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Survey on Self Balancing Two Wheel Electric Prototype

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Abstract— Two wheeler vehicles are the essential part of transportation, bicycle, bikes and other vehicles are everywhere and we can say that they are one of the important parts of human needs. The transportation vehicles that are made today haven't changed from many years, means they constantly needs a rider to ride it or to balance it. Balancing a two wheel vehicle is a hard task as compare to the four wheel vehicle (cars). There are lots of innovations ongoing in the field of transportation as cars become electric, smart and safe, but at same time they are expensive too and not everyone can afford it. In other hand two wheeler bikes are cheap and most efficient way of transportation but because of lack of innovation they still need rider(human) to balance it, which means motorcycle constantly need human balance and ride it. Apart from that any transportation vehicle needed lots of fossil fuel which after burned emits carbon and it is harmful for our environment and causes pollution. Also balancing a bike on two-wheel without human interaction can achieve with the help of principle of gyroscope. Gyroscope is use everywhere from balancing large ship to space shuttle, the application of gyroscope is vast. So in this paper we can understand the mechanism for constructing Inline two-wheel electric bike which can balance itself with the help of gyroscope and how we can made our transportation safer than ever and prevent accident, all by using the self balancing electric bike.

Keywords— Gyroscope, Accelerometer, Automatic Balancing Bike, Pollution, Transportation, Electric bike, Environment.

INTRODUCTION

The deployment of electric vehicles in vast quantity can viewed as a carbon free transportation sector. As because of pollution the environment is also getting weaker and hence the quality of life also affect dramatically. The majority of the carbon emission is due to the fossil fuel vehicles. There is so much innovation when it comes to the four or three wheeler market, as most of the cars are now electric and come with lots of different feature when it comes to the human safety. In the other hand because of lack of innovation in manufacturing of the two wheel motorcycle we are still lacking behind when it come to rider safety. The solution here is making a bike which can balance itself using the principle of gyroscope so that the rider not have to worry about falling because of lack of balance over the bike. The idea here is to make a bike which can balance itself without human interaction. As the bike is balance itself with the help of gyroscope and some other sensors, it is also safe for the people which have certain disability.

From the couple of decades human tries to balance a two wheel vehicles itself with the help of gyroscope or using the principle of inverted pendulum. In 1903, Louis Grennan was first to patent a gyroscopic balancing vehicle. The vehicle was monorail but the project fails because of unstable behavior of gyrostats. The most famous self balancing vehicle in the market right now is Segway which is good for short distance travel but it also need human interaction to balance it and apart from balancing Segway is not close to the traditional bike that we use today for transportation as it only carry one human at a time and for very short distance.

Our system will consist of gyroscope and accelerometer and some other sensors capable of measuring the current angle of the vehicle and adjusts the rotation of the gyroscope according to the balance of vehicle. It is simply a two wheeled vehicle which balance itself even in its initial position. This project attracts so much to the field of control engineering. This project almost cover the modelling of bike, research in the field of electronics for controlling the system, also researching about suitable control system for the vehicle and implementation of the bike. The aim of this project is to balance a bike on two wheels and control it with android phone for steering and moving. Using simple commands this prototype model of self balancing bike can move forward and backward according to user.

DESCRIPTION OF THE SYSTEM:-

Main components that are use in proposed system are mainly divided into following section:

- Gyroscope
- 3-axis Accelerometer
- PID controller for logic processing

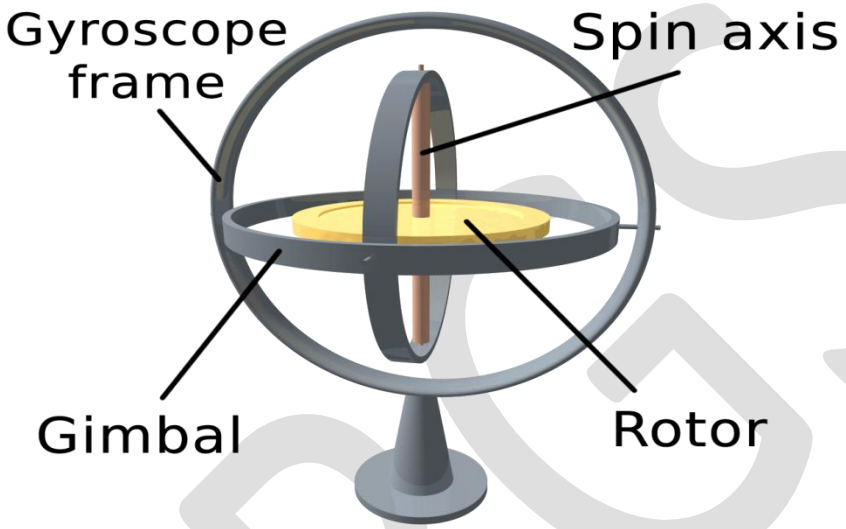

Figure 1: Gyroscope

Figure 1 shows a picture of gyroscope, there is wheel mounted on Gimbal there are three Gimble which support the rotation of the flywheel about a single axis. Accelerometer is use to measure acceleration force. PID controller is use to control the regulation of the speed.

