Multilevel Home Security System using Arduino & GSM

Viswanatha V.
Assistant Professor
Department of Electronics & Communication Engineering
Acharya Institute of Technology, Bangalore, India

Venkata Siva Reddy R.
Professor
Department of Electronics & Communication Engineering
REVA University, Bangalore, India

Ashwini Kumari P.
Assistant Professor
Department of Electrical & Electronics Engineering
REVA University, Bangalore, India

Abstract

This paper presents sensor based multilevel security system. It offers three levels of security using PIR sensor, temperature sensor, password based digital lock. It is basically wireless sensor network using Arduino Mega 2560 and GSM .This wireless sensor network is made up of sub systems like PIR sensors, fire alarm module which is made by temperature sensor, digital lock system and burglar alarm module into a single automated architecture for the purpose of practical implementation in smart home system. When sensors get signals or obtained signals crosses reference value, Arduino controller sends an information to the user having mobile through the GSM (Global System for Mobile Communication) module over a wireless communication .All the modules work parallel and independently by sharing computational resource i.e. microcontroller together. Hence a low cost, accessible, auto-configurable, secure and remotely controlled solution has been developed for smart home security system.
Keywords: Arduino MEGA, GSM, LCD, LM35 Sensor, PIR Sensor

_____

I. INTRODUCTION

Arduino is an open source platform which consists of both software and hardware. Hardware is a programmable circuit board i.e. Microcontroller and its software is integrated development environment tool which runs on computer and it is used to write and upload the code to the Arduino board. It is widely being used in most of the electrical and electronics applications because Arduino does not need a separate piece of hardware ie. Programmer for uploading code to the physical board whereas most previous microcontrollers needs separate programmer to load code onto the physical board. In addition to that Arduino IDE uses a simplified version of C++ that makes easy to learn the program [1], [3]. Finally Arduino gives a standard form factor which shares the usage of microcontroller into a more accessible package. The microcontroller board, Arduino Mega 2560 is based on the ATMega2560 and it is as shown in fig.1.On the board, there are 54 digital input or output pins, out of which 15 pins can be used as PWM pins and 16 analog input pins, 4 UARTs which are hardware serial ports, a 16MHz crystal oscillator for the process of internal operation, a USB connection, a power jack, an ICSP header and reset button [1]. This board supports everything that the microcontroller needs for the implementation of applications for more simplicity. The board can be powered up with USB port connected to computer or with AC-DC adaptor or external battery. Updating of Arduino Mega is Mega2560 and its special feature is, the power given via USB connection or with an external power supply can be selected automatically if both the power sources available [1].

Non-USB power ie.external power can come either from an AC to DC adaptor or battery. +ve terminal and −ve terminals of the battery is connected to Vin and Gnd pin headers of power connector respectively. Max 6 to 12 volts external DC supply can be given to the board. If the board is supplied with less than 7 volts then the board may supply less than 5 volts on input/output pins and the board may be unstable. If more than 12 volts is supplied to the board, voltage regulator may get over heated and damage the board [2]. Therefore the recommended range is 7 to a12 volts to the Arduino board.
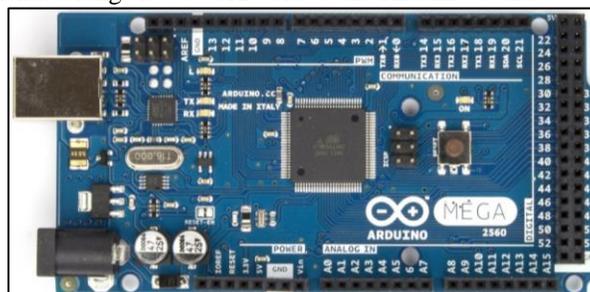

Fig. 1: Arduino Mega 2560

A. Security System

Wireless security is the prevention of unauthorized access or damage using wireless networks as a systematic solution for home security. Wireless technologies like Bluetooth. Infrared, Wi-Fi and GSM are available to access the system for security and automation [3], [6]. Now days everybody wants to take care to prevent intrusion because crime is increasing day by day. The proposed system characteristics involve remote control of appliances, system security and intrusion control using GSM based wireless technology.

