ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 8, Issue 3, March 2019

Perceive and Systematization of Transmissions Lines Fault Based on Convolutional Sparse Auto Encoder

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ABSTRACT: The efficiency of power systems is largely determined by the effectiveness of the inbuilt power equipment. Monitoring transmission parameters for faults and quick isolation of the system from faults helps to improve the system. The efficiency of power systems is largely determined by the effectiveness of the inbuilt power equipment. Monitoring transmission parameters for faults and quick isolation of the system from faults helps to improve the efficiency of the power systems reliability. fault detection and identification of SIGNLE PHASE overhead transmission lines is proposed. Fault detection techniques based on mean square value of the difference between incoming and outgoing single phase currents of each section. Many electricity transmission companies across the world and Ghana in particular are continuously looking for ways to utilize modern technologies, in order to improve reliability of power supply to consumers. Transmission lines are used to transmit electric power to distant large load centres. These lines are exposed to faults as a result of lightning, short circuits, faulty equipment's, miss-operation, human errors, overload, and aging. .To avoid this situation, and we need the exact location of fault occurrence. This problem is handled by a set of resistors representing cable length in KMs and fault creation is made by a set of switches at every known KM to cross check the accuracy of the same.

This project is locating fault in a power distribution line is a complicated and severe problem in power system.This is designed with microcontroller,GSM mobile,Driver circuit,conrol circuitd interfaced with GSM modem.It is useful for remote monitoring and control of multiple stand-alone distribution transformer plants.In normal conditions,the system records and periodically reports the overall performances,whereas,in case of incorrect behaviours,it immediately informs the operators.

The work described is a development of microcontroller –based protection of electric distribution system for the purpose of effective monitoring and sending information of distribution system.However,for a more general,flexible and cost effective implementation, the remote . Losses in distribution system are much higher than losses in transmission side and also fault are more frequent in distribution side. The survey indicates that 80% of the consumer's service interruptions are due to failures in distribution networks. Detecting and locating fault in power line is very necessary for healthy operation of power system.communications are based on the powerfull GSM networking is designed when the voltage through the line falls below a programmed voltage,and immediate indication is provided by the microcontroller through the GSM modem.The interfaced GSM modem will receive the signal and to send data from distribution side to the substation and to the line patrol staffs as a message.

KEYWORDS: Microcontroller, Remote monitoring, G**SM modem.**

I. INTRODUCTION

Electrical equipment is prone to disturbances which are fault imposed on the system such as overloading and short circuit [1]. This in turn causes damage to the power equipment in the power system and also at the consumer's end. The impact can bring about a short or long-term loss of the electric power in an area. Prompt attention to power

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ISSN (Online): 2278 – 8875

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Vol. 8, Issue 3, March 2019

transmission faults is very vital in power systems, avoiding harm and instability to the system. To overcome these challenges, a power transmission monitoring and fault detection system using GSM technology is proposed. Many electric power transmission companies such as Ghana Grid Company limited (GRIDco) in Ghana, have primarily relied on circuit indicators to detect faulty sections of their transmission lines. However there are still challenges in detecting the exact location of these faults. Although fault indicator technology has provided a reliable means to locate permanent faults, the technical crew and patrol teams still has to physically patrol and inspect the devices for longer hours to detect faulty sections of their transmission lines. . It is well known that when a fault occurs in overhead transmission lines systems, the abrupt changes in voltage and current at the point of the fault generate high frequency electromagnetic impulses called traveling waves which propagate along the transmission line in both directions away from the fault point. Breach in pre-set short circuit limit is monitored by comparing the current sensed with the pre-set limit. .If the current sensed is more than the pre-set current short circuit limit, the PIC
Micro-controller sends a signal for the relay to trip off the system, else the system remains connected. Whenever the set short circuit limit is breached, the system sends a fault detection SMS alert to the utility mobile phone a bi-directional communication was also achieved as the system can also receive command from the utility phone to set a short circuit limit [4]. With this system, an almost real time monitoring system is actualized However the power sector, right from generation to distribution of power is subjected to severe power losses [5]. it is quite paramount to ensure equipment such as transformers, circuit breakers, relays, panels etc. When power transmissions are been disturbed by fault, unless it is critical they tend to be overlooked. These faults, no matter how minor can lead to damage of the power system equipment and be a threat to human life. To overcome these, a GSM based monitoring and fault detection system is proposed to help monitor power transmission parameters. By incorporating fault detection also, the system can be isolated from the slightest fault occurrence promptly. Thus cost of maintenance is adequately contained to an extent. Power transformer which is regarded as the core of any electrical transmission and distribution system are used for stepping up voltage at the output of the generator [6].

