

FABRICATION OF ZERO TURN VEHICLE

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in

Automobile Engineering

By

RAVI ARAVIND T K (Register No.38860705)

YUKESH.J (RegisterNo.38860018)



DEPARTMENT OF AUTOMOBILE ENGINEERING SCHOOL OF

MECHANICAL ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

JEPPIAR NAGAR, RAJIV GANDHI SALAI, CHENNAI-600119

www.sathyabama.ac.in

MAY-2022



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with "A" grade by NAAC | 12B Status by UGC | Approved by AICTE

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai – 600 119

www.sathyabama.ac.in

DEPARTMENT OF AUTOMOBILE ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of RAVI ARAVIND TK (Register No.38860705) and YUKESH J (Register No.38860018) who carried out the project entitled **"FABRICATION OF ZERO TURN VEHICLE"** under my supervision from October 2021 to May 2022.

A handwritten signature in blue ink, reading 'A. Karthikeyan'.

Internal Guide
Dr.A.Karthikeyan, M.E., Ph.D

A handwritten signature in blue ink, reading 'Bupesh Raja'.

Dr.V.K. Bupesh Raja, M.E., Ph.D
Head of the department

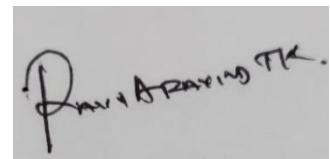
Submitted for Viva voce Examination held on 07-05-2022

Internal Examiner

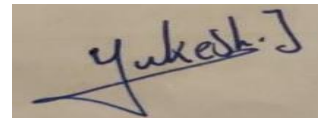
External Examiner

DECLARATION

We RAVI ARAVIND TK (Register No:38860705), YUKESH J (Register Number 38860018) hereby declare that the project report entitled Fabrication of zero turn vehicle done by me under the guidance of Dr. A. Karthikeyan M.E., Ph.D. at Sathyabama institute of science and technology, Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai-600 119 is submitted in partial fulfilment of the requirements for the award of bachelor of Engineering degree in Automobile.



1. RAVI ARAVIND TK _____



2. YUKESH J _____

DATE: 20/04/2022

PLACE: CHENNAI

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to the **Board of Management of SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. S. Prakash, M.E., Ph.D.**, Dean, School of Mechanical Engineering, and **Dr.V.K.Bupesh Raja, M.E.,Ph.D.**, Head of the department, Dept. of Automobile Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my project guide **Dr.A.Karthikeyan,M.E.,Ph.D.** for his valuable guidance, suggestions, and constant encouragement that paved way for the successful completion of my project work.

I wish to express my thanks to all teaching and Non-teaching staff members of the department of Automobile engineering who were helpful in many ways for the completion of the project.

ABSTRACT

The aim of the project is to fabricate the system i.e, Zero turn vehicle. Car parking has become serious problem in the cities. To overcome the problem, an alternative solution is proposed and the concept of zero turn vehicle has been introduced This project is based on how to improve that zero turn vehicle in front wheel steering system Manipulated by mechanisms related to radius of gyration and linear stability at high speeds in situations such as slow cornering. This could replace or replace the two-wheel steering used in cars. in this fabrication bevel gears are used to operate the turning system It gives full comfort while driving. The idea is to replace the wheel system rather than the entire steering system, which is more practical for the vehicle. The turning circle radius is substantially reduced and is practically equal to the length of the car when zero turn vehicle is achieved by turning the drive wheels at the same angle in the opposite direction at lower speeds. The frame for this project was built out of square bar. So the vehicle turns 360 degrees, it is extremely beneficial for turning in tight spaces, parking issues at malls, traffic signal points, and rear turning on narrow roads. The major goal is to increase the vehicle's zero turn steering capability while avoiding wheel wandering issues. The number of automobiles on the road is steadily increasing. It contributes to traffic congestion and pollution (noise and air). This technology has been developed to solve problems such as car maneuvering on small roadways and when parking. The car's maneuverability and control are much improved with zero turn steering. We've come up with a novel four-wheel steering design that allows the vehicle to turn with the smallest possible radius around its gravitational axis. Zero turning is achieved by turning the driving wheels in the opposite direction at the same pace. The turning circle radius of a vehicle can be reduced by directing there ar wheels in the opposite direction of the front wheels at moderate speeds.

LIST OF CONTENTS

CHAPTER NO	TITLE	PAGE NO
	ABSTRACT	V
	LIST OF CONTENTS	VI
	LIST OF FIGURES	VIII
	LIST OF TABLES	IX
1	INTRODUCTION	1
1.1	STREEING SYSTEM	2
1.2	FUNCTION OF STEERING SYSTEM	2
1.3	NEED OF STEERING	2
1.4	ZERO TURNING RADIUS VEHICLE	3
1.4.1	ADVANTAGES OF ZERO TURN VEHICLE	3
1.5	DIFFERENT TYPES OF STEERING WHEEL	4
1.6	CARTESIAN	6
2	LITERATURE SURVEY	7
3	AIM & OBJECTIVES	10
4	METHODS AND METHODOLOGY	11
4.1	METHODOLOGY	11
4.2	MATERIAL SELECTION	12
4.2.1	MILD STEEL	12
4.3	COMPONENTS USED	13
4.3.1	WHEELS	14
4.3.2	STEERING	14
4.3.3	BEVEL GEAR	15

