Development of web based SCADA application for monitoring parameter of transformer

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Abstract-**Now a day's SCADA system is used for Industrial application, Home automation, Green house automation, Power generation and Distribution. Generally these SCADA applications include level monitoring light and climate control security system. With new hardware and software technologies here a system is developed which can perform the similar to SCADA application at a lower cost and lower maintenance. This paper proposed viable solution for SCADA system which include application like water level monitoring, transformer temperature monitoring, displacement control, and oil level monitoring. This system can not only perform these industrial applications but also proposed a fine Web-based solution to access all these acquired data and equipment's. Here a web-based application is used which will allow the user to access the inter-organizational data or equipment in industries via internet. It also overcomes the problem of weak encryption used by the SCADA. A wireless based solution has universally accepted familiar and user friendly. The real time logging would allow warning to be flagged to the relevant person via alarm indication and massage through web service. This paper describes the design of an Web based SCADA system that allows real-time factory data to be made available to the necessary personnel, regardless of where they may be on the globe. The system developed is based around an HTTP Web Service written in Visual Basic .NET. The Web Service accepts client requests and retrieves the desired information from the control database.**

Keywords **:- Web-based SCADA, monitoring, automation, alarm indication, web service, real time logging.**

I. INTRODUCTION

SCADA means supervisory control and data acquisition system. SCADA system is used in industrial application such as oil and gas industries, chemical industries. It is applicable for monitoring and recording of oil level, switches condition, transformer temperature etc. it will give interface between human and machine for industrial application. Traditionally information of industrial equipment such as oil level monitoring, water level checking is done by manual data collection. The record is place in the form of chart. This is very time consuming and tiresome job. By using SCADA system it is eliminating the need of manual data collection. Now a day's SCADA system is used for power plant, electrical distribution section and water treatment. In the industry field devices are connected to SCADA network, which is connected to the data center. Operator control the devices from computer connected to the data center at a control room. SCADA field devices mainly consist of remote terminal unit, programmable logic controller. SCADA system consists of telephone line and computer network, fiber optic cable. SCADA system are connected in a monolithic way with a central data center and with a large amount of wiring required to connect different hardware element with a data center in a control room. Due to restricted access to this wired element traditionally security provision primarily focuses on physical protection measures. And therefore wireless sensor network are preferable.

A. SCADA systems include the following components:

1) A Human-Machine Interface or HMI are the apparatus which presents process data to a human operator and through which the human operator monitors and controls the process.

2) A supervisory (computer) system, gathering (acquiring) data on the process and sending commands (control) to the process.

3) Remote Terminal Units (RTUs) is connected to sensors in the process, converting sensor signals to digital data and sending digital data to the supervisory system.

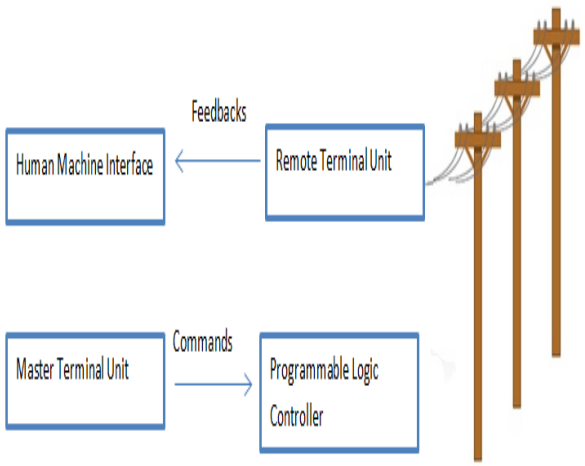

Figure.1 Component of SCADA System

B.Security Issues of SCADA

• It is a very bulky system, it requires a large maintenance.
• It is heavier and very expensive.
• It requires more power and having weak encryption.
• The SCADA system is more complicated than the sensor to panel type.

• Different operating skills are required, such as system analyzer and programmer are skilled person.
• With thousands of sensors there is still a lot of wire to deal with.
• The operator can see only as far as the PLC.
Because SCADA systems use more telephone lines, twisted pair cable, microwave radio, and spread spectrum techniques.

