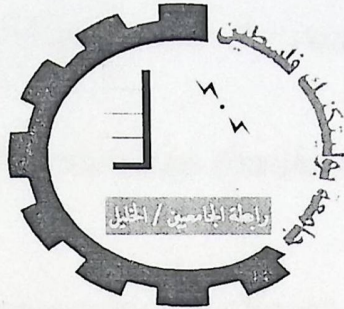# Palestine Polytechnic University

Collage of Administrative Sciences and Informatics

Department of Information Technology

"Small Project Scheduling and Chart Analysis"

Project Team

Abeer Al_Haddar

Anwar Al_Saafeen

A final project submitted in partial fulfillment of the requirements for the degree of B.Sc. in Information Technology.
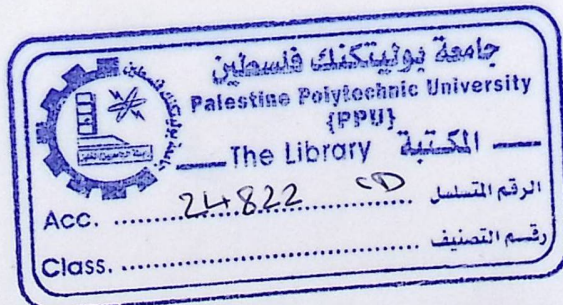
Supervisor

Ismail Romi

2010

Acknowledgment

The team advances great thanks to our ALLAH who innovates our soul.

Lights our brains, and illuminates the road of tomorrow...

The team members advance deep thanks to their dear supervisor Ismail Romi

Who have granted his support, orientation, guidance and advices...

The team advances deep thanks to our lecturers, friends, and to all who contributed the accomplishment of this project...

We can only say for their gratitude... Thank You...!

II

Dedication

To our beloved mothers whose heart beat with every notion flashed in our mind and every single letter we wrote down ...
To our fathers...

To the candle which lighted and guide us through darkness and frustrating moments...

To all the lovers of Palestine who died for it or still waiting...

And to all who are not cited and whose names may be inadvertently not mentioned...

Project team.

الملخص

يقوم هذا المشروع على فكرة بناء وتطوير الجدول الزمني، وتحليل الرسوم البيانية: حيث يهدف المشروع إلى تصميم واجهة تؤدي إلى جدولة الوقت، مع الأخذ بعين الاعتبار الخصائص الرئيسية لأي مشروع مثل (الوقت، التكاليف، الموارد)، وعند حدوث أي تغيير في أحد هذه الخصائص يجب أن ينعكس ذلك بشكل تلقائي على الرسم البياني، وهذا يجعل المشروع قابل للتطبيق في أي وقت خلال فترة حياة المشروع. ويهدف هذا المشروع إلى رسم شبكة يحدد عليها المسار الحرج بلون مختلف، بحيث يستطيع مدير المشروع معرفة المدة الزمنية اللازمة لإنجاز هذا المشروع. وقد تم استخدام منهجية البحث العلمي كأسلوب علمي موثوق.

في هذا المشروع تم التوصل إلى معرفة المدة الزمنية اللازمة لإتمام مشروع معين عن طريق شبكة الرسم الموجود على شاشة الرسم.

Abstract

The project is established on the idea of creating and developing an application of project scheduling and chart analysis. The main objective of this project is to design an interface that performs time scheduling with some features such as project network, critical path, and chart analysis, in terms of time, cost, and recourses (Human resources, material resources).When any of these features change, the chart dramatically produces the side effect of this change. This makes the project viable and practical at any time through the duration of the project. This project is considered a vital since it takes the previous related studies into consideration. finally the project achieve the following objectives :

1. In perfect way project manager can list all activities and detail of activities(Activity name, duration, cost, Est, Eet), that may face in the project .

2. Project manager can determine the dependencies between activities.

3. the system show activity on node(Network|), and determine critical path on the draw screen.

4. project manager in easier way can add, delete, update any activity.
   the user can watch AON, CPM

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Chapter one
Introduction

1.1Overview

Once you have set goals to achieve something, you will need to begin properly managing your time in order to work towards these goals. After a list has been created, a schedule will be needed to complete all the necessary tasks within a given period of time. Scheduling is an important tool for time management. When it has been done correctly, time will be minimized and stress will be decreased. You cannot totally get rid of stress, but in some cases stress can efficiently help you to complete the task in the proper time.

A schedule consists of a list of a project's terminal elements with intended start and finish dates. Terminal elements are the lowest elements in a schedule, which are not further subdivided. Those items are often estimated in terms of resource requirements, budget and duration in easiest way.

There are many available project scheduling software products, which can do much of the work of calculating the schedule and doing their chart automatically, and there are many books and tutorials that are available which are dedicated to teaching people how to use their software. However, before a project manager can use these tools, he or she should understand the concepts, dependencies, resource allocation, critical paths, charts and earned value. These are the real keys to planning a successful project.

In this Project we are looking to develop software that can achieve the mentioned goals with minimum requirements of time, human resources, etc. and or charting to get an easy way for achieving and analyzing an expected project with a minimum need for help or to appoint a special employee to manage your project or your activity; so we developed this software to make the scheduling and the charting easier.

With this project one can producing critical path or how to do change on it, and can also make crashing and manage change on activities in an easy and professional way .

