

DEVELOPMENT OF TIRE PRESSURE ALARM SYSTEM FOR MOTORCYCLES

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**This report is submitted
In fulfillment of the requirement for the degree of
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DECLARATION

I declare that this project report entitled “Development of Tire Pressure Alarm System for Motorcycles” is the result of my own work except as cited in the references

Signature :

Name :

Date :

APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Automotive).

Signature :

Name of Supervisor :

Date :

DEDICATION

To my beloved mother and father

ABSTRACT

The problems about road accidents mostly happen because of careless driver, weather condition, vehicle failure and vehicle safety condition. One of the main reasons that can be focus to solve the problem is by maintaining the safety of a vehicle. This project mainly focuses on the safety condition of motorcycles tire. The Tire Pressure Alarm System is a smart way and a smart system to help alert the rider of motorcycle regarding the tire pressure of their motorcycles. The main problem of this issues is the safety of motorcycle tire, tire that under inflated can cause overheat. It can lead to poor vehicle handling. The next one is the economy, the tire that does not have the optimum pressure will cause more problem in term of repairing the tire. The objectives of this project are to detect tire pressure by using pressure switch. Next is to transmit signal that will alert the rider of motorcycle about the low pressure of the tire and to maintain motorcycle tire at optimum pressure. This report gives an insight about Final Year Project involving developing a Tire Pressure Alarm System using pressure switch for its wireless communication protocol. Also, the report gives a brief overview of the actual prototype, its features, its mechanism and what can be done in future to enhance it. Furthermore, the report gives detailed information about the actual design, implementation of component and testing of a pressure switch in lab used to calibrate it at 160kPa (marked as low pressure). It then goes further to examine the actual result and analysis of the Tire Pressure Alarm System. Also highlighted in the report are additional features that can be implemented in the system. This report also draws a conclusion as to the suitability of using the Tire Pressure Alarm System to be installed at the motorcycle tires.

ABSTRAK

Masalah mengenai kemalangan jalan raya selalunya dikaitkan dengan faktor berkaitan kecuaiian pemandu atau penunggang kenderaan tersebut, kegagalan kenderaan berfungsi, cuaca sekeliling dan juga keselamatan kenderaan yang dinaiki. Projek ini menjelaskan sepenuhnya tentang keselamatan kenderaan iaitu motosikal. Sistem keselamatan tekanan tayar ialah sebuah sistem pintar yang dibina bagi menyampaikan maklumat terhadap penunggang motosikal mengenai tekanan udara di dalam tayar motosikal apabila tekanan berada pada tahap yang rendah. Masalah utama yang menyebabkan kemalangan ialah keadaan keselamatan pada tayar motosikal. Tayar yang berada dalam tekanan yang rendah akan menyebabkan tayar tersebut kelebihan haba dan memudahkan kenderaan hilang kawalan. Seterusnya, masalah ekonomi dimana pengguna motosikal perlu mengeluarkan belanja pada kadar yang kerap apabila tayar motosikal tidak berada pada tahap tekanan yang sepatutnya. Tayar motosikal akan mudah mengalami kerosakan apabila tekanan tidak pada tahap sepatutnya. Objektif projek ini ialah untuk mengenalpasti tekanan udara pada tayar motosikal dengan berpandukan pada suiz tekanan. Seterusnya, untuk mengeluarkan isyarat melalui bunyi dan lampu yang menyampaikan maklumat mengenai tekanan pada tayar motosikal apabila berada pada tahap yang rendah dan akhir sekali ialah untuk menyelenggara tayar motosikal untuk berada pada tahap tekanan yang optimum. Laporan ini berfokuskan tentang Projek Sarjana Muda melibatkan pembinaan sistem keselamatan tekanan tayar dengan menggunakan suiz tekanan bagi komunikasi tanpa wayar. Laporan ini juga menerangkan tentang prototaip sebenar sistem keselamatan, ciri-ciri sistem, komponen dan mekanisma yang digunakan. Selain itu, laporan ini juga menjelaskan mengenai maklumat sebenar reka bentuk, cara melaksanakan komponen dan proses percubaan terhadap suiz tekanan dalam makmal. Sistem ini ditetapkan untuk berfungsi pada tekanan 160 kPa ke bawah. Selepas itu, kaedah seterusnya yang dijalankan terhadap produk sebenar dan analisis yang dilakukan juga diterangkan di dalam laporan ini. Sistem keselamatan tekanan tayar ini juga menerangkan ciri tambahan yang dapat dilaksanakan. Akhir sekali, laporan ini menyimpulkan bagaimana kesesuaian sistem keselamatan tayar ini dipasang terhadap tayar motorsikal.

