A PROJECT REPORT

ON

"FOUR WHEEL STEERING USING GEAR AND MOTOR"

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This is to certify that the project work titled FOUR WHEEL STEERING USING GEAR AND MOTOR has been carried out by 14 members.

In partial fulfilment of the requirements for the award of Diploma in Mechanical Engineering during the academic year 2019-2020 at the S.R.R.S GOVT POLYTECHNIC, RAJANNA SIRCILLA-Dist. And is an authentic work carried by them under the supervision and guidance.

GUIDE HMES PRINCIPAL

EXTERNAL

A

PROJECT REPORT

STUDY OF FOUR WHEEL STEERING USING GEAR AND MOTOR

2017-2020

Submitted in partial fulfilment of the requirements for the award of Diploma in Mechanical Engineering.

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DECLARATION

The work here is original and to the best of our knowledge, it has never been presented anywhere else for academic or any other purpose.

DEDICATION

We dedicate this work to all the Lecturers and support staff of the Department of Mechanical Engineering at the college of SRRS GOVERNMENT POLYTECHNIC, Sircilla for their tireless and selfless efforts they spared in making us who we are today

We dedicate this work to all our family and friends who supported us morally to do what we believed in.

ACKNOWLEDGEMENT

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I would like to express my sincere thanks to all my colleagues and the members of the cloud computing research group. I would like to thank my parents for their valuable support and encouragement.

Last, but not the least my special thanks goes to our institute, SRRS GOVT POLYTECHNIC, for giving me this opportunity to work in the great environment.

Mechanical students

2017-2020

ABSTRACT

Production cars are designed to understeer and rarely do they oversteer. If a car could automatically compensate for an understeer/oversteer problem, the driver would enjoy nearly neutral steering under varying operating conditions.

Four-wheel steering is a serious effort on the part of automotive design engineers to provide near-neutral steering. Also in situations like low speed cornering, vehicle parking and driving in city conditions with heavy traffic in tight spaces, driving would be very difficult due to vehicle's larger wheelbase and track width. Hence there is a requirement of a mechanism which result in less turning radius and it can be achieved by implementing four wheel steering mechanism instead of regular two wheel steering.

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CHAPTER-01

INTRODUCTION

INTRODUCTION

1.1 Introduction

Production cars are designed to understeer and rarely do they oversteer. If a car could automatically compensate for an understeer/oversteer problem, the driver would enjoy nearly neutral steering under varying operating conditions. Four-wheel steering is a serious effort on the part of automotive design engineers to provide near-neutral steering. Also in situations like low speed cornering, vehicle parking and driving in city conditions with heavy traffic in tight spaces, driving would be very difficult due to vehicle’s larger wheelbase and track width. Hence there is a requirement of a mechanism which result in less turning radius and it can be achieved by implementing four wheel steering mechanism instead of regular two wheel steering.

Four wheel steering is a method developed in automobile industry for the effective turning of the vehicle and to increase the manuverbility. In a typical front wheel steering system the rear wheels do not turn in the direction of the curve and thus curb on the efficiency of the steering. In four wheel steering the rear wheels turn with the front wheels thus increasing the efficiency of the vehicle. The direction of steering the rear wheels relative to the front wheels depends on the operating conditions. Usually customers pick the vehicle with higher wheelbase and track width for their comfort and face these problems, so to overcome this problem a concept of four wheel steering can be adopted in the vehicle. Four wheel steering reduces the turning radius of the vehicle which is effective in confined space, in this project four wheel steering is adopted for the existing vehicle and turning radius is reduced without changing the dimension of the vehicle.

1.1.1 Background

The most effective type of steering, this type has all the four wheels of the vehicle used for steering purpose. In a typical front wheel steering system the rear wheels do not turn in the direction of the curve and thus curb on the efficiency of the steering. Normally this system is not been the preferred choice due to complexity of conventional mechanical four wheel steering systems.

Volume 12, Issue 1, April 2013 and sensors to monitor the vehicle dynamics and adjust the steer angles in real time. Although such a complex four wheel steering model has not been created for production purposes, a number of experimental concepts with some of these technologies have been built and tested successfully. Compared with a conventional two wheel steering system, the advantages offered by a four wheel steering system include: 1. Superior cornering stability. 2. Improved steering responsiveness and precision. 3. High speed straight line stability. 4. Notable improvement in rapid lane changing maneuvers. 5. Smaller turning radius and tight space maneuverability at low speed. 6. Relative wheel angles and their control.

The idea behind four-wheel steering is that a vehicle requires less driver input for any steering maneuver if all four wheels are steering the vehicle. As with twowheel-steer vehicles, tire grip holds the four wheels on the road. However, when the driver turns the wheel slightly, all four wheels react to the steering input, causing slip angles to form at all four wheels. The entire vehicle moves in one direction rather than the rear half attempting to catch up to the front. There is also less sway when the wheels are turned back to a straightahead position. The vehicle responds more quickly to steering input because rear wheel lag is eliminated. The direction of steering the rear wheels relative to the front wheels depends on the operating conditions. At low speed wheel movement is pronounced, so that rear wheels are steered in the opposite direction to that of front wheels. This also simplifies the positioning of the car in situations such as parking in a confined space. Since the rear wheels are made to follow the path on the road taken by the front wheels, the rear of a four wheel steering car does not turn in the normal way. Therefore the risk of hitting an obstacle is greatly reduced

.1.2 What is steering?

Steering is the term applied to the collection of components, linkages, etc. which will allow a vessel (ship, boat) or vehicle (car, motorcycle, and bicycle) to follow the desired course. The most conventional steering arrangement is to turn the front wheels using a hand – operated steering wheel which is positioned in front of the driver, via the steering column, which may contain universal joints, to allow it to deviate somewhat from a straight line. Other arrangements are sometimes found on different types of vehicles, for example, a tiller or rear–wheel steering. Tracked vehicles such as bulldozers and tanks usually employ differential steering that is, the tracks are made to move at different speeds or even in opposite directions, using clutches and brakes, to bring about a change of course or direction.

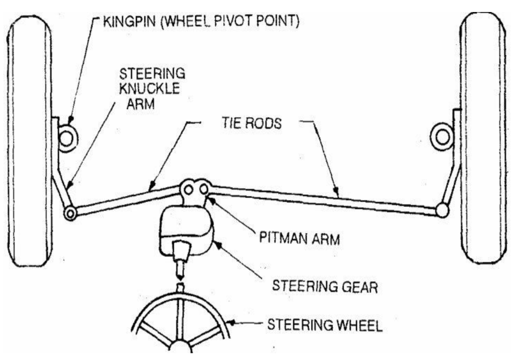

Fig No : 1.1

1.3 Problem Definition

Nowadays all vehicles uses two wheel steering system, but the efficiency of the two wheel steering (2WS) vehicle is proven that it is still low compared to the four wheel steering (4WS) system car. So, this project is base on how to prove that the four Wheel Steering system is better than two Wheel Steering system in terms of turning radius.

A vehicle with higher turning radius face difficulty in parking and low speed cornering due to its higher wheelbase and track width, but the passenger prefer the vehicle to be higher wheelbase and track width as it gives good comfort while travelling. In this scenario four wheel steering will be effective as the turning radius will be decreased for the same vehicle of higher wheelbase. In this project a benchmark vehicle is considered and four wheel steering is implemented without change in dimension of the vehicle and reduction in turning radius is achieved. For achieving reduction a mechanism is built which turns the rear wheels opposite to the front wheels.

Our objective is to demonstrate the application of 4 wheel steering mechanism and its advantage over two wheel steering mechanism using a gear and motor.

1.4 Basic Geometry

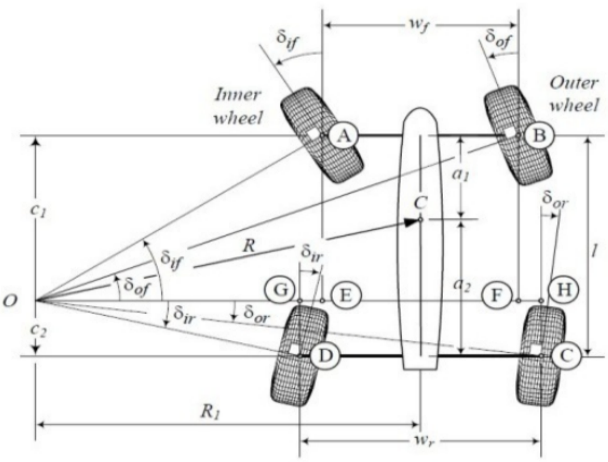

Fig No : 1.2

The steering linkages connecting the steering box and the wheels usually conforms to a variation of Ackermann steering geometry, to account for the fact that in a turn, the inner wheel is actually travelling a path of smaller radius than the outer wheel, so that the degree of toe suitable for driving in a straight path is not suitable for turns. The angle the wheels make with the vertical plane also influences steering dynamics (see camber angle) as do the tires.

Many modern cars use rack and pinion steering mechanisms, where the steering wheel turns the pinion gear the pinion moves the rack, which is a linear gear that meshes with the pinion converting circular motion into linear motion along the transverse axis of the car (side to side motion).This motion applies steering torque to the swivel pin ball joints that replaced previously used kingpins of the stub axle of the steered wheels via tie rods and a short lever arm called the steering arm

The rack and pinion design has the advantages of a large degree of feedback and direct steering "feel". A disadvantage is that it is not adjustable, so that when it does wear and develop lash, the only cure is replacement.

