90 Degree Steering Mechanism

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Abstract

A new absolute eco-friendly vehicle with independent, low emission transportation possible for people who utilize wheelchair 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 defined. Automotive of present time does not have the ability to steer through 90 degrees. Such vehicles can help disabled people effectively. A lot of researches have been done on this field so as to implement this methodology but it has not yet been implemented. The idea is to use electric motors on any two diagonal wheels and a counter phase system implementation. The mechanism works at low speed only. The steering mechanism uses rack and pinion in defined 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 depends fully on wheel chairs can easily enter the vehicle through the inclined passage provided at the rear side. Advantages of this system is 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, forklifts etc.

Keywords: counter-phase, eco-friendly, gear ratio, turning radius

I. INTRODUCTION

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.

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

- Large turning radius
- Large effort

Not eco friendly

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 basic requirement of this car is that it,

- Steers through 90 degree
- Runs on electric motor thus reducing emissions

A slope for entry on the rear end.

II. RELEVANCE

According to the census conducted by government of India 2001, 6,105,477 of the total population of 1,028,610,328 people are disabled with movement impairment which account for about 0.6% of the total. These people will need movement assisting devices for their locomotive purposes. In addition to this the growing old age population coupled with various ailments, increases the

requirement for these movement assisted devices. Across the world people with disabilities have poorer health outcomes, lower education achievements and less economic participation than normal people. This is partly because people with disabilities experience barriers in accessing service that many of us have long taken for granted, including health, education, employment and transportation as well as information. These difficulties are exacerbated in less advantaged communities.

To achieve the long lasting, vastly better development prospects, we must empower people with disabilities and remove the barriers which prevent them in participating in their communities; getting a quality education, finding a descent work and having their voice heard. Be it trains, planes or automobiles, disabled people still face massive challenges in getting around.

1) Disabled people travel a third less often than other people.
2) Over a third of disabled people who do travel experience difficulties, the most common being getting on or off the trains or buses.
3) The national average for accessibilities for buses is only around 30%
4) Of disabled people who use public transport, over half have to resort to using costly taxis for easier access.
5) Nearly two third of households containing a disabled person do not have access to a private car compared to 27% of the general population.
6) In terms of convenience and ease of use, taxis, mini cabs are aided the most highly, with rail services the worst!
7) More than 1 in 5 spaces is reserved for disabled drivers are abused by non-disabled motorists.
8) Bus drivers are rated as the most unhelpful public transport employees by disabled people, with 20 % of respondents saying that they are unhelpful, compared with 13% for train station staff, 6% for both on train staff and taxi drivers and just 2% for airline stewards.
9) Eight in ten disabled people never use light rail, tram or underground services, three quarters never use ferry services, and two thirds do not fly.
10) Nearly half of disabled people in India say they experience difficulty with travelling. A quarter experience difficulty traveling to and from the doctor or hospital, 23% have experienced problems visiting friends or relatives and 18% visiting leisure facilities.

Because of inadequate funding and enforcement, countless people with disabilities can't reliably vote, work, attend medical appointments or enjoy full independence. The lack of transportation keeps people out of the workforce and unable to contribute as tax payers and consumers.

III. OBJECTIVES

The aim is development of the specifications of the original 90 degree turning wheels for transverse parking project are outlined in this chapter. The development of suitable goals and specifications were crucial to the project's success as they guided both the design and aims of the project team. As part of the requirements of the project a number of goals were established to measure the success of the project. The primary goals were defined as the goals the group hoped to achieve a minimum for success. The main objectives of the project are –

- Better parking at home in narrow space and at multiplexes
- This type of car can be taken through traffic jam
- Car can be move easily
- Use of electrical drives to optimize power consumption.
- Maintenance is low
- Saving of Fuel
- Saving of Time

IV. PARTS AND COMPONENTS

Fig. 1: Front Right Fork Gear Mechanism

The figure 5.1 shows the front right fork with the gear mechanisms including the rack, pinion and the bevel gears. When the steering is steered in the clockwise direction, the rack moves towards the right, causing the pinion to rotate in the clockwise direction.

Fig. 2: Rear Right Gear Mechanism

The bevel gear which is welded to the pinion as shown in the figure 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.

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 5.2 shows the arrangement in the rear fork. The bearing used to hold the shaft is a pillar block which is also shown in the figure. The plummer block is welded to the supporting frame which is resting on the main frame.

