VIVA-TECH INTERNATIONAL JOURNAL
FOR RESEARCH AND INNOVATION

ANNUAL RESEARCH JOURNAL
ISSN(ONLINE): 2581-7280

DIFFERENTIAL PROTECTION OF TRANSFORMER USING ARDUINO

Prince Vishwakarma[1], Kushal Kolekar[2], Pratik Sawant[3],

Anojkumar Yadav[4]

[1](Electrical Engineering, VIVA Institute of Technology, India)
[2](Electrical Engineering, VIVA Institute of Technology, India)
[3](Electrical Engineering, VIVA Institute of Technology, India)

Abstract: *Transformers are the essential equipment in the power system. Therefore, the continuity of its operation could be very necessary. Differential safety approach may be hired to protect the Transformers. We have used differential relay mechanism with Arduino Nano & NodeMCU for IoT based Android App monitoring as well as local monitoring through I2C LCD. The NodeMCU is synchronized with Arduino microcontroller. Arduino Microcontroller is very high speed and cost-effective device with good accuracy. By programming in the Arduino, the protection of transformers may be done. Differential protection is employed for protection of transformer and that is done using Arduino as brains, the current sensor measure current entering and leaving the transformer and Arduino decide when to disconnect transformer according to ratio distinction and average of current*

Keywords - *Arduino,* ACS712, *LCD, Internet of Things, NodeMCU, Relay, Transformer, Thingspeak*

I.   INTRODUCTION

Transformers are an essential part of the electric system. Electricity systems experience errors at different times due to various reasons. There are different ways to protect the transformer, such as overcurrent, differential, etc. Each is used for different purposes. The type of transformer protection varies according to the application and the importance of the transformer. Transformers are specially protected from the outside as well as inner faults and overloads. The type of protection scheme used should minimize fault clearing time and should distinguish between fault conditions and overload conditions. Here the differential protection scheme for internal faults is used. Here in this schematic, we have used the microcontroller instead of the CTs and the mechanical relay. Here, the use of a microcontroller instead of a conventional relay offers many advantages such as fast fault detection and elimination and cost reduction compared to electromechanical and solid-state relays, relays based on a microcontroller perform real-time calculations that improve relay performance, facilitating faster and safer protection. for power transformer.

There is over current protection and protection against over fluxing. The magnetic flux will increase at the same time as the voltage will increase. This results increased iron loss and magnetizing current which leads insulation harm and over voltage protection. Lightning overvoltage surges originate from atmospheric discharges and they can reach their peak within a microsecond and subsequently decay very rapidly. Percentage differential current protection for the protection of transformers against internal short circuits and it gives the best overall protection for inner faults.

II.   SYSTEM ARCHITECTURE

2.1 Hardware Description

2.1.1 Arduino Nano

The Arduino is an open-source microcontroller board which based on the microchip ATmega328P. The IDE Arduino is used to program the microcontroller. It allows to read data coming from sensors and Arduino

IDE uses a simplified version of C++. In this research the Arduino platform has been used for building the hardware interface that interacts with web system

2.1.2 ACS712

The ACS712 module uses the famous ACS712 IC to live the current victimization of Hall's result principle. You need to choose the right range for your project as you will sacrifice accuracy for longer range modules have to. These modules output analog voltage (0.5V) compatible with the present flowing through the cable; Therefore, it is very easy to connect this module to any microcontroller

2.1.3 Transformer

Transformer is essential part of electrical system. A varying current in a transformer coil produces a varying magnetic flux, which in turn induces a varying electromotive force through a second coil wound around the same core. Electricity can be transferred between the two coils, without a metallic connection between the two circuits. Faraday's law of induction discovered in 1831 described the effect of voltage induced in any coil due to the change in magnetic flux surrounded by the coil. Transformers are used to step up or step-down alternating voltages in power supply applications and to couple the stages of signal processing circuits

