

# Design and Working System of Automotive Tyre Inflation System

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**ABSTRACT:** Tire pressure plays role in ensuring safe and economical driving. Improperly tires can affect stopping distance increase the chance of tire delimiting, reduces the handling characteristics which in turns affects the control of vehicle. Even then, many vehicles with under inflated tires are observed to be on the road due to the unawareness. Self – inflating tire (SIT) system is the combination of Electronic Control Unit (ECU) & pneumatic control unit (PCU). Self-inflating tire properly inflated the tire pressure. Therefor its improving the tire life. Self –inflating tire is designed for the slow leakage and small pressure. Due in to slow leakages and small puncture reduced the air pressure in gradually. SIT is maintaining the tire pressure at proper or required level. Self-inflating tire does not need the time by driver for filling the air pressure in tire. Self –inflating tire is mostly useful in military vehicles & commercial application.

**KEYWORDS:** Self – inflating tire, Tire Pressure, Vehicles, Air Pressure

## I. INTRODUCTION

The main purposes of a passenger car tire are the tread, the body with sidewalls, and the beads. The tread is the higher pattern in link with the road. The body chains the tread and gives the tire its unambiguous shape. The beads

are rubber-covered, metal-wire rolls that hold the tire on the wheel.

Computer systems now play a most important role in tire project. Complex studies of two substitute on years of test data allows tire engineers to act out the performance of tread design and other design limits. The software creates a three-dimensional colour image of a possible tire design and calculates the effects of different stresses on the future tire design. Computer recreations save money for tire manufacturers because many design boundaries can be open before a proto-type tire is really assembled and tested.

In calculation to tests of tread design and tire body structure, computers can act out the effects of different types of rubber compounds. In a current passenger car tire, as many as twenty different types of rubber may be used in different parts of the tire. One rubber compound may be used in the tread for good power in cold weather; another compound is used to give increased stiffness in the tire sidewalls.

After tire engineers are content with computer studies of a new tire, manufacturing engineers and expert tire assemblers work with the designers to produce tire models for testing. When design and industrial engineers are satisfied with a new tire design, tire factories begin mass production of the new tire.

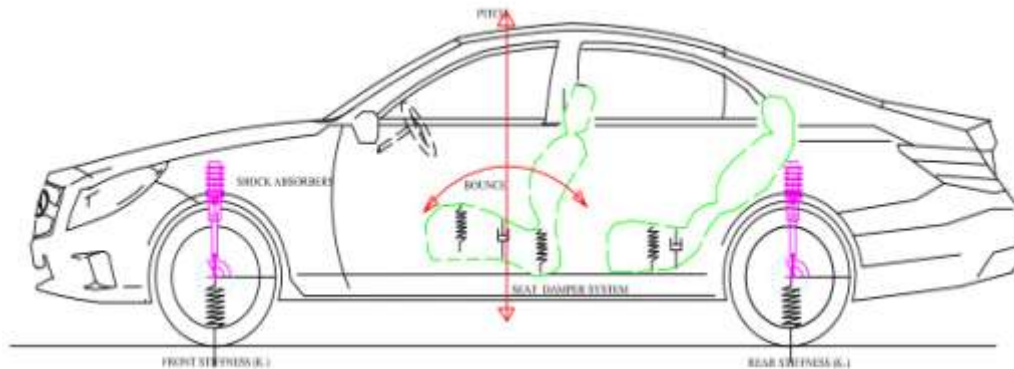


### Background

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 (Pletts, 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.

## II. DYNAMIC BEHIND THE AUTOMOBILE TYRESYSTEM



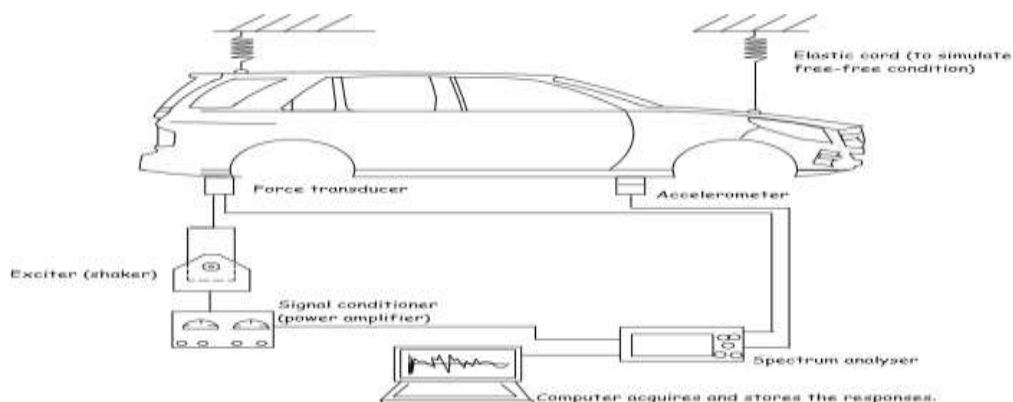
**CAD Illustration of the pitch, bounce capability (singiresu, 2011), p.539.**

