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UNIVERSITY OF DIYALA
ELECTRONIC
ENGINEERING DEPARTMENT

CONTROL SYSTEM BY USING GSM

A Project

Submitted to the Department of Electronic Engineering University of Diyala In Partial Fulfillment of the Requirements for the Degree of Bachelor in Electronic Engineering.

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وزارة التعليم العالي والبحث العلمي

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قسم الهندسة الالكترونية

CONTROL SYSTEM BY USING GSM

مشروع مقدم إلى قسم الهندسة الالكترونية في جامعة ديالى كجزء من متطلبات نيل درجةالبكلوريوس في الهندسة الالكترونية.

من قبل

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بأشراف

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CONTENTS

Abstract

This paper mainly focuses on the controlling of home appliances remotely and providing security when the user is away from the place. The system is SMS based and uses wireless technology to revolutionize the standards of living. This system provides ideal solution to the problems faced by home owners in daily life. The system is wireless therefore more adaptable and cost-effective. The GSM system provides security against intrusion as well as automates various home appliances using SMS. The system uses GSM technology thus providing ubiquitous access to the system for security and automated appliance control .Keywords: Short Message Service (SMS), Global System for Mobile communication(GSM),Radio Frequency(RF),AT Commands ubiquitous access and Automation. The aim of the paper is to investigate a cost effective solution that will provide controlling of home appliances remotely and will also enable home security against intrusion in the absence of home owner .The motivation is to facilitate the users to automate their homes having ubiquitous access. The system provides availability due to development of a low cost system. The home appliances control system with an affordable cost was thought to be built that should be mobile providing remote access to the appliances and allowing home security .Home 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 getting off the office does not get melted with the hot climate. Therefore this paper proposes a system that allows user to be control home appliances ubiquitously and also provide security on detection of intrusion via SMS.

Supervisors Certification

I certify that this project entitled (**CONTROL SYSTEM BY USING GS M**) was prepared under my supervision at the departments by of electronics engineering, College of engineering by **JANAAH KHALID** and **RAGHDA TAHIR** as partial fulfillment of the requirements for the Degree of Bachelor in Electronics Engineering .

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Name: **Msc. ADNAN M. T. AL-MAMOORl**

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Date: / / 2016

In view of the available recommendation, I forward this project for debate the examining committee.

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Name: ***Dr. Mohammed Salman***

Title: Lecturer (ph.D)

(Head of The Department)

Date: / /2016

Certificate of Examination Committee

We certify that the project entitled **(CONTROL SYSTEM BY YSING GSM).** And examining committee, examined the student **JANAAH KHALID** and **RAGHDA TAHIR** in contents, and that with our opinion, it meets the standard of a project for the Degree of Bachelor in Electronics Engineering.

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Approved For University of Diyala , College of Engineering and Electronic Department.

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Title: Lecturer

(Head of Electronic Engineering Department.

CHAPTER ONE
INTRODUCTION

1.1. Introduction to Project

“GSM based Control System” implements the emerging applications of the GSM technology. Using GSM networks, a control system has been proposed that will act as an embedded system which can monitor and control appliances and other devices locally using built-in input and output peripherals. Remotely the system allows the user to effectively monitor and control the house/office appliances and equipments via the mobile phone set by sending commands in the form of SMS messages and receiving the appliances status. The main concept behind the project is receiving the sent SMS and processing it further as required to perform several operations. The type of the operation to be performed depends on the nature of the SMS sent. The principle in which the project is based is fairly simple. First, the sent SMS is stored and polled from the receiver mobile station and then the required control signal is generated and sent to the intermediate hardware that we have designed according to the command received in form of the sent message .

GSM (Global System for Mobile Communications): It is a cellular communication standard. SMS (Short Message Service): It is a service available on most digital mobile phones that permit the sending of short messages (also known as text messaging service).

1.2. Background

The new age of technology has redefined communication. Most people nowadays have access to mobile phones and thus the world indeed has become a global village. At any given moment, any particular individual can be contacted with the mobile phone. But the application of mobile phone cannot just be restricted to sending SMS or starting conversations. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra-red, Bluetooth, etc which has developed in recent years goes to show the very fact that improvements are in fact possible and these improvements have eased our life and the way we live. Remote management of several home and office appliances is a subject of growing interest and in recent years we have seen many systems providing such controls. These days, apart from supporting voice calls a mobile phone can be used to send text messages as well as multimedia messages (that may contain pictures, graphics, animations, etc). Sending written text messages is very popular among mobile phone users. Instant messaging, as it is also known, allows quick transmission of short messages that allow an individual to share ideas, opinions and other relevant information. We have used the very concept to design a system that acts a platform to receive messages which in fact are commands sent to control different appliances and devices connected to the platform. We have designed a control system which is based on the GSM technology that effectively allows control from a remote area to the desired location. The application of our suggested system is immense in the ever changing technological world. It allows a greater degree of freedom to an individual whether it is controlling the household appliances or office equipments. The need to be physically present in

order to control appliances of a certain location is eliminated with the use of our system .

1.3. Problem Statement

Technology has advanced so much in the last decade or two that it has made life more efficient and comfortable. The comfort of being able to take control of devices from one particular location has become imperative as it saves a lot of time and effort. Therefore there arises a need to do so in a systematic manner which we have tried to implement with our system. The system we have proposed is an extended approach to automating a control system. With the advancement and breakthroughs in technology over the years, the lives of people have become more complicated and thus they have become busier than before. With the adoption of our system, we can gain control over certain things that required constant attention. The application of our system comes in handy when people who forget to do simple things such as turn ON or OFF devices at their home or in their office, they can now do so without their presence by the transmission of a simple text message from their mobile phone. This development, we believe, will ultimately save a lot of time especially when people don't have to come back for simple things such as to turn ON/OFF switches at their home or at their office once they set out for their respective work. The objective of this project is to develop a device that allows for a user to remotely control and monitor multiple home/office appliances using a cellular phone. This system will be a powerful and flexible tool that will offer this service at any time, and from anywhere with the constraints of the technologies being applied. Possible target appliances include (but are not limited to) climate control system, security systems, lights; anything with an electrical interface.

The proposed approach for designing this system is to implement a microcontroller-based control module that receives its instructions and command from a cellular phone over the GSM network. The microcontroller then will carry out the issued commands and then communicate the status of a given appliance or device back to the cellular phone.

