

Wireless Tire Pressure Monitoring System

Prof. Snehal.R.Javehri¹ Prachi Thorat² Mamta Gurme³ Darshana Paliwal⁴ Hrishika Shelar⁵

^{1,2,3,4,5}Department of Computer Engineering

^{1,2,3,4,5}TSSM's PVPIT, Pune, Maharashtra, India

Abstract— Sensor based Tire Pressure Monitoring System for Motor Vehicles is a tire pressure monitoring system used in any type of the vehicles. This technology involves two parts that is every tire pressure monitoring system and main board or display screen indicates status of all tires pressure and interconnected through wireless technology. In each tire pressure monitoring set there is a small kit consists of micro-controller, sound alarm, pressure sensor and battery. This small kit senses high and low air pressure inside the tire and informs to main circuit mounted on the display screen. Because of which driver or rider will come to know the air pressure status of every tire and can take appropriate action. Here sound alarm introduced in small kit to identify high pressure level if air inside the tire exceeds the defined level then sound alarm is generated. Light blinking facility is provided on the display screen to show low air pressure status of any tire. This communication between main circuit (display screen) and every tire kits is done through wireless medium which can be Wi-Fi or Bluetooth. The wireless charging is done to charge small tire kit though vehicle has main battery backup or charging point inside the vehicle. To protect the tire pressure kit from problem of overheating, cooling substance or cooling liquid is used as heat absorbent around the kit, which helps to maintain kits long life. Due to use of such technology road accidents caused due to low air pressure of tires can be avoided. The proposed technology gives information of all tire pressure to the user on the display screen, which minimizes human efforts to check air externally. Also cost on the air check instruments can be minimized due to this proposed work.

Key words: Wireless Communication), Sensors, Security, Client-Server Display Screen, Sound Alarm, Wireless Charging

I. INTRODUCTION

The field of invention describes 'Wireless tire air pressure monitoring system(WTPMS)' for avoiding traffic accidents, poor fuel economy, and increased tire wear due to under-inflated tires through early recognition of a hazardous state of the tires. A Wireless tire-pressure monitoring system (WTPMS) is a wireless system designed to monitor the air pressure inside the tires of various types of vehicles (4 wheelers, 2 wheelers, bus, truck etc.). WTPMS report real-time tire-pressure information to the driver of the vehicle, through a pictogram display. This pictogram display shows status of all the tires of the vehicle with high and low pressure indicator signals over this pictogram display. This display is mounted on the dashboard of the vehicle.

Here initially a small kit mounted in the tube or tubeless tire of the vehicle. Which consists of micro-controller, pressure sensor, small sound alarm, and small battery power. This kit is used in all the tires of the vehicle (bike, car, truck etc.). Pressure sensor senses air pressure inside the tire and informs to micro-controller. This micro-controller kit is communicated to the dashboard main kit

through wireless connection. It may be through Bluetooth or Wi-Fi. Thus all tires information displayed on the dashboard screen because of which driver of the vehicle comes to know about the status of air pressure inside the tires. This whole invention provides low air pressure and high air pressure status of the tire. Sound alarm is used to inform about high air pressure inside the tire and light will blink to show low air pressure status. Also the concept of wireless charging is introduced in this invention. Small tire kit battery charges through wireless charging. This wireless charging done between vehicles main battery/vehicle's charging point and tire's small kit battery. To minimize temperature of small tire kit which consists of (micro-controller, battery, pressure sensor), a cooling agent gas (Nitrogen or any low cost cooling gas) is used as heat absorbent to this small kit. This kit is packed in small bag and around this bag cooling agent liquid/ some solid heat absorbent material is used as heat absorbent to maintain life of this whole kit. Because of such invention, vehicle as well as users of the vehicles are protected from the road accidents happens due to low or high air pressure inside the tires.

Tire Pressure Monitoring System(TPMS) is a system which gives alert of tire pressure if it is below normal pressure and above normal pressure by Liquid Crystal Display(LCD) , light Emitting Diode(LED), and Buzzer so it get filled by proper inflation of air. Total weight of vehicle on the inflation in the tire. If air filled in the tire is not proper as recommended by the manufacturer of vehicle, action on the sidewall of tire are increases as a result tire get more contact with ground surface. Also more fuel is required as compared to tire with proper inflation. If tire pressure is not proper, stopping distance of vehicle changes and possible of rollover of vehicle. Report provided by National Highway Traffic Safety Administration (NHTSA) shows the effectiveness of TPMS by comparing TPMS equipped vehicle with without TPMS vehicle. As the fuel economy is depended on use of fuel if tire pressure is under inflated then it require more fuel it increase the fuel economy as a result more emphasis is on the TPMS so as to avoid the fuel consumption and accident.[1][2][3] There are two types of TPMS as indirect TPMS and direct TPMS in indirect TPMS the tire pressure is calculated on the angular velocity of each tire of vehicle in indirect TPMS system the tire pressure is provided is inaccurate if all the tire of vehicle is low then by using indirect TPMS will not give warning also in the curved surface the rotation speed of each tire may differ and produce faulty alarm

