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IOT Based Sensing System for Substation Automation and Monitoring

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Abstract: ***As we see in the present world, Substation Automation becomes a key concept in Smart Grid Technology. The purpose of our project is to sense the remote electrical parameters like current, voltage and frequency and send these real-time data over the internet using IOT module. The project is also designed to protect electrical circuitry by operating the relay and the relay gets activated when an abnormal condition occurs such as due to any fault like over current, over voltage electrical parameters exceed the predetermined value. The present substations system, Supervisory Control and Data Acquisition System (SCADA) and Distributed Control System (DCS) are the most standards used for substation automation and control. The sensor data can be conveniently accessed by any device on the Internet from the Internet of Things (IOT) by subscribing to it. In this project, we can also detect the different types of fault occurred in the system such as the line to ground fault (LG) etc.***

Keywords: Arduino Uno, Internet of Things (IOT), Proteus for hardware simulation, Current & voltage sensor, Wi-Fi module (ESP8266) etc.

I. INTRODUCTION

In a smart grid, system substation plays an important role in transmission, distribution and generation so the smart grid system must be expected to change the situation of the electrical grid by, the integration of the new solutions to manage the power system infrastructure reliably and intelligently. To improve the power quality, it is necessary to know which type of constraints occurred in the power system. The present work suggests an internet of things (IOT) based system for monitoring, visualization, storage and analysis of sensor data in a powerful way. In the present scenario electricity still suffers from low power quality and blackouts so the present work recommends a well- planned design approach for sensor management in substation using IOT. IOT has proven itself to be complementary with SCADA because IOT uses data that are collected by SCADA as a primary function. SCADA focuses on monitoring and control while IOT focuses on monitoring, acquiring, and analyzing the system data to improve quality, productivity, and reliability of the power system. The SCADA system works accurately for real-time monitoring of what is going on in the substation whereas IOT has an ability to monitor macro-level questions such as operational effectiveness across various subsystem, the process changes to improve performance, prediction of failure planned and actual comparison. Hence, the installation of IOT with substation is expected to enhance robustness, efficiency, and convenience of substation. The system provides adaptable solution to collect process and save data from sensors on a different platform. Electricity is a very handy and helpful form of energy. It plays an ever-growing role in our modern industrialized society. The electrical power systems are the highly non-linear, extremely huge and complex network.

II. LITERATURE SURVEY

A. Substation Monitoring and Control Using Microcontroller & GSM

1) Author: Mrs. Krupal Dhimar, 2Mr. Jenise Patel, 3Mr. Yasin Shaikh, 4Mr. Anas Musani, 5Mr. Krishn Patel

The purpose of this project is to accumulate the remote electrical parameters like voltage, current, and frequency and send these real time values over GSM network mistreatment GSM modem/phone on with the temperature at the power station. This project is also designed to secure the electrical circuitry by operating a relay. This relay gets operated whenever the electrical parameters exceed the predefined values. The relay can be used to switch off the main electrical supply. A user will send commands within the style of SMS messages to scan the remote electrical parameters. This system can also mechanically send the important time electrical parameters sporadically (based on time settings) within the style of SMS. This system can be designed to send SMS alerts whenever the relay trips or whenever the voltage or current exceeds the predefined value. This project makes use of a microcontroller. The controller can systematically communicate with the different sensors beingused. The controller is supplied with some internal memory to carry the code. This memory is employed to dump some set of assembly directions into the controller. And the functioning of the controller depends on these assembly directions. The controller is programmed using embedded c language

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III. PROPOSED WORK

A. Here we are using Arduino Uno as a controller in which we are monitoring voltage which is between under, over, threshold and monitors current and frequency parameters with temperature monitoring.

