HOME SECURITY SYSTEM

A Project and Thesis submitted in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering

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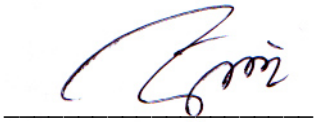
Certification

This is to certify that this project and thesis entitled "**Home Security System**" is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on January 2019.

Signature of the candidates



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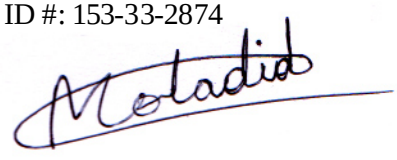

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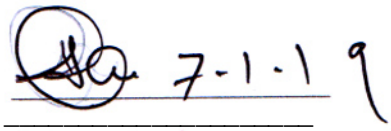

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The project and thesis entitled **" Home Security System,"** submitted by **Zoin chambugong, ID: 153-33-2874**, **and A.K.M. Mostahidul Islam, ID: 152-33-2677,** Session: Fall 2018 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering.**

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Dedicated to

Our Parents

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENT

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ABSTRACT

The main objective of this project is to develop a home security system using an Arduino board with sensor controlled by LCD. As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system, involving remote controlled switches. Presently, conventional wall switches located in different parts of the house makes it difficult for the user to go near them to operate. Even more it becomes more difficult for the elderly or physically handicapped people to do so. Remote controlled home security system provides a most modern solution with sensor. In order to achieve this, a sensor module is interfaced to the Arduino board at the receiver end while on the transmitter end, a Arduino application on the display sends ON/OFF commands to the receiver where loads are connected. By touching the specified location on the sensor, the loads can be turned ON/OFF automatically through this technology.

By this security system we can detect gas, fire, thief detector and automatic road lamp ON/OFF system.

We can use gas detector in kitchen, car garage and all gas component in the industry, home etc.

By the temperature sensor we can detect fire and get fire alarm by the buzzer and emergency signal light. We get notification by using LCD display.

We can detected thief by using motion detector sensor. We can use it in the home, garage and industry. When we absence this place the sensor detect thief.

By using LDR we can solution the light on/off system automatically in day time and night time. We can use the LDR on Road lamp, car parking area.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The 21st century is the era of smart technology. It was said that modern life is unimaginable without electricity but it this saying has changed. Now we say daily life is unimaginable without internet. Modern technology has advanced to another level of automatic and smart systems. There is no need to introduce the advancement of technology in modern times. As we know, the advancement has gone a long way and almost has reached to its peak of modernization. Today innovation has turned into a coordinated piece of individuals' lives. It has and keeps on affecting numerous parts of day by day life and has permitted better social association, simplicity of transportation, the capacity to enjoy excitement and media and has helped in the advancement in pharmaceutical. One of the most important devices of modern times is Smartphone. Another important element of modern age is the internet. The key to step into the world of automatic control system is the combination of Smartphone and the internet.

Therefore, with the help of these two and microcontrollers home automation was possible. If we look few years back, people have been using washing machine, water heaters, hair dryer etc. for household chores. Not in every house in Bangladesh but in western countries these machines are used daily for household chores. We can consider these machines as the starting of home automation. Now we are able to control TV, light, fan, refrigerator etc. with Android phones. This project is about easy and cheap home automation system and security system. The quantity of Smartphone clients in Bangladesh has expanded by 3.1 million to 8.2 million in 2015, as indicated by a current report distributed by Counterpoint Technology Market Research (Dhaka Tribune).Study shows that seventy five percent of the market share is Android and a total of one hundred and six million android Smartphone were shipped in the second half of 2012. Android Smartphone became

the top operating system in the market in the present time worldwide and it became the most popular operating system known to man. This is making android phone the most needed element of today's life. Home automation was possible with the help of this small device. The fast development of remote correspondence inspired us to utilize cell phones to remotely control a household appliance. Android controlled home system is not common in Bangladesh but is available in some offices to some extent. The fast development of remote correspondence inspired us to utilize cell phones to remotely control a household appliance. There is no actual definition of embedded system. Computer controlled devices can be termed as embedded systems. With the presentation of better equipment and better programming, cell phones have turned out to be capable gadgets and have turned into an imperative piece of individuals' day by day lives. As per Li et al. (2016) there are three ages of home computerization. Firstly, wireless technology with proxy server. Example: Next Zig bee automation. Artificial intelligence controls electrical devices. Example: Amazon Echo. The latest technology is robot interacting with human. Example: Robot Rovio, Roomba. We have good and cheap facilities to wireless networks and still developing in Bangladesh. The 2nd and 3rd generation from above, aren't available in Bangladesh. It doesn't mean that we don't want it. The government and some organizations are trying to develop our country in high technology. Now high technology is not bound within few features. The thing that takes high technology to next level is automatic system. That is why the demand of automatic electronic device is increasing. To accomplish that, home automation is necessary.

1.2 Background

The “Home security” concept has existed for many years. The terms “security of Home”, followed and has been used to introduce the concept of security of the house. Home security Systems represents a great research opportunity in creating new fields in engineering. Home security Systems includes centralized control of lighting, security system and other systems. To provide improved us comfort, security system. Home security Systems becoming popular nowadays and enter quickly in this emerging market. Each of the connection has their own unique specifications and applications. This project forwards the design of home security system using Android application. The Arduino microcontroller and other components and devices can be connected. The home appliances are connected to the input/output ports of Arduino microcontroller along with the power strip and their status is passed to the Arduino microcontroller. It presents the design and implementation of security system that can monitor via LCD display.

1.3 Objective

- To design a control system for home security system.
- To design a circuit that can efficiently control different appliances controlled to the smart control system.
- To design a circuit that can switch ON and OFF the security system automatically.

1.4 Methodology

- First the requirements of the project was carefully analyzed to design the home security system.
- The methodology of this project design can be divided into two sections; hardware and software implementations.
- Informations were collected from references books and websites to find out the
- Possible improvement.

Required components have been purchased from local market.

CHAPTER TWO

Literature review

2.1

Home security system can be described as introduction of technology within the home environment to provide convenience, comfort, security. [4].

There are many other projects done on home security system in different countries. They are all different from each other in designs; features, devices, elements and algorithm. They were designed according to specific needs and availability of components in the respective areas. Some of them are cheap; some of them are very expensive. Availability of both hardware and software is necessary to work. After a long searching, we have found a lot of articles. Searching for security purpose articles, we also found some projects done for garage security. These are mainly done in western countries. Many projects are done only for security purpose with Arduino. Again, the projects are done only for controlling home appliances using Arduino.

There are few projects on Fingerprint recognition module for strong home security issues. One of the projects used biometric method for next generation E-passport. The e-passport, as it is sometimes called, represents a bold initiative in the deployment of two new technologies: Radio-Frequency Identification (RFID) and biometrics. [6] [7].

Furthermore, there are projects done on fingerprint recognition module describing the methods how to identify the fingerprints. A wide variety of systems requires reliable personal recognition schemes to either confirm or determine the identity of an individual requesting their services. The purpose of such schemes is to ensure that the rendered services are accessed only by a legitimate user and no one else. Those papers didn't mention about how to use it for home security using any kind of microcontrollers [8].

Face recognition is another excellent and smart way that serves security purpose. We have found projects for door security using face recognition using Raspberry Pi. We avoided this part for the security purpose because error occurs more in face recognition than fingerprint recognition. Fingerprint has high accuracy. They didn't

explicitly mention about the security purpose or Raspberry Pi. They have only mentioned about the techniques of recognition. Different people have described the procedure of recognition in different ways. Basically all of them have tried to minimize errors for computer to recognize face [9].