1.4.BLOCK DIGRAM

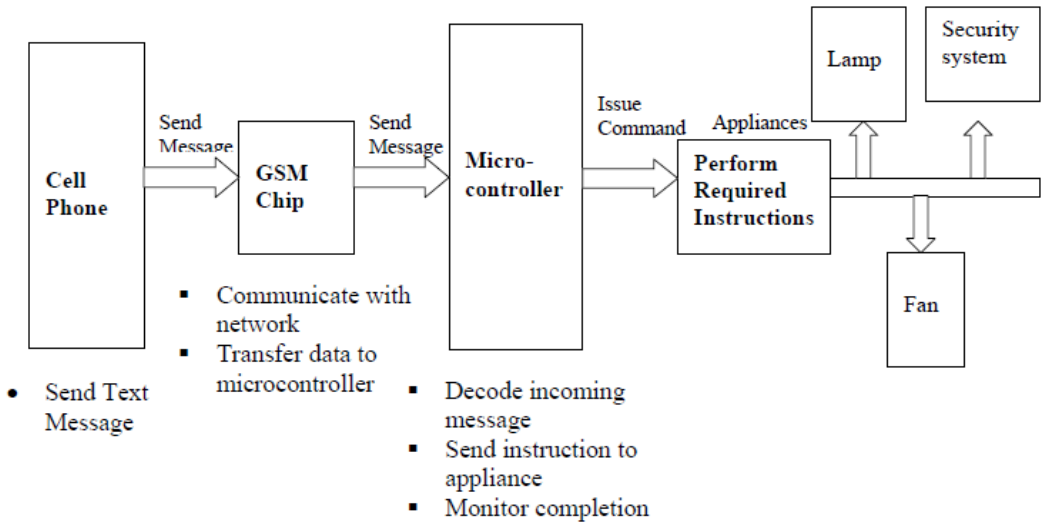


Figure 1.1

1.5. System Operation Flow Diagram

Assuming that the control unit is powered and operating properly, the process of controlling a device connected to the interface will proceed through the following steps;

• The remote user sends text messages including commands to the receiver.

• GSM receiver receives messages sent from the user cell phone.

• GSM receiver decodes the sent message and sends the commands to the microcontroller.

• Microcontroller issues commands to the appliances and the devices connected will switch ON/OFF.

CHAPTER TWO
SYSTEM SPECIFICATION

2.1. Scopes and Purpose of System Specification

The system specification shows the description of the function and the performance of system and the user. The scope of our project "GSM Based control system" is immense. The future implications of the project are very great considering the amount of time and resources it saves. The project we have undertaken can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates, device synchronization, etc. The project itself can be modified to achieve a complete Home Automation system which will then create a platform for the user to interface between himself and the household.

2.2. Goals and Objectives

The project "GSM based Control System" at the title suggests is aimed to construct a control system that enables the complete control of the Interface on which it is based .General objectives of the project are defined as;

a. To co-ordinate appliances and other devices through Short Message Service(SMS).

b. To effectively receive and transmit data via SMS.

c. To eliminate the need of being physically present in any location for tasks involving the operation of appliances within a household/office.

d. Minimize power and time wastage.

2.3. Operating Environment

The control system will include two separate units: the cellular phone, and the control unit. There will therefore be two operating environments. The cellular phone will operate indoors and outdoors whereas the control unit will operate indoors within the temperature and humidity limits for proper operation of the hardware.

2.4. Intended Users and Uses

This system is aimed toward all the average users who wish to control their household/office appliances remotely from their cell phones provided that the appliances are electrically controllable. Example of feasible appliances and applications under consideration include ;enable/disable security systems, fans, lights, kitchen appliances, and adjusting the temperatures settings of a heating/ventilation/air conditioning system.

2.5. Assumptions

Certain assumptions have to be made in order to implement our project. The list of assumptions for our project is;

a. The user and control unit will establish communication via GSM.

b. The cell phone and service provider chosen will support text messaging service.

c. The user is familiar with the text messaging program on their cell phone.
d. All service charges (standard messaging rates) from the service provider apply.
e. The controlled appliances can and will have to have an electrical interface in order to be controlled by the microcontroller.

2.6. Major Constraints

Along the course of project completion we encountered various problems and obstacles. Not everything that we had planned went smoothly during the project development span. Also we had a limited amount of time for its completion so we were under a certain amount of pressure as well. We had to start from the research phase at the beginning and needed to gain knowledge on all the devices and components that we had intended to use for our project. Other phases of the project included coding, debugging, testing, documentation and implementation and it needed certain time for completion so we really had to manage the limited time available to us and work accordingly to finish the project within the schedule.

2.7. Functional Requirements

The following is a list of functional requirements of the control unit/module **.**

a. The control unit will have the ability to connect to the cellular network automatically.

b. The control unit will be able to receive text messages and will be able to parse and

interpret text messages and instructions to be sent to the microcontroller.

c. The microcontroller within the control unit will issue its command to the electrical appliances through a simple control circuit.

d. The control unit will control the electrical appliances.

2.8. Constraints Considerations

The following is a list of constraint Considerations:

a. The controlled appliances will need an electrical control interface. This system is only capable of controlling electrical devices.

b. The control module will need to be shielded against electrostatic discharges. This will increase the reliability of the system.

c. Battery backup for controlling unit can be implemented in case of power disruption.

2.9. Technology Considerations

The considerations for this system will include a choice of networks, communication protocols and interfaces.

a. Cellular Networks: The widely available networks are based on GSM. This network provides wide area coverage and can be utilized more cost-effectively for this project.

b. Communication Protocols: The available communication protocol that we have used is SMS. The SMS is the most efficient because this project requires a cellular communication and limited data to be sent.

c. I/O interfaces between microcontroller and devices: Serial I/O is considered as options for connection between the GSM receiver and the microcontroller. Using the microcontroller, a control circuit will be implemented to control the electrical appliances.

2.10. Limitations

Our project has certain limitations and a list of such is mentioned below;

a. The receiver must reside in a location where a signal with sufficient strength can be received from a cellular phone network.

b. Only devices with electrical controlling input ports will be possible targets for control.

c. Operation of the controlling unit is only possible through a cell phone with SMS messaging capabilities.

d. The Controlling unit must be able to receive and decode SMS messages.

CHAPTER THREE
DESIGN

3.1. Circuit Components

3.1.1 Micro-Controller

3.1.1.a.introduction

An embedded microcontroller is a chip, which has a computer processor with all its support function (clocking and reset), memory (both program storage and RAM), and I/O (including bus interfaces) built into the device. These built in function minimize the need for external circuits and devices to the designed in the final applications. The improvements in micro-controller technology has meant that it is often more cost effective, faster and more efficient to develop an application using a micro-controller rather than discreet logic. Creating applications for micro-controllers is completely different than any other development job in computing and electronics. In most other applications, number of subsystems and interfaces are available but this is not the case for the micro-controller where the following responsibilities have to be taken:

• Power distribution
• System clocking
• Interface design and wiring
• System Programming
• Application programming
• Device programming

There are two types of micro-controller commonly in use. Embedded micro-controller is the micro-controller, which has the entire hardware requirement to run the application, provided on the chip. External memory micro-controller is the micro-controller that allows the connection of external memory when the program memory is insufficient for an application or during the work a separate ROM (or even RAM) will make the work easier.

b) PIC16F628A MICRO-CONTROLLER (18-pin Flash-Based, 8-Bit CMOS Microcontrollers with NANO Watt Technology)

