UNIVERSITI TEKNIKAL MALAYSIA MELAKA

INTRODUCTION OF DOUBLE GYROSCOPE CONCEPT FOR MOTORCYCLE

This report is submitted in accordance with the requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours

by

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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TAJUK: **INTRODUCTION OF DOUBLE GYROSCOPE CONCEPT FOR MOTORCYCLE**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

EN MUHAMMED NOOR BIN HASHIM

……

(Project Supervisor)

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ABSTRAK

Pada masa kini, kesesakan jalanraya selalu berlaku di banda-bandar besar setiap hari. Ramai penduduk menggunakan motosikal sebagai kenderaan utama untuk pergi ke tempat kerja mereka.tetapi, motorsikal mereka tiada alat penimbang giroskop untuk memberi keseimbangan sepanjang masa kepada penunggang apabila mereka dalam kesesakan atau jalan yang sempit. Oleh itu, projek ini membincangkan tentang mereka bentuk dan menghasilkan sebuah konsep penimbang giroskop untuk menstabilkan motorsikal. Ia boleh menstabilkan motorsikal dengan menggunakan kesan yang dikenali sebagai precession. Precession berfungsi sebagai contoh, jika arah daya yang dikenakan kepada giroskop yang sedang berputar adalah sama dengan arah pusingan giroskop, giroskop itu akan bertindak balas dengan berpusing arah berserenjang (iaitu 90°) daripada paksi daya tersebut. Oleh disebabkan demikian, ia dapat berterusan menstabilkan motorsikal. Tujuan menghasilkan konsep dua giroskop ini adalah untuk memudahkan penunggang motosikal untuk menstabilkan motor mereka.

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ABSTRACT

Nowadays, traffic congestion often happens in big cities every day. People tend to ride a motorcycle to go to their workplace to avoid the traffic jammed. But, their motorcycles do not have a gyroscope stabilizer to keep their motorcycle balance during in the traffic jammed. The gyroscope stabilizer helps to ensure that the motorcycle keep balance when the riders are having a difficulty to ride in a narrow road. Thus, this project discusses on designing and developing a concept of double gyroscope for motorcycle for balancing. It can balance the motorcycle by using the effect called precession. The precession function as example, if the force applied to the rotating gyroscope is following the spin axis of the gyroscope, the gyroscope will counter the applied force by rotating along perpendicular axis (which is 90°) to the applied force. From that, it can continuously balance the motorcycle. The purpose of developing the double gyroscope concept is to ease the motorcycle rider to keep their motorcycle balance.

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DEDICATION

Special dedication to my beloved family members, especially to my father Abu Hanifah Bin Ishak and my mother Roslinah Binti Mohd Yusup who always supported and encouraged me with motivation and love through my whole journey.

To my respected and professional supervisor, Sir Muhammed Noor Bin Hashim for endless guidance and support from bottom to the top.

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CHAPTER 1
INTRODUCTION

1.0 Introduction

The introduction, background, problem statement, objectives and scope of the project will be discussed in this chapter. This project will be focused on designing and developing a concept of double gyroscope for motorcycle for balancing. It can balance the motorcycle by using the effect called precession. The precession function as example, if the force applied to the rotating gyroscope is following the spin axis of the gyroscope, the gyroscope will counter the applied force by rotating along perpendicular axis (which is 90°) to the applied force. From that, it can continuously balance the motorcycle. The purpose of developing the double gyroscope concept is to ease the motorcycle rider to keep their motorcycle balance.

1.1 Project Background

A gyrocar is a two-wheeled vehicle. Gyrocar has a dynamic balance is provided by the rider, and in some cases by the geometry and mass distribution of the bike itself, and the gyroscopic effects from the wheels. Balance was provided by one or more gyroscopes in a gyrocar.

