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Design and Implement of Factory Security System

A project

Submitted to the Department of Communication University Of Diyala-Collage of Engineering in Partial Fulfillment of the Requirement for Degree Bachelor in Communication Engineering

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Dedication

This thesis is dedicated to

our families

with love and respect

Saif

Emad

Hasan

Acknowledgement

First of all , we thank God for granting us the will and strength with which this study was accomplished , and we pray that this blessings upon use continue though out our life , and a special peace is upon this messenger Mohammed .

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List of contents

List of Abbreviations

Abbreviations	Definition
GSM	Global system for mobile communication
SIM	Subscriber Identity module
SMS	Short message service
USB	Universal serial Bus
I^2C	Inter- integrated Circuit
SP	Serial port
PIC	Peripheral Interface Controller
OSX	Operating system extension
IDE	Integrated development environment
IDII	Interaction design institute Ivrea
FTDI	Future technology devices international
GIO	Guard interval length
ETSI	European standard Telecommunication standard
SS	Switching system
BSS	Base Station system
OSS	Operation and support system
HILR	Home Location Register
MSC	Mobil Services Switching Center
VLR	Visitor Location Register
AUC	Authentication Center
EIR	Equipment Identity Register
BSC	Base station Controllers
RF	Radio Frequency
BTS	Base Transceivers Station
LED	Light Emitting Diode
TX	Transmitted
RX	Received
EEPROM	Electrically Erasable Programmable Read-only Memory
SRAM	Static Random Access Memory

TTL	Transistor – Transistor Logic
PWM	Pulse Width Modulation
SS	Slave Select
MOSI	Master Out Slave In
MISO	Master In Slave Out
SCK	Slave Clock
SPI	Serial Peripheral Interface
AREF	Analoge Reference
SDA	Serial Data
SCL	Serial Clock
TWI	Two Wire Interface
COMM	Common
CDMA	Code Division Multiple Access
TDMA	Time Division Multiple Access
3GPP	Third Generation Partnership Project
UCS2	Universal character set,2
SMSC	Short Message Service Center
PCB	Printed Circuit Board
LPG	Liquid Petroleoum Gas

List of Figures

List Table

Abstract

This work aims to protect any building (homes, industries, hotels and hospitals) against fire risks (danger and damage) based on Propane gas (MQ-6) and flame leakage detection system, there are two cases to warn;

The first case(without mobile phone) to issue a warning aerobically by sound . and the second case (with mobile phone and arduino) will be sent a warning (calling) directly to the user through GSM networks.

1.1 General Introduction

Security and automation is a prime concern in our day-to-day life. The approach to home and industrial automation and security system design is almost standardized nowadays.

Home security is the most significant one for every homeowner either in an individual house or an apartment. To get the absolute peace of mind whether you are at first time home or out of home you must ensure that your home is installed with the perfect home security monitoring system. Industrial automation and security system can be used to provide security system for residential, industrial, and for all domestic and commercial purposes using GSM(Global System Mobile) technique. Security systems are certain electronic devices which are used to detect intrusions in home or industry [1].

Arduino is an open-source physical computing platform based on a simple (I/O) board consists a microcontroller, and a development environment for writing soft-ware for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors and controlling a variety of lights, motors and other physical outputs. Arduino projects can be stand-alone, or they can be communicating with software running on your computer (e.g. Flash, Processing, Proteus). Because this characteristics of Arduino, Arduino will be used in designing security system[2].

Mobile phones today are not just used to make calls. The use of mobile phones is changing with the development of technology and they can be used for different purposes. They can be used as clocks, calendars or controllers instead of being used just as phones. Today smart phones are available in the market with different applications and hardware which can be implemented without any further development or enhancement. With the help of the GSM network, a mobile can be used to receive multimedia data (text or image) from any place in the world if the GSM network is available and this is very important in security system [3].

GSM stands for Global System for Mobile Communication. The subscription and the mobile equipment are separated in the GSM, unlike in analog networks where the two are not separated. The smart card handling and storing a subscriber's data is the SIM (Subscriber Identity Module) card whereas the radio equipment is called mobile equipment. Hence, the combination of the Subscriber Identity Module and the mobile equipment is the mobile station [3].

Sensors are electronic devices that measure a physical quality such as light or temperature and convert it to a voltage. This process of changing one form of energy into another is called transduction. Often, sensors are also referred to as transducers[4].

1.2 Literature Survey

Literature survey for many previously published researches is presented, as follows:

In 2012,V.Ramya and B. Palaniappan, design PIC (Peripheral Interface Controller)16F877 microcontroller based toxic gas detecting and alerting system. The hazardous gases like LPG andpropane were sensed and displayed each and every second in the LCD display. If these gases exceed the normal level then an alarm is generated immediately and also an alert message SMS (Short Message Service) is sent to the authorized person through the GSM [5].

In 2013, Selvapriya et.al,designed a gas leakage detection system consist of LPG (Liquefied Petroleum Gas)gas sensor for sensing the leakage and produce the result in audio and visual formats also alerts human via SMS. The sensor has excellent sensitivity combined with a quick requital time. The sensor has also sense iso-butane, propane and cigarette smoke [6].

In 2014, Nandeesh G Set.al, designed aGSM GPS based home and industry security system and tested with the mobile network.in this system GPS and GSM were used. GPS finds location and sends location information where the fire occurs to nearest fire station and police station and also open emergency windows. this system sent SMS which used GSM- GPS (Global Position System)Module (sim548c) and ATMEL89S51 microcontroller, sensors, relays and buzzers.[7].

In 2015, PushkarYelaveet.al, proposedtechnique of security system for oilfield industries using GSM and Zigbee.Thesystem was able to receive all the oil parameters like the current oil level, temperature of oil, leakage of gas. ZigBee transmitter was placed at the site location and another ZigBee receiver was placed at the control panel. Information received at the receiver will be sent to the PC. The security people will take an appropriate action according to the problem failure like power failure, fire generated, oil overflow etc. and the acknowledgement will be received by the receiver at the control unit after rectification of the above problems [8].

1.4 Aims of the Work

The aims of this work can be summarized, as follows:

1. protect any building(homes, industries, hotels and hospitals) against fire risks (danger and damage) based on Propane gas (MQ-6) and flame leakage sensors(without mobile phone) to issue a warning aerobically by sound .
2. protect any building(homes, industries, hotels and hospitals) against fire risks (danger and damage) based on Propane gas (MQ-6) and flame leakage sensors(with mobile phone and arduino) will be sent a warning (calling) directly to the user through GSM networks.

1.5 Organization of research

This thesis consists of five chapters, which can be briefly presented as:

Chapter one: Presents a general introduction and literature survey for the present work.

Chapter two: Illustrates the main concepts of security system, GSM, Hardware Overview of The System that include sensors and Microcontroller (Arduino).

Chapter three: This chapter focuses on description of hardware of the proposed system

Chapter four: Presents the software used and the language in which the program code is defined is mentioned.

Chapter five: Includes the main conclusions of the work and suggestions for future works.

2.1 Introduction

The major discussion in this chapter focuses on wireless security system and gives introduced, detailed review of each one of the requirements and specifications to develop it.

2.2 Security System

Today, there is need to security factors almost in all the life system like in home, companies and factories etc.Security is the degree of protection against danger, damage, loss and crime.

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 threat. Moreover, there are many other reasons why people need security at their life. The first reason that this system is established is to create a peace of mind for people so that they can feel safe inside or outside their building. This will help them to execute their work without any fear of their security. The other reason is to help in getting timely information about visitors at built [9].

The Security system consists of two part hardware and software, then it is important to have some idea about the physics and the working principle behind the hardware devices and software before using it.

2.2.1 WIFI Home Security System

WIFI (Wireless Fidelity)home security is a surveillance system that could monitor user home. This is home security systems use webcam as monitoring device. It is using computer as monitoring unit that can access from everywhere to watch the configure camera. This system use software application of webcam that can detect motion on the remote location. By configure desire sensitivity of the webcam, it will take snapshot when got movement on its location. It will notify user when it detect motion on the screen. This system can either send email or SMS message to user cell phone [10].

.2.2 Mobile phone Home Security System

Mobile phonesecurity system install on most of the house in city. This system prefer by most of the people is due to is high efficiency of the system. This system will automatically make call alert and dial to pre-set cell phone when any sensor had been triggered. At the same time, it also makes a call to police station that nearby user home to make a report. Police will go to monitor current situation when they receive call [11].

2.3 Hardware Overview of The System

The system consists of two units: the transmitter unit (microcontroller with the mobile phone, sensors and relay) and the receiver unit mobile phone.

