International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Development of Four Wheel Steering System for a Car

Sanket I Naik[1], Norvin Louis[2], Prashant S[3], Vedanth C Y[4]

[1,2,3,4]*Anjuman Institute of Technology and Management, Bhatkal Under the guidance of* Mohammed Ibrahim
(Professor of Mechanical Engineering department AITM, Bhatkal)

Abstract - *Nowadays most of the vehicles use the two wheel steering mechanism as their main handling system. But the efficiency of the two wheel steering vehicle is proven to be low compared to the four wheel steering vehicles. Four wheel steering system can be employed in some vehicles to improve steering response, increase vehicle stability while moving at certain speed, or to decrease turning radius at low speed. It enables the car to be steered into tighter parking spaces. A Four Wheel steering (4WS) System is also known as "Quadra Steering System". This system can works in following three phases Negative phase, positive phase and neutral phase*

***Key Words*: Four wheel steering system(4WS), Quadra Steering System, Negative phase, positive phase, Neutral Phase.**

1. INTRODUCTION

Four-wheel steering (4WS) is an advanced control technique which can improve steering characteristics this is a method developed in automobile industry for the effective turning of the vehicle and to increase the manuerbility. In a typical front wheel steering system the rear wheels do not turn. 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. 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.

The vehicle with higher wheel base and track width face problems of turning as the space is confined, the same problem is faced in low speed cornering. Usually customers pick the vehicle with higher wheel base 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 and overcome parking problems of the vehicle which is effective in confined space.

2. LITERATURE REVIEW

[1] Dr.Dinesh.N.Kamble has discussed that, Conventional steering mechanism involves either the use of Ackerman or Davis steering systems. The disadvantage associated with these systems is the minimum turning radius that is possible for the steering action. This difficulty that is associated with the conventional methods of steering is eliminated by employing a four wheel steering system. In this system, the wheels connected to the front axles are turned opposite to each other, and so are the wheels connected to the rear axle. The wheels on the on left half vehicle rotate in one direction and the ones on the right half of the vehicle rotate in the opposite direction. This arrangement of the wheels enables the vehicle to turn 360 degrees, without moving from the spot, i.e. the vehicle has zero turning radius.

[2] Mr.Swapnil A. has discussed that t, A model for 4WS system is created to test all the possible cases available in four wheel steering system. Four wheel steering system is critical and it is also popular in large farm vehicles and trucks. Some of the modern steering found it most widespread use in monster trucks, intercity buses also utilizes four wheels steering to improve road stability.

3. BACKGROUND THEORY

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. However, a few cars like the Honda Prelude, Nissan Skyline GT-R have been available with four wheel steering systems, where the rear wheels turn by an angle to aid the front wheels in steering. However, these systems had the rear wheels steered by only 2 or 3 degrees, as their main aim was to assist the front wheels rather than steer by themselves.

With advances in technology, modern four wheel steering systems boast of fully electronic steer-by-wire systems, equal steer angles for front and rear wheels 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. The idea behind four-wheel steering is that a vehicle all four wheels are steering the vehicle. As with two wheel- 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 straight ahead position. The vehicle responds more quickly to steering input because rear wheel lag is eliminated.

4. PHASES OF FOUR WHEEL STEERING

In this type of steering system, we can steer a front wheel, as well as the rear wheel of the vehicles simultaneously. This steering mainly includes two types of steering:

Front wheels and rear wheels are steered in the same direction and are parallel to each other. This type of system is very useful during lane changing. Front wheels are steered in the direction opposite to that of the rear wheel. This steering system reduces the space required by the vehicle during turning as compared to that of the two wheel steering system.

Quadra Steer is the system that gives full size vehicles greater ease or maneuverability while driving or tugging trailer at low speed, and improves stability, handling and control at higher speed. The present "Four Wheel Steering" works mechanically with help of linkages. The system utilizes a manual manipulator to control and direct the articulation (left and right turning) of rear wheels.

The system operates in three phases: Negative, Neutral and Positive.

At lower speeds, rear wheel turns in opposite direction from the front wheel. This is negative phase. At moderate speed, the rear wheel remains straight or neutral.

