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IOT Based Underground Cable Line Fault Detection

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ABSTRACT: IOT based underground cable line fault detection system is helpful for find out faults and its location in very easy manner .Underground cables have been widely used with the development of power system grid .Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear, rodents .Detecting fault source is difficult because entire line is to be dug in order to check fault at cable line. The repairmen know exactly which part has fault and only that area is to be dug to detect the fault source. Thus it saves a lot of time, money and allows to service underground cable lines faster. We use IOT technology that allows the authorities to monitor and check faults over internet. The system detects fault with the help of potential divider network laid across the cable. When a fault gets created in a cable line, a specific voltage gets generated as per the resistors network combination. This voltage is sensed by the microcontroller and is updated to the user. The information conveyed to the user is the distance to which that voltage corresponds to. The microcontroller detects the fault cable line data and displays this data over LCD display, it transfers this data over internet to display online. Thing Speak to develop the online system that links with the system to display the cable faults online.

KEYWORDS: Thing Speak

1. INTRODUCTION

Underground cables have been widely used with the development of power system grid. Till last decades cables were made to lay overhead & currently it is to lay underground which is superior to earlier method. Because the underground cable are not affected by any adverse weather condition such as storm, snow, heavy rainfall as well as pollution. But when any fault occur in underground cable, then it is difficult to locate the exact location of fault. Today the world is become digitalized so this paper is intended to detect the location of fault in digital way. The underground cable system is more common practice followed in many urban areas. While faults can occur for different reason in cableline, the repairing process related to that particular cable is difficult due to not knowing the exact location of cable fault. As it is very difficult to find the exact location or faulty location maually, which suddenly affects the efficiency of the cable wire due to losses occurred. Nowadays many techniques had already been implemented in order to detect cableline fault. But the problem came up is how to detect fault in cable wire when it is under grounded, and how to access or retrieve those data related to faulty location whenever it is required.

In order to fill those gaps, we proposed the system which detects the exact location of the fault and through the means of IoT it's serially communicated towards server. The project "IoT based underground cable line fault detection system "is used for find out and locating the faults. The manual method is very time consuming. Here, we propose a cable fault detection over IoT that detects the exact fault position over IoT that makes repairing work very easy. For most of the worldwide operated low voltage and medium voltage distribution lines underground cables have been used from many decades. The complexity of the whole network comprises numerous components that can fail and interrupt the power supply for the end user. Use of underground power cable is expanding due to safety considerations and enhanced reliability in transmission and distribution in recent times. Due to safety reasons and high power requirements use of underground cables has been increased. To increase the reliability of the system proper fault detecting and locating techniques are required. The inaccessibility of the underground cable makes the location and detection of fault in the cable a challenging task. The fault detecting and locating techniques play a very important role in maintaining the system and thereby increasing the reliability.

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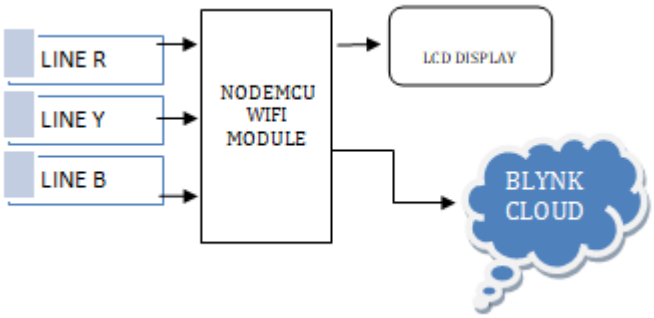
II. LITERATURE SURVEY

The following papers propose IoT-based systems for detecting faults in underground cables using sensors and alerting users through mobile devices or central servers:

B. Nithya et al.: A fault detection system with high accuracy and efficiency. N.H. Amina et al.: A fault detection and location system that also includes GPS and a mobile app for real-time monitoring. N. Nithya and S. Priya: A cost-effective system based on wireless sensor networks and accurate detection through changes in electrical parameters. M.K. Biswas et al.: A reliable and efficient system that uses Raspberry Pi and cloud analysis to measure current and voltage. M. Rathinam and S. Sathiyabama: A system that employs machine learning algorithms for accurate and efficient fault detection. Overall, these papers report the effectiveness of their IoT-based systems for fault detection in underground cables, with various advantages such as accuracy, cost-effectiveness, reliability, and additional features like GPS, mobile apps, or machine learning.