In 1911, the concept was designated in fiction "Two Boys in a Gyrocar: The story of a New York to Paris Motor Race" by Kenneth Brown. First concept of Gyrocar is The

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Shilovski Gyrocar which custom-made in 1912 by the Russian Count Pyotr Shilovsky (Spry & Girard 2008). The gyrocar was motorized by a modified Wolseley C5 engine of 16 - 20 hp, with a bore of 90 mm and a stroke of 121 mm. The weight of the gyrocar was 2.75 tons and it had a very large turning circle (Zhang 2014).

Figure 1. 1: Concept in Fiction "Two Boys In A Gyrocar: The Story of a New York to Paris Motor Race"

(Source: <http://cs.pikabu.ru/post_img/2013/11/14/6/1384413785_201760158.jpg> 17/05/17)

In 1927 Louis Brennan, funded to the tune of £12,000 by John Cortauld built a more successful gyrocar. The two contra-rotating gyros were stored under the front seats, spun in a horizontal plane at 3500 rpm by 24 V electric motors driven from standard car batteries.

In the automotive industry, safety means that users, operators or manufacturers do not face any risk or danger coming from the motor vehicle or its spare parts. Safety play an important role to ensure that users of the vehicle are not exposed to danger. Hence, gyroscope in motorcycle provide a feature that can help the motorcycle to keep it balance and prevent from falling that can hurt the user of the vehicle.

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The gyroscope is a spinning wheel or disc that axis of rotation is free to assume any orientation by itself. There are many types of gyroscope such as the electronic, microchip-packaged MEMS gyroscopes found in consumer electronics devices, solid-state ring lasers, fiber optic gyroscopes, and the extremely sensitive quantum gyroscope (Spry & Girard 2008).

The function of the gyroscope is to maintain direction in tunnel mining in gyrotheodolites, and inertial navigation systems. Gyroscopes also can be used to build gyrocompasses, which balance or replace magnetic compasses in ships, aircraft, spacecraft, and vehicles which is to assist in stability or be used as part of an inertial guidance system.

Figure 1. 2: Example of Gyroscope

(Source: <http://www.sciencekids.co.nz/images/pictures/physics/gyroscope.jpg> 17/05/17)

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1.2 Problem Statement

The main problem that is faced by the people is traffic congestion frequently occurs in big cities every day. People tend to ride a motorcycle to go to their workplace to avoid the traffic jammed. But, their motorcycles do not have a gyroscope stabilizer to keep their motorcycle balance during in the traffic jammed. The gyroscope helps to ensure that the motorcycle keep balance when the riders are having a difficulty to ride in a narrow road.

1.3 Objectives

The purpose of this project is to design a prototype of double gyroscope for motorcycle for balancing. The gyroscope is expected will be able to stabilize the motorcycle. In short, the objectives are:

i. To design a prototype of double gyroscope for motorcycle for balancing
ii. To develop a prototype of double gyroscope for motorcycle

1.4 Scope of Project

The scope of this project will be focusing on two main sections. The first main section will focus on designing the prototype of the double gyroscope concept while the second main section will be focusing on fabricating the prototype of the double gyroscope concept for motorcycle.

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In the designing of the prototypes, some sample of designs of the gyroscope stabilizer will be taken from the website or article journal from past researcher and then showed in methodology chapter. Then, the designs will be compared to find the most effective and suitable concept by using the concept selection method. Concept screening and concept scoring matrix will be used to calculate the total marks and rank all the designs. The design that obtain the highest marks will be chosen to be sketched in blank paper. The sketch will contain all the dimensions and measurement for all the parts used in the concept design.

Besides that, a prototype of the gyroscope will be fabricated. Processes involved to fabricate the design concept are measuring process, cutting process, bending process, drilling process, assemble the parts by using the bolt and nuts, electrical work process and touch up process. Then the prototype will be analyzed to determine whether the gyroscope concept can stabilizes the motorcycle concept.

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CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter will be discussed about certain published information from past researcher regarding to the gyroscope, permanent magnet and perpetual motion. The history for the gyroscope, permanent magnet and perpetual motion also will be explained in this chapter. Besides, the basic function of the gyroscope, permanent magnet and perpetual motion also will be discussed in this part. It also will cover with some basic theories with a principle for a better understanding about this project.

