Iot Based Underground Cable Fault Detection Using PIC Microcontroller

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Abstract- *Monitoring and detection of High voltage stress in Underground cables. The monitoring of UG cables can be done by I2C protocol using embedded technology. Hall sensor is placed to measure the current level. Thus conversely provide the information about the UG cables. The data can be stored in master controller. Here, using PIC micro controller as a master. In case any abnormal voltage stress across the UG cable, the correction can be done in input side by using step-down transformer. The output side can be controlled. So that the balanced output got in the load side of UG cables. The fault message notification has been sent using IoT.*

Keywords- PIC Microcontroller, Relay, Hall sensor, Potential Transformer, Internet of Things, Step up Transformer.

I. INTRODUCTION

Today the world is facing a great challenge due to deregulation and growing demand of electrical power. Optimum power flow in proper environmental conditions and on commercial terms has increased the responsibilities of the power utilities. So its utilities work to provide most effective, environment-friendly, reliable and optimal power to consumer. Electric power can be transported from generating stations to load areas either by overhead lines system or by underground cables. The growing demand of electric power has led utilities to analyze both overhead and underground power distribution system considering their reliability, liability, maintenance and installation cost. Many countries like United States, European Union, and Australia are considering revising protocol for new power distribution installations and/or converting existing infrastructure to underground mode. Overhead lines have been considered generally most reliable for transmission and distribution of power technically and economically for many years. But modern technology has made possible to fabricate and utilize the highly reliable high voltage cables with overhead lines to improve the overall power network performance. Deregulation of the electricity supply markets and growing environmental awareness are creating exciting new markets for power transmission solutions based on underground cable technology.

Underground cable network now has become an important element in the power delivery chain from sub transmission to the doorstep of consumer. Importance of underground cable network and its efficient management in the modern day electric utility is of prime importance. Underground cable network has silent benefits of reliability and safety endowed with suitable technological developments. The underground cable has several advantages like less liable to damage through storms or lightning, low maintenance cost, less chances of faults, smaller voltage drop and better general appearance. However, their major drawback is that they have greater installation cost and introduce insulation problems at high voltages compared with the equivalent overhead system. For this reason, underground cables are employed where it is impracticable to use overhead lines. Such locations may be thickly populated areas where municipal authorities prohibit overhead lines for reasons of safety, or around plants and substations or where maintenance conditions do not permit the us of overhead construction.

II. SYSTEM ANALYSIS

IoT based underground cable fault detection using PIC controller is a system that enables detection of underground cable faults using PIC microcontrollers. The system consists of a main controller, a communication interface, and an underground cable fault detection sensor. The main controller is a PIC (Programmable Interrupt Controller) microcontroller that continuously monitors the condition of the underground cable. The communication interface allows the PIC controller to communicate with the sensor, the other components of the system, and the end user. The sensor is used to detect any faults in the underground cable, and the data is then sent to the PIC controller.

The PIC controller then processes the data and sends it to the communication interface, which relays it to the user. The user receives the data and can use it to detect the fault in the underground cable. The PIC controller can also be programmed to alert the user when the fault is detected. This system can be used to detect any kind of fault in the underground cable, such as shorts, opens, or breaks.

This system is reliable and efficient as it can detect faults in the underground cable quickly and accurately. It is also cost-effective as it does not require any additional equipment for installation. This system can be used for a variety of applications, such as detecting gas leaks, detecting water leaks, and monitoring the temperature of underground cable.

III. PROPOSED METHODOLOGY

The main function of the electrical transmission and distribution systems is to transport electrical energy from the generation unit to the customers. Generally, when fault occurs on transmission lines, detecting fault is necessary for power system in order to clear fault before it increases the damage to the power system. Although the underground cable system provides higher reliability than the overhead line system, it is hard to seek out the fault location. The demand for reliable service has led to the development of technique of locating faults. Cable faults are damage to the cable which affects a resistance in cable. If allowed to persist, this can lead to a voltage breakdown. As the cable fault detection is the process of locating the periodic fault, a programmed PIC microcontroller will display the precise digital value of series resistance voltage drop converted by ADC. This method deals with PIC and LCD. This system greatly reduces the time and operates effectively.

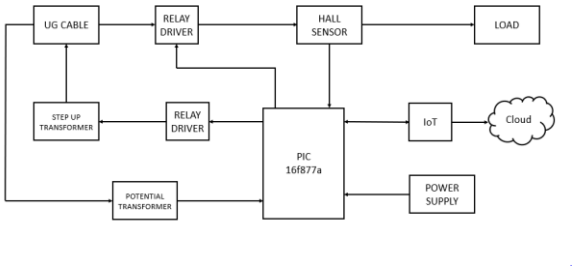

Figure1. Block Diagram

IV. SYSTEM DESIGN

The proposed system is used to monitoring and detection of High voltage stress in Underground cables. To implement the system which consist of Hall sensor, step-up transformer, and PIC micro controller. Hall sensor is placed to measure the current level. Thus conversely provide the information about the UG cables. The data can be stored in master controller. Here using PIC micro controller as a master. In case any abnormal voltage stress across the UG cable, the correction can be done in input side by using step-down transformer. In output side can be controlled by step up transformer. So that balanced output is maintained in the UG cables.