1.2 Study Questions

Scheduling is an important tool for time management. time will be minimized and effort will be decreased , one can efficiently complete the task in the proper time .This study tries to answer the following questions:

1. How to perform time scheduling?
2. How to produce critical path?
3. How to solve the drawing and charting problem?
4. How do change in the project features?
5. How to make crashing?

1.3 Project Objectives

To build software capable of the following:

1. Draw Network .
2. Determine Critical path.
3. Manipulate network dynamically.
4. Crashing, in order to reduce the period of the project.
5. Manage change on the activity (time, cost, resources).

1.4 Project importance

This study focuses on project scheduling, including (time,cpm, network,....), and the importance of this study comes in academic and practical, as follows :

1.4.1 Practical importance

This study enables project manager in managing project by providing him with suitable software

1.4.2 Academic importance

This study will be integrated with previous studies and it will provide more insight in the scheduling in order to achieve a good understanding of it.

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1.5 System requirements

1.5.1 Human Requirements

1. **Analyst**: analyze the system and to determine the duration of the project and the cost.

2. **Designer**: To design the interface and the project.

3. **Programmers**: We need them for implementing and testing the project.

4. **Employees**: We need employees to implement the project in the real world and to estimate the duration of the project and that is testing environment.

1.5.2 Physical Requirements

All requirement that achieved by nonhuman like these

1. **Computers:** in order to built the application on it.

2. **Programming Language:** in order to program the project to make it efficient to use.

3. **Data Base :** we need data base to save the information that input to the system and the operation that occur in the system.

4. **Search engine:** this is used to search for human in the system.

1.6 Feasibility study

This part will discuss the technical feasibility and the cost feasibility.

1.6.1 Technical feasibility

1. **Performance:** the system must perform all the requirements in the strongest way, by storing all information related to any activity in the database.

2. **Speed:** this includes (Speed of research, speed of interaction between the system and participants), when tracking activity all information need appear, by showing it in the drawing screen.

3. **Security:** This is needed to prevent unauthorized people to access or change the system or data base, so we can make security by the order of manager. By insert the password and user name

4. **Easy of use :**

- The easiness to access and to use the system: by insert the user/administrator name and password.

- Easy of refresh the system: can return the previous state by a button of refresh.

- Easy transfer the data.

1.6.2 Cost feasibility:

1. Hardware cost: The following table lists the cost of the H.W that we need to develop the system.

Table (1-1): The H.W cost

Item	Number Of Items	Cost Per Unit $	Total Cost
Computer (Dual Core)	1	750	750
Flash memory	1	15	15

Printers/ jet Laser2300	1	70	70
Total	835$		

2. Software cost: The following table lists the cost of the S.W that we need to develop the system.

Table (1-2): SW cost

Item	Number Of Item	Cost Per Unit $	Total Cost
Microsoft Windows XP Professional	1	120	120
Microsoft office professional 2003	1	100	100
Microsoft Visual studio.Net 2008	1	700	700
Total Cost	920$		

Time Schedule/ Gantt's Chart:

To discuss the time schedule of the project, it is good to refer to the Gantt chart that's shown in table (1-3) where the key activities are stated and the time period for their completion is depicted starting Feb-15-2009 .

Time Schedule/ Gantt's Chart:

To discuss the time schedule of the project, it is good to refer to the Gantt chart that's shown in table (1-3) where the key activities are stated and the time period for their completion is depicted starting Feb-15-2009 .

Table 1-3 Gantt's chart

Activities	February	March	May	June	Sep	Oct	Nov	Dec	Jan
1.Introduction	■								
2.Litrature review		■							
3. System analysis			■						
4.System design				■					
5.programming					■	■	■		
6. System testing						■	■	■	
7. Implementation								■	
8. Sys maintenance									■
9.Documentation	■	■	■	■	■	■	■	■	■

1.7 Document organization

Chapter one: Introduction: Includes an overview of the project scheduling and chart analysis, and the study question that relating to the project, objectives of our project, and the result that may reach to it.

Chapter two: literature review: includes the previous study that relate to our project so it contains topics like critical path ,project scheduling, crashing and many different key word and in the end of this chapter we include a table to summarize all the previous studying.

Chapter three: Functional requirement: The project team embedded on it all functional that must achieve the objectives of the project and the system must apply it; and also includes context diagram and data flow diagram in the end of this chapter.

implementation processes , and the environment that use in the system.

Chapter six: Testing: After ending the stage of application and programming the system , it will put under testing to ensure it meet the design and functional requirement. The importance of the testing is in the showing the dependence of units and forms in addition of the integration and acceptance testing.

Chapter seven: Maintenance: In this stage the system will be ready to work in real environment , there are many things to consider in order getting the system suitable to work in the environment and for preventing problems which can happen during the installation process

Chapter two

Literature review

2.1 Overview

There are many previous studies related to the scheduling and network diagramming, which are the central topics in project scheduling and chart analysis. Previous studies include papers and book, such as project management, and management information technology, that focus on many topics such as critical paths, and project scheduling and how we can shorter the duration of the project by making crashing to the critical path, and by adding additional resources and talking about networking and too much algorithm related to it, so this chapter aims at introducing the related topics to project diagram.

2.2 Project Scheduling

Project scheduling as discussed by(**Shumsky R 2003; Griffith A 2005**) that defined it as a way to provide a graphical representation of predicted task, milestones, dependences, resource requirements, task duration, and deadlines , The main activities in project scheduling are time scheduling, and resource scheduling, the following are description of them.

