

Server Room Security and Maintenance

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Abstract— Server room is one of the crucial spaces that require high security protection and maintenance. All the important data and information of an organization is stored in server. 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, which are simple to use (user friendly), easy calibrations, small and light weight, inexpensive and effective. Also fire detection system for the protection of the server room and to test the functionality of the system is crucial. We propose to use a microcontroller to implement this system. The sensor senses the parameters such as temperature, fire, intruder detection etc. This parameter are then processed by the microcontroller and then stored in the system. Based on the input received by the flame sensor the microcontroller regulates the air ventilation mechanism. The significance of this system is to develop internal server room security using air ventilation system and a mechanism to suppress fire. Also aim to provide an effective alert and control mechanism when the temperature of the scenario goes beyond a critical value. If the parameters go 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, 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 GSM Module.

Key words: Server Room Maintenance, Server Room Security

I. INTRODUCTION

The proposed system is designed to avoid the following mishaps: Many a times server room faces rise in temperature which may lead to system shutdown. In case of unwanted fire there will be a loss of data and also loss of property. Also there may be a case of data theft due to intrusion which may have a adverse effect on the company.

The system consists of a microcontroller based system security. The aim of this system is to provide an effective alert mechanism when the temperature and humidity of the scenario goes beyond a critical value. If the parameters go 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, 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. The objectives of this system are to develop fire detection system as the protection to the server and to test the functionality of the system. The significant of this system is to develop internal server room security using air ventilation machine as a main function to release gas element in server room.

II. SYSTEM STRUCTURE

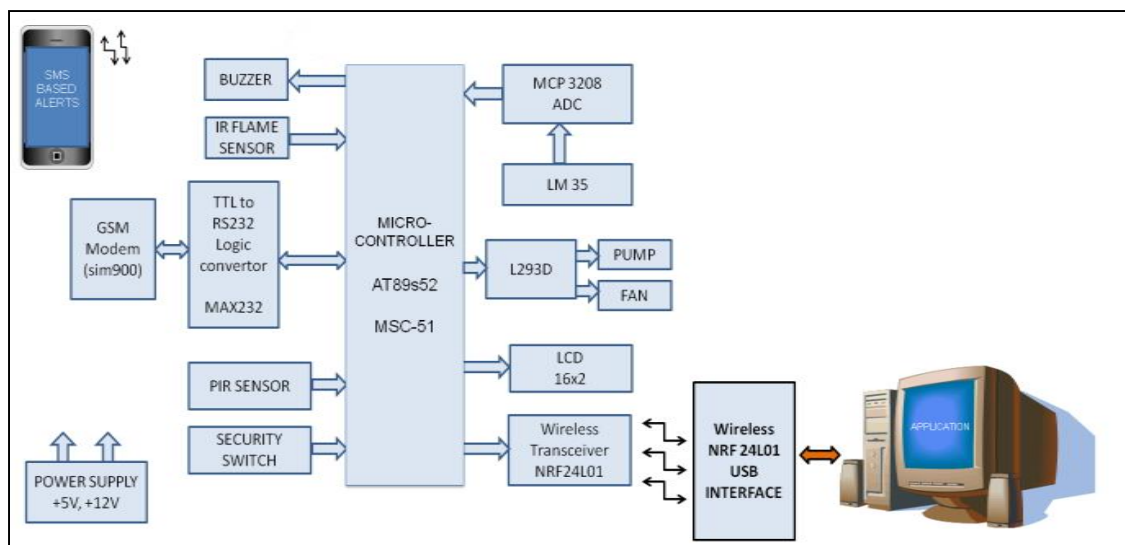


Fig. 1: Proposed Block Diagram

The system consists of three parts a) input capture b) processing c) output generation. The system detects the physical quantities and then it sends the parameters to the microcontroller which further process the data and the required output is generated.

Figure 1 shows the block diagram of the proposed system. The system is designed to ensure the server room security which is the main data acquisition centre. Designing of the System is carried out accounting all major possible threats affecting the server room.

Major threats are as follows:

- High temperature may lead to semi conductor malfunctioning.
- Fire break out
- Human presence in Restricted area

Proposed System is designed considering and covering all the major threats. System consists of Temperature sensor, flame sensor, motion sensor (PIR) which acts as the input to the given system.

LM 35 is a temperature sensor used which offers linearity, economical & easy availability. The analog o/p from the Temperature sensor is converted to digital using 12 bit A/D converter by microchip namely MCP 3208. High resolution ensures precision and accurate digital o/p with minimum approximation error.

PIR sensor gives digital o/p which is directly interfaced to the System, flame Sensor is designed using IR receiver. Fire emits a high amount of infrared light; flame sensor gives the digital o/p. LM 358 is a comparator used with IR Receiver to produce digital output.