The consumption of elericity is increasing at much faster rate. . Losses in distribution system are much higher than losses in transmission side and also fault are more frequent in distribution side. The survey indicates that 80% of the consumer's service interruptions are due to failures in distribution networks. Detecting and locating fault in power line is very necessary for healthy operation of power system. . In distribution line multiple faults detection and indication to Electricity Board (EB) deals with the problem of detecting the fault in the transmission lines and the automatic. Intimation to EB. This project deals with the design and fabrication of power supply, microcontroller and Global System for Mobile Communication(GSM) modem. This proposes greatly reduces the manpower, saves time and operates efficiently without human interference.

By using this project, we can detect the multiple faults of three phase transmission lines one can monitor the Temperature, Voltage, Current by means of GSM modem by sending message.

II. FAULT DETECTION IN POWER SYSTEM

Detecting and locating fault in power line is very necessary for healthy operation of power system. In electrical power line fault often occur many times making the power system unreliable. In this the using wireless sensor for detecting fault which includes phase to phase, short circuit and mainly line to ground fault in power line for better reliable and optimum operation of the system is presented. In the proposed concept power line is divided by WNS (wireless sensor network) nodes that could sense the faulty condition in power line, display to operator as well as send SMS through GSM modem to service engineer. This concept successfully analyze the asymmetrical faults which occurs in power line. In Wireless Sensor Network (WNS) current sensor ACS712 interfaced with Arduino mini pro converts the analog measured current value into digital form and then transmits the data to the main primary node through nRF24l01 transceiver. Parameters calculated in Arduino ATmega328.
UNO transmits data to control panel or substation so that immediate action can be done with the help of GSM technology.

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2.1TYPES OF FAULTS

The design of systems to detect and interrupt power system faults is the main objective of power- system protection. The faults can be divided into Seven types. They are shown below., a. Transient fault b. Symmetric fault c. Asymmetric fault

(a).Transient fault

A transient fault is a fault that is no longer present if power is disconnected for a short time and then restored; or an insulation fault which only temporarily affects a device's dielectric properties which are restored after a short time. Many faults in overhead power lines are transient in nature. When a fault occurs, equipment used for power system protection operate to isolate the area of the fault.

(b).Symmetric Fault

A symmetric or balanced fault affects each of the three phases equally. In transmission line faults,roughly 5% are symmetric. This is in contrast to an asymmetrical fault, where the three phases are not affected equally.

(c). Asymmetric Fault

An asymmetric or unbalanced fault does not affect each of the three phases equally. Common types of asymmetric faults, and their causes:

1. Line-to-Line :- A short circuit between lines, caused by ionization of air, or when lines come into physical contact, for example due to a broken insulator.

2. Line-to-Ground :- A short circuit between one line and ground, very often caused by physical contact, for example due to lightning or other storm damage.

3. Double Line-to-Ground :- Two lines come into contact with the ground (and each other), also commonly due to storm damage.

III. BACKGROUND STUDY

Globally, there are three phases in electric power supply system. These encompass the generation phase, the transmission phase and the distribution phase. Each of these phases involves certain distinct production processes, work activities and hazards.

3.1 The Generation Phase

The generating phase begins at the base station where stored energy of gas, oil, coal, nuclear fuel, or falling water is converted to electrical energy. In Ghana the generating power voltage from these stations, controlled by Volta River Authority (VRA) is usually from 13.2 kV to 24 kV [1]. This is further stepped up by transformers to higher voltages prior to transmission by GRIDco systems.

2.Transmission phase After generation, transformers at the generation substation then boost up the voltage to high voltages that ranges between 69KV to 330 kV [2] before it is transmitted over great distances across the country by GRIDco using transmission lines (cables). These transmission lines are constructed between transmission substations that are located at the generating stations and distribution substations The Transmission lines are mainly supported overhead on towers. At the receiving end of the transmission lines substations, these voltages are stepped down to between 34.5 to 138 kV. This power is then transferred to the distribution substation controlled by ECG and NEDco both in the southern and northern part of the country respectively. Review of transmission power.

The transmission system plays significant roles in the supplying of power to the consumers uninterruptedly. Monitoring of these systems is very essential if supplying of healthy power to the consumers is to be achieved. Incorporated in the transmission system is the protective system which helps in detecting the abnormal or fault signals. The protective relays in the protective system then isolate the faulted part from the entire system, ensuring minimal equipment damage and disturbance. Fault analysis is an essential concern in power system engineering in order to isolate faults quickly and ensure power supply is restored at the shortest possible time [7]. Power demand has resulted in higher line current loads, still bearing in mind that operators are limited by the system and line capacity [8]. Overloading the system will lead to overheating of the system insulation which ultimately result into the system failure [9]. Programmable Logic Controller (PLC). aids the improvement in power quality, ensuring a continuous and reliable supply of power to loads.

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3.1 Short circuit fault

Basically, faults can exist in four forms: they include line-to- line fault, double line-to-ground fault, single line-to-ground fault and three phase fault. Different magnitude of fault current can result from each of these types of faults. Short circuits damage can be prevented by employing the use of circuit breakers, relays, or other protection as they help to disconnect the power in response to high current [10].

