International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

IOT Based Fault Detection of UndergroundCables through Node MCU Module

Sayed Sajid[1], M. Abdul Nabi[2], S. Fazarthullah[3], S. Javid[4]
20x51a04b0@srecnandyal.edu.in[1], 20x51a04a3@srecnandyal.edu.in[2],
20x51a04b3@srecnandyal.edu.in[3], 20x51a04b4@srecnandyal.edu.in[4]
SANTHIRAM ENGINEERING COLLEGE NANDYAL[1,2,3,4]

***Abstract*— In the downtowns, underground cables are used rather than of overhead transmission lines. It is hard to go through the specific spot of the shortcomings. As India become prominent as a progression country, civilized field is too boosting every day. The underground lines are beat under the same circumstances its uses is additionally growing a result of its clear advantages such as lower line losses, lower maintenance cost and they are less powerless to the effects of serious climate. As it isn't clear it move extreme to identify propel area of the shortcoming. In this proposed work we are trying to rectify this problem by proposing a method which is good enough to the digital world. In this paper we have used IOT based technique with Google database for the fault detection with the help of Node MCU Wifi Module. It is totally based on IOT. We used here Node MCU which connects arduino sensors to Internet. We had created a Hot spot through router for communication. We connected each MCU Module with transformer and used Google data base to checking the status of transformers. The accuracy and efficiency of our proposed method is more as compare to the other techniques.**

Keywords*— *IOT, Node MCU Wifi Module, Arduino, Power Lines, Google Database, LL, LG and LLL;

I. INTRODUCTION

Electricity becomes a basic need in our daily life. Mostly activities of our life style depend upon electricity. Electricity has been involved in our life style in such a way that it plays a very important role in every field. The transformer is decisive equipment in power system for transmission and distribution. In power system underground cables are used to transmit the electric power from generators. Stations to Distribution point then it is transferred to the consumer ends by overhead and underground cables. Underground cables have to suffer various problems due to aging and different types of faults. To overcome these problems in cables, lots of Research work has been done. Here we proposed a method to rectify these problems.

There are so many online and offline methods available for detection of fault and life into underground cables. Murray loop, varley loop, ohm's law & Fourier transformation etc. methods are used for fault detection of earth or underground cables [2, 4].

- Murray loop method- This method, generally used for identifying the faults in earth cables. This test is based on the principle of Wheatstone bridge. By using this assessment, fault spot in an earth cable can be finding by arranging a Wheatstone bridge in it [8].
- Varley loop method.
- Ohm's Law.
- Fourier transformation.

For power network stability it is obligatory to minimize the fault as fast as possible. For this precise (accurate) methods or procedures are needed with fast speed of operation, to identifying the fault, thereby power distribution might be removed in little period. The fault detection is very easy in over head cables, while it is very complex in underground cables because for this numbers of techniques are limited.

In this paper we have study few techniques to minimize the various problems related to the underground cables but these techniques are not very efficient to detect the problem [3].

The principle highlight of the electric transmission and dispersion frameworks is to stir electric vitality from the age unit to the clients. For the most part, while flaw happens on transmission follows, identifying deficiency is significant for quality machine while in transit to clean blame before it will expand the harm to the power device in spite of the way that the underground link framework gives preferable dependability over the overhanging line gadget, it is miles tough to search out the issue territory. The call for consistent assistance has caused the improvement of procedure of discovering issues. At the time of bearing of late years, advancements of the shortcoming conclusion have been improved with projects of sign preparing methods & results in a nutshell based procedures. It has been discovered that the wavelet change is fit for researching the impermanent sign produced in quality framework.

So, we have proposed a new technique to diminish the fault related harms in underground cables. And the accuracy of our proposed scheme is high as compare to the range of methodologies. In this paper we have used IOT based technique with Google database for the fault exposure by means of the help of Node MCU Wifi Module. It is totally based on IOT. The accuracy and efficiency of our proposed scheme is more as evaluate to the other techniques.

II. RELATED WORK

There are lots of methodologies to identify shortcomings in power lines. In the current era faults are major problems in the power transmission lines. For better power quality and continuity of power it is necessary to reduce the faults from power lines as soon as possible. So many methods are proposed related to fault identification and reduction in power system. Some of them are explained here for example Murray loop method, Ohm's law method and many more.

A. Murray Loop Method

For Fault exposure Murray loop technique is used. This scheme is very straightforward. For observation or exposure of short circuit faults in underground line this method is used.

