Transmission and Distribution Monitoring System Using IoT

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Abstract: **In the last decade, much of the attention is made towards introducing the smart systems and appliances to meet the requirement of the century and make life comfortable. During the same period, electric power sector also made the necessary innovation to compensate the demand of today's electric supply and to make use of electric resources effectively by introducing "Smart-Grid". The smart grid is a part of transformation and reformation in the power industry sectors. The smart grid is a future modern power system that utilizes internet of thing to monitor, control and create various intelligent communications in the electrical system. In this paper, the author first presents the fundamental architecture of Internet of Things (IoT). They then outline the key technologies of IoT for Smart Grid. Finally, the ideas of applied communication and framework of transmission and distribution monitoring based IoT for Smart Grid is discussed. The deployment of IoT technologies in Power System infrastructures would accelerate the smart grid development and enhance the electricity delivery services becoming more robust, attractive, responsive and communicative.**

Index Terms: **Component, formatting, style, styling, insert.**

I. INTRODUCTION

Protection against fault in power systems (PS) 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. The power transformer is one of the most significant equipment in the electric power system, and transformer protection is an essential part of the general system protection approach. Transformers are used in a wide variety of applications, from small distribution transformers serving one or more users to very large units that are an integral part of the bulk power system.

In power systems, distribution transformer is electrical equipment which distributes power to the low-voltage users directly, and its operation condition is an important component of the entire distribution network operation. Operation of distribution transformer under rated condition (as per specification in their nameplate) guarantees their long life. However, their life is significantly reduced if they are subjected to overloading, resulting in unexpected failures and loss of supply to a large number of customers thus effecting system reliability. Overloading and ineffective cooling of transformers are the major causes of failure in distribution transformers and transmission system.

Increase in population leads to increase in demands of electrical power. With the increase in demand of power, the existing systems may become overloaded. Overloading at the consumer end appears at the transformer terminals which can affect its efficiency and protection systems. One of the reported damage or tripping of the distribution transformer is due to thermal overload. To avoid the damaging of transformer due to overloading from consumer end, it involves the control against over-current tripping of distribution transformer. Where the advancement of technology has given the edge to use the latest trends, such as microprocessor.

Microcontrollers are used as one of the requirements to apply in the remote protection of the transformer. For decades, fuse, circuit breakers and electromechanical relays were used for the protection of power systems. The traditional protective fuses and electrometrical relays present several draw backs.

Alternatively, some researches were conducted on relay which can be interfaced to microprocessors in order to eradicate the drawbacks of the traditional protective techniques, which led to many improvements in transformer protection in terms of lower installation and maintenance costs, better reliability, improved protection and control and faster restoration of outages. In view of the associated problems of traditional methods of protecting transformer, a proposed solution is chosen to develop a microcontroller based transformer protection prototype because the microprocessors based relays provides greater flexibility, more adjustable characteristics, increased range of setting, high accuracy, reduced size, and lower costs, along with many ancillary functions, such as control logic, event recording, self-monitoring and checking, etc.

LITERATURE REVIEW

Purusothaman, SRR Dhiwaakar, et al. explain about the focus is on the DG agents, grid agent and Mu agents. DG agents like the distributed energy resources (DERs), load, storage and the grid agents. The Mu agent acts as the communication channel between the DG agents to the higher level agents such as the control agent. The implementation of the system has been done using an Arduino microcontroller. Author Kabalci, Ersan, Alper Gorgun, and Yasin Kabalci, introduces an instant monitoring infrastructure of a renewable energy generation system that is constituted with a wind turbine and solar panel arrays. The monitoring platform is based on current and voltage measurements of each renewable source. The re lated values are measured with the developed sensing circuits and processed by an 18F4450 microcontroller of Microchip. The processed parameters are then transmitted to a personal computer (PC) over universal serial bus (USB) to be saved in a database and to observe the system instantly. The coded visual interface of monitoring software can manage the saved data to analyze daily, weekly and monthly values of each measurement separately. Jiju, K., et al. describes the development of an online monitoring and control system for distributed Renewable Energy Sources (RES) based on Android platform. This method utilizes the Bluetooth interface of Android Tablet or Mobile phone, as a communication link for data exchange with digital hardware of Power Conditioning Unit (PCU).Goto, Yoshihiro, et al explained about an integrated system that manages and remotely monitors telecommunications power plants has been developed and has started operations. The system is used to operate and maintain more than 200,000 telecommunication power plants, which including devices such as rectifiers, inverters, and UPSs, and air-conditioning plants installed in about 8,000 telecom munication buildings. Features of the system are the integrate the management and remote monitoring functions, into one system and improved user interfaces, which use information and communication technology such as web technology. Suzdalenko, Alexander, and Ilya Galkin identify the problem of the non intrusive load monitoring method of load disaggregation into separate appliances. When some local generators based on renewable energy sources are connected to the same grid, as they may be mismatched with loads variable in time.