	4.3.4 ACKERMAN STREEING MECHANISM	15
	4.3.5 RACK AND PINION	16
	4.3.6 LINKAGES	16
	4.3.7 CONNECTING ROD	17
	4.3.8 SHAFT	17
5	FABRICATION	18
5.1	MANUFACTURING PROCESS	18
5.1.1	METAL CUTTING	18
5.1.2	SAWING	19
5.1.3	WELDING	19
5.1.4	FRAME	20
6	RESULTS	22
6.1	OUTCOME AND FUTURE SCOPE	22
6.2	TIME ANALYSIS	24
	CONCLUSION	25
	REFERENCE	26

LIST OF FIGURES

FIGURE NO:	TITLE	PAGE NO:
1.1	TWO WHEEL STEER	4
1.2	FOUR WHEEL STEER	4
1.3	CRAB WHEEL	5
1.4	ZERO TURN	5
1.5	CARTESIAN ANGLE	6
4.1	METHODOLOGIES	11
4.2	WHEELS	14
4.3	BEVEL GEAR	15
4.4	RACK AND PINION	17
5.1	WELDING	20
6.1	FABRICATION MODEL 1	23
6.2	FABRICATION MODEL 2	23
6.3	FABRICATION MODEL 3	24

LIST OF TABLES

TABLE NO:	TITLE	PAGE NO:
4.1	MILD STEEL MATERIAL PROPERTIES	12
4.2	COMPONENTS USED	13
4.3	BEVEL GEAR DIMENSIONS	15
4.4	RACK & PINION GEAR MEASUREMENTS	16
5.1	MATERIAL SELECTION	21
6.1	TIME ANALYSIS	24

CHAPTER-1

INTRODUCTION

Zero turn vehicle due to its extremely short turn scan make the parking process a lot easier. There is a need for a mechanism that results in allow turning radius. The arrangement of wheel allows the vehicle can spin 360 degrees with out moving. The turning vehicle radius at zero. In typical front wheel steering system, there are wheels do not rotate in the direction of rotation, but in this system the back wheels rotate in the direction of the front wheels. The vehicle can move with a radius approximately equal to its length.

The wheel on the right half spins in single direction, the other wheel on the left half spins in the opposite direction. That is, the vehicle turns immediately. The car can turn without taking up extra space. This design will provide better comfort and also save the time of the customers. A vehicle with zero degree turning radius rotates around an axle that passes through its center of gravity, the vehicle turns at same point where it's standing.

No extra space can required for turning a car. As a result ,the vehicle must be rotated in a space equal to its length. In this arrangement, the steering was connected to the shaft, it was connected to front wheels. The steering wheel is used to guide the front wheel

Front wheel steering system works with Ackerman and Rack & pinion mechanism. The Ackermann steering system is a geometrical arrangements of vehicle's steering system links that allows the inner and outer wheels to rotate at the correct angle .A rack and pinion linear actuator consists of a circular gear (pinion) coupled to a linear gear (rack),which work together to convert rotational motion into linear motion Along with this mechanism, bevel gears mechanism has been introduced.

In this fabrication, bevel gear is arranged on the running board which is between the front and back wheel both left and right side. Hand lever is connected to top gear. Hand lever needs to be rotated in order for the top gear to rotate. When top gear rotates, both bottom gears rotate proportionally. Thus front and back wheels rotates automatically. Same applies to opposite side.

1.1 STEERING SYSTEM:

The essential objective of guiding is to ensure the wheel will be pointed in the correct heading. A progression of connections, poles, turns, and pinion wheels are normally used to achieve this. The objective of controlling is to ensure the wheels are going in the correct course.

A progression of connections, poles, turns, and pinion wheels are generally used to achieve this. One of the crucial standards is caster point, which expresses that wheel is guided with the turn point in front of wheel, making the controlling self-focus in the ideal bearing of development. We should consider the way that the internal wheel voyages away with a more modest range than the external wheel in a turn, in this way the level of toe that is sufficient for driving in an orderly fashion isn't proper for turns.

1.2 FUNCTION OF THE STEERING SYSTEM:

- To control the direction of movement of the vehicle.
- To provide vehicle directional stability while driving straight ahead.
- To allow the vehicle to continue straight ahead after completing a turn.
- The bumps on the road should be as moist as possible. This should coexist with the atmosphere of the road so that the driver can recognize the condition of the road without dealing with the consequences of being over run.
- To extend the life of the tyre by reducing tyre wear.

1.3 NEED OF STEERING

- The steering should be extremely precise and simple to operate.
- The effort should be modest and the driver should not be over worked.
- It need to be able to maintain directional stability. This suggests that the vehicle tends to return to its original position. Maintain a straight-ahead posture after turning.

1.4 ZERO TURNING RADIUS VEHICLE:

A zero turn vehicle turns sharply around a vertical axis that passes through its center of gravity. Additional room isn't required for a zero-turn vehicle.

The vehicle spins in a circle with the same diameter as its length. The need for more room is not taken in to account.

The subject of this project is a spinning vehicle that rotates 360 degrees. Most people use this vehicle to transport commodities, emergency patients, and other items since it moves in all directions and has a more comfortable design that saves time.

Parking, U turns, and other issues plague standard wheel cars, causing them to waste time. As a result, we created 360-degree wheel spins vehicle to lessen and eliminated problem in both the industries and people's everyday lives. Without moving the car, the vehicle can make a turn. The vehicle can turn without needing anymore room.

Each of the four wheels in this system has a bevel gear attached to it, allowing it to rotate 360 degrees. The hand controls a 360-degree rotating wheel.

