

SELF BALANCING TECHNOLOGY FOR TWO-WHEELERS

ANANDAKRISHNAN N¹

¹B-Tech (student), Automobile Engineering, SCMS School of Engineering & Technology, Karukutty, Kerala, India

Abstract *Motorcycle dynamics is the physics of the movement of bicycles and bikes and their additives, due to the forces performing on them. Dynamics is a branch of classical mechanics, which in flip is a branch of physics. Bike motions of hobby encompass balancing, steering, braking, accelerating, suspension activation, and vibration. The look at those motions began in the late nineteenth century and continues these days. This paper could be in particular centered on the diverse strategies and technologies. This paper will be targeted on various strategies and technologies to self-stability motorcycles.*

Key Words: Gyroscope, Gyro wheel, PID, CMG, Flywheel

1. INTRODUCTION

Two-wheeler automobiles are one of the maximum growing transportation and journeying systems within the entire extensive international. But balancing of -wheelers has been the hassle as it regards to drivers protection and its balance beneath specific variable conditions consisting of acceleration, the angle of tilt of automobile, street conditions, the direction of curvature. This trouble of balancing is solved utilizing the usage of the gyroscopic effect. The gyroscopic effect occurs in a spinning wheel or disc wherein the axis of rotation is loose to anticipate any orientation via itself. When rotating, the orientation of this axis is unaffected using tilting or rotation of the mounting, consistent with the conservation of angular momentum. Due to this, gyroscopes are used for measuring or keeping orientation. The reactive couple to which the disc is subjected while the axis of spin rotates about the axis of precession is called a gyroscopic couple. The reactive gyroscopic couple enables stability of the car in opposition to the outside demanding couple. This phenomenon is used in airplanes, naval ships for steering, pitching & rolling. Self-balancing may be one of the destiny technologies advanced for the transportation machine. Self-balancing is widely classified into kinds, lively balancing, and passive balancing, energetic balancing is incorporated within the system through the use of extra helping wheels or counterweights to have a center of mass of lying on those weights. At the same time as passive balancing is completed by the usage of a gyroscope to produce a reactive gyroscopic couple. As a long way as wheelers are considered it involves quite a few protection and risk elements concerned. Many types of research are being achieved which will lessen the effect on the rider for the duration of a twist of fate. So, this a must technology for the future because the accident rates are growing every day, so this era will help to lessen the number of deaths due to two-wheeler accidents. In a observe finished by using the ministry of avenue shipping and highways they

have determined that the maximum variety of twist of fate deaths occurs within the age organization 18-35 and bikes are greater preferable modes of transport by way of this age organization and some other study shows that most people of deaths become caused by wheelers.

2. METHODS OF SELF BALANCING

2.1 SELF BALANCING USING FLYWHEEL

This system is designed to construct a two that inline-wheel motorbike prototype able to balancing itself using a reaction wheel. This motorcycle is capable of pressure and additionally comes to a complete stop without losing its balance. To maintain balancing, it reads sensor input to come across tilt angle and efficiently reacts to keep a constant vertical function. Sensor records are fed right into a manipulate system which outputs a balancing torque to a motor spinning the response wheel. The requirements consist of that the motorbike should be capable of accelerating, using in a straight line, and stopping without falling. Gyroscope & accelerometer are hired on this system to examine the motorcycle's tilt angle and its motion dynamics. They're fed via a complementary clear out to lessen noise and a proportional integral derivative (PID) controller is used to acquire modulated manipulate. The flywheel design has several benefits. This layout may be very solid; the bicycle can balance even in a stationary position. The mathematical version of this device isn't complex. Because of the relative math simplicity and the ease of starting and preventing, the controller would be enormously honest to put in force. This design would additionally permit the bike to journey in a rather instant line with the best small deviations. One of the principal dangers of this layout is that it does now not probable allow easy steering, especially for better speeds, thinking that the PID profits might be optimized for directly-line travel. Additionally, the body might be altered, inflicting the layout to appear much less like a motorbike than others.

2.2 SELF BALANCING USING GYRO WHEEL

The gyro wheel has a gyroscope inner. Gyroscopes are spinning wheels that showcase unique assets referred to as precession. Whilst pressure is placed at the pinnacle of a spinning wheel (inclusive of a rider falling on a bicycle), instead of falling, the gyroscope turns, or procedures, inside the course of the fall. This happens on ordinary bike wheels while the motorcycle is traveling at better speeds. Therefore, it is less difficult to trip after gaining momentum. Gyro wheel takes gain of these belongings even when the motorbike is

moving slowly. The disk inside the gyro wheel spins independently of the bike wheel. As a result, even when a rider is transferring very slowly at the bicycle, the precession of the gyro wheel is still felt. If the rider starts to evolve to fall, the gyro wheel precesses below the rider's weight, restabilizing the motorcycle. All gyros are just a tool in which something has a few rotational motions, and which generates a measurable signal while an external torque is carried out to it.

