AUTOMATIC TYRE PRESSURE AND METAL DETECTION SYSTEM IN FOUR WHEELER

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Keywords:

Periphery of the tyre, TPMS, chassis, elevator

Introduction:

According to 2019 survey by Ministry of road transport and highway transport research wing majority of accidents happened due to tyre brusting, tyre brusting is due to continuous air leakage and metal detection in the tyre, tyre smoothing and ageing causes tyre to blow out. 73% accident is due tyre brusting shown in the figure 1, metal present in the type will lighten small spark due to road friction. Once the metal is been detected by metal detection sensor, the sensor will communicate metal detection to the controller, in this project we are using NODE MCU for communication, proximity sensors are fabricated in the vehicle chassis at wheel arches , proximity sensors are placed at a distance range from 3 to 30mm from the periphery of the tyre. After metal is been detected by metal detection sensor, a caution buzz will be activated for 10sec , in that 10sec of time duration vehicle will be stopped and check for any air leakage. Continuous air leakage is due to puncture or wheel bend, tyre pressure monitoring system will detect pressure inside the tyre, any air leakage in the tyre is been communicated to TPMS, as per the specification for R13 155/80 tyre size the pressure required, maximum pressure 34 and minimum pressure 28 psi.

TPMS caution buzz

1. If max pressure exceeds more than 34 psi buzzer will be activated.

2. If min pressure exceeds less than 28 psi buzzer will be activated.

3. If there is a continuous air leakage buzzer notification will be fast.

Signals from proximity sensor and TPMS is been communicated to driver and is been displayed in the infotainment. By considering two signals from proximity and TPMS the controller will suggest the driver to stop the vehicle and to replace the punctured wheel with a spare wheel, Vehicle is been elevated up by using a motorized lead screw, vehicle lifted up to replace the punctured wheel.

Objectives:

Meatal piece present on the periphery of the tyre will increase friction, metal will cause abnormal wear out which decreases the tyre life. Puncture due to metal impression will lead to continuous air leakage, if the vehicle is at high speed there might be chances of tyre bursting due to friction and increasing tyre temperature.

This concept gives a caution notification of metal detection on the tyre and continuous air leakage in the tyre which prevents from accidents due to sudden tyre bursting or drag due continuous air leakage, we have also included vehicle fabricated elevator to elevate the vehicle to replace punctured wheel with a spare wheel.

Methodology:

Metal present on the periphery of the tyre will be detect by a metal detector fabricated in the chassis of the vehicle and placed at a distance range from 3 to 30mm,metal detection will be notified to the driver/owner by a caution buzzer, after metal detection the system will check any air leakage in the punctured wheel.

Metal detection and continuous air leakage will be notified and stopes the vehicle. Caution buzzer in this prototype will be activated from 10sec, in this time duration of 10sec there won't be any vehicle moment forward and backward moment will be stopped to prevent the vehicle and passengers from accident. Methodology and communication protocol from the sensor to the driver is been explained in the figure 1.0