Three researchers of Malaysia proposed a web-based indoor air quality system with GSM and Arduino. The system consists of gas sensor, temperature and humidity sensor, particle dust sensor and wireless sensor network (WSN) node as a wireless transmitter. A desktop computer acts as the base station [10].

According to Chen Shih-Chung, the systems proposed by him is designed that can be easily be adapted for various applications such as control of machines in machining industries, automotive industry, navigating mobile wireless nodes, automating offices etc.

There are few home automation systems that use ZigBee or Bluetooth for the wireless connection. With the help of Wi-Fi [8] and due to the introduction of IPv6the connection of almost unlimited number of embedded devices is possible. In Bangladesh, we use IPv4.

Isa Elina and Sklavos Nicolas proposed cameras and sensors inputs based system operates on different levels of user's access control, based on passwords policies. The system works through SMS communication via the available GSM network.

Al-Ali and Al-Rousan presented a design and implemented Java-based automation system through World Wide Web. It has got a standalone embedded system board integrated into a PC-based server at home [10].

Andrew, the writer of the book "Raspberry Pi Home Automation with Arduino", introduced Raspberry Pi and hoe to use it for home automation. He described the use of Raspberry Pi with Arduino for Linux operating system. The book describes some home appliances automatic control. First he described how to install all the necessary equipment and all required conditions. Firstly, he gave the history of Arduino and Raspberry Pi with all sockets, required shield specifications and all necessary ports with power supply. We were able to find necessary data of Arduino since were used it. Good examples of thermometer, opening and closing of curtain based on light and

temperature data are given. On the other hand, he didn't show any example related to security of home [10].

Annan Zhu, Peijie Lin and Shuying Cheng of Fuzhou University of China described the remote control system of home appliances using android phone through GSM network (2012 International Conference on Control Engineering and Communication Technology).They focused on the design of Android terminal, the communication between ARM and GSM module. Minimizing the difficulty in supplying the appropriate low-voltage DC for MCU and wireless module by a single live wire was also one of the tasks. Here we have found only the controlling of appliances using android, nothing more than that [12].

An article of Singapore by the authors Thomas Gonnot, Won-Jae Yi, Ehsan Monsef and Jafar Saniie showed a protocol standard for home automation system called Home Automation Device Protocol (HADP). Wi-Fi, Bluetooth 4.2, ZigBee IP, 6LoWPAN, IEEE 802.15.4 standards, and Ethernet network layer supporting IPv6 protocol were their components. Mainly they proposed a protocol if-this-then-that. So it connected many devices together using WIFI connection [13].

K. M. Abubeker, Jose J Edathala, Shinto Sebastian from India introduced PIR sensors and an intelligent power saving mode in ATM counter. This uses pyro-electric infrared sensors to detect pedestrians and the ATM users. The system is controlled by the real time clock RTC DS 1307 to differentiate the day and night time with a surveillance video. This gives an excellent security to the ATM counter. According to an article by Suresh, J. Bhavya, S. Sakshi, using PIR sensor with Arduino Mega is a cheap and effective security system that can inform about an intruder through text message. In India, people largely rely on personal security guard for home security. Same goes for Bangladesh. They made this easier and cheaper than costly surveillance video cameras [11].

Again, there is another article to prevent theft in home byP. Satya Ravi Teja, V. Kushal, A. SaiSrikar titled "Photosensitive security system for theft detection and control using GSM technology". They did it using LDR (Light Dependent Resistor) based sensor which acts as an electronic eye for detecting the theft or attempt. [14].

These are the few previous researches done on similar topic. It is mentioned earlier that most of them lack either the security system or the controlling system. We avoided the face recognition system for home security because people are trying to minimize a lot of error in recognition of face. The face has to be at a particular angle so that the computer is able to recognize. Therefore fingerprint recognition module is more reliable for door security. Some of these projects are done with Arduino, some of them are done with Raspberry Pi. The components, like sensors and shields are also of different models. Our aim is to combine those systems together i.e. controlling home appliances and security system with Arduino keeping it as cheap as possible.

CHAPTER THREE

PROJECT PARAMETERS

3.1 Introduction

To begin with the project, let's get the idea of all the components that we used for the project. It is very important to know all the information about both hardware and software specifications. The components we are using are as follows:

1. Arduino UNO (ATmega328)
2. Sensors:
    a. Gas Sensor MQ-2 (SEN 00091)
    b. PIR Motion Detector (HC – SR501)
    c. LM 35 Temperature Sensor
    d. Light Dependent Resistor (LDR) sensor
3. LCD Display with header (16x2)
4. Breadboard
5. Adapter (AC to DC 12V)
6. Buzzer
7. LED Light

3.2 Arduino Nano (ATmega328)

3.2.1 Introduction to Arduino ATmega328 Microcontroller

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC

adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards. The ATmega328 has 32 KB (with 0.5 KB occupied by the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library). Arduino Uno has a number of facilities for communicating with a computer, another Arduino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, onWindows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1)

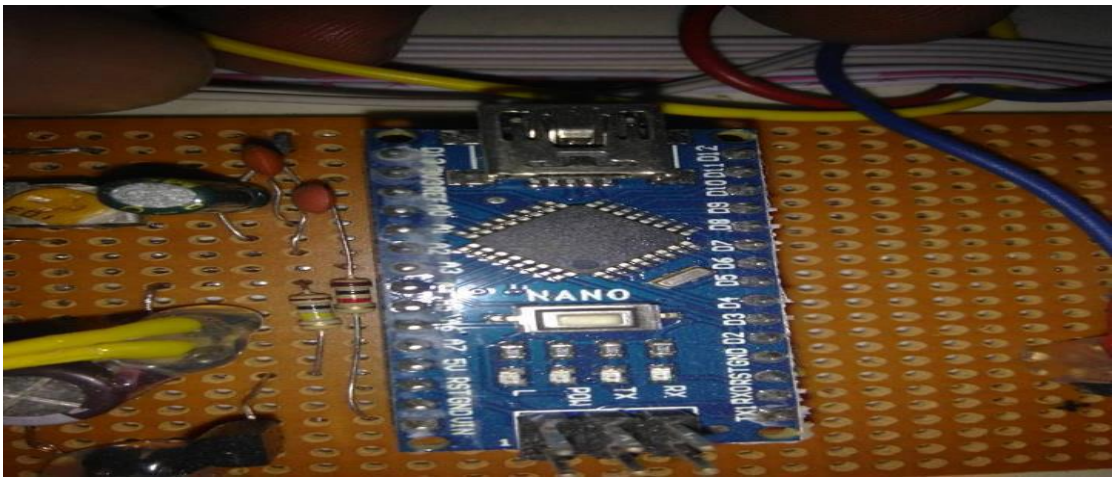


Figure 3.1: Mini USB Nano ATmega328 Microcontroller

3.2.2 Power of Arduino ATmega328

The Arduino Uno board 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 (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator 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 opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through 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 supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- 3V3. 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 microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

3.2.3 Input and Output of Arduino ATmega328

See the mapping between Arduino pins and ATmega328P ports. The mapping for the Atmega8, 168, and 328 is identical. 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 pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

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 Serial chip.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the 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 driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (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 and the analogReference() function. There are a couple of other pins on the board:

