BUILDING SECURITY SYSTEM

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in partial fulfilment for the requirements of a B.E Degree in

Electrical (Telecom) Engineering

JUNE 2015

ABSTRACT

Intrusion detection systems are an integral part of most vital government as well as private buildings. System under discussion is location and ranging system using sensors to detect target along a prescribed route. When used as security surveillance system, an intruder is treated as target and the sensors are installed in the perimeter of protected area. The sensors are installed inside as well as outside the buildings to monitor any movement in the vicinity of the subjected building. Cameras will also be installed as a 2^{nd} tier measure to detect any unauthorized movement. The presence of a target will reflect back the infrared waves to the sensor. Sensors will inform micro controller, which will send a message to the user informing him about the unauthorised entry. User with the help of camera streaming will be able to discriminate between legitimate targets and changes due to undesirable targets such as animals.

Supervisor Certification

It is hereby certified that the contents and form of the project report entitled “Building Security System”, submitted by the syndicate of

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has been found satisfactory as per the requirement of the B.E. Degree in Electrical (Telecom) Engineering.

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DECLARATION

We hereby declare that no content of work presented in this thesis has been submitted in support of another award of qualification or degree either in this institution or anywhere else.

DEDICATED TO

Almighty Allah,

Faculty for their help

and our parents for their support

ACKNOWLEDGEMENT

Nothing happens without the will of Allah Almighty. We thank Allah Almighty for giving us knowledge and strength to accomplish this task successfully.

We would like to thank our project supervisor, Brig (Dr) Faheem Arif, without his support and encouragement; it would not have been possible to complete this project.

We would also like to thank our colleagues for helping in developing the project and people who have willingly helped us to the best of their abilities.

Last but not least, we are very thankful to our parents, who bore the difficult times with us. Without their consistent support and encouragement we would not have accomplished our targets successfully.

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LISTS OF ABBREVIATIONS

1. 3G Third Generation
2. AT89S52 Atmel Micro controller
3. CCTV Close Circuit Tele Vision
4. CMOS Complementary Metal Oxide Silicon
5. Co^2 Carbon dioxide
6. CPU Central Processing Unit
7. DVR Digital Video Recorder
8. EA External Access
9. Fax Facsimile
10. GND Ground
11. GPRS General Packet Radio Service
12. GSM Global System for Mobile
13. IP Internet Protocol
14. KB Kilo Bytes
15. LDR Light Dependant Resistor
16. LED Light Emitting Diode
17. MCS 51 Micro Controller Series
18. MHZ Mega Hertz
19. PIC Peripheral Interface Controller
20. PSEN Program Store Enable
21. RAM Random Access Memory
22. SFR Special Function Register
23. SMS Short Message Service
24. TCP Transmission Control Protocol
25. TEMP Temperature
26. TTL Transistor Transistor Logic
27. UART Universal Asynchronous Receiver/Transmitter
28. US Ultra Sonic
29. XTAL Crystal

CHAPTER 1- INTRODUCTION

1.1 Background/Motivation

In today's age of digital technology and intelligent systems, home automation has become one of the fastest developing application-based technologies in the world. The idea of comfortable living in home has since changed for the past decade as digital, vision and wireless technologies are integrated into it. Intelligent homes, in simple terms, can be described as homes that are fully automated in terms of carrying out a predetermined task, providing feedback to the users, and responding accordingly to situations. In other words, it simply allows many aspects of the home system such as temperature and lighting control, network and communications, entertainment system, emergency response and security monitoring systems to be automated and controlled, both near and at a distance. Automated security systems play an important role of providing an extra layer of security through user authentication to prevent break-ins at entry points and also to track illegal intrusions or unsolicited activities within the vicinity of the home.

It is well known that there is a requirement for detecting unauthorized movement for high security areas such as prisons, air ports, ware houses, freight yards and defence installation. The numerous types of apparatus presently employed in these applications all have disadvantages; especially during adverse environmental conditions. Pressure sensitive devices can be ineffective in cold climate due to penetration of frost. Both acoustic and seismic sensors are prone to false alarms due to gust of wind or the proximity of vehicular traffic. Buried cables cannot detect movement of 2 persons at the same time.

A number of perimeter protection systems are based upon the disturbance of electromagnetic fields. Some systems rely upon the change of capacitance between two sensing wires. Others rely upon the change of impendence of two wire transmission line. Most of these systems have relatively poor sensitivity because they attempt to detect very small changes in a large quantity which usually is a function of the physical deployment of the sensors. This can result in false alarms due to vibration, rain, snow or variation in temperature and humidity.

1.2 Problem Statement

"What is the solution for increasing terrorism, burglary and robbery incidents? In recent years, various target detection systems have been studied as a security system for important military and civilian facilities to prevent terrorist attacks and there is always a requirement for detecting unauthorized movement at high security areas. "

1.3 Project Description and Salient Features

System under discussion is a Microcontroller Based Security System which can be adopted at home, office, banks and various other places. The project will include different type of sensors including IR, Ultraviolet and Temperature. When used as security surveillance system, an intruder will be treated as target. It will also include network and communication part where we will connect the CCTV cameras to have Visual Access and GSM Module for the communication purpose. Our system will also be applying preventive measures through Android Application which will control certain devices within the vicinity of our place.

The designed system consists of three basic stages. Its working and manufacturing required three stages. The basic methodology also moves around these working stages. Following stages were carried out for the project

- Interruption
- Instruction
- Control

Interruption is detected by the sensors placed then the instruction is controlled by visualizing the situation by having direct connection through micro controller and to instruct the system for further response while the control actions is performed by using automation system. All this process contains equipment manufacturing and their connectivity with some existing devices to achieve the desired goal.

