

# Differential Protection for Power Transformer using Microcontroller

Akshay Chilka, Abhishek Khapre, Prathamesh Narkhede

U. G. Scholars, UCOER, Pune.

Prof. Prasad R. Patil

Assistant Professor, E&TC, UCOER, Pune.

**Abstract**—Transformers are critical and expensive component of the power system. Due to the long lead time for repair and replacement of transformers it is need to innovate a system which is more reliable and efficient. We are designing a cost effective system in distribution transformer to protect it from thermal overload, unauthorized entry as well as EMF detection and section cut detection. Thermistor at the transformer will trigger the message to an operator if the temperature level exceeds threshold. IR sensors will detect unauthorized entry in transformer premises. Excess EMF may cause harm to field workers, EMF detection here will help them to know the decent radiation level. Section cut detection will ease the problem of finding faults in individual line.

**Index Terms**— EMF, IR sensors, thermal overload, Thermistor, Transformer.

## INTRODUCTION

The power transformer is one of the most significant equipment in the electric power system, and transformer protection is an essential part of the general system protection approach. Transformers are used in a wide variety of applications, from small distribution transformers serving one or more users to very large units that are an integral part of the bulk power system [1]. A power system is faulty when an undesirable conditions occur like unauthorized entry, overheating, excess EMF, Section cut.

The purpose of power system protection is to detect faults or abnormal operating conditions and to initiate corrective action. Relays must be able to evaluate wide variety of parameters to establish that corrective action is required. Obviously, a relay cannot prevent the fault. Its primary purpose is to detect the fault and take then necessary action to minimize the damage to the equipment or to the system. The most common parameters which reflect the presence of a fault are the voltages and currents at the terminals of the protected apparatus or at the appropriate zone boundaries [7].

The main goal of this project is:

- Power supply line cut detection.
- Electromagnetic frequency detection module.
- Overheating transformer indication.
- Unauthorized entry detection.

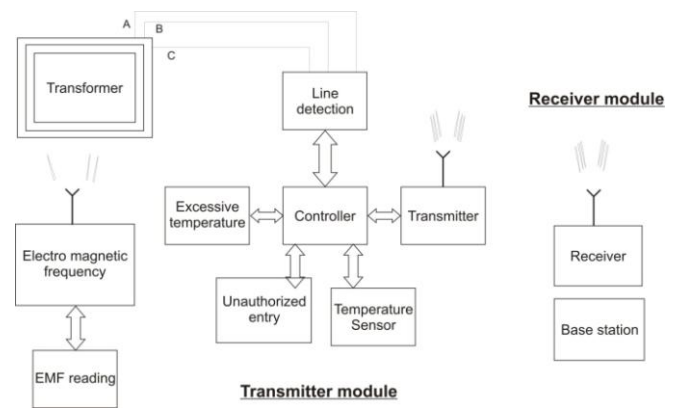


Fig. Block Diagram

**EMF Detection Module:** This module is used to determine harmful electro-magnetic field range for the field workers. This EMF can inflict severe damage to field workers.

**Temperature Sensor:** This sensor can sense the temperature of a transformer. For this purpose, thermistor is placed onto the transformer. It generates known voltage in response to its temperature.

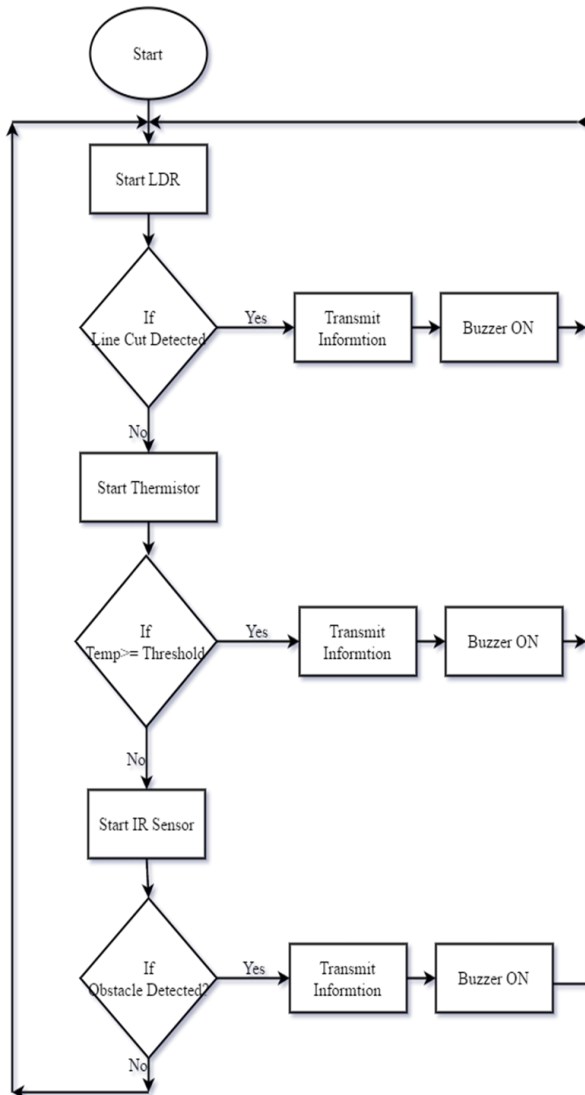
**Section (Line) cut Detection:** In this Line-cut detection part we are using IR sensor for wireless detection technique. Here we divide a zone into smaller sub-sections and they are connected to system through individual line. If line-cut occurs in any sub-section connected to this transformer, then this unit can easily detect that section for maintenance purpose.