3

Fig : 1.3

1.5 What is Four Wheel Steering ?

Four wheel steering is a method developed in automobile industry for the effective turning of the vehicle and to increase the manuverbility. In a typical front wheel steering system the rear wheels do not turn in the direction of the curve and thus curb on the efficiency of the steering. In four wheel steering the rear wheels turn with the front wheels thus increasing the efficiency of the vehicle. The direction of steering the rear wheels relative to the front wheels depends on the operating conditions. At low speed wheel movement is pronounced, so that rear wheels are steered in the opposite direction to that of front wheels. At high speed, when steering adjustments are subtle, the front wheels and the rear wheels turn in the same direction.

Four wheel steering or all wheel steering is a system employed by some vehicles to improve steering response, increase vehicle stability while maneuvering at high speed or to decrease turning radius at low speed. In an active four-wheel steering system, all four wheels turn at the same time when the driver steers. In most active four-wheel steering systems, the rear wheels are steered by a computer and actuators. The rear wheels generally cannot turn as far as the front wheels. There can be controls to switch off the rear steer and options to steer only the rear wheel independent of the front wheels.

By changing the direction of the rear wheels there is reduction in turning radius of the vehicle which is efficient in parking, low speed cornering and high speed lane change.

1.6 Types of Four Wheel Steering Mechanisms

There are mainly 3 types of four wheel steering system mechanisms
1.Mechanical Four Wheel System.
2.Hydraulic Four Wheel System.
3.Electro Hydraulic Four Wheel System.

1.Mechanical four wheel steering:

In a straight mechanical type of four wheel stering system two steering gears are used one for the front and the other for the rear wheels. A steel shaft connects the two steering gearboxes and terminates at an eccentric shaft that is fitted with an offset pin. This pin engages a second offset pin that fits into a planetary gear. The planetary gear meshes with the matching teeth of an internal gear that is secured in a fixed position to the gearbox housing. This means that the planetary gear can rotate but the internal gear cannot. The eccentric pin of the planetary gear fits into a hole in a slider for the steering gear. A 120 -degree turn of the steering wheel rotates the planetary gear to move the slider in the same direction that the front wheels are headed. Proportionately, the rear wheels turn the steering wheel about 1.5 to 10 degrees. Further rotation of the steering wheel, past the 120degree point, causes the rear wheels to start straightening out due to the double crank action (two eccentric pins) and rotation of the planetary gear. Turning the steering wheel to a greater angle, about 230 degrees, finds the rear wheels in a neutral position regarding the front wheels. Further rotation of the steering wheel results in the rear wheels going counter phase with regard to the front wheels. About 5.3 degrees maximum counter phase rear steering is possible. Mechanical 4WS is steering angle sensitive. It is not sensitive to vehicle road speed.

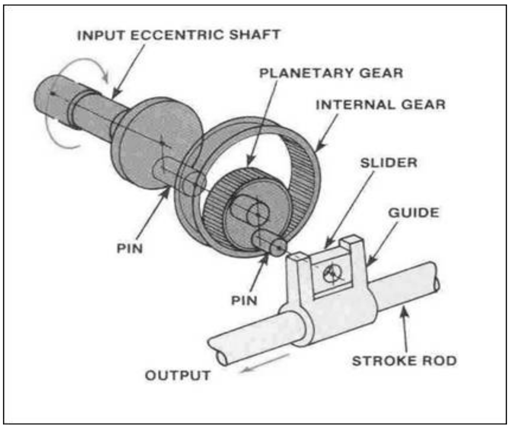

Fig No : 1.4

2.HydraulicFourWheelSteeringSystem

The hydraulically operated four wheel steering system is a simple design, both in components and operation. The rear wheels turn only in the same direction as the front wheels. They also turn no more than 11/2 degrees.

The system only activates at speeds above 30 mph (50 km/h) and does not operate when the vehicle moves in reverse. A two way hydraulic cylinder mounted on the rear stub frame turn the wheels. Fluid for this cylinder is supplied by a rear steering pump that is driven by the differential. The pump only operates when the front wheels are turning. A tank in the engine compartment supplies the rear steering pump with fluid.

The faster and farther the steering wheel is turned, the greater the fluid pressure. The fluid is also fed under the same pressure to the control valve where it opens a spool valve in the control valve housing. As the spool valve moves, it allows fluid from the rear steering pump to move through and operate the rear power cylinder. The higher the pressure on the spool, the farther it moves. The farther it moves, the more fluid it allows through to move the rear wheels. As mentioned earlier this system limits rear wheel movement to 11.2 degrees in either the left or right direction.

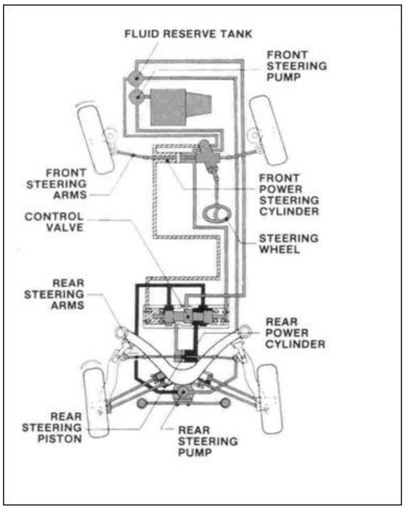

Fig No : 1.4

3.Electro Hydraulic Four Wheel Steering system

Several Four wheel steering systems combine computer electronic controls with hydraulics to make the system sensitive to both steering angle and road speeds. In this design, a speed sensor and steering wheel angle sensor feed information to the electronic control unit (ECU). By processing the information received the ECU commands the hydraulic system steer the rear wheels. At low road speed, the rear wheels of this system are not considered a dynamic factor in the steering process. At moderate road speeds, the rear wheels are steered momentarily counter 45 phase, through neutral, then in phase with the front wheels. At high road speeds, the rear wheels turns only in phase with the front wheels.

The ECU must know not only road speed, but also how much and quickly the steering wheel is turned. These three factors - road speed, amount of steering wheel turn, and the quickness of the steering wheel turn - are interpreted by the ECU to maintain continuous and desired steer angle of the rear wheels.

Two electronic sensors tell the ECU how fast the car is going. The yoke is a major mechanical component of this electro-hydraulic design. The position of the control yoke varies with vehicle road speed. For example, at speeds below 33 mph (53 km/h), the yoke is in its downward position, which results in the rear wheels steering in the counter phase (opposite front wheels) direction. As road speeds approach and exceed 33 mph (53 km/h), the control yoke swings up through a neutral (horizontal) position to an up position.

6

In the neutral position, the rear wheels steer in phase with the front wheels. The stepper motor moves the control yoke. A swing arm is attached to the control yoke.

The position of the yoke determines the arc of the swing rod. The arc of the swing arm is transmitted through a control arm that passes through a large bevel gear. Stepper motor action eventually causes a push-or-pull movement of its output shaft to steer the rear wheels up to a maximum of 5 degrees in either direction. The electronically controlled, 4WS system regulates the angle and direction of the rear wheels in response to speed and driver's steering. This speed-sensing system optimizes the vehicle's dynamic characteristics at any 46 speed, thereby producing enhanced stability and, within certain parameters.

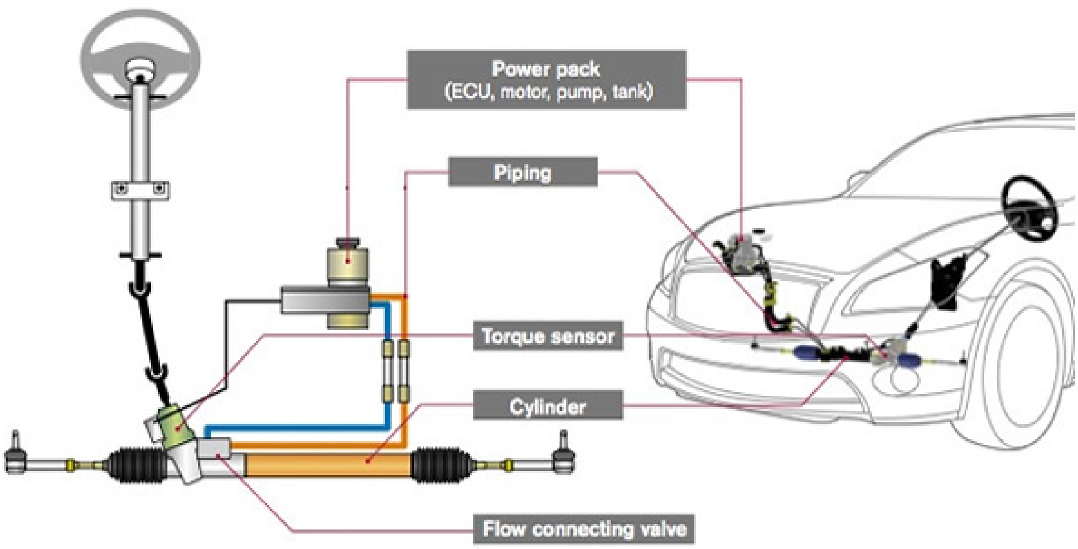

fig no : 1.5

CHAPTER-02

COMPONENTS REQUIRED

COMPONENTS

Basic Materials

1. DC Motor

2. Gears

3. Iron Rods

4. Wooden Base

5. Screws

6. Foam Base Board

2.1 Bonding Adhesive

Adhesive bonding is used to fasten two surfaces together, usually producing a smooth bond. This joining technique involves glues, epoxies, or various plastic agents that bond by evaporation of a solvent or by curing a bonding agent with heat, pressure, or time. Historically, glues have produced relatively weak bonds. However, the recent use of plastic-based agents such as the new "super-glues" that self-cure with heat has allowed adhesion with a strength approaching that of the bonded materials themselves. As a result, gluing has replaced other joining methods in many applications—especially where the bond is not exposed to prolonged heat or weathering. A large fraction of modern glues are carbon-based petrochemical derivatives. These can be used to bond almost any combination of surfaces, either by direct contact or by fastening both surfaces to a third as with adhesive tapes. Glues can serve as bonding agents in strong structural materials — one of the earliest and still common uses is the fabrication of plywood. Other related composites include fiberglass and various fiber-epoxies such as boron-epoxy and carbon-epoxy.

