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DESIGN & FABRICATION OF INTEGRATED STEERING SYSTEM

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ABSTRACT

This aims towards the alternative solution on the Zero Turn Vehicles. 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 Turning Four Wheel Mechanism with mechanical linkages operated system. Means in that mechanism positioning of the wheels will be directed by the central wheel positioning 12V DC geared motor. And due to that concept it is easy to changing position of wheel. The vehicle can rotate at their centre 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: Controller, Sensor,Steering Wheel Configuration, Turning Radius, Zero Turn Mechanism.

I. INTRODUCTION

This project is about design and fabrication of integrated steering systems rotating vehicle. As it is also battery-operated car thus no fuel is required. Hence it is economical to the environment. This will also reduce the cost of the car. This vehicle moves in all directions and this design provides better comfort and also saves the time of customers, most of the people using this vehicle to carry goods, patient etc. But most of the time, they have to face the problem like taking U turn etc.So have to design a 360 degree wheel rotating vehicle to reduce and eliminate problems in the industry and at the railway platform. Zero degree turning radius of a vehicle implies the vehicle rotating about an axis passing through the centre 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. Steering is used to provide the direction of front wheel. When power supply from battery to DC motor then rotary motion transfer from DC motor to the wheel.

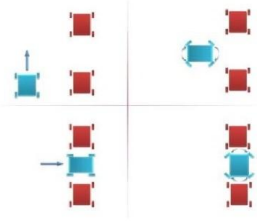

Figure 1 Parallel Parking

All electric concept of vehicle is that if it becomes a reality would prove to be a lot of fun to drive in the city. The vehicle runs on small electric motors, four motors attached separately to four "wheels" the wheels are actually spheres and can rotate 360 degrees around itself like a helicopter. The car is designed for a person taking small trips, probably around a city, who needs to move quickly and nimbly around obstacle like yellow cabs and bicycles. Maybe the coolest thing about the car is that the doors open. In a typical front wheel steering system the rear wheels do not turn in the direction of the curve and thus curb on the efficiency of the steering. 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. At high speed, when steering adjustments are subtle, the front wheels and the rear wheels turn in the same direction.

II.PROBLEM STATEMENT

A vehicle with higher turning radius face difficulty in parking and low speed cornering due to its higher wheel base and track width, but the passenger prefer the vehicle to be higher wheelbase and track width as It gives good comfort while travelling. In this scenario four wheel steering will be effective as the turning radius will be decreased for the same vehicle of higher wheel base. In this project a benchmark vehicle is considered and four wheel steering is implemented without change in dimension of the vehicle and reduction in turning radius is achieved. The main problem associated in city areas is traffic. This condition is very time consuming and also sometimes it is difficult to come out in the emergency situations for example of hospital or fire safety conditions. Sometimes it is difficult to park a vehicle in condition when two car parked one to another spaced between them. Thus this condition also consumes times for the life style. Also there may be chance of Sudden brakeage and chance of accident and damage for vehicle.

Figure 2 Stuck in traffic

Figure 3Parallel Parking Issues

III.LITERATURE REVIEW

JaishnuMoodily[1].: The idea of 360 degree wheel rotation load carry vehicle is analyzed from; 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]:Sudip 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.

K. Lohith[3]: Lohith 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.

ShirsathSachin[4]:In these pneumatic system is used to turn each wheel.If one wheel's drive is in forward direction,then other opposite wheel direction is in reverse direction.

Bansode S. P., Gaikwad A. A.[5]:Bansode& Gaikwad presented a model which works on pneumatic based method. They suggested instead of changing whole steering system if wheel system is changed it becomes more convenient to do a 360 turn.

3.1Components

- Chassis
- DC motor
- Microcontroller
- DC Driver
- Car wheel
- Keyword panel
- Battery

3.1.1 Chassis: The fixed frame forms the base of the 360 degree wheel rotation vehicle. This frame is made of Mild Steel (MS). It has four wheels attached to its two sides by sprocket bolt and iron pipe.

3.1.2 Dc Motor: In this vehicle one DC motor are provide in each wheel to move forward and backward direction. The specification of motor used is 12 V, with 60 rpm.When power supply from battery to DC motor then DC motor rotate in clockwise direction and when reverse current supply from battery to DC motor then DC motor will anticlockwise direction. Which will forward and backward movement of vehicle. An electric motor uses electrical energy to produce mechanical energy.

Figure 4 Motors

3.1.3 Wheel: Wheels are made of plastic.Wheels are connected with DC motor.Each wheel can rotate independently & also front wheels can move forward or in reverse direction.

Figure 5 Wheels

3.1.4 Bearings: In this vehicle bearing is use easy to move wheel from one direction to other direction. A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts.

3.1.5 Battery: Battery is one of the important parts of 360 degree wheel rotation vehicle which is connected to DC motor by electric wire. It is store electrical energy and supply to DC motor so vehicle will move forward and backward direction.

3.1.6 Dc Driver:L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

3.1.7 Arduino Uno: Arduinouno is a microcontroller which has 14pins,6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack and a reset button.

