"Motorbike Defect Checker and Predictor" –Android App to identify vehicle auto parts altered and their usage prediction

1st author:
Dr.Amith Caldera
Faculty of Computing
Sri Lanka Institute of Information and Technology
Sri Lanka
amitha.c@sliit.lk

2nd author:
Ms. Supipi Karunathilaka
Faculty of Computing
Sri Lanka Institute of Information and Technology
Sri Lanka
supipi.k@sliit.lk

S.L.D.P Pramodya.
Faculty of Computing
Sri Lanka Institute of Information and Technology
Sri Lanka
it20219598@my.sliit.lk

A.M.K.A.P Amarasingha
Faculty of Computing
Sri Lanka Institute of Information and Technology
Sri Lanka
it20257040@my.sliit.lk

Dissanayake D.M.D.H
Faculty of Computing
Sri Lanka Institute of Information and Technology
Sri Lanka
it20261764@my.sliit.lk

P. U. Rathnasooriya
Faculty of Computing
Sri Lanka Institute of Information and Technology
Sri Lanka
it20156206@my.sliit.lk

***Abstract*— As Sri Lanka has a high population of motorbike owners, out of them the most are Indian bikes, we have come up with this solution of selecting the best, safe and valuable motorbike for an individual just using his mobile phone. Therefore the buyer would not need the expert knowledge in identifying the defects by himself.**

The "Motorbike Defect Checker and Predictor" which is the final outcome of this research project is a complete mobile application that has the ability in providing it's users with an analysis of the overall condition of the motor bike which he/she is trying to purchase.

Currently the applications and methods used by different organizations in making an overall health condition of the vehicle has its separate components health check in separate companies. For an instance the part's quality and originality would only be checked by its manufacturer but here this specific application has the capability of identifying the defects, alternations, usage and finally give out prediction on the future usage and present condition of the motor bike.

Institutions like Hero Honda Service Center, Bajaj Service Center, and R & D Bike Modification Center are eager to help us with this endeavor by offering us additional information and support.

Additionally, the team has made all required preparations to build up data sets in the event that one of the aforementioned institutions or people refuses to allow data collection. Due to problems with accuracy from the built-up data sets, we would use the most.

Furthermore, the spare parts stores and other manufacturing sectors could be used to gather the required images of the auto parts for the training model. Industries like DSI tires, Bajaj spare parts, and Honda bike agents are ready to give us all the information we need, including authorization to take pictures.

I. INTRODUCTION

At the time of a vehicle purchase or motor bike purchase, the buyer tends to find the condition of the vehicle that he/she is trying to purchase. In this process the buyer do not have any mechanism or a metric that could be used as measurement of the vehicle' or the motor bike's condition. Therefore, most of us tend to ask for expertise knowledge where the seller would not be able to cover up the defects. Moos buyers tend to accompany an expert in the specific vehicle criteria and get an analysis regarding the vehicle's condition.

It's recommended to insert figures inside a text box. So your figure would go here (adjusting the text box to the appropriate size to match).

Thus when buying a motorbike we try to find out the most suitable value that would be granted for that specific motor bike. In this specific mobile application that we are trying to build up, we have identified the most critical specifications that a buyer would look at the time of purchase. They are the body parts that have been fixed, tyre usage, registration paper details and engine's condition. In order to identify all these specifications a common measurement or metric have not been introduced so far.

At present world we could find many innovative measurement criteria in specific areas such as in finding altered parts, the companies have come up with their methods which is only fixed into on criteria. For example Yamaha Company has its own methods in identifying their original parts. Rolls Royce engine builders have their own devices in identifying engine failure, Dunlop tyre builders have own methods in measuring the tyre usage and life expectancy, government officials have their own ways in identifying fraud documents, worn out vehicle details from true identity. But the application that we are planning to build has a combination of these criteria which it make one full combination of specification checker.

When identifying the initial scope for our research project we have used the following mechanisms since the vehicle industry is a huge industry in the present world. The scope that we have selected is only for Indian Motorbikes because it is the most widely sold type of motorbike. In future, we are planning to extend to all the other vehicles.