2.1.4 Single Channel Relay Module

A relay is an electrically operated switch. It consists of a series of input terminals for one or more control signals and a series of operational contact terminals. The switch can have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used when a circuit needs to be controlled by an independent low power signal or when multiple circuits need to be controlled by one signal. Relays were originally used in long-distance telegraph circuits as signal repeaters: they update the signal from one circuit by transmitting it to another circuit. Relays were widely used in telephone exchanges and early computers to perform logical operations

2.2 Software Description

2.2.1 ThingSpeak

One of main goal of this research is to make real time data widely available to authenticated users. This is possible through the use of Thing Speak, a web platform that enables users to store and analyse live data in the cloud. It works seamlessly with apps and interfaces

2.2.2 Android Application

The app created is designed to fetch the data in real time form the ThingSpeak platform with the help of an API. The app displays the measured readings of various parameters in a chart format. User can easily sign in with an email or with google to see the real time data

III.   METHODOLOGY

This project uses Arduino Nano and NodeMCU as the microcontroller. Arduino Nano is the main controller on this system. the current at both input and output of transformer is measured using current sensors. If both the currents are equal, then the system operates in normal condition. If there is a difference in the current values, then the relay switches off power supply to the device. The buzzer is activated when there is a difference between current values.I2C LCD Display is used to display current status of the system. The system can also be monitored using Android App mainly designed for this system. The NodeMCU collects all the data from the Arduino Nano and uploads it to Thing Speak Cloud Storage. The Android App reads records data from Cloud Storage and shows it.

IV.   RESULTS

If difference between values of current sensors sensed is very less then the system is Safe, and the transformer can switch on. For high difference between current sensor values the system shuts off as it is an alert condition**.**

V.   CONCLUSION

From this project we have got concluded that when internal fault takes place and the value of both currents are different the relay gets operated and the system gives alert by the sense of Arduino, so we come to know about abnormal working condition of transformer. Therefore, by using Differential protection scheme,
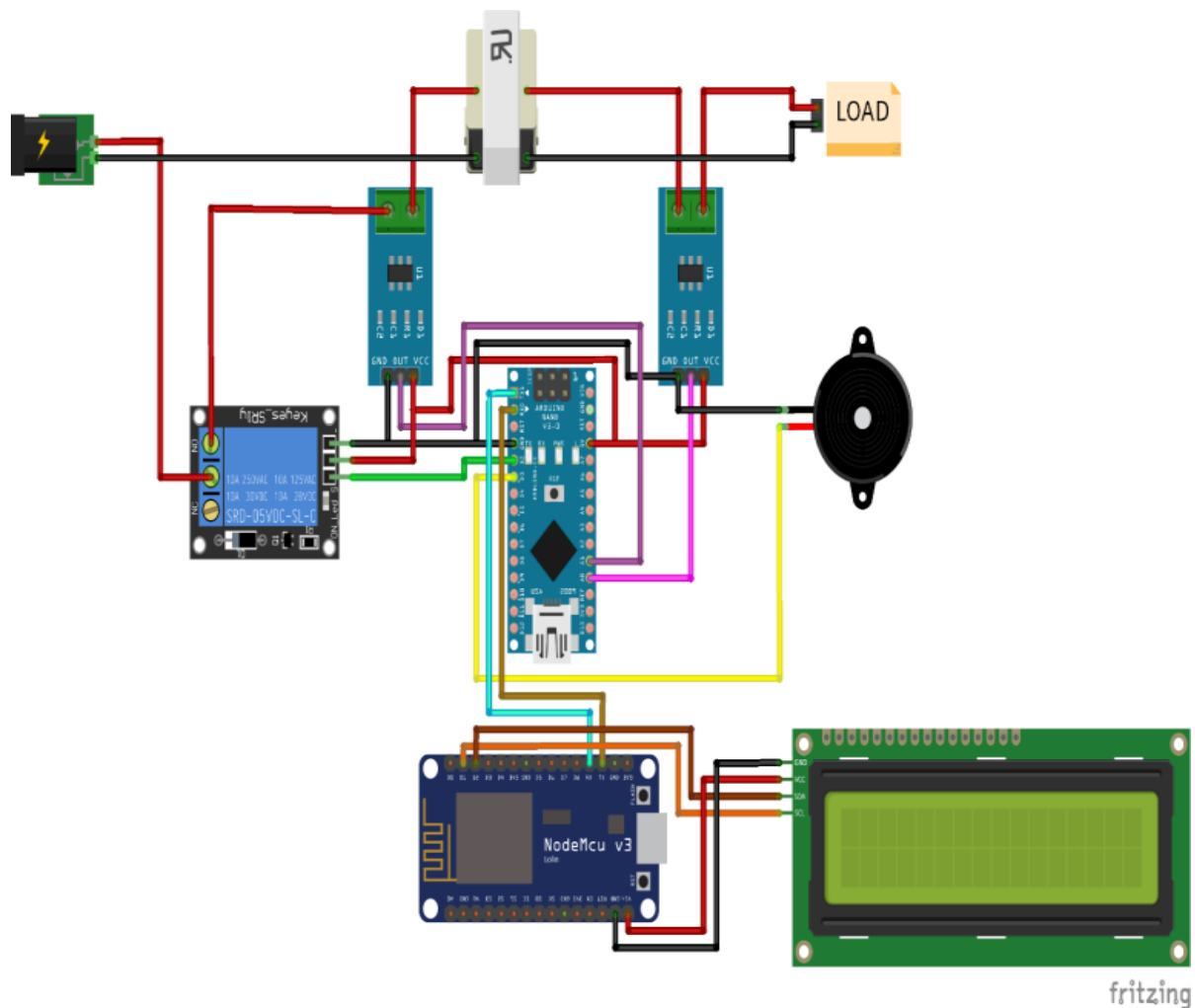
VIVA-Tech International Journal for Research and Innovation   *Volume 1, Issue 5 (2022)*
ISSN(Online): 2581-7280
VIVA Institute of Technology
10th National Conference on Role of Engineers in Nation Building – 2022 (NCRENB-2022)