3.2 GSM technology

GSM stands for Global System for Mobile communications. Developed in 1990, it has become the most popular standard for mobile phones in the world. The implementation environment determines the coverage area of each cell. The boundaries of cells can overlap between adjacent cells (large cells can be converted into smaller cells) [11]. The technology uses a blend of frequency division multiplexing (FDM) and time division multiplexing (TDM). Different users at different time slot use different frequency, hence when user is ON, uses channel 900MHz for three seconds, then hop to channel 910MHz for the next three seconds and so on. Frequency Hoping is the term giving to such process. Amongst the various frequency of the GSM, 900MHz is the operational frequency. It has the ability to re-use frequencies in order to increase capacity and at the same time coverage [12-13].

3.3 Short message service (SMS)

Short Message Service is a common economically affordable service used for receiving and sending messages in text. It uses the GSM network to transfer information. This method of transmitting data is quite popular due to convenience and low cost factor. A single text message can consist up to 160 characters. SMS mobile originated is a term used when a message is sent by a mobile, however when a message is received by a mobile it is termed SMS mobile terminated. Remote data communication and monitoring is supported by SMS due to it bi-directional data transfer and it stable performance. Amit sachen et al have discussed the user can read remote electrical parameters by sending a command in form of SMS messages [14]. Based on the setting, real time electrical parameter can be automatically sent in form of SMS periodically. Rectification of faults during occurrence of any abnormality in power lines and using SMS through GSM network to inform personnel of this action is also made available. Andriy Palamar et al proposed the system, a Cellular phone which as a Subscriber's Identifying Module (SIM) card with a specific number through which communication is made [15].

The medium of communication is wireless that works on the Global System for Mobile communication technology (GSM). Using cooperative relaying strategies [16-20] these gains are also possible for single-antenna nodes. The scholars considered the necessaryparameters to monitor in this research, with the overall objective of improving the reliability of the power system as a whole. With a cloud-based remote management solution, user can have immediate access to generator parameters via a regular web browser. Temperature sensors is used to sense the temperature of the room and a message is sent to the master mobile whenever the temperature rises beyond the threshold parameter using the GSM modem [21-22].

5.1 Microcontroller A microcontroller (MCU) is a small computer on a single integrated circuit (IC) containing a processor core, memory, and programmable input/output peripherals. Program memory is also often included on the chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, and power tools [12].

5.2 The PIC16F877 Microcontroller Programmable Intelligent Computer (PIC) is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640 originally developed by General Instrument's Microelectronics Division. The PIC16F877 falls in the mid-range of the PIC family of microcontrollers and finds use in a wide range of applications in diverse fields due to the fact that it is readily available. It also has a large number of pins (40 pins) with a maximum of three functions per pin which makes it much easier to use as compared to others with limited pins and a high number of functions per pin. It also has an optimal cost-to-performance ratio. The above mentioned desirable characteristic of the PIC16F877 microcontroller coupled with the fact that it has

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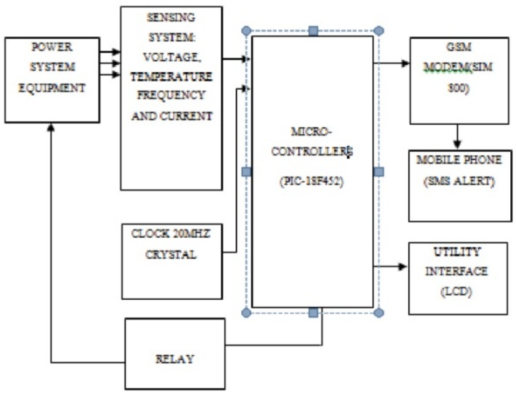
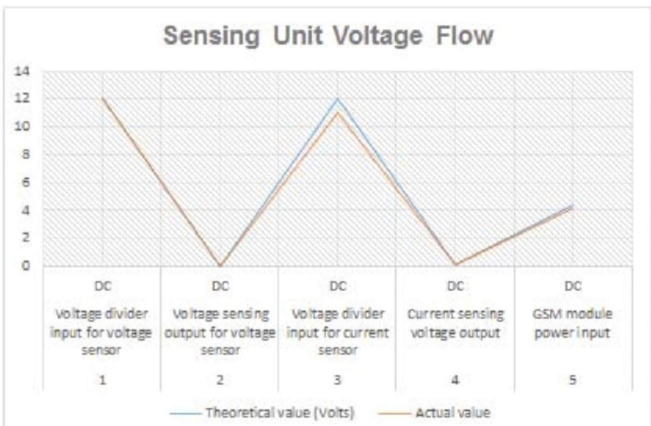
Vol. 8, Issue 3, March 2019

an in-built Analog to Digital Converter and sufficient program memory to store the control algorithm, have largely affected its choice for the design of the automatic fault detection and location system discussed in this work. 5.2.1 PIC16F877 Microcontroller Architecture The key features of the PIC16F877 microcontroller are summarily presented with the block diagram in Fig. 8 below.





