



## IOT BASED ONLINE TRANSFORMER MAINTENANCE SYSTEM

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**ABSTRACT** This paper screens the state of transformer protection oil and keeps up the transformer in solid condition. Because of absence of legitimate work, the power transformers in power board and the circulation transformers utilized as a part of open and private area are not looked after appropriately. The protecting oil in the transformer may infrequently come into contact with air because of spillage in the oil tanks or in related pipe lines, the oxidation response in the transformer oil happens, which will be additionally quickened because of temperature and nearness of impetuses like iron, copper and broke down metallic mixes in the transformer oil because of maturing. The above condition talked about will change the qualities of transformer protecting oil, which truly influences the execution of transformer and may prompts blast of transformer on the off chance that it isn't observed appropriately. The proposed framework performs sharpness and blaze point test which decides the qualities of oil whether to utilize it further or to purge and educated it to the individual worried through GSM and IoT.

**KEYWORDS :** Insulation oil, catalyst, explosion, acidity, flash point test, GSM, IoT

#### MATERIALS AND METHODS:

A transformer is basically a static electromagnetic gadget comprising of at least two windings which interface with a typical attractive field. The primary motivation behind power or dispersion transformer is to exchange electric power starting with one voltage level then onto the next. It deals with the essential of electromagnetic enlistment. The principle segments of the transformer are center, winding, protection (strong or fluid) and tank. The oil utilized as a part of transformer is mineral oil. Which is a protecting oil utilized for cooling purposes in the middle of the windings.

Protecting materials or protects are to a great degree differing in root and properties. They are basically non-metallic, natural or inorganic; uniform or heterogeneous in piece; regular or manufactured. A large number of them are of regular starting point as, paper, fabric, paraffin wax and normal tars. Wide utilize is made of numerous inorganic protecting materials, for example, glass, pottery and mica. Properties of insulating materials are resistivity, breakdown voltage, permittivity and dielectric misfortune, and so forth.

#### TRANSFORMER OIL

Oil utilized for protection in transformers is mineral oil and it is acquired by refining unrefined oil. Creature oils and vegetable oils are not utilized for this reason as these shape unsaturated fats on warming which are destructive for the cellulosic paper utilized as a part of protection. Mineral oils were being used as fluid dielectrics in electrical hardware for more than hundred years now. In spite of the accessibility of an assortment of manufactured oils, with significantly more prevalent properties, mineral oils held its way, because of their plenteous accessibility and economy.

Impressive measures of cash have been put resources into the introduced control hardware in the electrical vitality frameworks. Power transformers are an essential piece of it. They speak to a profitable resource for the utilities, and are relied upon to be utilitarian more than many years. In prior days it could happen that power transformers with long operational years and impressive feeble or a potential wellspring of inconvenience were essentially supplanted. Cash was no issue and the last vitality client needed to pay the bill at last. Today the worldview has changed and significant endeavors are coordinated into finding new methodologies utilizing transformer checking, conclusion and life evaluation.

#### IoT TECHNOLOGY

Internet of Things is characterized as Things having characters and virtual identities working in keen spaces utilizing canny interfaces to associate and impart inside social, ecological, and client settings. It can

be viewed as the Future of Internet, where each question is associated with different articles. Each protest is given an extraordinary personality in the system.

IoT empowered articles speak with each other, get to data over the Internet, and associate with clients making brilliant, unavoidable and constantly associated situations. IoT additionally empowers machine to machine correspondence which permits machines being controlled by the Internet and by different machines.

#### PROPOSED SYSTEM

Proposed system monitors the parameters of transformer. It uses current and voltage sensor to measure the current and voltage readings of transformer. From the current and voltage readings power factor can be calculated. By processing the values obtained, the system helps in conserving energy to a great extent and maintains transformer in good condition. It informs the person concerned in case of excess use of current voltage, power and energy through GSM and IOT.

#### CURRENT MEASUREMENTS

An electric current is a stream of electric charge. In electric circuits this charge is regularly conveyed by moving electrons in a wire.

The SI unit for estimating an electric current is the ampere (A), which is the stream of electric charge over a surface at the rate of one coulomb for every second. Electric current is estimated utilizing a gadget called an ammeter.

Current sensor detects electric current that is delivered to the load and produce a signal proportional to that current. The generated signal is given to the microcontroller. It gives the current readings. It is denoted by (I).

#### VOLTAGE MEASUREMENTS

The Potential transformer goes about as voltage sensor which is utilized to detect or measure the voltage spill out of the framework. The potential transformer ought to be put parallel to the heap. The bridge rectifier change over AC voltages into DC voltage and appended to the simple stick of Arduino.

#### POWER ESTIMATION

The power P in watts (W) is equivalent to the current in amps (A), times the voltage V in volts (V)  

$$P(W) = I(A) \times V(V)$$

#### ENERGY ESTIMATION

The measure of energy utilized (or provided) relies upon the power and the ideal opportunity for which it is utilized.  

$$E(J) = P(W) \times T(S)$$

## REAL POWER

In AC circuits, When circuit is unadulterated resistive, at that point the equation utilized for control is  $P = VI$ .

The unit of Active or Real power is Watt where  $1W = 1V \times 1A$ .

## REACTIVE POWER

The forces that ceaselessly skip forward and backward amongst source and load is known as receptive Power (Q)

Reactive power is given by  $Q = VI \sin\theta$  which can be certain (+Ve) for inductive, negative (-Ve) for capacitive load.