Many of these materials make superior stress-bearing components. Whether bonding metal to metal, plastic, glass, rubber, ceramic, or to another substrate material, adhesives distribute stress load evenly over a broad area, reducing stress on the joint. As they are applied inside the joint, adhesives are invisible within the assembly.

fig no : 2.1

2.1.1 Types

Master Bond's metal bonding systems are presently employed in industries ranging from aerospace, optical and electronic to oil/chemical processing, medical and automotive. Available chemistries include:

- Epoxies
- Silicones
- Polyurethanes
- Polysulfide
- Cyanoacrylates
- UV curve

2.2. DC MOTOR

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homo-polar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source—so they are not purely DC machines in a strict sense.

DC motor is an electric motor that runs on direct current (DC) electricity. DC motors were used to run machinery, often eliminating the need for a local steam engine or internal combustion engine. DC motors can operate directly from rechargeable batteries, providing the motive power. Modern DC motors are nearly always operated in conjunction with power electronic devices

2.2 Types of brushed DC motor

1. DC shunt wound motor

2. DC series wound motor

3. DC compound motor (two configurations):

4. Cumulative compound

- Differentially compounded
- D. Permanent Magnet DC Motor

5. Separately-excited.

1. Brushless DC motor

Some of the problems of the brushed DC motor are eliminated in the brushless design. In this motor, the mechanical "rotating switch" or commutator/brush gear assembly is replaced by an external electronic switch synchronized to the rotor's position. Brushless motors are typically 85-90% efficient or more (higher efficiency for a brushless electric motor of up to 96.5% were reported by researchers at the Tokai University in Japan whereas DC motors with brush gear are typically 75-80% efficient.

Midway between ordinary DC motors and stepper motors lays the realm of the brushless DC motor. Built in a fashion very similar to stepper motors, these often use a permanent magnet external rotor, three phases of driving coils, one or more Hall Effect sensors to sense the position of the rotor, and the associated drive electronics. The coils are activated, one phase after the other, by the drive electronics as cued by the signals from either Hall effect sensors or from the back EMF (electromotive force) of the un-driven coils. In effect, they act as three-phase synchronous motors containing their own variable-frequency drive electronics. A specialized class of brushless DC motor controllers utilizes EMF feedback through the main phase connections instead of Hall Effect sensors to determine position and velocity. These motors are used extensively in electric radio-controlled vehicles. When configured with the magnets on the outside, these are referred to by moderators as out-runner motors.

Brushless DC motors are commonly used where precise speed control is necessary, as in computer disk drives or in video cassette recorders, the spindles within CD, CD-ROM (etc.) drives, and mechanisms within office products such as fans, laser printers and photocopiers. They have several advantages over conventional motors:

Brushless motors are usually used in small equipment such as computers and are generally used to get rid of unwanted heat.

They are also very quiet motors which is an advantage if being used in equipment that is affected by vibrations.

Modern DC brushless motors range in power from a fraction of a watt to many kilowatts. Larger brushless motors up to about 100 kW rating are used in electric vehicles. They also find significant use in high-performance electric model aircraft.

2. Coreless or iron DC Motors

Nothing in the design of any of the motors described above requires that the iron (steel) portions of the rotor actually rotate; torque is exerted only on the windings of the electromagnets. Taking advantage of this fact is the coreless or ironless DC motor, a specialized form of a brush or brushless DC motor. Optimized for rapid acceleration, these motors have a rotor that is constructed without any iron core. The rotor can take the form of a winding-filled cylinder, or a self-supporting structure comprising only the magnet wire and the bonding material.

The rotor can fit inside the stator magnets; a magnetically-soft stationary cylinder inside the rotor provides a return path for the stator magnetic flux. A second arrangement has the rotor winding basket surrounding the stator magnets. In that design, the rotor fits inside a magnetically-soft cylinder that can serve as the housing for the motor, and likewise provides a return path for the flux.

Related limited-travel actuators have no core and a bonded coil placed between the poles of high-flux thin permanent magnets. These are the fast head position retainer for rigid-disk ("hard disk") drives.

The unique advantage of ironless DC motors is that there is no cogging (vibration caused by attraction between the iron and the magnets) and parasitic eddy currents cannot form in the rotor as it is totally ironless. This can greatly improve efficiency, but variable-speed controllers must use a higher switching rate (>40 KHz) or direct current because of the decreased electromagnetic induction.

These motors were originally invented to drive the capstan(s) of magnetic tape drives, in the burgeoning computer industry. Pancake motors are still widely used in high-performance servo-controlled systems, humanoid robotic systems, industrial automation and medical devices. Due to the variety of constructions now available the technology is used in applications from high temperature military to low cost pump and basic servo applications.

NOTE: Here we used GEARED DC motor

fig no : 2.2

2.3 Foam Board

Foam core or Foam board is a very strong, lightweight, and easily cut material used for the mounting of photographic prints, as backing in picture framing, in 3D design and in painting. It is also in a material category referred to as "Paper-faced Foam Board". It consists of three layers — an inner layer of polystyrene foam clad with outer facing of either a white claycoated paper or brown kraft paper.

The original white foam core board was made in 1/8 inch (3 mm) and 3/16 inch (5 mm) thicknesses for the graphic arts industry by Monsanto Company under the trade name "Fome-Core" starting in 1957. Monsanto sold the business to International Paper in 1993, and the business is currently operated by 3A Composites. It is now widely-used as backing in art and document mounting and picture framing, with archival-quality variants now available from several companies. It ranges in thickness from 1/16" - 1/2". It is not recyclable or biodegradable in normal situations.

2.3.1 Construction variant and composition

The surface of the regular board, like many other types of paper, is slightly acidic. However for modern archival picture framing and art mounting purposes it can be produced in a neutral, acid-free version with a buffered surface paper, in a wide range of sizes and thicknesses.

Foam cored materials are also now available with a cladding of solid (non-foamed) polystyrene and other rigid plastic sheeting, some with a textured finish.

Foam-core does not adhere well to some glues, such as superglue, and certain types of paint. The foam tends to melt away and dissolve]. Some glue works well in casual settings, however, the water in the glue can warp the fibers in the outer layers. Best results are typically obtained from higher-end spray adhesives. A hot glue gun can be used as a substitute, although the high viscosity of hot glues can affect finished projects in the form of board warping, bubbles, or other unsightly blemishes.

Self-adhesive foam boards, intended for art and document mounting are also available, though these can be very tricky to use properly; this is because the glue sets very fast. It is considered cheaper to buy plain foam board and then re-positionable spray mount adhesive.

2.3.2 Uses

Foam core is commonly used to produce architectural models, prototype small objects and to produce patterns for casting. Scenery for scale model displays, dioramas, and computer games are often produced by hobbyists from foam-core. It's also often used by photographers as a reflector, in the design industry to mount presentations of new products, and in picture framing as a backing material; the latter use includes some archival picture framing methods, which utilize the acid-free versions of the material.

2.4 Gears

A gear or cogwheel is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part to transmit torque, in most cases with teeth on the one gear being of identical shape, and often also with that shape on the other gear. Two or more gears working in tandem are called a transmission and can produce a mechanical advantage through a gear ratio and thus may be considered a simple machine. Geared devices can change the speed, torque, and direction of a power source.

The most common situation is for a gear to mesh with another gear; however, a gear can also mesh with a non-rotating toothed part, called a rack, thereby producing translation instead of rotation.

The gears in a transmission are analogous to the wheels in a crossed belt pulley system. An advantage of gears is that the teeth of a gear prevent slippage.

When two gears mesh, and one gear is bigger than the other (even though the size of the teeth must match), a mechanical advantage is produced, with the rotational speeds and the torques of the two gears differing in an inverse relationship.

In transmissions with multiple gear ratiossuch as bicycles, motorcycles, and carsthe term gear, as in first gear, refers to a gear ratio rather than an actual physical gear. The term describes similar devices, even when the gear ratio is continuous rather than discrete, or when the device does not actually contain gears, as in a continuously variable transmission.

2.4.1 Working

Gears are used in tons of mechanical devices. They do several important jobs, but most important, they provide a gear reduction in motorized equipment. This is key because, often, a small motor spinning very fast can provide enough power for a device, but not enough torque. For instance, an electric screwdriver has a very large gear reduction because it needs lots of torque to turn screws, but the motor only produces a small amount of torque at a high speed. With a gear reduction, the output speed can be reduced while the torque is increased. Another thing gears do is adjust the direction of rotation. For instance, in the differential between the rear wheels of your car, the power is transmitted by a shaft that runs down the center of the car, and the differential has to turn that power 90 degrees to apply it to the wheels.