III. THE COMMUNICATION SYSTEM

The GSM modem is a wireless modem that works with a GSM wireless network. Unlike the dial-up modem, the GSM modem sends and receives data through waves. It requires a SIM card from a wireless network carrier to function. Whenever the set threshold is bridged, the system sends an instant message to the utility mobile phone, stating the existing fault and the location using the GSM modem.

3.1 Operation of the GSM

GSM Modems are controlled by the microcontroller using the AT commands. However the GSM modem supports a fixed and extended set of AT commands. Defined in the GSM standards are these extended set of AT commands which enables the following functions; - Send SMS messages. - Reading, writing and searching phone contacts. - Monitor signal strength. - Read, write and delete SMS messages

3.2 The switching device relay

The relay acts as an electrical disconnection to isolate the entire system on the occurrence of fault. It shut down or de- energizes other electrical equipment in the system, which will then allow work to be carried out further down the line. As an electrical device for automatic control, it is actuated by variation in the conditions of the electrical circuit.

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Vol. 8, Issue 3, March 2019

3.3.1 Operation of the relay

The rated coil voltage of the relay used is 5V DC. This voltage is required for the relay to perform the function of opening or closing it switch. This 5V DC is fed to the relay coil terminals. The magnetic field within the coil collapse whenever there is a sudden interruption in the flow of current through the relay coil as a result of the switch opening. The coil will respond by producing a sudden, large voltage across its leads, causing a large surge of current through it.

TABLE 1: showing discrete voltage readings of the power unit.

S/N	Measurement	Voltage type (AC or DC)	Theoretical value (Volts)	Actual value (Volts)
1	From the Mains	AC	220	214
2	After Stepping down	AC	12	11.2
3	After rectification	DC	12	11.8
4	After regulation	DC	5	5.08

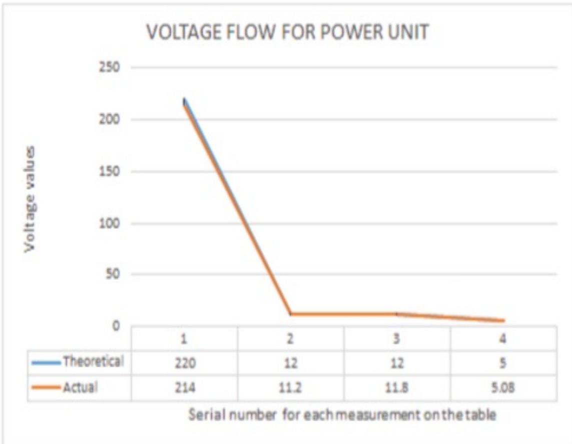

Figure 5: Graphical representation of Table 2

IV. RESULTS AND OBSERVATIONS

The short circuit limit configuration was tested. A current limit of 50A was configured using a mobile phone. The current value set was sent to the SIM in the GSM module with the "#" symbol before the digits i.e. #50, as this is what the microcontroller recognizes (imputed in the code).

This was executed by powering up the system and connecting a load with current rating exceeding the pre-set limit of 700W. For the purpose of testing, an electric iron device was used, as it had a befitting current rating of 1000W. The system tripped off after the short circuit fault was imposed on the system. Hence confirming the test for fault detection and switching system (relay) functionalities.

4.1 Unit testing

The values of the output voltage of each power unit were observed and noted. These values were compared with theoretical values as shown in Table 1. Figure 5 is the graphical representation of Table 1. Table 2 shows the values of the voltage from the sensing units and Figure 6 is its graphical representation

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ISSN (Online): 2278 – 8875

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Website: www.ijareeie.com

Vol. 8, Issue 3, March 2019

A fault detection system enabled by the use of the GSM wireless network for communication was achieved. The fundamental objectives of this research work were achieved as the system designed was able to detect transmission fault. The occurrences of faults were displayed and the message was sent through the GSM network over to the utility mobile phone. A bi-directional communication was established as the system was able to receive command from the utility phone to set a short circuit limit.

S/N	Measurement	Voltage type (AC or DC)	Theoretical value (Volts)	Actual value (Volts)
1	Voltage divider input for voltage sensor	DC	12	12.02
2	Voltage sensing output for voltage sensor	DC	0.0099	0.010
3	Voltage divider input for current sensor	DC	12	11.08
4	Current sensing voltage output	DC	0.0909	0.092
5	GSM module power input	DC	4.4	4.2

WORKING OF GSM MODEM A GSM

s modem is a wireless modem that works with GSM wireless networks. A wireless modem is similar to a dial-up modem. The main difference is that a wireless modem transmits data through a wireless network whereas a dial-up modem transmits data through a copper telephone line. Most mobile phones can be used as a wireless modem. To send SMS messages, first place a valid SIM card into a GSM modem, which is then connected to microcontroller by RS 232 cable. After connecting a GSM modem to a microcontroller, you can control the GSM modem by sending instructions to it.

