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IOT Based Circuit Monitoring System

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❖ Abstract :-

The purpose of this project is to acquire the remote electrical parameters like Voltage, Current and Frequency and send these real time values over IOT network using IOT Modem/phone along with temperature at power station. This project is also designed to protect the electrical circuitry by operating an Electromagnetic Relay. This Relay gets activated whenever the electrical parameters exceed the predefined values. The Relay can be used to operate a Circuit Breaker to switch off the main electrical supply.

User can send commands in the form of IOT NOTIFICAITON messages to read the remote electrical parameters. This system also can automatically send the real time electrical parameters periodically (based on time settings) in the form of IOT NOTIFICAITON. This system can be designed to send IOT NOTIFICAITON alerts whenever the Circuit Breaker trips or whenever the Voltage or Current exceeds the predefined limits.

This project makes use of an onboard computer which is commonly termed as microcontroller. This onboard computer can efficiently communicate with the different sensors being used. The controller is provided with some internal memory to hold the code. This memory is used to dump some set of assembly instructions into the controller. And the functioning of the controller is dependent on these assembly instructions. The controller is programmed using Embedded C language.

❖ Project Objectives :-

a) The main objective of this project is to use open source platform to continuously monitor and control the circuit breaker.

b) There is a shift in the maintenance paradigm from time-based maintenance to as-needed maintenance. This shift comes with the benefit of maintaining adequate circuit breaker performance while reducing overall maintenance costs & unnecessary downtime.

❖ Introduction :-

Electricity is an extremely handy and useful form of energy. It plays an ever growing role in our modern industrialized society. The electrical power systems are highly non-linear, extremely huge and complex networks. Such electric power systems are unified for economic benefits, increased reliability and operational advantages. They are one of the most significant elements of both national and global infrastructure, and when these systems collapse it leads to major direct and indirect impacts on the economy and national security.A power system consists of components such as generators, lines, transformers, loads, switches and compensators. However, a widely dispersed power sources and loads are the general configuration of modern power systems. Electric power systems can be divided into two sub-systems, namely, transmission systems and distribution systems. The main process of a transmission system is to transfer electric power from electric generators to customer area, whereas a distribution system provides an ultimate link between high voltage transmission systems and consumer services.

Electric utility substations are used in both the transmission and distribution system and operate independently to generate the electricity. A typical substation facility consists of a small building with a fenced-in yard that contains transformers, switches, voltage regulators, and metering equipment that are used to adjust voltages and monitor circuits. The distance between the Generators and loads may be in terms of hundreds of miles. Hence, the amount of huge power exchanges over long distances has turned out as a result of the lack of quality of the electric power.

To improve the quality of power with sufficient solutions, it is necessary to be familiar with what sort of constraint has occurred. Additionally, if there is any inadequacy in the protection, monitoring and control of a power system, the system might become unstable. Therefore, it necessitates a monitoring system that is able to automatically detect, monitor, typify and classify the existing constraints on electrical lines. This brings up advantages to both end users and utility companies. In general, distributed control agents are employed to offer reactive control at several places on the power network through the devices namely: 1.) Power System Stabilizers (PSSs), 2.) Automatic Voltage Regulators (AVRs), 3.) FACTS and much more.

As maintenance of a transformer is one of the biggest problems in the Electricity Board (EB). During strange events for some reasons the transformer is burned out due to the over load and short circuit in their winding. Also the oil temperature is increased due to the increase in the level of current flowing through their internal windings. This results in an unexpected raise in voltage, current or temperature in the distribution transformer. Therefore, we are proposing the automation of the distribution transformer from the EB substation. In the automation, we consider the voltage, current and temperature as the parameters to

be monitored as the transformer shows its peak sensitivity for the same. Hence, we design an automation system based on microcontroller which continuously monitors the transformer. Because of the microcontroller operation, the transformer presents in the substation which is turned off in the main station.

❖ Literature Review :-

In past few years many theories were proposed about the circuit breaker system using IoT.

- **Gauri Vartak (et.al), (November 2021)"Smart Circuit Breaker using IoT Technology".**

Thus, with the implementation of IOT based circuit breaker the safety of the line man is ensured while working on high power lines by manually controlling the circuit system using Blynk application. The overall circuit breaker performance is maintained while reducing maintenance costs and unnecessary downtime. Also, the restriction of the unauthorized and non-interference of the outsiders with the supply circuit can be achieved. In this way we have proposed a smart circuit breaker by making it very reliable for the user to handle it using IoT.