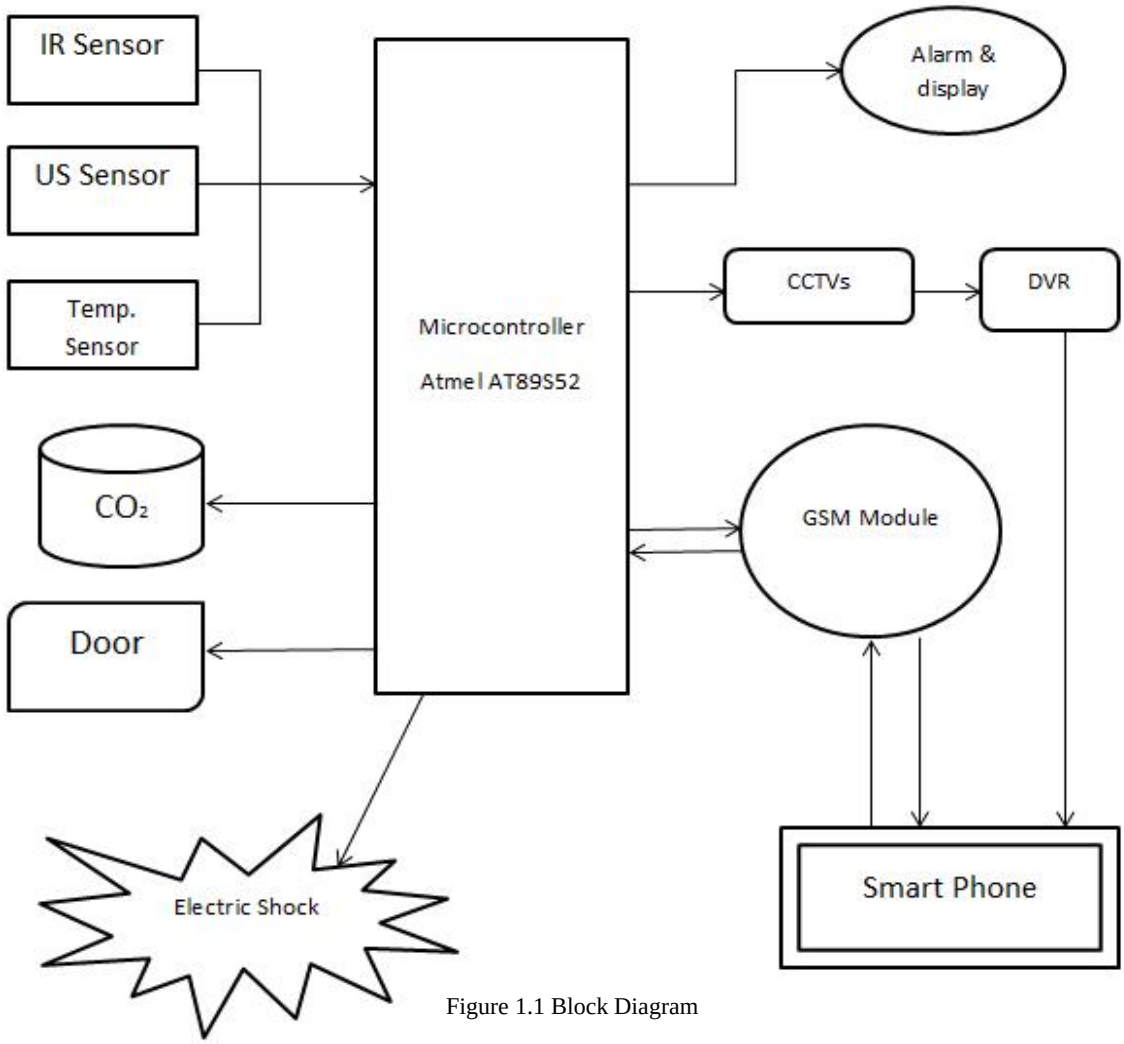


Figure 1.1 Block Diagram

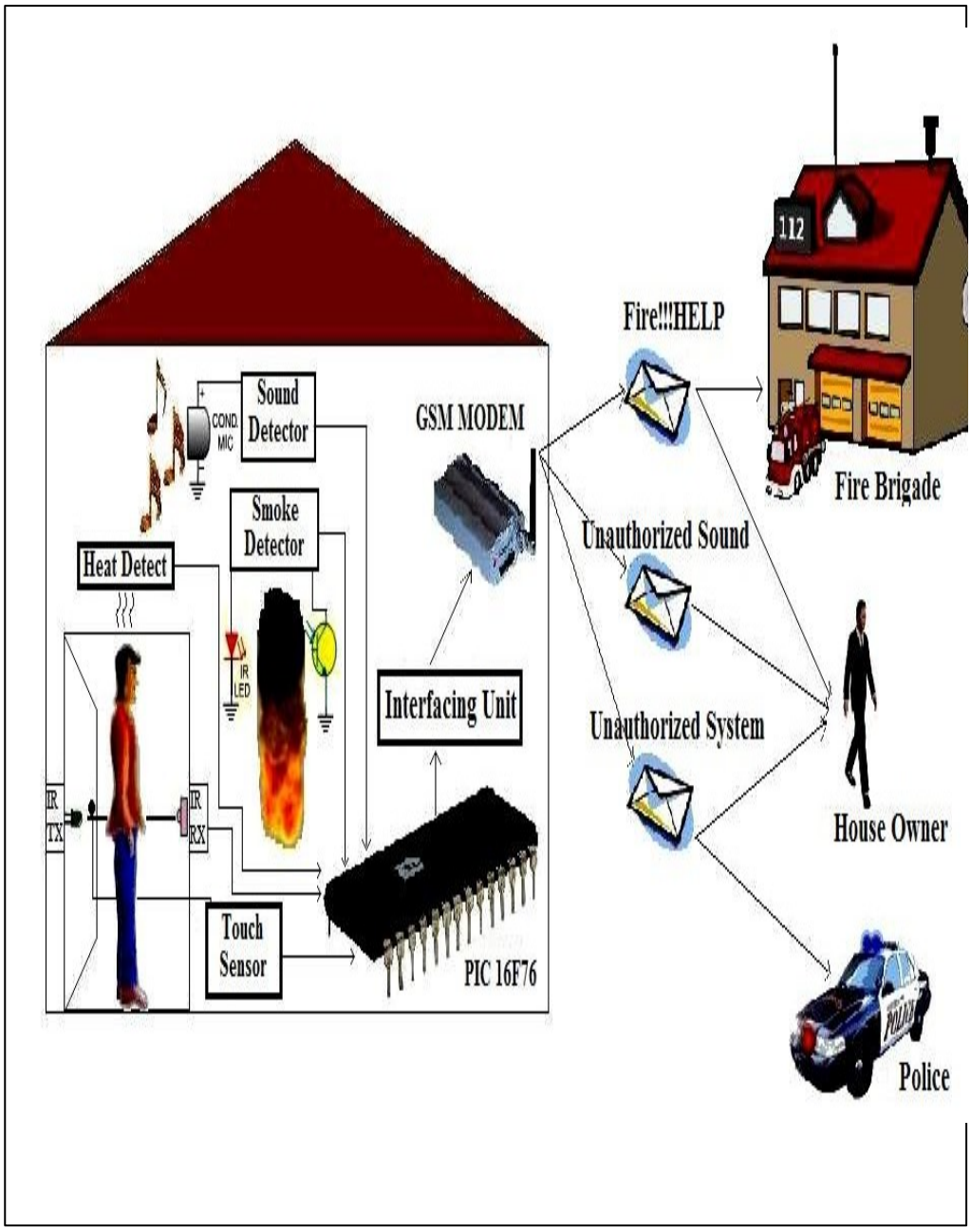


Figure 1.2

1.4 **Scope, Objectives, Specifications And Deliverables**

In this project, we will be designing a building security system which will use different scanners including IR, Ultraviolet and Temperature Sensors. CCTV cameras will also be used to monitor the situation. The control centre or the security handling authorities will be informed using GSM module by sending an SMS.

1.4.1 **Scope of Work**

The scope of work is :

- The basic study of the GSM Architecture
- Requisite study about the Micro-Controller Programming

- To make use of various sensors
- To have thorough knowledge about the components used in the project

1.4.2 **Objectives**

Project Objective
The objective of this project is to design an intelligent and innovative intrusion detection system to detect intruders by means of different sensors for area surveillance.

Academic Objective
The academic objectives include:

- To design a security system connected to different Wireless Technologies.
- To simulate different circuit designs of Sensors.
- To develop the hardware to secure a building from unauthorised access.
- To test the system on a model.

1.4.3 **Specifications**

Specifications and features of prototype are given below:

- Low input power to be used
- Continuous power supply used to excite the Sensors, Micro controller and Cameras
- Operating Temperature: -10°C to +55°C
- Intrusion location detection with 90 % accuracy
- Intruder following capability using cameras
- Uniform detection along coverage area
- Software-controlled android application
- Fire alarm

1.4.4 **Deliverables**

In case of any un-authorized entry, a back-up mechanism will be activated to stop the intruder. To make the response easy and fast we are going to design an android application as well. The three different steps performed by the system are

- Detection
- Information
- Prevention

The project basically involves the design of hardware architecture which includes securing a building, it will be implemented using PIC Micro controller interfaced with a GSM module. A small working model will be designed to show the working of secure building system. An android application will also be designed to make the design handy. The final design will be tested and practically implemented on a mini model. The project will be completed by Apr 2015.

CHAPTER 2-LITERATURE REVIEW

2.1 Overview

Our project mainly deals with understanding and implementing the present technologies. In this we have carried out a thorough understanding of the proposed solution to the problem given in various research papers and come to an ultimate design of our intrusion detection system. In addition to this basic understanding, design of a system which uses different sensors and integrating it with different wireless technologies need to be dealt with in this portion along with few other academic concepts for better implementation of the system.

2.1.1 Use and implementation of sensors

The system uses four different types of sensors which detect any unwanted condition and send a response to a central unit.

2.1.2 Detection of Intrusion

This will include the detection of any unauthorised entry to the protected area.

2.1.3 Location Detection

Next step in our approach would be to detect location of intrusion which will be done with the help of different sensors and will be reinforced with the help of CCTV camera.

2.1.4 Preventive Measures

Preventive measure will be carried out which will include locking the doors or electric shock.

2.1.5 Implementation on a Model

This will be the main portion of our project where the above mentioned is implemented on a model.

2.1.6 Real time Testing

The final system will then be tested.

2.1.7 Evaluation

The result of our final implementation will be compared with the expected results.

2.2 Approach

The approach used to achieve our project is summarized in the following flow chart

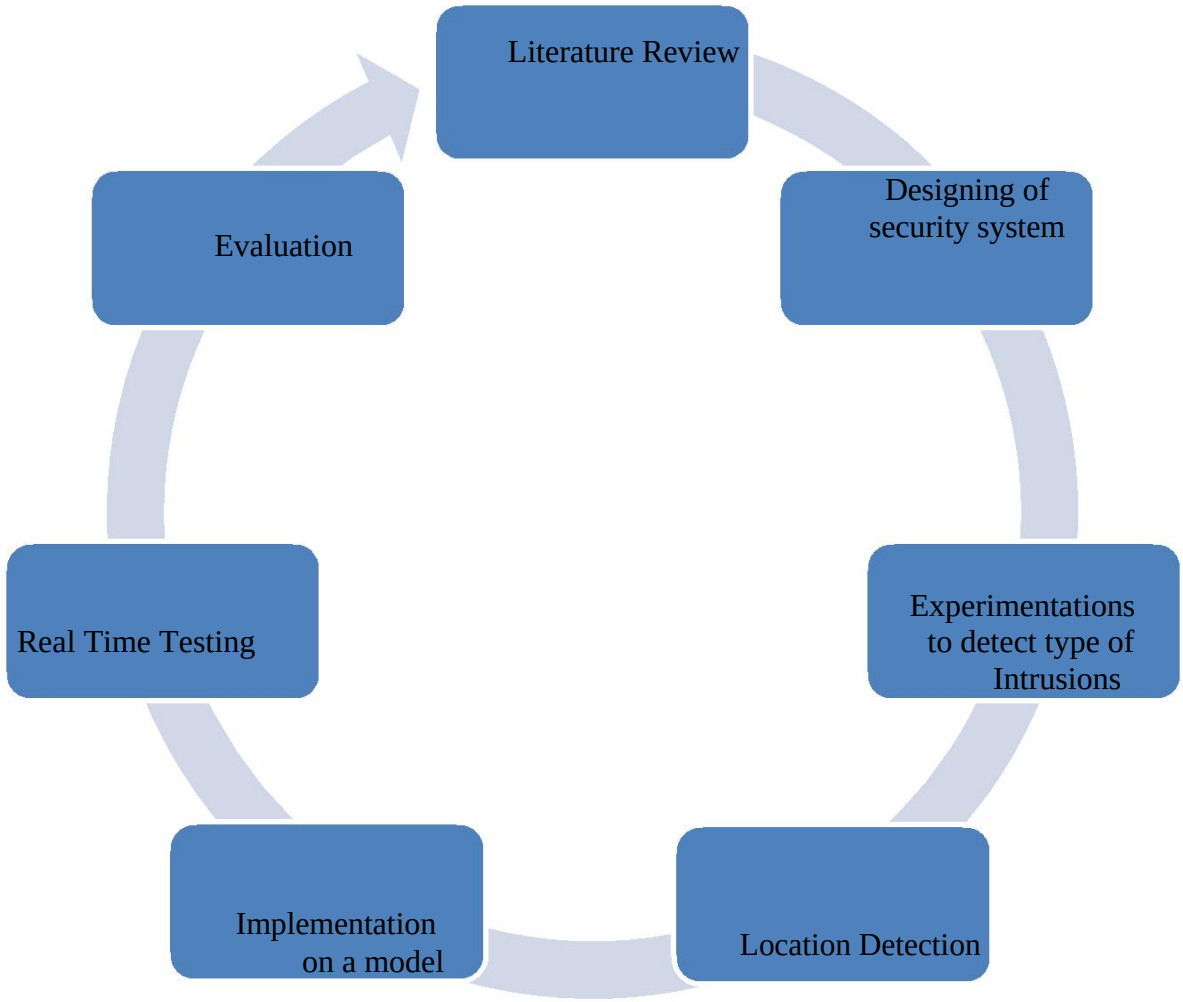


Figure 2.1

2.3 **Literature Review**

It is well known that there is a requirement for detecting unauthorized movement for high security areas such as prisons, air ports, ware houses, freight yards and defence installation. A lot of research has been done in the design of various types of automated security systems. Sensor-based systems that rely on contact or movement-sensors or contact-based systems such as fingerprint and palm print scan or keypad-activation that require substantial amount of contact with an input device. Many security systems are based on only a single system. In an event of system failure or intrusion of the user authentication, there is no backup system to monitor the home continuously. This shortcoming can be dealt with using multiple security systems (or multi-layered security systems). However, multi-system implementations will definitely be more demanding in terms of computational cost and organization. This requires careful integration and sharing of resources. Thus, a feasible system should be effective, practical and reasonable in cost.

