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# Zero Turn Four Wheel Mechanism

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## ABSTRACT

**This aims towards the alternative solution on the Zero Turn Vehicles. If we only changing the wheel system instead of total steering system, that is more convenient for the vehicle. Actually Zero Turn Vehicle system used in Jeep Hurricane. In that the wheel positioning system was directly connected to the steering system, due to that reason steering system was more complicated. So, we try to solve that problem by new concept of Zero Turning Four Wheel Mechanism with mechanical linkages operated system. Means in that mechanism positioning of the wheels will be directed by the central wheel positioning 12V DC geared motor. And due to that concept it is easy to changing position of wheel. The vehicle can rotate at their center position in 360 degrees. And if any vehicle rotate in at 360 degrees, then it will easy to solve the parking problems in at public places, malls, multiplexes etc.**

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## I. INTRODUCTION

In present world of industrialization and fast growing population automobile has become basic necessity for transportation of goods and passengers. Kartz Benz of Germany in 1885 developed the world's first three wheel automobile with Otto cycle petrol engine. Gattlieb Daimler and Wilhelm Maybach at same time build the first motorcycle. Benz after sometime invented accelerator for speed regulation, spark plug, battery ignition system, gear shift, radiator for cooling of the engine and clutch with this inventions, the production of automobile was started and world's first automobile had been produced. By Benz in the year 1893, the first four wheel automobile was introduced.Four wheel steering is a method developed in automobile industry for the effective turning of the vehicle and to increase the manuverbility. 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. In four wheels 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.In city driving conditions the vehicle with higher wheelbase 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 wheelbase 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 of the vehicle which is effective in confined space, in this project four wheel steering is adopted for the existing vehicle and turning radius is reduced without changing the dimension of the vehicle.

 

## II. STEERING WHEEL CONFIGURATIONS

There are four steering wheel configurations as follows.

1. Two Wheel Steer: In two wheel steering system, front wheel takes turn while the rear wheels are restricted to turn and follow the front wheels.

2. Four wheel steer: In four wheel steering system, front as well as rear wheels are turn but in opposite direction as that of front wheel.

3. Crab steer: In crab steering system, all the wheels are turn in same direction.

4. Zero turn steer: in zero turn steering system, the angle of wheel is so set that, the vehicle moves in a circle of zero radius.

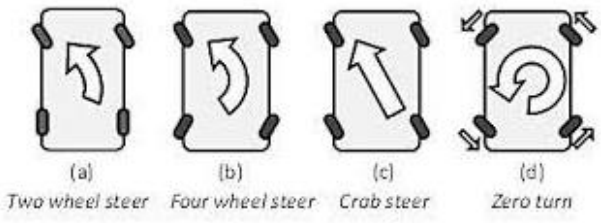


**Fig.1**. Steering Wheel Configuration

## III. CONSTRUCTION AND FUNCTION

Our zero turn four wheel steering vehicle will move on power supply from an A.C. source. So we are connecting the plug of the battery eliminator to an A.C. supply now alternating current is supplied to the battery eliminator which is converted into D.C. supply and transferred to the switch board. The switch board is a combination of two ways switches and ON/OFF switch. Now to give the constrained motion i.e. forward and reverse motion, we are using a set of two on and off switch and two 2 ways switches. To provide the forward motion we are moving the two way switch to the up position. Now pressing the corresponding on and off switch we are moving all the four wheels in the forward direction thus resulting in a forward motion of the vehicle. In our model turning the wheel in 90 degree is optional and which can be achieved by pressing the joystick. When the wheels are to be rotated to 90 degree or less, then power is given to the two motors which are individually connected to the power supply. When power supply is given then the motors shaft rotates, in turn it rotates the spur gear which is mounted on its shaft. This gear rotates the bigger spur gear, which is connected to the shaft and it rotates the shaft, which transmits the power to the two wheels assembly which are connected to the two ends of the shaft. On the end of the shaft worm gears are fixed through which angular power is transmitted to the wheels. And all the four wheels turn to the left side or right side which is optional.

