

DESIGN AND DEVELOPMENT OF ETHERNET CONTROL SYSTEM FOR EMBEDDED WEB SERVER USING ARM PROCESSOR

(Monitoring & Control of Highway Bridges using embedded web server)

Prof. D. B. Rane¹ Miss. Pallavi Zingade² Mr. Shrawankumar Bhat³ Miss. Sonal Bagat⁴

^{1,2,3,4}Electronics Engg., P.R.E.C., Loni

dbrane_123@rediffmail.com

pallavizingade13@gmail.com

shrawanbhat1991@gmail.com

Bagalsonal13@gmail.com

Abstract: We describe the application of civil infrastructure for Monitoring and controlling long term degradation & bridge safety is the major concern to the government and the people. Although there are so much safety majors taken to ensure the protection of bridge, still there is no effective system which can monitor and control the status of the highway bridges from a centralized location. Aim of this proposed project is to develop the device that monitor the vibrations on the bridges, control the vehicles traffics on bridge by the traffic signal and carry the appropriate weight of vehicle on bridge. The values of these parameters are updated on the main PC server with the regular span of interval. The administrator helps to monitor the condition from any location in a web page. So it provides the idea related to maximum weight carriage capacity of the bridge & safety of the bridge. So any emergency situation like natural calamities such as earthquake, hurricanes, tornadoes, fire etc. occurs, the decision can be taken immediately after verifying the live data. This project has ARM processor based embedded system connected to Ethernet module which is connected to router. Personal IP address enters on HTML web page & this address is called from the host which is connected to the router.

Key Terms: ARM processor, Ethernet, Accelerometer, Load cell, Bridge safety, PC, IP address, HTML.

I. INTRODUCTION

Dam safety system is the latest technology having greatest demand in civil infrastructure which can control and monitor using ARM processor. The administrator monitor the situation of that location on web page which helps to give maximum level of water which can be store the safety level of water. The NIC card is connected to wireless router. The private IP address is entered on the HTML page and host calls this address to the wireless router [1]. Monitor and control the temperature model through internet, server communicates with an Ethernet IC, communicate with client computer using ARM processor. The client with TCP/IP packets used to send/receive data to/from Microcontroller. So the server using internet explorer gets connected to the client computer which allows the user to command the control/monitor the temperature model [2]. Now a day's most demanding in industry consumer application is Data Acquisition System. Instead of human beings most of the work is completed by electronic machine. So it will acquire data and relay the data back to the base. The supervisor in

multisite job operation is being replaced by Data Acquisition and control devices. Due to the ease of this single person can monitor as well as interact with ongoing work from a single base station. The main purpose of this system is to collect the data in simplest way using Linux operating system which is suitable and popular choice for Embedded PC system. In this system, the compiling of data is to be done in central server and then transmitted to the clients via internet. In this system first of all access the server then access the data [5]. Using this technology user can monitor and control number of home appliances, electronic device as well as industrial appliances and device without computer owner of the whole system can communicate with Ethernet module and Ethernet module can communicate with whole system. This system is able to manage the home appliances & industrial device from anywhere location of the outside area. The server used to provide the powerful network solution and it enable to web access for automation as well as different system can be monitored. This system is the optimized solution with greatest demand in modern era for instrumentation, household device control and industry automation. Various sensor installed at the working location to sense the real

time environmental condition such as humidity, pressure, temperature, light etc [6].