LITERATURE REVIEW

The bike which can balance itself is very popular project in robotics and engineering. There is lot of work going on about balancing bike and some are already done and a lot of work still need to done. The following section is our literature review on this particular topic.

In 1903, an Irish-Australian inventor Louis Grennan was first to patent a gyroscopic balancing vehicle. Brennan patented a monorail which can gyroscopically balance, he designed it for military use, Louise Grennan successfully demonstrated the apparatus in 1909. He mounted gyrostats (modified gyroscope) along the body of the monorail, by using gyrostats monorail balanced itself whenever its equilibrium was disturbed. But if gyrostats would fail in use, the whole system would fail. Thus because of Brennan feared of failure he prevented the monorail from being mass-produced [1].

In 1912, Russian inventor Dr.Pyotr Shilovsky in collaboration with Louis Grennan developed and designed a two wheel car with gyroscope sitting in the middle of the body of car for maintaining stabilizing force. The car us 20 horsepower Wolseley engine which running the flywheel as well as a rear drive wheel [2][3].

Nbot is small scale robot which is built by David P Anderson. This robot won the one of the NASA competition in the year 2003. It uses the inertial sensor which is commercially available to balance the robot.

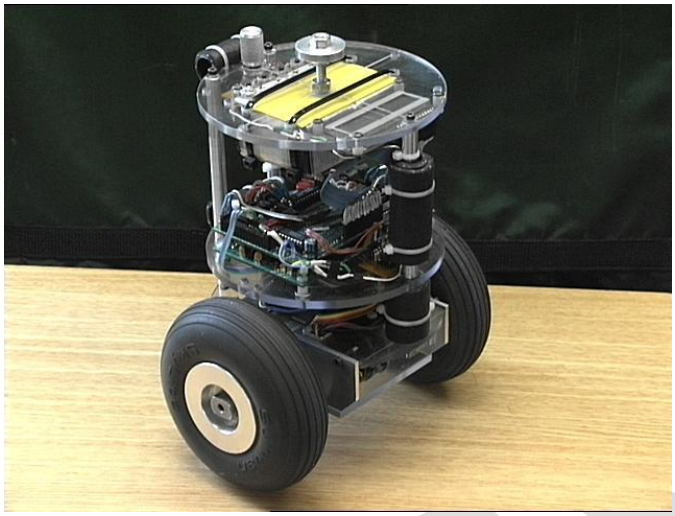

Figure 2: Nbot Robot [3]

Nbot uses almost four sensors to maintain its balance this sensors are optical encoder to measure the position of the vehicle and other three sensors are accelerometer, gyroscope and tilt angle sensors [4].

The self balancing and two wheel robot SEGWAY HT is commercially available and it is invented by Dean Kamen who has design more than 140 systems. It is manufactured by SEGWAY Inc. The feature of this robot is that it is able to balance itself and the user can standing on top of it and navigate the vehicle according to him. However, this uses more than one gyroscope and a few other sensors to keep it balanced vertically. Ginger is alternate name for SEGWAY before it commercially available [5].

The more innovative approach to construct a balancing robot was used by Steven Hassenplug. He developed a balancing system the chassis of the body of system is constructed by using the LEGO Mindstorms robotics kit. The balancing method of controlling the system is very unique with two Electro-Optical Proximity Detector sensors is used to provide the tilt angle information for the controller. This system of Steven Hassenplug omits the conventional use of gyroscope that has been used by previous robot researchers.

The group from Columbia University developed a modern version of Brennan's monorail. But unfortunately, the group was not able to create a working prototype. The main problem was the electronic component of the model continuously overheated during testing, causing the motor to malfunction [6].

In CES (Consumer Electronics Show) 2017 Honda unveiled the 'Riding Assist' technology which is the best example and working model of self balancing bike. Honda Riding Assist technology allows motorcycle to maintaining balance in slow speed. The bike doesn't use gyroscope for balancing because according to Honda it increase the weight of the bike.

TECHNICAL CHARACTERISTICS OF PROPOSED BALANCING BIKE

The balancing bike has a battery which can be rechargeable and provide enough power to rotate flywheel as well as drive motor. The bike is heavier than a conventional bike because of the use of gyroscope in it and environmental friendly to other motorized transportation modes. [7].

1) Purpose	To prevent rider from falling during accident, To keep bike balance itself, for transportation.
2) Motor : Type	Engine Type- hub motor, brush and brushless motor.

3) Battery: Type	Type- Lithium polymer rechargeable battery Voltage- 12V
4) Other	Gyroscope, accelerometer, Aurdino chip and other necessary sensors

Table 1: Generic description of balancing bike

The bike can be operate with the help of android application for moving forward as well as backward and also for steering the bike left or right. It can have a Bluetooth receiver which receives all the command made from the android application. The brain of this bike will be the Aurdino chip which can be highly customizable.