Arduino Uno Board is used as the microcontroller board. The mobile phone is used as a controller to send instructions and as a recipient to receive the responses and alerts from the microcontroller unit, whereas the Arduino Board is the unit responsible for controlling the different parts and acts as the brain of the system. The GSM modem is responsible for communication between the mobile phone and the mobile station [12]

2.3.1 Microcontroller

Microcontrollers are used in automatically and autonomously controlled products and devices, such as auto mobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes[12].

It’s a processor with low power, low cost, dedicated for a single task, on-board program memory, on-board data memory, I/O pins, analog and digital out, timer/counter circuits and Bus protocols (serial bus, USB, I^2C, SP,.. etc.).In an embedded system, the Microcontroller is the heart of the system. Hence it must be selected correctly according to the application of the

system. There are many families of microcontrollers available such as ATMEL, ATMEGA, and PIC (Peripheral Interface Controller) etc. Two microcontrollers supported by e-Atelier Arduino and Microchip PIC as shown in Figure 2.1 both have many advantage like it's enable you to turn your concepts into working prototypes and can be developed everywhere in your career at low cost also You can re-use blocks of code and hardware, or re-use work of others[13].

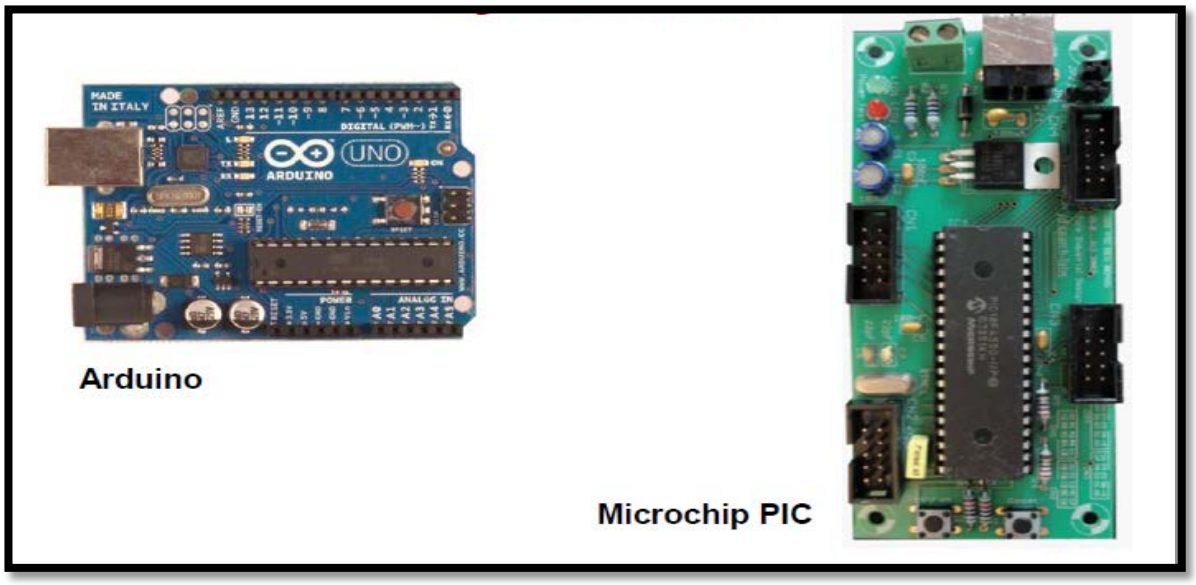


Fig.(2.1) microcontrollers supported by e-Atelier

Arduino is a single-board microcontroller and an open source physical computing platform based on a simpleinput/output (I/O) board and a development environment that implements the Processinglanguage Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators.

It's designed to make the process of usingelectronics in multidisciplinary projects more accessible. The hardware consists of asimple open source hardware board designed around an 8-bit Atmel AVR microcontroller,though a new model has been designed around a 32-bit Atmel ARM. The Arduino software is supported by Windows, Macin-tosh OSX and Linux operating systems despite the fact that most microcontrollers are limited to Windows operating system. The software language is based on AVRC programming language and can be expanded through C++ libraries. There are sixteen officials Arduino's that have been commercially produced to date[14].

2.3.1.1 Arduino Platform

A platform is defined as a system that serves as a base to run a series ofelements, either hardware or software.Arduino platform is composed of two major parts:-

a. **The Arduino board (Arduino Hardwar)** is a small microcontroller board, which is a small circuit (the board or shield) that contains a whole computer on a small chip (the microcontroller). Then the Ardniuo board which is the piece of hardware you work on when you build your objects[14] as shown in Figure 2.2.a.
b. **The Arduino IDE (integrated development environment)**, the piece of software you run on your computer. You use the IDE to create a sketch (a little computer program) that you upload to the Arduino board. The sketch tells the board what to do as shown in Figure 2.2.b [14].

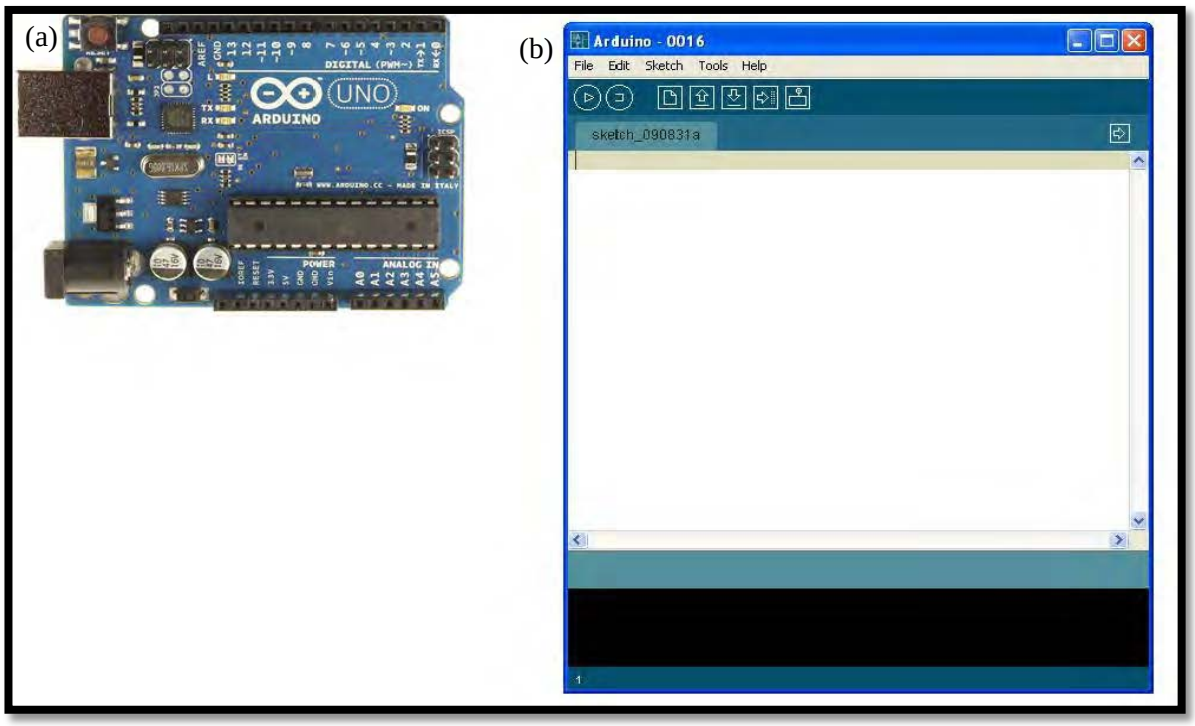


Fig. (2.2) Arduino Uno a) Development Board, b) Programming Environment

2.3.1.2 Arduino History

The project Arduino first began in 2005 at Interaction Design Institute Ivrea (IDII) butthe dawn of Arduino began in year 2002 when Massimo Banzi cofounder of Arduino was appointed as an associate professor to teach the studentsof IDII to promote modern ways of interactive design. Banzi wanted to offer his students something modern and inexpensive so

everybodycould carry their works without many obstacles. By then, the most used tool in themarket was BASIC Stamp, which was expensive. So as an alternativeBanzi wanted to develop something better. Banzi was also involved in processing, the processing language. So with the help of a Colombian studentHernando Barragán who was working on a wiring platform, they tried to make processing for hardware and make it simpler andeasier to use. After working on the project. They came up with a prototype, which wasthe birth of Arduino as shown in Figure 2.3 [15].

