International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-05, Issue-12, Mar 2020

Identification of L-G Fault in Power System by Machine Learning using LabVIEW

Deepa V Bolanavar[*1],

[*1]**Department of Electrical and Electronics Engineering, New Horizon College of Engineering Bangalore, India. deepavb02@gmail.com**[1]

ABSTRACT - Electricity and Accessibility of electricity are the greatest achievements in the field of engineering in recent years, ahead of computers and airplanes. When we have bulk generation, transmission over long distance, and utilization by number of users it is necessary to follow systematic, reliable efficient and economic approaches. With the increasing complexity and growth of power networks and their economic and integrated operation, several central or regional automatic load dispatch centers with real time computer control is been established. By using the SCADA (Supervisory Control and Data Acquisition), it is possible to achieve nationwide on-line monitoring and real time control of power system. It is very much essential to protect the power system from various abnormal conditions by identifying the abnormalities in short time. The common abnormality in the power system are unsymmetrical faults which will unbalance the system. This paper presents the Machine learning model used in energy systems to indicate the presence of most widely occurring single line to Ground (L-G) fault.

Keywords: Machine Learning (ML), SCADA, Power System, Single Line to Ground Fault.

I. INTRODUCTION

In the proposed system model, the state of art Machine learning(ML) application is utilized efficiently to identify the common fault occurring in the power stem i.e Single Line to Ground fault(L-G). It is very much essential to monitor and protect the power system components from different abnormal conditions. One of the most common abnormalities is occurrence of fault due to which over current flows in the system and damage the system elements. In order to select the protective switchgears the analysis of faults and measurement of current during fault conditions is necessary.

Transmission Line (TL) FAULT:

TL must transmit power over the required distance economically and satisfy the requirements prescribed in particular cases. It is required to transmit a certain amount of power, as a given power factor, over a given distance and be within the limit of given the regulation, efficiency and losses. The lines should stand the weather conditions of the locality in which they are laid.

The lines should possess enough capacity to transmit the required power, maintain three continuous supplies without failure, and should be strong so that there are no failures due to mechanical breakdowns also.

Causes of Faults:

1) Breaking of conductor/ Failure of insulation. 2) Immediate change in load 3) Overloading 4) Mechanical defect 5) Lack of maintenance 6) Overheating of stator and rotor 7) Lightning stroke 8) Overvoltage 9) Low frequency 10) Excitation losses[2].

Minimization of Faults:

1) Improved system Design 2) Improved Quality of Components 3) Better and Adequate protective Relaying 4) Better operation and Maintenance

The common type of faults are Series and Shunt Type
Shunt Type Fault: a) Symmetrical Faults

b) Unsymmetrical Faults

Series Faults: a) One Open conductor Fault

b) Two Open Conductor Fault

In this paper, identification of unsymmetrical fault

L-G is explained by using Machine Learning. The modelling of the system is done in LabVIEW.

Symmetrical Fault: A three phase fault is a symmetrical fault. Before and after the fault the response of the system will be same.

Ex: L-L-L fault, L-L-L-G fault.

L-L-L Fault:

 DOI : 10.35291/2454-9150.2020.0179

ISSN : 2454-9150 Vol-05, Issue-12, Mar 2020

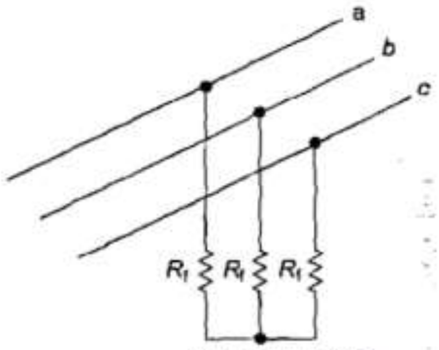


Fig. 1 LLL Fault

L-L-L-G Fault

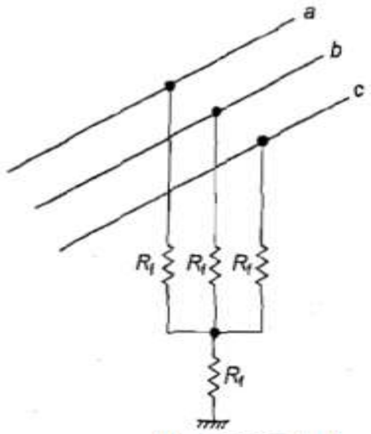


Fig. 2 LLLG Fault

Unsymmetrical Fault: Once the fault occurs in the three phase system, the magnitude and phase both will be changed[2].

