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WHEEL ALIGNMENT MONITORING SYSTEM USING LASER TRIANGULATION AND TIME OF FLIGHT WITH TCP/IP COMMUNICATION PROTOCOL

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ABSTRACT

A new method on wheel alignment is presented in the calibration and angle of reflection of tyres. Conventional wheel alignment monitoring system is big, bulky and limited accessible time in workshop operating hours. Hence, smaller and portable wheel alignment monitoring system is introduced in this research by using communication protocol between sensors, microcontroller and mobile phone application. The objectives of this research are to find best mounting place for the sensors from tyre in terms of distance and angle of sensors and also to design wheel alignment monitoring system which is light and portable. In this work, the light reflection theory is applied whereby the controlled factors are included in angle of reflection, camber, caster toe, mounting angle and the first position of sensors after calibration are considered. The uncontrolled factors are included in light noise, dust noise and shaking effect. Through the experiment analysis the key factors are obtained based on the laser triangulation principle. The optimum design is completed based on the formula and calibration experiments. The result shows for laser tyre alignment system and the characteristics are established on the highest rate of changes of infra-red readings from the sensor which is $60°$ angle. The finding also shows that higher sensitivity of infra-red setup is recommended by comparing results of infrared transmitter/receiver, constant of distance of tyre from both infra-red receiver/transmitter and constant of angle of tyre for angles. In this work, the wheel alignment is calibrated with the angle of reflection of tyres are considered and viewed on mobile application. The data from wheel alignment system is passed from the combination of receiver and transmitter connected to microcontroller to the mobile application. The TCP/IP communication protocol is applied. The controlled factors are including in data of angle of reflection, data of first time calibrated, data of current calibration, timestamp and data profile of the sensors. The uncontrolled factors such as communication delay, Wi-Fi signal and shaking effect when the vehicle is moving are also considered. The findings from the experiment analysis the key factors are obtained. The best characteristics for laser tyre alignment system relies on the highest rate of changes of infra-red readings from the sensor which is using 60 degree of angle, in other words it means higher sensitivity of infra-red setup is better. In the nutshell, early detection provided by this wheel alignment monitoring system can reduce accident by increasing the awareness or alertness of the driver regarding their vehicle alignment condition.

ACKNOWLEDGEMENT

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CHAPTER ONE
INTRODUCTION

This chapter provides a brief introduction to the research work and describes the organization of the thesis. It explains the overall structure of the thesis and includes a general overview of this work, the project objectives and the rationale of the study. Also, the limitations are highlighted in this chapter.

1.1   BACKGROUND OF THE PROBLEM

Nowadays, the rate of people dying every day is increased by many factors. Among them is car accident. Majority of the people in the world use car as a transportation method and there are various factors leading to car accident including car faulty system. From this car faulty system, it can be narrowed down to wheel faulty or wheel alignment disorder[1]. It is known that car's wheel alignment can be monitored, adjusted and fixed inside the appointed car workshop.

Basically, there are few methods in wheel alignment system including calibration using charge coupled device (CCD) and 3D alignment[2]. Prior to wheel alignment measurement, one should understand the basic information regarding car alignment system. There are 3 parts of wheel alignment system consists of toe, camber and caster.
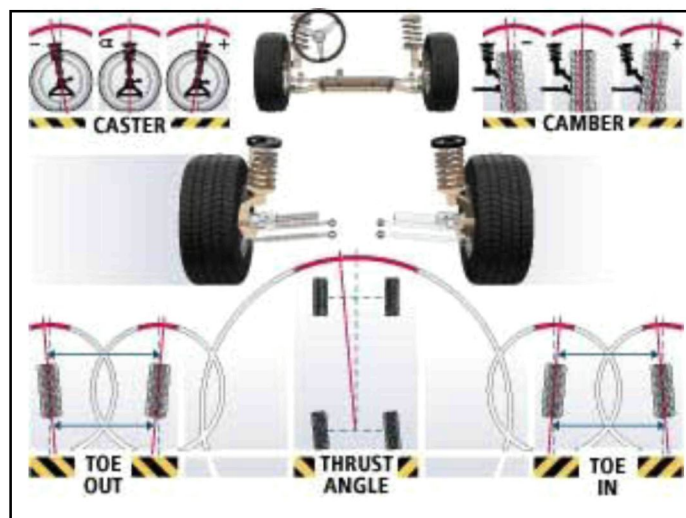

Figure 1.1: Wheel Alignment / Tracking [1]