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Fault Finding System for Distribution Transformers and Power Man Safety using IoT

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Abstract: ***Distribution transformer is a step down transformer which converts high voltage level to low voltage level. The main aim of this proposed system is to real time monitoring and finding the faults occurred in distribution transformer like Load current, Temperature, Oil level indication of the distribution transformer with the help of IoT (Internet of Thing).This system also provides power man safety during maintenance work. This will help to reduce the working effort and protect the distribution transformer by identifying faults before failure and actions can be taken.***
Keywords: Distribution Transformer, IoT, ADC, Microcontroller

I. INTRODUCTION

A distribution transformer is an electrical isolation transformer that converts high voltage level to lower voltage level. This is one of the most important equipment in the entire distribution system. It has been found that failure rate of distribution transformers in India is in the order of 12% to 15% as against less than 1% in developed countries. If sudden fault occurs due to voltage spikes, excessive load, short circuit in the distribution transformer leads to excessive generation of temperature and the risk of fire and its damage to the equipment. To avoid all these damage or risk of failure, it is needed to observe the parameters of the distribution transformer such as current, temperature and oil level. Sensors are used to sense key parameters of the distribution transformer and this data is sent to microcontroller and the recorded data is sent to substation through IoT technology along with notification [1]. The safety of power man can be done through this system by connecting and disconnecting of line through his smart phone using a password when he works on line. The person who works on the line for maintenance can only operate the control of turn ON and turn OFF the power of line. This will help to save the life of power man [2].

II. PROBLEM STATEMENT

In a distribution transformer the fault detection system itself is not possible. So there is a possibility of failure of distribution transformers due to short circuit and overload conditions. To avoid the failure of the distribution transformer it is needed to monitor Temperature, Load current and Oil level of the transformer. Also there is possibility of death of Power man when he works with line because of miscommunication between power man and substation instructor. So it is needed to avoid the failure of the distribution transformer and death of power man, the proposed system helps overcome these problems.

III. OBJECTIVES OF PROPOSED SYSTEM

A. Monitoring of over current.
B. Detecting Temperature rise.
C. Indication of oil level of the Distribution transformer.
D. Power man protection.

IV. BLOCK DIAGRAM

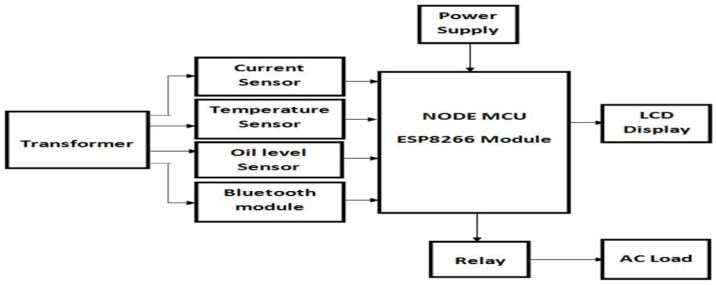


Figure 1: Block Diagram of working model

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Distribution transformer is one of the most important equipment of electrical power system which provides power to the end users. The life of a distribution transformer can be significantly increased by operating at rated suitable conditions.

The proposed system helps to monitor the parameters of the distribution transformer and keep it safe by using different sensors. This system contains NODE MCU ESP8266 Module, Current sensor, Float sensor, Temperature sensor, Bluetooth module, Transformer, LCD display, Relays etc.

The NODE MCU ESP8266 module is operated on DC voltage. Its operating voltage is 5V. It has a total of 30 pins. It has 16 input/output pins, receiver pin, transmitter pin, reset pin, 4 supply pin, 4 GND (ground) pin, EN (enable) pin. It is used to transmit and receive information by collecting the readings from the different sensors. The collected information by the sensors is in the form of analog. Here ADC (Analog to Digital Converter) is used to convert the collected analog information to digital form.

The NODE MCU ESP8266 module has inbuilt Wi-Fi module to transmit the collected information to substation to monitor the health of the distribution transformer. Here the step down transformer is used and supplied with 230V AC and secondary voltage of the transformer is 12V AC.

When a fault is occurred in the distribution transformer like over current, decrease in oil level, temperature rise is continuously monitored through the respective sensors. The current is observed by the current sensor. The current sensor ACS712 is used to monitor the current rating of the transformer. Temperature rise of the transformer is monitored through the LM35 temperature sensor, it ranges from -50°C to 150°C. Float sensor is used to monitor the oil level in transformer. Due to overheating the oil in the transformer evaporates and decreases in oil level. It is dangerous to life of a transformer. So this can be measured through a float sensor [1].

Here HC05 Bluetooth module is used for power man safety. The power man can handle this by operating through android mobile. Power man can easily disconnect the line while working on the fault line and connect the line once the work is complete by putting the suggested password to mobile and a major advantage is he can only operate that line [2].