Direct TPMS measure the accurate tire pressure each sensor on each vehicle measure the tire pressure and temperature which is installed on the tire and send to the receiver installed on the dashboard of vehicle as compared to the indirect TPMS direct TPMS is accurate than the indirect TPMS [4]

II. RELATED WORK

According to Pressure Monitoring System Using Wireless Communication by Vishnoi Singhal[1] states that Tire pressure monitoring system is an electronic system that monitors the air pressure and temperature of an automobile tire in Dynamic time and alerts the user by a giving alarm sound and display the dynamic values . A low tire pressure results in decreased mileage, tire life, safety and system performance. This paper presents a Tire pressure monitoring system that results in Better Mileage, improve wear and tear of tire, reduce number of accidents, proper handling of vehicle etc. The whole system programming is controlled by a microcontroller that is loaded with an embedded program.

According to System and method for tire pressure monitoring with optimal tire pressure indication during tire pressure adjustment by John S. Nantz[2] A system and method for remote monitoring of tire pressure provide an indication of feasible tire pressure when a tire indication valve is activated. A tire monitor mounted on a tire includes sensors for sensing tire pressure, and a transmitter for transmitting Wireless tire information signals having tire pressure. A controller mounted on board the vehicle determines a feasible pressure for the tire based on the temperature data and vehicle load information

According to Tire Pressure Monitoring System by AnDreW NImrlrzlmttLondon (GB)[3]A tire pressure monitoring or Alerting system comprises at least one receiver responsive to signals transmitted by transmitters associated With one or more tires. The system consisting a memory which stores a list of identity tags captured by the receiver, and a list of associated optimal values for each identity badge indicative of the confidence that the stored identity badge corresponds to a transmitter that associated to the vehicle. The list may be divided into a member and list comprising those identity tags that are deemed to refer and that possibly refer respectively to transmitters associated with the vehicle respectively. Initiators may be provided to initiate transmission from the transmitters in order to specify the position of each tire.

According to Wireless tire pressure system by Shin-Chung Chen [4] a Wireless tire pressure monitor system has multiple pressure sensors and at least one receiving module. The pressure sensors detect tire pressures and transmit Wireless signals representing the tire pressure. The at least one receiving module is mounted on a chassis of a vehicle at a geometric center of the pressure sensors and has an annular antenna. The annular antenna receives Wireless signals from the pressure sensor equally. Therefore, because distances between the receiving module and the pressure sensors are the same and the annular antenna has good receiving characteristics, the Wireless tire pressure monitor system has a high hit ratio for receiving Wireless signals.

III. PROPOSED METHODOLOGY

Wireless Tire Pressure Monitoring System (WTPMS)' i.e it comprises of Display screen 1010, Tire 1 to 4(1020, 1030, 1040, and 1050), cooling substance layer 1060, tire pressure kit 1070, sound alarm 1080, micro-controller 1090, battery 2000 and pressure sensor 2010.

FIG. 01 shows overall architecture of the present invention. Here Display screen 1010 present on the dashboard of the vehicle. This display screen shows overall status about all the tires of vehicle. Display screen consists of micro-controller, battery and blink light. This Display screen receives status of all the tires (Tire 1 1020, tire 2 1030, tire 3 1040, tire 4 1050) of the vehicle with the help of Bluetooth signals/Wi-Fi signals. These number of tires varies according to type of vehicle. Display screen is a kind of monitoring screen shows status of tire air pressure in the form of numbers, due to which driver can decide his/her next action to do. Tire 1 to 4 is the tires having small tire kit, mounted on every tire. Also this tire level kit sends signals about air pressure inside the tire to display screen. In the vehicle front tire having different air pressure than back tire. This air pressure in the tire varies according to type of vehicle. E.g. 4- wheeler car having 25 psi air pressure in front tire and 30 psi in back tire. This level is defined in the tire kit. Small tire kit 1070 is surrounded by small layer of cooling substance 1060 or nitrogen liquid for cooling purpose. Such kind of facility provided to protect the kit from problem of overheating. This Small kit is packed inside a small bag and then surrounded by cooling substance. Small tire kit consists of sound alarm 1080, micro-controller 1090, battery 2000 and pressure sensor 2010. Here sound alarm is used to know defined level of the air pressure inside the tire. If air pressure exceeds this defined level then this sound alarm will be blown. Thus the person who fills air inside the tire will come know to stop this operation. Micro-controller 1090 handles the responsibility of sending status signal of air pressure to main display screen's micro-controller. Also receives power signal from transmitter to recharge the battery 2000 placed inside the kit by using functionality of automatic charging. Micro-controller gives signals to sound alarm for activation or de-activation. Micro-controller defines the air pressure limit with the help of pressure sensor 2010. Pressure sensor senses air inside the tube or tubeless tire, and informs to micro-controller about the status of air pressure. This is the overall working of present invention that is 'Wireless Tire Pressure Monitoring System (WTPMS).

