Innovative Journal for Opportunities and Development in Science &Technology,
Volume 3,Issue 5, June.2023
Paper Id: – IJ2022V3I5 -1A-C,
ISSN 2582-6026

# SMART IOT BASED TRANSFORMER PARAMETER MONITORING AND CONTROLLING USING LORA COMMUNICATION

**[1]Pradip Vilas Taware, [2]Dr. Parkale Y.V., [3]Kiran Ramesh Sapkal**

[1]PG Scholar,,Dept. of E & TC Engineering, SVPM'S COE, Malegaon Bk.
[2]Assistant Prof., Dept. of E & TC Engineering, SVPM'S COE, Malegaon Bk.
[3]PG Scholar, Dept.of E & TC Engineering, RDTC, Pune

**ABSTRACT**- This presents a new Lora communication framework for condition monitoring and controlling of larger number of distribution transformers as they are one of the influential and important equipment in the power distribution network. Great numbers of distribution transformers are required to distribute power over a wide area. That being the case, it is essential to keep an eye on its condition for satisfactory operation of any distributive system.This article describes a technique for leveraging LoRa (Longrange) technology to monitor a nd assess the health of distribution transformers using particular sensors and devices.
This enables the use of Lora modules to record important operational indicators for each distribution transforme r within a 10kilometer radius, including voltage, load current, winding and oil temperatures, oil level in the cons ervator, and the state of the breather silica gel.Using a Lora gateway, this data is transmitted to an IoT platform. If a distributional parameter, transformer exceeds the predefined value/level, alerts will be received on the developed web application showing the particular transformer's location, to take necessary action.

***Index Terms***- Internet of Things (IOT), LoRa (Long-range), distribution transformer, distribution network, voltage, load current, winding temperatures, oil temperatures, oil level in conservator, breather silica gel status

## I. INTRODUCTION

### 1.1 INTRODUCTION

The transformer is an essential component of the electrical system's network.There is at least one transfor mer visible everywhere.Today, it would be hard to go even a minute without power.
Every essential function, whether it be for homes, businesses, or industries, depends on the availability of power Without them, any enterprise will stall and may suffer severe financial consequences.
(2) The necessity for a realtime distribution transformer monitoring system is becoming more and more pressin g.a system that monitors all operating parameter changes and sends realtime data to the monitoring centre.In ord er to give functional data for the life of transformers, critical operational parameters are monitored.in an optimal way and the asset which is in operation stays for a long time. It will also help to pick out problems before a failure, and by doing so cost can be saved and will achieve more consistency. It will be an attractive option due to extensive use of internet and wi-fi devices for sending data as well as for other network applications (1) LoRa

(which stands for long range) is a spread spectrum modulation technique derived from chirp spread spectrum (CSS) technologies. The modulation technique used in LoRa makes it robust to channel noise since the entire allocated bandwidth is used to broadcast a signal (information or data). Furthermore, the security of the LoRa system can be guaranteed as the transmission is spread in a pseudo-random way which presents like a noise, hence the modulation technique had provided the basic security for the LoRa system. Aside from that, LoRa is the best option for IoT solution which required a long range of data communication while keeping very little power usage (6).

### 1.2 PROBLEM STATEMENT

In today's world, the power system network of a smart grid holds the prime importance because of the high demand of quality power supply. It is usually done by deploying multiple approaches for monitoring, protecting and controlling mechanisms. In distribution networks, the distribution of transformer is an essential part. In the point of view of Libyan, the power system network can be monitored by such systems, which can be controlled in a certain degree. The average life of transformers is 20-25 years. [1]. The transformers are mainly installed when their operational life is about to end. The monitoring methods currently being used are related with electrical parameters and those parameters does not give any idea about the condition of the distribution transformer internally. For such an important asset in power system, periodical maintenance is not sufficient. An online monitoring system is required, which base on the conditions to maintain the transformers. The condition of the equipment will be monitored remotely, in the meantime a maintain and control schedule can be arranged in real time. A doctor analyses different symptom of a disease by understanding it before suggesting a cure. In a similar way, before making a proper decision, condition monitoring techniques use different parameters, both internal and external that are linked to a transformer, to predict its status of operation. Based on the severness which is the main feature in asset management, the decision can be used to schedule maintenance or removal and replacement. But existing monitoring device systems used for monitoring distribution transformer has some insufficiencies. The system used for detection is very inconsistent. The performance of a system depends on multiple factors such as unstability of a device, jamming capability of a device, result of accuracy in data when data is measured is low or there is no affect on another system.

