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MONITORING UNDERGROUND CABLE FAULTS USING IOT

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Abstract: Underground cable systems are widely used in cities. Because of the wide range of possible causes for cable problems, locating the exact site of the problem during removal or repair can be difficult. This study suggests a technology solution that uses a Wi-Fi module to determine the location of the problem before passing that information to a chosen website via the internet. As a result, the authorized party on the other end will have additional information.
Keywords:- ADC MCP 3204, Relay Driver ULN 2803 , ATMEL AT89s52 MSC-51, Wi-fi Module ESP-8266.

1. INTRODUCTION

Global electrical distribution systems have relied on underground wires for many decades. Underground voltage lines are often utilized to strengthen distribution networks against external forces. Underground cables are widely used in electrical grids due to the numerous advantages they offer over other connection kinds. Underground wires give more safety and protection from storms and lightning than above-ground cables in inclement weather. It is less expensive across longer distances, is less damaging to the environment, and requires little upkeep. However, if a wire does break, determining the source of the problem may be challenging. This technique is then used to determine the type of problem discovered digitally. Locating the broken segment of an underground cable speeds up power restoration, improves system stability, and eliminates outages.

2. TYPES OF FAULTS & DETECTION

Microcontroller code is transmitted to locate specific faults in underground lines. A microcontroller and an LCD screen that displays the distance in kilometers can help us locate an underground cable problem.

Switches are used to manually activate the blunders. Cables come in a range of shapes and sizes. Each wire has a distinct resistance that is defined mostly by its constituent elements. The resistance value changes with cable length. Voltage varies in response to changes in resistance. The technical name for this circumstance is a flaw. The many mistake categories are listed below.

If the insulator fails between the phase conductors or between the phase conductor and the ground, a short circuit ensues. When insulation fails, electricity can flow more freely, resulting in a short circuit.

Open Circuit Fault

When a circuit is broken in any way, an open-circuit defect arises. When a circuit is not closed, it is called "open."

Earth Fault

An earth fault occurs when a charged conductor mistakenly makes contact with the earth or another machine. The fault current returns to its source via the grounding system and anything grounded to it.

3. BLOCK DIAGRAM DESCRIPTION

The proposed system employs Ohm's law, relay switches, and microcontrollers to discover problems in subterranean cables that are away from the base station. This division creates four unique subsets, as seen in Figure 1.

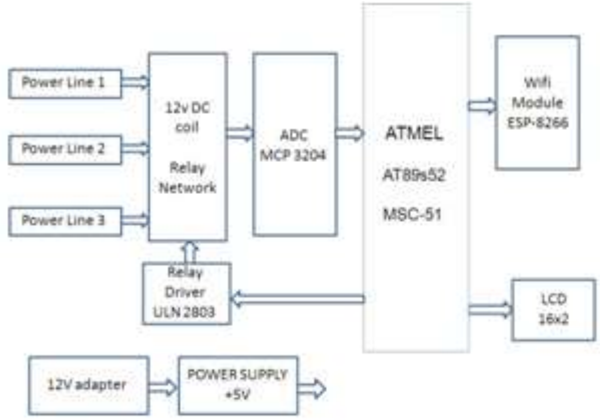

Fig.1. Flowchart depicting the procedure

DC power supply

A step-down transformer reduces the voltage of the 230V AC source, a full-wave bridge rectifier converts the alternating current to direct current, and a regulator maintains the DC voltage.

Cable fault detection

The three-phase cable, resistor chain, and valves distinguish this component. The current-detecting components of the cable are a series of resistors and switches. This component causes the flaw, allowing the problem to be located anywhere.This section calculates the amount of current change by measuring the voltage drop caused by a change in resistance length.

Controlling

The functioning component includes an analog-to-digital converter (ADC), which receives an alternating current (AC) input from the current-detection circuit and transforms it to a digital signal for transmission to the microcontroller. The distance to the flaw is calculated by the microcontroller in the control unit using our code.

Display part

In the event of an issue, the LCD screen on this component is linked to a microcontroller and shows data regarding the cable's health and distance from the base station.

A series resistor is used in the suggested arrangement to provide a low DC voltage at the feeder end. This might be regarded as a rudimentary illustration of OHM's law. The quantity of current in the event of a short circuit varies with the length of the damaged wire. The voltage drop of the series resistor is modified here, and the ADC sends the relevant digital data to the programmed microcontroller, which displays the result in kilometers. Throughout the system, various resistor values are employed, such as a 1 kiloohm resistor for a 1 kilometer wire.