These two loop tests (Murray & Varley Loop) are usually used for identifying the faults in earth cables. This trial is based on the law of Wheatstone bridge. By using this experiment, fault site in an earth cable may be finding by arranging a Wheatstone bridge in it. In this scheme we first need to connect a sound cable of same length as of defective cable. Sound cable means the cable without any error and we have to short circuit the ends of both the cables (sound cables & faulty cable) [5]. Now we connect a galvanometer in between beginning of both working cable & not working cable. Now we connect two registers crosswise the working cable & not working cables in such manner that these both the registers are variable. Now the entire loop will form as a Wheatstone bridge. Then we attach one battery via the ground. For balancing the bridge we regulate the value of both the registers till the galvanometer shows the zero value. We shall carry out the shortcoming spot by comparing the resistances. We should have the values of both the resistances [1, 6].

B. OHM'S Law

Under this practice an unsophisticated OHM's law is applied to establish the short circuit shortcoming. A DC voltage is tested at the feeder side over a series resistor; rely on the distance end to end of shortcoming of the cable current deviate. The voltage leak crosswise the series resistor adjusts consequently, this voltage drop is used in estimate of fault zone. This scheme is made with a compilation of resistors showing the cable length in KMs & fault formation is made by a set of switches at each known KM to cross ensure the exactness of the same [7]. The voltage go down over the feeder resistor is specified to an ADC which builds up an exact superior information which the made to order

microcontroller would show the alike in Kilo Meters, the deficit happening at what division and which phase is shown on a 16X2 LCD interfaced through the microcontroller. In this approach we utilize a microcontroller ATMega8 which is of 8-piece. The program is baked into ROM of microcontroller written in either Embedded C or low level computing construct. The power contribution comprises of a stage down transformer 230/12V, which steps down the voltage to 12V [3, 7, 9].

That is changed over to DC utilizing a Bridge rectifier. Waves are evacuated utilizing a capacitive channel and it's then managed to +5V utilizing a voltage controller 7805 which is mandatory for the activity of the microcontroller and diverse parts. Comprises of venture down X_mer which is 230 V step-down to 12 V. In which circuit DB107 is utilized to shape attach rectifier which conveys throbbing dc voltage and then bolstered to capacitor channel the yield voltage from rectifier is encouraged to channel to take out any ac segments nearby considerably after amendment. The sifted DC voltage is specified to controller to produce 12V steady DC voltages. Murray loop method applies the whetstone bridge to estimate accurate distance of fault site from base station and sends it to the users mobile. While in Ohm's law, when any shortcoming take place, voltage fall will fluctuate depending on the length of fault in line, since the current varies. Both the methods deploy voltage convertor, microcontroller & potentiometer to stumble on the fault sight underneath LG, LL, and LLL shortcoming.

Consequently, a gadget which can identify the area of shortcomings doesn't exist. So as to distinguish the area of issues of UGCs, a few techniques have been formed and can lists into three. Primary techniques: feedback pulse method, travelling wave method, and impedance system.

Junction of two diverse transmission mediums, approaching waves will deliver yield a reflected wave and come back to the first stipulation [9]. This rule has applied in the Time Domain Reflection procedure with the imminent medium being the conductor of a conductor and the approaching medium where the interference of the line at cut off, where the convergence of the two mediums is the function of event of short out. (ii) Travelling wave method: The wave spread course of action [4, 5] measure the production time of the wave coming about because of the event of a happening on the transmission line.

Voltage or flow of charge information can be utilized. This tactic requires very precise time organization when the occurrence area is resolved, When the episode wave on the power lines or on the other hand at abundant areas on the electrical framework. Working experience shows that, this policy is exceptionally exact and the probability of issues is ceaselessly found. To decide the area of the issue, a heartbeat is useful to the transmission line. Contingent upon the greatness and the stage point, we can settle on the situation of the deficit. Reflector strategy to decide cut off in the control network is appeared in [1, 4].

The intelligent heartbeat comprises of two primary sorts, voltage and flow heartbeats. The qualities of those heartbeats are lofty recurrence and lofty plentifulness. In request to acquire the reflect heartbeat from the short out deficiency point, the estimating gear must have a decent class with an adequate inspecting time (barely any kHz) and a vast estimating plentifulness (a few kV). (iii) Impedance system. The process of decisive the fault site is based on the estimate of the flow of charge and the voltage together with the data of the total resistance of the line for the period of the operation instantly before the short circuit occurred to calculate the fault site. The impedance system [6] really depends on the shortcoming resistance and inaccuracy in the case of too much fault resistance [10]. The technique of aggregation can be separated into two categories: (i) based on a wiring and (ii) based on two terminals depends on the number of terminals at which the voltage and flow data are composed. This scheme frequently used with digital reserve relays is situated on the shield side of 110kV line.

