Underground Cable Fault Detection Using Internet of Things

Poojari Niharika[1], Puli Dharani[2], Sanjana Singh[3], Mrs.K. Sumalatha[4]
UG Scholar[1,2,3], Associate Professor[4]
Malla Reddy Engineering College for Women (Autonomous)
Department of Electronics and Communication Engineering,
Hyderabad, Telangana-500100.

niharikapoojari23@gmail.com[1], dharanipuli13@gmail.com[2],
sanjanasingh123.mp@gmail.com[3], mrecwsumalatha@gmail.com[4]

ABSTRACT

The goal of this work is to spot the particular location of a fault in underground cable lines from the supply station to the precise location of the fault in any unit, during this case kilometers. When a fault arises in an underground cable line for any cause, the mending method for that faulted cable becomes problematic because of the absence of a correct system for tracking the precise position of the fault and also the kind of fault that happened within the cable. For this, a system should be designed to find the precise position of the fault within the distribution line system for all 3 phases R, Y, and B, and for varied sorts of fault circumstances. Single line to ground, double line to ground, and 3 section faults are mentioned during this work. The system programs a microprocessor, display, Fault Sensing Circuit Module,, and proper power supply arrangement with regulated power output is made in this project. As a result, if there's a short circuit within the kind of a line

to ground in any phase/phases, the voltage across series resistors changes an, associate degreed an analogue signal within the variety of a dip is made by the fault sensing circuit of the introduced system, that is then fed to associate degree ADC built-in within the already programmed microcontroller to make the precise digital knowledge, and once process the info, the output are going to be displayed within the connected liquid crystal display with the precise location of the fault.

INTRODUCTION

The detection of faults is one of the biggest drawbacks of underground wires. Visual inspection procedures are ineffective because the cables are placed beneath the surface (directly or inside pressurized ducts). In the case of Overhead Lines, this is not the case. We'll need to create unique methods to detect cable failures.

• Fault with an open circuit

• A short circuit has occurred.

• Earth faults

When moisture enters the insulation, the majority of the defects arise. Inside the cable, the paper insulation is highly absorbent. Mechanical loss during transit, the lying process, or numerous stresses faced by the wire during its operational life are some of the other causes. The lead sheath is frequently destroyed, mainly as a result of atmospheric pollutants, soil, and water or, on rare occasions, caused by mechanical damage and lead crystallization caused by vibration.

i .Open Circuit Fault (OCF) Is a type of fault that occurs when a circuit issue is caused by an open circuit in the conductors, as the name implies. Discontinuity occurs when one or more cable conductors (cores) break. Mechanical tension causes the cable to come out of its joint, causing this discontinuity. This is referred to as an open circuit fault.

ii. Short Circuit Fault It can only be found in multi-cored cables. A short circuit occurs when two or more conductors of the same cable come into touch with each other. Visual detection is impossible without dismantling the cable. When the individual insulation of the cables is destroyed, a short circuit issue arises. A megger can also be used to detect it.

LITERATURE REVIEW

S. Kucuksari et. Al [2010] Optical current transformers (OCTs) are available from several vendors to replace magnetic current transformers (CTs). The efficiency of certain currently available optical and conventional CTs is compared in this research. In a laboratory, the steady and transient reactions of the two systems are evaluated. Field data is also collected and analyzed to ensure that optical systems may take the role of traditional instrument transformers. In addition, the impact of ambient temperature on OCT performance and OCT step response have been examined. Optical CTs are more than available to replace conventional CTs, according to the findings. In addition, the findings reveal that OCT has a better frequency response than traditional CT. The differences between field and lab readings are due to experimental mistakes. Unlike traditional CTs, the OCT may produce a digital output that adheres to the IEC 61850 standard.

