

# A Survey on Automatic Air Inflating System for Automobile

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**ABSTRACT:** Aim of this study show that a drop in tyre pressure by just a few PSI can result in the reduction of gas mileage, tire life, safety, and vehicle performance, we have developed an automatic, self-inflating tire system that ensures that tyres are properly inflated at all times. Our design proposes and successfully implements the use of a portable compressor that will supply air to all four tyres via hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel. The rotary joints effectively allow air to be channeled to the tyres without the tangling of hoses. With the recent oil price hikes and growing concern of environmental issues, this system addresses a potential improvement in gas mileage; tyre wear reduction; and an increase in handling and tyre performance in diverse conditions.

**KEYWORDS:** Puncture, Safety, Digital Air Compressor, Inflating system.

## I. INTRODUCTION

According to Concept, about 80 percent of the cars on the roads are driving with one or more tires under inflated. Tires loose air through normal driving (especially after hitting pot holes or curbs), permeation and seasonal changes in temperature. They can lose one or two psi (pounds per square inch) each month in winter and even more in the summer. And, you can't tell if they're properly inflated just by looking at them. You have to use tire pressure gauge. Not only is under inflated bad for your tire but it's also bad for your gas mileage, affects the way your car handles and is generally unsafe. When tires are inflated, the tread wears more quickly. According to Goodyear, this equates to 15 percent fewer miles you can drive on them for every 20 percent that they're under inflated. Under inflated tires also overheat more quickly than properly inflated tires, which cause more tire damage.

Today automobile sector plays a big role in the economics of all the countries in the world and lots of researches have been carried out to improve the efficiency of the vehicle one the techniques to improve the efficiency of an automobile is inflate the tyre regularly. As its well-known, one of the most serious problem that the large motor vehicle have whether they are for the transportation of passenger or cargo and especially those used for middle or longer distance travel, resides the ensuring the correct performance of the tyres. This means making sure that tyre are inflated and stay inflated for the right amount of pressure for the load being carried and for road condition this way one can ensure not only the preservation of outer covering of the tyres, but also the correct operation of vehicle without any risks. Fig.a. shows the faded area below indicates areas of excessive tread wear.[10]

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Figure (a). Difficult to Notice Under-Inflated Tire[11]

## II. LITERATURE REVIEW

Bezuidenhout in discuss The South African Sugar cane industry has identified central tyre inflation (CTI) as a technology that could improve vehicle performance and reduce costs. This specific need is due to the fact that transport comprises up to 20 % of a cane grower's production costs because of poor vehicle utilization. Consequently it is important that transport costs should be reduced in order for the sugarcane industry to maintain profitability[1]. Central tyre inflation technology offers benefits such as improved mobility and savings in road maintenance costs, but more importantly can also reduce the two largest operational expenses on a transport vehicle namely fuel and tyres as per Oberholzer[2]. As per Kaczmarek During World War II the mobility requirements in the former Soviet Union and Warsaw pact countries were extremely demanding due to poor road and highway quality. Consequently, a considerable effort was made by these countries to develop systems to improve mobility, including primary suspensions and central tyre inflation systems[3]. Kaczmarek (1984) stated that "One of the most effective and well proven systems that have been adapted to wheeled tactical vehicles to improve the overall vehicle mobility is CTI." However, after World War II no serious consideration of the benefits of CTI occurred until the early 1980's, where after most of the military tactical vehicles produced in the United States were equipped with CTI discuss by Adams[4]. Sturoset *al.* Say's Tyre deflection is the key to understanding the use of CTI technology. Tyre deflection is defined as the change in tyre section height from the freestanding height to the loaded the height. The percentage deflection is the ratio of that change to the freestanding section height. At the lowered inflation pressures (increased tyre deflection), the tyre's imprint or contact the area is greatly increased and the load is applied over a substantially larger area[5]. Foltz and Elliot discuss that A CTI system permits a vehicle operator to optimize tyre and vehicle performance by varying inflation pressures in response to changing operating conditions (load, road and vehicle speed) while the vehicle is moving[6]. In this study, the air pressure of tyre is maintained by using automatic tyre inflation system.

**Case Study on Automatic Tyre Inflation Management:** The aim of this study is to design and fabricate a system in which there is proper inflation in the tyre at all times which produce fuel savings of 1-4% and increase tyre life by up to 10%. A trial was done in this case paper involving two cement tankers in NSW Australia operated over a period of 12 weeks in 2013. For first 6 weeks central inflation system was turned ON in both tankers and for another 6 weeks central inflation system was turned OFF in the both and graphs are prepared showing trucks with central inflated system is good in conditions like average vehicle idle time, average vehicle time spent using power take off, average vehicle GHG emissions, average vehicle fuel consumption across the trial period.[7]

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## III. EFFECT OF TYRE PRESSURE ON VEHICLE PERFORMANCE

The algorithm automatically generates mask image without user interaction that contains only text regions to be inpainted. Proper air pressure in a tire helps to distribute the weight of a vehicle evenly across the tire's tread pattern, so the tire (and the vehicle) is at its most stable. When a tire is under-inflated or over-inflated, it loses stability, negatively affecting handling, cornering, and stopping. Eventually the tire will also start to wear unevenly. Under-inflated tires tend to show wear on the outside edges of the tread as shown in fig.(b), while over-inflated tires show wear down the middle of the tread. With incorrect inflation pressure more tyre wear and thus there is a need to change tyre quickly.



