International Journal of Innovative Research in Science and Engineering
Vol. No.3, Issue 04, April 2017
www.ijirse.com
ISSN (O) 2454-9665
ISSN (P) 2454-0663

PROTOTYPE OF SELF-BALANCING TWO WHEELER

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ABSTRACT

The project focuses on the concept of developing a two wheeler bike & it's validation with the help of a prototype. The project deals with an experiment carried out to produce gyroscopic effect on the prototype. The prototype is a two wheel vehicle in which rotating discs imparted act as gyroscope to produce a counter balancing force i.e. gyroscopic effect when the vehicle prototype looses balance on either sides. Thus the vehicle stabilizes itself. Wherein even if an external force is applied to the system the gyro sensors deployed in it sense the force and develop a force of similar magnitude but in opposite direction due to presence of two gyroscopes used in the vehicle, thus the vehicle does not loose it's balance even if the external force is applied to it.

Keywords: Gyroscopes, Gyroscopic Effect.

I. INTRODUCTION

Motorbike is a very popular transport around the globe. It has been very popular due to its energy efficiency, compact design, convenience and attractive look. Many youngsters consider it as fashionable ride while people in the developing country often use it as a low priced vehicle with better fuel efficiency.

However, despite of the features and popularity motorbike has lack of safety and is very risky. Therefore, motorbike accidents are fatal. An injury is must while death is more frequent scenario.

The major lacking in motorbike addressing the safety features are the passenger's body is exposed during ride time which allows the passengers to get off the vehicle and exposes him to impact with roadside elements and the chance of damage is limitless.

On the other hand many people does not consider it as a transport as it does not have the comfort features like the car while two wheel vehicle can save energy and space.

We designed a vehicle which can minimize the damage during an impact. We all are familiar with the balancing of two wheeler. Little consideration shows that balancing of bike is done by two key factors:

1. Mass distribution (center of gravity).

2. One direction motion.

So to overcome this drawback of balancing self-stability of two wheeler is achieve by gyroscopic effect. The gyroscopic effect is widely used in air or sea vehicles such as air planes and ships; where in always external disturbing couple is acting on the vehicle. Thus, for the stability of such vehicles it is essential to neutralize the effect of external disturbing couple which can be done by applying equal and opposite couple.

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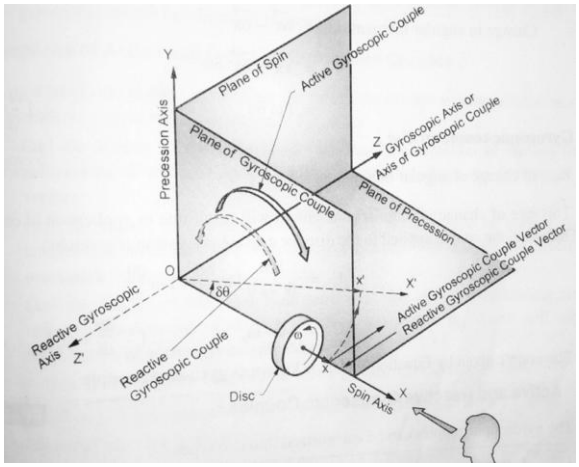

Fig.1 Principle of Gyroscope

II. 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

III. OBJECTIVES

The objective of building a self-balanced two wheeler vehicle is mainly to ensure safety of the rider. We have considered the scenario of our country, Bangladesh in this manner. Enormous numbers of people become victim of fatal accidents. Moreover, the cars in the cities are increasing day by day but the roads are not increasing. So if a vehicle that can serve like a car and just takes the small amount of place like a motorbike whether for parking or running on roads, would be a better solution for people. With the cabin the rider is safe from impact of thrust and with the self-balancing property of the vehicle; the rider is safe from falling. We are trying to make a compact size vehicle for low power consumption too.

IV. PROPOSED CHASSIS STRUCTURE

The design of the chassis is kept very simple. The rotating disks are accommodated at round space in the middle of the chassis. They are quite apart from each other to rotate and tilt according to the self-balancing principle. It helps to stabilize the vehicle perfectly. At the same time enough space is allotted to connect two wheels at both of the ends. The wheels are connected to the chassis using axles. This chassis is mainly built with steel. The hub motors are attached firmly with their mount in the hub motor chambers. The batteries or other components can be kept above the hub motor chamber. For example, on the chassis above the hub motor chamber there will another compartment for engine. The compartment for the rider and the luggage will be above the main chassis. The chassis will consist of batteries, wires, gyroscope and engine. The automatic gear system will also be controlled from here. The main motors, electrical components will be accommodated here the hub motors have been kept in such a way they can move according to the tilting angle as mentioned earlier. The chassis was let to be tilted either ways. The

ISSN (O) 2454-9665
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wheels are designed a bit wider than the usual two wheel vehicles to have a better stability. Wheels are wide enough to keep the vehicle standing still when it is not rolling and the engine is off without any help of the self-balancing technology.

