

Design and Implementation of a Smart Security System Using GSM Technologies Via Short Message Service(SMS) and Calling Function

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Abstract— This paper proposes the development of a GSM – based smart security system. It is a combination of electronic devices /equipment working together to detect a fire and any human moment. GSM SIM-300, Microcontroller, Sensors have been used to realize this system. This is a cost effective system that detects fire or smoke or human presence and sends alert information to a registered mobile phone for quick and immediate action thereby, avoiding unnecessary and costly industrial and domestic breakdown. A Short Message Service (SMS) and a Calling function is used as a method of wireless connection in the designed system.

Keywords— GSM SIM-300, Microcontroller, cost effective, SMS, Calling function, wireless connection.

I. INTRODUCTION

What is a security system? Security is the degree of protection against damages, danger, loss and crime. A security system provides a form of protection that ensures the safety and security of the assets and the threat but is not limited to the elimination of either the asset or the threat. Now a day's wireless technology is used instead of wired topological connection. GSM (Global System for Mobile Communication) technology makes used to communicate input signal from appliances to output message on device. That means after detection of any intrusion GSM Modem sends the appropriate message to registered phone. The signals or data which is comes from sensors or other equipment digitize it by GSM module and send it to receiver. The wireless communication is increasing day by day [2]. This has motivated us to use mobile phones to identify the problem and to receive a feedback SMS about the security and safety. The system operates with the help of sensors installed in this system.

Existing systems

1. Wired System,
2. RF Based Security System,
3. Web enabled Security System.

Disadvantage of Existing Systems

1. Difficult to maintain
2. Need internet access
3. Distance.

Proposed System

The proposed system uses GSM module which enables us to know the security status when we are away.

II. ARCHITECTURE OF THE SYSTEM

It can be implemented to any levels of the security system. The architecture of the system mainly consists of three components the GSM MODEM and the interface circuit that include the different sensors used. The function of the GSM MODEM is the remote communication between the user and the controller through the RS232 serial communication standard. The function of the controller is to continuously check the inputs coming from the different sensor and send message through the GSM network in case of emergency. The microcontroller is connected to different devices like smoke detector, stepper motor, PIR motion detector sensor. The GSM is connected with the user, police station, and fire brigade

through the mobile cellular network [1], [3]. An interface circuit has been designed which includes sensors as input devices. Then the programmed microcontroller has been connected to the interface circuit and the GSM MODEM through the serial port of the GSM MODEM.

