Design and Implementation of Client-Server based Remote Motor Control System Using LabVIEW for Industrial Applications

N.Shalini[1], S.Sivasakthi[2]

PG Student [EST], krishnasamy College of Engineering &Technology, Tamilnadu, India [1]

Associate professor & Head, Dept. of EEE, krishnasamy College of Engineering &Technology, Tamilnadu, India[2]

Abstract— **In modern industrial field, the requirement for monitoring and controlling system is one of the most important criteria for minimizing the power consumption. In this paper, an effort is made to monitor and control the motor through TCP/IP connection using virtual instrumentation, LabVIEW. A web server is a system which hosts a web site and provides services for any requesting client. The server system which contains PIC Microcontroller module which is connected to the internet so that motor can be monitored and controlled from remote places, the client system runs on LabVIEW platform is also connected to the same internet. By typing the IP address of server system on the client side the user gets connected to the remote system and proceeds the monitoring and controlling process. Here the command is entered in PC with LabVIEW which is used as interface software for communicate with microcontroller by accessing the IP address of server system. With the help of LABVIEW software the system provides high accuracy and flexibility.**

Index Terms— **LabVIEW, Microcontroller, TCP/IP, Web server.**

I. INTRODUCTION

With the increasing scale of control systems in industrial field, the web server as a gateway to connect serial devices and networks to achieve the minimum cost can be used as web-based remote control. Through introducing internet in to control network, it is possible to achieve remote sensing monitoring and controlling for equipments. A web server in the device provides access to the user interface functions for the device through a device web page. The web technology is changing to the new design and new models and the computers are connecting to the World Wide Web through internet. The data can be exchanged among the computers which are longer distances through the internet connected to the World Wide Web. This feature facility provides us to transmit the data to the long distance. For accessing the information from the remote location computers, need a web server. This will maintain the database of the information. People from the remote location using the IP address will be access the information. The user can request a particular web page from the web server. The client through the network to send control commands to the motor, while the motor is running the state through the network back to the client. LabVIEW front panel is designed for user interface to display waveforms of measured physical quantities from serial port, connected to embedded board and display waveform on waveform chart. It contains a knob for selecting the number of measurements per average, a control for selecting the measurement type, a digital indicator to display the output value, and a stop button. An elaborate front panel can be created without much effort to serve as the user interface for an application. The software designed in LABVIEW offers high flexibility for dynamic user requirements and variety of data to be acquired and also user can monitor and control number of processes from remote location or choose any function to handle process parameters to automate system and avoid human interventions. The most common use of web server is to host websites, but there are other uses such as gaming, data storage or running enterprise applications.

The paper is organized as follows: in Section II the related work about web server. Section III will describe the proposed system architecture. Section IV we will introduce the details of software implementation. In Section V presents the results and discussion and Section VI will describe the conclusion and future work.

II. RELATED WORK

This paper demonstrate the multi client-multi server architecture based on switched Ethernet can be used as a real time communication for possible applications in industrial automation, this system describes (MC-MS) architecture on a local area network (LAN) was developed using user datagram protocols as the communication protocol [1].With the development of internet and the coming of the post-PC era, the embedded systems is becoming the center of interest in the current IT industry and exhibiting broad potential market. In the meantime, the access of embedded systems into the internet has become an important direction of the

ISSN: 2278 – 7798

present internet development [2].This paper designs a powerful Web-based gateway for the on-site monitoring equipment network composed by RS-485, CAN and other communication protocols, thus to bridge between them and the Internet, allowing remote users can browse and manage these on-site monitoring equipments through browser anytime and anywhere [3].Through introducing internet in to control network, it is possible to achieve remote sensing monitoring and controlling for equipments [4].

Compared to the Existing research, this paper aims to easier the users to monitor and control the motor in industries by computer using TCP/IP connection. So developing a cost effective and high efficiency controller is designed in this system.