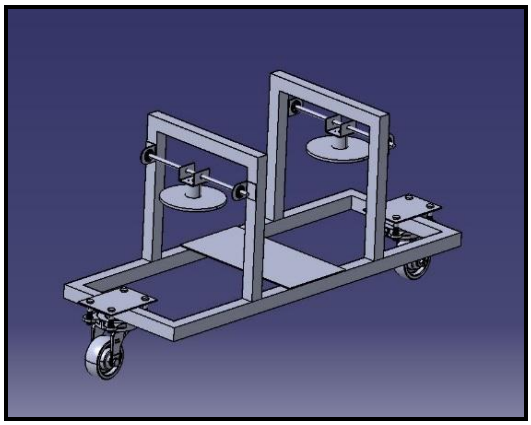

Fig.4.1 Prototype CAD Model

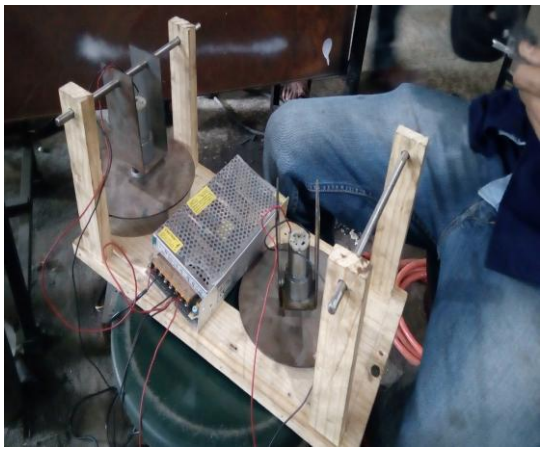

Fig.4.2 Manufactured Structure

V. WORKING CYCLE

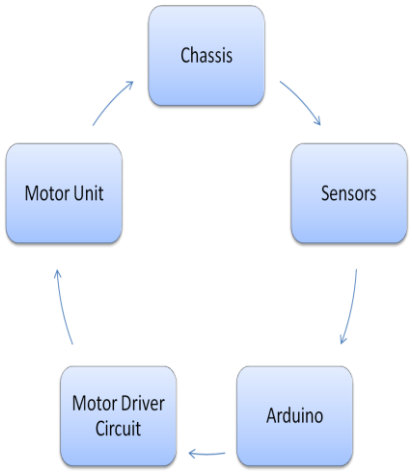

Fig.5 Working Cycle

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VI. FLOW CHART

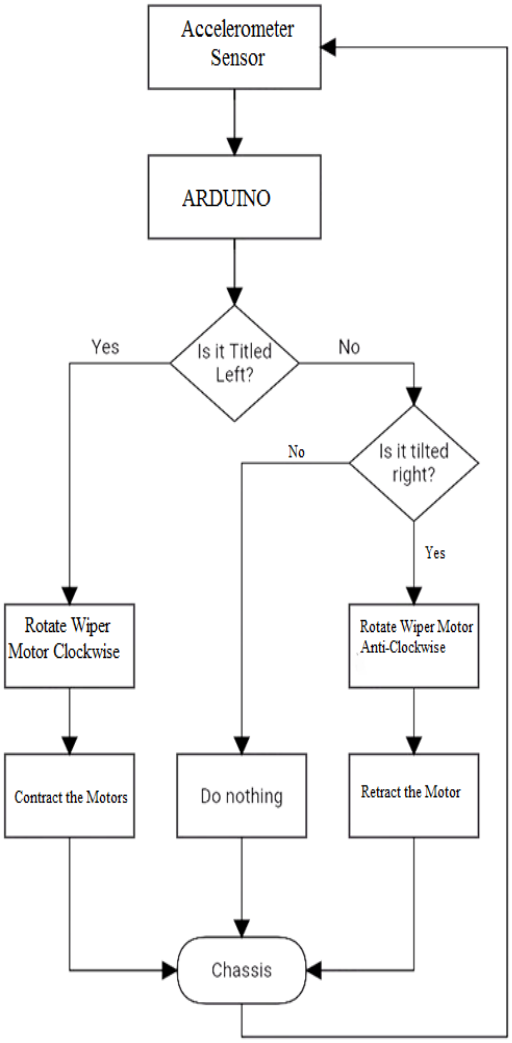

Fig.6 Flow Chart

VII. WORKING

The chassis is fitted with different sensors like gyro sensors, accelerometer which senses its current position. The output of sensor is transmitted to the arduino. The arduino then drives the motor driver circuit to control the wiper motor and thus the wiper motor controls the orientation of the hub motor to stabilize the chassis.

