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Installing A Cable Fault Detector Underneath

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Abstract: *The project's goal is to calculate the underground cable fault's distance in kilometres from the base station. In many urban locations, the underground cable system is a standard practice. When a fault in a cable arises for any reason, it is challenging to repair that cable since it is difficult to pinpoint the specific position of the fault. The proposed system was designed to locate the fault precisely.*

Keywords: *cable fault detection, LCD, Arduino, Voltage cables*.

I. INTRODUCTION

Underground cables have been extensively used for power distribution networks over the years. This is because of their suitability for underground connections, better security from activities of vandals and thieves, and resistance to hazardous climatic conditions such as thunderstorms and whirlwind. They are cheap, easy to maintain and environmentally friendly. They have reduced maintenance and operating costs such as lower storm restoration cost. Also, underground cables eliminate the menace of wind-related storm damage. They are not subjected to destruction caused by flooding which usually spoil and interrupt electric service. They ensure fewer transitory interruptions through tree falling on wires or electric poles falling down thereby improving public safety. Life-wire contact injuries is drastically reduced. It leads to the elimination of unattractive poles and wires on the streets thereby enhancing the visual range of the drivers and pedestrians on the streets [1].

Voltage cables are being used more and more. Despite these blessings, finding fault with underground cables can be a downright daunting task. Therefore, it is crucial for the growth of a very green technology to detect faults in those cables. These documents aim to design a device that can identify faulty factors in an

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underground cable to facilitate faster recovery, improve system reliability, and minimize downtime. Underground cabling rig can be very useful for distribution especially in big cities, airports and security shows.

When faults appear, energy flow is redirected towards the fault and supply is prevented to the community [2]. Ultimate voltages are unstable. Timely detection of faults is very vital in electrical cables. To achieve this, a microcontroller is used in this document to quickly find four main types of faults and send a trigger signal to the relay. Our contribution to this research is the design and operation of an underground cable fault locator which can be used to find faults within a line and isolate the relevant equipment or the equipment connected to it. The device has the ability to find the type of error that occurred on a faulty line. An Atmega328p microcontroller is used to locate the fault through the designed circuit, moreover, it is displayed on the LCD screen. A relay circuit is also connected to the circuit to prevent the system from breaking by separating the faulty circuit from the healthy circuit. The proposed system works with the help of first converting the analogue indicators into virtual signals. These alerts are generated using the microcontroller, the microcontroller will evaluate the default signal for the input from the ADC and check the given set value range, if the input is above or below the set value range, the microcontroller will send a signal to the relay to assemble the circuit and also send a parallel signal to the LCD To show the type of error that occurred. Thus, the flight is performed and the perception of the type of error in this work [3].

Embedded systems are designed to perform a few specific tasks, rather than being a laptop of choice for some obligations. Some of them also have general real-time performance limitations that must be met, in addition to protection and utility; Others may also have low or no overall performance requirements, allowing system hardware to be simplified to reduce costs.

Wireless communication has become an important function of industrial products and a popular research topic in the past ten years. In fact, there are more cell phone subscriptions than stressful line subscriptions. Recently, an area of commercial interest has been low-value, low-power, short-distance Wi-Fi connectivity used for non-public Wi-Fi networks." Technological improvements provide smaller, more powerful devices for

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incorporating computational processing. With new technologies and devices come commercial sports and the need for staff in those areas of technology. There may be a high demand for engineers with insight into embedded systems and wireless communications. Unfortunately, there are few attractive environments to work in for development and classroom use, so students do not regularly learn about the technology in Sometime through hands-on physical laboratory activities. Communication media were twisted pair, optical fibre, infrared, usually wireless radio.

