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Self-Balancing Two-Wheeler with Gyroscope

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Abstract: - *The bicycle's Environmental friendliness and light weight make it a good means transportation. A robot bicycle is, by nature, an unstable system whose inherit nonlinearity makes it difficult to control. This in turn, brings interesting challenges to control engineering community. Researchers have been exploring different mechatronic solutions for dynamically balancing and maneuvering robotbicycle. A self-balancing robot bicycle uses sensors to detect the roll angle of thebicycle and actuators to bring it into balance as needed, similar to an invertedpendulum. It is thus an unstable nonlinear system. A self-balancing robot bicycle can be implemented in several ways. In this work, we review these methods, and introduce our mechanism which involves a control moment gyro (CMG); an attitude control device typically used in spacecraftattitude control systems. A CMG consists of a spinning rotor and one or more motorized gimbals that tilt the rotor's angular momentum. As the rotor tilts, the changing angular momentum causes gyroscopic precession torque that balances the bicycle.*

Keyword: **-** Gyroscope, Gyro bike, CMG, etc.

I. INTRODUCTION

The bicycle's Environmental friendliness and light weight make it a good means transportation. A robot bicycle is, by nature, an unstable system whose inherit nonlinearity makes it difficult to control. This in turn, brings interesting challenges to control engineering community. Researchers have been exploring different mechatronic solutions for dynamically balancing and maneuvering robotbicycle.

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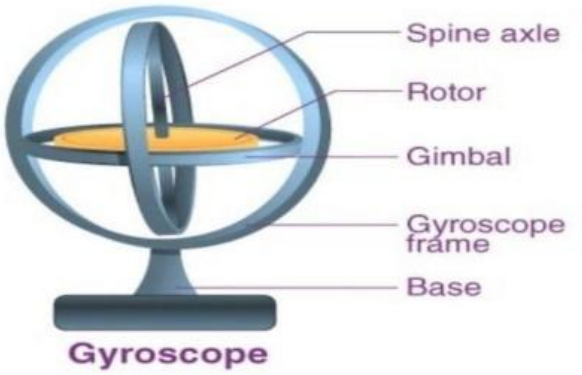
A self-balancing robot bicycle can be implemented in several ways. In this work, we review these methods, and introduce our mechanism which involves a control moment gyro (CMG); an attitude control device typically used in spacecraft attitude control systems. A CMG consists of a spinning rotor and one or more motorized gimbals that tilt the rotor's angular momentum. As the rotor tilts, the changing angular momentum causes gyroscopic precession torque that balances bicycles.

GYROSCOPE: The device has a spinning disc that is mounted on the base such that it can move freely in more than one direction so that the orientation is maintained irrespective of the movement in the base.



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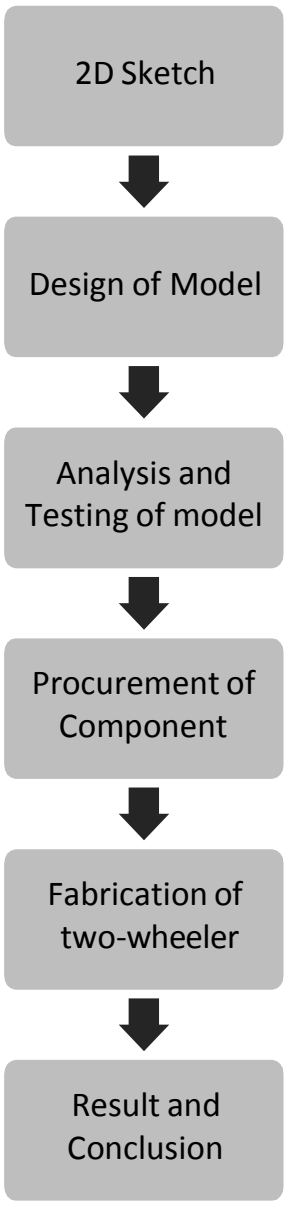
II. METHODOLOGY

Methodology & steps to solve the problem:



2D model sketch is made according to the dimensions. The design was subjected to analysis and defects were scrutinized. Different stresses acting on the components were found out. Accordingly, the components required for the model isbought and tested. The base was made from the wooden plank and slots were cut toaccommodate the wheels.

According to the 3D model wheels were attached at the front and rear ends onthe slots made with the help of screw and bolt. They are arranged in such a way toenable free forward and backward motion.

Suitable mild steel frame is tooled, by measuring the distance between two supporting frames. The assembly of the frame is done by combining the mild steel to which the main driving motor and flywheel is fixed, which has free axis of rotation and allows precession.

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A 12v DC battery is connected to both the motor bythe aid of connecting wires and was mounted on the base frame. The voltage regulator which is connected between the battery and the motor ismonitored and the rpms were calculated. The gyroscope two-wheeler was fabricatedand tested for stability.

III. Problem Statement

Now a day, if person have to commute from one place to another, he has to use bike or a car. Those who commute with car don't need effort for self-balancing of vehicle but in case of bikes balancing is very important particularly at low speed. So,to overcome this drawback of balancing self-stability of two-wheeler is achieve by gyroscopic effect.

