International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-2, July 2019

Accident Prevention by Monitoring and Control of Vehicle Tyre Pressure using Wear & Tear and Pressure Sensor

K.Madhana mohan, K.Balavikash, S.Harish, M.Jayabalaji, B.Vignesh

Abstract--- Maintaining Optimal tyre pressure is an important feature that paves the way for better control of the vehicle and thus improves the safety of the Vehicle and Humans. This paper aims to find the solutions in case of abnormal tyre pressure and hence ensure safety of the Vehicle. Reports from the National Highway Traffic Safety Administration (NHTSA) suggest that abnormal tyre pressure-related crashes cause 660 fatalities and 33,000 injuries every year. In order to ensure the safety of tyre and thereby the vehicle safety, pressure of the tyre is measured and monitored. In this project, the pressure and as well as the wear and tear in the vehicle's tyre is also monitored and measured. The readings are sent to the controller and based on the value of the sensors the necessary ignition is controlled and in case of tyre pressure crossing the prescribed limits ignition is cut off and the vehicle comes to a halt in a safe manner and thus accident is prevented.The main aim of such a system is to add intelligence to vehicle and reduce number of accidents thus reducing the inconvenience during driving due to improper inflated tires The safety of the vehicle, durability of tires and vehicle's fuel efficiency can thus be improved

Keywords— Vehicle accident prevention, tyrepressure, wear and tear of tyre, pressure sensor, ultrasonic sensor, vehicle ignition.

I. INTRODUCTION

Cars with advanced features meeting with accidents in good road conditions have been a cause for concern and it has been found that bursting of tyre has been one of the major reasons behind it. The Ministry of Road Transport has decided to write to the Bureau of Indian Standard (BIS) asking it to modify the existing specifications of tyres produced in India to make it on par with global standard. Under inflation is one of the most common causes of tyre blowout. Under-inflated tyre will bulge out owing to the car's weight causing it to bounce up and down when the vehicle is driven at high speed. This the results in the high level of friction and eventually increases the heat in the tyre than weakening it and finally it results in tyre blowout.

Figure 1: Tyreblowout

An overloaded vehicle also can lead to a burst tyre due to the tyre being put under more pressure than its built to endure. Couple this with an under-inflated tyre and there's a high chance of a tyre blowout. One of the leading causes for tyre damage is umder-inflation and severe cracking with air loss might result by it. Umder-inflation also results in reduces load capacity, creating excessive sidewall flexing, and thus rolling resistance shoots up, which results in excessive heat and thus mechanical damage is unavoidable. On the other hand Over inflation increases stiffness resulting inuncormfortable driving experience and thus excessive vehicle vibrations are produced and also increases the chances of impact damage.

Statistics shows that when tyres are 20% underinflated, tyre life decreases by 30% and fuel economy shrinks by 3%. With only a miniscule percentage of Car drivers regularly checking for Car tyre pressure ,finding a solution to tyre pressure related accidents are highly imperative. [1].

II. TYRE INFLATION, TREAD AND TOE

Improperly inflated tyre has a fair chance of wearing off quickly The tread of the tyre is the rubber on its surface that makes contact with the road. Tread thus helps in improving the traction of the vehicle with the road. If the tyre pressure is too low, or even too high; the contact patch of the tyre will not be in a position to handle the pressure from the vehicle and thus the Tread wears off in an uneven manner. This happens when one side of the tread blocks is wearing faster than the other side circumferentially.

Revised Manuscript Received on 30 July 2019.
* Correspondence Author
K.Madhana mohan*, Assistant Professor Department of Electronics and Instrumentation Engineering, Sri Sairam Engineering College, Chennai-44. (madhanamohan.ei@sairam.edu.in)
K.Balavikash, Student Department of Electronics and Instrumentation Engineering, Sri Sairam Engineering College, Chennai-44. (balakk609@gmail.com)
S.Harish, Student Department of Electronics and Instrumentation Engineering, Sri Sairam Engineering College, Chennai-44. (harishs1997@gmail.com)
M.Jayabalaji, Student Department of Electronics and Instrumentation Engineering, Sri Sairam Engineering College, Chennai-44. (jayabalaji02@gmail.com)
B.Vignesh, Student Department of Electronics and Instrumentation Engineering, Sri Sairam Engineering College, Chennai-44. (balasubramaniumvignesh@gmail.com)

Thus improper inflationas shown in fig. 2 causes the tread to wear off resulting in minimized traction which could result in an accident [2][5].