All this information is transmitted to ESP8266.The received information is displayed in LCD display. At the same time this information is uploaded to substation through the cloud server by using IoT.

An IoT consists of different sensors and communication mediums. IoT based devices share sensor data through cloud. And this data can be sent to different user interfaces like smart phones and computers and actions can be taken.

V. COMPONENTS DETAILS

Table 1: Components specification

SI. No	Components	Specification
1	Transformer	230/12 V
2	NODE MCU ESP8266 Module	5 V
3	Current sensor	ACS712
4	Temperature sensor	LM35
5	Bluetooth module	HC05
6	LCD display	16 x 2
7	Relay	12 V DC
8	Diode	1N4007
9	Capacitor	2200µF
10	Voltage regulator	7805
11	Lamp load	40 W

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VI. RESULT AND DISCUSSION

Figure 2 shows the working model of the proposed system. In this working model the measurement of load current, oil



Figure 2: Working model of proposed system

Level and temperature of the transformer can be done through respective sensors. These collected measured values are sent to the substation with the help of NODE MCU ESP8266 module and it has inbuilt Wi-Fi module. IoT helps to visualize the data and improve accuracy, reliability without human intervention. We can solve problems and maintain the transformer from failures. Power man safety is done by putting a password to turn ON and turn OFF the line with the help of Bluetooth module HC05. It will save the life of a power man.

Table 2: Data collected from working model

SI. No	Date	Time(hrs)	Temperature(°C)	Load current(A)	Oil level	Line
1	2020-02-28	05:58:17	32.54	0.0323	1	1
2	2020-02-28	05:58:38	32.54	0.0138	1	0
3	2020-02-28	05:59:01	32.54	0.0338	0	1
4	2020-02-28	05:59:23	32.87	0.0132	1	0
5	2020-02-28	05:59:45	35.44	0.0972	1	1
6	2020-02-28	06:01:07	36.09	0.5432	1	0
7	2020-02-28	06:01:30	36.41	0.9720	0	1
8	2020-02-28	06:01:52	35.44	0.8508	1	0
9	2020-02-28	06:02:13	34.44	0.9508	0	1
10	2020-02-28	06:02:34	34.44	0.9509	1	0

Table 2 is showing the collected data from the working model of the proposed system. It includes Date, Time, Temperature, and Load current, Oil level of the transformer and indication of line connected or disconnected from power man. Oil level data in Table 2 indicates, '1' for high and '0' for low. Line data indicates, '1' for line connected and '0' for line disconnected. These data stored with respect to time and date gets updated for every 20 seconds. All this data stored in **Thing speak** software can be accessed any time.

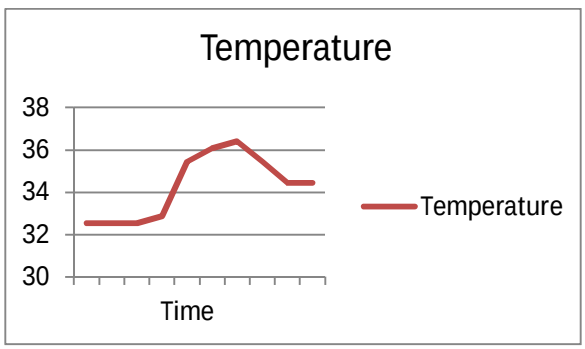


Figure 3: Relation between Temperature and Time

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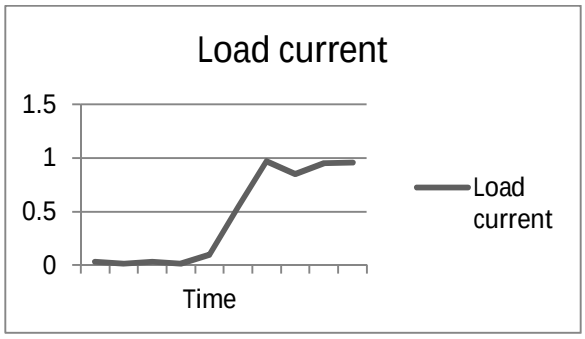


Figure 4: Relation between Load current and Time

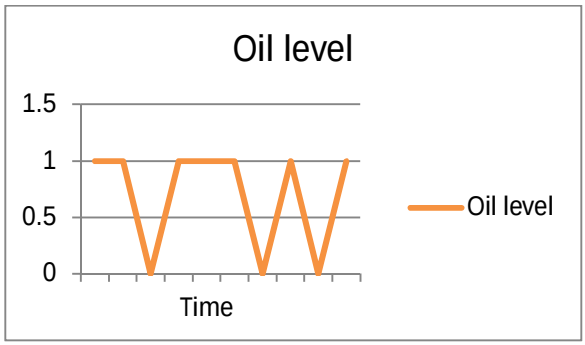


Figure 5: Relation between Oil level and Time

The relation between Temperature v/s Time, load current v/s Time and Oil level v/s Time are shown in figures 3, 4 and 5 respectively.