Introduction to Arduino

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without working too much about doing something wrong, worst-case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

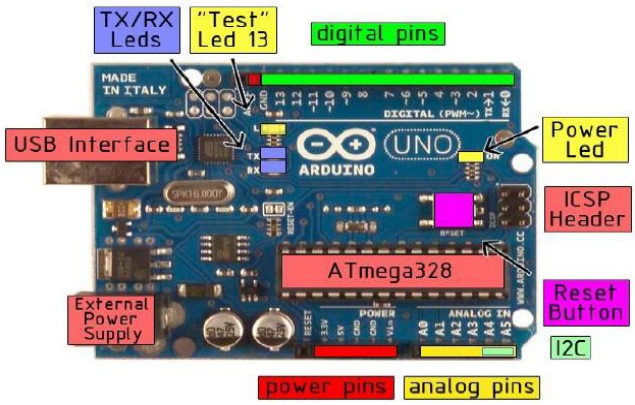

Fig.1 Arduino design

II. LITERATURE SURVEY

Over the years, researchers have made several efforts to design and implement an electronic underground cable fault detector that will help to overcome the problems as well as challenges encountered in the use of underground cables and detection of faults that occurs in the underground cables but unfortunately, there were limitations to their designs.

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A broad deficiency area model for underground force cable in conveyance Framework utilizing voltage current estimations at the sending-end has just been proposed by Yang, Xia, in a paper distributed in November 2008. The paper presents an investigation of a proportional circuit that models a blamed underground cable framework utilizing circulated parameter approach. Investigation of succession organizes in three-stage arrange by applying the limit conditions is additionally introduced. Utilizing the examination, he area of the issue is resolved with the assistance of current and voltage conditions.

Zhao, W [4], proposed a superior way to deal with cable flaw area framework, basically comprising of synchronized testing method, wavelet investigation and voyaging wave standard. Alongside the prologue to three significant methods and a blueprint of the new plan, this paper presents a definite wavelet examination of broken transient waveforms and consequently decides the best wavelet levels for this specific application.

Gilany et.al [5] distributed in January 2007, introduced a wavelet-based issue area conspire for matured cable frameworks when synchronized advanced deficiency recorded information are accessible at the two terminals of the cable. The wavelet peculiarity identification hypothesis is utilized as an amazing sign handling device to appraise the area of the issue in multi end-matured cable frameworks.

Schulze et.al [6], "Two Terminal Fault Location on Unsymmetrical Transmission Lines", IEEE,2010 , introduced the blackout of a line because of an issue can be costly, subsequently the issue must be cleared as quick as could be expected under the circumstances. Computerized security transfers comprise of shortcoming locators dependent on a few strategies.

Xu Sun et al.[7] " Underground Power Cable Detection and Inspection Technology Based on Magnetic Field Sensing at Ground Surface Level ", IEEE ,2014 introduced that IOT based underground cable line shortcoming discovery framework being useful to discover flaws and its area in simple way .Underground cables have been broadly utilized with the advancement of intensity framework lattice.

Manish Paul et.al.[8] 'Underground Cable Fault Locator 'says that before endeavoring to discover underground cable blames on direct shrouded essential cable, it is basic to realize where the cable is arranged and what course it takes. On the off chance that

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the issue happens on the auxiliary cable, at that point realizing the specific course is much progressively basic. Since it is very hard to locate a cable deficiency without realizing where the cable is, it bodes well to ace cable finding and following before start the shortcoming finding process.

In [9] Developed a prototype that uses the idea of OHMs law to detect faults in cables. The proposed system uses a set of resistors representing cable distance in Kilo meters and fault detection is by a set of switches at every Kilometer (kms) to validation the accuracy of the detection. The type of fault at any particular distance is displayed on the LCD interfaced with the microcontroller. Their work is only simulation as no design and construction work is involve

In [10] proposed fault location model for underground power cable using microcontroller. The hardware model of Underground Cable Fault Locator is implemented and favorable results were brought forward. This hardware model can locate the exact fault location in an underground cable. There needs to further enhance the work so that it can also locate open circuited cable

III. PROPOSED SYSTEM

To achieve the implementation of the microcontroller based underground cable fault detector some approach was taken. First is designing the circuit on a computer system, collection of the electronic components and other materials required for the project. After which the programming of the ATmega328p microcontroller using programmer kit was done. The components were assembled to the project board (temporary board) and tested before transferring it to the Vero board (permanent board). Finally, the entire system was tested and the casing was done.