III. SYSTEM ARCHITECTURE

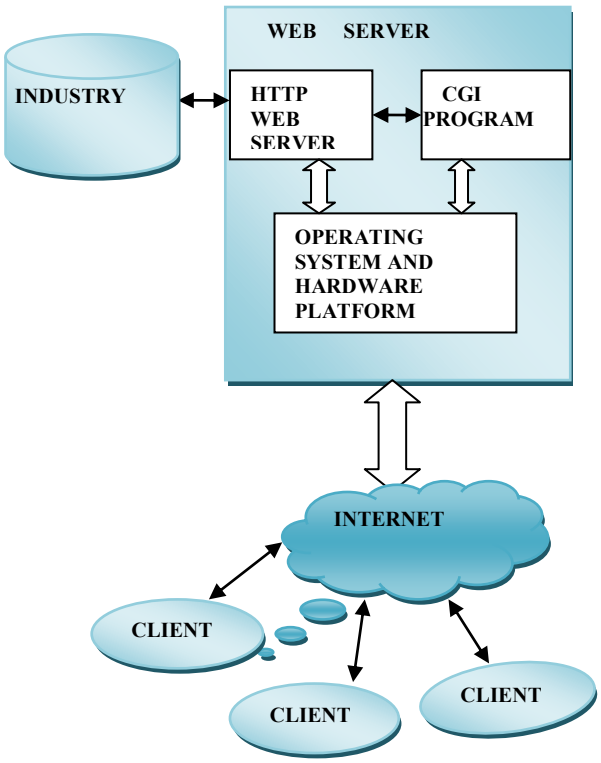

Fig 1 web server architecture

A. Web Server Architecture

Web server will be introduced to the field test and control equipment in hardware platform and software system, with the support of the traditional test and control equipment for a change in the TCP/IP for the bottom communication protocol. The Fig 1 shows the concept of web server. Web server software system usually include center processing module, HTTP engine, file system, configuration module, security module, application program interface. The server is the core of the central processing module, it is the control and the scheduling, HTTP engine realize the HTTP protocol, the file system access to resources, configuration module and security module implements the server configuration and security mechanism, application server interface implementation and application interaction.

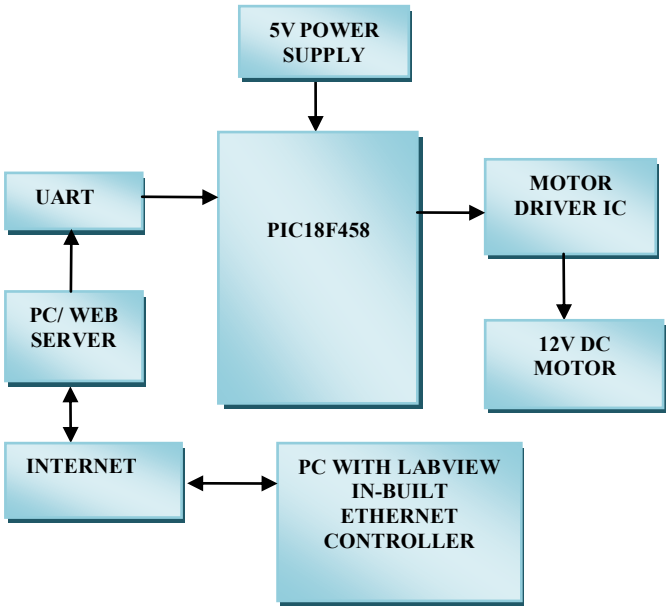

Fig 2 Basic block diagram

In our proposed work, we use PIC 18F458 Micro controller, which is shown in fig 2.This board takes constant 5V as input. Here PC with internet act as a web server which is connected to the Microcontroller through UART and also DC motor is connected to the controller by using motor driver unit; the entire section is connected to the remote PC with LabVIEW via internet. By typing the IP address of server system the user (i.e.) client gets connected to the remote system and also monitor & control the motor from anywhere in the world through internet connection.

