

ZERO TURNING RADIUS MECHANISM IN STEERING SYSTEM

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Abstract— Nowadays most of the vehicles use the two wheel steering system. And the two wheel steering system gives low of efficiency when its compared to four wheel steering system, in some vehicles the four wheel steering system employed. Four wheel steering technology keep stability and also reducing of the turning radius while certain moving. Now aim of our paper to develop an alternative solution for two wheel steering system. The main intension is to improve zero turning of vehicle without wheel wandering problems. This system gives zero turn in centre of axis of the vehicle. The turning also equal to the length of the vehicle to form the zero turn (or) 360 degree of turning. Hence there is a requirement of a mechanism that results in less turning radius and achieved by implementing four wheel steering mechanism instead of conventional two wheel steering mechanism. This 360 degree of rotation for vehicles to solve parking problems, traffic problems, malls, multiplexes and etc.

Keywords -- Zero turning mechanism, Mechanical linkage, Steering wheel configuration, Turning radius, Parallel parking.

I. INTRODUCTION

The various functions the steering wheel are to control the angular motion of the wheels, when the certain speed given to run the vehicle. And various modifications are implemented in the automobile. A zero degree turning radius that is been analyzed in vehicles such as jeep hurricane, JCB, and nano pixel. Centre of turning radius = length of the vehicle. The zero turning in 360 degree of rotation about an axis passing through the centre of gravity of the vehicles. Also the vehicle no need of much spaces, and vehicle can be turned in the space equal to the length of vehicle itself. Most Important about the conventional steering mechanism uses Ackerman or Davis steering system turning purpose during vehicle is on the road. The disadvantages associated with the system is about a minimum turning radius. And that all the conventional method of steering systems are eliminated by

employing of four wheel steering system. In this system wheels are connected to the front axle of the vehicle and each wheels turns opposite to other, there is each wheels are not depend on other wheels. And this arrangement for the front wheels is also kept in the rear axle of the vehicle. In automobile sector the zero turn radius system were found, and the advancement of this system is about our project. We are going to modify and use some hydraulic function and system instead of existing mechanism used in four wheel and 360 degree zero turn radius in the vehicle.

II. MAIN INTENTION OF OUR PAPER

In automobile sector, the zero turning mechanism was invented. Also that mechanism for zero turn is very complicated. So we are going to modifying this form that existing and put hydraulic system as mechanism for zero turn. Hence this arrangement also reduces complicated as well as gives good performance.

III. CONVENTIONAL STEERING SYSTEM

The steering mechanism used for turn in desired path and achieve the steering condition. Most of conventional steering systems are two wheel steering system. Each wheel steered with pivot point of wheel. The main function of steering system is to achieve the angular motion of the wheel. And the steering gears are used to converts the rotary motion into angular motion of front axle of wheels. Controlling of the direction of vehicle while the riding. Mainly the rack and pinion are used in conventional steering system.

IV. ACKERMANN STEERING SYSTEM

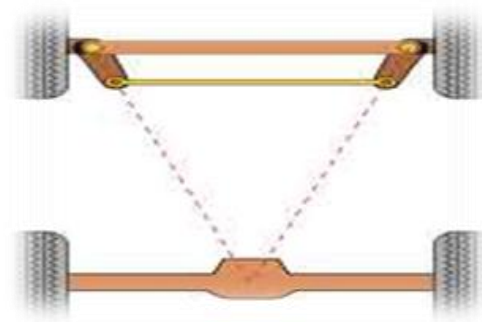


Figure 1 Ackermann steering linkage.

Ackermann steering geometry is geometric arrangement of linkages used in vehicles. And was invented in 1817 by the Georg Lankensperger. With perfect Ackermann, at any angle of steering, the perpendicular line through centre point of all

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the wheels will meet at a common point. And this may difficult to arrange with simple linkage. Hence modern car does not uses Ackermann steering system because it ignores important dynamics.

1) FOUR BAR MECHANISM IN STEERING SYSTEM

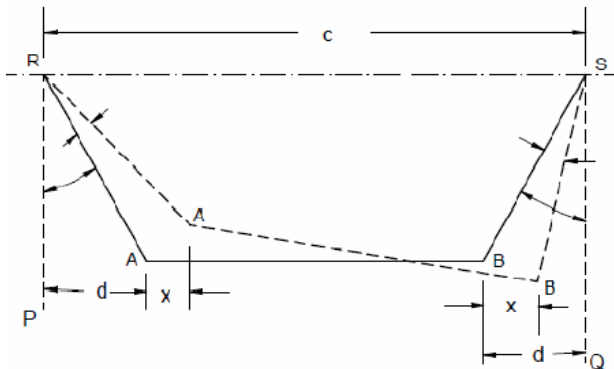


Figure 2 four bar linkage of steering.

The four bar mechanism as shown in fig.2 also linked to the front of wheels of the vehicles. using of four bar mechanism, the steering wheels are can be turned in desired direction. And the kinematics and kinetics of four bar linkage of a vehicles to turn as well as reducing of radius of front wheels. By this vehicle can improved the better steering.

V. ZERO TURNING STEERING SYSTEM

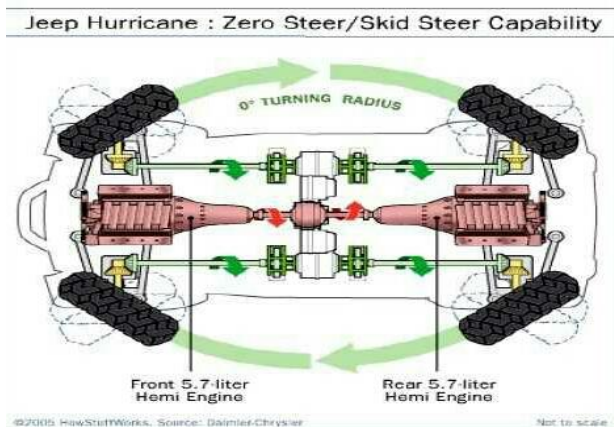


Figure 3 Jeep Hurricane.

