

# An Automated Monitoring and Alert System for a Typical Server Room

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## Abstract

In this paper presents, the design and implementation of an *Automated Monitoring and Alert System for Typical Server Room*. This project is based on a microcontroller by Dallas Semiconductor known as TINI (Tiny Internet Interface) DS80C400. The system can send SMS messages, send out emails, etc to alert to appropriate personnel to maintain a high availability of services.

**Keywords:** Alert, Monitoring, TINI

## 1.0 Introduction

The TINIDS80C400 Evaluation kit was used to control and monitor hardware such as servers. The objective of this project is the use of existing technology to provide a solution to the problem of monitoring and controlling server room hardware from a remote location.

## 2.0 TINI – Tiny Internet Interface

Tiny InterNet Interface (TINI) is a platform developed by Dallas semiconductor to provide system designers and software developers with a simple, flexible and cost effective means to design a wide variety of hardware devices able to connect directly to corporate and home networks. The platform is a combination of a small but powerful chipset and a Java™ programmable runtime environment [1].

### 2.1 TINI Software Architecture

The TINI software architecture consists of multiple components.

**Java Virtual Machine (JVM):** This is in the highest layer and its main function is execution of the different applications using the API and the infrastructure provided by TINI Operating System. It can support all the primitive types, threads and strings [1].

**Native Methods:** this layer includes the methods to access to the network protocol stack's socket layer as well as non-networking device drivers [1].

**TINI Operating System:** This is responsible for managing all system resources including access to the memory, scheduling multiple processes and threads of execution, and interacting with both internal and external hardware components [1].

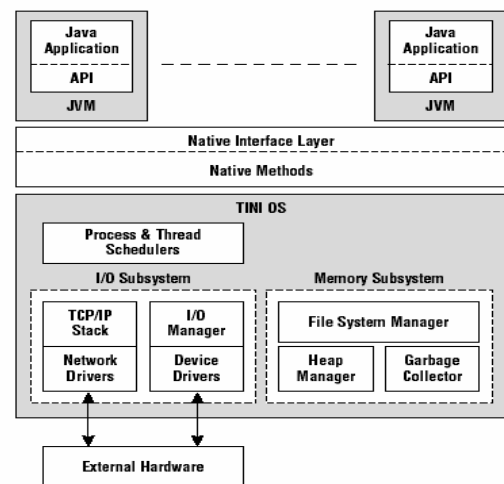


Figure 1-TINI Software Architecture [1]

### 2.2 Communication features provided by TINI

The TINI board comes with a wealth of on board features such as dual CAN<sup>1</sup> interfaces, dual 1-wire® interfaces, 10/100 Base-T Ethernet along with dual serial ports. Two of these primary interfaces are used in this experiment that is serial and Ethernet interfaces [1].

The TINI reference board based on the DS80C400 processor is known as the DSTINIm400 reference module. The DSTINIm400 is only available in one configuration, which has 1MB of nonvolatile, static RAM and 1MB of flash. It is available as a 144-pin SODIMM module and is shown in Figures 2 [1].

<sup>1</sup> CAN (Controller Area Network)

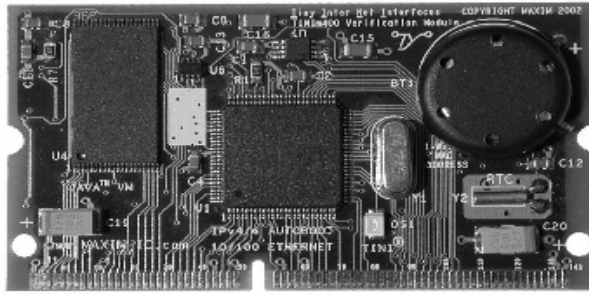


Figure 2 DSTINI400 [1]

The DSTINI400 socket board (Figure 3) is aimed at aiding the application development process.

It provides the following physical connectors:

- 144-Pin SODIMM Connector
- 9-Pin Female DB9 Connector.
- 9-Pin Male DB9 Connector.
- RJ45.
- RJ11.
- Power Jack

### 3.0 Power Monitoring Module

This section introduces how power monitoring module was developed. It sends signals to TINI board through the serial interface and indicates power status of the server room.

If a power failure occurs in the server room and TINI board will be notified within 5 seconds. There is a grace period of one minute before an SMS alert is sent to the appropriate personnel indicating that there is power failure in server room.

#### 3.1 Power Monitoring Circuit

A power monitoring circuit was developed using an 8-bit analog to digital converter which is connected to a MAX232 IC that converts the TTL signal in to RS232 protocol. This output was connected to the serial interface of the TINI board.

On the TINI board, a Java thread known as PowerTester<sup>2</sup> senses the signal from power monitoring circuitry and if the signal is not present it indicates commercial power failure and act accordingly.

<sup>2</sup> PowerTester is class name of the java programme.

### 4.0 Temperature Monitoring Module

This section introduces the temperature monitoring module. This module uses a thread running in the background called TemperatureWorker<sup>3</sup> started from TINIWebServer<sup>4</sup>.

