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DETECTION AND CONTROL OF FAULT IN ISLANDED MICROGRID

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Abstract: Distributed Generation (DG) is a new source that is used in sales structures. The directorates-general get involved both with the help of switchgear operators and indirectly with the help of customers. Customer load centers. Excessive use of DG leads to the development of the resistor quality, the development of the voltage profile and lower losses. Due to the growing desire for the release of resistance agents in resistance structures, their problems must be investigated. The main problems facing the distributed armed forces are unplanned islands. Unplanned islands pose some risks to resistance structures and the mechanic working with the wrong equipment. The proposed technique is mainly based on the wavelet revision and a new classifier called Neural Artificial. Network (ANN) and Support Vector Machine (SVM): The proposed technology is used in an IEEE 14 bus network in MATLAB / SIMULINK software. Island detection precision of the proposed technique. In this system, it is assumed that the generator as a wind turbine is an issued resource. Finally, the ANN and SVM ratings are compared and finally the final offer for the fine classifier for island detection for the distributed generator device is prepared.

Keywords: Microgrid System, *Matlab/Simulink*

I. INTRODUCTION

In distribution system distributed generator (DG) are newly used. GDs are linked directly by the operators of the distribution devices or indirectly by the customers. GDs are typically connected near user load centers. it ends in the development of the power quality, the development of the voltage profile, lower losses. On the other hand, the reduction of fossil fuels and environmental problems force nations to use the resources of the dispensed power (DER). in the world are the power of the wind, the power of the sun, gasoline cells and microturbines. Island formation DER detection during connection to a switchgear is an important issue. Strategies, Sign Processing Strategies, and Intelligent Classifiers mainly based on Overall Strategies Local strategies are divided into sub-categories called energetic and passive. With passive locking strategies, island name is mainly fully recognized based on the evaluation and monitoring of voltages or modern waveforms from the DG connection point. When the difference between the call and the time within the distribution device is small, island detection of the distribution device with passive strategies has become difficult. The scenario in which island detection strategies cannot effectively detect island fame is described as the No Detection Zone (NDZ) of any method. Passive techniques have large NDZs, so researchers recommend energy techniques. In the case of energy technologies, a voluntary disruption of the community is implemented and the reaction of the community is evaluated, energy technologies have none. However, NDZ, the techniques are so complicated and have unintended effects on the electrical equipment's extraordinary electricity. Passive techniques, on the other hand, are so simple and do not affect the community's extraordinary electricity. It is shown that the adaptive identifier technique was used to estimate the frequency deviation of the not uncommon site coupling hyperlink (PCC) factor as a target character that can stumble in the island situation with a current imbalance energy close to 0, which is the advantage of the adaptive identification technique over various sign estimation techniques her little sampling window. Tag was measured on the network side, and the island situation was recognized mainly based on a feature extracted from the sign measured before opening the application switch. Day and then the synthetic neural community was adept at stumbling across island situations based mostly on extracted skills. A new island detection technique has been introduced, mainly based on the concept of chaos that can encounter the island situation with an energy-electricity mismatch close to zero. The technique was developed with the modified frequency of the coupling factor hyperlink at a not uncommon place (PCC) as the input signal of the pressed Helmholtz oscillator. The W-transform and the S-transform were used to extract the lean series stress over the course of an island event. The energy content material and known deviation from the shape of the transforming S were actually tested in detecting island activity, and disturbances due to load rejection ANNs were mixed with wavelet, which breaks warnings into bands with unique frequencies. ANN version to perceive the island situation. Tech can stumble in island situations with an excessive level of precision and an exquisite element of payload performance.

II. ISLANDING

Islanding is the situation in which a distribution system becomes electrically isolated from the remainder of the power system, yet continues to be energized by DG connected to it. Traditionally, a distribution system doesn't have any active power generating source in it and it doesn't get power in case of a fault in transmission line upstream but with DG, this presumption is no longer valid. Current practice is that almost all utilities require DG to be disconnected from the grid as soon as possible in case of islanding. IEEE 929-1988 standard requires the disconnection of DG once it is islanded. Islanding can be intentional or non-intentional. During maintenance service on the utility grid, the shutdown of the utility grid may cause islanding of generators. As the loss of the grid is voluntary the islanding is known. Non-intentional islanding, caused by accidental shut down of the grid is of more interest. As there are various issues with unintentional islanding. IEEE 1547-2003 standard stipulates a maximum delay of 2 seconds for detection of unintentional island and all DGs ceasing to energies the distribution system.

III. ISLANDING DETECTION METHODS

Island recognition techniques Island location strategies are for the most part partitioned into nearby and distant strategies, as demonstrated in Figure 1 Local strategies depend on estimating a few boundaries or factors on the microgrid side, including detached strategies and dynamic techniques including voltage, current, recurrence and stage for island identification. Dynamic strategies purposefully infuse an unsettling influence to check whether it is influencing voltage, recurrence, force, or impedance boundaries. Distant strategies depend on correspondence between the microgrid and the fundamental organization to screen the switches right away. Far off strategies have almost no NDZ, which no affects power quality. Distant techniques are extremely powerful in multi-inverter frameworks; however, they require enormous ventures. It's not efficient in little systems.

