PC Based Design and Fabrication of Wireless Industrial Surveillance System using Lab VIEW

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Abstract- In an industry, number of electrical equipments are connected at different locations of the plant. It is difficult to monitor all the parameters of every equipment continuously, also collection of such numerous information and analysis is time consuming. The Wireless Industrial Surveillance System using real time operating system (RTOS) is an application designed to monitor the individual device or parameter at the time of requirement. This is a kind of wireless sensor networking used in supervisory control system. It can be designed with a single cluster sensor polled by the central monitoring station for its status and also the control operation of stand by device can be made from the control room. The cluster of sensors are connected to a AT89C51 based system the sensor channels are scanned with interrupt based program to make the system more efficient and fast responsive. The Central monitoring station receives the information on polling and this system is designed using a PC. An application program is designed using Lab VIEW (Laboratory virtual instrumentation engineering workbench) to monitor the sensor nodes. The sensor node sends the status information on receiving a request from the central monitoring station, as the data communicated by polling method.

Index Terms- Lab VIEW, RF trans-receiver, AT89C51 microcontroller, RTOS

I. INTRODUCTION

Wireless sensor networking used in supervisory control system have few stations, each station monitors a number of electrical equipments. Every station has a microcontroller running with a RTOS to monitor the parameters. The sensors activate the interrupt service routines (ISR) to protect the devices locally, so the protection relays reacts faster compare to the scanning type of OS. The local node stores the parameters in memory and provides an audio visual indication. Every local station has a unique address and connected with a wireless trans-receiver. The local stations are normally scanning the receiver and that is in a super-loop. There is a central Station used for surveillance, when it is required to monitor the different parameters or equipments of local stations then the user will run a high level program in the PC and monitor the local station by sending request to the local station by its address and its parameter number. The local station will receive the address and after recognition retrieve the information regarding the particular parameter number from the controller memory and send to the central station for required analysis purpose. The local stations are running on RTOS and the ISR can be designed to send the automatic SOS report to the central nodes. When the parameters are very crucial then the ISR can include sending the SOS report along with local protection. As every local station is acting as a cluster of smart sensor, it is possible to provide interlock between the parameters and stations.

1.2 DESIGN PRINCIPLE:

Hardware Design: The sensor network is connected to an AT89C51 based motherboard. The mother board is having on board 2.4GHz FSK trans-receiver. The trans-receiver module is compatible to 8 bit digital data format at 9600 baud rate for transmit in air and receive the same. The trans-receiver is designed with CC2500 IC. This IC is used as a trans-receiver for demodulating FSK modulated data to recover the digital data and vice versa. There is a RF trans-receiver connected to communicate the data between the central station and local station.

The Central station is also designed by using a PC that is interfaced with a trans-receiver to communicate data between the local and central station. The PC receives and sends digital data through a similar RF trans-receiver The RF trans-receiver process wireless signal and generates digital data and the PC read the received data for decoding. The decoded data is interpreted and displayed on a LCD screen for user information.

Software Programming:

In this application there are two platforms used to develop the programs. The local stations (Station1,…,Station N) are designed with AT89C51 microcontroller and programmed by using assembly language; the flow diagram is designed on the basis of embedded RTOS. The Central station is designed with a PC based application program developed with Lab VIEW. The SOS message from local stations received at PC. The entire system is basically works like a supervisory control system for enhancing the capability of surveillance of different equipments and analyzing the performance of the system. The data communication between the local station and central station is implemented by poling method.

1.3 CIRCUIT DESCRIPITION:-

1.3.1 Power Supply:-

The power supply designed for catering a fixed demand connected in this model. The basic requirement for designing a power supply is as follows,

1. The different voltage levels required for operating the devices: +5 Volts required for

operating microcontroller and +12 is required for drivers and amplifiers and comparators etc.

2. The current requirement of each device or load must be added to estimate the final capacity of the power supply.

There are two methods for designing power supply, the average value method and peak value method. In case of small power supply peak value method is quit economical, for a particular value of DC output, the input AC requirement is appreciably less. In this method the DC output is approximately equal to V_m.