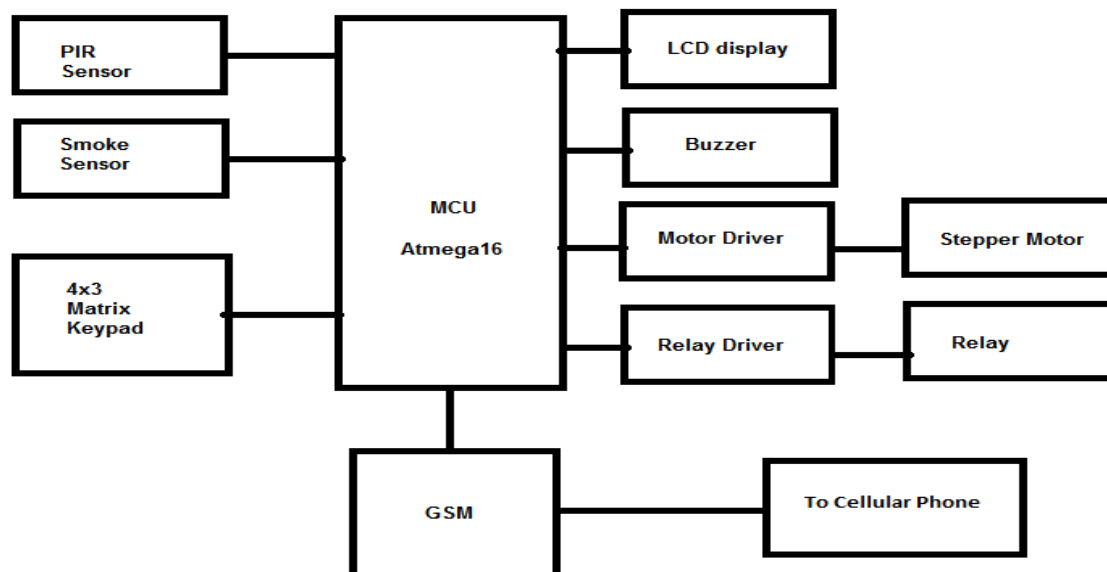


FIG 1: BLOCK DIAGRAM OF CIRCUIT

2.1 Sensing Devices

2.1.1 PIR Sensor

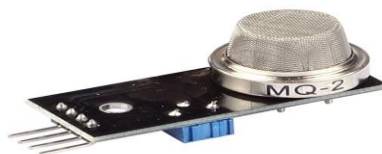
A Pyroelectric Infrared Sensor (PIR sensor) is an electronic sensor, in that type of sensor measures the infrared (IR) light radiating from objects or human in its field of view. The normal sensor emits the radiation but in this sensor detect the radiation. The PIR Sensor has a range of approximately 20 feet (6 meters). The sensor is designed to identify the slowly changing conditions that would happen normally as the daily progresses and the environmental condition changes, but it responds by making its output when sudden changes occur, such as when there is motion. This device is designed mainly for indoor use. Operation outside or in very high temperatures may affect stability negatively [1]. Due to the high sensitivity of PIR sensor device, it is not recommended to use the same condition like rapid environmental changes and strong shock or vibration and also not working in direct sun light or direct wind from a heater or air condition.



FIG 2: PIR SENSOR

2.1.2 Gas and Smoke Sensor:

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

**FIG 3: GAS SENSOR**

2.2 GSM Modem:

GSM (Global System for Mobile Communication) is a wireless network system that uses a mobile operator and functions just like a mobile phone. The GSM modem has a SIM card slot, thus giving the modem a mobile number of its own and enabling it to activate communication over the network. The user can send or receive an SMS as well as make or receive voice calls over the modem interface. The GSM modem may be connected to a computer directly through the serial port or to a microcontroller using RS232. Thus the modem can be used to develop embedded applications. There are a set of AT commands that are used to establish communication between the microcontroller and the GSM modem. The GSM modem used in this security system uses SIM300 module. It has a power and network LED making it convenient to debug. There is also a wire antenna on the modem to provide better reception. SIM300 has an adjustable baud rate of 1200-115200bps. However, in this system it is set to 9600bps [3]. The GSM modem consumes only 0.25A during normal operation and about 1A during transmission.

**FIG 4: GSM MODEM USING SIM300 MODULE**

TABLE 1
AT COMMANDS

AT Command	Meaning
AT+CMGS	Send message
AT+CMSS	Send message from storage
AT+CMGF=1	To set in text format
AT+CMGD	Delete message
ATD	Dial command
ATH	Hold command

2.3 ATMEGA16 Microcontroller:

ATmega16 is an 8-bit microcontroller which delivers high performance at a low power consumption rate. It has an advanced RISC (Reduced Instruction Set Computing) architecture. The maximum frequency of operation is 16MHz at 4.5V. It has 16KB of in-system self-programmable flash program memory, 1KB of internal static RAM and 512 bytes of internal EEPROM. The microcontroller is a 40 pin IC out of which 32 pins are programmable I/O ports. These ports are divided into four groups of 8 pins each called PORTA, PORTB, PORTC and PORTD [2], [5]. The IC and its pin configuration are shown in Figure.

