ISSN No. 0976-5697
Volume 5, No. 5, May-June 2014
International Journal of Advanced Research in Computer Science
RESEARCH PAPER
Available Online at www.ijarcs.info

Designing of Embedded System for Distributed Temperature Monitoring

Madhuri Joshi
Department of MCA,
Marathwada Institute Of Technology,
Aurangabad (MS) INDIA

Madhusudan Jathar
Scientific Officer (G)
Computer Division,
Raja Ramanna Center for Advanced Technology,
Indore (MP) INDIA

Suresh Mehrotra
Department Of Computer Science & IT
Dr.Babasaheb Ambedkar Marathwada University
Aurangabad(MS)INDIA

Abstract: The paper describes the development of distributed temperature monitoring system using DS80C400 microcontroller. The system is capable of monitoring the temperature through Ethernet. The 1-wire temperature sensors have been used in the system for the simplicity as no glue logic is required for converting this analog parameter in to digital form. An appropriate GUI environment has also been developed so that temperatures could be monitored remotely using any web browser.

Keywords: Embedded-systems, DS80C400, 1-Wire sensors, Legacy Device, JVM, RTMS.

I.INTRODUCTION

The embedded systems can be used for various purposes such as control of experimental parameters at remote areas. DS80C400 microcontroller has successfully been used for the purpose. In this research, Local area network based distributed environmental parameters like temperature, humidity; wind direction etc monitoring system is being developed. A temperature monitoring station has been developed and tested using 1-wire temperature sensor. The results are very encouraging. The 1-wire sensor is read with DS80C400 microcontroller based card. This card supports TCP/IP protocol so remote monitoring becomes very easy. HTML based GUI for this purpose has also been developed. This paper described this development. The DS80C400 card also has serial ports and weather cock is planned with legacy device with serial port. This device will read the various reed switches and give correct wind direction. Similarly, humidity sensor will be used with 1-wire interface.

II. OBJECTIVES OF THE PRESENT SYSTEM

a. Main objective of the system is to monitor the temperature through remote control.
b. The system will be mounted at various places in Marathwada region.

III.EXPERIMENTAL SETUP & SCIENTIFIC APPROACH

The ever broaden use of internet has lead to the development of embedded systems. The main objective of developing embedded system is to create such systems that can operate independently and automatically, with minimum human interaction. One important area is to monitor weather parameters remotely. So we have developed such a system that monitors temperature remotely.

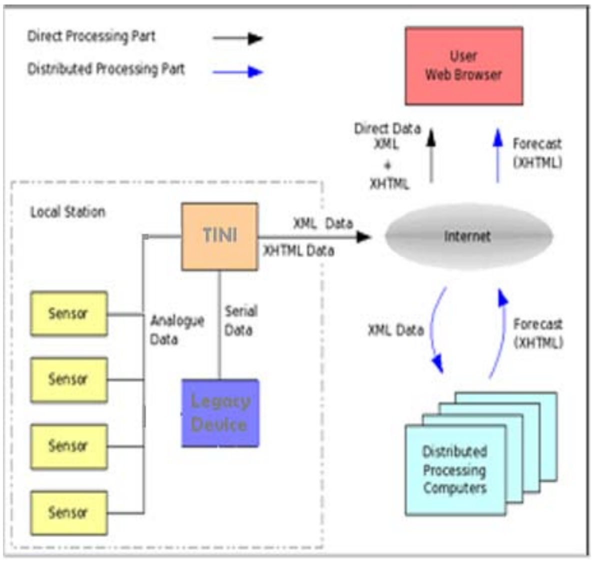

Figure (1) The Architectural Design Of Remote Temperature Monitoring System (RTMS).

The figure(1) shows the architecture of the remote temperature monitoring system (RTMS).The schematics is divided into two parts,

a. A Remote Area Station and,
b. A Server Station.

A Remote area substation consists of web enabled networked microcontroller i.e. DS80C400 microcontroller, 1 wire temperature sensors and legacy device. These 1-wire sensors are placed at different locations over the remote substation. For the purpose of remote monitoring, these remote substations must necessarily be connected to server station. To establish the communication between remote substation and server station, it is the need of the system to bridge the gap between remote station and the internet. In this regard the DS80C400 microcontroller developed by

Dallas semiconductor provides the ready solution [1]. The DS80C400 microcontroller board is web enabled so it can be directly connected to internet. Both local and wide area networks can be accessed using the IPV6 stack. Direct support for Ethernet allows designs that connect to a LAN. PPP enables IP over serial, which supports networking over wireless connections or through phone lines using analog modems. 1-Wire temperature sensor [2] is a semiconductor device. The name is derived from the fact that it only uses 1 wire for communication. Many of such 1 wire sensors can be connected. The operating range of DS18B20 is -55 C to +125 C with an accuracy of ±0-5C. The data which is collected by temperature sensor is then transferred to the database. The legacy device is connected to DS80C400 through user serial port. The Legacy device has LCD display, accessible through serial port.

IV. SOFTWARE AND RESULTS

The system software plays an important role in this system, both on user side as well as on server side. We have used an 89C400 based board. The board has onboard memory & also embedded java. As IP networks have become more pervasive, it is now a necessity to develop network enabled embedded systems. However, network protocols tend to be complicated to code and require a lengthy test cycle. The runtime environment provides the entire software infrastructure needed to write network-aware applications for IP-ready microcontrollers. The runtime environment provides a full TCP IPv4/v6 protocol stack verified for compliance to Internet standards. The network stack is driven by a multitasking operating system. Using the runtime environment and its built-in APIs, We have written an application software and used the peripherals available ON-board.

