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A research paper: Four wheel three mode steering system

Syed Siraj Ahmed[1], Muhammed Danish Iqbal[2], Qazi Fahad Siddiqui[3], Shahnawaz Hussain Siddiqui[4], Mirza Zulfiqar Ali[5]
[1] Professor, Department of Mechanical Engineering, Everest College of Engineering, Aurangabad, India
[2-4] Student, Department of Mechanical Engineering, Everest College of Engineering, Aurangabad, India

Abstract
Nowadays the every vehicle existed mostly still using the two wheel steering system to control the movement of the vehicle whether it is front wheel drive, rear wheel drive or all-wheel drive. But due to the awareness of safety four wheel steering vehicles are being used increasingly due to high performance and stability that they bring to the vehicles. In this report, the performance of four wheels steered vehicle model is considered which is optimally controlled during a lane change manoeuvre in three type of condition which is low speed manoeuvre medium speed manoeuvre and high speed manoeuvre. Four Wheel Steering Rear Wheels Control. For parking and low-speed manoeuvre the rear Wheel steer in the opposite direction of the front wheels, allowing much sharper turns. At higher speeds, the rest wheels steer in the same direction as the front wheels. The result is more stability and less body lean during fast lane changes and turns because the front wheels don't have to drag non-steering rear wheels onto the path. This Steering is the term applied to the collection of components, linkages, which will allow for a vehicle to follow the desired course. An exception is the case of rail transport by which rail tracks combined together with railroad switches provide the steering function. 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. Other arrangements are sometimes found on different types of vehicles, for example, a tiller is rear–wheel steering. Tracked vehicles such as tanks usually employ differential steering that is, the tracks are made to move at different speeds or even in opposite directions to bring about a change of course. In convertible four wheel steering with three mode steering can be changed as needed which assists in parking at heavy traffic conditions. While the vehicle enters a congested or narrow area there would be no one who doesn't wish for, if they would be able to reduce the turning radius of their vehicle or if they could move the whole vehicle sideways without turning the vehicle.

Keywords: three mode steering; four wheelers, critical roads, effective perform

1. Introduction
Nowadays, the condition of increasing road traffic makes the handling of vehicles more difficult. The present scenario demands an exploration of new vehicle handling mechanism, which in turn forces us to find out an alternative way instead of current system or a modified steering mechanism for better handling. While the vehicle enters a congested or narrow area there would be no one who doesn't wish for, if they would be able to reduce the turning radius of their vehicle or if they could move the whole vehicle sideways without turning the vehicle. Here, comes the application of three Mode Interchangeable four Wheel Steering, which provides the same by steering the rear wheels too as our requirement. With the help of this system, the rear wheels also can be turned with respect to the direction of front wheels whenever required. Thus, the vehicle can be controlled more effectively especially during cornering, parking. When both the front and rear wheels steer toward the same direction, they are said to be in-phase. When the front and rear wheels are steered in opposite direction, this is called anti-phase, counter-phase or opposite phase. Our project concentrates on the advancement in steering in race courts, it's highly unlikely for cars to turn the car across the lane with front wheel steering in high speed. The wheels would tend to lock resulting in skidding of car probably leading to accident. Hence both rear and front wheels should be steered to control the car. Whenever it comes to short radius, cars with front wheel steering generally stumble. It's because front wheels generally will be steered properly across the short turning radius. But the rear wheel which follows it will not be steered properly. Hence special engagements are required to steer both rear and front wheels. With the help of this system, the rear wheels also can be turned with respect to the direction of front wheels whenever required. Thus, the vehicle can be controlled more effectively especially during cornering, parking. When both the front and rear wheels steer toward the same direction, they are said to be in-phase. When the front and rear wheels are steered in opposite direction, this is called anti-phase, counter-phase or opposite phase.

2. Constriction and method used
1. Consists of a rack-and-pinion front steering system that is hydraulically assisted by a twin tandem pump main power source.
2. The rear wheel steering mechanism is also hydraulically assisted by the main pump and electronically controlled - according to the front steering angle and vehicle speed.
3. The rear steering shaft extends from the rack bar of the front steering gear assembly to the rear steering-phase control unit.