A. System Studied and Data Acquisition

A simple three-phase power system is studied in this paper as shown in Fig. 1. The length of the 220 kV transmission line is 200 km and the system frequency is 50 Hz. The transmission line connects two sources and has positive sequence impedance Z1 = 4.76 + j59.75 Ω and zero sequence impedance Z0 = 77.70 + j204.26 Ω. The system is modeled in MATLAB/Simulink, with which the data used in this paper is simulated. The three phase voltage and current signals are collected by the relay employed at source 1 at the sampling frequency of 20 kHz. By varying the tunable system parameters, a dataset of voltage and current signals is generated. The system parameters used for simulation are listed in Table I. Concretely, the fault distance is the distance between fault point and the relay, and the pre-fault power angle is the phase difference between source 1 and source 2 when the fault occurs. As we try all combination of the parameters, a total of 24948 data samples are collected in the dataset. Moreover, as the sampling frequency is 20 kHz, we are able to test the effect of sampling frequencies that are less than or equal to 20 kHz.

B. Unsupervised Feature Learning by Sparse Autoencoder

In this paper, we use the SAE introduced in [32] to achieve unsupervised feature learning. Concretely, a SAE has a visible layer, a hidden layer and a reconstruction layer, and the training process ensures that the output vector corresponding to the reconstruction layer restores the input vector as much as possible for each unlabeled data sample x ∈ Rn in the training

dataset. Thus, when the training process is properly completed, the hidden nodes within the hidden layer are expected to give effective feature representations of the data in the training dataset. Given an input vector x, the output vector h(x) of an SAE is calculated as where the first term measures the total squared error between the input and output data and the second term is the weight decay term used to limit the magnitude of the weights so that the autoencoder is not prone to over fitting. The third term is the sparsity penalty term, in which β controls the weight of this termwe can make sure that for a given input vector x, the activation level of the majority of the hidden nodes is close to zero, while a

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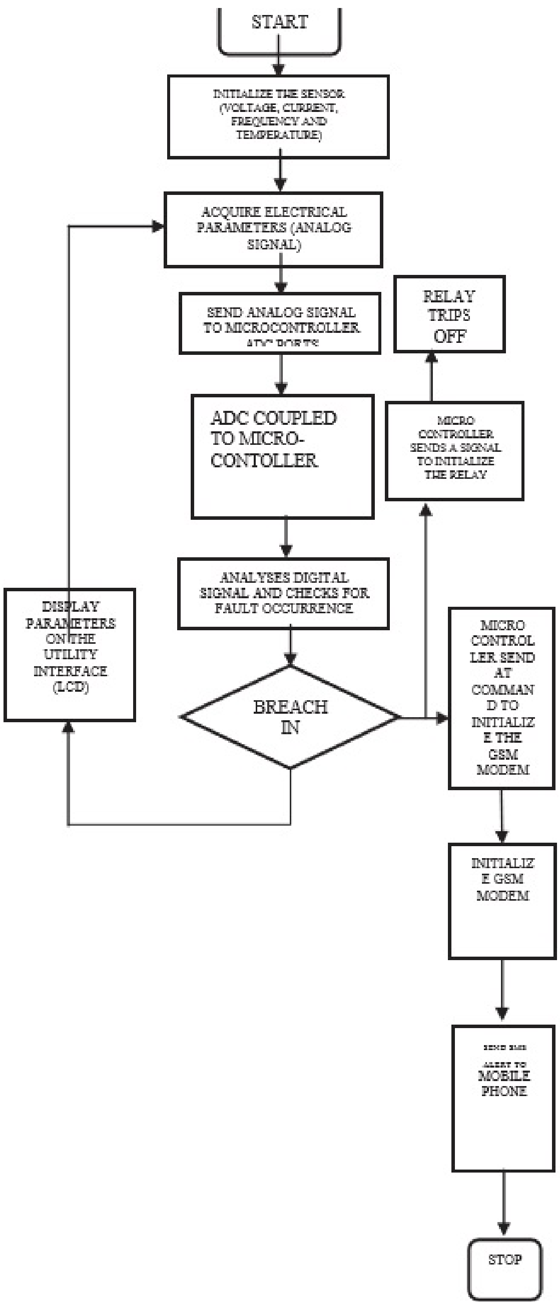
Vol. 8, Issue 3, March 2019

small proportion of the hidden nodes are highly activated. This indicates that we can easily find some highly relevant feature representations of the input vector x by looking at the activations of the hidden nodes in the hidden layer. To train the SAE, we optimize the cost function J by iteratively updating the weight and bias values using back-propagation algorithm.