1. Time scheduling "note in project scheduling" discussed by (**Shumsky R 2003**) talks about the random activity time in which the dependence between events limited the benefits of extra resources. This dependence also improve the effect of randomness, so that variations in project times tend to increase the length of the total project, so what is the effect of variations? they calculated that the original (non-crashed) Inter Trust project will take 22 weeks with no variation in activity times. But if activity times vary, they can expect the project to take longer than 22 weeks, so for any project subject to randomness, Expected **project duration > Project duration calculated from expected durations of individual activities**

2. Resource scheduling (**Šeda M 2007; Griffith A 2005; Shumsky R 2003**) **" flexible heuristics for project scheduling with limited resources"** discussed by (**Šeda M 2007**) talks about Project planning under limited resources and they say that it:

- Inter dependence among activities due to sharing the same resources.
- Dependence of resource consumption on the manner in which the activity is subdivided.
- Dependence on the limits of availability of the various resources

"scheduling practicesand project success" discussed by (**Griffith A 2005**) shows the resource loading that its Involvement evaluating the project schedule, the most critical resource, and defining how much of each resource a specific will be needed. Also it's helps to ensure alignment between the cost estimate and schedule., enable one to evaluate peak labor , provides a model for resource leveling which result in more effective project, focuses the team on the critical resource , help coordinate scarce resource when managing a portfolio of project.

" note in project scheduling " discussed by **(Shumsky R 2003)** shows that resource constraint it an invaluable method for shortening the duration of a project is the ability to run multiple activities in parallel.

2.3 Types of scheduling

Type of scheduling is defined as a large (complex) project, and a small project **(Billows D 2007)** and the studies below describe a brief description of them.

1. Large project discussed by **(Billows D 2007)** these studies talk about the large project and how you can select the suitable project.

"project management planning" discussed by **(Billows D 2007)** shows that when the project scale increases the demand on project management's technique increases. Rather than with working with project management software that is a static representation of start and finish date they move up to software that simulates the project and reschedules and optimizes it every time we make change.

2. Small project discussed by **(Billows D 2007)** These studies talk about the small project , how can one select it to use ,and the tool one uses for it.

" **project management planning"** discussed by **(Billows D 2007)** shows that project management in this kind is with only duration rather than work estimate and resource capacity and there is no need to develop or to track a project budget. In this level your range of choice is very broad and many packages will meet these limited needs if these are Gantt chart and Pert chart. And in this level organization does not consolidate all the project in the portfolio nor does it manage the overall utilization of the people who work on the project.

2.4. Critical Path Method (CPM)

Critical path method discussed by **(Shumsky R 2003;Griffith A 2005)** These researches define critical path method as the longest path through the network and the length of critical path equals duration of project .the following paragraph shows brief discussion to these studies.

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"note in project scheduling" discussed by **(Shumsky R 2003)** aims to describe and to calculate the PERT and CPM. Through the following example as shown in table (2-1) for entering trust information system tables and illustrations.

Table (2-1) Description of inter trust information system project

Source: Shumsky R (2003) Note in project scheduling

Description	Immediate predecessors	Duration (week)	System Analysts
A	–	4	2
B	A	4	2
C	B	4	2
D	C	2	1
E	A	6	1
F	C,E	6	2
G	E	6	1
H	F,G	4	2

The information in this table else represented by a network diagram

Figure (2-1) Activity B, E may begin only after activity A end.
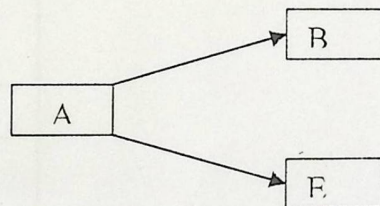
Figure (2-1) dependent activity

Source: Shumsky R (2003) Note in project scheduling

From this figure we can determine the critical path (A-B-C-F-H-End) (4+4+4+6+4=22

weeks) for the small project, but for the larger project with thousand of activity finding longest path is difficult. So we can find critical path using the following equations:

Walk list head

Activity 1.Eet= Activity Est + Activity1.Duration

Activity I. Est=pre .Eet

Activity .Eet=Activity I.Est+Activity I. Duration

Walk list back

Last activity.Let= Last activity.Eet

Last activity . Lst=Last activity.Let-Last Activity.Duration

Activity I.Let=suc.Lst

Activity I . Let=suc.Lst

Activity I.Lst=Activity I.Let- Activity I .Duration

The result of these equations shown in **Figure next**
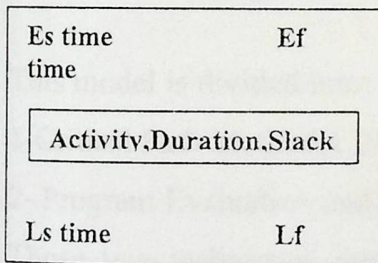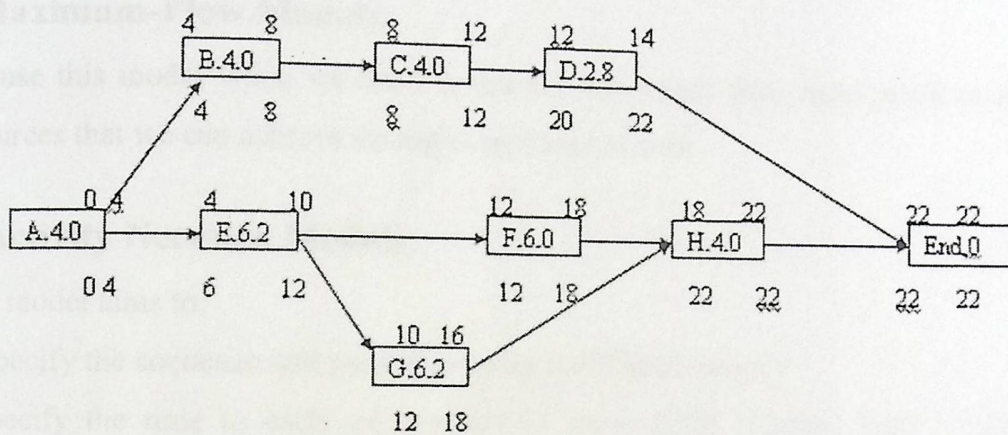
Figure (2-2): calculate critical path

Source: Shumsky R (2003) Note in project scheduling

"Scheduling Practices and Project success" discussed by (Griffith A 2005) it talks about critical path that Project schedule that based on CPM at the time of authorization have less cost growth, less schedule slip, better cost performance. For the purpose of this study project schedule were rated as CPM if they met a set of minimum criteria , The schedule's individual activities must be networked together using predecessors and/or successors. In addition, the start and finish dates of the activity must be based on standard network calculation algorithms.

2.5 Network diagram

Network discussed by ((Moead, Mahmod 2005)

"**Project management**" discussed by (Moead, Mahmood 2005)   they express
network in different methods:-

1- Shortest –Path Method:

This method is used when the goal we need to specify the shortest path between two
points or the shortest path between one point and all other points in network and the
shortest path between each two points in network

2-Maximum-Flow Models:

We use this model when we need to specify maximum flow from profit or money
resources that we can achieve through applying network.

3- Activity Network Models:

This model aims to:

a- specify the sequence and parallel activity in different project

b-specify the time to each activity and to know CPM (Critical Path Method) in
network of the project.

This model is divided into:

1-Critical Path Method(CPM).

2- Program Evaluation and Review Technique(PERT).

Those two techniques are very important in the scope for the improvement and
scheduling different projects applied operation.

The rules to draw network:-

First:-

Any project must have many steps to apply the network method:

1- The ability to divide the project into small units may be independent activity or
connected activity.

 2- Each project has Start and End Event and between them there is a group of
interference activity.

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3- The basic unit in the project is the activity that expresses of any effort we do in the project.

Second:-

can express the unit and component of project through different specific engineering shapes like:-

1-Event: period of time that refers to achieving some activities and the start of other activities, and the End to each Activity, we can express it by two Events.

Different shapes to represent the Event:-

No.1   No.2   No.3
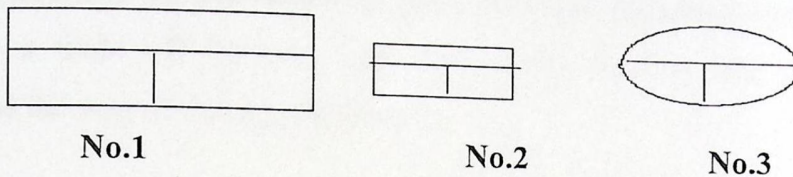
Figure (2-3): Event

Source: Moead, Mahmood (2005) Project management

2-Activities:-

One of the element of the project that they must achieve and locate between two Events(the first Event called Preceding Event and the second Event called succeeding Event) so they cannot begin Succeeding Activities if they don't finish all preceding activities .activities need :(Time, Money Resources, represent by Arrow).

they can divide Activities into Two Parties :-

A-Real Activities: - All activities that must be achieved to transfer from one Event to another one. There are (Normal Real Activities), (Critical Real Activities).

B- Dummy Activities: - All activities that don't need time, resource...etc, so all time that represent it is zero, and they use it to solve the problem (more than one activity starts from the same EVENT and both activities end just in one EVENT).

This can be shown as the flowing:
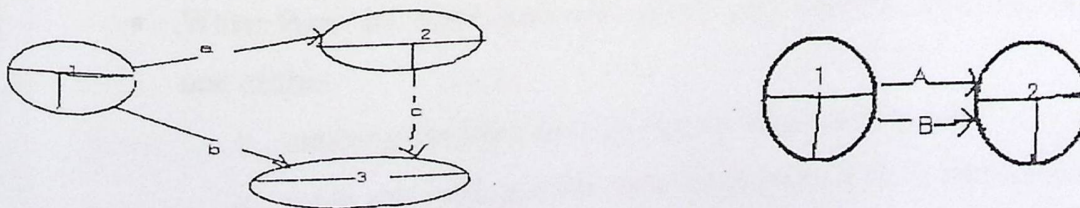
Figure (2-4): Activities

Source: Moead, Mahmood (2005) Project management

The sequence phase for applying the project depends on the basic Network

All the productive and services (Projects, Program) don't appear on uncertainty way, but it needs to prepare it, scheduled it ,control, and review it so it contains:-

- Planning stage.
- Scheduling stage.
- Controlling stage.