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

➢

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

3.2.4 AVR Architecture of Arduino ATmega328 Microcontroller

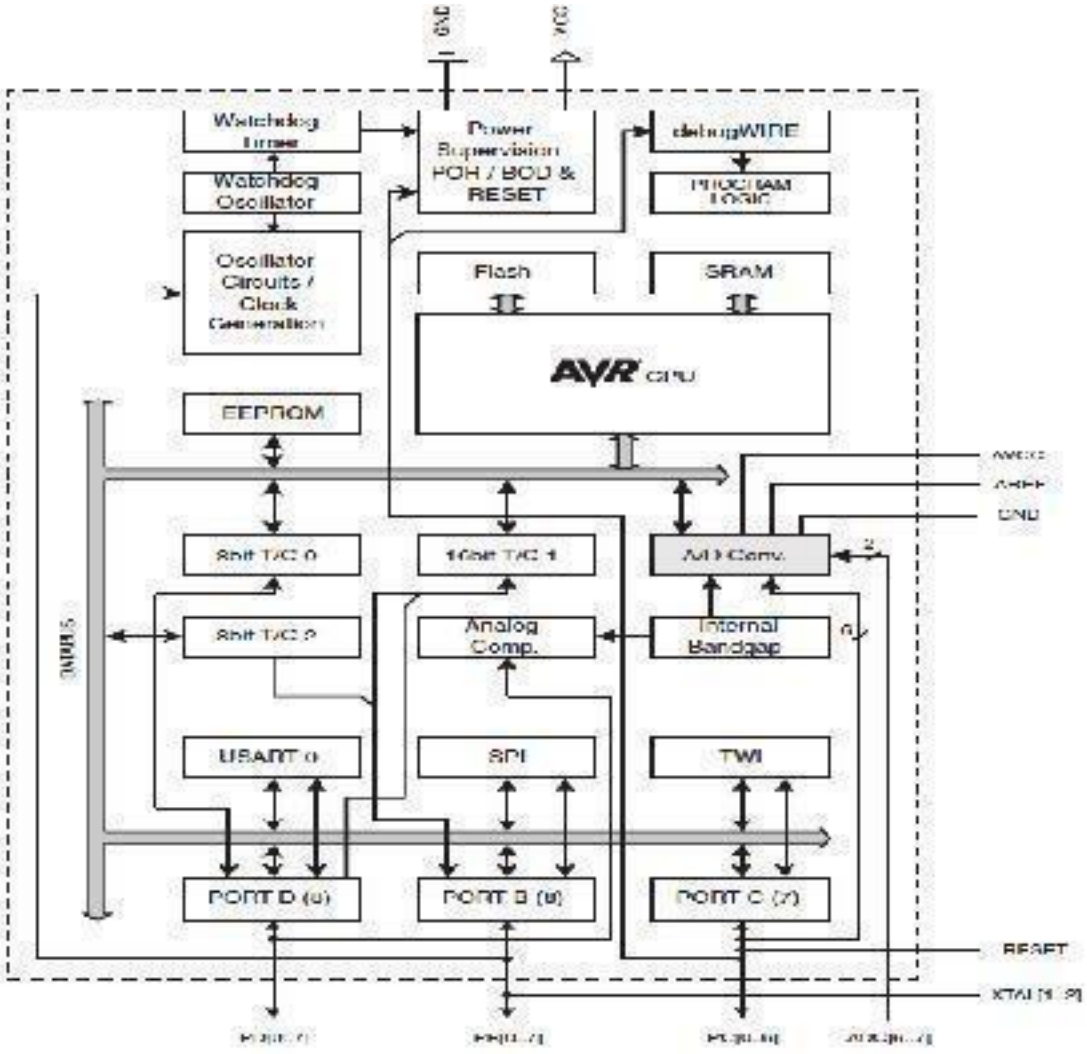


Figure 3.2: AVR Architecture of Arduino ATmega328 Microcontroller

3.2.5 AVR Architecture Specification

❖

Clocks and Power

- CPU-Details coming
- Flash – program memory-256K
- SRAM – data memory-8K
- EEPROM

3.2.6 Memory

- Flash (256K) (15-bit addresses)
  - Program memory – read only Non-volatile
  - Allocate data to Flash using PROGMEM keyword
- **SRAM (8K)**
  - Temporary values, stack, etc.
  - Volatile
  - Limited space!
- **EEPROM (4K)**
  - Long-term data

Table 3.1: Details of Arduino UNO (ATmega328) Microcontroller.

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 boot loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

3.3 Brief Introductions to the Sensors.

Introductions and overview of the sensors we used are given below:

3.3.1 Gas Sensor MQ 2:

MQ2 gas sensor can be used to detect the presence of LPG, Propane and Hydrogen, also could be used to detect Methane and other combustible steam, it is with low cost and suitable for different application

Features:

- Operating Voltage is +5V
- Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and even methane
- Analog output voltage: 0V to 5V
- Digital Output Voltage: 0V or 5V (TTL Logic)
- Preheat duration 20 seconds
- Can be used as a Digital or analog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

Figure 3.3: MQ 2 Gas Sensor.

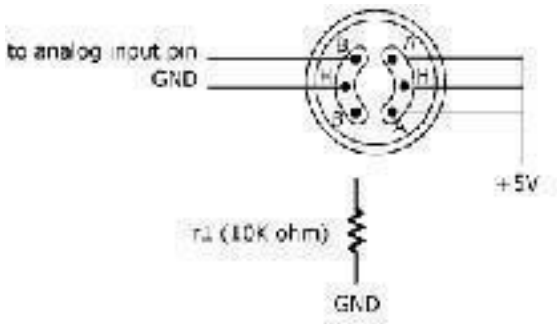


Figure 3.4: Pin out diagram of gas sensor.

Description:

Table 3.2: Description of Gas sensor

For Module		
1	Vcc	This pin powers the module, typically the operating voltage is +5V
2	Ground	Used to connect the module to system ground
3	Digital Out	You can also use this sensor to get digital output from this pin, by setting a threshold value using the potentiometer
4	Analog Out	This pin outputs 0-5V analog voltage based on the intensity of the Gas
For Sensor		
1	H -Pins	Out of the two H pins, one pin is connected to supply and the other to ground
2	A-Pins	The A pins and B pins are interchangeable. These pins will be tied to the Supply voltage.
3	B-Pins	The A pins and B pins are interchangeable. One pin will act as output while the other will be pulled to ground.

3.3.2 PIR Motion Detector (HC – SR501):

Table 3.3: Pin Configuration of Motion Sensor.

Pin Number	Pin Name	Description
1	Vcc	Input voltage is +5V for typical applications. Can range from 4.5V- 12V
2	High/Low Output (Dout)	Digital pulse high (3.3V) when triggered (motion detected) digital low(0V) when idle(no motion Detected
3	Ground	Connected to ground of circuit

Figure 3.5: (a) PIR Motion Detector (Top view). (b) PIR Motion Detector (bottom view).

