



Palestine Polytechnic University

**College of Information Technology and Computer
Engineering**

Graduation project

Home Medicine Management System

Project team

Sabal Abdullah.

Mariam Mhaisen.

Project Supervisor

Eng. Elayan Abu Gharbyeh.

Hebron - Palestine

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فلسطين بوليتكنك

فلسطين – الخليل

هندسة تكنولوجيا كلية

Home Medicine Management System

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محيسن مريم

وهندسة

كلية تكنولوجيا

هندسة

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Dedication

To Our Beloved Palestine

To our families.

To all our friends.

To Palestine Polytechnic University.

To all our teachers.

May ALLAH Bless you.

And for the work group

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We would like to show our appreciation to our advisor Eng. Elayan Abu Gharbyeh, for his valuable support, encouragement, useful suggestions and supervision, throughout our studying period in general and this project particularly.

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Your students:

Sabal Abdullah & Mariam Mhaisen

2014

Abstract:

The microcontrollers nowadays are available in every property as well as the Global System for Mobile Communications (GSM) technology. This mass expansion of technology helps people to control their life to make it easier and more comfortable. This project helps people of special needs or patients to remember the time of medicine using the GSM technology. The system is designed to send messages to inform the patient of the medicine time, which will cost nominal charges compared to other technologies, additionally, using various types of alarms such as voice, visual and sensible helps variety of groups such as deaf, blind and elderly people who may have illness or patients in any hospital or hospice.

:
تقنيات الدقيقة للهواتف
(GSM) بحياتهم اليومية لجعلها
تقنية (GSM). ليقوم
سيكلف تكاليف رمزية
التنبيه كالتنبيه
تقنيات
نصية للمريض لتذكيره
الاحتياجات لتذكيرهم
ادويتهم
سبيل
يساعد
;

1

Chapter One

INTRODUCTION

1.1 Overview.

1.2 Project Idea Description.

1.3 Motivation.

1.4 Project scope.

1.5 Summary.

CHAPTER 1

1.1 Overview:

The widely used GSM technology helps us to use the availability of mobiles to design system which can help many groups of community such as deaf people ,blind ,and seniors who may has of illnesses or patients in any hospital. In This chapter we aim to describe the main idea and the advantages of our project in general and personal fields. Then we aim to determine the scope of the project.

1.2 Project Idea Description:

The system should be able to notify the patient at the timing of medicine by sending message to patient mobile through GSM modem device. The message contains patient's and medicine's name. In addition, the system should display the content on the display device (LCD screen). A specific drawer which contains the pills should open. There is also voice and LED alarm that grab the patient's attention at the medicine time. Microcontrollers are used in controlling products and devices. The microcontroller connects all other devises with each other, such as connecting the PC (Personal Computer) with GSM modem, display screen, voice alarm, LED alarms and the drawers. Nowadays, the majority of computers and peripherals are equipped with USB (Universal Serial Bus). Accordingly, we have chosen to use USB interface between PC and the microcontroller to be able to transfer the data stored at the database on the PC to the microcontroller in order to activate the system. When the time of medicine comes, the drawer which contains the pills open, as the microcontroller send signals to drawer and GSM modem as well as other devices, such as display screen, sound and light alarm.

Fig.1.1 shows the home medicine system.



Fi

g 1.1: Electronic Home Medicine System.

1.3 Motivation:

The main aim to be achieved is to help our society to keep their health. This project helps people of special needs to be able to remember the time of the medicine. Also to help deaf people by adding a screen and light alarm and to help blind people by making a voice alarm.

Also designing this system achieve some personal aims for us such as learning new languages like C#, and learning how to connect the microcontroller with other devises.

1.4 Project scope:

a) Context of project: using GSM technology is new in this domain, which make the project novel. We can use this system in senior's houses.

b) input/output information: In this system we need to enter the patient's information and store it in database. In addition of the database information there is another input to the M.C, the button of the drawer that when we pressed it the drawer will close.

The microcontroller signals which control the system is the output of the project.

c) Function: saving patients information is input function, the nurse or the housekeeper store the data on database. Then the system should compare the PC time with the medicine time which is stored already in database to activate the system by sending messages. Notifying the patient is another function in this system which makes the system able to alert the patient by voice and light alarm. Also display the content of the message is important to the nurse or house keeper to know whom the specific patient so it's another function.

1.5 Summary:

This chapter describes the main idea of the electronic home pharmacy and its idea description .then determine the project scope by determine the input, output and function of the project.

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Chapter two

Literature review and theoretical background

2.1 Overview.

2.2 Theoretical review.

2.3 Literature review.

2.4 Summary.

CHAPTER 2

The main aim of this chapter is to determine the similar projects which may have the same ideas.

2.1 Overview:

In this chapter we will discuss the theoretical background and compare our project (Home Medicine Management System) to other former projects in Palestine and other countries that are considered similar to our project on various aspects.

2.2 Theoretical review:

The device contains software and hardware and database. So the technologies that we used in our system are as follow:

- PC that contain the information of medicine in the database, a microcontroller that interface in order to control the monitor of drawer, displaying screen, the alarms and the GSM modem.
Microcontroller (M.C) sends signals to the specific motor to open the drawer which contains the pills (i.e. medicine), at the same time the M.C also sends signal to the screen to display the information stored already in the data base .the M.C also send signal to the light and sound alarm to inform the patient of the medicine time, the use of these visual and voice alarm which help the patient to recognize the device in case the mobile is switched off for example. Then, the M.C send signal to the GSM modem which should be able to connect with the mobile and send a message for patient's mobile as an alarm to providing the patient with the necessary data such as: medicine name.
GSM modem stand for Global System for Mobile (communications), the reason why we used the GSM modem specifically, due to ultra-small size, lightweight, easy to integrate, low power consumption, and High performance with low price.
- USB stands for Universal Serial Bus, the computers and peripherals are equipped with USB connectivity. The USB connectivity can be found in a wide range of devices.

- The database in PC that stores large amount of information of medicine like the name of patient, illness, the name of the medicine... etc.
- Alert the patient if the mobile is closed or he/she forgot the medicine; the alarm voice will inform the patient of the time of medicine.
- Display screen in order to display the information stored in the data base such as patient name, the name of medicine, and the medicine time.
- Drawers that open and close, when the time of medicine comes, it opens, after that it closes so it wouldn't harm other people like children.

2.3 Literature review:

As mentioned on the overview paragraph, this chapter will discuss other projects that are considered similar to our project:

First:(*Pharmacy system*).

This software is built to serve the commercial pharmacies by organizing and managing the contents of pharmacies. It gives the ability to sort medicines by the manufacturer so it makes it easy to deal with selling and purchasing operations, also it gives the available amount of medicines.^[1] This project has similarities and differences design compared to our project.

The similarities are for example: Makes pharmacies management easy and simple, also

Data entry, modifying and deleting to/from database system for both projects are easy.

The differences are:

- 1- Our project is available for home, hospital and home for elderly use while Pharmacy System is useful for commercial pharmacies only.
- 2- Pharmacy System has the ability to provide the user to find the location by software ⁽¹⁾, but our project GSM modem that sends the message to the mobile user everywhere.

Second: (*Alrahma Pharmacy*).

Alrahma Pharmacy: this system is used to enter the data of medicine such as name of medicine, number of medicine, medicine elements ,shape of it, supplier number, production date ,and expiration date. ⁽²⁾

ALrahma Pharmacy project has similarities and differences when compared to our project.

The differences are:

- 1- Our project is available for home, hospital and home for elderly use while Alrahma Pharmacy is useful for pharmacies only.
- 2- Alrahma Pharmacy is intended for pharmacy management and financial controlling, while our project is designed as a multitasking tool that remind the patient of the time the medicine should be taken, quantity, specific conditions (i.e. before or after food) through GSM technology that allow the pre-programmed system to send SMS alarm along with necessary medical information to the intended patient.
- 3- Alrahma pharmacy helps in making pharmacy more organized, while our project helps in reducing human involvement and human errors (e.g. memory, availability ...etc.) that might lead to serious medical issues.

2.4 Summary:

Theoretical background”, this chapter introduces a background related to the main concept and technologies of the project. It’s a background of microcontroller, GSM modem and network, connecting the devises

3

Chapter Three

Project management Plan

3.1 Overview

3.2 Project Management Plan:

3.2.1 Activity network diagram

3.2.2 Risk

3.2.3 Project Resources and cost Estimates:

3.2.3.1 Software resources

3.2.3.2 Hardware resource

3.3.3 Human resources

3.2.3.4 Total Development Cost

3.3 Project methodology:

3.3.1 Options

3.3.2 Analysis of each option

3.4 Project component:

3.4.1 Hardware components

3.4.1.1 Microcontroller (M.C) PIC 18F4550

3.4.1.2 GSM modem (GM862-QUAD)

3.4.1.3 Buzzer alarm

3.4.1.4. 2x16 LCD

3.4.1.5 CD drives stepper motor

3.4.1.6 A LED lamp

3.4.1.7 Computer

3.4.1.8. Mobile

3.4.2 Software components

3.5 Summary.

CHAPTER THREE

3.1 Overview

In this chapter we will focus on and describe the project plan, task, risks management, resources, estimated costs, project methodology, and software and hardware components.

3.2 Project Management Plan:

3.2.1 Task set:

A task set is a collection of work tasks.

❖ Communication:

Identify all the stockholders and the end users of our project.

Determine the scope of our project; also determine all the inputs and outputs of the access control system and all the functions that it performs.

❖ Planning:

- Determine the schedule: all the resources and the components needed for our project.
- Risk management: in this chapter we will determine the risk that concerns future incidents and how to plan to avoid them, also how to reduce their effects.

❖ Modeling:

- Analyze the system: analyze all the requirements in order to design the project correctly, also to determine the goals and benefits.
- Design: we will design the project in order to achieve the requirements determined by hardware components.

❖ Implementation:

- Coding and programming of application: We will use c# language to implement our project. Then Using database program, SQL server (management system to store).
- Testing: after implement and collect all the hardware system we have to test the project if it works well or not.

The table 3.1 shows the task set and there dependencies.

Table 3.1: Task set.

Definition	task	Dependency
Communication	T1	-----
Determine the schedule	T2	T1
risk management	T3	-----
analyze the system	T4	T1
Design	T5	T4
Coding and programming of application	T6	T5
Testing	T7	T6,T5,T4
Deployment	T8	T7
Maintenance	T9	T8

3.2 Activity network diagram:

An Activity Network Diagram is a diagram of project activities that shows the sequential relationships of activities using arrows and nodes. Fig. 3.1 shows the activity network diagram.

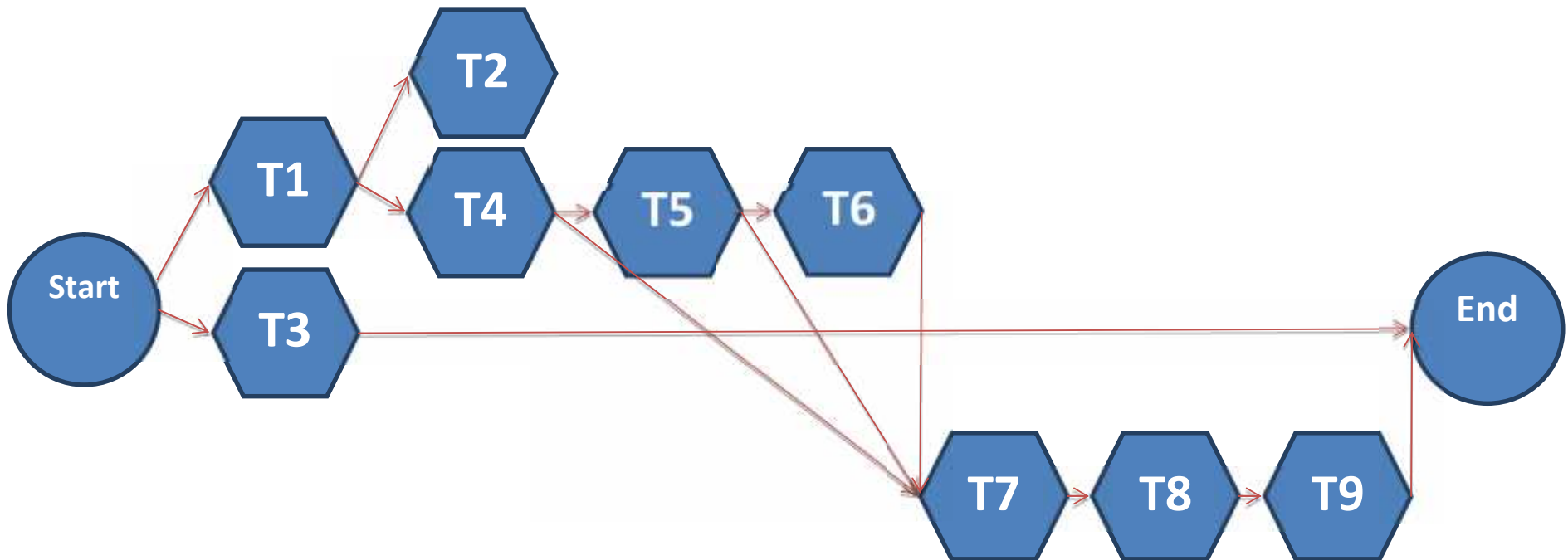


Fig3.1: Activity network diagram.

3.2.2 Risks:

In this section we will determine the risks that may affect the progress of the project and how to plan to avoid them, or how to reduce their effect. The types of risks the project is:

- People Risk.
- Components Risk.
- Budget Risk.

The following table shows the risks, and the impact and the effect of each one.

Table 3.2 Risk Probability and Analysis

Risk ID	Possible Risks	Probability*	Impact
R1	Medicines are not filled on their proper input place.	30%	1
R2	The medicine is in form liquid.	30%	2
R3	Lack of training on tools.	30%	2
R4	Inability to deliver on time.	20%	1
R5	Electricity shut down.	10%	1
R6	May not receive the hardware device on time.	10%	1
R7	Errors on mechanical performances.	10%	3
R8	Patient is not around the device.	20%	3

Impact values:

1- Catastrophic.

2- Critical.

3- marginal.

4- Negligible.

* These percentages represent the results of our statistics and questioner distributed to a random sample of 100 students in PPU.

A risk management strategy provides a structured and coherent approach to identifying, assessing and managing risk. Table 3.3 describes the management strategies.

Table 3.3 Risks management strategies.

Risk ID	Management Strategy
R1	This risk can be mitigated through proper training and enhancement of the users awareness
R2	This risk can be mitigated through further development of the device so it can accept liquid medicines, but due to our time limitation, we will assume that all medicines are in a form of tablets.
R3	Training is important for these kinds of devices it is related people health. A catalog and user manual attached to the device so this risk can be reduced.
R4	Refer to university regulation
R5	A chargeable battery can be attached to the device in addition to the user's option to purchase a generator.
R6	Contact the suppliers in advance in order to provide us with the hardware as fast as possible
R7	This risk can be reduced to a lower level through periodic maintenance and device check.
R8	As mentioned on Chapter 2, the device contains GSM modem that sends messages to the user, additionally, the patient may carry one or two potions of medicine for urgent absent.

3.2.3 Project Resources and Cost Estimates:

In this section we will review the system cost estimation in term of system Hardware, system software, and human resources.

3.2.3.1 Software resources:

The following table contains the software that will be used in our system and its costs. The costs are in US dollars.

3.4: Table for software resources.

Resource	Provider	Price
Microsoft office 2007	Internet	\$ 100
Visio	PPU	\$ 50
Microsoft visual studio 2010	PPU	\$ 75
Micro C	Internet	\$ 75
Total cost	\$ 300	

3.2.3.2 Hardware resource:

The following table contains the hardware components that will be used in our system and its costs. The costs are in US dollars.

3.5: Table for hardware resource.