There are a lot of intricacies in the different types of gears. In this article, we'll learn exactly how the teeth on gears work, and we'll talk about the different types of gears you find in all sorts of mechanical gadgets.

2.4.2 Gear ratio

The gear ratio of a gear train, also known as its speed ratio, is the ratio of the angular velocity of the input gear to the angular velocity of the output gear. The gear ratio can be calculated directly from the numbers of teeth on the gears in the gear train. The torque ratio of the gear train, also known as its mechanical advantage, is determined by the gear ratio.

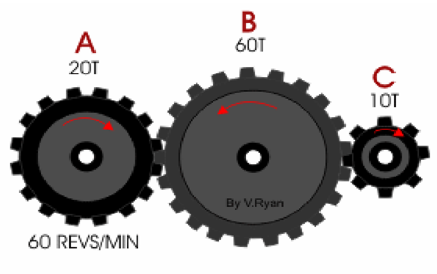

fig no : 2.3

fig no : 2.4

2.4.3 Formula:

If a simple gear train has three gears, such that the input gear GA meshes with an intermediate gear GI which in turn meshes with the output gear GB, then the pitch circle of the intermediate gear rolls without slipping on both the pitch circles of the input and output gears. This yields the two relations

$$\frac{\omega_A}{\omega_I} = \frac{N_I}{N_A}, \quad \frac{\omega_I}{\omega_B} = \frac{N_B}{N_I}.$$

The speed ratio of this gear train is obtained by multiplying these two equations to obtain

$$R = \frac{\omega_A}{\omega_B} = \frac{N_B}{N_A}.$$

Notice that this gear ratio is exactly the same as for the case when the gears GA and GB engaged directly. The intermediate gear provides spacing but does not affect the gear ratio. For this reason it is called an idler gear. The same gear ratio is obtained for a sequence of idler gears and hence an idler gear is used to provide the same direction to rotate the driver and driven gear, if the driver gear moves in clockwise direction, then the driven gear also moves in the clockwise direction with the help of the idler gear

2.4.4 Types

There are different types of gears:

1. Spur Gear
2. Helical Gear
3. Herringbone Gear
4. Bevel Gear
5. Worm Gear
6. Rack and Pinion
7. Internal and External Gear
8. Face Gear
9. Sprockets

1. Spur Gear:

Parallel and co-planer shafts connected by gears are called spur gears. The arrangement is called spur gearing. Spur gears have straight teeth and are parallel to the axis of the wheel. Spur gears are the most common type of gears. The advantages of spur gears are their simplicity in design, economy of manufacture and maintenance, and absence of end thrust.They impose only radial loads on the bearings. Spur gears are known as slow speed gears. If noise is not a serious design problem, spur gears can be used at almost any speed.

fig no : 2.5

2. Helical Gear:

Helical gears have their teeth inclined to the axis of the shafts in the form of a helix, hence the name helical gears. These gears are usually thought of as high speed gears. Helical gears can take higher loads than similarly sized spur gears. The motion of helical gears is smoother and quieter than the motion of spur gears. Single helical gears impose both radial loads and thrust loads on their bearings and so require the use of thrust bearings. The angle of the helix on both the gear and the must be same in magnitude but opposite in direction *fig no : 2.6*, i.e., a right hand pinion meshes with a left hand gear.

3. Herringbone Gear:

Herringbone gears resemble two helical gears that have been placed side by side. They are often referred to as "double helicals". In the double helical gears arrangement, the thrusts are counter-balanced. In such double helical gears there is no thrust loading on the bearings

fig no : 2.7

4. Bevel Gear:

Intersecting but coplanar shafts connected by gears are called bevel gears. This arrangement is known as bevel gearing. Straight bevel gears can be used on shafts at any angle, but right angle is the most common. Bevel Gears have conical blanks. The teeth of straight bevel gears are tapered in both thickness and tooth height.

fig no : 2.8

5. Worm Gear:

Worm gears are used to transmit power at 90° and where high reductions are required. The axes of worm gears shafts cross in space. The shafts of worm gears lie in parallel planes and may be skewed at any angle between zero and a right angle. In worm gears, one gear has screw threads. Due to this, worm gears are quiet, vibration free and give a smooth output. Worm gears and worm gear shafts are almost invariably at right angles.

fig no :2.9

6. Rack and Pinion:

A rack is a toothed bar or rod that can be thought of as a sector gear with an infinitely large radius of curvature. Torque can be converted to linear force by meshing a ra.ck with a pinion: the pinion turns; the rack moves in a straight line. Such a mechanism is used in automobiles to convert the rotation of the steering wheel into the left-to-right motion of the tie rod(s). Racks also feature in the theory of gear geometry, where, for instance, the tooth shape of an interchangeable set of gears may be specified for the rack (infinite radius), and the tooth shapes for gears of particular actual radii then derived from that. The rack and pinion gear type is employed in a rack railway.

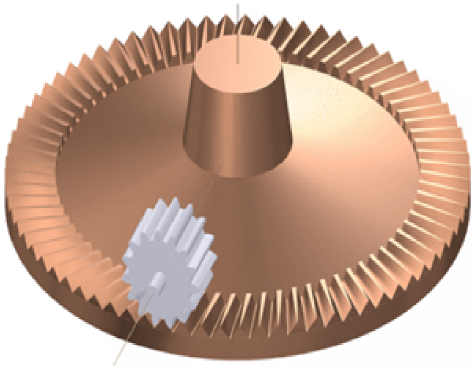

fig no : 2.10

7. Internal and External Gear:

An external gear is one with the teeth formed on the outer surface of a cylinder or cone. Conversely, an internal gear is one with the teeth formed on the inner surface of a cylinder or cone. For bevel gears, an internal gear is one with the pitch angle exceeding 90 degrees. Internal gears do not cause direction reversal.

8. Face Gear:

Face gears transmit power at (usually) right angles in a circular motion. Face gears are not very common in industrial application.

fig no : 2.11

9. Sprockets:

Sprockets are used to run chains or belts.

They are typically used in conveyor systems.

fig no : 2.12

2.5 Iron Pipe

Iron is a chemical element with symbol Fe (from Latin: ferrum) and atomic number 26. It is a metal in the first transition series. It is by mass the most common element on Earth, forming much of Earth's outer and inner core. It is the fourth most common element in the Earth's crust. Its abundance in rocky planets like Earth is due to its abundant production by fusion in high-mass stars, where the production of nickel-56 (which decays to the most common isotope of iron) is the last nuclear fusion reaction that is exothermic. Consequently, radioactive nickel is the last element to be produced before the violent collapse of a supernova scatters precursor radionuclide of iron into space.

Iron metal has been used since ancient times, though copper alloys, which have lower melting temperatures, were used even earlier in human history. Pure iron is soft (softer than aluminium), but is unobtainable by smelting. The material is significantly hardened and strengthened by impurities, in particular carbon, from the smelting process. A certain proportion of carbon (between 0.002% and 2.1%) produces steel, which may be up to 1000 times harder than pure iron. Crude iron metal is produced in blast furnaces, where ore is reduced by coke to pig iron, which has a high carbon content. Further refinement with oxygen reduces the carbon content to the correct proportion to make steel. Steels and low carbon iron alloys along with other metals (alloy steels) are by far the most common metals in industrial use, due to their great range of desirable properties and the abundance of iron.

Types of Iron

Wrought Iron

Wrought iron is an iron alloy with a very low carbon (0.04 to 0.08%) content in contrast to cast iron (2.1% to 4%), and has fibrous inclusions known as slag up to 2% by weight. It is a semi-fused mass of iron with slag inclusions which gives it a "grain" resembling wood, that is visible when it is etched or bent to the point of failure. Wrought iron is tough, malleable, ductile and easily welded. Before the development of effective methods of steelmaking and the availability of large quantities of steel, wrought iron was the most common form of malleable iron. A modest amount of wrought iron was used as a raw material for compound discovered. refining into steel, which was used mainly to produces words, cutlery, chisels, axes and other edged tools as well as springs and files.

Cast Iron

Cast iron is iron or a ferrous alloy which has been heated until it liquefies, and is then poured into a mould to solidify. It is usually made from pig iron. The alloy constituents affect its colour when fractured: white cast iron has carbide impurities which allow cracks to pass straight through. Grey cast iron has graphite flakes which deflect a passing crack and initiate countless new cracks as the material breaks.

Cast iron tends to be brittle, except for malleable cast irons. With its relatively low melting point, good fluidity, castability, excellent machinability, resistance to deformation and wear resistance, cast irons have become an engineering material with a wide range of applications and are used in pipes, machines and automotive industry parts, such as cylinder heads (declining usage), cylinder blocks and gearbox cases (declining usage). It is resistant to destruction and weakening by oxidation (rust).

Cast iron is made by re-melting pig iron, often along with substantial quantities of scrap iron, scrap steel, lime stone, carbon (coke) and taking various steps to remove undesirable contaminants. Phosphorus and sulfur may be burnt out of the molten iron, but this also burns out the carbon, which must be replaced. Depending on the application, carbon and silicon content are adjusted to the desired levels, which may be anywhere from 2–3.5% and 1–3%, respectively. Other elements are then added to the melt before the final form is produced by casting.