1.4.1 ADVANTAGES OF ZERO TRUN MECHANISM:

- The turning radius is reduced.
- It's so simple that even an inexperienced driver can do it.
- In the congested areas of metro cities, this is extremely handy.
- It is quite simple to park a car in a little place.
- Eco-Friendly
- Less Noise Operation
- Less maintenance
- More Efficient
- Car can easily be parked

1.5 DIFFERENT TYPES OF STEERING WHEEL:



Fig1.1 Two wheel steer

- Two-Wheel Steer: Only one axle is operated in this mode.
- Only With two-wheel steering, only one axle is driven. The front wheels of the two-wheel steering system are rotated by the manual steering wheel in front of the driver. Problems with two-wheel steering systems are wide spread in parking lots, and traffic.



Fig1.2 Four wheel steer

- Four-wheel steer: Both axles are driven in the same direction, but in opposing directions.

- In this configuration the axles are driven in opposite directions. four-wheel steering system, wheels attached to the front axle turn in opposite directions, of the wheels attached to the back axle turn equally in opposite directions. The left half of the vehicle wheels spins in single way, while right side wheels rotate in the opposite direction.



Fig1.3 Crab wheel

- Crab steering occurs all of the wheel can turning in the equal direction



Fig1.4 Zero turn

- Zero turn steering: The car travels a circular course in this mode..

1.6 CARTESIAN:

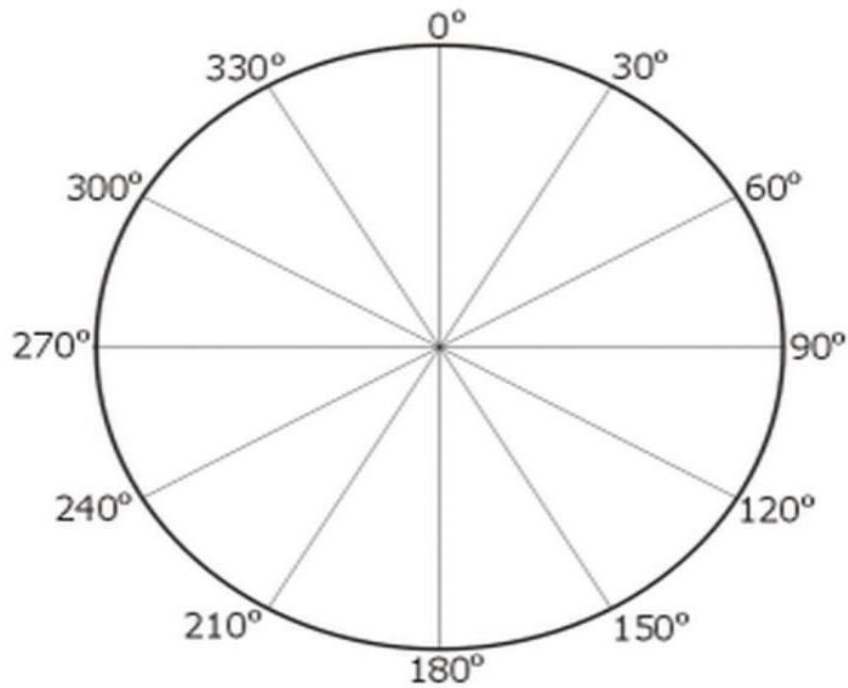


Fig1.5 Cartesian angle

- 30° to 45° is the standard value for passenger vehicle.
- 90° is the parallel movement of the vehicle.
- 180° is the half-rotation of the vehicle.
- 360° turning is the concept of our vehicle so we decided to stop vehicle at any degree.
- All the 4-wheels turn 45° and turn in opposite direction too.

CHAPTER 2

LITERATURE SURVEY

1. Shir sath Sachin and Jadhav Kiran Study of zero turn vehicle

The most important characteristics of a vehicle, such as steerability and handling that create an alternative to traditional two-wheel steering systems, have become an integral part of today's world. Traditional steering uses the Ackermann or Davis steering system, both of which have the disadvantage of not being able to turn with a small radius. The ability to provide zero-turn steering without sacrificing vehicle steerability and handling is a major challenge for automotive. The main goal is to improve the vehicle's zero-turn maneuverability while avoiding wheel wobble problems.

2. Vivek singhrai and Deepti kushwaha, Zero-turning steering system

A car with an easy-to-use steering mechanism and a reasonable price has been introduced. The car has been introduced as a battery-operated, low-noise, environmentally friendly vehicle. At low speeds and on wet or slick road surfaces, The cornering movement of the vehicle becomes more stable and controllable. Vehicle maneuvering on tight roadways and when parking become less of a problem. This technique decreases the amount of time spent parking and turning. In tight places, a vehicle can do a U-turn with a turning radius of half its length. The turning round radius of the vehicle was considerably reduced by directing the rear wheel. The vehicle's steering ability is simple. In city situations, this vehicle is ideal.

3. Sumeet Shah, Nikhil Wadgane and Chaitanya Patil, Design and Fabrication of Zero Turn Vehicle

As the world's population grows, so does the need for vehicles. People are experiencing issues such as automobile parking in congested area as a result of the growth in the number of vehicles on the road. The major qualities of a vehicle, such as steering ability and handling, have become a huge serious concern in the current day. Parking has become a major issue in the country. To address the issue, a different approach is offered, and the notion of Zero Turn Vehicles is established. The idea is to replace the wheel system rather than the entire steering system, which is more practical for the vehicle. The turning circle radius is substantially reduced and is approximately similar to that of zero turn, which can achieved by turn the drive wheels in same rate on the opposite direction at lower speeds.

