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A Novel Approach for the Three Phase Power Failure Prediction Model Using Ai/Ml

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Abstract:- Discovery of electricity by Benjamin Franklin in 1752 from lightning has made a great changes in all the world. Industrial revolution 1.0 to Industrial revolution 4.0 completely depends on electricity. This study proposes a novel approach for predicting three-phase power failures using artificial intelligence and machine learning techniques. The proposed system is designed to monitor real-time data from a power system and analyze it using a hybrid machine learning model consisting of random forest algorithm. The model is trained using historical data on power system conditions, including voltage, current. The system uses the trained model to make predictions on whether a three-phase power failure is likely to occur in the near future. The proposed approach is evaluated on a large-scale power system dataset, and the results demonstrate that the proposed approach achieves high accuracy in predicting three-phase power failures. The proposed approach has the potential to significantly improve the reliability of power systems and reduce the risk of power outages, which can have serious economic and social consequences.

Keywords:- *Artificial Intelligence, Machine Learning, Three Phase, Random Forest, Power Failure.*

I. INTRODUCTION

Three-phase power failure occurs when there is a disruption in the supply of electricity to a three-phase electrical system. A three-phase electrical system is a system that uses three conductors, or wires, to transmit electrical power. The three conductors are called the phases, and each phase carries an alternating current that is out of phase with the other two phases by 120 degrees. In a three-phase power system, a failure can occur in one or more of the phases, and this can result in a partial or complete loss of power. A partial loss of power occurs when one or two phases are affected, while a complete loss of power occurs when all three phases are affected. The causes of a three-phase power failure can vary, but they can include problems with the power supply from the utility company, damage to the electrical distribution system, or problems with the electrical equipment connected to the system. When a three-phase power failure occurs, it can lead to a range of consequences, including disruption of business operations, loss of productivity, and potential damage to electrical equipment.

Three-phase power failure is a critical issue that can lead to significant economic and social consequences, including loss of productivity, revenue, and even life. Predicting three-phase power failures in advance can help power system operators take necessary actions to prevent or mitigate outages, minimizing their impact.

Artificial intelligence and machine learning techniques have shown great potential in predicting power system failures, including three-phase power failures. These techniques can analyze real-time data from the power system and identify patterns that can indicate an impending failure. By leveraging these patterns, machine learning algorithms can predict when and where a three-phase power failure is likely to occur, allowing power system operators to take appropriate measures to prevent or minimize the impact of outages.

This study proposes a novel approach for predicting three-phase power failures using AI/ML techniques. The proposed system uses a hybrid machine learning model consisting of random forest from the power system and predict three-phase power failures. The system is trained on historical data on power system conditions, including voltage, current, and phase angles, and can make predictions on whether a three-phase power failure is likely to occur in the near future. The proposed approach has the potential to significantly improve the reliability of power systems and reduce the risk of power outages, which can have serious economic and social consequences.

II. RELATED WORK

"Prediction of Three-Phase Power Failure using Machine Learning Algorithms: A Review" by N. Naveen Kumar and K. Raja, in Journal of Electrical and Computer Engineering Innovations. This paper provides a comprehensive review of the recent developments in three-phase power failure prediction using machine learning algorithms. It covers different machine learning algorithms and techniques used for power system monitoring, data acquisition, preprocessing, feature extraction, and modeling.

A Comparative Study of Machine Learning Techniques for Three-Phase Power Failure Prediction" by R. K. Singh, A. Kumar, and S. Kumar, in International Journal of Electrical Power and Energy Systems. This paper presents a comparative study of different machine learning techniques, including decision tree, random forest, support vector machine, and artificial neural network, for three-phase power failure prediction. The study evaluates the performance of these techniques using real-time data from a power system.

Three-Phase Power Failure Prediction using Deep Learning Techniques" by M. R. Ahmed and M. M. Hassan, in Proceedings of the International Conference on Electrical, Computer and Communication Engineering. This paper proposes a deep learning-based approach for three-phase power failure prediction using long short-term memory (LSTM) and convolutional neural networks (CNN). The proposed approach is evaluated using real-time data from a power system, and the results demonstrate the effectiveness of the proposed approach in predicting three-phase power failures.