III. PRAPOSED WORK

In this technique we are using Node MCU module WIFI, system. The function of the Node MCU is, to provide the connectivity between arduino sensors to internet. For the internet communication in the Node MCU we are creating a Hotspot through router. We are connecting every Node MCU with a transformer (means one node MCU for every transformer individually). We are using Google database for checking the status signal of transformer in case of the failure, status signal will send. In the flow chart we are showing all the process of the method step by step. We are starting the technique by using transfer and Node MCU WIFI module. It is IOT based program [11, 12]. Node MCU Wifi module is connected with Transformer sets, one MCU module for each Transformer [1, 8]. Node MCU Wifi module will take signal status of transformer sets and will pass it to the next step. If power is passing through the Node MCU (If signal is receiving by Node MCU module from Transformer) individually, then by Wifi connection it is detected that line is safe and the notification is saved in Google data base. If the signal is not received by the Node MCU Wifi module that means fault occurrence is notified and action against this fault will be taken. By this method with the help of Node MCU Module Wifi connection, we easily detect the fault occurrence of the line with very fast operation. And the architecture of proposed method is given in “fig.1.”.

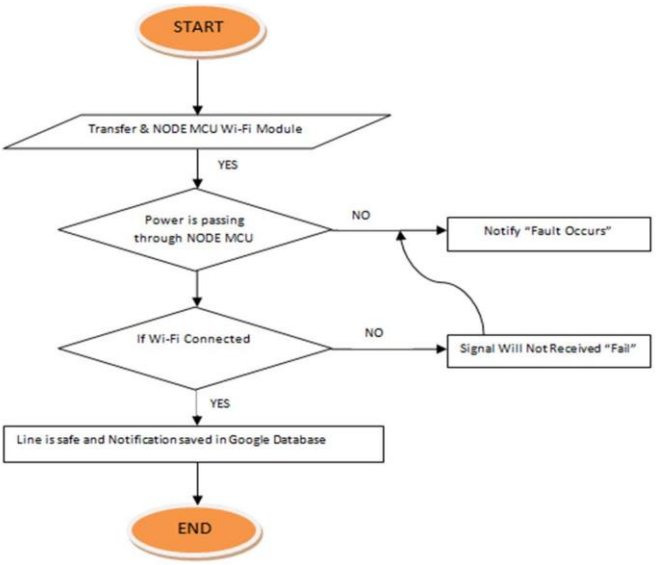

Fig.1. Architecture of proposed methodology.

In the connection diagram, we are showing the Power Transformation from power generating point to distribution centre by underground cables. Four distribution steps down transformers are connected as shown in connection diagram the four transformers are 1, 2, 3 and 4 respectively. All transformers are connected for a particular area individually. All transformers are connected in parallel. A Node MCU Wifi Module with Google data base system is connected with the underground cables. In this system, a set of MCU Wifi Modules are connected [10]. One MCU Wifi module is connected with each transformer by underground cables. The Node MCU Wifi module will receive the status signal of the transformers individually, and pass it to the notify centre, where it is recorded in Google database. If in any condition status signal is not received by Node MCU that means fault is occurred in that particular line. And after detection of fault, next step will be taken.

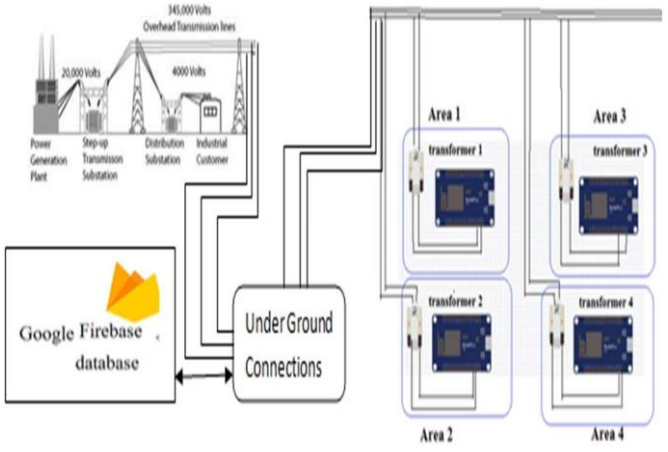

Fig.2. Circuit Connection of for Underground cables connected with Google database.