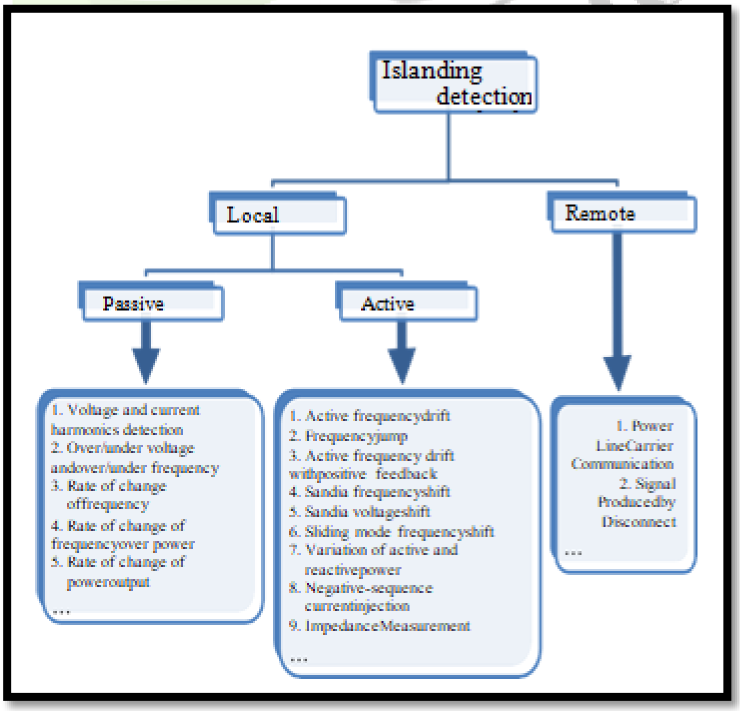

Figure 1:- Classification of Islanding detection techniques

IV. METHODOLOGY

The 3-phase current of the IEEE bus system is measured on busbar 7, the common busbar for the 14-bus system model. This measured current is sent to Wavelet's Multi-Resolution Analysis-based (MRA). Power calibration subsystem for calibrating the spectral energy of the current signal measured on busbar 7. This spectral energy is calibrated for the three-phase current for different island conditions in different distribution generation systems. The calibrated spectral energy data are used for training the artificial neural network (ANN) and the support vector machine (SVM).

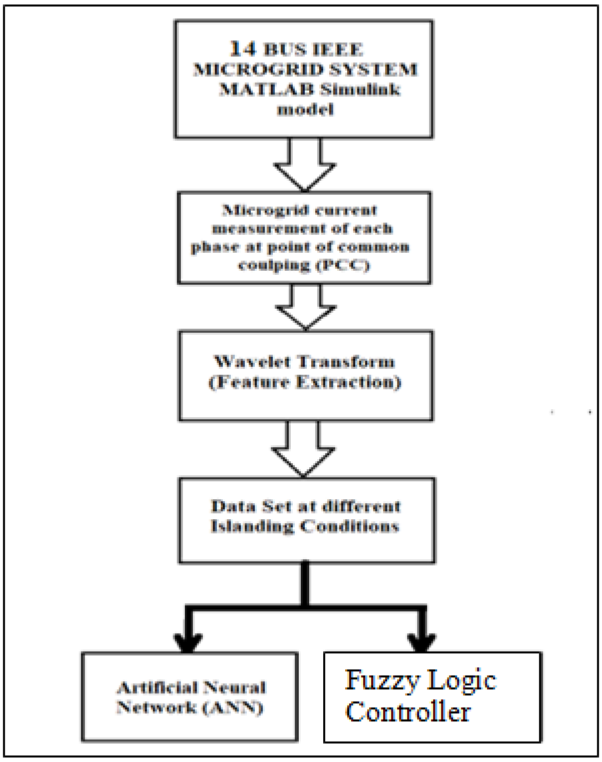

Figure 2:- Methodology

V. SIMULATION MODEL

Figure 3 shows the complete matlab simulink model of proposed approach in which IEEE 14 bus subsystem, Wavelet transform subsystem model is design for taking the reading during different islanding condition.

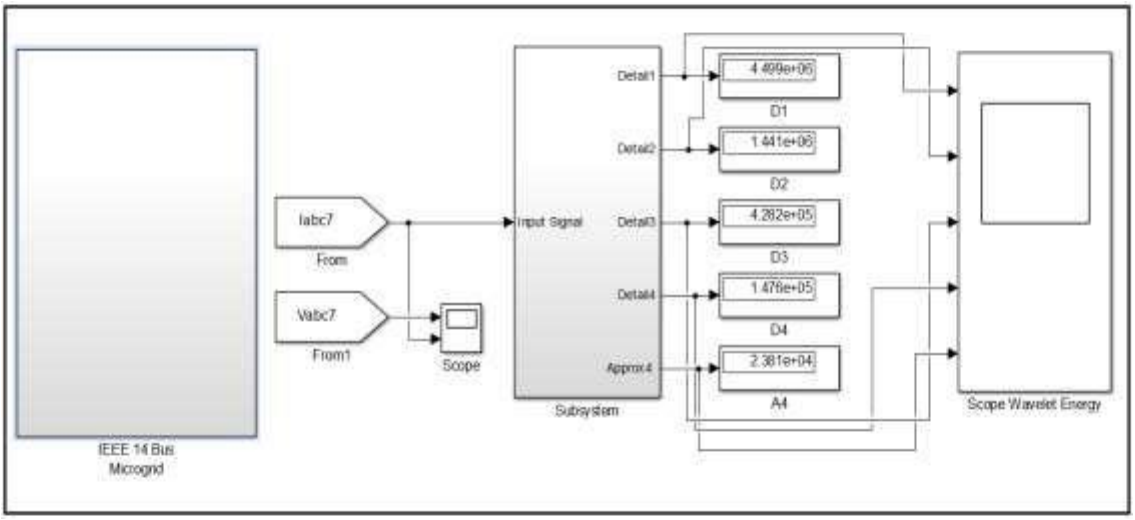

Figure 3:- MATLAB Simulink model of complete system

IEEE 14 Bus Subsystem

Figure 4 shows the complete IEEE 14 bus subsystem model. The transmission line connected in between each bus bar and transmission line resistance, inductance and capacitance. There are five generator are connected at bus bar 1, 2, 3, 6, and 8 while RL loads are connected at remaining bus for system.