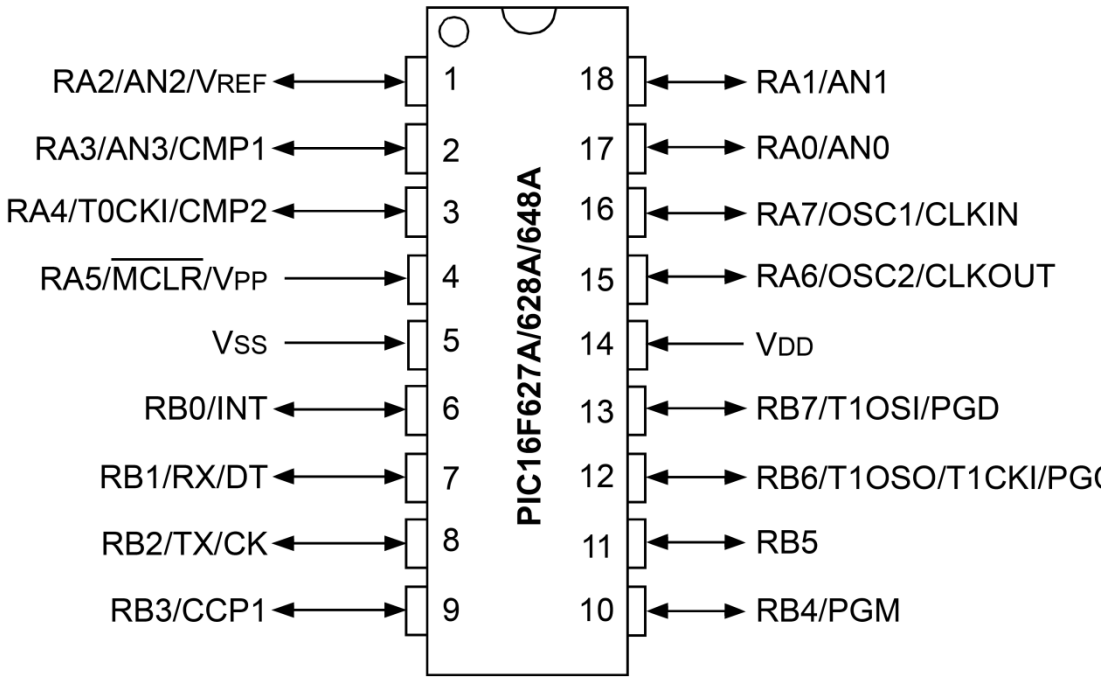


Figure 3.1.

High-Performance RISC CPU:

• Operating speeds from DC – 20 MHz

• Interrupt capability.

• 8-level deep hardware stack.

• Direct, Indirect and Relative Addressing modes.
• 35 single-word instructions:
- All instructions single cycle except branches.

Special Microcontroller Features:

• Internal and external oscillator options:
- Precision internal 4 MHz oscillator factory calibrated to ±1%.
- Low-power internal 48 kHz oscillator
- External Oscillator support for crystals and resonators
• Power-saving Sleep mode.
• Programmable weak pull-ups on PORTB.
• Multiplexed Master Clear/Input-pin.
• Watchdog Timer with independent oscillator for reliable operation.
• Low-voltage programming.
• In-Circuit Serial Programming™ (via two pins)
• Programmable code protection.
• Brown-out Reset.
• Power-on Reset.
• Power-up Timer and Oscillator Start-up Timer.
• Wide operating voltage range (2.0-5.5V).
• Industrial and extended temperature range.
• High-Endurance Flash/EEPROM cell:

- 100,000 write Flash endurance.
- 1,000,000 write EEPROM endurance.
- 40 year data retention.

Low-Power Features:

• Standby Current:
- 100 NA @ 2.0V, typical
• Operating Current:
A @ 32 kHz, 2.0V,□- 12 typical
A @ 1 MHz, 2.0V,□- 120 typical
• Watchdog Timer Current:
A @ 2.0V, typical.□- 1
• Timer1 Oscillator Current:
A @ 32 kHz, 2.0V,□- 1.2 typical
• Dual-speed Internal Oscillator:
- Run-time selectable between 4 MHz and
48 kHz
s wake-up from□- 4 Sleep, 3.0V, typical

Peripheral Features:

• 16 I/O pins with individual direction control
• High current sink/source for direct LED drive
• Analog comparator module with:

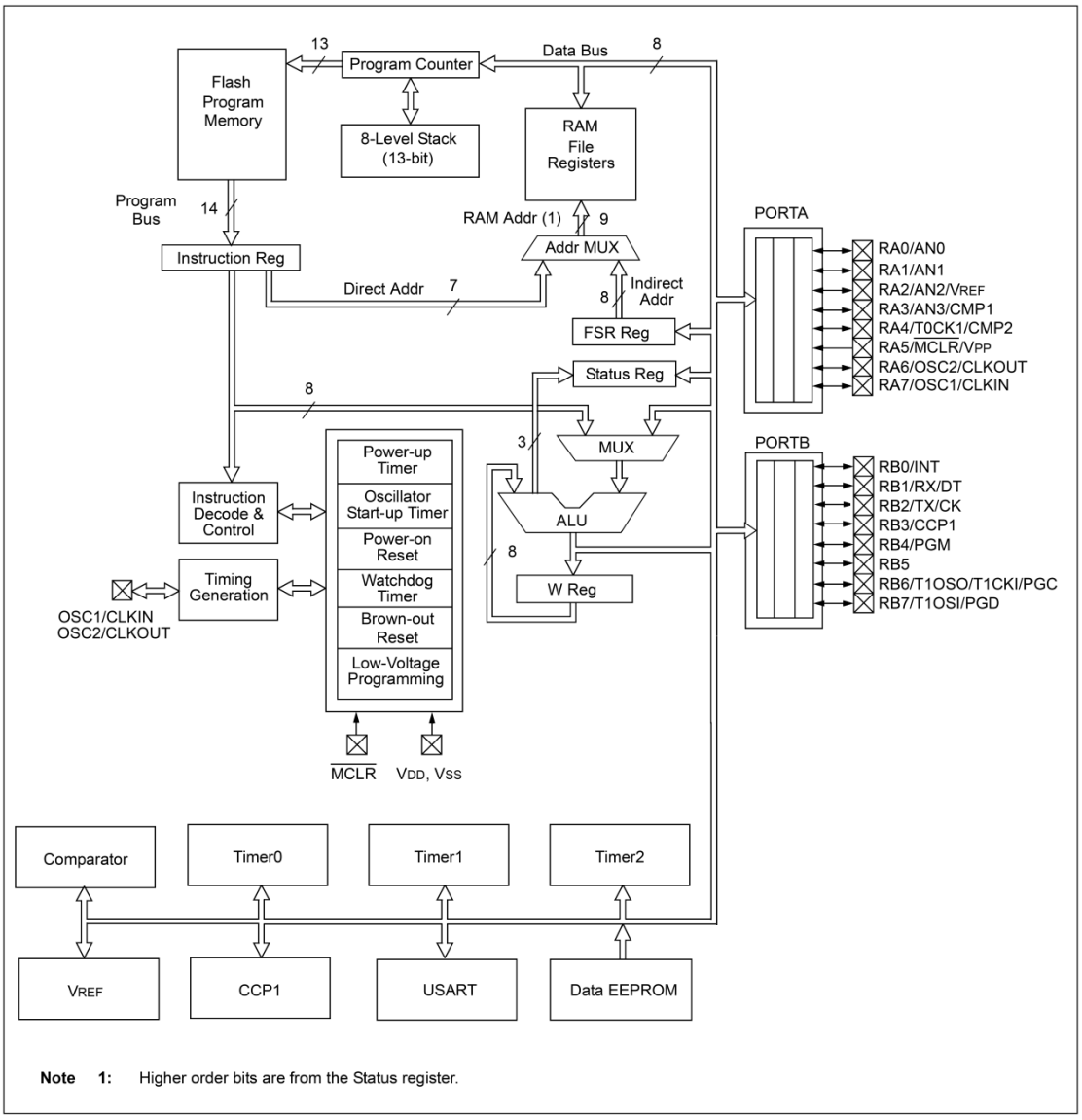
- Two analog comparators
- Programmable on-chip voltage reference
(VREF) module
- Selectable internal or external reference
- Comparator outputs are externally accessible
• Timer0: 8-bit timer/counter with 8-bit
programmable prescaler
• Timer1: 16-bit timer/counter with external crystal/
clock capability
• Timer2: 8-bit timer/counter with 8-bit period
register, prescaler and postscaler
• Capture, Compare, PWM module:
- 16-bit Capture/Compare
- 10-bit PWM
• Addressable Universal Synchronous/Asynchronous
Receiver/Transmitter USART/SCI