The unit of reactive power is Volt-Ampere receptive. VAR.  $VAR = 1V \times 1A$ .

## APPARENT POWER

Add up to control in an AC circuit, both scattered and ingested/returned is alluded to as evident power. The addition of reactive power to true power is called apparent power.

Apparent Power =  $\sqrt{(\text{True power}^2 + \text{Reactive Power}^2)}$

$$S = \sqrt{P^2 + Q^2}$$

The unit of apparent power is Volt-Ampere VA.

## POWER FACTOR

Power factor is characterized as a proportion of true power to apparent power. It is the measure of point between the current and voltage phasors.

Power factor = true power / Apparent power

## THINGSPEAK

The underneath outline delineates where an IoT benefit fits in an IoT biological system in figure 1

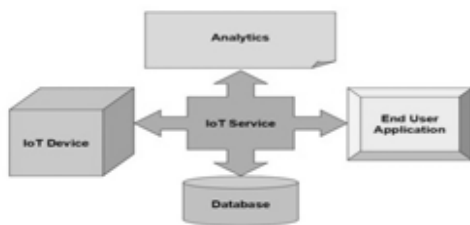


Figure 1. IoT service in IoT ecosystem

Thing Speak is a stage giving different administrations only focused to building IoT applications. It offers the capacities of ongoing information gathering, picturing the gathered information as graphs, capacity to make modules and applications for working together with web administrations, interpersonal organization and different APIs.

**CLOUD SERVICE** The collected user's data is communicated to a cloud server which is responsible for facilitating the accessibility of such a data anywhere through the Internet. The cloud server implements a wide set of data management services including data storage, data analytics, and data visualization in addition to providing an appropriate application program interface (API) and software tools server shown in figure 2.

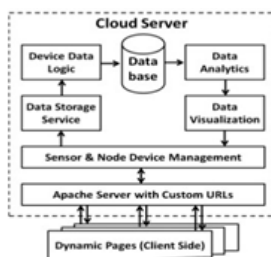


Figure 2. Cloud computing

## CURRENT SENSOR SCT 013 000

A present sensor is a gadget that identifies electric current in a wire, and creates a flag relative to that present. The produced flag could be simple voltage or present or even an advanced yield when associating with a controller.

## VOLTAGE MEASURING CIRCUIT

The Potential transformer is go about as voltage sensor which is utilized to detect or measure the voltage spill out of the framework. The potential transformer put parallel to the heap. The scaffold rectifier change over AC voltages into DC voltage and joined to the simple stick of Arduino.

## GSM

Overall system for adaptable correspondence (GSM) is an exhaustively recognized standard for automated cell correspondence. GSM is the name of systematization accumulates set up in 1982 to influence a normal European cell to telephone standard that would characterize points of interest for a holder European flexible cell radio structure working at 900 MHz. It is assessed that various countries outside of Europe will join the GSM affiliation.

## RESULT ANALYSIS

The active power, reactive power, apparent power is used to calculate the power factor. The power factor value should be greater or equal to 0.7. If the power factor is lesser than 0.7 it will result in overheating and electric stress leading to winding losses and degradation of winding. The damage to winding result in sludge formation it will seriously affects the life time of transformer insulation oil and transformer.

## CONCLUSION

The proposed system calculates power factor to determine the condition of winding of transformer and its insulating oil and to predict whether to change, purify the oil or to continue with the same oil. The proposed system helps to maintain the transformer in the healthy condition. The proposed system concentrates only on power factor. In the future system power factor correction is going to be considered and helps in conserving energy to a great extent.

## REFERENCES

- [1] A. A. Nelson, G. C. Jaiswal, S. Ballal et al., "Economical aspects of remote condition monitoring system for distribution transformer," in Power, Automation and Communication (INPAC), 2014 International Conference on. IEEE, 2014, pp. 45–49.
- [2] F. Beidou, W. Morsi, C. Diduch, and L. Chang, "Smart grid: Challenges, research directions and possible solutions," in 2010 2nd IEEE International Symposium on Power Electronics for Distributed Generation Systems (PEDG), pp. 670–673.
- [3] E. Kolyanga, E. Kajuba, and R. Okou, "Design and implementation of a low cost distribution transformer monitoring system for remote electric power grids," in Industrial and Commercial Use of Energy (ICUE), 2014 International Conference on the. IEEE, 2014, pp. 1–7.
- [4] L. Berrio and C. Zuluaga, "Concepts, standards and communication technologies in smart grid," 2012 IEEE 4th Colombian Workshop on Circuits and Systems (CWCAS), pp. 1–6.
- [5] M. El Brak and M. Essaïdi, "Wireless sensor network in smart grid technology: Challenges and opportunities," in 2012 6th International Conference on Sciences of Electronics, Technologies of Information and Telecommunications (SETIT), pp. 578–583.
- [6] Perkasa, C. N. Lelekakis, T. Czarzejko, J. Wijaya, and D. Martin, "A comparison of the formation of bubbles and water droplets in vegetable and mineral oil impregnated transformer paper," IEEE Trans. Dielectr. Elect. Insul., vol. 21, no. 5, pp. 2111–2118, 2014.
- [7] Perkasa, C. Y., N. Lelekakis, J. Wijaya, and D. Martin, "Investigating bubble formation in vegetable and mineral oil impregnated transformer paper insulation systems," presented at the IEEE Australasian Univ. Power Eng. Conf. (AUPEC), Australia, 2012.