B. PIC 18F458Microcontroller

It has the special feature of inbuilt CAN Module. PIC18f458 is 28/40-Pin High performance, Enhanced Flash Microcontrollers. It has High performance RISC CPU. It has Advanced Analog Features like 10-bit, up to 8-channel Analog-to-Digital Converter module (A/D).It has Special Microcontroller Features like Power-on Reset (POR), Power-up Timer (PWRT) and Oscillator Start-up Timer (OST) Watchdog Timer (WDT) with its own on-chip RC oscillator. It has Flash Technology with Low-power, high-speed Enhanced Flash technology, fully static design and wide operating voltage range (2.0V to 5.5V).

C. UART

A UART (Universal Asynchronous Receiver/Transmitter) is the microchip with programming that controls a computer's interface to its attached serial devices. It provides the computer with the RS-232C Data Terminal Equipment interface so that it can "talk" to and exchange data with modems and other serial devices. The block diagram of UART is shown in fig 4. It converts the bytes and it receives from the computer along parallel circuits into a single Serial bit stream for outbound transmission and also it handles interrupts. The serial transmit block has two buffers (FIFO) into which data is written by the CPU I/F block. After the data is written into the buffers it is transmitted serially on

ISSN: 2278 – 7798

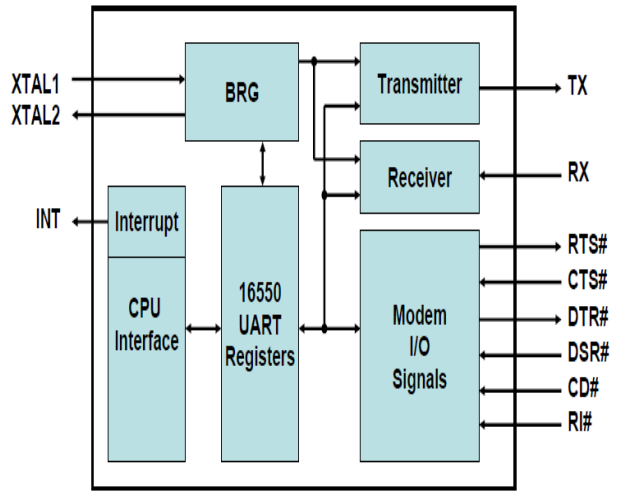

Fig 4 UART Block Diagram

to TXD. As long as the FIFO is not full the serial transmit block sets the signal TX_RDY high. The serial receive block has four buffers (FIFO). The block check for the parity and the validity of the data frame on the RXD input and then writes correct data into its buffers. It also sets the signal RX_RDY low if its FIFO is empty. The CPU I/F block is responsible for reading the status register, data register and writing data into interrupt enable register and data register. It receives control signals from the CPU for performing certain tasks.

D. Driver Unit

We can drive DC motors using L293D driver IC, it provides bidirectional currents of up to 600-Ma at voltages from 4.5V to 36V. ICs are designed to drive inductive loads such as dc motors, bipolar stepping motors, relays and solenoids as well as other high-current or high-voltage loads in positive-supply applications. All input of these ICs is TTL compatible and output clamp diodes for inductive transient suppression are also provided internally. These diodes protect our circuit from the Back EMF of DC Motor.

E. DC Motor

A DC motor is a mechanically commutated electric motor powered from direct current (DC).It is designed to run on DC electric power, which will operate in the ratings of 12v DC and supports 0.6A.The stator is stationary in space by definition and therefore its current. The current in the rotor is switched by the commutates to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque. DC motors have been popular in the industry control area for a long time, because they have many good characteristics, for example: high starting torque characteristic, high response performance.

F. Power Supply

The board takes 5V input; **power supply** is a device that supplies electric power to an electrical load. The term is most commonly applied to electric power converters that convert one form of electrical energy in to another, though it may also refer to devices that convert another form of energy (mechanical, chemical, solar) to electrical energy. A regulated power supply is one that controls the output voltage or current to a specific value; the controlled value is held nearly constant despite variations in either load current or the voltage supplied by the power supply's energy source.

IV. SOFTWARE IMPLEMENTATION

Remote control system is realized using LabVIEW (short for Laboratory Virtual Instrumentation Engineering Workbench) is a platform and development environment for a visual programming language from National Instruments. LabVIEW is commonly used for data acquisition, instrument control, and Industrial automation on a variety of platforms including Microsoft Windows, various flavors of UNIX, Linux, and Mac OS. The main idea behind the remote control system is to access and control the speed of motor from a distant place using suitable communication method.

