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FABRICATION OF AUTOMATIC TIRE INFLATING SYSTEM

Chris Smilee Elvise I[1], Gowtham M[2], Ms. Gomathi Prabha[3]

[1]ME Lean Manufacturing, PSG College of Technology, Coimbatore, Tamil Nadu, India
[2]ME Lean Manufacturing, PSG College of Technology, Coimbatore, Tamil Nadu, India
[3]Assistant professor, Dept of Mechanical Engineering, PSG college of Engineering, Coimbatore, Tamil Nadu, India

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Abstract -*Driven by studies that 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, we have developed an automatic, self-inflating tire system that ensures that tires 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 tires 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 tires 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; tire wear reduction; and an increase in handling and tire performance in diverse conditions*

***KeyWords*: Tire, Inflation system, Vehicle Performance, Vehicle Efficiency, Vehicle Safety.**

1. INTRODUCTION

The "Automatic tire inflation and deflation system" is a Mechanical device which is widely used in automobile works. The manual work increases the effort of the man power (operator) during the air checking in vehicles. The Air Maintenance Technology system developed through this project replenish the lost air and maintains optimal tire cavity pressure whenever the tire is rolling in service, thus improving overall fuel economy by reducing the tire's rolling resistance. Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, Pneumatics form an attractive medium for low cost automation.

1.1 Technical Requirements

In order to avoid modification to the vehicles current electrical supply, the system needed to be capable of operating off a 12 volt source. Reviews the tire pressure management system's technical requirements, goal values, and results. Pressure in the tire varies with surface temperature, it was practical to maintain the pressure within 1 PSI of the desired value. In conjunction with Maintaining tire Pressure, TPMS also needed to display the current tire pressure of all four tires within ±1 PSI of the desired value. Ideally, the general requirement of TPMS was to maintain 32 PSI). When tires are under inflated, the thread wears more quickly. 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.

Fig -1: Tire wear

2. WEIGHTING FACTOR

When three proposed solutions were drafted, with the capabilities to meet the technical requirements, certain design criteria were weighted to help aide the prototype selection. It was important that TPMS was user friendly. Since the primary customer for TPMS was the automotive market, it was vital that the system would have a relatively high air flow rate, so the customer would not wait long periods of time between pressure alterations.

REQUIREMENT	GOAL VALUE	VERIFICATION
1.Passively maintain tire pressure	Change in pressure less than 1 PSI over 24 hours	Set pressure, measure after 24 hours
2. Power use	Operate with vehicle's 12v electrical system	Ensure operation with 12V source
3. Inflation/ Deflation time	Inflation/ Deflation one 28 inch tire from 15 to 30 OSI within 3 min	Measure time to inflate/deflate tire
4.Present pressure settings	Have preset pressure settings for normal, towing, off-road, snow/ice	Visually verify that user interface includes presets
5.Flat or Leak notification	Alert driver if a tire has a leak or had gone flat	Test system for flat and leak conditions
6.Pressure display	Inform driver of the current tire pressure of the front and rear tires	See if user interface displays tire pressure
7.Automatic	Maintain tire pressure within 1 PSI of target with no user input	Test with no user input and measure pressure
8.Pressure control	User will be able to set the tire pressure between 15-45 PSI	Test system at both extremes of the pressure ranges

Table -1: Requirements value

Design Criteria	Weight	Centralized Compressor system	Self-actuated air pumps on wheels	High pressure reservoirs
Minimal maintenance	0.22	4	4	1
High air flow rate	0.33	5	1	4
Minimal un-sprung mass	0.09	5	2	5
Ability to change desired Pressure easily	0.22	5	2	5
Low product cost	0.1	3	2	4
Minimal operation noise	0.04	3	5	5
Ease of design	0.04	3	2	4
Ability to isolate system from Environment	0.13	5	2	3
TOTAL SCORE	1	4.36	2.43	3.29

Table -2: Design criteria

2.1 Types of pressure measurements

- Silicon piezo resistive pressure sensors
- Absolute pressure sensor
- Gauge pressure sensor
- Vacuum pressure sensor
- Differential pressure sensor
- Sealed pressure sensor
- Pressure-sensing technology
- Piezo resistive strain gauge
- Electromagnetic