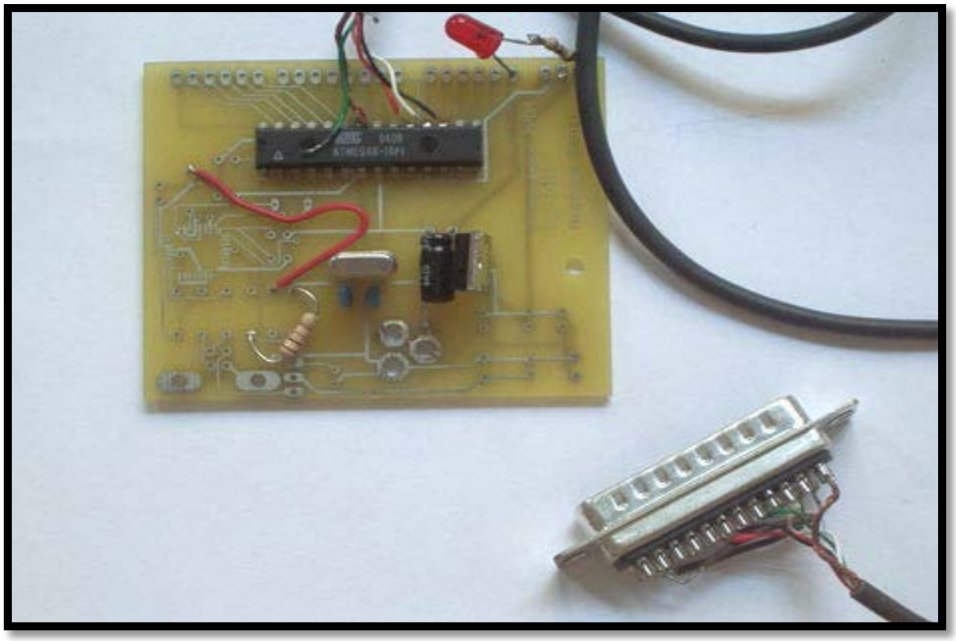


Fig. (2.3) First prototype board

With issues in IDII funding running out, Banzi and the cofounders decided the project to be open source, so that the product would be better. The hardware was then complete and only the remaining part was software, which was later built with collaboration of other team members[15].

2.3.1.3 Types of Arduino

One of the most confusing things about Arduino is that there are too manydifferent choices with different sizes, colors and form factors.Arduino itself have the latest Arduino Uno and older version ArduinoDuemilanove, Arduino Mega2560 (Uno version of Mega with lots of Input and Output pins),Arduino Mini (smallest version, need another board (FTDI) to connect to USB), ArduinoNano (breadboard version), LilyPadArduino (wearable version, for fashion

designers), FIOand Arduino Bluetooth (No USB or serial port) as shown in Figure 2.4. These different form factor caters to differentneeds like size and height requirements, number of input/output pins, cost and shieldscompatibility [12].

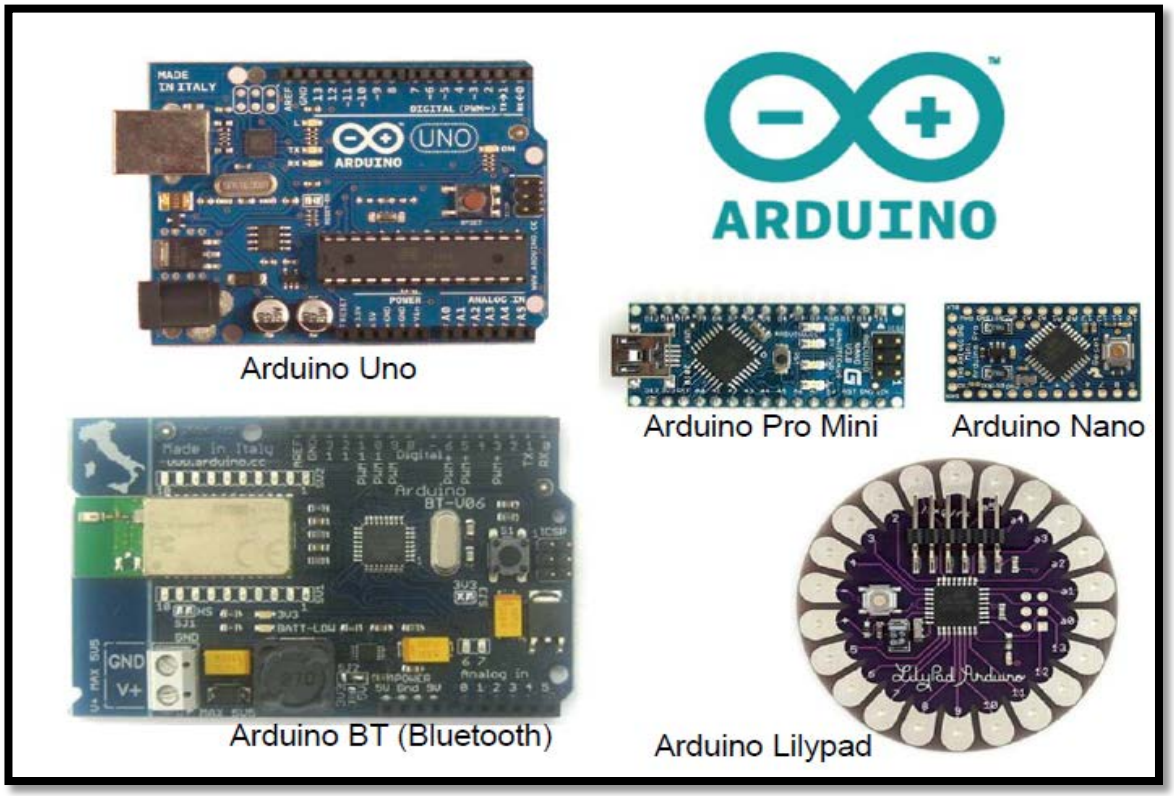


Fig. (2.4) Some of Ardniuo Types

2.3.2 GSM Technology

The GSMstands for Global System for Mobile Communication. GSM is a global system for mobile communication, it's an international digital cellular telecommunication.

The GSM standard was released by ETSI (European Standard Telecommunication Standard) back in 1989. The first commercial services werelaunched in 1991 and after its early introduction in Europe; the standard went global in1992. Since then, GSM has become the most widely adopted and fastest-growing digitalcellular standard, and it is positioned to become the world's dominant cellular standard. Today's third era GSM systems convey excellent and secure versatile voice and information administrations with full abilities over the world. GSM is a massively fruitful engineering and as uncommon story of worldwide accomplishment.

GSM platform is a hugely successful technology and as unprecedented story of globalachievement. Since the first GSM system was industrially launched, it turned into, the

world's heading and fastest developing portable standard. The GSM Association evaluates that advances characterized in the GSM standard serve 80% of the worldwide portable business, including more than 5 billion individuals crosswise over more than 212 nations and domains, making GSM the most omnipresent of the numerous guidelines for cell systems.

Today's GSM platform is living, growing and evolving and already offers an expandedand feature-rich 'family' of voice and enabling services.The Global System for Mobile Communication (GSM) network is a cellular telecommunication network with a versatile architecture complying with the ETSI GSM900/GSM 1800 standard. Siemen's implementation is the digital cellular mobilecommunication system D900/1800/1900 that uses the very latest technology to meetevery requirement of the standard[16].

Table (2.1) GSM Air Interface Specifications.

S.N.	Parameter	Specifications
1	Reverse Channel frequency	890-915MHz
2	Forward Channel frequency	935-960 MHz
3	Tx/Rx Frequency Spacing	45 MHz
4	Tx/Rx Time Slot Spacing	3 Time slots
5	Modulation Data Rate	270.833333kbps
6	Frame Period	4.615ms
7	Users per Frame	8
8	Time Slot Period	576.9microsec
9	Bit Period	3.692 microsecond
10	Modulation	0.3 GMSK
11	ARFCN Number	0 to 124 & 975 to 1023
12	ARFCN Channel Spacing	200 kHz
13	Interleaving	40 ms
14	Voice Coder Bit Rate	13.4kbps

2.3.2.1 The GSM Network

The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS). The basic GSM network elements are shown in Figure 2.5 [17]