- **Bhagwan Kharat (et.al), (May 2017)" Internet of Thing (I.O.T) Base Controlling & Monitoring of Circuit Breaker"**

Proposes a system that presents the architecture of an online monitoring and diagnosis System of an electrical equipment which has role to acquire, transfer and process information about monitored equipment. An interface is designed on top of which different local as well as system applications can be recorded. Controller will continuously transmit parameters of circuit breaker to control room and also displayed on Monitor of computer as well as after C.B trip SMS get sent to the registered mobile number. Once message is received, the operator or any authorized person will give command to set or reset the breaker. It minimizes the fault clearing time and improves maintenance method which increases life time and reliability of the circuit breaker.

- **Abhijit Das (et.al), (November 2018)" IOT Based Circuit Breaker Monitoring & Control".**

Proposed a system that develops monitoring & control scheme of a typical circuit breaker using Adriano Mega 2560 embedded microcontroller along with Ethernet

Shield for integration of IOT. The system facilitates diagnose of the electrical and mechanical health of circuit breaker in real time. It uses Open-source platform which eliminates the concern regarding reliability & security of the safety/safety related/strategic application as complete source code implementation is open & fully accessible to the user.

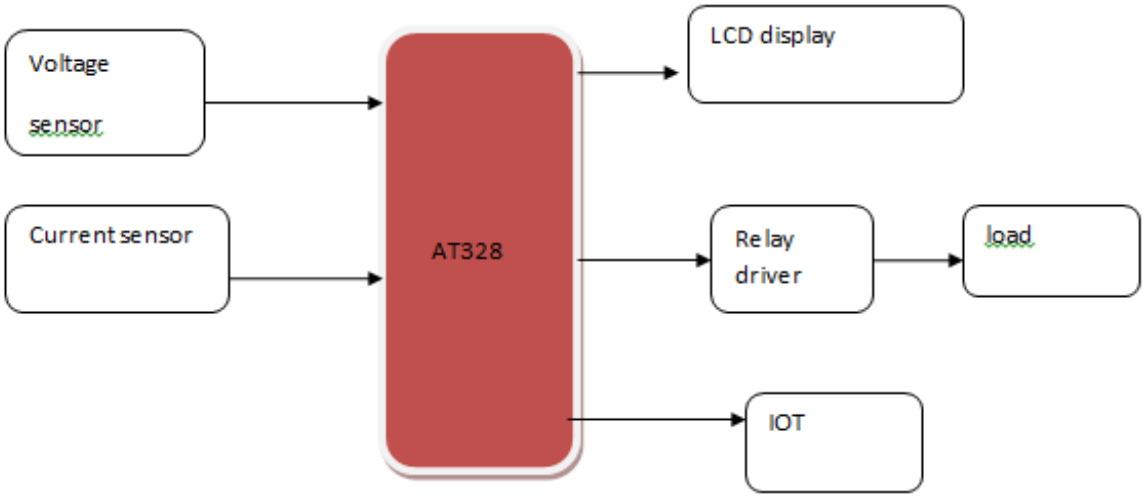
- **Samruddhi B. Parbat (et.al), (March 2020)" IOT Based Circuit Breaker Monitoring and Control".**

In this way we are going to make circuit breaker smart and making its operation very reliable and makes its data available for all the users by using the internet of things. Also, maintenance time and downtime of the system reduces and also security of the system get increase. By using the smart electronic components data can be available in operators' hand so he can make changes according to the requirements of the system