EXISTING SYSTEM

The current framework for underground link issue recognition utilizing Arduino normally includes manual assessment or dependence on customary shortcoming identification techniques, which are work escalated, tedious, and frequently need constant observing capacities. The trend toward proactive and more effective fault detection is being shifted with the introduction of Arduino-based solutions. Along underground cable networks, sensors and Arduino microcontrollers are used to monitor parameters like voltage, current, and temperature. Information gathered by the sensors is handled locally and sent to an incorporated framework for investigation. High level calculations running on the Arduino board or an associated gadget examine this information to recognize peculiarities demonstrative of link issues. Upon identification, cautions are set off for opportune intercession. This approach offers a financially savvy and versatile arrangement, empowering early shortcoming recognition, diminished personal time, and further developed support proficiency in underground link organizations.

DISADVANTAGES:

One inconvenience of utilizing Arduino for underground link shortcoming discovery is its inborn equipment limits, including confined computational power and memory limit, which might think twice about the capacity to carry out refined issue recognition calculations or handle enormous datasets proficiently.

PROPOSED SYSTEM

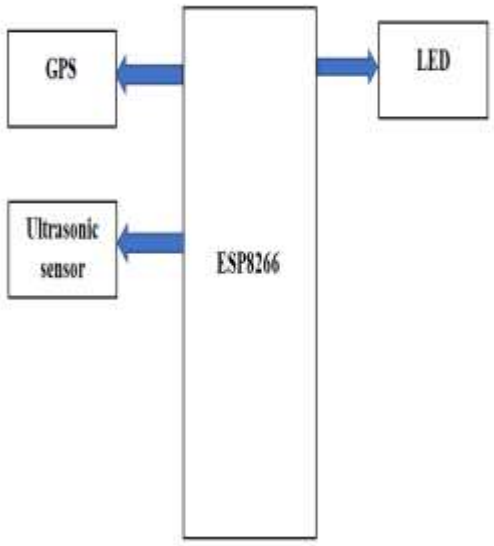
This paper presents a fault location example for underground power cable by using the Internet of Things, which is dependent on the internet, signifying that information will be delivered via the internet. The idea of this technique is to determine the distance in kilometers between a cable fault and a base station, as well as the location of the cables fault. The simple notion of Current Transformer Theory is used in this study (CT Theory). When a fault develops, such as a short circuit, the voltage drop varies based on the length of the issue in the cable; because the current fluctuates, a current transformer is used to calculate the fluctuating current. The signal modifier manipulates the voltage change, and the required computations are performed by a microcontroller.

ADVANTAGES:

- Early Detection

- Remote Monitoring
- Cost Savings
- Improved Reliability
- Data-driven Insights
- Enhanced Safety

BLOCK DIAGRAM:



HARDWARE COMPONENTS REQUIRED

- Ultrasonic
- LEDS
- GPS
- Esp8266

SOFTWARE REQUIRED

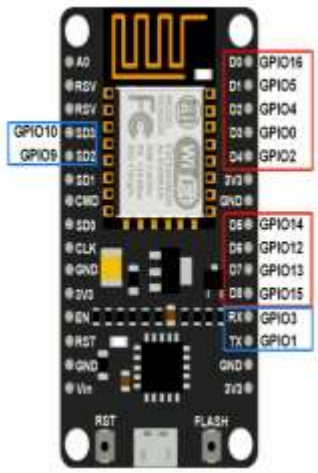
- Arduino ide

HARDWARE DESCRIPTION

Node MCU

Introduction

General-purpose input/output (GPIO) is a pin on an IC (Integrated Circuit). It can be either input pin or output pin, whose behaviour can be controlled at the run time.



The **ESP8266** is a very user friendly and low cost device to provide internet connectivity to your projects. The module can work both as a Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making **Internet of Things** as easy as possible. It can also fetch data from internet using API's hence your project could access any information that is available in the internet, thus making it smarter. Another exciting feature of this module is that it can be programmed using the Arduino IDE which makes it a lot more user friendly. **GPS**

The Global Positioning System (GPS) is a satellite-based navigation system made up of at least 24 satellites. GPS works in any weather conditions, anywhere in the world, 24 hours a day, with no subscription fees or setup charges.

