Volume 6, Issue 7, July 2016 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

An Ethernet Based Real Time Monitoring of Data Acquisition and Control System Using Rasp-Pi

Ratan R Patil, V. K. Bhosale
Electronics and Telecommunication Department, Dr. BAMU University, Aurangabad, Maharashtra, India

Abstract—This paper presents the real time monitoring of different input data environmental conditions. A large number of distributed input output data acquisition system based on ARM11 processor with Ethernet port and Raspberry Pi boards has been investigated and developed. The hardware board uses 32-bit Raspberry Pi having ARM1176JZF-S 700 MHz processor with Raspbian operating system and software platform uses Python for operating system [1]. All these system contain different devices that are very sensitive to current deviation, voltage variation, and to all the power quality equipments and quantities. This system is able to measure and store any kind of signals like electrical and non - electrical Signals on embedded server and along with this all data can be seen in view log. It can able to monitor all the input data continuously without any disturbance. The acquired data can be displayed on embedded web server pages at different system and at the same time can be transmitted through RJ-45 Ethernet port network to remote Data Acquisition and Control System with continuous manner by using internet protocol[3].

Keywords—ARM1176JZF-S 700 MHz processor, RJ-45 Ethernet network, data acquisition system, Raspbian operating system

I. INTRODUCTION

The earlier data acquisition and control system were based on PLC, GSM and Zigbee for data monitoring and controlling. The proposed system designed for data acquisition and control system based on Ethernet network. This system provides real time monitoring and can access different industrial parameters directly without any interaction with additional server. This system avoids many complication of the system such as cost increment, volume increment, lots of wire connection, WSN etc using Ethernet based web server system. The other purpose behind this system is designing the system which can monitor and control different parameters of any industry through internet. As system consist of embedded web server so that the person can access industrial parameters remotely throughout the time.

This system has one Raspberry Pi board having ARM11 processor as core which handles different operation. Processor does the operation over measured signals which are coming from various input as well as external sources and it can control the industry environment by continuous monitoring via embedded web server. It support system program that provides an interface between hardware and application programs. This operating system is commonly equipped with different feature like: multitasking, synchronization, interrupt and event handling, input/ output, inter-task communication, Timers and Clocks and Memory management. Embedded web pages are designed by using Hyper text mark-up language.

II. LITERATURE SURVEY

The proposed system is available on ARM based data Acquisition & Control using Wireless Network. This system is based on ARM Processor with RTOS, GSM, GPS, and Sensors. This system is useful for industrial applications with a real-time monitoring and controlling. Real time operating system can be ported to ARM hardware and its designed support with all types of DACS system[2].

Joby Antony et al. presents paper on Distributed Data Acquisition and Control System Based on Embedded Web Server. This is designed for a distributed data acquisition and control system. The given system measures all types of electrical as well as thermal parameter. In this paper they have used Browser or server mode to control system in which web pages shows measured data from anywhere from the any location. This system provides the facility to manage operation through RJ45 -Ethernet network to remote DDAS. By using HTTP internet protocol devices can be control remotely.

The ARM based embedded system for industrial application using TCP /IP networks support, implementation for IDACS system . This IDACS is nothing but Online Interactive Data Acquisition and Control system which is made up using ARM based embedded web server. This IDACS is a digital distributed control system. The system capability was increased by using single chip IDACS[4].

Mitsugu, presents paper on Application of ZigBee sensor network to data acquisition and Monitoring. The wireless sensor network is expected to be a key technology for several applications such as home automation, building control, energy saving and automobile monitoring. Development kit products, in which a temperature sensor, optical sensor, push button switch and circuit of beeper is assembled on circuit boards, are provided by ZigBee module vendors for

applications such as room lighting and air conditioning controllers. This ZigBee modules are potentially suitable for many other applications[6].

K.vijay Chandra, G.Mamatha presents paper on Design of Remote I/O data acquisition system with zigBee. In the field of modern wireless communication, there are mainly some technologies that provide solutions to the wireless data transmission network, such as: GSM, CDMA, 3 G and Wi-Fi. These solutions make network with high efficiency and good quality, but still with high Cost. So it was difficulty in popularizing with low cost and at the circumstance of infra stureless or Infrastructure destruction. According to this situation, in this paper, the key components of the Information Terminal and the wireless receiving modules on the data Collection and wireless transmission network were Designed with the principle of zigBee and 51 Series of single-chip computer as the core hardware, Besides, combining with the current technology on the Wireless Ad Hoc Networks. A short-rang wireless data Sampling and transmission network was putting up, Which provides a low-powered and high-performance. Wireless data communication system, works in ISM (Industrial Scientific Medical) Band[7].