Device
Program
Memory Data Memory
I/O CCP
(PWM) USART Comparators Timers
Flash 8/16-bit
(words)
SRAM
(bytes)
EEPROM
(bytes)
PIC16F627A 1024 224 128 16 1 Y 2 2/1

PIC16F628A 2048 224 128 16 1 Y 2 2/1

PIC16F648A 4096 256 256 16 1 Y 2 2/1.

C) BLOCK DIGRAM



Note 1: Higher order bits are from the Status register.

Figure 3.2

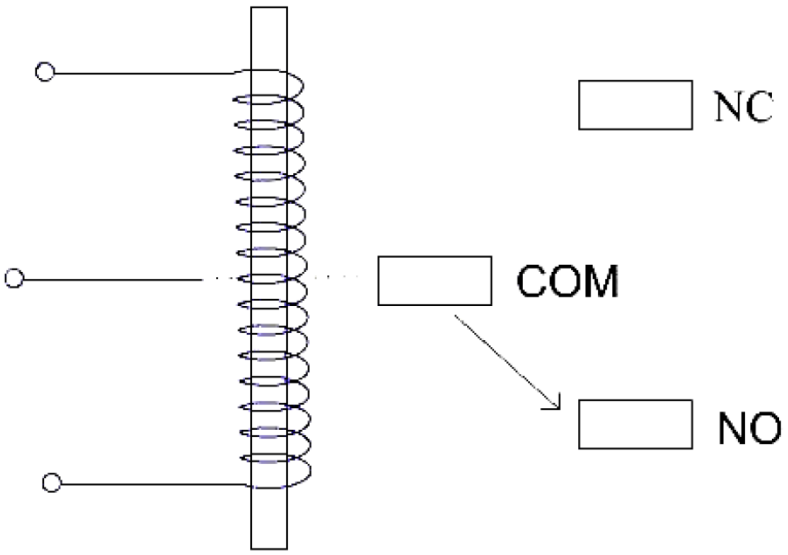
Table 3-1 PIC16F627A/628A/648APINOUT Description

TABLE 3-2: PIC16F627A/628A/648A PINOUT DESCRIPTION (CONTINUED)

Name	Function	Input Type	Output Type	Description
RB4/PGM	RB4	TTL	CMOS	Bidirectional I/O port. Interrupt-on-pin change. Can be software programmed for internal weak pull-up.
	PGM	ST	—	Low-voltage programming input pin. When low-voltage programming is enabled, the interrupt-on-pin change and weak pull-up resistor are disabled.
RB5	RB5	TTL	CMOS	Bidirectional I/O port. Interrupt-on-pin change. Can be software programmed for internal weak pull-up.
RB6/T1OSO/T1CKI/PGC	RB6	TTL	CMOS	Bidirectional I/O port. Interrupt-on-pin change. Can be software programmed for internal weak pull-up.
	T1OSO	—	XTAL	Timer1 oscillator output
	T1CKI	ST	—	Timer1 clock input
	PGC	ST	—	ICSP™ programming clock
RB7/T1OSI/PGD	RB7	TTL	CMOS	Bidirectional I/O port. Interrupt-on-pin change. Can be software programmed for internal weak pull-up.
	T1OSI	XTAL	—	Timer1 oscillator input
	PGD	ST	CMOS	ICSP data I/O
VSS	VSS	Power	—	Ground reference for logic and I/O pins
VDD	VDD	Power	—	Positive supply for logic and I/O pins

Legend: O = Output, — = Not used, TTL = TTL Input, CMOS = CMOS Output, I = Input, OD = Open Drain Output, P = Power, ST = Schmitt Trigger Input, AN = Analog

3.1.2.RELAY



NC: - Normally Connected

NO: - Normally Open

COM: - Common

Figure 3.3

The relay driver is used to isolate both the controlling and the controlled device. The relay is an electromagnetic device, which consists of solenoid, moving contacts (switch) and restoring spring and consumes comparatively large amount of power. Hence it is possible for the interface IC to drive the relay satisfactorily. To enable this, a driver

circuitry, which will act as a buffer circuit, is to be incorporated between them. The driver circuitry senses the presence of a “high” level at the input and drives the relay from another voltage source. Hence the relay is used to switch the electrical supply to the appliances. From the figure when we connect the rated voltage across the coil the back EMF opposes the current flow but after the short time the supplied voltage will overcome the back EMF and the current flow through the coil increase. When the current is equal to the activating current of relay the core is magnetized and it attracts the moving contacts. Now the moving contact leaves from its initial position denoted “(N/C)” normally closed terminal which is a fixed terminal. The common contact or moving contact Establishes the connection with a new terminal which is indicated as a normally open terminal “(N/O)”. Whenever, the supply coil is withdrawn the magnetizing force is vanished. Now, the spring pulls the moving contact back to initial position, where it makes a connection makes with N/C terminal. However, it is also to be noted that at this time also a back EMF is produced. The withdrawal time may be in microsecond, the back EMF may be in the range of few kilovolts and in opposite polarity with the supplied terminals the voltage is known as surge voltage. It must be neutralized or else it may damage the system.