Hardware component	Price per one in NIS
PIC 18f4550	50\$
buzzer alarm	30\$

16x2 LCD	20\$
GSM modem/sim900b	80\$
Mobile	100 \$
Server(PC)	400 \$
DC Motorsx2	20\$
Box	50\$
Others	50\$
Total cost	800\$

3.2.3.3 Human resources

The project team consists of two students, work 32 weeks for two semesters, 3 hours a day with \$2 per hour, assuming 4 working days a week.

Each student get : (32 weeks * 4 days * 3 hours * \$2) = \$768

And the total for 2 students cost is : \$768 * 2 = **\$1536**

3.2.3.4 Total Development Costs

Table (3.6) Total development cost.

Resource	Cost (\$)
Hardware resources	800
Software resources	300
Human resources	1536
Total	2636

3.2.3 Time Estimation :

The project plan follows the time schedule, which includes the related tasks of study and system analysis.

- **First semester:**

ID	Task Name	Start	Finish	Duration	سبتمبر 2013				أكتوبر 2013				نوفمبر 2013				ديسمبر 2013	
					1/9	2/9	3/9	4/9	5/9	6/9	7/9	8/9	9/9	10/9	11/9	12/9	1/10	2/10
1	Identify stockholders and end-users	9/16/2013	9/17/2013	2d														
2	Meet users to gather requirements	9/18/2013	9/20/2013	3d														
3	Determine the scope	9/23/2013	9/24/2013	2d														
4	Modify scope	9/25/2013	9/26/2013	2d														
5	Determine schedule	9/27/2013	10/3/2013	5d														
6	Risk management	10/4/2013	10/13/2013	5d														
7	Analysis	10/11/2013	11/14/2013	23d														
8	Design	11/15/2013	12/18/2013	22d														

Fig 3.2: First semester.

- **Second semester :**

ID	Task Name	Start	Finish	Duration	أبريل 2014				مايو 2014				يونيو 2014				يوليو 2014	
					1/4	2/4	3/4	4/4	5/4	6/4	7/4	8/4	9/4	10/4	11/4	12/4	1/5	2/5
1	coding	2/3/2014	4/11/2014	50d														
2	testing	4/14/2014	4/25/2014	10d														
3	Operation	4/26/2014	5/6/2014	7d														
4	maintenance	5/7/2014	5/15/2014	7d														

Fig 3.3: Second semester.

3.3 Project methodology:

In this section we will talk about the devices and components which we will use in this project.

3.3.1 Options:

Any project in the world has options; if we want to do anything we consider all options in order to choose a suitable one. That is why we consider different options in designing our project. For example when choosing the microcontroller we considered the PIC or the Arduino kit. We choose the PIC due to its low cost, wide availability, large user base and serial programming (and re-programming with flash memory) capability[3]. We use exactly PIC 18f4550 because it is ideal for low power.

Another option of single motor or using CD drive, but we decide to use CD drive because it's cheaper and we can exchange its direction in an easy way and it's easy to implement.

The other option we think about is using GSM modem for sending messages or Bluetooth. We decide to use GSM modem because of the large range than Bluetooth.[6]

3.3.2 Analysis of each option:

- Why we chose CD drive instead of other motors?
Generally stepper motors are costly as compared to a normal DC motor. Stepper Motor is probably the first thing you need to know about, if you are interested to learn robotics.(the next one would be Servo Motors). In order to reduce the cost you can use a stepper motor from waste floppy drives or CD-DVD drives.
- “Why did we choose PIC18f4550 instead of other family members?”
 1. Full Speed USB 2.0 (12Mbit/s) interface.
 2. Full Speed Transceiver.
 3. 16 Endpoints (IN/OUT).
 4. Streaming Port.
 5. Internal Pull Up resistors (D+/D-).
 6. 48 MHz performance (12 MIPS).
 7. Pin-to-pin compatible with PIC16C7X5.”[3]

- Why did we choose GSM modem over other modems?
GSM is the most widespread, it is the most prevalent mobile communication technologies . It solved the problem: to divide the finite RF spectrum among multiple users.
 1. GSM is mature.
 2. Less signal deterioration inside buildings
 3. Ability to use repeaters.
 4. GSM covers virtually all parts of the world

3.4 Project component:

The components used in this project are:

3.4.1 Hardware components:

The system is made up of parts of hardware, these parts are:

3.4.1.1 Microcontroller (M.C) PIC 18F4550:

“A microcontroller is often described as a ‘computer-on-a-chip’. It can be used as an ‘electronic brain’ to control a product, toy or machine.

PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology. The name PIC initially referred to "Peripheral Interface Controller". PICs are popular with their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.” [3]

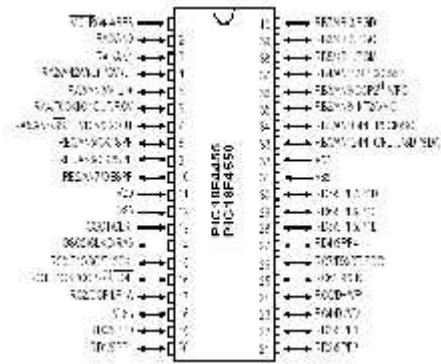


Fig3.4: Microcontroller (M.C).

3.4.1.2 GSM modem (GM862-QUAD):

“This GSM module will allow you to connect your embedded device anywhere in the world where cell phones are used. This version is compatible device with various 850/1800/1900MHZ frequencies of cellular networks across the globe.

This GSM module is at first easy to use because it has embedded SIM card reader, antenna connector and the module is simply controlled via AT commands. On the other hand it has many other features that allow making your application without any compromise.”[16]



Fig 3.5: GSM.

3.4.1.3 Buzzer alarm

“Buzzer alarm is about the loud noise maker. A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices . Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.”[7]



Fig3.6: buzzer.

3.4.1.4. 2x16 LCD

“A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly.

LCDs are available to display arbitrary images) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

Its low electrical power consumption ,made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome.”[15]



Fig 3.7: LCD.

3.4.1.5 CD drives stepper motor:

“Disk-drives have many expensive components and you can get old bad disk-drives freely or very cheaply. Generally stepper motors are costly as compared to a normal DC motor. In order to reduce the cost you can use a stepper motor from waste floppy drives or CD-DVD drives.”[4]



Fig3.8: CD drives stepper motor.

3.4.1.6 A LED lamp

“A LED lamp is a light-emitting diode . LED lamps have a lifespan and electrical efficiency that is several times better than incandescent lamps.

Electrical efficiency of LED devices is higher than other lighting and continues to improve, with some chips able to emit more than 100 lumens per watt. LEDs do not emit light in all directions, and their directional characteristics affect the design of lamps. The light output of single LEDs is less than that of incandescent and compact fluorescent lamps; in most applications multiple LEDs are used to form a lamp, although high-power versions (see below) are becoming available.”[8]



Fig 3.9: led.

3.4.1.7 Computer

A computer is a general purpose device that can be programmed to carry out a set of arithmetic or logical operations. In this project it will have the entire patient information stored in its database.



Fig 3.10: Computer.

3.4.1.8. Mobile

“A mobile phone (also known as a cellular phone, cell phone, and a hand phone) is a device that can make and receive telephone calls and messages .Basic mobile phone services to allow users to make calls and send text messages. All GSM phones use a SIM card to allow an account to be swapped among devices. Some CDMA devices also have a similar card called a R-UIM.”[9]



Fig 3.11: Mobile.

3.4.2 Software components:

Software components that we will use in this project are as following:

1. Microsoft office 2007: we will use it to document and edit all the work and to write chapters.
2. Visio: this software will be used to draw all the diagrams needed.
3. Microsoft visual studio: this will be used to writ the code and to compile it , also to create the data base.
4. Micro C: to programming the PIC.

3.5 Summary:

In this chapter we specified the tasks to this project. We determined the resources and components to be used and the dead line. We also determined the budget for hardware and software resources.

4

Chapter four

Software-Based Project

4.1 General Overview.

4.2 Requirement Description.

4.3 CRC(class Responsibility and collaborator modeling).

4.4 Class Hierarchies and Relationships.

4.5 Summary.

CHAPTER FOUR

4.1 General overview :

In this chapter we will talk about the requirement description and the class responsibilities collaborator to determine the use cases in this system. Then we will talk about the relationships between each class in this system

.

4.2 Requirement Description:

“Requirements Description engineering is the process of eliciting bloke stakeholder requirements and needs and developing them into detailed, agreed requirements documented and specified in such a way that they can serve as the basis for all other system development activities.

The software engineer can create a set of scenarios that identify a thread of usage for the system to be constructed. The scenarios, often called use-cases, provide a description of how the system will be used.

To create a use-case, the analyst must first identify the different types of people (or devices) that use the system. These actors represent roles that

People (or devices) play as the system operates. Defined somewhat more formally, an actor is anything that communicates with the system or product and that is external to the system itself.”[10]

In this system we can define five actors: the nurse or the person who enter the patient information in the database which stored in PC, the microcontroller, the patient, the motors and GSM modem.

The following describe the details of the use cases:

First Use-case: receiving a message from the system.

Primary actor: patient.

Goal in context: to set the system to send message to the patient through GSM modem.

Preconditions: the system has been programmed and the GSM activated and mobile activated.

Trigger: the patient should see the message and then go to the system in order to take the medicine.

Scenario:

1. The patient received a message from the system time.
2. If the mobile is off he/she knows about the medicine time by the buzzer or led alarm and if he/she beside the system, he/she can see the content of the LCD display.
3. The drawer is opens by pressing the button.

Exceptions:

1. When the GSM modem has error and not active, the message not received.
2. When the drawer not opened.
3. When the mobile is out of service or closed.

Priority: essential, must be implemented.

When available: at medicine time.

Frequency of use: many times per day.

Channel to actor: via GSM modem.

Secondary actors: nurse or anyone take care of patient.

Fig.4.1 shows the function of patient actor. This includes receiving message from GSM modem. Also after the drawer is opened the patient should take the medicine from the drawer and close the drawer.

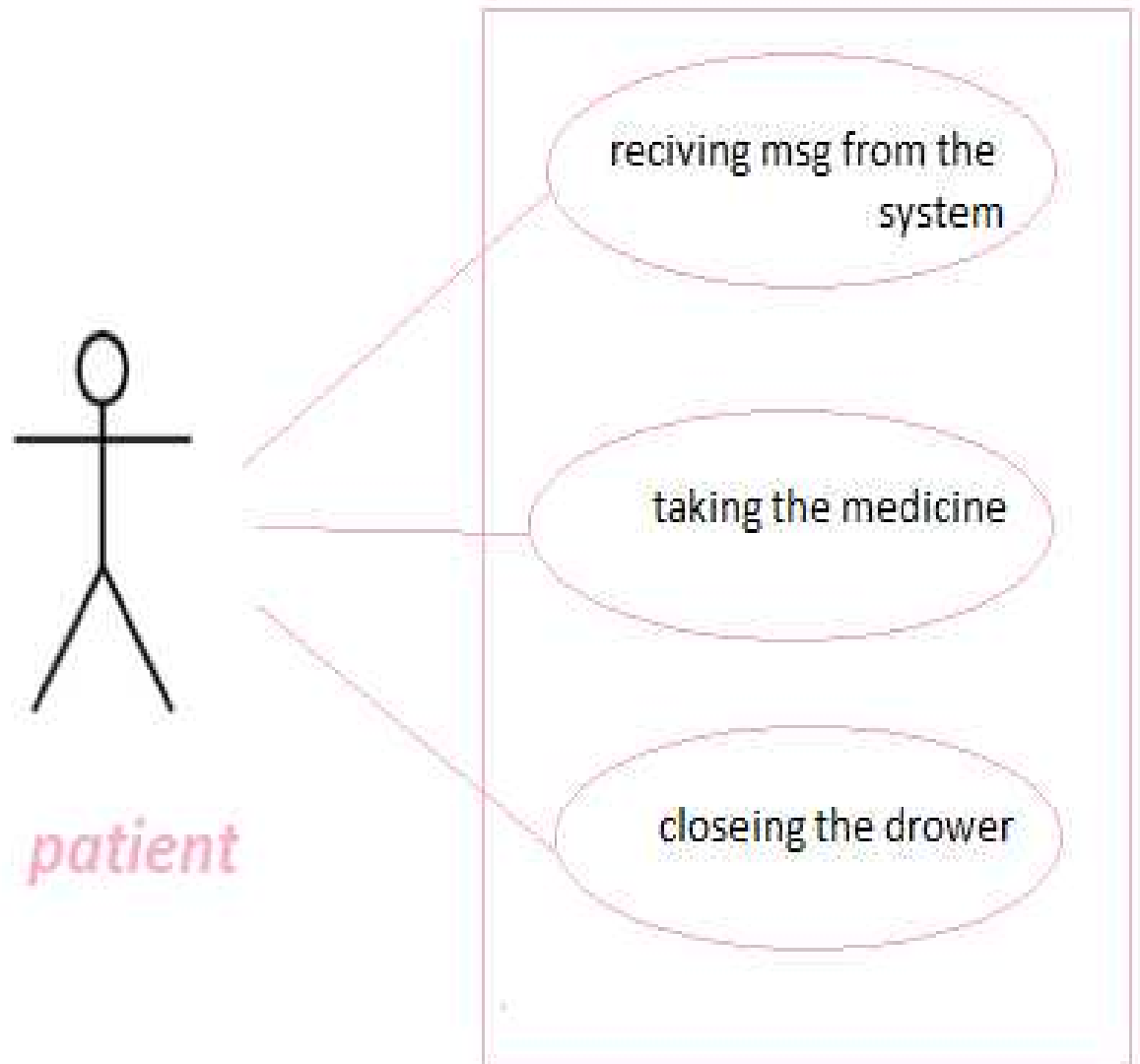


Fig 4.1: patient actor.

Second Use-case: take the medicine.

Primary actor: patient.

Goal in context: receive message to the patient through GSM modems, then patient go to take the medicine.

Preconditions: the system has been programmed and the GSM active to receive message to the patient mobile and the mobile will be activated.

Trigger: the patient should see the message or buzzer or LCD and then go to the system in order to take the medicine.

Scenario:

1. The patient received message from the system in the time on.
2. If the mobile is closed he/she know about the medicine time by the buzzer or led alarm and if he/she beside the system he/she can see the content of the LCD display.
3. The drawer now is open by press the button that he/she takes the medicine and press the button to close the drawer.

Exceptions:

1. When the GSM modem has error and not activated so the message not receiving.
2. When the drawer not opened.

Priority: essential, must be implemented.

When available: at the medicine time.

Frequency of use: many times per day.

Channel to actor: via drawer and button.

Secondary actors: nurse or anyone take care of patient.

Third Use-case: closing the drawer.

Primary actor: patient.

Goal in context: receive message to the patient through GSM modems, then patient go to take the medicine, after that close the drawer.

Preconditions: the system has been programmed and the GSM active to receive message to the patient mobile and the mobile active, and the button active to close the drawer.

Trigger: the patient should see the message or buzzer or LCD and then go to the system in order to take the medicine after that closed drawer.

Scenario:

1. The patient received message from the system in the time on.
2. If the mobile is closed he/she know about the medicine time by the buzzer or led alarm and if he/she beside the system he/she can see the content of the LCD display.
3. The drawer now is open by press the button that he/she takes the medicine and press the button to close the drawer.

Exceptions:

1. When the GSM modem has error and not active, so the message not receiving.
2. When the drawer or button same thing wrong and not opened.

Priority: essential, should be implemented.

When available: when the patients take the medicine.

Frequency of use: many times per day.

Channel to actor: via button.

Secondary actors: nurse or anyone take care of patient.

Fourth Use-case: receiving signal from microcontroller.

Primary actor: motor.

Goal in context: to activated microcontroller in order to send signal to motor.

Preconditions: the system has been programmed and the M.C active to send signal to the motor.

Trigger: the microcontroller and all devises turn on.