It utilizes a TINI Verification Module and a DS1920<sup>5</sup> iButton® 1-Wire temperature sensor. The thread reads data from the sensor and passes the reading to the Web Server for displaying the time and temperature read from sensor.[2]

### 5.0 Server Status Monitoring Module

Authors developed a Java program called PingWorker.java<sup>6</sup> which was integrated to TINIWebServer program. This thread runs in background and pings all the servers and take an echo reply from the servers available in the server room. Then it sends the status of servers to web server master program.

The IP addresses of currently available servers were coded into this program to gather status of servers in the server room.

The Figure 4 indicates how the web server display, the server status in the server room. It display as “Running” that the server is working properly without interaction and server with any failure indicate as “x”.

<sup>3</sup> TemperatureWorke is class name of the java programme.

<sup>4</sup> TINIWebServer is class name of the java programme.

<sup>5</sup> DS1920 is the part number of the temperature monitoring sensor manufactured by ibutton.

<sup>6</sup> PingWorker.java is programme name to find server status.

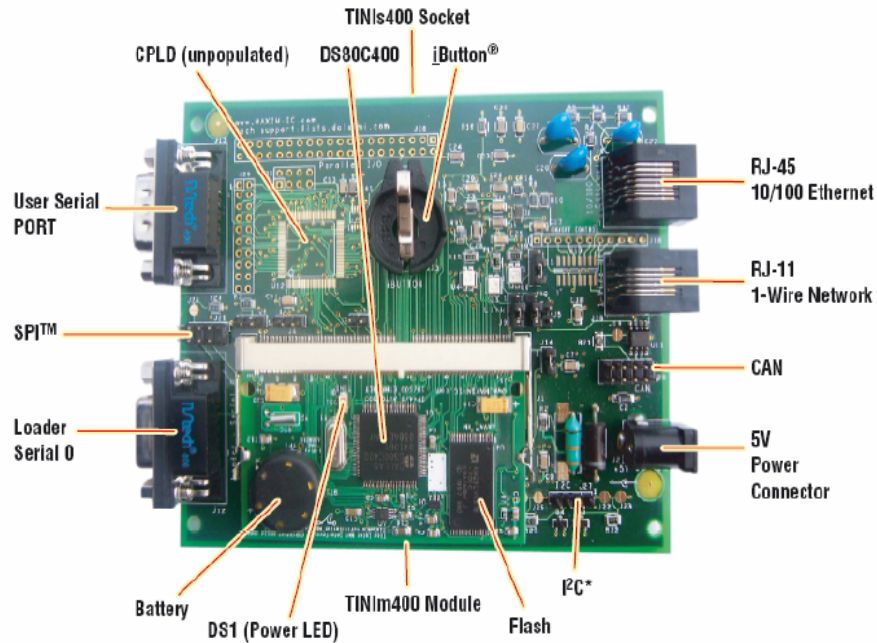


Figure 3. DSTINIs400 socket board [1]

Server Room Status
Power Status : ON AC power
Mail Server Status : Running
Web Server Status : Running
NAT Server Status : Running
Dialup Server Status : X
Proxy Server Status : Running
DB Server Status : Running

Figure 4 .The web page indicates server status.

## 6.0 SMS Alert Module

Using this module, the web server sends an SMS alert to appropriate person to indicate that power is lost in the server room.

There is a one minute grace period before sending SMS. This grace period allows some time to start Power Generators or to use backup power prior to sending the SMS messages. The text message indicates “Power Went Off” and “Power Came Back”.

In the temperature monitoring module, Web Server program check the temperature status, if temperature increases more than 23°C it automatically sends SMS alert to appropriate personnel indicating that. This alerting program is implemented to send two SMS alerts in consecutive intervals.

## 7.0 Shutdown and Restart Critical Servers

TINI does not support hosting secure web sites, shutting down and therefore, restarting servers through the web interface was not implemented.

Although telnet uses unencrypted usernames and password, a shutdown system was developed for Windows 2003 servers on an experimental basis.

Client server socket<sup>7</sup> programme called ServerApp.java<sup>8</sup> and ClientApp.java<sup>9</sup> is designed to achieve this objective. In Windows Server side ServerApp is deployed and in Tini ClientApp is deployed with port 4444 opened for listening for incoming connections [2].

Compiled ServerApp.java needed java runtime environment installed in server (in Windows 2003 Server) and put into server. Batch file is written to run server application in the startup.

## 8.0 Conclusions

Objectives of the project were achieved successfully using the TINI DS80C400. The system has been in operating at the Open University of Sri Lanka since completion. The system has been highly stable and reliable during more than 3 months of operation.

<sup>7</sup> A socket defined as “a logical connection or channel for computer applications to pass information back and forth between networked computers and each socket is made up of an IP address and a port number”.

<sup>8</sup> ServerApp.java is programme deployed in Server.

