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Tire Pressure Monitoring and Automatic Air Filling System in Cars

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ABSTRACT

Roads are the most important modes of transport now a days & cars are integral part of it. Tyres lose air through normal driving-especially when run through pot holes & permeation. Moreover temperature changes are also one of the reason due to which tyres lose air. Thus vehicles run with an under-inflated tyre which may cause accidents. Studies show that a drop in tire pressure by just a few PSI can result in the reduction of gas mileage, tire life, safety, and vehicle performance. This project aims to develop an automatic, selfinflating tire system. Such a system ensures that tires are properly inflated at all times. Our project design is successfully tested and implemented with help of centralized compressor. The compressor will supply air to all four tires via hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel. The Rotary joint is an integral component of the system-which has half of its part rotating with the wheel & rest half part is stationary. Considering today's ever increasing environmental threats; oil price hikes & energy consumption our system is most compatible and potential improvement in gas mileage & tyre wear reduction which leads to an increase in performance of Tyre in Diverse Conditions.

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I. INTRODUCTION

Automobiles have become an important and reliable companion of humans. The usage of the automobiles is increasing in a rapid manner. The various Automobile industry are now competing each other to win the hearts of humans. In order to do so, the companies are improving the safety systems in automobiles. The more reliable, the more successful the car becomes. In ancient time, after the discovery of wheel by man, it has been used extensively for various purposes and it is vital part of human life for ages. These wheels runs human life faster and faster with new technology and one such technology is on board air inflation system used in automobiles. Tires are the second-highest cost for the trucking industry. The on board air inflation system is used to maintain the pressure of tires in running condition. The environmental conditions varies according to region, seasons because of this, it require maintaining the tires pressure for better performance according to conditions. In a super highway, tire fault is very hard to prevent and a severe problem to drivers. It is one of main reasons of the sudden traffic accidents. Statistics shows that the number of the traffic accidents happened owing to tire break is about 70% of the whole. In India, the proportion is nearly up to 37% [Loya. C., Joshi P., 2013]. Researchers indicate the key measure of avoiding tire-break is to keep the tire pressure near to its standard value and discover tire pressure release in time. Thus, tire pressure monitoring system (TPMS) has been drawing attention of many researchers and engineers.

The majority of automobile drivers do not adequately maintain their tire pressure, even though tire loses approximately one to two pounds per square inch (PSI) of air a month. Underinflated tires cause a greater contact surface area with the road, resulting in higher friction between the road and tire. This significantly decreases tire life and fuel economy. Vehicle handling characteristics are also adversely affected due to low tire pressures. So to prevent these effects a TPMS and Automatic air filing system in vehicle is very helpful.

The most important application of this system is in military vehicle. For the military vehicle, the environmental condition, land conditions are continuously varying and they have to face very worst condition like heavy rainfall, snowfall, deserts. At that remote place no such devices are

available for maintenances of the tires. At some crucial times like war conditions or any flood conditions there is no time to filling the air. It consists of compressor, which supplies air and air tank is used to stored air at constant pressure. This pressurize air can be filled into tires through flexible ducting with the help of rotary bearing. The pressure conditions are achieved by pressure gauges.

The tire pressure monitoring and automatic air filling system can not only make the driver more safety, but also save fuel and protect the tire. Tire safety is attracting the driver's attention; the United States had developed laws to enforce the TPMS installation in the car. In this paper, the basic structure and the implement method, automatic filling of air are introduced. This is an electronic system designed to monitor air pressure inside the tires on various types of vehicles. This system report real time tire pressure information to the driver via a display. Proper tire inflation pressure improves fuel efficiency, reduces breaking distance, improves handling, and increases tire life, while under inflation creates overheating and can lead to accidents. The main causes of under inflation are natural leakage, temperature changes and road hazards. The accurately measured temperature and pressure values were obtained by using SMART transmitter pressure sensor. The excellent agreement between the pressure and temperature results measured by the sensor and the direct measurement data is presented.

II. OBJECTIVE

Provide Proper tire Pressure

The ideal functional objective of our design is its capability to adjust the pressures in all four tires of a passenger vehicle to obtain the proper pressure for varying road/driving conditions.