Fig. 3: Right Shaft with Plummer Block

Figure 5.3 shows the pillar block supporting the shaft on the front end which is also supported by frames welded to the main frame. The Plummer blocks are supported by standard 15M bolts on both sides. The frame used here is of 1inch type which is selected because it is commonly available in the market. The Plummer blocks are mounted at both the ends. 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 piece housings. Thus the housing a clean environment.

Fig. 4: Height Adjustment for Forks

The height adjustments on each wheels where made so as to make each wheels perpendicular and to level the frame horizontally. This is done with the help of spirit levels and scales of proper measurements. The adjustment is made with the help of an MS plate in which three holes are drilled at three ends of a triangle of dimension 17mm*14mm*6mm. 8 adjustments are made in this format. 13mm, 12mm and 10mm holes are made and similar bolts are inserted through it in such a way that 13mm hole passes through the center of the wheels, 12mm and 10mm holes are on the fork as shown in figure 5.4.

Fig. 5: 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. The entry door is made by using frames of cross patterns and attached to the main frame using 3 hinges. The dimension is 60cm*95cm. the wheels at a distance of 30cm away from the hinge.

Fig. 6: Steering Rack and Pinion

V. COUNTER-PHASE MECHANISM

This project basically focuses on counter-phase systems in which the rear wheels turns in the opposite directions as that of the front wheels in almost the same angles. 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.

Figure 6.4.1 shows the normal position of steering. When the steering wheel turns left as shown in figure 6.4.2, the pinion which is connected to the steering turns counterclockwise, which in turn moves the rack linked to it towards left. The rack is linked to both the forks of the front wheels through the pinions attached to the fork, thus the wheels turn according to the rotation of the steering wheel. This is simply the basic form of rack and pinion mechanism. Each fork has 4 bevel gears attached to it. The right front gear is linked to the corresponding rear gear through a shaft having bevel gears at the ends. These bevel gears are attached to the shaft through the axis of the shaft. When the front gears rotate, it rotates the gear on the shaft which is perpendicular to each other, this rotates the bevel gear at the other end of the shaft. This gear thus rotates the bevel gear at the back wheel and that rotates the rear wheel.

Fig. 7: Normal Condition

Fig. 8: Counter-phase

VI. CADD DRAWING AND ANALYSIS

Fig. 9: solidworks model

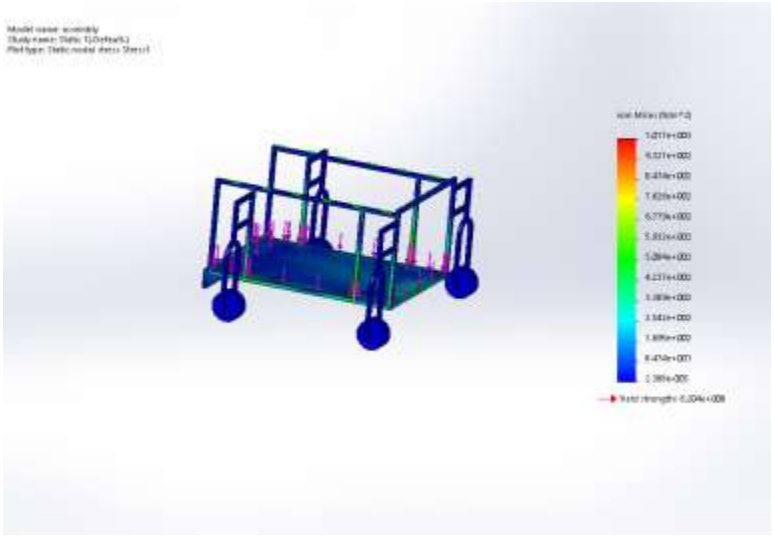

Fig. 10: Analysis of 1000N uniformly Distributed load

The analysis is conducted by applying uniformly distributed load of 1000N on it and the system is stable. The system collapsed when the load was increased to 1400 N, ie 1400N is the maximum load it can withstand. Maximum load the system requires is pretty much less than 1000 N.

VII. CONCLUSION

The problem for the project was to design a car which steers through 90 degrees. 90 degree steering mechanism basically helps to reduce the efforts and space required for a person to steer his vehicle. The 90 degree steering mechanism is established using rack and pinion mechanism which is feasible to manufacture, easy to set up, and highly efficient in attaining counter-phase. A new absolute eco-friendly vehicle with independent, low emission transportation by using electric motors of proper specifications possible for people who utilize wheel chair is designed, with a rear entry facility. Components used in this system are easy to manufacture, material used is feasible, reliable and easily available in market. The main disadvantage of this system is that it can run only at a maximum speed of 35Km/h. An advanced system of solar cells can be used on the roof of the car thereby making the system partially recharging.

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