Scenario:

1. The microcontroller send signal to the motors to open.
2. The motors rotation opens the drawer then the patient or the nurse take specified pills.
3. The nurse or the patients press the button which will close the drawer back.

Exceptions:

1. When the M.C has error and not active, so the signal doesn't receive to motor.
2. When the drawer same thing wrong and not opened.

Priority: essential, must be implemented.

When available: when the medicine on time.

Frequency of use: many times per day.

Channel to actor: via Hbridge and pins that connected with M.C

Secondary actors: use relay to exchange the direction of the motor.

Fifth Use-case: opening and closing the drawer.

Primary actor: motor.

Goal in context: to activated microcontroller in order to send signal to motor.

Preconditions: the system has been programmed and the M.C active to send signal to the motor.

Trigger: the microcontroller and all devises turn on.

Scenario:

- 1.The microcontroller send signal to the motors to be opened. It sends to the DC motor which will be work and open the drawer which contains the pills.
- 2.The motors rotation opens the drawer then the patient or the nurse take specifies pills.
- 3.The nurse or the patient press the button which it will close the drawer back.

Exceptions:

1. When the M.C has error and not active, so the signal doesn't receive to motor.
2. When the drawer same thing wrong and not opened.

Priority: essential, must be implemented.

When available: when the medicine on time.

Frequency of use: many times per day.

Channel to actor: via Hbridge and bins that connected it with M.C

Secondary actors: using CD driver to get rid of motors connection.

Fig. 4.2 represent motor actor. This actor should make some operations like receiving signal from the microcontroller on time. In addition of opening and closing the drawer.

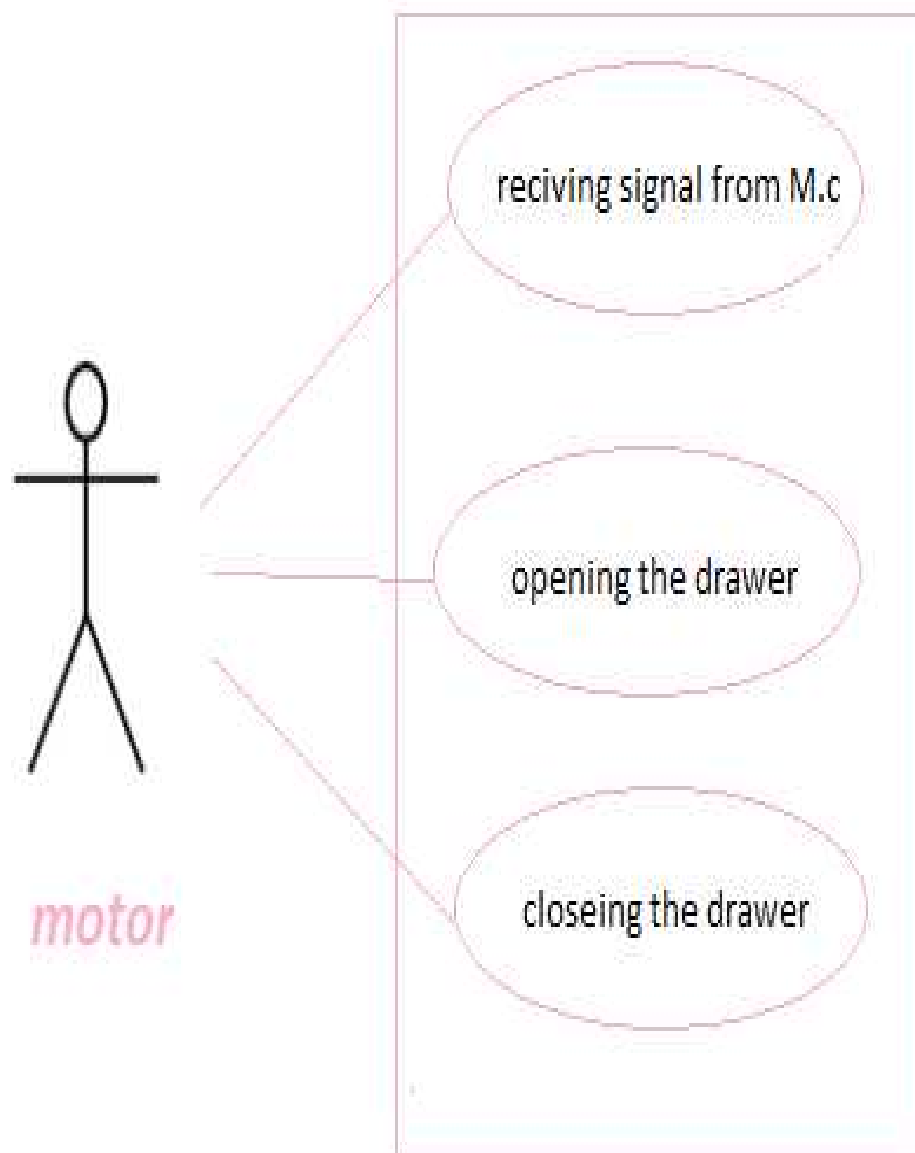


Fig 4.2: motor actor.

Sixth Use-case: sending signal to LCD, led, buzzer, motor and GSM modem.

Primary actor: microcontroller (M.C).

Goal in context: active PC and send the patient information by USB to M.C in order the microcontroller in order to send signals.

Preconditions: the PC and the database activated to send the patient information to M.C by USB.

Trigger: the PC and microcontroller and all devices turn on.

Scenario:

1. The nurse enter the patient information on database, she/he can enter the information of two patients here in this system. Then in medicine time the the PC send data to the microcontroller by USB to be the system worked.
2. The microcontroller store the data in its own memory then send signals to each device in the system to inform the patient that on time.
3. When activation occurs, the GSM modem sends the data to the mobile and in the same time the LCD displays the content of the message. Also the led and buzzer alarm will work and the drawer will open.

Exceptions:

1. When the M.C has error and not active, so the signal doesn't receive to motor.
2. When the PC has something wrong and didn't send data to M.C.

Priority: essential, must be implemented.

When available: when the medicine on time.

Frequency of use: many times per day.

Channel to actor: via pins of M.C.

Secondary actors: using Adriano.

The Fig. bellow describes all the functions of microcontroller actor.

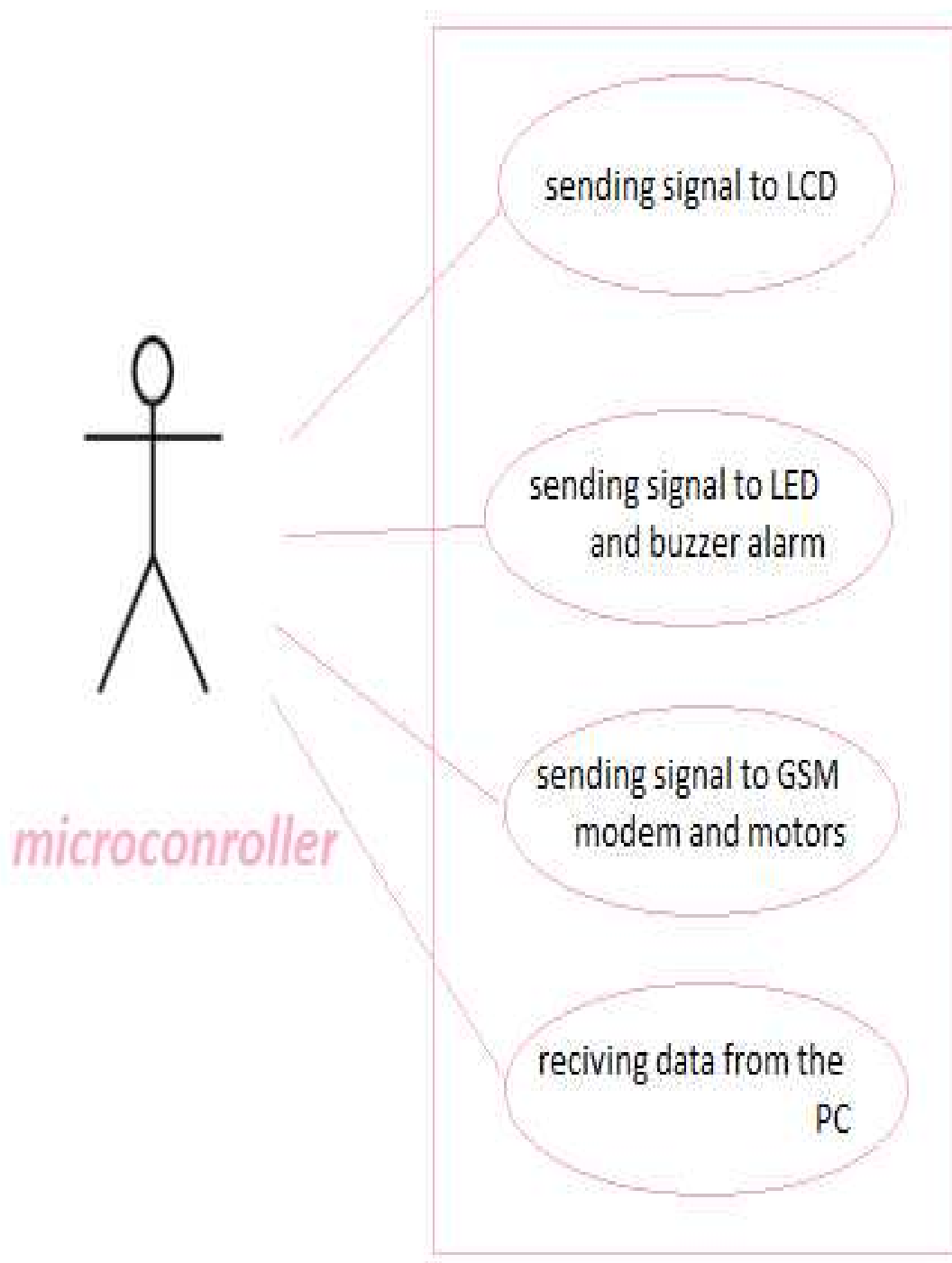


Fig 4.3: microcontroller actor.

Seventh Use-case: enter the patient information and refreshing it.

Primary actor: nurse.

Goal in context: to set the PC and database.

Preconditions: the PC and the database activated to send the patient information to M.C.

Trigger: the PC (database) turns on.

Scenario:

1. The nurse brings the patient data from patient's doctor and puts the specific pills in the drawers.
2. The nurse enters this information in the database to store it in the computer.
3. The nurse takes the pills and gives it to the patient, then close the drawer by pressing the button.

Exceptions:

1. When the database has something wrong.

Priority: essential, must be implemented.

When available: when we have the patient and when the medicine change.

Frequency of use: many times per day.

Channel to actor: via database.

Secondary actors: doctors or someone.

Fig. 4.4 represent nurse's or house keeper's actor.

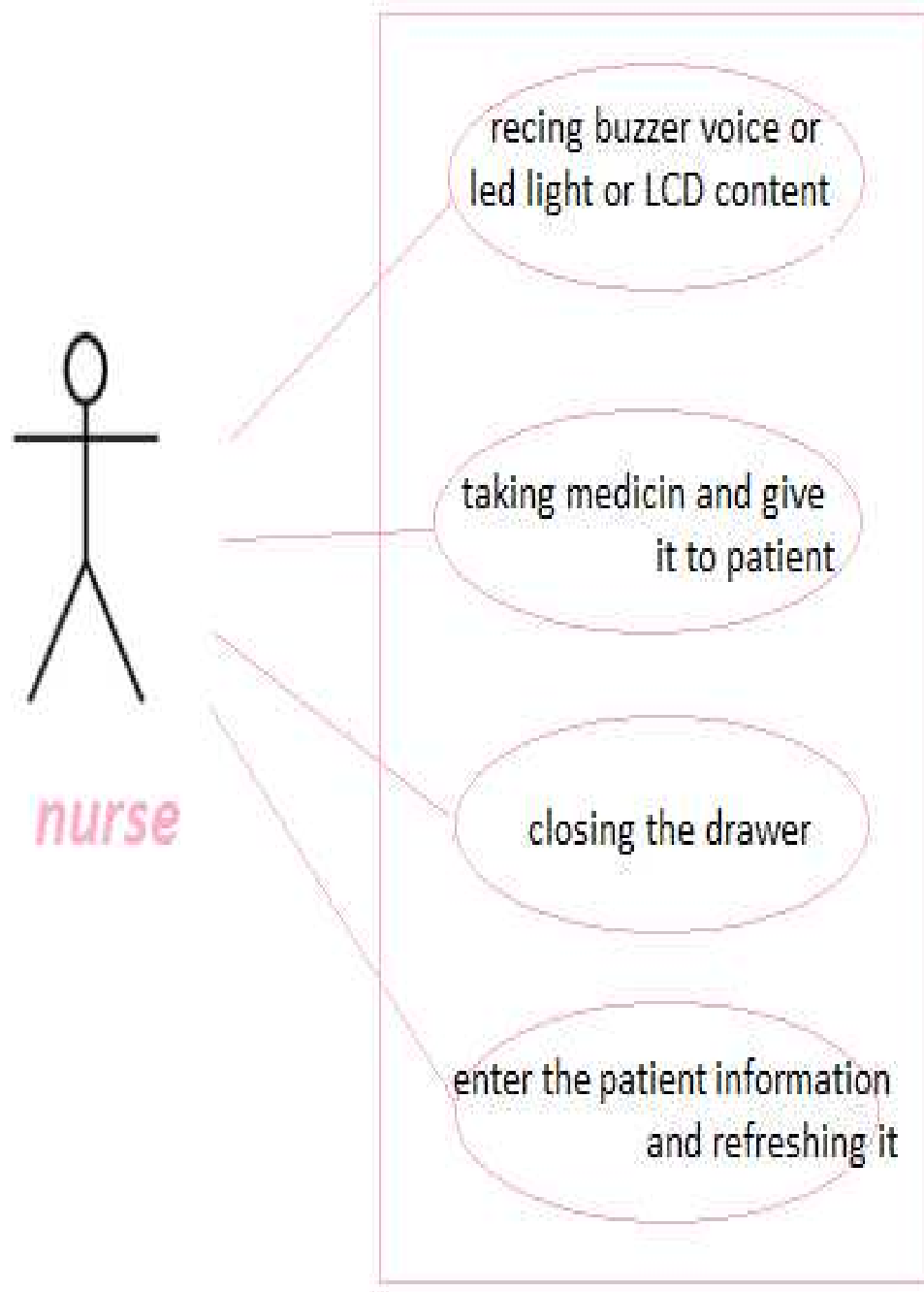


Fig 4.4: Nurse actor.

Eighth Use-case: sending message to the patient mobile.

Primary actor: GSM modem.

Goal in context: to set the M.C and connected it to GSM.

Preconditions: the M.C activated and sends the signal to GSM modem.

Trigger: the GSM and M.C turns on.

Scenario:

1. The GSM modem received signal from the microcontroller when the on time medicine.
2. When the GSM- which is connected with microcontroller serially- be active it send message to patient mobile which stored in the database.

Exceptions:

1. When the GSM modem has an error.
2. When the mobile out of serves or closed.

Priority: not essential, because we have LCD, led and buzzer.

When available: when the on time the medicine.

Frequency of use: many times per day.

Channel to actor: via mobile.

Secondary actors: using Bluetooth technology extend of GSM network.

Fig. 4.5 represent GSM modem's actor and the operations of this actor explained in fig bellow.