4. PatilR.V, Jadhav K.R ShirsathS.V, Zero turn vehicle

The goal of this study is to come up with an alternative to the traditional two-wheel steering method. The major qualities of a vehicle, such as steering abilities and handling, to be become major aspect in the modern period. Conventional steering's uses of the Davis steering or Ackerman systems, both of which have the drawback of not being able to make a minimal radius turn. For automakers, provide zero turning steer without sacrificing steering ability zero-turn, vehicle handling is a big challenge. The major goal is to increase the vehicle's zero turn steering capability while avoiding wheel wandering issues. The number of automobiles on the road is steadily increasing. It contributes to traffic congestions and pollutions (air and noise). This is used to solve problems like vehicles maneuvering' son limited roadways and parking.

5. Dr.Dinesh.N.Kamble, Er. Amitesh Kumar , Zero Turn Four Wheel Steering System

The introduction of a vehicle with a low-cost and user-friendly steering mechanism. The focus of this paper was on a steering system that provides viable answers to a number of present maneuvering constraints. By introducing separate mechanisms to standard steering's and 360°steering, a prototype for the suggested technique was constructed. This prototype was discovered to be extremely maneuverable in compact places, allowing for 360°steering. Various techniques were tried and tested in orders to assist the engagements of the wheels in the desired directions, with that most convenient method being chosen.

6. Dig vijay N. Chavan , Design of Zero Turn with Pneumatic Material Handling System .

There can be no rotation without turning the wheels. Safety and comfort are taken into mind when transporting materials. A low-cost, user-friendly link mechanism for a zero lap beam made of pneumatic material. Without pulling the wheels, it can turn to zero. Material handling is done with safety and comfort in mind. In a tiny space, we can readily handle the material.

CHAPTER-3

AIM AND OBJECTIVES

AIM:

The aim of the project was about designing a modal that can replace replacements for sensor-operated four-wheel and two wheel steering vehicles in automobiles.

OBJECTIVES:

We want to lower the car's turning radius to near zero by allowing it to rotate around its central axis. To build a steering mechanism that will make driving a car easier. In the case of parallel parking, to save time and fuel usage. To tackle problems that trucks and buses face while steering, such as generating blockages and traffic jams. Therefore, the project was based on proving that four wheel steering is superior to two wheel steering and four wheel steering with sensors in terms of radius of gyration, linear stability at more speeds.

In situations such as slow cornering, parking, driving, etc. in tight spaces and busy cities, high speeds lane change would be very difficulties due to high wheel base to track breadth as it given good comfort while travelling.