Provide Automatic System

Next objective is to provide all of the said benefits to the user through an automatic system, thus minimizing user intervention. Specifically, it is desired that the system automatically increase the tire pressures for the given road conditions. However, since this objective is closely linked with the ideal objectives in maintaining the proper tire pressure, and thus unattainable due to time constraints, this objective will not be pursued.

Low Cost Device

For both the customer and end user (vehicle owner), it is imperative to keep the price of the device as low as possible. Considering the potential benefits and cost savings that this design has to offer and the prices of optional equipment for passenger vehicles with similar complexity, the target price range for this device has been identified as Rs. 3000 –5000. This is the price for both the OEM and vehicle owner, assuming tha t the OEM does not mark up the price. In addition, this price range should be able to support the costs of components of the system, manufacturing, and any necessary installation. Tire pressure monitoring and automatic filling system provide automatic air filling into the tire when air pressure inside the tire becomes low.

Scope

After going through various surveys we understood several problems of tire due to low air pressure. From this we decided the scope of our project. Literature survey will be most important part because from that we will get to know about recent techniques used and their functions.

III. TIRE PRESSURE MONITORING SYSTEMS

TPMS concepts

In this section, the types of TPMS and their functionality are presented. Also, their advantages and disadvantages along with the applications of TPMS are discussed.

Types of TPMS

Based on the method of measuring air pressure and sending that information to the driver of the vehicle, tire pressure monitoring systems are broadly classified into two types, namely direct and indirect.

Direct TPMS:

Direct TPMS calculates the pressure drop based on actual pressure measurements through physical pressure sensors installed on the wheel rims inside each tire. The data can then be transmitted to the vehicle's electronic control unit (ECU) to instantly inform the driver. The capabilities of Direct TPMS can always be extended by employing additional components, such as microcontrollers (MCUs) and radio frequency (RF) devices.

Indirect TPMS:

Indirect TPMS, as the name suggests measures the air pressure indirectly and most of the existing systems are based on wheel speed measurements. It detects under-inflation by using the speed sensors located in the anti-lock braking system (ABS) to compare wheel rotating speeds making use of the fact that an under-inflated tirehas a slightly smaller diameter, thus it rotates at a different rate from properly inflated tires. But the disadvantage of indirect TPMS is that the vehicle has to be in motion. Also the vehicle driver cannot keep track of the individual tire pressures. Further if all four tires lose the same amount of air, then the relative change will be zero limiting the effective functionality of the TPMS to only three tires.

Features of Tire Pressure Monitoring System

- Measure and display tire air pressure with an accuracy able to detect under inflation conditions of less than 25% of the recommended cold inflation pressure.
- Locate tire involved in pressure defect (optional).
- React to fast and slow leaks (<5secs) for early warning.
- Warn for punctures.
- Alert for proper tire maintenance.
- Can monitor spare tire pressure.
- Can monitor tire pressure when stationary and deliver key-on information to the driver.

IV. SYSTEM STRUCTURE

Component Used:

Fig 1. Compressor

Fig 2: Rotary Joint

Figure 3: Pressure Sensor

Fig 4. Arduino microcontroller

V. RESULT SETUP

Fig 5: Actual Model

Bearings are fixed to the rigid supports via nuts and bolts. The axle is rotate on which wheel or rim is mounted on one end. One end of coupler is connected to axle and other end is connected to rotary joint. There are electronic sensors are used to detect the tire pressure with the help of pressure gauge. When the pressure in the tire reduced below the required level then the sensors senses the pressure level and send feedback signal to compressor for maintaining pressure level of the air in the tire.

VI. CONCLUSION

Low pressure in the tire causes accidents, reduction in the mileage, imbalance of vehicle, Increase fuel efficiency. So we developed model which maintain the tire pressure by supplying air whenever required. Automatic tire pressure monitoring and air filling system ensures that all tires are always properly inflated and thus improves the tire life, safety, reduction of gas mileage and vehicle performance by supplying air to all tires via hoses and a rotary joint whenever there is a pressure drop inside the tire.

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