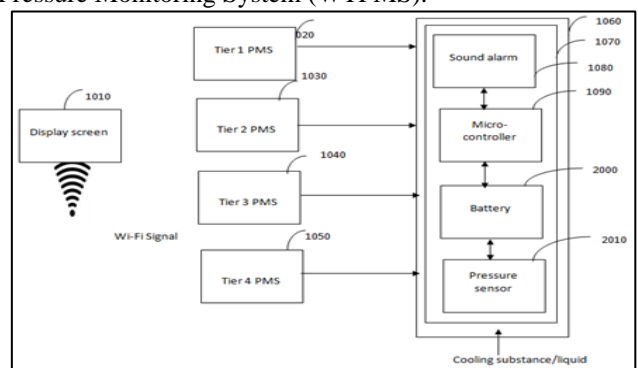


Fig. 1: Architecture of WTPMS

The advantages of wireless tire pressure monitoring system are as follows:

- 1) Wireless Tire Pressure Monitoring System (WTPMS)' checks air pressure of all tires through kit and displayed on the screen, so driver don't have to check externally.
- 2) 'Wireless Tire Pressure Monitoring System (WTPMS)' beeps sound alarm for high pressure, so user

- come to know the defined level of air pressure inside the tire of the vehicle.
- 3) 'Wireless Tire Pressure Monitoring System (WTPMS)' is not so expensive.
 - 4) 'Wireless Tire Pressure Monitoring System (WTPMS)' saves human efforts.
 - 5) 'Wireless Tire Pressure Monitoring System (WTPMS)' avoid road accidents/ any unwanted disasters.
 - 6) 'Wireless Tire Pressure Monitoring System (WTPMS)', uses wireless technology to cost and complexity of wired connection is avoided.
 - 7) 'Wireless Tire Pressure Monitoring System (WTPMS)', is small kit to mount on the tire.
 - 8) Cooling substance or liquid used around tires pressure monitoring kit to improve tire kit's life from problem of overheating.
 - 9) Due to 'Wireless Tire Pressure Monitoring System (WTPMS)', air pressure monitoring is easy.
 - 10) Previous instruments to check air pressure could be replaced also cost on those instruments can be saved.
 - 11) To show low air pressure, light blinking facility is provided on the display screen.

IV. CONCLUSION

The invention designed to monitor tire pressure of any type of vehicle with the help of wireless technology and wireless charging/ remote charging. The invention introduces two different working, first working defines tire level air pressure monitoring system. This system involves small operational kit includes micro-controller, battery and pressure sensor near the air filling valve. This whole kit is surrounded by temperature absorbent substance/ cooling agent (Nitrogen) to minimize the effect of overheating and protect the system form the effect of overheating. Here pressure sensor senses low or high are pressure inside the tire and informs to the kit. When driver trying to feel high air pressure which is above the defined level (e.g. 25 psi/30 psi depends on type of vehicle), this high air pressure sensed by the sensor then sound alarm is generated. Because of which the person who is doing this air filling work come to know at what level air feeling needs to stop. Also light will blink on the display screen when display screen receives low air pressure signal. Second part of the invention involves display screen working, here the status of all the tires air pressure are displayed on this display screen which is mounted on the dashboard. This transmission of signal done through wireless communication. This can be Bluetooth or Wi-Fi. Also this whole invention involves power supply which done through battery. To recharge tire pressure kit battery, wireless charging methodology is used. This wireless charging done through vehicles main battery backup or vehicles insider charging kit .By applying all above methodology in the vehicle one can enhance tire air pressure monitoring system.

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