PIR Sensor Features:

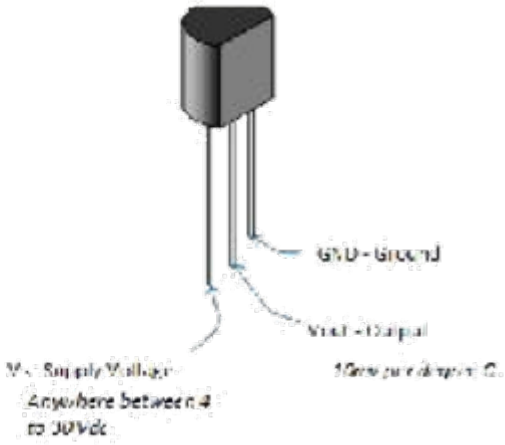
- Wide range on input voltage varying from 4.V to 12V (+5V recommended)
- Output voltage is High/Low (3.3V TTL)
- Can distinguish between object movement and human movement
- Has to operating modes - Repeatable(H) and Non- Repeatable(H)
- Cover distance of about 120° and 7 meters
- Operating temperature from -20° to +80° Celsius

PIR Sensor Applications:

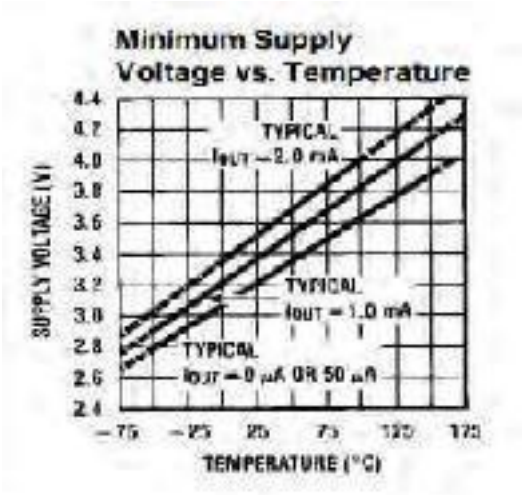
- Automatic Street/Garage/Warehouse or Garden Lights
- Burglar Alarms
- Security cams as motion detectors
- Industrial Automation Control

3.3.3 Thermistor 10k Temperature Sensors:

LM35 is a precision integrated circuit temperature measuring device. Its output is voltage which is linear to the temperature. LM35 device draws only 60 μA from the supply, it has very low self-heating of less than 0.1°C in still air.



(a)



(b)

Figure 3.6: (a) Pin configuration of LM35 temperature sensor. (b) The graph shows linear relationship of applied voltage and temperature.

FEATURES: This sensor is easy to use because it is already calibrates into Celsius.It is very low costing. It can take -55o to +150oC range. It takes only 0.1W for 1mA load.

LM35 Temperature Sensor Applications:

- Measuring temperature of a particular environment
- Providing thermal shut down for a circuit/component
- Monitoring Battery Temperature
- Measuring Temperatures for HVAC applications.

3.3.4 LDR lighting sensor:

The Light Dependent Resistor (LDR) is just another special type of Resistor and hence has no polarity. Meaning they can be connected in any direction. They are breadboard friendly and can be easily used on a perf board also.

The symbol for LDR is just as similar to Resistor but adds to inward arrows as shown above. The arrows indicate the light signals.

Figure 3.7: LDR sensors.

LDR Features

- Can be used to sense Light
- Easy to use on Breadboard or Perf Board
- Easy to use with Microcontrollers or even with normal Digital/Analog IC Small, cheap and easily available

Applications:

- Automatic Street Light
- Detect Day or Night
- Automatic Head Light Dimmer
- Position sensor
- Used along with LED as obstacle detector
- Automatic bedroom Lights
- Automatic Rear view mirror

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3.5 LCD (Liquid Crystal 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. It is available in a 16 pin package with back light, contrast adjustment function and each dot matrix has 5×8 dot resolution.

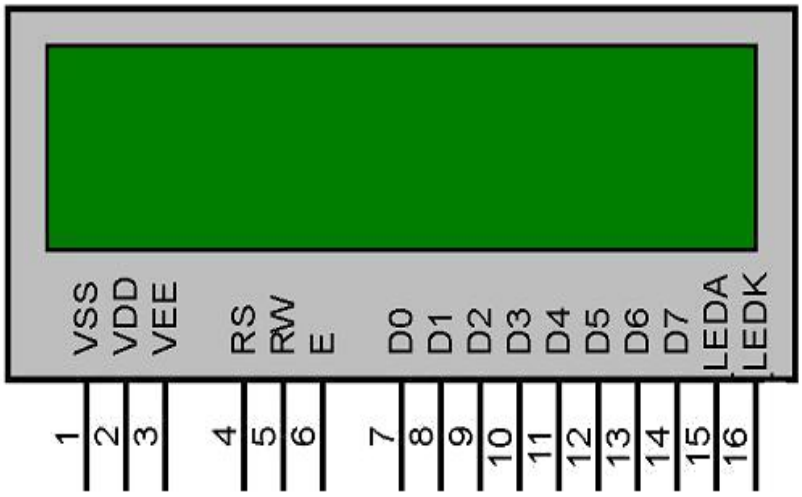


Figure 3.8: Liquid Crystal Display

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD

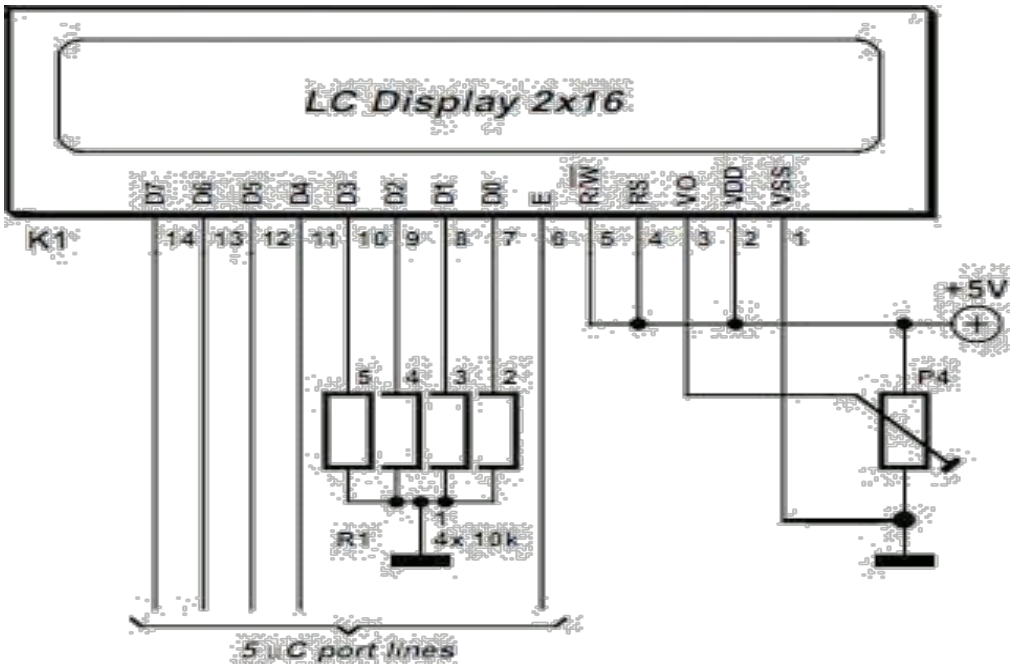


Figure 3.9: Connection diagram of LCD

3.5.1 Pin Description of LCD:

Table 3.4: Pin Description of LCD

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register	Register
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4

3.6 Buzzer:

This module is a low cost alarm buzzer called Piezo Buzzer. This device is the alarm for this system. It starts ringing when temperature increases very high and smoke is detected. It also starts ringing when PIR sensor is high.

Figure 3.10: Piezo Buzzer.