A. *Research Problem*

Most individuals who are trying to purchase a motor bike for the first time or with some experience on motor bikes faced the issue in analyzing the present condition that the bike is in. Here all individuals face many issues and get tricked by many sellers. Not only due to its value but in legal conditions the alternations has its own effects.

According to the latest gazette issued by Democratic Socialist Republic of Sri Lanka if any changes are done that could affect the following : - (a) exceed the weight, dimensions or limitations of its prototype, (b) alter its shape, design or external appearance, (c) loose the purpose for which it was manufactured, (d) loose its equilibrium and the parts which affect them lamps, lights, light covers, wheels, wheel covers, rims, tyres, mudguards, side mirrors, body kits, stickers could end up in serious legal actions [11].

As Sri Lanka has a higher number of motor bikes registered during a year rather than other all vehicles., our focus was on to motor bikes .
[2].Below values are the number motor bikes registered in Sri Lanka during following years.

204,811 = 2010	253,331 =2011	192,284 =2012
169,280 =2013	272,885 =2014	370,889=2015
340,129 =2016	344,380 =2017	339,763=2018
284,301 =2019	151,634 =2020	8,011 =2021
3,358 =2022		

Therefore the number of transactions that occur due these motor bike purchases are at a higher rate, which arises the issues that the individuals that get deceived due to misleads by the sellers of these motorbike who conceal the real condition of the motor bike.

Therefore our application gives an output of condition of the specific motor bike by combining all the functionalities of the four components that we have implemented. Where a customer would have a safe, better vehicle with less repairs and defects so that he/she would be able ride right after the purchase.

B. *Research Gap*

The most difficult aspect of this study is that there has never been any previous research or automated procedure for identifying the other applications that has the same capabilities as our application. However, we could not come across a single application that has all these four components in a single mobile or a desktop application.
If an individual needs to find all these criteria in a motor bike he/she needs to have an expert knowledge in auto mobile industry. On the other hand, there are some university researches that conducted by specializing some areas such as in identifying defects of an aircraft engine[11]. They cannot, however, recognize and analyze without expertise. By utilizing the proposed mobile application " Motorbike Defect Checker and Predictor " and scanning the fish with a smartphone camera, anyone may quickly identify and obtain well-analyzed information.

Despite the lack of research on using technologies to identify motorbike defects, there is research on locating defects and their utilization in motorbike parts. These programs also make use of image analysis and machine learning. The following differences between current applications and our upcoming application, "Motorbike Defect Checker and Predictor," can be seen, though.

1.Faculty of Automation, Computers and Electronics, University of Craiova, 200585 Craiova, Romania [11]

a. This paper describes the implementation of a solution for detecting the machining defects from an engine block, in the piston chamber. The solution was developed for an automotive manufacturer and the main goal of the implementation is the replacement of the visual inspection performed by a human operator with a computer vision application.

2.The Toyota team wanted to focus our initial work on the most customizable vehicle: the Tacoma. [4]

a. The proposed AR tool included the following key elements:
b. The customer identifies the vehicle model name
c. App uses machine learning to detect single or double cab, and bed length
d. App has the ability to lock on to an existing vehicle
e. Users can then select from a list of available accessories
f. The App then visualizes AR accessories on the actual vehicle.

II. METHODOLOGY

A. *Identify the altered parts from the original parts*

The main object of this research project is to develop a mobile application to provide the user a summary regarding the motorbike which he/she is going to purchase. Is it in a proper condition to be used, Are there any repairs to be done, Are there any part to be altered . This mobile application will be developed for all users of different ages, anybody interested in purchasing a motorbike.

Capture images of the auto parts in the vehicle and compare them with the original parts and provide a summary regarding the altered parts. Here the user can get an idea about the value of the motor bike , if many alternations are done will it be suitable for that price.

Specific Objectives

- Capture image of the auto part

Capture a quality image of the specific parts of the motor bike such as head lamp, side mirror, signal lights, side cups, fuel tank.