B. The Line to the Ground fault.

C. All data will be updated over IOT using an online web server.

IV. BLOCK DIAGRAM

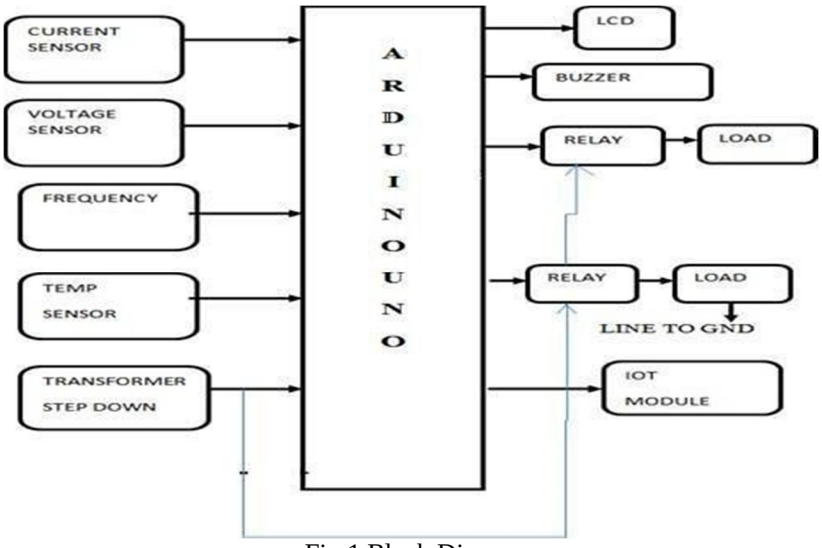


Fig.1 Block Diagram

V. HARDWARE MODEL

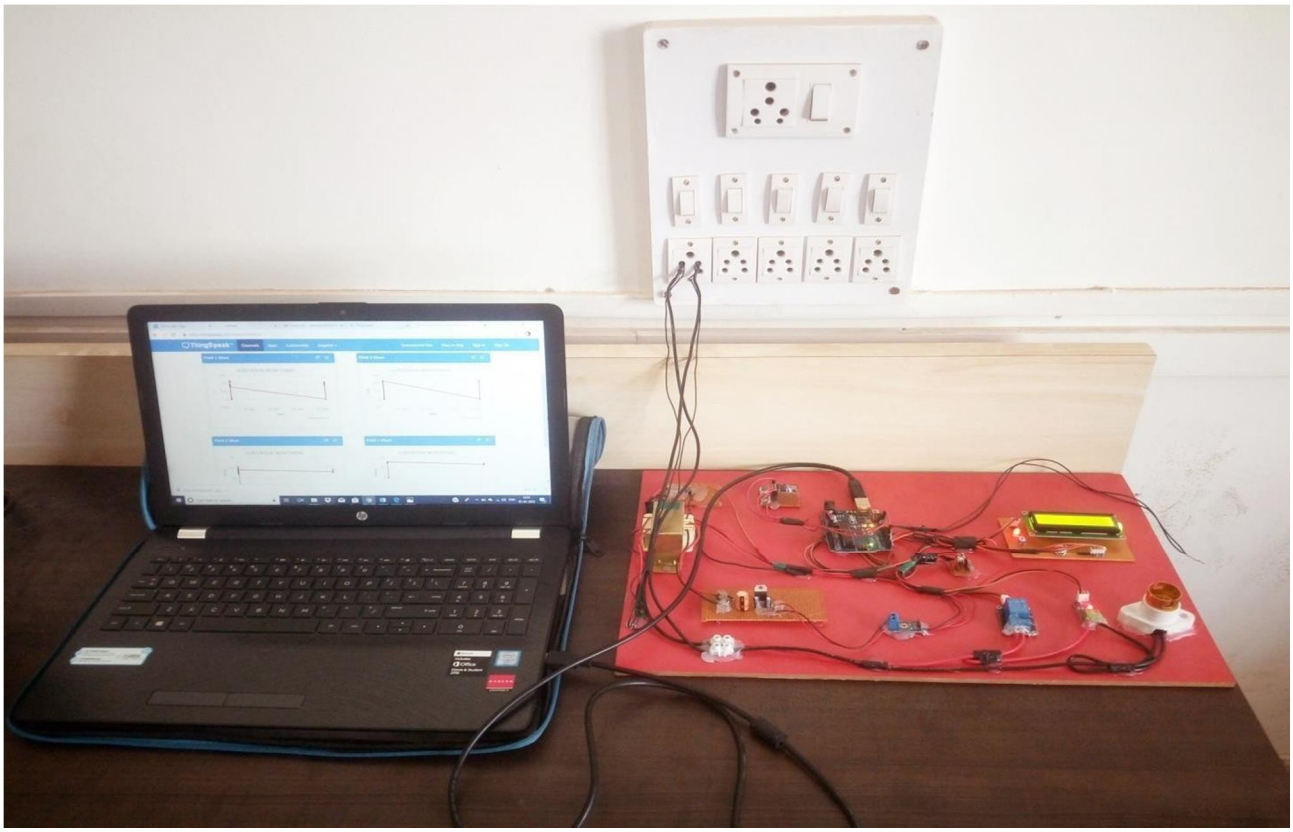


Fig.2 Hardware Module

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VI. WORKING

Fig. shows the hardware module of the project. This is a prototype module named as sensing system for substation automation and monitoring. In this module various types of sensors are used for sensing the different types of electrical and physical quantities such as voltage, current, frequency and temperature accordingly.

Here we are using Arduino Uno as a controller in which we are monitoring voltage which is between under, over, threshold and monitors current and frequency parameters with temperature monitoring as well as it also detects the Line to the Ground fault. After sensing the different quantities, LCD display will show the real time data for analysis purpose. The whole process is monitored by Arduino Uno microcontrollers. The graphical representation of the parameters is done by IOT module to identify easily. Also, with the help of this system, we can collect and store the real-time data for future use. If any fault occurred in the substation this fault can be detected and cleared easily.

VII. DATA TRANSMISSION OVER IOT