CHAPTER FOUR
GSM TECHNOLOGY AND SHORT MESSAGE SERVICES

4.1. GSM TECHNOLOGY

GSM is a global system for mobile communication GSM is an International digital cellular telecommunication. The GSM standard was released by ETSI (European Standard Telecommunication Standard) back in 1989. The first commercial services were launched in 1991 and after its early introduction in Europe; the standard went global in 1992. Since then, GSM has become the most widely adopted and fastest-growing digital cellular standard, and it is positioned to become the world's dominant cellular standard. Today's second-generation GSM networks deliver high quality and secure mobile voice and data services (such as SMS/ Text Messaging) with full roaming capabilities across the world.

GSM platform is a hugely successful technology and as unprecedented story of global achievement. In less than ten years since the first GSM network was commercially launched, it become, the world's leading and fastest growing mobile standard, spanning over 173 countries. Today, GSM technology is in use by more than one in ten of the world's population and growth continues to sour with the number of subscriber worldwide expected to surpass one billion by through end of 2003. Today's GSM platform is living, growing and evolving and already offers an expanded and feature-rich 'family' of voice and enabling services. the Global System for Mobile Communication (GSM) network is a cellular telecommunication network with a versatile architecture complying with the ETSI GSM 900/GSM 1800 standard. SIEMEN'S implementation is the digital cellular mobile communication system D900/1800/1900 that uses the very latest technology to meet every requirement of the standard.

4.2 .GSM ARTCHITERCUR

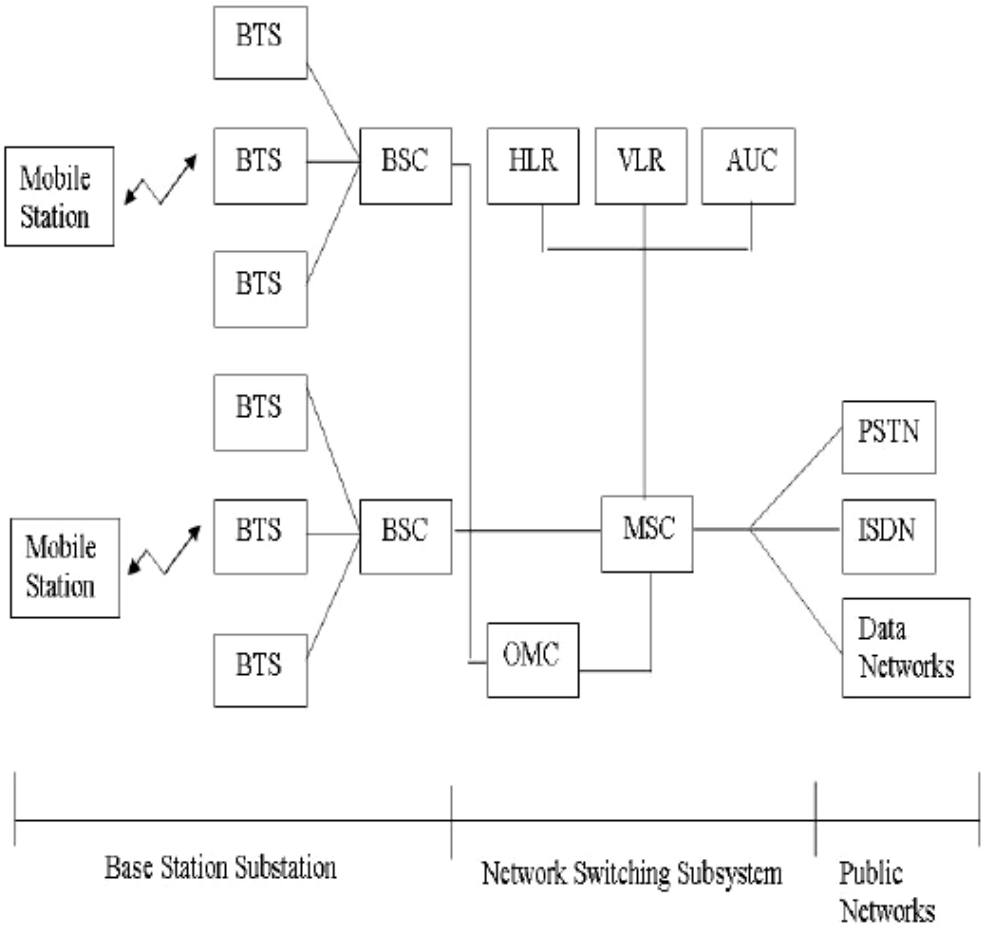


Fig 4.0 GSM Architecture

4.3. BASIC SPECIFICATION IN GSM

Table 4.1

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

4.4. GSM Services

GSM services follow ISDN guidelines and classified as either tele services or data services. Tele services may be divided into three major categories:

• Telephone services, include emergency calling and facsimile. GSM also supports

Video tex and Tele tex, through they are not integral parts of the GSM standard.

• Bearer services or Data services, which are limited to layers 1, 2 and 3 of the OSI

reference model. Data may be transmitted using either a transparent mode or nontransparent mode.

• Supplementary ISDN services, are digital in nature, and include call diversion,

closed user group, and caller identification. Supplementary services also include the short message service (SMS).

4.5. SHORT MESSAGE SERVICE:

SMS stands for Short Message Service. It is a technology that enables the sending and receiving of message between mobile phones. SMS first appeared in Europe in 1992. It was included in the GSM (Global System for Mobile Communication) standards right at the beginning. Later it was ported to wireless technologies like CDMA and TDMA. The GSM and SMS standards were originally developed by ETSI. ETSI is the abbreviation for European Telecommunication Standard Institute. Now

the 3GPP (Third Generation Partnership Project) is responsible for the development and maintenance of the GSM and SMS standards.

One SMS message can contain at most 140 bytes (1120 bits) of data, so one SMS message can contain up to:

• 160 characters if 7-bit character encoding is used. (7-bit character encoding is suitable for encoding Latin characters like English alphabets.)

• 70 characters if 16-bit Unicode UCS2 character encoding is used. (SMS text messages containing non-Latin characters like Chinese character should use 16- bit character encoding.) Once the message is sent the message is received by SMSC, which must then get it to the appropriate mobile device. To do this the SMSC sends a SMS request to Home Location Register (HLR) to find the roaming customer. Once HLR receives the request, it responds to the SMSC with the subscriber's status:

1 Inactive or active.

2 Where subscriber is roaming.

If the response is "inactive", then the SMSC will hold onto the message for a period of time. When the subscriber access his device, the HLR sends a SMS notification to the SMSC and the SMSC will attempt delivery.

