Smart Transformer Monitoring

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Abstract - The distribution system is one of the most important components of the electrical system. The transformer is a kind of continuous working equipment whose purpose is to improve the efficiency of the transmission system. In this manner, a method for continuous online monitoring of distribution transformers using the Internet of Things (IOT) is proposed. Transformers are subject to various faults, such as excessive voltage, excess, and high temperature, oil levels and humidity. All of these shortcomings are constantly monitored by the controller, and the controller periodically transmits the health information of the transformer to the Wi-Fi module through the controller. This data can be accessed from anywhere. Therefore, the application of this method can successfully achieve the maintenance of distribution transformers.

The operation of the distribution transformer under the rated conditions ensures long service life. However, if they are overloaded, their service life will be greatly reduced, resulting in sudden failures and disruptions to a large number of customers, which could affect the viability of the system. Transformer overload, oil and torque temperature rise are the main causes of supply transformer failure. Physically monitor the distribution transformer by visiting the People's Transformer site and analyzing the parameters. A simulation circuit is designed in Proteus software and programmed in MPLAB software

I. INTRODUCTION

Electrical line protection is proposed based on the comparison of the size or phase of a fault location or power quality using an electro-mechanical device or solid state device. These methods include measuring voltage and current, voltage from current to current, differential current, low voltage balance, fault current switching and faulty equipment. In current power systems, high speed fault detection is always needed to improve transient stability. The rotational kinetic energy introduced into the power system during an error is proportional to the square of the fault erasure time. Therefore, compared to any other type of dynamic control (which can only be used after a computer acceleration), speeding up the faults close to more power sources greatly reduces system acceleration. From the point of view of improving transient stability, it is very urgent to find this need quickly and eliminate mistakes. High-speed fault removal based on travel wave voltage and current transient technology. Unfortunately, these methods do not adapt to system operating conditions, and most existing electrical system security technologies cannot handle the parameter information in voltage / current signals after a fault.

II. EXISTING METHODS

1 Benaissa, O. M., Hadjeri, S., & Zidi, S. A. “Impact of PSS and SVC on the power system transient stability”. 8th International Conference on Modelling, Identification and Control (ICMIC).2016.

Power System Stabilizer (PSS) is a control device that ensures maximum power transmission, thereby improving stability in the power system. BSS is widely used to reduce electro-mechanical oscillations occurring in electrical systems, which are due to interference. If there is not enough moisture available, the oscillations increase, which can lead to instability. The static reactive power compensation (SVC) is also used to improve the stability of the system because of its role in reducing the reactive power in the power transmission lines. This article discusses the power transmission lines of two generators in two districts and the BSS of a power system (SVC). Use the design and equipment of the control system and study the effects of wet oscillator stability on electrical systems after the fault in the transmission line of the research model, such as the type used (BSS-Universal and Multiband) and Automatic Voltage Regulator (AVR).

2 Xu, K. “Fault Diagnosis Method of Power System Based on Neural Network”. International Conference on Virtual Reality and Intelligent Systems (ICVRIS).2018.

Power systems facilitate transmission and distribution failures, passing electromagnetic interference and crosstalk interference between transmission coupling layers during power transmission and distribution. In order to improve the performance of fault detection, a multi-sensor fusion measurement system proposes an electrical system based on a neural network algorithm for fault detection. The supply signal is sent to the power transmission connection layer to extract from the power system, and the transmission supply signal distortion and association rules are noted. The spectrum analysis model is used to extract the spectral properties of the transmission information of the power system, and fault detection and fault types are identified based on spectral differences.

