ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Vol 2, Issue 3, March 2017

Design and Development of Tilt Steering Mechanism with Lowered Centre of Gravity for Improved Turning Speed

[1] Sushant M. Patil [2] Uzer A. Sutar [3] Vaijinath G. Gadhave [4]Dhananjay B. Surve
[5]Rohit P. Phadatare [6]Sourabh S. Wasker
[1] Assistant Professor, [2][3][4][5][6] UG Student
[1][2][3][4][5][6]Department of Automobile Engineering,
Annasaheb Dange College of Engineering & Technology, Ashta. (India)

***Abstract:*-- Now a day'sRollover accidents are among the most dangerous type of vehicular crashes. They account for the highest fatality rate with more than 10,000 people killed every year in a rollover accident. Sport Utility Vehicles and light weight trucksare more susceptible to rolling over, because they have a higher center of gravity. In this paper the mechanism reports into the enhancements in vehicle dynamics by changing the height of centre of gravity by suitable methods. The main objective of the mechanism is to lower the height of centre of gravity during turning and thus enhancing the vehicle dynamics. Present day cars run at fast speeds and are getting faster day by day. As speed increases the threat to the lives of driver and passengers and other road pedestrian also increases. The major threats to human life are skidding and toppling. In this mechanism hybridizing of both the concepts i.e. turning and tilting at the same time has achieved. By altering the orientation of the front assembly,new mechanism designed which imparts entirely different orientation to the wheels while turning. Hence by changing the orientation it is able to tilt as well as turn the wheels extracting maximum benefits from this system which are being discussed in this paper. System modifies the steering mechanism of the vehicles. It has the unique ability to turn as well as tilt the front wheels simultaneously while synchronizing it with the tilting of the front wheels.**

***Keywords*-Steering Wheel, Tilt Steering mechanism, Speed, Center of Gravity, Stability, Rolling, Skidding.**

I. INTRODUCTION

In today's world the major threats to human life are skidding and toppling. To overcome this threats various mechanisms and electronic gadgets are used in present day vehicles which are as follows.1) Antiroll bars, 2) Antiskid Braking Systems, 3) Wider Tires, 4) Traction Control System,5) Electronic Stability Control. All these systems add to the complexity and weight of the cars and also reduce efficiency. The present invention will be of great importance for the assessment of vehicle dynamics at high speed turning conditions.In 2014, Nehal [1] proposed to study and Development of Electric Personal Transporter Based on Lean to Steer Mechanism for three wheel vehicle. In 2015, Khan

[2] studied design of Steering Mechanism for three wheel vehicles, based on leaning. In 2015, Balambica [3] was designed Pro-E model ofTilting Mechanism for a Four Wheeler with help of DC stepper motor.In 2006, Michael [4] was research the three wheeler vehicle with processor controlled tilting andsteering mechanism.This paper contains experimental set up or prototype of tilt steering mechanism for for wheel vehicle. Use of tilting steering mechanism as well as turning of front wheels has been considered to lower the centre of gravity and stability is increased at high speed turning.

II. EXPERIMENTAL SETUP

The system consists of four wheels, two in front and two in rear, as shown in figure. The rear wheel is the driving wheel. A tilting steering mechanism is used in the front axle. The drive for the vehicle is provided by a motor, which is mounted above the rear wheel. It consists of four helical coil springs in the front and rear. One batteries are used for the power supply. The battery arrangement is mounted on the rear side of the assembly.Chassis is a skeletal frame on which various mechanical parts like tires, axle assemblies, brakes, steering etc. are bolted. The material of frame is steel which are made of hollow pipe. Tilt steering mechanism fitted between front wheels. Lower wishbone and higher wishbone types has been used for tilting the front wheels. Independent suspension adopted for this mechanism.Coil spring has been used for each wheel. For high speed, the differential is necessary for giving a drive to vehicle but it increases the cost mechanism. So chain drive is used forthe mechanism developed. Use of one extra wheel for giving drive by using motor and battery.DPDT switch is

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Vol 2, Issue 3, March 2017

used for controlling the vehicle speed. The tilt steering mechanism basically performs the function of turning the front wheels either left or right as well as it tilts the front wheel at an angle up to 35 degree which helps to maintain the stability of vehicle during turning. The steering wheel is tilt approximately 15 cm to the left and right.Depending upon the direction of force applied on the steering wheel it is tilting the tire to left or right.

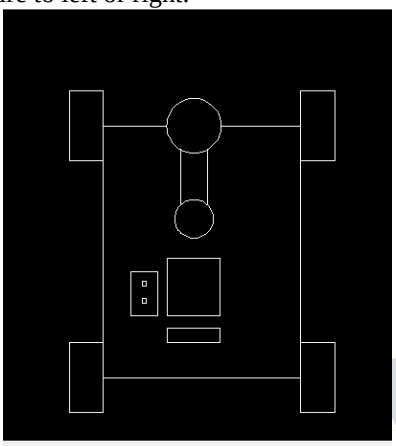

Figure 1: AUTO CAD Model of Experimental Setup

III. DESIGN OF SETUP

3.1 System Design

Following parameterswere focused in system design:-

3.1.1 System Selection Based on Physical Constraints

While selecting any machine it must be checked whether it is going to be used in a large-scale industry or a small-scale industry. Developed model is useful for the small-scale industry. So space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room.The mechanical design has direct norms with the system design. Hence the foremost job is to control the physical parameters, so that the distinctions obtained after mechanical design can be well fitted into that.

