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SOLAR BASED AUTOMATIC TYRE INFLATION SYSTEM

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ABSTRACT

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. Tyres are the second-highest cost for the trucking industry. The on board air inflation system is used to maintain the pressure of tyres in running condition. The environmental conditions varies according to region, seasons because of this, it require maintaining the tyres pressure for better performance according to conditions. 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 tyres. At some crucial times like war conditions or any flood conditions there is no time to filling the air. Thus there arises a need for automatic tyre inflation system. This can be done by employing appropriate technique. This project deals with the design and fabrication of automatic tyre inflation system.

Key words: Cascaded multilevel inverter, developed H-bridge, multilevel inverter, voltage source inverter etc.

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I. INTRODUCTION

About 80 percent of the cars on the road are driving with one or more tyres under inflated. Tyres lose 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 the 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 a tyre pressure gauge. Not only is under inflation bad for your tyres but it is also bad for your gas mileage, affects the way your car handles and is generally unsafe.

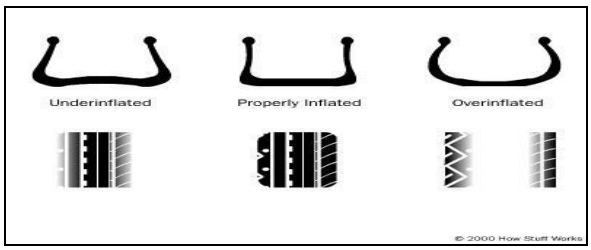


Fig.1.1: Tyre inflating conditions

When tyres are under 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 tyres also overheat more quickly than properly inflated tyres, which cause more tyres damage.

Because tyres are flexible, they flatten at the bottom when they roll. This contact patch rebounds to its original shape once it is no longer in contact with the ground. This rebound creates a wave of motion along with some friction. When there is less air in the tyre, that wave is larger and the friction created is greater and friction creates heat. If enough heat is generated, the rubber that holds the tyres cords together begin to melt and the tyre fails.

Because of the extra resistance an under inflated tyre has when it rolls, your car's engine has to work harder. AAA (Authentication, Authorization & Accounting) statistics show that tyres that are under inflated by as little as 2 psi reduce fuel efficiency by 10 percent.

This system based on tyre pressure monitoring systems (TPMS), which are in widespread commercial use due to legal situations and their positive impact on vehicular comfort and safety standards, advanced tyre monitoring

systems (ATMS) are currently under investigation. Pressure sensor is used to measure pressure inside the tyre.

Fig.1.2: Tire wear patters observed for different tire inflation pressures

Problem Statement

The under-inflation of pneumatic tires, a typical problem in sedans and light duty vehicles, affects the vehicle's handling characteristics. An automated tire monitoring and inflation system can ensure adequate tire pressure to better accommodate handling requirements.

When tyres are under-inflated, the tread wears more quickly Hence we the group of engineer has decided to make a system called Solar Based Tyre Inflation System.

II. LITERATURE SURVEY

1. Paper Title: Effects of central tire inflation system son ride quality of agricultural Vehicles (B.T. Adams et. al,)

Most research and solutions to improving the ride of agricultural vehicles to date have focused on suspending either the cab of the vehicle or the operator seat. If the operator has ever reduced the inflation pressure in radial tires, they know that the ride can be greatly improved by reducing the inflation pressure. Since the tires are theonly primary suspension on most agricultural vehicles, a central tire inflation system(CTIS) would seem to be a reasonable choice of technologies to improve the ride ofthe vehicle without a substantial redesign or increase in cost. Since the benefits of CTIS were demonstrated in World War II, CTIS has become standard equipment on most wheeled military vehicles.

