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A REVIEW PAPER ON TYRE WEAR MONITORING USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT

Tyre monitoring is a critical part of keeping vehicles safe and reliable, image processing can be used to help identify issues with tyres before they become a safety hazard. In this paper, we'll explore how image processing can be used to monitor tyres and identify potential problems. We'll also provide some tips on how to get the most out of image processing for tyre monitoring. Image processing is one of those technologies that have seen a lot of advancement in recent years. With image processing, we can now do things that were once impossible, such as monitoring tyre pressure using images

Keywords: Tyre Wear, Image Processing.

I. INTRODUCTION

Image processing can be used to effectively monitor tyres for a variety of purposes. For example, Image processing can be used to detect tyre wear, identify tyre irregularities, and track tyre performance over time. Tyre wear can be monitored by analyzing images of the tread surface over time. By tracking the depth of the tread, image processing can provide an accurate assessment of when a tyre needs to be replaced. Tyre irregularities can be detected by analyzing images of the tyre surface. By identifying irregularities such as bulges, cracks, or uneven wear, image processing can help to prevent potential problems. Finally, tyre performance can be monitored by tracking the tyres contact patch. By analyzing the contact patch, image processing can provide information on the tyres grip, traction, and wear. There are many It is no secret that the road conditions can have a significant impact on the performance of a vehicle. In order to maintain optimal performance, it is important to regularly check the condition of the tyres. This can be a time-consuming and difficult task, but it is essential to the safety of the vehicle. Image processing can be used to streamline the process of monitoring tyres. By capturing images of the tyres and using algorithms to analyze the images, it is possible to quickly and accurately identify any issues. This information can then be used to make necessary repairs or replacements. Benefits to using image processing to monitor tyres. First, it is a non-destructive testing method, which means that the tyres do not need to be removed from the vehicle in order to be inspected. Second, image processing is a fast and efficient way to check the condition of the tyres. Third, it is a relatively low-cost method of monitoring tyres, fourth, it is a great way to spot small problems before they become big problems. Monitoring tyres with image processing is a great way to keep your vehicle safe and running at its best.

II. LITERATURE REVIEW

[1] Mr. Praful Darekar et al. 'Detection of tyre wear using Colour Coding' 2018.

In this paper about the numerous aspects of the road may cause tyre wear. This informs us how effective pavements are in reducing tyre wear and how tyre movement affects the state of the road and its lifespan. This paper highlights the primary tyre management technologies that are predicted to increase tyre and wheel system dependability by monitoring tyre pressure, deformation, wheel loading, friction, or tread wear. The compatibility of the sensors with tyre rubber, wireless transmission, and battery installations are only a few of the issues that must be taken into account when placing sensors in tyres, wireless data transfer and sensors, car tyres with intelligence. To assess both regular and excessive tyre wear, researchers have developed a tyre surface inspection device incorporating laser sensors. Unlike the present approaches, this system makes use of

laser sensors to concurrently assess the degree of tyre wear and detect the current abnormal wear status. As a result, the users can receive services that are more accurate than previously.

[2] Mr. Harshal Bhanare et al. 'Quality Inspection of Tyre using Deep Learning based Computer Vision' 2019.

In this paper, a prototype tyre tread depth measuring system was created. TensorFlow, Keras, Caffe, Theano, and other learning frameworks were investigated in this system in order to determine which framework is superior for creating and maintaining source code. The cameras' specifications were displayed. The trigger is a photomultiplier switch, and the lasers used are line laser emitters and a photoelectric switch.The surface of the tyre tread can be entyrely covered by two-line laser emitters. The maximum opening angle of the laser emitter is 110°, and the laser line width is 0.5mm. The fundamental justification for using a photoelectric switch is that the supporting plate's trigger location is a line. Building an end-to-end model using deep learning allows all of the features to be automatically learned and categorised. In deep nets, each layer can be changed in accordance with the final task, leading to cooperation between the layers and a significant increase in task accuracy.

[3] Mr. Akarsh Prabhakara et al. 'Osprey: a mmWave approach to tyre wear sensing' 2020.