Ex: 1) Single Line to Ground fault (L-G), 2) Line-Line-Ground fault (L-L-G), 3) Line-Line fault (L-L)

1) Single Line to Ground fault (L-G)

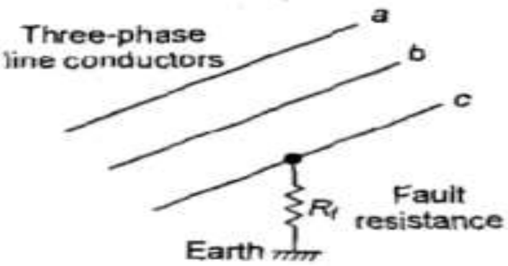


Fig. 3 LG Fault

2) Line-Line-Ground fault (L-L-G)

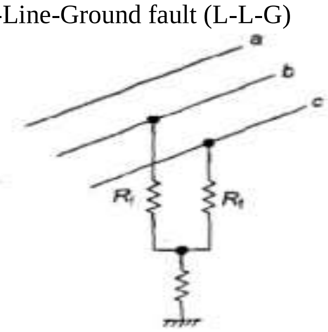


Fig. 4 LLG Fault

3) Line-Line fault (L-L)

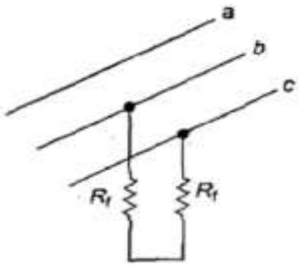


Fig. 5 LL Fault

Single Line to Ground fault (L-G)

About 70% of the fault occurring in power systems are of Single Line to Ground (L-G). **single line-to-ground fault** on a transmission **line** occurs when one conductor comes in contact with the neutral conductor. Such types of failures may occur in power system due to high-speed wind, falling off a tree, lightning, etc.

Single Line to Ground fault is more severe when fault occurs at the generator terminals.[2] (Zn=0).

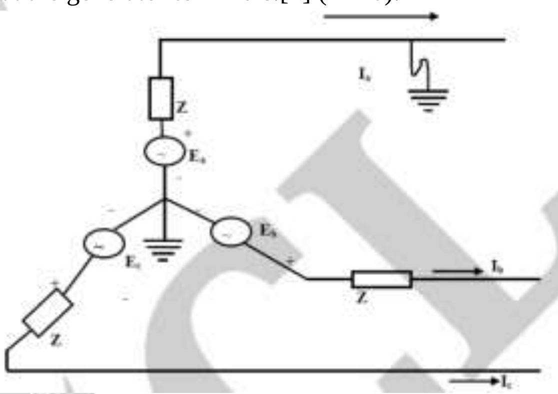


Fig 6. Representation of fault

The fault Current is given by

$$I_f = \frac{3\ Ea}{Z_1 + Z_2 + Z_0}$$

Single Line to ground Fault with Zf

$$I_{a1} = \frac{Ea}{Z_1 + Z_2 + (Z_{g0} + 3Z_n) + 3\ Z_f}$$

Machine Learning (ML)

Machine learning (ML) models have been widely used in the modeling, design and prediction in energy systems. During the past two decades, there has been a dramatic increase in the advancement and application of various types of ML models for energy systems. In order to achieve nationwide on-line monitoring and real time control of power system through SCADA, ML plays a vital role. ML is basically depending on the capturing and maintaining the Data at different time periods[1].

 DOI : 10.35291/2454-9150.2020.0179

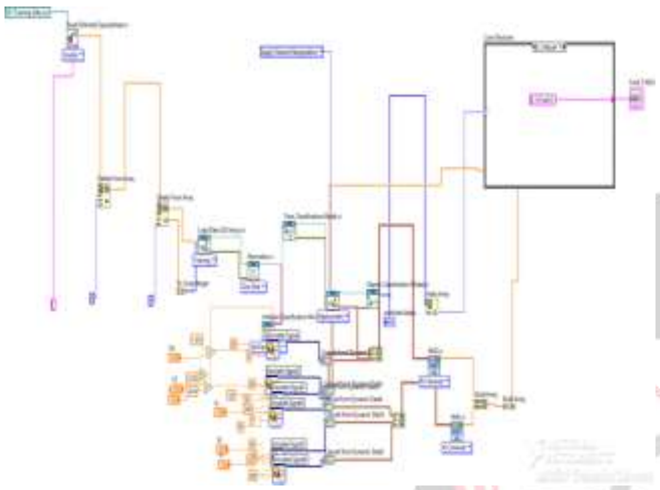
International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-05, Issue-12, Mar 2020

ML is an outstanding tool to obtain rise in the accuracy, robustness, precision and generalization. Hybridization is reported to be effective in the advancement of prediction models, particularly for renewable energy systems, e.g., solar energy, wind energy, and biofuels. Moreover, the energy demand prediction using hybrid models of ML have highly contributed to the energy efficiency and therefore energy governance and sustainability

