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A Survey for Underground Cable using IoT in Fault Detection

Mrs S. Jonisha[1], Akilesh. K. H[2], Arvind S Kumar[3], Balaji. N[4]
[1]*Asst. Professor,* [2, 3, 4]*B.E Student, Dept of CSE, S.A. Engg College*

Abstract: ***In a line or cable generally, a fault will occur is not severe it will be unseen but these minor faults will lead to damage of the transformer. A supply line can be affected by conditions of overvoltage and overcurrent condition. During the occurrence these conditions, the incident goes unreported for a long duration. Manual reporting can lead to long outage time. During this time the public will not be able to use any electrical appliances that require current to work. It is cumbersome to the residential public as well as the people who are admitted in the hospital. Thus we made an survey how the wireless cable fault detection and protection system is made by using different techniques and it will also help us to realize an almost real-time system process in underground cable transformation i.e.., how the fault is detected in real time and the transformer is protected at the earliest is analyzed.***

Keywords: IOT, LCD, PSCAD, CSW, APT, e.tc..,

I. INTRODUCTION

In early days cable faults often occurs due to natural calamities like heavy rain, cyclonic storm, earthquake and floods. While a fault occurs in the cable for certain reason, at that time the fixing process related to that particular cable is difficult due to the fact that the location of the fault in the cable cannot be found. Our Project uses the Ohms law theory, when a low DC voltage is applied at the feeder end through a series resistor, then the current that is passed through the cable would vary according to the location of the fault that is detected in the cable as the resistance is proportional to the fault distance. The domain we use in this project is IOT (Internet of Things). The Internet of things (IoT) is the network of devices such as phones, home appliances, computer, vehicles, that contain software, electronics, and connectivity which allows these devices to connect to the internet, interact with these devices and help them to exchange data that is available in these devices. The data that is obtained from the cloud server is analysed and sent to the backend for the data to be processed. The data that is processed in the backend is then displayed in the webpage with the location of the fault in the cable. The fault is also displayed on a LCD display that is available in the base station. An alert message to the control room will also being sent in case of detection of the fault in the cable.

II. SURVEY FOR CABLE FAULT DETECTION

The microcontroller of the 8051 family and uses ADC to develop a precise data which will help to determine the location of the fault [1]. It also discusses about two methods for finding the faults such as on line method and offline method. The components used are a microcontroller an LCD, a relay, a transformer which is a step down transformer which can be used to reduce the amount of current going to the system. It also uses the principle of the Faraday law of electromagnetic induction.

In underground cable fault detection [2] in case if a fault occurs it will sent a signal to base station. Processors that are used in it are 32 stick microcontrollers with 8051 processor, transformer, 64KB outside memory and 64KB program memory. The advantage of this paper is that it reduces working cost and it finds the error in the field [2]. The disadvantage of this paper is that it will not locate the exact location and it also takes time to find the cable fault.

The locations of the cable fault can detected and help the field crews. The software created to find the location for this project was created to run on IBM compatible 80386 computer [3]. Fault types such as open, short circuit faults can be identified. There is no way to identify the faults that occured before and no alert facility in this system.

Fault location technique is of two types namely tracer and terminal. The terminal methods used in this paper are bridge technique and other terminal methods are murry loop and pulse radar [4]. Multiple point grounding technique is used so the cables are connected in multisections. The algorithm that is used in this project is fault location algorithm.

Power cables are most commonly used in urban areas, when any kind of fault occurs in the cable we should find it and repair as soon as possible. Sheath grounding current is studied here and 35KV power system is used to control the steady state and transient

capacity current [5]. Power system computer aided design (PSCAD) software is used to find the fault.110kv of voltage is used here. Flow of current in metal sheath is monitored by using current sensors [5].

EMPT software is used to model a 11KV cable and the fault is analysed by using system configuration and fault conditions [6]. Fault is of two types namely, Typical fault responses, Response for fault close to busbar. Fault transient capture unit is used to analyse the fault in the distribution cable [6]. It is insensitive to system source, fault resistance, fault inception type.