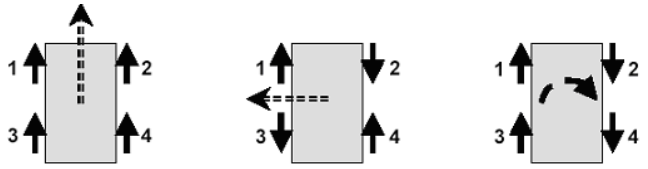


**Fig.2**. Vehicle Direction and Wheel Rotations

When the steering wheel is turned from its straight head position by an angle of 120 degree or smaller, the 4WS system performs to increase in-phase steering of the rear wheels angle.When the steering wheel angle exceeds 120 degree, the rear wheels gradually straighten up then turn in the opposite direction.The car requires just about the same length as itself to park in a spot. Also since the 360° mode doesn‘t require steering inputs the driver can virtually park the vehicle without even touching the steering wheel. All he has to do is give throttle and brake inputs, and even they can be automated in modern cars. Hence such a system can even lead to vehicles that park by themselves.

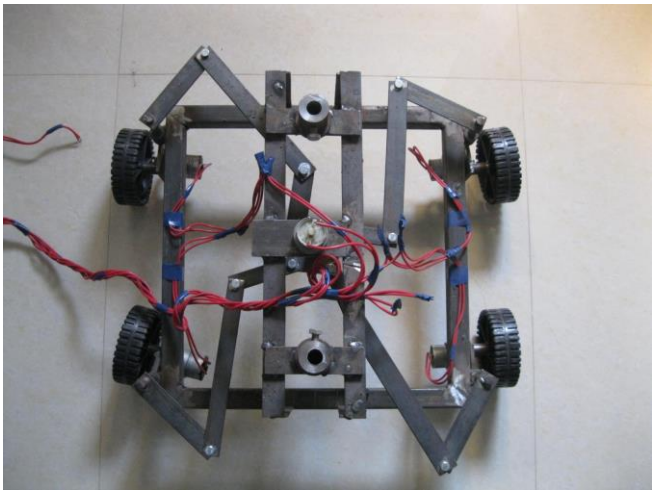

**Fig.3**. Zero Turn Four Wheel Model

Due to the better handling and easier steering capability, driver fatigue can be reduced even over long drives. The only major restriction for a vehicle to sport four-wheel steering is that it should have four or more wheels. Hence, every kind of private and public transport vehicle, be it cars, vans, buses, can benefit from this technology. Military reconnaissance and combat vehicles can benefit to a great extent from 360 modes, since the steering system can be purpose built for their application and are of immense help in navigating difficult terrain.

 

## IV. RESULTS

TABLE I
TIME ANALYSIS OF THE MODEL

| Criteria | Zero Turn Vehicle | Conventional vehicle |
|---|---|---|
| **Time required to turn in 360 degree (sec)** | 14 | 188 |
| **Turning radius (mm)** | 42 | 140 |

## V. CONCLUSION

A vehicle featuring low cost and user friendly steering mechanism has been introduced. This paper focused on a steering mechanism which offers feasible solutions to a number of current manoeuvring limitations. A prototype for the proposed approach was developed by introducing separate mechanism for normal steering purpose and 360 steering purpose. This prototype was found to be able to be manoeuvred very easily in tight spaces, also making 360° steering possible.

The time analysis, for the time required to perform a parallel parking manoeuvre and a 360 degree turn was carried out, and it was established that the implementation of the modification, led to decrease in the time required for the performance of the above operations. The prototype was tested to ensure the conformity with same. The steer forces required on each wheel was obtained and applied. The disadvantages associated with the current prototype were the need to pull two different levers to engage the system, and the space constraints for incorporating the system.

The forces acting on each wheel was obtained and the force that required to be applied on the steering wheel, in order to engage the wheels in the required direction was calculated. The features that enhanced the prototype were the increase in maneuverability in limited space, and the parallel parking ability. The disadvantages associated with the current prototype were the need to pull two different levers to engage the system, and the space constraints for incorporating the system.

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