Steel

Steel (with smaller carbon content than pig iron but more than wrought iron) was first produced in antiquity by using a bloomery. Blacksmiths in Luristan in western Iran were making good steel by 1000 BCE. Then improved versions, Wootz steel by India and Damascus steel by China were developed around 300 BCE and 500 CE respectively. These methods were specialized, and so steel did not become a major commodity until the 1850s.

New methods of producing it by carburizing bars of iron in the cementation process were devised in the 17th century AD. In the Industrial Revolution, new methods of producing bar iron without charcoal were devised and these were later applied to produce steel

In the late 1850s, Henry Bessemer invented a new steelmaking process, involving blowing air through molten pig iron, to produce mild steel. This made steel much more economical, thereby leading to wrought iron no longer being produced.

fig no : 2.13

2.6 Screws

This article is about the fastener. For the screw as a simple machine, see Screw (simple machine). For other uses, see Screw (disambiguation).Screws come in a variety of shapes and sizes for different purposes. U.S. quarter coin (diameter 24 mm) shown for scale.

A screw, or bolt, is a type of fastener characterized by a helical ridge, known as an external thread or just thread, wrapped around a cylinder. Some screw threads are designed to mate with a complementary thread, known as an internal

fig no : 2.14

Thread, often in the form of a nut or an object that has the internal thread formed into it. Other screw threads are designed to cut a helical groove in a softer material as the screw is inserted. The most common uses of screws are to hold objects together and to position objects.

2.7 Toy Wheel

A wheel is a circular component that is intended to rotate on an axial bearing. The wheel is one of the main components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel and flywheel.

Common examples are found in transport applications. A wheel greatly reduces friction by facilitating motion by rolling together with the use of axles. In order for wheels to rotate, a moment needs to be applied to the wheel about its axis, either by way of gravity, or by the application of *fig no : 2.15*

another external force or torque.

2.7.1 Mechanism And Function

The wheel is a device that enables efficient movement of an object across a surface where there is a force pressing the object to the surface. Common examples are a cart pulled by a horse, and the rollers on an aircraft flap mechanism.

Wheels are used in conjunction with axles; either the wheel turns on the axle, or the axle turns in the object body. The mechanics are the same in either case.

The low resistance to motion (compared to dragging) is explained as follows (refer to friction):

- The normal force at the sliding interface is the same.
- The sliding distance is reduced for a given distance of travel.
- The coefficient of friction at the interface is usually lower.

Bearings are used to help reduce friction at the interface. In the simplest and oldest case the bearing is just a round hole through which the axle passes (a "plain bearing").

Example:

- If a 100 kg object is dragged for 10 m along a surface with the coefficient of friction μ = 0.5, the normal force is 981 N and the work done (required energy) is (work=force x distance) 981 × 0.5 × 10 = 4905 joules.
- Now give the object 4 wheels. The normal force between the 4 wheels and axles is the same (in total) 981 N. Assume, for wood, μ = 0.25, and say the wheel diameter is 1000 mm and axle diameter is 50 mm. So while the object still moves 10 m the sliding frictional surfaces only slide over each other a distance of 0.5 m. The work done is 981 × 0.25 × 0.5 = 123 joules; the work done has reduced to 1/40 of that of dragging.

Additional energy is lost from the wheel-to-road interface. This is termed rolling resistance which is predominantly a deformation loss. This energy is also lowered by the use of a wheel (in comparison to dragging) because the net force on the contact point between the road and the wheel is almost perpendicular to the ground, and hence, generates an almost zero net work. This depends on the nature of the ground, of the material of the wheel, its inflation in the case of a tire, the net torque exerted by the eventual engine, and many other factors.

A wheel can also offer advantages in traversing irregular surfaces if the wheel radius is sufficiently large compared to the irregularities.

The wheel alone is not a machine, but when attached to an axle in conjunction with bearing, it forms the wheel and axle, one of the simple machines. A driven wheel is an example of a wheel and axle. Note that wheels pre-date driven wheels by about 6000 years, themselves an evolution of using round logs as rollers to move a heavy load -- a practice going back in pre-history so far, it has not been dated.

2.7.2 Principles

TRACTION:

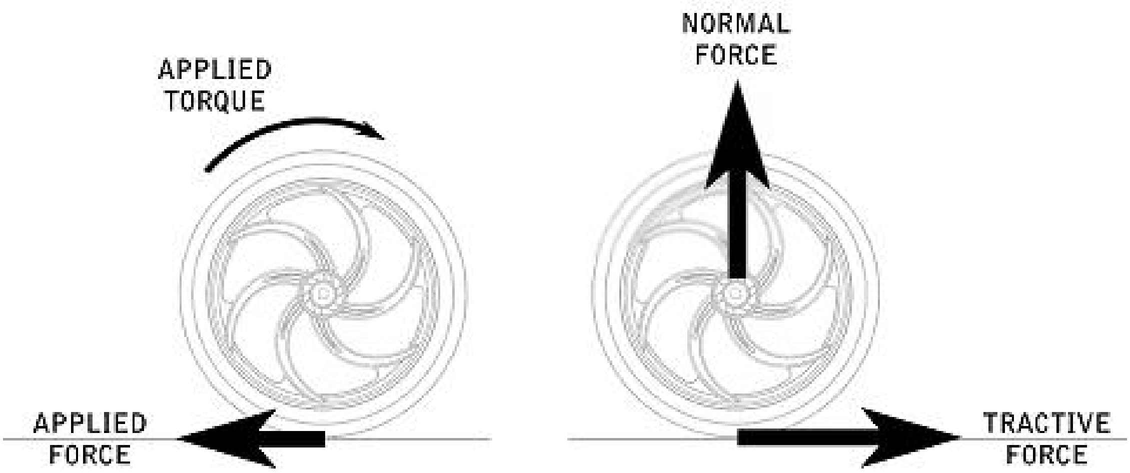

fig no : 2.16

Traction is defined as friction between a drive member (wheel) and the surface it moves upon. It is the amount of force a wheel can apply to a surface before it slips. A rolling wheel is in static contact with the ground if it is not slipping.

As seen in the diagram to the right, when a torque is applied to a wheel, it results in an applied force along the ground. If there is friction between the wheel and the ground, an equal and opposite force called the tractive force pushes back against the wheel. The applied force is the force of the wheel on the surface. The tractive force is the force of the surface on the wheel. This is a perfect example of Newton's Third Law of Motion: Forces are interactions between two objects; they always come in pairs of equal magnitude and opposite direction. The force of object 1 on object 2 is always equal in magnitude and opposite in direction to the force of object 2 on object 1. So, the greater the "applied force" of the wheel on the ground, the greater the force of the ground on the wheel (and thus the robot)!

The tractive force is equal to the frictional force between the wheel and the ground. If the wheel is rolling and not slipping, the tractive force is equal to the static friction force.

If the applied force exceeds the maximum static friction, then the wheel will start to slip and the tractive force will equal the maximum kinetic friction force.

Since traction is dependent on the friction of the wheel and the surface, you must maximize this friction. It is known that friction is dependent on coefficient of friction (between the wheel and the surface), and the normal force (the weight of the robot pressing the wheel to the surface). To increase traction, you must either increase the coefficient of friction or increase the normal force on the wheel.

There are a variety of components in the VEX Robotics Design System that can be used to gain traction including several types of wheels. Each of these has different characteristics on different surfaces; experiment to determine which wheel is best for a given application.

Friction between the wheels and the floor is not the only friction present in VEX robots. Friction also acts as a brake on the rotating components of the robot. The VEX Robotics Kit has several parts designed to reduce friction in a robot design. The plastic parts such as the bearing blocks, spacers, and washers allow other parts to be separated with a material providing a lower friction value. Metal against metal contact is not desirable in moving systems.

Traction between two surfaces depends on several factors:

- Material composition of each surface.
- Macroscopic and microscopic shape (texture; macro texture and micro texture)
- Normal force pressing contact surfaces together.
- Contaminants at the material boundary including lubricants and adhesives.
- Relative motion of tractive surfaces - a sliding object (one in kinetic friction) has less traction than a non-sliding object (one in static friction).
- Direction of traction relative to some coordinate system - e.g., the available traction of a tire often differs between cornering, accelerating, and braking.
- For low-friction surfaces, such as off-road or ice, traction can be increased by using traction devices that partially penetrate the surface; these devices use the shear strength of the

CO-EFFICIENT OF TRACTION:

A coefficient of friction is a constant which describes the "grippyness" of two surfaces sliding against one another. Slippery objects have a very low coefficient of friction, while sticky objects have a very high coefficient of friction. This constant is determined for a pair of surfaces, not a single surface, and ranges from near zero to greater than one. Each pair of materials has a coefficient of static friction and a coefficient of kinetic friction.

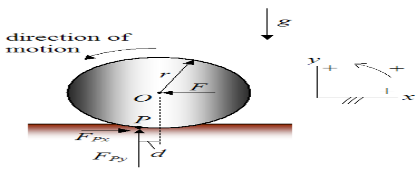

fig no :2.17

Do not confuse this with actual sticky surfaces like tape or high friction coatings that bind to the other surface. These surfaces almost need to be looked at as being joined together as one. For instance, tapes resist sliding even when there is no normal force (push down), or a negative normal force (pull up) when they are clearly not part of the other object.

GYROSCOPIC EFFECT:

The gyroscopic effect is a very interesting property of rotating elements that allows fast spinning objects to maintain their spinning direction in space. Thus, the wheels tend to maintain their equilibrium position. Except that they do not; or at least the gyroscopic effect is not enough. In order to prove this, they tried to lock the steering axis. This way, if the gyroscopic effect is enough to keep it stable, the vehicle should stay put at these speeds. The result is that it falls down as fast as a static vehicle.