Fig 1. Circuit Diagram

transformer is protected from faults with the using of Arduino working an electromagnetic relay. inn current at each winding varies through by a huge value which may be measured accurately by current sensor. And we have derived very reliable protection as Current transformer is bypassed and it's only for small size transformer. For bigger size either current sensor with high rating is used or actually current is stepped down through CT

Acknowledgements

REFERENCES

[1]   M.A.Date, Bhuvanesh Oza, N.C.Nair "Power System Protection" Hand Book Edition 2002

[2]   Adil Naseem, Naveed Alam "Protection of Distribution Transformer Using ARDUINO Platform" Science International Journal; ISSN 1013-5316

[3]   Cristina Ciulavu, Elena Helerea "Power Transformer Incipient Faults Monitoring "Annals of University of Cariova, Electrical Engineering; ISSN 1842-4805

[4] Ishant Sharma, Tarak Patel, Prof. Dhaval Tailor "Differential Protection of Transformer Using Arduino" International Journal of Innovative and Emerging Research in Engineering Volume 3, Issue 7, 2016

[5] Don Wilcher, "Learn Electronics with Arduino", illustrated Edition, Apress, 2012

[6] Sarfaraz Nawaz Syed, S. Radhika, M.N. Sandhya Rani "Differential Current Protection of Transformer

[7] "Using Arduino with Voice Alert" International Journal of Innovations in Engineering and Technology, Volume 6 Issue 2 December 2015

[8] Michael Margolis "Arduino Cookbook" Hand Book Edition 2011

[9] Arduino – Home Page from http://www.arduino.cc

[10] https://www.engineersgarage.com/articles/gsm-gprs-modules

[11] https://www.engineersgarage.com/contribution/high-quality-voice-recorder-using-ic-apr33a

[12] Hobson, A., "Instrument Transformers" IET Journals & Magazines Volume: 91, Issue: 20 January 2010