2.3.SELF BALANCING USING CONTROL MOMENT GYRO

Manipulate second gyro (CMG) consists of a spinning rotor with large, consistent angular momentum, however whose angular momentum vector course can be changed with recognition to bicycle via rotating the spinning rotor. The balancing is executed via the usage of CMG, a PID controller for feedback, and an imu sensor to stumble on roll attitude. The spinning rotor is established on a gimbal, and making use of torque to the gimbal consequences in a precessional, gyroscopic response torque orthogonal to each rotor spin and gimbal axes. The CMG is a torque amplification tool due to the fact small gimbal torque input produces large manipulate torque at the motorcycle. An imu sensor might come across the roll perspective. This roll fact is feed to an onboard controller which in turn will command the CMG's gimbal motor to rotate such that a gyroscopic precession torque is produced to stability the bicycle to an upright role. The machine makes use of an unmarried gimbal CMG and generated the best one-axis torque. The advantage of such a system is that it's far capable of producing a big amount of torque and has no ground reaction forces. The drawback is that such a device consumes more strength and is heavier.

3. ERROR REDUCTION IN SELF BALANCING

Errors reduction in self-balancing motorcycles is especially accomplished by submitting algorithm estimation. The automatic self-balancing bike makes use of an accelerometer and gyro sensor to govern its flywheel route and velocity. They're integrated with a complementary Kalman filter out for remarks management. In this new approach via which the mistake of two self-balancing bike sensors can be decreased and it avoids the use of traditional Kalman filter out which can't meet real-time modulation. A correction set of rules can come out actual-time motorcycle posture inside the right manner consistent with the traits of navigation sensor error from the generation of nonlinear least-squares error version based at the method dynamic regulator. By way of computer simulation, an error through the gyro and accelerometer can be corrected. Kalman filter out fused the facts of gyroscope and accelerometer version and errors of the sensors pose estimation can be corrected. The mathematical derivation of dynamic regulator shows that this method of decreasing posture estimation error is viable and powerful, and may gain better correct estimates inexpensively. Dynamic filter estimates the nation of the system and dimension noise and remarks. The comments

control presents an efficient recursive technique to solve the minimum mean square by using the remarks correction of foremost estimation of nonlinear top-quality estimation of the very last kingdom vector. The principle concept of inertial sensor records fusion is using gyroscopes and accelerometers' unique error characteristic records collected on the way to correct their errors. The most useful estimation of the two-robot pose is obtained via the dynamic regulator and gyro bias calibration, automated tracking deviation.

4. CONCLUSIONS

Stabilization of a wheeled automobile performs a primary position inside the complicated transportation machine around the globe. Of all of the above methods defined above, gyroscopic stabilization appears to be price powerful & smooth to put in four-wheelers. However, the addition of a gyroscope will increase the weight of the device & it does not permit clean steerage. In addition, the gyroscope and accelerometer require a more subtle included system to gain proper management. On any other facet, balancing without using gyroscope seems to have more design balance & it additionally lets in to smooth guidance and controls, therefore in near future, this such machine can show to be more powerful than balancing by way of the use of gyroscopic impact. The numerous self-balancing techniques based on diverse ideologies along with keeping the center of gravity, executed via controlling falling perspective balancing two-wheeled automobiles is a tremendous hard assignment consequently it needs a lot to revel in and it's far proper balanced via retaining centers of gravity in movement and rest kingdom with the aid of growing one of a kind methods. Thinking about the future, the latest studies have shown that the demand for two-wheelers is increasing every day and those also choose to shop for wheelers with more era as properly.

REFERENCES

- [1] PROTOTYPE OF SELF-BALANCING TWO WHEELER Rishikesh Patil¹, Kunal Satalkar², Vivek Shirsath³, Vineet Singh⁴, Ass. Prof. Avani Karyakarte⁵ Department of Mechanical Engineering, Genba Sopanrao Moze College of Engineering Balewadi, Pune (India)
- [2] Design and Fabrication of Self Balancing Two Wheeler Vehicle Using Gyroscope Pallav Gogoi^{#1}, Manish Nath^{#2}, Bumi Trueman Doley^{#3}, Abhijit Boruah^{#4}, Hirok Jan Barman^{#5} # Department of Mechanical Engineering, (School Of Technology) Assam Don Bosco University, Azara Campus, Airport Road, Azara, Guwahati – 781 017
- [3] A Review on Various Self-Balancing Methods Anandu V, Ajith R, Asif Ali, Karthik Surendran, Department of Mechanical Engineering, Heera College of Engineering and Technology Trivandrum, India Jijo G Kumar

Assistant professor Department of Mechanical Engineering, Heera College of Engineering and Technology Trivandrum, India

- [4] Sandeep Kumar Gupta, Veena Gulhane, "Pose Estimation Algorithm Implication for Bicycle using Gyroscope & Accelerometer: Design Approach", International Journal of Scientific and Research publications, Volume 4, Issue 2, February 2014

- [5] Mukesh Kumar Prasad, Nilesh W. Nirwan, "Design and Fabrication of Automatic Balancing Cycle", International Journal of Science, Engineering and Technology Research (IJSETR), Volume 5, Issue 2, February 2016.