III. SYSTEM DEVELOPMENT

This Ethernet based data acquisition and control system for industrial application is powerful development platform based on Raspberry Pi board has ARM11 as core. Proposed system Architecture contain ARM11 processor is centre core with operating system as shown in figure 1. In this system, 32 bit Raspberry pi board is used with ARM11 as core. This processor has reach sources which includes the USB, inbuilt Ethernet port, 512 MB RAM,128 KB cache memory, Micro

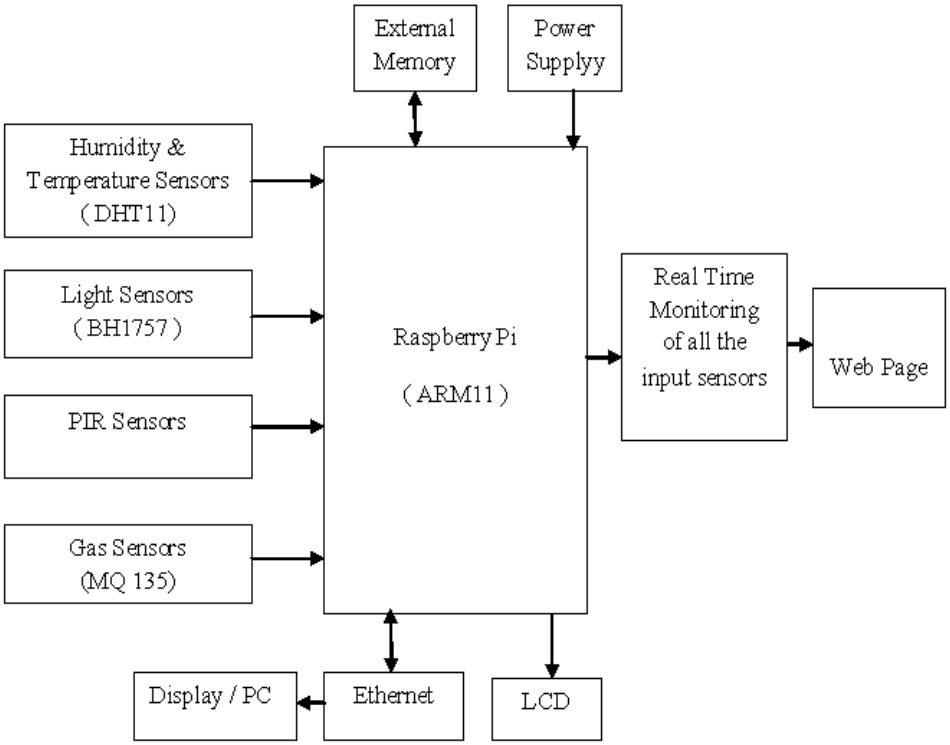

Figure 1: Block diagram of the system

SD slot, 700mA (3.5W) power, video/audio port with camera interface. This modules can help to achieve Ethernet services using web server. The real time monitoring is take place and this system also connect client PC to Ethernet through a web browser and then gets access to the embedded web server. The system is assembled with acquisition/control system channels and separated from each other. Each input and output channel can select a variety of electrical and non-electrical signals like current, voltage, resistance, temperature etc.

Processor:

In this system Raspberry Pi is the heart of the whole system which have seen in iphone 3G and Kindle 2 , so it shows the capabilities of this processor with the other powerful little devices that are available now a days. This processor contains chip of 32 –bit with 700 MHz system on chip which is totally based on the ARM11 architecture. This chip come in a variety of model architecture with different cores to allow the various capabilities at different price point of view. This processor contains different types of architecture like Model A architecture which has 256 MB of RAM and Model B architecture has 512 MB of RAM[1].

The Secure Digital (SD) Card slot:

Everything is stored on an SD card since this system has no hard drive it requires SD card to store or install Raspbian operating system. So that system will need at least 4GB of SD card and it can use it up to 8 or 16 GB depends on the capacity of the installation of operating process[1].

The USB Port:
On the Model B architecture there are two USB ports but model A has only one. There are total four USB ports available on the newly Raspberry Pi board. In this some USB devices draw up to 500mA. Original Raspberry Pi supported 100mA.

Ethernet Port:
The Model B architecture contains a unique RJ45 Ethernet port which provide LAN connection for the whole system. It can show the different parameter by making embedded web server with the help python programming. The model A does not support the USB connection so need to provide it by externally but in Model B it is available onboard . By using wi-fi connectivity via USB dongle is another solution for this system[1].

HDMI Connector:
The High Definition Multimedia Interface device provides digital audio and video output. It support 14 different resolutions and this HDMI signal can be converted to DVI which is used by the many monitors of different computer system[1].

IV. EXPERIMENTAL RESULTS

The experimental result shows the output of the different sensors that have interface with Raspberry Pi board with general purpose input output (GPIO) pins. While interconnecting this system to the server particular IP address is allocated to the device. This IP address will generate according to the connection that are provided to the system whether it is LAN , mobile or Ethernet connection. When this system get connected it will show the web page as shown in below figure. This is real time monitoring of the input devices connected to the system. By using this system different interfacing also make with the help of general purpose input output (GPIO) pins and different devices can be controlled remotely using web server.

