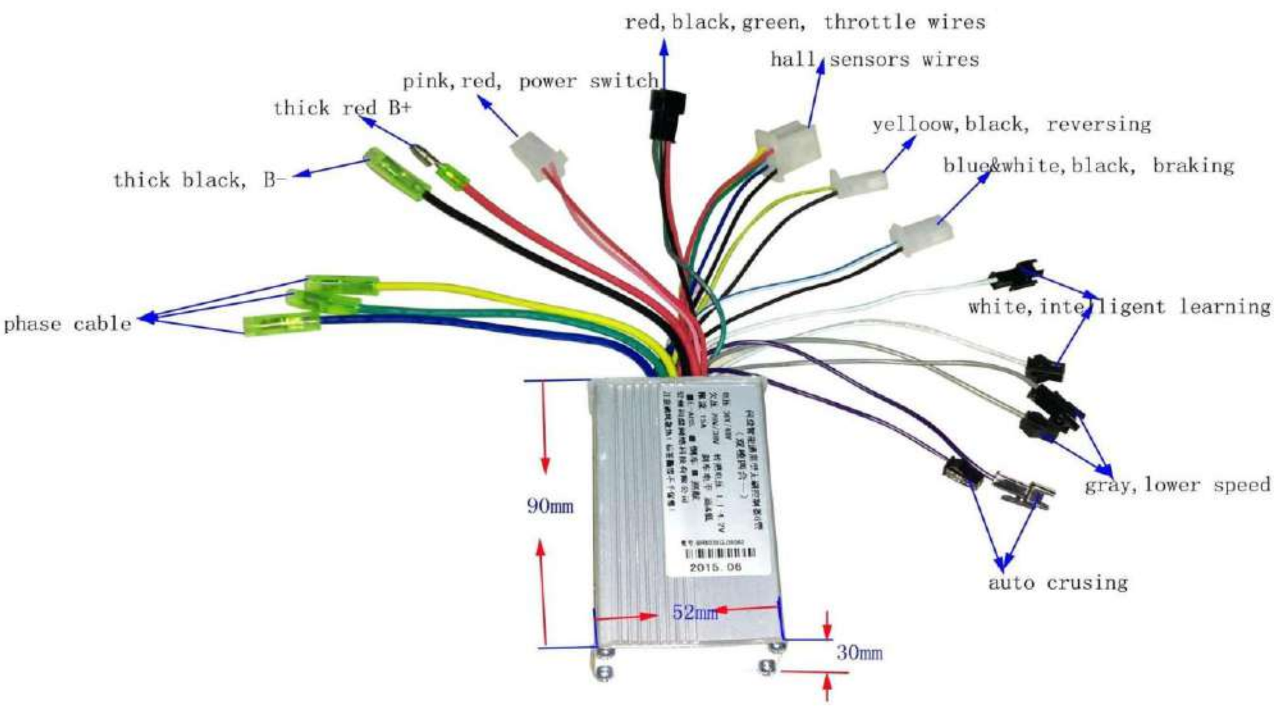
5. **Commutator:** A commutator is a rotary electrical switch in some motors that supplies current to the rotor. It consists of a cylinder composed of multiple metal contact segments on the rotating armature of the machine. Two or more electrical contacts called "brushes" made of a soft conductive material like carbon press against the commutator, making sliding contact with successive segments of the commutator as it rotates, supplying the current to the rotor. The windings on the rotor are connected to the commutator segments. The commutator periodically reverses the current direction in the rotor windings with each half turn (180°), so the torque the magnetic field of the stator exerts on the rotor is always in the same direction. Without this current reversal, the direction of torque on each rotor winding would reverse with each half turn, so the rotor would stop. Commutators are inefficient and commutated motors have been mostly replaced by brushless direct current motors, permanent magnet motors, and induction motors.

