JOURNAL OF CRITICAL REVIEWS
ISSN- 2394-5125 VOL 7, ISSUE 15, 2020

A Study On Predictive Maintenance Of Select Cars In Telangana

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Received: 14 April 2020 Revised and Accepted: 8 August 2020

ABSTRACT
Predictive maintenance helps in predicting the failure of the machines or equipment beforehand. It saves the costs and also increases the life of the machine or vehicle. The present study on predictive maintenance of the select cares is undertaken to study the percentage of cars that require maintenance and replacement of the parts. Primary data is collected from 1000 customers of deccan motors company and SPSS 16 version is used to analyse the data and find out whether performance of the vehicle is dependent on the maintenance and replacement of the parts is dependent on the performance of the vehicle. Chi-square and correlation analysis are data analysis techniques that are used to analyse the data. The study concludes that there is a high negative correlation between performance and maintenance and low negative correlation between replacement and performance.

Keyword: Predictive maintenance, Predictive work flow, replacement

INTRODUCTION

Maintenance involves cost effective practices of servicing, functional checks, repairing or replacing of necessary devices/ infrastructure, parts of equipment or machinery, products and supporting utilities in business, industries, government organisations and residential installations. Its primary objective is to up haul and up keep the equipment by undertaking the activities either before or after a failure so that the machine or equipment is operational. Maintenance management is how effectively and efficient we manage the machines, equipment and resources so that there is smooth flow of materials or products through supply chains. Predictive maintenance is one of the method of maintenance management which is used to predict the measures to be taken when the machine or equipment or vehicle goes beyond the prescribed standard. This paper focuses on predictive maintenance of the automobiles specifically cars.

Predictive maintenance is a contemporary approach which evaluates the condition of equipment by gathering data using sensitive instruments like vibration analyser's, optical tooling, pressure guage, amplitude meters, temperature gauge, audio gauges, and resistance gauges offline or online by performing periodic checking. Predictive maintenance is a proactive strategy that tries to predict the future trend when an equipment or machine might fail so that maintenance work can be performed just before that happens.

Most predictive inspections are carried out in the organization while equipment is in service, thereby minimizing disruption of operations of normal system. Adoption of predictive maintenance can result in substantial cost savings and higher system reliability. Predictive maintenance is a technique to predict the future failure point of an equipment or a machine component, so that replacement of the component happens based on a plan, just before it fails. Thus, equipment downtime is minimized and the component lifetime is maximized.

NEED OF THE STUDY

Predictive maintenance is a proactive strategy to reduce the unplanned downtime or idle time costs. This study provides the customers of Deccan motors pro-active information when a certain part on the vehicle needs maintenance or replacement. Hence this study is undertaken to analyse when the replacement of the parts of the vehicles is required to reduced downtime and extend the vehicle life.

OBJECTIVES OF THE STUDY

1 To study the requirement of maintenance and replacement of parts for select cars manufactured by Deccan motors company

2 To analyze the relationship of maintenance and performance

3 To analyze the relationship of replacement of performance

The following hypothesis are framed based on the above objectives and can be tested for their significance:

MAINTENANCE

H_{01}: Performance is statistically independent of Maintenance

H_{11}: Performance is statistically dependent of Maintenance

H_{02}: There is no significant correlation between performance and maintenance.

H_{12}: There is significant correlation between performance and maintenance.

REPLACEMENT

H_{03}: Replacement is statistically independent of Performance

H_{13}: Replacement is statistically independent of Performance

H_{04}: There is no significant correlation between performance and replacement.

H_{14}: There is a significant correlation between performance and replacement.

RESEARCH METHODOLOGY

Descriptive study is conducted on various sensors of vehicles and build a predictive maintenance solution and accordingly the customer will be notified when their vehicle needs maintenance or replacement of a specific part. This study on predictive maintenance of cars is conducted by gathering primary data using questionnaire from 1000 customers of Deccan motors company which manufactures automobiles mostly passenger vehicles. The cars have sensors for all the critical parts such as carburetor, battery etc to monitor their performance and condition. Secondary data is collected from E-journals, websites, company books.