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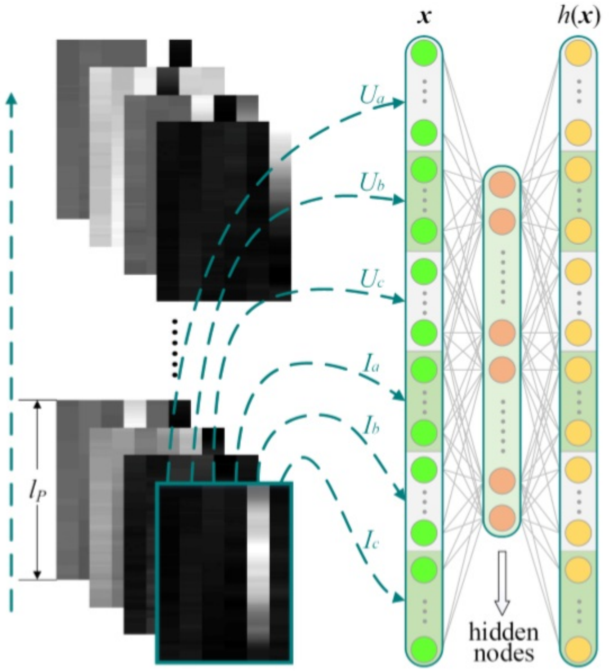

Fig. 2. Schematic diagram of learning multi-channel features of voltage and current signals by SAE.

The schematic diagram of the unsupervised feature learning procedure is illustrated in Fig. 2. In this paper, the voltage and current signals are displayed using grayscale images, such that the correlations across the channels can be clearly observed. First of all, we randomly cut out a large number of patches from the training dataset. A zero component analysi(ZCA) whitening transform is then applied to the patches, the theoretical foundations of which can be found in [35], [36]. Concretely, for a given d × m matrix X containing m d-dimensional data samples, we use U = (XXT)−1/2 = PD−1/2P T (XXT can always be represented as PDP T using some orthogonal matrix P and diagonal matrix D) to transform X to XZ:

XZ = UX (4)

We then replace X with XZ, so that the dimensions are uncorrelated with one another and the dimensions all have the same variance [36]. After applying ZCA to the patches cut out from the training dataset, the pixels within the patches become uncorrelated and have the same variance, namely 1. For each channel, the brightest pixel reaches the positive maximum (crest), whereas the darkest pixel reaches the nega- tive maximum (trough). As we use all six channels of voltage and current signals simultaneously to extract the features, the size of each patch is 6 × lP , lP being the length of the patches. Thus, both x and h(x) in Fig. 2 are 6lP × 1 vectors. Specifically, at the sampling frequency of 20 kHz, if lP is set to 30, then a patch covers a time span of 1.5 ms. After obtaining the patches from the signals, an SAE is trained in accordance with the above-mentioned method, and the hidden nodes can, therefore, learn the features which, when combined, represent the intrinsic local characteristics of the multi-channel signals within the dataset. As introduced in [32], the element corresponding to the jth hidden node of the

. The Framework for Fault Detection and Classification

In this paper, we propose and implement a framework based on CSAE to complete both the fault detection and classification tasks. A fault diagnosis system is built on the basis of this framework. Concretely, the system output is expected to be “non-faulty” when no fault occurs. A fault is detected when the output of the system changes to a specific fault type.

The framework for fault detection and classification based on CSAE is demonstrated in Fig. 4. Given a multi-channel signal, a 6×lW window moves along the signal and an output is given for each windowed signal segment.

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Concretely, when the moving window arrives at the ith column of the multi- channel signal, pixels within the windowed signal segment form a 6 × lW matrix, whose first column and last column are denoted as pi−lW +1 and pi, respectively. Correspondingly, the system output (the classified fault type) of this matrix is denoted as t(i). After the output t(i) is given, the window moves one column forward, so that pi−lW +1 is excluded from the matrix and pi+1 is included as the last column. In the case of online monitoring, such a procedure is uninterruptedly repeated.

For each windowed multi-channel signal segment (6 × lW matrix), we first use the features extracted by the SAE to map the 6×lW matrix into convolved feature vectors. Each feature Fr (r = 1,2,...,k) is a 6 × lP matrix, and all the features move forward one column a time through the window while calculating dot products with all the patches they encounter. We restrain the features within the two ends of the window as they move along, so the size of each convolved feature vector is, therefore, 1×(lW −lP +1). Also note that the features have been ZCA whitened previously so that the same whitening process is also applied to the patches prior to calculating the dot products. Thus, with k features available, we can get k convolved feature vectors in this feature mapping process, namely m1 to mk. Despite the fact that we need to obtain k convolved feature vectors with the size 1 × (lW − lP + 1) for each window, which involves many calculations when com- pleted alone, the computational burden can be greatly reduced when we compute feature mapping for multiple successive windows. Simply put, for the current window, all but the last elements of the convolved feature vectors can be directly obtained from the previous window.