It is of great importance to carefully take into account the effect of high speeds on reciprocating machine elements in order to properly and adequately balance them out otherwise they would produce vibrations as with reference to the text by (Kottayam, 2002-2003, p. 1). These vibrations would in turn cause accelerated wear of components such as the bearings and worse still it may lead to complete machine failure or cause significant damage to both the machine and the ground that supports it (Randall, 2011). In this project researcher An Experimental Modal Analysis (setup shown in the diagram below) is carried out on a vehicle during its production and the results are used to find the limiting levels of vibration absorption that is required and this information is used in

focuses in the tyre area on an automobile which is reasonably responsible for vibration absorption and vehicle safety considering that it is the lone means of contact of the ground and the machine in question.

The tyres and the automobile's suspension system have been designed with the capability to absorb vibrations from both the ground and the vehicle henceforth maintaining a balance of masses (Kottayam, 2002-2003) and thus keeping low levels.

the designs of vehicle tyres, determination of tyre sizes depending on overall load, both the NVM and the GVM values, and also in the design of the shock absorbers to allow for pitch and bounce (Beard & Sutherland, 1993).



**Experimental modal analysis. (Singiresu 2011, p.903.)**

The linking shock absorbers and leaf springs from the car suspension see to it that all the induced oscillations by the unevenness of a variable road- surface are safely isolated from the vehicle and dissipated away as per principles of vibration isolation (Singiresu, 2011). The tyres are made of resilient material (rubber)

which provides grip and absorbs energy (Khurmi & Gupta, 2005) thereby preventing damage to the ground at the same time offering ride comfort. Overly these effects result to vehicle safety and optimum performance given that the tyres operate at the set optimum service press ure levels. The tyre is also tested for a Finite

Element Analysis (Anghelache & Moisescu, 2008), to study its responses and mode shapes during operation for compressive stresses due to the weight of the car, the impact loading or shock loading when operating at NVM and at GVM. The analysis is done for shear stresses and bending stresses during breaking and turning of the car (Anghelache & Moisescu, 2008). Thus so the proper monitoring and maintenance of tyre pressure would ensure that the vehicle operates within range of these stresses in the wind's viscous drag basing on drag effects (Douglas, et al., 2005, p. 430), eliminating the additional effect of the drag force of an underinflated tyre which would mean increased fuel efficiency, enhanced convenience, and tyre life longevity thus minimal maintenance or replacements costs.

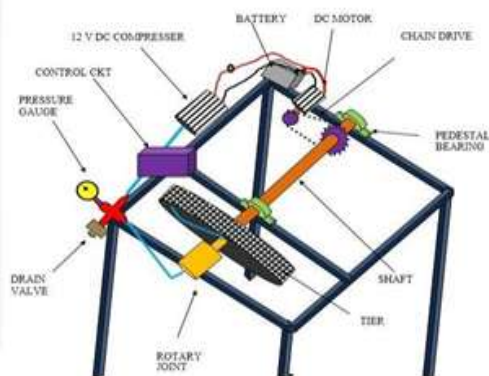
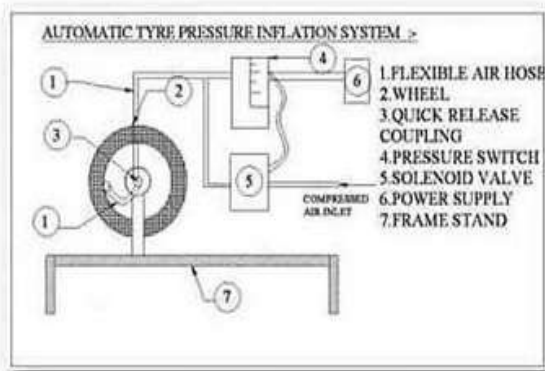
### III. DESIGN METHODOLOGY AND RELATEDWORKING

#### Selection of Parts:

- 1) Solenoid Valve
- 2) Compressor
- 3) Rotary Joint
- 4) Pressure Sensor
- 5) Bearing WORKING:

In the process of automatic tyre Inflation system, 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. 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 tyre. 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 rotates well as to supply compressed air simultaneously when requires.



