90 Degree Turning Wheels of Car for Transverse Parking

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Abstract— Since last few decades we have seen an ample amount of advancement in the automobile industry, especially in the cars. We also want to give some modifications to a conventional car in order to improve the viability of car or a four wheel drive vehicle. The main advantage is to achieve angular motion (90 degree) of the wheel; more than in the holonomic vehicles. Omni-directional vehicles provide higher quality maneuvering capability as compared to the common non holonomic vehicles. The ability to move along any direction irrespective of the orientation of the vehicle makes it an attractive option in dynamic environment. We used some arrangements to achieve the intended task. Here we have discussed not only the project model, but also how the concept of the omni directional vehicle is viable on the road. We have discussed about transmission and suspension system which will be used in the actual vehicle. We have also described the role of steering system so that the research paper will be giving an idea about the actual Omni-directional vehicle. We have also elaborated the role of and types of the gears as the gears have extemporary role in the experiment.

Key words: Wheels, Worm and worm gears, Spur gears, DC Motors, Battery, Frame

I. Project Goals

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.

II. Introduction

In highly populated areas it can be difficult to find available parking spots.

Frequently parking spots are located on the side of the road, leaving the driver with no choice but to attempt parallel parking. In general it is considered to be a rather challenging maneuver. Since parallel parking requires driving backwards it becomes difficult to coordinate the correct motion of the car. Some drivers have to perform multiple corrections before they park the car properly. In the worst case an accident can occur.

A car that can perform parallel parking by itself would save drivers time, especially those that are not very good with parallel parking. In addition cars that can parallel park autonomously in a reliable manner would most probably reduce the number of accidents related to parking. The objective of our work is to implement parallel parking using a car like robot. The robot that we used is of type pioneer 3. We restricted the motion of the robot to model the motion of a car. Using our model we present a solution to the autonomous parallel parking problem.

A. Literature and Research:

[1]Author- SH. Azadi and Z. Taherkhani_Autonomous Parallel Parking of Car Based Parking Space Detection and Fuzz Controller International Journal of Automotive Engineering Vol.2Number 1 January 2012.

- The research in car parking problem is derived from general motion planning problem and its usually defined as finding a path that connect the initial configuration to the final one with collision free capabilities and by considering nonholonomic constraints.
- Using our model we present a solution to the autonomous parallel parking problem
- Computation of a path to be followed to accomplish the parking maneuver.
- There is a sufficient space on the obstacle we choose to go.
- The obstacle avoidance and parking spot localization worked with a success rate of approximately 90%.
- We also would like to improve our actual parallel parking producer by alloying the robot make adjustment once it is parked.

III. Methodology and Working

This chapter lists all the subsystems and provides a more in depth coverage of the vehicle. Each subsystem section start with a design Section which tells the original intent of the subsystem and a list of design goals. They also contain the actual implementation which describes how it will be finally constructed.

A. Construction:

The other main components are worm pinion & worm gear. This arrangement is used to transmit vertical motion into horizontal motion or vice versa. In this vehicle we used this arrangement to turn the wheel at 90 degree in a steady state condition. There is a switch incorporated in the vehicle which is used to lock & unlock the wheels for turning 90 degree. Likewise other vehicles during turning in normal running condition, the drive is in front wheels.

B. Mechanism and Working:

In our project we are using techniques which is generally used for driving the vehicle by the motors, Compaq gear boxes & worm gear arrangement which are used for every individual wheel. In our modern vehicle since there is no differential we are using four motors & gear boxes for individual wheel which drive the wheel. In order to provide angular motion i.e. 90 degree in the wheels we are using worm gear arrangement. While for rotating the wheel, we use two seperate Geared motors.

C. Worm Gear and Pinion Arrangement:

Worm gears are used to transmit power at 90° and where high reductions are required. The axes of worm gears shafts cross in space. The shafts of worm gears lie in parallel planes and may be skewed at any angle between zero and a right angle. In worm gears, one gear has screw threads. Due to this, worm gears are quiet, vibration free and give a smooth output. Worm gears and worm gear shafts are almost invariably at right angle.