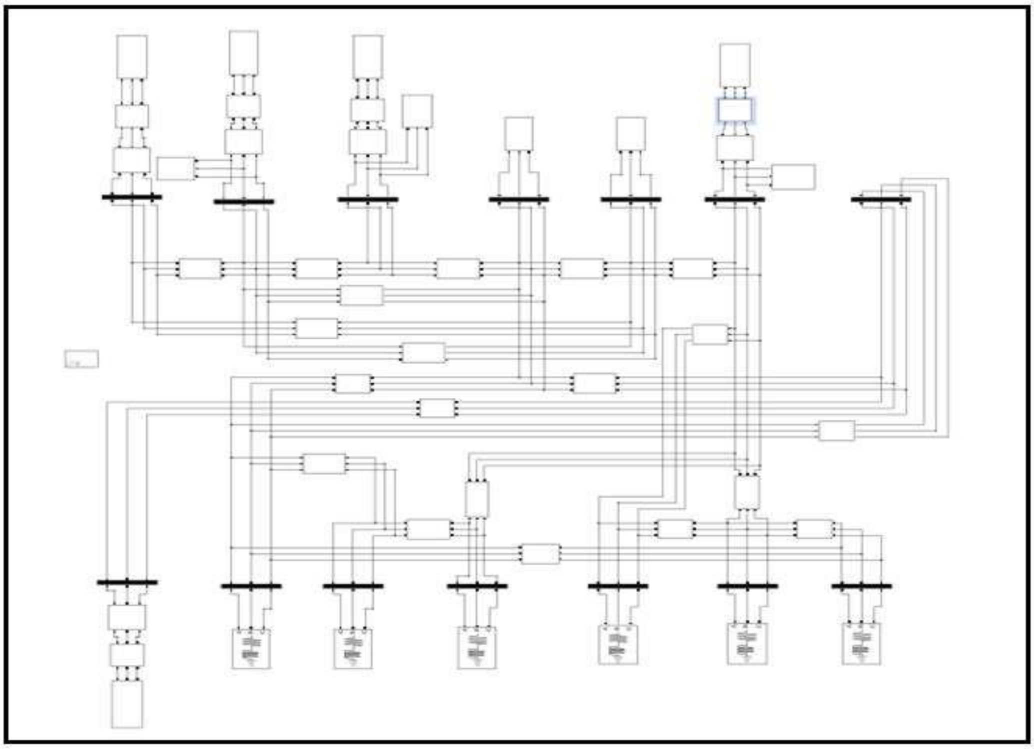

Figure 4:- IEEE 14 Bus system

Wavelet Transform Subsystem

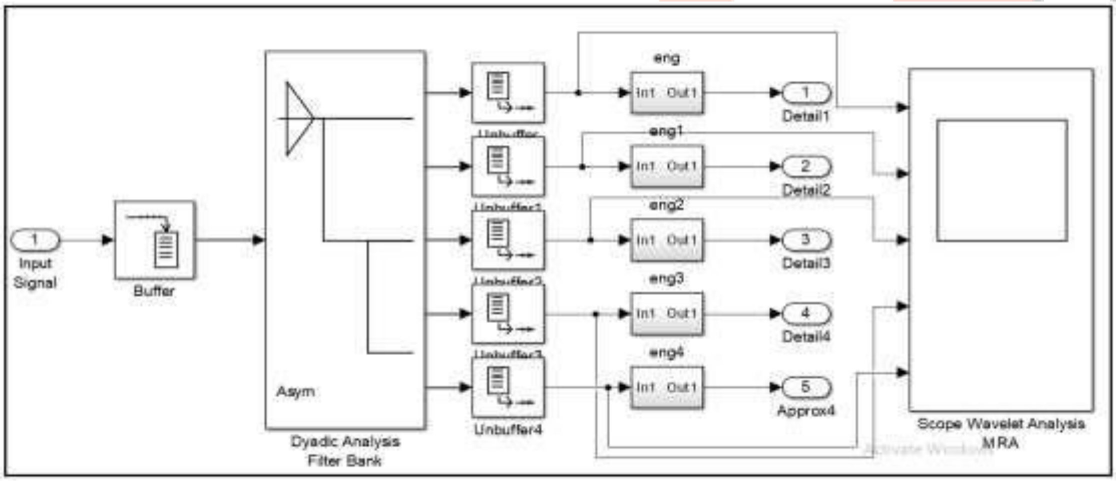

Figure 5: MATLAB simulink model of wavelet transform and spectral energy calibration subsystem model

Figure 5 shows the wavelet multi resolution analysis subsystem with spectral energy calibration subsystem shown in figure 6. The total four level use for multiresolution analysis using Daubechies 2 (Db2) mother wavelet. Input for mother wavelet is input three phase current measured at bus bar 7 of IEEE system while output is wavelet features of Detail D1 to D4 and Approximation A4 at level 4. Then after spectral energy of D1 to D4 and A4 are calibrated using spectral energy calibration subsystem connected at each signal shown in figure 6.