2.6 Crashing

Crashing discussed by (Shumsky R 2003; Moead, Mahmod 2005) they define crashing as a trade off between cost and project duration, and the next paper demonstrates the way of making duration.

" note in project scheduling" discussed by (Shumsky R 2003) talks about crashing a project to shorten duration When a project falls behind its schedule, extra people may be assigned to the job to speed it up, even for an on-time project there may be opportunities to 'crash' the project by hiring personnel or purchasing additional equipment. A manager must estimate the costs and benefits of speeding up the project.

"project management" discussed by (Moead, Mahmood 2005) show how to crash in steps as the following:

- ❖ Completion the expense of the early and late times to the project and determine the critical path.
- ❖ The expense of reduced cost for every time duration and all activities in project and then determine the degree of cost slop.
- ❖ Then making the gradation crash, as in the following rules:
  - Start crashing with the time of the critical path
  - Crash the activity that has the minimum degree of cost slop.
  - When there are more than one critical path then the crashing may to one of this:
    - o crashing the joint activity time between critical paths
    - o crash not joint activity time from every path at the same time unit
- ❖ be sure of the critical path still critical.

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❖ Calculate the total indirect cost.

❖ Determine the duration of the project to be completed which the total of direct and indirect cost become the least.

2.7 Resource Constraint Project Scheduling Problem (RCPSP)

RCPSP discussed by (Elkyari A et al ,2003; Lambrechts O et al,2005) All of these studies defined RCPSP as a general Scheduling problem which consists in scheduling a set of activities taking into account temporal and resource constraints .

" **stable solutions for dynamic project scheduling problem**" discussed by (Elkyari et al,2003). They demonstrate an environment for solving dynamic RCPSP , Here We are capable of dynamically handling a various set of events :

- **Temporal events:**   addition, retraction, or modification of classical and generalized precedence, disjunction or overlapping constraints between two activities which are useful to deal with.

- **Activity related events**: addition, retraction, or modification of an activity which are useful to handle new orders, order removals, duration or resource needs modifications ,etc..

- **Resource related events:** addition, retraction, or modification of a resource which are useful to handle machine breakdowns, newly repaired machines, etc.

The process used to solve dynamic RCPSP is handled incrementally from this first solution:

- **Upon the addition of a new information**: If a conflict with the current solution is identified, (the conflict is analyzed using recorded explanations, some decision are undone, some new decisions are made until a new optimal solution is obtained.

- **Upon the removal of existing information**: The related constraints are incrementally removed and re-optimization is performed (starting from the current solution and stored information about past search).

"Proactive and reactive strategies for resource –constraint project scheduling with uncertain resource availabilities" discussed by (Lambrechts O et al, 2005)

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In this paper they introduce a new variable of the RCPSP for which the uncertainty is modeled by means of resource availabilities that are subject to unforeseen breakdowns. And it shows an optimal solution for the RCPSP, since the objective of the deterministic RCPSP is to minimize the project make span, the associated schedule will usually be very dense. This means that activities are scheduled compactly with as little resource and time slack as possible. In such a schedule even a minor disruption in the resource availabilities during a scheduling period will have a major impact on the starting times of all activities that are scheduled in subsequent periods. Therefore, it can be expected that such a schedule will perform very badly for the weighted instability cost objective. The optimal solution for the RCPSP associated with the project instance of figure 2-5
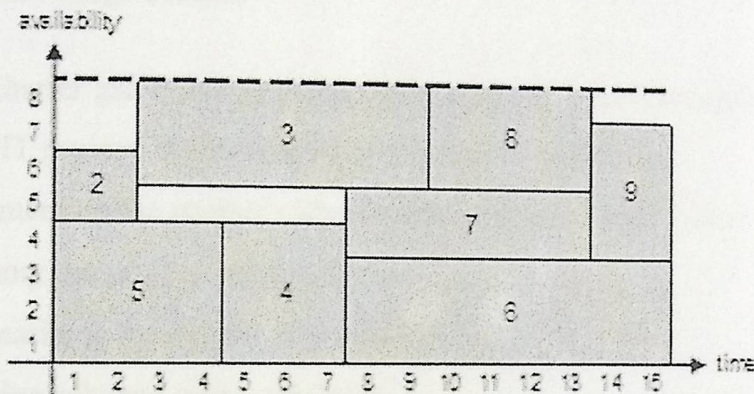
Figure (2- 5) : Minimal Make span Schedule

Source: Lambrecht O , Demeulesteer E, Herroelen W (2005) Proactive and Reactive Strategies for Resource-Constrained Project Scheduling with Uncertain Resource Availabilities.

2.8. Developing the project charter and baseline project plan

1. Why is it important to have several status and decision points throughout the project's life cycle?

2. How does business case from the project charter / project plan?

3. Why is it important to celebrate the small but important success?

Project charter defines project infrastructure, project manager, project team, stakeholder, and it formalizes the project's MOV scope. Project process contains project management, project oriented process.

Project management process group:

- Conceptualize and initialize.
- Develop project charter and plan.
- Execute and control project.
- Close project.
- The Project Management Body of Knowledge (PMBOK) views project integration management as one of the most important knowledge area.

Project integration includes:

- Project plan development.
- Project plan execution.
- Overall change control.