Power	1.1Kw
Speed	2000-6000 rpm
Phase	Three Phase Motor
Voltage Required	48V

CONTROLLER:

There are two distinct types of controllers designed to match either a brushed motor or brushless motor:

- Controllers for brushless motors brushless motors typically have Hall sensor commutation for speed measurement. The controllers generally provide potentiometer adjustable motor speed, closed-loop speed control for precise speed regulation, protection logic for over voltage, over current and thermal protection. The controller uses pulse width modulation to regulate the power to the motor.
- Controllers for brushed motors. Brushed motors are also used in e-bikes but are becoming less common due to their intrinsic lower efficiency. Controllers for brushed motors however are much simpler and cheaper due to the fact they don't require hall sensor feedback.



BATTERY:

A **battery** is a power source consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells; however, the usage has evolved to include devices composed of a single cell.

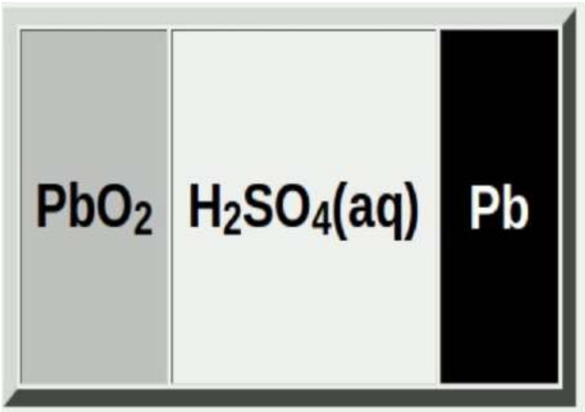
Primary (single-use or "disposable") batteries are used once and discarded, as the electrode materials are irreversibly changed during discharge; a common example is the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and mobile phones.

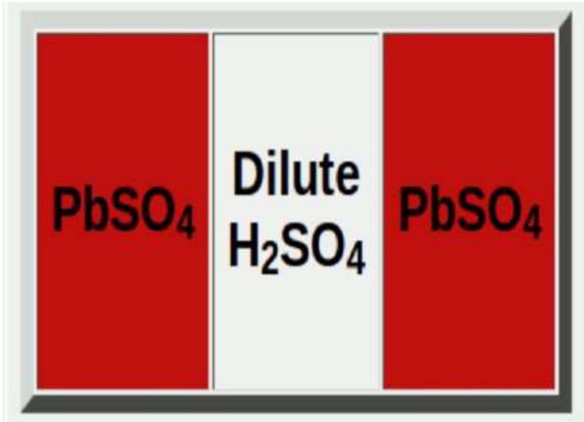
Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to small, thin cells used in smartphones, to large lead acid batteries or lithium-ion batteries in vehicles, and at the largest extreme, huge battery banks the size of rooms that provide standby or emergency power for telephone exchanges and computer data centres.

Batteries have much lower specific energy (energy per unit mass) than common fuels such as gasoline. In automobiles, this is somewhat offset by the higher efficiency of electric motors in converting electrical energy to mechanical work, compared to combustion engines.

Charging and Discharging

The basic overall charge/discharge reaction in lead–acid batteries is represented by: $Pb(s) + PbO2(s) + 2H2SO4(aq) \rightarrow 2PbSO4(s) + 2H2O(l)$