The idea behind this project is to meet the upcoming challenges of the modern practical applications of wireless communication and to make a practical use of wireless communication and

control system. There are many real life situations that require control of different devices remotely and to provide remote security.

2.3.1 **IR Sensor**

All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is invisible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose.

When used as part of a burglar alarm, the electronics in the IR typically control a small relay. This relay completes the circuit across a pair of electrical contacts connected to a detection input zone of the burglar alarm control panel which is micro controller in our case. The system is usually designed such that if no motion is being detected, the relay contact is closed—a 'normally closed' (NC) relay. If motion is detected, the relay opens, triggering the alarm.

2.3.2 **US Sensor**

Ultrasonic transducers are transducers that convert ultrasound waves to electrical signals or vice versa. These devices work on a principle similar to that of transducers used in radar and sonar systems, which evaluate attributes of a target by interpreting the echoes from radio or sound waves, respectively. Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions, convert it to an electrical signal, and report it to a computer.

Ultrasonic sensors are used to detect movement of targets and to measure the distance to targets in many automated factories and process plants. Sensors with an on or off digital output are available for detecting the movement of objects, and sensors with an analog output which varies proportionally to the sensor to target separation distance are commercially available. They can be used to sense the edge of material as part of a web guiding system.

2.3.3 **Temp Sensor**

The most commonly used type of all the sensors are those which detect Temperature or heat. These types of temperature sensor vary from simple ON/OFF thermostatic devices which control a domestic hot water heating system to highly sensitive semiconductor types that can control complex process control furnace plants.
These are non-linear devices and their standard resistance values at room temperature is different between different thermistor’s, which is due mainly to the semiconductor materials they are made from. The **Thermistor**, have an exponential change with temperature and therefore have a Beta temperature constant (β) which can be used to calculate its resistance for any given temperature point. One infers the temperature of an object from which the radiant power is assumed to be emitted (some may be reflected rather than emitted). Sometimes the inference requires a correction for the spectral emissivity of the object being measured.

2.3.4 **Fire Extinguisher**

A fire extinguisher, or extinguisher, is an active fire protection device used to extinguish or control small fires, often in emergency situations. It is not intended for use on an out-of-control fire, such as one which has reached the ceiling that will endangers the user. Agent displaces oxygen (CO_2), removes heat from the combustion zone or inhibits chemical chain reaction (Halons). CO_2 is a clean gaseous agent which displaces oxygen. CO_2 is not suitable for use on fires containing their own oxygen source, metals or cooking media. Although it can be rather successful on a person on fire, its use should be avoided where possible as it can cause frostbite and suffocation.

2.3.5 **CCTV Camera**

CCTV cameras can produce images or recordings for surveillance purposes, and can be either video cameras, or digital stills cameras. IP cameras or network cameras are analogue or digital video cameras, plus an embedded video server having an IP address, capable of streaming the video (and sometimes, even audio). Because network cameras are embedded devices, and do not need to output an analogue signal, resolutions higher than CCTV analogue cameras are possible.

An analogue or digital camera connected to a video server acts as a network camera, but the image size is restricted to that of the video standard of the camera. However, optics (lenses and image sensors), not video resolution, are the components that determine the image quality. Network cameras can be used for very cheap surveillance solutions (requiring one network camera, some Ethernet cabling, and one PC), or to replace entire CCTV installations (cameras become network cameras, tape recorders become DVRs, and CCTV monitors become computers with TFT screens and specialized software. Digital video manufacturers claim that turning CCTV installations into digital video installations is inherently better). There continues to be much debate over the merits and price-for-performance of Network cameras as compared to analog cameras. Many in the CCTV industry claim that many analog cameras can outperform network cameras at a lower price.

2.3.6 **Digital-Video Recorder**

A digital video recorder (DVR) is a consumer electronics device or application software that records video in a digital format to a disk drive, USB flash drive, SD memory card, SSD or other local or networked mass storage device. The term includes set-top boxes (STB) with direct to disk recording facility, portable media players (PMP) with recording, recorders as camcorders that record onto Secure Digital memory cards and software for personal computers which enables video capture and playback to and from a hard disk drive.

Hard-disk based digital video recorders make the "time shifting" much more convenient, and also allow for "trick modes" such as pausing live TV, instant replay of interesting scenes, chasing playback where a recording can be viewed before it has been completed, and skipping of advertising.

CHAPTER 3- DESIGN AND DEVELOPMENT

3.1 Introduction

Home/ Bank/ Office security has been a major issue where crime is increasing and everybody wants to take proper measures to prevent intrusion. In addition there was a need to automate home so that user can take advantage of the technological advancement in such a way that a person can access his home appliances even from comfort of an office.

In the block diagram shown above all the general parts of the system are shown. This design can be regarded as the best design because it provides security up to 3 tiers. The system will be able to detect any intrusion through IR sensor at tier 1. At tier 2 US sensor will be used to confirm any detection of IR sensor. CCTV cameras are used at 3rd tier to ensure that no false alarm is given. Other techniques of Home Security such as buried cables have some disadvantages like the intrusion can only be detected when a person is in motion which is not the case in our design. One more disadvantage of the buried cable design is that only one person can be detected at a time which is not the case in our design.

After detecting any intrusion, the control unit will be informed. A message will also be sent to the user's cell phone to alert the user about the situation taking place at the protected location. User will be able to send the necessary instructions about switching ON the camera. The coverage can then be seen on the cell phone and then further instructions can also be given through android application.

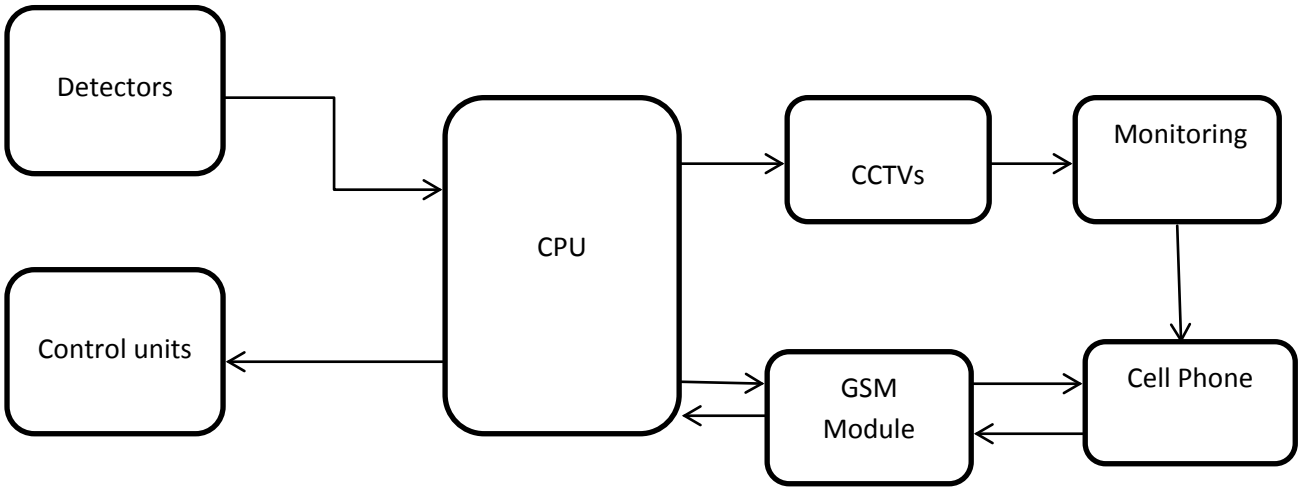


Figure 3.1

3.2 Working of Components

The step by step working of each element of the project is described below:

3.2.1 **GSM Module (SIM 900D)**

The SIM900 is a complete Quad-band GSM solution which can be embedded in the user applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements, especially for slim and compact demand of design. The SIM900 is integrated with the TCP/IP protocol extended TCP/IP commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

Figure 3.2

- SIM900 is designed with a very powerful single-chip processor integrating core
- Quad - band GSM/GPRS module with a size of 24mmx24mmx3mm
- An embedded Powerful TCP/IP protocol stack

3.2.2 **Atmel AT89S52**

Micro-controller is the most important part of the project. The basic function performed by the microcontroller is to take data from the sensor, alert the user and then respond according to the instructions of the user. The microcontroller will be connected with a GSM module which will generate the requisite messages to the user and will receive information from the user to perform further action deemed necessary by the user. Micro controller will generate three different messages to the user according to the threat detected by the sensor

- IR Sensor = Entrance door threat
- US Sensor = Security threat
- Temp. sensor = Fire alarm

According to the message, the user can judge the situation and can view the place through the

CCTV camera on his cell phone. The switching of CCTVs will be done manually through the microcontroller. Control actions will also be controlled with the help of microcontroller.

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8KB of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

3.2.2.1 **Features**

- Compatible with MCS®-51 Products
- 8K Bytes of In-System Programmable Flash Memory
  - Endurance: 10,000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode

3.2.2.2 **Description**

By combining a versatile 8-bit CPU with in-system programmable flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a Highly-flexible and cost-effective solution to many embedded control applications.