II. APPLICATION ARCHITECTURE

In the proposed system included two substation indicated by two step down transformer here we monitor the transformer supply failure and temperature of transformer and under voltage condition for the transformer. For monitoring these things transformer parameters we used web-based SCADA system. In these installations of visual basic software this is simple mounting the device. Also it consumes less power than that of the SCADA system. Plugging in the network cable and using a patch cord to connect to the server, LPT port of the PC, or production equipment cell to be protected. Using the Internet capability of the production control console, with a password protected login, the security device can be set up and enabled in moments from a template on the device manufacturer's website. The utilization of asymmetric key encryption is suggested.

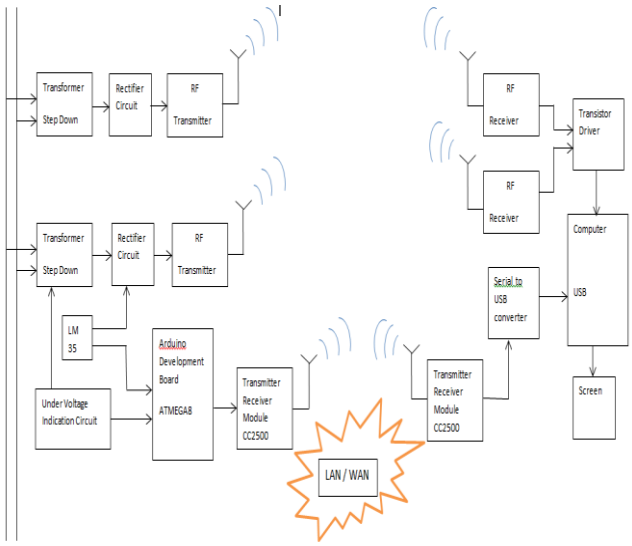

Figure.2 Block Diagram of Proposed System

It can gives security to the data that will be transmitted from the SCADA and the remote assets. Once a system is connected to the internet, it is not impossible for other internet users to have access to the system that is why encryption is very important. Our proposed Scheme can increase the security of the System.