3.1.2 Arrangement of Various Components

Keeping into view the space restrictions the components should be laid such that their easy removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in component arrangements.

3.1.3 Components of System

As already stated the system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact. A compact system design gives a high weighted structure which is desired.

3.1.4 Man Machine Interaction

The friendliness of a machine with the operator that is operating is an important criteria of design. It is the application of anatomical & psychological principles to solve problems arising from Man – Machine relationship. Following are some of the topics included in this section.

- Design of foot lever
- Energy expenditure in foot & hand operation
- Lighting condition of machine.

3.1.5 Chances of Failure

The losses incurred by owner in case of any failure are important criteria of design. Factor of safety while doing mechanical design is kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

3.1.6 Servicing Facility

The layout of components should be such that easy servicing is possible. Especially those components which require frequents servicing can be easily disassembled.

3.1.7 Scope of Future Improvement

Arrangement should be provided to expand the scope of work in future. Such as to convert the machine motor operated; the system can be easily configured to required one. The die & punch can be changed if required for other shapes of notches etc.

3.1.8 Height of Machine from Ground

For ease and comfort of operator the height of machine should be properly decided so that he may not get tired during operation. The machine should be slightly higher than the middle level, also enough clearance should be provided from the ground for cleaning purpose.

3.1.9 Weight of Machine

The total weight depends upon the selection of material components as well as the dimension of components. A higher weighted machine is difficult in transportation & in case of major breakdown; it is difficult to take it to workshop because of more weight.

IV. RESULTS AND CONCLUSION

Track has been built to take trial of tilt steering mechanism. Track is of rectangular in shape to measure the

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Vol 2, Issue 3, March 2017

tilting angle of wheel and also measure a speed of vehicle at cornering. This trial is taken on smooth road condition for better results.Readings of angle of tilt and speed of vehicle with tilt steering mechanism and without tilt steeringmechanism has been noted.

Table 01:Reading of Experimental Setup

Sr. No.	Parameters	With tilt steering mechanism	Without tilt steering mechanism
1.	Tilting angle	30	12
2.	Speed of vehicle	90	60

From these measurementsit is concluded that the turning speed of vehicle with tilt steering mechanism is more than speed of vehicle without tilt steering mechanism. The Main advantages of project are lower center of gravity which enhances the vehicular dynamics drastically. Lower the centre of gravity lesser is the probability of roll over. e.g. formula-1 cars turn at fast speeds without toppling, as their centre of gravity is extremely low.The tilting of tires provides the necessary camber angle required while cornering to the vehicle hence further enhancing the vehicular dynamics. The combination of the lower center of gravity and camber angle enhances the stability of the system highly while cornering.The another advantage is reduction in fuel Consumption now execution turns at increased velocities without too much braking hence directly saving fuel which was being lost in earlier mechanisms due to undesired breaking at turns.

V. FUTURE SCOPE

In the future, the model will be modified to run on the solar system. The model will also implement into the actual vehicle.

VI. ACKNOWLEDGEMENT

The authors gratefully acknowledge the help and cooperation of Prof. R. A. Kanai, Executive Director, ADCET, Ashta, Dr. R. G. Desavale, Professor, RIT, Rajaramnagar and Dr. S. A. Patil, Professor and Head, Department of Automobile Engineering, ADCET, Ashta and Prof. V. R. Patil, ADCET, Ashta, Sangli, India, in carrying the design and actual readings.

REFERENCES

[1] Nehal Ahmad, Jawwad A.K. Lodhi, Nafees P. Khan, 2014,"Development of Electric Personal Transporter Based on Lean to Steer Mechanism", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), pp. 69-76.

[2] Dr V Balambica, ErVishwa Deepak, 2015, "Tilting Mechanism for a Four Wheeler",International Journal of Engineering Research, Volume No.4, Issue No.12, pp : 640-642

[3] Jawwad A.K. Lodhi, Nafees P. H. Khan, 2015, "Design of Steering Mechanism for vehicles, based on leaning", International Journal on Recent and Innovation Trends in Computing and Communication, Volume: 3 Issue: 2, pp. 022– 025.

[4] Arun Singh, Abhishek Kumar, Rajiv Chaudhary, R. C. Singh, 2014," Study of 4 Wheel Steering Systems to Reduce Turning Radius and Increase Stability", International Conference of Advance Research and Innovation (ICARI), pp. 96-102

[5] K. Singh, "Automobile Engineering Vol. 1, Standard Publishers Distributors, New Delhi, pp 220-231

[6] N.K. GIRI. , Automobile Mechanics.

[7] R. B. Gupta, "Automobile Engineering, Satya Prakashan", New Delhi, pp 33.18 - 33.24.