The SPSS16 version is used for data analysis. Tools used are crosstabs, correlation, regression, percentages and graphs

REVIEW OF LITERATURE

PREDICTIVE MAINTENANCE WORKFLOW

The figure 1 below outlines the predictive maintenance workflow from start to finish. The main aim of predictive maintenance is identify breakdowns before they actually happen by monitoring the equipment conditions.

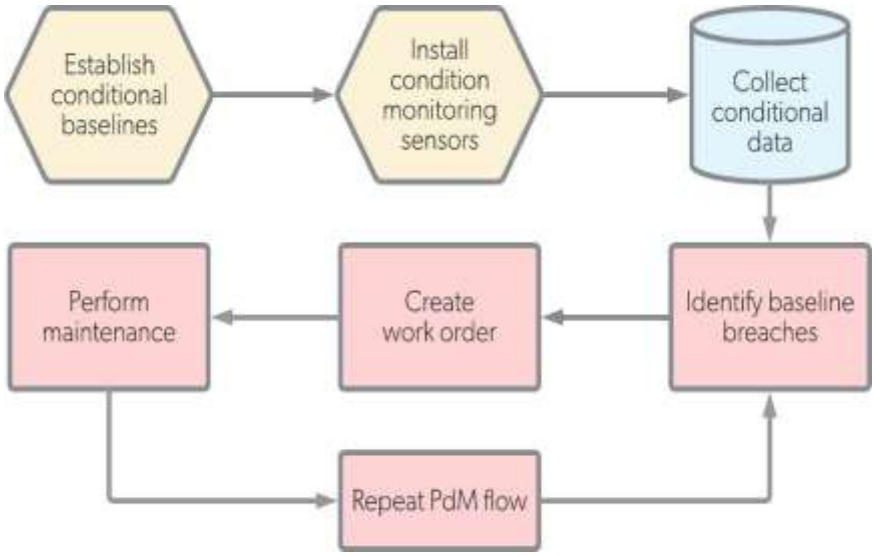

Figure 1: Predictive Maintenance workflow

All the staff and operators of the equipment or machines are trained before the they implement Predictive Maintenance (PdM) technology. The maintenance team establishes baselines/acceptable condition limits for assets that will have sensors. Internet of things devices/sensors are installed and affixed to the asset. The IOT device is connected to a CMMS or remote dashboard where data is collected and analysed. Inspections are automatically triggered by a CMMS when the condition limit is exceeded or the person monitoring the dashboard schedules the inspection manually. Baseline breaches are identified and work order is created to process further. Maintenance measures are performed so that there is no breakdown of the machines/equipment/vehicles.

Arindam Chaudhuri (2017) in his research paper "Predictive Maintenance for Industrial IOT of Vehicle Fleets using Hierarchical Modified Fuzzy Support Vector Machines" mentioned that there is a great potential for the

use of predictive maintenance as there is a gradual increase of machines being controlled and managed using networked smart devices. He also mentioned that Predictive maintenance has the potential of reducing the idle time of machines and labour and also to great extent time associated with inspections and preventive maintenance is also reduced. He recommended a hierarchical modified fuzzy support vector machine (HMFSVM) for better implementation of telematics data for ensuing preventative management.

Rune Prytz (2014) in his thesis on "Machine learning methods for vehicle predictive maintenance using off-board and on-board data" mentioned how reliability can be improved and investigated supervised and unsupervised methods for predicting vehicle maintenance. Different ways of doing data representations and deviation detection were also investigated.

Patrick ,K. Bo Ding , lluju , K. Tet , Y. (2019) in their research article on "IOT-based predictive maintenance for fleet management" mentioned that Consensus self-organized models approach (COSMO), which is an example of a predictive maintenance system for diagnoses faulty buses and proposed a semi-supervised machine learning algorithm that attempts to improve the sensor selection performed in COSMO.

Chong, C. Ying, L. Carla Di Cairano , G. Scott, T. (2019) in their paper on "Automobile Maintenance Prediction Using Deep Learning with GIS Data" mentioned that conventionally, the prediction models in predictive maintenance are established using historical maintenance data or sensor data. An experimental study based on real-world maintenance data was conducted to understand the performance of deep neural network improved with the help of GIS data.

