Life Cycle Forecasting of Smart Factory Equipment Using Artificial Intelligence

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***Abstract*— Life cycle estimation is one of the major issues in almost every industry. Conventional life time forecasting methods generally require manual input that is tiresome process. Life cycle can be forecasted with sufficient percentage of accuracy using machine learning algorithms. This paper recommends that artificial neural network (ANN) can be used to predict life cycle of equipment satisfactorily. It can classify parts whether a part is in productive state or obsolete. Therefore, any equipment can be repaired or replaced before its actual failure. Thus, unexpected interruption in production can be avoided.**

Keywords—Artificial neural network, life cycle, useful life, smart factory.

I. INTRODUCTION

A product or item doesn't work satisfactorily as it is intended to perform all the time. Catastrophic failure can occur during its entire life cycle. In the early stage and later stage of life cycle, the uncertainties are most likely to occur. Therefore, a prior knowledge of useful life i.e., the time span when the product works as expected, is important in industries [1]. A smart factory equipment life cycle has been shown in Fig. 1. Life cycle prediction of equipment holds immense importance in order to replace an obsolete part with same or similar parts. Otherwise, the production of smart factory can be delayed for equipment failure. Conventional techniques require manual inputs. They are laborious, time consuming and they are provided by the manufacturer most of the time. Hence, an efficient life cycle prediction method can save significant amount of money every year [2-3]. Artificial intelligence has drawn the attention of the researchers to effectively solve the real world problems efficiently. Also, artificial neural network can play a significant role to perform this task. It works in the same way as the human brain works [4]. There are artificial neurons to process the data. The ANN must be trained with sufficient amount of data. ANN learn from input training data to produce the output. The more the training data, the more the better result.

II. PROPOSED SYSTEM ARCHITECTURE

Life cycle of any equipment in a factory depends on several factors, such as, production start and end date, factory operation time, production temperature etc. These parameters will be taken as input in the input layer of ANN. Then ANN algorithm will predict the life cycle of the factory equipment. Our proposed system will give the predicted life cycle which is the output of

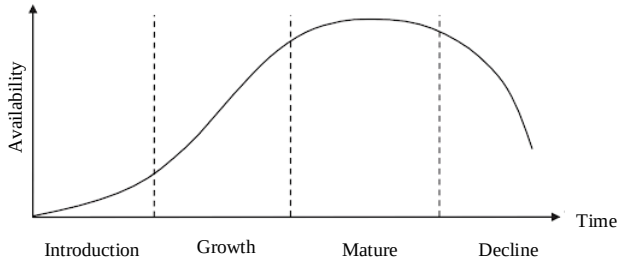

Fig. 1. Smart factory equipment life cycle

ANN. After that the algorithm will subtract seven days from the predicted life cycle due to avoid any kind of production disturbance. Then the final predicted date will be stored in database which is actually a week ahead of the actual prediction. This technique will increase the accuracy of the algorithm. Therefore, responsible persons can take necessary action with seven days in hand. Again, the probability of production collapse due to any equipment failure can be removed.

In Fig. 2, ANN model with input, output and hidden layers has been shown. The input layers contain different variables that can affect the equipment life span. First, an algorithm is used to calculate the difference between the start production date and end production date of every factory equipment and will store the difference. Then the difference will be considered as one of the inputs of ANN. The other inputs of ANN are factory operation time and factory environment temperature.