2.8 Wood

Wood is a hard, fibrous structural tissue found in the stems and roots of trees and other woody plants. It has been used for thousands of years for both fuel and as a construction material. It is an organic material, a natural composite of cellulose fibers (which are strong in tension) embedded in a matrix of lignin which resists compression. Wood is sometimes defined as only the secondary xylem in the stems of trees,[1] or it is defined more broadly to include the same type of tissue elsewhere such as in tree roots or in other plants such as shrubs.

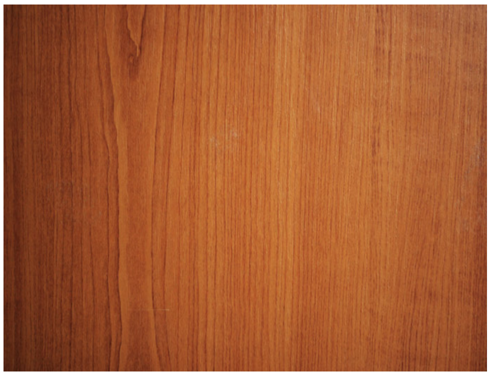

fig no : 2.18

In a living tree it performs a support function, enabling woody plants to grow large or to stand up by themselves. It also mediates the transfer of water and nutrients to the leaves and other growing tissues. Wood may also refer to other plant materials with comparable properties, and to material engineered from wood, or wood chips or fiber.

The Earth contains about one trillion tones of wood, which grows at a rate of 10 billion tons per year. As an abundant, carbon-neutral renewable resource, woody materials have been of intense interest as a source of renewable energy.

It is the oldest material used by humans for construction after stone. Despite its complex chemical nature, wood has excellent properties which lend themselves to human use.

It is readily and economically available; easily machinable; amenable to fabrication into an infinite variety of sizes and shapes using simple on-site building techniques;

- Exceptionally strong relative to its weight
- A good heat and electrical insulator;
- of increasing importance
- It is a renewable and biodegradable resource.

However, it also has some drawbacks of which the user must be aware. It is a “natural” material and is available in limited amount.

CHAPTER-03

WORKING PRINCIPLE

Concept

The steering system converts the rotation of the steering wheel into a swivelling movement of the road wheels in such a way that the steering-wheel rim turns a long way to move the road wheels a short way

For a car to turn smoothly, each wheel must follow a different circle. Since the inside wheel is following a circle with a smaller radius, it is actually making a tighter turn than the outside wheel. If you draw a line perpendicular to each wheel, the lines will intersect at the center point of the turn. The geometry of the steering linkage makes the inside wheel turn more than the outside wheel.

The steering effort passes to the wheels through a system of pivoted joints. These are designed to allow the wheels to move up and down with the suspension without changing the steering angle. They also ensure that when cornering, the inner front wheel - which has to travel round a tighter curve than the outer one - becomes more sharply angled. The joints must be adjusted very precisely, and even a little looseness in them makes the steering dangerously sloppy and inaccurate. There are two steering systems in common use - the rack and pinion and the steering box.

On large cars, either system may be power assisted to reduce further the effort needed to move it especially when the car is moving slowly.

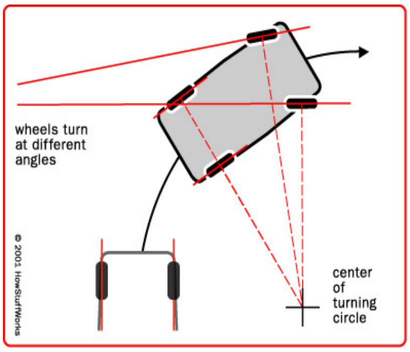

fig no : 3.1

Working of our Project

Steering wheel is powered manually or wirelessly when the vehicle has to be turned or guided in a particular direction.

The steering wheel, with the help of a shaft, powers the driver gear whenever the vehicle needs to take a turn.

The driver gear rotates as per input and actuates the gear assembly in such a way that front gears and wheel hub steers in the desired direction and rear gears and wheel hub moves in opposite direction.

A dc motor is connected at all 4 wheels which powers the wheel to head in a particular direction.

When the gear rotates, the wheel hub rotates and thus, the vehicle steers in a particular direction using 4-Wheel Steering mechanism.

A driver gear is connected to an array of driven gears to actuate the mechanism of 4 wheel steering. When the driver gear is rotated manually or wirelessly, it powers the array of gears in such a way that the front gears move the wheel hub in desired direction and the rear gears move the rear wheel hub in opposite direction.

High torque motors are coupled to 4 wheels which powers all the 4 wheels and vehicle is moved forward direction.

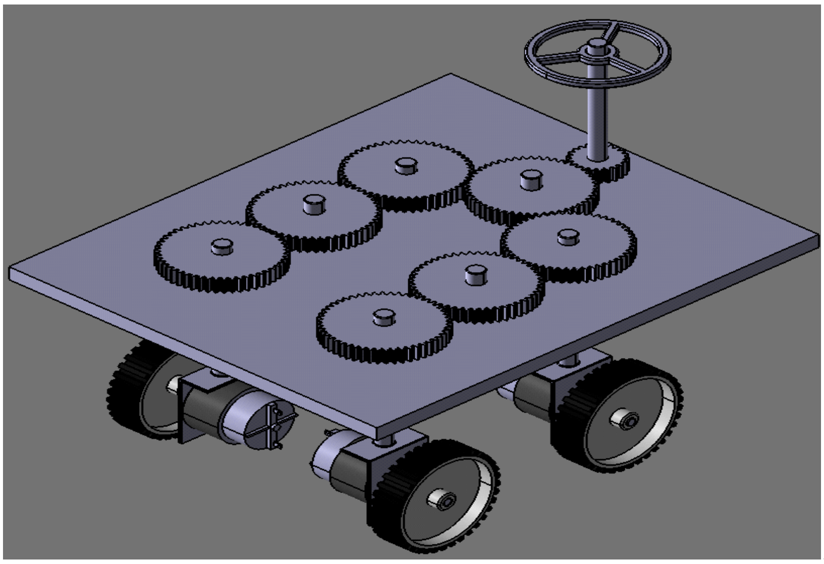.

fig no : 3.2

The system is controlled from the remote control consisting of 4 Diodes – 4007 diodes, Slide switch – to control the forward and backward movement of the wheels, micro switch – to control the left and right movement of the wheels, capacitor of 3700 microF which stores the extra energy and transformer which gives an AC of 24 volt by using the full wave rectifier power supply circuit. Bridge circuit is used of the diodes to convert the AC coming from the transformer into the Full wave DC.Wiper motor transfers the power to the spur gears system which moves the tyres with the help of the rod connected through Gear

The system allows a driver to use only light forces to steer a heavy car. The rim of a 15 in. (380 mm) diameter steering wheel moving four turns from full left lock to full right lock travels nearly 16 ft (5 m), while the edge of a road wheel moves a distance of only slightly more than 12 in. (300 mm). If the driver swivelled the road wheel directly, he or she would have to push nearly 16 times as hard.

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CHAPTER-04

CONSTRUCTION

CONSTRUCTION

MATERIAL SELECTION

Material selection plays a very important role in machine design. For example, the cost of materials in any machine is a good determinant of the cost of the machi8ne. More than the cost is the fact that materials are always a very decisive factor for a good design. The choice of the particular material for the machine depends on the particular purpose and the material for the machine depends on the particular purpose and the mode of operation of the machine components. Also, it depends on the expected mode of failure of the components.

Engineering materials are mainly classified as:

- Metal and their alloys, such as iron, steel, copper, aluminium etc.
- Non-metals such as glass, rubber, plastic etc. metals are further classified as ferrous metals and non-ferrous metals.

Ferrous metals are those metals which have iron as their main constituent, such as cast iron, wrought iron and steels. Non-ferrous metals are those which have a metal other than iron as their main constituent, such as copper, aluminium, brass, tin, zinc etc.

For the purpose of this project, based on the particular working conditions machine component were designed for only the ferrous metals have been considered.

Also, certain mechanical properties of metals have greatlyinfluenced our decisions. These properties include:

1.Strength:

It is the ability of a material to resist the externally applied force without break down or yielding the internal resistance offered without break down or yielding the internally applied force is called stress.

2.Stiffness:

It is the ability of a material to resist deformation under stress.

3.Elasticity:

It is the property of a material to regain its original shape after deformation when the external force are removed.

4.Plasticity:

It is property of a material which retains the deformation produced under load, permanently.

5.Ductility:

It is a very important property of the material enabling it to be drawn into wire with the application of a tensile force. A ductile material is both strong and plastic. Ductile materials commonly used in engineering practical (in order of diminishing ductility) are mold steel, copper, aluminum, nickel, zinc tin and lead.

6.Malleability:

It is a special case of ductility which permits materials to be rolled or hammered into thin sheets. A malleable material is plastic but not 80 essentially strong. Examples include; lead soft steel, wrought iron, wrought iron, copper and aluminum in order of diminishing malleability.

7.Toughness:

It is the property of a material to resist fracture due to high impact loads like hammer blows, when heated. This property decreases.

8.Brittleness:

It is the properties of a material opposite to ductility, it is the property of breaking of a material with little permanent deformation when subjected to tensile load, brittle materials snap off without giving any sensible elongation. Cast iron is a brittle material.