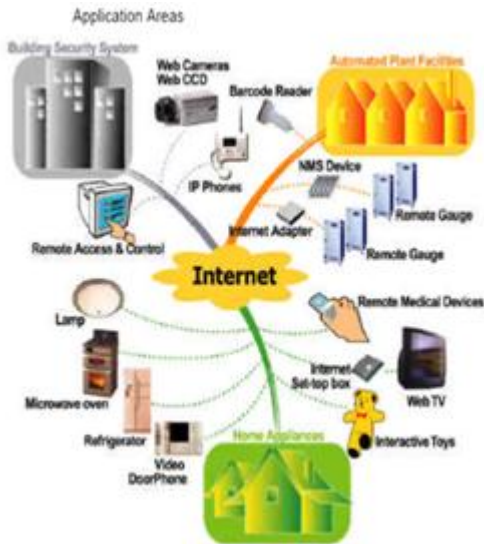


Fig. Application Areas of EWS

II. EMBEDDED WEB SERVER

This is the system which runs on computer program and that are responsible for accepting the request of the HTTP's from the clients. This is called as web browser and serving them HTTP response with the data contents, which usually are web pages like HTML documents and linked with the objects. Web server which is developed on ARM processor IC is called as embedded web server.

Embedded Web Server is the Web Server which can monitor and control the equipments with the hardware and software platforms. It allows the simple web pages and that web pages allow to display and modifications of platform parameter. It transfer the data into an internet possess with a TCP/IP protocol which is the communication protocol and web server technology as its core it has work with unmodified client, browsers, it is portable to a variety of embedded operating systems. There are small and lightweight and allows secure accesses.

Embedded Web Server is used to convey the current position of the data of embedded systems and provided it to the unmodified client browsers.

III. SYSTEM ARCHITECTURE

The architecture of Embedded Web Server consists of client/server, browser/server for easy maintenance, more flexibility, up gradation and low development cost. There is a difference between client/server and browser/server. The difference is that there is a no need of development of client program in browser/server, so that it becomes easy for the developers to concentrate on improvement of the server and this mode is simple to use, easy to extend and convenient to

maintain. EWS excels traditional PC server for its low power consumption, small size, high performance, low cost, portable and easy to deploy. It can achieve better performance under flexible environment, which require real time response and high systems net reliability.

Fig. shows the proposed concept of monitoring and controlling highway bridges system with architecture of EWS.

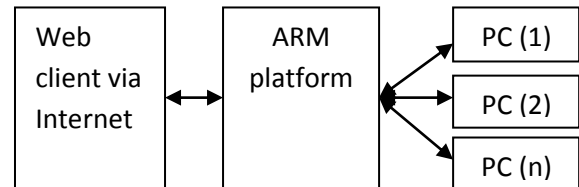


Fig. Architecture of EWS

III. HARDWARE DESIGN

Fig. shows the block diagram of monitoring and controlling highway bridges using Ethernet control system for embedded web server using ARM processor.

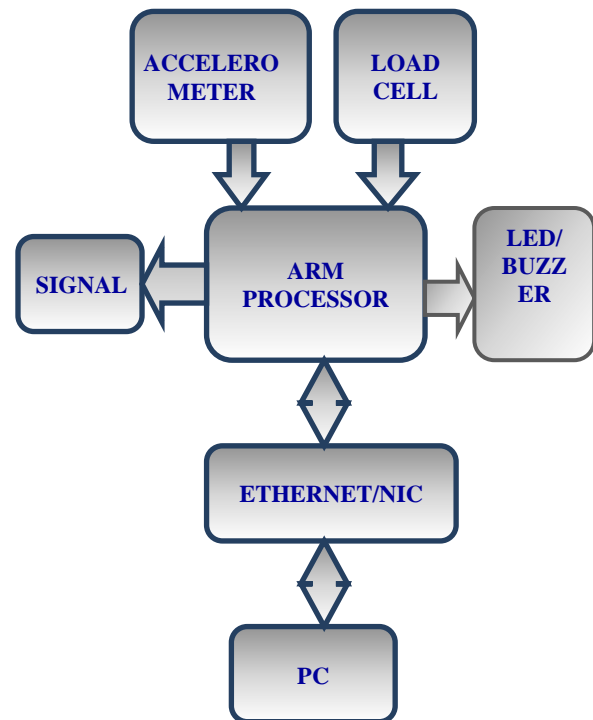


Fig. Block diagram of hardware system

ARM PROCESSOR:

ARM processor is 16-bit/32-bit ARM 7 TDMI-SCPU having real time emulation and embedded trace support ,

ARM processor have Embedded flash memory ranging from 32Kb to 512Kb.