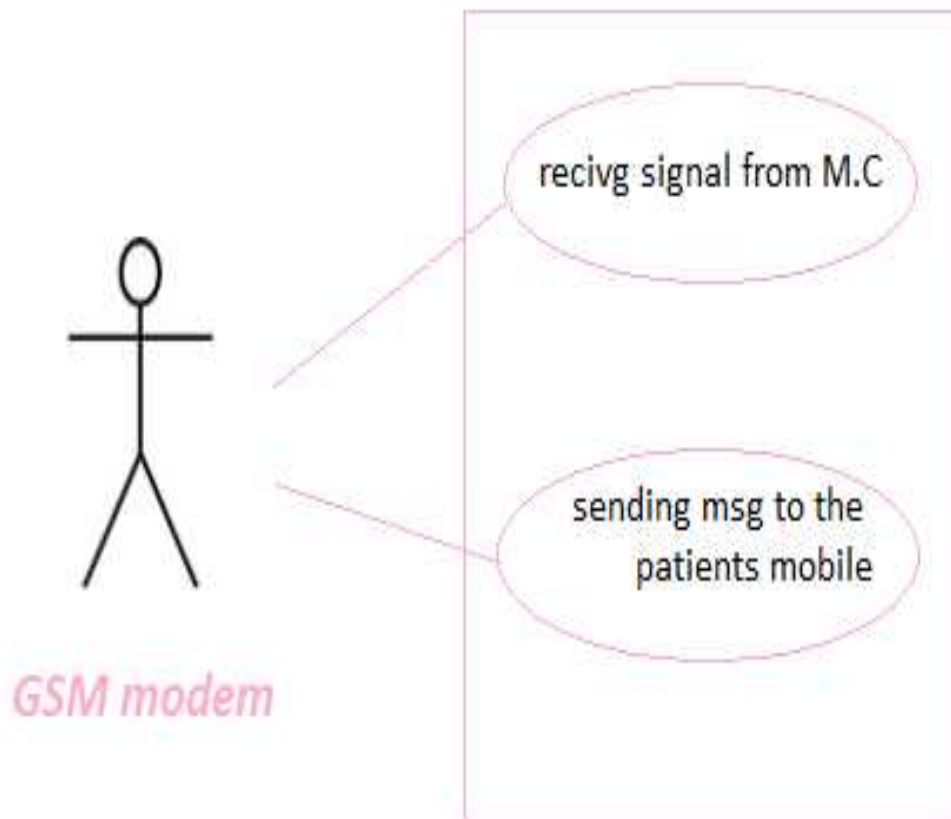


Fig 4.5: GSM modem actor.

4.3 CRC(class Responsibility and collaborator modeling):

“Class-responsibility-collaborator (CRC) modeling provides a simple means for identifying and organizing the classes also the CRC model is really a collection of standard index cards that represent classes. The cards are divided into three sections. Along the top of the card you write the name of the class. In the body of the card you list the class responsibilities on the left and the collaborators on the right.”[11]

Table 4.1: Microcontroller. Class

Class: Microcontroller.	
Description : microcontroller (M.C) send signals to specific motor to open the drawer which contains the pills (i.e. medicine), at the same time the M.C also send signal to displaying screen to display the information stored already in the data base .the M.C also send signal to the light and sound alarm to inform the patient of the medicine time.	
Responsibility: <ul style="list-style-type: none">-Defines the microcontroller type.-Send signal to LCD.-Send signal to GSM modem.-Send signal to motor.-Send signal to voice.-Send signal to LED.-control GSM modem.	Collaborator: ----- LCD GSM Motor Voice LED GSM

Table 4.2: Computer Class.

Class: Personal computer PC.	
Description : The database in PC that stores a lot of information of medicine like the name of patient, illness, the name of the medicine... etc.	
Responsibility: <ul style="list-style-type: none">-Defines the PC type.-Transfer the information to microcontroller.-Have database.	Collaborator: ----- USB -----

Table 4.3: GSM Class.

Class: GSM modem.	
Description: which can send message to the patient to inform him/her about time of medicine, patient's name, illness, and the name of the medicine?	
Responsibility: -Defines the GSM type. - Received signal from microcontroller. -Send message to the patient.	Collaborator: ----- Microcontroller. Mobile.

Table 4.4: USB Class.

Class: USB stand for Universal Serial Bus.	
Description: we will use USB interface between PC and microcontroller due to its ability to transfer the data which are stored in database in PC to microcontroller to allow the system do its job.	
Responsibility: -Defines the USB type. - Interface between PC and microcontroller.	Collaborator: ----- Microcontroller, PC.

Table 4.5: Mobile Class.

Class: Mobile.	
Description: received the message that have the information about patient on time from the GSM modem.	
Responsibility: -Defines the Mobile type. - Received message.	Collaborator: ----- GSM.

Table 4.6: LED Class.

Class: Led.	
Description: we used the light the system in order the patient to seen the display if his/her mobile is closed.	
Responsibility: - Received the signal from microcontroller.	Collaborator: ----- Microcontroller.

Table 4.7: LCD Class.

Class: LCD display.	
Description: LCD to display the information stored already in the data base like patient name, the name of medicine, and time	
Responsibility: - Received the data from microcontroller. -Display the information in LCD.	Collaborator: Microcontroller. PC.

Table 4.8: Buzzer Class.

Class: buzzer alarm.	
Description: if the patient mobile is closed or he/she forgot the medicine; the alarm voice will inform the patient of the time of medicine.	
Responsibility: - Received the signal from microcontroller.	Collaborator: Microcontroller.

Table 4.9: Motor Class.

Class: Motors.	
Description: motors that open and close, when the time of medicine occurs, it opens, after that it closes so it wouldn't harm other people like children	
Responsibility: - Received data from MC. -Controlling of drawer (open or close).	Collaborator: Microcontroller. -----

Table 4.10: Button Class.

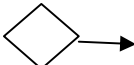
Class: Button.	
Description: the button that can send the signal to motor to closed it.	
Responsibility: - Send signal to motor.	Collaborator: Motor

4.4 Class Hierarchies and Relationships:

The type of relationships that we have in our project:

1-Has knowledge of. 

2- Depend-upon. -----

3- Is-part-of. 

The first one is like: the relationship between the USB and port. The second one is like: relationship between mobile depends upon GSM, microcontroller depend upon PC, GSM modem depends upon microcontroller, also lead, motor, LCD display, voice depends upon microcontroller, and button depends upon motors. The third one like: the microcontroller is part of our system. In the following tables relationships between classes.

The Fig 4.6 bellow determines each class with its functions and entity.

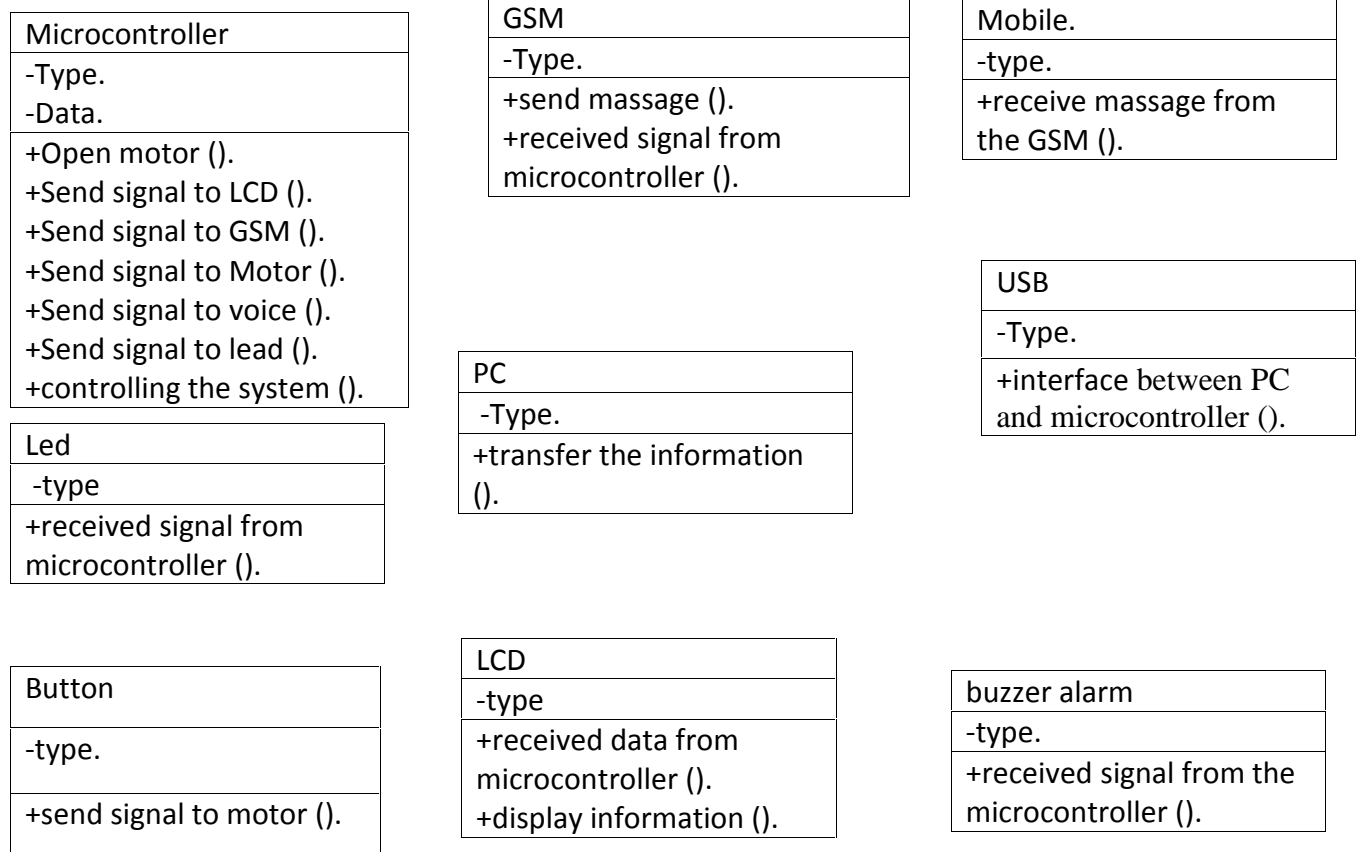


Fig 4.6: classes.

Fig. 4.7: describe the relationship between each device in the system with the other.

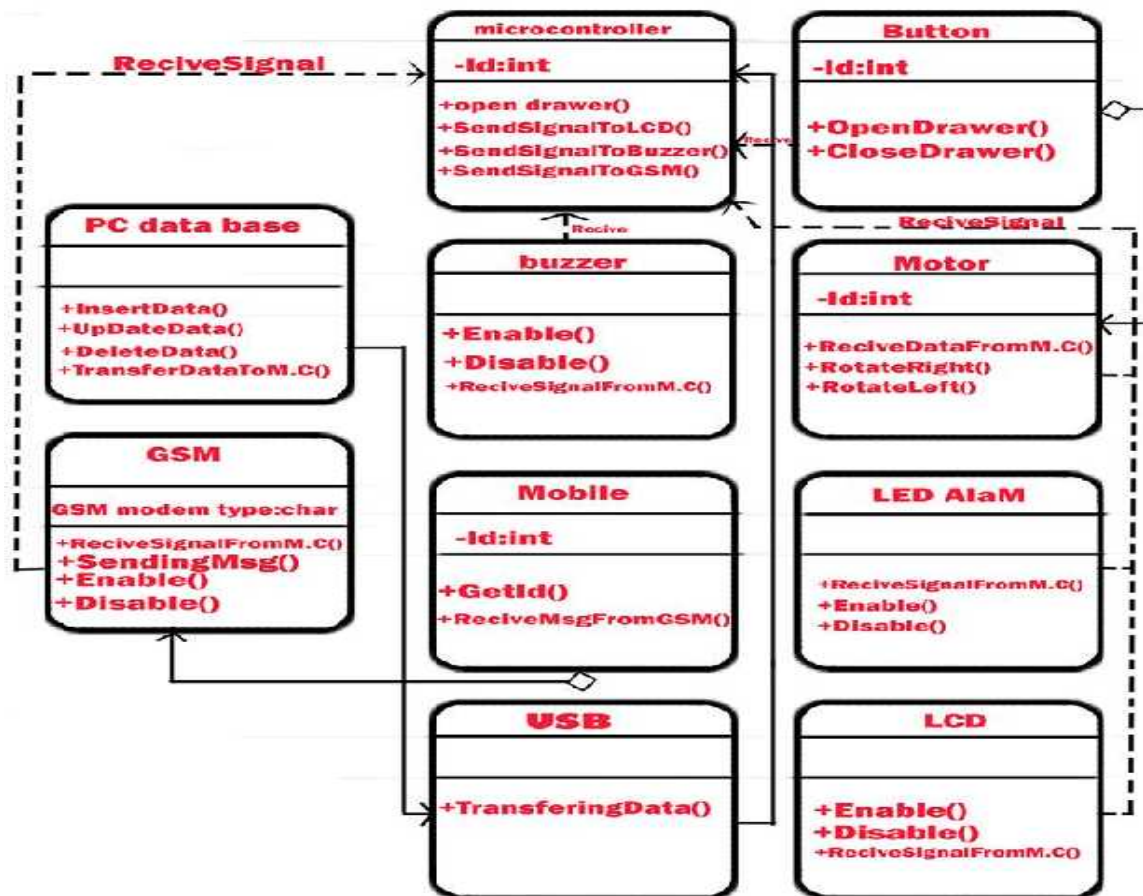


Fig 4.7: class relationships.

4.5 Summary:

In this chapter we determined each class and its relationship with the system, also determined the main functions that depend to each device. So now it will be easy to start connect the devices to generate new system which we aimed to work.

5

Chapter Five System Design

5.1 Overview.

5.2 Object Relational Model.

5.3 State Behavior Modeling.

5.3.1 Control Flow.

5.3.2 Data Flow.

5.3.2 State flow.

5.4 Subsystem Design.

5.5 class and object design.

5.6 Software interface design

5.7 User Interface Design.

5.8 Hardware Interface Design.

5.9 Summary.

CHAPTER FIVE

5.1 Overview:

In this chapter we will focus on the design section and draw the main system block diagram to specify the system software and hardware components

Also we will talk about object relational model, state behavior modeling for software and hardware, subsystem design and hardware software interfacing design.

Fig. 5.1 This Fig. describes the basic system abstraction; this abstraction shows that the main device in the system is PIC (18f4550) which connect all the other devices.

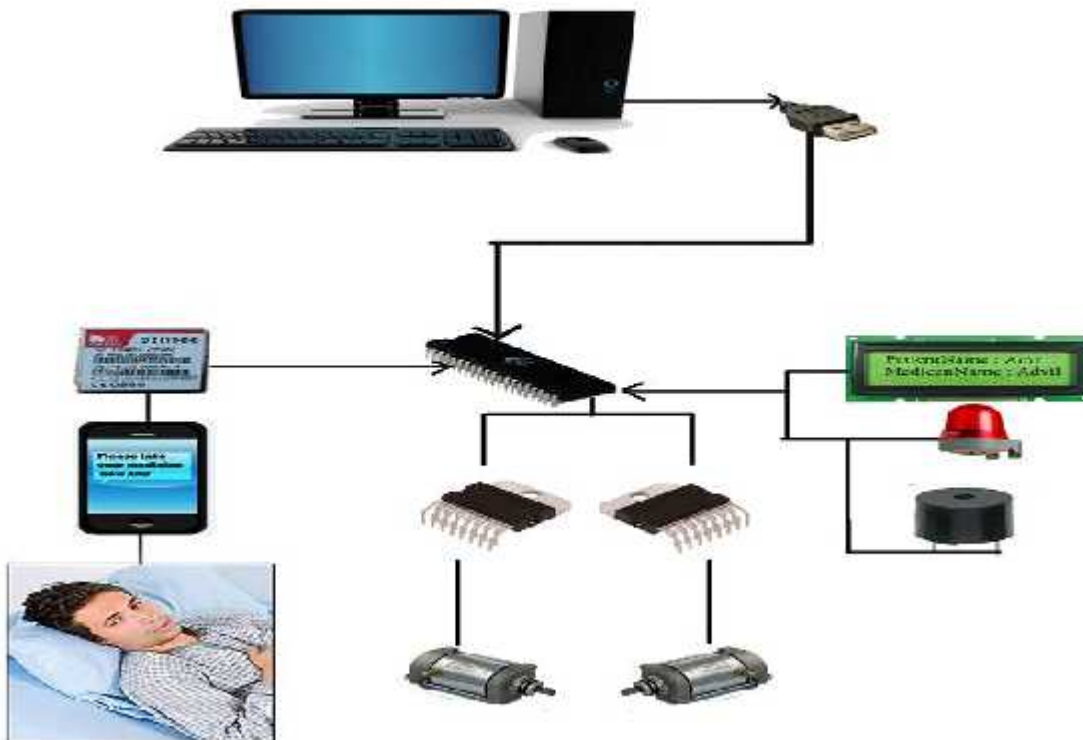


Fig 5.1: Basic system abstraction.