4. The rear steering system is comprised of the input end of the rear steering shaft, vehicle speed sensors, a steering-phase control unit direction and a power cylinder and an output rod
5. A centering lock spring is incorporated, which locks the rear system in a neutral position in the event of hydraulic failure. Additionally, a solenoid in case of an electrical failure is included.
6. The 4WS system varies the phase and ratio of the rear-wheel steering to the front wheels, according to the vehicle speed.
7. It steers the rear wheels toward the opposite phase of the front wheel during speeds less than 35km/h for a tighter turn and "neutralizes" them at 35km/h.
8. Above the speed of 35 km/h, the system steers toward the same phase-direction as the front wheels, thereby generating an increased cornering force for stability.
9. The maximum steering angle of the rear wheels extends 10 degrees.

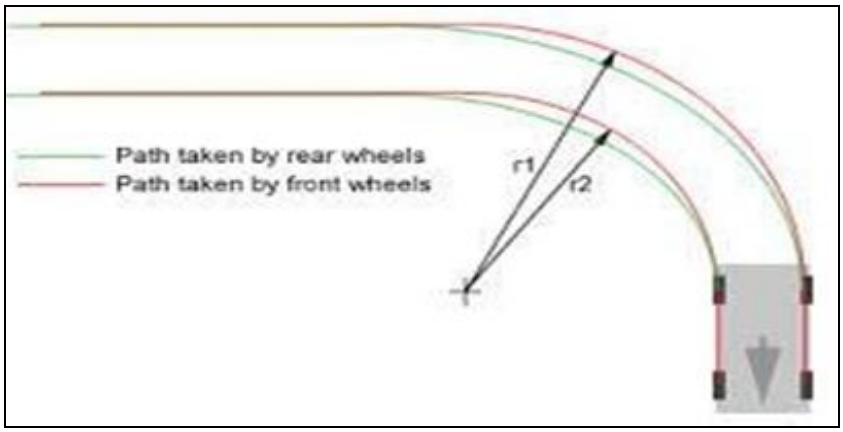

Fig 1: Top View mechanism

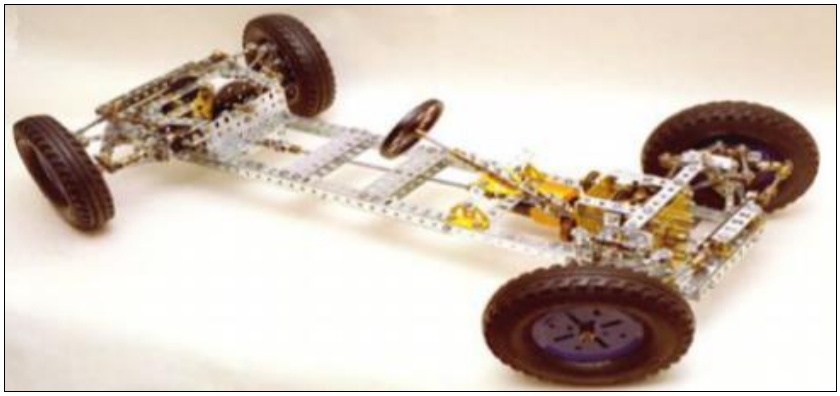

Fig 2: Short Turning Radius

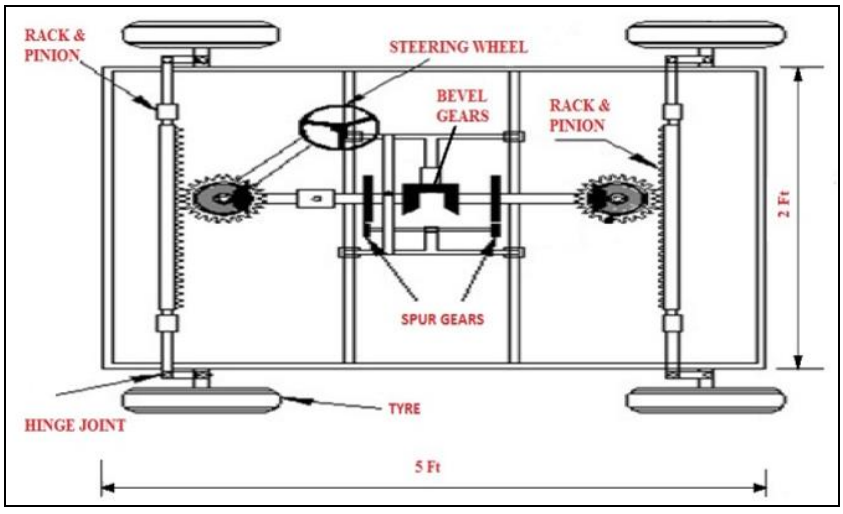

Fig 3: A Model of Four Wheel Steering System

Whenever it comes to short radius, cars with front wheel steering generally stumble. It's because front wheels generally will be steered properly across the short turning radius. But the rear wheel which follows it will not be steered properly. Hence special engagements are required to steer both rear and front wheels. Before Parallel parking and high-speed lane change are achieved by steering both the wheels in same direction. Vehicle to be turned in short turning radius by steering both the wheels in opposite direction.

The various type of steering control mechanisms are used for four wheeler vehicles. This is also one of the steering mechanism and which is utilized for three mode operation based on the condition required. The operation and mechanism of this unit and its function have been studied. At the end, the mechanism is assembled. This is more advantages of other types of steering mechanism since it has more easily to operate and also less time consumption, easy handling etc. The project carried out by us made an impressing task in the field of automobile industries. It is very usefully for driver while driving the vehicle. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been provided.

Fig 4: Reduced Turning Radius Mode

In third mode of operation when another lock nut is inserted. The gear arrangement is moved to other side, the bevel gear disengages and the spur gear gets engaged. Due to spur gear arrangement, the rear wheel steers in opposite direction to the front wheel. This results in third mode steering. Fig shows the third mode operation. In second mode operation when the lock nut is inserted, the other two modes can be used. When the gear arrangement is pushed to one position, the bevel gears get engaged and the steering of rear wheel is ensured and is in same direction as that of the front wheels. Fig shows the second mode operation.

Fig 5: Bevel gears

