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# TRANSFORMER PARAMETER MONITORING BY IOT

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## ABSTRACT

This paper proposes the method to design and implement designing and recording of key parameters of a distribution transformer like load currents, oil level, voltage level and temperature. The idea of on line screening system integrates with a stand alone Arduino and different sensors. It is set in at distribution transformer side and the above parameter are recorded using the ARDUINO Microcontroller. The gained parameters are managed and recorded in the system memory. If any abnormality or an emergency situation arises in the system, then the values will be displayed in the screen according to some predefined instructions programmed in the microcontroller. This mobile will help the transformers to work smoothly and detect problems before any catastrophic failure.

## I. INTRODUCTION

The Transformer Screening System is defined as a group of components built together in order to sense and screen various parameters of a pole-mounted transformer or ground transformer that are vital to its functionality. This device is involved to an existing transformer's lines with minimal energy and remains nonintrusive to the lines and its components. As pole-mounted transformers and ground transformers are the most common types of transformers out in the general public, the device is cost effective such that the practicality of placing one on every transformer is reachable. Given that the device is not connected straightly to the transformer, the method for powering the device and screening the transformer's parameters was a problem initially that had to be tackled. In order to draw power to the device without the use of any inner power source, induction coils were used. This inductive power pickup is covered around the low side of the transformer (120V), so that cost can be kept down due to less insulation needed. Recognizing that the voltage going through the induction coils can be far greater than what is needed to power the device; a couple voltage regulators were used to limit the amount of voltage going into the device. To achieve the desired results, Diodes instIncorporated AP1186 regulators were used. Although the device draws power from the lines in order to check system failure if power is out, the device has a battery backup located inside of the system. Overall the transformer screening system has the capability of screening the transformer's voltage, current, temperature, and possibly the phase angle. The voltage sensor is constructed from scratch to happen our needs and consist of a plate, an op-amp, two capacitors, and four resistors.

A Rogowski coil was used to screen the current going in to and out of the transformer. This option came about due to the statement that the current across the lines varies drastically over time and as such the Rogowski coil has the capability of measuring such broad ranges. Methods for screening the temperature of the transformer ranged almost as drastically as the current in the lines. After several considerations, a thermal infrared sensor was chosen: the MLX90614ESF-AAA Infrared Temperature Sensor 90◦ FOV. This sensor was placed on the device such that it has a straight line of sight to the transformer. Finally, the last parameter that the device dealings are the phase angles of both the high side and low side of the transformer. Once all of the sensors find an accurate reading from the power lines, the information travels to the microprocessor inside of the device. Texas Instruments' MSP430-F2013 has been taken as the ideal microchip. This component can be considered the brain of the device and as such it has a lot of duties it must sustain. There are two main functions that it has: link every piece of hardware together at a central point and relay information at the correct time to the wireless component.

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## II. LITERATURE REVIEW

Distribution transformer is a main asset in distribution network. Its operation and control are important aspects which control the reliability and quality of power Supply A remote condition screening system for distribution transformer is discussed here. Different parameters are acquired and managed in remote terminal unit. [1]

This communicates the data to the operator end by internet. Consistent with parameter values, health index of a transformer is found out at the operator end interface. Analysis is basedon health index. This system is different from power transformer state screening systems in condition screening techniques used and communication. A cheaper system is designed which surely evaluates the health status of a transformer. [2]

To screen the transformer parameters such as voltage, current, frequency and temperature and to control using microcontroller with the help of Zigbee transceiver. It explains how to screen the above parameters and isolate the power supply during emergencies. [3]

The paper include a protection system for 3-phase induction motor from single phasing, voltage, current, speed and temperature variations. [4]

The distributed transformer networks remote screening system (DTRMS) is industrialized and constructed, for screen and record the parameters like temperature, oil level status, of a distribution transformer. Real time clock and data communication module which based on Zigbee protocol. [5]