A. Internet Of Things Concept

The Internet of things (IoT) is the extension of Internet connectivity into physical devices and everyday objects. Embedded with electronics, Internet connectivity, and other forms of hardware (such as sensors), these devices can communicate and interact with others over the Internet, and they can be remotely monitored and controlled.

The definition of the Internet of things has evolved due to convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems.[5] Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers.

B. ESP8266 Wi-Fi Module

ESP8266 offers an entire and self-contained Wi-Fi networking resolution, which permits it to either host the applying or to dump all Wi-Fi networking functions. When it's the sole application processor within the device, it's able to boot up directly from associate external flash. It has integrated cache to enhance the performance of the system in such applications, and to attenuate the memory needs.

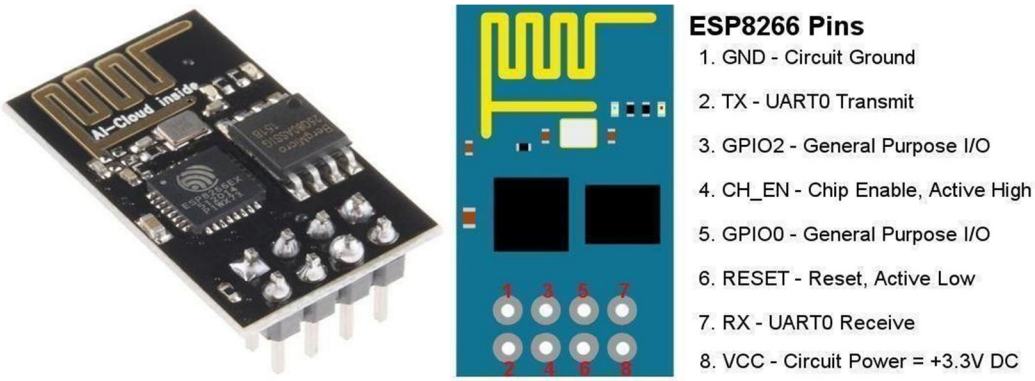


Fig.3 Wifi Module

C. Hardware Requirement And Software Requiremet

1) Hardware Requirements Specification: There should be required devices to interact with software.

a) Arduino Uno

b) LCD Display

2) Software Requirements Specification

a) Arduino IDE(Programming)

b) Proteus (Simulation)

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3) Specification Of Component