1.4 Sensor Interfaced:-

1.4.1 Over Voltage Detector: - That output signal is compatible with the controller because the current will flows from the collector of the transistor whenever the base voltage is high due to the transistor action. Similarly the output is low in the absence of the input signal to the signal conditioning circuit from the comparator. The Circuit diagram has been shown in Figure 3.

1.4.2 Over Current Detector: - This circuit is designed to detect over current. In this section a special type of CT is used to detect very low current. The output of this CT is an AC voltage proportional to the Load current. The CT voltage varies with load current. The Circuit diagram has been shown in Figure 3.

1.4.3 Over Temperature detector: - To detect the over temperature / fire detection or above the room temperature. The Circuit diagram has been shown in Figure 3.

1.5 Mono-shot Multivibrator:- A monostable multivibrator (MMV) often called a one-shot multivibrator, is a pulse generator circuit in which the duration of the pulse is determined by the R-C network, connected externally to the 555 timer. In such a vibrator, one state of output is stable while the other is quasi-stable (unstable). For auto-triggering of output from quasi-stable state to stable state energy is stored by an externally connected capacitor C to a reference level. The time taken in storage determines the pulse width. The transition of output from stable state to quasi-stable state is accomplished by external triggering. The schematic of a 555 timer in monostable mode of operation has been shown in figure 3.

1.6 LED Indicator: - The indicator section consists of a light emitting diode and its driver circuit is designed on the basis of current required to glow the light emitting diode.

1.7 Relay and Relay Driver: - To activate and deactivate the high voltage load (Electrical appliances) for that a relay is required as an element. Here relay itself cannot actuate (ON/OFF) of its own for that a driver is required, here a transistor as a driver is used which is configured as a switch.

1.8 Operation of Remote Section

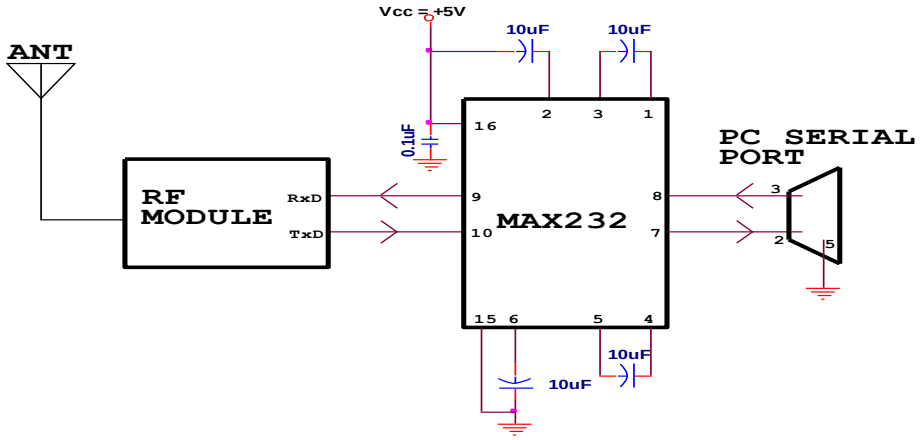

Figure -1

In figure 1 the output of the RF module port is fed to the PC and vice versa through a SIU circuit, because the transition output signal of the PC serial port is not compatible with the RF module port and vice versa. The SIU unit will convert the CMOS output signal into serial transition output TTL signal and vice versa. At normal condition, the PC serial port is in ideal condition no serial data transmission occurs. Whenever a KEY is pressed on the keyboard of that PC, the corresponding ASCII value is converted into a serial data format and that output signal is fed to the controller (RxD) as input signal through SIU section.