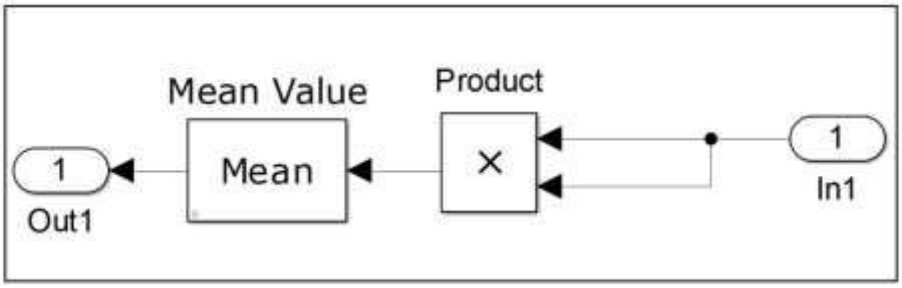

Figure 6:- Spectral Energy calibration subsystem MATLA simulink model

Artificial Neural Network Approach

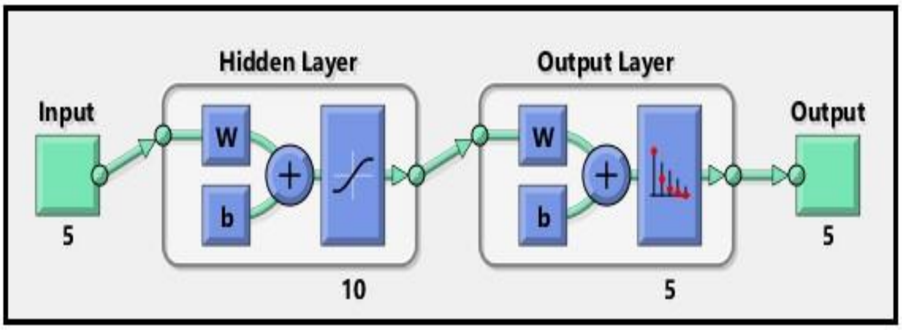

Figure 7: ANN configuration for islanding classification

Figure 7 shows the Generalized structure of Artificial Neural Network in which there are total 10 number of neurons in hidden layer while 5 neurons in output layer. Total number of inputs and outputs are 5 and 5 respectively. Inputs are calibrated spectral energy of Details D1 to D4 and Approximation A4 while outputs are five generator location for islanding detection.

VI. RESULTS AND DISCUSSION

Simulation Results

Three phase voltage and current measurement

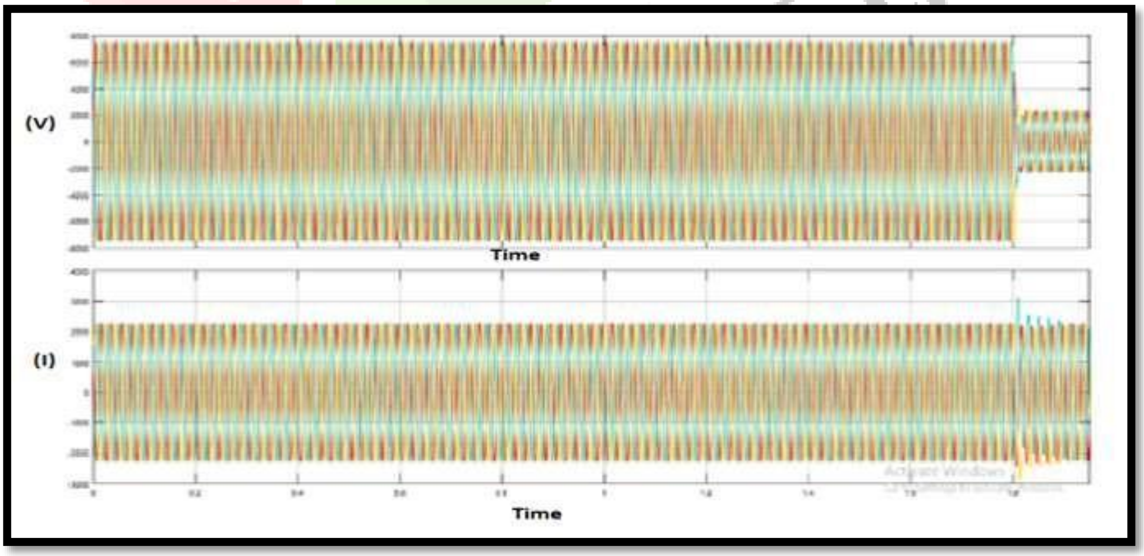

Figure 8: -Three phase voltage and current of IEEE 14 bus system when islanding occurs at generator 5 at 1.8 sec time

Figure 8 Shows three phase voltage and current measured at bus bar 7 of IEEE 14 bus microgrid system during islanding occurs at generator 5 at 1.8 sec simulation time. Upper axis shows the three phase voltage which drop from 1.8 second but not zero because of islanding occurs at generator 5 while current of system also drops from 1.8 sec simulation time. Similarly figure 13 to 15 shows the three phase voltages and current waveform when islanding event occurs at generators 1, 2, 3 respectively.