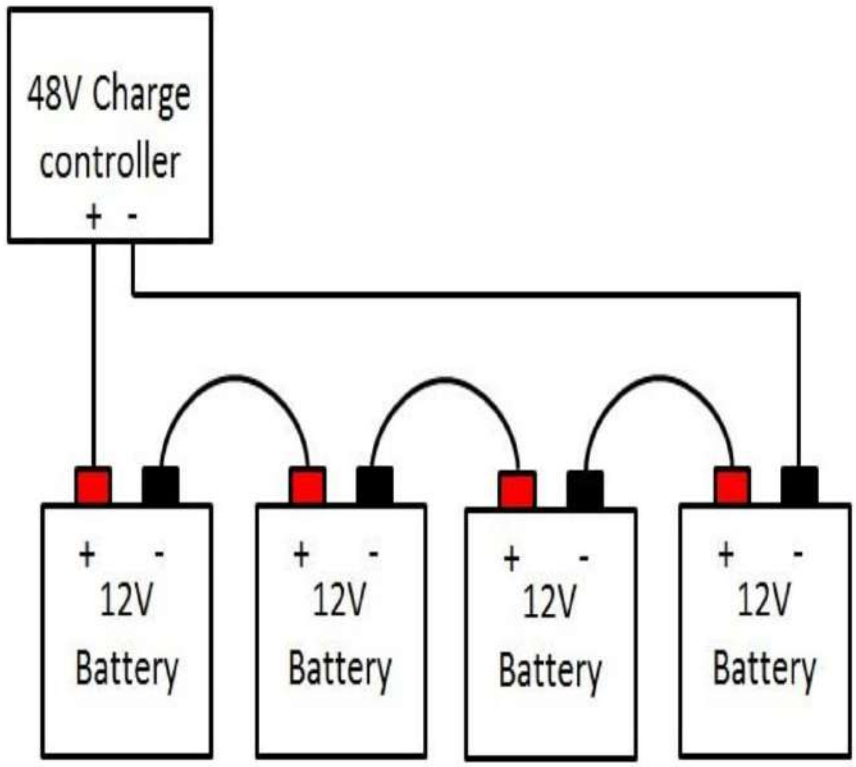




CHARGING **DISCHARGE**

Arrangement

We are using four lead acid batteries of 12volt and 60ah and arranging them in series to increase the voltage up to 48volt.



Principal of Operation

Batteries convert chemical energy directly to electrical energy. In many cases, the electrical energy released is the difference in the cohesive or bond energies of the metals, oxides, or molecules undergoing the electrochemical reaction. For instance, energy can be stored in Zn or Li, which are high-energy metals because they are not stabilized by d-electron bonding, unlike transition metals. Batteries are designed so that the energetically favourable redox reaction can occur only when electrons move through the external part of the circuit.

ACCESSORIES

1. Ignition Switch

Technical Specification

Finish Type	Polished
Switch Operation	Manual
Switch Type	Key Lock
Material	Aluminium
Weight	100g

2. Meter

Technical Specification

Display	Analog
Material	Plastic
Weight	200-500g
Wattage	12v
Voltage	12v

3. Headlight

Technical Specification

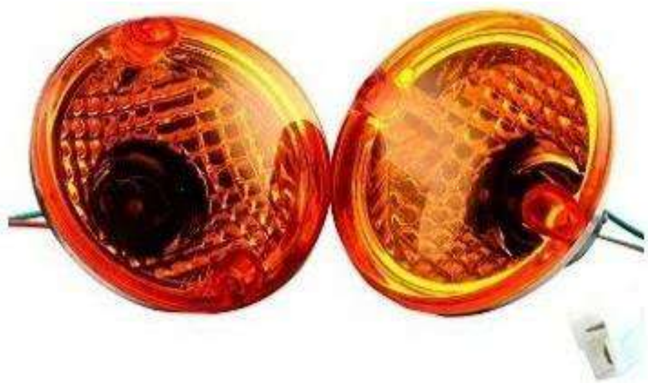
Power	5A
Body Material	Iron
Shape	Round
Voltage	Round