Fig 5.2 specifies the main block diagram of the project which determines the connection and interface s between each component with the PIC(18f4550).

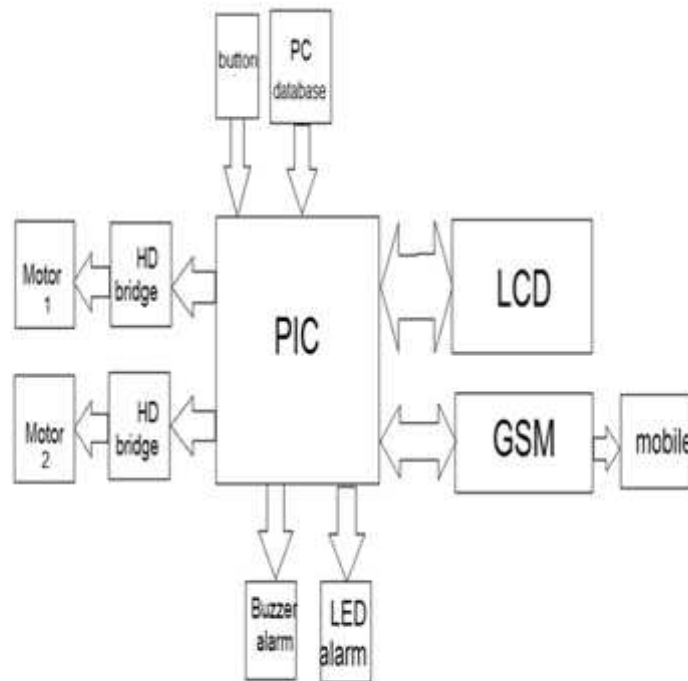


Fig 5.2:block diagram

5.2 Object Relational Model:

“The CRC (Class Responsibilities Collaborator) modeling approach determines the first element of the class and object relationships.

The first step is to understand the responsibilities for each class. The next step is to define these collaborator classes that help in activating each responsibilities”. [10]

“A relationship exists between any two classes that are connected. Once the names relationships have been established, each end is evaluated to determine cardinality”.[10]

In Fig.(5.2) we have two options exist : 1 to 1, or 1 to many. For example, the pharmacy Home System contains a single USB and single microcontroller. At least one LCD must be presented. However, there may be many LCD's present (the 1: m notation indicates this).

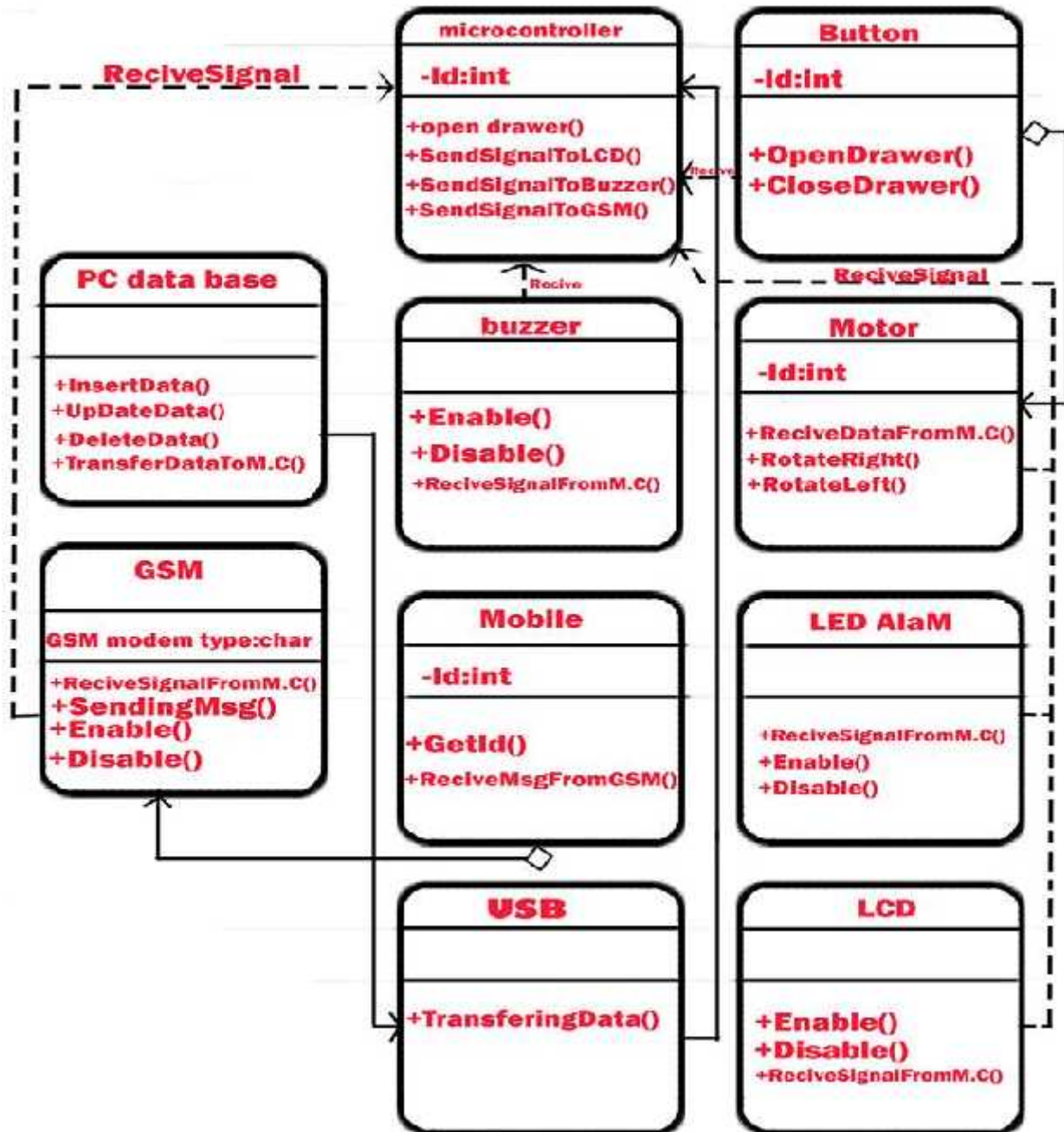


Fig 5.3: Object Rational Model

5.3 State Behavior Modeling:

Here we will determine each control, data and state flow.

5.3.1 Control Flow:

Control flow is the managements of data flow between computers or devices or between nodes in a network so that the data can be handled at an efficient pace [11].

Fig. 5.3 specifies the system how it works from the beginning when we store the patient's information to the end when the patient takes the medicine from the drawer.

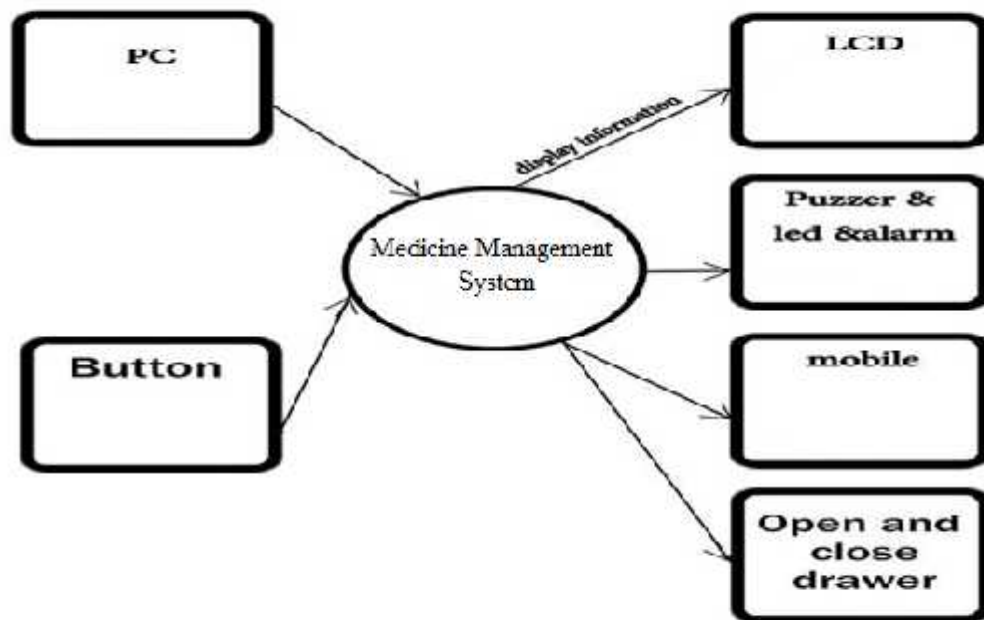


Fig. 5.4: Control Flow

5.3.2 Data Flow:

Data flow diagram (DFDs) help system designers and others during initial analyses stage visualize a current system or one that may be necessary to meet new requirement [12].

Fig. 5.4 describes the first level in DFD which contains the input and output. The system has two inputs (PC and Button) PC includes the patient's information. Finally, the output (LCD, LED alarm, buzzer alarm, motors and mobile).

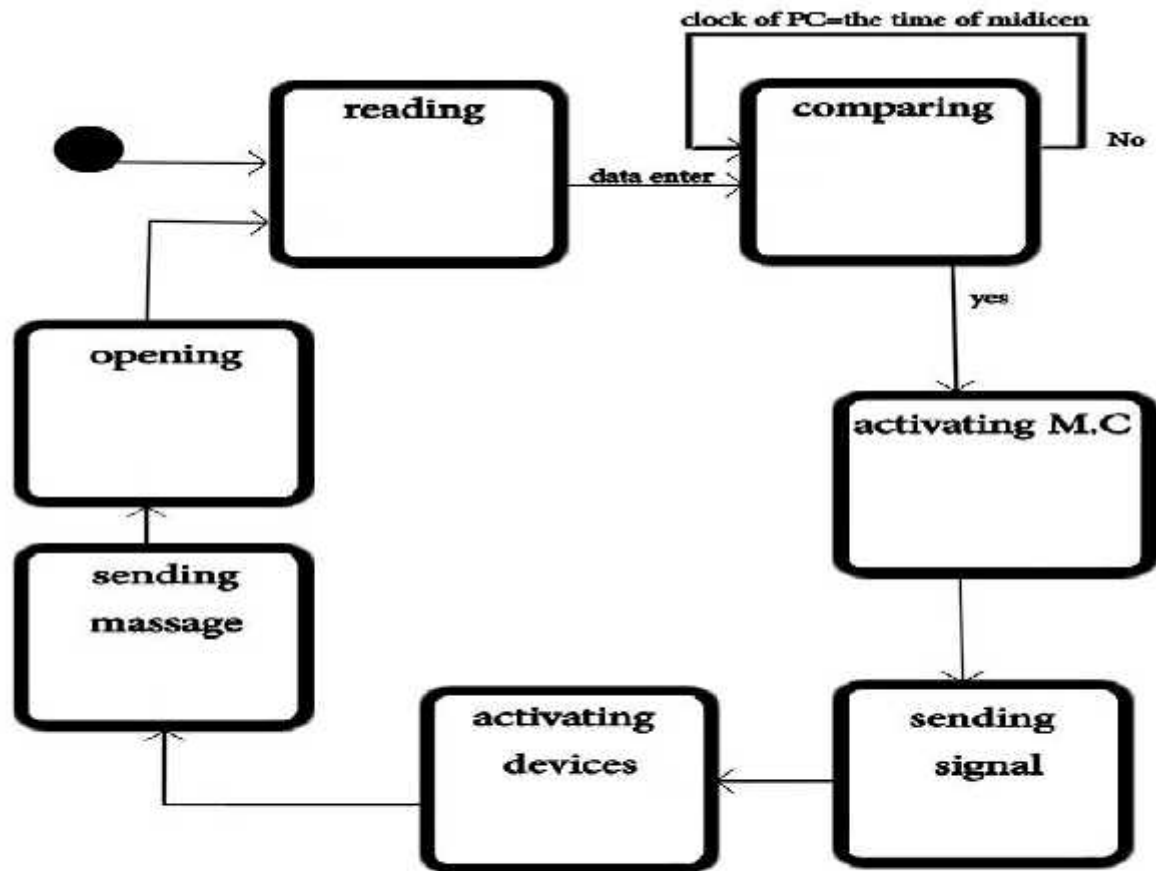


Fig 5.5: Data Flow

5.3.2 State flow:

State flow diagram represents active states for each class and the events that cause changes between these active states. Fig. 5.5 illustrates a state diagram for the system.

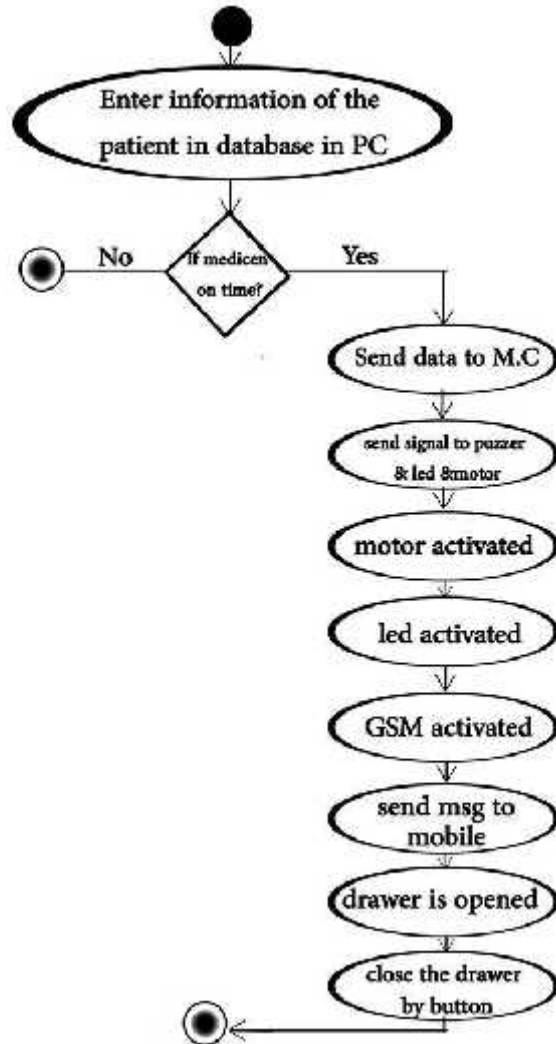


Fig 5.6: State Flow

5.4 Subsystem Design:

This section describes each subsystem:

- PC with MC :

This subsystem defines the relationship between M.C and PC which connected with each other by USB Fig (5.6).