In the design and construction of the scissors lift, the procedures followed to achieve a positive result are laid down in the preceding text. But first, a look at the operations and tools involved.

Operations

- Marking out
- Cutting
- Drilling
- Joining (bolt and nut)

Tools

- Engineers rule
- Scriber
- Hack saw
- Hand file

- Drilling machine

- Pliers
- Try square
- Electric grinder

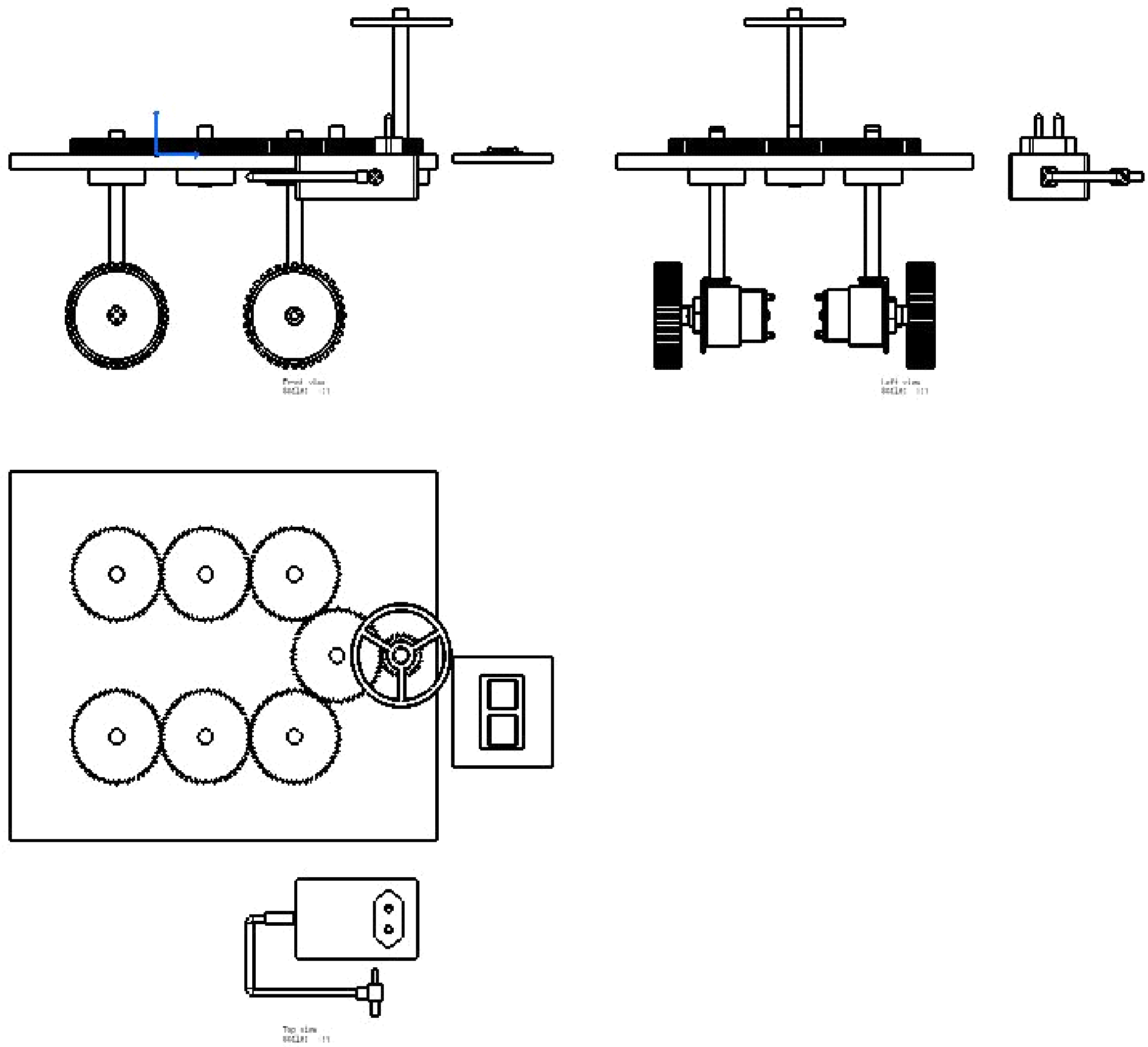
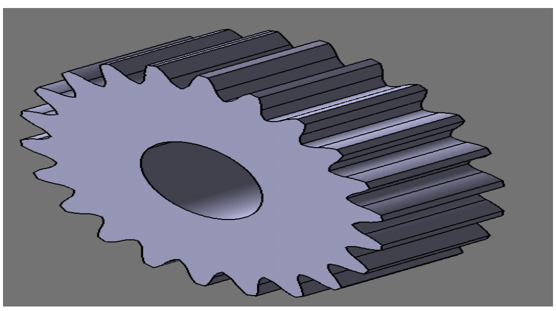


fig no : 4.1

1. DRIVER GEAR



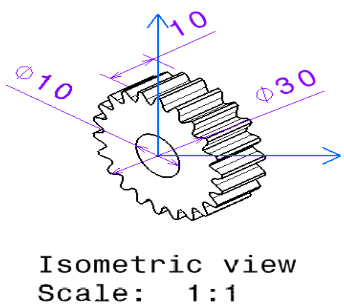
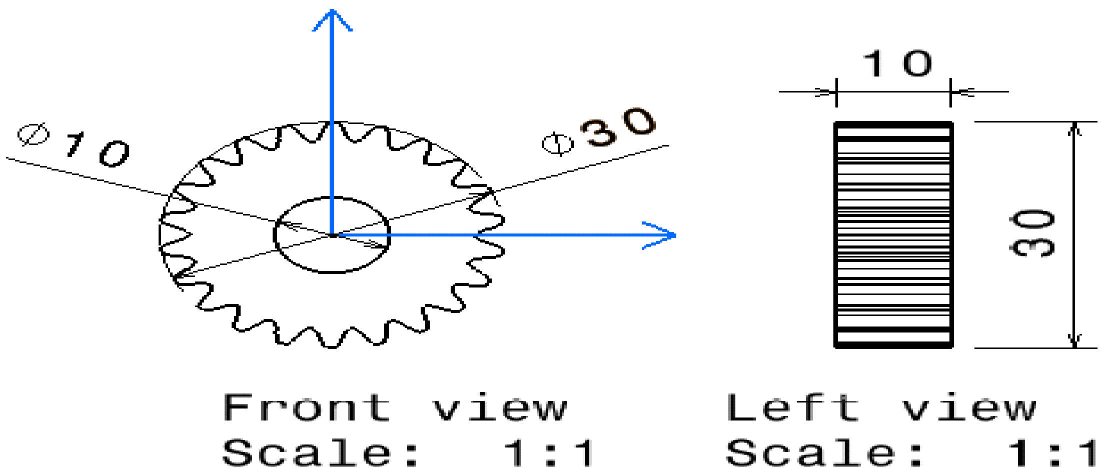


fig no : 4.2 *fig no : 4.3*



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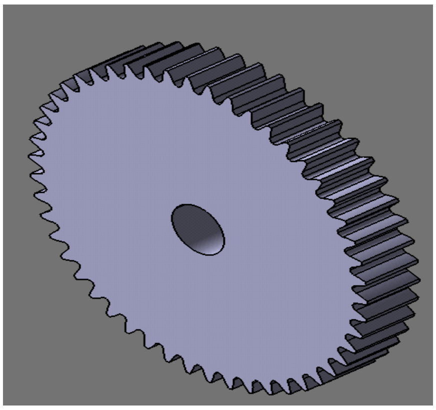
2.DRIVEN GEAR