III .EXPERIMENTAL SETUP OVERVIEW

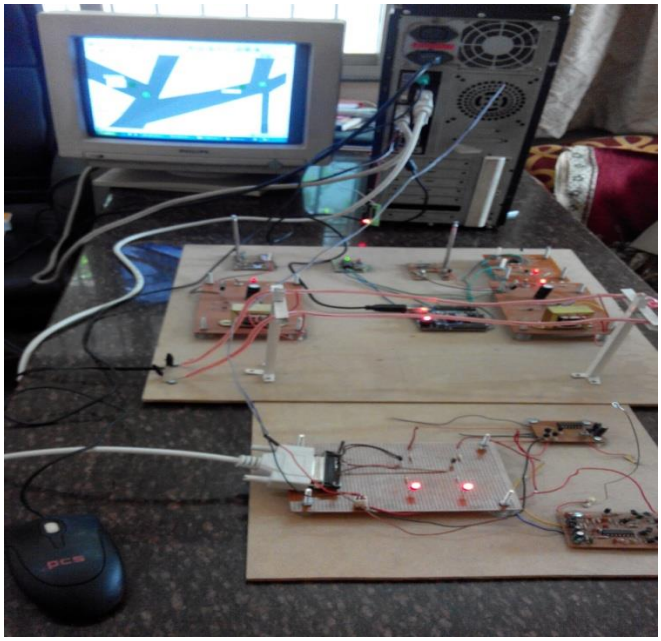

Figure.3 Experimental Setup of System

A. Transmitter Circuit:
Figure shows Transmitter circuit for web based SCADA. Here we assume two substations substation1 and substation 2 indicated by center tap step down transformer of rating 500mA 9-0-9.When grid is not faulty then single phase 230V AC supply is given to transformer. Transformer steps down the voltage and sends it to rectifier circuit. In rectifier circuit AC signal convert into DC. Capacitor is use to filter DC supply. It converts pulsating DC into plane DC. Its output goes to regulator 7805. The regulator regulates the DC supply. If unregulated DC supply is given to circuit then RF transmitter is burst. Therefore we using regulator. When supply is ON LED will glow and output is send to RF transmitter which is of frequency 22MHz. Then it will transmit. But if grid is fail then LED is OFF and RF transmitter stop passing frequency. For showing grid failure we are using toggle switch.
In substation 2 we are deal with temperature sensing and under voltage condition. Temperature sensor LM35 is three pin IC. One pin is connected to positive 5V supply one is connected to ground and middle pin connected to analog input of ARDUINO microprocessor. When temperature is decreases below set point it will generate a signal and pass analog signal to analog pin of ARDUINO microprocessor. ARDUINO have internal 10 bit analog to digital convertor. In ARDUINO C++ use as a programming language. Under voltage circuit is shown in figure. The entire configuration is wired around the IC 741 and it becomes the heart of the circuit. Basically it is configured as a comparator with one of its inputs clamped to a fixed reference level while the other input used as the sensing terminal. As seen in the diagram, the non-inverting input is provided with a fixed reference voltage through a resistor zener network.

This input is fixed to about 4.7 volts. The other inverting input pin 2 is wired via a preset to sense the input supply voltage from the source. The preset (pot) is adjusted at a low voltage level than the fixed reference voltage at the other pin of the IC as soon as the source voltage becomes lower than the desired level. When this happens the output of the IC immediately becomes high, illuminating the connected LED. The illuminated LED immediately provides the indication of a low voltage situation so that the required actions may be initiated. Optionally, the output may be LED, eliminating the headache of monitoring the LED condition every now and then. Initially keep the 100K preset link disconnected. If voltage is below than 4.7 V then it will send a low pulse and adjust the 10K preset such that the upper relay operates and confirm the triggering by subsequently moving the preset. The LED will respond by switching ON to the fixing of this preset. Now reconnect the 100K preset feedback link. Next, adjust the 100K preset such that the relay opens. Ignore the lower relay as it will switch ON as soon as the input supply is switched ON, so its operation is obvious. That's it, the low battery warning circuit is all set now and will accurately respond to the above settings or any different setting that may be preferred and implemented by the particular user. The output from temperature sensor and under voltage circuit will give low going pulse. Output given to ARDUINO transmitter signal is passes through the receiving signal of transmitter receiver module CC2500.

B.Receiver Circuit:

Above figure shows receiver circuit. The frequency of RF transmitter 22MHz and 33MHz will receive in RF receiver 22MHz and 33MHz through the air. RF receiver uses as a decoder in which we get high pulse when frequency is flowing through air. If grid is fail RF receiver stop working. RF receiver is give high pulse to the transistor base which gives low pulse at collector node and it will give to status pins (s0) of LPT port. When grid is not faulty the both the frequency showing low pulse. The number of pulse is continuously checked by PC. When fault occur on a grid the number will change. PC will check two things simultaneously. 1) LPT ports output from RF receiver 1 and 2 and output of CC2500. 2) The output from CC2500 is given from USB to serial convertor. From this we get temperature and under voltage value. Which are given through coding in a VB.net Its output is graphically present on a web page using HTTP protocol. When temperature change and under voltage is take place it will showing on a screen in a graphical user interface representation and also give a alarm.

C.Hardware Requirement:

Transformer 9-0-9 500mA
Arduino Development board
Diode 1N4007
Capacitor 2200uf
Op-amp IC741, 8 pin
RF transmitter as encoder SSk modulation 3V, 22MHz and 33MHz
Temperature sensor LM 35
Transmitter and receiver model Cc2500, 3 V
USB to serial converter
RF transmitter as decoder 22MHz and 33MHz
Transistor driver BC547
Relay 5V, 5 pin
Zener diode 4.7V
Toggle Switch
Zero PCB

D.Software Part

```
Partial Class _Default
    Inherits System.Web.UI.Page
 Protected Sub Button1_Click (By Val sender As Object,
By Val e As System.EventArgs) Handles Button1.Click
   If TextBox1.text = "ADMIN" And TextBox2.text =
"OMSAI" Then
       Response. Redirect("monitoring.aspx.vb")
   Else
      Label1.Text = "invalid userid or password"
   End If
    End Sub
 Protected Sub TextBox3_TextChanged (ByValide
sender As Object, ByValide As System.EventArgs)
Handles
TextBox3.TextChanged
   End Sub
     End Class
```

By using the above software part in visual studio we created a Log In web page. After Log In we get the status of transformer is shown as per figure 4. In this both transformer normally works and temperature and under voltage condition is showing.