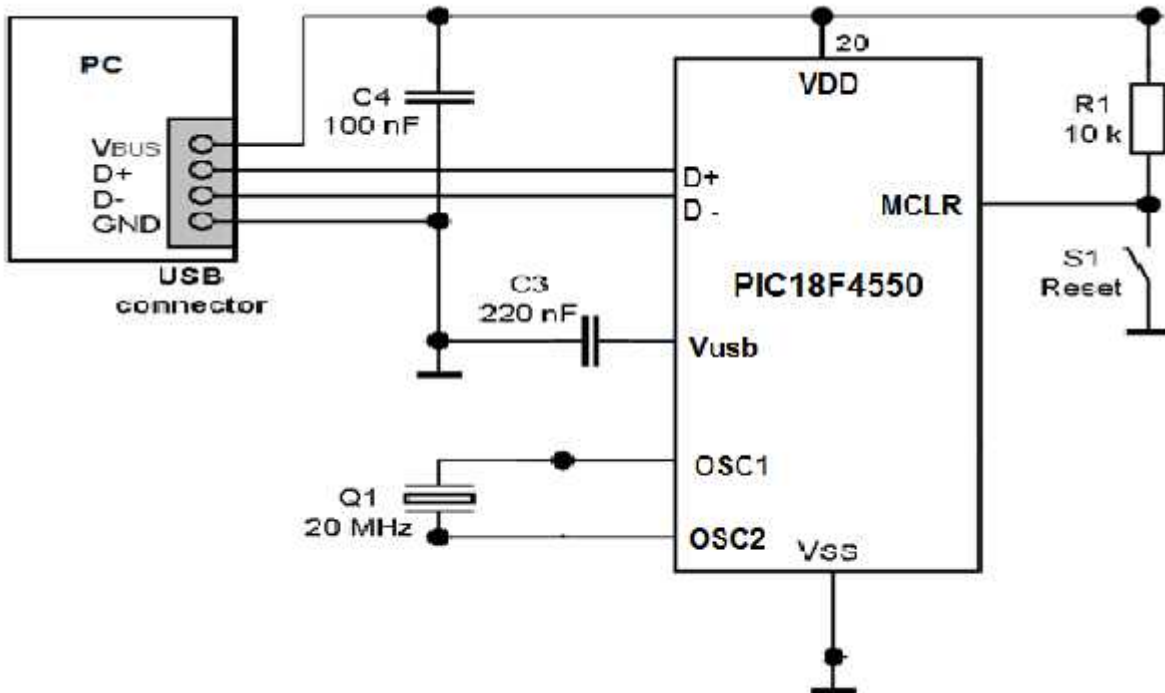


Fig. 5.7: PC with MC

- MC with GSM

The Fig.5.8 bellow shows the main connecting between GSM modem and the microcontroller. In GSM modem there is one transmitter and one receiver's wires, these wires transfer the data and signals between each MC and GSM modem and RW pin is to switch the GSM modem on.

Also there is input in the MC to control the open and close the drawer.

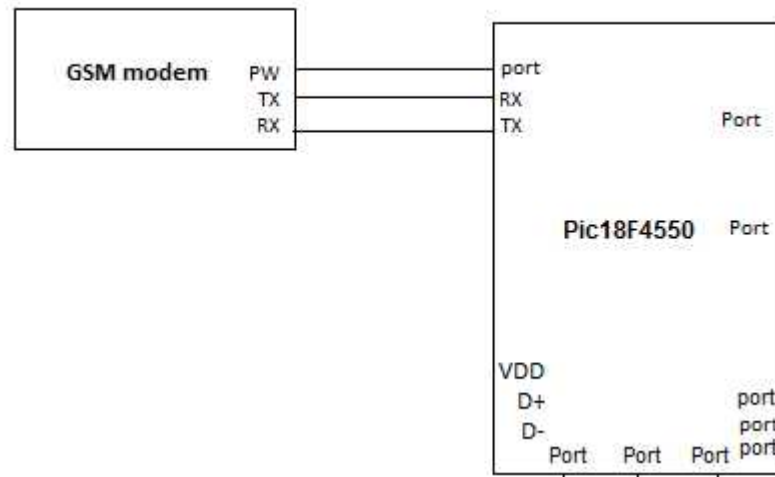


Fig. 5.8: MC with GSM.

- Motors and PIC18f4550.

The Fig. bellow shows the connecting between the motors and the PIC. There are 2 HD Bridge between the motors and MC, for each motor there is one HD Bridge to control the directions of the movement of the motor when the drawer opens and closes.

Fig.5.9 shows the connection of the first motor. That the two points of the motor connect with one side of the relay. Then to transistor to the PIC(Port B 2 and 3).

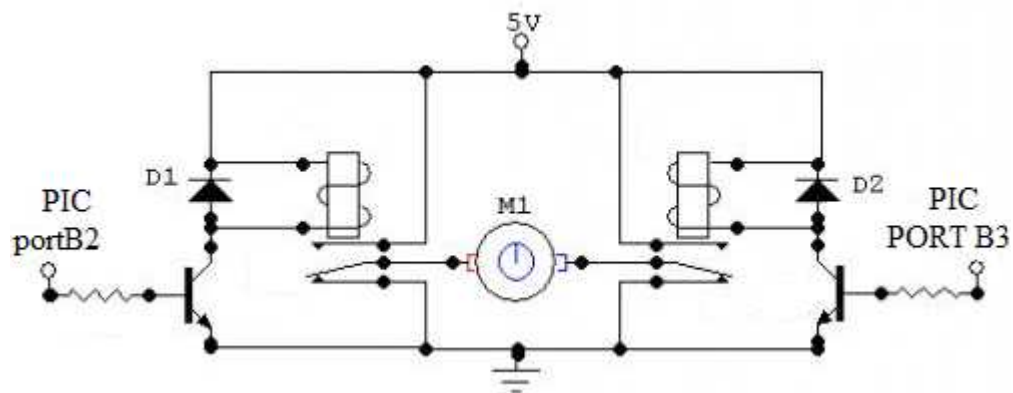


Fig.5.9: Motor 1 with PIC.

Fig. 5.10 shows the connection of the motor with the pins of the PIC (4 and 5).

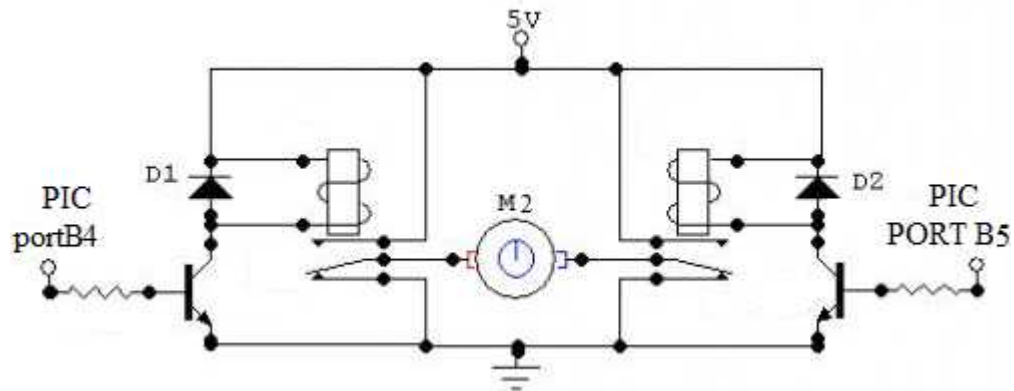


Fig. 5.10 motor 2 with PIC

- LCD and MC.

The Fig. 5.11 bellow shows the connection between the LCD and MC. There are mainly 7 wires for transferring the data, also there is E, RS and R/w signals each one is control some operation in the LCD.

E (enable the LCD)

RS(register selection)

RW (read write)

Vo(for the contrast of display)

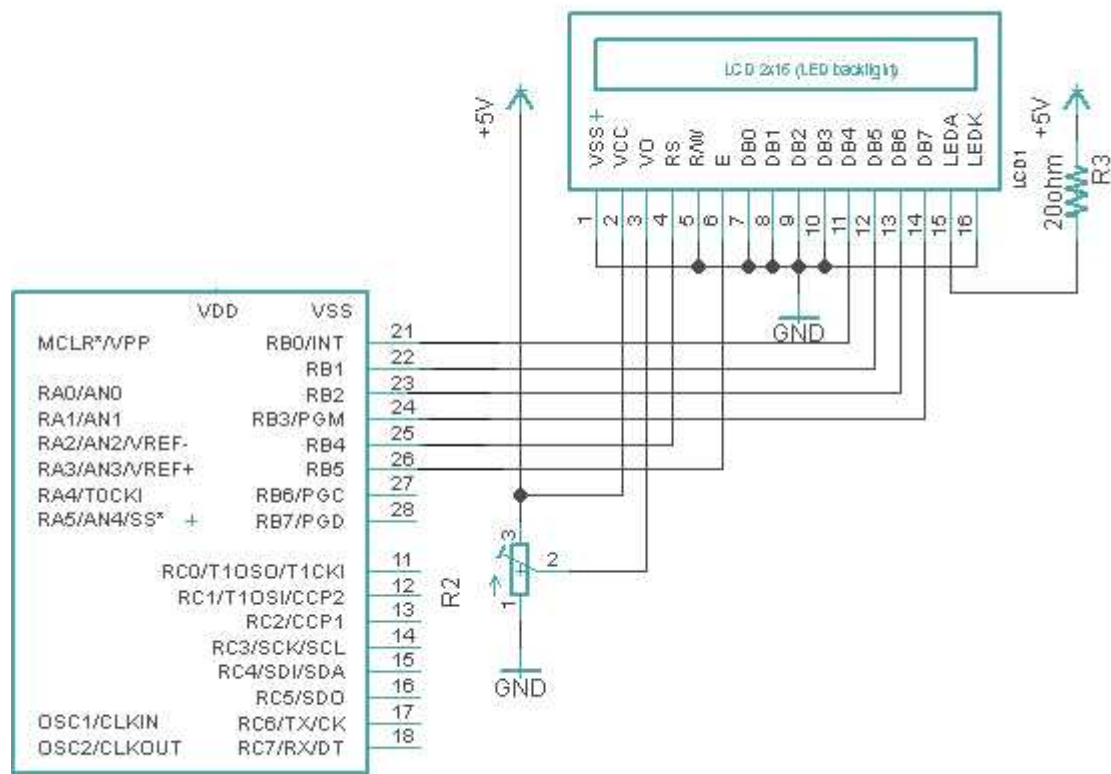


Fig 5.11: LCD with MC.

- LED alarm.

In Fig.5.12 bellow specify the connecting of LED alarm.

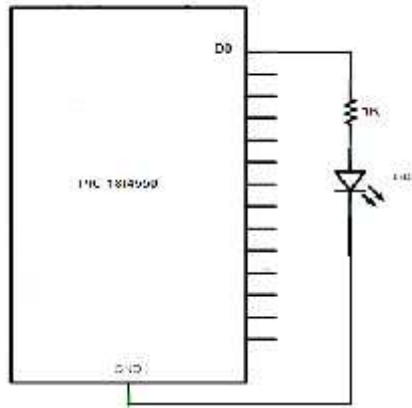


Fig5.12: LED and MC

- Buzzer alarm:

The Fig.5.13 bellow specifies the buzzer alarm.

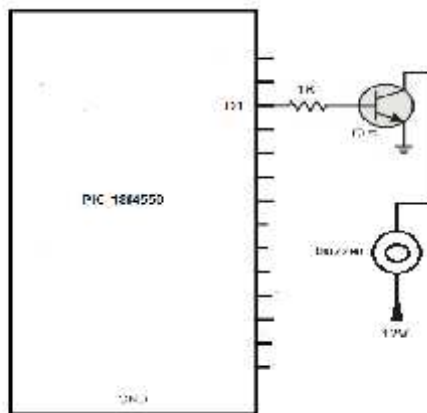


Fig 5.13: Buzzer and MC

5.5 class and object design.

Class name: Microcontroller.

Functions:

+OpenDrawer(): is function which it does not return any value. When this function is called, drawer will be opened.

+SendSignalToLCD(): is function which it does not return any value. it sends a command to LCD to be activated.

+SenSignalToBuzzer(): is function which it does not return any value. it sends a command to Buzzer to be activated.

+SendSignalToLed(): is function which it does not return any value. it sends a command to LED to be activated.

+SendSignalToGSM(): is function which it does not return any value. it sends a command to GSM to be activated.

Class name: PC(database).

Functions:

+InsertData(): this function allow the user to insert the patient information in the database.

+UpdateData(): this function allow the user to update the patient information.

+DeleteData(): this function allow the user to delete the patient information.

+TransfareDataToMC(): this function dose not return value. It allows the USB to transfer the data to microcontroller.

Class name: GSM modem

Functions:

+recvSignalFromMC(): this function does not return a value. It allows the GSM to receive signals from MC and process it.

+sendMSG(): this function sends a message to the mobile after getting the ID of it.

+Enable(): this function will activate the GSM modem.

+Disable(): this function will disable the GSM modem.

Class name: Buzzer alarm

Functions:

+RecvSignalFromMC(): this function does not return a value. It allows the buzzer to receive signals from MC and process it.

+Enable(): this function will activate the buzzer alarm.

+Disable(): this function will disable the buzzer alarm.

Class name: Mobile.

Attributes:

-ID : int : maybe there is more than one mobile stored in data base so we need to determine the ID for each mobile number.

Functions:

+GetID() : this function return integer value . it could be the phone number of the patient or nurse.. etc.

+ReciveMsgFromGSM(): this function dose not return a value. Its allow the system to send message to specific ID.

Class name :USB

Functions :

+transferringData() :this function allow the USB to transfer data between PC and microcontroller.

Class name: Button

Attributes :

-ID :int :in our system we have tow drawers ,so we need to determine each button.

Functions:

+OpenDrawer() :this function allow the drawer to be opened.

+CloseDraswer():this function allow the drawer to be closed.

Class name : motor.

Attributes :

-ID : Int : :in our system we have two motor ,so we need to determine each motor.

Functions :

+RecvDataFromMC():this function dose not return a value. Its allow the motor to receive signals from MC and process it.

+RotateRight(): to open drawer.

+RotateLeftOP:to close drawer.

Class name: LCD

Functions:

+Enable(): this function will active the LCD.

+Dissable():this function will disable the LCD.

+RecvSignal(): to allow the LCD to recive signal from microcontroller.

+RecvData(): this function transfare the data to LCD to be shown in the LCD.

Class name : LED

+ReciveSignalFromMC():this function dose not return a value. Its allow the LED to receive signals from MC and process it.

+Enable(): this function will active the LED.

+Dissable():this function will disable the LED.

5.6 Software interface design

In this section we will talk about object interfacing that explain the software dependencies classes by using sequence diagram shown in the fig bellow.