**Drawing Automatic Tyre Pressure Inflation System.**

**Solenoid Valve:** 2/2 air solenoid valves direct acting solenoid valves and don't require a smallest operating incongruity pressure. The coil is wound up, it lifts the solenoid plunger, which typically rests on the valve seat and lifts it to open the main valve orifice.



**Compressor:** Air compressors can prove a play a positive role for many dissimilar tasks, the best part is that the air compressors can be reasonably useful when you are fixed up in different situation on the road. You should make it a point to have a unfailing air compressor with you in your personal vehicle when you are drifting. Generally we are not carrying this with us while rootless and day to day is just needed the most while you have held in such condition like if you are in hurry and tyre of your vehicle get wounded. Here, we are using the compressor 12V. This air compressor has numerous functions and can easily operate under 110 V AC.



**Dimensions: 16 x 13 x 8cm Maximum Output: 250 PSI/20.7 bar Robust and Durable Design 22" Nyl on Air Hose**

It is available with high value rubber hose. It has a 9ft, 10 inch cord that proves to be quite useful. Thus the cord is fit sufficient to reach 4 tires with a lot of ease.

**Rotary Joint:** We are designing thus device for common passengers vehicles, and the main task is the presence of the axial shaft that runs conventional into the centre of the wheel forcing us to find unusual method of routing the air.



Our proposed standing with the spindle. Within this rotary joint will allow air to pass from the static half of the joint into the half that is rotating

**Pressure Sensor:** A pressure sensor amount pressure, typically of gases or liquid. Pressure is an appearance of the force vital to stop a fluid from mounting, and is usually stated in terms of force per unit area. A pressure sensor is generally acts as a transducer; it produces a signal as a function of the pressure forced.



Pressure sensors are used for controller and monitoring in thousands of day to day statement. Pressure sensors can also be used to indirectly amount other variables such as gas flow, speed, level. Pressure sensors can otherwise be called pressure transducer, pressure indicators, etc.

**Bearing:** It is a mechanical component, which supports another component. It passes relative movement between the reaching surfaces while conveying the heaps. They decrease the crushing and transmit the movement sufficiently.



#### Advantages:

- 1) Reduced tyre blowouts since tyres remain at the proper inflation level at alltimes.
- 2) Reduce maintenance cost and timeefficiency. Reduce humanefforts.
- 3) Increase the vehicleefficiency.
- 4) Increase the life span of tyre
- 5) Avoids accidents andfatality.

#### Applications:

- 1) It can be used in militaryvehicles.
- 2) It can be used in emergency vehicles like ambulance, police vehicles and firevehicles.
- 3) It can be used in trucks andtrailers.
- 4) It can be used in very costly vehicles where maintenance of standard isimportant.
- 5) It can be used in sports cars as there is need of regular checking of air pressure intyres.

#### IV. FUTURESCOPE

As previously mentioned, the main beneficiaries of this advancement in technology that will allow for tyre pressure to be adjusted for driving conditions will be the vehicleowners.

Despite an initial investment in the technology, they will experience a reduction in tire wear and an increase in fuel economy; both of which will result in saving money in the longrun.

It is plausible to say that society as a whole will benefit from the resulting design.

The reduction in tyre disposal in landfills and decrease the rate of consumption of natural resources will truly benefit society. Also, the improvement in vehicle safety will benefit all people who drive a vehicle on the roadways.

However, not everyone will benefit from this technology.

Both tire manufacturers and the petroleum industry will be negatively affected by this resulting design. Tire manufacturers will be negatively affected since this product is being designed with the reduction of tire wear in mind.

The demand for their products will decrease as tires last longer and fewer replacements are needed.

This is similarly true for the petroleum industry since this product results in an increase in fuel economy for passenger vehicles, and the demand for oil will go down.

#### V. RESULT AND CONCLUSION

We applied all these techniques to reduce the process time and human efforts of the conventional manual air filling system. The system helps to reduce cost and friction between surface of tyre and road so that will reduce the wastage of tyre material. As a result, it will increase the life of tyre. After fabrication of automatic tyre inflation system, the result obtained that if the system utilization will be executed in proper by taking and concerning all the relevant according to the project demand the process time, cost and human efforts can be reduce in a great manner.

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