Underground Cable Fault Detection using Raspberry Pi and Arduino

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Abstract – The aim of this project is to determine the underground cable fault. This project uses the simple concept of CT Theory. When any fault like short circuit occurs, voltage drop will vary depending on the length of fault in cable, since the current varies CT is used to calculate the varying .The signal conditioner manipulates the change in voltage and a microcontroller is used to make the necessary calculations so that the fault distance is displayed by IOT devices.

Index Terms – Current Transformer, Fault Detection, Internet of Things.

1. INTRODUCTION

This project is to determine underground cable fault using specific application. If the short circuit or any physical damage is occurred then the voltage across cable lines changes .The changes which occurred can be calculated using CT theory.CT Theory provides simple and accurate means of sensing current flow in power conductors.Signal conditioner manipulates the analog signal for the further processing. Arduino is used to send the values to raspberry pi. The processed values are displayed in IOT devices.

2. RELATED WORK

A. UNDERGROUND CABLE FAULT DISTANCE CONVEYED OVER GSM

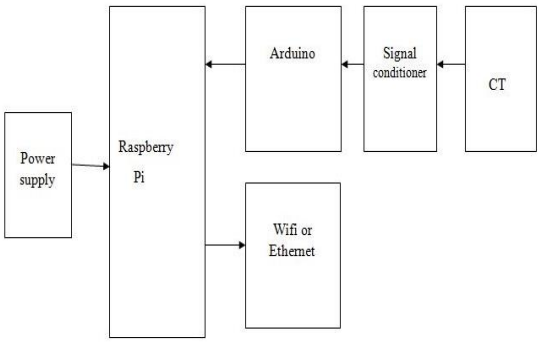
The underground cable fault is detect by applying a dc voltage at the feeder end through a series resistor, then the current would vary depending upon the location of the fault in the cable as the resistance is proportional to the distance and SMS is send to the mobile through GSM.

B. MULI CYCLE FAULT DETECTION AND LOCATION FOR MEDIUM VOLTAGE UNDERGROUND CABLE

This paper proposes a novel method for detecting and locating a multi-cycle incipient fault in a cable and location for medium voltage in underground cable. The incipient fault is modeled as a self-clearing arcing fault.

3. SYSTEM ARCHITECTURE

As per today's model trend the communication in urban areas are done by underground cable connection. If fault occurs in the cable it is difficult to find the exact location. The standard CT theory is used.CT Theory provides simple and precise denotes of sensing current flow in power conductors.Signal conditioner manipulates the analog signal for the further processingArduino is utilized to send the reading to raspberry pi.Incase of fault occurrence the values get exhibited in IOT display devices.



4. ADVANTAGE

Less maintenance. It has higher efficiency. Less fault occur in underground cable. No of faults can rectified using log in certain areas.

5. BLOCK DESCRIPTION

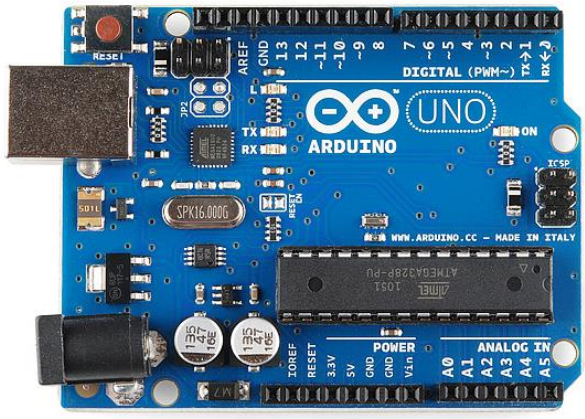
A. RASPBERRY Pi

The Raspberry Pi is the second generation Raspberry Pi. It replaced the original Raspberry Pi 1 Model B+ in February 2015. Raspberry Pi 1 it has: A 900 MHz quad-core ARM Cortex-A7

CPU, 512RAM.(Pi 1) Model B+, it also has: 2 USB ports, 26 GPIO pins, Full HDMI ports , Ethernet port, Combined

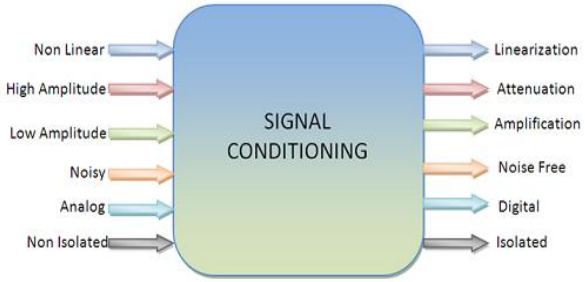
3.5mm audio jack and composite video,Camera interface (CSI),Display interface (DSI),Micro SD card slot.

B.ARUDINO



Arduino is an open source, computer hardware and software company project.The user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. This contains all the required support needed for microcontroller.