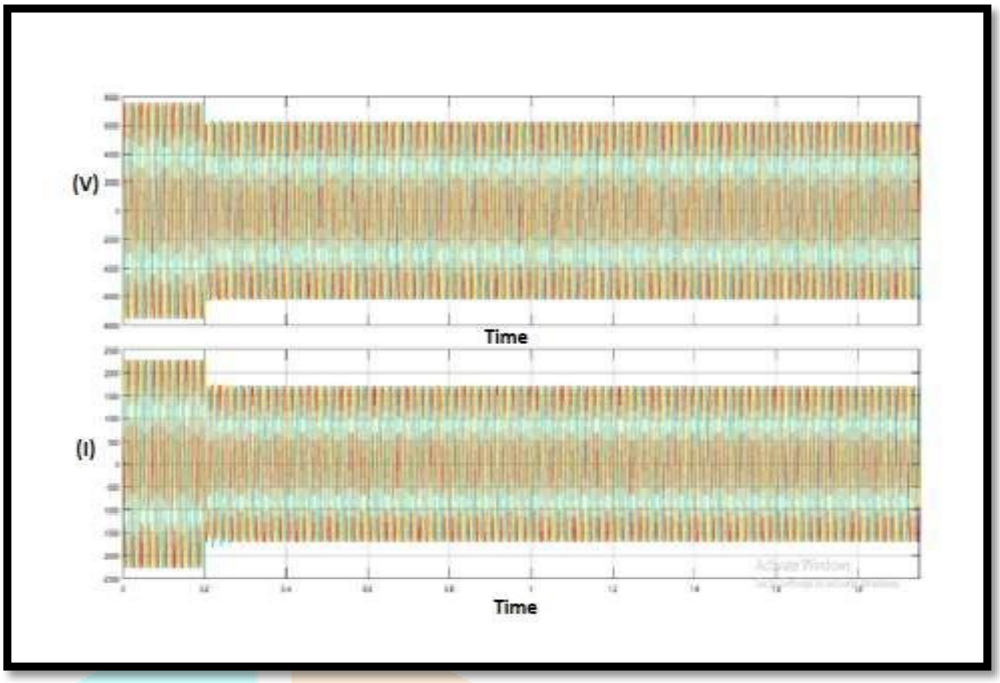

Figure 9: Three phase voltage and current of IEEE 14 bus system when islanding occurs at generator 1 at 0.2 sec time

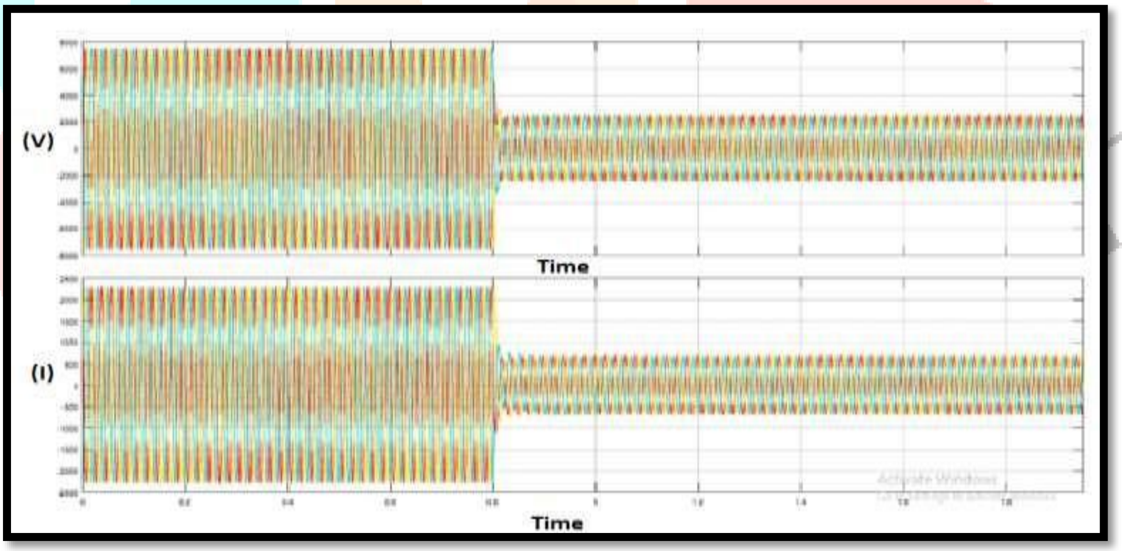

Figure 10: Three phase voltage and current of IEEE 14 bus system when islanding occurs at generator 2 at 0.8sec

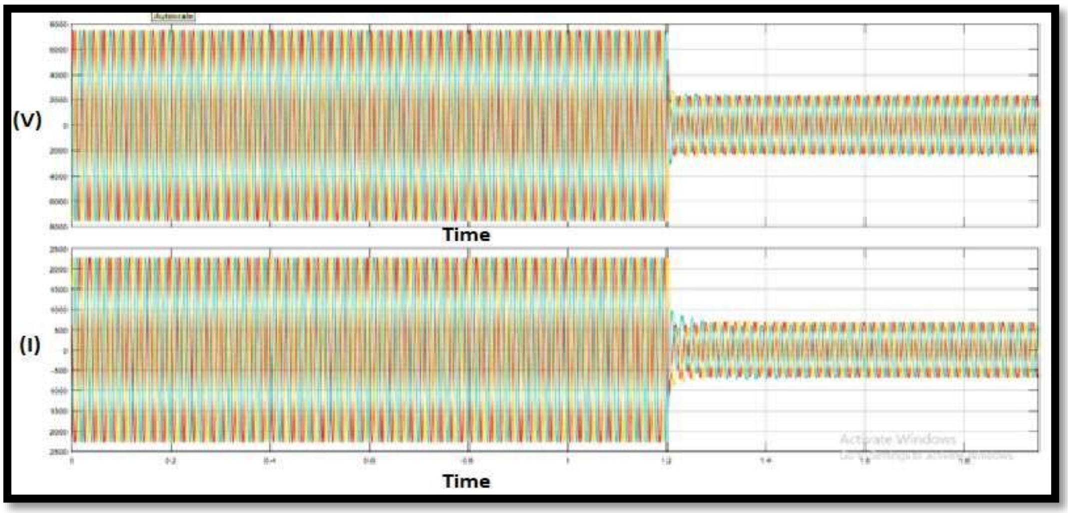

Figure 11: Three phase voltage and current of IEEE 14 bus system when islanding occurs at generator 3 at 1.2 sec time