The SMSC transfer the message in a Short Message Delivery Point to Point format to the serving system. The system pages the device, and if it responds, the message gets delivered. The SMSC receives verification that the message was received by the end user, then categorizes the message as "sent" and will not attempt to send again. SMS provides a mechanism for transmitting short message to and from wireless devices. The service makes use of an SMSC, which acts as a store and forward system for short messages. One major advantage of SMS is that it is

supported by 100% GSM mobile phones. Almost all subscription plans provided by wireless carriers include inexpensive SMS messaging service.

4.6. What makes SMS messaging so successful worldwide?

SMS is so success all over the world. SMS messaging is now one of the most important revenue sources of wireless carriers. Some of the reasons are discussed below.

• SMS Messages can be sent and read at any time.
• SMS Message can be sent to an offline Mobile Phone.
• SMS Messaging is less disturbing while you can still stay in touch.
• SMS are supported by 100% GSM Mobile Phones and they can be Exchanged between different wireless carriers.

4.7. SMS Service Providers (SMS Gateway Providers, SMS Resellers, SMS Brokers)

There is a demand for SMS connectivity from applications that does not require the sending or receiving of large amount of SMS messages. One example is a remote monitoring system. If the remote monitoring system finds that a certain server is not responding, it will send an SMS alert to the system administrator mobile phone. This remote monitoring system will have a very small amount of SMS traffic per month since the servers being monitored should be working fine most of the time.

Since a wireless carrier usually doesn't provide direct SMSC or SMS gateway access to user without a large amount of SMS traffic, some companies come out to fill the gap. These companies are called SMS service providers. SMS service providers are also known as SMS gateway providers, SMS resellers and SMS brokers because of the following reasons:

• SMS gateway providers-: An SMS service provider provides an SMS gateway for its user to send SMS message to. This SMS gateway will then route the SMS message to another SMS gateway or SMSC.

• SMS reseller and SMS broker-: SMS service provider buy a large amount of SMS message from a lot of wireless carrier at low price per SMS message. They then sell the SMS message at a price higher than the cost . Another advantage of using the SMS connectivity services of SMS service providers is that their network coverage is very good. They work hard to cover as many wireless networks as possible so as to make their services attractive.

4.8. Short Message Service Center (SMSC)

SMSC is a combination of hardware and software responsible for the relaying and storing and forwarding of short message between an SME and mobile device. The SMSC must have high reliability, subscriber capacity, and message throughput. In addition, the system should be easily scalable to accommodate growing demand for SMS in the network. Normally, an IN-based solution will allow for a lower entry cost compared to point solutions because it can support other applications on single hardware platform and share resources, thereby spreading the

deployment cost over several services and applications. Another factor to be considered is the ease of operation and maintenance of the application, as well as the flexibility to activate new services and upgrade to new software releases.

Nepal has two mobile companies:

• Nepal telecommunication

• Spice Nepal PVT .Ltd.

Both companies have their own SMSC. Nepal telecommunication has +9779851028801.

Similarly Spice Nepal Pvt. Ltd. has +9779800009000.

4.9. Short Message Peer to Peer Protocol

The short message peer to peer protocol (SMPP) is a protocol for exchanging SMS messages between SMS peer entities such as message service centers. It is often used to allow third parties (e.g. content suppliers like news organizations) to submit messages, often in bulk. The protocol is based on complimentary pairs of request / response PDUs exchanged over OSI layer 4 (TCP/IP session or X.25 SVC3) connections. PDUs are binary encoded for efficiency.

CHAPTER FIVE
SOFTWARE DEVELOPMENT

5.1. SOFTWARE INTRODUCTION

The software for our project was developed using a simple high level Language tool in C. The software extracts the sent message from the SIM location at a regular interval and processes it to control the different appliances connected within the interface.

The PROTEUS Environment: Proteus PIC Bundle is the complete solution for developing, testing and virtually prototyping your embedded system designs based around the Microchip Technologies TM series of microcontroller. This software allows you to perform schematic capture and to simulate the circuits you design.

5.2 . the Code of sending SMS by using GSM:

*/

:Project name *

SMS Control

:Description *

Controlling 4 Relays over SMS and retreiving status SMS containing state of relays, 4

:Test configuration *

MCU: PIC16f628a

:NOTES *

The Relay control SMS messages should contain commands: - "R1ON", "R1OFF", "R2ON" ... and "Status?" (it is case sensitive and without quotes). In example, "R1ON" command turns ON the Relay1 which is on porta.f0 pin , "R4OFF" turns OFF the Relay4 which is on ...porta.f3 pin ... etc

You can send only the "Status?" inquiry via your SMS (or add it to the SMS containg relay commands) and then you'll receive an INFO about the

:state of relays. An example of one control message is below

R1ON R2OFF R3ON R4OFF Status?" (Note that there is no need " .(for separaion chars (spaces in this case

Valid message is also: "R1ONR2OFFR3ONR4OFFStatus?"; just be careful about the case of letters.

/*

Set of AT commands //general commands //

```
const char atc0[] = "AT";                    // Every AT command starts with ""AT

const char atc1[] = "ATE0";                  // Disable command echo

const char atc2[] = "AT+CMGF=1";             // TXT messages

const char atc3[] = "AT+CMGS=\"0123456789\""; // Send message to cell number : 0123456789 (Enter your cell phone number instead of (0123456789

const char atc4[] = "AT+CMGR=1";             // Command for reading message from location 1 from inbox

const char atc5[] = "AT+CMGD=1,4";           // Erasing all messages from inbox
```