A. TCP/IP Communication in LabVIEW

Internet Protocol (IP), User Datagram Protocol (UDP), and Transmission Control Protocol (TCP) are the basic tools for network communication. The name TCP/IP comes from two of the best-known protocols of the internet protocol suite, the Transmission Control Protocol and the Internet Protocol.

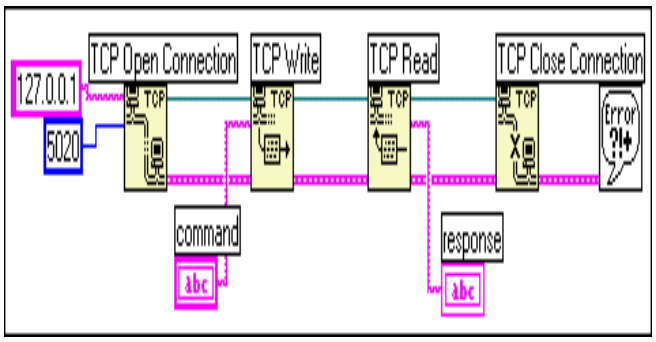

Fig 6 Client Application

TCP/IP communication provides a simple user interface that conceals the complexities of ensuring reliable network communications. As with DAQ, instrument, and File I/O communication, the process involves the connection, reading and writing the information, and closing the connection. The following block diagram fig 6 represents a client application that initiates a connection to a remote server with TCP Open Connection.

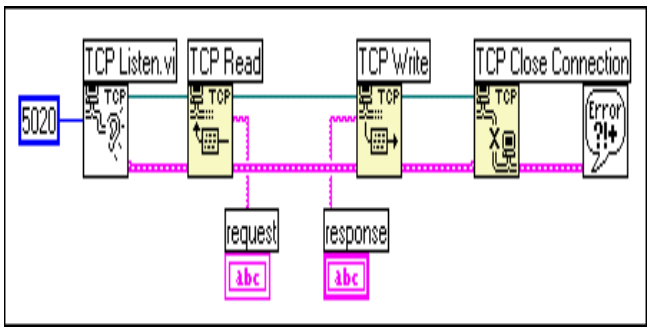

Fig 7 Server Application

ISSN: 2278 – 7798

The programmer is responsible for developing both the client and the server. The following block diagram shows how the server uses the remote address output value of the TCPListen VI to determine whether a remote client has permission to access the server.

B. Block Diagram Panel

We can construct the block diagram by writing together objects that perform specific functions. When we place a control or indicator on the front panel, LabVIEW automatically creates a corresponding terminal on the block diagram. LabVIEW software is simple and easy to use, when you need to implement measurement and control, adding a data acquisition card you can achieve the following functions, including collect the data of the controlled object, dynamic display and real-time control. In control system the computer compares the signal coming from the sensor with the reference value which is called as set point here. According to the set point the controller makes a decision and sends a control signal to hardware equipment.

C. Front Panel

LabVIEW front panel is designed for user interface to display waveforms of measured physical quantities, control number of byte counts, setting baud rate, selection of communication port number i.e. VISA resources name, and error control techniques etc.It contains a knob for selecting the number of measurements per average, a control for selecting the measurement type, a digital indicator to display the output value, and a stop button. The simulation result for remote control system is shown in fig 8.

