

Design and Development of Active Four Wheel Steering System

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ABSTRACT: In recent time, an automobile industry is widely used two wheel steering system. But, four wheel steering system has many advantages which are very useful as compared to two wheel steering system still 4WS has not widely used. In four wheel steering system, all the four wheels are steered by driver to take a sharp turn for parking purpose or in a traffic situation.

Four wheel steering system is not a new technology but it has not gained more popularity than two wheel steering system even though experimental results has told that four wheel steering system is more suitable than two wheel steering system. Because the turning radius of any four wheel vehicle is decreased by the implementation of four wheel steering system.

Four wheel steering system has excellent maneuverability, high stability and it is a solution to over steer/under steer. Due to four wheel steering system, driver can easily control and steer the car and decrease the driver effort.

KEYWORDS: Steering Mechanism, Turning Radius, Maneuverability and Stability

I. INTRODUCTION

Two wheel steering system is able to control the vehicle but it is not enough to drive the vehicle in small, narrow space or in traffic. So this project relies on this concept and has four wheels steering to control the vehicle in almost all condition.

From past research, we were observing that four wheel steering system is not completely effective at a high speed. Because at high speed vehicle cannot take a turn using four wheels and if using then there will be a chance of skidding. We are going to improve steering by combining 4WS and 2WS systems. In this project, the rear wheels are disengaged from the front wheels at a high speed and at a low speed both front and rear wheels are steered the vehicle.

- (1) When the vehicles require taking a sharp turn then the rear wheels turn in the opposite direction of the front wheels so the vehicles take a turn at low turning radius. In order to accomplish this concept, Ackerman's steering mechanism is installed and chain drive is used to connect front and rear wheel steering in this project.

II. LITERATURE SURVEY

We preferred many research papers, reference books related to this topic and review papers. By observing that papers, we got a lots of information and ideas regarding our concept. Some of these papers are described below:

- I. stability of four-wheel-steering system
[School of Science, Tianjin Polytechnic University, China b College of Mechanical Engineering, Tianjin University, China, Accepted 19 June 2006]
- II. Design and Simulation of 4 Wheel Steering System
[International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 12, June 2014]
- III. Design and manufacturing of a system to measure the turning radius of Vehicle
[International Journal of Engineering Science & Advanced Technology, Volume-4, Issue-6, 536-540]

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- IV. Four wheel steering system for Automobile
[Novateur publications, International Journal of Innovations in engineering research and technology, volume 2, issue 4apr.-2015]
- V. Wheel Steering System
[International Journal of Engineering Research and Technology. ISSN, Volume 6, Number 3 (2013), International Research Publication House]
- VI. Dynamic Modeling and Steering Performance Analysis
Of Active Front Steering System
(State Key Laboratory of Automotive Simulation and Control,
Jilin University, 130025Changchun, China First Automobiles Group Corporation, 130011Changchun, China)
- VII. Optimizing the turning radius of a vehicle using symmetric four wheel steering system
[International Journal of Scientific & Engineering Research, Volume 4, Issue 12, December-2013]

III.COMPONENTS

The active four wheels steering required the following main components to obtain higher manoeuvrability.

- Frame
- Rack and pinion
- Spur gear
- Chain drive
- Steering System
- Wheels

IV.CALCULATIONS

(Note: The following calculations are done in SI units only, while for convenience supportive notes are been made)
All the following dimensions are taken from the calculation and also based on some empirical equations. We followed this calculations and dimensions to prepare our model. We refer the equation from literatures and books and study these equations and obtained the following dimensions described in the table 1. We include all the required standards in the calculation and based on this data we made a working model of four wheel steering system.

Sr. No	Standards	Dimensions
1.	Wheelbase	55"
2.	Lock to Lock Turns	3.27 ⁰
3.	Track Width Front and Rear	48"
4.	Tie rod length	46"
5.	Front sprocket diameter	84mm
6.	Rear sprocket diameter	100mm