The proposed system is an IOT enabled underground cable fault detection system. The basic principle behind the system is Ohms law. When fault occurs in the cable, the voltage varies which is used to calculate the fault distance.

• The system consists of Wi-Fi module, Microcontroller, and Real-Time Clock.

• The power supply is provided using step-down transformer, rectifier, and regulator. The current sensing circuit of the cable provides the magnitude of voltage drop across the resistors to the microcontroller and based on the voltage the fault distance is located.

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In this section, the design, analysis, specification as well as method or steps taken to realize the implementation of the microcontroller based underground cable fault detector was described. The design of the system is made up of several units. Figure 2 shows the power supply unit, probe terminal unit, microcontroller unit and LCD display unit.

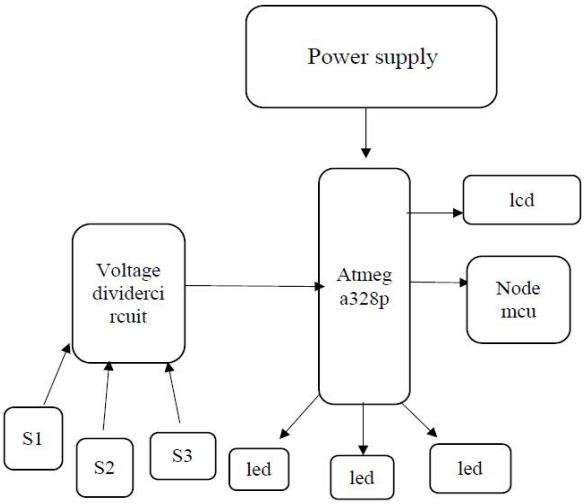

Fig.2 Block diagram

IV. RESULTS

Power Supply

All digital circuits require regulated power supply. In this article we are going to learn how to get a regulated positive supply from the mains supply

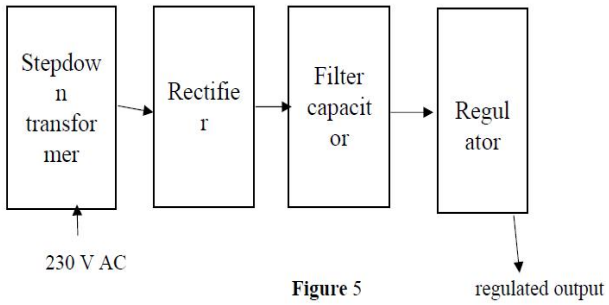

Figure 5

Fig.3 Power supply

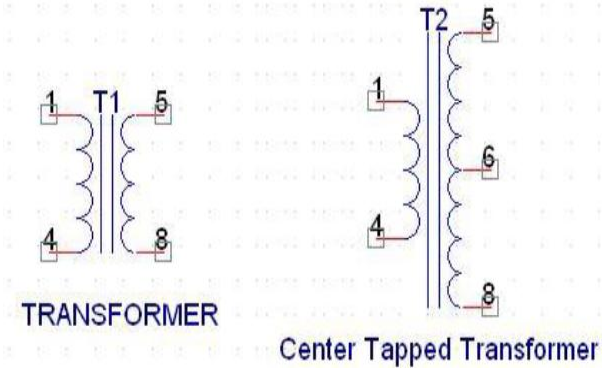

Fig.4 Transformer

A transformer consists of two coils also called as “WINDINGS” namely PRIMARY & SECONDARY

Circuit Diagram

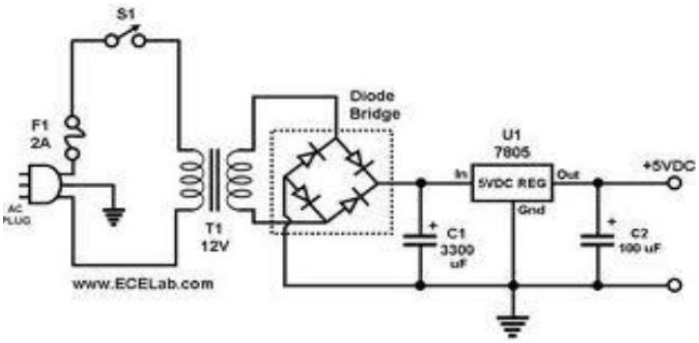

Fig.5 Circuit diagram

IC 7805:7805 is an integrated three-terminal positive fixed linear voltage regulator. It supports an input voltage of