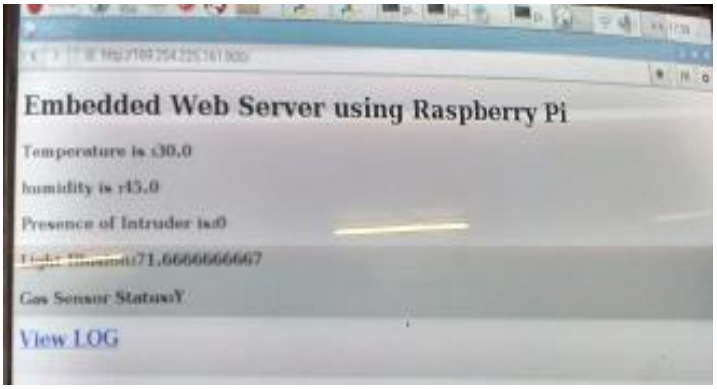

Figure 2: Web Page

Result analysis for Temperature and Humidity sensor:
The continuous monitoring of the temperature and humidity sensor is displayed on the web pages. In some of the system temperature sensor is used to measure temperature at which the material gets heated.
Temperature and humidity sensor can be use to drive FAN. According to the output coming from the temperature and humidity sensor, the FAN will operate. When temperature increases above 45°C then FAN will turn ON and when temperature decreases below 45°C then FAN will turn OFF. Similarly when humidity increases above 50% then FAN will turn ON and when humidity decreases below 50% then FAN will turn OFF. The continuous monitoring of the temperature and humidity sensor will get on web pages with the help of output driver FAN.

Result analysis for Light sensor 1750:
In this system it shows the continuous monitoring of the light intensity on the web pages. Another method to control this system is when light intensity is less than 10 lx then light bulb will be turn ON and when light intensity is greater than 10 lx then light bulb will be turn OFF. The continuous monitoring of the light intensity can be seen on the web pages with the help of output driver light bulb.

Air quality sensor (Gas sensor) Analysis:
It can detect any kinds of toxic gases. As soon as any gases found in surrounding the real time monitoring of the air quality sensor can be seen on the web pages. As a output driver, buzzer can be connected with this system.

Result analysis for PIR Sensor:
No output driver is connected here but it will show the real time monitoring on the web pages if any object or moving body detected. If obstacle detects, it gives 5V as output voltage to processor and if no obstacle is detected it gives 0V.

V. CONCLUSIONS

By using this system we get real time monitoring of the overall system, as different sensing parameters are connected to the input. In another system we can continuously monitor or access different industrial parameters directly without any

interaction with additional server. This system is operated by different sensors to acquire the signals and control the devices remotely. Embedded web server also used to share the data with clients online. Both way are efficiently carried out by Raspbian operating system.

Thus the system provides higher authority of data acquisition, controlling , multitasking and the reliability of the control. With the different design ideas of user, this project explains all the parts of the system like hardware, software, computer code, and other considerations to make the construction process. Whatever we think we can implement it by using this system with Raspberry Pi board.

ACKNOWLEDGMENT

The authors happy to acknowledge the help towards staff, and students to encourage and support . It is beyond my word power to enhance and acknowledge for guidance to those who have helped me to complete this paper in such a presentable manner. The author extremely thankful to guide for his valuable guidance, inspiration, motivation and cooperation towards completion of my paper.

REFERENCES

[1] Book “Getting started with Raspberry Pi”, written by matt Richardson & Shawn Wallace, December 2012: First Edition

[2] Suraj.U.Patinge and Mrs.G.M.Kadu, “Design of ARM Based Data Acquisition & Control Using Wireless Network”, International Journal on Recent and Innovation Trends in Computing and Communication, Volume 3 Issue2, 2015, pp.11-14.

[3] Joby Antony & Sachin Sharma, Basanta Mahato, Gaurav Chitranshi , "Distributed data acquisition and control system based on low cost Embedded Web servers" ,International Journal of Instrumentation, Control & Automation (IJICA), Volume 1, Issue 1, 2011

[4] Bhushan R. Khangare, and Mrs. A. P. Rathakanthiwar, “Design of ARM Based Embedded System for Industrial Application Using TCP/IP Network”, International Journal of Engineering Research and Applications (IJERA), April 2014, pp. 6-10.

[5] Kyasa Shobha Rani & Prof .B .Brahma Reddy, “Design of On-line Interactive Data Acquisition and Control System for Embedded Applications”, International Journal of Research in Computer and Communication technology, IJRCCT,ISSN 2278-5841, Vol 1, Issue 6, November 2012.

[6] Mitsugu, “Application of ZigBee sensor network to data acquisition and Monitoring” in Measurement Science Review, Volume 9, No.6, 2009.

[7] K.vijay Chandra, G.Mamatha , “Design of Remote I/O data acquisition system with zigbee” in International Journal of Electrical and Electronics Engineering (IJEEE), ISSN (PRINT): 2231 – 5284, Volume-I, Issue-II, 2011.