LPC2148 tiny in size with low power consumption which is ideally used for miniaturization such as access control and point of sale. Serial communication interfaces ranging from a USB 2.0 full speed device, multiple UART's, SPI, SSP to I2C bus and on chip SRAM of 8Kb up to 40Kb.

ACCELEROMETER:

The MMA6361L/MMA7361L is a low power, low profile capacitive a micromachined accelerometer featuring is signal conditioning, a 1-pole low pass filter, temperature compensation and g-select which not require external devices. The MMA6361L/MMA7361L includes a sleep mode that makes it ideal for handheld battery power electronics.

For bridge monitoring and controlling 2- axes accelerometer is used that can be interfaced to analog channels of ADC.

1-accelerometer used on the ground floor near the pillar of the bridge and another accelerometer is used on the top of the bridge. The accelerometers are used for the vibration measurement.

LOAD CELL:

Load cell is used to measure the weight carried out by the bridge load cell outputs a low voltage analog output which has to be amplified and then fed to ADC.

ETHERNET MODULE:

The name Ethernet invented from the concept of Ether. The Ethernet is the standard of signal and number of wiring for the physical layer of OSI model through the network access at the media access control (MAC) and data link layer. Ethernet station communicates to each other on the top of the physical layer by transmitting the data packets and small blocks of data. Standard IEEE 802.3 is the standard of Ethernet. Twisted pair is combined versions of Ethernet for connecting the end systems to the network analog with the fiber optic versions for site backbone, is the most wide spread wired LAN technology.

IV. SOFTWARE DESIGN:

Embedded C: As the ARM processor used for this concept, it require using the programming language "Embedded C". The "Embedded C" is efficient high level gives the low level and high level access to the hardware. It is well defined language. It supports middle level, high level and low level features. The embedded C run time library contains many standard routine such as conversion of numeric formatted output floating point arithmetic. This is a very portable language based on ANSI standard and it is easily obtained for most system.

TCP/IP Protocol: TCP/IP protocol suite is the communication protocol which implements the stack of protocol on which the most commercial network and internet executes. TCP provides the reliable sequential delivery of stream of octets from a program on one PC to another program on another PC. TCP protocol is utilized by measured internet application like WWW transferring of file, administration of remote and E-mails. TCP/IP suite is the two layer programming, assembling of messages or a smaller packet file are managed by the higher layer and these of messages or file into smaller packets are transmitted to the internet and received by the TCP layer and that reassembles the packets into the original message and the lower layer that means internet protocol manages the addressing part of the each packets so it will reaches to the correct location.

HTTP protocol: HTTP protocol is used to communicate between web browser and web server this protocol is the frame work of web communication by providing the control information handling request are transmitted between server and browser.

Client-server communication: Client access the equipments which are connected to the server then it enters configured IP address and it monitor the equipments through the HTML web page.

V. OUR APPROACH

Our approach is to monitor and control the vibration measurement and load rating on the highway bridges to avoid the accident by using Ethernet control system and EWS. Web server technology is developed for bridge monitoring which is interfaced with both accelerometer and load cell to facilitate vibration sensing of natural calamities on bridge evaluation and load rating on bridges to avoid the accident due to natural calamities and natural troubles related to environment. Put one of the accelerometer on the top of the bridge and another accelerometer on the ground floor near the pillar of the bridge for vibration measurement. Load cell mounted below the pillar of the bridge. So it will identify that how much weight of the vehicles bridge can carry? If the weight on the bridge is more than its limit then it will glow the red LED and passes the message as "bridge is blocked" and if the weight on the bridge is within its limit then the green LED will glow and passes the message as "you may go now" and if accelerometer senses any natural calamities then it will display the web page through Ethernet.