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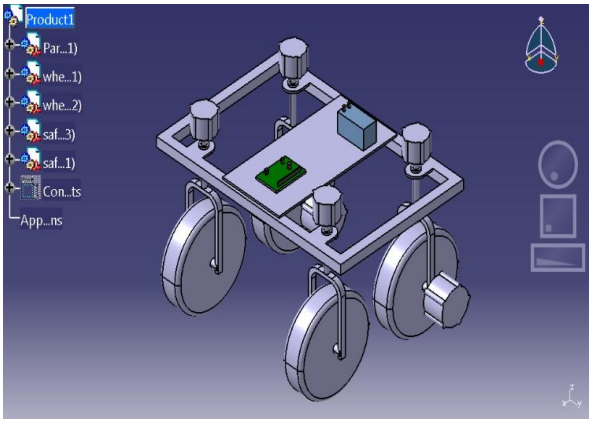
3.2 OUR PROPOSED PROTOTYPE:



Fugure 6 Catia Model

Figure 7 Actual Model

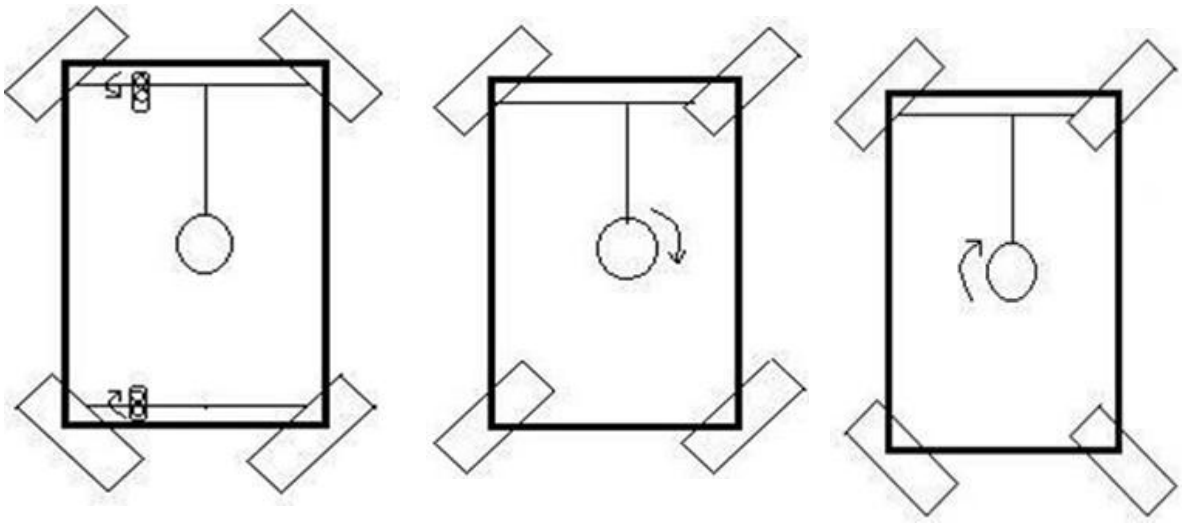
3.3WORKING: In this prototype,first vehicle is stopped & each wheel is turned at desired angle with motor.Motor are controlled by microcontroller(Arduino Uno).

DC motors are used in each wheel to provide forward and backward movement of this vehicle, also a battery is used to provide electrical energy of each DC motor. It has turning radius nearly equal to negligible of length of the vehicle itself.

Front Wheel are given drive by Motor due to which front tyres will rotate in forward & reverse direction.

When command is given from controller,due to microcontroller DC driver will cause motor to rotate in desired direction & so wheel will rotate.

For 360 turn in clockwise direction,wheels are rotated at desired angle,and left wheel roatates in front direction & right front wheel rotate in reverse direction



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3.4MOTOR CALCULATIONS

Specification and calculation:

- 60 rpm
- 12 V
- 18 W

Torque of motor: $\zeta = \frac{P \times 60}{2 \times 3.14 \times N} = \frac{18 \times 60}{2 \times 3.14 \times 60} = 2.866$ Nm = 2.866×10^3 N-mm

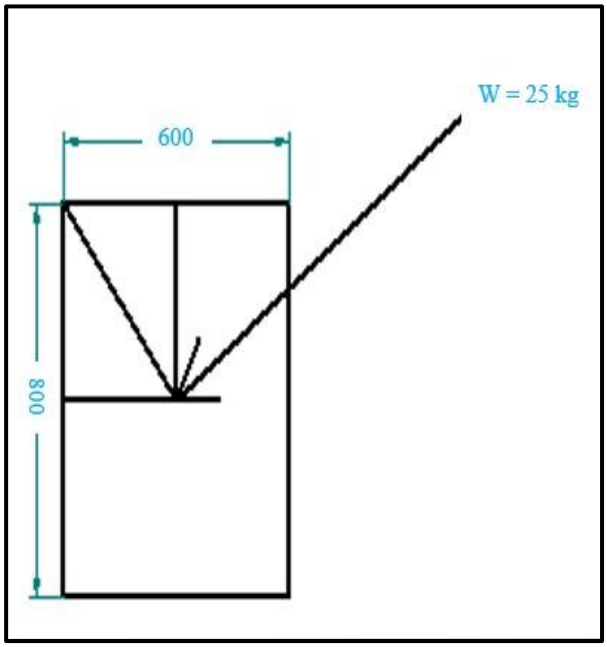
The motor shaft is made of MS and its allowable shear stress (F_d)= 42 MPa