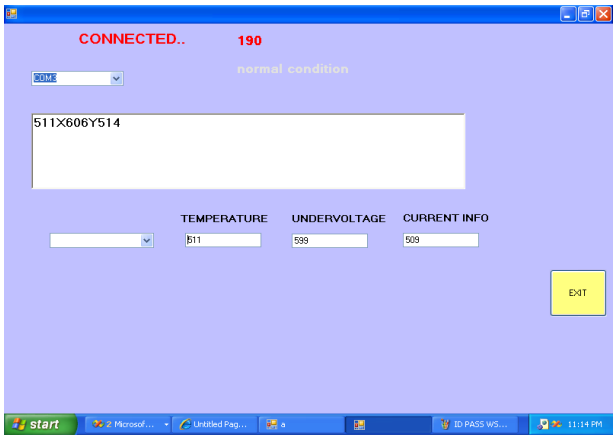

Figure.4 Screen Shot Of Status Of Transformer And Temperature And Under Voltage Condition

IV EXPERIMENTAL RESULT

Experimental results are shown by the graphical user interface.

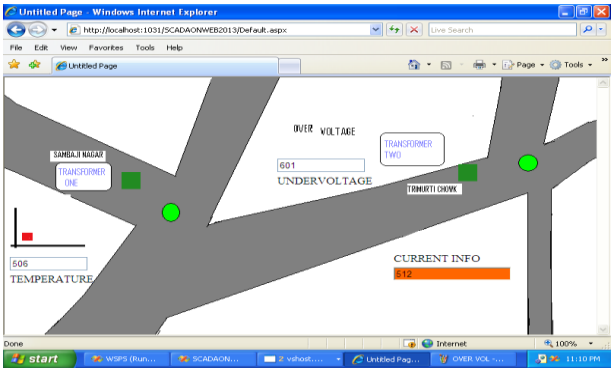

Figure.5 Screen Short Of Graphical User Interface

Entry of events occurred in system is continuously monitoring by data entry block or table

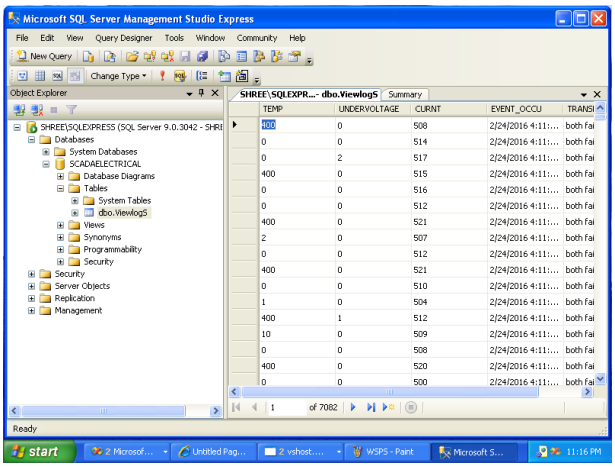

Figure.6.Screen Shot Of Data Entry Sheet.

V CONCLUSION AND FUTURE WORK

This paper presents a system which has a supervisory property (Monitoring) as well as the data acquisition property (Data Repository) like an SCADA system. The developed system is much cheaper than that of the SCADA and also web based SCADA system consumes less power than actual SCADA system. This project offers a low cost solution for the small scale industries to be used in various automation like E-Agriculture, Home/Building automation and so on. This system can not only perform these industrial applications but also proposes fine windows based solution to access all these acquired data and equipments. It also shows an graphical representation of Under voltage and temperature condition. Here a remote based application is used which will allow the user to access the industrial data/equipments in industries via internet, it also overcome the problem of weak encryption used by the SCADA. This system is fully user-friendly and very cost effective with good user interface and flexibility. Apart from these advantages there are some limitations of this system like the problem of network coverage area of the users while sending the messages of equipment incorrect operation or position and faults graphically representation.. To overcome this problem an alarm is also used here to sound in a predetermined fashion. In future this system using .NET platform may replace many SCADA solutions by using the advent programming skills.

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