Hub motor electromagnetic fields are supplied to the stationary windings of the motor. The outer part of the motor follows, or tries to follow, those fields, turning the attached wheel. In a brushed motor, energy is transferred by brushes contacting the rotating shaft of the motor. Energy is transferred in a brushless motor electronically, eliminating physical contact between stationary and moving parts. Electric motors have their greatest torque at start-up, making them ideal for vehicles as they need the most torque at start-up too. Their greatest torque occurs as the rotor first begins to turn, which is why electric motors do not require a transmission. Two hub motors has been used in this vehicle so that these motors can help to stabilize the force during tilt, Hub motor controller is needed to connect the hub motor with batteries through wires. Two motor controllers will be used to drive two hub motor.

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The wipers combine two mechanical technologies to perform their task:

1. A combination electric motor and worm gear reduction provides power to the wipers.
2. A neat linkage converts the rotational output of the motor into the back-and-forth motion of the wipers

Wiper motor is used here to solve the balancing problem. When the vehicle is tilted left to a certain angle then a signal comes and starts the motor. The motor is expected to force the vehicle to right, thus it balances the vehicle. Again if the vehicle is tilted right to a certain angle, another signal comes and starts the motor. The motor gives a force to the left balancing the vehicle. If the vehicle is straight and not tilted beyond the threshold angle, the motor does not start. Wiper motor works as a bidirectional motor and mainly is responsible for changing the orientation of the two rotating hub motors.

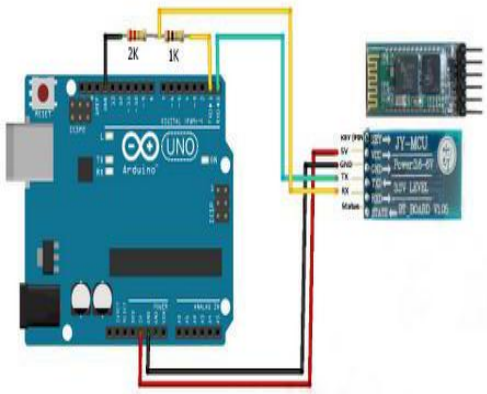

Fig.7.1 Arduino

Fig.7.2 Hub Motor

Fig.7.3 Wiper Motor

VIII. CONCLUSION

This is a two wheeler vehicle has many more safety features than motorcycles which make it more reliable. Safety is one of our top priorities with this vehicle. However, the most important safety feature is our gyro stability system. This will keep the vehicle upright even in a collision, preventing the vehicle from flipping or rolling. On the other hand it will also protect the passenger from rain, wind, dust as it is a covered vehicle. It will also be more comfortable than any other motorbikes at the same time will require a very small space of parking. The idea of two

ISSN (O) 2454-9665
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wheeler self-balanced vehicle is new. The vehicle is designed considering cost effectiveness and fuel efficiency factors.

From the thesis project some certain observation are provided:

1. The force experienced due to the tilt of rotating wheels depends on the RPM of the wheel, the weight of the wheels and the angle of tilt.
2. The higher the RPM, the bigger the counterforce. That means the counterforce is much larger when the RPM of the hub motor is larger.
3. The direction of rotating wheel tilt determines the force direction of when spinning is in a particular direction.
4. Weight attached to hub motor helps to stabilize the balancing.
5. The more the tilt angle, the more force is needed to stabilizes the chassis.

This vehicle needs much more development for future works. Firstly two powerful hub motors are needed for balancing it. The RPM should be over a thousand with attached weight of at least 10-15kg or more. Then the weight should be distributed equally in the chassis. If the weight is more on the right, the vehicle will be tilted on that side more. This is applicable for the left side too. So this unequal distribution of weight can be a problem during balancing. Again, a calibrated gyroscope is needed to get the tilt angle. A Wired connection with the gyroscope to arduino can be much more convenient for the set up. A PCB can be very helpful too for the motor driving circuit as it reduces wires and thus the reliability of the connection increases.

IX. ACKNOWLEDGEMENT

We take this opportunity to thank all those who have contributed in successful completion of this dissertation. We would like to express our sincere thanks to our guide Prof.Avani Karyakarte who has encouraged us to work on this topic and valuable guidance wherever required. We wish to express our thanks to, Prof.Avani Karyakarte, H.O.D. Mechanical Engineering Department, G.S.Moze College of Engineering, for their support and help extended. Finally, we are thankful to all those who extended their help directly or indirectly in preparation of this report.

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