AT89s52 is the micro controller used, which synchronizes all the logical and operations. Being an MCS-51 compatible (8051 family) with double memory and an extra timer suits the best for proposed application. I/O ports in all providing 32 I/O pins are used to interface all the sensor's and output devices.

DC motor (fan) is used for auto room temperature maintenance. L293D acts as an push-pull amplifier providing high voltage and current to drive the motor. CO2 generation is carried by mixing Ammonia & Baking powder by the controlled pump action, in case of fire breakout.

Buzzer is a 5v DC buzzer to indicate the danger in case of fire or intruder. PIR sensor detects motion and alerts the user or admin.

Sim900 a is a modem used to enable GSM connectivity with the proposed System, which sends SMS and dials a call in case of an emergency.

NR424L0I based wireless transceivers are used to monitor various parameters at a distinct and isolated place for analyzing. VB based application is created developed to display the data received wireless from the Server room on the PC for monitoring.

A. AT89S52

The pin diagram of AT89S52 is shown in figure 2.

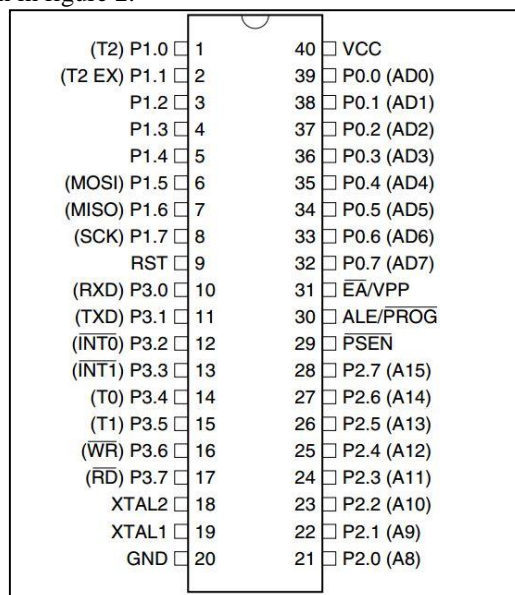


Fig. 2: AT89S52 Pin Descriptions

1) Features:

- Compatible with MCS®-51 Products.
- 8K Bytes of In-System Programmable (ISP) Flash Memory – Endurance: 10,000.
- 4.0V to 5.5V Operating Range.
- Fully Static Operation: 0 Hz to 33 MHz. 3-level Program Memory Lock. 256 x 8-bit Internal RAM.
- 32 Programmable I/O Lines.
- Three 16-bit Timer/Counters.
- Eight Interrupt Sources.

- Full Duplex UART Serial Channel. Low-power Idle and Power-down Modes.
- Interrupt Recovery from Power-down Mode.
- Watchdog Timer.
- Power-off Flag.
- Fast Programming Time.
- Flexible ISP Programming (Byte and Page Mode).
- Green (Pb/Halide-free) Packaging Option.

B. Flame Sensor

1) Module Features:

- The detection angle of 60 degrees or so, particularly sensitive to the flame spectrum.
- Sensitivity adjustable (shown in blue digital potentiometer adjustment).
- The comparator output signal clean, good waveform, driving ability, more than 15mA.
- With adjustable precision potentiometer sensitivity adjustment.
- The working voltage of 3.3V-5V.
- The output format: digital switching outputs (0 and 1).A fixed bolt holes for easy installation.
- Small plates PCB Size: 3.2cm x 1.4cm.
- Using a wide voltage LM393 comparator

2) Module for use:

The Infrared receiver module is shown in the figure 3.

- The flame sensor flame most sensitive to ordinary light is also a reaction, generally used as a flame alarm purposes.
- A small plate output interface can be directly connected to the microcontroller IO port
- With the flame sensor to maintain a certain distance, so as not to damage the sensor temperature, the flame of a lighter test distance 80cm, for the greater flame, the farther the distance test



Fig. 3: Infrared Receiver Module

C. Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Buzzer is shown in the figure 4. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.



Fig. 4: Buzzer

D. SIM900 GSM/GPRS Module

SIM900 GSM/GPRS Module is shown in figure 5. It is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.

1) Features

- "SIM900 is designed with a very powerful single-chip processor integrating AMR926EJ-S core".

- Quad - band GSM/GPRS module with a size of 24mmx24mmx3mm”.
- SMT type suit for customer application”.
- An embedded Powerful TCP/IP protocol stack”.
- Based upon mature and field-proven platform, backed up by our support service, from definition to design and production



Fig. 5: SIM900

E. MAX232

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The MAX232 IC is shown in the figure 6. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other. The intermediate link is provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R₁ & R₂) can accept $\pm 30V$ inputs. The drivers (T₁ & T₂), also called transmitters, convert the TTL/CMOS input level into RS232 level. The transmitters take input from controller’s serial transmission pin and send the output to RS232’s receiver. The receivers, on the other hand, take input from transmission pin of RS232 serial port and give serial output to microcontroller’s receiver pin. MAX232 needs four external capacitors whose value ranges from 1 μ F to 22 μ F.