- Compare it with the trained images

Compare the images captured with the images in our trained models. To check whether they have been altered of original.For this part of the research, we are expecting to use a trained machine-learning model. We are expecting to pre-train the model using genuine motorbike spare part images along with all the

This is expected to be done by taking pictures of each replaceable part of each bike and using those data to feed into the image-processing ML model. Other than that, some images and information can be gathered from the sites using techniques like web scraping.

Colour pre-processing:
Before feeding the images into the model to train, the images are expected to pre-process with respect to their colour in order to remove noise and get an unbiased accurate reading from the image. Furthermore, we are expected to apply appropriate colour models like HSV (Hue, Saturation and Value).

Conversion to binary image:
In this part of the algorithm, we expect to convert the images from the saturation model to binary images. In a binary image, each pixel assumes one of only two discrete values. Analysing an image this way makes it simpler to distinguish its structural features. In this case, it becomes easier to separate the spare part from the background.

- Provide an output regarding the alternations.

Finally the application will be providing whether the specific part has been altered or in it original condition.

B. Identify defects in the engine by the sound of the engine.

Identifying the defects in the engine using the sound of the engine, the user needs to record a voice of the engine sound and the application takes it as an input to analyse the defects

Specific Objectives

- Capture Voice of engine.

The user will have to record a few voice clips of the sound of the engine to identify whether the strange noise is of these 1. Tick, tick tick, 2. Bump & grind, 3. Creepy krink, 4. Boo hiss, 6. Snap, crackle, pop.

- Analyze the sound

All these strange noises are detected and analysed in order to identify whether a particular bike contains one of these.

During this segment of our research, we are planning to perform engine condition check using voice recognition technology which is related to computer vision in the machine learning domain. We are going to train a voice-recognition model with sound clips of healthy motorbike engines and unhealthy ones and for the processing, the Log-Mel Spectrogram (LMS) as the input feature is used[9].

LMS is calculated for each frame of an auditory sample. Then a map is generated by forming the features of each frame along the time axis. This input feature in machine learning models is well suited to our requirement and it is proven to be effective in many audio processing tasks, due to its ability to capture the spectral information in a form that is well-suited for machine learning algorithms to learn from.
And for the processing, we are planning to use a trained Convolutional Neural Network (CNN) because of its efficiency in applications related to image processing, speech recognition, language modelling.

C. Compare the vehicle details with the registration paper details.

Comparison of vehicle details along with the registration papers.Here the user needs to capture images of the registration paer and chasis number, engine number, color, number plate of the vehicle
Also the user needs to enter the details manually using the registration paper details.

Specific Objectives

- Capture images of the registration paper and vehicle details

Here user can capture the images of the registration paper, engine number, chassis
number, colour, and number plate.

- Compare the images of captured

Using text detection, and binarization the characters in the images can be detected
and provide the user with feedback on the compared data.

Colour pre-processing:

Before feeding the images into the model to train, the images are expected to pre-process with respect to their colour in order to remove noise and get an unbiased

accurate reading from the image. Furthermore, we are expected to apply appropriate colour models like HSV (Hue, Saturation and Value).

Conversion to binary image:

In this part of the algorithm, we expect to convert the images from the saturation model to binary images. In a binary image, each pixel assumes one of only two discrete values. Analysing an image this way makes it simpler to distinguish its structural features. In this case, it becomes easier to separate the spare part from the background.

- Output the accuracy of the detail

D. Tyre usage prediction along with life expectancy

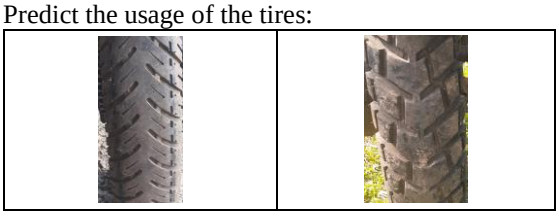
Our main objective is to provide a reliable, user-friendly, and accurate system that predicts the remaining useful life of motorbike tires using AI and ML techniques. To further enhance the predictive capabilities of our system for estimating the remaining life span of motorbike tires, we can leverage the power of vision transformers. By incorporating vision transformers into our system, we can extract meaningful features from images of motorbike tires, enabling us to better understand and analyze their wear and tear patterns.