4. Brake Light Switch

Technical Specification

Current	2A
Power Source	Battery
Weight	50-100g
Frequency	50Hz
Voltage	12v

5. Side Indicator



Technical Specification

Lighting Type	LED
Phase	Single
Reflective	Yes
Voltage	12v

6. Buzzer Flasher

Technical Specification

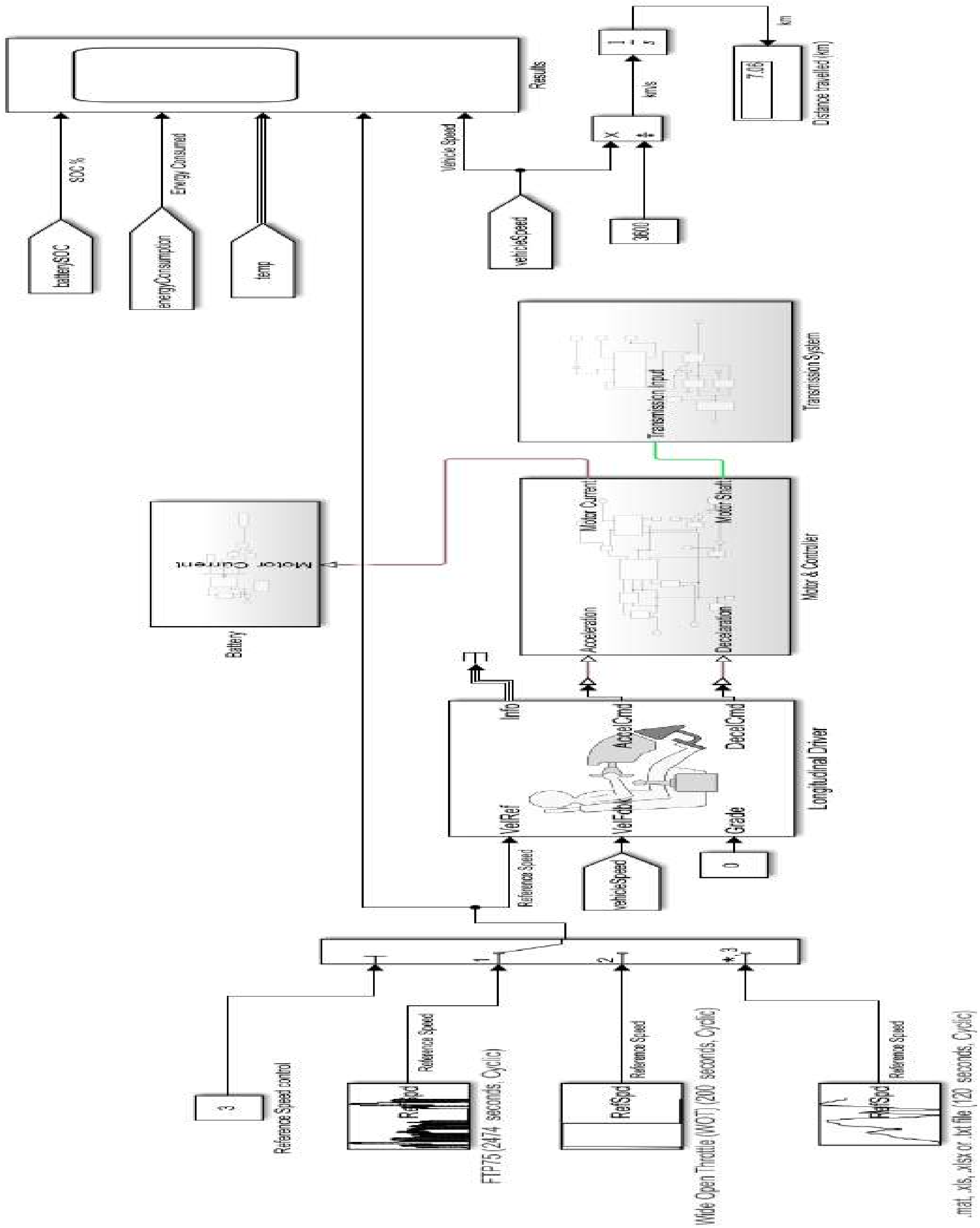
Buzzer Size	22.5mm
Material	ABS
Flashing Frequency	1 sec ON, 0.5 sec OFF
Frequency	50Hz
Voltage	24VDC

7. Horn

Technical Specification

Power Souce	Battery
Material	Plastic
Sound Level	20db
Voltage	12VDC

DIAGRAM



Results
SOC %
Energy Consumed
Vehicle Speed
batterySOC
energyConsumption
temp
vehicleSpeed
3600
km/s
km
7.06
Distance travelled (km)
Battery
Motor Current
Motor & Controller
Acceleration
Deceleration
Motor Shaft
Transmission Input
Transmission System
Longitudinal Driver
VelRef
VelFdbk
Grade
Info
AccelCmd
DecelCmd
Reference Speed
0
3
Reference Speed control
RefSpd
FTP75 (2474 seconds, Cyclic)
Wide Open Throttle (WOT) (200 seconds, Cyclic)
.mat, .xls, .xlsx or .txt file (120 seconds, Cyclic)

Breaking System

PURPOSE OF BRAKING SYSTEM

- Stop the vehicle by converting kinetic energy to heat energy.
- Heat energy is created in the brakes by friction.
- Friction is created between a moving and non- moving surface at each wheel to generate the heat.
- Discs and drum brakes are the most common type of braking system used.