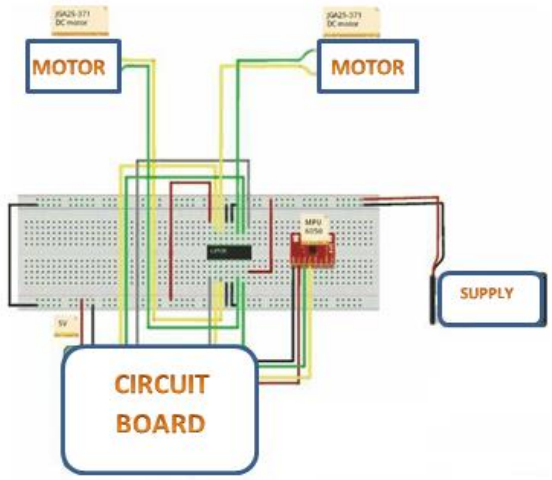

Figure 3: Control System Circuit Diagram

The above shown Circuit diagram consists of two switches used for controlling the working of commercially available Segway. The switch is called engage switch and all series get power from the constant power supply of the 12V battery. The Circuit board is programmable to control the steering of the Segway and control the speed of the device.

EXISTING SYSTEM

Numerous projects are still going on in the field of automobile like electric bike and self balancing bike and some are already done. We have studied some of the previous work in this filed and we find that a lot of self balance vehicles use different types of gyroscope and various types of sensor to maintain their balance and almost most of them are electric vehicles. The great example is SEGWAY HT, the commercially available product which uses two parallel wheels instead of two-in-line wheel for maintaining balance and it constantly need human to maintain its balance. Segway is best for personal use but not suitable for every one as it is expensive and only carries one person at a time.

So it is clear that two wheel motorcycle use today are not advance and from many years instead of its design nothing revolutionary change, they still use the same traditional petrol engine and are not capable of maintaining their balance. Vehicles that are use today are responsible for the carbon emission and hence it causes pollution. There are some electric bikes available in transportation sector but they are not self balanced and advance. Also bikes available today are not capable of maintaining its balance when rider moves its hands from steering wheel or from handle. These are the some things that lead us to the making of self balancing bike.

FUTURE WORK

The proposed system can be more useful in future when there is high demand for electric vehicles because of the lack of fossil fuel. It can be the best transportation option as we are looking forward to build actual bike using this principle. We can also use some advance algorithm which are capable of reading the data from the bike and its surrounding to move itself without human interaction. In future this work can be done.

CONCLUSION

This paper presents the results of an exploratory survey on a market for electric self balance bike. This research work demonstrates the remarkable use of the balancing bike for the people whose concern is safety first and people with certain disability. Research also quantifies the market for electric bike in the transportation sector as compare to the conventional vehicles. It clear from our research that there must be cheap and alternative way for transportation in urban as well as rural area which is advance and comparatively cheap than current conventional vehicles.

REFERENCES:

[1] Brennan, L. (1905) U.S. Patent No. 796, 893. Washington, D.C.: U.S. Patent and Trademark Office.

[2] *The New York Times*, "How New Gyro Car Worked In London,"May-17-1914,[Online]. Available: https://en.wikipedia.org/wiki/Gyrocar

[3]*Chapman, Giles (2009). "Schilovski Gyrocar". The Illustrated encyclopedia of extraordinary automobiles. New York, USA: Dorling Kindersley Limited. p. 37.* ISBN 978-0-7566-4980-7.

[4] Anderson, D.P, 'Nbot, a two wheel balancing robot' [Online]. Available: http://www.geology.smu.edu/~dpa-www/robo/nbot

[5] Moore, Bill, "EV World's first test drive of the Segway personal mobility machine", Jul. 24, 2002 [Online]. Available: http://www.evworld.com/databases/storybuilder.cfm?storyid=358

[6] Carter, De Rubis, Guiterrez, Schoellig, Stolar. "Gyroscopically Balanced Monorail System Final Report" (2005) Columbia University.

[7] Fyhri, A., Fearnley, N., "Effects of e-bikes on bicycle use and mode share," Transp. Res. Part D, vol. 36, pp. 45–52, 2015.

[8] Ray Jarvis ''Do-it-Yourself Segway Mobile Robot Platform''ARC Centre for Perceptive and Intelligent Machines in Complex Environments: *Intelligent Robotics Monash University, 2005.*

[9] C.H. Ross, J. C. Hung, "Stabilization of an Unmanned Bicycle," *Proc. IEEE Region III Convention, 1968, pp. 17.4.1-17.4.8.*

[10]Nguyen Gia Minh Thao et al.A PID Backsteeping Controller For Two- Wheeled Self-Balancing Robot, *IEEE IFOST Proceedings, 2012.*

[11] Baptista, P., Pina, A., Duarte, G., Rolim, C., Pereira, G., Silva, C., Farias, T., "From on-road trial evaluation of electric and conventional bicycles to comparison with other urban transport modes : Case study in the city of Lisbon, Portugal," Energy Convers. Manag., vol. 92, pp. 10–18, 2015. [

[12] Yongjun Hou, Greg R.Luecke, October 5-8 2003, 'Control of the Tight Rope Balancing Robot', Proceedings of the 2003 IEEE International Symposium on Intelligent Control,Houston, Texas, Pg(s): 896-901.