B. Block Diagram

The block diagram of the security system is as shown in fig.2 and it consists mainly of the blocks as follows,
−   Source
−   Sensing block
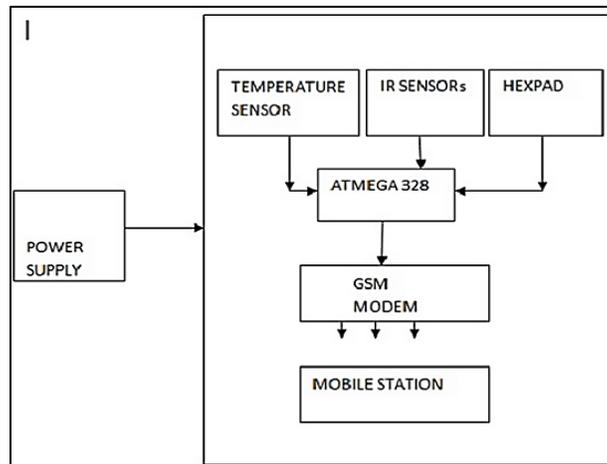−   Decision making block
−   Alert system

Fig. 2: Block Diagram of Security System

−   Source
Power to the Arduino microcontroller is supplied through a 12 V, 1 ampere adapter.
−   Sensing Circuit
Temperature sensor: LM35 is employed to monitor ambient temperature conditions in the premises. The LM35 is better compare to linear temperature sensor which is standardized in Kelvin, since a large constant voltage is subtracted from the output to get convenient centigrade scaling which is done by device itself [4],[6]. No user is required to do this. The LM35 is easily interfaced to readout or control circuitry because of its special characteristics of low-output impedance, linear output and precise inherent calibration.
−   Keypad
In matrix keypads, four columns and four rows combination is use to determine the state of the button to the microcontroller or any other host device. Pushbutton is used in each key, one end is connected to one row and the other end is connected to one column [4]. Based on the state of columns, microcontroller can understand which button is pressed.
−   Decision Making Block
Here, Arduino mega microcontroller board is used which decides the appropriate action to be taken as and when required. The Arduino Mega can be powered via the USB connection or with an external power supply.
   The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter or battery [5]. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.
−   Alert System
In the hardware Implementation, alert system consists of buzzer which produces audio signal and this device can be mechanical, piezoelectric or electromechanical system [3]. Typically it is used in alarm, timers and confirmation of user inputs such as mouse click or keystroke
−   GSM Module
Extension of GPRS is GSM that supports higher data transmission rate .Basically GSM module is used to setup a communication between the host and GSM module. In this implementation, host is mobile device and any data comes from microcontroller is sent to user through the GSM module over wireless communication [3].
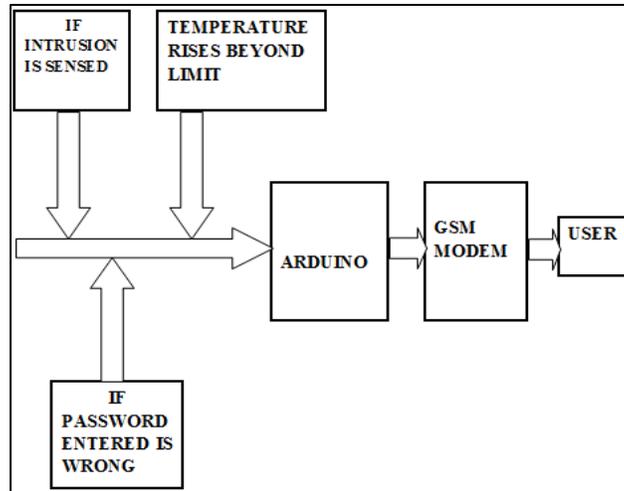
II. WORKING PRINCIPLE

Fig. 3: Block Diagram Depicting the Working of Security System

Three level home security systems are depicted in terms of blocks as shown in fig.3 and is explained as follows.