CHAPTER-4

METHODS AND METHODOLOGY

4.1 METHODOLOGY

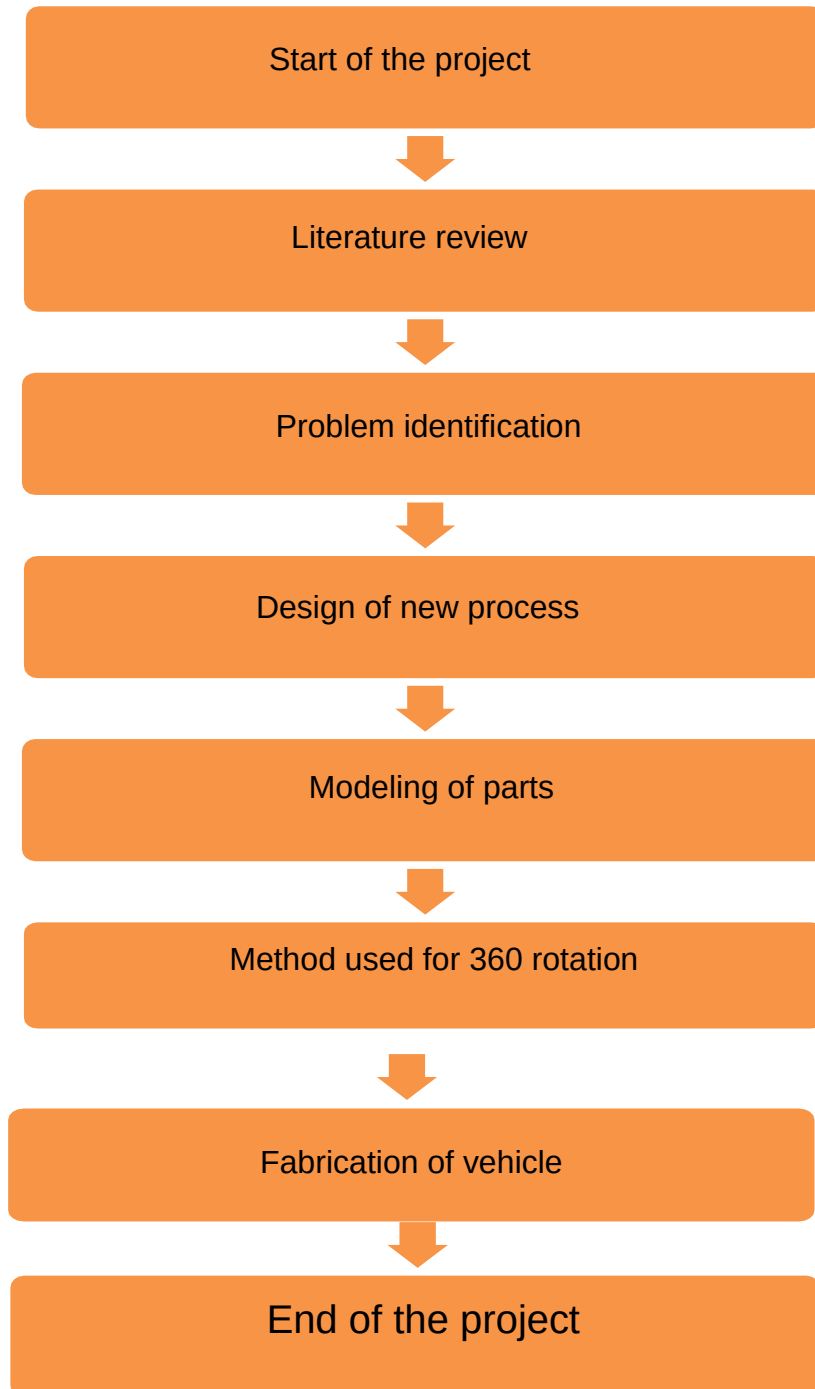


Fig: 4.1 Methodologies

4.2 MATERIAL SELCTION

Mild Steel and Aluminum are used as material for the production of car body structure because of its material properties like stiffness, strength, hardness, availability, Non-corrosive, easily machined and cast, Light weight yet durable and low cost of the material. The properties required for the manufacturing of car body are

- The material should have high strength.
- The material should have high fatigue resistance.
- The material can be easily available for manufacturing
- The material can be easily manufactured into complex shapes to match the design of the designer.

4.2.1 Mild steel

Table4.1 Mild steel material properties

	Stainless steel	
Properties	METRIC	UNIT
Density	7870	kg/m ³
Young's Modulus	210	GPa
Poisson's Ratio	0.303	Noun it
Yield Strength	250	MPa
Ultimate Tensile Strength	440	MPa

Mild steel, commonly known as "low carbon steel," is a form of carbon steel having a low carbon content. The quantity of carbon found in mild steel is typically 0.05 percent to 0.25 percent by weight ,whereas heavier carbon steels are typically stated as having a carbon content of 0.30 percent to 2.0 percent, depending on the source. The steel would be classified as cast iron if any more carbon was added.

Mild steel isn't an alloy steel, thus it doesn't have a lot of other elements in it besides iron. You won't find a lot of chromium, molybdenum, or other alloying elements in mild steel. Due to its low carbon and alloying element content, it possesses a number of characteristics that set it apart from higher carbon and alloy steels.

4.3 COMPONENTS USED:

Table4.2 Components Used

S.NO	COMPONENTS
1	Wheels
2	Steering
3	Bevel Gears
4	Ackerman steering mechanism
5	Rack & pinion
6	Linkages
7	Connecting Rod
8	Shaft

4.3.1 WHEELS:

A wheel is a spherical component that revolves around an axle bearing. It is one of the six simple machines and one of the wheel and axle's main components.



Fig 4.2 WHEELS

Wheels and axles allow heavy things to be moved more readily, allowing for easier mobility or transit while sustaining a load or doing labor in machines. Other types of wheels include a ship wheel, a steering wheels, a potter wheel, and a flywheels.

4.3.2 STEERING:

The main function of steering is to confirm that wheels are pointed on the proper direction. A series of links, rods, pivots and gears are usually used to accomplish this. The goal of steer to make sure the wheels are going on the right direction. A series of links, rods, pivots and gears are usually used to accomplish this. One of the fundamental principles is caster angle, which states that each wheels is driven with a pivot points ahead of the wheels, allowing the steer to self-center on the desired directions of motion. We must considered the fact of the inner wheels travels a path with a lesser radius than the outer wheels in a turn, thus the degree of toe that is sufficient for driving in a straight line, for turning is uncomfortable.

4.3.3 BEVEL GEAR:

In a bevel gear, the axes of two shaft intersect, and tooth-bearing sides of gear are conical. Bevel gear are installed on shaft that are 90degree apart, although they can be made to operate at other angles as well.

Table 4.3 Bevel gear dimension

	Small bevel gear	Big bevel gear
Outer diameter	40mm	60mm
Inner diameter	15mm	15mm
Thickness	20mm	20mm
No. of teeth	10Nos	16Nos
Teeth distance	11mm	10mm



Fig 4.3 Bevel gear

4.3.4 ACKERMAN STEERING MECHANISM:

The Ackermann steering's system is a geometrical arrangement of links in a vehicle's steering's that allows the inner and outer wheels to turn at the proper angles. This model is fully parameterized, allowing for component sizing and customization.

4.3.5 RACK & PINION:

A rack and pinions linear actuators consists of a rotator gear (pinions) that engages a linear gears (rack), the works together to convert rotational motions into linear motions. When the pinion is rotated, the rack operate son a linear manner. I frank is driven linearly the pinion will be forced to rotate. Straights and helicals gear can be used in rack and pinions drives. Power is transmitted from the steering to the rack and pinions. From the bevel gears power was transmitted to the operating mechanism. The front wheels operated use a rack and gears steerings mechanism. A transfers rod to placed between the front and rear steering gear boxes to transfers the motion to the rear steerings gearbox. The rear wheel assembly has been modified, and internal gears have been added to drive the rear wheels. As a result, zero-degree rotation is achieved.

Table 4.4 Rack and Pinion gear Measurements

Rack Gear			Pinion Gear		
Length	300mm		Length	20mm	
Height	19mm		Diameter	30mm	
Width	19mm		Inner dia holes	15mm	
No. of. teeth	38Nos		No. of. teeth	10Nos	
Teeth distance	8mm		Teeth distance	10mm	

4.3.6 LINKAGES:

The steering link age is a part of the steering system that assists in transferring motion from the steering wheel to the vehicle's wheels and turning them in the proper direction at the proper speed.