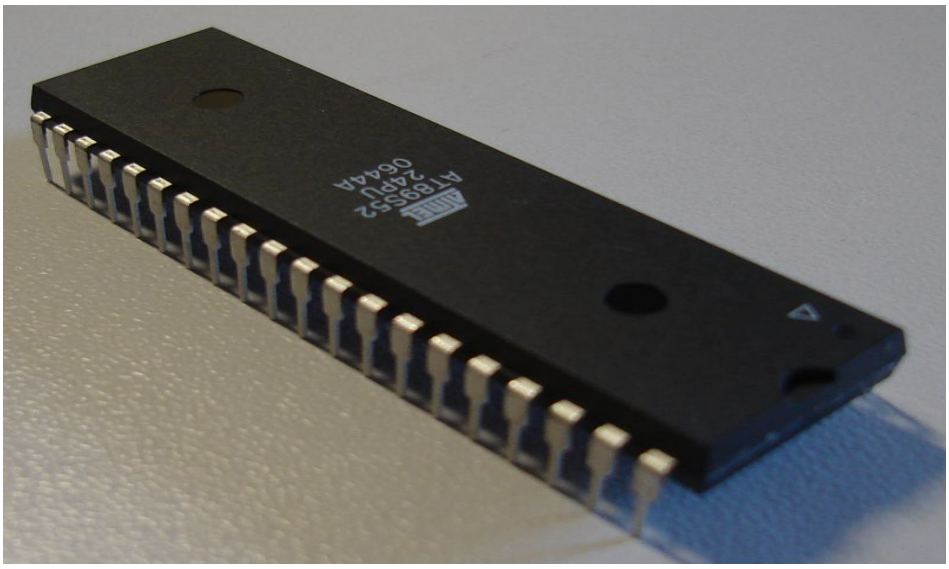


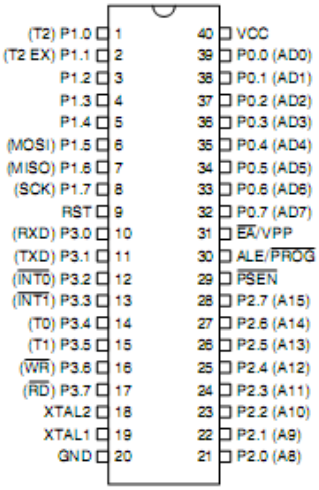
Figure 3.3

Some of the features of AT89S52 are 8KB of flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a Six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and Interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

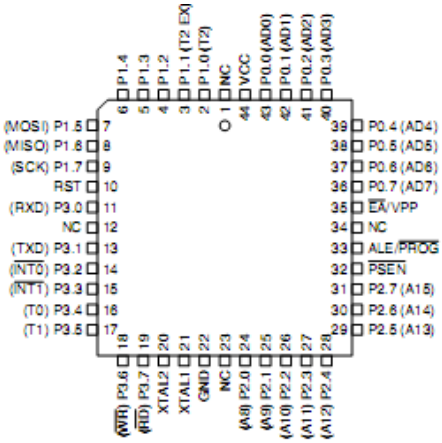
3.2.2.3 **PIN Configuration**

The pin configuration of microcontroller is as under

40-lead PDIP



44-lead PLCC



2.2 44-lead TQFP

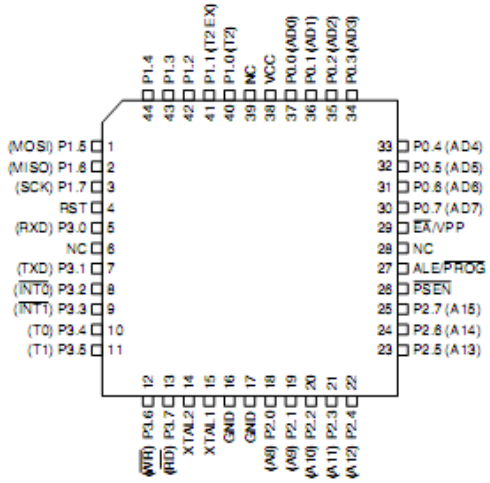


Figure 3.4

3.2.2.4 **PIN Description**

Vcc Supply voltage.

GND Ground

Port 0

Port 0 is an 8-bit open drain bidirectional I/O port. As an output port, each pin can sink eight TTL inputs. Port 0 can also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory. In this mode, P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1

Port 1 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups.

In addition, P1.0 and P1.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively, as shown in the following table.

Port 1 also receives the low-order address bytes during Flash programming and verification.

Port Pin	Alternate Functions
P1.0	T2 (external count input to Timer/Counter 2), clock-out
P1.1	T2EX (Timer/Counter 2 capture/reload trigger and direction control)
P1.5	MOSI (used for In-System Programming)
P1.6	MISO (used for In-System Programming)
P1.7	SCK (used for In-System Programming)

Table 1 AT89S52 pin configuration

Port 2

Port 2 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 2 output buffers can Sink/source four TTL inputs. When 1s are written to Port 2 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current because of the internal pull ups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that uses 16-bit address. In this application, Port 2 uses strong internal pull-ups when emitting 1s. During accesses to external data memory that uses 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the Special Function Register. Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

PSEN

PSEN is the read strobe to external program memory. When the AT89S52 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/VPP

External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming.

XTAL1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2

Output from the inverting oscillator amplifier

Memory Organization

MCS-51 devices have a separate address space for Program and Data Memory. Up to 64 KB each of external Program and Data Memory can be addressed.

Program Memory

If the EA pin is connected to GND, all program fetches are directed to external memory. On the AT89S52, if EA is connected to VCC, program fetches to addresses 0000H through 1FFFH are directed to internal memory and fetches to addresses 2000H through FFFFH are to external memory.

Data Memory

The AT89S52 implements 256 bytes of on-chip RAM. The upper 128 bytes occupy a parallel address space to the Special Function Registers. This means that the upper 128 bytes have the same addresses as the SFR space but are physically separate from SFR space. When an instruction accesses an internal location above address 7FH, the address mode used in the instruction specifies whether the CPU accesses the upper 128 bytes of RAM or the SFR space. Instructions which use direct addressing access the SFR space. For example, the following direct addressing instruction accesses the SFR at location 0A0H.

MOV 0A0H, #data

Instructions that use indirect addressing access the upper 128 bytes of RAM. For example, the following indirect addressing instruction, where R0 contains 0A0H, accesses the data byte at address 0A0H, rather than P2 (whose address is 0A0H).

MOV @R0, #data

Note that stack operations are examples of indirect addressing, so the upper 128 bytes of data RAM are available as stack space.

3.2.3 **IR Sensor**

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. The Infrared sensor is mainly used to detect any intrusion into the perimeter. As Infrared waves are not visible to the human eye

so the performance of this sensor becomes more reliable. When somebody passes through the gate of the room it will intercept the infrared beam. This will cause detection and the central unit will be informed about the entrance. As long as the light falls on the detector it remains constant in its state, but when something breaks the beam and it stop reaching the detector it raises an alarm. Active infrared sensors are excellent as a safeguard at the door opening because of their ability to continue recognizing changes that occur in the detection area. Some sensors may incorporate a second row of detection areas to create a safety area in addition to the standard first row.

3.2.4 **US Sensor**

Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo. The ultrasonic sensors will be placed in the centre of the room. When somebody enters the room it causes reflection of the sound waves back to sensor and will be detected. Virtually all materials which reflect sound can be detected, regardless of their colour. Even transparent materials or thin foils represent no problem for an ultrasonic sensor.

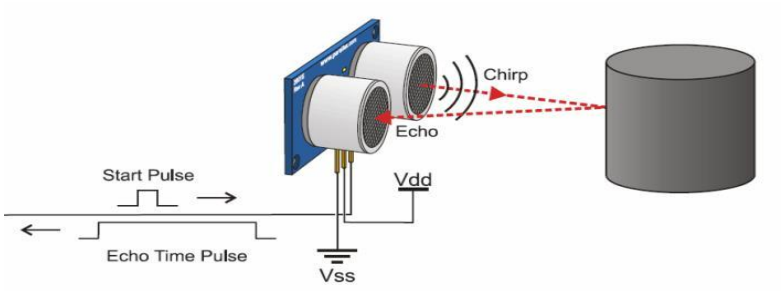


Figure 3.5

3.2.5 **Temperature Sensor**

Third type of sensors placed in the room is the temperature sensor. The purpose of this sensor is just to detect the overheating which can be caused by fire or short circuit. Different type of temperature sensors can be used. The sensor used is this project will simply be having a transistor with 2 comparator state. With the rise in temperature the output of transistor changes as the thermal energy of electrons increases. The change in the characteristics of the device is in terms of the passage of voltage through them, which is directly proportional to the magnitude of the temperature difference between them.

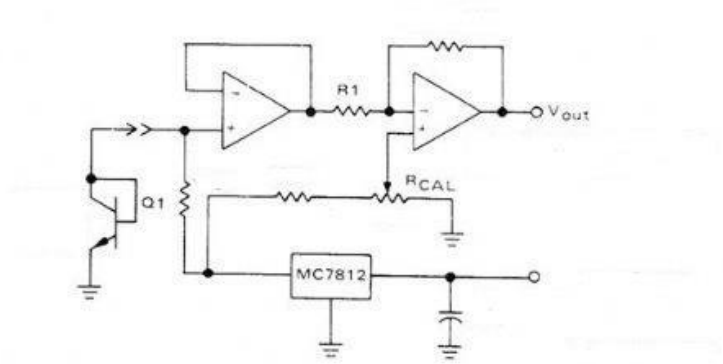


Figure 3.6

3.2.6 **DVR & CCTVs**

The next part in the system is the DVR and the CCTVs. The CCTVs provide the live video feed of the different parts of the building. The DVR (digital video recorder) is used to give the live streaming on so it may be accessed from anywhere in the world. One camera will be placed inside the room and the 2nd will be moveable so that it can provide coverage from different angles.

3.2.7 **Control Actions**

Three different types of control actions will be used in the system

- Locking of door
- Gas shower CO_2
- Electric shock

The door can be closed or opened whenever required. The CO2 will be used to control the fire. The electric shock can also be used to stop any unauthorized entry. In the model direct shock will not be possible so the system will use LED which will indicate the current cage.

3.3 **Software Implementation**

The software elaboration of the designed system makes it easy to test the desired results and make the change in the system so that it becomes more efficient. The system contained some parts which need their software implementation to make the hardware easy and efficient. The major software works consisted of

- Basic circuit simulations
- Microcontroller programming and testing

Some software based works were carried out for network configuration of the CCTVs and DVRs.

3.3.1 Basic circuit simulations

The simulation process for sensors and central module was done to make the hardware implementation easy and effective. Proteus was used for the simulation of the sensors and micro controller. The availability of microcontrollers and their programming option in proteus made it easy to check the programmed logics of the software. This was done with the help of virtual terminal as GSM Module was not available in Proteus.

