Zero Turn Vehicle

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Abstract— The aim of this paper is the alternative solution on the Zero Turn Vehicle. 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 Turn Vehicle with pneumatic operated system. Means in that positioning of the wheel will be directly depends on the compressor. 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.

Keywords—Zero Turn Mechanism, Steering Wheel Configuration, Turning Radius.

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 ottocycle 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.

Ashok Leyland, Hindustan motors, Mahindra & Mahindra, Maruti Suzuki, Swaraj, Tata Motors, Escorts etc. are the various automotive industry in India. The varieties of models are been designed and produced by these companies to fulfil the market competition and consumer requirement or satisfaction. The features of cars are developed such as power window, centre lock, power brake system, power steering, tubeless tires etc. to fulfil. The market demand, more than 3.7 million automotive vehicles were produced in Indi in 2010 and in 2011 production was 3.9 million units.

According to society of Indian Automobile manufacturers, annual vehicle sales are projected to increase to 4 million by 2015. Fuel economy, aesthetic features, ergonomics spare available and other features are focused by the companies. Now days, companies are providing the car at minimum cost such as Nano.

In power steering, by means of pneumatic, hydraulic or electrical system the front wheel steering is easier. Power steering reduces the efforts required to steer the vehicle. But, the turning circle radius of vehicle doesn’t reduce. In many or all vehicles are steered by turning the front wheels in desired direction, while rear wheels following there are several problems of parking at public places, parking at home, parking at multiplexes and traffic jam etc. So, to overcome this problems, main aim is to developing the system having minimum turning radius or required minimum turning space.

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.
III. PNEUMATIC OPERATED ZERO TURN VEHICLE:

Zero turn vehicle means the vehicle rotating about axis passing through centre of gravity of vehicle. Vehicle do not require extra space to turn, so the vehicle turns in the space equal to longest length of vehicle itself.

Longest length acts as a diameter for zero turn of vehicle. Turning radius of conventional steering is large in normal vehicle. But in zero turn vehicle the outer turning radius of vehicle is reduced.

IV. CONSTRUCTION

Zero turn vehicle system consists of three double acting pneumatic cylinders which are actuated by 5/2 Direction Control Valve. Polyurethane tubing’s are used to supply compressed air from 5/2 Direction Control Valve to pneumatic cylinders. Mechanical linkages are arranged between wheels and piston rod of pneumatic cylinders. Wheels are driven by side shaft D.C. Gear motor.

Basic frame structure is as follows:

- Wheel base (b)= 35mm
- Wheel track(a)= 72mm
- Pivot centre= 61mm

V. WORKING

Zero turn vehicle is based on the principle of pneumatic system in which compressed air is used to tilt the all wheels of four wheel drive vehicle to turn the vehicle in 360 degree. Zero turn vehicle is pneumatically operated in which three cylinders are used as an actuator.

Zero turn vehicle is the name itself giving the meaning that a vehicle take the sharp turn with zero turning radius and follow exact circular path without leaving its vertical axis passing through the centre. The air is pressurized in the compressor. The pressure and temperature of the air is increased and it is supplied to cylinder through 5/2 directional control valve. Manually operated 5/2 directional control valve is used to control the path of the pressurized air. Polyurethane hoses are used to carry the pressurized air and supply it to the 5/2 directional control valve, cylinders and further. The pressurized air which is supplied to the cylinder will move the piston in reciprocating motion. The piston cylinder is called as a actuator. The piston rod is connected to the wheel through the mechanical linkages. Due to actuation or motion of the piston, mechanical linkages are also actuated and give desire motion to the wheels of the vehicle. In mean while the dc motors which are connected to the each wheel give the four wheel drive to the vehicle. The dc motor can be rotate in clockwise direction as well as Anticlockwise direction which are control by controller. The current is supplied to the dc motor through adapter which converts the ac supply into dc supply. Steering system of the vehicle is controlled by 12 volt dc motor. When supply of compress air is start, 5/2 directional control valve is manually operated to tilt the wheels to take zero turn. At that same time by means of controller dc motors are actuated and give the drive to the vehicle so that it can take zero turn. When there is no necessity of the zero turn the lever of 5/2 directional control valve is put into normal position and vehicle can move as per normal vehicle.

VI. RESULT

The result for prototype model are as follow:

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<tr>
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<th>Zero Turn Vehicle</th>
<th>Conventional vehicle</th>
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</thead>
<tbody>
<tr>
<td>Time required to turn in 360 degree (sec)</td>
<td>14</td>
<td>188</td>
</tr>
<tr>
<td>Turning radius (mm)</td>
<td>42</td>
<td>140</td>
</tr>
</tbody>
</table>
VII. CONCLUSION

New technologies or systems are developed in automobile that are related to safety, ergonomics and efficient drive.

Thus, this project work might be useful in automobile industries. For practical application, this can be used in light motor vehicle. By using this technology, the turning radius of vehicle is reduced. Therefore by reducing the turning radius of vehicle, there are various advantages in daily life such as,

- Easy turning back at narrow roads.
- Easy parking at malls, multiplexes and at home in narrow space.
- Easy removal of vehicle from traffic jam.

REFERENCES