Torque: $\zeta = \frac{3.14 \times F_d \times d^3}{16}$

$5.72 \times 10^3 = \frac{3.14 \times 42 \times d}{16}$

d = 7.031 mm

The standard nearest size diameter is 8mm



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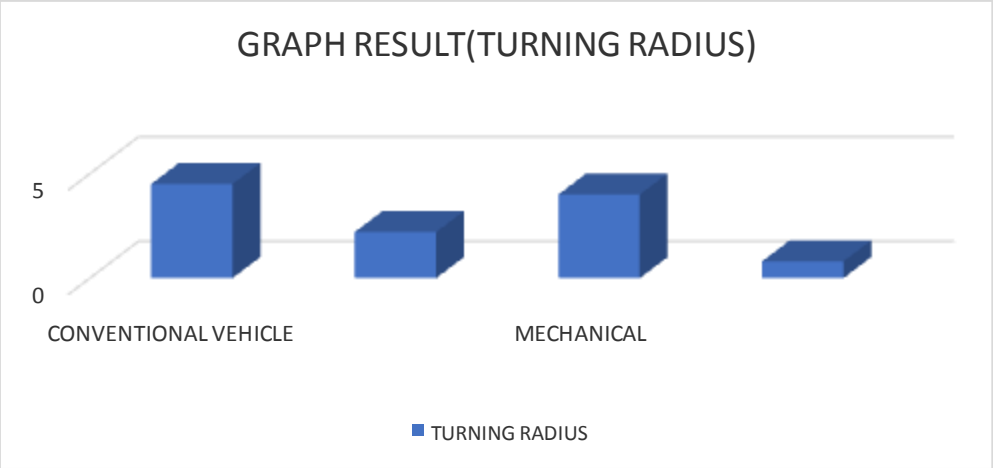
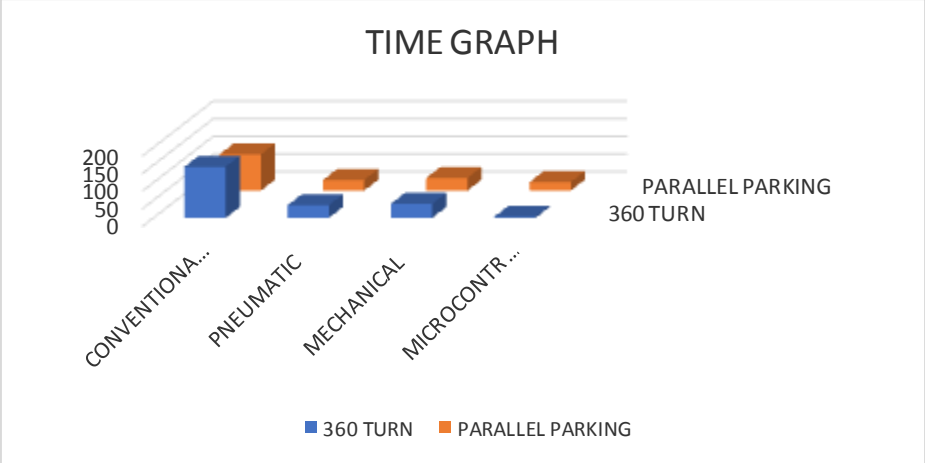
3.5OUR THEOROTICAL CALCULATIONS

CRITERIA	CONVENTIONAL VEHICLE	360 turn by Mechanical Method	ZERO TURN VEHICLE BY PNEUMATIC METHOD	360 TURN BY MICROCONTROLLER
TURNING RADIUS(m)	4.5	4	2.2	0.8
TIME REQ. FOR 0 TURN(SEC)	145	40	36	30
PARALLEL PARKING(SEC)	103	36	30	24





3.6ADVANTAGES

1) Eco Friendly

2) Less Noise Operation

3) Battery Operated thus No Fuel Required

4) Non Toxic And No Hazardous

5) Less Costly

6) Less Maintenance except battery requirement

7) More Efficient

8) Car Can Easily Park

3.7 APPLICATION

1) In Industries for automation of raw material like Automated Guided Vehicle

2) In Automobiles Application

3) In Big Industries For Transportation of Raw Material

4) To Park The Vehicle In Parallel Direction

5) Take easily U-Turn

IV.CONCLUSION

A low cost vehicle which work on microcontroller & DC motor has been made will rotate vehicle in 360.It will be helpful in many industries.Also Vehicle will be able to rotate in tight spaces easily & parallel parking & U-turn problem will be solved.

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