ALERT CALIBRATION MAINTENANCE (AlertCaLM) APPLICATION FOR CONDITION BASED MAINTENANCE

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ABSTRACT

Maintenance of equipment to prevent failures has become increasingly important. Maintenance technology has evolved over time based on condition-based. Faults and failures of induction machines can lead to excessive downtimes and generate large losses in terms of maintenance and lost revenues, and this motivates the examination of on-line condition monitoring. The idea of condition-based maintenance (CBM) is to monitor equipment using several sensors to allow real-time diagnosis of impending failures and prediction of equipment condition. Condition based Maintenance (CBM) is a maintenance process used by industry to actively manage the health condition of equipment or machine in order to perform maintenance only when it is needed and at the time. This paper presents a neuro-fuzzy modeling approach for condition based maintenance as to achieve the result in investigating the CBM function in reducing the inventory cost, reduce the number of failures by analyses the data collection of the machine vibration based on condition based maintenance and develop android system to implement in maintenance process. The process of developing this project is to understand the concept of condition based maintenance use in controlling the lifetime of the machine.

Keywords: Fuzzy systems, Neural network, Condition-based maintenance, Diagnosis, Android System.

1.0 INTRODUCTION

An industry is a production or business that is formed based on the concept of organized groups in producing of goods or services. Many changes occur in this industry field, especially in the manufacturing industry to improve the process and production using advanced technologies. Industrial areas are modernized with the use of engineering and manufacturing technology to accelerate, simplify and increase efficiency in making products. Furthermore, many useful and advanced machines are used to make this industrial field in successful. So the maintenance management was taken up as a serious issue based on this dynamic industrial revolution nowadays. The rapid modernization need for high yielding productivity management to better-quality of development which are use hi-tech and complex machines and equipment. Therefore, high cost investment is needed for the production process and frequent failure may result in production downtime.

Based on this issue, the appropriated maintenance activities are required, which will minimize the occurrence of such failures and increase the consistency of production. So, as a way to improve this problem, condition-based maintenance (CBM) is used to perform maintenance on equipment that acts as a repair or replacement process based on the current state of the equipment. Condition based maintenance (CBM) is one of the important feature for industry for the fault detection process. The process of CBM can be proceeded after the analysis of the data had been made. As developing this CBM process in mobile technology, this project is carried out to produce a maintenance alert application for the android platform.

2.0 PROBLEM STATEMENT

Nowadays, varies equipment and machines in the industry have many functionalities. They are required to perform their intended functions in their lifetime. In order to maintain the equipment, the condition of the machines or equipment has to be identified for proper maintenance planning. Computer monitoring (CM) has been used to tell or inform condition of the machine or equipment. However, CM data not being utilized in CBM design making in determining the time for maintenance process. Therefore, this project utilizes the CM data to develop an alert maintenance application in android platform.

3.0 OBJECTIVE

1. To investigate the use of condition monitoring data for fault detection.
2. To develop the alert maintenance application for android system.

4.0 LITERATURE REVIEW

At present, a lot of literatures is available that describes the management of maintenance, especially those associated with the project which is about CBM, maintenance of machines or equipment in the industry. Among, Sunisa and Jittiwut (2011) has outlined that machine will be costly and any breakdowns can result in undesirable creation interference. The machine will be ordinarily furnished with security system extending from basic indicator checking to more progressed real-time condition observing, and deficiency location and analysis. Basic protection systems are focused around over-present and over voltage assurance plans where faults that irregularly or gradually create are for the most part undetected. So, an AI technique which is an application of an Artificial Neural Network (ANN) is used for discovering a little fault in a course shield of an impelling motor, which cannot be portrayed by comparisons.

5.0 ARTIFICIAL INTELLIGENCE TECHNIQUE, SOFTWARE AND DATA ANALYSIS

The vibration data are used to process using adaptive Neuro fuzzy inference system (ANFIS) as an artificial intelligence technique. This technique is used because it is a class of adaptive network, which is a kind of artificial neural network that are functionally equivalent to fuzzy inference systems (FIS). ANFIS is represented using Takagi–Sugeno fuzzy inference system and uses a hybrid learning algorithm. Implementation of ANFIS is for developing fuzzy rules with suitable membership functions to have required inputs and outputs. FIS is computing tool to which fuzzy if-then rules and fuzzy reasoning compose bases that performs the mapping from a given input knowledge to desired output using fuzzy theory. This suggested ANFIS has several properties which are having a single output, obtained using weighted average defuzzification. All output membership functions are constant. It also has no rule sharing. Different rules do not share. The same output membership function, namely the number of output membership functions must be equal to the number of rules. The output is zero the order Sugeno-type system and it has unity weight for each rule.