The system software has been developed in Java. For running on DS80C400 platform these class files are converted in to .tini files. All the support files for the GUI are uploaded on to DS80C400[3]. To run the server software on DS80C400 it is accessed using Telnet. We are using LCD of legacy device for local temperature display as shown in screen shot Figure(2) here.

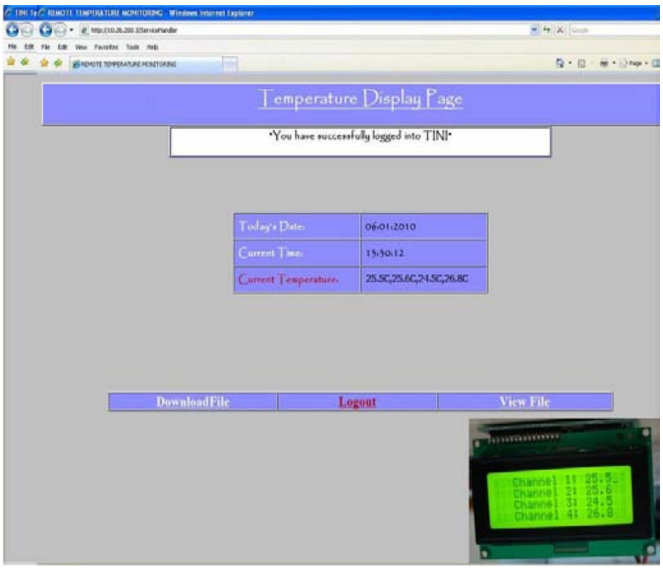

Figure (2) Local Temperature Readout and Remote Display

The communication protocol is developed to provide communication [4], [5] between 1 wire sensor, legacy device and DS80C400. At server station the interactive web pages are created to collect the data from RTMS. These web pages shows the two options-

a) Legacy Device
b) Temperature Monitoring.

Using the legacy device option one can pass the text on to the legacy device located at remote station[6].The same is shown in Figure(3).

Figure (3)Sending Message At Remote Station From Server

The temperature monitoring option is having user login screen. This gives user authentication to use the data from RTMS[7]. After successful login the data can be viewed from different channels along with view file, download file, logout options. Automatic network boot allows increased reliability of an embedded design. An application can be downloaded from the network to local memory and then executed by the microcontroller. This removes the need to have nonvolatile local storage. Another significant benefit to network boot is the ability to update an application remotely. The data downloaded at server may further be used for statistical manipulation. System has been tested under different conditions.

V. FEASIBILITY OF THE SYSTEM

The feasibility of the embedded system is studied with respect to the following points:-

a. Software Up gradation Capabilities:

For developing our embedded system we have used advanced microcontroller and development environment tools, so the embedded system software development became easy. Further we can modify and upgrade the software as well as hardware. As the conversion process for converting class file into the appropriate hardware format is difficult and time consuming hence we need to check the software in every aspect then only upgrade the same.

b. Size:-

The size of embedded system is the important factor. The care has been taken while developing the embedded system that it should be portable, easy to handle and install. Our embedded system is very small in size, portable and easy to install.

c. Fault Tolerant:-

The system can recover from component failure if any. It is easy to replace the failed component and resume the system with newly installed components.

d. Recoverable:-

The failed processes during the fault or failure of component can restart hence the embedded system we have developed is recoverable.

e. Consistency:-

The system can coordinate the actions of component in presence of failures also. So the users need not to visit the weather station location unless the failure of hardware components occurred. If failure in case of software occurred, it can be done easily by accessing the microcontroller on server. There is less possibility of software failure.

f. Scalable:-

The system is said to be scalable because it can also operate while new components are added. It remains effective when there is a significant increase in the number of resources and the number of users.

g. Predictable:-

The system is predictable as it provides desired response in timely manner.

h. Power Consumption:-

The embedded system needs +5v power supply. The microcontroller board is having lithium battery cell, which if once charged will work for 10 years. The sensors which are used here they are connected in such a way that they uses parasite power from microcontroller board. The liquid crystal display will also needs +5v power supply. In all the embedded system consumes less power hence the embedded system is feasible in terms of power consumption.

i. Cost:-

While designing an embedded system cost is the most important factor. Initial cost of developing, debugging and testing the hardware and software cost is a one –time non recurring cost. Our embedded system costs around 10000/- which is very less for on node as compared to the other embedded systems developed for weather monitoring. Node cost will definitely come drastically down if requirement is in bulk quantity.

Considering all the points, our embedded system is feasible technically, operationally and economically[6][7].

VI. APPLICATIONS OF THE PRESENT SYSTEM IN VARIOUS AREAS

a. To help Metrology department, as they do not have station everywhere.
b. The system can be modified for monitoring Server room’s temperature.
c. The system can also be used for monitoring ICU rooms in hospital in case of AC failure the temp will go high & equipment in the ICU may malfunction.
d. Finally, since this system support 1-wire devices we can also control some parameters using these devices remotely.

VII.CONCLUSION AND FUTURE WORK

The system will monitor the temperature and the reading will be automatically integrated to database which may further be used. Suitable hardware and software is developed to implement the system. At initial stage the development is done for limited area. The system may be used for monitoring of other parameters besides Temperature.

VIII.REFERENCES

[1] The DS80C400 Specification and Developer’s Guide by Don Loomis.

[2] Linux journal developing AVR microcontroller on Linux. 1996-2004

[3] mayankaggarwal.net/Documents/report.pdf

[4] http://www.neonbox.org/tini/tini.html

[5] http://tiniant.sourceforge.net/

[6] “Distributed system for weather database through TINI Microcontroller”, Madhuri Dixit-Joshi, M.R.Jathar, S.C.Mehrotra,Knowlegde Engineering-db,Pg-73-79, Narosa Publishing house,14 Jan 2011.

[7] http://www.kriso.ee/knowledge-engineering-db-9788184871234.html