Thus, we only need to calculate the last element of the convolved feature vectors, which takes only k convolutional operations. This significant reduction in computational burden undoubtedly facilitates the online implementation of the proposed method. After feature mapping, the convolved feature vectors then go through the pooling stage to generate shortened feature repre- sentations. With the help of this pooling operation, the model is less prone to overfitting and becomes more translation- invariant [37]. In this paper, we implement the simple mean pooling by calculating the mean values of the 1 × sp disjoint segments within the convolved feature vectors, sp being the number of adjacent elements to be pooled together. It should be noted that it is acceptable if the length of the convolved feature vectors is not divisible by sp, in which case the last few elements of the vectors are abandoned. After pooling all the k convolved feature vectors, we get k pooled convolved feature vectors, namely d1 to dk. The length of the pooled convolved feature vectors, np, is determined by rounding down (lW − lP + 1)/sp, that is,

WORKING OF GSM MODEM A GSM

modem is a wireless modem that works with GSM wireless networks. A wireless modem is similar to a dial-up modem. The main difference is that a wireless modem transmits data through a wireless network whereas a dial-up modem transmits data through a copper telephone line. Most mobile phones can be used as a wireless modem. To send SMS messages, first place a valid SIM card into a GSM modem, which is then connected to microcontroller by RS 232 cable. After connecting a GSM modem to a microcontroller, you can control the GSM modem by sending instructions to it.

WORKING

working of distribution line fault detector and intimate using GSM is based on the microcontroller. In this the distribution line consist of 220v, 50 Hz supply, as that we can't use the 220 v supply directly to the working kit. So instead of that we are using the step down transformer for step down the input voltage into 12 v ac supply which makes as the supply voltage to the kit. The 12 v step down voltage from the transformer is given to rectifier which converts the ac supply into dc supply for the purpose of only the dc source or supply is used as the source for the microcontroller. After converting as dc supply, the boost circuit which we are using is used to boost up the voltage if necessary (or) regulates the same voltage level. To run a microcontroller it is in need of driver circuit and control unit.

Driver circuit

Driver circuit provides pulse to the microcontroller by using TLP250 IC. In this we are using seven switch and they get supply from center tapped transformer. The tlp250 IC which get input current gets 5mA, but the output supply current is increased into 11mA and the output voltage is 10-35V. So, we are using in this micro controller.

Control Unit

Control unit which is used in microcontroller to control device when it attains the maximum or minimum level of voltage from the rated voltage. This rated voltage is programmed in the microcontroller. This program gives the instruction to the GSM modem.In this we are using PIC16F877A as microcontroller. The integrated circuits(IC)

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

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contained both processor and peripherals (Timers, ADC,USART,EEPROM,I2C,SSP,PSP) are inbuilt is called PIC microcontroller.in this pic controller the pin RA0,RA1 and RA2 are the pins which are used for the load input which the load variation is set down through this pin only. If the load is varied by using of these three pins it will be triggered the micro controller to run.

Methods The method adopted for the study is applied on single line diagram shown in Fig. 1. 20 numbers of different faults have been created on test-bed for tuning the fuzzy mem- bership function and fuzzy rules. The Data are acquired through CRIO and post fault data generated for different types of fault are used to evaluate the performance of the proposed fuzzy logic based fault classification system. The power system is developed taking into consideration the acquired data as shown in Fig. 1 in Lab view software. The fuzzy logic based fault classification is first experimented i.e. on offline environment for finding the optimal system. This optimal fuzzy logic based classification system is then applied on the system for any fault on real time. It is observed during the analysis of the data that depending on the type of fault i.e. line to ground faults, line to line faults, line to line to ground faults or three phases fault, the waveform changes accordingly. It is significant to mention that during fault the voltage tends to reduce to zero and current tends to rise. Different types of faults are characterized in terms of δ1, δ2, δ3 and δ4, which calcula- tions are shown below (Susilo et al. 2013). Post fault current samples are solved as below