Figure (b). Tyre wear patterns observed for different tyre inflation pressures

The main motivation for properly inflated tyre is to distribute the vehicle load evenly across the tyre footprint thereby providing good contact with the road, passenger comfort, responsive handling and uniform tyre wear. It should be remembered that it is the air pressure inside the tyre that supports the weight of the vehicle. Two situations can arise with improperly inflated tyres namely, under-inflated and over-inflated.

In the case of under-inflated tyres, the tyre life could be reduced considerable if the tyre pressures is maintained low for long periods of time. Tyre manufacturers Michelin and Goodyear have claimed a reduction in tyre life of up to 30 % if tyres are operated 20 % below recommended pressure. Tyre also bends and distorts more, resulting in over-heating and increased RR. In a test conducted by tiretrack.com [4], it was even found that the vehicle was a few seconds slower around a track on under-inflated tyres, with drivers reporting a detached feeling from the vehicle in the corners. For the over-inflated case, the tyre could sustain damage when riding over road surface irregularities such as potholes and bumps. Passenger comfort is also marginally compromised. Increasing the tyre pressure results in a decrease in tyre-road contact area, resulting in slightly poorer traction and braking capabilities. Figure 11 shows typical tyre wear patterns observed for under-inflated, recommended and over-inflated tyres. An under-inflated tyre tends to wear at the shoulders more than at the centre, since the pressure is not sufficient at the tyre centre to bear the load. For over-inflated tyres, the wear is severe along the centre due to bulging of the tyre. Proper tyre pressure becomes particularly important in wet weather conditions from a safety point of view. Tread depth, tyre footprint size and tread design play a vital role in determining the hydroplaning characteristics and wet traction performance of a tyre. From a series of test conducted by Michelin it was concluded that the tyre pressure plays an important role in determining the tyre's contact patch surface area, especially at increasing vehicle speeds. Tests revealed that an under-inflated tyre would hydroplane at speeds lower than well inflated tyres for the same height of standing water.

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## IV. WORKING PRINCIPLE

This mechanism works on the principle that the compressor supplies air to the tire when the vehicle is running. The air from the compressor is supplied to the rotary joint, from where the air is supplied to the tire which is under-inflated because of the implementation of rotary joint the air is easily supplied to the tire without tangling the hoses. An automatic compact air compressor, shutdown automatically when the required tire pressure is reached. In the process of automatic tyre inflation system as shown in fig.(c), the compressor is used to compress the air. The air is taken from the atmosphere and compressed it at required pressure. There is ducting which is used connect to the compressor outlet port and one end of the rotary joint. The compressed air is supplied to the rotary joint through the ducting. Two Pedestal bearings are used to support the axle of the assembly. 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.

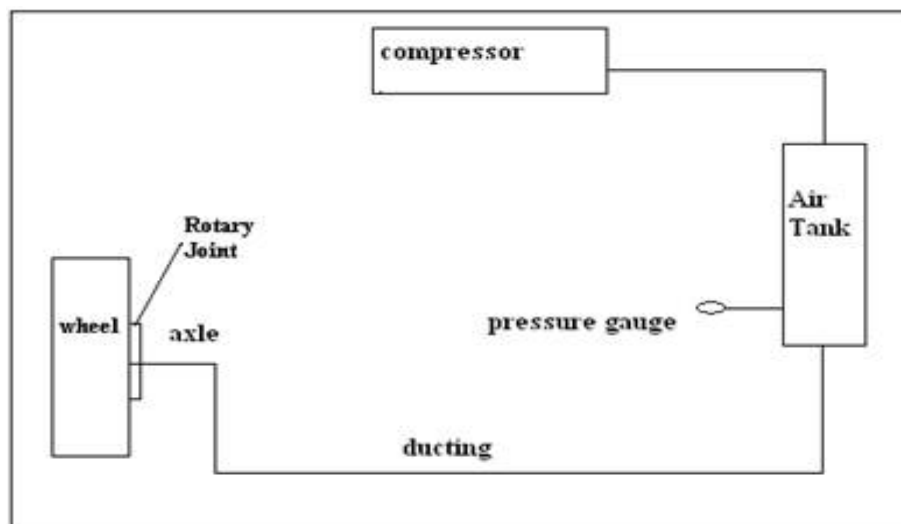


Figure (c). Block Diagram of air inflating system[11]

There are electronic sensors are used to detect the tyre pressure with the help of pressure gauge. When the pressure in the tyre 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. Compressor works on the 12V battery of the vehicle and it is reciprocating in nature that's why it's easy to obtain the desired pressure level. Rotary joint is used to rotate well as to supply compressed air simultaneously when required.