**Excessive Temperature:** Input to this block is a temperature sensor output. This block checks the temperature value, if it reaches beyond transformers maximum feasible value then excessive temperature module send indication signal to the base station.

**Un-authorized Entry and Anti-Theft Circuitry:** Any un-authorized person will not able to enter into transformer base premises as well as we are providing anti-theft circuitry for transformer. For this purpose we are using HMI.

**RF transmitter:** All the signals from these 4 units are send base station using RF transmitter.

### FLOWCHART



### ALGORITHM

- Step 1 : Start Transformer.  
 Step 2 : Start LDR, Thermistor, IR Sensor.  
 Step 3 : Check whether temperature is greater than or equal to threshold, if 'yes' then transmit info to base station and turn ON the buzzer.  
 Step 4 : Check IR sensor for unauthorized entry, if 'yes' then transmit info to base station and turn ON the buzzer.  
 Step 5 : Detect Section Cut, if 'yes' then transmit info to base station and turn ON the buzzer.  
 Step 6 : Repeat steps 3, 4, 5.

### CONCLUSION

System provides protection of transformers for monitoring the temperature. In contrast to the older mechanical devices, our model will send an alarm if problems occur so that operational problems do not go undetected offering a higher level of security and dependability. And with the advent of

new technology, we have integrated the EMF detection module into the protection scheme.

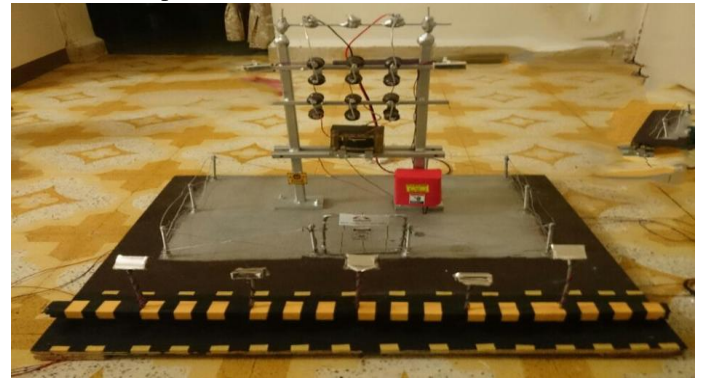


Fig. Transformer Model

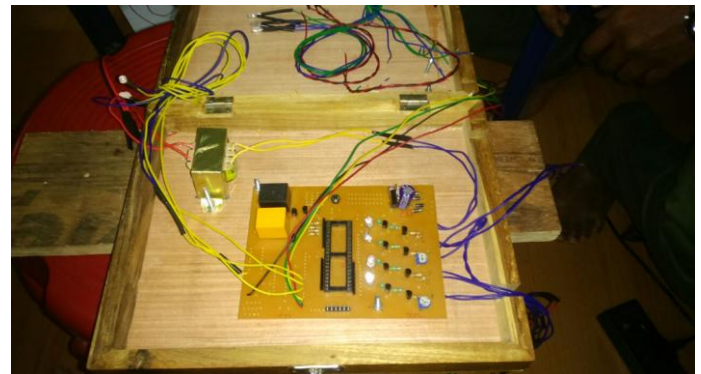


Fig. Circuit Setup

Thermistor continuously monitors temperature of transformer and whenever temperature goes beyond threshold value, it triggers a pulse to microcontroller, which in turns passes that information for transmission, and it turns on the buzzer and LED at the station.

IR sensor is used to keep the track of entries. It detects the entries and keep sending that information to microcontroller. Whenever microcontroller finds if there is any unauthorised entry, it rings the buzzer and turns on the LED at the station so the operators will know about the unauthorised entry.

Various zones that transformer is feeding to are divided into sub-sections, and an individual line is taken from each of the sub-section. Therefore, if there is damage to any specific line then it is detected by LDR and LED for the specific line goes down so the operators can easily know which section has cut.

### ACKNOWLEDGMENT

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**First Author:** Akshay Chilka, B. E. E&TC, UCOER Pune.

**Second Author:** Abhishek Khapre, B. E. E&TC, UCOER Pune.

**Third Author:** Prathamesh Narkhede, B. E. E&TC, UCOER Pune.

**Fourth Author:** Prof. Prasad Patil, E&TC, UCOER Pune.