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LIST OF ABBREVIATION

RF	Radio Frequency
IR	Infra-Red
ASK	Amplitude Shift Keying

CHAPTER 1

INTRODUCTION

1.1 THE BACKGROUND

“Tire Pressure Alarm System” is a solution to the problem of road accidents and a method to lessen the uprising number of casualties on the road caused by motorcyclists. Since a higher number of road accidents occur from motorcyclists as well as poor maintenance of the motorcycles (Rana, 2009). This project is aimed at motorcycles in Malaysia the number of accidents involving motorcycles is vastly increasing over time. The “Tire Pressure Alarm System” is a smart and innovative way to alert motorcyclist regarding the tire pressures of their motorcycles, much like how a car has a “check engine lights” (Balaji, Madhav, & Sundar, 1963). The importance of keeping one’s motorcycle tire pressure in check is to avoid loss of control during operation of the motorcycle. Many motorcyclists are unaware when their tires are under pressure.

The “Tire Pressure Alarm System” is user friendly as well as cost effective. The basic concept of the tire is to make the riders more aware regarding their safety on the road. Tire pressure can drop due to a number of factors including the weight of the vehicle, period length of the usage of the tire, unsuitable tires that do not match the rim of the tires, and the condition of the terrain of the road which could possibly puncture the tire. Sometimes, pressures loss can occur during a motorcycle ride without the rider noticing it. The main purpose of this tire is to alert the motorcyclist regarding the sudden loss of pressure so the motorcyclist could take action (Oncept, 2010). Once action is taken, the vehicle will be more secured and safer for further riding hence contributing to the road safety and decreasing accidents caused by faulty tires.

This report assesses the feasibility, potential and cost-effectiveness of applying tire pressure alarm systems in motorcycle for the purpose of reducing road accidents in

motorcyclists. In addition, potential safety benefits have been estimated as well as a range of other impacts that may affect cost-effectiveness and also the environment. Below, results of the following topics are summarized:

1. Reduce road accidents of motorcyclist
2. Keep the tire pressure at optimum level
3. Save cost by keep the tire for longer lives
4. Cost-effectiveness compared to readily tire monitoring system in market
5. The potential of tire pressure alarm system for fuel saving and CO2 reduction

In carrying out the project, it was necessary to carry out an extensive research on tire pressure monitoring systems and their properties. It was also important that the tire pressure alarm system mechanism and the relevant standards associated with it were understood.

This alarm system consists of pressure switch which is calibrated at 160 kPa for the switch to “ON” or complete thus transmit the signal to the transmitter, and then the transmitter will give signal to the receiver which is the buzzer to emit sound (Jogdand, Naveed, & Maske, 2012). The sound which will act as the alarm will alert the motorcyclist that the tire pressure already reach 160 kPa which is marked as low pressure for a tire. The principal for the pressure switch are normally-close and normally-open. For this alarm system, its normally use normally-close switch.

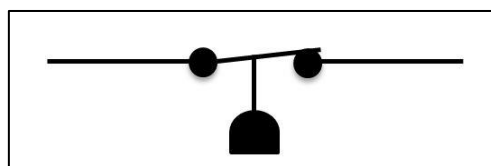


Figure 1: Normally closed pressure switch

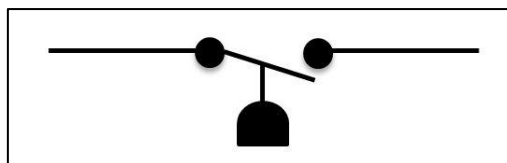


Figure 2: Normally Open pressure switch

1.2 THE PROBLEM STATEMENT

This project aims at reducing the accidents caused by negligence of tire pressure and help to alert the motorcyclist on the condition of the tire through implementing a tire pressure alarm system. It provides security in avoiding the inflated tire problem where a motorcyclist will have a problem to find nearby mechanics in the middle of road.