The steering mechanism of zero turn system used for achieve the 360 degree of turning in centre of vertical point of the vehicle. All the four wheels are independent from another one wheel at same axle. Also this concept was used by the vehicle jeep hurricane as shown in fig.3 with different configurations modes of steering in the vehicle jeep hurricane. The limitation of this concept is that skilled drivers can only drive this, because of more complicated.

1) STEERING CONFIGURATIONS

Various steering configurations, they are

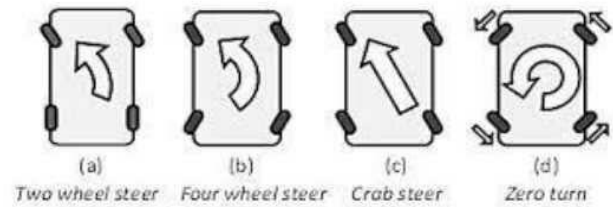


Figure 4 steering configurations

2) TWO WHEEL STEER:

The front axle of two wheels of vehicle are turns in both right and left direction.

3) FOUR WHEEL STEER:

Both axle are driven but each one opposite to another.

4) CRAB STEER:

In the vehicle all the wheels are take turn to same direction is known as crab steering.

5) ZERO TURNING STEER:

In this each wheels take direction opposite to another wheel and to forms 360 degree of rotation at centre of point.

VI. MODELING OF ZERO TURN VEHICLE



Figure 5 Normal mode modeled in Fusion 360.

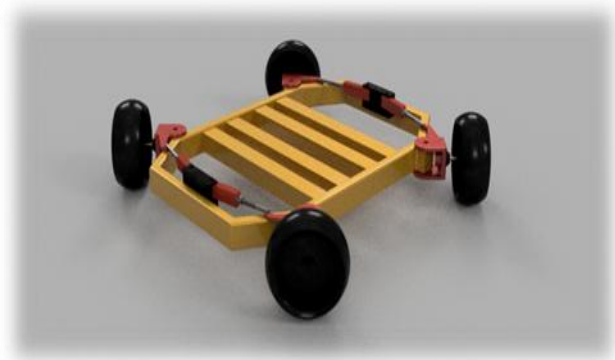


Figure 6 Zero turning mode modeled in Fusion 360.

These are modeled and purely rendered in "Fusion 360" design tool that was recently came to the market from the

“Autodesk group”. There are two modes both normal and zero turning mode of steering in the image.

1. In normal is shown in fig.5 mode the vehicle goes on the road and take turn to right or left sides by help of two wheel steering system.
2. In zero turning mode is shown fig.6 each wheels are turned opposite to another wheel of each two front and rear axles. Hence when some torque applied to accelerate the vehicle, that can rotate and form 360 degree of circle at centre point of vehicle without any minimum radius. That is known as zero turning.

VII. ELEMENTS USED IN PROJECT

1) CHASSIS :



Figure 7 Chassis.

Chassis shown in fig.7 is a part of vehicles, used for keep stable and sustain every parts and components of vehicle. Also keep all the parts are mounted with safe.

2) DC MOTOR :



Figure 8 DC motor.

The DC motor shown in fig.8 is a electrical device, used for useful mechanical rotary energy by supplying of electrical DC current. Hence we are used that dc motors for our required purpose of project.

3) TIE ROD:

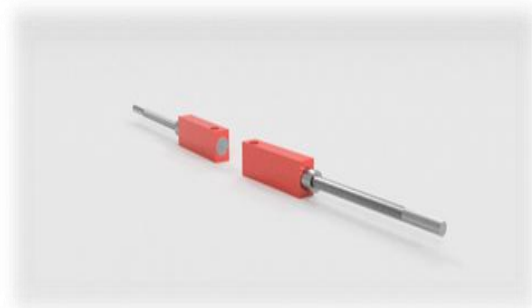


Figure 9 Tie rod modeled in Fusion 360.

Tie rod shown in fig.9 is a part of vehicle used connect rack end to the wheel. And as a pinion attached with rack, pinion rolls rack moves and tie rod push and pull the wheel to the desired direction.

4) GEARS :



Figure 10 Gears

A gear shown in fig.10 or cogwheel is a rotating machine part having cut teeth or cogs mesh with another toothed gear wheel. Geared devices can also change the speed, torque and direction of power source. Hence the gears are used here to moves the tie rods through rotary motion form dc motor to slider motion of tie rod.

VIII. ADVANDAGES

- Improved steering responsiveness and achieve precision.
- Relative wheel angles and control.
- Superior concerning stability.
- Small turning radius
- Tight space maneuverability at low speed.
- Achieved 360 degree of rotation at both directions.

IX. CONCLUSION

The paper for the featuring of a vehicle is low cost and friendly steering mechanisms been introduced. And focused on the steering mechanism which offers feasible solution to number of maneuvering limitations. Different steering mechanism was included with hydraulic system. And the modifications for the project were done from existing steering

mechanism. In order to achieved the methods of steering modes in the required direction as per needed. The features that enhanced the prototype were increase in maneuverability in limited space. And 360 degree of rotation was implemented and modified from existing by this paper.

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