3.3.2 **Microcontroller Programming and Testing**

The central control unit of the system consist of a microcontroller "Atmel AT89S52" which receives all the interrupts and respond accordingly. The programming of microcontroller was done in assembly language and then was converted into binary by using software. The basic software used in microcontroller programming and in burning process are:

- MPlab
- Kiel Microvision

3.3.3 **Hardware Implementation**

Realization of the idea was made by the hardware implementation. The manufacturing stage of hardware has three fundamental stages which are associated with each other to form the structure of the project. The 1st part is the sensors that detects any unwanted situation and informs the central control unit about it. The 2nd part of the hardware consists of DVR and CCTVs that allows the user to monitor the situation on the smart phone and carryout any required preventive measures by instructing the central processing unit. The 3rd part consists of the preventative measures which minimize any damage or loss of the property. CCTV allows the authorized person to use the best possible control action according to the situation faced by the system. Following steps were undertaken in manufacturing.

1. Designing schematic diagram
2. Transfer of schematic into PCB layout
3. Developing process
4. Soldering process
5. Connecting the parts
6. Testing

All these parts are explained according to their built-up sequence.

3.3.3.1 **Design schematic diagram**

A schematic is a representation of the elements of a system using abstract, graphic symbols rather than realistic pictures**.** It is a drawing showing all significant components, parts and their interconnections to a circuit, device or project by means of standard symbol. The very first step in hardware implementation of an electrical project is to make its schematic diagram. Schematic diagrams for each sensor and control unit was separately made by having its proper mathematical calculations which showed the best possible results according to the need of system. The mathematical results were then verified in software simulations and then applied in hardware. The schematic diagrams make the implementation process easy because the placement of all the components and the connections of these components with each other became clearly known.

3.3.3.2 **Transfer schematic into PCB layout**

The fundamental steps involved in the conversion of schematic into PCB are

- Set the Grids & Units to desirable values
- Set the Board outline
- Set the Pads options
- Set the design rules
- Set custom shortcuts

3.3.3.3 **Developing process**

In the process of development of the circuit, all the components were placed according to the schematic diagram. The etching is primarily done to make the connections more clear so that the placements to components become better. Before placement of the components drilling was carried out. All the components were placed according to the schematic diagram.

3.3.3.4 **Soldering process**

Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal (solder) into the joint, the filler metal having a lower melting point than the adjoining metal. The components were fixed on PCB with the help of soldering. The most common problem suffered during soldering is wrong solder or the loose solder which causes the short circuit or the open circuit respectively.

3.3.3.5 **Connecting the parts**

After making all the individual board of sensors and central control system, the connections were made between these systems. Central power supply provided power to all the sensors and central control unit while for the operation of control actions and the monitoring units (DVR & CCTVs) separate power adopter were utilized. During the connection following points were kept in mind:

- Length of wire were kept according to the requirement
- Wires were not rigid
- Connections were kept compact
- Proper insulation
- Short circuits were avoided
- Joints were ducked
- Color matching of wires

Switches and sockets were used to make the connections easy.

3.3.3.6 **Testing**

All the circuits were tested with Digital Multi-Meter and oscilloscope. The response of the control actions in was also verified. The testing of CCTVs includes their proper working and the light adjustment in order to get the proper image quality.

3.3.4 **Networking**

Networking is defined as interaction with others to exchange or share information with other people, groups or institutions to develop mutually beneficial relationships, or to access and share information between nodes. The nodes may be computers, output devices or DVRs. The system was designed to share the recorded information from the security governed place to the user. DVR is a device that can be directly connected with the ip core with help of a network provider. User can remotely access the anywhere in the world by just having using that particular IP. The ip allocated to that particular device should be unique so that it could be accessed anywhere at any time. After configuring DVR on that particular ip, the data can be accessed on the smart phone or any other device through ip core.

3.3.5 **Modeling**

Wooden ash board is used to make the model. The model was designed by the group and for its realization the help of a carpenter was taken. The model is shown below

Figure 3.7

The model has three basic parts. The basement part was used for the placement of central units and DVR, the side boxes were used for the placement of sensors and the control circuits while the 3rd part is a central hollow room, equipped with the sensor terminals. A central door along with automatic opening and closing was placed which could be used to stop the It is the best depiction of a building.

CHAPTER 4 – ANALYSIS AND EVALUATION

4.1 Microcontroller Programming

The first step in the programming of microcontroller is to define the ports for input and output. Input ports take data from the sensors while output ports feed the relays.

2nd step in programming is to define the timer, delay and the basic libraries used in program. Microcontroller will take that after each defined interval and will check the sensor output after each interval.

In next step the microcontroller is then further programmed with a serial connection with the GSM module. The GSM module will be instructed by the controller to send the data to user or the micro controller.

The next step will be for microcontroller to collect data from the sensor and send the specified messages to the specified number. The code was then defined for the micro controller to receive instructions and to switch on or off the specified relays.

The code was written and then assembled using an assembler. Following are the results after assembling the code which was written on the micro controller.

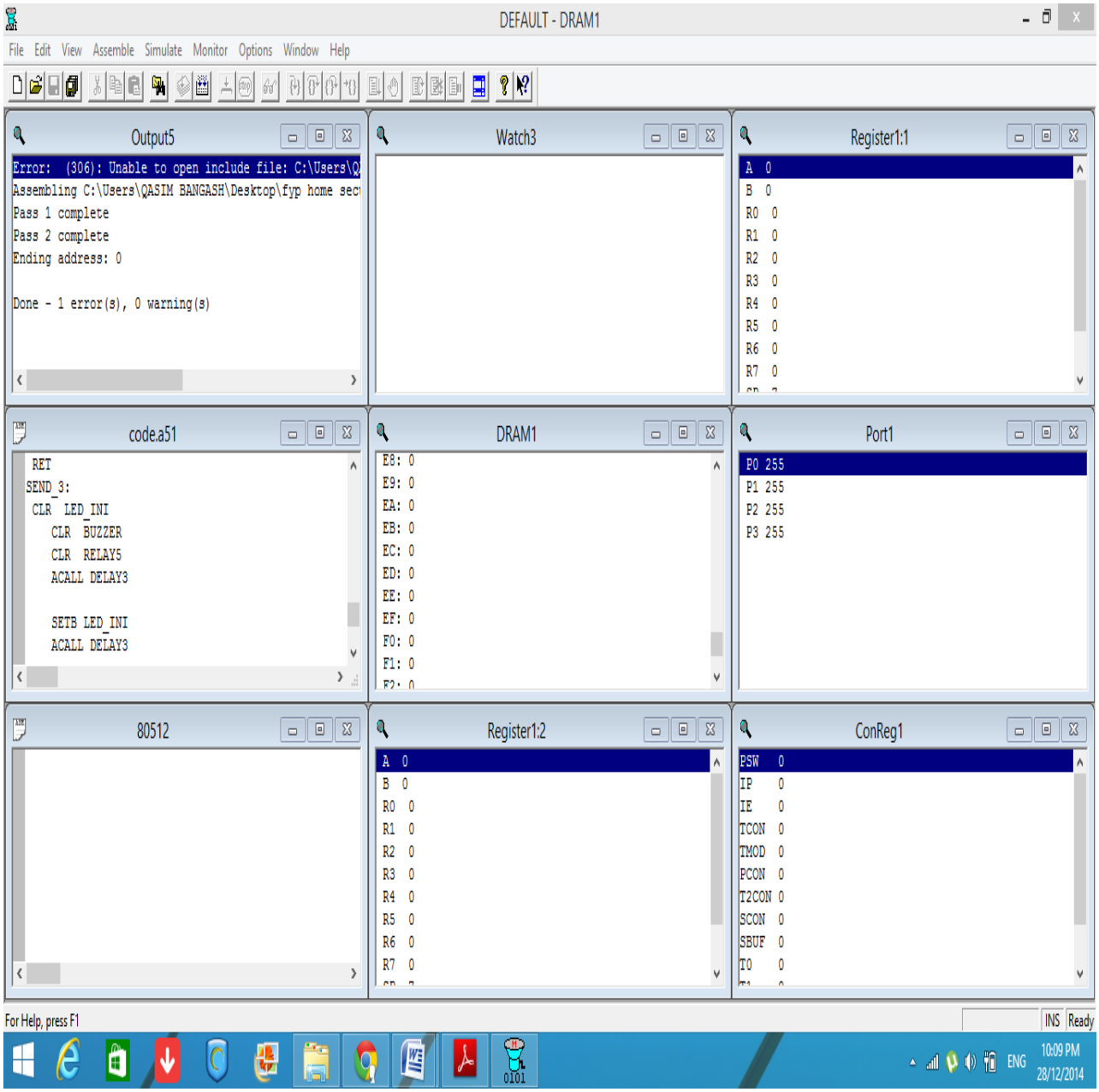


Figure 4.1

4.2 **Relay Kit**

The information from microcontroller is utilized at the relay kit to perform different actions according to the need of situation. The relay kit consists of 5 relays and a buzzer. The buzzer and relay one is further associated with the CCTV. They relay 2 to 5 are controlled from the microcontroller and will be controlled by the user. These relays are connected with the LCD in series which shows working conditions of the relay. Glowing LED shows that relay is in triggering mode. The basic relay diagram is shown below.