4. COMPONENTS

The system's components are as follows:-

Step Down Transformer

A step-down transformer positioned in the power supply portion reduces the 230V to 12V. The N1:N2 ratio, or the difference in the number of turns in the primary and secondary windings, determines how a transformer steps down.

Rectifier

The rectifier receives power from the transformer. It converts pulsating alternating current electricity to pulsed direct current power. A half-wave or full-wave converter will suffice. The system employs a bridge rectifier due to its extra advantages, such as its high degree of stability.A bridge is built in this circuit by connecting four diodes in series. A rectifier is a type of electrical component that converts alternating electricity (which can flow in either direction) into direct current. This is known as repairing something. Rectifiers are often employed in DC power supply systems and high-voltage DC power transfer systems, but they also have a wide range of other uses. However, the output of a rectifier is not limited to DC power.

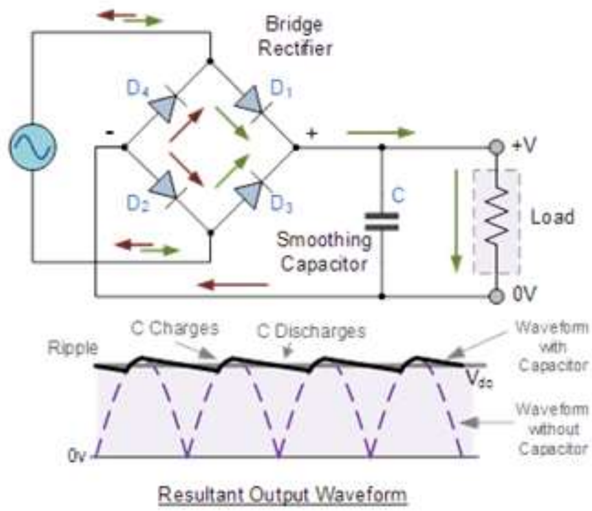

Fig.2. An illustration of a rectifier's circuitry

Voltage Regulator

A zener diode's voltage regulator function is widely used. This diode's voltage is controlled by a reverse bias.The proposed design necessitates the use of both a 5V and a 12V power supply. These voltage measurements would be obtained if a 7805 or 7812 voltage regulator was employed. The initial digit, 78, indicates a promising start. The second and third digits (05 and 12) show the appropriate quantities of output voltage. The L78xx family is a group of positive regulators with three terminals.

ADC

The MCP3204 is a 12-bit A/D converter that is very efficient and low-power, making it excellent for use in embedded control systems. The 12-bit ADC capability and industry-standard serial interface of the MCP3204 make it easy to integrate into any microcontroller. The MCP3204 has a sample rate of 100k samples per second and is used for low error output. The resolution for analog inputs is really high.

Microcontroller

In 1981, Intel introduced the 8051 line of 8-bit microcontrollers. This is a very popular microcontroller subfamily. The 8051 microprocessor was nicknamed a "system on a chip" because of its multiple integrated functions, which included several I/O pins, 128 bytes of RAM, 4Kb of ROM, two timers, one serial port, and four I/O pins. Because it is an 8-bit CPU, the 8051 can only process 8 bits of data at a time. When data shorter than 8 bits is broken into smaller chunks, the CPU can process it more quickly. Although the greatest amount of ROM that can be installed is 64 Kb, most manufacturers just install 4 Kb.