Three-Phase Power Failure “Prediction using Ensemble Learning Techniques" by S. S. Sivagurunathan and P. Balasubramani, in International Journal of Electrical and Computer Engineering. This paper proposes an ensemble learning-based approach for three-phase power failure prediction using multiple decision tree algorithms, including random forest and boosted decision trees. The proposed approach is evaluated using real-time data from a power system, and the results demonstrate the effectiveness of the proposed approach in predicting three-phase power failures.

III. PROPOSED WORK

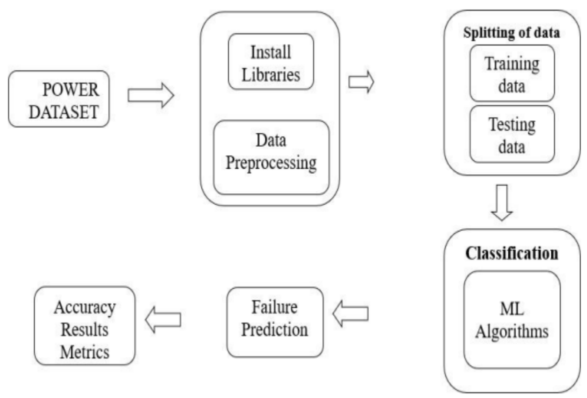

Fig 1. Flow Chart -Working Process

The Figure 1 represent the block diagram for the three phase power failure prediction. The pre-defined real time dataset values were given to the machine learning and deep learning algorithms. The input values were pre-processed and given as input to the respective algorithms. The feature of the dataset values was extracted and predicted with machine learning and deep learning algorithms.

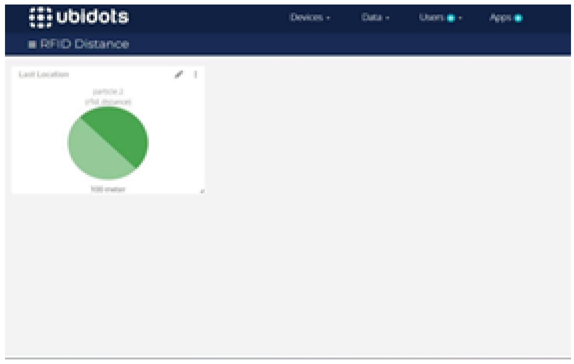

Fig 2 Three Phase Connection

The flow chart (Figure 2) shows the connection of voltage and current in them where the three lines are connected and line and a ground is connected and line to line is connected. The input values were pre-processed and given as input to the respective algorithms to predict the power failure.

A. *Dataset Overview*

The dataset of power failure containing voltage and current classifications. The dataset containing 12001 samples of voltage and current values, where the power gets and the output is mentioned as binary values.

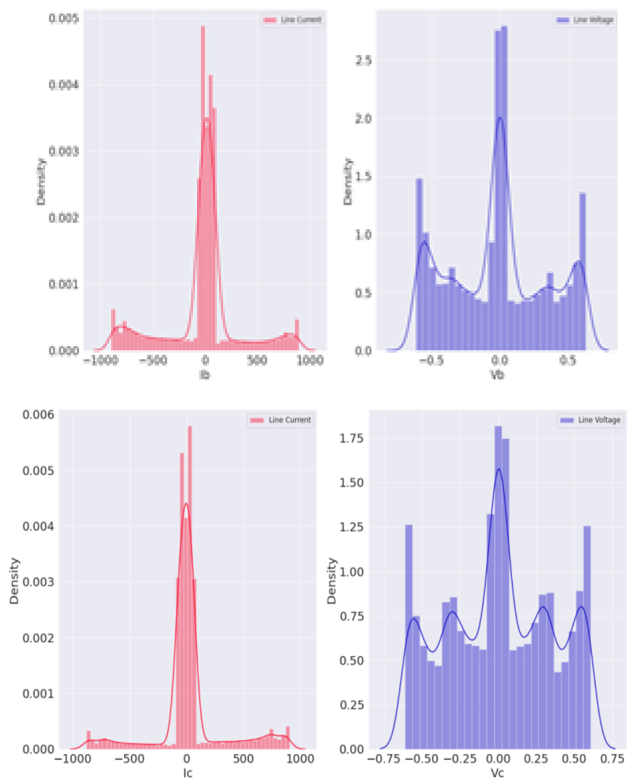

Fig 3 Voltage and Current values

The dataset containg all the three voltage and current value which is used to get the prediction by Machine learning algorithms.

