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A Review on 90 Degree Steering Mechanism

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***Abstract*—A new absolute eco-friendly vehicle with independent, low emission transportation possible for those that utilize wheelchair might positively be an improvement in this system. For this, an eco-friendly vehicle, like an electrical car which may steer through ninety degrees, so reducing the turning radius with low efforts must be outlined. Automotive of modern times doesn't have the power to steer through ninety degrees. Such vehicles will facilitate disabled individuals effectively. Lots of researches are done on this field thus on implement this technique however it's not yet been implemented. The concept is to use electrical motors on any two diagonal wheels and a counter phase system implementation. The mechanism works at low speed solely. The steering system uses rack and pinion in outlined gear ratios with the help of some bevel gears. The rear wheels are mounted in such a way that the power is transmitted even when it is being steered through 90 degrees. The vehicle is designed in such a way that it has facilities for disabled people to enter into and out of the vehicle without any external help. Even for people who depend fully on wheel chairs can easily enter the vehicle through the inclined passage provided at the rear side. Advantages of this system are that it can work in limited space and it reduces the time and effort for steering through 90 degrees thus making the system more flexible. It can be used for other applications such as parking, farm vehicles, trucks, forkliftsetc.**

Keywords—Turning Radius; Gears; Four-Wheel Steering; 90 degree Streering Mechanism; Counter Phase Steering;

I. INTRODUCTION

The most typical steering arrangement is to show the front wheels employing a hand–operated steering wheel that is positioned before of the driver, via the steering column, which can contain universal joints to permit it to deviate somewhat from a straight line. Primary function of the steering system is to attain angular motion of the front wheels to negotiate a turn. this can be done through linkage and gear mechanism that convert the rotary motion of the steering wheel into angular motion of the front road wheels. There are primarily two kinds of steering mechanisms [1].

Conventional Steering Mechanism: In such steering system, only the front wheels are steered towards right or left According to the requirement because of at rear their dead axle is present[2].

Four Wheel Steering System: In such mechanism, the all four wheels are to be steered per the steer perform to drive towards left or right. four-wheeled steering, 4WS, conjointly known as rear-wheel steering or all wheel steering, provides a way to actively steer the rear wheels throughout turning maneuvers. It shouldn't be confused with four-wheel drive during which all four wheels of a vehicle are powered. It improves handling and helps the vehicle build tighter turns. Production-built cars tend to underneath steer or, in few instances, over steer. If a automobile may mechanically catch upon an under steer/over steer drawback, the driver would get pleasure from nearly neutral steering under varied conditions[3-6].

90 degree steering mechanism basically helps to reduce the efforts and space required for a person to steer his vehicle. Most of us can’t even imagine what life would be like with disability. We take walking, running, driving a car for granted, but for those who spend much of their day in wheel chair, these things are a challenge. Although accessibility has improved drastically over the past few decades, many things especially vehicles aren’t just designed with disabled person in mind. This 90 degree mechanism can be implemented in vehicles that can be designed especially for the disabled, for whom, simple vehicle designs are necessary [2]. In the current scenario, the vehicles that the disabled use are simply the same ones that normal people use, with some basic attachments such as side- wheel attachments used in scooters. The major problems in these systems are such as large turning radius, large effort, not eco friendly, etc. To account for the difficulties mentioned above, a new absolute eco-friendly vehicle with independent, low emission transportation possible for people who utilize wheel chair could definitely be an improvement in this system. For this, an eco friendly vehicle, like an electric car which can steer through 90 degrees thus reducing the turning radius with low efforts has to be designed. The primary goals of this research is to

design 90 degree steering mechanism with objective such as Better parking at in narrow space, to optimize power consumption, low maintenance cost as well as energy and timesaving.

II. FOUR WHEELSTEERING

Four-wheel steering, 4WS, conjointly referred to as rear-wheel steering or all-wheel steering, provides a method to actively steer the rear wheels throughout turning maneuvers. It shouldn't be confused with four-wheel drive during which all four wheels of a vehicle are power-driven. It improves handling and helps the vehicle create tighter turns [5]. Production-built cars tend to under steer or, in few instances, over steer. If a automobile might mechanically complete an under steer /over steer drawback, the driver would enjoy nearly neutral steering beneath varied conditions. 4WS may be a serious effort on the part of automotive style engineers to produce near-neutral steering. The front wheels do most of the steering. Rear wheel turning is usually restricted to 0.5during an opposite direction turn. Once each the front and rear wheels steer toward a similar direction, they're same to be in phase and this produces a sort of sideways movement of the automobile at low speeds. Once the front and rear wheels are steered in wrong way, this can be referred to as anti-phase, counter-phase or opposite-phase and it produces a sharper, tighter turn[6].