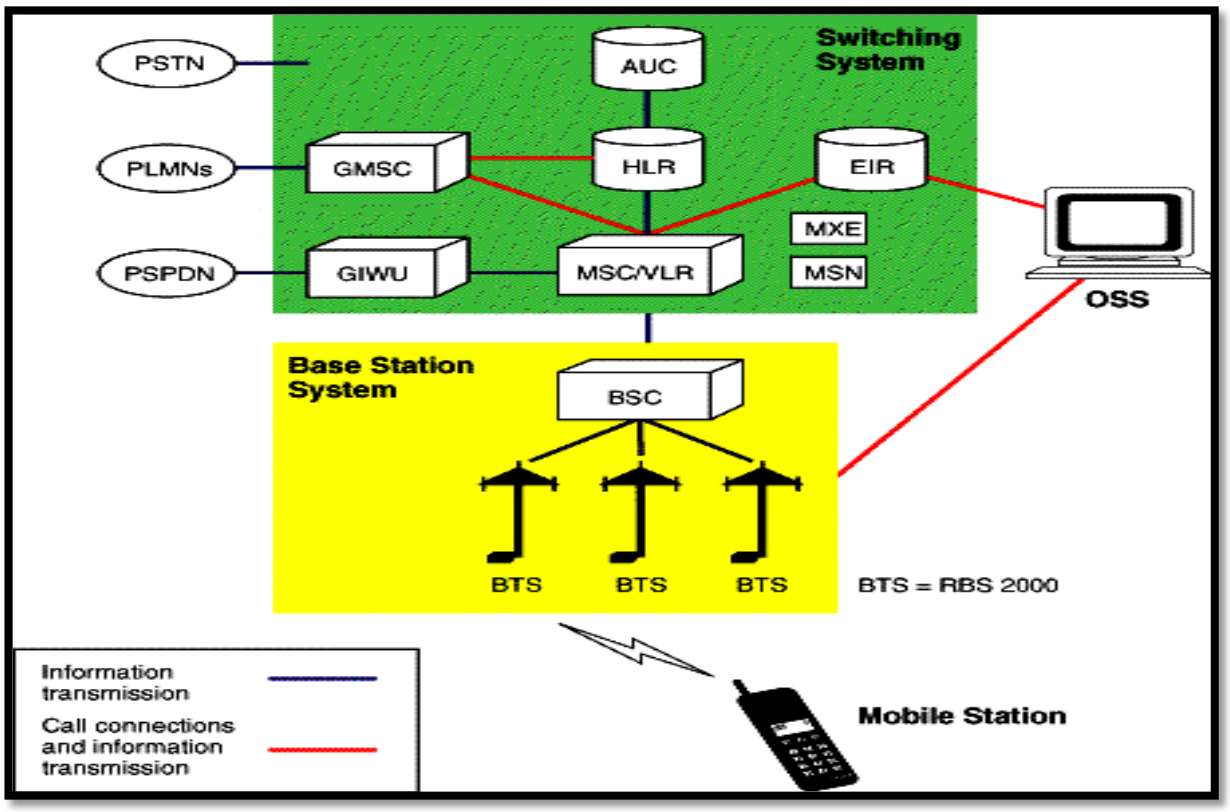


Fig. (2.5) The GSM Network

The Switching System (SS) is responsible for performing call processing andsubscriber-related functions. The switching system includes the following functional units [17]:

a. **Home Location Register (HLR)**:-The HLR is a database used forstorage and management of subscriptions. The HLR is considered themost important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered inthe HLR of that operator.

b. **Mobile Services Switching Center (MSC)**:-The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others.

c. **Visitor Location Register (VLR)**:-The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about themobile station from the HLR. Later, if the mobile station makes a call,the VLR will have the information needed for call setup without having to interrogate the HLR each time.

d. **AuthenticationCenter (AUC)**:- A unit called the AUC providesauthentication and encryption parameters that verify the user's identity and ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world.

e. **Equipment Identity Register (EIR)**:-The EIR is a database thatcontains information about the identity of mobile equipment thatprevents calls from stolen, unauthorized, or defective mobile stations.The AUC and EIR are implemented as stand-alone nodes or as acombined AUC/EIR node.

The Base Station System (BSS) All radio-related functions are performed in the BSS, which consists of basestation controllers (BSCs) and the base transceiver stations (BTSs).

• **BSC**:- The BSC provides all the control functions and physical linksbetween the MSC and BTS. It is a high-capacity switch that providesfunctions such as handover, cell configuration data, and control ofradio frequency (RF) power levels in base transceiver stations. Anumber of BSCs are served by an MSC.

• **BTS:-**The BTS handles the radio interface to the mobile station. TheBTS is the radio equipment (transceivers and antennas) needed toservice each cell in the network. A group of BTSs are controlled by aBSC.

2.3.3 Sensor

Sensors are electronic devices that measure a physical quality such as light or temperature and convert it to avoltage. This process of changing one form of energy into another is called transduction. Often, sensors are alsoreferred to as transducers. Sensors can be broadly classified in two categories: digital sensors and analog sensors.A digital sensor's output can only be in one of two possible states. It is either ON (1) often +5V, or OFF (0), 0V.Most digital sensors work with a threshold. Is the incoming measurement below the threshold, the sensor willoutput one state, is it above the threshold, the sensor will output the other state. In

contrast to a digital sensor, ananalog sensor's output can assume any possible value in a given range. Very often the output of an analog sensoris a variable resistance that can be used to control a voltage.

Also there are different classifications of sensors according to different criteria. For example, sensors can be classified according to the material and technology, application, transduction principles or property. The sensor itself may be a passive or an active device. A passive sensor is designed to receive and measure the signal whereas an active sensor is a device used for measuring signals transmitted by the sensors that were reflected, refracted or scattered. The only difference between the active and passive sensor is about transmitting the signal by the device[3, 4].

Independent of the active or passive nature of a sensor, there are several properties associated with a sensor that are critical to the sensor performance. Some of the more important properties are shown below:

- Response time and recovery time
- Reproducibility
- Aging
- Stability (short term, long term), sensitivity and resolution
- Dynamic range
- Selectivity
- Size, weight and cost.

The response time of a sensor is the time taken by the sensor to reach 90% of its steady state value after the introduction of the measured, whereas the recovery time is the time taken by a sensor to be within 10% of the value it had before the exposure to the measured. The sensor with less response time and recovery time is considered to be a good sensor. The ability of the sensor to produce the same characteristic upon the repeated exposure to a particular measured is referred to as reproducibility. The sensor with excellent reproducibility will have the same recovery time, response time as well as the same response for a particular measured. However, there is some degradation on the sensor signature after a long use of the sensor and it is natural. The time taken by a sensor for the degradation is commonly known as aging. Sensitivity and resolution are the critical properties of a sensor for the application with the precise measurement system or for the application sensing the potentially dangerous measured. The smallest change in the measured that a sensor can detect is the resolution of

the sensor and the change in the output per unit change in the measured is the sensitivity of the sensor. The importance of properties of a sensor depends on the application where the sensor has to be used. For example: In the detection of highly toxic gas, sensitivity is the important property, in online control system where the measured is exposed repeatedly, reproducibility and aging are the important properties whereas in application relating to the implantation of biosensor in the animals, weight and size becomes the important properties[14].

3.1 Introduction

This chapter explains step-by-step development of hardware system of the proposed system.

3.2 Work Description

The description of work can be classified into three parts:

1. Building security system alert the person by alarm.
2. Building GSM security system alert person by make call .

3.3 System Design

The proposed system is consist of several boards starting with Arduino Uno as a base, sensor board on top of Solderless Breadboards , mobile phone, then the system looks compact in size and very handy to use. This chapter gives detailed review of each of this part along with its working principle.

3.3.1Arduino Uno

Since Arduino is an open-source electronics prototyping platform based on a flexible, easy-to-use hardware and software. It is intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments [18], so in this work, Arduino Uno was used because of ease of programming compared to other type of microcontroller.

3.3.1.1 Arduino Uno Hardware

Arduino Uno is one of the microcontroller boards manufactured by the Arduino and it is a microcontroller board based on the Atmel's ATmega328 microcontroller. "Uno" means one in Italian and the uno board is the latest in a series of USB (Universal Serial Bus) Arduino boards which is the reference model for the Arduino platform.