1.9 BLOCK DIAGRAM

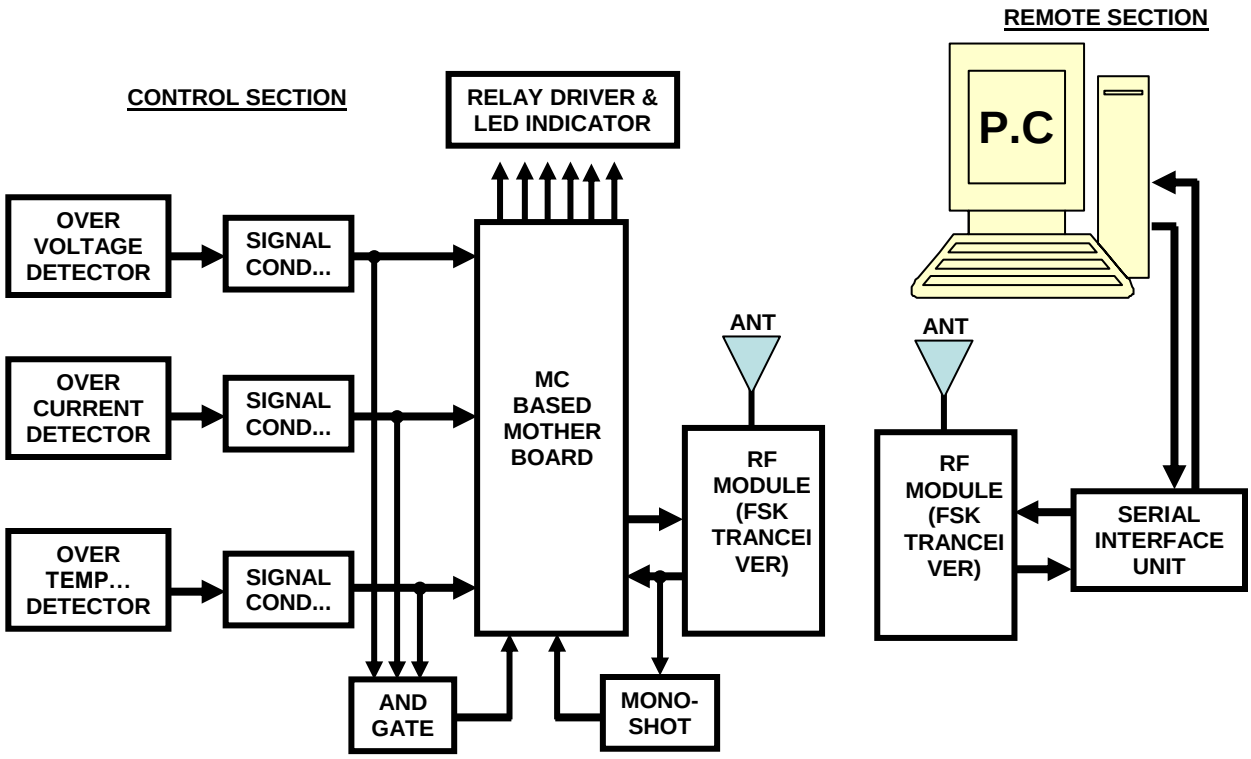

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Figure 2

1.10 Control section circuit diagram

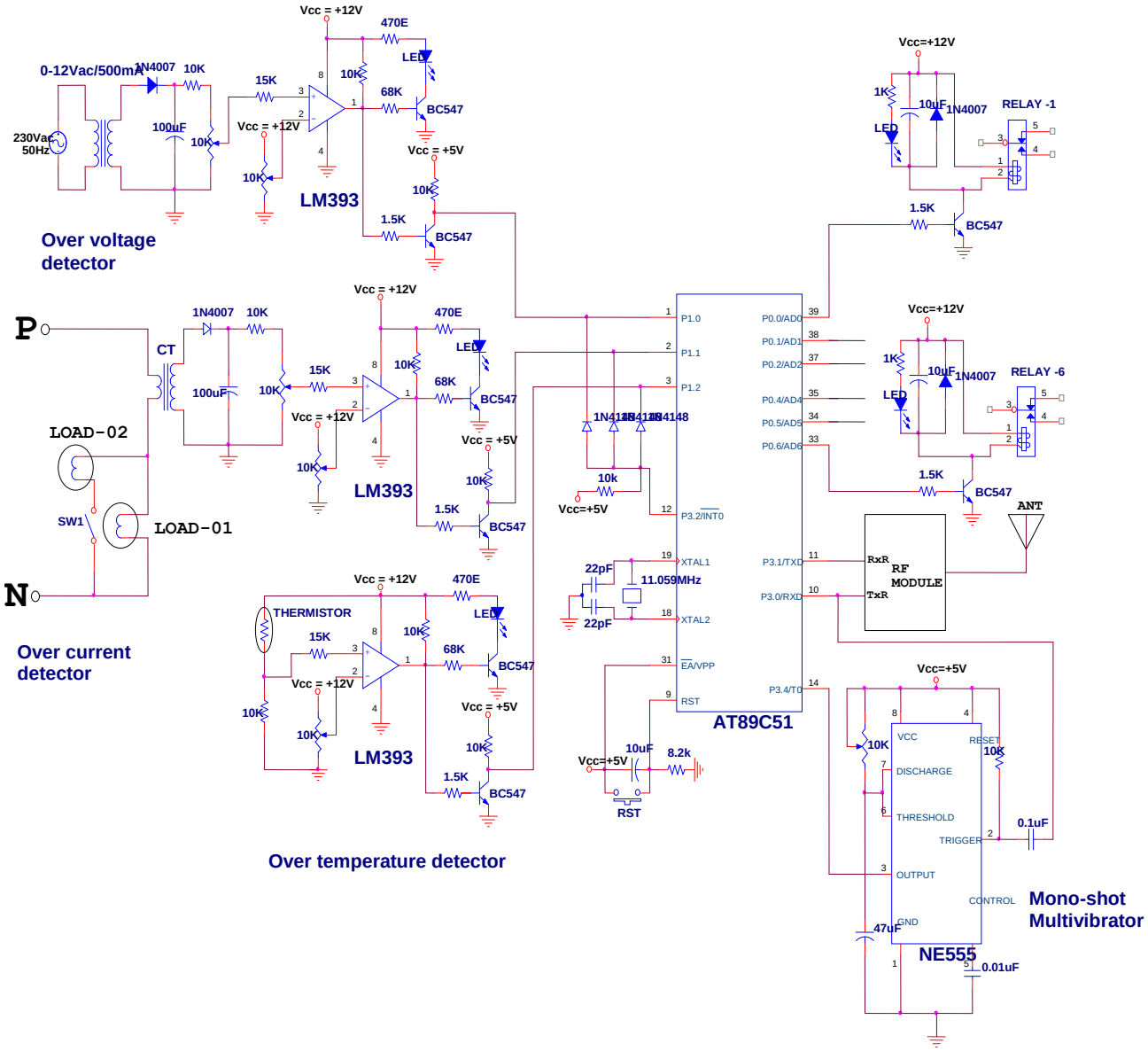


Figure 3

1.11 Hardware part of industrial surveillance system using Lab VIEW

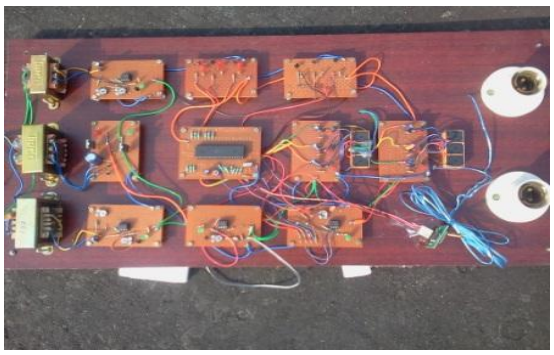


Figure 4

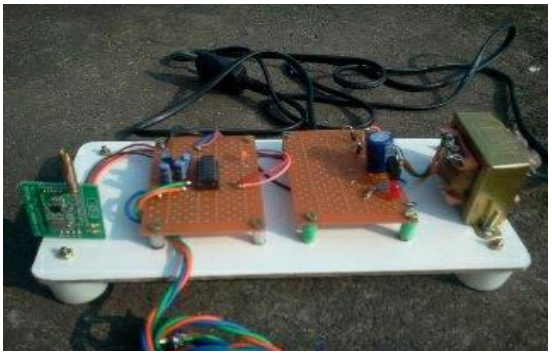


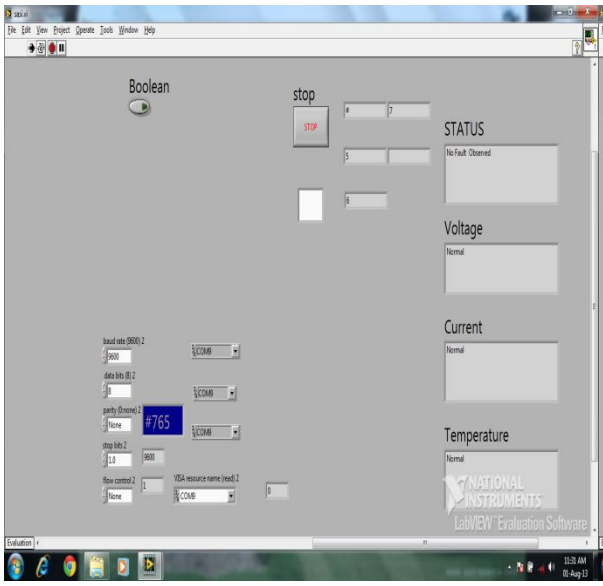
Figure 5

1.12 RESULT AND DISCUSSION:-

In this paper an application is designed for continuous monitoring the individual various parameters (current, voltage and temperature) at the time of requirement. PC monitors the local station by sending