COMPONENTS	RATING
Arduino Uno	5V,40mA ,3.3(DC current),50mA
Voltage Sensor	0 to 25V (voltage input rang),3.3v-5v (output voltage) Current Sensor100mV/A,5.0vsingle supply operation
Relay	0-25 V,10A
LCD	16*2-character display,3.3V,1/16 duty cycle
Transformer	230v/12v (step down transformer) Temperature Sensor -30V, 55 0 to +1500 range

TABLE NO.1 SPECIFICATION OF COMPONENTS

D. Applications And Advantages

1) Application

a) This system can be implemented in industries.

b) This system can be used for monitoring and controlling the home appliances.

c) The system can be used in a smart substation.

2) Advantages

a) To improve the quality of power.

b) To Maintain Continuity of supply.

c) Real-time monitoring.

d) Stored real time data can be used for energy forecasting.

E. Result

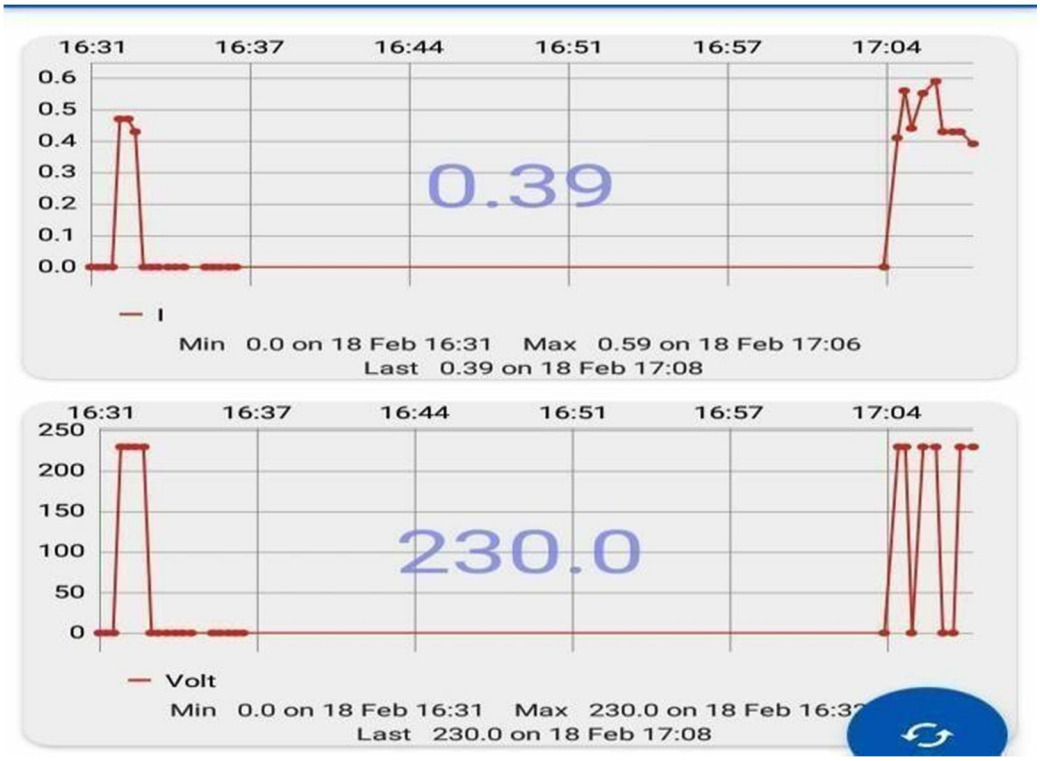


Fig. 4 voltage and current waveform

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Fig. 5 frequency & temperature waveform

VIII. CONCLUSION

The whole process is monitored by Arduino Uno microcontrollers. The graphical representation of the parameters is done by IOT module to identify easily. Also, with the help of this system, we can collect and store the real-time data for future use. If any fault occurred in the substation this fault can be detected and cleared easily. Hence the distribution is created safer, reliable and economical by suggests that of the planned system. The project can be easily and efficiently used in smart substations. The present substations system, Supervisory Control and Data Acquisition System (SCADA) and Distributed Control System (DCS) are the most standards used for substation automation and control. The sensor data can be conveniently accessed by any device on the Internet from the Internet of Things (IOT) by subscribing toit.

