Autonomous Smart Server Guard for Advanced Safety Measure Using Wireless Mobile Technology

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Abstract: Real-time monitoring of temperature has become crucial in cases like server room, incubators of infants in hospitals, coal mines, green houses etc. In all these cases we prefer a temperature sensor which ensures user's safety, proper alarming conditions, be simple to use (user friendly), easy calibrations, small and light weight, inexpensive and effective. The aim of this system is to provide an effective alert mechanism when the temperature of the scenario goes beyond a critical value. The temperature change in each instant of the surrounding is fed into the database and here it is processed by the pc, which monitors it. Then if the parameter goes beyond a critical value, which can be calibrated initially, an alarm is turned on in the room to give a primary warning to the person in-charge of the locality. If there is no adequate response and the temperature is allowed to rise, an SMS (Short Message Service) notification is given via wireless modem to the responsible person. An emergency call is also made to the responsible person via the wireless modem and a recorded voice is played. This way the alert mechanism reaches effectively to the concerned

Keywords: Incubators; Wireless Modem; SMS; Voice call.

I. INTRODUCTION

Temperature is a parameter which human race has learnt to control but at times its arbitrary change can prove to be a menace. In the case of large firms, most of the companies that lose their vital information go out of business the next year. The cost per GB of storage tends to be astonishing. A server failure could bring a large setback for a corporation. Also software related problems are taken care by anti-virus, spyware etc. Nowadays hardware related problems are also taken care but they all lack a proper alert mechanism. High temperatures can adversely affect power supplies, potentially causing damage to a system’s internal electronics. Situations arise when certain alert mechanisms fail or it seems insufficient. Thus we are in need of a proper system which can provide effective warning about the situation.

II. PROBLEM DEFINITION

The server room at our Amrita University, Amritapuri Campus had witnessed AC failures which caused huge data loss with worse impact on user data. According to the statistics available from ICTS of Amrita University, in the past two years server failure occurred twice due to AC failure. First one was in Dec. 2008. That was a major failure and it affected around 50GB of data. ICTS told that they were able to retrieve all data but it demanded a combined effort of around 20 experts for 15 days, both from our institution and HP, the service provider. That is, whenever there is a problem for server we can retrieve data, but the time and manpower required to do that is immense.

The second failure which occurred last year was not too severe. Though a system is in place to inform the system administrators and server room staffs (henceforth referred as caretakers) about this failure, it was not fool proof. It sends only an SMS to the server room caretakers. SMS was not effective as these failures happened only during night times and caretakers missed the SMS. Also the system in place is very costly. So we propose an autonomous called Amrita Autonomous Smart Server Guard (AASSG) which uses the wireless modem not only to SMS the caretakers but also to place a call and play a voice message. The vault we designed recommends to monitor constantly the temperature of the server room which is an autonomous, micro controller based system, which alerts the caretakers first with an alarm, then with an SMS and a voice call via wireless modem attached to the sever, when the temperature in the server room will reach critical conditions.

III. RELATED WORKS

Related works in this area make use of the Short Message Service (SMS) facility as alert mechanism as seen in the paper [1]. The temperature and humidity sensor used in tissue culture lab make use of this mechanism and sends a message showing the present parameter status and displays the message “Tissue culture lab parameters exceeded”. But at times such an alert could go unnoticed, in case if the intended person in sleeping. Another work in [2] makes use of the alarming system for the attending staff. This system can fail if the attending staff is away for an emergency situation. A temperature rise and an alarm following it would be unnoticeable. The paper [3] deals with getting values of temperature (of the instrument or environment to which the sensor is exposed to) by SMS for the user. Also, by creating a database in microcontroller, this setup can be modified to alert the user with an “ALERT SMS” when the temperature varies above some critical value.

AASSG presented in this paper is different as we are processing the data in the server with custom software. The response of our system when the temperature is greater than
critical value is far more advanced as we include the facility of placing a voice call which could prove to be a better alert mechanism.

A. Temperature as Threat

Recent studies made by a computer hardware and software manufacturing private corporation named AVTECH [4] has shown that of all the environmental conditions that can easily bring any IT facility to a complete stand still in minutes if problem arise and go unaddressed, the most crucial one is the temperature. The Environmental Threat Factors Pie Chart is shown in Fig.1.

![Environmental Threat Factors Pie Chart](image)

It is concluded from the study that if the cooling system fails, the temperature will rise from the industry standards of 68°F to above 85°F, in 8.6 minutes (approx). For every 18° rise in temperature above 68°F, servers lose about 50 percent of their reliability.

IV. MATERIALS AND METHODOLOGIES

The AASSG consists of the temperature sensor, PIC16F877A µC, PC and a GPRS modem. The system can be divided into parts namely, Sensor and Microcontroller module, Microcontroller and PC module, SMS and Voice Call Gateway.