A. RESULTS

In this procedure, with the help of Node MCU Module Wifi link, we can easily identify the fault happening of the line with very fast process. The fault location is detected by MURRAY LOOP Method and the spot of the fault is detected with the help of Node MCU Module. By applying the Node MCU method on the outcomes in B Phase for LG fault are calculated and the same approach is applied on the Y B Phase for LL fault and get efficient and more precise results for fault detection in underground lines. In "fig.3." We are showing the consequences analysis of LL fault.

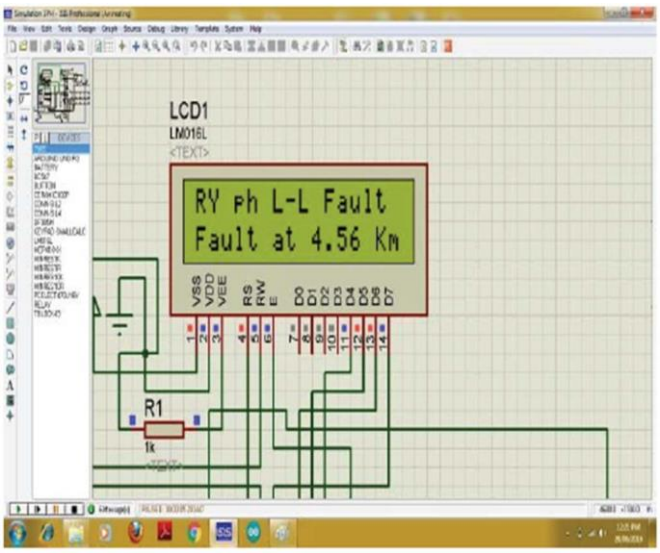

Fig.3. Window display LL fault.

Y B Phase for LLL fault and get efficient and more precise results for fault detection in underground lines. In "fig.4." We are showing the results analysis of LLL fault.

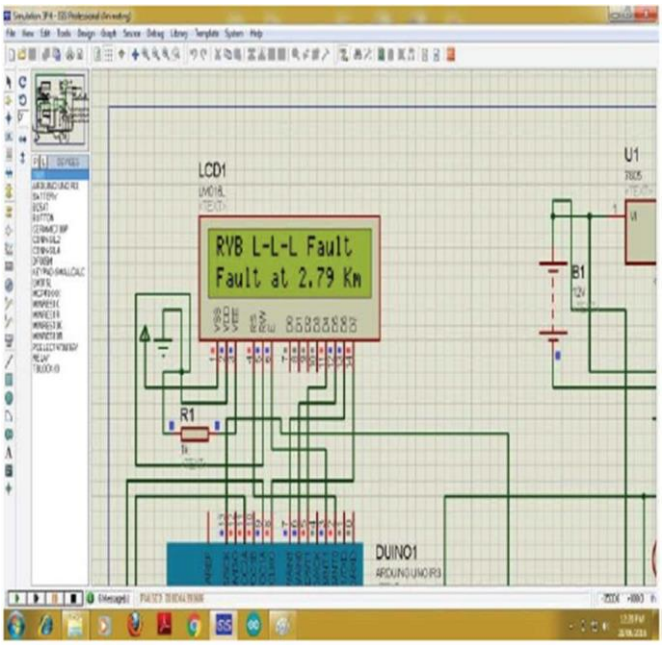

Fig.4. Window display LLL fault.

In the "fig.5." We are showing the results analysis of LG fault. Y R Phase for LG fault and get efficient and more exact results for fault detection in underground lines.

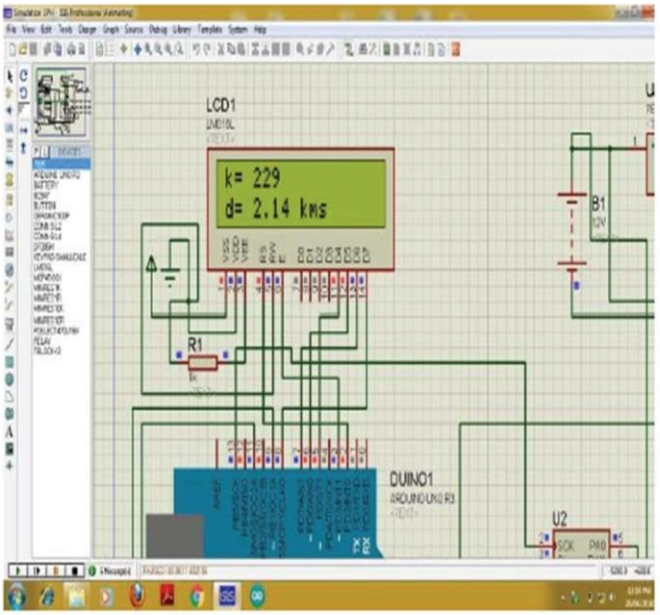

Fig. 5. Window displaying LG fault.