3 Liu, J., Yang, X., Luo, S., Li, X., He, Y., & Fan, "Forward Fault Identification Element based Transient Power for DC line Protection in UHVDC System". IEEE Power & Energy Society General Meeting (PESGM).2018.
As far as reliability is concerned, with high power over long distances, DC line errors pose a great threat to ultra-high voltage direct current (UHVDC) systems. In this way, the forward fault identification element is proposed for DC line protection in the UHVTC system. The forward fault detection element is based on the transient power (TP), defined as the product of the transient voltage and the transient current in the given frequency band. Because the alarm characteristics of the DC line are fully considered, the forward fault detection element can detect errors from forward external errors on the entire long line. Proposed a polarization selection criterion based on transient force. If you use directional components, you can create a fast and reliable security plan. The proposed forward fault detection element can overcome the alarm effect problem of long DC lines affected by some conventional protection methods. In order to improve the performance of the single-ended travel wave based method, a related link is proposed to compare travel wave directions on either side of the line
4 Wang, C., Jia, K., Zhao, H., Bi, T., Li, Z., & Liu, B. "A new protection scheme for DC substation system based on single-ended measurement". 20th International Conference on Electrical Machines and Systems (ICEMS).2017.
DC Securities Selection and Speed Requirements. This method proposes a new DC protection scheme for the DC subsystem. This solution is based on the characteristic and misalignment of the single-ended natural variation of the first and second derivatives of a DC current. To distinguish between errors from internal mistakes and external mistakes to identify errors. The proposed project can quickly identify, disseminate, or disseminate internal or external misinformation and meet the requirements for safe speed, reliability and selectivity. The flexible DC subsystem is a multi-terminal DC power network. This has attracted the attention of scholars at home and abroad for the multi-voltage large-scale distributed generation and fully controllable current friendly interfaces. However, there are several key technologies for flexible DC secondary power systems, and safety is one of them.

III. PROPOSED METHOD & SYSTEM DESIGN

Power system protection is a technique that relays or fuses or both makes it more sensitive to fault and abnormal conditions and avoids false alarms under normal operating conditions. Therefore, it is advisable to make the right decision by complicating whether the device is in an abnormal state or if the system can absorb it and return to normal working conditions. A safety relay is a preventative device that operates after a failure and helps reduce downtime, damage, power outages and related problems

For the system to function normally, it is necessary to quickly isolate the system with minimal interference from the area. Both of these functions fail and can lead to major system disruption and improper operation, including increased equipment damage, increased personnel risks, and the possibility of long service interruptions. As the size and complexity of power systems increase, it is important to quickly and accurately identify different system faults using more powerful methods. It is desirable to design a reliable and fast method to classify power system faults with different system parameters and fault conditions. Mistakes in any transmission line can basically be classified as balanced errors and asymmetric errors. These defects are called symmetric and asymmetric errors, respectively.