Fig. 6: MAX232

F. L293D IC

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

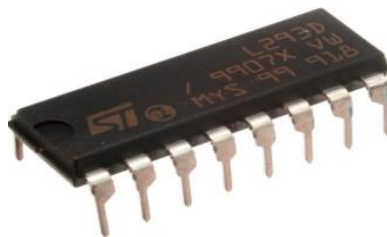


Fig. 7: L293D IC

G. Wireless Transceiver (NRF24L01)

The nRF24L01+ (nRF24L01p) are a single chip 2.4GHz transceiver with an embedded baseband protocol engine (Enhanced Shock Burst™), suitable for ultra low power wireless applications. The nRF24L01+ is designed for operation in the world wide ISM frequency band at 2.400 - 2.4835GHz. To design a radio system with the nRF24L01+, you simply need an MCU (microcontroller) and a few external passive components. The high air data rate combined with two powers saving modes make the nRF24L01+ very suitable for ultra low power designs. nRF24L01+ is drop-in compatible with nRF24L01 and on-air compatible with nRF2401A, nRF2402, nRF24E1 and nRF24E2. Intermodulation and wideband blocking values in nRF24L01+ are much improved in comparison to the nRF24L01 and the addition of internal filtering to nRF24L01+ has improved the margins for meeting RF regulatory standards.

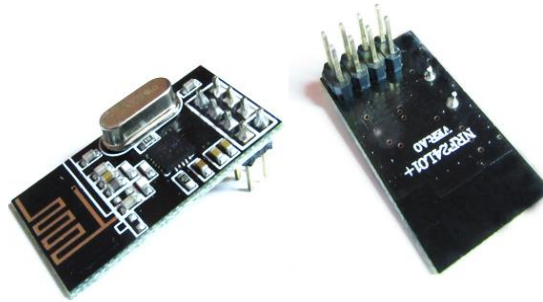


Fig. 8: nRF24L01 transceiver

H. Temperature Sensor (LM 35)

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With **LM35**, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every °C rise/fall in ambient temperature, *i.e.*, its scale factor is 0.01V/°C.



Fig. 3: 10 LM35 Sensor

I. MCP 3208

The Microchip Technology Inc. MCP3204/3208 devices are successive approximation 12-bit Analog to-Digital (A/D) Converters with on-board sample and hold circuitry. The MCP3204 is programmable to provide two pseudo-differential input pairs or four single ended inputs. The MCP3208 is programmable to provide four pseudo-differential input pairs or eight single ended inputs. Differential Nonlinearity (DNL) is specified at ± 1 LSB, while Integral Nonlinearity (INL) is offered in ± 1 LSB (MCP3204/3208-B) and ± 2 LSB (MCP3204/3208-C) versions.



Fig. 9: MCP 3208 ADC

J. USB Interface (NRF 24L01)

This module based on Nordic nRF24L01, highly integrated, ultra low power (ULP) 2Mbps RF transceiver for the 2.4GHz ISM (Industrial, Scientific and Medical) band. Nordic nRF24L01+ integrates a complete 2.4GHz RF transceiver, RF synthesizer, and baseband logic including the Enhanced Shock Burst™ hardware protocol accelerator supporting a high-speed SPI interface for the application controller.

1) Key Features

- Worldwide 2.4GHz ISM band operation.
- Up to 2Mbps on air data rate.
- Ultra low power operation.
- 11.3mA TX at 0dBm output power.
- 12.3mA RX at 2Mbps air data rate.
- 900nA in power down • 22µA in standby-I.
- On chip voltage regulator.1.9 to 3.6V supply range.
- Enhanced Shock Burst™.
- Automatic packet handling.
- Auto packet transaction handling.
- 6 data pipe MultiCeiver™.

- Air compatible with nRF2401A, 02, E1 and E2.
- Low cost BOM.
- ± 60 ppm 16MHz crystal.
- 5V tolerant inputs.

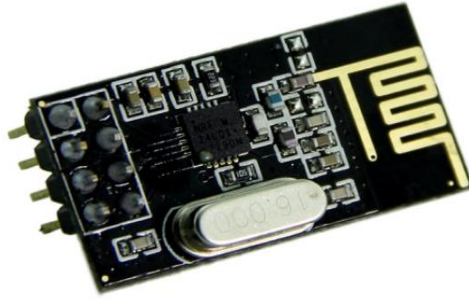


Fig. 10: nrf24l01 module

K. LCD Module (16x2)

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module as shown in the figure 11, is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix.