In a four-wheel-steer car, this high-speed sway are often damped or perhaps eliminated through the utilization of same- side steering. Once the rear wheels are turned at a similar time and within the same direction because the front wheels, the rear end turns with the front, and also the cornering forces occur at each axles at the same time. The car slides swimmingly to the side without sway or slow down.

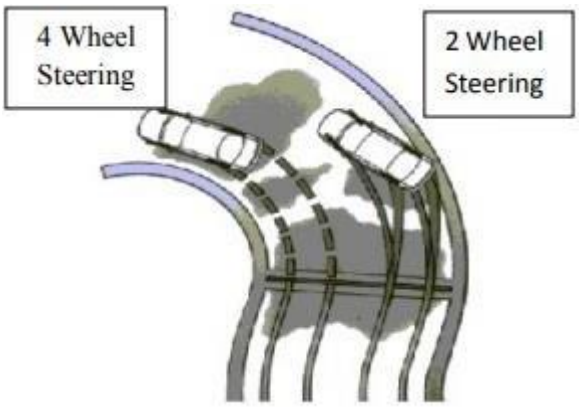

Figure 6: Comparison between two drives

A. TechnicalDetails

In machine steering systems, the rear wheels are steered by a computer and actuators. The rear wheels usually cannot flip as so much because the front wheels. Some systems allow the rear wheels to be steered within the other way because the front wheels throughout low speeds. This enables the vehicle to show during a considerably smaller radius—sometimes critical for large trucks or tractors and vehicles with trailers. Several modern vehicles supply a type of passive rear steering to counteract traditional vehicle tendencies [7]. On several vehicles, once cornering, the rear wheels tend to steer slightly to the outside of a turn, which may reduce stability. The passive steering system uses the lateral forces generated during a turn (through suspension geometry) and therefore the bushings to correct this tendency and steer the wheels slightly to the within of the corner. This improves the stability of the car, through the turn. This impact is named compliance under steer and it, or its opposite, is present on all suspensions. Typical strategies of achieving compliance under steer are to use a Watt's Link on a live rear shaft, or the use of toe control bushings on a twist beam suspension [8]. On an independent rear suspension it's usually achieved by dynamic the rates of the rubber bushings within the suspension. Some suspensions will continually have compliance over steer because of geometry. Four-Wheeled steering found its most widespread use in monster trucks, wherever maneuverability in small arenas is essential, and it's additionally standard in large farm vehicles and trucks. Some of the modern European Intercity buses additionally utilize four-wheel steering to help maneuverability in bus terminals, and additionally to improve road stability. Previously, Honda had four-wheeled steering as an option in their 1987–2000 Prelude and Honda ascot Innova models (1992–1996). Mazda additionally offered fourwheel steering on the 626 and MX6 in 1988. General Motors offered Delphi's Quadra steer in their consumer Silverado/Sierra and Suburban/Yukon. However, only 16,500 vehicles are sold-out with this technique since its introduction in 2002 through 2004. Because of this low demand, gm discontinued the technology at the top of the 2005 model year.[2] Nissan/Infiniti provide many versions of their HICAS system as commonplace or as an possibility in abundant of their line- up. a new "Active Drive" system is introduced on the 2008 version of the Renault laguna line. it had been designed as one of many measures to increase security and stability. The Active Drive ought to lower the results of under steer and reduce the chances of spinning by entertaining a part of the G- forces generated during a turn from the front to the rear tires. At low speeds the turning circle are often tightened thus parking and

maneuvering is easier.

B. Modes in 4WS system

Four Wheel Steer: In Four Wheel Steer mode the rear wheels can perpetually follow the front ones and can offer the tightest turning circle [9]. You will switch to and from this position at any time within the field and therefore the rear wheels will re- align mechanically no matter the front wheel position.

Crab Steer: Crab steering may be a special kind of active fourwheel steering. It operates by steering all wheels within the same direction and at an equivalent angle. Crab steering is used once the vehicle must proceed in a exceedingly line however under an angle (i.e. once moving masses with a reach truck, or during filming with a camera dolly), or once the rear wheels might not follow the front wheel tracks (i.e. to reduce soil compaction once using rolling farm equipment).