3. Tire inflation system setup

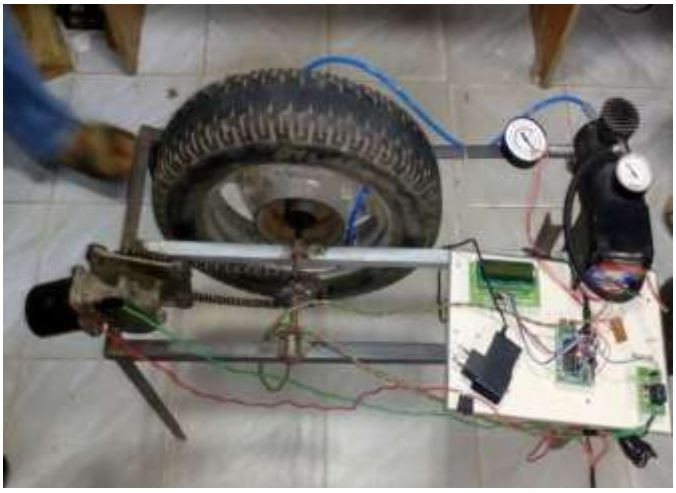

Fig-2 Tire inflation system

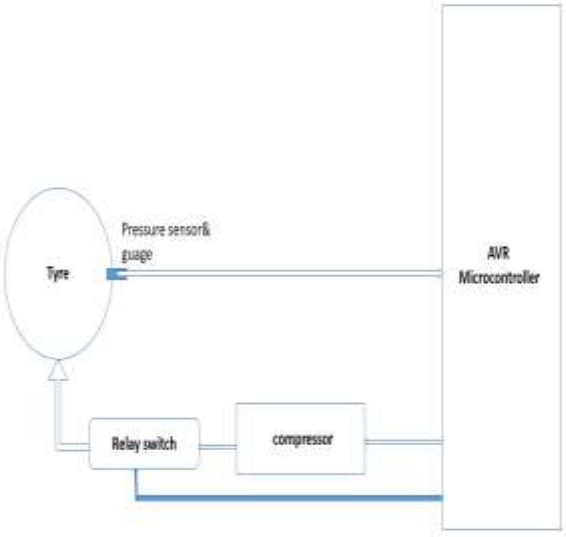

Fig-3 Block diagram tire inflation system

4. Main Components

1. Pumping unit
2. Pipe-network / air carriage system.
3. Delivery systems and valves.
4. Sensor mechanism / on – off switching

4.1 Pumping Unit

It comprises of the compact pump, hose, specially designed wheel alloy and the tire. The wheel is designed to serve the purpose of pumping and wheel rotation with minimal air leakage. The pump is fitted to the car either magnetically or screws. Magnetic fixing is to avoid the pump from falling at any cost. 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. Next part in this unit is the wheel alloy. The alloy is modified to suit this project. This project involves the connection of the pump and the tire's valve permanently, even during the motion of the car.

4.2 Compressor

An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use. The energy contained in the compressed air can be used for a variety of applications, utilizing the kinetic energy of the air as it is released and the tank depressurizes. When tank pressure reaches its lower limit, the air compressor turns on again and re-pressurizes the tank.

4.3 Relay switch

Relay switch is one of the electrically operated automatic switch, nowadays in the modern automobile world automation is growing up day to day so according to the scenario automated operations are most appreciated by the experts so in that place relay switch plays the vital role.

4.4 Sensor mechanism / on – off switching.

Undoubtedly the most vital component of the system to be expertly engineered with precisely accurate pressure preset limits to initiate pressure supply On-state whenever the tire has deflated to a value of pressure less than the provisional optimum boundary value Popt-min and Off-state whenever the tire has gained enough pressure to value just below Popt-max. The values Popt-max and Popt-min are values such that they are 0.3 bars plus and minus optimum tire operating pressure respectively.

4.5 AVR Micro controller

A microcontroller is a small computer on a single integrated circuit. In modern terminology, it is a System on a chip. A microcontroller contains one or more CPUs along with memory and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips.

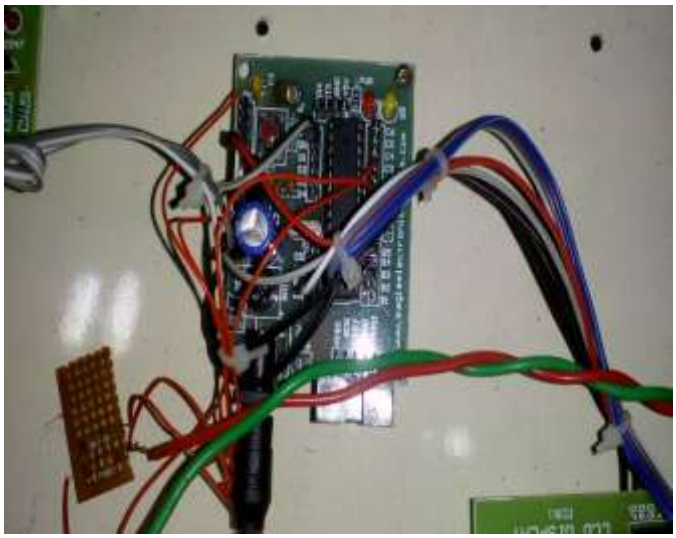

Fig-4 AVR Micro Controller

4.6In System Programmer (embedded C program)

In system programmer is a programmer which is used to program the microcontroller by connecting with a computer system by using the USB port, after connecting the embedded C program is implemented in to the microcontroller.
In this project we gave the input in the program as when the pressure reaches zero level in the gauge the compressor actuates and when reaches twenty it shuts off, thus the embedded C programmer is implemented.

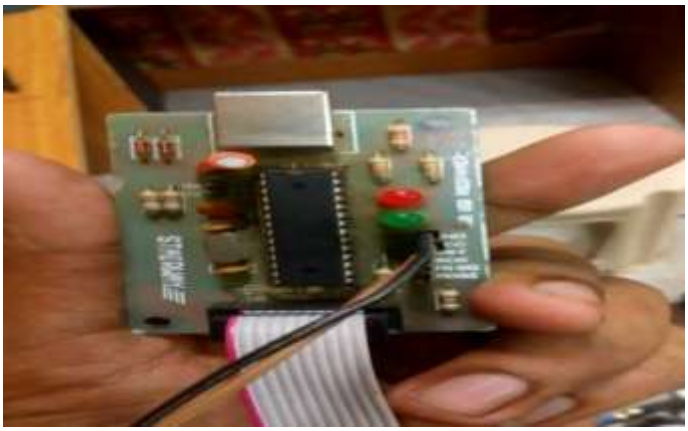

Fig-5 Embedded System

5. CONCLUSION

This system helps us to improve tire life, reduces tire wear, increase fuel efficiency and also increases the overall safety of the vehicle, this system also helps us to ensure the tire pressure constantly. And it also gives proper inflation and deflation system to the vehicle. Used in all automobiles, military vehicles, emergency vehicles like ambulance, police vehicles and fire vehicles, trucks and trailers. It can be used in very costly vehicles where maintenance of standard is important, sports cars as there is need of regular checking of air pressure in tires.

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