Main requirements

- A braking system must decelerate a vehicle in a controlled & repeatable manner under a variety of conditions
- Slippery wet & dry roads
- Rough & smooth roads
- Straight line & cornering conditions
- High & low rates of deceleration New or worn linings
- Laden or unladen Towing
- Permit the vehicle to travel at a constant speed downhill
- Hold the vehicle still when parked on the flat or a gradient.

BRAKING FUNDAMENTALS

- **PRINCIPLE:**

- Friction between braking surfaces converts kinetic energy into heat.
- In drum brakes, wheel cylinders force brake linings against the inside of the drum.
- In disc brakes, pads are forced against a brake disc.

Several factors can influence Vehicle Braking:

- Road surface
- Road conditions
- Weight of the vehicle
- Load on the wheels during stopping
- How the vehicle is being driven.

A basic Braking system has a:

- Brake pedal
- Master cylinder to provide hydraulic pressure
- Brake linings and hoses to connect the master cylinder to the brake assemblies
- Brake assemblies – Drum or Disc that stop the wheels.

DRUM BRAKES

Drum brakes have a brake shoe that expands against the inside of a drum. Disc brakes clamp a flat disc between two pads.

COEFFICIENT OF FRICTION:

The coefficient of friction is the measurement of friction between pairs of surfaces.

STOPPING DISTANCE:

The distance in which the vehicle stops by applying force.

BRAKE FADE:

It is the reduction in stopping power caused by a buildup of heat in the braking surfaces.

WEIGHT TRANSFER:

In dynamic braking condition weight transfers from rear wheels to front wheels.

SKIDDING:

When force of braking exceeds force of adhesion between tires and the road.