The system will analyze historical data to identify patterns and make accurate predictions using algorithms like Random Forest, Support Vector Machine (SVM), and Maximum Entropy. In contrast, the incorporation of vision transformers into our system enhances its capabilities by allowing for a detailed analysis of motorbike tire images. This expansion enables us to provide more accurate predictions of the remaining useful life span, identify defects, promote safer driving practices, and reduce costs associated with tire replacements.

The ultimate goal is to improve tire maintenance schedules, minimize the risk of tire failure, and provide valuable insights to tire and bike manufacturers and end users. The research seeks to enhance the understanding of tire wear and tear, provide a means to identify defects in the tires for someone having no understanding of tire defects, promote safer driving practices, and reduce costs associated with tire replacements.[1]

Specific Tyer usage

- Predict the usage of the tires:



Predict the current mileage of the tire by looking at an image of a tire considering the
factors like thread depth, texture, wearing patterns, and shape.

- Identify Defects in tyer:

Generating a report on the current status of the tyer. Identify uneven wear and squared-off tyers, and tyer punches like similar conditions.

- Suggesting fixes:

If a defect is identified, suggest possible fixes to the conditions.

- Predict the life expectancy of the tire:

Predict the lifespan that can be expected of the tire based on the current conditions.

III. RESULTS AND DISCUSSION

This research component aims to develop a Identify the altered parts from the original parts Prediction System that utilizes Artificial Intelligence (AI) and Machine Learning (ML) techniques. The main object of this research project is to develop a mobile application to provide the user a summary regarding the motorbike which he/she is going to purchase.

First of all, users have to login to the system with their username(email) and password or using single sign on services like google or Facebook accounts. After that they can navigate to the interface given for Identify the altered parts from the original parts Prediction page. There is a button to take a picture which is then taken as the input to do the predictions. Capture images of the auto parts in the vehicle and compare them with the original parts and provide a summary regarding the altered parts. Here the user can get an idea about the value of the motor bike, if many alternations are done will it be suitable for that price.

This research component aims to develop Identify defects in the engine by the sound of the engine Prediction System that utilizes Artificial Intelligence (AI) and Machine Learning (ML) techniques. In here we develop model to Identify the defects in the engine using the sound of the engine.

There is a button to take a picture which is then taken as the input to do the predictions. The user needs to record a voice of the engine sound and the application takes it as an input to analyses the defects. Here the user can get an idea about condition of engine.

This research component aims to develop Comparison of vehicle details along with the registration papers Prediction System that utilizes Artificial Intelligence (AI) and Machine Learning (ML) techniques. The main object of this research project is to develop a mobile application to provide the user a summary regarding vehicle details along with the

registration papers. In here we develop model to compare of vehicle details along with the registration papers. Comparison of vehicle details along with the registration papers Prediction page. There is a button to take a picture which is then taken as the input to do the predictions. Here the user needs to enter details manually capture images of chasis numbe, engine number, color, number plate of the vehicle. Here the user can get an idea about vehicle details.

This research component aims to develop a Motorbike Tires Usage Prediction System that utilizes Artificial Intelligence (AI) and Machine Learning (ML) techniques to accurately estimate the remaining useful life of a motorbike tire. The proposed research will focus on developing a system that can accurately predict the remaining useful life of a motorbike tire. The ultimate goal is to improve tire maintenance scheduling, minimize the risk of tire failure, and provide valuable insights to tire and bike manufacturers and end users.

There is a button to take a picture which is then taken as the input to do the predictions. Prediction model classifies the tire image based on the condition of the tire into one of three categories as 'Good', 'Moderate' or 'Bad' and identify defects if there is any. After the prediction output is taken, that output is sent back to the user interface as a use prediction level and as an expected lifespan based on the usage. The proposed system seeks to improve maintenance scheduling, reduce the risk of tire failure, and enhance overall motorbike safety.