The project charter and baseline project plane provide a tactical plane for carrying out or executing IT project, the mechanisms of it are the following:

- Documenting the project's Measurable Organizational Value(MOV).
- Defining the project infrastructure.
- Summarizing the details of the project plane.
- Defining role and responsibilities.
- Showing explicit commitment to the project.
- Setting out project control mechanism.

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- Summarizing the details of the project plane.
- Defining role and responsibilities.
- Showing explicit commitment to the project.
- Setting out project control mechanism.

Figure (2-6): the project frame work _ define the MOV

Source: Brown C, Dehayes D , Hoffer J, Perkins W Management information

technology

2.9 Summary

Table (2-2) Summary of the literature view

he Study	Objectives	The Results
.Management nformation technology Mahmod ,Moead 2005)	The project scheduling and budget	Find the equations to calculate estimated cost. Estimate cost= activity duration*cost /resource
. Project management	All concepts that relate to the network	Gant Chart(small project) ,Pert Chart (large project)
Note in project cheduling (Robert 2003)	Aims to describe a set of tools that have proven to be consistency to project manager.	The tools they describe in this Paper are: 1- Project Evaluation and Review Technique (PERT), 2-Critical Path Method (CPM).
Selecting project lanagement software Billows 2007)	Managing in:- 1- smaller and larger project 2- multi project environment	Software for these multi project users runs from $400-$20,000 network versions to run on LAN a team communication capability in large numbers.

e Study	Objectives	The Results
Study of scheduling practices and oject success (Andrew 2005)	Empirically measures the effect that project scheduling practices have on process plant project success.	4- Detailed review of the schedul by the core project team
Proactive and reactive for resource onstrained project scheduling with certain resource availabilities amberchets.O&Herroelen.W&Deme lemester.E,2005).	This study aims to build a robust schedule that meets the project due date and Minimizes the schedule instability cost.	No matter how much one tries to protect the scheduling
Project scheduling tools and eir public perception HEORGHIU . F ,PMP, April 2007)	The study aims to adopt the Microsoft project package due to the easiness of this understanding	The main result of this study is Microsoft goes tightly shoulder in their strives for new customers
Stable solution for dynamic project heduling problems((ELKGARI .A URET.G and JUSSIEN.N ,2005)	The study aims to introduce a constant-based technology to handle dynamic RCPSP (Resource Constrained Project Scheduling Problem).	The main result of this study is to introduce new approach for solving dynamic(RCPSP) instances.
Flexible Heuristics for project heduling with limited resources IILO SEDA".	To shift activities in time when resources requirements exceed their available amount.	There are many strategies to achieve this shift

2.10 Conclusion

As a result of all the previous studies we can obtain all equations that apply it to establish scheduled table, and after reading many paper the work team find many key words that focus on critical path , project scheduling ,crashing the project ,network diagram , type of scheduling , and RCPSP. And from this keywords can result the following:

Calculating the duration of the project from the beginning to the end through Earliest start time, earliest end time, latest start time, latest end time.

Calculating the estimated cost of the project. Estimated cost= estimated duration * true cost of the resources.

Calculating critical path which is the longest path through the network and the length of critical path equal duration of project, using the following equations :

Activity 1.Eet= Activity Est + Activity1.Duration

Activity I. Est=pre .Eet

Activity .Eet=Activity I.Est+Activity I. Duration

Walk list back

Last activity.Let= Last activity.Eet

Last activity . Lst=Last activity.Let-Last Activity.Duration

Activity I.Let=suc.Lst

Activity I . Let=suc.Lst

Activity I.Lst=Activity I.Let- Activity I .Duration

Chapter three
System Analysis

3.1 Functional requirements

3.2 Non functional requirements

3.3 Context diagram

3.4 Data flow diagram

3.1 Functional requirements

The phase of collecting the requirements and analysis it is very important especially for building the system in perfect way, so the work team in this semester will show all descriptions of functional requirements(what the system must do),and nonfunctional requirements that exist in our system .The functional requirement are divided into two main categories: namely: Administrator function, and user function.

3.1.1 Project Manager functions

Login:

This function is used to authenticate and authorize project manager login information(user name/password), if project manager enter wrong name or password a message box appear .

Add activity:

This function allows project manager to add new activity details(name, duration, description ,Est ,Eet), and dependent activity in the scheduling system.

Delete activity:

This function allows project manager to delete activity and its details(name, duration, description, Est, Eet) and dependent activity in scheduling system.

Update activity:

This function allows project manger to update activity and all details or part of activity details (name, duration, description ,Earliest Start Time, Earliest End Time).

Draw activity on node:

This function will achieve and appear on the form when the project manager add activity and its dependent.

Determine critical path:

This function allow project manger to determine critical path after draw activity on node .

3.1.2 User function:

Login :

This function is used to authenticate and authorize users login information(user name/password), if user enter wrong user name or password a message box appear , after login correctly user can watch the result of the system (activity on node, critical path).

3.2Non-functional requirements

1. Compatibility

System should be compatible   because it will be added as new feature to system.

2. Ease to use

Project manager will interact with the system to draw through an ease-to-use graphical user interface. Furthermore, the generated drawing will contain visual (charts.) representation for the results.