Wavelet Spectral energy calibration

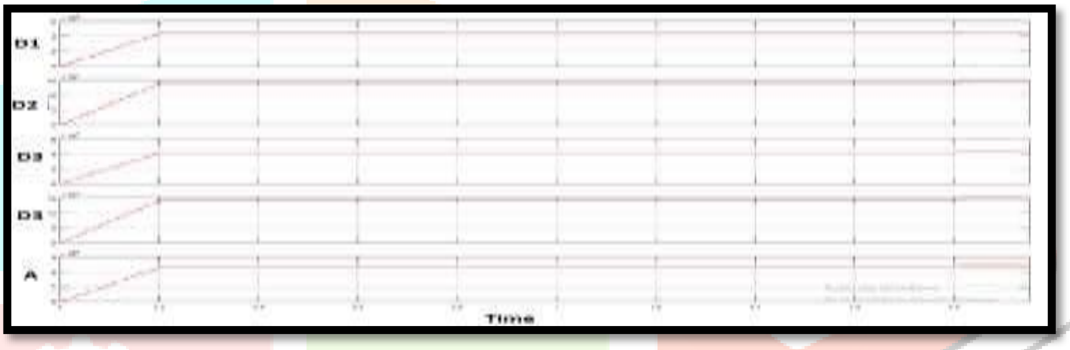

Figure 12:- Wavelet spectral energy of multi resolution analysis signals detail D1 to D4 and Approximation A4 signal of three phase current when islanding occurs at generator 5 at 1.8 sec

Figure 12 shows the wavelet spectral energy calibration of Detail D1 to D4 and Approximation A4 signal after wavelet multi-resolution analysis of three phase current of IEEE 14 bus microgrid system. This figure shows the spectral energy during islanding occurs at generator 5 at 1.8 second simulation time. Similarly, figure 13 to 15 shows the spectral energy calibration after wavelet multi-resolution analysis during islanding occurs at 1, 2 and 3 respectively.

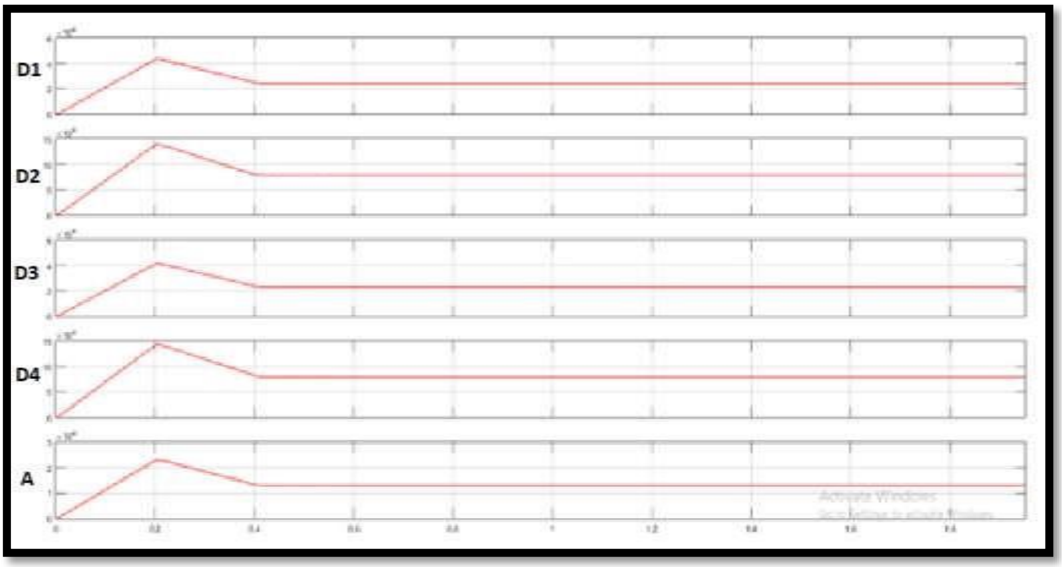

Figure 13: Wavelet spectral energy of multi resolution analysis signals detail D1 to D4 and Approximation A4

signal of three phase current when islanding occurs at generator 1 at 0.2 sec time