CHAPTER FOUR
Hardware and Software Implementation

4.1 Hardware Implementation:

An Arduino board consists of an Atmel 8-bit AVR microcontroller with complementary components to facilitate programming and incorporation into other circuits. An important aspect of the Arduino is the standard way that connectors are exposed, allowing the CPU board to be connected to a variety of interchangeable add-on modules known as shields. Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I²Cserial bus, allowing many shields to be stacked and used in parallel. Official Arduinos have used the megaAVR series of chips, specifically the ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega2560. A handful of other processors have been used by Arduino compatibles. Most boards include a 5 volt linear regulator and a 16 MHz crystal oscillator (or ceramic resonator in some variants), although some designs such as the LilyPad run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer. This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer.

At a conceptual level, when using the Arduino software stack, all boards are programmed over an RS-232 serial connection, but the way this is implemented varies by hardware version. Serial Arduino boards contain a level shifter circuit to convert between RS-232-level and TTL-level signals. Current Arduino boards are programmed via USB, implemented using USB-to-serial adapter chips such as the FTDI FT232. Some variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods.

(When used with traditional microcontroller tools instead of the Arduino IDE, standard AVR ISP programming is used.)

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila, Duemilanove, and current Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs. These pins are on the top of the board, via female 0.10-inch (2.5 mm) headers. Several plug-in application shields are also commercially available.

The Arduino Nano, and Arduino-compatible Bare Bones Board and Boarduino boards may provide male header pins on the underside of the board to be plugged into solderless breadboards.

There are many Arduino-compatible and Arduino-derived boards. Some are functionally equivalent to an Arduino and may be used interchangeably. Many are the basic Arduino with the addition of commonplace output drivers, often for use in school-level education to simplify the construction of buggies and small robots. Others are electrically equivalent but change the form factor, sometimes permitting the continued use of Shields, sometimes not. Some variants use completely different processors, with varying levels of compatibility.

Components can be divided into two categories: sensors and modules. All of them are described below:

4.1.1 Sensors:

All sensors are connected with the microcontroller through wires. All input voltages are applied from the microcontroller with the computer. They are described below with diagram. In this section hardware implementation of all sensors are described below.

4.1.2 Gas Sensor:

In the MQ series of gas sensors, there is a small heater inside with an electro-chemical sensor. Connect both A pins together and B pins together then apply VCC to the coupled A or B pin. We applied GND through variable resistor RL (2K to 47K Ohms) to remaining coupled A or B pins. The heater pins H and H connected with VCC and GND.A and B pins shouldn’t be interconnected. The sensor mainly depends on the heating of the coil the heater uses 5VDC supply. The sensor is

directly connected to the Arduino Mega. The output is an analog signal; it is read with an analog input. Gas sensor output pin is connected with ardiuno mega digital pin 22.

4.1.3 PIR Motion Detector:

The hardware implementation includes two versions of applications with different power switching outputs and power supply: relay power output version and triac power output version. In this system we have used 2 PIR sensors; one for the unusual motion detection inside the room and another for automatic light ON and OFF when someone enters into the room. PIR security sensor is connected with digital pin 26.

4.1.4 LM35 Precision Temperature Sensor:

There are only three pins. The output pin (pin 2) is connected to the analog input of Arduino board.

4.2 16x2 LCD Display:

A register select (RS) pin that controls where in the LCD's memory data will be writing is connected with analog pin 9.An Enable pin that enables writing to the registers is connected with analog pin 8.Data pins (D4 -D7) are connected with corresponding analog pins (4, 5, 6, 7).Power supply pins +5V and GND is connected in the breadboard.

Pin configuration table: All connections of the sensors and modules are givenbelow:

LCD Display pins:

Table 4.1: Pin connection of LCD display with microcontroller.

SL	Ardiuno UNO	LCD
1	4	D7
2	5	D6
3	6	D5
4	7	D4
5	8	En
6	9	Rs

4.3 Software implementation:

The Arduino Mega2560 can be programmed with the Arduino software. The Atmega2560 on the Arduino Mega comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header .The Arduino integrated development environment (IDE) is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring projects. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a "sketch".

Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier. Users only need define two functions to make a runnable cyclic executive program.

Arduino C Programs

- Arduino calls these “sketches”
  - Basically C with libraries
- Program structure
  - Header: declarations, includes, etc.
  - setup()
  - loop()
- Setup is like Verilog initial
  - executes once when program starts
- loop() is like Verilog always
  - continuously re-executed when the end is reached

4.3.1 Sensors:

A sensor is an electronic device that responds to any change in physical phenomenon or environmental variables like heat, pressure, humidity, movement etc. The sensors are all analog-to-digital sensors. These sensors produce continuous output signal. Computer cannot read or analyze continuous values so all the sensors need to be calibrated with respect to some reference value or standard for accurate measurement. After that the signal produced by the sensor is analyzable. One of the

most important characteristics of sensors is that the output should change linearly with the input. The working process of the sensors we used is given below:

4.3.2 Gas Sensor (SEN 00091):

The sensor takes three minutes time before the reading becomes stable. This is programmed with the function analogWrite( ) and delay. When gas is detected it sends a message to the mobile through GSM module and rings the fire alarm.

4.3.3 PIR Motion Detector (HC – SR501):

The main part of the algorithm is to focus on measuring voltage from PIR sensor. It also includes input measurement filtration SWSD_DeInit( ) and SNSD_Init( ) used for deinitialization and initialization, then find the output voltage by filtration of signal from PIR sensor.

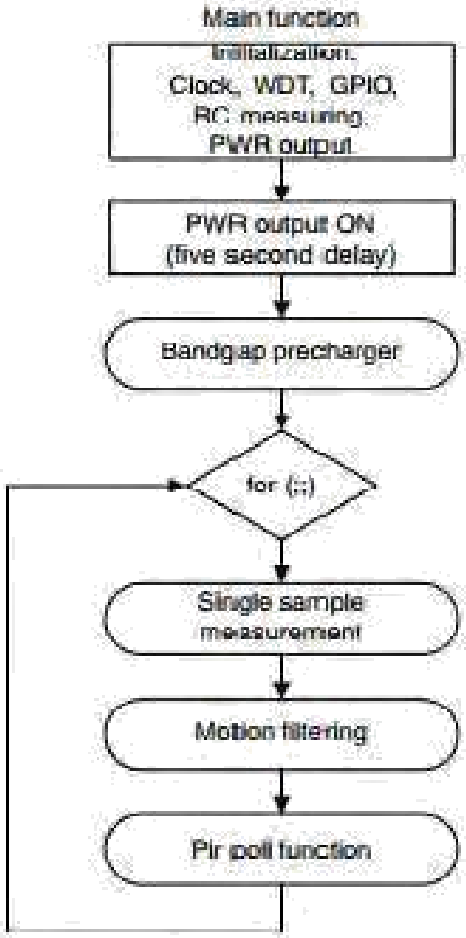


Figure 4.1: Motion detection software flowchart.

4.3.4 LM 35 Precision Temperature Sensor:

This sensor reads the temperature of the room and displays it to the LCD monitor. The system sends text message through GSM to the Android phone. The temperature is shown in Celsius. It starts with the function analog Read( ) and the formula for Celsius is

ADC value=sample*1024/reference value.

CHAPTER FIVE

WORKING PRINCIPLE

5.1 Working Principle

In this project we used the Arduino ATmega328P Microcontroller. It is connected to the all parameters and controls those parameters. For wireless control we can use a GSM module for signal transmission. We can use some input and output device. Input devices as Gas detect sensor, Motion sensor, LDR sensor, Fire alarm sensor and output devices is Light, fan, TV. Whenever any fault occur in this system then microcontroller sense that and send notification from GSM module. If gas sensor senses any gas or smoke it gets a high signal and send it microcontroller then microcontroller find it and send us notification from GSM module. Also LCD display is show that which device fault detected. Again if catch fire the temperature sensor sense it and send notification to the phone.