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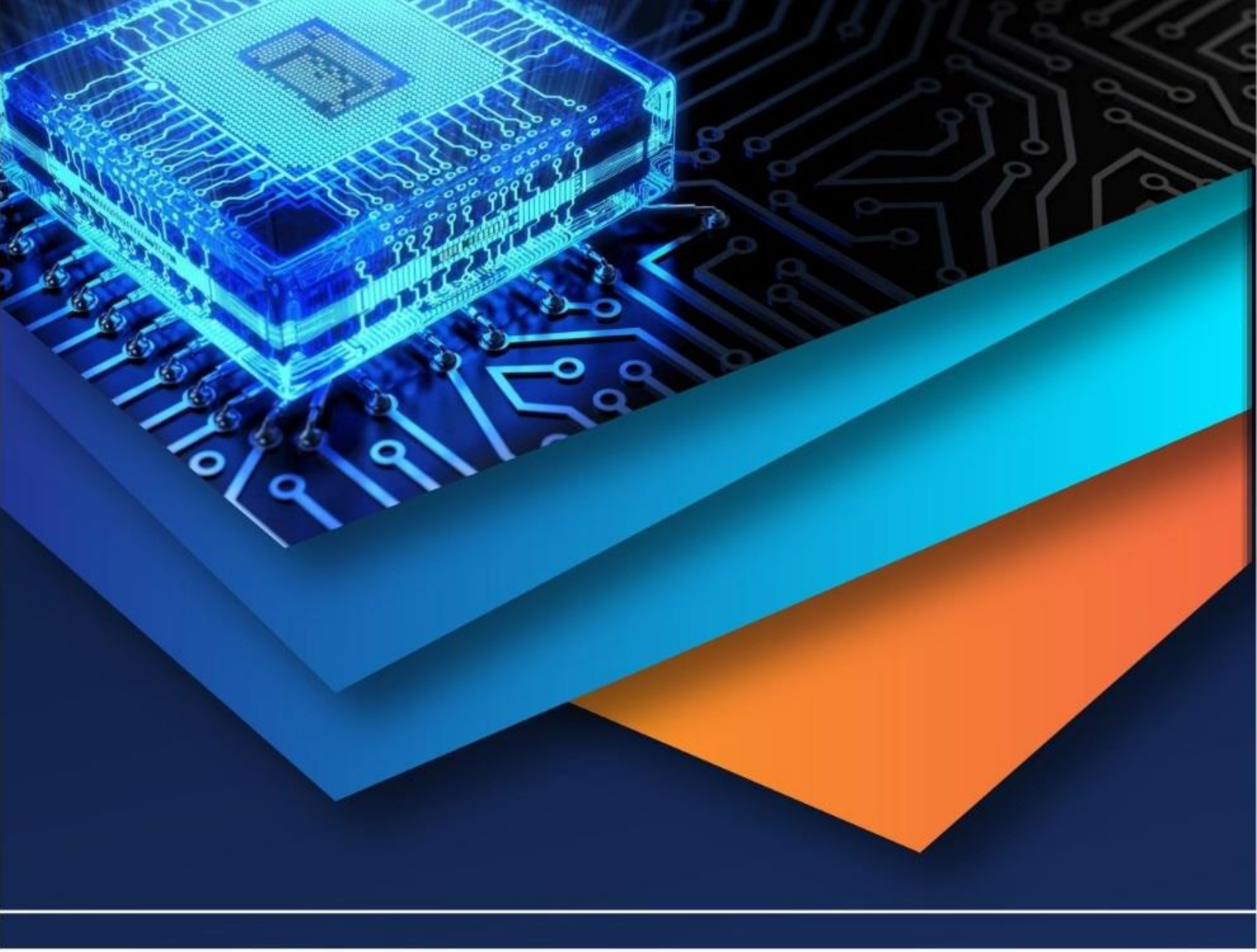
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