II. CONSTRUCTION

COMPONENTS OF TRANSMISSION AND DISTRIBUTION SYSTEM

- AC SUPPLY
- TRANSMISSION TOWER
- TRANSFORMER (12V)
- SOLAR PANEL
- BATTERY
- MICROCONTROLLER
- LEDs & FANs
- SWITCHES
- PCB
- WIRES

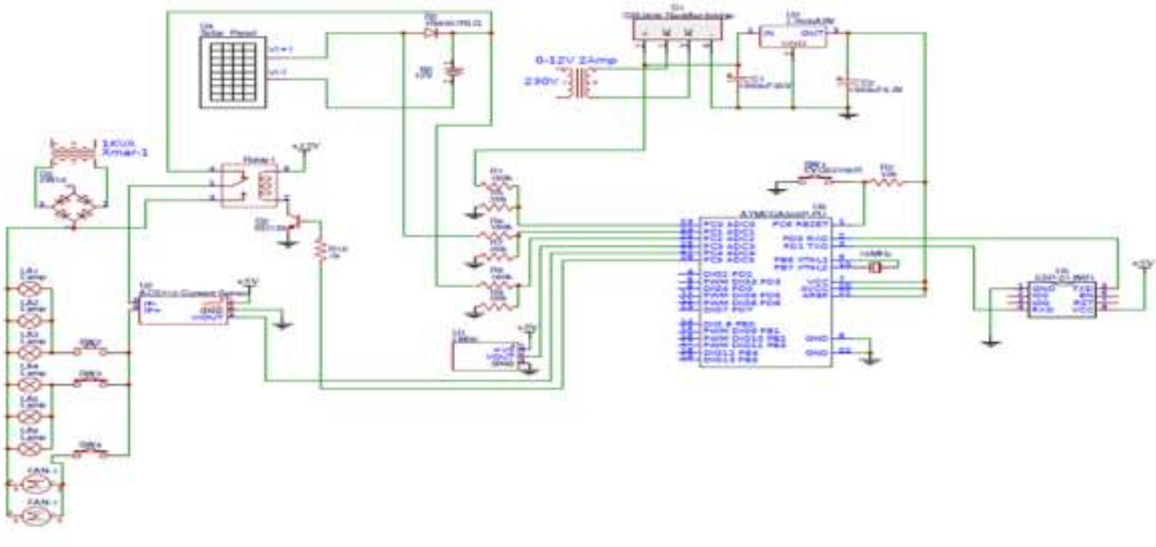

Fig: Circuit Diagram

IV. WORKING

The system is designed to monitor and measure the parameters of the transmission and distribution system. In this system we have used a solar panel which generates the electricity power from the sun light and stores this generated power into the battery used in this system. We have connected three types of loads. First load consists of a group of three lamps connected with the microcontroller through a switch. The second load also consists of a group of three lamps connected through another switch as shown in the circuit of the system. The third type of load consists of two fans also connected with the controller through a switch. Initially the first and second loads are turned on as the system is powered. All the loads will be drive by the solar power stored in the battery. The system continuously measures the solar voltage and battery voltage through a voltage divider circuit. These measured values are then fed to the microcontroller. The microcontroller compares the measured value with the pre-defined values in the program. And also sends the data to the IOT application continuously. The system consists of a temperature sensor used to measure the temperature of

the distribution transformer. If the temperature exceeds 60 degree Celsius then the fans connected in the system will turn on by the controller.
If the solar voltage drops down below the pre-defined value the system will send an alert message which will be sent to the IOT application for alerting the user. And when the solar power fails down the loads will be automatically shifts on the mains supply by the system to avoid the supply failure for the loads used in this system. To shift the loads from solar power to mains supply a relay is used in this system. The microcontroller triggers this relay to shift the loads on the mains supply. The system also designed to measure the load current continuously. For this we have connected a current sensor which measures the load current and sends the measured value to the microcontroller. The microcontroller will send all the measured parameters to the IOT application through Wi-Fi modem used in this system. When the load shifts on the mains supply due to failure of solar power the system will also measures the mains voltage for protection purpose.

V. ADVANTAGES

1. It prevents circuit from damage.
2. Avoid interruption in power supply.
3. Transformer safety.
4. Save time.
5. Save men power.
6. System can be monitor for anywhere.

VI. DISADVANTAGES

1. Circuit becomes bulky.
2. There is chance then software can be hacked and our personal information can be misuse hence all the safety risk become the consumer responsibility
3. Privacy is a bigissue for Iot.

VII. CONCLUSION

The remote monitoring system that has been developed was useful in understanding the conditions of the transformer. It also enables the operator to monitor the parameters far away from the transformer without the displacement of the crew. This system uses very little power consumption and has a long life. This system is cost effective and is easy to operate, to maintain, and to reproduce massively with low cost for applications in the field.

VIII. FUTURE SCOPE

We can also use a GSM modem to send alert message to the authorized person which will help in case of poor internet network.

COST ESTIMATION:

Component	**Specifications**	**Cost(Rs)**
Transformer	12-0-12V 2A	**200/-**
Resistor	2.2K,10K,470K,100E	**1/-**
Capacitor	1000uF, 100uF, 33pF	**5/-**
Diode	IN4007	**2/-**
LED	3mm	**5/-**
Switch	PUSH TO ON	**10/-**
Crystal	4MHz	**20/-**
Microcontroller	ATMEGA328P	**350/-**
Regulator	LM7805	**15/-**
LCD	16X2	**250/-**
Toggle switch		**20/-**
Wi-Fi	ESP01	**2500/-**
Battery	12V	**1000/-**
Solar Panel	12WATT	**500/-**
Temperature Sensor	LM-35	**250/-**
Current Sensor	ACS712	**550/-**
Potentiometer		**25/-**
Total Cost		**5703/-**

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Figures and Tables

Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table captions should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation **"Fig.1"** in the text, and "**Figure 1**" at the beginning of sentence. Use10 **point Times New Roman** for figure labels. Use words rather than symbols or abbreviations when writing figure-axis labels to avoid confusing the reader. As an example, write the quantity "Magnetization", or "Magnetization, M", Not just "M".

Table 1 Table Type Styles

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X. ACKNOWLEDGMENT

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression, "One of us (R.B.G.) thanks..." Instead, try "R.B.G.thanks". Put applicable sponsor acknowledgment shere; DO NOT place the month efirst page of your paper or as a foot note.