Protecting of Automotive Vehicle Tyre by Maintaining the Pressure in Tyre through Pressure Monitoring System

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Abstract

Tire is the most essential part of automobile and it plays crucial role in ensuring safe driving. Even then, almost every automobile on the road run with either one or more under inflated tires. Detailed survey has come with result that drop in tire pressure by just few psi leads to the reduction in gas mileage, tire life, safe driving and vehicle performance. Unawareness of exact pressure requirement, sudden environmental changes are also some of causes for tire running with improper pressure. Automatic tire pressure controlling and self-inflating system ensures correct pressure in the tire all the time. Drop in pressure is detected by hissing sound made by tire and system will starts refilling the tire automatically according to the requirement of the tire. This system is named automatic because it checks the tire pressure constantly using pressure gauge and accordingly gives alert signals to the driver. Aim of this project is to stabilize all automobile tires with ideal pressure, make system absolutely automatic, achieve satisfactory fuel efficiency, construct an affordable system, increase tire life and reduce accident rate has been achieved by installing the system in vehicle.

Keywords: Automatic Control, Safe Driving, Self-Inflating System, Tire Pressure, Vehicle

I. INTRODUCTION

A variety of tire monitoring strategies have been proposed to aware driver of low tire pressure. Under inflated tires run on the road due to unawareness of the fact that properly inflated tires can safe tire life up to 20% which is nine months more of its life span. It can also save fuel from 4% to 10%, increase braking efficiency up to 20%, and ease the self-steer.
The research finding shows that the air pressure in the car drops 10 to 20 kpa a month which is equivalent of adding a 70kg person into the car. Inflating accurate tire pressure save the tire from extra heating, explosion and also help decrease maintenance cost.

Compressor is used in this system to collect the air from atmosphere, compress it and deliver to the tire for inflation. Under inflated tires tend to wear at the edges more than at the center as the pressure is not sufficient at the center to bear the load. As against this for over inflated tires wear is higher at the center due to bulging of tires. Wearing of the threads causes the skidding of the tire hence leads to major danger accidents. All of related studies shows that under inflation from axle tires result in under-steer tendencies while rear axle under inflation creates over steer behavior hence disturbing the car handling. This system is addressed to be automatic as it automatically checks the tire pressure by using pressure gauge and if tire pressure is decreased below ideal condition than the compressor starts to supply the air to refill the tire. It also predicts about the puncture when there is continuous reduction of its set optimal value. The advantage of the system is that it does not require any special attention from user side once after the system being installed. It discards the requirement of checking tire pressure manually, thus saving time and labor. With the recent oil price hikes and ever increasing environmental Automatic Tire Pressure Controlling and Self Inflating System: A Review.

The system addresses a potential development in a gas mileage, tire wear reduction, and an improvement in handling and tire performance in adverse condition. This kind of systems are all- ready being installed in military vehicles and commercial cars for safety purpose and to feel the luxury driving but this system is being introduced for all types of customer vehicles with the absolute motive to give safety assurance and comfort driving. Now with the installation of this system one can drive vehicle under
all worst sudden varying environmental conditions like heavy rainfall, snowfall, deserts. Specially at remote places this kind of system proves to be most helpful as repairing devices for maintenance of the automobile are very critically available. At some crucial times like war conditions or any flood condition there is no time to refill the tire with air hence Automatic tire controlling and self-inflating tire system is very essential to be encouraged to install in every automobile to face all tire related issues and enjoy safe and comfort driving.

II. BACKGROUND

There has been a notably increasing number of inconveniences let alone untimely expenses caused by tyre problems, including and not limited to increased fuel consumption. Majority of scenarios have been where one fails to make it to work or to an appointment in time due to a flat tyre and on top of that is forced to fish out money to get the car operational again simply due to tyre pressure issues (Varghese, 2013). Many drivers do the routine of passing through a pressure refilling point every morning before they get to work which is a both inconvenient and expensive way to maintain tyres, and as such some drivers choose to ignore under inflated tires (Omprakash & Kumar, 2014). Unfortunately they do not know that in doing so they increase the overall fuel consumption of the vehicle. The instauration of a proper and automated tire pressure inflation system would be an innovational advent that would answer to the many vehicle hustles related to tyre pressure systems currently being faced, incidentally reducing tyre repair costs by 28% according to Bradley (1997) as cited by (Pelts, 2006). The under-inflation of car-tyres attribute to high maintenance cost of the tyres, elevated fuel consumption and inconveniences or holdups to the user which has negative effects on finances and it causes delays to work and other appointments. The aim of the paper is to design an automatic tyre inflation system for tyre pressure monitoring and maintenance so as to improve the service provision to cost ratio of any sedan car as well as provide user comfort ability and convenience.

III. PRESSURE INFLUENCE ON: VEHICLE PERFORMANCE; TYRE LIFE; FUEL

The detail from the analysis discussed above is used in the dimensioning and structural outlay of the tyre, i.e. resilient material selection, size ratio with the vehicle, as well as optimum operating pressure levels. Effects of incorrect operating tyre pressure levels are shown by the picture below:

How tyres look like in different cases

Fig. 3: How tyres look like in different cases

IV. METHODOLOGY

The researchers at this juncture will elaborate the methods that are going to be used in coming up with the automated pressure system for tyres, some of which will include the use of AutoCAD 2007 and Solid Works 2014 which are Computer Aided Design Packages to produce working drawings for the various components of the system, furthermore the assimilation of the sensor technology implementation by means of modelling using Android Studio 2.0 and Java SDK for coding.

V. COMPRESSOR UNIT

The compressor component is the one that will produce the required pressurized air, thus so its position will be critically considered since it will need to supply all wheels equally. The compressor unit/s also has to be powered by a secondary source other than the battery to avoid overloading.
VI. PIPE-NETWORK / AIR CARRIAGE SYSTEM

This is the network of pipes which will actually carry the pressurized air to the wheels upon request conveyed by the respective sensor mechanism on the wheel. It will be short and delicately made in order to fit for rotating wheels, preferably it will be imbedded in main wheel assembly structures so as to avoid any chances of damage. These also should be strong so they can withstand the force due to pressurized air.

VII. DELIVERY SYSTEMS AND VALVES

This pertains to the small tubes which will connect to the tyre and deliver the air from tanks or compressor. The whole system will be made with a dense supply of self-actuating valves to ensure safe and efficient delivery of pressurized air to wherever it is purposed. One way valves/check valves to prevent backflow, quick relief valve for safety kill switches and controller/regulator devices to keep the pressure constant.

VIII. SENSOR MECHANISM / ON – OFF SWITCHING

Undoubtedly the most vital component of the system to be expertly engineered with precisely accurate pressure preset limits to initiate pressure supply On-state whenever the tyre has deflated to a value of pressure less than the provisional optimum boundary value Popt-min and Off-state whenever the tyre has gained enough pressure to value just below Popt-max. The values Popt-max and Popt-min are values such that they are 0.3 bars plus and minus optimum tyre operating pressure respectively.

IX. CONCLUSION

The use of vehicles as a mode of transport is notably growing by day and the ultimate goal of the engineering discipline would be to ensure satisfactory service provision. Proper and efficient tyre pressure maintenance is one of the answers to such endeavor and as such this design project contribute an idea that can be implemented and be of great savings to motorists. The design shows promise that once employed of fulfilling the objectives of this project of cost savings and ensuring convenience of the motorist.

REFERENCES

[6] © IEOM Society International