In the motion sensor area if any movable objects are find the sensor then microcontroller get high signal and send notification. We can use the LDR for outside light control, when night the lights on automatically and when day the lights off automatically. In the other devices like lights, fan, TV is on/off from Android application. When the system runs the lights are off. If we want to on light then we can use an Android application. When we press light on then GSM module receive the command and send to microcontroller to on lights. Similarly fan or TV controlled from Android application.

5.2 Block Diagram of Home Security System

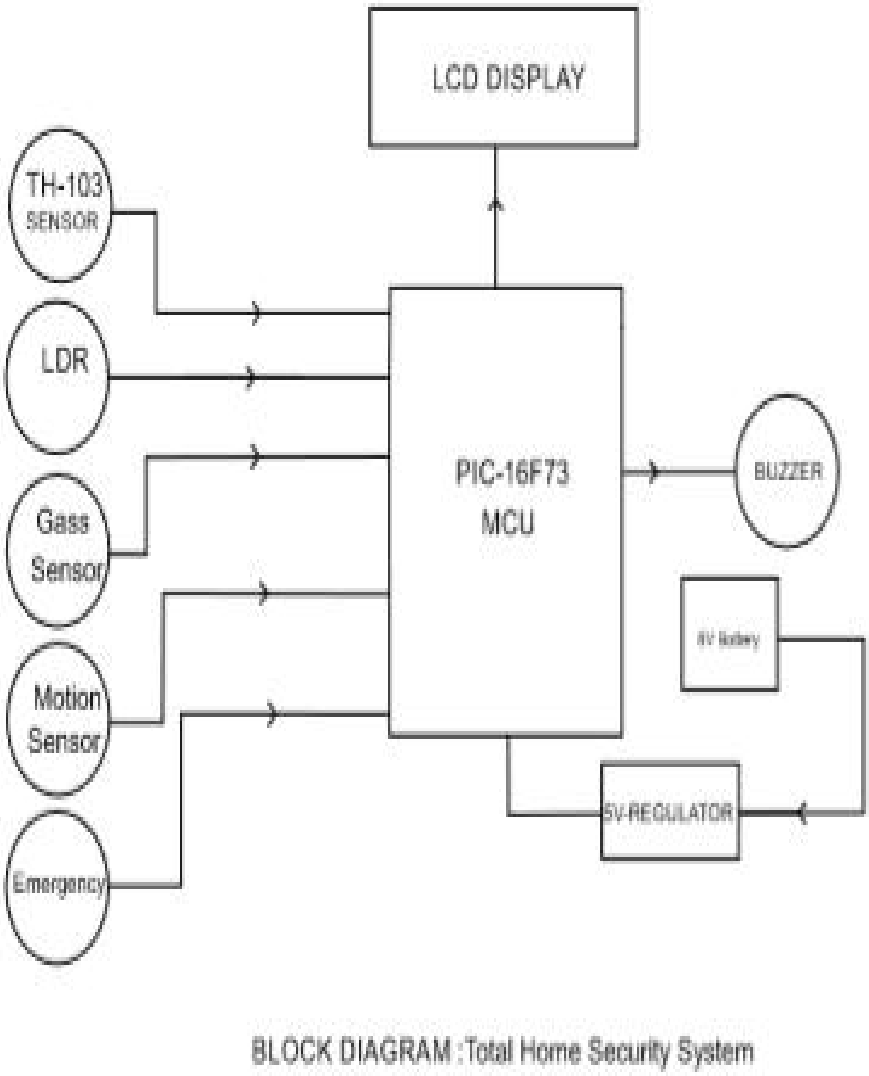


Figure 5.1: Block Diagram of Home Security System.

5.3 Circuit Diagram of Home Security System

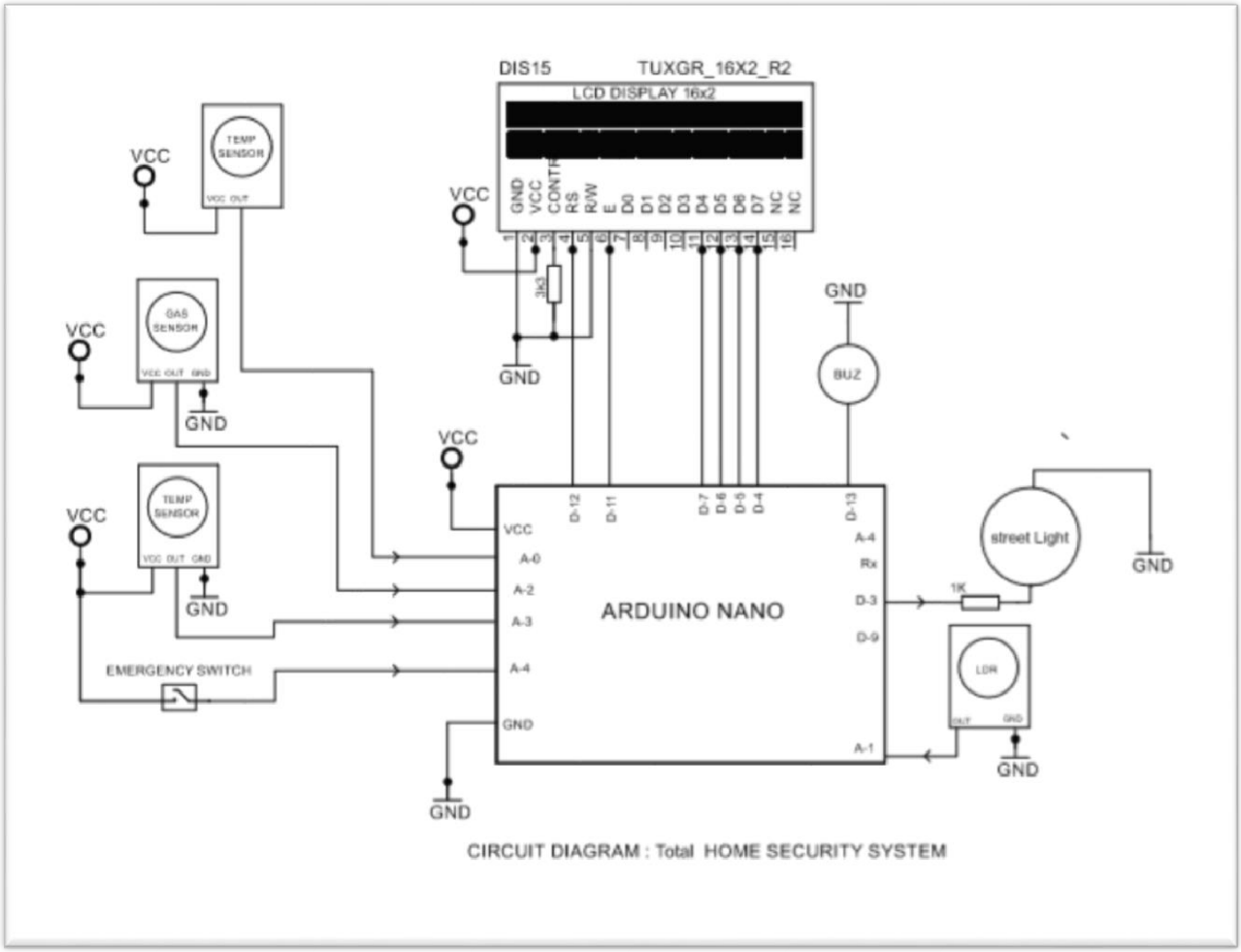


Figure 5.2: Circuit Diagram of Home Security System.