1) Connect a 12V, 1A adapter to GSM module after inserting the SIM card and then wait for the network initialization.
2) Connect USB cable to Mega 2560 with laptop or connect one more adapter to Mega 2560 DC pin to supply the power.
3) As soon as we press the password set push button, the LCD will start to display.
4) When display shows "SET 5 digit password", enter 5 digit password which will be shown on the LCD display. Set the password and lock it.
5) Enter the correct password then press "A" to unlock. Only if the password is correct, motor will rotate and door will open.
6) Two PIR sensors are used for two separate rooms and one PIR sensor is located in each room.
7) If any intrusion is sensed in any room then the buzzer attached to the PIR sensor starts alarm and simultaneously the camera motor will also rotate to track the motion so that the viewer can see the live recording.
8) PIR sensors can be tested by creating an obstruction in front of any PIR sensor, the buzzer will beep and camera motor will rotate.
9) Then, check with wrong password. If password is incorrect, then the motor controlling door will not rotate and simultaneously the message is sent to the owner and also when someone try to change the password, the message will be sent to the owner.
10) After the user enters the premises by entering the correct pass key and needs to reactivate the system while leaving, "B" key is to be pressed.
11) If the owner wants to change the password then enter the present correct password and press "C" key. Enter the new password to set the new password.
12) The temperature sensor, LM3 senses the temperature when it exceeds the set ambient temperature of the premises. A message "temperature is not normal in the room", is sent by the GSM module alerting the owner of the same.

Table – 1
The Entire Methodology is summarized in Table 1

If, Password is incorrect Temperature rises beyond limit Intrusion is detected Then,	*These outputs will be fed into the Arduino*	*Arduino with the help of GSM module and a SIM card will send a message accordingly*	*The owner of the registered number will receive the message*

III. SOFTWARE & PROGRAM

A. Software

The Arduino Mega2560 is capable of communicating with other Arduino, computer or other microcontrollers. The ATmega2560 affords hardware UARTs of numbers four for serial communication (TTL)[1].On board ATmega8U2 channels, one of them over USB offers virtual communication port to software on the computer (OS window needs a .in file, but OSX and Linux OS recognize the board as a COM port robotically) [1],[2]. The Arduino tool has a serial monitor which allows simple data to be sent to and from the Arduino board. The RX and TX LEDs on the Arduino board get flash when data is being transmitted via the ATmega8U2 chip and USB connection to the computer (but not on pins 0 and 1 for serial communication) [2],[3]. A serial library permits for serial communication on any of the Mega's digital pins.

B. Program

Logic of the program used for the implementation of hardware using Arduino controller is depicted in terms of flowchart shown in fig.4
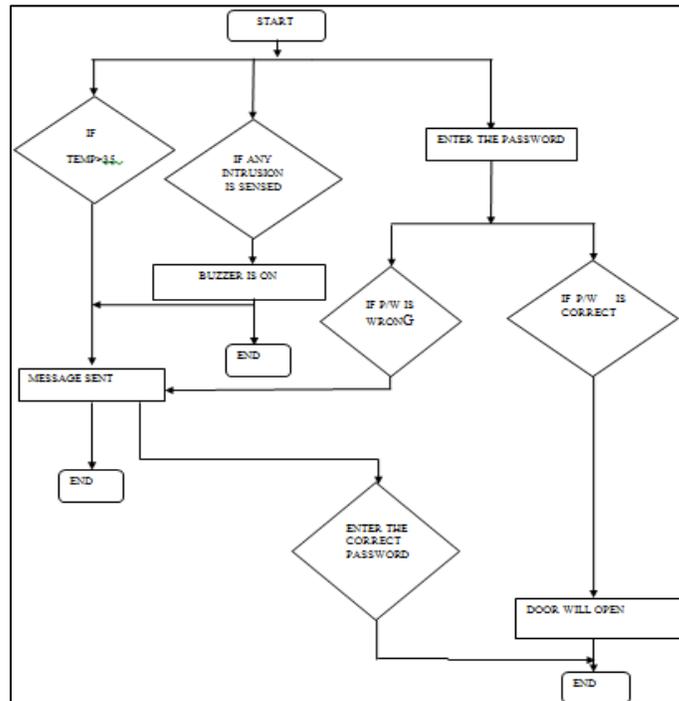