2.Paper Title: Effects of tyre inflation pressure and forward speed on Vibration (Do Minh Cuong et. al,)

Relationships among intensity of vibrations, tractor speed, soil moisture content and tyre inflation pressure are important for the design of tractor suspension systems. This study was designed to evaluate the effect of tyre inflation pressure and forward speed on tractor vibration in the paddy fields of Southern China by using a two-wheel-drive unsuspended tractor with different combinations of forward speed, tyre inflation pressure and soil moisture content. During experiments, the vertical vibration accelerations in front and rear axles and triaxial vibration accelerations of the tractor body were measured using three accelerometers. Fourier analysis was applied to determine root mean square acceleration values in the low frequency range from 0.1 to 10 Hz. The results of the study indicate that tractor vibration is strongly affected by changing forward speed and tyre inflation pressure, and especially by changing forward speed and rear tyre inflation pressure. The research also shows the variation in the pattern of vibration intensity especially at the tractor's front axle when field soil moisture content is changed. The values of RMS acceleration on front, rear axle and tractor body were significantly decreased by decreasing forward speed and tyre inflation pressure when working with two different of field soil moisture contents. Most of the acceleration peaks were observed at the front, rear axle and tractor body when the rear tyre inflation pressure was 180 kPa.

3.Paper Title: Automated Automotive Tire Inflation System Effect of Tire Pressure on Vehicle Handling (Mark Reiter and John Wagner,)

The under-inflation of pneumatic tires, a typical problem in sedans and light duty vehicles affects the vehicle's handling characteristics. An automated tire monitoring and inflation system can ensure adequate tire pressure to better accommodate handling requirements. In this paper, the variance of longitudinal and lateral forces, plus aligning torque, have been numerically investigated for different tire inflation pressures using the STI tire model. The tire/road interface results were integrated into a comprehensive simulation to evaluate vehicle handling behavior. A quadruple lane change test revealed that the required steering wheel angle increased by up to 47.7% for front axle tire inflation pressures at70% of nominal values, whereas the vehicle slip angle was up to 77.8% larger when all tires were inflated to 70% of the recommended pressure. These results suggest that under-inflated front axle tires result in under steer tendencies while rear axle under-inflation creates over steer behavior.

4.Paper Title: The effect of liquid ballast and tyre inflation pressure. (Joao M. Serrano et. al,)

A three-year research project was carried out to study tractor-implement dynamics during till age operations. Field tests with trailed disc harrows were carried out under real working conditions within dry medium textured soils, and subject to primary and secondary till age. The specific objective of this study was to evaluate the effect of liquid ballast and tyre inflation pressure on tractor performance parameters.

5.Paper Title: Investigating the effect of velocity, inflation pressure, and vertical load on rolling resistance of a radial ply tire (Hamid Taghavifar & Aref Mardani,)

A single-wheel tester facility at Department of Agricultural Machinery of Urmia University was utilized to investigate the effect of velocity, tire inflation pressure, and vertical load on rolling resistance of wheel. A Good year 9.5L-14, 6 radial ply tire was used as the tester wheel on clay-loam soil and was installed on a carriage traversing the length of soil bin. Three inflation pressures of 100,200, and 300 kpa as well as three levels of velocity (i.e. 0.7, 1.4, and 2 m/s) and five levels of vertical load applied on wheel (i.e. 1, 2,3, 4, and 5 kN) were examined. Covariance analysis of resulted data revealed that rolling resistance is less effected by applicable velocities of tractors in farmlands but is much influenced by inflation pressure and vertical load.

III. METHODOLOGY

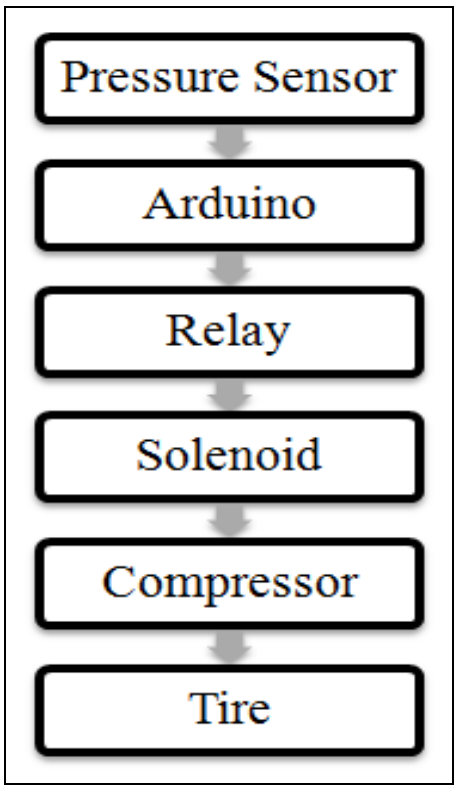
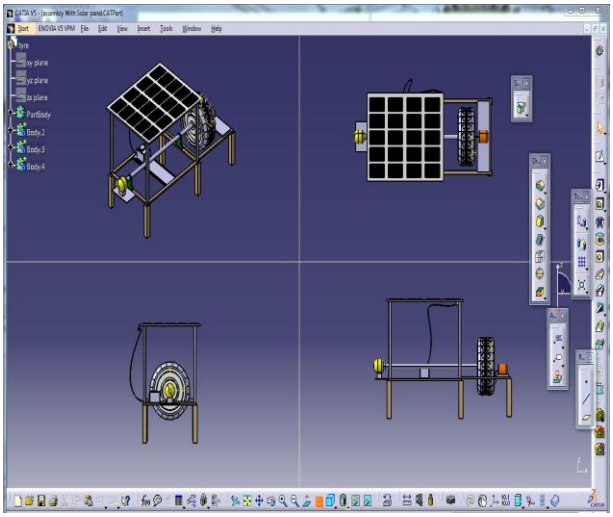