III. BLOCK DIAGRAM



IV. DESIGN AND METHODOLOGY

Many techniques have been developed in cable line fault detection over the last few decades. Generally we use overhead lines. It can easily identify the faults but in rushed places or familiar cities we can't use overhead lines. So, we are moving to underground cables. In this paper it use IoT technology that allows the authorities to monitor and check faults over internet. The system detects fault with the help of potential divider network laid across the cable. Whenever a fault gets created at a point shorting two lines together, a specific voltage gets generated as per the resistors network combination. As the existing system is not efficient ,this paper propose a system based on IoT. The objective of this project is to determine the distance of underground cable fault from base station in kilometers using an IoT Gecko platform. The underground cableline system is used in many urban areas. Various fault locating methods like the sectionalizing methods, acoustic detection method, Murray loop methods are not used much because they suffer from many disadvantages. The sectionalizing method can't be employed because section wise checking of underground cable is not possible. The acoustic method may become disastrous at the time of rain and it is a bit cumbersome method too. The Murray loop method is based on the principle of Wheatstone and due to different resistances of leads There are many electrical, telephone and other signal cables are laid underground. In normal methods we have to check with the machine where the fault is occurred .

It required lot of time and the workload is also more. In IoT based underground cableline fault locator whenever a fault is occurring in the cable line we can see the location in the IoT Gecko online system. Then the admin can inform to the repairman. Many time faults occur due to construction

works and other reasons. It is difficult to dig out cablelines full because it do not know the exact location of the cableline fault. In case if it is a short circuit , the voltage across series resistors changes accordingly. This voltage is sensed by the microcontroller and is updated to the user. The information conveyed to the user is the distance to which that voltage corresponds to the fault occurring at a particular distance and the respective phase is displayed on a LCD and also it transfers this data over internet to display online. This paper use Thing Speak to develop the online system that links with the system to display the cable faults online. The project is assembled with a set of resistors representing cable length in KM's and fault creation is made by a set of switches at every known KM to cross check the accuracy of the same.

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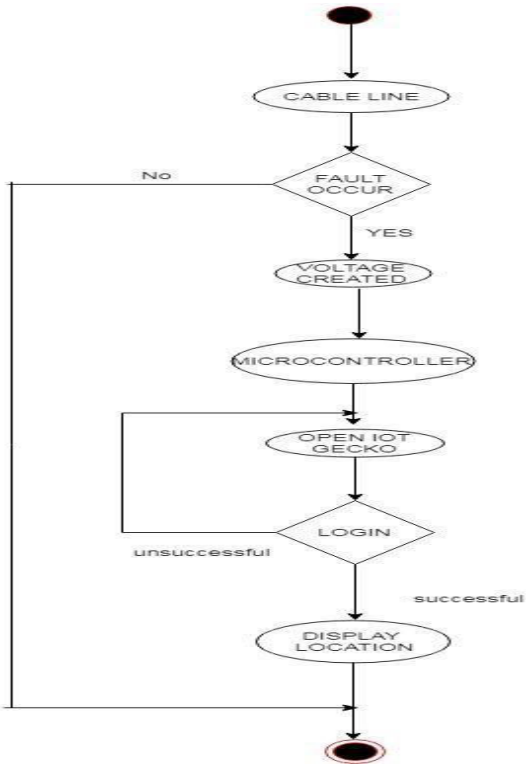

Figure 1: Flow chart of the System

HARDWARE DESCRIPTION:

RECTIFIER

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as *rectification*, since it "straightens" the direction of current. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, stacks of copper and selenium oxide plates, semiconductor diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches.