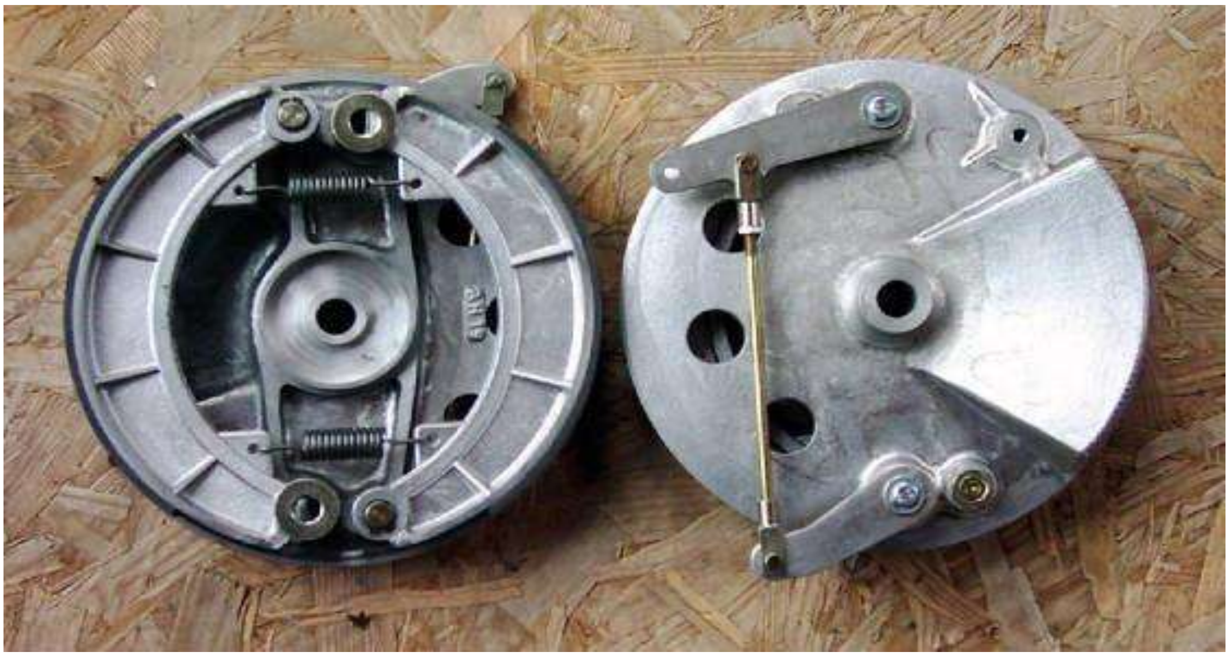
Design Considerations

- Effective heat dissipation
- Multiplication of force
- Sealing of the system
- Materials – coefficient of friction, heat resistance, wear out rate
- Front & rear forces – weight transfer
- Variation in operating conditions
- Legal requirements

Weight Transfer

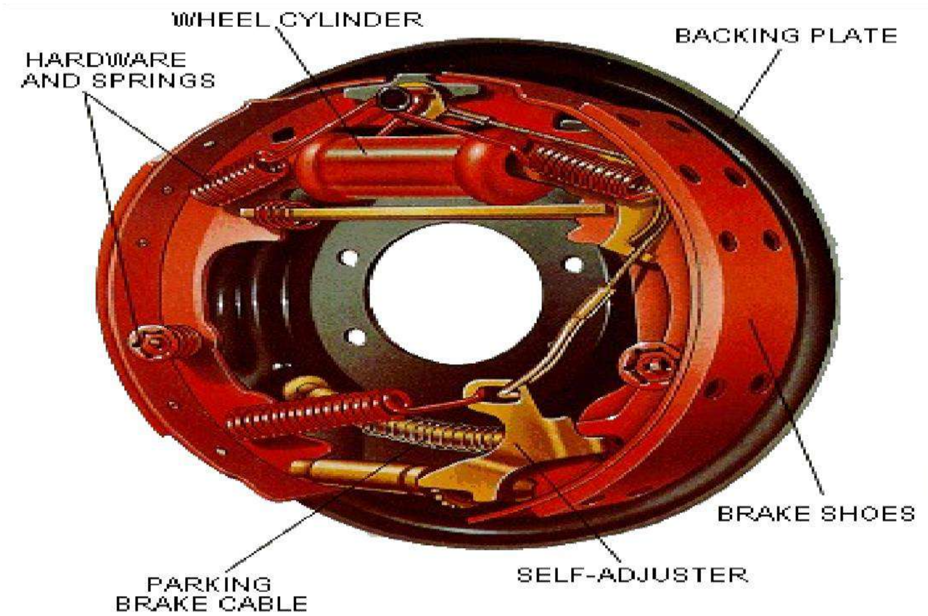
- Usually more weight on front axle (Front Engine)
- Transfer of weight to front under braking
- So larger braking force can be generated at the front
- Achieved by differentiating pressure to the rear - limiting valve to reduce pressure or difference in master cylinder sizes.

DRUM BRAKES



Drum Brake

- Drum brakes have a drum attached to the wheel hub and braking occurs by means of brake shoes, expanding against the inside of the drum.
- A drum brake is a brake in which the friction is caused by a set of shoes or pads that press against the inner surface of a rotating drum. The drum is connected to a rotating wheel.