## II. PROPOSED SYSTEM

A realtime distribution transformer monitoring system is increasingly necessary given the aforementioned needs.a system that monitors all operating parameter changes and sends realtime data to the monitoring centre. As a result, important operational parameters are tracked to offer functional data for the lifespan of transformers enabling their optimal usage and extending the useful life of the asset.Additionally, it will be helpful to identify issues prior to a failure, which will save money and lead to greater consistency.The state of each transformer is determined via GPS.Due to the widespread usage of the internet and wireless gadgets,

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## III. METHODOLOGY

### 3.1 Block Diagram: -

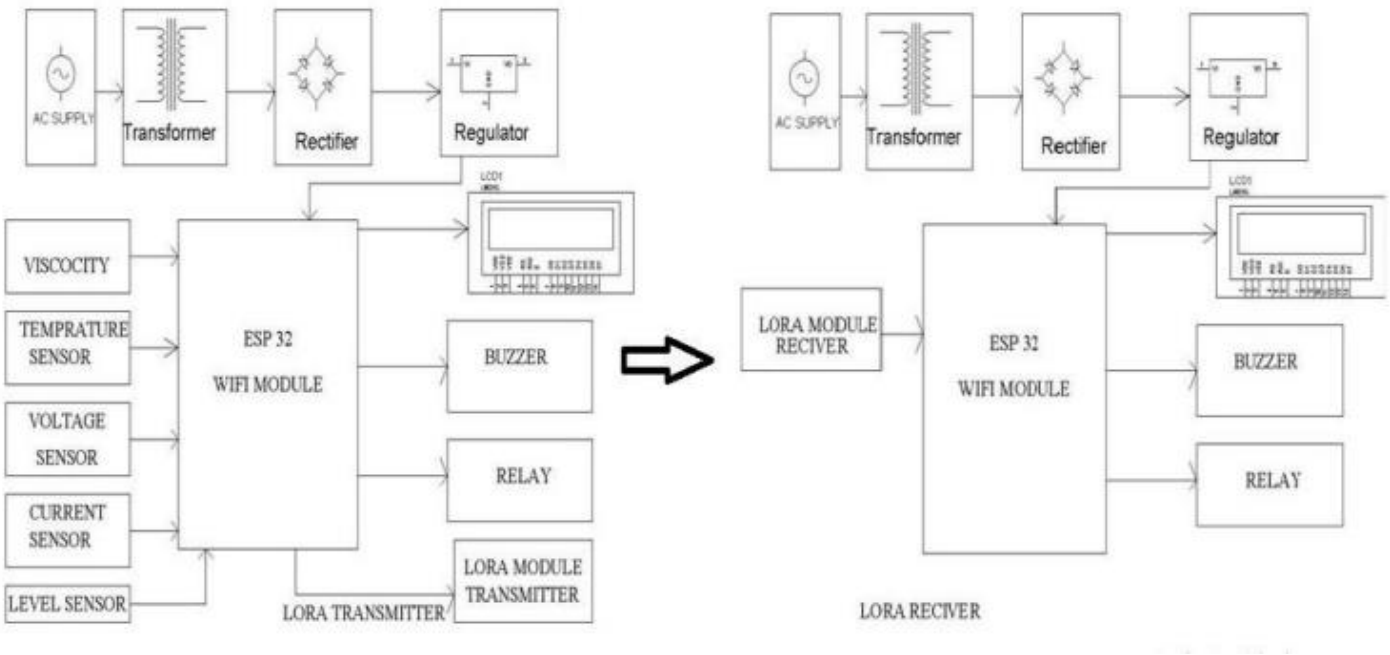


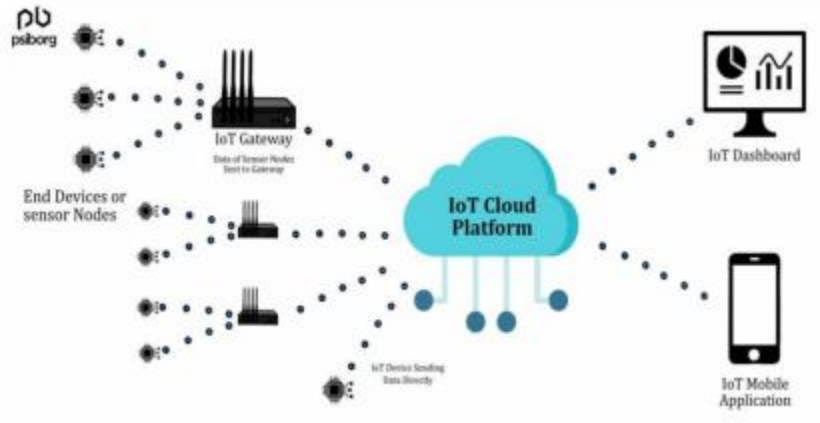

Fig.No. 1 Block Diagram for Proposed System

The block diagram shown in Fig. gives a clear picture of the work. The intension is to get parameters data from distribution transformers for their monitoring and controlling. For this we are using a potential transformer with bridge rectifier and potential divider circuits to measure voltage, A Hall effect current sensor for measuring current, two temperature sensors, an ultrasonic sensor and a colour sensor TCS230.These sensors are connected to Arduino microcontroller which can be placed at different transformer's location. The data sensed by the arduino at different locations, is transmitted to cloud server using Dragino Lora shield and a LoRa gateway which is placed in the substation. For a lora module to send data and a gateway to receive data they have to be registered on the IoT platform with unique identities. The data from all nodes/devices in the range is received by the gateway in the form of RF packets. Each RF packet contains unique MAC address and the data. Based on the MAC address present in the received data packet the gateway will identify the device. The n the gateway which is configured with Wi-Fi sends the data to IoT platform (cloud). A web application is created on the IoT platform with monitoring and controlling features. When any parameter of a transformer is abnormal, an alert is received on the web page, so that a command to control the operation of particular transformer can be given through the same platform. When a command is issued, based on the MAC address gateway will transmit the command to respective transformer and the command will get executed by the arduino microcontroller with the help of actuators.

The measuring parameters considered, to monitor the distribution transformers are voltage, current, oil temperature, winding temperature and status of silica gel in breather, which is done by using following sensors.