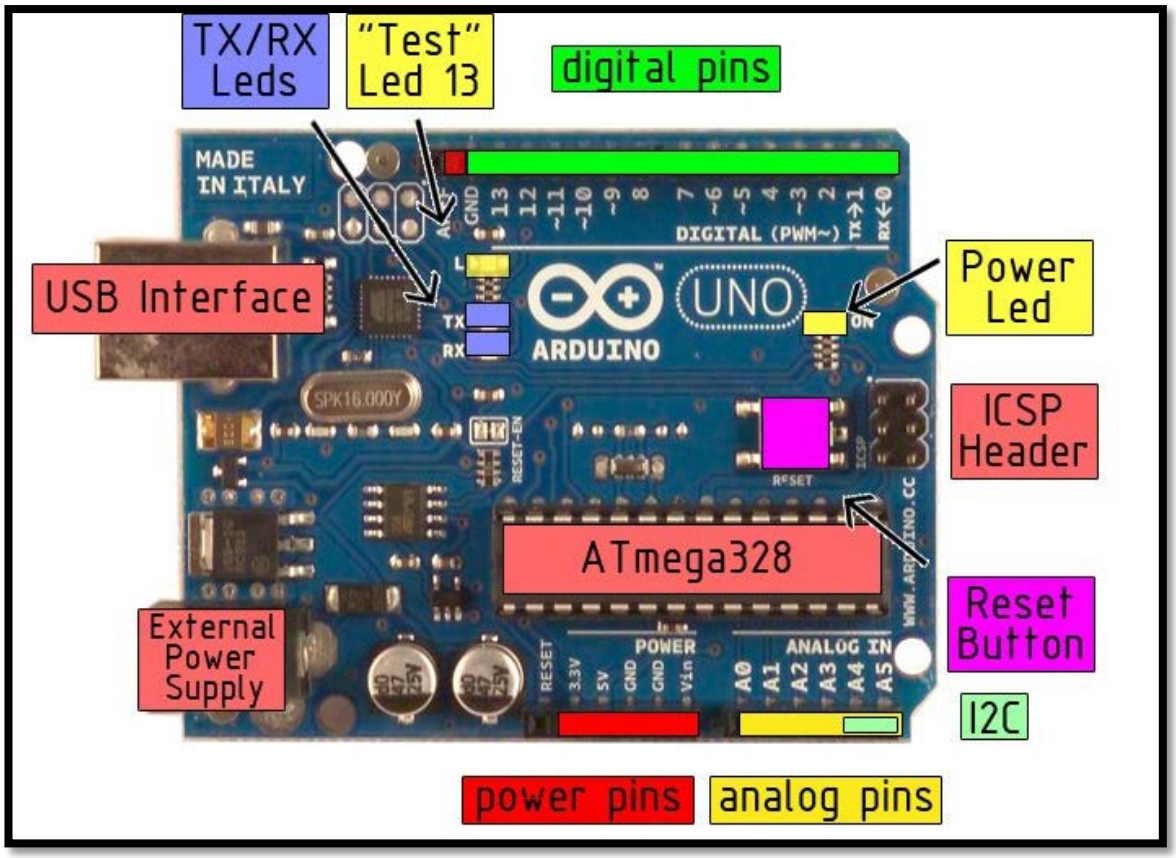


Fig. (3.1) Arduino Uno Hardware

On the far left is the USB (Universal Serial Bus) connector as shown in Figure 3.1. This connects the board to your computer forthree reasons: to supply power to the board, to upload your instructions to the Arduino, and to send data to and receive it from the computer.

On the right is the power connector. Through this connector, you can power the Arduino with a standard mains power adapter. The microcontroller (ATmega 328) is the “brains” of the Arduino. It is a tiny computer that contains a processor to execute instructions, includes various types of memory to hold data and instructions from our sketches, and provides various avenues of sending and receiving data. The first row offers power connections and the ability to use an external RESET button. The second row offers six analog inputs that are used to measure electrical signals that vary in voltage. Furthermore, pins A4 and A5 can also be used for sending data and receiving it from other devices. Sockets (or pins) numbered 0 to 13 are digital input/output (I/O) pins. They can either detect whether or not an electrical signal is present or generate a signal on command. Pins 0 and 1 are also known as the serial port, which is used to send and receive data to other devices, such as a computer via the

USB connector circuitry. The pins labeled with a tilde (~) can also generate a varying electrical signal, which can be useful for such things as creating lighting effects or controlling electric motors. Next are some very useful devices called Light-Emitting Diodes (LEDs); these very tiny devices light up when a current passes through them[12].

The Arduino board has four LEDs: one on the far right labeled ON, which indicates when the board has power, and three in another group. The LEDs labeled TX and RX light up when data is being transmitted or received between the Arduino and attached devices via the serial port and USB. The L LED is for your own use (it is connected to the digital I/O pin number 13). The little black square part to the left of the LEDs is a tiny microcontroller that controls the USB interface that allows your Arduino to send data to and receive it from computer[12].

Table 3.1: Summary of Arduino Uno

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

3.3.1.2 Arduino Development Environment

The Arduino development environment contains a text editor for writing code, message area, a text console, a toolbar with buttons for common functions, and a seriesof menus. It connects to the Arduino hardware to upload programs and communicatewith them as shown in Figure (3.2).

Software written using Arduino are called **sketches**. These sketches are writtenin the text editor. Sketches are saved with the file extension *'.ino'*. It has features forcutting/pasting and for searching/replacing text. The message area gives feedback whilesaving and exporting and also displays errors. The console displays text output by theArduino environment including complete error messages and other information. Thebottom righthand corner of the window displays the current board and serial port. Thetoolbar buttons allow we to verify and upload programs, create, open, and savesketches, and open the serial monitor[19].

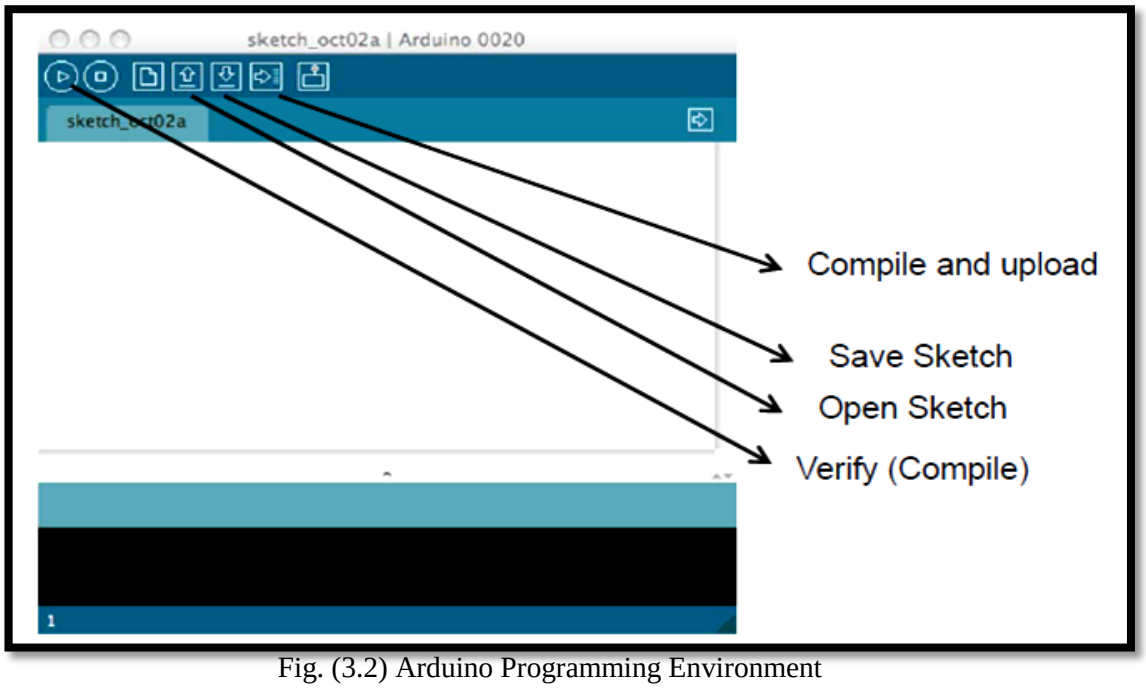


Fig. (3.2) Arduino Programming Environment

3.3.1.3 SCHEMATIC & REFERENCE DESIGN

1- Power:- The Arduino Uno can be powered via the USB connection or with an external powersupply. The power source is selected automatically. External (non-USB) power can comeeither from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected byplugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery

canbe inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate

on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin maysupply less than five volts and the board may be unstable. If using more than 12V, the voltageregulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN:-** The input voltage to the Arduino board when it's using an external power source (as opposedto 5 volts from the USB connection or other regulated power source). You can supply voltagethrough this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V:-** This pin outputs a regulated 5V from the regulator on the board. The board can be suppliedwith power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pinof the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, andcan damage your board. We don't advise it.
- **3.3V:-**A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND:-**Ground pins.
- **IOREF:-** This pin on the Arduino board provides the voltage reference with which the microcontrolleroperates. A properly configured shield can read the IOREF pin voltage and select theappropriate power source or enable voltage translators on the outputs for working with the 5Vor 3.3V.