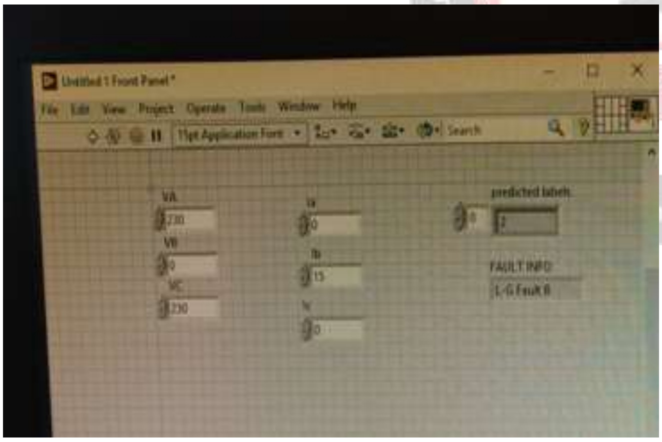
This paper shows how ML is helpful in identifying the L-G fault in a short period accurately.

II. MODEL

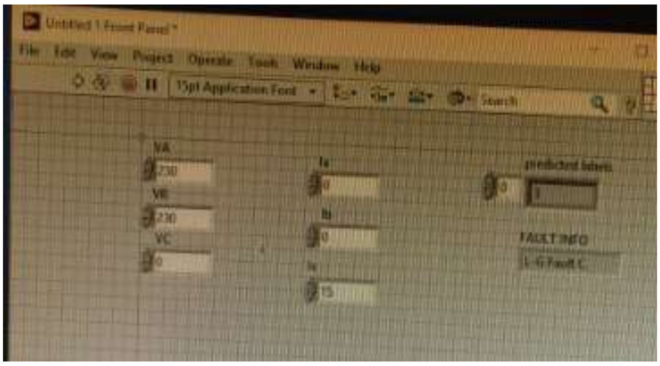
The model is developed using LabVIEW integrated with Machine Learning.



III. RESULT



The above result obtained shows that the fault has occurred in Line B therefore Voltage in Line B =0 and high current flows through Line B.



The above result obtained shows that the fault has occurred in Line B therefore Voltage in Line B =0 and high current flows through Line B.

IV. CONCLUSION

The similar model can be configured for identifying the different types of power system parameters. It is evident that with the use of Machine Learning system can be operated more efficiently and early detection of the fault is possible.

REFERENCES

[1] Amir Mosavi 1,2,3 , Mohsen Salimi 4 , Sina Faizollahzadeh Ardabili 5 , Timon Rabczuk 6 , Shahaboddin Shamshirband 7,8,* and Annamaria R. Varkonyi-Koczy 'State of the Art of Machine Learning Models in Energy Systems, a Systematic Review' Energies 2019, 12, 1301; doi:10.3390/en12071301

[2] Md Irfan Ahmed1 , Saket Saurabh2 , Hasan Kamaal3 "A Matlab Based Fault Analysis of TL" International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 5 Issue VI, June 2017.

[3] Saket Saurabh, Md Irfan Ahmed, and Pallavi Soni, "Optimal Power System Analysis Using MATLAB", International Journal of Multidisciplinary Research and Modern Education (IJMRME) , vol. 3, Issue 1, pp. 432-436, June 2017

[4] Ram Kumar, Md Irfan Ahmed, and Rizwan Ahmed, "Optimal Power System Using PSO Technique", International Journal of Multidisciplinary Research and Modern Education (IJMRME) , vol. 2, Issue 1, PP No. 159-165, 2015.

[5] Swapnil C. Naghate, Saurabh M. Dhuldhar, and Ashvini B. Nagdewate, "Transmission Line Fault Analysis By using MATLAB SIMULATION," International Journal of engineering Sciences and research Technology, pp. 330–334, Feb. 2015.

[6] Prajakta V. Dhole, and Farina S. Khan, "Transmission Line Fault Analysis using Bus Impedance Matrix Method," International Journal of Engineering Research & Technology, vol. 4, Issue 3, pp. 948-954, March 2015.

[7] Papiya Dutta, Ahad Esmaeilian, and Mladen Kezunovic, "Transmission-Line Fault Analysis Using Synchronized Sampling," IEEE TRANSACTIONS ON POWER DELIVERY, pp. 1-9.

[8] Deshmukh, M.; Deshmukh, S. Modeling of hybrid renewable energy systems. Renew. Sustain. Energy Rev. 2008, 12, 235–249

 DOI : 10.35291/2454-9150.2020.0179