a request to the local station. The local station receives the address and after recognition retrieves the information regarding the particular parameter from the controller memory and send to the central station for required analysis purpose and to display the status using LAB VIEW. The character "#" indicates that all the parameters are in normal condition. The character "*" indicates that fault has been occurred. The character "5" indicates that the status of voltage is in normal condition. The character "1" indicates that the status of voltage is not in normal condition. The character "6" indicates that the status of current is in normal condition. The character "2" indicates that the status of current is not in normal condition. The character "7" indicates that the status of temperature is in normal condition. The character "3" indicates that the status of temperature is not in normal condition. When the program will run in Lab VIEW the following result will be displayed on the front panel of Lab VIEW.

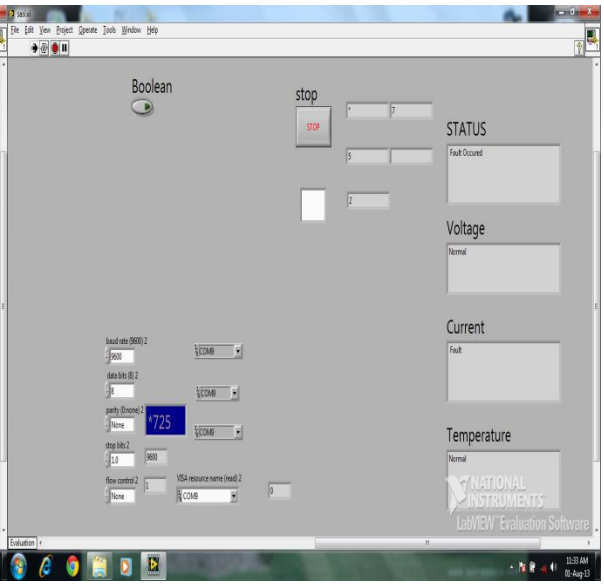
Condition	Status	Voltage	Current	Temperature	Remark
Normal condition	No Fault	Normal	Normal	Normal	Figure 6
For Over Voltage	Fault	Fault	Normal	Normal	Figure 8
Over Current	Fault	Normal	Fault	Normal	Figure 7
Over Temperature	Fault	Normal	Normal	Fault	Figure 9