B. Random Forest

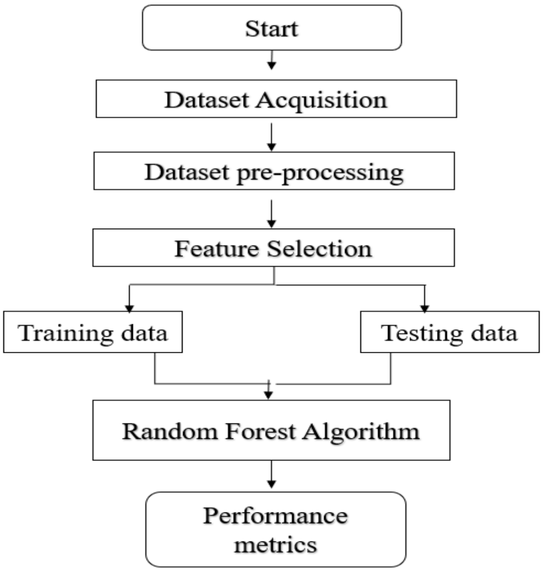

Fig 4 Random Forest process Flow Chart

The random forest algorithm is made up of a collection of decision trees, and each tree in the ensemble is comprised of a data sample drawn from a training set with replacement, called the bootstrap sample. Of that training sample, one-third of it is set aside as test data, known as the out-of-bag (oob) sample, which we'll come back to later. Another instance of randomness is then injected through feature bagging, adding more diversity to the dataset and reducing the correlation among decision trees. Figure 4 gives the flow diagram of the algorithm. Depending on the type of problem, the determination of the prediction will vary. For a regression task, the individual decision trees will be averaged, and for a classification task, a majority vote—i.e the most frequent categorical variable—will yield the predicted class. Finally, the oob sample is then used for cross-validation, finalizing that prediction. statistically to start the neural network. By using the random forest algorithm by training the and measuring the metrics to check the performance of the algorithm the matrices such as accuracy, F1 score, recall, precision, accuracy to show the working efficiency of the algorithm. In three phase power failure prediction we are training the model according to the dataset and predicting the output.

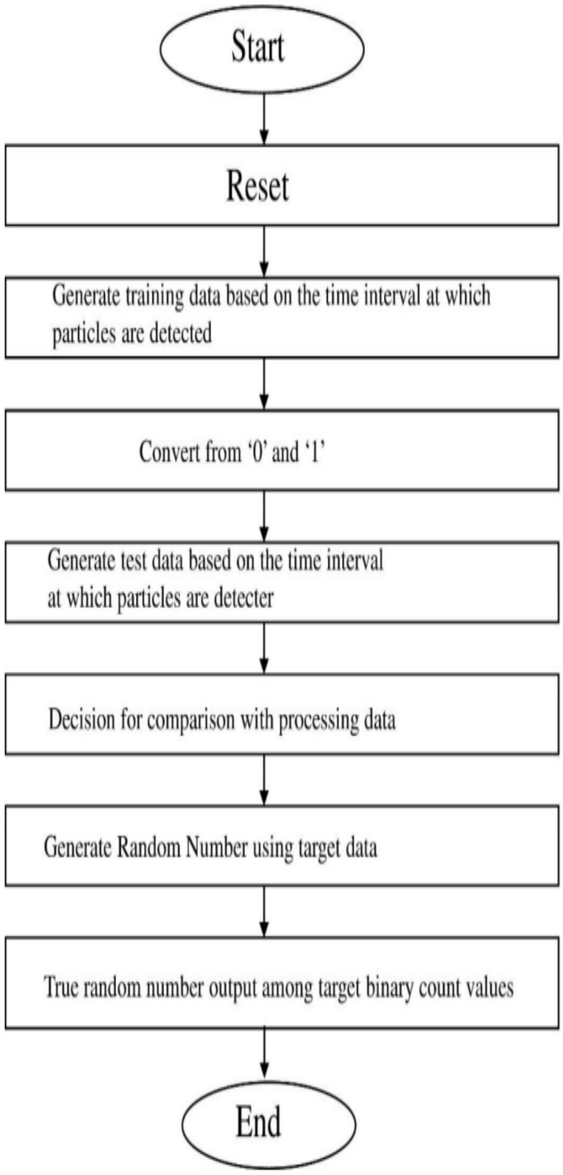

Fig 5 Process Flow of RF Algorithm

Image augmentation is done to increase the dataset and the augmented dataset was split into train and test. 80% of the images were used for training and 20% of the images were used for testing. Figure 4 Random Forest Classifiers by itself creates a binary values one among them and split the positive and negative proportions. With this trained model we are calculating the metrics such as Accuracy, Loss, Precision, Recall, F1 Score, Mean Square Error, Mean Absolute Error, Specificity and Sensitivity.