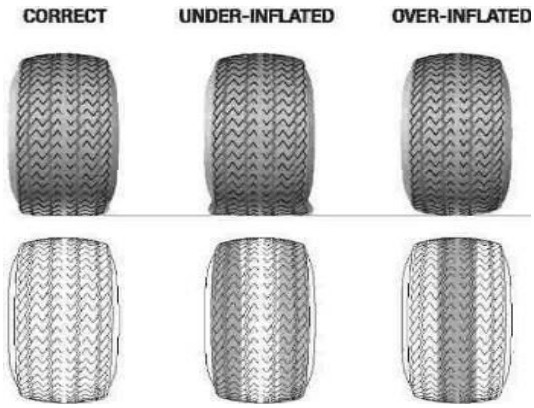

Figure 2: Tyre tread wear and tear due to improper inflation

Toe refers to the symmetric angle that is made by each wheel of the vehicle with that of the longitudinal axis of the vehicle. Having proper toe is analogous to having even tread wear and thus the life of the tyre is increased. Thusimproper inflation pressure can result in wearing out of tread in an uneven manner and also possibly result in toe in or toe out as shown in fig. 3, which can pave the way for accident of the vehicle.

Figure 3: Toe tyre wear due to improper inflation

III. EXISTING METHODOLOGY & RESULTS

The TPMS or tyre pressure monitoring system in its direct or indirect form is currently being used to monitor the tyre pressure and take control action. In the case of the direct TPMS sensors are fitted in the tyre adjacent to the valves for monitoring the pressure and an appropriate control action will be taken by the control unit to prevent any accident.

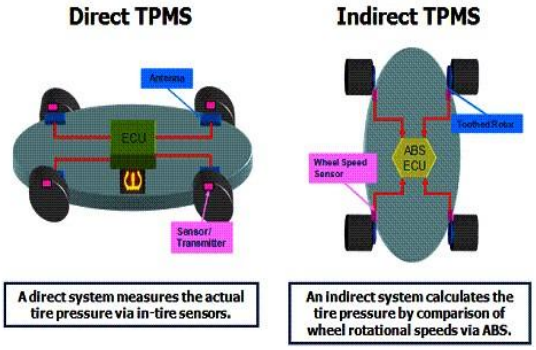

Figure 4: Direct and Indirect TPMS

In the case of indirect TPMS no sensors are used and the speed of the individual tyres is used to interpret the size of the tyre. Based on the size of the tyres a warning signal will appear on the dashboard with regard the safety of the vehicle. The indirect TPMS also have few disadvantages. Since deviation of pressure in any one of the tyre with the other three being at the same pressure is considered as an aberration and as a result the driver needs to reset the indirect TPMS.Thus the driver has been given an added responsibility which he may not oblige to do in order to stay in his comfortzone. Due to these factors there is still competition among the car manufacturers in choosing between direct TPMS and indirect TPMS.

IV. PROPOSED METHODOLOGY

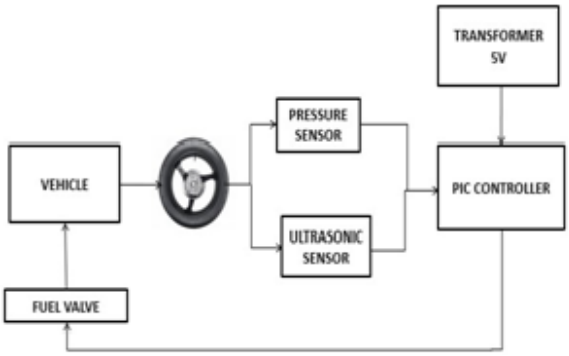

Figure 5: Block diagram

In analyzing the direct TPMS and indirect TPMS system we can conclude that in both the case a control action has been initiated after there is a change in pressure value inside the tyre and no provision is provided to warn the driver with regards to the possibility of a change in the pressure towards critical values which can have the potential to cause an accident. In our Proposed methodology we are using an ultrasonic sensor]4] to monitor the thickness of the tyre caused by uneven tread in the tyre or toe in the tyre, thus ensuring a greater care in assessing the possibilities of an accident occurring due to the eventual change in pressure even before it occurs and thus saves the life of the vehicle occupants. In our project once the warning signal is raised the controller makes sure that the ignition is stopped by cutting off the fuel valve [3].