Fig. 1: Worm Gear and Pinion Arrangement

IV. Designing Calculation and Kinematic Analysis

A. Design of Worm Gear:

1) Rated power=Pr=VI=12*8=84Watt
- Design Power=Pd=Pr*Kl=84*1.75 (T-XI-5)
- Pd=147watt

2) Tooth Load=Ft=Pd/Vp
- Vp=3.14*Dg*Ng/60
- Vp=2.094M Ft=147/2.094=70.2/M=70.2*3.14/Pc
- Ft=220.54/Pc watt

3) Bending Load=Fb=So*Cv*b*Y*M
- So=84Mpa .... (T-XVI-10)
- Cv=6/ (6+Vp)............. (T-XVI-15)
- Cv=6/(6+2.094M)=6/(6+0.666Pc)...........(=Pc/3.14)
- b=2.38Pc+6.25............. (T-XI-2)
- Y=0.314
- Fb=84* 6/(6+0.666Pc)*(2.38Pc+6.25)*0.314*(Pc/3.14)
- Apply Boundary Condition
- Fb=Ft
- Pc=1.737mm
- Pc should be a multiple of 5
- Pc=5mm
- Dg=63.66mm
- b=18.15mm
- Ft=44.108N
- Fb=489.108N
- Fb>Ft

Design Is Safe:

4) Fw=Dg*b*K2
- K2=0.7................... (T-XVI-17)
- Fw=63.66*18.15*0.7
- Fw=808.8N

5) Efficiency=
- (cos$-0.3tan12)/(cos$+0.3tan12)
- tan$=tan14.5*cos12
- $=14.196
- Vr=(3.14*Dw*Nw)/(cos12*1000)
- Vr=1.413m/sec
- Efficiency=58%

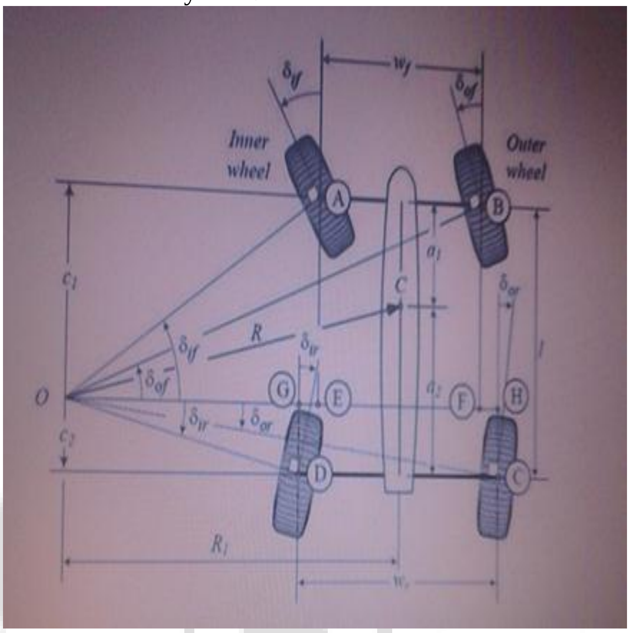

Fig. 2: Steering angles position of Instantaneous center for turning radius 4.4m. [6]

B. CAD Model of 90 Degree Turning Car:

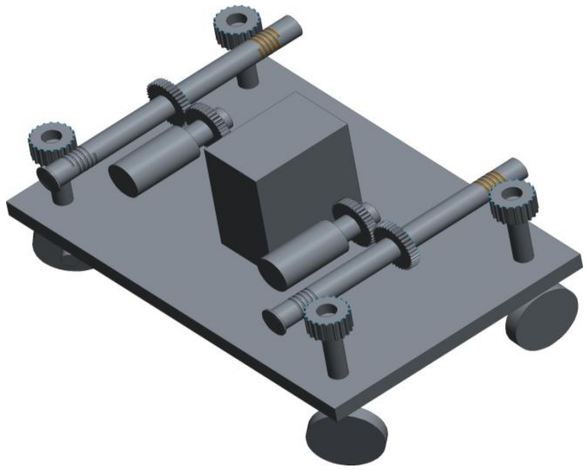

Fig. 3: CAD Model of 90 Degree Turning Car

V. Conclusion

The purpose of developing this paper is to avoid parking problem, minimize the space between two parked cars to minimize the time required for parking reduces the problem of accidents during parking and to improve the design of existing vehicles.

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