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10 volts to 35 volts and output voltage of 5 volts. It has a current rating of 1 amp although lower current models are available. Its output voltage is fixed at 5.0V. The 7805 also has a built-in current limiter as a safety feature. 7805 is manufactured by many companies, including National Semiconductors and Fairchild Semiconductors.

The 7805 will automatically reduce output current if it gets too hot. The last two digits represent the voltage; for instance, the 7812 is a 12-volt regulator. The 78xx series of regulators is designed to work in complement with the 79xx series of negative voltage regulators in systems that provide both positive and negative regulated voltages, since the 78xx series can't regulate negative voltages in such a system.

The 7805 & 78 is one of the most common and well-known of the 78xx series regulators, as it's small component count and medium-power regulated 5V make it useful for powering TTL devices.

LCD Module

To display interactive messages, we are using LCD Module. We examine an intelligent LCD display of two lines,16 characters per line that is interfaced to the controllers. The protocol (handshaking) for the display is as shown. Whereas D0 to D7th bit is the Data lines, RS, RW and EN pins are the control pins and remaining pins are +5V, -5V and GND to provide supply. Where RS is the Register Select, RW is the Read Write and EN is the Enable pin.

The display contains two internal byte-wide registers, one for commands (RS=0) and the second for characters to be displayed (RS=1). It also contains a user-programmed RAM area (the character RAM) that can be programmed to generate any desired character that can be formed using a dot matrix. To distinguish between these two data areas, the hex command byte 80 will be used to signify that the display RAM address 00h will be chosen. Port1 is used to furnish the command or data type, and ports 3.2 to3.4 furnish register select and read/write levels. The display takes varying amounts of time to accomplish the functions as listed. LCD bit 7 is monitored for logic high (busy) to ensure the display is overwritten.

Liquid Crystal Display also called as LCD is very helpful in providing user interface as well as for debugging purpose. The most common type of LCD controller is HITACHI 44780 which provides a simple interface between the controller & an LCD. These LCDs are very simple to interface

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with the controller as well as are cost effective.

2x16 Line Alphanumeric LCD Display

Fig.6 LCD

ESP 8266

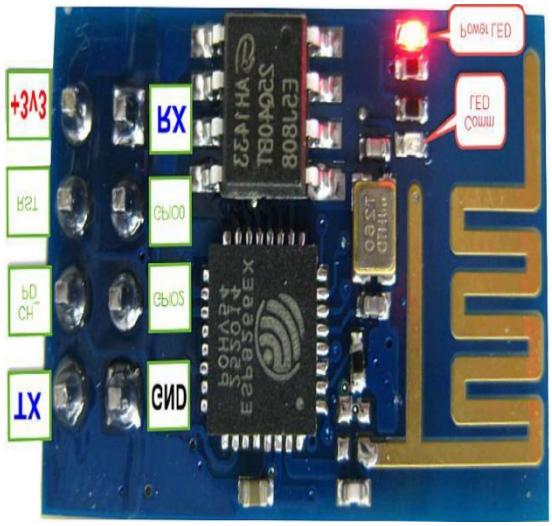

Fig.7 ESP 8266

ESP8266 Features

1)802.11 b/g/n protocol

2)Wi-Fi Direct (P2P), soft-A

3)Integrated TCP/IP protocol stack

4)Integrated TR switch, balun, LNA, power amplifier and matching network

5)Integrated PLL, regulators, and power management units

6)+19.5dBm output power in 802.11b mode

7)Integrated temperature sensor

8)Supports antenna diversity

9)Power down leakage current of < 10uA

10)Integrated low power 32-bit CPU could be used as application processor

V. CONCLUSION

The project "UNDERGROUND CABLE FAULT DETECTION" has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

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