Table I. Outcomes in B Phase for LG fault.

Real length(km)	Outcome (km)	Accuracy(%)
2	2.16	94.3
3	3.14	94.8
4	4.25	94.9
5	5.34	93.2
6	6.36	94.9
7	7.40	95.1

Table II. Outcomes in Y B Phase for LL fault.

Real length (km)	Outcome (km)	Accuracy(%)
2	2.1	96
3	3.05	97.8
4	4.07	98.9
5	5.10	99.2
6	6.02	99.9
7	7.07	100

Table I and Table II showing the outcome results of the detected faults with accuracy.the average accuracy in B Phase for LG fault and average accuracy in Y B Phase for LL fault respectivelly, is 94.53% and 98.63%.

IV. CONCLUSION AND FUTURE WORK

In the proposed effort the difficulty of detecting the fault in underground lines is done on the basis of Node MCU Wifi Module. We projected an IOT based model for healthier recognition of fault in the cables. We proposed a method to detect the fault place from the underground cables through Node MCU Wifi module. This is provided that best outcome and accuracy compare then other methods. This technique is also given that a very fast speed of operation, which is very essential for the continuity and stability of power quality. In the future we can use this technique for detection of faults in power lines/cables as well as for transformers by connecting various sensors. And here the average accuracy of our praposed system in Y B Phase for LL fault respectivelly, are 94.53% and 98.63%.

V. REFERENCES

[1] M. R. Hans, S. C. Kor, and A. S. Patil, “Identification of underground cable fault location and development,” 2017 International Conference on Data Management, Analytics and Innovation (ICDMAI), 2017.

[2] R. Salat and S. Osowski, “Accurate Fault Location in the Power Transmission Line Using Support Vector Machine Approach,” IEEE Transactions on Power Systems, vol. 19, no. 2, pp. 979–986, 2004.

[3] R. Salim, M. Resener, A. Filomena, K. R. C. D. Oliveira, and A. Bretas, “Extended Fault-Location Formulation for Power Distribution Systems,” IEEE Transactions on Power Delivery, vol. 24, no. 2, pp. 508–516, 2009.

[4] M.-S. Choi, D.-S. Lee, and X. Yang, “A line to ground fault location algorithm for underground cable system,” KIEE Trans. Power Eng., pp.
267–273, Jun. 2005.

[5] HeenaSharma, M.T.Deshpande, RahulPande “Different types of fault Analysis and Techniques of Fault Location Using PSCAD”,Internation Journal of Emerging Technology and Advanced Engineering(2250-2459)May2013.

[6] Willaim R.Stagi, “Cable injection technology,” IEEE Latin American Conference., 2007.

[7] Mahmoud Gilany, Doaa khalil Ibrahim, and El Sayed Tag Eldin, “Travelling wave-based fault location scheme for multiend-aged underground cable system,” IEEE Trans. On Power Delivery, Vol 22 No.1, January 2007.

[8] C. K. Jung, J. B. Lee, X. H. Wang and Y. H. Song, “A study on fault location algorithm on underground power cable system,” Proceedings of IEEE Power engineering society general meeting, pp 2165-2171, 2005.

[9] C. F. Jensen, “Fault in Transmission Cables and Current Fault Location Methods,” Springer Theses Online Location of Faults on AC Cables in Underground Transmission Systems, pp. 7–18, 2014.

[10] T. S. Sidhu and Z. Xu, “Detection of Incipient Faults in Distribution Underground Cables,” IEEE Transactions on Power Delivery, vol. 25, no. 3, pp. 1363–1371, 2010.

[11] L. H. Son, S. Jha, R. Kumar, J. M. Chatterjee, and M. Khari, “Collaborative handshaking approaches between internet of computing and internet of things towards a smart world: a review from 2009–2017,” Telecommunication Systems, vol. 70, no. 4, pp. 617–634, 2018.

[12] M. Khari, A. K. Garg, A. H. Gandomi, R. Gupta, R. Patan, and B. Balusamy, “Securing Data in Internet of Things (IoT) Using Cryptography and Steganography Techniques,” IEEE Transactions on Systems, Man, and Cybernetics: Systems, vol. 50, no. 1, pp. 73–80, 2020.