V. EXPRIMENTAL SETUP

An IoT enabled network must be setup with the PIC controller as the central controller.A series of sensors must be connected to the PIC controller to detect any faults in the underground cable lines. These sensors will be able to detect any faults like short circuits, burnouts, overloads, etc.The PIC controller must be programmed to read the data from the sensors and send the data to a remote monitoring system.

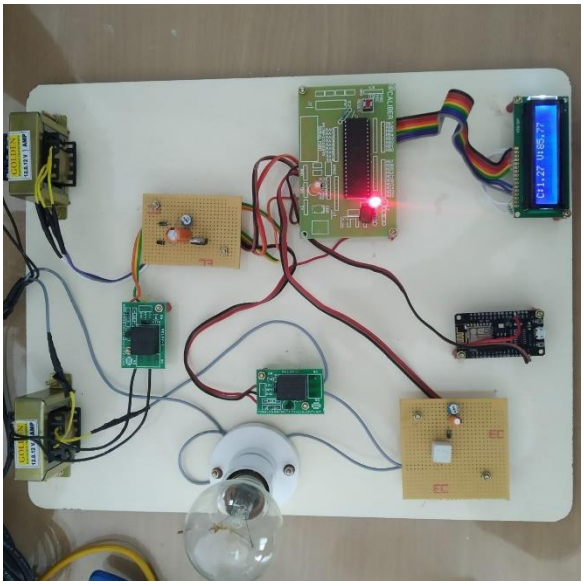

Figure2. Snapshot of Proposed Hardware Kit

The remote monitoring system must be setup to receive the data from the PIC controller and display it in a graphical user interface. The graphical user interface should be able to display the data in a readable format so that an operator can interpret the data and take necessary action. The PIC controller should be programmed to generate an alert message in case of any faults detected by the sensors. A separate system should be setup to receive the alert messages and record the data for future reference.

VI. RESULT AND DISCUSSION

The system was successful in detecting and locating the faulty cable precisely and in a timely manner, without the need for manual intervention. The system also proved to be highly reliable, with accurate fault detection even in harsh weather conditions.

Figure3. Status of current and voltage of UG cable

The main advantage of this system is its ability to detect and locate faults at an early stage, sending alerts to the concerned personnel notification. The system was able to detect faults such as short circuit and open circuit accurately.

Figure4. Voltage stress detection notification

The PIC controller used in the system played a crucial role in implementing the fault detection algorithm. The controller was programmed to analyze the data obtained from the sensors installed at the cable ends and detect the fault. Upon detection of the fault, the controller sent a signal to the GSM module to send notification alerts to the concerned authorities.

Figure4. Open circuit fault detection

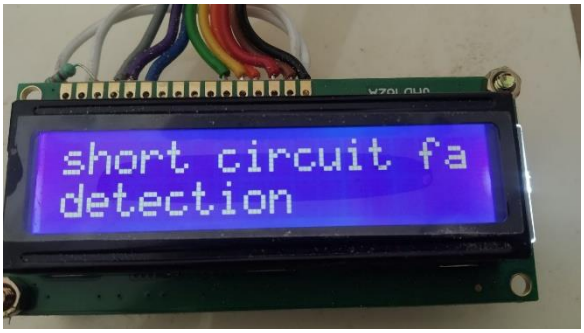

Figure5. short circuit fault detection

The IoT-based approach enabled the system to be remotely monitored and controlled. The data obtained from the sensors was transmitted to the cloud, where it could be analyzed and stored for further analysis. The cloud-based system also enabled the concerned authorities to access the real-time status of the cable network from any location.

Overall, the IoT-based underground cable fault detection system using PIC controller proved to be a reliable and efficient method for detecting cable faults. The system's accuracy in detecting and locating the faults, coupled with its cloud-based monitoring capability, makes it an ideal solution for power utilities. The system's ability to send alerts to concerned personnel ensures swift action is taken to restore power supply and minimize downtime.

EXISTING SYSTEM	**PROPOSED SYSTEM**
No detection of voltage stress level.	Detection of voltage stress level and correction made.
No use of sensor	Hall sensor is used
Arduino controller is used	PIC controller is used
IoT not Interfaced	IoT Interfaced

Table1. Comparison of proposed system with existing system

VII. FUTURE SCOPE

It is wide and varied. It can be used to detect cable faults in a variety of applications, from residential to industrial. It can be used to detect problems in buried or submerged cables and canbe used to detect potential damage

to cables due to natural disasters such as floods or earthquakes.

It can also be used to detect cable faults in remote locations, such as the ocean floor, by using long-range acoustic sensing technology. Additionally, the use of IoT-enabled devices can enable real-time monitoring of cables and provide proactive alerts when faults are detected. This can enable quick response times and help reduce downtime. Finally, the use of AI-based algorithms can help to improve the accuracy and speed of fault detection, making it more reliable and efficient.

VIII. CONCLUSION

Monitoring and detection of voltage stress in MV or HV Underground cables can be done by embedded technology. I2C protocol was implemented successfully in this system. Master and slave operation controlled by PIC 16f877a microcontroller andIOT ESP8266 device. Abnormal voltage stress across the UG cable could be corrected by using step up and step down transformer. In this work the short circuit fault , low voltage fault, high voltage fault at a particular distance in the Underground Cables can be detected using Ohm's Law which enables to rectify fault efficiently. This system can be beneficial to the underground cables.

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