A Conformal Surface Wave (CSW) is placed on the power cable to excite the electromagnetic surface [7] waves along the cable. Unshielded XLPE power cables were used to find the feasibility of surface wave propagation. The length of the cable is usually received with a error from a error percentage of 1.4% to 8.4%.

The transmission system model is created using SIMULINK or similar software like Matlab. The value of voltage and current obtained from the SIMULINK is fed to Artificial Neural Network (ANN) to detect the fault type [8]. The faults such as LG, LL, LLG, LLL, LLLG can be found. OrCad is used to locate the location of the fault. The Parameters used are R=0.727 Ω/km, L= 0.334 mH/km, C= 1.05 μF/km and length of the line = 10 km.

Two algorithms are used to detect and classify the fault at the distribution voltage levels. Based on the Wavelet analysis, one algorithm detects the fault induced in transistors [9]. Based on the super-imposed fault analysis the other algorithm is suitable to detect the SLG fault. This system performs simple and less computation with fewer thresholds and has a easily upgradable firmware.

To find the faults in the cable in spite of where the cable fault occurs ie, underground and overhead. The fault location of the occurred fault is derived using the discrete fourier Transform, modal Transformation Theory and distributed line model [10]. The cable will have a surge impedance of 10% with the underground cable having a range of 40 to 60Ω and the overhead cables with the range of 400 to 600Ω. The Simulations were carried out with the help of MATLAB with a extension of Power system Blockset [10]. The faults such as Single Phase line, three phase line can be detected.

Two methods used to find the distance of the underground cable fault are ohms law and Murray loop. The Murray loop and Varley Loop methods are used and they follow the principle of Wheatstone Bridge [11]. The bridge rectifier DB107 is used to form bridge rectifier and it delivers a pulsating DC voltage and it is fed into the capacitor filter[11]. The average accuracy is above 95% in this system.

The ohms law is used to detect the fault in the system. The system uses a Step down transformer with 4 diodes forming a bridge rectifier which delivers a pulsating DC. IC LM7805[12] is used to get 5V DC irrespective of the input DC range from 7V to 15V and a 8-bit AVR RISC based microcontroller is used [12]. The external access is provided with the help of a 8051 microcontroller which helps to access the program form in the on-chip program memory.

To evaluate the fault that occurs in underground cables by APT and GPS. It performs two series of time tagged signals to perform evaluation on faults by analyzed using wavelet analysis [13]. The fault is calculated with high precision using the principle of type D fault locator. The process is done in multi resolution operation using various travelling wave methods.

The uses of real time expert system to locate fault in high voltage underground cables. It can detect pre location of faults in underground cables by impulse method [14]. Using ICE, the measurements of time interval can be displayed in oscillation screen. The method used in this project is patter matching method that shows the increase decrease and equal points on waveform [14].

The fault that occurs in underground cables can be varied by single-phase and two-phase grounding. The faults mainly occur by mechanical damage, over voltage or overload [15]. The fault in this project is displayed in liquid crystal display using analog to digital convertor and microcontroller. Major error occurs in point of two- phase related to measuring error [15]. To improve the accuracy in cable fault detection high precision galvanometer must be selected.

III. FUTURE WORK

To detect the faults of the cables present underground, we can implement an inbuilt API system to send messages to the control board regarding the fault of the cable at that particular location. Whenever there is a fault in a cable, that particular area will be displayed in LCD display that will be present in the base station as well as in the website which can be created for viewing the faults in the cable at anywhere anytime using a Wi-Fi module. By using cloud computing, provides real time storage of data and IOT helps to provide real time monitoring of underground cable. XAMPP server can be used with PHP 5.0 for efficient server side scripting. The system can be used for developing with Apache, MySQL and NodeJS for better and easy user access for users. We can also use a current sensing unit for detecting whether the current passes through the cable or not. The ESP8266 Wi-Fi module is also used to locate the cable fault. It will be able to detect the fault and protect it. An inbuilt API is used to send messages as an alert to a mobile phone.