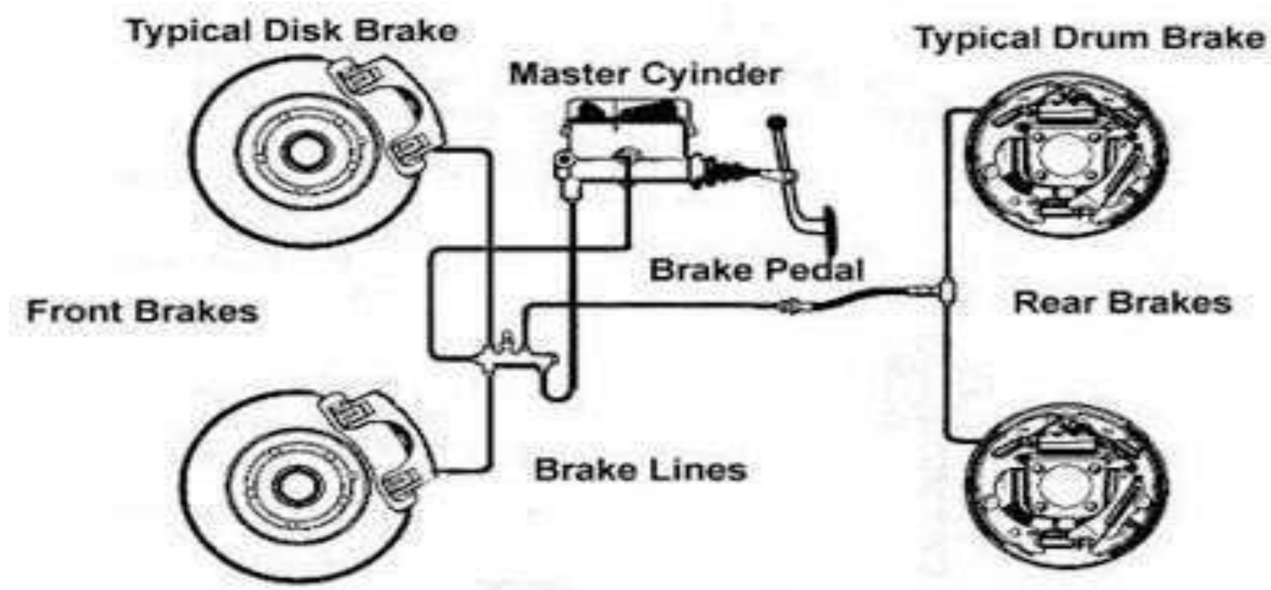
Master Cylinder

- The single-piston master cylinder transforms the applied pedal force into hydraulic pressure which is transmitted simultaneously to all four wheels.
- The master cylinder is connected to
- The brake pedal via a pushrod.
- The rod from the brake pedal pushes on the piston. It moves, closing off the compensating port and trapping fluid ahead of the primary cup. Any fluid trapped in the cylinder is then forced through a valve called a residual pressure valve, into the brake lines.