There are three main reasons why maintaining the right tire pressure is important. The first is safety. Tires that are under inflated can overheat, whereas the optimum pressure is desirable and over inflated tires can lead to poor vehicle handling on the road.

The second reason is economy. Over or under inflated tires suffer more damage than those with the correct pressure and need to be replaced more regularly. Vehicles with under-inflated tires have increased rolling resistance that requires more fuel to maintain the same speed.

The third reason for maintaining the correct tire pressure is the environment. Correct tire pressures help to maintain optimum fuel efficiency. This can equate to lower carbon dioxide emissions coming from your vehicle than those with incorrect tire pressures and that has to be good for the environment.

1.3 THE OBJECTIVES

The objectives for this project are:

1. To detect tire pressure by using the pressure sensor.
2. To transmit signal thus giving alarm and light to the motorcyclist when the tire pressure detected is low.
3. To maintain the motorcycle tire pressure at optimum pressure.

1.4 SCOPE OF THE PROJECT

The scopes of this project are:

1. Based on knowledge of automotive and design study that related to enhance the safety of the motorcycles.
2. The idea of this project will translate into fabrication, up to testing process and improvement of the tire pressure alarm system.

1.5 GENERAL METHODOLOGY

The actions that need to be carried out to achieve the objectives of this project are listed below:

1. Specification
Specification will cover about the measurement of the motorcycles tire, the mechanism that needs for the alarm system.
2. Design and Measurement
Measure criteria that needed to complete the tire pressure alarm system. Finding and design the mechanism and parts such as pressure sensor, signal transmission, motorcycle rim and circuit board for the system.
3. Analysis and proposed solution
Analysis will be present on how the principle and the working of the mechanism. This will show how the system reacts to the pressure of the tire when it is low. Solution will be proposed based on the analysis.
4. Fabrication
Fabricating will include the process of installing the pressure sensor and all the mechanism to the motorcycle rim.

5. Testing

Testing will show how the result of the alarm system working and when the pressure of the tire is low, it will detect and give the signal through a sound.

6. Improvement

Improvement consists of installing another function to the alarm system for a better safety such as LED signal.

The methodology of this project is summarized as shown in the Figure 3.