At higher speed, the rear wheel are in the positive phase turning in the same direction as the front wheels.

4.1POSITIVE PHASE

In this system all wheels turn in same direction. This system is used at high speeds. This helps reduced centrifugal force on turns and prevents skidding of vehicle.

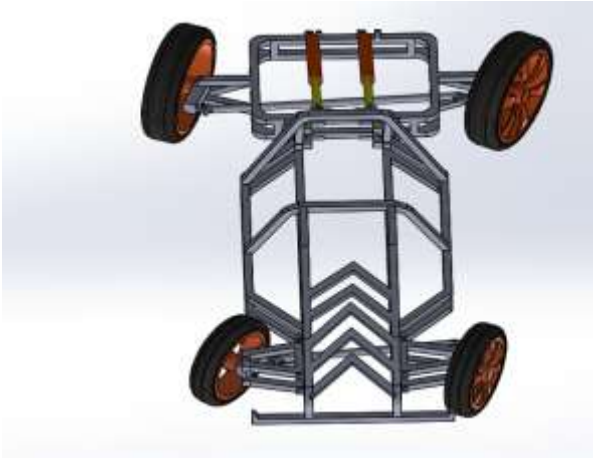

Fig 4.2 POSITIVE PHASE

4.2NEGATIVE PHASE

In this system pair of wheels turn in alter direction. This system is used at low speeds. This enables the vehicle to turn in minimal possible space.

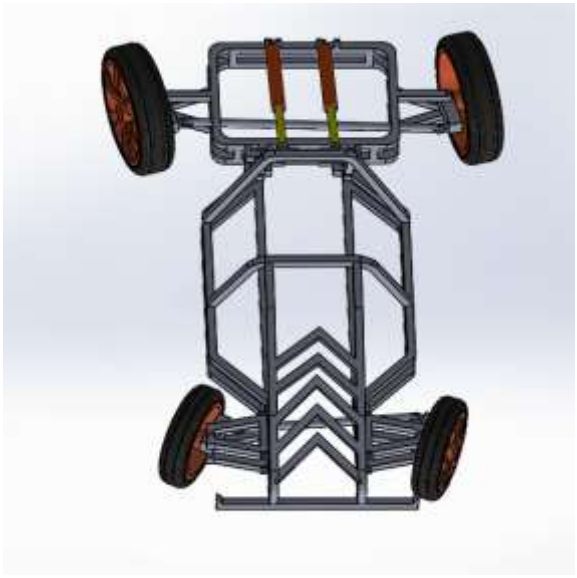

Fig 4.2 negative phase

4.3Neutral Phase

In this drive only the front axle moves either in clockwise or anticlockwise direction and the rear wheel being unmoved. This is the drive that we see in day to day life in all the four wheelers

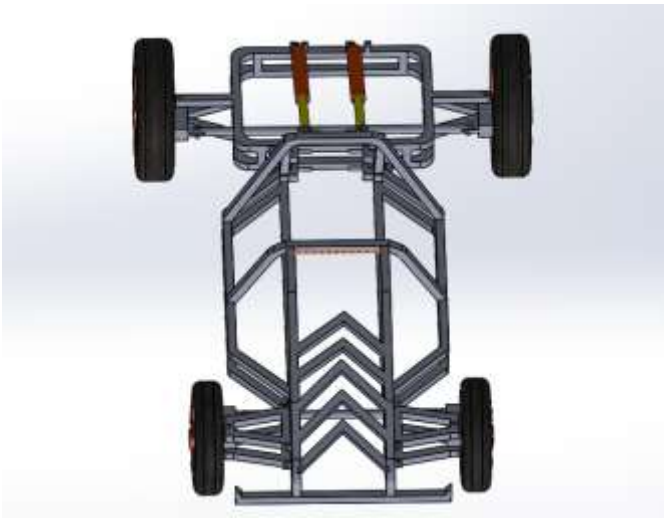

Fig 4.3 neutral phase

5. ADVANTAGES

1. The vehicle's cornering behaviour becomes more stable and controllable at high speeds as well as on wet or slippery road surfaces.