LED (Light Emitting Diode)

The lighting emitting diode is a p-n junction diode. It is a specially doped diode and made up of a special type of semiconductors. When the light emits in the forward biased, then it is called a light-emitting diode.

ULTRASONIC SENSOR

Ultrasonic sensors service the market by providing a cost effective sensing method with unique properties not possessed by other sensing technologies. By using a wide variety of ultrasonic transducers and several different frequency ranges, an ultrasonic sensor can be designed to solve many application problems that are cost prohibitive or simply cannot be solved by other sensors.

SOFTWARE DESCRIPTION

The Arduino Incorporated Improvement Climate (IDE) is an easy to use programming stage intended for programming Arduino microcontrollers. It offers a straightforward connection point for composing, gathering, and transferring code to Arduino sheets, making it open to the two novices and experienced engineers. With a large number of libraries and local area support, the Arduino IDE works with fast prototyping and improvement of hardware projects, empowering clients to release their inventiveness and rejuvenate their thoughts proficiently and successfully.

APPLICATIONS

Underground cable fault detection using IoT involves deploying sensors along underground cable networks to monitor parameters such as temperature, current, and voltage. These sensors continuously transmit data to a centralized system via the Internet, where advanced algorithms analyze the data in real-time to detect anomalies indicative of cable faults. Upon detection, the system generates alerts, pinpointing the location of the fault for swift maintenance intervention, thereby minimizing downtime, reducing repair costs, and enhancing overall network reliability.

CONCLUSION

The underground string fault discovery system has been successfully designed and tested. This system is intended to descry the circuit fault in the underground lines by using Arduino microcontroller. The Arduino microcontroller works grounded on the affair of the detector values. By using Arduino regulator find out exact fault position. Once faults do in the string, the display unit displays the exact fault position. In this system, the measured current is detected as being in the small or medium current range. The RMS value per current cycle is transmitted to a back- end covering system to negotiate real- time monitoring. This system detects only the position of short circuit fault in underground string line, and descry the position of open circuit fault, to descry the open circuit fault capacitor is used in ac circuit which measure the change in impedance & calculate the distance of fault.

REFERENCES

[1] Ajaei, F. B., Sanaye-Pasand, M., Davarpanah, M., RezaeiZare, A. and Iravani, R. (2011) 'Compensation of the current-transformer saturation effects for digital relays', IEEE Trans. on Power Delivery, vol. 26, no. 4, pp. 2531– 2540.

[2] Cai, D., Regulski, P., Osborne, M. and Terzija, V. (2013) 'Wide area inter-area oscillation monitoring using fast nonlinear estimation algorithm', IEEE Trans. Smart Grid, vol. 4, no. 3, pp. 1721–1731.

[3] Chen, K. L. and Chen, N. (2011) 'A new method for power current measurement using a core-less Hall Effect current transformer', IEEE Trans. Instrumentation and Measurement, vol. 60, no.1, pp.158–169.

[4] Frolec, J. and Husak, M. (2010) 'Wireless sensor system for overhead line ampacity monitoring', in Proc. 2010 8th International Conference on Advanced Semiconductor Devices & Microsystems, Smolenice, Slovakia.

[5] Gungor, V. C. and Hancke, G. P. (2009) 'Industrial wireless sensor networks: challenges, design principles, and technical approaches', IEEE Trans. on Industrial Electronics, vol. 56, no. 10.

[6] Gungor, V. C., Lu, B. and Hancke, G. P. (2010) 'Opportunities and challenges of wireless sensor networks in smart grid', IEEE Trans. on Industrial Electronics, vol. 57, no. 10, pp. 3557–3564.

[7] Han, J., Lee, H. and Park, K. (2009) 'Remote controllable and energy-saving room architecture based on ZigBee communication', IEEE Trans. on Consumer Electronics, vol. 55, no. 1, pp. 264–268.