The objective of using ANFIS is ANFIS application to synthesize the controllers (automated fuzzy control tuning) and for the models is to explain past data and predict future behavior. The software that will use to process the data is using MATLAB where the ANFIS tool is used. Based on this project, the vibration data divide into two partitions which are 30% for testing data and 70% set training data set. This 70% training data set uses to discover potentially predictive relationships. The implemented of the training set is to build up a model while a test (or validation) set is to validate the model built. The constant membership function is used as the output membership function type because the output result only want in a constant value whether in 1 or 0. From the process, the rule of the data will be created as intelligently, the structure of the network and the surface of analysis also will create.
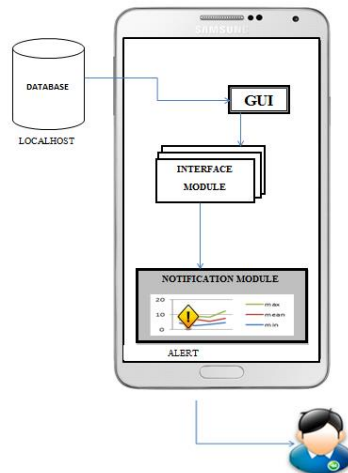
Figure 5.1: AlertCaLM System Architecture

The Figure 5.1 above shows how the application of AlertCaLM works. The technician maintenance will open AlertCaLM and make registration process first if the technician is not registered yet. After that, for technician that already register, they will login the system by using their email and password. Then, technician maintenance can view the description about the apps and can view the graph of the data that consist of three types of data which are min, mean and max. The data are obtained from the database and display on the smart phone interface. If the point of data is declared in bad condition of the machine, it will pop up an alert to inform the technician maintenance.

6.0 RESULTS

A method using adaptive fuzzy logic to interpret current signal of machine for the condition monitoring was presented. Correctly processing theses current signals and inputting them to a fuzzy decision system achieved high diagnostic accuracy.
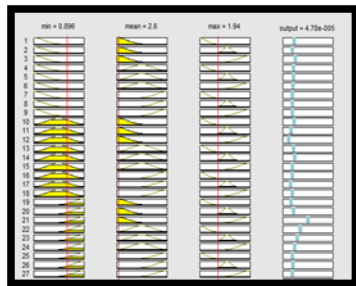

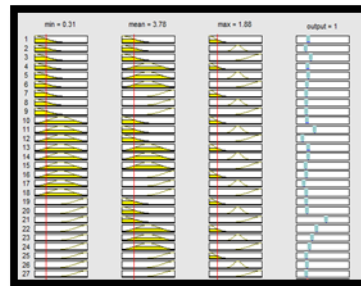**Fig. 6.1: Fuzzy inference diagram for a healthy machine functionality.**

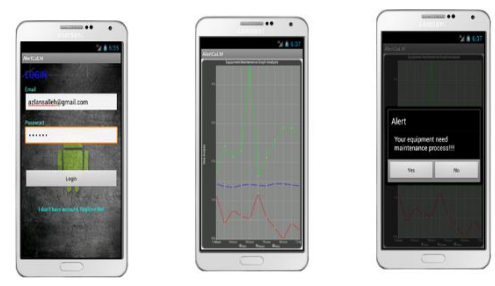**Fig. 6.2: Fuzzy inference diagram for a damaged machine functionality.**

Fig. 6.3: Example of android application for CBM

For Fig. 6.1, it is ruled that was analyzed which the three input values of min= 0.896, mean= 2.595 and max=1. 935 that produce the condition result of machine is in good condition or in healthy condition (output=4.78e-005) with nearest to 0. For Fig. 6.2 it is ruled that was analyzed which three input values of min= 0.31, mean= 3.782 and max=1.88 that produce the condition result of the machine in a damaged condition (output=1) exactly. Then, based on these analytical data, the android application will be developed as developing this CBM process in mobile technology. The example of developing an Android application is shown in Fig. 6.3 above.

7.0 DISCUSSION

Fuzzy system can effectively deal with information, both quantitative and qualitative. They are suitable for applications of CBM as an expert qualitative heuristic knowledge can be incorporated in the model building process. This model can be improved using quantitative historical data / experiments. CBM system is designed to provide advanced notice and alarm or to shut down a process. The human operator is required to assess the situation and make appropriate decisions. In other words, the CBM system and human operators have to work together to solve problems.

8.0 CONCLUSION

In conclusion, this project is to develop an application based on the problem in determining appropriate efficiently of equipment or machine. The analysis of data is conducted using the fuzzy logic method as beginning process to get the result of the maintenance process. Then, an alert application will be developed in android platform based on the result. Hence, this project can give a new solution for helping maintenance activities in the industry.

ACKNOWLEDGEMENTS

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