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Smart Transformer Protection Unit

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***Abstract*—** The transformer is an essential part of the transmission and appropriation framework. The point of creating, transformer security structure is to oversee in such a manner, that we are utilizing microcontroller and IoT to give programmed security and continuous observing to the transformer. There are numerous flaws happening on a transformer, for example, over-voltage, under-voltage, extraordinary temperature, and so on. The unit is structured so that it will be good with a wide range of dispersion and force transformer of any appraising. These pack presented sensor, microcontroller, IoT module. To shield the transformer from any cataclysmic disappointment. Also, the framework shows continuous information on the PC at the working station. This framework can use for identifying issues before they happen because of this we can forestall flaws that are expensive to fix and bring about lost assistance. We give an imaginative structure to build up a framework for checking the voltage, current, temperature, and oil parameters of a transformer in a substation or in the field. The proposed structure is produced for the client to effectively perceive the transformer on the off chance that it is endured by any issues and what are the current online parameters. This framework will assist the transformers with operating easily and distinguish issues before any disastrous disappointment.

Keywords— Transformer, Faults, Protection, Inrush Current, Relay, IOT module, Monitoring, controlling & protection, microcontroller

I. INTRODUCTION

As we know, the transformer is the heart of the whole electrical power system. It is very essential to protect them from various faults happens in the system due to some natural or unnatural faults. Protection against fault in an electrical power system is very essential and vital for reliable performance. A power system is said to be faulty when an undesirable condition occurs in that power system, where the undesirable condition might be short circuits, over-current, overvoltage, etc. This system with a unique concept to date is been designed specifically to have complete extreme secure protection for transformers ranging from KVAs to MVAs.

Its main objectives are as follows: -

- To detect & prevent faults that are costly to repair and result in a loss of service.
- The system will be designed for monitoring voltage, current, phase angle, temperature& oil parameters of the transformer in a substation or the field.
- It will be equipped with an IoT module for a machine to machine wireless communication.
- The system parameters will be displayed on the PC or any internet operated device.
- The system will have a TFT display that will display online status in graphical and tabular data.
- The system will have all required main protection assembly to protect the transformer, with a backup power supply.

Later enormous enthusiasm for Machine to Machine correspondence is known as the Internet of Things (IoT). They need to take a gander at it consistently by utilizing this task. It can limit working endeavors and improve precision, dependability, proficiency in this venture. Sensors are utilized to detect the fundamental parameters of gear, for example, voltage (over-voltage, under-voltage), over current, high temperature, oil level this detected information is sent to the microcontroller. This controller checks break down information gave by sensors and offer directions to assurance gadgets according to prerequisite and this information further send to the IoT module of these information ensure the correct data is close by for the administrator and the administrator can settle on valuable choices before any disastrous disappointment based on that information of parameters .with the goal that we need a continuous observing framework to identify every working parameter activity and send to the observing focus in

time. It prompts Online checking of key operational parameters of transformers can give valuable data about the soundness of transformers which will push the utilities to ideally utilize their transformers and keep the advantage inactivity for a more extended period.

II. EXPERIMENTAL

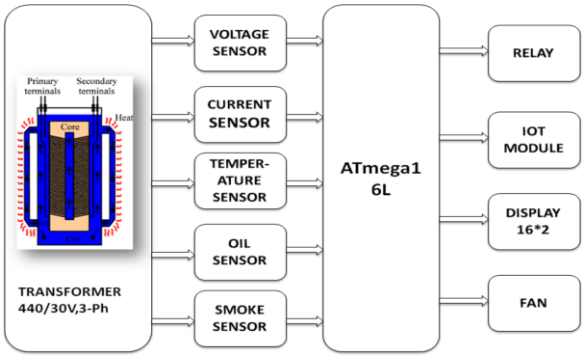

Fig. Block diagram of the transformer protection unit

We are utilizing the most recent innovation to develop this venture, it's a model since this task or this framework can be utilized in a high evaluating transformer which is exorbitant to us and because of whole wellbeing conditions we are indicating the entire intimation structure on a model. In this structure, we are acquainting different sensors with sense different parameters of the transformer in different climate conditions. This information can use for the insurance of the framework and use to decrease debacle happens because of a flaw condition. We are additionally associating this information to the "IoT module " for continuous observing and in the event that any flaw happens in the framework, at that point the administrator can without much of a stretch recognize shortcoming area and issue type so it can decrease recuperation time and increment proficiency.
Segments utilized in the structure are as per the following:-

1. VOLTAGE SENSOR

A voltage sensor i.e. PT (Potential Transformer) is a sensor is used to calculate and monitor the over-voltage and under-voltage in the transformer. If sudden changes occur in voltage, the sensor senses the fluctuation in voltage and relay trip automatically and hence transformer is protecting from over-voltage and under-voltage conditions. Sensors are basically a device that can sense or identify and react to certain types of electrical or some optical signals.

2. CURRENT SENSOR

A current sensor i.e. CT (Current Transformer) is a sensor is used to calculate and monitor the over-current in the transformer. If sudden changes occur in current, the sensor senses the fluctuation in current and relay trips automatically and hence the transformer is protecting from over-current conditions.