//

Responses to parse //

꞉const GSM_OK = 0

꞉const GSM_Ready_To_Receive_Message = 1

꞉const GSM_ERROR = 2

//

Relay connections //

꞉Sbit Relay1 at RA0_bit

꞉sbit Relay2 at RA1_bit

꞉sbit Relay3 at RA2_bit

꞉sbit Relay4 at RA3_bit

꞉sbit Relay1_Direction at TRISA0_bit

꞉sbit Relay2_Direction at TRISA1_bit

꞉sbit Relay3_Direction at TRISA2_bit

꞉sbit Relay4_Direction at TRISA3_bit

//

꞉sbit LED_ON_OFF at RB0_bit

꞉sbit LED_ON_OFF_Direction at TRISB0_bit

//

char SMS_Message[55]; // SMS Message string

State machine control variables //

꞉char gsm_state = 0

```
ǂshort  rsp
char status_req = 0; // Status request variable
(Send command or data to the Telit GM862 Module - (const //
(void GM862_Send(const char *s
}
Send command or data string //
} (while(*s
ǂ(++UART1_Write(*s
{
Terminatation by CR //
ǂ(UART1_Write(0x0D
{
(Send command or data to the Telit GM862 Module - (RAM //
//   (void GM862_Send_Ram(char *s1
}
Send command or data string //
} (while(*s1
ǂ(++UART1_Write(*s1
{
Terminatation by CR //
ǂ(UART1_Write(0x0D
{
Compose Status SMS //
ǂ(unsigned ComposeMessage(char* Message
```

```
Send Status SMS //
(void Send_Msg(char* Msg
}
꞉(GM862_Send(atc2       //
꞉(Wait_response(GSM_OK       //
꞉(GM862_Send(atc3
꞉ (while (rsp != GSM_Ready_To_Receive_Message
꞉(GM862_Send_Ram(Msg
꞉(UART1_Write(0x1A
꞉(UART1_Write(0x0D
꞉ (while (rsp != GSM_OK
{
Send status SMS to the cell phone number defined by the atc3 const  //
string
()void Send_Status
}
꞉(ComposeMessage(SMS_Message
꞉(Send_Msg(SMS_Message
{

sec pauseᵒ //
()void Wait
}
꞉(Delay_ms(3000
{
```

```
**********************************//
(void Wait_send_command(const char *txt
}
(while(1
}
ǂ(GM862_Send(txt
if (rsp == GSM_OK) break;     // If GSM862 says "OK" on our baud rate we program can continue
ǂ(Delay_ms(500
{
{
**************************************//
Main //
()void main
}
CMCON = 7;          // Disable comparators
Initialy, relays are turned off //
ǂRelay1 = 0
ǂRelay2 = 0
ǂRelay3 = 0
ǂRelay4 = 0
//
ǂRelay1_Direction = 0
ǂRelay2_Direction = 0
ǂRelay3_Direction = 0
```

꞉Relay4_Direction = 0

Setup interrupts //

RCIE_bit = 1; // Enable Rx1 intterupts

꞉PEIE_bit = 1

꞉GIE_bit = 1

//

꞉LED_ON_OFF = 0

꞉LED_ON_OFF_Direction = 0

꞉(UART1_Init(9600

꞉(Delay_ms(200

Wait(); Wait(); Wait(); // Wait a while till the GSM network is configured

. Wait_send_command(atc0); //send AT command

Wait_send_command(atc1); // Disable command echo

Wait_send_command(atc2); // Set message type as TXT

(Wait_send_command(atc5); // Delete all messages (if any

꞉()Wait

꞉LED_ON_OFF = 1

while(1) // infinite loop

}

(while(1

}

GM862_Send(atc4); // Read SMS message on location 1

if (rsp == GSM_OK || rsp == GSM_ERROR) break; // If GSM862 says "OK" on our baud rate we program can continue

```
꞉(Delay_ms(500
{
if (status_req){       // Send status SMS if it's been requested
꞉status_req = 0
꞉()Send_Status
{
} (if (rsp == GSM_OK
Wait_send_command(atc5);     // Delete all messages (if
(any
{
꞉()Wait
{
{
**********************************************************/
/*********************
Compose Status SMS //
(unsigned ComposeMessage(char* Message
}


RCIE_bit = 0;               // Disable Rx1 intterupts
꞉'Message[0] = '\0
SMS header //
꞉(":strcat(Message, "INFO
(strcat(Message, "\r\n");      // Add new line (CR + LF
//
```

Add the status of Relays to the SMS Message //

ؼ("if (Relay1) strcat(Message, "R1 - ON

ؼ("else   strcat(Message, "R1 - OFF

(strcat(Message, "\r\n");   // Add new line (CR + LF

ؼ("if (Relay2) strcat(Message, "R2 - ON

ؼ("else strcat(Message, "R2 - OFF

(strcat(Message, "\r\n");   // Add new line (CR + LF

ؼ("if (Relay3)strcat(Message, "R3 - ON

ؼ("else strcat(Message, "R3 - OFF

(strcat(Message, "\r\n");   // Add new line (CR + LF

ؼ("if (Relay4)strcat(Message, "R4 - ON

ؼ("else strcat(Message, "R4 - OFF

(strcat(Message, "\r\n");   // Add new line (CR + LF

//

SMS footer //

ؼ(".strcat(Message, "End

```
(strcat(Message, "\r\n");      // Add new line (CR + LF
//

RCIE_bit = 1;               // Enable Rx1 intterupts

꞉(return stlern(Message
{
Reading the data from UART in the interuppt routine //
()void interrupt
}
꞉char tmp
ꟾif (RCIF_bit == 1)     // Do we have uart rx interrupt request
}
tmp = UART1_Read();                    // Get received byte
Process reception through state machine //
We are parsing only "OK" and "> " responses //
(switch (gsm_state
}
} :case  0
rsp = -1;                // Clear response
"if (tmp == 'O')              // We have 'O', it could be "OK
'gsm_state = 1;              // Expecting 'K
" <" if (tmp == '>')               // We have '>', it could be
' ' gsm_state = 10;              // Expecting
```

```
"if (tmp == 'E')                // We have 'E', it could be "ERROR
'gsm_state = 30;                // Expecting 'R
"ʕif (tmp == 's')               // We have 'S', it could be "status
'gsm_state = 40;                // Expecting 't
if (tmp == 'R')                 // We have 'R', it could be "RxON" or
""RxOFF
(gsm_state = 50;                // Expecting x = (1,...,4
꞉break
{
} :case  1
<- 'if (tmp == 'K') // We have 'K
}
gsm_state = 20;                 // Expecting CR+LF
{
else gsm_state = 0;             // Reset state machine
꞉break
{
} :case 10
(' ' == if (tmp
}
We have "> " response //
rsp = GSM_Ready_To_Receive_Message; // Set
reception flag
{
gsm_state = 0;                  // Reset state machine
```

```
꞉break
{
} :case 20
if (tmp == 13)                  // We have 13, it could be CR+LF
gsm_state = 21;                 // Expecting LF
else gsm_state = 0;                  // Reset state machine


꞉break
{
} :case 21
(if (tmp == 10
}
rsp = GSM_OK;               // We have "OK" response  and We
have LF, response is complete
{
gsm_state = 0;                   // Reset state machine
꞉break
{
} :case 30
"if (tmp == 'R')                 // We have 'R', it could be "ERROR
gsm_state = 31;                 // Expecting 'R ',
else gsm_state = 0;                  // Reset state machine
꞉break
{
} :case 31
```

```
"if (tmp == 'R')                // We have 'R', it could be "ERROR
'gsm_state = 32;                // Expecting 'O
else gsm_state = 0;                 // Reset state machine
؛break
{
} :case 32
"if (tmp == 'O')                // We have 'O', it could be "ERROR
'gsm_state = 33;                // Expecting 'R
else   gsm_state = 0;                // Reset state machine

؛break
{
} :case 33
'if (tmp == 'R')     // We have 'R
}
We have "ERROR" response //
rsp = GSM_ERROR;          // Set reception flag
{
gsm_state = 0;                // Reset state machine
؛break
{
} :case 40
"؟if (tmp == 't')                // We have 't', it could be "Status
'gsm_state = 41;                // Expecting 'a
```

```
else
gsm_state = 0;              // Reset state machine
꞉break
{
} :case 41
"ʔif (tmp == 'a')             // We have 'a', it could be "Status
'gsm_state = 42;              // Expecting 't
else
gsm_state = 0;              // Reset state machine
꞉break
{
} :case 42
"ʔif (tmp == 't')             // We have 't', it could be "Status
'gsm_state = 43;              // Expecting 'u
else
gsm_state = 0;              // Reset state machine
꞉break
{
} :case 43
"ʔif (tmp == 'u')             // We have 'u', it could be "Status
'gsm_state = 44;              // Expecting 's
else
gsm_state = 0;              // Reset state machine
꞉break
```

```
{
} :case 44
"؟if (tmp == 's')                // We have 's', it could be "Status
'؟' gsm_state = 45;               // Expecting
else
gsm_state = 0;                 // Reset state machine
؛break
{
} :case 45
'؟' if (tmp == '?'){               // We have
status_req = 1;                 // Status has been
!requested
{
gsm_state = 0;                  // Reset state machine
؛break
{
} :case 50
if (tmp == '1')                 // We have '1', it could be "R1ON" or
""R1OFF
'gsm_state = 51;                // Expecting 'O
else
if (tmp == '2')                 // We have '2', it could be "R2ON" or
""R2OFF
'gsm_state = 60;                // Expecting 'O
else
```

```
if (tmp == '3')                // We have '3', it could be "R3ON" or
""R3OFF
'gsm_state = 70;               // Expecting 'O
else
if (tmp == '4')                // We have '4', it could be "R4ON" or
""R4OFF
'gsm_state = 80;               // Expecting 'O
else
gsm_state = 0;                 // Reset state machine
꞉break
{
} :case 51
if (tmp == 'O')                // We have 'O', it could be "R1ON" or
""R1OFF
'gsm_state = 52;               // Expecting 'N' or 'F
else
gsm_state = 0;                 // Reset state machine
꞉break
{
} :case 52
'if (tmp == 'N'){              // We have 'N
Relay1 = 1;                    // We've got the R1ON
!command
꞉gsm_state = 0
{
else
```

```
"if (tmp == 'F')                // We have 'F', it could be "R1OFF
'gsm_state = 53;                // Expecting 'F


else
gsm_state = 0;                  // Reset state machine
꞉break
{
} :case 53
'if (tmp == 'F'){               // We have 'F
Relay1 = 0;                     // We've got the R1OFF
!command
꞉gsm_state = 0
{
else
꞉gsm_state = 0
꞉break
{
} :case 60
if (tmp == 'O')                 // We have 'O', it could be "R2ON" or
""R2OFF
'gsm_state = 61;                // Expecting 'N' or 'F
else
gsm_state = 0;                  // Reset state machine
꞉break
{
```