A. Sensor and Microcontroller Module

1) Temperature Sensor

The LM335 series are precision, easily-calibrated, integrated circuit temperature sensors. They are two terminal devices like a zener and has a break down voltage directly proportional to the absolute temperature at +10mV/°K. The LM335 operates in the range of -40°C to +100°C.LM335Z can measure temperature ranging from -40°C to +100°C, which is the exact range necessary for AASSG. The analog output from LM335 is given to RA0 pin of PIC16F877A. The PIC Microcontroller monitors the voltages variations from LM335 and generates the digital output. We define a critical temperature value inside the PIC so that whenever the ADC converted value (the 10 bit value) exceeds this, an alert is generated to the caretaker by raising an alarm. Figures 3 and 4 show the circuit diagram.
using the Proteus which is used to simulate the temperature sensor and the PIC microcontroller module.

Fig 3. When the input voltage is 0.5V (any voltage below the cut-off, here 1V)

Fig 4. When the input voltage is 3V (any voltage above the cut-off, here 1V)

B. Microcontroller and PC Module

The 10 bit ADC converted data is sent to the PC via RC6 pin of PIC16F877A using USART module available in the PIC microcontroller. As shown in figure 5 the u-C output is given to the level shifter MAX232 and interfaced to the PC via RS232 cable. The level converted signal is now given to the computer using a RS232 cable.

C. SMS and Voice call Gateway

A GSM (Global System for Mobile Communication) modem is used to alert the caretakers when there is a temperature breach in the server room.
V. Server Guard Algorithm (SGA)

AASSG implements the algorithm called Server Guard Algorithm (SGA). The flow chart of SGA is shown in Fig 6. The custom software in place compares the temperature values from the sensor via u-C with a lower critical value. When the temperature exceeds lower critical value, an alarm signal is generated in the server room to alert the caretakers. If there is no response for a fixed amount of time or the temperature exceed the higher critical value, then an SMS is generated followed by a voice call to all the caretakers. The list of caretakers is already stored in the database of the server.

![Server Guard Algorithm (SGA) Flow Chart](image)

VI. Experimental Setup

The modem which we are using is GPRS/GSM modem. GSM/GPRS modem can be used to send messages and also make a call through computer. HyperTerminal can be used to control the modem.

For interfacing HyperTerminal with modem there are some steps which we should follow.

A. Setting up GSM modem

GSM/GPRS modem is connected to the computer using a RS-232 cable. It is connected to the serial port of the computer. The GSM modem will map itself as a COM serial port in the computer.

B. HyperTerminal Configuration

- On the Windows Start menu, select the Run dialog box and type hypertrm.exe.
- On the Connection Description screen, type a name and an icon is selected for the definition. The Connect To dialog box appears.
- The primary COM port is selected for the Connect.
- The COM Properties dialog box appears.
- On the COM Properties dialog box, the following selections are made.
  - Bits per sec: 115200
  - Data bits: 8
  - Parity: none
  - Stop bits: 1
  - Flow control: Hardware

C. Initial setup AT commands

To setup and check the status of the GSM modem, we use the following AT commands.

\[
\text{AT} \quad \text{Returns a "OK" for confirmation.}
\]

\[
\text{AT}+\text{CPIN}="\text{xxxx}\" \quad \text{To enter the PIN for the SIM}
\]

\[
\text{AT}+\text{CREG}\? \quad \text{A "0,1" reply confirms that modem is connected to GSM network}
\]

\[
\text{AT}+\text{CSQ} \quad \text{Indicates the signal strength, 31.99 is maximum.}
\]

D. Sending SMS using AT commands

\[
\text{AT}+\text{CMGF}=1 \quad \text{To format SMS as a TEXT message.}
\]

\[
\text{AT}+\text{CSCA}="+\text{xxxxx}\" \quad \text{Set the SMS center's number.}
\]

To send a SMS, the AT command to use is $\text{AT}+\text{CMGS}$. $\text{AT}+\text{CMGS}="+\text{yyyyy}" <\text{Enter}>$ The SMS text message here $<\text{Ctrl-Z}>\text{AT}$ The "+yyyyy" is the recipient's mobile number.

E. Making call using AT commands

- In the blank HyperTerminal window, type atz and then press Enter. The modem responds with OK. If the modem does not respond with OK, it is not configured properly in Windows.
- Type at+fclass=1 and then press Enter. The modem responds with OK. If the modem responds with Error, type at+fclass=2 and then press Enter. If the modem does not respond with OK, the modem does not support faxing.
- In the HyperTerminal window, type atdt<phone number> and then press Enter. You should hear modem pick up and dial the number.
- Close HyperTerminal.
Figure 9 shows the lab setup of the Amirta Autonomous Smart Server Guard.

VII. FUTURE WORK.

Today, there are sensors available in the market, which can sense almost all biological parameters of our body. This includes blood pressure, ocular pressure, ECG, fall detection etc. Our setup can be used in elderly care to detect these parameters and alert the doctors and relatives of the elders in critical cases.

CONCLUSION

The temperature monitoring system proposed here is one of the cheapest and also the most sophisticated system that can be used for this purpose. Cheapest in the sense that it only uses components which are easily available in the market, and sophisticated in the sense, that the proposed system not only uses GSM modem to send SMS, but also the modem will be instructed by the pc to make a voice call. It thus acts as a more efficient alert mechanism. Future research on the topic will focus on using the system in elderly care to detect biological parameters and alert the doctors and relatives of the elders in critical cases.

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