3. Performance

the system must perform all the requirements in the strongest way, by store all information related to any activity in the strongest data base.
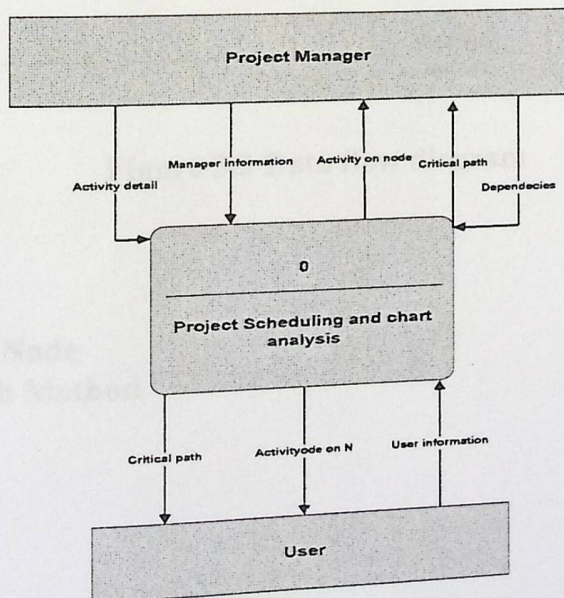
3.3 Context diagram:

Figure 3.1 Context diagram
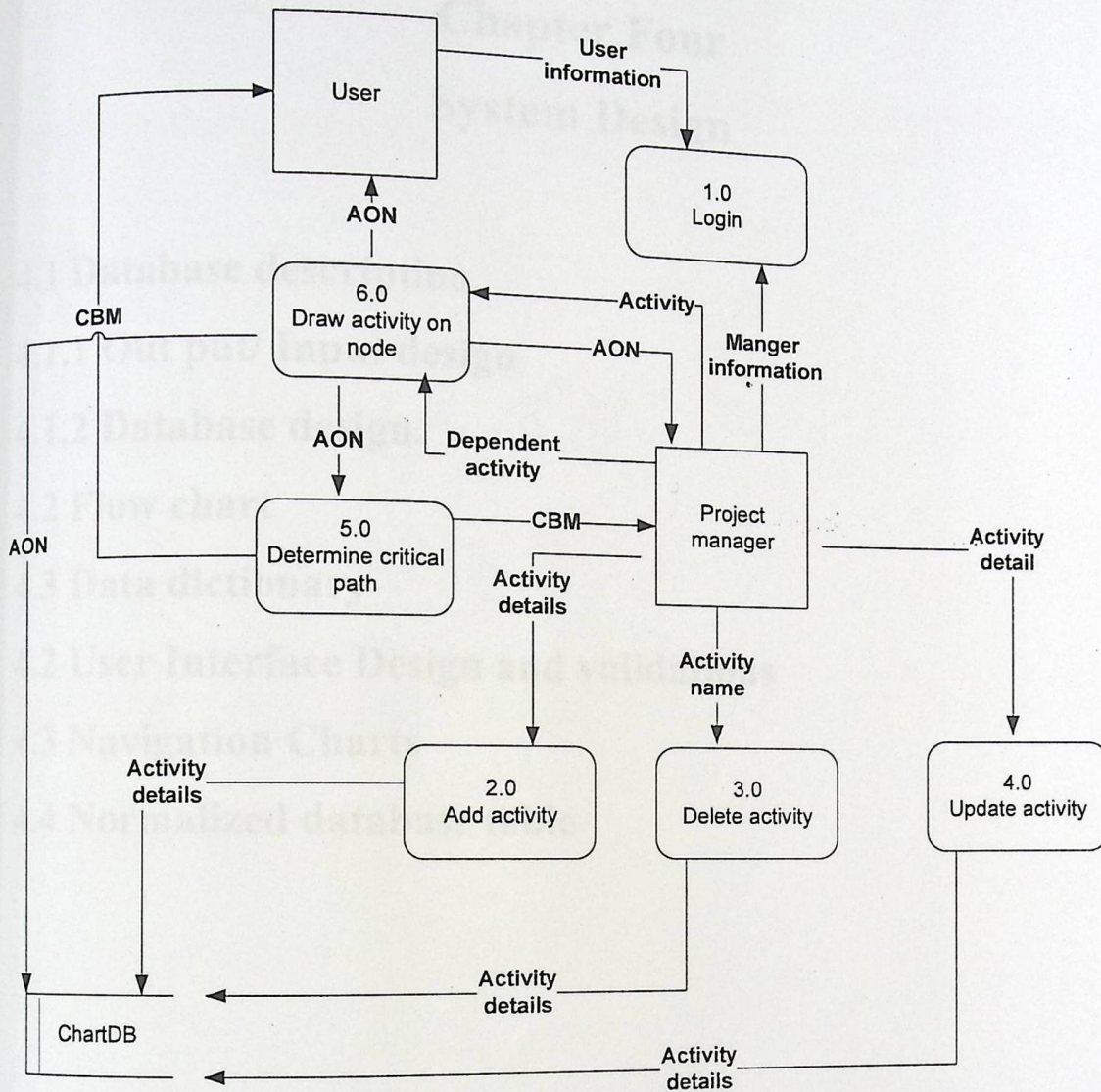
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3.4 Data flow diagram:

Figure 3.2 Data flow diagram

AON: Activity On Node
CBM: Critical Path Method

Chapter Four
System Design

4.1 Database description.

4.1.1 Out put/ Input design

4.1.2 Database design.

4.2 Flow chart

4.3 Data dictionary

4.2 User Interface Design and validations

4.3 Navigation Charts

4.4 Normalized database table

This chapter discuss the design of the system in addition of database design and description, and the interface design.