2. Less tyre wear.

3. The vehicle's response to steering input becomes quicker and more precise throughout the vehicle's entire speed range.

4. The vehicle's straight-line stability at high speeds is improved.

5. Smaller turning radius and tight space manoeuvrability at low speed.

6. Stability in lane changing at high speeds is improved.

7. Vehicle maneuvering on narrow roads and during parking becomes easier.

8. Improved steering responsiveness and precision.

9. Controllable on wet or slippery road surfaces

6. DISADVANTAGES

1. Initial cost is high.

2. It increases the crabbing effect while driving.

3. It cannot be applied without power steering

7. APPLICATION

1. **Parking:** 4ws system realizes a smaller turning radius then is possible with 2ws system. As a result vehicle is turned in small radius at parking.

2. **Junctions:** On a cross roads or other junction where roads intersect at 90 degrees or tighter angle with the help of 4ws, we can

3. **Slippery road surfaces:** In slippery road surface, we can easily get out as we can steer all four wheels.

4. **Narrow roads:** On narrow roads, reducing rotation of the steering wheels make the easier turn of vehicle.

5. In Ghaat sections, where we have to steer the vehicle in very less space.

6. In U-turns.

8. CONCLUSION

Four wheels steering system is very useful in low speeds. From four wheels steering systems we overcomes the all problems and we get a necessary desire output... Thus, the four wheel steering system has got cornering capability, steering response, straight-line stability, lane changing and low speed maneuverability. Even though it is advantageous over the convectional two wheel steering system, four wheel steering is a complex and expensive. This paper focused on a steering mechanism which offers feasible solutions to a number of current maneuvering limitations

9. ACKNOWLEGEMENT

We consider it as a privilege to articulate a few words of gratitude and respect to all those deserving individuals who guided us in this project. First and foremost, we would like to extend our profound gratitude and sincere thanks to our guide professor **MOHAMMED IBRAHIM,** Department of Mechanical Engineering, AITM, Bhatkal**.** Who constantly supported and Encourage us during every step of dissertation. We really feel highly indebted to him for constantly guiding us to continue our work and giving us short term goals.

We are thankful to our project co-ordinator Prof.Dr. **Padmayya S Naik** and our HOD **Dr. K Fazlur Rahman** Professor, Department of Mechanical Engineering, AITM, Bhatkal for them immense support throughout this project.

We take this opportunity to thank **Dr.M.A Bhavikatti,** Principal, AITM, Bhatkal for his encouragement and useful suggestions to pursue this work.

10. REFERENCES

[1] Dr.Dinesh.N.Kamble (December-2014)"Zero turn four wheel steering system" International Journal of Scientific & Engineering Research, Volume 5, Issue 12, , page no 1635-1638.

[2] Mr.Swapnil A(march 2015) "Four wheel steering system". Volume 1, issue 3, Page.no.18-20.

[3] Dilip S Choudhari (October 2014) "Four wheel steering system for future" Int. Journal of Mechanical Engineering & Robotics Research, Vol. 3, No. 4.

[4] K. Lohith, Dr. S. R. Shankapal, M. H. Monish Gowda (April 2013) "Development of four wheel steering system for a car". SASTECH Journal 91 Volume 12, Issue 1.

[5] V. Arvind (December-2013)"Optimizing the turning radius of a vehicle using symmetric four wheel steering system" International Journal of Scientific & Engineering Research, Volume 4, Issue 12,

[6] Brabec P, Maly M and Vpzenilek R(2004), "Control System of Vehicle Model with Four Wheel Steering", International Scientific Meeting Motor Vehicles & Engines, Kragujevac.

BIOGRAPHIES

Sanket I Naik
Department of Mechanical Engg,
Anjuman Institute of Technology and Management, Bhatkal.

Norvin Louis
Department of Mechanical Engg,
Anjuman Institute of Technology and Management, Bhatkal.

Prashant S
Department of Mechanical Engg,
Anjuman Institute of Technology and Management, Bhatkal.

Vedanth C Y
Department of Mechanical Engg,
Anjuman Institute of Technology and Management, Bhatkal.