Bevel gears are gears where the axes of the two shafts intersect and the tooth bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone. The most familiar kinds of bevel gears have pitch angles of less than 90 degrees and therefore are cone-shaped. This type of bevel gear is called external because the gear teeth point outward. The pitch surfaces of meshed external bevel gears are coaxial with the gear shafts; the apexes of the two surfaces are at the point of intersection of the shaft axes. Bevel gears that have pitch angles of greater than ninety degrees have teeth that point inward and are called internal bevel gears. Bevel gears that have pitch angles of exactly 90 degrees have teeth that point outward parallel with the axis and resemble the points on a crown. That's why this type of bevel gear is called a crown gear. Miter gears are mating bevel gears with equal numbers of teeth and with axes at right angles. The tooth shape for bevel gears is determined by scaling spur gear tooth shapes along the face width. The further from the intersection of the gear and pinion axes, the bigger the tooth cross sections are. If the tooth face were to extend all the way to the axes intersection, the teeth would approach infinitesimal size there.

3. Result

Ackerman Steering Mechanism With perfect Ackermann, at any angle of steering, the centre point of all of the circles traced by all wheels will lie at a common point. But this may be difficult to arrange in practice with simple linkages. Hence, modern cars do not use pure Ackermann steering, partly because it ignores important dynamic and compliant effects, but the principle is sound for low speed manoeuvre the turning circle of a car is the diameter of the circle described by the outside wheels when turning on full lock. There is no hard and fast formula to calculate the turning circle but you can get close by using this.

3.1 Advantages

1. Reduced turning radius.
2. Implementation is easy.
3. Mode change is easy.
4. Less time for mode change.
5. Better straight-line stability.
6. Better high speed manoeuvre.
7. Improved steering response.
8. Reduces the snaking effect.
9. Removes the use of traction control.
10. Improved efficiency by 40-45%

4. Conclusions

We make this project entirely different from other projects. Since concepts involved in our project is entirely different that a single unit is used to various purposes, which is not developed by any of other team members. The project carried out by us made an impressing task in the field of automobile industries. It is very usefully for driver while driving the vehicle. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire. It should not be confused with four-wheel drive in which all four

wheels of a vehicle are powered. With the help of this system, the rear wheels also can be turned with respect to the direction of front wheels whenever required. Thus, the vehicle can be controlled more effectively especially during cornering, parking or when we get into a congested or narrow area.

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