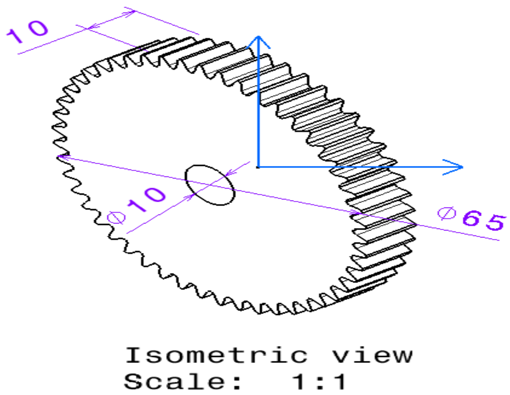


fig no : 4.5 *fig no : 4.6*

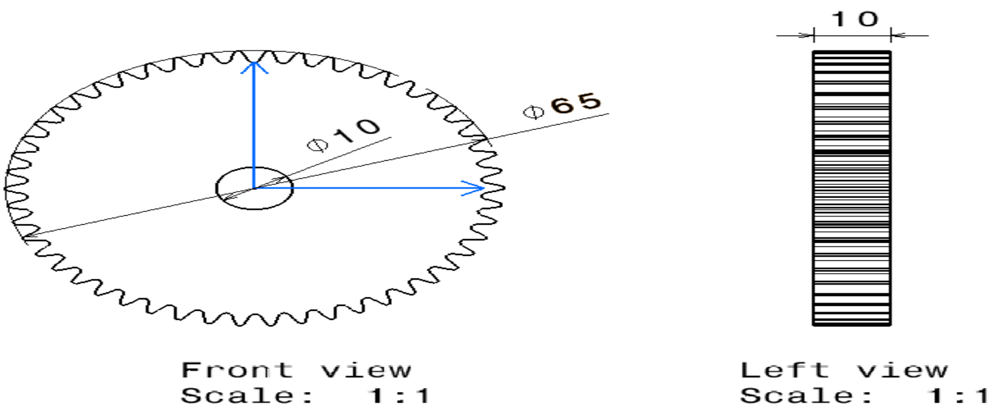
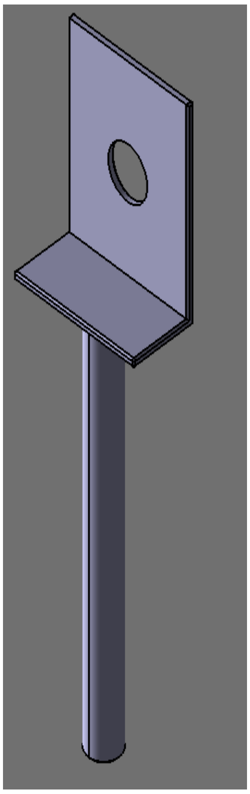
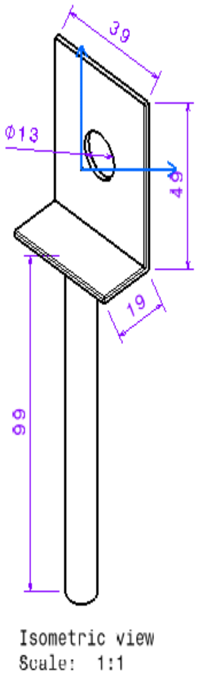


fig no : 4.7

3. MOTOR CLAMP





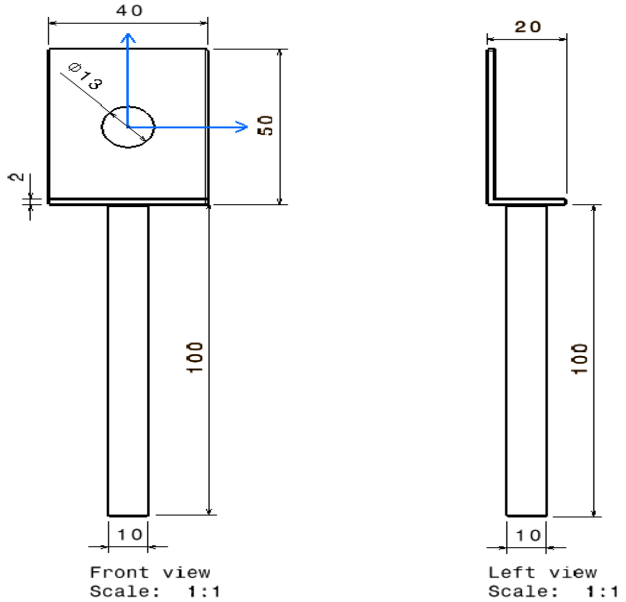


fig no : 4.8 *fig no : 4.9* *fig no : 4.10*

4. DC MOTOR NUT

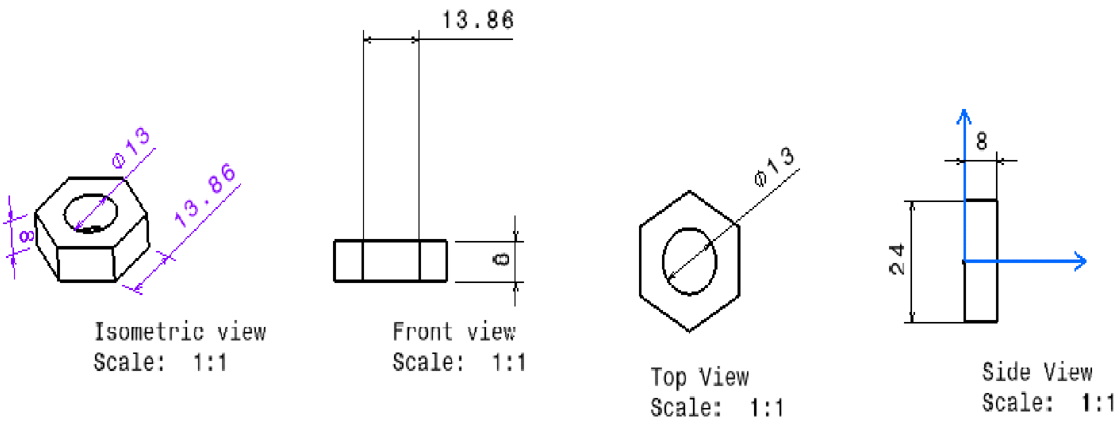


Fig no : 4.11

CHAPTER-05

ADVANTAGES,DISADVANTAGES

AND

APPLICATIONS

ADVANTAGES,DISADVANTAGES AND APPLICATIONS

5.1 ADVANTAGES

- **Superior cornering stability**: The vehicle cornering behaviour becomes more stable and controllable at high speed as well as on wet slipping road surfaces.
- **Improved steering response and precision**: The vehicle response to steering input becomes quicker and more precise throughout the vehicle enter speed range.
- **High speed straight line stability**: The vehicle's straight –line stability at high speed is improved. Negative effects of road irregularities and crosswinds on the vehicles stability are minimized.
- **Improved rapid lane-changing maneuvers**: This is stability in lane changing at high speed is improved. In high speed type operation become easier. The vehicle is less likely to go into a spin even in situations in which the driver must make a sudden and relatively large change of direction.
- **Smaller turning radius**: By steering the rear wheels in the duration opposite the front wheels at low speed, the vehicle's turning circle is greatly reduced. Therefore, vehicle manoeuvring on narrow roads and during parking become easier.
- **Controlling**: Computer-controlled Quadra steer can be switched on and off and has an effective trailer towing mode.

5.2 DISADVANTAGES

- The four wheel system , due to construction of many new components, the system becomes more expensive.
- The system includes as many components (especially electronically) there is always a chance to get any of the part inactive, thus the system become in operative.

5.3 APPLICATIONS

- **Parking**: During a parking a vehicles driver typically turns the steering wheels through a large angle to achieve a small tuning radius. By counter phase steering of the rear wheels, four wheel system realizes a smaller turning radius then is possible with 2ws system. As a result vehicle is turned in small radius at parking.
- **Junctions**: On a cross roads or other junction where roads intersect at 90 degrees or tighter angles, counter phase steering of the rear wheels causes the front and rear wheels to follow more or-less path. As a result the vehicle can be turned easily at a junction.
- **Slippery road surfaces**: During steering operation on low friction surfaces, steering

of the rear wheels suppress sideways drift of the vehicle's rear end. As a result the vehicles direction is easier to control.

- **High speed straight line operation**: When travelling in a straight line at high speed, a vehicle's driver frequently needs to make small steering correction to maintain the desired direction; in phase steering of the rear wheels minimizes these corrective steering inputs.
- **Narrow roads**: On narrow roads with tight bends, counter-phase steering of the rear wheels minimizes the vehicle's turning radius, thereby reducing side-to –side rotation of the steering wheels and making the vehicle easier to turn.
- **U-Turns**: By minimizing the vehicle's turning radius, counter –phase steering of the rear wheels enables U-turns to be performed easily on narrow roads.

CHAPTER-06

COST ESTIMATION

COST ESTIMATION

S. No.	Used Material	No.	Dimensions			File	Cost
			LengthxBreadth (mm^2)	Dia (mm)	Thickness/Height (mm)		
1	Wooden Rectangular Base	1	300x250	NA	10	YES	100
2	Driver Gear	1	NA	30	10		400
3	Driven Gear	7	NA	65	10		2800
4	Steel Driver Shaft	1	NA	10	120		100
5	Steel Dummy Shaft	3	NA	10	40		750
6	Wheel	4	**std**				200
7	Foam base Washers	8	NA	40	10		
8	Motor Clamp	4	40x40	10	100		
9	Foam base Steering Wheel	1	NA	60	10		
10	DC Motor Nut	4	M14x1.5				
11	Dc Motor 12V	4	**std**				800

CHAPTER-07

CONCLUSION

CONCLUSION

Four wheel steering is a relatively new technology, that imposes manoeuvrability in cars, trucks and trailers .in standard two wheels steering vehicles, the rear set of wheels are always directed forward therefore and do not play an active role in controlling the steering in four wheel steering system the rear wheel can turn left and right . To keep the driving controls as simple as possible. The aim of four Wheel system is a better stability during overtaking manoeuvres, reduction of vehicle oscillation around its vertical axis, reduced sensibility to lateral wind, neutral behaviour during cornering, etc., i.e. improvement of active safety.

An innovative feature of this steering linkage design is its ability to drive all four wheels using a single seeing actuator. Its successful implementation will allow for the development of four wheel steer power base with maximum manoeuvrability, uncompromised static stailty, front and rear wheel tracking and optimum obstacle climbing capability.

Our system uses simple design and low cost, easy to use components to replicate systems of day to day life.

With this project we aim to demonstrate a four wheel steering system which is a relatively new technology, that imposes maneuverability in cars, trucks and trailers .in standard two wheels steering vehicles, the rear set of wheels are always directed forward therefore and do not play an active role in controlling the steering in four wheel steering system the rear wheel can turn left and right . To keep the driving controls as simple as possible. The aim of 4WS system is a better stability during overtaking manoeuvres, reduction of vehicle oscillation around its vertical axis, reduced sensibility to lateral wind, neutral behavior during cornering, etc., i.e. improvement of active safety.

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