2- Memory:- The ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KBof SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

3- Input and Output:- Each of the 14 digital pins on the Uno can be used as an input or output,using pinMode(), digitalWrite(), and digitalRead()functions. They operate at 5 volts. Each pincan provide or receive a maximum of 40 mA and has an internal pull-up resistor(disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data.These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serialchip.

External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt ona low value, a rising or falling edge, or a change in value. See the attachInterrupt() functionfor details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output withthe analogWrite() function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI

Communication using the SPI library.

LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGHvalue, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits ofresolution (i.e. 1024 different values). By default they measure from ground to 5 volts,though is it possible to change the upper end of their range using the AREF pin andthe analogReference() function. Additionally, some pins have specialized functionality:

TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication usingthe Wire library.There are a couple of other pins on the board:

AREF. Reference voltage for the analog inputs. Used with analogReference().

Reset. Bring this line LOW to reset the microcontroller. Typically used to add a resetbutton to shields which block the one on the board.

3.3.2 Sensor

There are different types of sensors. In this work, two types of sensorsgas sensor (propane gas) and flame sensor are used for the security application, as the cost of this sensor is very less and it has reasonably very good sensitivity.

3.3.2.1 GAS Sensor

This propane gas sensor detects the concentrations of LPG, isobutane, and propane in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of 300 to 10,000 ppm. The sensor can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5 V. This sensor is simple analog voltage interface requires only one analog input pin from your microcontroller. Figure (3.3) shows propane gas sensor[20].

Fig. 3.3Propane Gas Sensor

The Features of propane gas sensor are :

1. High sensitivity to LPG , iso-butane , propane
2. Fast response .
3. Stable and long life .
4. Simple drive circuit .
5. Detect for 1000 ppm of LPG concentration in air.

Figure(3.3) PIRA) PIR sensors, B) Working PIR

3.3.2.2 Flame Sensor

A **flame detector** is a sensor designed to detect and respond to the presence of a flame or fire. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is properly lit; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect

the flame .The flame sensor is very sensitive to IR wavelength at 760 nm ~ 1100 nm light [21].

Fig. (3.4) Flame Sensor

3.3.3 Relay

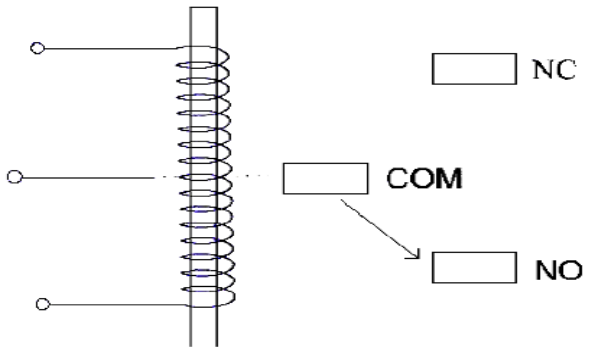
The relay driver is used to isolate both the controlling and the controlled device. The relay is an electromagnetic device, which consists of solenoid, moving contacts (switch) and restoring spring and consumes comparatively large amount of power. Hence it is possible for the interface IC to drive the relay satisfactorily. To enable this, a driver circuitry, which will act as a buffer circuit, is to be incorporated between them. The driver circuitry senses the presence of a “high” level at the input and drives the relay from another voltage source. Hence the relay is used to switch the electrical supply to the appliances [22]

3.3.3.1 Relay Module

A relay is an electrically operated switch that allows you to turn on or off a circuit using voltage and/or current much higher than the Arduino could handle. There is no connection

between the low voltage circuit operated by Arduino and the high power circuit. The relay protects each circuit from each other.

Relay is used in the circuit because it is an electrical operated switch that connected to the output. A relay in this system is an electrical switch that opens and closes under the control of microcontroller. The relay switch connections are usually labeled as **Common (COM)**, **Normally Closed (NC)** and **Normally Open (NO)**. The circuit is connected to COM and NO if it is switched to ON when relay coil in ON while to switch OFF the circuit connect the COM and NC together and then the relay coil is in OFF state. Therefore, the output was connected to COM and NO. Figure (3.5) shows the relay that has been used for this project.



NC: - Normally Connected
NO: - Normally Open
COM: - Common

Fig. (3.5) Relay for switching

3.3.4Solder less Breadboards

A solder less breadboard is an essential tool for rapidly prototyping electronic circuits. Components and wire push into breadboard holes. Rows and columns of holes are internally connected to make connections easy. Wires run from the breadboard to the I/O pins on the

Arduino board. Make connections using short lengths of 22 g solid wire stripped of insulation about 0.25” at each end. Here is a photo of a breadboard showing which runs are connected internally. The pairs of horizontal runs at the top and bottom are useful for running power and ground. Convention is to make the red colored run +5 V and the blue colored run Gnd. The power runs are sometimes called “power busses” [23].

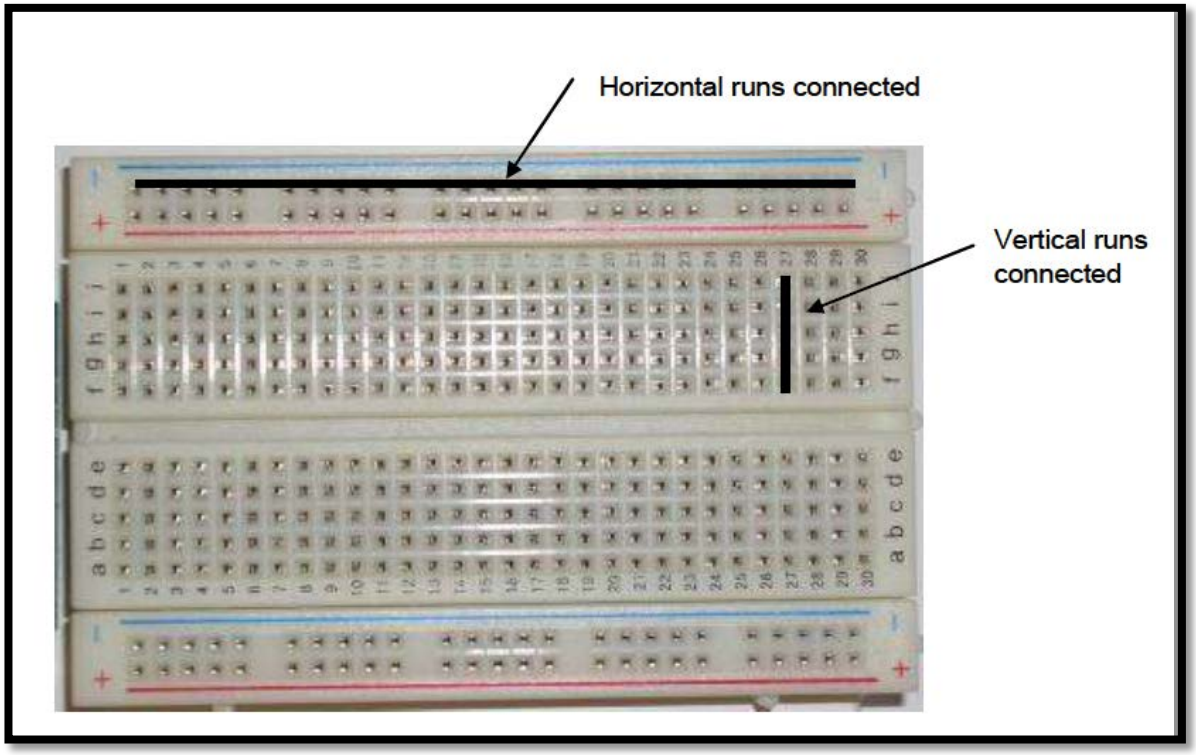


Fig. (3.6) Solderless Breadboards

3.3.5 Mobile Phone

In this work, using two types of mobile phone. The first type is Nokia 7610 make call and iphone as show in Figure (3.7).

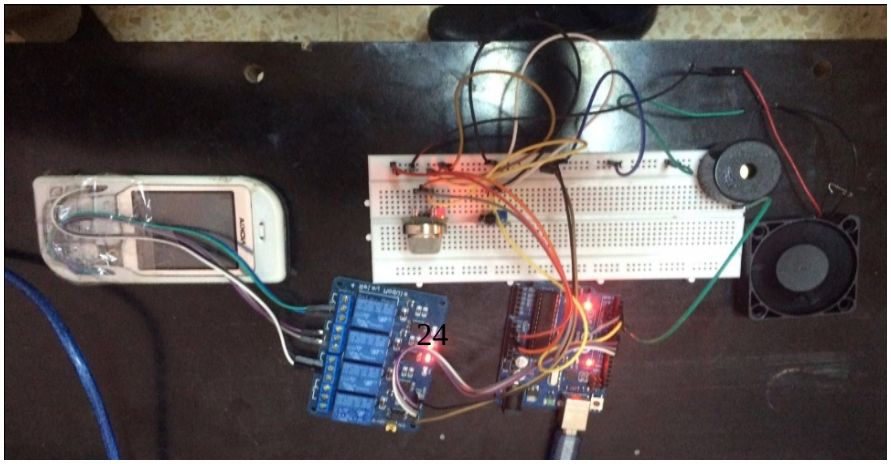


Fig. 3.7

Figure (3.7) Gsm security system

3.4 Proposed System

The description of Proposed System can be classified into two parts:

3.4.1 Building security system alert the person by alarm (without mobile)

The proposed system in this case consists sensor, transmitter, receiver and speaker as shown in the Figure (3.11).When the flame or gas sensor is work the arduino activate the buzzer .