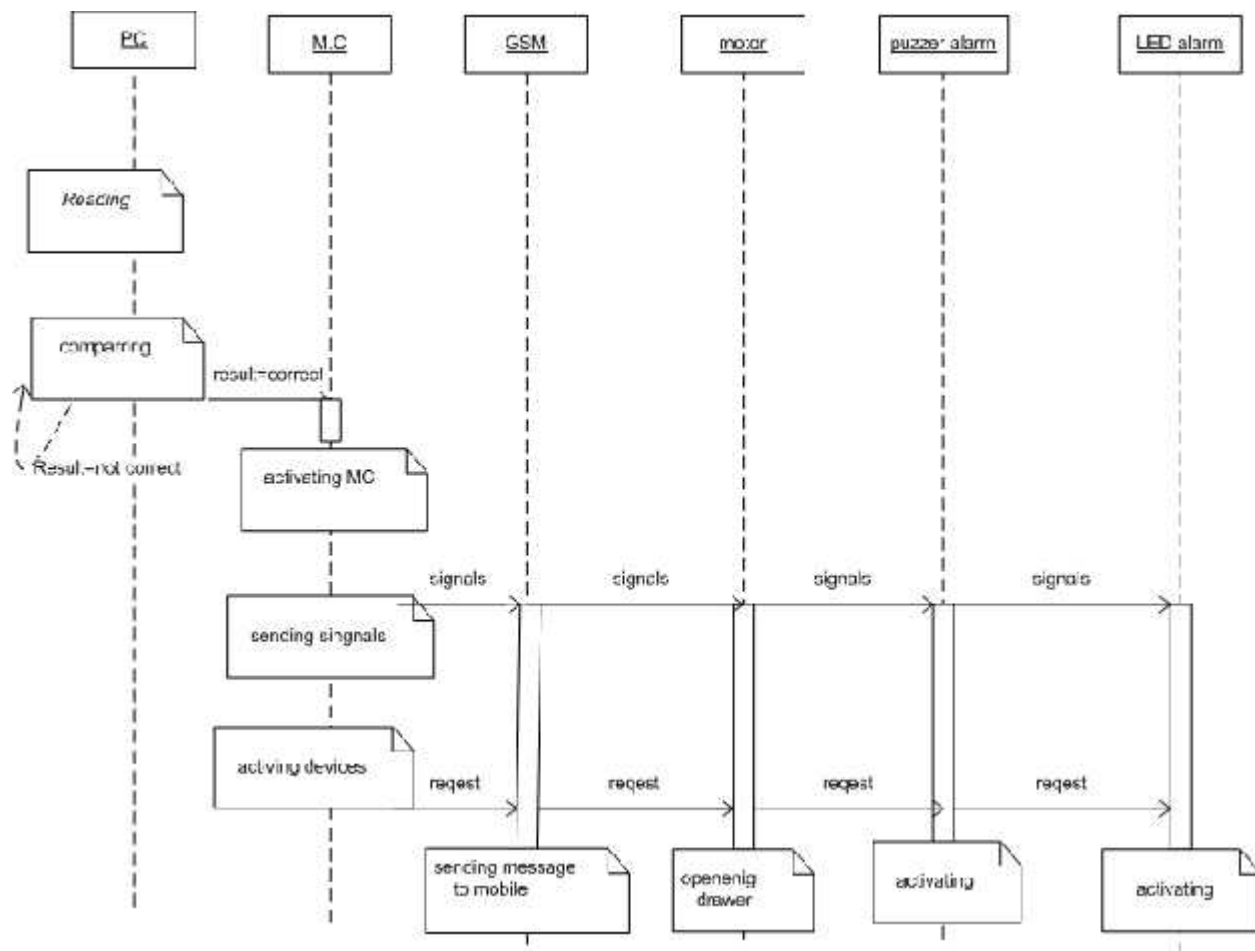


Fig 5.14:Sequence diagram.

5.7 User Interface Design

The interfaces that will be implemented in this project are as following:

- In case the nurse or who want to enter the patient information, asked to enter the patient name, medicine name and the time of the medicine is shown below.



The screenshot shows a software interface for entering patient information. At the top, there is a status bar with the text "Trouble not found" and a "TIME NOW" label next to a text input field. To the right of this is a "Run" button. Below the status bar, there are four labeled text input fields: "Name", "Medicine", "Phone", and "Door". At the bottom of the form is a table with seven columns: "id", "Name", "Medicine", "Door", "Phone", and "Time". The table has one row with empty cells.

id	Name	Medicine	Door	Phone	Time

5.15: Patient information

- The patient will received message from the system, its content as shown below.



5.16: Mobile information.

5.8 Hardware Interface Design:

In the fig bellow specify the main interface between each component in the system. This Fig show the main input and output from each component such as GSM modem has 3 main interfaces between it and M.C (PW: power of the GSM to become the devise on or off, RX to receive data form M.C ,and TX to transfer data to M.C).

In LCD there is three pins for controlling the LCD (E: enabling the LCD, RS: to implement the LCD if it will be command or just data displaying also RW: to determine if we wont to display data on LCD or read data from LCD).

Also there is 7 lines to represent the data connected to one of the ports of the PIC.

In addition, the connected between Motor and MC via HBridge needs three input from M.C and two output to DC motor shown in fig bellow.

Each Buzzer alarm, Led alarm and the button will connect with one of the ports in PIC.

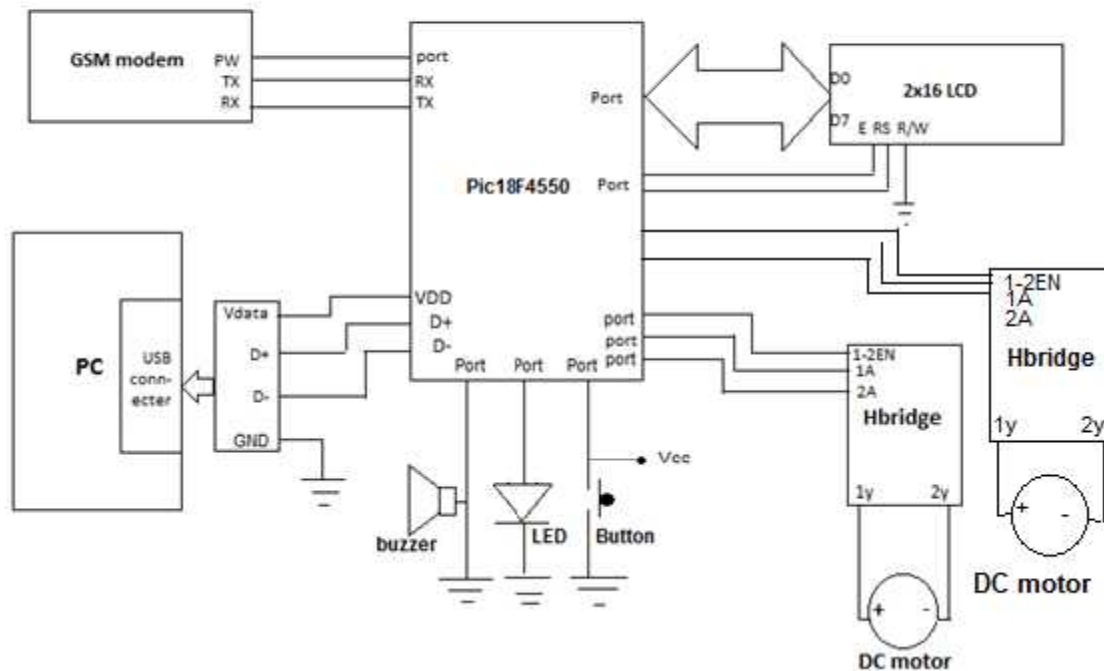


Fig 5.17: Hardware interface Design

5.9 Summary:

This chapter we described the project objectives, a general block diagrams and explains how the system works. Knew the specific component which will we use and what tha main interfaces between each devise.

6

Chapter SIX

Project Implementations

6.1. Overview.

6.2. Subsystems.

6.2.1 LCD with Microcontroller.

6.2.2 PIC with GSM modem.

6.2.3 PIC with Buzzer.

6.2.4 PIC with motors.

6.3: 12 volt power supply.

6.4: user interface implementation.

6.5 :Summary.

CHAPTER SIX

6.1. Overview:

This chapter includes detailed hardware and software, where the hardware and software are explained as a group of modules. Each module contains the real circuits with real connection and interface.

6.2. Subsystems:

In this section we will divide the system in subunits to implement and explain each pin's connection with the other device.

6.2.1 LCD with Microcontroller:

Each LCD has 14 pins. To connect the LCD we have to know the operation of each pin.

Fig. 6.2 shows the number of each pin. That pin1 for Vss, pin2 for VDD, pin3 VEE, pin4 for RS, pin5 RW, pin6 for E and from pin7 to pin14 for the data.

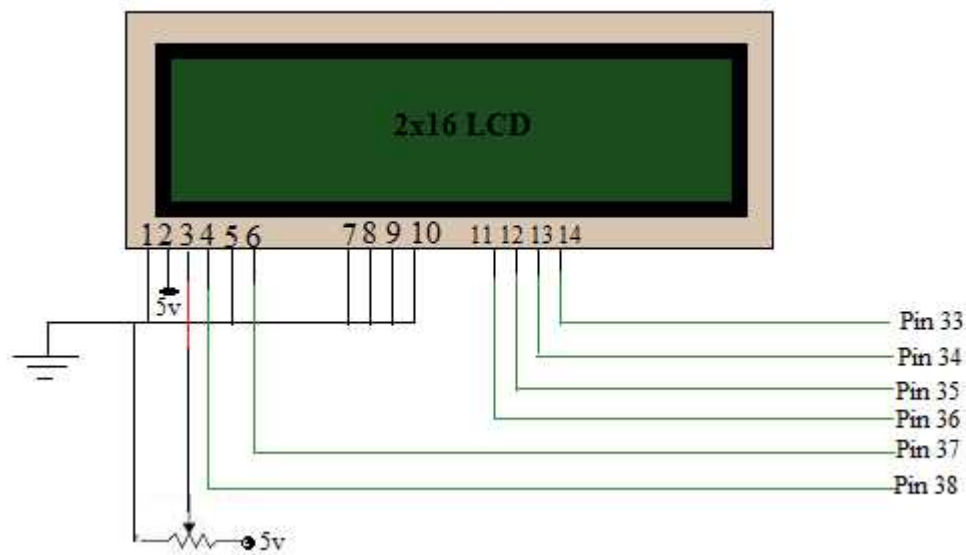


Fig. 6.1: Real circuit for LCD and microcontroller.

Fig. 6.1 connect with microcontroller PIC18f4550 that the pin 11 to pin 14 transferring the data between PIC and LCD .Fig. 6.2 is the datasheet of the PIC to identify each number of pins.

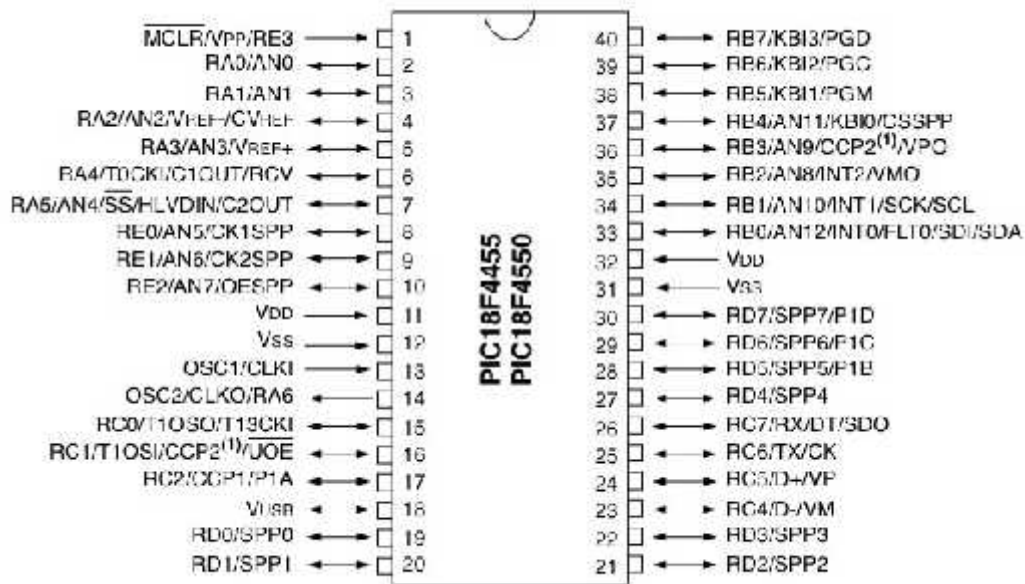


Fig. 6.2: Datasheet of PIC18f4550.

After finishing the hardware connection we programmed code to implement the LCD and its pins in” micro C pro PIC “. At the first identify the LCD module connection, and once the system work it should display “Mariam&Sabal” at the first row, PPU in the second. (Fig.6.3)

Also building some operations in C# to transfer data between the databases via the PIC to display the content stored in database like the patient name and medicine name.



Fig. 6.3. the First data displayed in the system.

6.2.2 PIC with GSM modem:

The first stage connect GSM modem (sender) and PIC, by sending the needed AT commands as a strings using C language (through pin 25 RX) to GSM modem, receive the response (through pin 26 TX) from the GSM modem. Fig. 6.3 shows the connection between GSM and PIC.

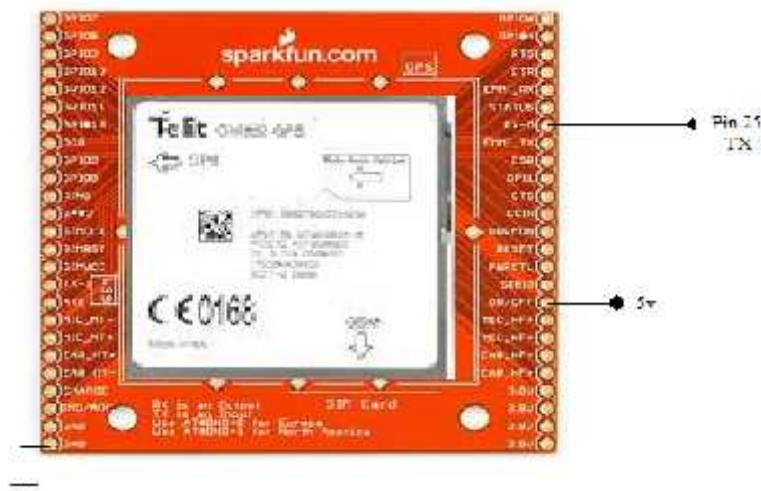


Fig. 6.4 GSM with PIC

“AT commands are used to control modems. AT is the abbreviation for Attention. These commands come from Hayes commands that were used by the Hayes smart modems. The Hayes commands started with AT to indicate the attention from the MODEM. The dial up and wireless MODEMs (devices that involve machine to machine communication) need AT commands to interact with a computer. These include the Hayes command set as a subset, along with other extended AT commands.”[11]

So we need some AT command to send message to the number stored in database we should using this AT command

UART1_Write_text("AT+CMGS="). This command take the phone number stored in database and send message to this number after take the medicine name to display on mobile.

In addition of sending message this command “UART1_Write_text ("Take your medicine ")” used to write specific words to display in the message.

Using this command “send_at("AT");” and put it loop to modify the changing on speed between the two devices (GSM and PIC).

6.2.3 PIC with Buzzer:

The buzzer we used is 12 volt. It has three pins the first connected to 5 volt, the second to the ground and the last one to 12 volt from the power supply. Fig. 5.12 explain the real circuit for connect the PIC with the buzzer.

The buzzer connected with port D1. That when the time which stored in database is equal to the time of the PC the buzzer will work until the user come and switch the button off.

6.2.4 PIC with motors:

The motors needed to open and close the drawer. So Fig.5.9 and 5.10 describes the pins of microcontroller connected with each motor that rotate the motor right by using the first relay and the other one using to close or rotate the motor left.

Here there were 4 probabilities of drawer statuses; the first one the drawer 1 closed and drawer 2 also closed, drawer 1 closed and the second opened, the drawer 1 opened and drawer 2 closed and drawer 1 opened and drawer 2 opened. These four probabilities identify which motor should be closed when the button is switched off.

Function “door” return the status of the drawers shows in Fig.6.5.

```

• void draw(char x,char y)
• {
cc  if(x--166y--1)
• {
•   rd2_bit=1;
•   delay_ms(1500);
•   rd2_bit=0;
• }
• if(x==166y==2)
• {
•   rd3_bit=1;
•   delay_ms(1500);
cc  rd3_bit=0;
• }
• if(x--266y--1)
• {
•   rd4_bit=1;
•   delay_ms(1500);
•   rd4_bit=0;
• }
• if(x==266y==2)
• {
cc  rd5_bit=1;
•   delay_ms(1500);
•   rd5_bit=0;
• }
• }

```

Fig.6.5: probabilities of drawer's status.

After checking the drawer status which should be opened at the medicine time; the microcontroller sends signal to port b2 (pin35) to be the motor rotate right and pin(36) to rotate left. And in the other motor pin(37 and 38) responsible for motors motions.

6.3 12 volt power supply (VPS):

The CD drive (motors) and the buzzer need 12 volt power supply so the system should provide this voltage to the devices by using lm7805 regulator. Fig. 6.6 shows how the system provides each voltage.