## III. FLOW CHART

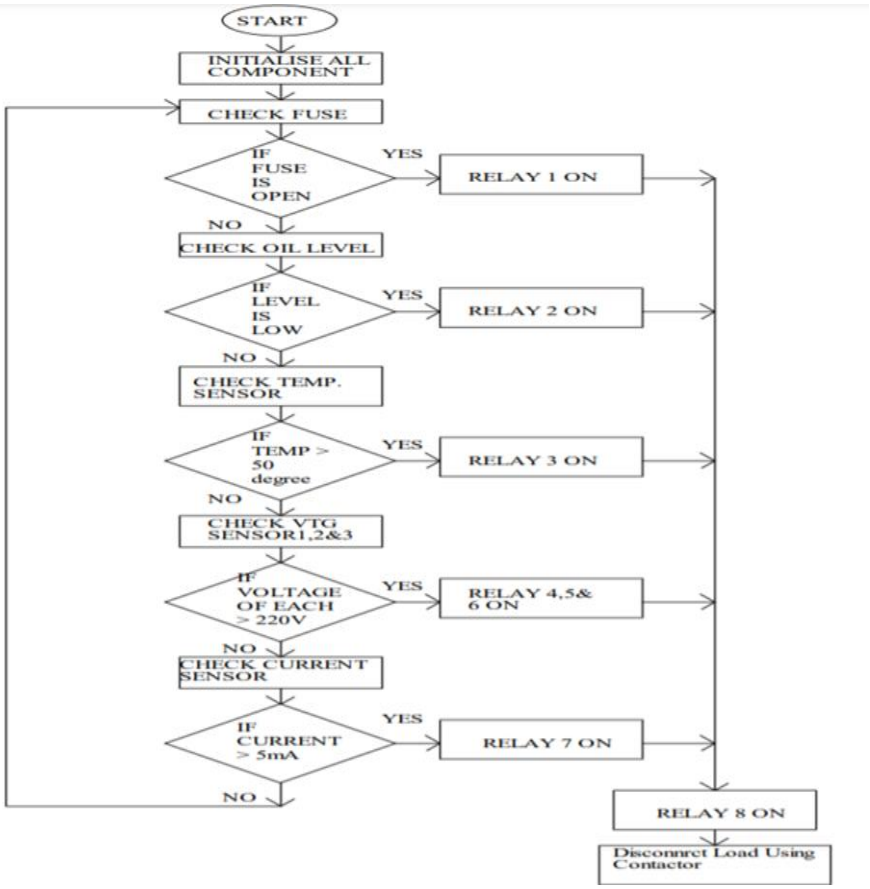


**Fig:** Flowchart of System

## IV. DISCUSSION

The overall goal of the Transformer Screening System is to effectively and accurately read and record valuable information about either pole mounted transformers or those which lie on the ground. Once recorded, the information is sent through wireless connections to a central hub computer which would be situated at the electric company's transfer stations or substations. Installed on the computer is the muse program that

transfers the data to database located on the electric company's server. The web application then presents all of the information in a nice, neat, systematized fashion, so that the electric companies can easily detect a failure in their power lines. Several key goals of this whole device are that it needed to be extremely affordable, due to the large quantity of transformers in a given radius, and small enough to suitable on the same pole as the transformer. Also those two goals, the device is broken up into 3 categories, each with their own goals and objectives: Power, Sensors, Logic Hardware. Power to the device is the most critical aspect of this paper and as such has a large amount of expectations and regulations that it had to follow. For instance, our device draws a minute volume of power from the power lines itself to run our system. Due to the dangers that come with working with high voltage power lines and the possibility of external contact, safety was the first objective. Our method of attaching to the power lines needed to be safe to the ignorant public as well as to the nature around it. Basically, we could not have our system detonate if a bird lands on it, in addition we could not kill the bird either. Additional important aspect of the power system is that it had to be reliable and non-intrusive to existing power lines. Reliability is always an important objective of any product and as such, our device needed to stay within a certain range of voltage, current, and temperature. Any high values of the three would end up destroying the inner components of our device and possibly cost the electric company valuable time and money. As mentioned our device needed to be non-intrusive to the existing power lines due to the statement that any disturbance created by our system will ultimately cause signals to be lost and power levels to be distorted. The final aspect of our power system is the backup power structure which allows our device to steadily send signals to our central hub long after the main power has been disconnected A screening system is effective so long as the sensors within it are accurate and exact. Because of this, for our system to fully live up to a professional standard the sensors had to be extremely precise at reading in the preferred information. Overall there are three sensors that read: the voltage and current across the lines and the temperature inside of the transformer. The goal was to assign a coil to both the input line as well as the output line in order to record both the high side and low side of the voltages and currents. Like the power system, the sensor devices required to be safe and also non-intrusive to the existing power lines. A couple major anxieties were the possibility of arcing between the coils and the creation of a ground or short within the transformer. If either of these things were to happen then there would be a catastrophic failure at the site, so our system needed to be able to assure these dilemmas do not arise. Because of the high voltage and current frequently running through the power lines, our sensors had to be able to handle an extreme number of voltages and amperes for a long period of time. Also, the sensors needed to be able to step down those extreme values in order to not abolish the inner components of transformer screening system. Another goal for the sensor devices was to read the internal temperature of the transformer externally without breaching the transformer's outer extremities.

Finally, the sensory system had to be easy to install and exchange. The objective was to treat the coils as clamps that can easily be inserted and removed from the power lines without the need to separate the lines from the transformer itself. This allows for speedy replacement if a sensor failure arises. Once information about the transformer has been measured, the information goes through various inner components of the device. These components have two major goals that they had to meet. First, the components needed to have a logic aspect to it that would define if the information from the sensors has exceeded their threshold values. If there were such an occurrence, the logic component would alert the wireless elements and start the emergency cycle. The second primary goal was that the components required to relay the information, without any lose in accuracy, to the wireless elements. This step was extremely important due to the statement that if any of the data became corrupt or altered in any way then the detection system and alert mechanism would not work successfully. As microchips of today cost only cents to make, we tried to keep the total cost of the entire package under a few dollars. Also, another goal we tried to realize was to have the microchips easy to remove and install. These features make it possible for the consumer to swiftly and easily replace any damaged part of the logic circuitry at a cost effective value. To conclude, the Transformer Screening System should be able to meet all of the various goals and objectives mention above. These goals and objectives confirmed that our device system runs effectively and proficiently in any situation that it might encounter in the real world.