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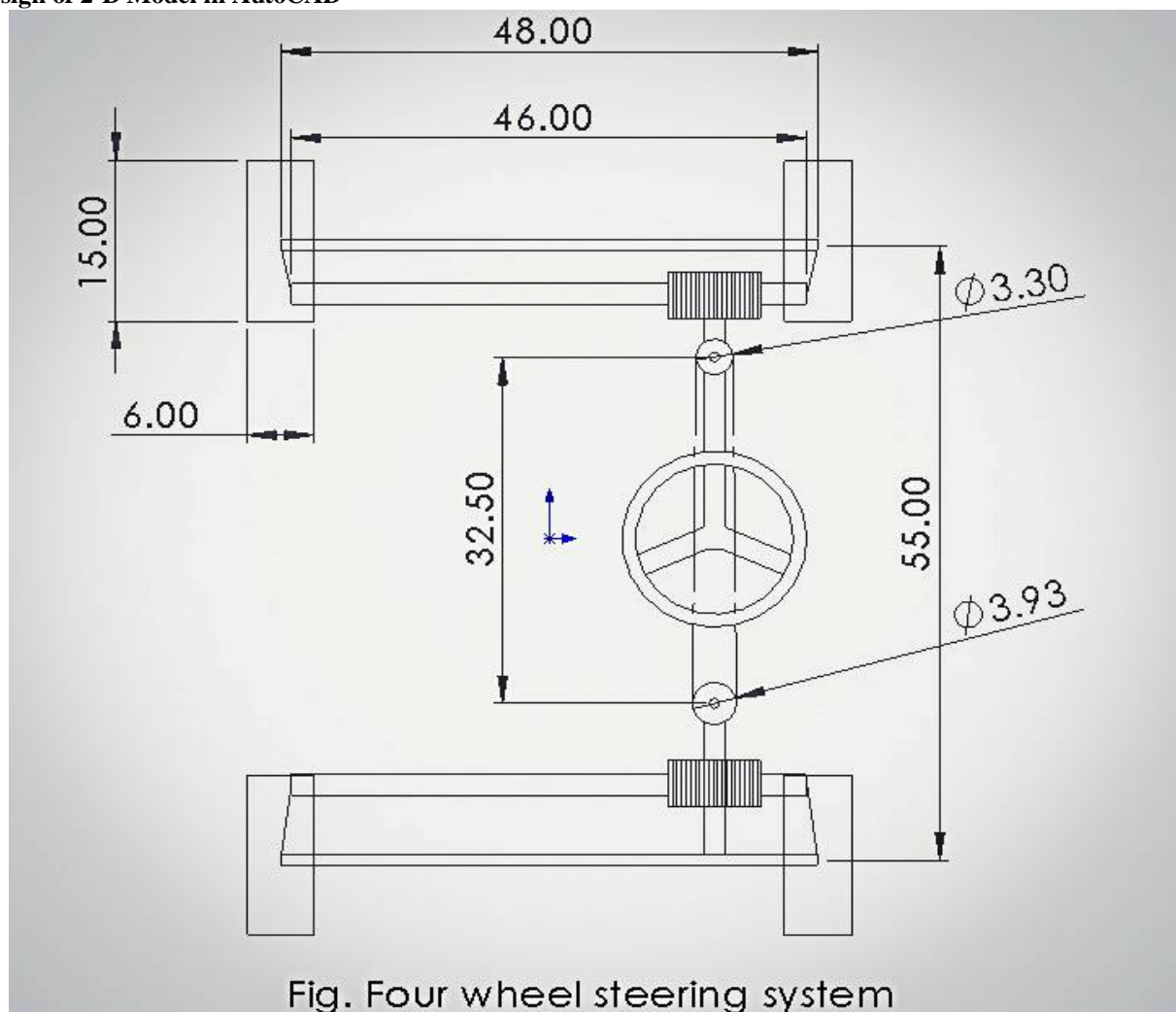
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7.	Length of chain	32.5"
8.	Tyre Diameter	15"
9.	Length of Rack	4.35"
10.	Module Of Pinion	2mm

Table (1). Specification of model

V. DESIGN

Design of 2-D Model in AutoCAD



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The above figure shows the model of four wheel steering system in which all the four wheels are steered when rotate steering wheel. This design is prepared in AutoCAD by using measurements which are obtained from the calculation. This is a final design of our model and based on this design we prepared working model of our project. The entire dimension described in the image is obtained from the calculation. In our project model, all the wheels are steers by using chain drive mechanism. In the chain drive mechanism, two sprockets are involved which can be connected by chain. In two sprockets, one is bigger than other. Bigger sprocket is attached to rear pinion shaft and smaller is mounted on the front pinion shaft.

VI. CONCLUSION

In this project, we developed an effective four wheel steering system which gives a better result at low and high speed. So, it increases maneuverability, stability and also used to decrease turning radius and driver effort. It also works in traffic and parking condition. There are the following results that we obtained from the experimental testing of model.

Turning Radius	Two wheel steering	Four Wheel steering
By calculation	5.394m	2.099m
By experimental	4.42m	2.00 m

Table (2) .Final result of our model

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