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AUTOMATIC TILTING VEHICLE

Borade A.B.*[1], Sandbhor P.D.[2], Temgire N.[3]& Mulani R.[4]
*[1]Mechanical Engineering, Jaihind Polytechnic, Kuran., India
[2]Mechanical Engineering, Jaihind Polytechnic, Kuran., India
[3]Mechanical Engineering, Jaihind Polytechnic, Kuran., India
[4]Mechanical Engineering, Jaihind Polytechnic, Kuran., India

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ABSTRACT

The use of an electrical narrow tilting car instead of a large gasoline car should dramatically decrease traffic congestion, pollution and parking problem. This is the reason why most car companies are producing narrow track electrical car prototypes. These narrow track cars have an increased rolling tendency.In our project work we have tried to develop a tilting mechanism for a narrow track car to give it the flexibility of a motor cycle.This feature enables the car to tilt in to the curve while negotiating it. Our analysis shows that to increase the maximum curve at speed by more than 50%. The detailed calculations are enclosed within. The method we have used is a simple mechanical tilting system controlled by a simple DC stepper motor which is controlled electronically.This tilting mechanism if successful should dramatically increase the maximum speed in curves. This should also provide the advantages of increased passenger comfort and handling.The idea is to develop a tilting car of narrow track that seats two people in tandem. This can be operated on reduced lanes thereby increasing the effective capacity of highways.

INTRODUCTION

Narrow track cars are without doubt the future of urban mobility. These cars have a very short wheel track in comparison to normal cars. Most of the international car companies have production models and prototype of narrow track cars. Some examples are Nissan Land Glider, Nissan Pivo, Honda 3R-C, etc. Such cars are mostly single seated or double seater with back to back seating configuration. These cars have several advantages:

1) Half the width means half the weight, more rigidity, more access to narrow roads, easier parking and much quicker transit times.
2) In an electric vehicle, the lighter weight of this much smaller vehicle will help to enhance torque power characteristics of an electric motor to achieve “linear acceleration”.
3) At highway cruising speeds, such cars will be using half the frontal area and half the drag co efficient, plus reduced running losses make for a very energy efficient vehicle. All these advantages make the narrow track vehicle as appealing as an alternative to the car.

Such cars combine the comfort of a car with the functionality of a motor bike. But these cars have a very important and dangerous drawback. With a very comparatively narrow track and heights almost equal to normal cars, these cars are very susceptible to rolling. As of now all such narrow track cars are electrically driven and have a limited top speed and hence this drawback is comparatively negligible. But sooner or later these cars will have to get highway cruising speeds. Then this drawback will be of grave importance.Our project took shape as an attempt to face this drawback. We thought so if the cars has the functionality of a motor cycle why not give it the flexibility of a motor cycle. This gave use to the idea of an auto-tilting car. There has been many tilting body designs in rail but what we have done is not just a body tilting, in it the car tilts as a whole. Recently there had been some development in making three- wheeled tilting cars like the carver, but only prototypes or concepts exist in the field of four-wheeled tilters.

MATERIALS AND METHODS

The objective of this project work is to successfully develop a design of a tilting mechanism for a narrow tilting car. The mechanism is to be reliable, simple, cost-effective and practically feasible. The aim of this tilting mechanism is to provide banking to the car on unbanked curves, so as to enable added threshold speed on curves in comparison to a narrow non-tilting car. This system is also supposed to enhance passenger comfort as the side force felt by passengers in a car taking a turn is comparatively less in a tilting car. Also in our purpose is the fabrication of a mini-prototype –a remote controlled toy car-to demonstrate the tilting in real world.

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The methodology adopted to use standard and presently used components in design rather than to design all components from ground up. The advantage of this method is that, you do not have to spend ridiculous amount and time in testing the integrity of each part as they have already proved their worth in real world applications.Initially the frame design was adopted from an already existing narrow car and minor changes were made to suite our purpose, the tilting mechanism first devised was based on using power screw driven by stepper motor lifting and lowering each wheel of the car. This mechanism was later dropped in testing phase due to following disadvantages.

1. It had a very large response time, this was not suitable for a car approaching curve at a very high speed.
2. Wear and tear of screw and contact nut bearing is too high to be satisfactorily used in a car.
3. The system used four high torque steppers, this along with controls could shoot up the cost of production.

Due to these disadvantages, the power screw design was dropped and a fully new design was defined. The prototype car also uses the same tilting mechanism setup.

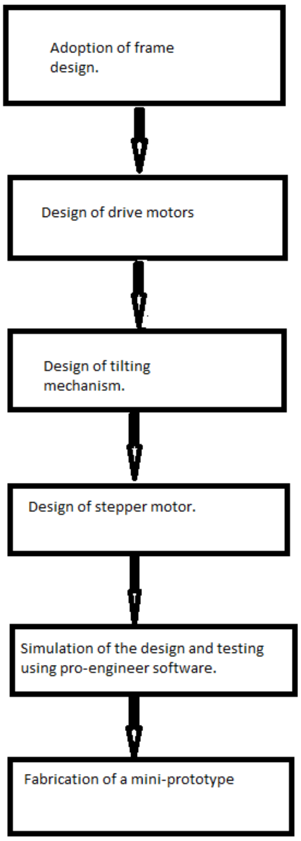

Fig 1 :Procedure For Project Following

Analysis

Creo Elements/Pro has numerous analysis tools available and covers thermal, static, dynamic and fatigue FEA analysis along with other tools all designed to help with the development of the product. These tools include human factors, manufacturing tolerance, mould flow and design optimization. The design optimization can be used at a geometry level to obtain the optimum design dimensions and in conjunction with the FEA analysis.

Manufacturing

By using the fundamental abilities of the software with regards to the single data source principle, it provides a rich set of tools in the manufacturing environment in the form of tooling design and simulated CNC machining and output.

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Tooling options cover specialty tools for molding, die-casting and progressive tooling design.

TABLES

Table 1: list of materials used.

MATERIAL
CAD Softwares
Lithium ion Battery
Stepper Motor

CONCLUSION

It can be seen from the above result that, our objective to increase the threshold velocity of a narrow car in a curve has been successful. The design of the car and tilting mechanism worked flawlessly in simulation as well. The mini-prototype to demonstrate tilting is also working successfully, all these facts point to the completion of our objective in high esteem.

ACKNOWLEDGEMENTS

1. The car design in itself is futuristic and can be soon find in some production versions of four-wheeled tilting cars.
2. A feature can be added to the existing suspension using a minor programming change, the system can also act as body leveler in transverse direction using the level sensor, this feature enables added gradability in sideward direction.

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