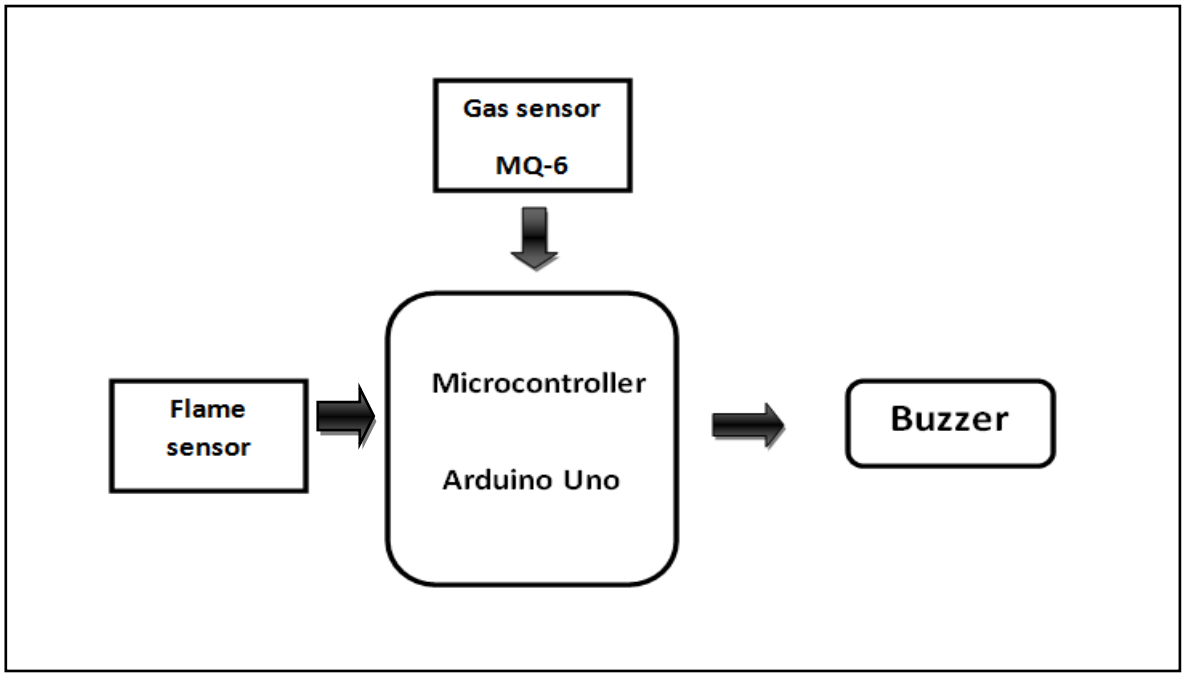


Fig. 3.8 Block Diagram of Wireless Security by Alarm

3.4.2 Building GSM security system alert the person by(make call)

When occurs a gas leak or fire the absence of the owner companies, homes and factories or any building ,the owner receives a call from a registered number In the mobile device that was placed in the protection device for the purpose of the alarm

to take necessary actions. The block diagram of building GSM Security System Alert Person By make call is shown in Figure (3.9)

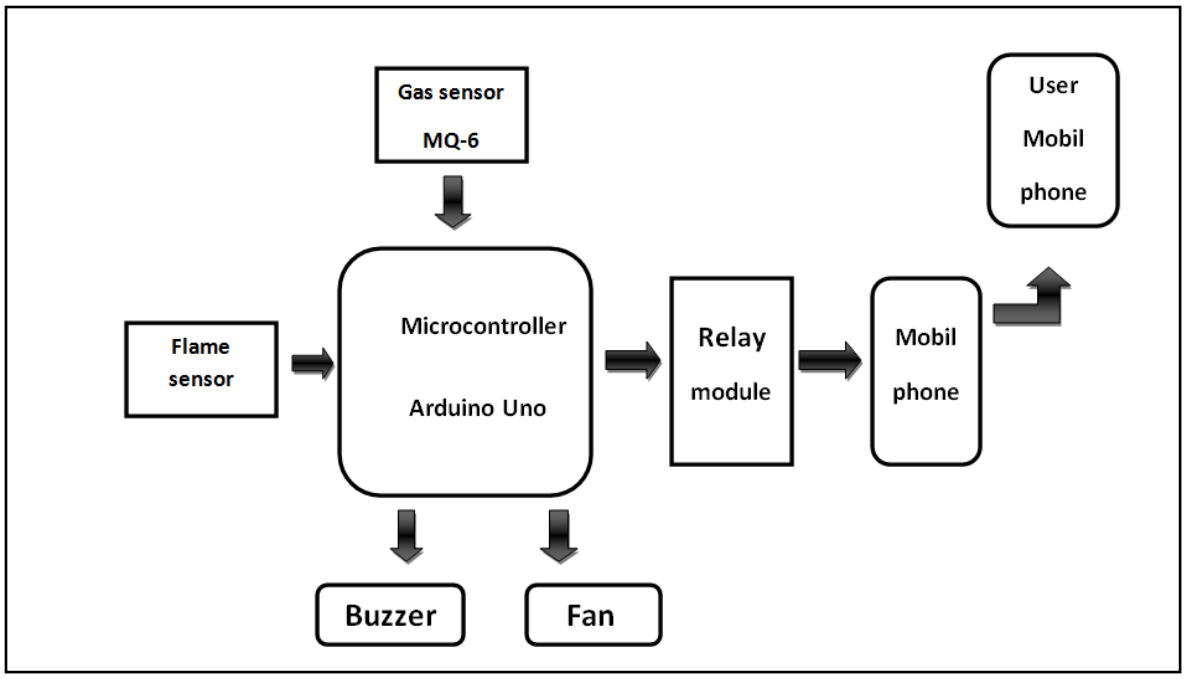


Fig. 3.9Building GSM Security System Alert Person By make call

4.1 Introduction

In this chapter the software used and the language in which the program code is defined is mentioned and the program code are explained. The software for our project was developed using a simple high level language tool in C. Depending on Gas leak or fire , there are two cases to warn:

4.1.1 Security Alarm System (without GSM)

It shows line alarm. It provides higher alarm sound. This system (alarm system) just rings an alarm for the part of security such as in case of fire and gas. Hardware components consists of arduino microcontroller , sensor, buzzer and fan. When sensor, activated the buzzer will activate as shown in Figure (4.1).