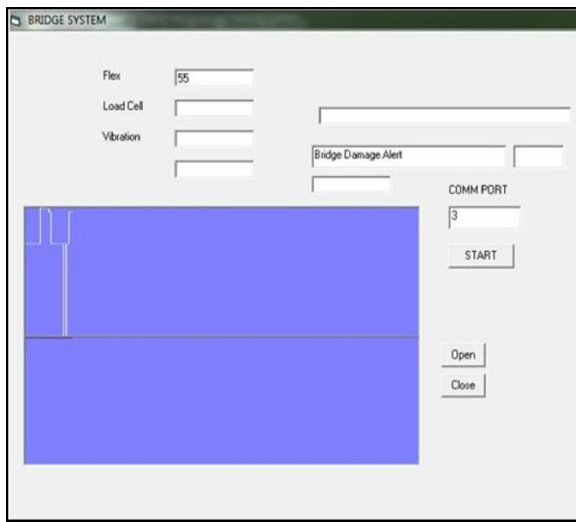


Fig. Web page of bridge monitoring system

VI. CONCLUSION

The embedded web server that has been designed can be used with industrial equipment medical instrument, controlling and monitoring of bridges and dam (civil infrastructures) in many other places. An administrator monitor and control the device with a simple but enhanced and much powerful user interface without additional hardware. Poorly designed and configured software architecture might even generate high response time while the physical resources display low utilization. A remote user only requires common internet browser to carry out experiments on real hardware

REFERENCES

- [1]. "Implementation of industrial Ethernet communication based on Embedded system" by Yanjun FANG, Bo XI Meicheng CHEN and Jingyu LIU, 2006 IEEE International Conference
- [2]. Mr.M.R.Gaikar, Prof.S.G.Galande, Prof.D.B.Rane "Ethernet Controller Arm Processor" International Journal of Electronics, Communication and Soft Computing Science and Engineering ISSN: 2277-9477, Volume 2, Issue 1
- [3]. S.P.Magadam, B.T.Salohke Department of Electronics Engineering, T.K.I.E.T Warananagar, Kolhapur, Mah., India "Embedded Ethernet Controller using ARM LPC2138" International Journal of Electronics Communication and Computer Technology (IGECCT) Volume 3 Issue 3 (May 2013)
- [4]. Ms.Divya Agrawal, Associate Prof.Vinay Jain "A Novel Approach of Light Weighted Web Server based on Arm-9" International Journal of Scientific and Engineering Research Volume 3, Issue 12 December-2012 ISSN 2229-5518

- [5]. Soumya Sunny P., Roopa .M "Data Acquisition and Control using Embedded Web Server" International Journal of Engineering Trends and Technology- Volume 3 Issue 3-2012 ISSN:2231-5381
- [6]. Jyotsna A Nanajkar, Vismita D Nagarale "Embedded Web Server based Automation" International Journal of Engineering and Innovative Technology(IJEIT) Volume 2, Issue 9, March 2013 ISSN:2277-3754 ISO 9001:2008 Certified
- [7]. "Switch Ethernet for factory communication" by Jorgen Jasperneite, 8th IEEE International conference on Emerging Technologies and factory automation, 15-18 oct. 2001 pages 205-212 Vol.1
- [8]. Ms.M.S.Pooja Kulkarni, Ms.SnehalUpadhye, Dr.(Mrs.)NeelimaIyyer "Embedded Ethernet Module-Tool for Researcher" International Journal of Enhanced Research In Science Technology and Engineering VOL.1, ISSUE 1, OCT.2012 ISSN NO:2319-7463
- [9]. VaishaliPatil, Avichal Kapoor "Real Time Embedded Web Server based LED's Control using ARM Processor and Ethernet " International Journal of Engineering Research and Applications(IJERA) ISSN:2248-9622 Vol.3, Issue 2, March-April 2013, pp.1346-1349
- [10]. AkanshaS.Fating, T.H.Nagarare "An Approach to Develop Embedded System for Web based Monitoring and Controlling of Renewable Energy Sources" International Journal of Computer Science and Network(IJCSN) Volume 2, Issue 3, June 2013 ISSN(Online):2277-5420.

[11]. www.embeddedcraft.org/armbasics

[12]. www.egnite.de/en/software/nutos.html

[13]. www.ethernut.de/en/firmware/nutos.html