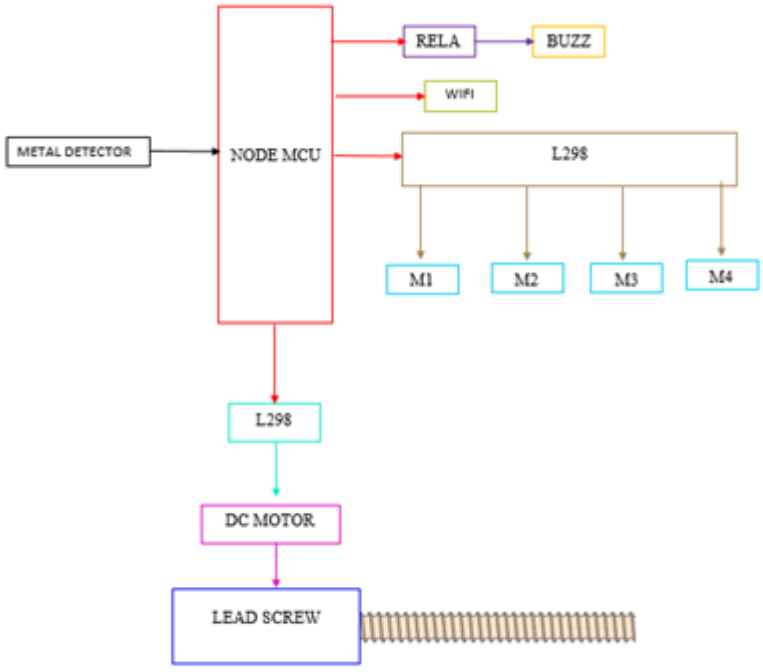

Figure 1.0

Communication Protocol:

Metal detection will be communicated to NOD MUC, metal detection will activate the buzzer which indicates to stop the vehicle, and NOD MCU will send signals to driver motors through L298 motor driver control circuit. Which stopes the vehicle, buzz will be activated for 10 sec once the buzzer stopes the vehicle will be lifted by an inbuilt elevator to replace the punctured wheel with a spare wheel.

Materials Required:

Sl.No	Materials	Material Tyre	No of items
1	MS 2mm sheet	Mild steel	1
2	MS 10 mm lead screw	Mild steel	2
3	NODE MCU	Printed circuit board	1
4	L298	Microcontroller PCB	2
5	Wheels	Tube spoke wheels	4
6	Regulator	AC/DC convertor board	1
7	Johnson 10 kg torque motor	Non gear DC motor	4
8	Johnson gear motor	Dear DC motor	2
9	Metal detector	Copper coil wires	1

Conclusion:

As this project is about safety of the vehicle and passenger, system through sensors detects any abnormality in the tyre and notifies to the vehicle owner/driver about tyre condition, any abnormality found the vehicle will stop and prevent the vehicle and passenger from accident

Once after metal detected on the periphery of the tyre the microcontroller will gradually cutoff the speed of the vehicle and finds the safe zone to park the vehicle and fix the tyre with a spare wheel.

After the owner/driver confirmation of puncture found the vehicle will start to vehicle by using the vehicle fabricated elevator to replace the puncture wheel with spare wheel

Scope for future work:

- Future real time application vehicle elevation will be done by hydraulics, hydraulics motor will be driven by an engine of the vehicle.

- Before elevating the vehicle there will be a conformation window pop up on the infotainment for the confirmation.
- There will be a voice command feature which assists how to replace punctured tyre with a spare wheel so that person who don't have a knowledge about replacing the tyre can also fix it.
- Separate window will be provided in the infotainment system to monitor the tyre pressure and metal detection on the tyre, system also monitor the tyre health and number of kilometers covered and life of the tyre.

Reference

1. Integrated automated jacks for 4-wheelers. European Journal of Applied Engineering and Scientific Research, 1(4), 167-172
2. Brian S. Elliott (2018), "Air-Over-Hydraulic Jacks", Compressed air operations manual, McGraw-Hill Professional, pp. 56–58
3. Parr, Andrew. Hydraulics and Pneumatics: A Technician's and Engineer's Guide. 1st Edition. Oxford: Butterworth-Heinemann, 2016
4. K. N. Choi, "Characteristics of metal sensor using variable frequency," The Journal of the Korea Institute of Electronic Communication Sciences, vol. 9, no. 2, pp. 161–166, 2014.
5. K. N. Choi, "Two-channel metal detector using two perpendicular antennas," Journal of Sensors, vol. 2014, Article ID 412621, 11 pages, 2014
6. Bergen, H. J. van Weers, C. Bruineman et al., "Design and validation of a large-format transition edge sensor array magnetic shielding system for space application," Review of Scientific Instruments, vol. 87, no. 10, article 105109, 2016.
7. Wahyu, K., Kusumawardana, B., Irianto, I., & Efendi, M.Z. (2011). Rancang Bangun Sistem Kontrol pada Kompresor Tekanan Udara Sebagai Pengisi Udara Untuk Ban Kendaraan. Thesis, PENS, Surabaya.
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