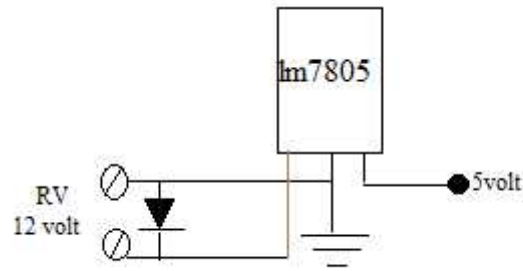


Fig. 6.6: Regulator.

6.4 user interface implementation:

This section determines the limits which represented of the number of characters the user can entered to the system which include 16 character for the medicine name and the patient name, and 10 digits for the phone number.

(Fig. 6.7)

The screenshot shows a user interface with three input fields. The first field contains the text 'SabalAbduallaaaa' and has a limit of 16 characters. The second field contains the text 'panadoooooooooooo' and has a limit of 16 characters. The third field contains the text '0123456789' and has a limit of 10 digits.

Fig. 6.7 users limits.

6.5 Summary:

When we divided the system to subsystem and all of subsystem works well, in next chapter we will testing the components.

7

Chapter Seven

Testing Chapter

7.1 Introduction.

7.2. Components testing.

7.2.1. Testing the microcontroller (PIC 18f4550).

7.2.2 Testing GSM.

7.2.3 Testing buzzer.

7.2.4 Testing LCD.

7.2.5 Testing motors.

7.3 testing sub systems.

7.3.1 LCD with PIC.

7.3.2 PIC with GSM modem.

7.3.3 PIC with buzzer.

7.3.4 PIC with motor.

7.3.6 PIC with PC.

7.4 Test the system.

CHAPTER SEVEN

7.1 Introduction:

In hardware and software working, debugging and testing are considered to be the most important phase. Testing must be applied in a way that makes it easy to perform.

The procedures we followed in testing the system is step by step and bottom to up strategy.

Therefore after finishing the design of the system and drawing the system schematic, the next step was to test each chip individually and then implement the system by using micro C and visual studio 2010. The sockets of each chip were placed on the blank board, the Vcc and the ground for each chip was connected. Then we ensured that all these lines are connected correctly.

After that the chips are connected with each other , the connectivity and the output of each chip used in the system are checked accurately, then the whole system is checked to worked properly.

7.2. Components testing:

Before connecting any circuit, we make sure that each chip is working correctly by checking all of its pins, and measure all the component that are needed for building the circuits such as LCD ,PIC ,buzzer , GSM modem , motors , and led.

7.2.1. Testing the microcontroller (PIC 18f4550):

In testing the PIC we made a small circuit to make sure that the PIC is working well. At the first we put the PIC in the breadboard and connected it with LEDs in Port D. After that connected the breadboard with USB cable to gives Vcc and ground to the circuit.

Then we wrote a small code in micro C to blinking the LED's such as the following:


```

void main()
{
    TRISB = 0 ;    // set PORTB as OUTPUT

    for(;;)        // forever
    {
        PORTB = 0xff ;    // turn all LEDs ON
        Delay_ms(500) ;    // wait 500 ms
        PORTB = 0 ;    // turn all LEDs OFF
        Delay_ms(500) ;    // wait 500 ms
    }
}

```

Fig. 7.1: blinking LED's.

7.2.2 Testing GSM:

The first stage of this test was performed between GSM modem (sender) and PIC, by sending the needed commands as a strings using C language (through pin 25 RX) to GSM modem, receive the response (through pin 26 TX) from the GSM modem, and turn on /off LED in port D according to the response.

We used AT command to test if the GSM sends messages or not by using” UART1_Write_text(“AT+CMGS=\\”0597376338\\”);” this command send message of free content to test that the GSM modem can send messages. Its send message to default phone number,in our poroject we used the phone number of one of the team work. Fig.7.2 shows that.

```

char i=0;
delay_ms(1000);
UART1_Write_text("AT+CMGS=\\\"0597376338\\\"");
UART1_Write(0x0D);
delay_ms(2000);
while(*s){UART1_Write(*s++);}

```

Fig. 7.2 testing GSM Modem.

7.2.3 Testing buzzer:

In order to test the buzzer connected the buzzer with VCC and ground to make sure the device is works.

7.2.4 Testing LCD:

There is some steps to test LCD shows in Fig. 7.3.

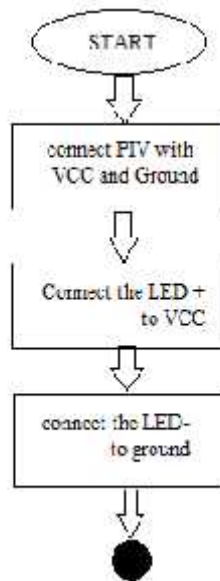


Fig. 7.3 steps of testing LCD.

After these steps if the LCD activate and gives light so the LCD is works. That by using micro C we wrote small code to write our names and university name while the first line in LCD contains “Mariam&Sabal”, and the second line contains “PPU”. The fig.7.4 below shows the output.



Fig. 7.4: Testing LCD.

7.2.5 Testing motors:

We disconnected the wires between CD drives and the motor and connect the two sides of the motor with external wires connected already to VCC and ground. While the motor rotate left and right after connect the VCC and ground that means that the motor works in good way.

7.3 testing sub systems:

In this section we connect each devise with microcontroller to test the ability of the subsystems to works together.

At the first of all things we should know the present time by enabling the timer to reach the time of the PC. Fig. 7.5 shows the time of the PC after press RUN.



Fig. 7.5 timer.

7.3.1 LCD with PIC:

Testing LCD required connect each pins in LCD with certain pin in the PIC which explained in the design chapter.

After that implement the module connection of the LCD by connect RS pin in LCD with port B5, EN with port B4, D4 in LCD with port B0, D5 with port B1 , D6 in LCD with port B2 and D7 in LCD with port B3. Then in the main initialize LCD after that clear the display to clear all the past information, and then write the needed text in first row or the second.

We make some buttons to test the LCD with PIC. After inserting the patient name and medicine name, we press the button test .Fig. 7.6 shows these buttons.

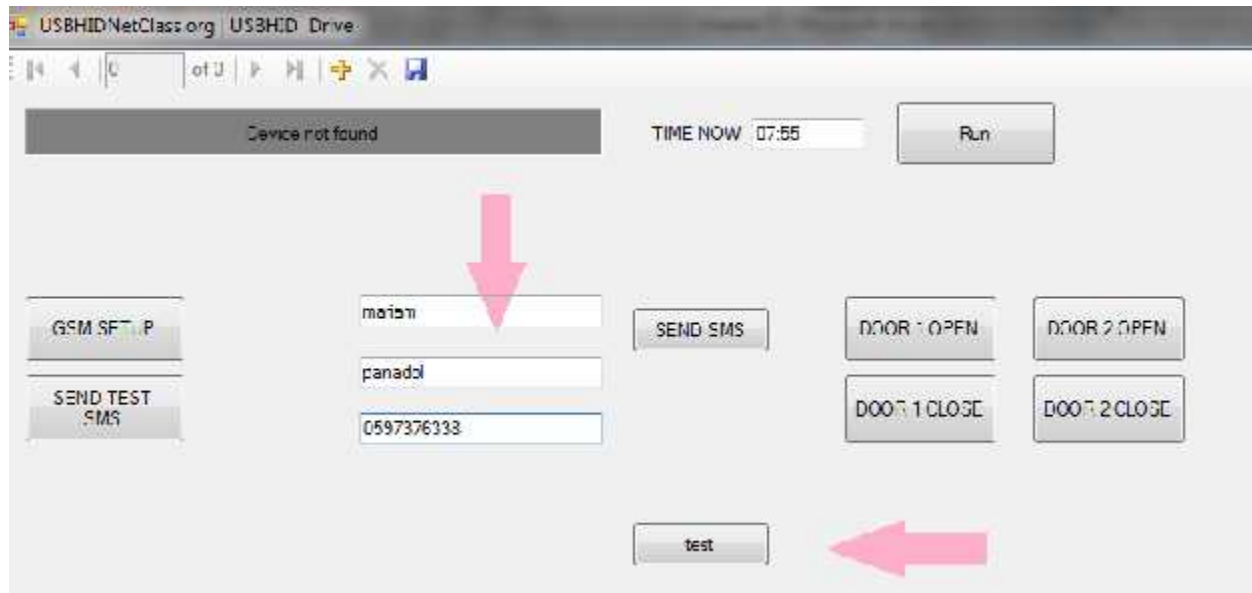


Fig. 7.6 testing LCD with PIC

The output of this test was shown in Fig. 7.7.



Fig.7.7 LCD output.

7.3.2 PIC with GSM modem:

This system needs to send message to patient mobile using GSM modem, at the first we have to test sending messages. So we built function to send SMS to mobile number. In Fig.7.6 the button test also test the sending message to the entered number.

The Fig.7.8 below shows the output of the test (mobiles message content).



Fig.7.8: mobile output

7.3.3 PIC with buzzer:

The buzzer worked whether the drawer 1 worked or 2.so determine when the buzzer alert depend on char x. while it equals to 1 the buzzer alert. Fig. 7.9 shows part of the code to determine when the buzzer alert.

```
void alarm(char x)
{
    if(x==0) RD1_bit=0;
    if(x==1) RD1_bit=1;
}
```

Fig. 7.9: alarm.

The test button shows in Fig 7.6 also test the buzzer alarm after each time of entering the data.

7.3.4 PIC with motor:

Testing the PIC and motor require some addition devices to provide the two rotations for the motor; Left and right rotation. At the first we added two HD bridge relays for each motor.

For testing the motors we create 4 buttons; Door 1 open, Door 2 open, Door 1 close and Door 2 close. Each button for specific operation. Fig.7.10 shows the testing for each drawer (close and open).by pressing Door 1 open the first drawer opened, also by press Door 1 close the drawer closed.



Fig. 7.10 testing motors.

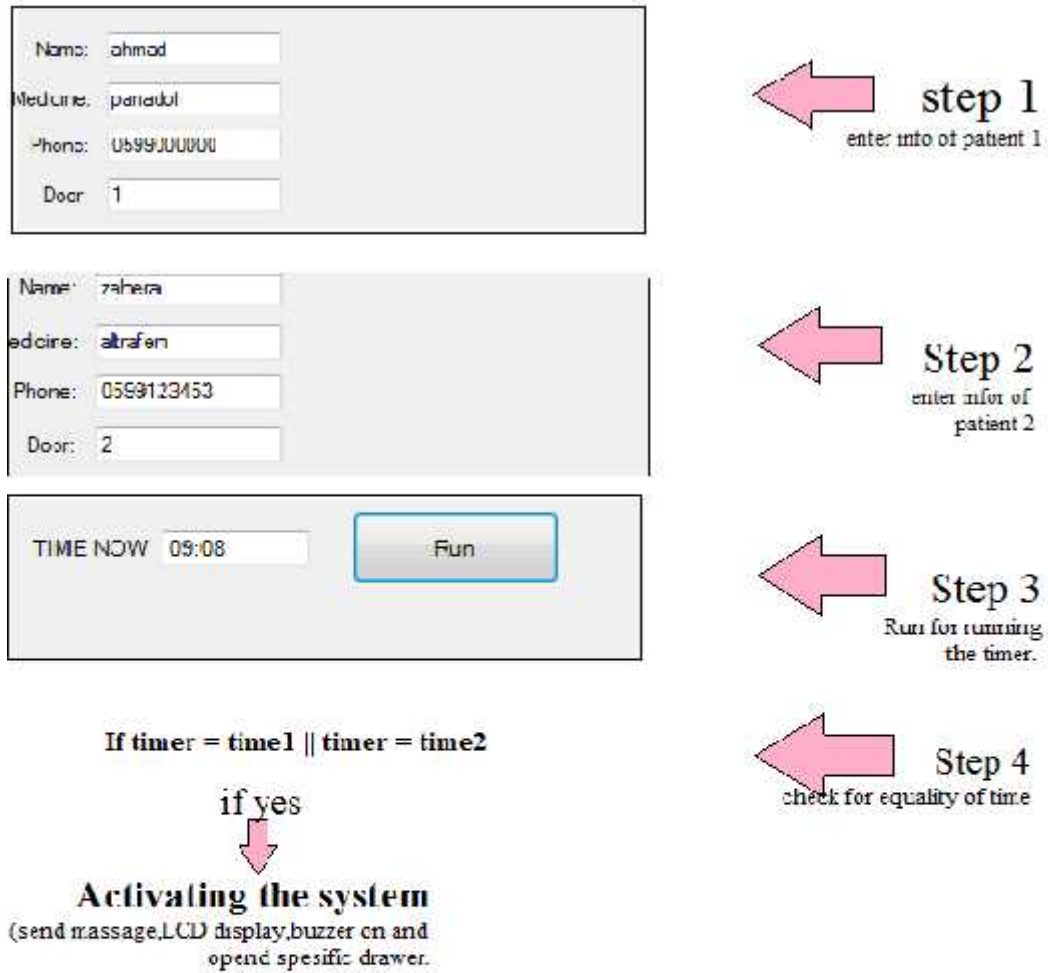
7.3.6 PIC with PC:

Testing each device in the systems needs USB connection to load the implementation code to the PIC. So if the code applied and gives result, that means that the connection between the PC and PIC is worked will.

Also the PC gives notes to the user when the USB cable ready to transfer data by using USB _bootloader.

7.4 Test the system:

At the end the system gave the expected output. Fig. 7.11 shows the steps which the user have to do.



7.11 testing the system.

8

Chapter Eight

Conclusion and Future Work

8.1 Problems.

8.2 Conclusion.

8.3 Future work.

CHAPTER EIGHT

This chapter introduces some significant concepts or tools. Also, it represents the conclusion extracted during designing and implementing the system. The chapter illustrates the system implementation achievements and output.

8.1 Problems:

We were able to solve all the problems and overcome all difficulties we faced.

Here are problems faced the project team during the system implementation:

- When we started our work on the project, we had built prototypes for all circuits using old breadboard which led into damage for some integrated chips(IC's).
- Internal damage in some devised due to the wrong connection.
- Time and effort were wasted because of the bad choices we have made such as:
 - In the first semester we decided to use DC motor, but the difficulties of controlling these motors led us to use CD drives which it had easy implantation and these components available in the markets.
 - Using CD drives is a decision made this semester; we spent several weeks studying how to connect it.
 - Also there was problem finding the suitable GSM modem for our system. But at the end we found GSM modem in the university's lab's.
This GSM modem had some problems of the high speed of processing and had some destroyed pins.

8.2 Conclusion:

Working on this project leads us to gain new experience that we have learned from books; we have learned different approaches and experiences specially the way of thinking and how to develop an approach to solve problems.

There were different problems that we have faced and solved in the implementation phase, we learned how to track different signals, chip by chip, and module by module, and how to use different tools and utilities.

- The most significant issues on this project were communication, testing, and documentation. Communication with each other among the group members is externally vita.
- Building this system was a great way of combining all we have learned over the five years in PPU. We were able to design build and implement the project. We learned how to manage our time.
- The project was a challenge for us, as the team spent 20-30 hours a week working on the project in the last month. We learned a lot and used everything we had learned in our classes to solve the problems and come up with solutions to make this system work.
- There is a big difference between theories and the real world implementation.
- The most important phases of our project took place. In this semester, including: schematics building, device testing, sub-systems testing and system programming. All of that were introduced in the next three chapters prepared in this semester.
- Each device was tested individually in its own circuit in order to make sure it work properly and do its expected job.
- Using the LCD and mobile messages can help the people who death to take the medicine on time.
- We make sure that the reminder also arrives to the patient while he is outside the home.

8.3 Future work:

We tried our best to choose the rational design to achieve the objectives of our project. We also believe that any work can't reach the perfection. Still a lot of thought and ideas can be utilized to enhance the current work achieved. Here are some of them:

1. Providing more than two drawers to help more patients.
2. Developed the system to be able to use in the hospital and health centers.
3. Change some of the features of the system such as using mobile application instead of using PC to enter the patient information.

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