<sup>9</sup> ClientApp.java is programme run in TINI

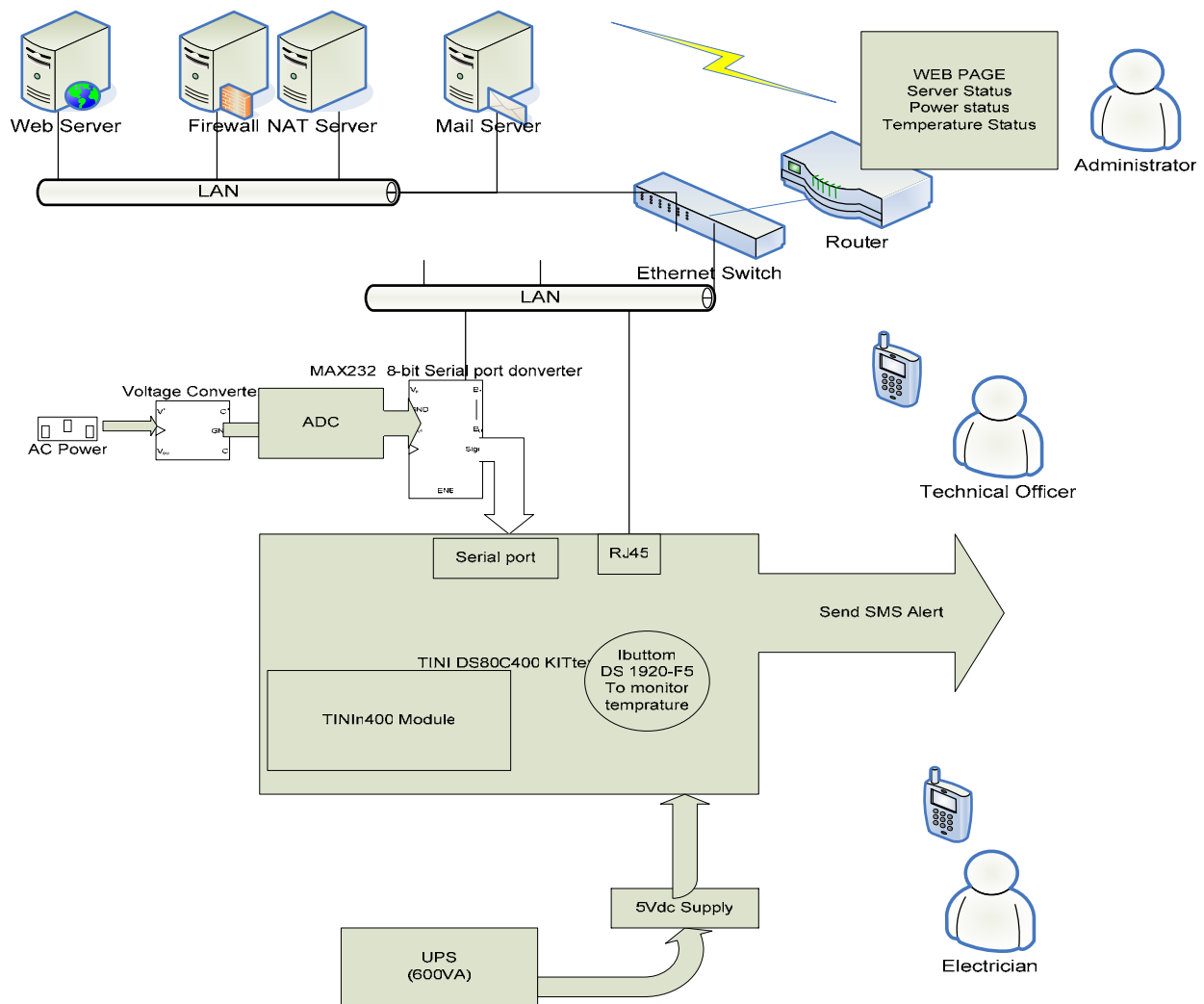


Figure 9. Overall System Block Diagram.

## 9.0 Further Work & Enhancements

At present the system could only shutdown and restart Microsoft Windows based servers, but in future work it is possible to extend this feature to Linux servers as well.

It may be useful is to introduce security measures such as authentication login/password interface would be suitable for permitting the access only to authorized personnel.

Functionality of TINI board could be extended to monitor more than one server room; if any institute have two or three server rooms to monitor, temperature and power status can be measured using different sensors and circuitry because heat sensors, can be fixed to TINI board using 1-wire<sup>®</sup> port (RJ11 connector)

Through TINI serial interface modem could be utilized to send recorded messages in Sinhala, English or Tamil language to appropriate person's telephone extension.

The system could be further enhanced to support smoke detection.

## References:

- [1] Don Loomis, (June 2001), *The TINI Specification and Developer's Guide*, Publisher Addison Wesley Professional.
- [2] Sun Microsystems Inc (1994-2006) *The Source for java developers*. Available electronically from <http://java.sun.com/>-accessed on February 5, 2006