IV. Literature Survey

The research that our team conducting focuses on 4 major components as Identify the altered parts from the original parts, Identify defects in the engine by the sound of the engine, Compare the vehicle details with the registration paper details, Tyre usage prediction along with life expectancy. This whole application so has the ability of getting a full analysis of the current condition of the vehicle. Also provides the answer to the question of the buyer whether it is adequate for the price? , whether it is in condition for use ?.

When we focus our attention to other researches conducted on vehicle they mainly focus on internal defects such as engine defects [10] of aircrafts which are more critical in safety measures.

Also the companies such as TOYOTA, Honda, Yamaha, Land Rover, Dunlop, Kenda have their own researches on vehicle defect identification using Augmented reality, computer vision and deep learning. .For an instance TOYOTA company has its own system to fit alternative pars to its vehicle using Augmented Reality to check whether it would be suitable [12].

"A Predictive Maintenance Framework for Motorbikes" by T. Sudhakar and K. Gopinath (2019)This study proposes a predictive maintenance framework for motorbikes that uses a combination of data analytics and machine learning techniques to predict defects. The authors collected data from a fleet of motorbikes and used it to train a predictive model that could accurately identify potential defects. The study found that the proposed framework could reduce maintenance costs by up to 30%.

"An Intelligent Fault Diagnosis System for Motorcycles Based on Fuzzy Logic" by F. Xu and X. Wu (2016)
This study proposes an intelligent fault diagnosis system for motorcycles based on fuzzy logic. The authors collected data from a fleet of motorcycles and used it to train a fuzzy logic model that could accurately identify faults. The study found that the proposed system could significantly improve the accuracy of fault diagnosis in motorcycles.

Overall, these studies demonstrate the potential of data analytics and machine learning techniques for predicting defects and diagnosing faults in motorbikes. A predictive maintenance framework that uses a combination of these techniques could help reduce maintenance costs and improve the safety of motorbikes on the road.

In contrast all these applications which are mostly desktop application will not provide an solution to our research problem that we have come up with. Where the user could get an evaluation on the motor bike that he/she trying to buy from anywhere in Sri Lanka at anytime.

Although the mobile application provide a solution to a simple issue that individuals face due to lack of automobile engineering knowledge the buyer would be satisfied if the current condition of the vehicle that he/she is willing to purchase.

V. Conclusion

In conclusion, this study has shed light in helping a motorbike purchaser or an owner to find the present condition of his/her motorbike. Our findings have shown a significant correlation between the condition of the motorbike and the buyer, if the buyer is a person who has no knowledge regarding the motorbikes.

The aspects that we consider such as the originality of the spare parts, condition of the engine, condition of the tyres, clearness of the legal details give a true background of the motorbike that the buyer is willing to purchase.

Our research has certain limitations, including a relatively small sample size and a reliance on self-reported data. Future studies could employ longitudinal designs and incorporate more objective measures, such as expanding this to all automobiles including SUVs, Dual purpose vehicles, Luxury vehicles, to provide a comprehensive understanding of the subject.

In light of the implications of our findings, automobile engineers, Vehicle manufacturing organizations should collaborate to develop a comprehensive model with a population, data sets and complex algorithms in order to take this small scale application to a large scale industrial usable application.

In retrospect, this journey of exploration has highlighted the need for a complex application which could be used by all the individuals around the world where the buyer will not have any chances of getting mislead by vehicle owners and sellers.

As we conclude this study, we invite readers to reflect on their own digital habits and consider the role of using a mobile application to get the true condition of the vehicle that he/she is willing to use in future. By fostering awareness and promoting mindful engagement, we can collectively work towards harnessing the potential benefits of using a simple mobile application rather than using complex tools and mechanisms in getting the condition of the vehicle.

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to all those who have contributed to the completion of this research project.

First and foremost, I am immensely grateful to my supervisor, Dr. Amithalal Caldera and co-supervisor Ms. Supipi Karunathilaka , for their guidance, support, and invaluable insights throughout the entire research process. Their expertise and encouragement have been instrumental in shaping this study.