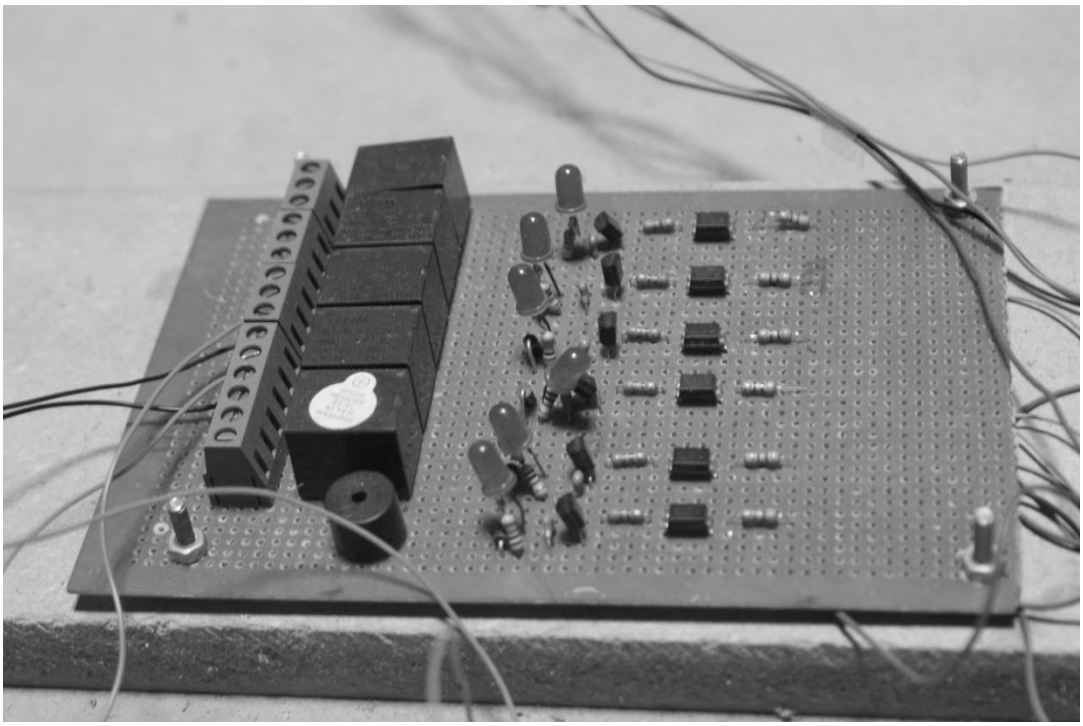


Figure 4.2

4.3 **Bottleneck**

One of the main bottle neck we faced during preparation of model was the height of sensors which were being installed. The height of the sensor can not be too low as even animals coming close to the door will trigger an alarm and it can not be too high as a robber can avoid it by sitting and going inside the house. The IR sensor should be installed at a height of 4 feet so that it avoids both the circumstances.

One other bottleneck we faced was installation of US sensor. The model being small so sound can be reflected from the wall of the model. The solution to this problem was solved by using a US sensor which was precisely feasible for the model. The range of the US sensor was such that the wall of the room will not effect the US sensor.

4.4 **Alarms**

The microcontroller PIC 16F877A is also placed to make a visual alert to the control unit. When any sort of threat will be detected the microcontroller will give a written display to the LCD. In any case of any harm the LED will glow up. The basic programming and the simulation diagram is shown below.

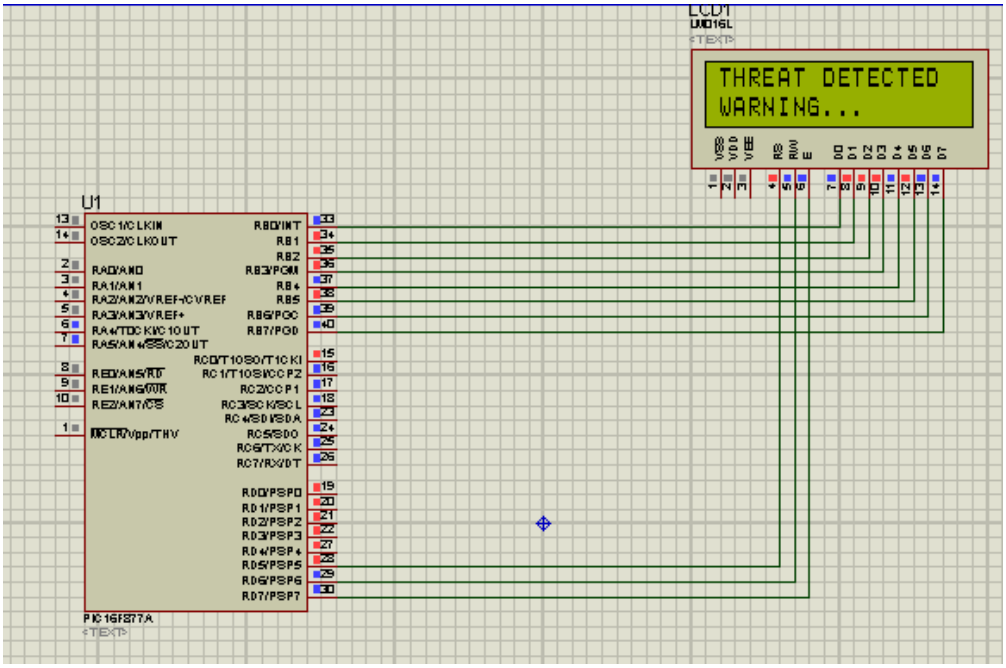


Figure 4.3

4.5 **Testing**. Different tests were performed to check the working of sensors. Their range was adjusted by varying the rheostat and was made compatible with the manufactured model. All the output parameters of devices, speed of motors used, response of camera and proper connectivity was verified at the end of process. In response to an incorrect output the required adjustment was carried out in the system.

4.6 Results

After making connections of all the systems, the model was checked by an entry into the room. The entry was detected by the sensors installed in the room. The control actions were also implemented successfully. Three different messages were generated on three different inputs and control actions were successfully implemented to stop the threat.

CHAPTER 5- FUTURE RECOMMENDATIONS

The system can be made better by improving the control actions and by making all the system IP based instead of GSM. The time delay can be reduced to a great extent by using IP based system. As 3G is available now so it would become much easier to access the system through internet instead of the GSM services which will be faster and more accurate.

Future work in this area should emphasize the ability to locate multiple intrusions. Preliminary results show the capability to detect and locate intrusions, but further work must go into the stabilization of the system and improving the detection and localization range. Additionally, work on signal processing is needed. This leads to the expectation that, with suitable signal analysis, the system may be able to distinguish between people, animals and environmental disturbances. This step is key to the practical implementation of this system, as false alarm rates will depend on the ability to distinguish human intruders from animals or environmental disturbances. Significant reduction in false and nuisance alarms can be obtained by applying an adaptive learning technique. With the adaptive learning technique, the signal processing algorithms are continually adapted to the changing environmental conditions and nuisance alarm rates. The adaptive learning technique declares an alarm when the processed signal parameters are within the range of human target and it declares an alert when a cell threshold is exceeded but the processed signal parameters are not within the range of human target. The adaptive learning process both time and frequency domain features of sensor signal and then applies target recognition technique to distinguish true target from false alarms. The frequency domain features can be processed using Fast Fourier transform algorithm.

The ability to detect multiple disturbances would provide a better understanding of the practical application of the sensor to perimeter security as the ability to detect simultaneous disturbances along varying points of the perimeter is essential.

This type of sensor might be utilized in areas other than home security as well. For instance, it could be used for knowing the timings of entry of works by boss in the morning in order to avoid any late comers and to maintain discipline in schools, government organizations or offices. Once validated in the field, this system could see countless beneficial uses throughout our world.

Finally, in order to make the system better some image processing technique can be used so that one will only get an alarm when an unauthorized person tries to enter the room. The authorized person will be automatically judged by the camera and will not be treated as an intruder. It will make the users own entry easy and will become a part of banking system in which the bank staff often have to visit the locker where no other person will be allowed.

CHAPTER NO 6- CONCLUSIONS

6.1 Overview

The aim of this project was to design a system which provides a highly reliable security system. The main focus was to make the project easy to use. Keeping this in mind, different easy user interfaces were introduced. Secondly, users are allowed to carry out preventive measures according to the situation.

6.2 Objectives Achieved

A model has been developed to depict a building. Different sensors were attached to the model to protect it from unauthorised access. The sensors detect movement of individuals moving into and out of the house. Cameras are attached to further enhance the security of the model. Various preventative actions have also been achieved with the help of a an android application.

6.3 Applications

The system has the application area ranging from a simple home refuge device to a complex locker to prison security system. The system can not only defend against any unwanted interruption but also make a rapid action to stop that unwanted entry. Some of the applications of the project are as under.

- It can be used for theft protection which is a major concern nowadays.
- It can also be used by police as well as army to control the militancy.
- It can be used in banks to protect the entry and exit in locker rooms.
- It can also be used in military to guard against entry into any room which is out of bound for any unauthorized entry.

CHAPTER NO 7- REFERENCES

[1] Research Paper Regarding “Embedded Based 3G Security System for Prison” By S. Dharanya & V. Divya Institute of Technology, New Dehli

[2] Intrusion, Fire, Access and Networks which is a project done in Springfield USA. By Michael Caggiano USA

[3] “Wireless Communication” by Rappaport

[4] Fundamentals of Wireless Communication by David Tse & Pramod Viswanath

[5] White Paper on GSM Security by Christian Kroger

[6] Providing Security in 4G Systems : Unveiling the challenges (School of Engineering and Computer Sciences)

[7] Advanced research on Monitoring and controlling of bank security system by “S Ramesh & Sharoti Arora” SRM University, Ghaziabad India.

[8] Robert Keith Herman, “Perimeter Surveillance System”, US patent no 4091637

Appendix A

DESIGN AND DEVELOPMENT OF

BUILDING SECURITY SYSTEM

Extended Title: Design and development of building security system using PIC Microcontroller

Brief Description of The Project / Thesis with Salient Specs:

In this project, we will be designing a building security system which will use different scanners including IR, Ultraviolet and Temperature Sensors. CCTV cameras will also be used to monitor the situation. The control center or the security handling authorities will be informed using GSM/3G-module by sending an SMS.

In case of any un-authorized entry, a back-up mechanism will be activated to stop the intruder. To make the response easy and fast we are going to design an android application as well.

The three different steps performed by the system are

1. Detection
2. Information
3. Prevention

Deliverables : The project basically involves the design of hardware architecture which includes securing a building, it will be implemented using PIC Micro controller interfaced with a GSM module. A small working model will be designed to show the working of secure building system. An android application will also be designed to make the design handy. The final design will be tested and practically implemented on a mini model. The project will be completed by Apr 2015.