Suresh, A. (2019) in their paper on "Cloud-Based Predictive Maintenance and Machine Monitoring for Intelligent Manufacturing for Automobile Industry" mentioned that the importance of prediction in today's industrial purposes and the authors tried to estimate the fault that can occur in the machines and decide the time that can cause a critical situation.

DATA ANALYSIS AND INTERPRETATION

When 1000 customers' vehicles underwent predictive maintenance procedure, it was found that 54% of the cars require maintenance and 46% of them do not require maintenance. And 94.7% of the vehicles require replacement and 5.3% of them do not require replacement. Sensors were used in the important parts in the vehicles to understand whether cars require maintenance or not.

USING CHI- SQUARE TEST

Table no 1: Chi-Square Test for performance and maintenance

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.000E3[a]	293	.000
Likelihood Ratio	1.380E3	293	.000
Linear-by-Linear Association	669.525	1	.000
N of Valid Cases	1000		

From the above table 1, it can be interpreted that as p value (0.00) is less than 0.05, H01 is rejected. It indicates that performance is dependent on the maintenance of the vehicle.

Table no 2: Chi-Square Tests for performance and replacement

	Value	Df	Asymp.Sig. (2- sided)
Pearson Chi-Square	1.000E3[a]	293	.000
Likelihood Ratio	414.511	293	.000
Linear-by-Linear Association	155.018	1	.000
N of Valid Cases	1000		

From the above table 2, it can be interpreted that as the p value (0.00) is less than 0.05, HO2 is rejected. It indicates that replacement of the vehicle parts is dependent on the performance indicator.

USING CORRELATION

Table 3: Output table of correlation analysis for maintenance and replacement

		maintenance	Performance	replacement
Maintenance	Pearson Correlation	1	-.819**	.218**
	Sig. (2-tailed)		.000	.000

	N	1000	1000	1000
Performance	Pearson Correlation	-.819**	1	-.394**
	Sig. (2-tailed)	.000		.000
	N	1000	1000	1000
Replacement	Pearson Correlation	.218**	-.394**	1
	Sig. (2-tailed)	.000	.000	
	N	1000	1000	1000
**. Correlation is significant at the 0.01 level (2-tailed).				

INTERPRETAT

From the above table 3, it can be interpreted that

- There is high negative correlation (-0.819) between the performance indicator and maintenance. As p value is 0.00 which is less than 0.05 hence Ho3 is rejected. It implies that any change in the performance indicator causes an opposite change in the maintenance. It indicates that if performance is good then there is a less maintenance required.
- There exists low negative correlation between the performance and replacement that is the -0.394. It implies that any change in the performance will cause opposite change in the replacement. It means if performance is good then there is a less replacement.

CONCLUSION

From the analysis it can be concluded that 54% of cars require the maintenance and 94.7% of cars do not require the replacement of parts. There is a significant relationship between performance and maintenance, and performance and replacement. Hence, predictive maintenance can provide an ROI and is a source of cost-savings.

REFERENCES

1. Arindam, C.(2017). Predictive maintenance for industrial IOT of vehicle fleet using hierarchical modified fuzzy support vector machines. In Conference Proceedings,1-15.DOI:10.3233/IP170067
2. Chong, C. Ying, L. Carla Di Cairano, G. Scott, T.(2019). Automobiles Maintenance Prediction using deep learning with GIS Data. Social Science Review,34(8), 1-96.
3. Patrick, K.Bo Ding ,lluju, K. Tet, Y. (2019). IOT-based predictive maintenance for fleet management. A Literature Review, (151), 607-613.DOI:1177/08944564329
4. Rune, P. (2014). Machine learning methods for vehicle predictive maintenance using off- board and on board data. Halmstad University Press, (81), 447-452.DOI:10.9776/1307
5. Suresh, A. (2019). Cloud-Based Predictive Maintenance and Machine Monitoring for intelligent manufacturing for industry. In Conference 2015 Proceedings,74-89 .DOI: 10.4018/978-1-5225-9023-1.ch006
6. https://www.onupkeep.com/learning/maintenance-types/predictive-maintenance