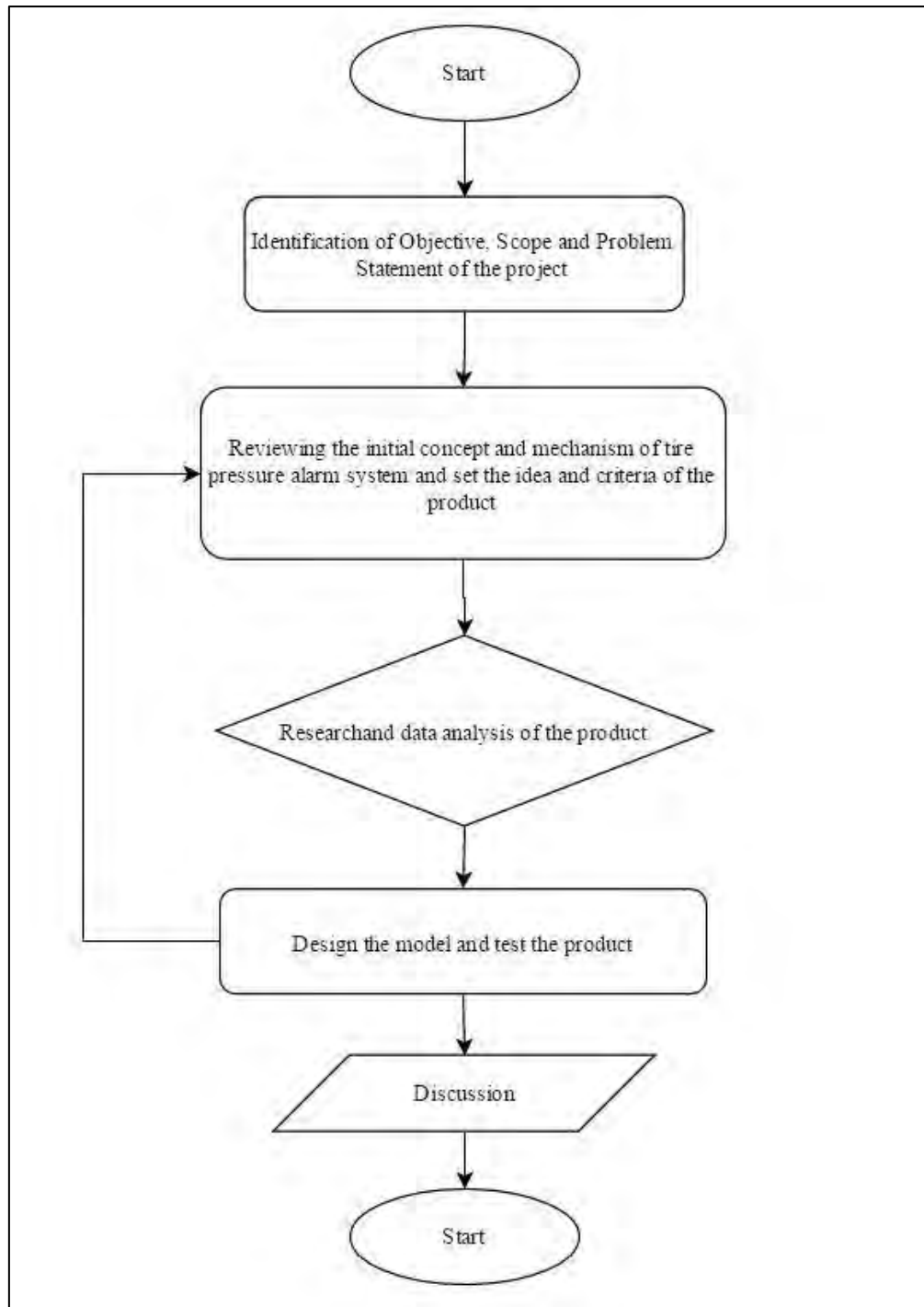


Figure 3: Flow Chart of the Project.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will describe the scientific studies on matters connected with the tire pressure alarm system as describe previously and also the state of knowledge on tire of motorcycle. A thorough review of the existing products and parts on the market that can be references also adopted in this chapter. The revenue for this study was quoted from the website, reports pattern and journals also for the success of this PSM study. The matters that to be discussed is the scientific description about tire of motorcycle, the function of tire pressure alarm system, the effective pressure to be used for the system, the mechanism used in the alarm system, tire pressure alarm system from the existing products and also the practical used in automobile industry.

2.2 PHYSICAL DESCRIPTION OF MOTORCYCLE

The description consists of explained two rigid frames joined at the steering axis with freedom, restrained by a linear steering damper of the front frame which is the front suspension to steer relative to the rear one of a motorcycle. The front frames of a motorcycle consist of the front wheel, forks, handlebars and the fittings. The rear frames consist of the main structure of the motorcycles, the engine gearbox assembly, the petrol tank, seat, rear forks, and rear wheel which attached rigidly to the rider. Each frame has longitudinal plane symmetry and the axis through the front frame mass centre parallel to the steering axis. (LaSalle, 1986) The road wheels are rigid discs each making point contact with the road and the roll without longitudinal slip on a flat level road surface. The housing of the steering head bearings is connected to the rear frame by the two flexible mechanisms. One allows relative lateral translation, while the other allows relative rotation about an axis perpendicular to the

steering axis. The diagram below shows the specific view how the part attached to each other in a motorcycle body.