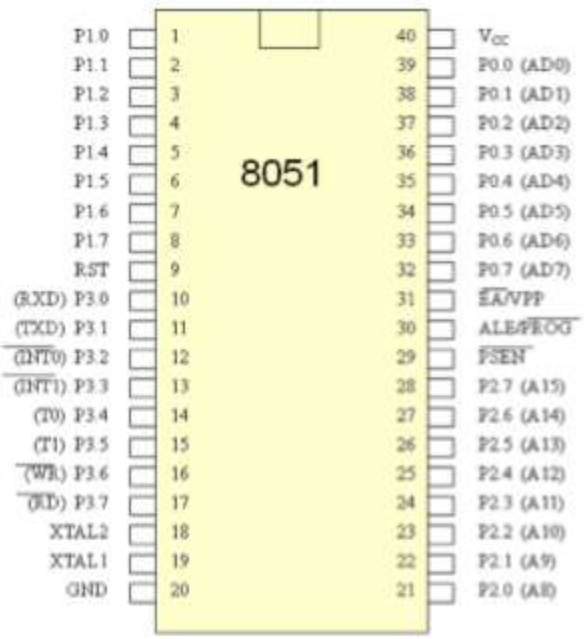

Fig.3. The pins on the microcontroller's function

LCD

Data can be exchanged between LCDs and microcontrollers.LCD display sizes that are commonly used are 16x2 and 20x2. Each column in a 16 by 2 grid represents the number 16, while each row represents the number 2. LCDs are commonly used in digital clocks and can display either random visuals (as on a general-purpose display) or predefined graphics with minimum visible or concealed information.

Wi-fi Module

The ESP8266 WiFi Module, with its built-in TCP/IP protocol stack, may act as a gateway for any microcontroller to access your WiFi network. The ESP8266 features on-board memory for program data and the ability to send updates to a defined server address on a regular basis. The AT command set software is already included with each ESP8266 module, so all you need to do to use it is connect it to a microcontroller. This has comparable WiFi capabilities to a WiFi Shield. The cheap ESP8266 module is supported by a big and active community.

5. ALGORITHM AND FLOWCHART

ALGORITHM

Step1
Initialize the ports, declare timer, ADC, LCDfunctions.
Step2
Begin an infinite loop; turn on relay 1 by making pin 0.0high.
Step3
Display "R:" at the starting of first line in LCD.
Step4
Call ADC Function, depending upon ADC output, displaysthe fault position.
Step5
Call delay.
Step6
Repeat steps 3 to 5 for other two phases.

FLOWCHART

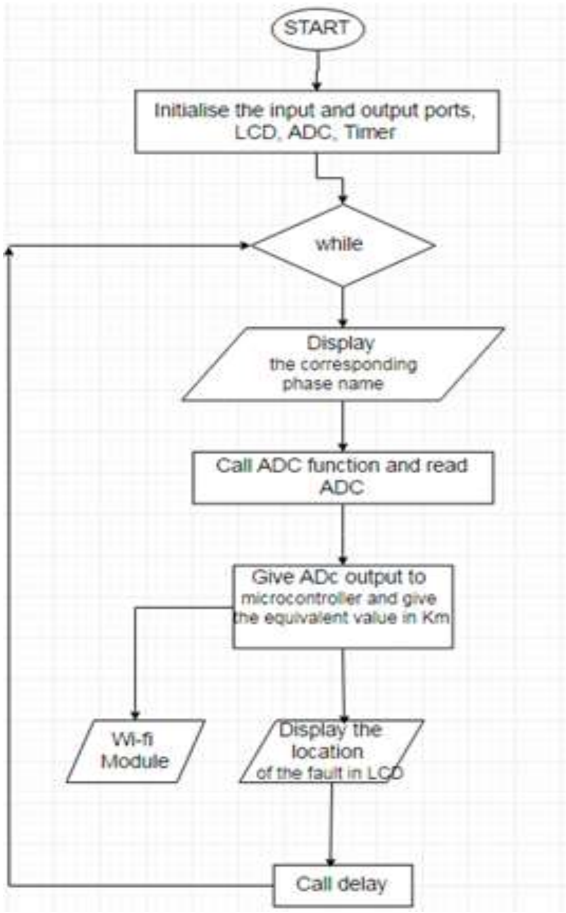

Fig.4. a diagram illustrating how the method works

6. CONCLUSION

It can be difficult to determine the best time to inspect buried wires for short circuits. Ohm's law helps us to precisely locate an issue in a specific wire phase. On a dedicated website, an Internet of Things (IoT)-enabled microcontroller and display gadget locate the location of a cable issue. The issue today is with the wire's right phase. The buzzer system will sound an alarm if there is an issue while uploading data to a certain website. A buzzer system will sound an alarm if an issue is found in a buried line. We can now deal with the problem right away.

7. FUTURE SCOPE

This study suggests a way for detecting buried cable line open circuit and short circuit problems. A capacitor is used in a circuit that senses variations in resistance and calculates the distance to the fault to locate open circuit faults. A similar neural network structure would be used in future studies to estimate fault section and location.

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