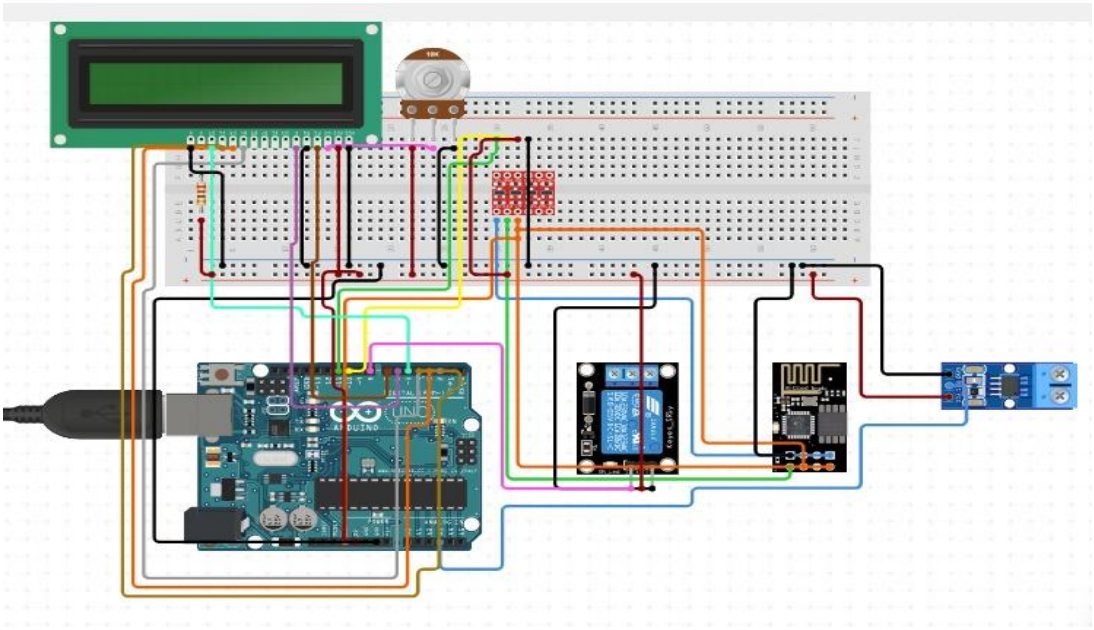
❖ Problem Statement :-

To improve the quality of power with sufficient solutions, it is necessary to be familiar with what sort of constraint has occurred. Additionally, if there is any inadequacy in the protection, monitoring and control of a power system, the system might become unstable. Therefore, it necessitates a monitoring system that is able to automatically detect, monitor, typify and classify the existing constraints on electrical lines. This brings up advantages to both end users and utility companies.

❖ **Block Diagram :-**



❖ **Circuit Diagram :-**



❖ **List of Components with their Specifications :-**

Sr. No.	Name of Component	Specifications/Rating	Quantity
01	AT328 SERIES MICROCONTROLLER	5v	01
02	IOT MODULE	5v	01
03	ADC	5v	01
04	BUZZER	4v	01
05	RELAY	AC	01
06	CURRENT SENSOR	-	01
07	LED	-	01
08	WI FI MODULE	5v	01
09	CIRCUIT BREAKER	220v	01
10	SWITCHES	-	01
11	LCD DISPLAY	16*2	01
12	CAPASITOR	-	02

❖ **Advantages, Disadvantages, Applications :-**

➢ **Advantages :-**

1. Devices can be operated from anywhere in the world.
2. Efficient and low cost design.
3. Low power consumption.
4. Real time monitoring.
5. Improve circuit breaker reliability and minimize downtime
6. Maximize circuit breaker life with maintenance activity to address abnormal operation
7. Provides true dynamic loading capability
8. Minimize condition monitoring costs through unified monitoring of various parameters for the entire circuit breaker
9. Integrate with your facility's computerized maintenance management software (CMMS)
10. Measure and record loading of your circuit breakers and prevent overloading.

➢ **Disadvantages :-**

1. Depending on the network signal strength
2. Sometimes it may happen that due to weak signal data cannot be send at quick instant. But this problem is not for so much time period.

➢ **Applications :-**

1. This system can be implemented in industries.
2. This system can be used to monitoring and controlling the home appliances.
3. This system can be implemented to monitoring and controlling Distribution Circuit breakers located at remote areas.

❖ **Conclusion**

In modern control centers, system operators get alarm messages from many devices in real time. From alarms, it is still very hard to find out location and type of the potential equipment problem. One needs an automatic way of processing the events to identify whether sequences of equipment operation were as expected. Instead of many alarm messages, only one report should be sent to the operators with concise information about success or failure of a switching sequence. In the case of a breaker, report will offer more detailed message whether the breaker failure logic worked out properly and finally disconnected faulted section. This kind of analysis enables tracking of every CB operation allowing reconstruction of an entire sequence of operations.

In our project we studied designed to attain real time control &monitoring of Circuit Breaker. Measure and record loading of your output of C.B and prevent overloading & increasing whole system life.

This reports shows a conceptual implementation of IOT basedCircuit Breaker Monitoring & Control which will reduce thesize of the circuit breaker & facilitate the concept of as needed maintenance approach. Moreover, this will eliminate the concern regarding security vulnerability of third party system as the platform is opensource. Being a prototype conceptual implementation, future work can be done on EMI/EMC compliance, implementation of open source inferential engine in order to receive recommendation on maintenance; Integration with computerized maintenance managementsoftware, development of open source hosting server etc.

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