Fig. 4: Flowchart of Three Levels of Home Security System

IV. HARDWARE IMPLEMENTATION

1) Arduino Mega 2560
2) Temperature sensors
3) H bridge motor driver circuit
4) Passive Infrared Sensor
5) Global system for mobile communication
6) Keypad
7) Liquid Crystal Display

A. Hardware

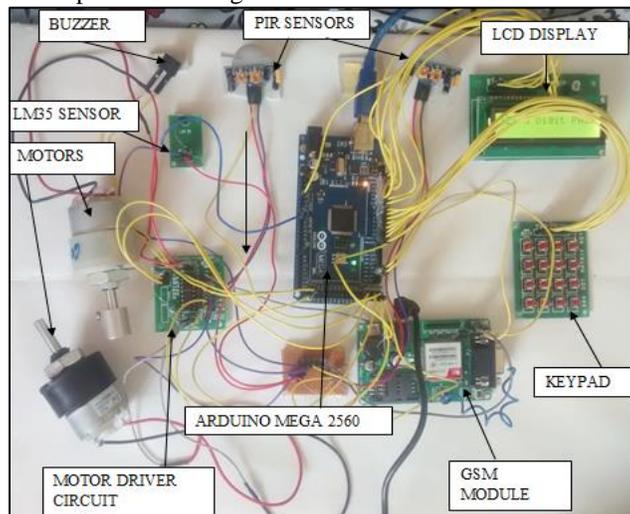Complete hardware implementation is depicted in the fig.5

Fig. 5: Complete Hardware of Arduino Based Security System

V.   RESULTS

A.   Case 1. When PIR Sensor Detects Intrusion, the Message given in fig.6 Sent to the Owner
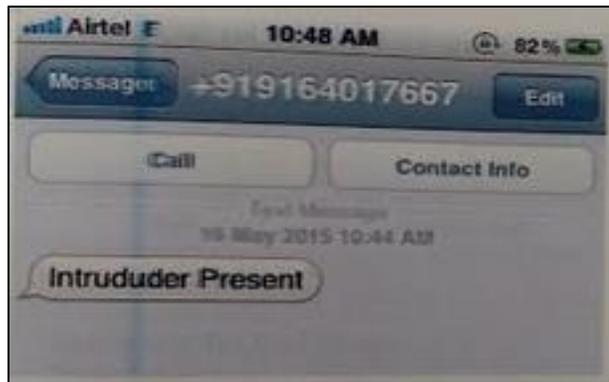

Fig. 6: Message Received by the Owner

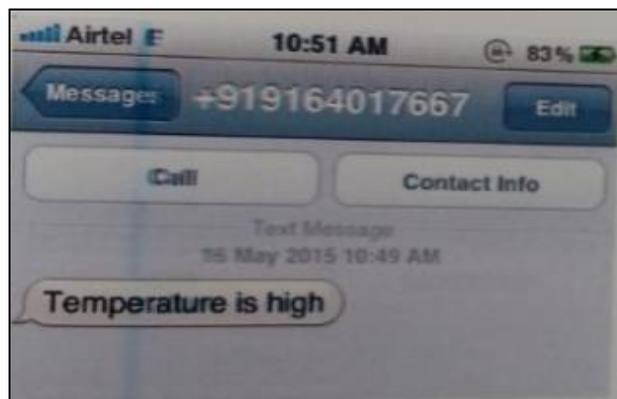*B.   Case .2 when Temperature Exceeds Ambient Limits, the Message given in fig.7 Sent to the Owner*