Globally, a major factor in vehicular accidents is tyre wear. Beyond affecting safety, tyre wear also has an impact on performance and is a crucial factor in determining when to change tyres, one of the major maintenance costs in the global trucking business. We think it's critical to gauge and keep an eye on tyre wear in every car. Tyre wear is now measured manually, which is incredibly tiresome. Given the hostile temperature, pressure, and motion of the tyre, embedding sensor electronics to assess tyre wear is difficult. Furthermore, road debris that may collect in tyre grooves can damage off-tyre sensors that are installed in the well, such as laser rangefinders. This study introduces Osprey, the first mmWave on-vehicle sensing device that can continually assess accurate tyre wear and is resistant to road debris. The main innovation of Osprey is to use large volume, currently available automotive mmWave RADAR, install it in the tyre well of cars, and watch for reflections of the RADAR's signal from the surface and grooves of the tyres to evaluate tyre wear even in the presence of debris. This is accomplished using a super-resolution Inverse Synthetic Aperture RADAR method that takes advantage of the tyre's inherent rotation to increase range resolution to sub-mm. By affixing particular metallic structures in the grooves that function as spatial codes and provide a distinctive signal when linked with the rotation of the tyre, we demonstrate how our technology can remove debris.

[4] Mr. Jianchen Zhu et al. 'Automobile tyre life prediction based on image processing and machine learning technology' 2021.

With the aid of image processing and machine learning, they began to predict tyre life in order to decrease traffic accidents. They discovered that there are four different types of tyre wear with different levels of wear. They chose the car whose tyre pressure was within the range (2.5/0.3) for the sampling while also taking into account the influence of tyre pressure on the data base. A revolutionary technique for shortening tyre life for cars is presented. We may start the image processing procedure once we have gathered all the necessary data. This experiment shows that the intended approach for estimating tyre life exhibits great accuracy, high efficiency, and cheap cost. It creates an original picture database and processes the original image, extracting texture information as it goes.

[5] Mr. Sebastian Huber et al. 'TyreEye: Optical On-board Tyre Wear Detection' 2022.

Automotive tyre tread depth must be regularly checked since it has a substantial impact on a car's safety. However, there is presently no on-board technology that can determine tyre wear in proper driving situations with an inaccuracy of less than 0.6mm. This is equivalent to 37.5% of the required minimum tread depth in the majority of nations. In this study, we introduce the idea of TyreEye, a wheel well-mounted optical system that faces the road. Using adaptive canny edge recognition, this gadget captures the longitudinal tread groove's cross-section and derives its contour. Since they offer the minimum permitted tread depth, the tread wear indicators are used to calibrate the scale. In order to evaluate this technology, we used a variety of tyres, lighting setups, and road types. It beats all other on-board tyre wear detection techniques shown in state-of-the-art, with a mean absolute error of 0.57mm in real-world situations. Although the results are highly encouraging, it could be challenging for automobile firms to adopt due to the hardware costs and sensitivity to dirt. Additional use cases, including as tyre pressure estimate, tyre damage detection, and road friction coefficient calculation, can be used to combat this.

[6] Mr. Ye Liu et al. 'Impact of vehicle type, tyre feature and driving behaviour on tyre wear under real-world driving conditions' 2022

Tyre wear produces airborne particle emissions in addition to huge bits of microplastic, which have drawn a lot of attention due to their detrimental effects on the environment, human health, and the water system. However, research on tyre wear under actual driving circumstances is scant. In the current study, the left-front and left-rear tyre wear of 76 taxi cars was measured approximately every three months in terms of volume loss in mm3. From September 2019 to June 2021, a period of 22 months, more than 500 measurements were taken. The impacts of vehicle type and tyre type on tyre wear were assessed using some of the data. Additionally, an artificial intelligence technique called Extreme gradient boosting (XGBoost) was employed to investigate

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III. CONCLUSION

The aforementioned research publications' findings cast doubt on the theory supporting further study into the application of image processing techniques for the identification of various wears and faults in the tyre business. There is a need for an alternative way because the current ones are not only not particularly time or cost effective, but also quite difficult to utilise. The authors of the relevant works have given their whole attention in order to approach useful and fruitful information..

IV. REFERENCES

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[4] Jianchen Zhu et al. ''Automobile tyre life prediction based on image processing and machine learning technology'', Sage Journals 2021.

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