2.1 Gyroscope

Louis Brennan was first considered the single track gyroscopic vehicle problem in 1905, later then many extensions were developed and some prototypes were made (Spry & Girard 2008). The differences in the several schemes lie in the number of gyroscopes active, the direction of the spin axles comparative to the rail, and in the technique used to produce the acceleration of the spin axle. Gyroscopic vehicle is one of such a new prototype commuter vehicle that can run on the road safely and efficiently.

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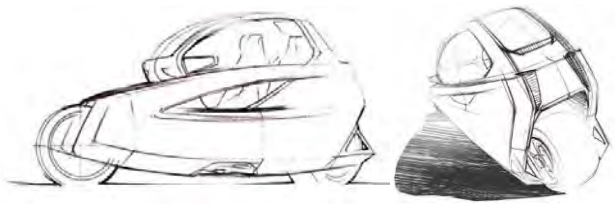

Figure 2. 1: Example of Gyroscopic Vehicle, Draft NEWT (Zhang 2014)

Gyro is a many faceted, spatially-stabilized torque (orbital) geometrics phenomenon and an energy device that has a load-bearing, force-seeking, spatially-anchored stability reference (Congress et al. 1998). While, gyroscope is whichever device that can measure angular velocity (Jr. 1992). Properties of gyroscopes can be found in heavenly bodies in motion, artillery projectiles in motion, turbine rotors, different mobile installations on ships and aircraft propeller rotating (Review 2010). The online Museum of Retro Technology cites many articles and samples of gyrocars such as 1961 Ford Gyrocar prototype called the Gyron and a prototype from Gyro Transport Systems of Northridge, California that was on the cover of the September are also included, 1967 issue of ”Science and Mechanics” (Spry & Girard 2008).

2.1.1 Type of Gyroscope

Gyroscope is the most important thing of an inertial navigation system or any direction system. Gyroscope was invented a century ago and have been used as references to recognize inertial state of a moving body. Since Kettering bug to the Apollo spacecraft, the value of gyro has determined the performance of the general mission. Gyroscope has been a feature behind ‘make or break’ of the many missions.

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Gyroscopes have changed over the period and hence, many technologies on which gyroscopes are founded today, though only some of them find their place in the real-world applications. It is fascinating to know more about several types of gyroscopes and understanding how they operate.

Two of the types of gyroscope are Ring Laser Gyroscope (RLG) and Fiber Optics Gyroscope (FOG). Both ring laser and fiber optic type gyroscopes function based on a basic principle which is Sagnac effect. Sagnac effect includes splitting a beam of light in two and transfer them through different opposite paths and then producing interference between the two beams. The fringe pattern is detected and the rotation of the platform can be calculated based on the fringes. In a ring laser type gyroscope, the ring is the segment of the laser while in a fiber optic gyroscope, light from an external laser is penetrated through a fiber optic cable (Source: <http://www.aeronsystems.com/gyroscopes-and-their-types/> 21/05/17)

Figure 2. 2: Example of Ring Laser Gyroscope (RLG)

(Source: <http://www.pref.tochigi.lg.jp/kogyo/english/img/voice/025_04.jpg> 21/05/17)

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Figure 2. 3: Example of Fiber Optics Gyroscope (FOG)

(Source: <http://emcore.com/wp-content/uploads/2016/02/EMP-1-Fiber-Optic-Gyroscope-FOG.jpg> 21/05/17)

Besides, Micro-Electro-Mechanical Systems (MEMS) gyroscope also one of the types of gyroscope. Usually, MEMS sensing structures range from 1 micrometer to 100 micrometers. MEMS gyroscopes use a vibrating part for rate measurement. The fundamental principle is, slightly vibrating body has a tendency to continue vibrating in its plane of vibration. Consequently, if the orientation of the platform to which a vibrating body is involved is changed, the vibrating body will apply a force on the platform. This force can be measured and can be used to obtain the output (Source: <http://www.aeronsystems.com/gyroscopes-and-their-types/> 21/05/17)

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