Aim:

- To develop a simplest, safe & efficient Self stabilizing two-wheeler.
- To reduce the cost & weight of the system.

IV. Objective

The two-wheel vehicles during operation face the issue of balancing especially with untrained rider. Lot of time and fuel could be wasted by learners of the two- wheel vehicle in balancing of the vehicle during training period. So, the main objective of this work is to design and develop a self-balancing electric two-wheel vehicle which can balance itself with or without rider even vehicle may be in motionor stationery. The controller has two different objectives: to sense the velocity of vehicle in order to operate the actuator for manipulation of rake angle and other is theangle sensor to manipulate the steering angle with respect to vertical. The simultaneous adjustment of these two sensors will maintain the motorcycle stable. The actual set up will be experimented further aiming to balance the vehicle indifferent condition of loads.

V. Conclusion

This gyroscopic effect is commonly used in air or sea structures such as aircraft and cars,whereby the vehicle is often disturbed by external upsetting couple. Therefore, it is important to neutralize the influence of external disrupting couples for the safety of these cars, which canalso be achieved by adding equivalent and opposite couples.

The gyroscopic couple effect in the two-wheeler can be achieved in any rugged environment independent of any external factors. The design is derived in such a way that this principle can be used and seen in real life including some exceptions which include conditionalfactors. This refers to the life span of the material used to design the component and the method of manufacturing.

In modern times where additive manufacturing is used for manufacturing precision components, the same method can also be used for manufacturing the later. To increase the efficiency of the entire two-wheeler system lightweight materials are used which can also be used to increase the mobility. This technique adopted in a two-wheeler can help physically challenged people drive conveniently and when used in heavy duty vehicles this system can beeasily used to check the stability of the vehicle every now and then using a control system. Thegyroscopic systems which are regularly utilized as a part of planes and ships principally for adjustment reason can be adequately utilized for self -adjustment of a two wheeled vehicle in an airplane the main (central) control system.

The idea with cutting edge hardware is additionally advanced to improvement of an idea auto by an engine that balances out as well as self-adjusts regardless of whether the outer force(s) is connected. Although it has certain disturbances it can be effectively introduced in a wide range of bicycles. This undertaking is socially essential venture which is made by considering numerous valuable lives which can be saved and will be open for all monetary territory individuals and solid techniques. When the gyroscopic device is controlled entirely bya control system, automation can be achieved. As a whole this technique helps us to build a balanced platform, which can be used for various applications.

References

[1] D. Herlihy, Bicycle: The History, New Haven, CT: Yale Univ.Press,2004, Proceeding International Cycling Hostory Conference, Freehold, NJ,July 29 Aug 1,2009.

[2] K. Astrom, R. Klein, and A. Lennartsson, "Bicycle dynamics and control," IEEE Control Syst. Mag., vol. 25, no. 4, pp. 26–47,2005.

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[3] V. Cerone, D. Andreo, M. Larsson, D. Regruto, "Stabilization of aRiderless Bicycle A Linear-Parameter-Varying Approach," IEEE Control Syst. Mag., vol. 30, no. 5 pp. 23– 32, 2010.
[4] H. Kurokawa, "A Geometric Study of Single Gimbal Control MomentGyros." Agency of Industrial Technology and Science, Ministry of International Trade and Industry, Japan, Report of Mechanical Engineering Laboratory,1997.
[5] K. Yamafuji, "Useful Robots and Hopeful Robots", Fuji TechnologyPress, 2011.
[6] Girouart, B., Sebbag, I., and Lachiver, J., "Performance of the Pleiadee-HR Agile Attitude Control System," Proceedings of ESA International Conference on Spacecraft Guidance, Navigation and Control Systems, ESA, Noordwijk, The Netherlands, 2002, pp.497-500.
[7] Beznos AV, Formalsky AM, Gurfinkel EV, Jicharev DN, Lensky AV,Savitsky K V, et al. "Control of autonomous motion of two-wheel bicycle with gyroscopic stabilization." In: Proceedings of the IEEE international conference on robotics and automation, 1998, p.2670-5.
[8] Lee S, Ham W. "Self-stabilizing strategy in tracking control of unmanned electric bicycle with mass balance." IEEE internationalconference on intelligent robots and systems, 2002, p.2200-5.
[9] Tanaka Y, Murakami T. "Self-Sustaining Bicycle Robot with Steering Controller," Proceedings of international workshop on advanced motioncontrol, 2004, p. 193-197.
[10] M. Romano, B. N. Agrawal, "Attitude Dynamics/Control of Dual-BodySpacecraft with Variable-Speed Control Moment Gyros," Journal of Guidance, Control and Dynamics, vol. 27, no. 4, pp. 513-525,2004.
[11] Conference articles: I. Puente, H. Gonzalez-Jorge, P. Arios, J. Armesto,lan-Based Mobile Laser Scanning System, a review. International Society for Photogrammetry and Remote Sensing (ISPRS) Workshop for Laser Scanning, 2011.