5.4 Arduino Nano Microcontroller and Control Unit

A control unit is a main part of the system that controls its operation. In this device Microcontroller ATmega328 is used as the controller unit which controls the relay. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega2560 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The firmware uses the standard USB COM drivers, and no external driver is needed.

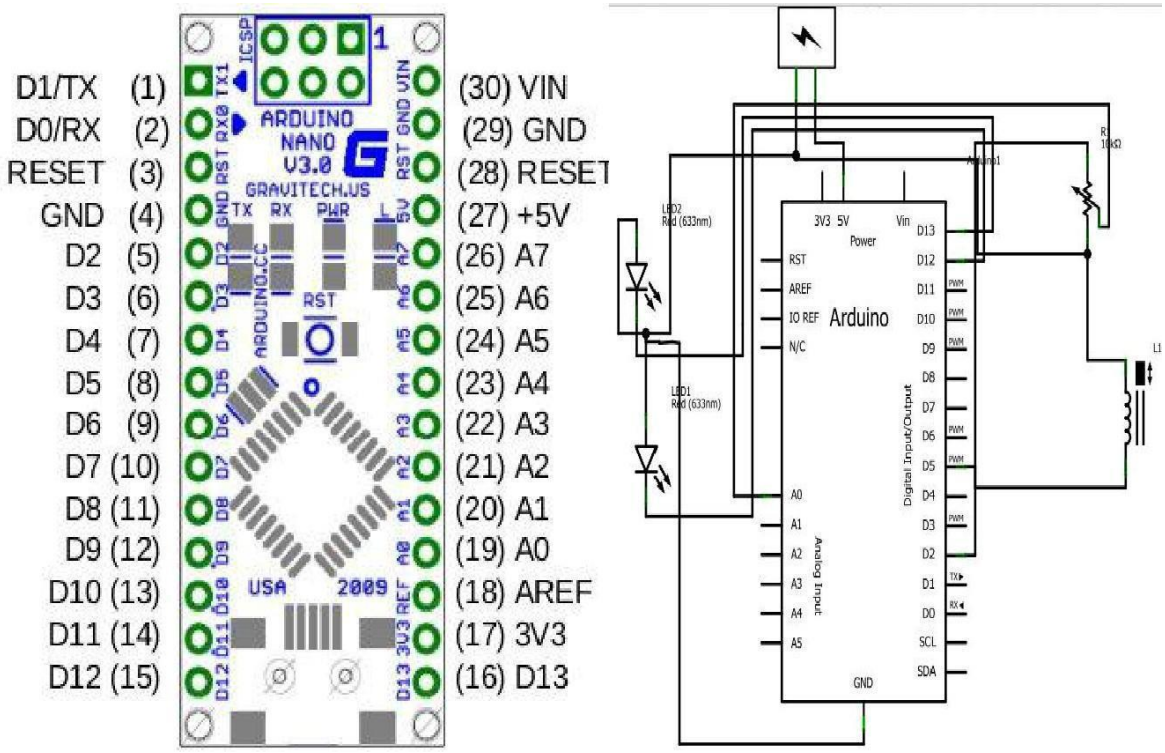


Figure 5.3: ATmega2560 Microcontroller.

5.5 Apparatus

1. Arduino UNO (ATmega328P)

2. Sensors:

   a. Gas Sensor MQ-2 (SEN 00091)

   b. Motion Detector (HC – SR501)

   c. LM 35 Temperature Sensor

d. Light Dependent Resistor (LDR) sensor

3. GSM Shield SIM800L
4. LCD Display with header (16x2)
5. Breadboard
6. Adapter (AC to DC 12V)
7. Buzzer
8. LED Light

5.6 Advantages

- First and foremost installation cost is least to establish the system.
- For developing the system users need to install the little circuit board containing a low cost microcontroller, motion sensor etc.
- Its program installation is very easy.
- Home automation is possible to cut down electricity bill; since it saves energy.
- It is obvious that today‘s world is busier than in days what went before. It saves the time.

5.7 Applications

- This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled in home.
- Smart Home Automation system used for controlled home parameters and security purpose.
- By some modifications this project can be used in any Institution.
- This project can be used in hospital or Clinic where need to be advance security.

5.8 List of Components with price:

Table 5.1: List of Components with price

SL no	Components	Price in TK
1	Arduino UNO	1,150.00
2	LCD Display	400.00
3	Power supply	500.00
4	PIR Motion sensor	300.00
5	Gas leak sensor	400.00
6	Temperature sensor	200.00
7	Buzzer	120.00
8	LEDs	100.00
9	sample PCB	800.00
10	Other parts	1,500.00
11	Accessories cost	2,000.00
12	Total	7470.00
13	**Market price=**	**20,000.00**

CHAPTER SIX

RESULTS AND ANALYSIS

6.1 Results

After connecting and programming all the components with the, we conducted the experiment. We have run all the components according to the proposed system. We have designed a prototype of a house placing inside room and outside door. All modules and microcontroller are kept together with a lot of wires.

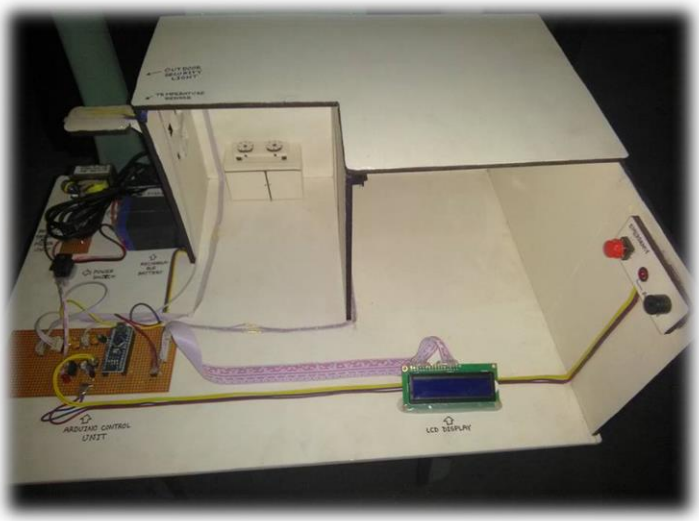


Figure 6.1: View of the home automation system showing different sensors and modules placed in the required places.

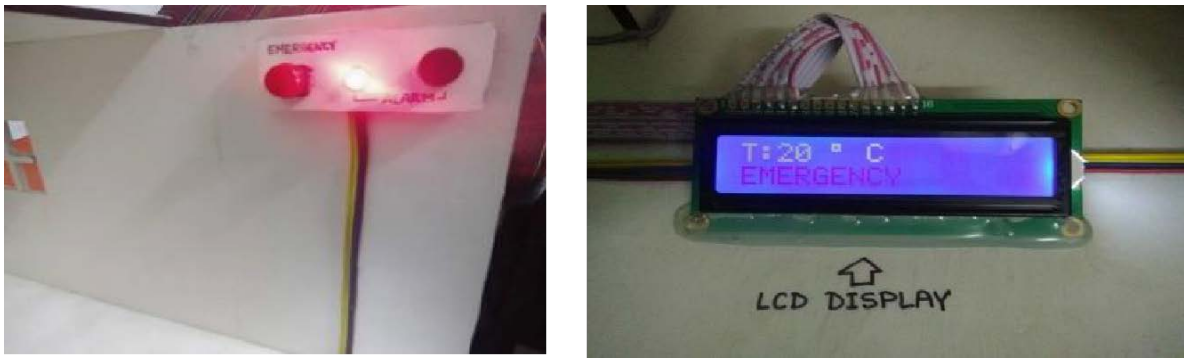
- Road Lamp is turned ON night time and Road Lamp is turned OFF Day time.