I would like to thank my colleagues and friends S.L.D.P Pramodya, A.M.K.A.P Amarasingha, D.M.D.H Dissanayaka, P. U. Rathnasooriya for their constant encouragement and valuable discussions. Their feedback and suggestions significantly improved the quality of this research.

I am indebted to the staff of Sri Lanka Institute Of Information Technology for their assistance in accessing resources and facilities, which greatly facilitated the smooth progress of this study.

I am indebted to the staff of all the institution Stafford Motor Co. (Pvt) Ltd - Automobile Body Repair & Paint Division, David Pieris Motor Company (Pvt) Ltd - Head Office provided us with all the data needed to make this research a successful, for their assistance in accessing resources and facilities, which greatly facilitated the smooth progress of this study.

Finally, I am grateful to my family for their unwavering support, understanding, and patience throughout this research journey.

FUNDING

This research was made possible by the generous support of S.L.D.P Pramodya, A.M.K.A.P Amarasingha, D.M.D.H Dissanayaka, P.U. Rathnasooriya. The authors would like to express their gratitude for the financial assistance provided to conduct this study

REFERENCES

[1] J.R. Parker “Algorithms for Image Processing and Computer Vision, Second Edition.” Computer Vision, Graphics, and Image Processing, Published by Wiley Publishing, Inc. 10475 Crosspoint Boulevard Indianapolis, IN 46256 Copyright 2011 Published by Wiley Publishing, Inc., Indianapolis, Indiana Published simultaneously in Canada www.wiley.com

[2] Department of Motor Traffic. (n.d.). Department of Motor Traffic. https://dmt.gov.lk/
In-Text Citation: (Department of Motor Traffic, n.d.)

[3] Ilminen, Gary. “Top 6 Strange Motorcycle Noises | What They May Mean.” Ultimate Motorcycling, 29 Mar. 2016, ultimatemotorcycling.com/2016/03/29/to p-6-strange-motorcycle-noises-what-theymay-mean.

[4] “Toyota Accessories Augmented Reality [TAAR] App. (2021, November 17). Groove Jones. https://www.groovejones.com/toyota-accessories-augmented-reality-taar-app/
In-Text Citation: (Toyota Accessories Augmented Reality [TAAR] App, 2021)

[5] https://d-nb.info/1159675910/34

[6] https://www.researchgate.net/profile/Ashf Shafin/publication/344519283_Automatic_Environmental_Sound_Recognition_AESR_Using_Convolutional_Neural_Network/links/5f7de369458515b7cf6f22d7/Automa tic-Environmental-Sound-RecognitionAESR-Using-Convolutional-NeuralNetwork.pdf

[7] Tokozume, Yuji, and T. Harada. “Learning environmental sounds with end-to-end convolutional neural network,” 2017 IEEE International Conference on Acoustics,

[8] [“How Optical Character Recognition Algorithms Redefine Business Processes &Mdash; ITRex.” ITRex, 6 Apr. 2022, itrexgroup.com/blog/how-ocr-algorithmsredefine-business-processes.

[9] D. Barchiesi, D. Giannoulis, D. Stowell and M. D. Plumbley, “Acoustic Scene Classification: Classifying environments from the sounds they produce,” in IEEE Signal.

[10] Upadhyay, A., Li, J., King, S., & Addepalli, S. (2023, February 1). A Deep-Learning-Based Approach for Aircraft Engine Defect Detection. MDPI. https://doi.org/10.3390/machines11020192
In-Text Citation: (Upadhyay et al., 2023)

[11] NewsWire - Sri Lanka’s largest News aggregator. (2023, March 20). NewsWire. https://www.newswire.lk/
In-Text Citation: (NewsWire - Sri Lanka’s Largest News Aggregator, 2023)

[12] https://www.autopartspro.co.uk/

Make sure to remove all placeholder and explanatory text from the template when you add your own text. This text should not be here in the final version!