} :case 61

'if (tmp == 'N'){ // We have 'N

Relay2 = 1; // We've got the R2ON
!command

꞉gsm_state = 0

{

else

"if (tmp == 'F') // We have 'F', it could be "R2OFF

'gsm_state = 62; // Expecting 'F

else

gsm_state = 0; // Reset state machine

꞉break

{

} :case 62

'if (tmp == 'F'){ // We have 'F

Relay2 = 0; // We've got the R2OFF
!command

꞉gsm_state = 0

{

else

꞉gsm_state = 0

꞉break

{

} :case 70

```
if (tmp == 'O')                 // We have 'O', it could be "R3ON" or
""R3OFF
'gsm_state = 71;                // Expecting 'N' or 'F
else
gsm_state = 0;                  // Reset state machine
꞉break
{
} :case 71
'if (tmp == 'N'){               // We have 'N
Relay3 = 1;                     // We've got the R3ON
!command
꞉gsm_state = 0
{
else
"if (tmp == 'F')                // We have 'F', it could be "R3OFF
'gsm_state = 72;                // Expecting 'F
else
gsm_state = 0;                  // Reset state machine
꞉break
{
} :case 72
'if (tmp == 'F'){               // We have 'F
Relay3 = 0;                     // We've got the R3OFF
!command
꞉gsm_state = 0
```

```
{
else
꞉gsm_state = 0
꞉break
{
} :case 80
if (tmp == 'O')                 // We have 'O', it could be "R4ON" or
""R4OFF
'gsm_state = 81;                // Expecting 'N' or 'F
else
gsm_state = 0;                  // Reset state machine
꞉break
{
} :case 81
'if (tmp == 'N'){               // We have 'N
Relay4 = 1;                     // We've got the R4ON
!command
꞉gsm_state = 0
{
else
"if (tmp == 'F')                // We have 'F', it could be "R3OFF
'gsm_state = 82;                // Expecting 'F
else
gsm_state = 0;                  // Reset state machine
꞉break
```

```
{
} :case 82
'if (tmp == 'F'){              // We have 'F
Relay4 = 0;                   // We've got the R4OFF
!command
꞉gsm_state = 0
{
else
꞉gsm_state = 0
꞉break
{
default: {                          // Unwanted character
gsm_state = 0;                // Reset state machine
꞉break
{
{


{
{
**********************************************************/
/*********************
```

5.3. Recommendation

This project is a small implication of our concept in automating and monitoring a system. The practical applications of this project are immense and can have vast level of implementation. This small concept can be used in fields such as weather forecasting, remote sensing, robotics, aeronautics, home automation, and many other related fields where continuous monitoring and regulation is needed. So this is not the end of the project but rather is a step towards exploring other possibilities that it brings with it. We feel very happy to work in such a challenging project which has tremendous application and possibilities. We recommend our brothers and sisters to work in such field, which actually gives a lot of satisfaction while working. The project work in the fact gives a lot of confidence to fight out in this challenging world. As one proceeds one cannot believe how much knowledge he/she gains and the teamwork, which the project work teaches, really will have a new experience.

5.4. Future Improvements

The future implications of the project are very great considering the amount of time and resources it saves. The project we have undertaken can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates, device synchronization, etc. The project itself can be modified to achieve a complete Home Automation System which will then create a platform for the user to interface between himself and his household.

CHAPTER SIX
CONCLUSION

CHAPTER SIX

6.1.coclusion

The project we have undertaken has helped us gain a better perspective on various aspects related to our course of study as well as practical knowledge of electronic equipments and communication. We became familiar with software analysis, designing, implementation, testing and maintenance concerned with our project. The extensive capabilities of this system are what make it so interesting. From the convenience of a simple cell phone, a user is able to control and monitor virtually any electrical devices. This makes it possible for users to rest assured that their belongings are secure and that the television and other electrical appliances was not left running when they left the house to just list a few of the many uses of this system. The end product will have a simplistic design making it easy for users to interact with. This will be essential because of the wide range of technical knowledge that homeowners have.

6.2.REFRENCE

1-Thermo Recorder TR-5 Series Data Sheet

2-Data logger, oscilloscope, signal generator and more!

3- http://www.microchip.com

4-http://www.mikroe.com

5-Microcontroller Based GSM/GPRS Projects: Advanced Microcontroller Projects Paperback – 6 Apr 2010
by Dogan Ibrahim (Author), Ahmet Ibrahim (Author)

6-https://www.picotech.com

7-http://www.labcenter.com/index.cfm