This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.



Fig. 11: LCD modules (16X2)

III. SOFTWARE USED

A. Keil MicroVision

Embedded system means some combination of computer hardware and programmable software which is specially designed for a particular task like displaying message on LCD. If you are still wondering about an embedded system, just take a look at these circuit applications using 8051 microcontroller. You can call these applications embedded systems as it involves hardware (8051 microcontroller) and software (the code written in assembly language).

Some real life examples of embedded systems may involve ticketing machines, vending machines, temperature controlling unit in air conditioners etc. Microcontrollers are nothing without a Program in it.

One of the important part in making an embedded system is loading the software/program we develop into the microcontroller. Usually it is called “burning software” into the controller. Before “burning a program” into a controller, we must do certain prerequisite operations with the program. This includes writing the program in assembly language or C language in a text editor like notepad, compiling the program in a compiler and finally generating the hex code from the compiled program. Earlier people used different softwares/applications for all these 3 tasks. Writing was done in a text editor like notepad/wordpad, compiling was done using a separate software (probably a dedicated compiler for a particular controller like 8051), converting the assembly code to hex code was done using another software etc. It takes lot of time and work to do all these separately, especially when the task involves lots of error debugging and reworking on the source code.

Keil MicroVision is a free software which solves many of the pain points for an embedded program developer. This software is an integrated development environment (IDE), which integrated a text editor to write programs, a compiler and it will convert your source code to hex files too.

Here is simple guide to start working with Keil uVision which can be used for

- Writing programs in C/C++ or Assembly language.
- Compiling and Assembling Programs.
- Debugging program.

- Creating Hex and Axf file.
- Testing your program without Available real Hardware (Simulator Mode).

B. Visual Studio

The Visual Studio 2010 IDE was redesigned which, according to Microsoft, clears the UI organization and "reduces clutter and complexity." The new IDE better supports multiple document windows and floating tool windows, while offering better multi-monitor support. The IDE shell has been rewritten using the Windows Presentation Foundation (WPF), whereas the internals have been redesigned using Managed Extensibility Framework (MEF) that offers more extensibility points than previous versions of the IDE that enabled add-ins to modify the behaviour of the IDE.

Visual Studio 2010 comes with .NET Framework 4 and supports developing applications targeting Windows 7. It supports IBM DB2 and Oracle databases, in addition to Microsoft SQL Server. It has integrated support for developing Microsoft Silver light applications, including an interactive designer. Visual Studio 2010 offers several tools to make parallel programming simpler: in addition to the Parallel Extensions for the .NET Framework and the Parallel Patterns Library for native code, Visual Studio 2010 includes tools for debugging parallel applications. The new tools allow the visualization of parallel Tasks and their runtime stacks. Tools for profiling parallel applications can be used for visualization of thread wait-times and thread migrations across processor cores. Intel and Microsoft have jointly pledged support for a new Concurrency Runtime in Visual Studio 2010 and Intel has launched parallelism support in Parallel Studio as an add-on for Visual Studio.

The Visual Studio 2010 code editor now highlights references; whenever a symbol is selected, all other usages of the symbol are highlighted. It also offers a Quick Search feature to incrementally search across all symbols in C++, C# and VB.NET systems. Quick Search supports substring matches and camel Case searches. The Call Hierarchy feature allows the developer to see all the methods that are called from a current method as well as the methods that call the current one. IntelliSense in Visual Studio supports a consume-first mode which developers can opt into. In this mode, IntelliSense does not auto-complete identifiers; this allows the developer to use undefined identifiers (like variable or method names) and define those later. Visual Studio 2010 can also help in this by automatically defining them, if it can infer their types from usage. Current versions of Visual Studio have a known bug which makes IntelliSense unusable for systems using pure C (not C++).

Visual Studio 2010 features a new Help System replacing the MSDN Library viewer. The Help System is no longer based on Microsoft Help 2 and does not use Microsoft Document Explorer. Dynamic help containing links to related help topics based on where the developer was in the IDE has been removed in the shipping product, but can be added back using a download from Microsoft.

IV. ADVANTAGES

- The system is easy to implement.
- The system is reliable.
- The offline Application to monitor Temperature continuously.
- The System has a self protection mechanism against fire activities.
- Also the system provides protection against intrusion.
- Most importantly, the system is economical unlike the current systems used in the market.

V. CONCLUSION

- The server room maintenance and security system proposed here is one of the economical and effective systems. The system uses components which are easily available in the market. The facility of making a call in addition to the SMS in alert system makes it more effective.
- As a whole, the system acts an efficient alert system which can be used in server rooms.
- The proposed system proves that the fire can be controlled from spreading by reducing the content of the oxygen in server room along with this the system is designed to provide security against an intruder and rise in temperature

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