3. TEMPERATURE SENSOR

The LM35 series is a precision integrated-circuit temperature sensor with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range.

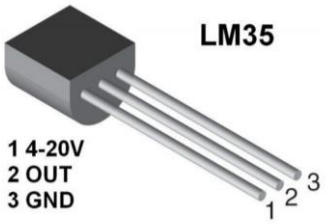

Fig. LM35 sensor

4. SMOKE SENSOR

A typical 117/15.2-kV, 37/50/62.5-MVA Power Transformer can contain approximately 10000 gals (37855 l) of oil. Larger transformers can contain much more oil. Transformers are filled with oil for several reasons, the most important of which is insulation. Additionally, the oil is used as a coolant and as a dielectric fluid preventing arcing, the electrical breakdown of gases accompanied by the discharge and resulting ionization known as the corona. For comparison, a “semi” truck gasoline tanker truck holds 9000 gallons, give or take. Since oil is a combustible liquid, when a transformer fault or failure occurs, the transformer itself can provide both the ignition source and fuel for a fire. At the time of fuel fire, the smoke sensor MQ-5 sensor sense the smoke and suddenly relay trips automatically so that the transformer shuts down and hence the transformer protects from fire.

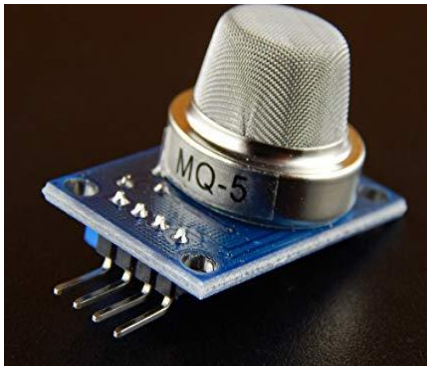

Fig. MQ-5 sensor

5. OIL LEVEL SENSOR

The float switch is a type of level sensor, a device used to detect the level of oil within a transformer tank. The switch is used as an indicator, an alarm, or to control the oil level of the transformer. where the switch detects the rising level of oil in the transformer tank and energizes an electrical pump which then pumps liquid out until the level of the liquid has been substantially reduced, at which point the pump is switched off again. Float switches are often adjustable and can include substantial hysteresis. That is, the switch's "turn on" point may be much higher than the "shut off" point.

6. MICROCONTROLLER

A microcontroller is embedded inside of a system to control a singular function in a device. ATMEGA 16 Microcontroller is that controls all sensors it receives data from the sensor and then sends the data to the IoT module, Relay, and cooling fan.

7. IOT MODULE

An IoT (Internet of Things) module is a small electronic device embedded in objects, machines and things that connect to wireless networks and sends and receives data. To provide Real-time monitoring to the transformer the data collected by IoT from microcontroller and store data in the cloud then sends to the operator through the internet connection. IoT module provides real-time monitoring to the transformer**.**

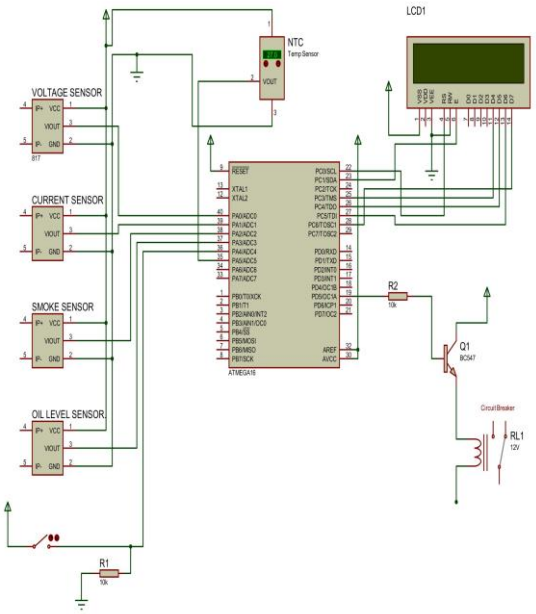

Fig. circuit diagram of the transformer protection unit

III. ACKNOWLEDGMENT

The issue of significant expense upkeep due to the disfigurement of transformer twisting because of the ruinous powers created in the transformer center and twisting get together under deficiency condition because of flaw present or some other parametric change could be redressed by the created assurance structure. The planned unit is fit for giving all the current essential insurance to the transformer which incorporates differential assurance, confined earth flaw security, over-current insurance, overvoltage assurance with temperature observing and controlling by means of cooling structure just as it additionally gives over-temperature insurance. The propelled highlight incorporates a correspondence framework for information trade by means of the IoT module. This predefined structure makes the unit fit for trading information with the ideal framework set at wherever with high productivity and unwavering quality with great similarity and availability. The locally available presentation mounted on the unit is equipped for giving the information in an appropriate graphical and unthinkable structure which is anything but difficult to peruse and see likewise gives a great deal of useful information. The progressed IoT module procedure helps in better methods for interchanges which upgrade the improvement in the constant observing procedures. This framework most developed procedures and assurance gear to give 100% proficiency.

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