REGULATOR

A regulator is a device which has the function of maintaining a designated characteristic. It performs the activity of managing or maintaining a range of values in a machine. The measurable property of a device is managed closely by specified conditions or an advance set value; or it can be a variable according to a predetermined arrangement scheme. It can be used generally to connote any set of various controls or devices for regulating or controlling items or objects.

LCD DISPLAY

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light- modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. Each pixel of an LCD typically consists of a layer of molecules aligned between two transparent electrodes, and two polarizing filters the axes of transmission of which are perpendicular to each other.

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WIFI MODULE

WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

TRANSFORMER

Transformer is static device which transfer electrical energy from one circuit to other circuit with change in voltage or current without change in frequency. In this step down transformer is used. Usually, DC voltage s are require d to operate various electronic equipment and these voltages are 5V, 9V or 12V.

RELAY DRIVER

A Relay driver IC is an electro-magnetic switch that will
be used whenever we want to use a low voltage circuit to switch a light bulb ON and OFF which is connected to 220V mains supply. There are various ways to drive relays. Relays are switches that open and close circuits electromechanically or electronically.

MICROCONTROLLER

A microcontroller is a small computer on a single integrated circuit. In modern terminology, it is similar to, but less sophisticated than, a system on a chip or SoC; an SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (pro along with memory and programmable input/output peripherals.

SOFTWARE SPECIFICATION:

C LANGUAGE

A programming tool or software development tool is a
program or application that software developers use to create, debug, maintain or otherwise support other programs and applications. The term usually refers to relatively simple programs that can be along with application and system software. C is a general-purpose, imperative computer programming language, supporting structured programming, lexical variable scope and combined together to accomplish a task, much as one might use multiple hand tools to fix a physical object.

EMBEDDED C

Use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements.

THINGSPEAK

According to its developers, "Thing Speak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thing Speak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates".

Thing Speak was originally launched by ioBridge in 2010 as a service in support of IoT applications. Thing Speak has integrated support from the numerical computing software MATLAB from MathWorks, allowing Thing Speak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from MathWorks.

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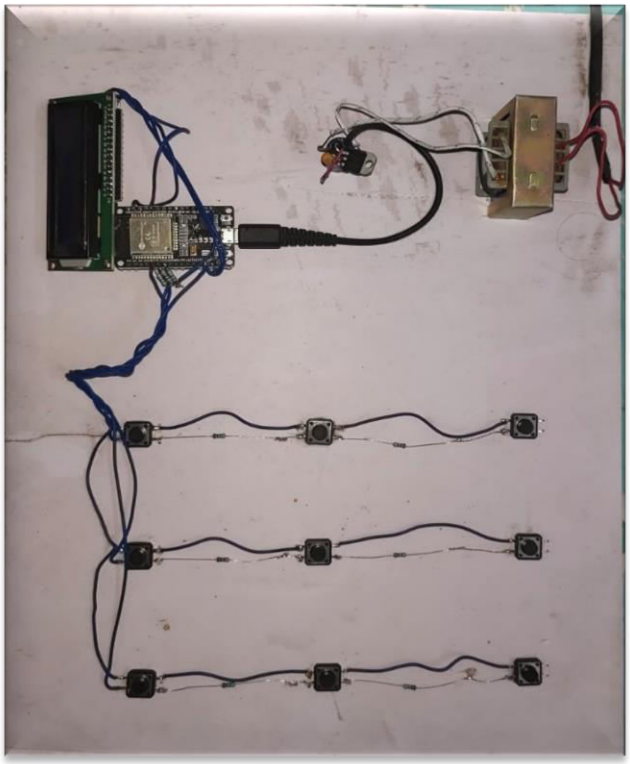

Hardware Design

V. CONCLUSION

The paper IoT based underground cable line fault detection system was executed successfully. which makes fault detection very easier.It can clearly determine the location where the fault is occurred .The repair man only need to dug the place where fault is occurred. This paper enables the researchers to detect and locate the faults in underground cable with the help of IoT Gecko. Hence, the method used in this paper operates in a sequential manner and proves to be useful in detection and location of faults in underground cables

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