$$\delta_1 = \frac{\mathrm{I_a} - \mathrm{I_b}}{\max(I_a, I_b, I_c)}$$

$$\delta_2 = \frac{\mathrm{I_b} - \mathrm{I_c}}{\max(I_a, I_b, I_c)}$$

$$\delta_3 = \frac{\mathrm{I_c} - \mathrm{I_a}}{\max(I_a, I_b, I_c)}$$

$$\delta_4 = \frac{\mathrm{I_0}}{\mathrm{I_1}}$$

- If δ_1 is high and δ_2 is medium and δ_3 is low and δ_4 is high it is an $L_a - G$ fault;
- If δ_1 is low and δ_2 is high and δ_3 is medium and δ_4 is high it is an $L_b - G$ fault;
- If δ_1 is medium and δ_2 is low and δ_3 is high and δ_4 is high it is an $L_c - G$ fault;
- If δ_1 is medium and δ_2 is high and δ_3 is low and δ_4 is low it is an $L_a - L_b$ fault;
- If δ_1 is low and δ_2 is medium and δ_3 is high and δ_4 is low it is an $L_a - L_c$ fault;
- If δ_1 is high and δ_2 is low and δ_3 is medium and δ_4 is low it is an $L_b - L_c$ fault;
- If δ_1 is medium and δ_2 is high and δ_3 is low and δ_4 is high it is an $L_a - L_b - G$ fault;
- If δ_1 is low and δ_2 is medium and δ_3 is high and δ_4 is high it is an $L_a - L_c - G$ fault;
- If δ_1 is high and δ_2 is low and δ_3 is medium and δ_4 is high it is an $L_b - L_c - G$ fault;
- If δ_1 is medium and δ_2 is medium and δ_3 is medium and δ_4 is low it is an $L_a - L_b - L_c$ fault;

Describe the triangular membership function as triplets with respect to the points A, B and C. It is observed that points A and C have membership value of 0.0 while point B has membership value of 1.0. Extensive study has been carried out to select proper triples values of triangular membership function of δ1, δ2, δ3 and δ4.

Laboratory Virtual Instrument Engineering Workbench (LabVIEW) is a powerful and flexible instrumentation and analysis software application tool which was developed in 1986 by the National Instruments. LabVIEW is

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Vol. 8, Issue 3, March 2019

extremely flexible and commonly used for data acquisition, instrument control, data processing and industrial automation. The CRIO device can interface between computers and Test-bed set up. Figure 4 shows sche- matic of real time monitoring and controlling.

Hardware implementation

We have used National Instruments Controller with 667 MHz Dual-Core ARM Cortex- A9 processor running in the NI Linux Real-Time, also integrated Chassis has Artix-7FPGA. LabVIEW 14 Version has been used for programming and implementation of logics. For the compilation process LabVIEW uses Xilinx Vivado 2013.4 as Compilation Tool. Table 4 shows the compilation result.

. The proposed logic detects and classifies the fault accurately. The results show that the proposed logic is efficient and appropriate.To attain our concept need to use pic16f877a controller, voltage sensor, current sensor, speed sensor, buzzer, temperature sensor, LCD. The project is assembled with a set of resistors representing cable length in KMs and fault creation is made by a set of switches at every known KM to cross check the accuracy of the same. The voltage drop across the feeder resistor is given to an ADC which develops a precise digital data which the programmed microcontroller would display the same in Kilo meters. The fault occurring at what distance and which phase is displayed on a 16X2 LCD interfaced with the microcontroller. If the temperature higher than the threshold value at that time buzzer and LCD will give intimation. Calculated values are sends t o the internet with help of IOT.RTC is used here to time and date reference, that when the event occurs.

CAUSE:	AFCI SYMPTOM						SOLUTION:
	Trips right away	Trips within 5 sec.	Trips in 1 min. to 1 month	Trips when any small load runs on the circuit	Trips when some- thing runs on another circuit	Never trips, even when "TEST" is pushed	
1 Overload	--	--	yes	--	--	--	Reduce wattage in use on circuit
2 Short circuit	yes	yes	--	--	--	--	Short
3 Overheating AFCI	--	--	yes	--	--	--	Replace AFCI and put in diff. location in panel
4 Ground- fault	yes	yes	--	yes	--	--	Ground fault
(4) Neutral shared with another circuit	yes	--	--	yes	yes	--	Call experienced electrician
5 Arc- fault	--	--	yes	--	--	--	See C below
AFCI device miswired	yes	--	--	yes	--	yes	AFCI's own white goes to neutral bar, circuit white to "load neut"
Bad AFCI	rare	--	--	--	--	yes	Replace

V. CONCLUSION

Here we have examined the hypothesis that the visual system possesses mechanisms that attempt to compensate for neural delays while in ecologically typical forward motion. In the first half of the paper we derived a 7 by 4 matrix of predicted illusion classes (Table 1), amounting to the prediction of a broad pattern of illusion across four perceptual modalities, and due to seven kinds of stimulus features. In the second half of the paper we presented evidence via a survey of the visual perception literature that this pattern of illusions appears to exist (Table 2). Because our optic-flow-regularities hypothesis was originally developed with only the classical geometrical illusions in mind (Changizi, 2001, 2003; Changizi & Widders, 2002)—which amount to just one of the 28 illusion classes—the success of the general prediction amounts to a predictive success story for the optic-flow-regularities hypothesis, and for perceiving-the-present more generally.

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Vol. 8, Issue 3, March 2019

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