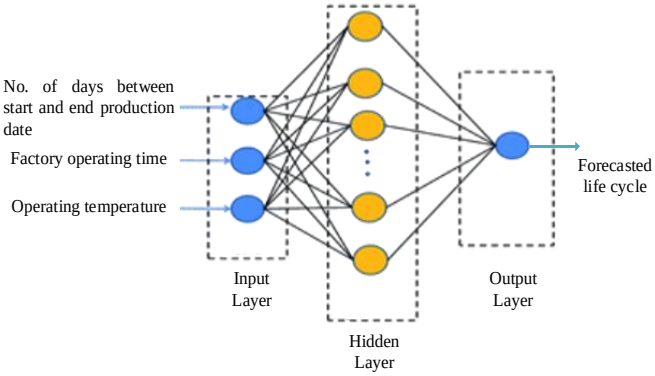

Fig. 2. ANN network architecture

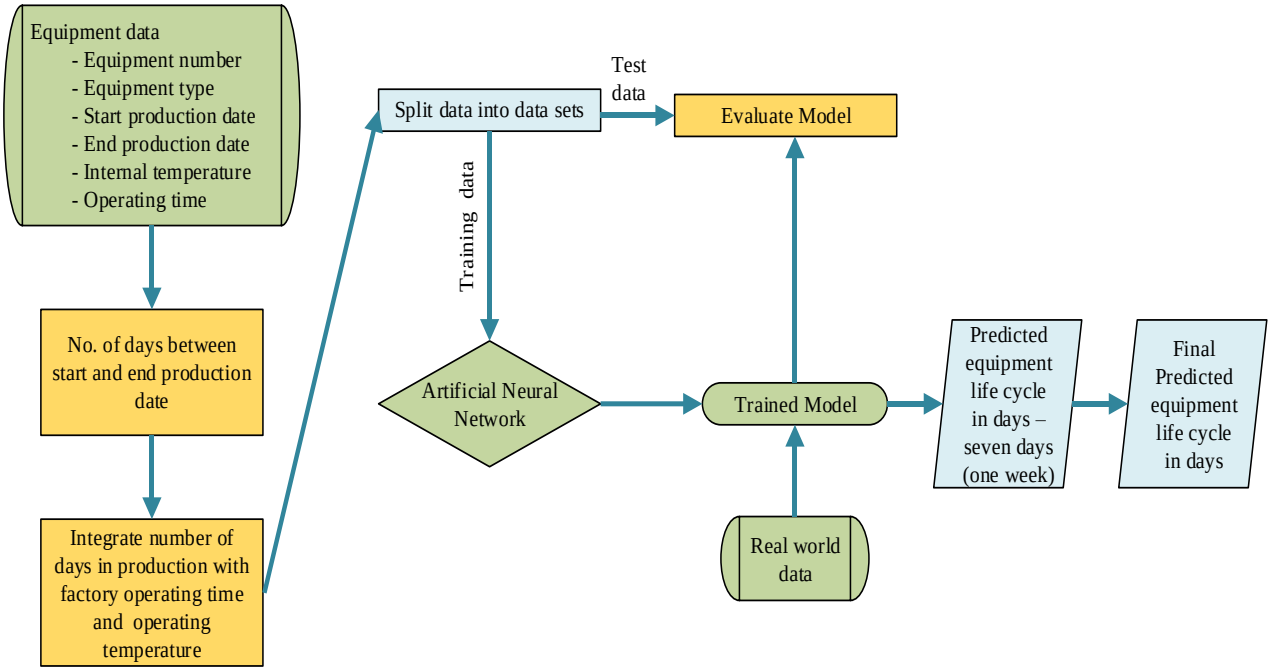

Fig. 3. Proposed model for life cycle prediction of smart factory equipment.

In this model, the whole dataset is split into two data sets i.e.; training dataset and test dataset. 80% data of the dataset will be used as training dataset to train the model and the rest 20% data will be used as test dataset to test the performance of the model. The output of the ANN is the prediction of the life-cycle of equipment. Then it will go through another algorithm which will give one week ahead predicted date. Detailed pictorial representation has been shown in Fig. 3.

III. CONCLUSION

Studies show that both obsolescence risk and life cycle can be predicted using Artificial Intelligence. Artificial Neural Network is a method used to model a system or phenomenon. This artificial neural network method works by modeling a system both linearly and non-linearly based on previous knowledge about the system. Proper forecasting can turn reactive approach into a proactive approach. Thus, millions of dollars can be saved annually.

IV. FUTURE WORK

In future, the proposed model can be applied to large real world factory datasets along with some advanced methodology to accurately predict the life cycle of factory equipment to avoid production loss.

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