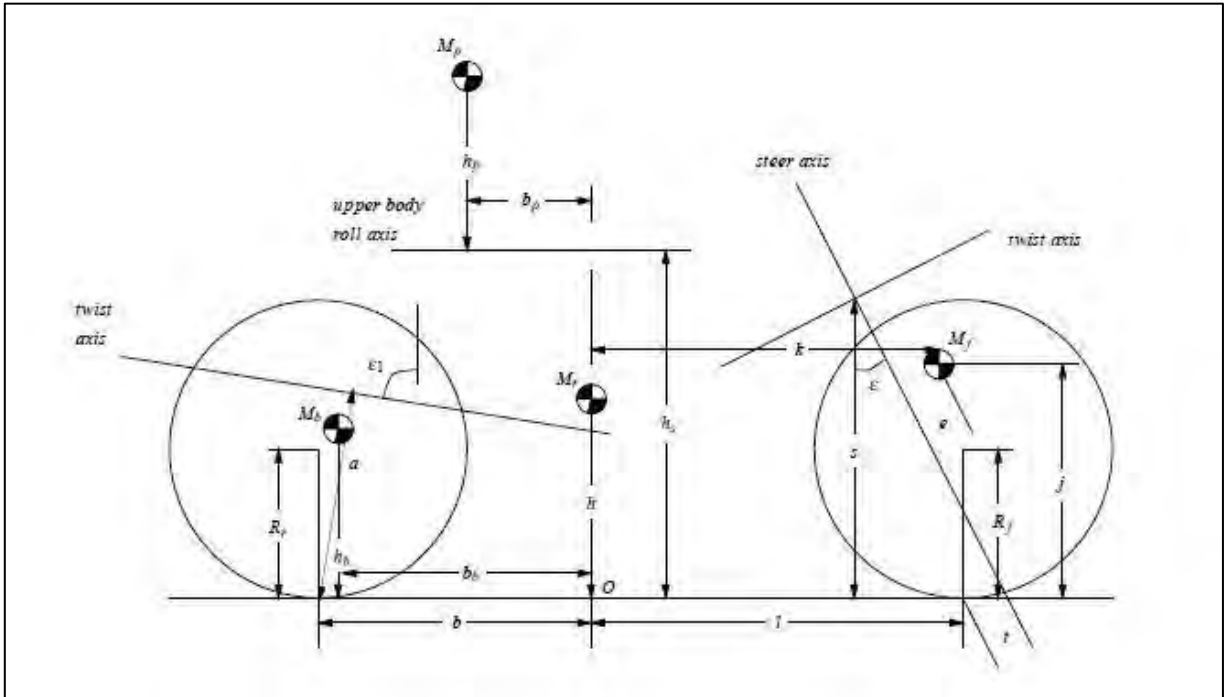


Figure 4: Diagrammatic of the motorcycle

(LaSalle, 1986)