IV. CONCLUSION

It's a difficult task to find the faults in underground cables. The work consequently shows the stage, separation and time of event of blame with the assistance of microcontroller and ESP8266 Wi - Fi module in a website page. The robustness of the algorithm was tested and proved against various type of faults occurring in underground cables. Thus the survey shows how this scheme has the ability to recognize the faults in cable sections. By performing many simulations of this system, how we can find the fault location with 100% accuracy. It will also take time to detect the exact location at first but after continuous processing the fault can be found.

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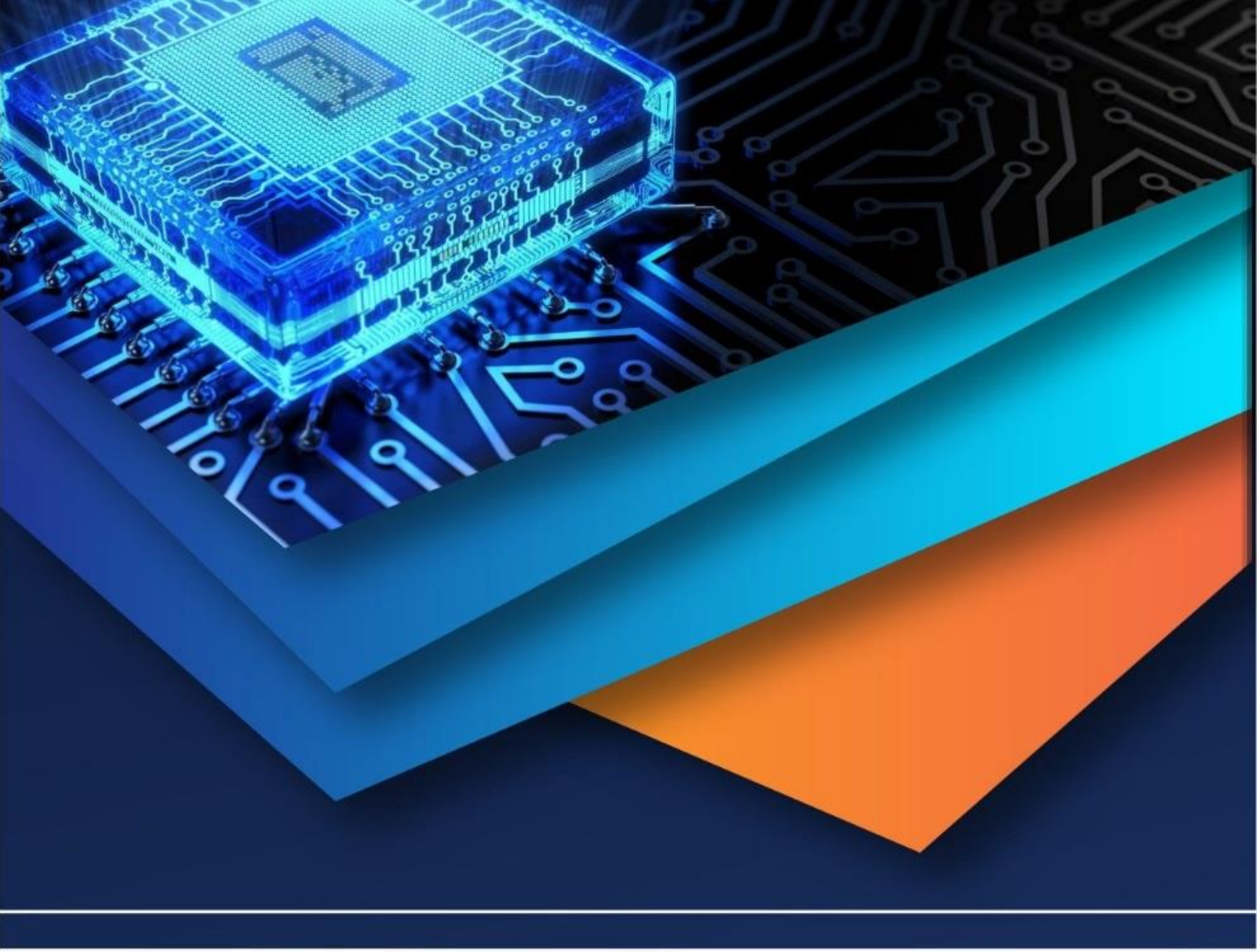

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