4.3.7 CONNECTING ROD:

Each track rod is connected to a steering arm, which is connected to the wheel hub, which is bolted to the wheel. All of these connections ensure that the wheels turn together when the rack moves. The track rod, on the other hand, is crucial.

4.3.8 SHAFT:

Shaft is a common and necessary machine component. It's a spinning portion with an circular cross-section that utilized to transmit power in general. The shaft might be hollow or solid. The shaft is supported by bearings and transmits power via a series of gears or pulleys. The shaft is subjected to forces such as bending moment, torsion, and axial force are all forces that act on the shaft.

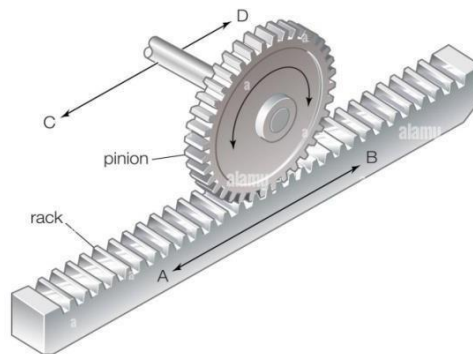


Fig 4.4 RACK & PINION

CHAPTER 5

FABRICATION

5.1 MANUFACTURING PROCESS:

Manufacturing process are steps that raw material go through to obtain the finished product. The material from which the design is made is the first step in the production process..

These materials are later converted into desired parts through manufacturing methods. Treatment (such as heat treatment or coating), machining, or refinishing materials are all examples of manufacturing operations.

The manufacturing process includes quality assurance tests and checks performed during or after production, as well as the planning of these production process priors to production.

5.1.1 METAL CUTTING:

Metal cuttings, often referred to as machine's, is the removal of unwanted materials from an metal block.

The cutting technique works by breaking the material on which it is working. The part of the bone that is fractured is usually in small pieces called chips. grinding, shaping, Cutting, (or planning), broaching, drilling, turning and milling are all common cutting processes. Although cutting machines, tools, and methods may seem highly diverse, a simple model called orthogonal cutting can explain the basic mechanism that causes fractures.

In all machine operations, the work pieces is a shape that can completely cover the size of the final part. The goal is to get rid of any excess material and finish the job. Typically, this cutting is done in several stages, in which at each stage the object is placed in a fixture and the tool reaches the exposed piece of the machine in that part.

As a result, setup changes are time-consuming and costly, so we should try to complete the cutting process in as little setup as possible. Process planning is the act of determining the sequence of individual operations, grouping them into (the minimum number of) setups, and determining the fixture to be used for each setup.

5.1.2 SAWING:

Cold saws are saws that cut a wide variety of metals, including sheet metal, with a circular saw blade. The name of the saw refers to the action that occurs during the cutting process, which prevents both the metal and the blade from getting too hot. A cold saw is a type of saw machine that operates on electricity and is usually stationary rather than portable.

Circular saw blades for cold saws are often made of high-speed steel. This type of steel blade is wear-resistant even when used on a daily basis. As a result, you will be able to complete many cutting projects before the blade needs to be replaced. High-speed steel blades are very beneficial when saws are used to cut thick sections of metal. Circular saw blades for cold saws are often made of high-speed steel. This type of steel blade is wear-resistant even when used on a daily basis. As a result, you will be able to complete many cutting projects before the blade needs to be replaced. When saws are used to cut thick metal parts, high-speed steel blades are very beneficial.

5.1.3 WELDING:

Welding is a method of connecting metals that are similar in composition. Welding is a method of joining metals by melting and fusing the base metals and the filler metal. Welding is a technique that uses precise, localized heat input. The majority of welding is done using ferrous metals like steel and stainless steel. Weld joints are typically as strong as or stronger than the basic metals they link.

Welding is used to create permanent connections. Automobile bodywork, aero plane frames, machine frames railway carriages,, tanks, structural works, boilers, furniture, ship building and general repair work, are all made with it.

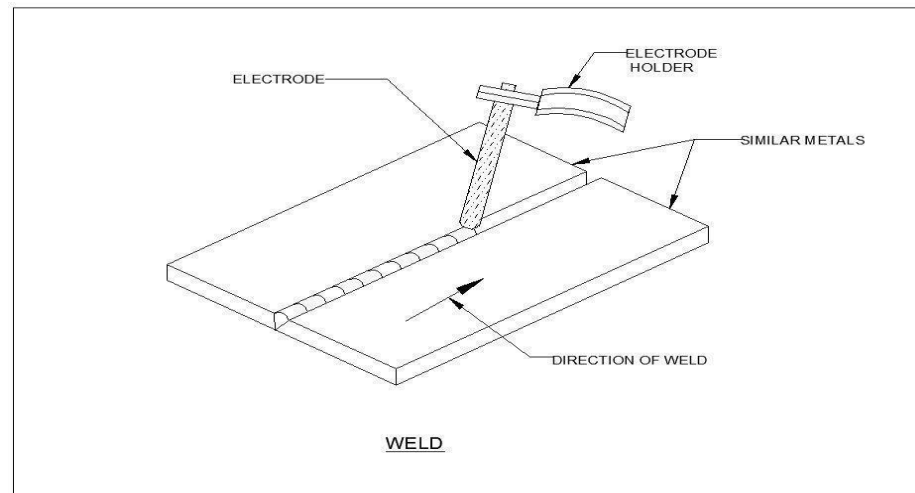


Fig5.1Welding

5.1.4 FRAME:

The frame is utilized to carry the entire arrangement setup. It must be capable of supporting the entire arrangement's weight. Arc welding would be used to create a permanent junction. As a result, the frame is crucial to our project.