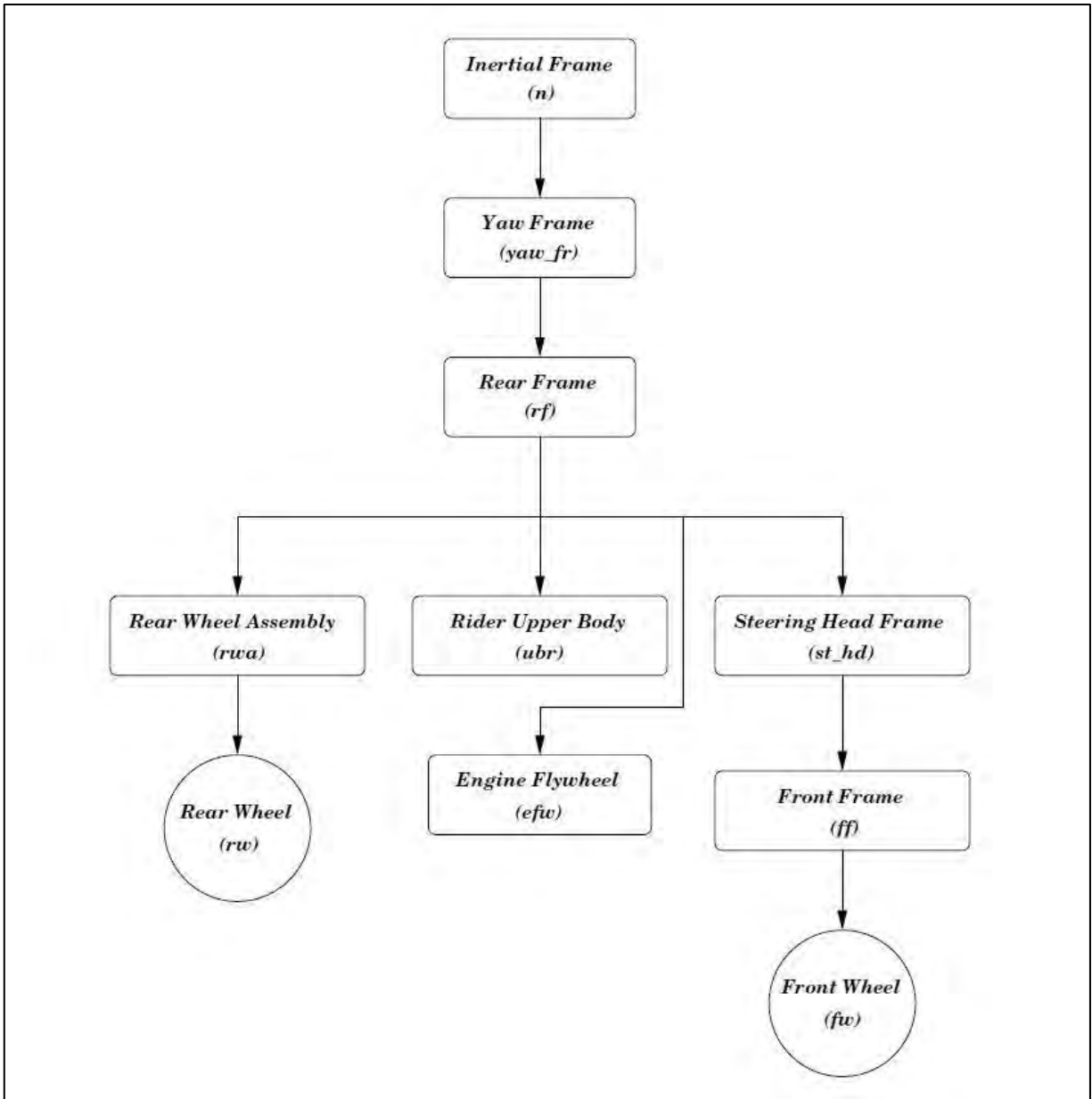


Figure 5: Body Structure Diagram of the motorcycle

(Evangelou, 2003)

2.3 EVOLUTION OF TIRE

A tire means a covering for a wheel, usually made of rubber reinforced with cords of nylon, fiberglass, or other material and filled with compressed air. Its history starts in the early 1800s, where Charles McIntosh was experimenting with latex, the sap from a tree found in the Amazon. The sap was brought back to the country and was analyzed. Unfortunately, it showed undesirable qualities which it became brittle in cold weather but become sticky at hot weather. Then rubber experimentation was widespread both in Europe and America to try to stabilize its properties.

Afterwards, many inventors discovered many things in a way to improve the properties of the tires. In 1839, Charles Goodyear found that by adding Sulphur, can make the tire more elastic and stronger. In 1845, Dunlop invented pneumatic tire and in late 1892, the first detachable pneumatic tire was invented by two agricultural engineers, brothers Michelin. They market their ideas successfully. Their tire consisted of a separate tube with an outer cover bolted into the rim. (Oponeo.net, 2016)

Then, there are many inventions about tire and in 1947 came the first radial tire, a tire that has revolutionized the transport industry. Furthermore, about tire wear, it is a dead giveaway that the wheels are out alignment or that steering or suspension parts are worn. There are six types of tire wear:

- Over inflation
- Under inflation
- Feathering
- One side wear
- Second rib-wear
- Cupping