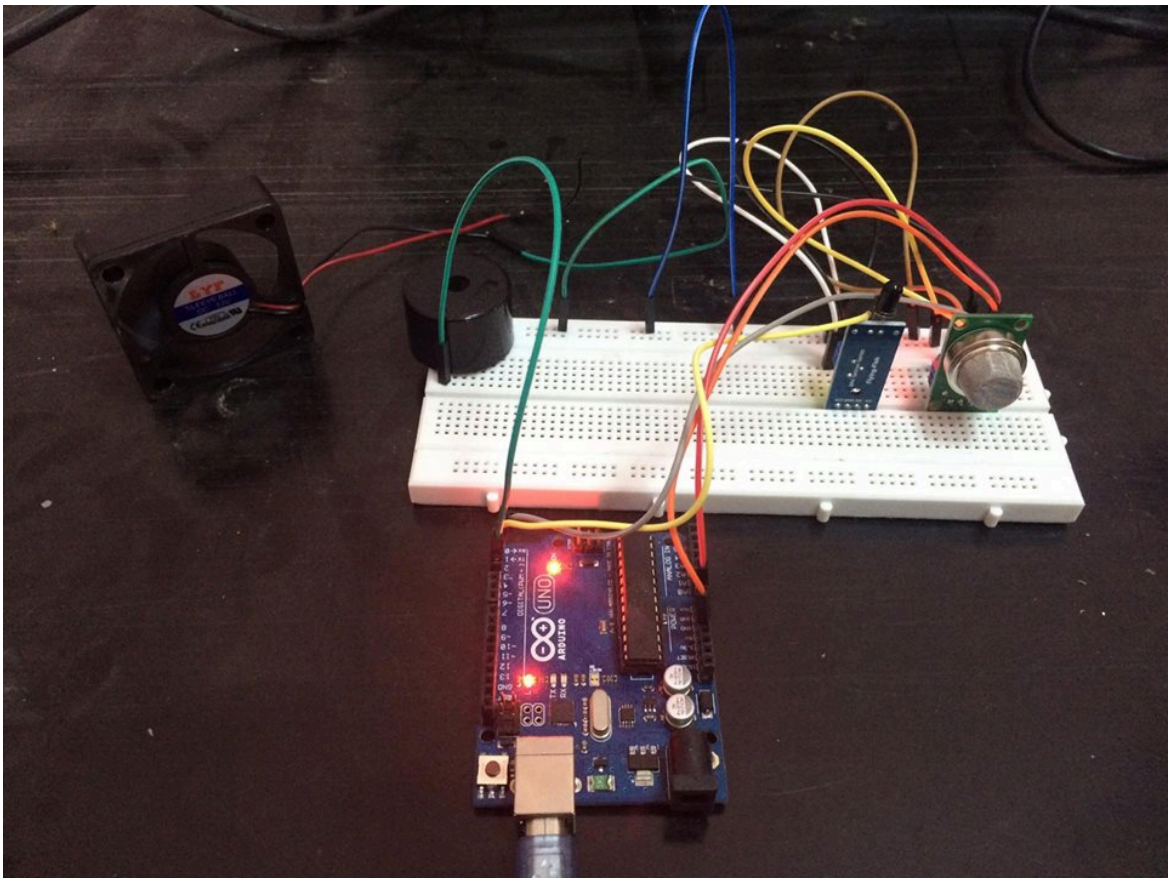


Fig. 4.1 Hardware of Security Alarm System (without mobile)

4.1.2 Hardware of Security Alarm System (with GSM)

The hardware of this case consists of Gas sensor (propane gas) , flame sensor, arduino microcontroller, relay module and mobile phone. When sensor activated the microcontroller control the relay module to make call as shown in Figure (4.2) to a user phone number as shown in Figure (4.3).

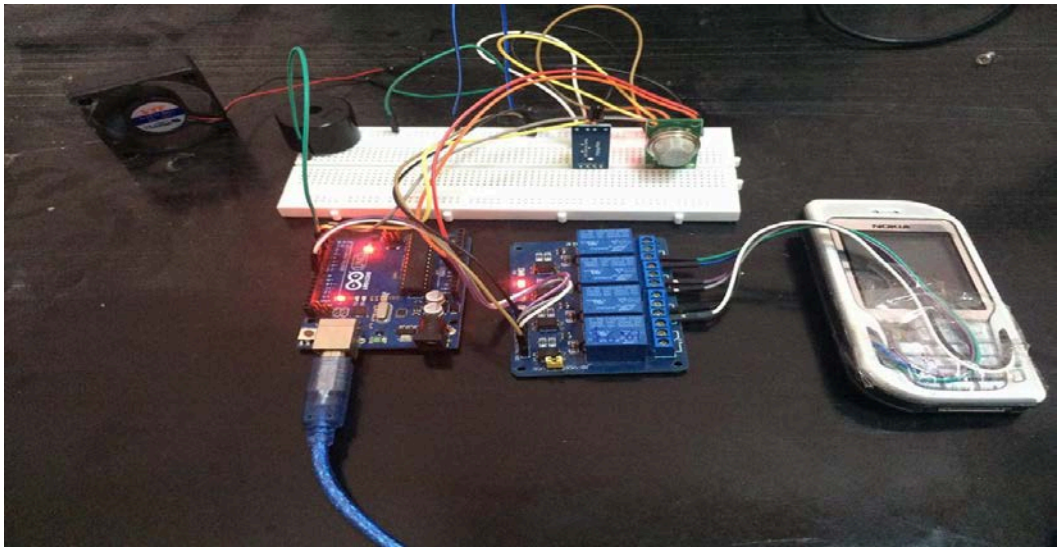


Fig. 4.2 security system alert with GSM person by call

4.2 Software of Security Alarm System (with GSM)

The mobile phone that is connected with Arduino through an relay module to control it . In this work, mobile using to make call. The mobile is an important part of the system responsible for communication between the microcontroller and the mobile phone. AT commands are used to interface the module as well as to configure it. AT commands are inserted in C-language as a string of characters which are sent to the module using the terminal program.

The instructions are defined within a program as a C-language code which could be actuated at a specific moment. The code would then be simply compiled and uploaded into the Arduino unit as shown in Figure (4.3)

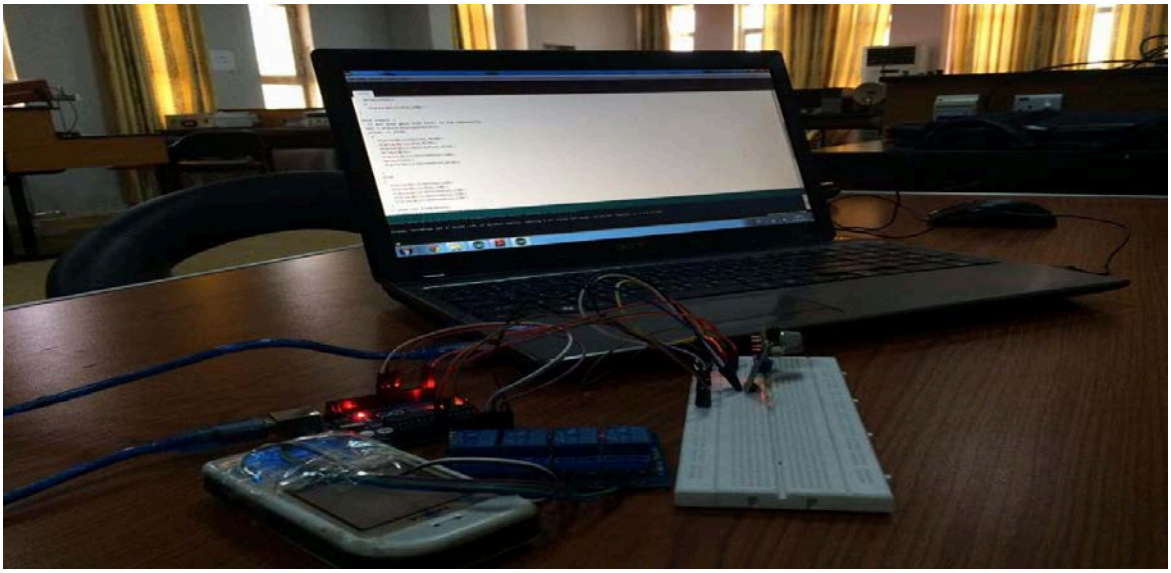


Fig. 4.3 hardware and software of system

5.1 Conclusions

The important points that are noted during practical work and discussion of the resultsare given below:

1. Full proof security system, since It is consist of Gas sensor (propane gas) , flame sensor , arduino microcontroller, relay module and mobile phone, When sensor activated the microcontroller control the relay module tomake call to a user phone number then No need to keep eye on surveillance continuously.
2. two layer security system. The work can be classified into two parts:

a) Building security system alert the person by alarm
b) Building GSM security system alert person by make call

3. Can be used in any place.
4. Low power consumption, only 2.4mWatts. and Battery operated, can be backed up & also mains operated.
5. Highly sensitive gasand flame sensors.
6. Low cost operating system using Arduino module [AT-mega328] in C programming language. Also overall cost effective and parts are easily available on the market.

5.2 Suggestions for Future Works

1) Adding another sensors for our security system.
2) Using another types of Arduino and compare these types with that used in this work.

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الخلاصة

يهدف هذا العمل الى حماية الشركات والمنازل والمصانع ضد الخطر والضرر باستخدام حساس الغاز واللهب الذي يكشف عن حدوث تسرب للغاز او الحريق وهناك حالتين للتحذير . الحالة الاولى بدون جهاز الموبايل لاصدار تحذير عن طريق الصوت .

الحالة الثانية (جهاز موبايل وارويني) ، سوف يتم اجراء اتصال الى المستخدم عبر شبكات GSM

يتم بناء هذا النظام عمليا بأستخدام الاجهزة مفتوحة المصدر (اردوينواونو 328) بجانب البرمجة حيث استخدام لغة C في برمجة (اردوينو اونو328) .