5.2 CONSTRUCTION AND WORKING:

We are developing a zero turn vehicle using bevel gear setup and hand operated lever in this project. The zero turn vehicle varies with normal steering setup. We are using total 6 sets of bevel gears in our fabrication 60mm dia bevel gears = 12 no's. Four number of bevel gear sets are used in four wheel hubs to get zero turn radius. Two sets of bevel gears are used in center of the vehicle to control the turning of left and right wheel pairs. Bevel gear 5 & 6 are engaged with addition albig size bevel gear for zero turning radiuses. Left wheel gear numbers 1& 2 are driven with Gear number 6. Right wheel gear numbers 3 & 4 are driven with gear number 5. Gear number 5 & 6 driven with hand operated lever. The left& right pair of bevel gears are actuated with the rotational operation of hand lever .With this rotational operation we can achieve zero radius vehicle by turning all the four wheels with 45degree angle on opposite phase direction.

A wheel is a round object with a rim and a hub as key components that revolve around an axle to allow it to travel freely over the ground. Normal steering mechanism is achieved by rack & pinion. the rack and pinion is a type of linear actuator that comprises a circular gear (the pinion) engaging a linear gear (the rack), which operate to translate rotational motion to linear motion. Driving this pinion in to rotation cause the rack to be driven linear. Finally we can achieve zero turning radius with our bevel gear setup..

Table5.1 Material selection

Material's	Measurement's	Nos
Bevel gears	60mm dia	2
Bevel gears	120mmdia	12
Connecting rod	14mm dia	-Nil-
Hand separated levers	-Nil-	2

Chapter 6

RESULTS

6.1 OUTCOME & FUTURE SCOPE:

A vehicle with a high turning radius has a greater wheel base and track width, making it difficult for parking and cornering at low speeds. In this case, zero turn steering would be successful because the radius turning would be reduced to the same vehicle's with a high wheel base. As the turning radius decreases, the time taken by the vehicle to make a turn and the path traveled by the vehicle at the time of the turn decreases. The zero-turn vehicle is designed in such a way that it should switch from 4WS to 2WS as and when required. The 4WD system is primarily design for parking, if the vehicle's needs to travel faster than 10 kilometers per hour, it must be in two-wheel-drive mode.

There's always a method to grow in technology since it's a necessity. Furthermore, the concept of zero radius turning is straight forward, simple to implement, and not at all bulky. Furthermore, it is less expensive than competing concepts now on the market. This mechanism is even more realistic, and it was designed with the functionality of JCB's land-moving trucks in mind. With the implementation of this system, traffic difficulties, particularly in cities like Mumbai where street widths are equal to the maximum length of vehicle, can arise, and this method could be come the ultimate vehicle need. In light of all of the aforementioned criteria, there is a bright future for implementation purposes.



Fig6.1 Fabrication model 1



Fig6.2 Fabrication model 2



Fig6.3 Fabrication model 3

6.2 TIME ANALYSIS:

Table6.1Time analysis

	Time taken for 360°(sec)	Time taken for parallel parking(sec)	Turning radius(cm)
Zero turn vehicle	16	37	43.5
Normal steer	192	129	14

CONCLUSION

It is a vehicle with user friendly steering system. This paper focus on 360 Turning (Zero Turn Vehicle). This mechanism provides a viable solution to many existing maneuver limitations. The cornering behavior of the vehicle becomes high stable to controlled at lower speed as well as on wet/slippery road surface. This system reduces parking and turning time. U-turning of the vehicle in narrow places with a turning radius of half the length. The vehicle is best suited for city conditions. In future it can so be implemented in three wheelers and electric vehicles. Depending on the manufacturing it can be compactly applied to all types of vehicles. A car with an easy-to-use steering mechanism and a reasonable price has been introduced. The following conclusions are formed based on the findings of the analysis. At low speeds and on wet or slick road surfaces, the vehicle's cornering behavior becomes more stable and controllable. The vehicle's response to steering input improves in speed and accuracy.

An easy-to-use steering mechanism and a reasonably priced car is offered. The following conclusions have been drawn based on the findings of the analysis. At low speeds and on wet or slick road surfaces, the vehicle corner behavior become more stable and control. Vehicle response to steering input improves speed and accuracy

An easy-to-use steering mechanism and a reasonably priced car is offered. The car is to use as a battery-powered, low-noise, eco-friendly vehicle. At low speeds and on wet or slick road surfaces, the vehicle corner behaviors become more stable and control. Reduces the problem of parking when and when putting vehicle manure on narrow roads. This technology reduces the time taken for parking and turning. In tight places, a vehicle can do a U turn with a turning radius of half its length. The turning circle radius of a vehicle by directing the rear wheels. The vehicle's steering ability is simple. The vehicle is best suited for city driving.