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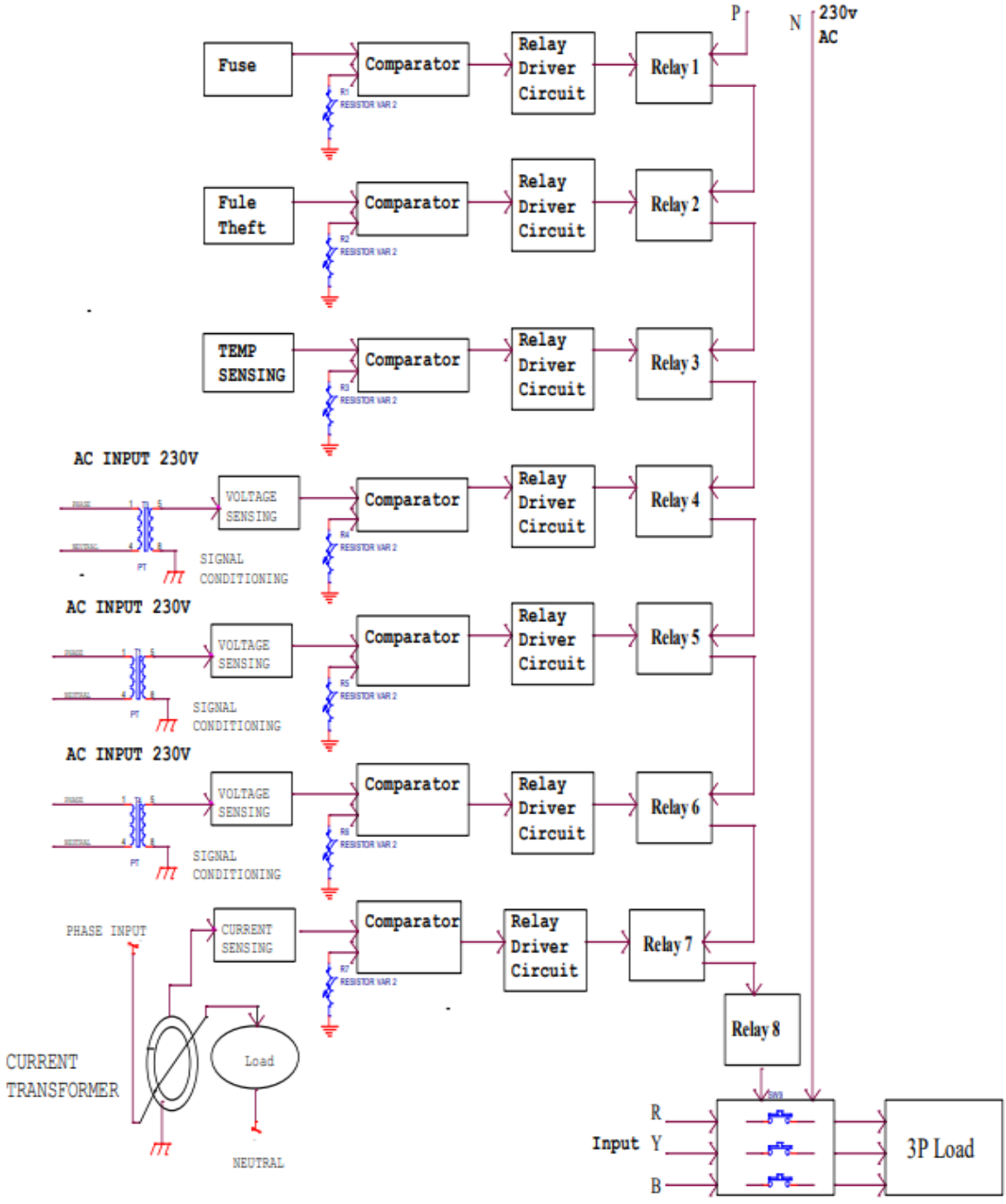
## V. BLOCK DIAGRAM




## VI. CONCLUSION

Transformers are among the most general and expensive piece of equipment of the transmission and distribution system. Regular screening health condition of transformer not only is economical also adds to increased reliability. The GSM based screening of distribution transformer is valuable as compared to manual screening and also it is reliable as it is not possible to screen always the oil level, temperature rise, load current, voltage, theft arise manually. Transformer is undergoing fault from the message sent to mobile. We can recover the system in less time Sensitivity and reliability of this scheme is very high for the abnormal and faulty conditions, as this protection scheme works within the fractions of seconds when fault or abnormal condition arise. This protection system is fully automated and requires no manual boundary. In future, this work can also be done using PLCs, and related technique can also be applied for construction of numerical relays.

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