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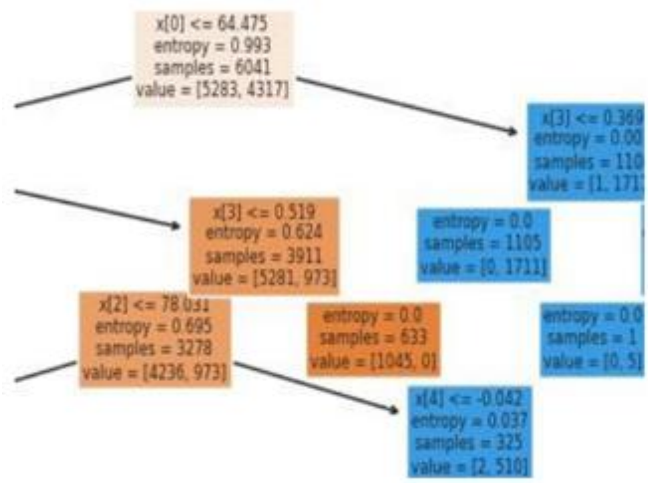

Fig 6 Process Output of RF Algorithm

It is an ensemble method, meaning that a random forest model is made up of a large number of small decision trees, called estimators, which each produce their own predictions. Figure 5 shows the relation in decision trees to compare and predict the values. The random forest model combines the predictions of the estimators to produce a more accurate prediction. The estimators that is used to print this decision tree is 10.

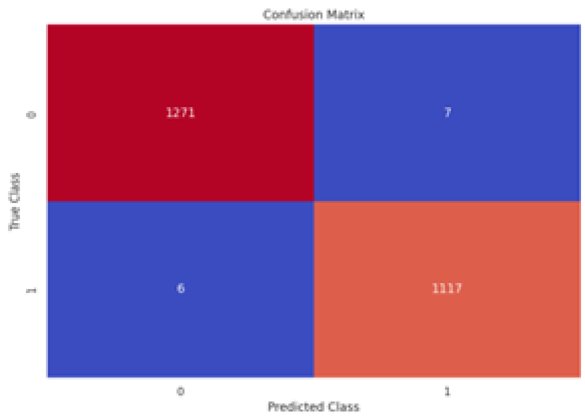

Fig 7 Confusion Matrix

- True Positive (TP): The model correctly predicted a positive instance.
- True Negative (TN): The model correctly predicted a negative instance.
- False Positive (FP): The model incorrectly predicted a positive instance when the actual label was negative (Type I error).
- False Negative (FN): The model incorrectly predicted a negative instance when the actual label was positive (Type II error)

Table 1 Metrices of RF Algorithm

Metrics	Random Forest
Accuracy	99.542%
F1 Score	99.510%
Recall	99.466%
Precision	99.554%
AUC	99.537%

Table 1 gives the performance metrics of RF algorithm,

Accuracy = (TP + TN) / (TP + TN + FP + FN)
F1 Score = 2 * (Precision * Recall) / (Precision + Recall)
Recall = TP / (TP + FN)
Precision = TP / (TP + FP)

IV. CONCLUSION

Predicting three-phase power failure using AI/ML is a promising and rapidly developing field that has the potential to greatly improve the reliability and stability of power systems. By leveraging machine learning algorithms and advanced data analytics techniques, AI/ML can effectively predict power failures before they occur, allowing operators to take preventive measures and avoid costly downtime and damage to equipment.

The proposed model of three phase power failure, and it achieves the correct identification of them with accuracies of 99.542% using RF algorithm respectively. It also identifies whether the power failure has acquired at the precise time for given current and voltage input with accuracies of 99.542% using RF algorithm respectively.

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