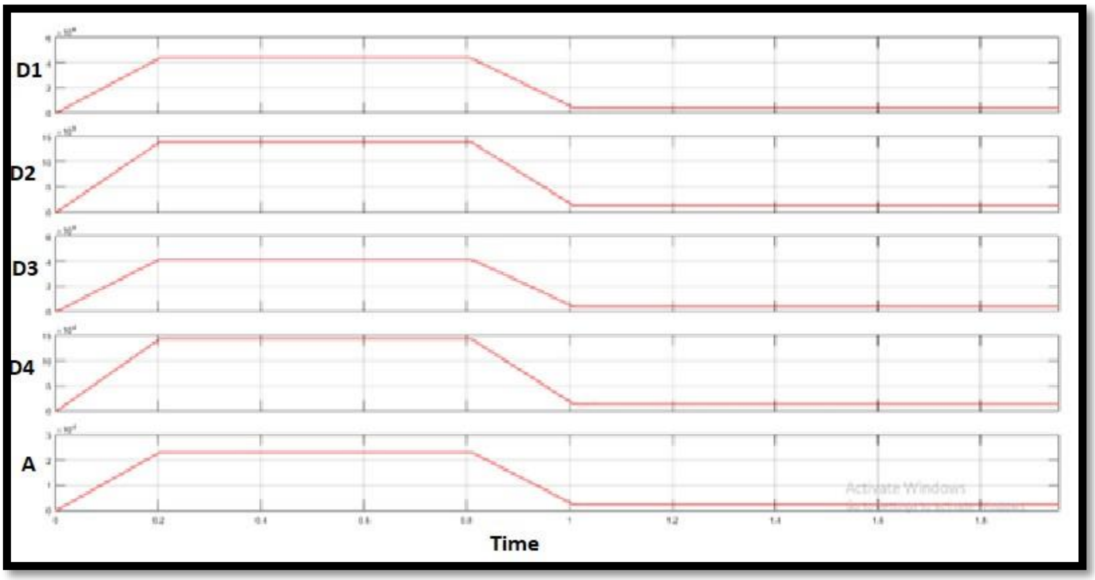

Figure 14: Wavelet spectral energy of multi resolution analysis signals detail D1 to D4 and Approximation A4 signal of three phase current when islanding occurs at generator 2 at 0.8 sec time

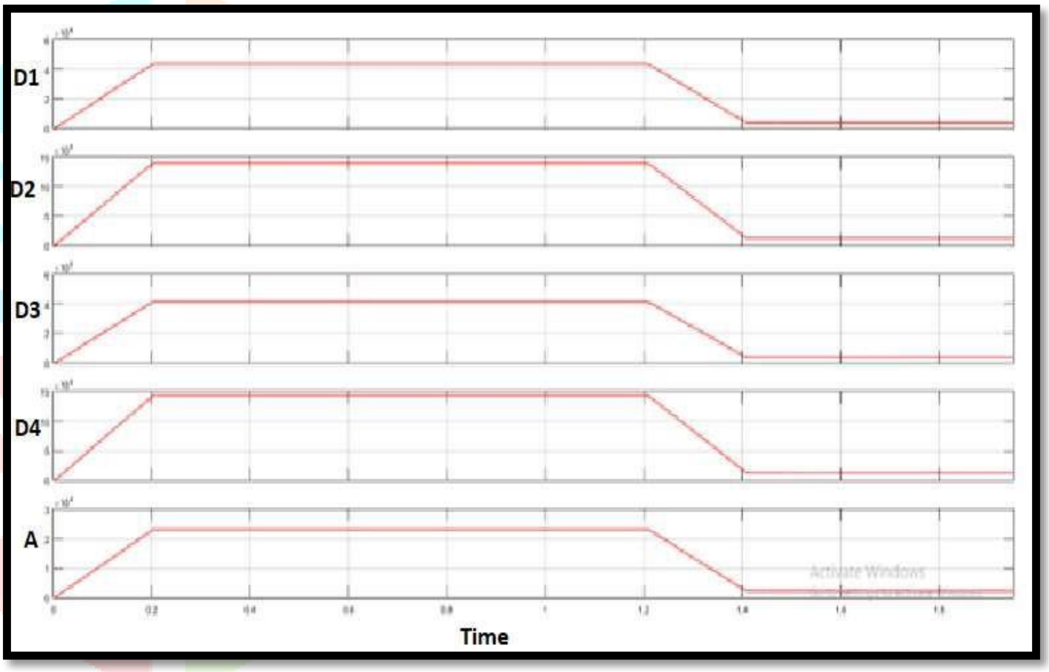

Figure 15: Wavelet spectral energy of multi resolution analysis signals detail D1 to D4 and Approximation A4 signal of three phase current when islanding occurs at generator 3 at 1.2 sec time

Artificial Neural Network (ANN) Results

Figure 16 shows the training window for back propagation algorithm based ANN in which it is clear that during training of ANN it takes 37 epochs and gradient of training is 0.0833.