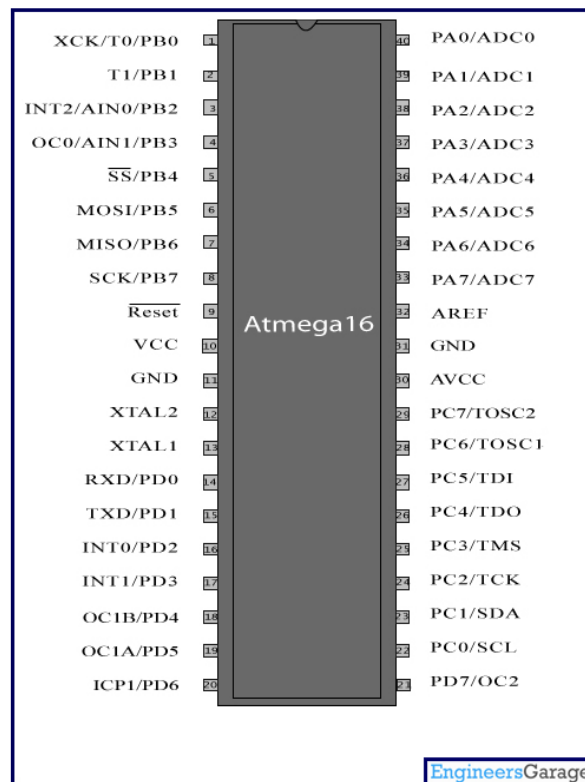


FIG 5: PIN CONFIGURATION OF ATmega16

2.4 Relay Driver Circuit:

Relays are components which allow a low-power circuit to switch a relatively high current on and off, or to control signals that must be electrically isolated from the controlling circuit itself. Newcomers to electronics sometimes want to use a relay for this type of application, but are unsure about the details of doing so. To make a relay operate, you have to pass a suitable 'pull-in' and 'holding' current (DC) through its energizing coil [5]. And generally relay coils are designed to operate from a particular supply voltage often 12V or 5V.



FIG. 6: RELAY

2.5 LCD Display

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 and 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. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. The data register stores the data to be displayed on the LCD [4].

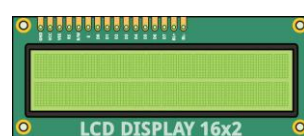


FIG. 7: LCD DISPLAY

2.6 Working Control and Interface Circuit

Nowadays, microcontrollers are so cheap and easily available that it is common to use them instead of simple logic circuits like counters for the sole purpose of gaining some design flexibility and saving some space. Some machines and robots will even rely on a multitude of microcontrollers, each one dedicated to a certain task. each one dedicated to a certain task [5]. Most recent microcontrollers are “In System Programmable”, meaning that you can modify the program being executed, without removing the microcontroller from its place.