C.SIGNAL CONDITIONING

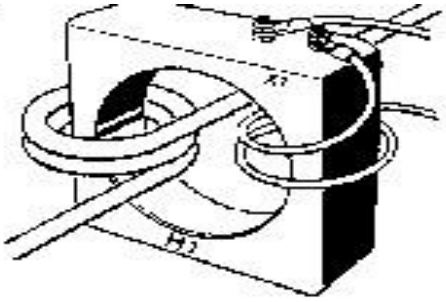


Signal conditioning is the manipulation of a signal that prepares it for the next stage of processing. Manipulating an analog signal in such a way that it meets the requirements of the next stage for further processing. Most common use is analog-to-digital converters Applications involve environmental or structural measurement, such as temperature and vibration, from sensors.

D. CURRENT TRANSFORMER

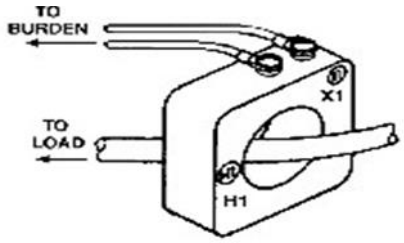
Current transformers (CT's) provide a simple, inexpensive and means of sensing current flow in power conductors. They are available in 3 basic configurations: Ring Core CT's are available for measuring currents from 50 to 5000 amps, with windows from 1" to 8" diameter. Split Core CT's are available for measuring currents from 100 to 5000 amps, with windows in varying sizes from 1" by 2" to 13" by 30". Wound Primary CT's are designed to measure currents from 1 amp to 100 amps. Wound primary CT's are available in ratios from 2.5:5 to 100:5

SELECTING CURRENT TRANSFORMER



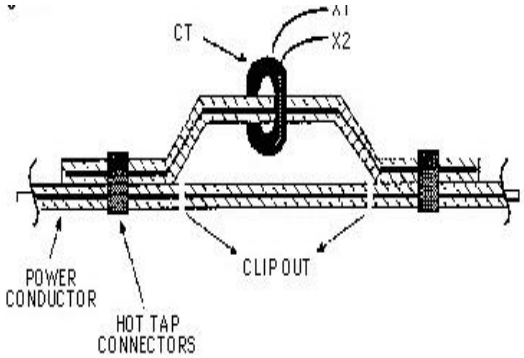
A "Selection Guide" is provided in this catalog to aid in selecting the type of CT for your application. Non-standard ratios can be obtained by looping the conductor through the window to add or subtract current flow.

Mounting CT's



CT's are generally located in the main breaker panel or in branch distribution panels where space is always at a premium. CT's do not have to be installed 90 degrees to the conductor run they are generally held in place with plastic tie wraps. CT's with mounting feet are available if appearance is important and there is enough room to accommodate this type of mounting arrangement.

Installing CT's



Window type CT's should be mounted with the H1 side of the window towards the power source. The X1 secondary terminal is the polarity terminal. The polarity marks of a current

transformer indicate that when a primary current enters at the polarity mark (H1) of the primary, a current in phase with the primary current and proportional to it in magnitude will leave the polarity terminal of the secondary (X1). If a CT test switch is used, the switch must have a "make-before-break" contact pattern to assure that the CT is not open-circuited during transition.

E. ETHERNET/WIFI

Ethernet is a family of computer networking technologies. It was commercially introduced in 1980 and first standardized in1983 as IEEE 802.System communicating over Ethernet divide a stream of data into shorter pieces called frames. Each frame contains source and destination addresses. Error checking data so that damaged frames can be detected and discarded frames can be detected and discarded. Ethernet evolved to include higher bandwidth, improved media access control methods, and different physical media. The coaxial cable was replaced with point to point links connected by Ethernet repeaters or switches.

WIFI

WiFi is a technology for wireless local area networking with devices based on the IEEE 802.11 standards.802.11 is the "radio frequency" needed to transmit Wi-Fi, it was defined by Vic Hayes who created the IEEE 802.11 committee. Devices that can use Wi-Fi technology includes personalcomputers,smartphones,digital cameras, tablet computers,digital audio players and modern printers.

6. MODULE DESCRIPTION

Current transformer for cable analysis sensing current flow in power conductors. Signal conditioner for converting values common use is in analog-to-digital converters Applications involve structural measurement, such as temperature and vibration.Arduino for interaction Arduino act as a interface between raspberry pi and signal conditioner.It process the analog values to digital values .The processed values fed into raspberry pi for necessary calculation.Raspberry pi 3 for creating log whwn the log is created the values are going for necessary calculations. Ethernet/WIFI for the visiblity of values.

7. CONCLUSION

Achieves higher detection accuracy, especially for high impedance incipient faults; Supervising almost the entire length of cable ,uses the simple concept of CT Theory so fault can be easily detected and repaired, it detect the exact location of short circuit fault in the underground cable from feeder end in km.

FUTURE SCOPE

In this project it detect only the location of short circuit fault in underground cable line, and also detect the location of open circuit fault hence by implementing a new technique we overcome this.

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