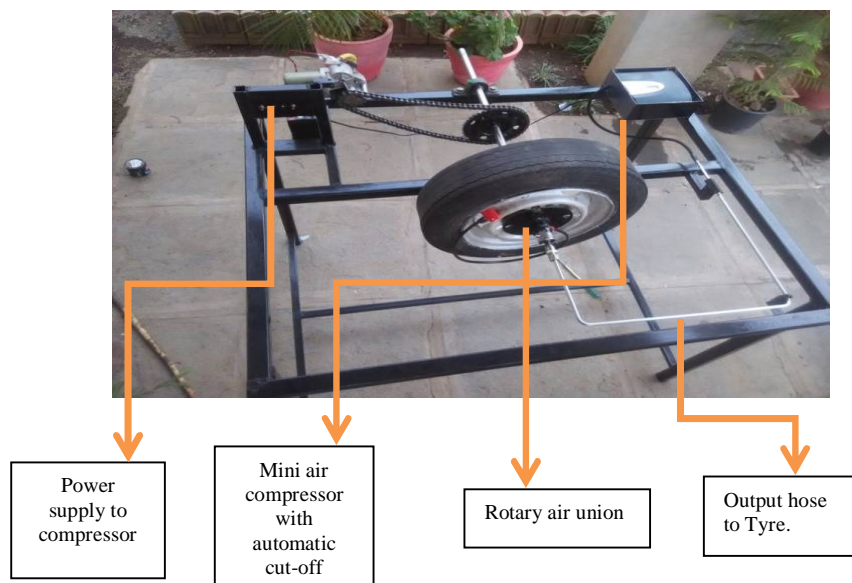
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## V. COMPONENT'S OF SYSTEM

The different components are used to build up the assembly of air inflation system as shown below.



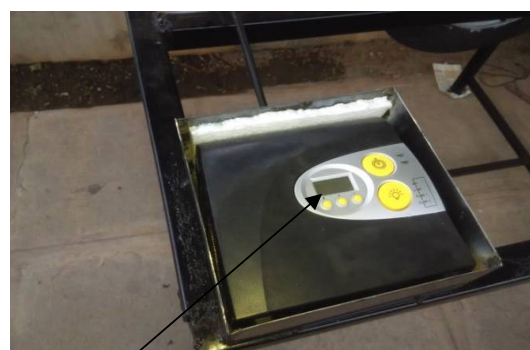
Figure(d). Component's of System



Input from  
Compressor  
unit

Output to the  
Rotating wheel

1.Rotary air union device



Digital displaying air inflating unit

2.Digital air compressor

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Table.1.Specification of Digital air compressor is given below

Item Weight	939 g
Product Dimensions	27 x 9 x 21 cm
Item model number	RCP-A20A
Additional Features	DIGITAL DISPLAY WITH AUTO CUT-OFF, BRIGHT EMERGENCY LIGHTS, INCLUDES INFLATION ACCESSORIES
Voltage	12 Volts
Power Source	Dc
Material	ENGINEERING PLASTIC

### 3. Hoses And Pipes:

They are used to supply the air to the vehicle tires.

### 4. Steel Square Pipes:

Steel square tubes of 1.5 inch x 1.d inch are used to fabricate the table for support.

### 5. Pedestal Bearing

### 6. Car Wheel

### 7. Dc Motor

Specifications:

- VOLTAGE: 12 V
- RPM: 24
- POWER: 17 W

### 8. Car Battery (12V):

An automatic battery is a type of rechargeable battery that supplies electric energy to an automobile. Usually this refers to an SLI battery (starting, lighting, and ignition) to power the starter motor, the lights and the ignition.



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## VI. TESTING AND RESULTS

The ideal objective is to fill the proper air pressure in under inflated tire while vehicle is in motion which we have achieved if such system is implemented in vehicles the mileage of the vehicle is increased and tire wear is reduced.

Table .2. Average time for various PSI

TIRE PRESSURE (in PSI)	READING 1 (in sec)	READING2 (in sec)	AVERAGE (in sec)
5	250	265	257.5
10	305	310	307.5
15	375	350	362.5
20	480	475	477.5
25	600	610	605

The above table shows that by changing the psi the time taken for inflation of air in tyre changes.

## VII. CONCLUSION

The dynamically self inflating tire system would be capable of succeeding as a new product in the automotive supplier industry. It specifically addresses the needs of the consumers by maintaining appropriate tire pressure conditions for reduced tire wear, increases fuel efficiency, increases overall safety of vehicles. It helps in the monitoring of tyre pressure constantly, provides inflation or deflation of the tyre, and helps in attaining better mileage also helps in providing comfortable driving.

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