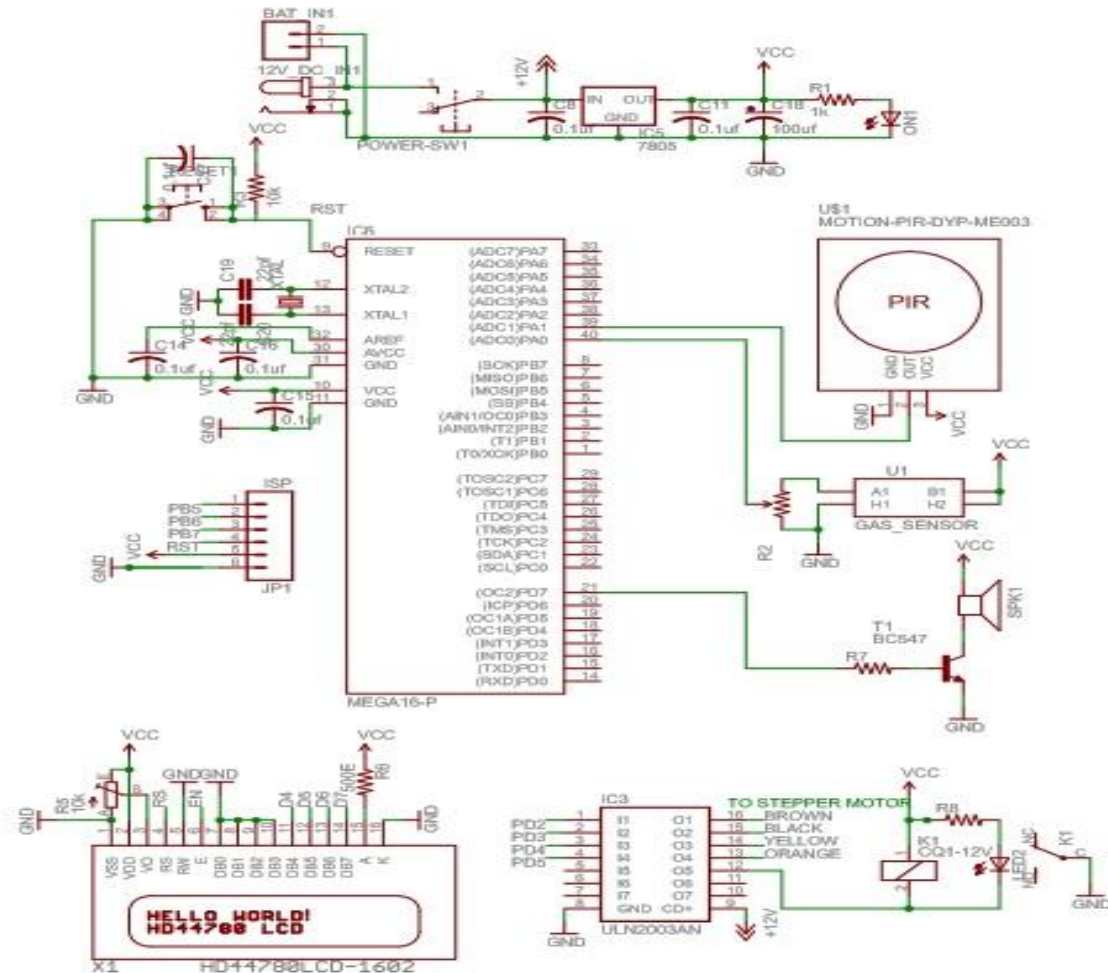


FIG. 8: SCHEMATIC OF THE CIRCUIT

2.7 Working of The System:

The system is fully controlled by the microcontroller and the microcontroller will continuously monitor the sensors, detector and GSM modem. If the voltage level of sensor input pins goes to one (1) then it will send the “AT + CMGS =USER MOBILE NUMBER” to GSM modem through serial port. The GSM modems will response with the character “>”. After receiving “>” character microcontroller again send the type of security problem SMS + CTRL Z to GSM Modem. GSM modem will send the type of problem to user [4], [6]. For example any moment detected in security area at the time microcontroller pin number 39 goes to logical one (1). Microcontroller sensed the change and immediately send AT + CMGS = “+8888888888” to GSM modem, GSM modem give “>” character to microcontroller. After receiving “>” Character microcontroller again sends the “MOMENT DETECTED” SMS to GSM Modem. GSM modem sends the SMS to user. After the SMS has been sent a call is being initiated. “ATD USER MOBILE NUMBER” this command can be used to request a call to a registered number. A maximum of five inputs are given on a temporary basis and more number of inputs can be given as per the requirement [6].

III. RESULTS

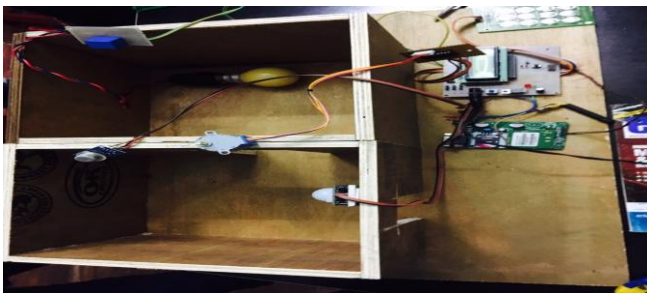


FIG. 9: WORKING MODEL

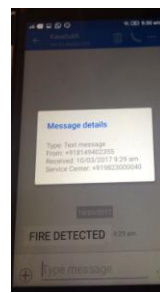


FIG. 10: SMS FEATURE

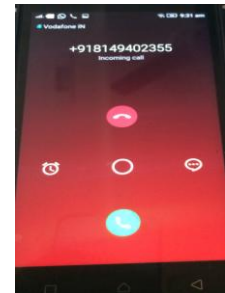


FIG. 11: CALL FEATURE

IV. CONCLUSION

In this project, a low cost, user-friendly, simple, secure and universally acceptable solution for security has been introduced. This approach has achieved the target to control the device remotely using an GSM-based system satisfying user needs and requirements. The system is cost-effective as compared to the previously existing systems in the market and can be easily implemented with high reliability and security. The basic level of security control and remote monitoring has been implemented. The system is extendible and more levels can be further developed. Hence, we can conclude that the required goals and objectives have been achieved.

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