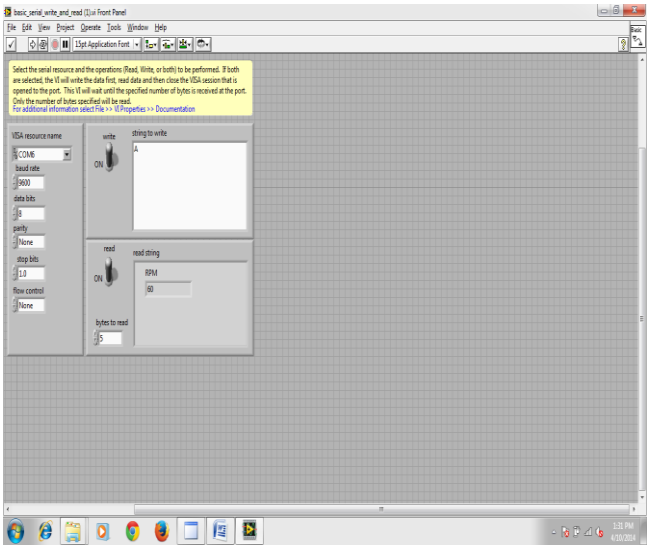

Fig 8 front panel output for remote control system

V. Results And Discussion

By using PC with LABVIEW act as a web server it is connected to the internet and the whole device is connected to remote PC through internet. The software designed in LABVIEW offers high flexibility for dynamic user requirements and variety of data to be acquired. We have introduced the general design concept of the web server and the policy of TCP/IP reduction, special the reduction of TCP, whose goal is to allow easy access to and exploitation of remote equipment. This web server gives the common devices an Internet interface and gains a good performance. So it is find that virtual instruments have the good flexibility and powerful functions in the application of the measurement system, which means it is a good choice in the design of industrial control system with high measuring precision, easily manipulation, high accuracy, better stability etc.This system is very suitable for acquiring data or signals form a large scale industry field.

VI. Conclusions And Future Work

In this paper, we have demonstrated system design and implementation of web server using remote control system is well suited for Industrial automation through internet is a good solution, which is faster and accurate. So that, it is possible to access that web page through internet and can able monitor and control the motor. The system has been implemented, tested and we have achieved accurate and reliable transmission of data to the IP address and representation of waveform in LabVIEW. In the future, we can upgrade this system to its portable or handy form of system by replacing the PC to a PIC based mobile computers so that approach to the parameters to be measured become easier and can perform remote measurements and monitoring.

ACKNOWLEDGMENT

The authors thank the Management and Principal, of Krishnasamy College of Engineering and Technology, Cuddalore, Tamilnadu for providing excellent computing facilities and encouragement.

REFERENCES

[1] Naveen Bibinagar and Won-jong Kim, *Senior Member, IEEE* "Switched Ethernet-Based Real-Time Networked Control System with Multiple-Client–Server Architecture" *IEEE Trans. on Mechatronics*, vol. 18 No. 1, February 2013.

[2] Jie Xiao, FenShi Zeng "Design and Implementation of Embedded Web Server" *IEEE* International Conference on Computer Science & Education vol. 4, pp. 479-482, July, 2012 (ICCSE 2012).

[3] Li Xian-Hui, Liu Jing-Biao Cai Wen-Yu. " Design and Implementation of Web Server Control System Based on STM32" *IEEE* International Conference on Intelligent Networks and Intelligent Systems vol. 4, pp. 146-149, 2012.

[4] Alen Rajan, Aby K. Thomas, Rejin Mathew "A Comparative Performance Analysis of ARM based Web Servers with Integrated and External Ethernet Interfaces for Industrial Applications", International Journal of Computer Applications (0975 – 8887) Volume 44– No.21, April 2012.

[5] M Deepak C.Karia, Vispi Adajania "Embedded Web Server Application Based Automation and Monitoring System" IEEE International Conference on Signal Processing, Communication, Computing and Networking Technologies ICSCCN 2011.

[6] Ali Ziya Alkar, Member, IEEE, and Mehmet Atif Karaca "An Internet-Based Interactive Embedded Data-Acquisition System for Real-Time Applications" IEEE Transactions on instrumentation and measurement Vol.58, NO. 3, March 2009.

[7] National Instruments, "Integrating the Internet into Your Measurement System: DataSocket Technical Overview," www.ni.com/Internet.

[8] Andrew S. Tanenbum,"Computer Networks",Aderson Winsley Publications, Vol.3, 2004

[9] National Instruments, "G programming Reference Manual

[10] National Instruments Web Page: www.ni.com

ISSN: 2278 – 7798