Fig. 7: Message Received by the Owner

C.   Case. 3 When Change in Password is detected, the Message given in fig.8 sent to the Owner
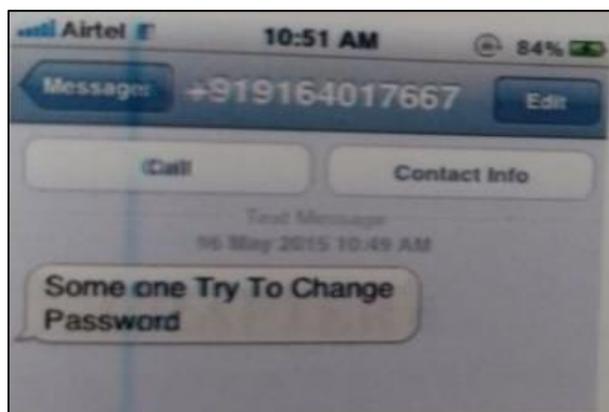

Fig.8 Message Received by the Owner

D.   Case .4 When Correct Password is Entered, the Message Given in fig.9 Sent to the Owner

Fig. 9: Message Received by the Owner

VI. CONCLUSION

Home Security is a main concern worldwide. Since the technology is getting advanced, various home based security systems are developed and implemented to protect our homes from illegal invasion. In this paper, multilevel home security (MHSS) which has been designed and developed consists of motion sensor, temperature sensor, GSM module, LCD display and an alarm circuit. Alarm system is to alert the house owner and neighbors and also sends alert messages to the house owner.

  Hence to conclude the basic three levels of home security system, the use of Arduino Mega microcontroller lets us control many subsystems and at the same time letting the use of single system. The system can be further developed using automatic gas breaking detector/motion detector so the solution can be integrated with these and other security systems. In addition this system will be self-contained power supply system and not prone to electric failure.

REFERENCES

[1] Deepali Javale,Assistant Professor,Dept. of Computer Engg ,MAEER's MITCOE Pune, India ;Mohd. Mohsin Student ,Dept. of Computer Engg,MAEER's MITCOE ,Pune, India ;Shreerang Nandanwar ,Student ,Dept. of Computer Engg ;MAEER's MITCOE ,Pune, India ;Mayur Shingate Student ,Dept. of Computer Engg ;MAEER's MITCOE ,Pune, India. (2013, March). Home Automation and Security System Using Android ADK. International Journal of Electronics Communication and Computer Technology (IJECCT). [Online]. 3(2). Available:
[2] http://www.academia.edu/14501543/Home_Automation_and_Security_System_Using_Android_ADK.
[3] Dinesh Suresh Bhadane Department of E&TC Sandip Polytechnic, Nashik, Maharashtra, India ;Monali D. Wani, Department of E&TC Sandip Polytechnic, Nashik,Maharashtra,India ;Sanjeev. A. Shukla, Department of E&TC SITRC, Nashik, Maharashtra, India.(2015, February). A Review on Home Control Automation Using GSM and Bluetooth. International Journal of Advanced Research in Computer Science and Software Engineering.[Online].5(2).Availablr: https://www.scribd.com/document/267053611/A-Review-on-Home-Control-Automation-Using-GSM-and-Bluetooth.
[4] Bhargav B. Patel, Assistant Professor, E & C Department, GTU University, Gujarat, India ;Keyur Chauhan, Assistant Professor, E & C Department, GTU University, Gujarat, India ;Suchita B. Patel , Assistant Professor, M.Sc IT Department, S.P University, Gujarat, India.(2015,January). Wireless Visual Visitor Verifier for Home Security Using Smart Phone. International Journal of Advanced Research in Computer Science and Software Engineering.[Online].5(1).Available: http://ijarcsse.com/Before_August_2017/docs/papers/Volume_5/1_January2015/V5I1-0246.pdf.
[5] Ms. Gunjan Jewani,Department of Computer science & Engineering,Nagpur,India ;Prof. Shubhangi Borkar,Department of Computer science & Engineering,Nagpur Institute of Technology,Nagpur ,India.(2015,February). Review On-A Knock Based Security System. - International Journal on Recent and Innovation Trends in Computing and Communication.[Online].3(2).Available: http://www.ijritcc.org/download/ICAET15TR011797.pdf.
[6] Wikipedia. Home automation, http://en.wikipedia.org/wiki/Home_automation.
[7] BTBee Alliance, "Products and Certification Overview," BTBee Alliance.
[8] The Android open source project, http://source.android.com/.
[9] https://www.yawcam.com.