REFERENCE

- 1 Chandan Kumar Sahu² , Yubaraj G M³ , Jahangeer A B⁴ "360 Degree Wheel Rotation Vehicle" International Journal of ISSN:2455-7137 Volume –02, Issue–05, May– 2017, PP– 75-81
- 2 Mr. Sharad P. Mali¹ , Mr. Sagar Jadhav² , Prof. D. U. Patil³ "Zero Turn Four Wheel Mechanism", International Engineering Research Journal (IERJ) Volume 2 Issue 2 Page 484- 486, 2016, ISSN 2395-1621.
- 3 Shirsath Sachin, Jadhav Kiran , Patil Rahul, Mohite Abhilash⁴ , D. D. Patil⁵ "STUDY OF ZERO TURN VEHICLE" International Conference On Emerging Trends In Engineering And Management Research, ICETEMR-1623rd March 2016 ISBN: 978-81-932074-7-5.4.
- 4 Jaishnu Moudgil¹, Shubhankar Mengi² , Mudit Chopra³ , Dr. Jaswinder Singh⁴ "360° Rotating Vehicle to Overcome the Problem of Parking Space" IJRMET Vol.5, Issue2, May-Oct 2015, ISSN :2249-5762
- 5 Sudip kachhia, Design of 360 Degree Rotating Car, International Journal of Advance Research and Innovative Ideas In Education, 2(5), 2016, 15–16.
- 6 K. Lohith, K. Lohith, Dr. S. R. Shankapal, M. H. Monish Gowda, Development of Four Wheel, Scholars Journal of Engineering and Technology, 12(1), 2013, 52-53.
- 7 Er. Amitesh Kumar, Dr. Dinesh. N. Kamble, Zero Turn Four Wheel Steering System, International Journal of Scientific & Engineering Research, 5(12), 2014, 22-24.
- 8 Mr. Sharad P. Mali, Mr. Sagar Jadhav, Prof. D. U. Patil, Zero Turn Four Wheel Mechanism, International Engineering Research Journal, 2(2), 2016, 484-486
- 9 Neville, A., Stanton, Marsden P. (2001), From implications of automation in Vehicles, Automotive engineering, Vol. 109, No. 9, Pp. 102-106.
- 10 Rahmaan, Mohammad Ubaid Ur, et al. "360 Degree Wheel Rotation Vehicle."
- 11 Kumar, Er. Amitesh, Dr. Dinesh, and N. Kamble. "Zero Turn Four Wheel Steering System. "International Journal of Scientific & Engineering

- 12 Kumar, K.Sarava. " Fabrication of 360 Degree Rotating Wheel
- 13 Bulatovsky,V.,and L.Pedko."Four-Wheel Steering System."(2018)
- 14 KirpalSingh(2011),Automobile Engineering,12thEdition,Standard Publication Distributors.
- 15 S.V.Shirsath,K.R. Jadhav,R.V. Patil,A.V.Mohite, Prof.D.D.Patil, ZERO TURN VEHICLE International Research Journal of Engineering and Technology.
- 16 Er.AmiteshKumar,Dr.DineshN.Kambale,Dec.2014 Study of 4 Wheel Steering Systems to Reduce Turning Radius and Increase Stability
- 17 ArunkumarSM,ChandankumarSahu,YubarajGM,JahangeerAB,"360 Degree Rotating Vehicle"
- 18 JaishnuMoudgil,ShubhankarMengiandMuditChopra,Rotating Vehicle to Overcome the Problem of Parking Space
- 19 UgaleSachinS.et.al, "Design, development and modeling of a zero turn vehicle
- 20 Mr.Sharad P.Mali, Mr.SagarJadhav, Prof.D.U.Patil, Zero Turn Four Wheel Mechanism.
- 21 Dr.S.R.Shankapal,M. H. MonishGowda, Developmentof FourWheel
- 22 Arun Singh *, Abhishek Kumar, Rajiv Chaudhary, R. C. Singh
- 23 Kirpal Singh,"Automobile Engineering", Standard publishers
- 24 Wheel Steering System Md. DanishAkhtar,2013
- 25 Zero Turn Four Wheel Steering system Er. Amitesh Kumar, Dr.Dinesh N.Kambale,Dec.2014
- 26 Study of 4 Wheel Steering Systems to Reduce Turning Radius and Increase Stability

14%

ORIGINALITYREPORT
SIMILARITYINDEX

PRIMARYSOURCES

1

www.coursehero.com

Internet

2

www.ijert.org

Internet

3

data.conferenceworld.in

Internet

4

www.slideshare.net

Internet

5

st.sathyabama.ac.in

Internet

6

www.grdjournal.com

Internet

7

prantaesolutions.com

8

Internet
N.Kosmidis,G.Ch.Ioannidis,G.A.Vokas,C.S.Psomopoulos."Analysisandsimulationof

four-



**CHENNAI
INSTITUTE OF
TECHNOLOGY**
Transforming Lives

CERTIFICATE

**CHENNAI
INSTITUTE OF TECHNOLOGY**
Sarathy Nagar, Kundrathur, Chennai - 600069.

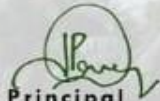
ICAMT 2022
International Conference on Advances in Manufacturing Technology

Certificate

This is to certify that
RAVI ARAVIND TK
from **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY**
has presented the paper entitled
FABRICATION OF ZERO TURN VEHICLE
in the **International Conference on Advances in
Manufacturing Technology - ICAMT 2022**
organised by Department of Mechanical Engineering,
Chennai Institute of Technology on 25th & 26th Mar, 2022



Organizing Secretary



Principal



Certificate No: ICAMT2022_113

CHENNAI INSTITUTE OF TECHNOLOGY

Sarathy Nagar, Kundrathur, Chennai - 600069.

ICAMT 2022

International Conference on Advances in Manufacturing Technology

Certificate

This is to certify that

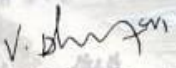
YUKESH J

from

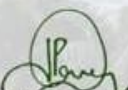
**SATHYABAMA INSTITUTE OF SCIENCE AND
TECHNOLOGY**

has participated in the **International Conference on
Advances in Manufacturing Technology - ICAMT 2022**
organised by Department of Mechanical Engineering,
Chennai Institute of Technology on 25th & 26th Mar, 2022




Organizing Secretary




Principal