Academic Objectives :

The project will involve:

- Understanding and use of GSM Module
- Acquaintance and utilization of different sensors
- Comprehending and employing Micro controller
- Exercising C++ programming

Application / End Goal Objectives :

The main goal of this project is to detect unauthorized movement for high security areas such as

prisons, airports, ware houses, freight yards and defence installation. The device can be used for

- Securing building for safe storage of documents or money
- Protection from theft
- Protecting important Military equipment

Previous Work Done on The Subject :

Following work exist on the subject :

- An Intelligent and Cost Efficient Home Security System (ICEHSS) Mehran University of Engineering & Technology, Jamshoro
- http://www.slideshare.net/somsthecute/gsm-based-home-security-system-project-report Rajistan Techincal University, India
- http://www.studymode.com/essays/Gsm-Based-Home-Security-System-1436745.html Amity University Uttar Pradesh, India

References:

- ISSN: 2277-3754
  ISO 9001:2008 Certified

  International Journal of Engineering and Innovative Technology

  Volume 2, Issue 4, October 2012

- http://www.electronicshub.org/gsm-based-projects/

- http://www.engineersgarage.com/contribution/sms-based-security- system

- Indian Journal of Science and Technology
  Embedded Based 3G Security System for Prison

  www.indjst.org | Vol 6 (5) | May 2013

Material Resources Required :

- Sensors
- Microcontroller
- GSM module
- CCTV cameras
- DVR
- Controlling systems (gas shower, electric shock system)
- Alert systems (alarm, LCD)

No of Students Required : 4

Special Skills Required :

Matlab Programming

C++ Programming

Proteus

Handling Micro controller

Appendix B

Timeline

Ser	Task	2014						2015				
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	**Learning Micro controller Programing**											
2	**Requirement Engineering**											
3	**Design & Architecture**											
4	**Coding/Implementation**											
5	**Testing(Unit/Integration)**											
6	**Testing**											
7	**Documentation**											

Appendix C

COST BREAKDOWN

DVR	4000
IR Sensor	500
US Sensor	700
GSM Module	4500
Resistor/Capacitor	500
Micro controllers	600
Video Cable	500
Cameras	4000
Model Preparation	4000
Total	**19300**

Appendix D

DEMONSTRATION OUTLINE

After completion of the coding process without errors, the code was included in a proteus file. Complete circuit of the design was included in the proteus file. Following is the result after running the proteus file.