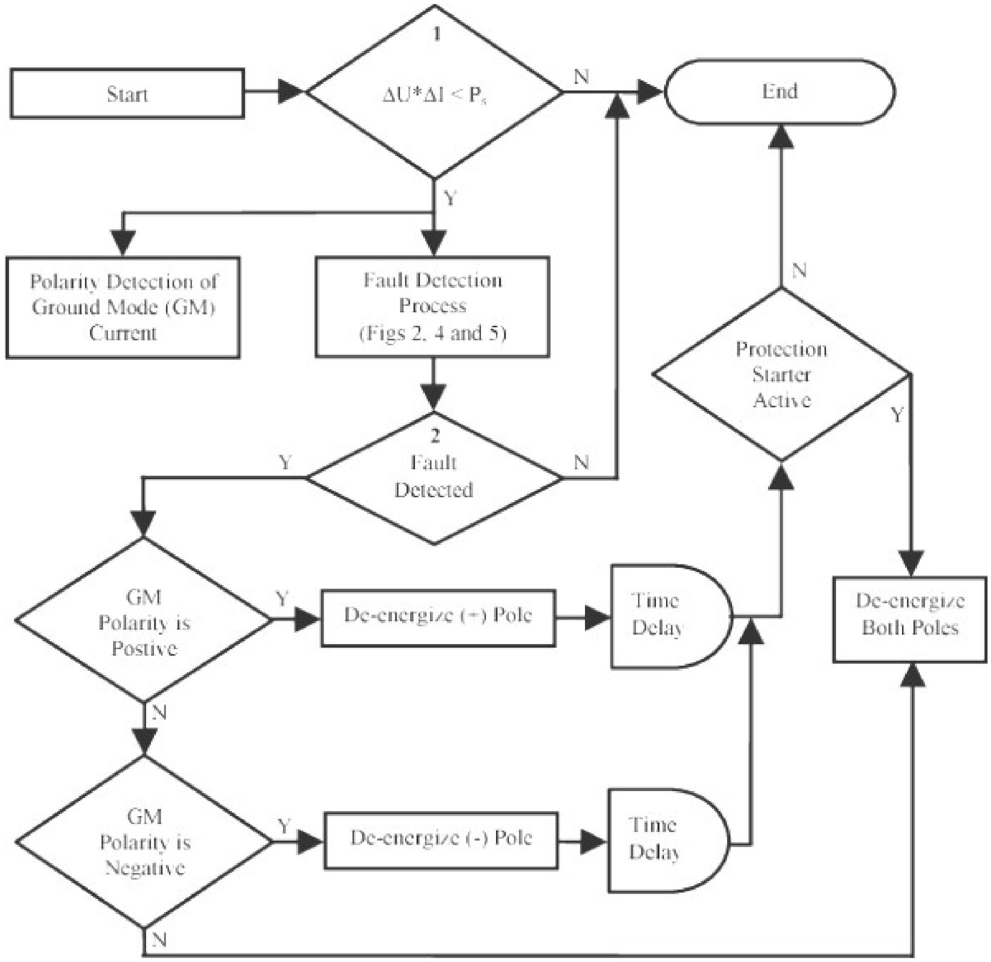


Fig 1 Flow Chart

In maximum cases it can be seen that the failure experienced is asymmetric. Symmetric and asymmetric errors are further classified as serial and parallel errors. There is a series of faults in the impedance of the line, which does not include any neutral or ground or grid connections. This indicates increased voltage and frequency and reduced current in the affected phases. For example, one or two rows of circuit breaker openings. The security system has various objectives, including identifying the wrong molecules from the health system. Due to the isolation from the health care system, it is necessary to classify the nature of the mistake for further information and report creation. Fault classification provides information about the phase of the fault, such as the severity of the fault.

IV. FUNCTIONAL SIMULATION:

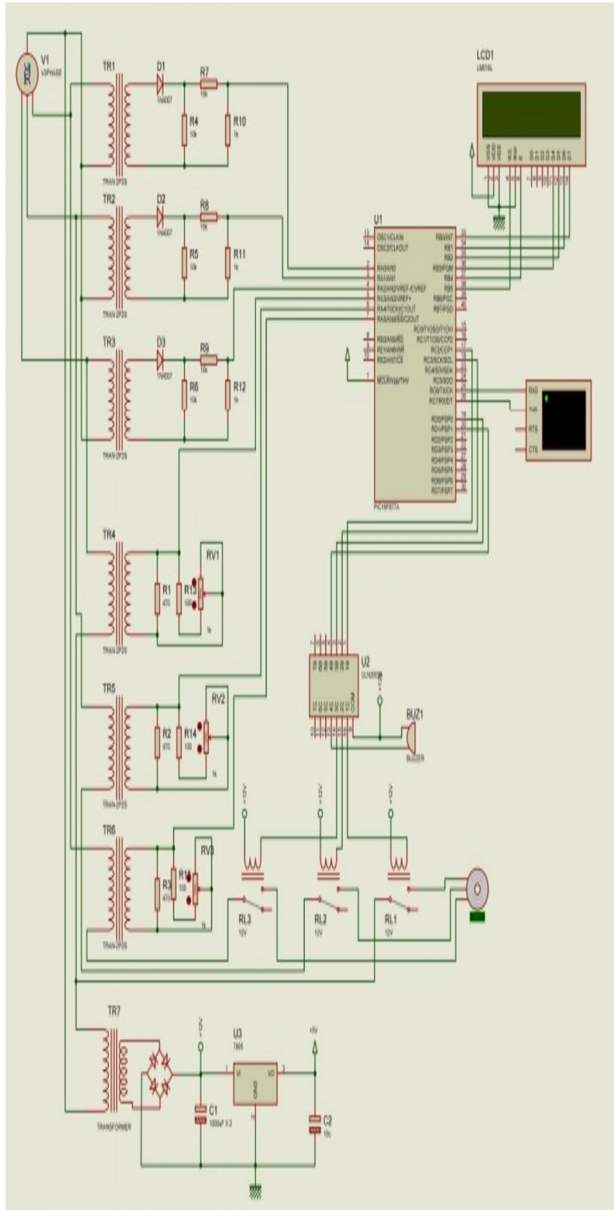


Figure 2: Functional Simulation

The protective scheme against fault condition of transmission line. Three CTs are installed, one on each phase of the feeder and are connected across the three relay coils. In case of a fault condition is occurred the solenoid plunger system of the relays work to close the trip coil circuit, which in turn presents the circuit breaker, thereby disconnecting the protected feeder and send the message to the concern via IOT

V. RESULTS ANALYSIS:

After multiple testing procedures conducted on this system, we found out that the system is efficient enough and functioning well for it to be used and implemented in the real-life scenarios. The readings of the data were accurate due to the accuracy of the sensors used and also confirmed with their reading by comparing with the internet readings of the particular values. There was a slight different between the reading the internet values and the values we obtained in our system, this is due to the distance where we are testing our device from the nearby weather station, this is a disadvantage of weather readings from the internet sources and local news station because if your particular location is much further from the nearby weather station means the readings that you will obtain are inaccurate. By this reason we concluded that our system readings were the ones which are more correct.