VII. CONCLUSION

The fault finding system for distribution transformer using IoT is useful to collect the parameters like load current, oil level indication, temperature in real time. This is very helpful to monitor the performance of a distribution transformer when a fault occurs due to short circuit or overload conditions. The collected data from this system is easily accessed any time in different user interfaces like smart phones and computers. By using this system it is possible to reduce failure of the distribution transformer in overload condition. It will also help to save the life of a power man by connecting and disconnecting lines through his mobile by putting a secured password in emergency conditions.

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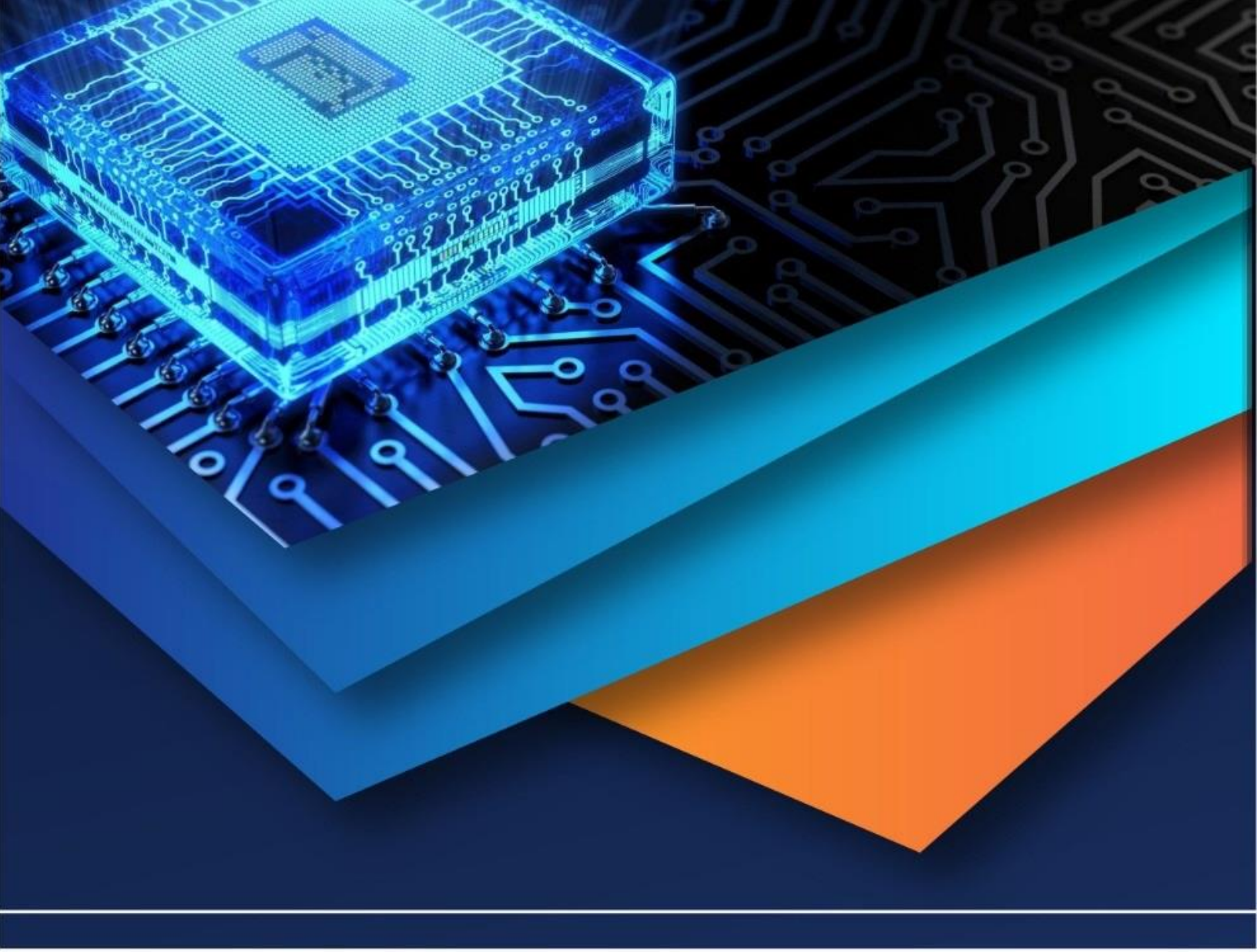


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