

Design and Analysis of 360 Degree Turning Vehicle

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Abstract: The design and manufacture of a 360-degree DC motor and a steering wheel vehicle are designed to reduce the rotation time from one direction to the other. This vehicle can be moved in all directions in the same position by the steering, the pinion, the DC motor, the bearings and the chain drive. The main function of this vehicle is to move easily from one direction to another. The modern development and economic progress of the Indian society have led to an increase of people on the platform, the increase of the vehicle on the road, due to the lack of space, in the hospital is a big problem in the country. The purpose of this study is the development of a system to reduce the radius of the vehicle. In this system, the first vehicle stops and the wheels are turned in the required direction through the driving system and the DC motor. It has a turning radius equal to almost the length of the vehicle itself. This vehicle was used to transport goods in various areas, such as the platform, hospital, industry and market.

Keyword: Bearings, Chain Drive, Dc Motor, Pinion, Rudder and Wheel

I. INTRODUCTION

The advanced new technology has led to various modifications in the automobile sector. Out of these, zero degree turning radius which is being analyzed in various vehicles e.g. hurricane jeep, JCB, Nano Pixel etc [1]. The turning circle of a vehicle is the diameter described by the outside wheels when turning on full lock. There is no hard and fast formula to calculate the turning circle but it can be calculated using this;

Turning circle radius= (track/2) + (wheelbase/sin (average

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steer angle)) [2]. Zero degree turning radius of a vehicle implies the vehicle rotating about an axis passing through the center of gravity of vehicle i.e. the vehicle turning at the same place, where it is standing.

No extra space is required to turn the vehicle. So vehicle can be turned in the space equal to the length of the vehicle itself. This technology exists in heavy earth movers like excavator which consists of two parts i.e. the upper part cabin and lower part crawler chain. The upper part of excavator can rotate about its center, so that the direction of cabin can be changed without changing direction of lower

part. Conventional steering mechanism involves either the use of Ackerman or Davis steering systems. The disadvantage associated with these systems is the minimum turning radius that is possible for the steering action. This difficulty that is associated with the conventional methods of steering is eliminated by employing a four wheel steering system.

In this system, the wheels connected to the front axles are turned opposite to each other, and so are the wheels connected to the rear axle. The wheels on the on left half vehicle rotate in one direction and the ones on the right half of the vehicle rotate in the opposite direction. This arrangement of the wheels enables the vehicle to turn 360 degrees, without moving from the spot, i.e. the vehicle has zero turning radius.

This helps in maneuvering the vehicle in tight spaces such as parking lots and within small compounds. The various functions of the steering wheel are, to control the angular motion the wheels; direction of motion of the vehicle, to provide directional stability of the vehicle while going straight ahead, to facilitate straight ahead condition of the vehicle after completing a turn, the road irregularities must be damped to the maximum possible extent. This

should co-exist with the road feel for the driver so that he can feel the road condition without experiencing the effects of moving over it.

II. LITERATURE SURVEY

Jaishnu Moudgil, et al. [1], presented a 360 degree rotating car to overcome the problem of parking space. This car has zero degree turning radius of a vehicle implies the vehicle rotating about an axis passing through the center of gravity of vehicle i.e. the vehicle turning at the same place, where it is standing. No extra space is required to turn the vehicle. So vehicle is to be turned in the space equal to the length of the vehicle itself. In this presentation, so got idea of 360 degree wheel rotation vehicle and have plane to make 360 degree wheel rotation load carry vehicle, this vehicle is to be used in different area like industries, hospital, railway platform, etc.

Sudip kachhia [2], presented a 360 degree rotating vehicle to overcome the problem of parking space. This project is about design of 360 degree rotating car to move in all direction. This design provides better comfort and also saves the time of customers, that's why it is also the reliable for the customer. As it is also battery operated car thus no fuel is required. Hence it is economical to the environment. This also reduces the cost of the car, and also got idea to use battery to operate this vehicle.

Lohith, et al. [3], presented a four wheel steering system for a car. In four wheel 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 with the use of DC motor to turn left and right. In this presentation, the use of DC motor is to rotate the wheels 90 degree left and 90 degree right from original position.

Amitesh Kumar, et al. [4], presented zero turn four wheel steering system, the various functions of the steering wheel are, to control the angular motion the wheels, direction of motion of the vehicle, to provide directional stability of the vehicle while going straight ahead, to facilitate straight ahead condition of the vehicle after completing a turn, the road irregularities must be damped to the maximum possible extent. This project the use of steering is to rotate front wheels.

Sharad P. Mali, et al. [5], presented zero turn four

wheel mechanism, in this project people have used DC motor and wheel to vehicle rotate 360 degree at a same position. So in this project, the idea is to arrange of DC motor and wheel.

III. OBJECTIVE OF PROJECT WORK

To find the method of fabricating the rotating wheel system.

To fabricate according to selected method .

To make some experiments on the fabrication in different conditions.

To study the future implementation on the system

IV. PROBLEM IDENTIFICATION AND WORKING

The most frequently used type of steering, are using the front two wheels of the vehicle. This type of steering suffers from the comparatively larger turning circle and the extra effort required by the driver to negotiate the turn. Some types of industry battery trucks and industry backhoe loaders use this type, where only the two rear wheels control the steering. It can produce smaller turning circles, but is unsuitable for high speed purposes and for ease of use. Many modern cars use rack and pinion steering mechanisms.

