

## Automatic Tyre Inflation Systems - A Review

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**Abstract**— If there is a drop in tire pressure by a few PSI can result in the reduction of gas mileage, tire life, safety, and vehicle performance. The only part of a vehicle which is not getting automated is tires. The main working principle of the Tire Inflation System is that the compressed air is passed through the rotary joint into the nozzle fitted in Rim of the Wheel. The rotary joint thus allows the air to flow through itself along with providing the rotary motion of the wheel assembly. The rotary joints effectively allow air to the tires without the tangling the hoses. Hence the tire is inflated automatically when vehicle is in motion simultaneously with the help of rotary joint.

**Key words:** Tyre Inflation Systems

### I. INTRODUCTION

National Highway Traffic Safety Administration and the Department of Transportation want to make sure you have the tools to avoid being in one of the 11,000 tire-related crashes that happen each year. Moreover, statistics state that 80% of passenger vehicles on the road have at least one under-inflated tire. Tires can lose air through normal driving or after hitting pot holes or curbs). Bad quality roads in rainy season and temperature changes can further deteriorate the situation. Tires lose 1 or 2 Psi each month in the winter and even more in summer and rainy season. It is difficult to predict the condition of tires just by looking at them and we have to use a tire pressure gauge.

The objective of Tire Inflation System is to inflate the tire automatically when vehicle is in motion simultaneously and also helps to manage the pressure of tires in the running condition of a vehicle. Tire Inflation System detects when the air pressure in a particular tire has dropped and to monitor the air pressure of the tire and to notify the driver if there is a problem with the pressure of a particular tire. This system eliminates the need to check tire pressure manually and continuously, which saves time while ensuring consistent and proper tire inflation.

### II. LITERATURE REVIEW

#### A. Design of Automatic Tyre Inflation System

Hemant Soni, Pratik Golar, Ashwin Kherde [1], 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. This 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. outer covering of the tyres, but also the correct operation of vehicle without any risks. 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.1(a), 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.

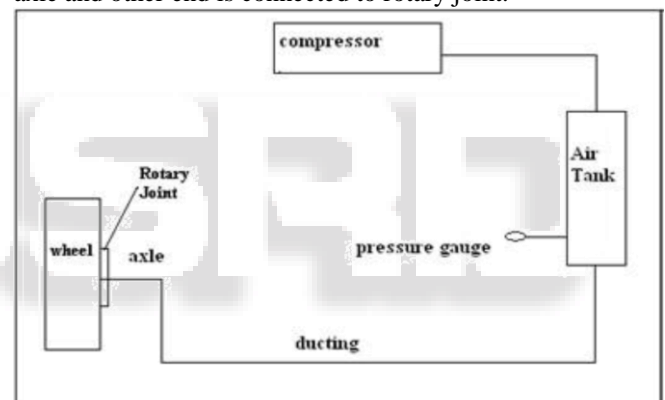


Fig. 1(a): Block Diagram of air inflating system.

#### B. M.A.R.S - Mechanized Air Refilling System

P.Omprakash, T.Senthil Kumar [2], Every section of an automobile is getting automated except one- Tires. To inflate a tire, the driver has to go to a gas station or he has to attach a pump manually. Both these involve human labor. This project is aimed at removing such unwanted strain and save time. Another problem in tires is a puncture. A sudden puncture can cause the driver to lose control, culminating in an accident. The project's minor objective revolves around this. It warns the driver of a puncture and saves life. It also saves a lot of money by giving more longevity to the tire and better mileage. As the tire is filled with optimum air, the friction between the tire and the road is maintained properly. Henceforth, the tire is not damaged much and the fuel consumption is reduced. The project is destined to be a life and money saver

The system consists of control, pumping and display unit.