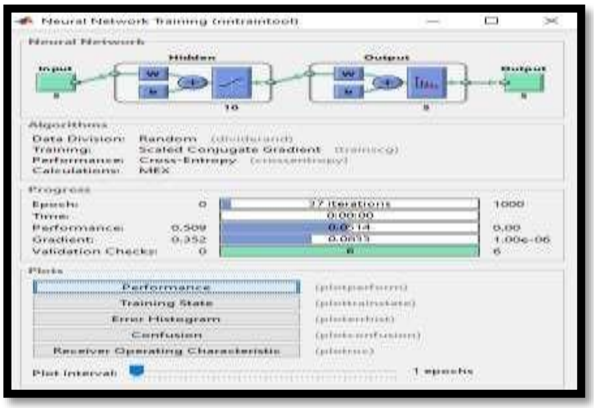

Figure 16: Training window of ANN

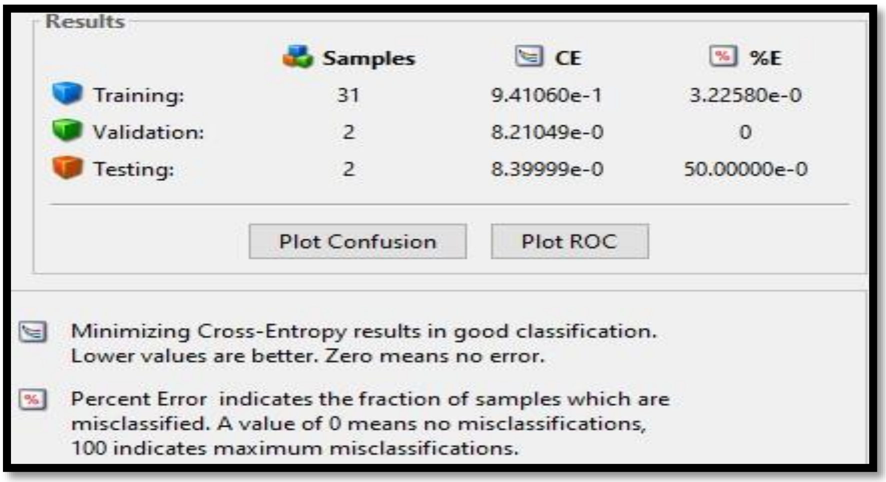

Figure 17: Training results after training of ANN

Figure 17 shows, for training of ANN, total 35 data sample was utilized out of which 31 data set i.e. 90% data utilized for training. For validation and testing 5% dataset was utilize i.e. 2 sample data set. Also MSE (Mean square error) for all data set was 0.50 % after successful training of ANN.

Figure 18 shows that 94.3 % data are perfectly classify the different islanding detection and 5.7 % data not classify properly i.e. ANN not confused for classification. It means that for remaining 5.7 % data set neural network was in confusion state for classify islanding detection i.e. not confused for training of data.

Figure 19 shows the receiver operating characteristic is a metric used to check the quality of classifiers. For each class of a classifier, roc applies threshold values across the interval [0,1] to outputs. For each threshold, two values are calculated, the True Positive Ratio (the number of outputs greater or equal to the threshold, divided by the number of one targets), and the False Positive Ratio (the number of outputs less than the threshold, divided by the number of zero targets).

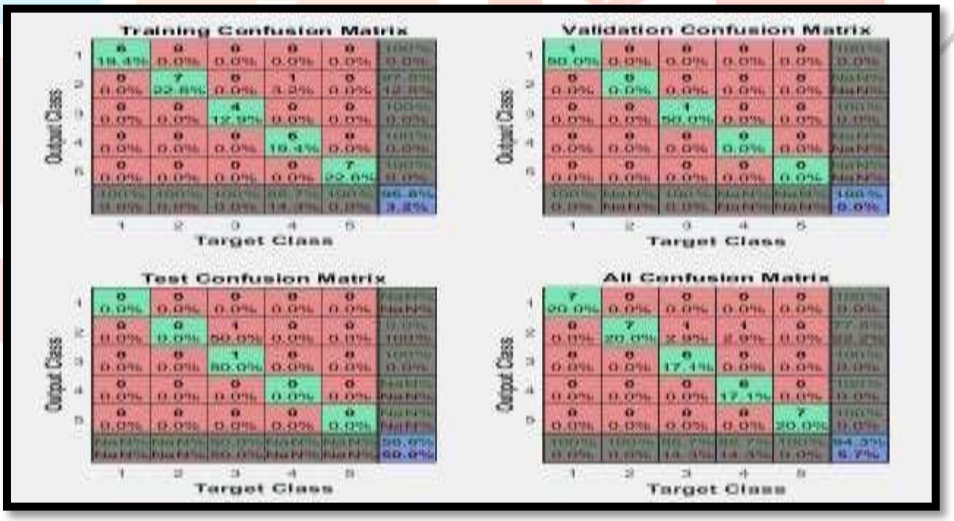

Figure 18: Confusion matrix of ANN after training

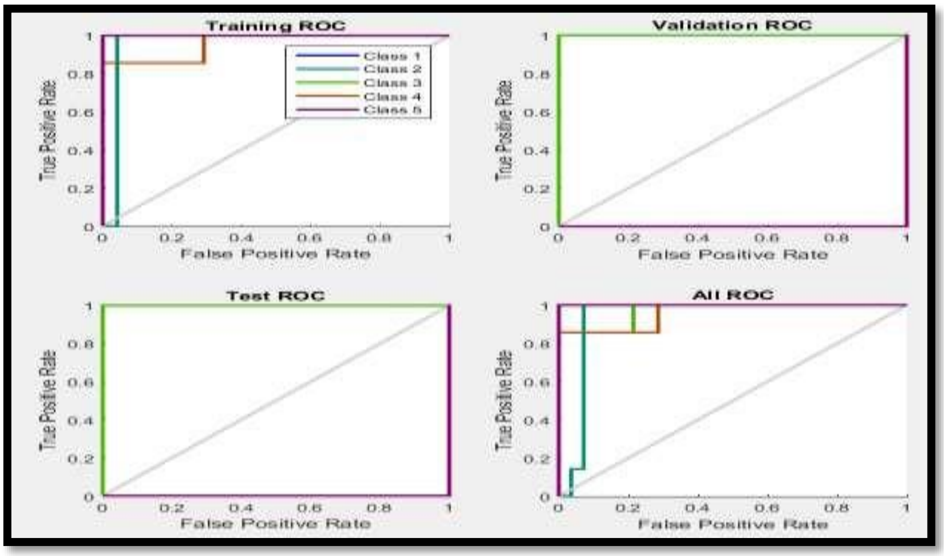

Figure 19: Receiver operating characteristics (ROC) of ANN after training

VII. Conclusions

The proposed system is based on wavelet transform and a new classifier named as Artificial Neural Network (ANN) .The proposed method is implemented on a 14 IEEE bus grid in MATLAB/SIMULINK softwareThe results show the high accuracy of islanding detection of the proposed method. In this method, five generators as wind turbine is assumed as a distributed resource. This method implemented for classify or detection of islanding of generator in IEEE 14 bus system. In this methodology, we were classifying the islanding generator number using ANN. It is observed that ANN classify the event of islanding upto 94.3% . Hence it is clear that ANN provide best classification results for detection of islanding generator number event.

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