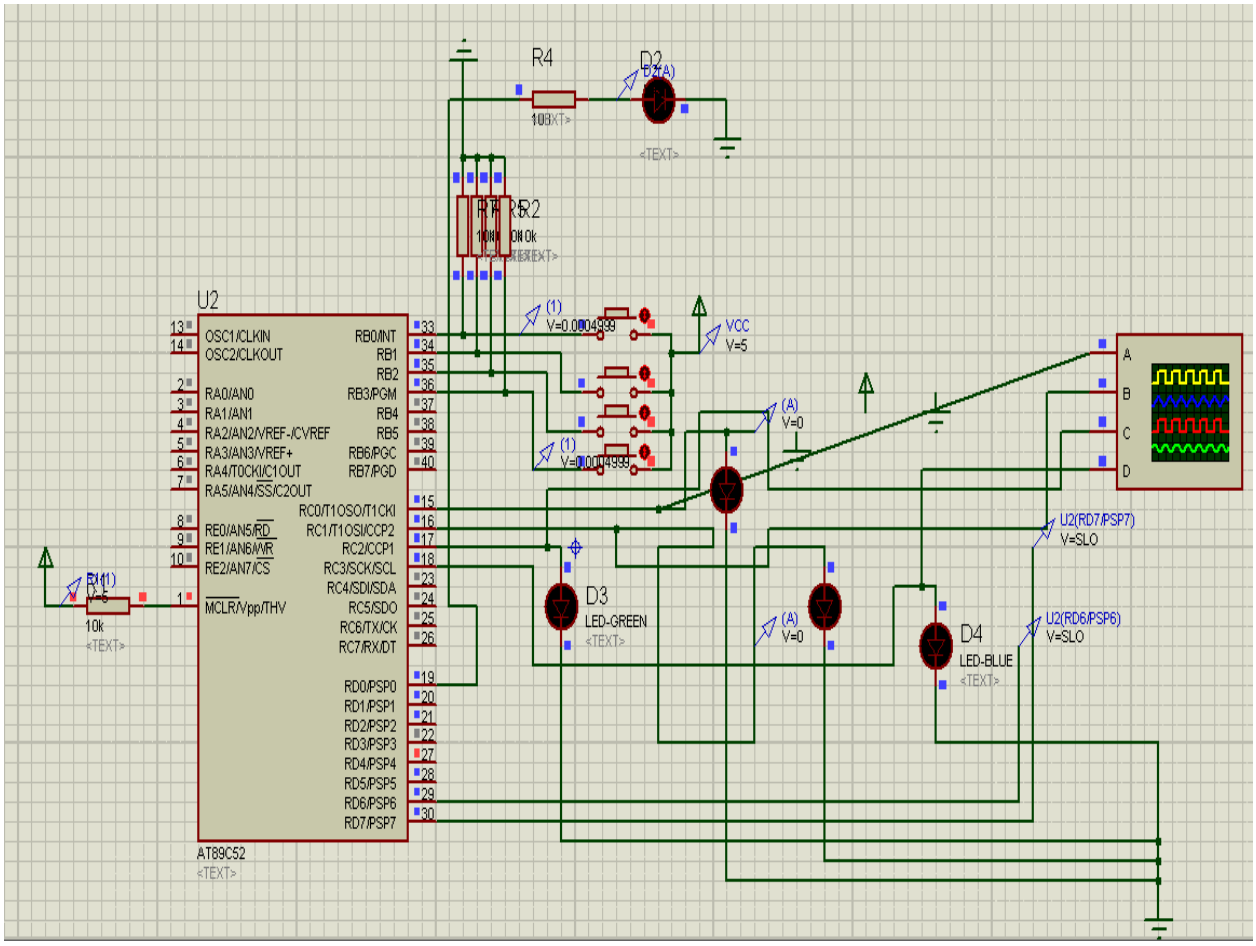


Figure D.1

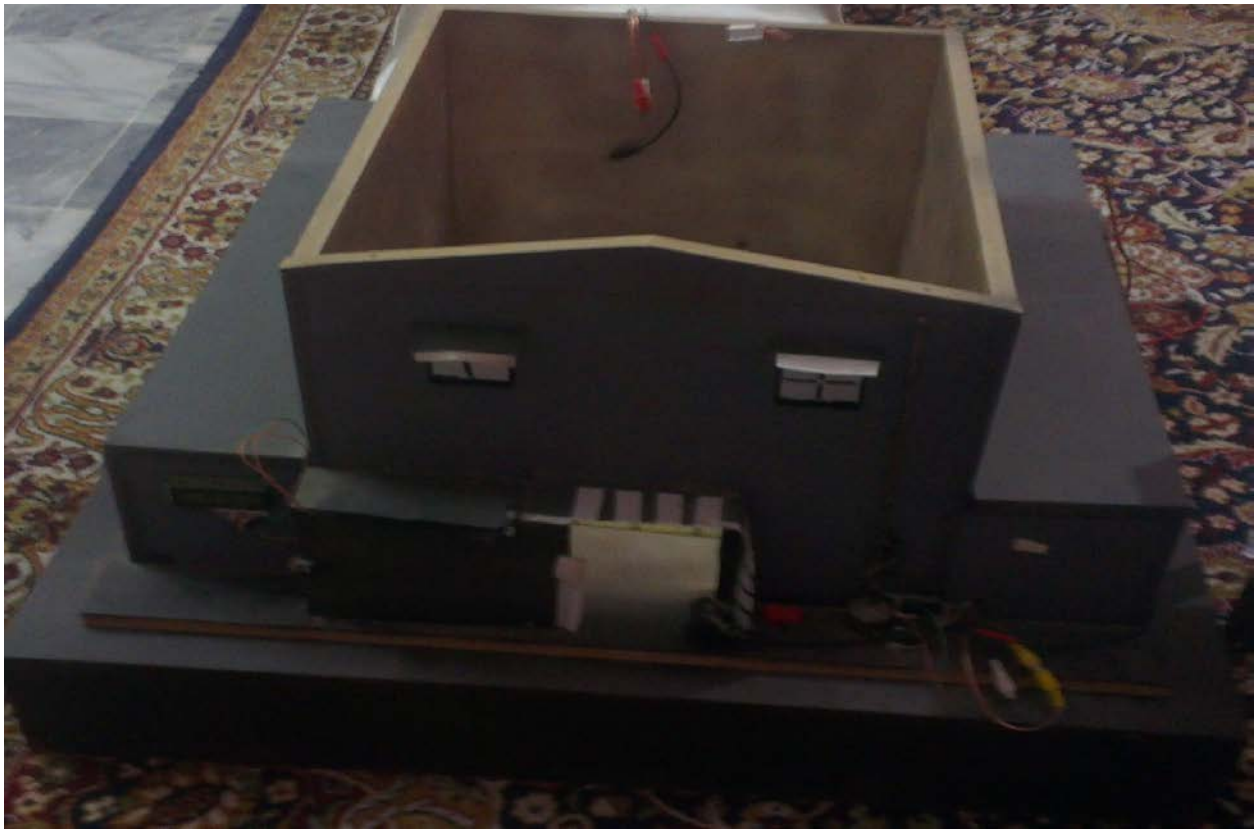


Figure D.2

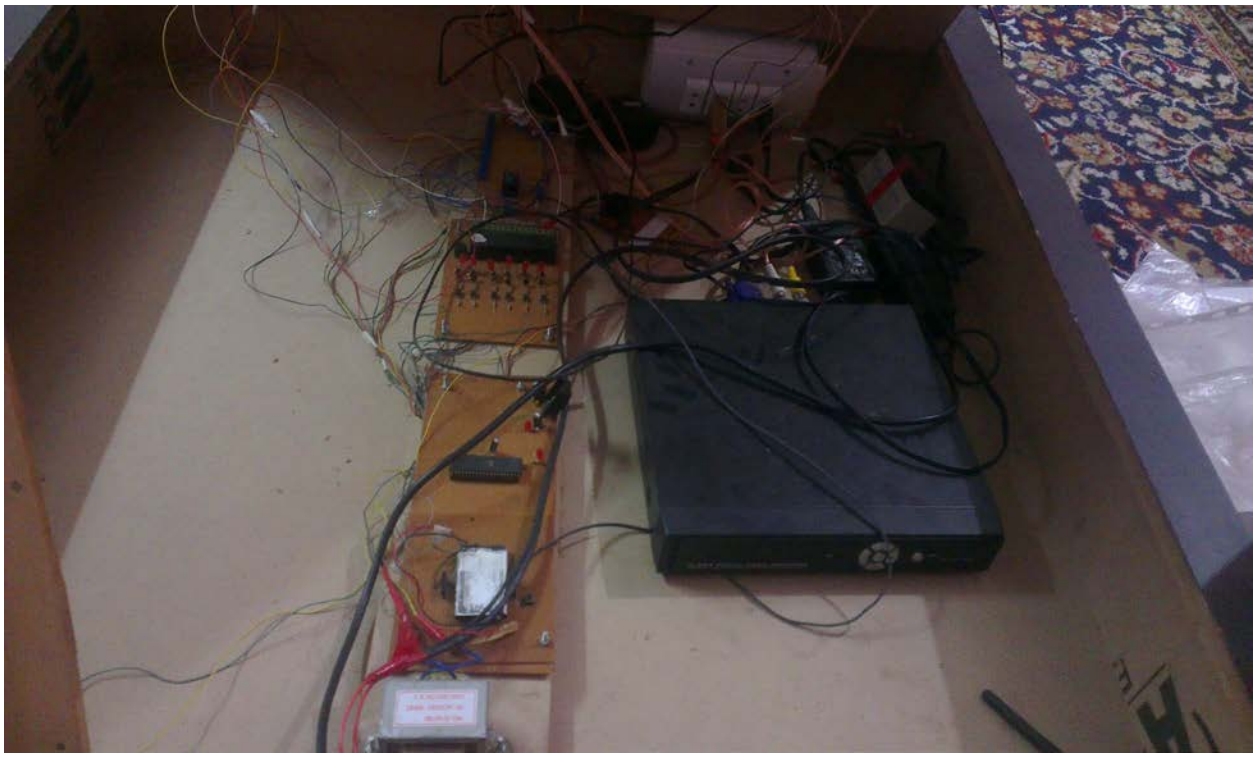


Figure D.3

Figure D.3

Appendix E

PROJECT CODE

The first step in the programming of microcontroller is to define the ports for input and output. Input ports take data from the sensors while output ports feed the relays.

```
LED_INI     BIT   P1.0

RELAY1      BIT   P2.0
RELAY2      BIT   P2.1
RELAY3      BIT   P2.2
RELAY4      BIT   P2.3
RELAY5      BIT   P2.4
BUZZER      BIT   P2.5

CR    EQU   13
LF    EQU   10
TEMP1       EQU   4AH
OK    BIT   24H
SW1   BIT   P1.1
SW2   BIT   P1.2
SW3   BIT   P1.3
SETB  RELAY1
SETB  RELAY2
SETB  RELAY3
SETB  RELAY4
SETB  RELAY5
SETB  BUZZER
```

2nd step in programming is to define the timer, delay and the basic libraries used in program. Microcontroller will take that after each defined interval and will check the sensor output after each interval.

```
MAIN:
        MOV   TMOD,#20H  ;TIMER 1 , MODE 2
        MOV   TH1,#-3
        MOV   SCON,#52H   ;8-BIT , 1 STOP , REN ENABLED
        SETB  TR1    ;START TIMER 1
        LCALL         DELAY3
        LCALL         TX232
        DB      "AT",CR,LF,0
        LCALL         DELAY3
        LCALL         TX232
        DB      "AT+CMGF=1",CR,LF,0      ;TEXT MODE
        LCALL         DELAY3
        LCALL         TX232
        DB      "AT+CMGD=1",CR,LF,0      ;TEXT MODE
START:        SETB  OK
ML01: ACALL         RX
        CJNE  A,#'+',ML01
TEST1:JB      SW1,TEST2
         LJMPSEND_1
         LJMPMAIN

TEST2:JB      SW2,TEST3
         LJMPSEND_2
         LJMPMAIN
```

```
TEST3:JB      SW3,ML01
        LJMP SEND_3
        LJMP MAIN
      SJMP  FIRST
      LJMP  START
FIRST: LCALL      DELAY3
      LCALL       TX232
      DB    "AT+CMGR=1",CR,LF,0     ;TEXT MODE
      CPL   LED_INI
ACT01:
      MOV   B,#10
ML022:      ACALL       RX
      DJNZ B,ML022


      MOV   B,#14
      MOV   R0,#6DH
RIZ11:LCALL       RX
      CJNE  A,#0,RIZ2
      SJMP  CMM1
RIZ2:  INC    R0
      DJNZ  B,RIZ11
```

In next step the microcontroller is then further programmed with a serial connection with the GSM module. The GSM module will be instructed by the controller to send the data to user or the micro controller.

```
CMM1:
      MOV   R0,#6DH
```

```
        MOV   DPTR,#MSG_A
        LCALL COMP1
        JB    OK,CMM2
        CLR   RELAY1
        ACALL       DELAY3
        SETB  OK
        LJMP  MAIN
CMM2:
        MOV   R0,#6DH
        MOV   DPTR,#MSG_1
        LCALL COMP1
        JB    OK,CMM3
        SETB  RELAY1
        ACALL       DELAY3
        SETB  OK
        LJMP  MAIN
CMM3:
        MOV   R0,#6DH
        MOV   DPTR,#MSG_B
        LCALL COMP1
        JB    OK,CMM4
        CLR   RELAY2
        ACALL       DELAY3
        SETB  OK
        LJMP  MAIN
CMM4:
```

```
        MOV   R0,#6DH
        MOV   DPTR,#MSG_2
        LCALL COMP1
        JB    OK,CMM5
        SETB  RELAY2
        ACALL       DELAY3
        SETB  OK
        LJMP  MAIN
CMM5:
        MOV   R0,#6DH
        MOV   DPTR,#MSG_C
        LCALL COMP1
        JB    OK,CMM6
        CLR   RELAY3
        ACALL       DELAY3
        SETB  OK
        LJMP  MAIN
CMM6:
        MOV   R0,#6DH
        MOV   DPTR,#MSG_3
        LCALL COMP1
        JB    OK,CMM7
        SETB  RELAY3
        ACALL       DELAY3
        SETB  OK
        LJMP  MAIN
```

```
CMM7:
        MOV   R0,#6DH
        MOV   DPTR,#MSG_D
        LCALL COMP1
        JB    OK,CMM8
        CLR   RELAY4
        ACALL       DELAY3
        SETB  OK
        LJMP  MAIN
CMM8:
        MOV   R0,#6DH
        MOV   DPTR,#MSG_4
        LCALL COMP1
        JB    OK,EXIT_F1
        SETB  RELAY5
        ACALL       DELAY3
        SETB  OK
        LJMP  MAIN
EXIT_F1:
        LJMP  MAIN
COMP1:
        MOV   TEMP1,R0
        JZ    COMP1_L1
        CJNE  A,TEMP1,COMP1_EXIT
        INC   R0
        SJMP  COMP1
```

```
COMP1_L1:CLR OK
                RET
COMP1_EXIT:SETB OK
                RET
TX232:
TX_NEXT:CLR     A
        MOVC    A,@A+DPTR
        JZ      TX_RET
        LCALL   TX
        SJMP    TX_NEXT
        TX_RET:     jMP     @A+DPTR

;======= SERIAL PRINT ==========================

TX_PRINT:   CLR    A
        MOVC    A,@A+DPTR
        JZ      TX_EXIT
        ACALL   TX

        INC     DPTR
        SJMP    TX_PRINT

TX_EXIT:    RET

;======== DELAYS ================================
```

```
DELAY3: MOV R5,#5
DL3:    MOV R6,#255
DL2:    MOV R7,#255
DL1:    DJNZ R7,DL1
        DJNZ R6,DL2
        DJNZ R5,DL3
        RET
;======== SERIAL DATA TRANSMIT ==================

TX:     MOV   SBUF,A
        JNB     TI,$
        CLR     TI

        RET
;======== SERIAL DATA RECEIVE ==================
RX:     JNB     RI,$
        MOV   A,SBUF
        CLR     RI
        RET
;=======================================
SEND_1:

   CLR  LED_INI
   CLR  BUZZER
   CLR  RELAY5
   ACALL DELAY3
```

```
   SETB LED_INI
   ACALL DELAY3
```

In this section the microcontroller collect data from the sensor and send the user the above specified messages to the specified number. The user number is also specified in this section.

```
        ACALL       DELAY3
        ACALL       TX232
        DB      "AT",CR,LF,0
        ACALL       DELAY3
        ACALL       TX232
        DB      "AT+CMGF=1",CR,LF,0     ;TEXT MODE
        ACALL       DELAY3
        ACALL       TX232
        DB "AT+CMGS="03453030870"",CR,LF,0
        ACALL       DELAY3
        ACALL       TX232
        DB      "SECURITY THREAT",0
        RET
SEND_2:
   CLR  LED_INI
   CLR  BUZZER
   CLR  RELAY5
   ACALL DELAY3
   SETB LED_INI
   ACALL DELAY3
        ACALL       DELAY3
        ACALL       TX232
        DB      "AT",CR,LF,0
```

```
        ACALL       DELAY3
        ACALL       TX232
        DB     "AT+CMGF=1",CR,LF,0     ;TEXT MODE
        ACALL       DELAY3
        ACALL       TX232
        DB "AT+CMGS="03338110930"",CR,LF,0
        ACALL       DELAY3
        ACALL       TX232
        DB     "ENTERANCE DOOR THREAT",0
        RET
SEND_3:
   CLR  LED_INI
   CLR  BUZZER
   CLR  RELAY5
   ACALL DELAY3
   SETB LED_INI
   ACALL DELAY3
   ACALL     DELAY3
   ACALL     TX232
        DB     "AT",CR,LF,0
        ACALL       DELAY3
        ACALL       TX232
        DB     "AT+CMGF=1",CR,LF,0     ;TEXT MODE
       ACALL       DELAY3
        ACALL       TX232
        DB "AT+CMGS="03453030870"",CR,LF,0
```

```
        ACALL       DELAY3
        ACALL       TX232
        DB      "FIRE ALARM",0
        RET
;================================================
```

In the last section the micro controller is defined for the received instructions and is programmed to switch on or off the specified relays.

```
TEXT1:      DB      "SYSTEM INIT",0
MSG_A:      DB      "RELAY1 ON",0
MSG_1:      DB      "RELAY1 OFF",0
MSG_B:      DB      "RELAY2 ON",0
MSG_2:      DB      "RELAY2 OFF",0
MSG_C:      DB      "RELAY3 ON",0
MSG_3:      DB      "RELAY3 OFF",0
MSG_D:      DB      "RELAY4 ON",0
MSG_4:      DB      "RELAY4 OFF",0
MSG_E:      DB      "RELAY5 ON",0
MSG_5:      DB      "RELAY5 OFF",0
```