This project consists of steering, pinion, DC motor, wheel, bearings, iron tube, battery and chain transmission. In this system, the vehicle is first stopped and the wheels are turned in the direction required by the driving system and the DC motor. The teeth of the pinion are fully meshed with the chain mechanism used to rotate the rear wheels using a DC motor. The steering is used to ensure the direction of rotation of the front wheels using the pinion and chain drive assembly. The DC motors are used on each wheel to provide the forward and backward movement of this vehicle, and a battery is also used to supply electrical power to each DC motor. It has a turning radius that is almost equal to the length of the vehicle itself. This system should be useful in hospitals, small industries and even platforms.

- 360 degree wheel rotation vehicle consist of steering, chain sprocket, chain drive, iron pipe, battery, DC motor and wheel.
- In this vehicle sprocket of front wheel and sprocket of steering are connected by first chain drive and sprocket of rear wheel connected to second chain drive and DC motor has is given to each wheel to provide forward and backward movement of vehicle.
- When steering is to rotate clockwise and anticlockwise direction by hand then sprocket is connected with steering also rotates clockwise and

anticlockwise direction. This rotary motion transfers to front wheels by chain drive because teeth of sprocket and chain drive are completely mesh to each other. Bearing is provided with sprocket which allows the wheel to rotate 360 degree. So as a result front wheels of this vehicle rotates in 360 degree direction by steering at a same position.

- When power is supplied from the battery to DC motor then DC motor starts to rotate in clockwise direction and also sprocket will rotate in clockwise direction because sprocket bolt is connected to DC motor, the same rotary force is transferred to other rear wheels by chain drive because sprocket of rear wheel are connected by chain drive and bearing has provide with sprocket which allow to wheel rotate. So as a result rear wheels also rotate 90 degree left from original position and reverse current flow from battery to DC motor then rear wheels rotate 90 degree right from original position.
- When power supply from battery to DC motors of each wheels then each DC motor starts rotate then wheels also rotate with DC motor because wheels and DC motors are connected by bolts and nuts. As a result vehicle moves in forward direction and when reverse current flow from battery to DC motors, then DC motors start rotate in opposite direction. As a result vehicle is move in backward direction.

The main components used to fabricate the model are:

- Steering
- Sprocket
- Chain drive
- Wheel
- Iron pipe
- DC motor
- Bearing
- Fixed frame
- Battery

Methods used for 360° Rotation

To facilitate turning of the vehicle the rear tires of the car should rotate at least 25-30 ° in the opposite direction of the front tires. To rotate tires in the opposite direction a dc motor is used also shows the steering motor. This motor helps in rotating tires to the prescribed angle necessary for the driver.

Switches for both the steering motor will be in the hands of the driver so he can rotate the rear tires to the prescribed rotation angle.

The steering motor configuration includes; voltage -6v, speed – 1200 rpm, power – 52 w.

For front tires, a rack and pinion arrangement is used for rotation of the tires. Normal rotation of rack and pinion arrangement ranges between 25-35° [2] , to increase the rotation of the tires the length of the rack is increased keeping in mind the relation ($\theta = 8 t/l$, where t = track width and l = wheelbase) [2] .

This relation is used in the Ackerman steering system which facilitates the rotation of the outer tires more than the inner tires as they have to cover a larger distance as compared to the inner tires. Power or simple Steering could be used as per the needs of the driver. The drive to the vehicle is provided by a dc series motor. The configuration includes; voltage-24 v, speed-1200 rpm and power- 150 w.

Performance analysis

The performance analysis of the 360 degree wheel rotation vehicle has clearly shown that it is more efficient, economical and effective. In this project forward and backward movement of vehicle and turning of rear wheel of the vehicle are getting power from the battery in the form of an electrical energy. This energy is has stored into a 12V battery and then supplied to the components. As the electrical power is used and transmitted to components by the use of electrical wires in place of any mechanical arrangement, this results in less noise, less wear of components and less vibration. Use of battery provides a smooth flow of current toward the components. Most of time people are facing problem in parking and railway platform because other vehicle are taking more space to move from one direction to other direction. But developed 360 degree wheel rotation vehicle this problem easily solved. Because this vehicle has capability to move from one direction to other direction in very less space. In this project a DC motor and battery are used according to load carry capacity which is of 5 kg, but vehicle able to carry more load if use more than 12V of battery.

V. ADVANTAGES, DISADVANTAGES AND APPLICATION

Advantages, disadvantages and application of 360 degree wheel rotation vehicle shown below;

Advantages

- It consumes very less time to turn from one direction to other direction.
- It is more efficient compare to other type of load carry vehicle.
- This type of load carry vehicle is easily parked in any direction.
- It is less costly load carry vehicle.

- Eco friendly.
- Less noise operation.
- Battery operated thus no fuel required.
- More efficient.
- Battery is using in this 360 degree wheel rotation vehicle to move forward and backward, so it is a kind pollution free vehicle

Disadvantages

- This type of load carry vehicle is not applicable to carry more weight.
- Battery power is required to move of the vehicle.

Application

- In Industries for automation of raw material like automated guided vehicle.
- In automobile sector there are so many types of vehicle are using to carry goods from one position to another position, there is space problem in the industry so this vehicle is used in automobile applications because this vehicle consumes very less space compare to other type of vehicle.
- This vehicle is used in small Industries for transportation of raw material from one position to another position.
- Modern development and economical progression of Indian society resulted in increase of vehicle in park so there are also problem. In park other vehicle are taking more space to move from one direction to other direction and 360 degree wheel rotation vehicle have capability to move parallel direction so this vehicle is easily move from one direction to other direction in park.
- Take easily U-turn because front wheel of this vehicle are rotating freely by steering, chain drive and sprocket arrangement.
- It is used in hospitals to carry the patient from one room to another room. Because there are lots of patients those are staying in one room.

VI. 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 maneuvering 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 maneuvered very easily in tight spaces, also making 360° steering possible. The time analysis, for the time required to perform a parallel parking maneuver 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.

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