(a) **(b)**

Figure 6.2: (a) Road Lamp (LED) OFF day time. (b) Road Lamp ON night time.

➢

Emergency is turned ON and OFF using text command



(a) **(b)**

Figure 6.3: (a) Light (LED) OFF. (b) Light ON.

When temperature is very high; temperature is measured through LM35 sensor. To test fire alert system, we have used a lighter and hold it near the LM35. The LCD display shows “gas leakage” when smoke and harmful gas is detected. At the same time it is notified with text message. LCD display shows theft detection from the second PIR sensor. Intruder alert is notified. When all the sensors are high the Piezo Buzzer starts ringing. When there is fire inside the house notification of both high temperature and smoke is sent through signal.

(a) **(b)**

Figure 6.4: (a) Testing fire near the temperature sensor. (b) Notification of fire.

The system sends text and also displays it to the monitor when there is gas leakage inside the house.

(a) **(b)**

Figure 6.5: (a) Notification in sensor. (b) Warning in the LCD display.

Figure 6.6: (a) Testing the PIR sensor for detecting intruder. (b) LCD display showing thief detected.

6.2 Analysis

This thesis is not a complete project. This is a prototype of another larger system for lager house. There are a lot of important matters to observe in this project. After performing all the tasks we have seen that the voltage and current is not the same always as given in the components' specifications. We have used a lot of devices that that need high and constant supply. Otherwise there is delay in the task. There is also a risk of destroying the devices if there is very high voltage supply .The number of wires that we have used in this project doesn't make significant power loss but the modules need constant power supply. In case of the GSM module, it needs 3A current to send and receive text message. Otherwise no communication is possible. From the test we conducted it seems the mobile communication is very fast .To maintain a constant power supply, we had to add DC-DC buck converter and an adapter. There will be a problem if there is no electricity or internet .All sensors need time to give a stable reading like, temperature and motion sensor. Again, in processing text command, it has maximum 4 seconds delay. The sensitivity of the sensors can be varied according to the need of the user. The whole program is written in a single Arduino IDE so it is very easy for the user to change any kind of function. Overall the use of this automation system is easy, flexible and reliable. We can easily add extra features with system.

CHAPTER SEVEN

Discussion

From the project carried out, we find the system effectively low cost and user friendly. The whole house remains under the user's control all the time. In future we may find some devices that are more reliable, faster and cheaper. We have tried to make a good controlling and security system. The components that we have used can be changed with the latest device but it should have the right software and the right driver. The system is very easy to install. For this, just need internet connection and for motion detection a motion sensor. Home Security is definitely a resource which is capable of make a home security. People can be in command of their electrical devices via these Home security devices and set up the controlling actions in the workstation. We think this device have high potential for marketing in the future. All the tasks of this project are done successfully. We were able to fulfill our goals as proposed in this system. We had our limitations in time and expenses but we hope that it will serve as basis of other latest systems as that of western countries. Almost all scientific and latest technologies have both good and bad sides. That doesn't mean we should avoid technology. This type of work inspires us to do better for our country. Smart Technology is a blessing for our country. We should try to avoid the bad consequences and use it for our betterment.

CONCLUSION

This project is based on microcontroller, due to which hardware requirement is reduced. Hence we can conclude that the required goals and objectives of our project have been achieved. It provides the flexibility & system reliability with low cost as well as less maintenance. It provides remote access to the system to deliver service at any time of the day. With this system, we can control as well as monitor the devices by LCD display.

Appendix

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(12,11,10,9,8,7);

#define Fan 5
#define Light 4
#define TV 6
#define BUZ 13
#define STRL 3
#define SERIESRESISTOR 1000
#define TEMPIN A0
#define GASPIN A2
#define MPIN A3
#define LDRPIN A1
#define EPIN A4

int temp=0,i=0,cnt,cnt1;
int led=2;
int LDR,GAS=0,MOTION,EMERGENCY,almstp=0;
int tp;
char str[15];
void setup()
{
  lcd.begin(16,2);

  lcd.setCursor(0,0);
  lcd.print(" HOME SECURITY ");
  lcd.setCursor(0,1);
  lcd.print(" AND AUTOMATION ");
  delay(1500);
  lcd.clear();
  lcd.print("Circuit Digest");
```

```
  delay(1000);

  lcd.clear();

  SendMessage1();
}
////////////////////////////////////////////////////////////////////////
////////////////////////////////////////////////////////////////////////
void loop()
{
  DISPLAY1();
  SENSOR();
  }
////////////////////////////////////////////////////////////////////////
////////////////////////////////////////////////////////////////////////
void DISPLAY1()
{
    lcd.setCursor(0,0);
    lcd.print("T:");
    lcd.setCursor(2,0);
    lcd.print(tp);
    lcd.setCursor(5,0);
    lcd.print((char)223);
    lcd.setCursor(6,0);
    lcd.println("C         ");

    delay(100);
}
////////////////////////////////////////////////////////////////////////
void SENSOR()
{
  LDR = analogRead(LDRPIN);
  MOTION = analogRead(MPIN);
  tp = analogRead(TEMPIN);
```

```
 tp = (tp / 10);
 GAS=analogRead(GASPIN);
 EMERGENCY=analogRead(EPIN);

 ////////////////////////////
 if( tp > 34 )
 {
  almstp =1;
  alarm();
 }
 if(MOTION > 450)
 {
  almstp =2;
  alarm();
 }
 if(LDR > 820)
 digitalWrite(STRL, HIGH);
 if(LDR < 800)
 digitalWrite(STRL, LOW);

 if(GAS > 300)
 {
  almstp =3;
  alarm();
 }
 if(EMERGENCY > 100)
 {
  almstp =4;
  alarm();
 }
 }
 ////////////////////////////
}
```

```
//////////////////////////////////////////////////////
void alarm()
{
  int alm=0;
  for(alm=0;alm < 6;alm++)
  {
     SENSOR();
     digitalWrite(Light, LOW);
     digitalWrite(Fan, LOW);
     digitalWrite(TV, LOW);

     digitalWrite(BUZ, HIGH);
     lcd.setCursor(0,1);
     lcd.print("                ");
     delay(300);
     digitalWrite(BUZ, LOW);

     lcd.setCursor(0,0);
     lcd.print("T:");
     lcd.setCursor(2,0);
     lcd.print(tp);
     lcd.setCursor(5,0);
     lcd.print((char)223);
     lcd.setCursor(6,0);
     lcd.println("C        ");

     if(almstp==1)
     {
      lcd.setCursor(0,1);
      lcd.print("FIRE DETECTED ");
     }
     if(almstp==2)
```

```
      {
       lcd.setCursor(0,1);
       lcd.print("THIEF DETECTED ");
      }
      if(almstp==3)
      {
       lcd.setCursor(0,1);
       lcd.print("GAS DETECTED ");
      }
      if(almstp==4)
      {
       lcd.setCursor(0,1);
       lcd.print("EMERGENCY   ");
      }
      ////////////////////////////
      delay(300);
  }
  almstp=0;
  lcd.setCursor(0,1);
  lcd.print(" OK   OK   OK   ");
}
```

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