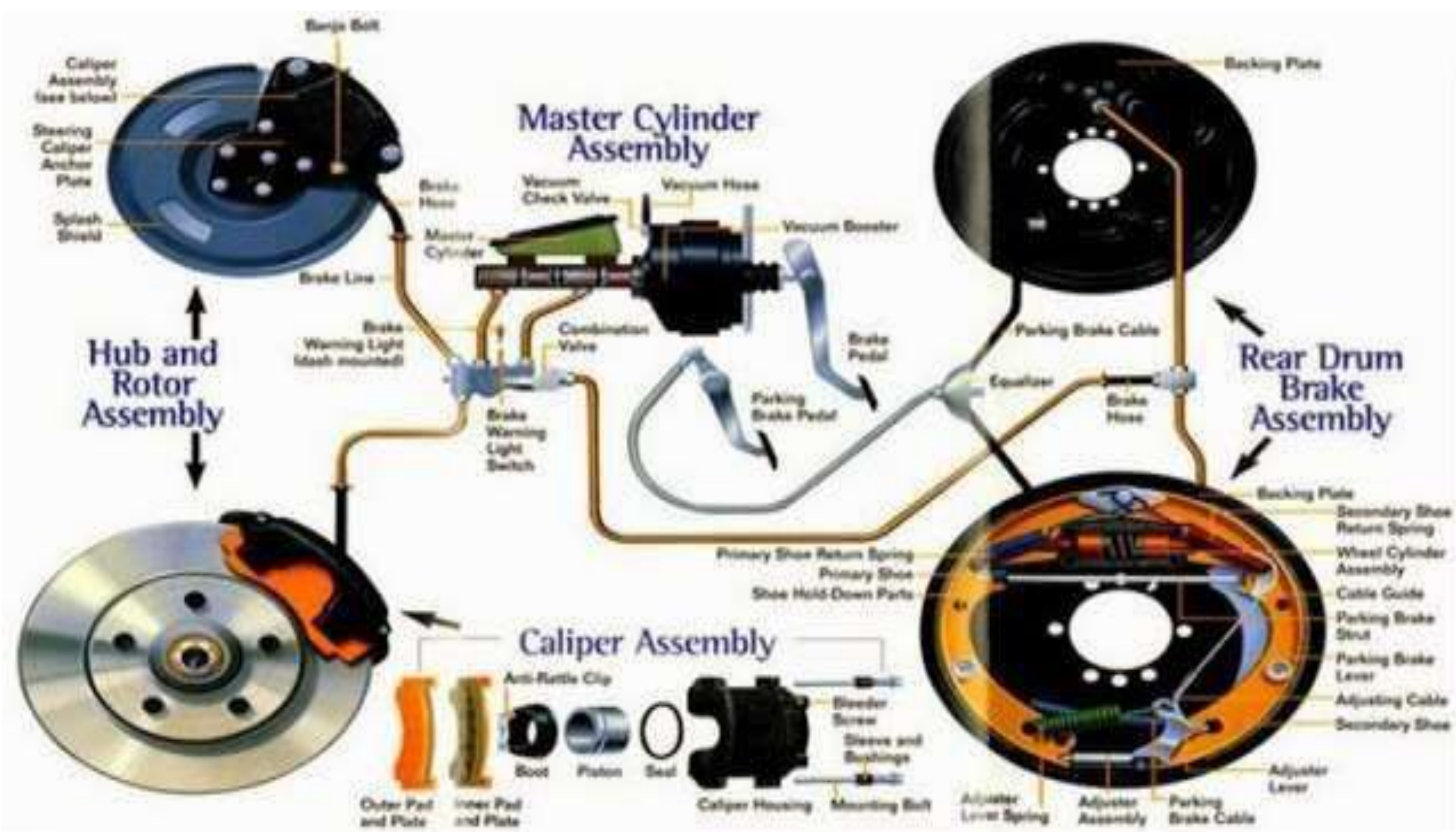
Working of Drum Brakes

- Shoes press against a rotating surface.
- In this system that surface is called a drum.
- Drum brake also has an adjuster mechanism, an emergency brake mechanism and lots of springs.
- The shoes are pulled away from the drum by the springs when the brakes are released.

LAYOUT OF BRAKES ASSEMBLY



Typical Automotive Braking System



CALCULATIONS

- **For Motor:**

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

- **For Battery:** 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

ADVANTAGES

- 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 of 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.

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.

APPLICATION

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

CONCLUSION

Design of electric car is made in this research. Designing of electric car with suspension is made in this research which shows that electric cars can be made for educational, research purpose and publically. All the design work of electric car 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 manufacturing an electric car with low budget with a good speed up to 60 kmph. In this car adding suspension system provides the vehicle safety by giving flexibility around turns and rough roads it also provides cushioning against bumps or irregularities present on the road surface. Assembling an alternator which will charge the battery while the car is running, this helps in increasing the distance travelled by the vehicle.

REFERENCES

- AMBEPRASAD KHUSWAHA,SHUBHAM S.KENJELE,JAY A PATEL "Design and fabrication of cost effective electric go kart" .
- D RAVIKANTH,DR.K.RAJAGOPAL,VSS MURTY "Design of go kart vehicle"
- ASHARF SHAIK, MOHD. YOUSUF AHMED, MIRZA MUJAHID BAIG "Suspension System of Electric GO KART".
- Electric Vehicle Technology Explained by James Laminie and John Lowry.
- WWW.GOOGLE.COM
- Wikipedia.com