The signal communication in and out of the Controller will be through a radio frequency (RF) transmitter because a wired connection from a rotating tyre to the vehicle's electronic control unit will be less effective than a wireless model. The receiver in turn, analyzes the data and will send command signals to the central unit of vehicle which in turn will trigger a warning message on the vehicle dashboard.The Controller circuit is the main component involved. The Controller is PIC Microcontroller circuit soldered on a PCB board. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, an LCD, 2 Comparators,8 channels of 10 bit A/D Coverter,2 compare/PWM functions, etc.,

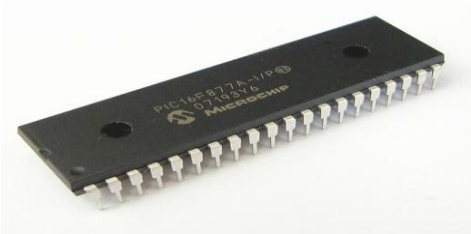

Figure 6: PIC16F877a Controller

The main work of the controller used here is to receive the respective values from t/he sensors and based on those values, take a necessary actin, i.e to indicate the driver about the change over the predetermined value and hence on further time period if the necessary action has not been take, i.e on further indication, it has to cut off the fuel valve so that the engine is turned off and motion of the vehicle is restricted such that any damage is not possible and safety is ensured

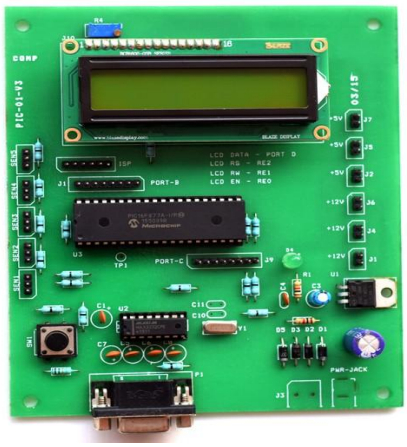

Figure 7: Soldering done on PCB board

V. SENSOR SYSTEM

5.1 PRESSURE SENSOR

The Pressure sensor employed here will be of a capacitive type which measures the tyre pressure value in analog form and converts the measured value into an electrical signal at its output. The pressure sensor is used to measure the pressure value in the tyre and send the information to the microcontroller. Based on the value of the pressure the necessary action will be taken. The maximum and minimum set point for the pressure will be given to the controller to indicate the driver.

Figure 8: Pressure Sensor

5.2 ULTRASONIC SENSOR

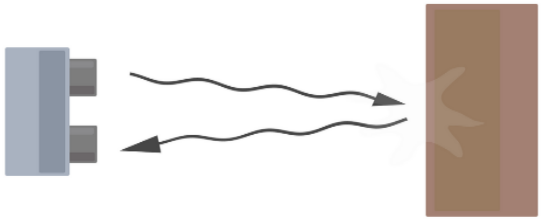

Figure 9: Ultrasonic Sensor concept

The ultrasonic sensor used is Hc-SRO4 the ultrasonic sensor is placed in the mudguard so that the distance between the tyre and the mudguard is found and the value is set to the controller. When there is a deviation in the set point value of the ultrasonic value compared to the predetermined value, then the signals are sent to the controller and necessary indication is done. Note that as pressure value changes, ultrasonic value also changes, hence the pressure value is also considered and necessary control action is taken[4].

Figure 10: Ultrasonic Sensor

VI. CONCLUSION AND FUTURE SCOPE

Pressure in the tyre can vary drastically without the knowledge of the driver and hence usage of tyre pressure monitoring system (TPMS) is necessitated to ensure that proper tyre inflation is always monitored.

The road accidents due to tire failure contributes to 20% of the total road accidents caused yearly. By implementing this project, we would be able to prevent the accidents. Accidents are mainly due to our poor consciousness, but there are some factors apart from that, which is our negligence. This project can also be extended to host of other vehicles that includes heavy vehicles mostly plying in highways and expressways. With most of the care takers of the heavy vehicles instead of going for a tyre replacement they choose an alternate plan which is low cost and thereby endangering thousands of lives. Thus this project when extended to all the vehicles that ply on highways and expressways has the potential to fix more than 20 % of the accidents.

REFERENCES

1. Mr.V.S.Mane, NutanN.Bachulkar, Poornima B.Bargale, SnehalS.Kole,' Run time tire pressure monitoring and controlling system', International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 02 | Feb-2016.
2. Bar, A.S.; Sharma, R.K.; Singh, A., 2013 "Design and development of indigenous tyre pressure monitoring system" Communication and Computing, Fifth International Conference on Advances in Recent Technologies in , vol no., pp.451,456, 20-21
3. Sharda Mule, K. S. Ingle,' Review of Wireless Tyre Pressure Monitoring System for Vehicle Using Wireless Communication', International Journal of Innovative Research in Computer and Communication Engineering ; Vol. 5, Issue 3, March 2017.
4. Andy Huang,Yuu Ono,' Estimation of wrist flexion angle from muscle thickness changes measured by flexible ultrasonic sensor', International Conference on biomedical and health informatics'IEEE,ISBN 978-1-5090-2455-1.
5. Prof. Mr. Prashant. G. Salunkhe , Mr. Harshal R. Kulthe , Mr. Saiprasad N. Kolhe , Mr. Ayaan A. Khan,' Automatic tyre pressure monitoring system using wireless communication', International conference on recent trends in civil engineering, science and management.