1.13 OUTPUT OF VARIOUS PARAMETERS IN Lab VIEW:-



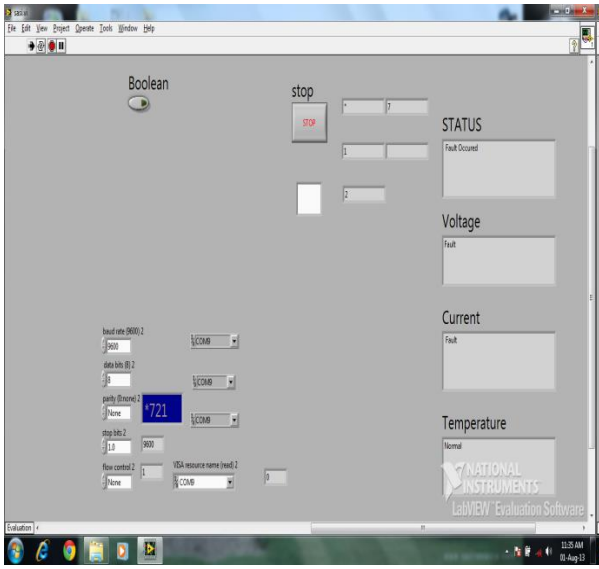
In normal condition

Figure 6

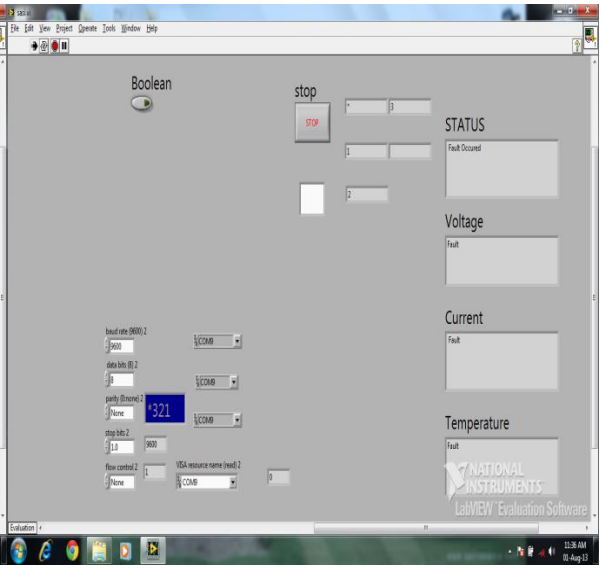


Over current

Figure 7



Over voltage
Figure 8



Over temperature
Figure 9

1.14 CONCLUSION

This fabricated model has been tested successfully and achieved reliable transmission of data to the remote site and representation of indications and controls using LAB VIEW. The observations are shown in above table. It may require slight modification to make suitable for working in the outdoor conditions.

REFERENCES

[1] Industrial Process Management Using LabVIEW. IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p- ISSN: 2278-8735. Volume 5, Issue 6 (Mar. - Apr. 2013), PP 46-56 www.iosrjournals.org

[2] A Novel Design of Low Cost Integrate Intelligent Security System for Industrial Surveillance. M. Kamaraju. / International Journal of Engineering and Technology Vol.2 (6), 2010, 406-409

[3] LabVIEW Software 2010 by National Instruments, http://www.ni.com.

[4] LabVIEW Graphical Programming by Gary W johnsion (TMH).

[5] Zhou Hongfu; Xiao Xinyan; Tang Yong, "Serial Communication Interface Design Based on Lab VIEW and VC Mix Programming", 8th International Conference on Electronic Measurement & Instruments, (ICEMI2007) PP44-49, (in English) (ISTP/EI, INSPEC).

[6] Muhammad Ali Mazidi & Mazdi THE 8051 MICROCONTROLLER AND EMBEDDED SYSTEMS, Pearson education.

[7] Ayala- INTRODUCTION TO 8051 MICROCONTROLLER.Op-amp and Linear Integrated circuit by R.A.Gakewad.

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