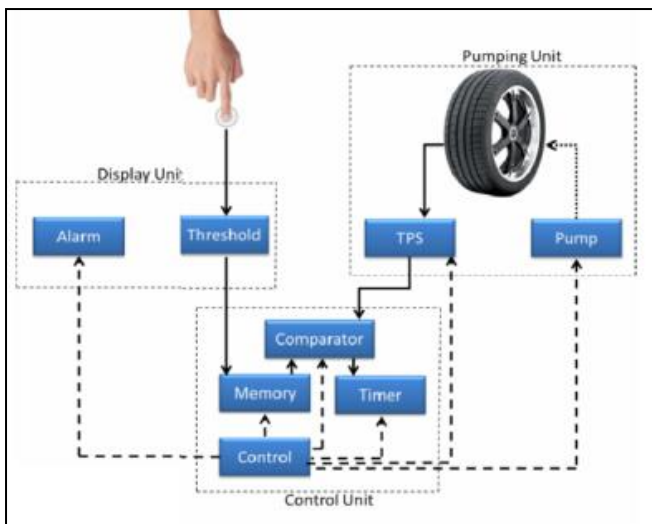


Fig. 2(a): Block Diagram

### C. Pumping system:

The pump will be fitted near the wheel, parallel to its axle. Each wheel will get a dedicated pump. The pump needs just 12v to operate. So a power supply from the car battery is more than enough for the proper functioning of the pump. The hose is made of a strong material to survive the rough conditions.

This project involves the connection of the pump and the tire's valve permanently, even during the motion of the car. In this case, the wheel's rotation must not damage the pump connection at any cost. So we go for a special design which facilitates the motion of the tire without damaging the connection. The design provides an airtight connection in the center of the wheel. This allows free motion. The valve used is a one way valve, to prevent the air from escaping through the same.

### D. Display unit:

This is not only a unit which gives information but also gets some data from the driver. A touch system will be well and good. On the first installation of the unit, the driver chooses his desired pressure level. This will be stored in the system's memory as the threshold value. This value can be changed by the driver depending upon the load of the vehicle. The optimum level is about 35-40 psi. When the driver starts the car, the system is switched ON and shows two options- Manual or Auto mode. As the name suggests, one is fully automatic while the other gets authentication from the driver every time it has to perform an action.

### E. Control unit:

This is the brain behind the system. It takes major decisions and coordinates the entire system. The inputs given to the system are from the display unit and TPS. Output is given to the display unit and pump. The following actions are taken by the control unit in order.

## III. RESULTS & DISCUSSION:

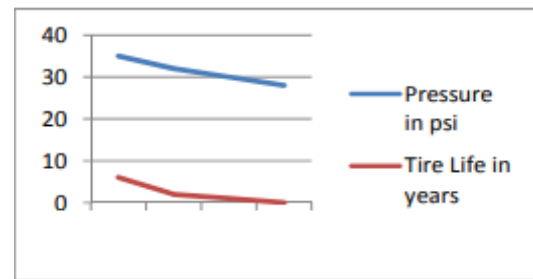


Fig. 2(b):

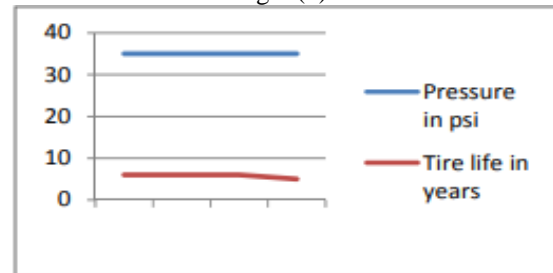


Fig. 2(c):

Fig. 2(b)- Before using the system, the pressure level is not maintained properly. Due to this improper maintenance of the tire, the life time of the tire falls rapidly. This causes the early replacement of tire. The under inflation also causes more wear and tear of the tire. This under inflation allows punctures to occur easily.

Fig. 2 (c)- After using the system, the pressure level is maintained properly. The tire is filled with optimum air. Thus the life time of the tire is maintained properly. As it is filled with optimal air the probability of puncture is greatly reduced.

## IV. CONCLUSION

In this study, two different systems were examined and analyzed. Automatic tyre inflation system helps in the monitoring of tyre pressure constantly, provides inflation or deflation of the tyre but pressures cannot be selected manually by the driver. In case of analysis of M.A.R.S - Mechanized Air Refilling System showed clearly that system improved the life time of the tire and also provided a smooth ride. It also increased the fuel efficiency. The prototype was able to tackle various conditions. It also proved vital in warning about the puncture and also has a display unit which shows tyre pressure and helps drivers to manually select the desired pressure. The analysis showed clearly that my system improved the life time of the tire and also provided a smooth ride. It also increased the fuel efficiency. The prototype was able to tackle various conditions. It also proved vital in warning about the puncture. My future implementation is to device a more compact version of my prototype.

## ACKNOWLEDGEMENT

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