**IoT Platform (Cloud):** IoT platforms are the central piece in the Internet of Things architecture that connect the real and the virtual worlds and enable communication between objects. IOT platform consists of 8

important building blocks: Connectivity & normalization, device management, database, processing & action management, analytics, visualization, additional tools, and external interfaces. Number of studies witnessed IOT application server on cloud platform was cost effective in maintenance and allow fast deployment as it uses application program interfaces (API) provided by cloud platform.




## IV. CONCLUSION

In comparison to manual monitoring methods, the IoTbased solution for monitoring and managing distribution transformers is quite simple and efficient. The goal is to use LoRa (Long Range) modules to communicate real-time data from each transformer to an IoT platform.A few benefits of this approach include constant monitoring of DTs, prompt alerts to correct any irregularity, hence extending the lifespan of distribution transformers, mak ing troubleshooting in the distribution network simpler, and ensuring the consumer's uninterrupted access to power.In order to prevent any potentially dangerous failures in the distribution network, this new IoTbased fram ework will result in receiving notifications on the web application for any violations in the rated values of para meters.

## REFERENCES

[1] Walid K A Hasan , Abobaker Alraddad, Abdulfatah Ashour, Yachao Ran, Mohamed A Alkelsh, Reyadh A M Ajele “Design and Implementation Smart Transformer based on IoT” 978-1-7281-2138-3/19/$31.00 ©2019 IEEE

[2] K. Hazarika, Gauri Katiyar, Noorul Islam “IoT Based Transformer Health Monitoring System: A Survey” 2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)

[3] GEORGE Y. ODONGO, RICHARD MUSABE1, DAMIEN HANYURWIMFURA , AND ABUBAKAR DIWANI BAKARI “An Efficient LoRa-Enabled Smart Fault Detection and Monitoring Platform for the Power Distribution System Using SelfPowered IoT Devices” IEEE Journal, Digital Object Identifier10.1109/ACCESS.2022.3189002

[4] Minar El-Aasse, Phoebe Edward, Mohamed Mandour, Mohamed Ashour, Tallal Elshabrawy "A comprehensive hybrid bit-level and packet-level LoRa-LPWAN simulation model" Elsevier journal, Internet of Things 14(2021)100386

[5] Shilpa Devalal, A. Karthikeyan "LoRa technology-an overview" Proceedings of the 2 nd, International conference on Electronics, Communication and Aerospace Technology (ICECA 2018) IEEE Conference Record

[6] Alireza Zourmand, Mohammad AbdulRehman , Chan Wai Hung, Andrew Lai kun Hing "Internet of Things (IoT) using LoRa technology" 2019 IEEE International Conference on Automatic Control and Intelligent Systems (I2CACIS 2019), 29 June 2019, Selangor, Malaysia.

[7] Umber Loreen, Ahcene Bounceur, Laurent Clevier "A Study of LoRa Low Power and Wide Area Network Technology" 3rd International Conference on Advanced Technologies for Signal and Image Processing - ATSIP'2017, May 22-24, 2017, Fez, Morroco.

[8] A.Ajitha , Dr. T. Anil Kumar "Development of IOT Based Solution for Monitoring and Controlling of Distribution Transformers" 2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT)