



## Network Device Monitoring System with SMS Alert

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### Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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### ABSTRACT

It is a very vital issue for a network administrator to monitor all the devices or services. A system administrator always has to aware whether all the devices or services are running properly or not but it is too difficult to monitor when an administrator is out of his system. To solve this problem in this article, a network device monitoring system has been designed which quickly detect network errors and failure of different servers or services and alert the specific authorized person through short message service (SMS). Arduino Mega 2560 main board is used in this system. It's connected with others devices such as Ethernet shield, GSM module, LCD display and Alarm system buzzer. Ethernet shield automatically check all network server IP address by using ICMP (Internet control message protocol) of TCP/IP protocol suit. If any server is not work properly then the system is considered as offline. The LCD display will show message whether the servers are running properly or not. If any server is in offline or fail to provide service it will show on the LCD display and Alarm system buzzer will produce beef sound and SIM 808 in GSM module will communicate with Arduino Mega to send the SMS to the specific mobile number.

**Keywords:** ICMP protocol; Arduino Mega 2560 board; Ethernet shield; GSM module; Buzzer; LCD display; SMS; IT.

## 1. INTRODUCTION

Information technology is growing very fast. It is evolving in every sector in our daily life. The rapid growth of IT in the business sector, the owners are involving different types of information technology's (IT) applications in their business and the computer networking system is one of them. Computer networking needs many kinds of IT stuffs for 24 hours to monitor different servers or services. The computer networking system is playing very important role to grow the business by involving different types of IT devices, giving platform to share different devices, data, information and resources. Therefore, the use of computer networking is increasing day by day among the organizations.

When computers are connected in a group to form a network it needs to manage and control the tasks of the network which is simpler task if the administrator is in office. But, while administrator is far, it becomes very difficult to manage the network [1]. Till now there are many techniques for monitoring network from remote place [2]. Administrator can be connected with his cell phone and email accounts to serve the purpose. The communication between the clients and the remote administrator is achieved with help of a central monitoring server. Using cell phone administrator can monitor and control the network using SMS service and see what activities are being going on in office [3]. Network monitoring can be useful in various applications such as college, university, malls, and offices. Network monitoring at the university/college level can be used for monitoring, logging and retention of network packets that traverse university networks. Network monitoring at the office level can be used to monitor the office network by the administrator at any time if at a particular point he/she cannot be present there. He/she does not have to depend on any third party information regarding the network and can instead check the network status himself using his mobile. Network monitoring at the malls is used to monitor all information of malls by administrator at any time if at particular time he/she cannot be present there [1]. This network monitoring system is designed to alert network administrator through SMS in a particular mobile and producing alarm in the specific device.

## 2. NETWORK MONITORING OVERVIEW

Network monitoring is a computer network's systematic effort to detect slow or failing network

components, such as overloaded or crashed/ frozen servers, failing routers, failed switches or other problematic devices. In the event of a network failure or similar outage, the network monitoring system alerts the network administrator (NA) [4]. Network monitoring can be:

### 2.1 Active

Occurs when a piece of equipment does the monitoring, which also acts as part of the overall network, possibly routing or supporting the connection in some way.

### 2.2 Passive

Occurs when data is copied and the monitoring device is not an active part of the network.

## 3. PROPOSED NETWORK DEVICE MONITORING SYSTEM

The proposed system was to design and implement an Arduino and GSM based network monitoring system for quickly detecting network errors in our office, industry, shopping mall, school, college, university or working place, alerting the network administrator through SMS. The system was able to send a SMS to alert the network administrator. It can monitor all kinds of down or slow servers, like Mail server, DB server, Web server, IRC server, Telnet server, FTP server, Router, Attendance machine, IP Camera and other devices as shown in Fig. 1.

When the power supply was turned ON, the whole system started to work successfully. In this research the Ethernet shield WIZNET W5100 check with enlisted network devices or IP address by using ICMP (Internet control message protocol) of TCP/IP protocol suit. It will ping every IP address or devices for determining that all those IP address replying or not. When all devices or IP Address replying then LCD module shows a message "ALL IP ADDRESS IS NOW ONLINE" and a SMS notification send to specific mobile number. If any IP address is not reply it will considered as offline. Then it alerts the network administrator or authorized person via SMS notification to his mobile number.

The proposed system will specify the network environment. By developing a system with SMS alert mechanism to examine and monitor the health of the network environment, administrator may know if there is any problem and resolve the problem immediately.

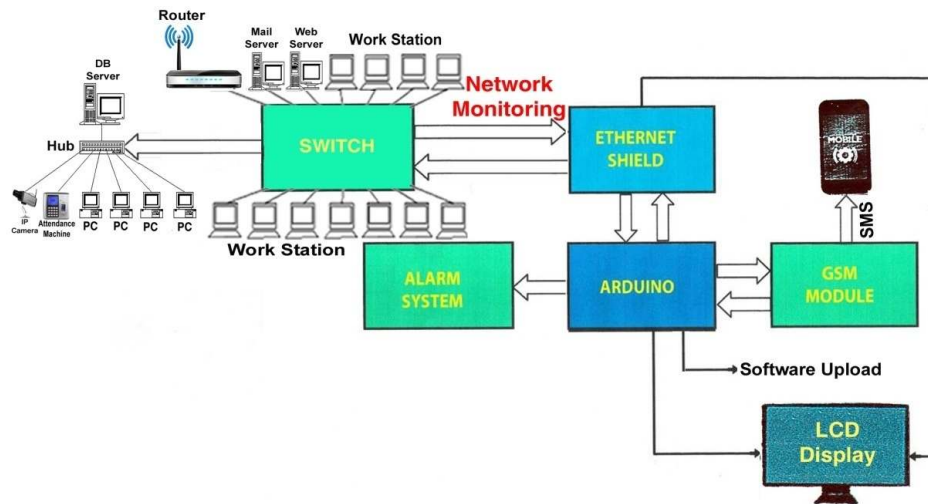


Fig. 1. Proposed system

#### 4. COMPARISON

At present, there are different types of network monitoring tools and techniques are available. Such as Android Based Network Monitor but it has limitation like the system does not support duplex communication between client and server [5]. Remote control and administration of Computer Network via SMS, GSM Based LAN monitoring system, Email Based LAN monitoring system, Mobile Phone based Remote Monitoring System, Nagios: network monitoring software, Manage Engine OpManager: network monitoring software, Microsoft Network Monitor/ Microsoft Message Analyzer: Its main feature is to analyze protocols and to have vision on network traffic [6], but each and every system has some limitations or drawbacks.

The proposed system compares with others network monitoring systems, the others maximum network monitoring systems are only software base. Cost is comparatively high; Installation, understanding and maintenance are not easy but in the proposed system, the software uploaded by boot loader, after running the software it run continuously by itself without helps of another computer. The mobile phone is not required to have any special applications or hardware devices to use this system, any mobile phone supporting the SMS service can be used.

#### 5. PROPOSED METHODOLOGY

This complete system requires Arduino Mega 2560 development board, Ethernet shield, GSM

module, LCD display, Power supply and other components for continuous network monitoring systems.

##### 5.1 The Arduino Mega 2560 Board

The Arduino Mega 2560 board is an open-source, less, extensible, electronics platform based microcontroller, easy-to-use hardware and software. The Arduino Mega 2560 was chosen for this system because of its abundance of digital inputs and outputs and its operating characteristics. It has 54 digital input/output pins, 4 universal asynchronous receiver/transmitter (UARTs), 16 analog inputs, 8 KB of SRAM, a 16 MHz crystal oscillator, 4 KB of EEPROM, 256 KB of flash memory, a USB connection, In Circuit Serial Programming (ICSP) header, a power jack and a reset button as shown in Fig. 2. It contains everything needed to support the microcontroller. "Simply connect it to a computer with an USB cable or power it with an AC-to-DC adapter or battery to get started [7]. In this research, Arduino is a main board. Arduino's connected with others devices.

##### 5.2 The Arduino GSM Shield/Module

The Arduino GSM shield allows an Arduino board to connect to the internet, make/receive voice calls and send/receive SMS [8]. The shield uses a radio modem M10 by Quectel (datasheet). It is possible to communicate with the board using AT commands. GSM AT command has set three control models for sending and receiving short message. Block

mode, Text mode and PDU (protocol data unit) mode. The code of Text mode is easy in sending and receiving short message The GSM library has a large number of methods for communication with the shield. The shield uses digital pins 2 and 3 for software serial communication with the M10, shown in Fig. 3. The M10 is a Quad-band GSM/GPRS modem that works at frequencies GSM850MHz, GSM900MHz, DCS800MHz and PCS1900MHz. It supports TCP/UDP and HTTP protocols through a GPRS connection. As always with Arduino, every element of the platform-hardware, software and documentation is freely available and open-source.

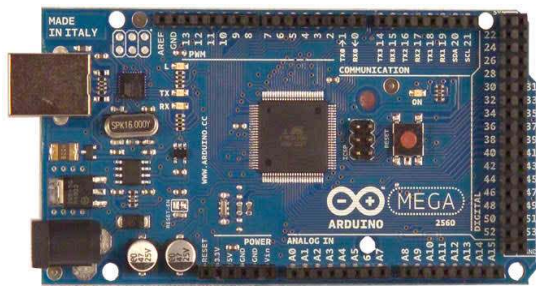


Fig. 2. Arduino Mega 2560



Fig. 3. Ethernet shield

### 5.3 GSM Module

GMS Module consists of Wireless CPU, SIM cardholder and power LED as shown in Fig. 4. It helps to transmit and receive the SMS with Arduino. A GSM module assembles a GSM modem with standard communication interfaces like RS-232 (Serial Port), USB etc., so that it can be easily interface with a computer or a microprocessor/ microcontroller based system. The power supply circuit is also built into the module and can be activated using a suitable adaptor. Like A GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. The GSM/GPRS module is designed to enable communication

between the microcontroller and GMS network. The GSM/GPRS modem can perform the following operation:



Fig. 4. GSM module

- Receive, send or delete SMS message in a SIM.
- Read, add, search phonebook entries of the SIM.
- Make, Receive, or reject a voice call [9].

It is recommended that the board be powered with an external power supply that can provide between 700 ma and 100 ma. Powering an Arduino and the GSM shield from a USB connection is not recommended, as USB cannot provide the required current for when the modem is in heavy use. The modem can pull up to 2A of current at peak usage, which can occur during data transmission.

### 5.4 LCD Display

Liquid crystal display (LCD) modules that display characters such as text and numbers are the most cheapest and simplest to use of all LCDs. Any LCD with an HD44780- or KS0066-compatible interface is compatible with Arduino. A 20x4 LCD display is very basic electronic module and is very commonly used in various devices and circuits [10]. A 20x4 LCD means it can display 20 characters per line and there are 24 such lines, shown in Fig. 5.

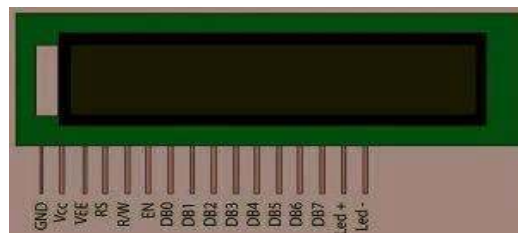


Fig. 5. LCD display

### 5.5 Alarm System Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric and finds extensive use in electronics circuits and designs especially to trigger an alarm or as a system alert device, shown in Fig. 6. The buzzer is simply powered with a regulated 5v [11]. Buzzer connected with Arduino board.



Fig. 6. Alarm system buzzer

## 6. EXPERIMENTAL SETUP WITH DESCRIPTION

This system consists of devices including Arduino Mega 2560 board, Ethernet shield, a 20x4 LCD display, alarm system and SIM 808 in GSM module with power supply. The block diagram shows in Fig. 7.

Arduino Mega 2560 is a main board. It's connected with other devices such as Ethernet shield, GSM module, LCD display and alarm system buzzer. Arduino communicates with Ethernet shield WIZNET W5100 by SPI (Serial peripherals interface) communication. Ethernet shield has two standard Rj- 45 connection ports which are connected with an Arduino and another port is connected with network device (such as Hub, Switch, and Router etc). It's connected with different servers or services such

as Mail server, DB server, Web server, IRC server, Telnet server, FTP server, router, Attendance machine, IP camera and other devices. LCD module is connected with arduino mega as a display module. We use SIM 808 for GSM module. It's consists a GSM antenna, SIM socket, SIM 808 GSM module, a power switch and a serial communication port to communicate with Arduino mega. It also consist a network and a status monitoring LED. Ethernet shield checks the all servers which are connected with network device and display the message on the LCD Display. If the Ethernet shield finds any server is offline then Ethernet shield send signal to Arduino Board after that alarm system produce a sound. Simultaneously Arduino board send signal to GSM module and GSM Module send message to the specific mobile phone and finally LCD display shows the status of the system continuously.

## 7. RESULTS AND DISCUSSION

The system assembled in laboratory. Test carried out and found it was working properly.

### 7.1 Results

When the GSM Module initialized it will check the ping list as desire.

When all IP were activated this message will shown on the LCD and one SMS will sent to the specific mobile number.

This system continuously will check all IP address if one of them is on offline then bellow message will show on the LCD and the buzzer will produce alarm. Finally, it will send a SMS to the specific mobile number as Fig. 12 Shows the message.

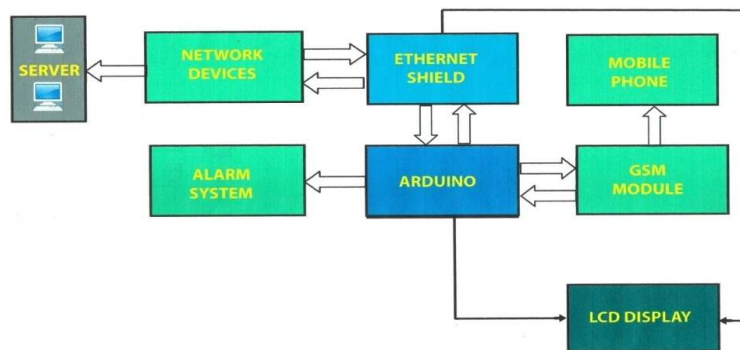


Fig. 7. Block diagram



Fig. 8. LCD displayed checking device IP address

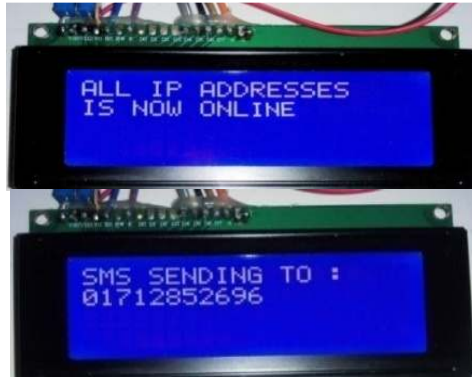


Fig. 9. SMS send to mobile

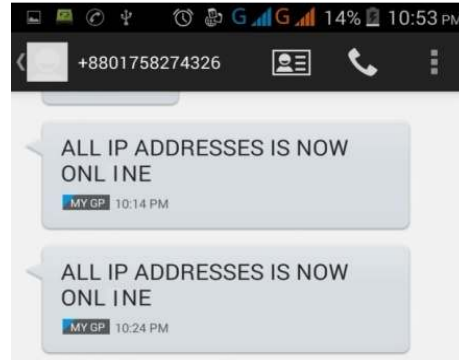


Fig. 10. Snapshot of SMS



Fig. 11. LCD displayed devices are offline and sending SMS



Fig. 12. Snapshot of SMS

## 8. ADVANTAGES

- 1) Convenience: SMS technology is very popular techniques and easy to use. This technology is easily accessible when needed.

- 2) Scalability: We can add any number of mobile numbers to the system as per our requirements to send the SMS.
- 3) Availability: - It is available anytime from anywhere.
- 4) Reliability:-We can get instant message from the system required to administrator remotely. It fails only when Mobile operator connection fails.
- 5) Transparency: Meet the Administrator's requirements and satisfaction. Our System is easily understandable to system administrator.

## 9. FUTURE SCOPE

After the completion of this project some challenges have been faced it is recommended that:

- Can be added keypad to entry IP address and mobile number.
- Can be added non IP based device for monitoring.

## 10. CONCLUSION

The main task of this research was to design and implement an intelligent network monitoring system for detecting network devices failure in a shortest time in our home, industries or work place and alerting the owner through SMS. For this reason, the system administrator can be worried free when he/she out of his work place or office. One of the most important point is that the administrator can use this system to monitor from anywhere in the world. The system can be installed at any place and can be monitored by any mobile phone which support the SMS service.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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