Rear Wheel Steering: Rear wheel steering tends to be unstable as a result of in turns the steering geometry changes therefore decreasing the turn radius (oversteer), rather than increase it (Understeer) [10]. A rear wheel steered automobile exhibits non-minimum phase behavior. It turns within the direction opposite of however it's at the start steered. A fast steering input can cause 2 accelerations, 1st within the direction that the wheel is steered, so within the opposite direction: a "reverse response." This makes it harder to steer a rear wheel steered vehicle at high speed than a front wheel steered vehicle.

Passive Rear Wheel Steering: several trendy vehicles provide a variety of passive rear steering to counteract traditional vehicle tendencies. As an example, Subaru used a passive mechanism to correct for the rear wheel's tendency to toe-out. On several vehicles, once cornering, the rear wheels tend to steer slightly to the outside of a turn, which may reducestability.

III. PARTS AND DESIGNMECHANISM

A. Front Right Fork with Gear Mechanisms*:* The gear mechanisms including the rack, pinion and the bevel gears as shown in Figure 1. When the steering is steered in the clockwise direction, the rack moves towards the right, causing the pinion to rotate in the clockwise direction. The bevel gear which is welded to the pinion also rotates in the same direction as that of the pinion. The bevel gear which is linked to the shaft rotates in the counter clockwise direction as viewed from the rear end [2].

B. Rear Right Gear Mechanism*:* When the shaft rotates, it also rotates the gear in the rear end of the shaft which makes the bevel gear on the rear fork rotate in the clockwise direction when viewed from the top. Figure 2 shows the arrangement in the rear fork. The bearing used to hold the shaft is a pillarblock.

Figure 1: Front Right Fork Gear Mechanism

Figure 2: Rear Right Gear Mechanism

C. Right Shaft with Plummer Block*:* The plummer block is welded to the supporting frame which is resting on the main frame. The Plummer blocks are mounted at both the ends as shown in Figure3. Plummer blocks application is to mount bearing safely enabling their outer ring to be stationary while allowing the rotation of the inner ring. The housing is bolted to a foundation through the holes in the base. Split type housings are usually two piece housings where the cap and base can be detached by certain series are one single piecehousings.

D. Height Adjustments*:* The height adjustments on each wheels where made so as to make each wheels perpendicular and to level the frame horizontally as shown in figure 4. This is done with the help of spirit levels and scales of proper measurements.

E. Rear Entry*:* The rear entry is made by building a slope at the rear end with an inclination of 30 degrees which is the normal inclinations that a wheel chair can climb as shown in figure 5. The entry door is made by using frames of cross patterns and attached to the main frame using 3 hinges.

Figure 3: Right Shaft with Plummer Block

Figure 4: Height Adjustment for Forks

Figure 5: Rear Entry

IV. WHEELSTEERINGTYPESBASEDONPHASE

Inphase Steering: In inphase steering system the rear 2 wheels direction and front 2 wheels direction are same way. This produces a kind of sideways movement of the car at low speeds [10].

Counter Phase Steering: In this phase steering system the rear 2 wheels direction is opposite of the front 2 wheels direction. It produces a sharper, tighter turn. This causes the system to take large radius turns smoothly and more efficiently compared to the counter-phase system. The drawback of this system is that it loses stability on attaining high speeds, i.e. attaining speeds more than 40Kmph but this speed is all it needs for a person on wheel chair and therefore is taken as the limit speed of the system. The counter phase system is obtained with the help of gear mechanisms in which racks, spur gears, bevel gears and shafts are used to link the steering with the rear wheels and the front wheels so that the steering can control both the front and the rear wheels.

V. CONCLUSION

Nowadays, the each vehicle existed principally still using the two wheel steering system to regulate the movement of the vehicle whether or not it's front wheel drive, rear wheel drive or all wheel drive. However attributable to the awareness of safety, four wheel steering vehicles are being employed more and more because of high performance and stability that they bring about to the vehicles. 90 degree steering mechanism essentially helps to scale back the efforts and space needed for a person to steer his vehicle. The 90 degree steering mechanism is established using rack and pinion mechanism that is possible to manufacture, simple to line up, and extremely economical in attaining counter-phase. a new absolute eco-friendly vehicle with independent, low emission transportation by using electric motors of proper specifications attainable for those who utilize wheel chair is meant, with a rear entry facility. Components utilized in this technique are simple to manufacture, material used is possible, reliable and simply available in market. the main disadvantage of this technique is that it will run solely at a maximum speed of 35Km/h.

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