Fig. working path

Pressure sensor is attached to the tire which, continuously check tire pressure. Pressure sensor is connected to the LED display with help of micro-controller. At micro-controller default value of tire pressure is set. Pressure get below default LED will be glow to give indication to driver. If pressure get dropped below default pressure air will be filled with help of inflator. Air will be filled up-to the tire pressure reach to the default value of tire pressure. Rotary coupling will be attached to the tire. We give drive by using DC motor. For transition of power chain drive will be used.

IV. DESIGN

Cad Model:



V. ADVANTAGES AND LIMITATIONS

Advantage:

Automatic tyre inflation system is a new product in the automobile market hence it has lot of opportunities into the market. It addresses the requirement of the consumer or the vehicle owner to increase the performance of the vehicle.

1) There will be a considerable reduction in tyre wear and tear due to uniform tyre pressure.
2) It increases fuel mileage hence the economy.
3) It increases overall safety of the passengers and vehicles.
4) As this device is new to the market and not used frequently in vehicles hence it has favorable market condition.
5) It will transfer the compressed air to the tyre with minimum leakage.

Limitation:

1) Rotary joint is the rotating part with the wheel hence it has a limited life needs maintenance.
2) Mechanical seal used in the rotary joint is needs to be replaced from time to time to make sure there will be no leakage of the compressed air.
3) If the system is mounted on the outer side of the wheel then aesthetics of the vehicle can be taken care.

VI. CONCLUSION

Automatic tyre inflation system has a potential to succeed in a automotive supplier industry it specifically addresses the need of the consumer by regulating the appropriate tyre pressure in a vehicle, which is useful for;

- Reduced tyre wear and tear
- Increased fuel economy
- Increased overall vehicle and passenger safety
- Standard of vehicle handling increases

Since this type of the product is not available in the market hence market conditions will be favorable for this system as humans are taking lot of care of their vehicle. Automatic tyre inflation system is capable of providing required air pressure for tyre at different conditions.

REFERENCES

[1] B.T. Adams, J.F. Reid, J.W. Hummel, Q. Zhang, R.G. Hoeft , “Effects of central tire inflation systems”, University of Missouri-Columbia, 234 Agricultural Engineering Building, Columbia, MO 65211, USA 2004.

[2] Do Minh Cuong, Sihong Zhu, Yue Zhu,“Effects of tyre inflation pressure and forward speed on Vibration”, College of Engineering, Nanjing Agricultural University, Nanjing 210031, PR China 2013.

[3] Mark Reiter and John Wagner,“Automated Automotive Tire Inflation System”, Mechanical Engineering Department, Clemson University, Clemson, SC 29634 USA 2010.

[4] Joao M. Serranoa, Jose O. Pec, J. Rafael Silvaa, Luis Marquez, "The effect of liquid ballast and tyre inflation pressure", University of Evora, Engineering Department, ICAM, Nucleo da Mitra, Apartado 94, 7002-554 Evora, Portugal 2009.

[5] Hamid Taghavifar & Aref Mardani,"Investigating the effect of velocity, inflation pressure, and vertical load on rolling resistance of a radial ply tire", Department of Mechanical Engineering of Agricultural Machinery, Faculty of Agriculture, Urmia University, Iran 2013.