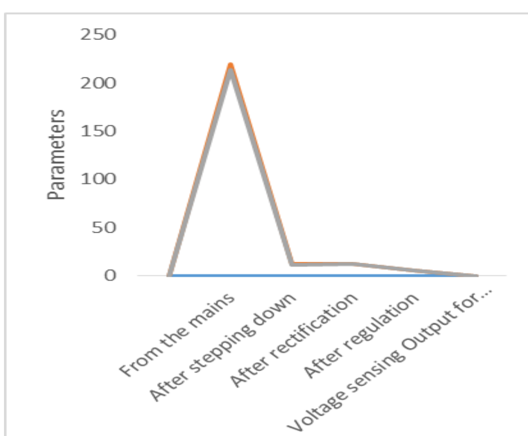
In order for the whole system to be fully equipped and work with solar energy then a bigger solar panel is required and a rechargeable battery that is capable enough to power all the components in the system. But for us we are

limited to power only few of the circuits in the whole system with the solar panel and other circuits will be powered with normal AC outlets.
Data that are logged locally in the device for it to be shared and analyzed for the big data analytics this file will need to be accessed within the system and then be shared to other members for analysis and achieve the goal of analysis of the data and information for a long period of time.
Never the less, the notifications that are sent with GSM module could also be expanded and add more notifications methods like using of tweets and email to send the message to the owner of the system if there are any abnormalities at the place where this prototype is placed at.

s.no	Measurement	Voltage type (AC to DC)	Theoretical Value (volts)	Actual Value
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
5	Voltage sensing Output for voltage sensor	DC	0.0099	0.010
6	Current sensing voltage Output	DC	0.0909	0.092
7	Voltage divider input for voltage sensor	DC	12	12.02

Fig 4: Tabulation of actual and simulated outputs

GRAPHICAL REPRESENTATION



The short circuit limit configuration was tested. A current limit of several amp was configured using a mobile phone. The current value set was sent to the IOT module with the symbol before the digits, 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. For the purpose of testing, an electric iron device was used, as it had a befitting current rating. 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

VI. DISCUSSION:

A fault in an electrical device is defined as a defect in its circuit. The faults are usually caused by mechanical errors, accidents, excessive internal and external stress, and low fault impedance, and the fault current is relatively high. In the event of a fault, the electric flow is directed towards the fault and provides an impact to the surrounding area. The voltage becomes unbalanced. This is required to detect failures as quickly as possible, which is why a toolkit uses a microcontroller to speed up its process. It detects the following four major faults and releases the travel signal. The four errors detected by the model are: overcurrent errors, fault undercurrent, and spark and UV detection, phase failure.

With the help of this mode, one can know at what stage a failure has occurred, and someone can elaborate on the specific function of the microcontroller and the LCD circuit. The main advantage of this circuit is that any ordinary person can use this circuit to know the type of failure. Since then, it has found a place to store expensive equipment that is attached to the main line for various medical hospitals, businesses and high-security applications. With some research work on transformers and relays, people can easily install new circuits. It provides detailed knowledge and detailed application of each element in each of the connected circuits. With a few variations of the circuit it is possible to design a new security system for each individual phase. Using the microcontroller, the items in the circuit are compact and easy to use.

VII. CONCLUSION

The designed system is connected to a distribution transformer, and extraordinary operating parameter information can be transmitted to a mobile device using the IOT network, thus achieving better communication. The results confirmed that the transformer was monitored by using wireless communications and eliminating the need for cables. The monitored parameters are transferred from the PIC microcontroller to the PC. The proposed method with the formula is universal and will change in a number of factors, such as tower data asymmetry, wireless connection reliability, cost and random cellular coverage depending on the connection usage. And requirements for cost-optimized incremental deployments. Information is obtained by placing the recommended system modules on each transformer. Data can be sent through the PC System module. The PC module is connected to a nearby network and sends the information to the monitoring node. It is possible to monitor and control multiple transformers. IOT systems can be used to send text messages to authorized persons.

more regarding this particular topic help to provide the base ground for the researchers to learn more and discover

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