4.1 Database Description

The system database will cover all the attributes that the system will need to work with. The database consists of three tables:

Activities .

Dependencies.

Users

4.1.1 Out put/ Input design:

shows screen for input design that give project manager permission to add activities and determine dependency between them, then the result(network, critical path) appear in the same screen as output.
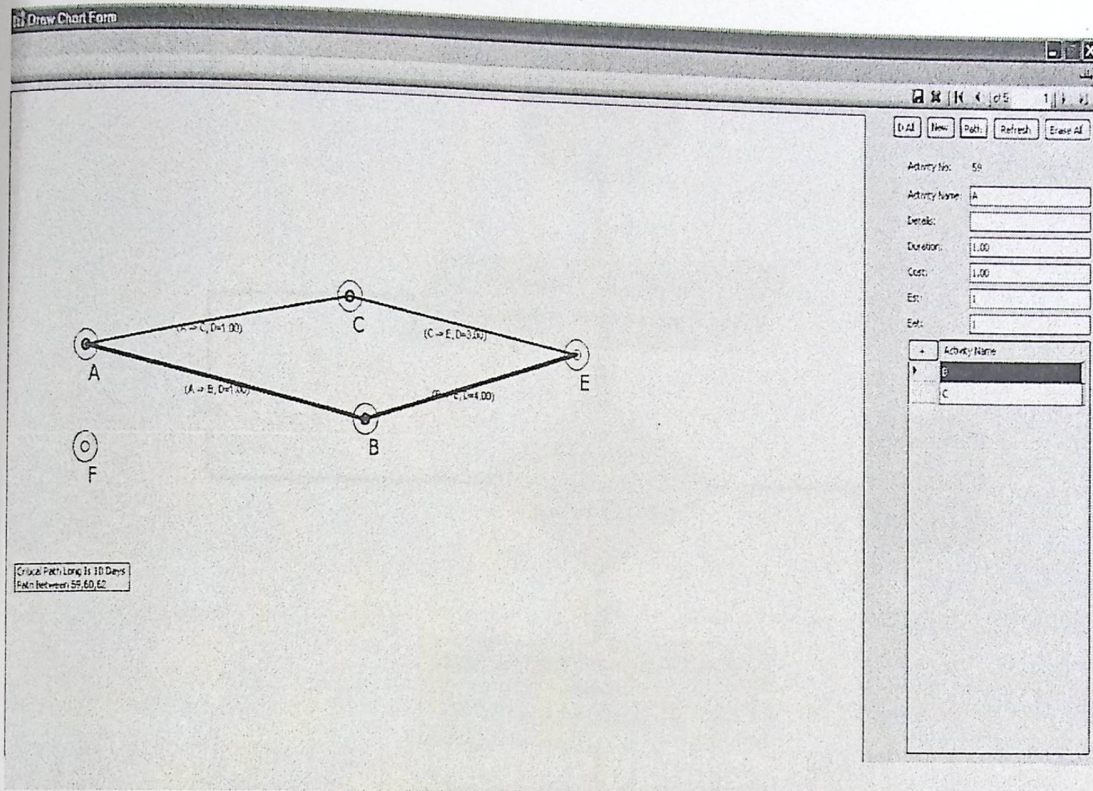

Figure 4.1 Out put/ Input design

4.1.2 Database design

shows the three tables of the system database and how they are related to each other .
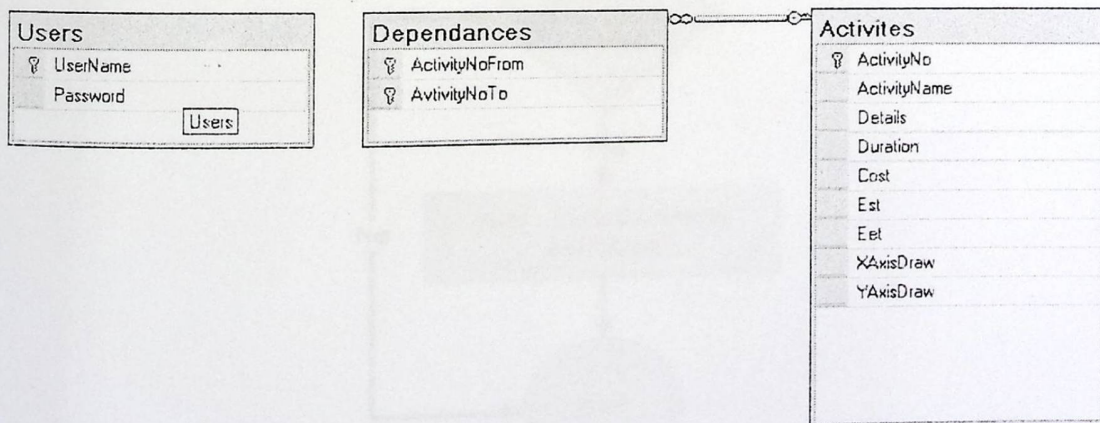

Figure 4.1 Database Design

4.2 Flowchart

Figure 4.3 shows login project manager with correct information and the permission of add activities and dependencies between them to draw network and determine critical path, and if there are any manipulation in the project.

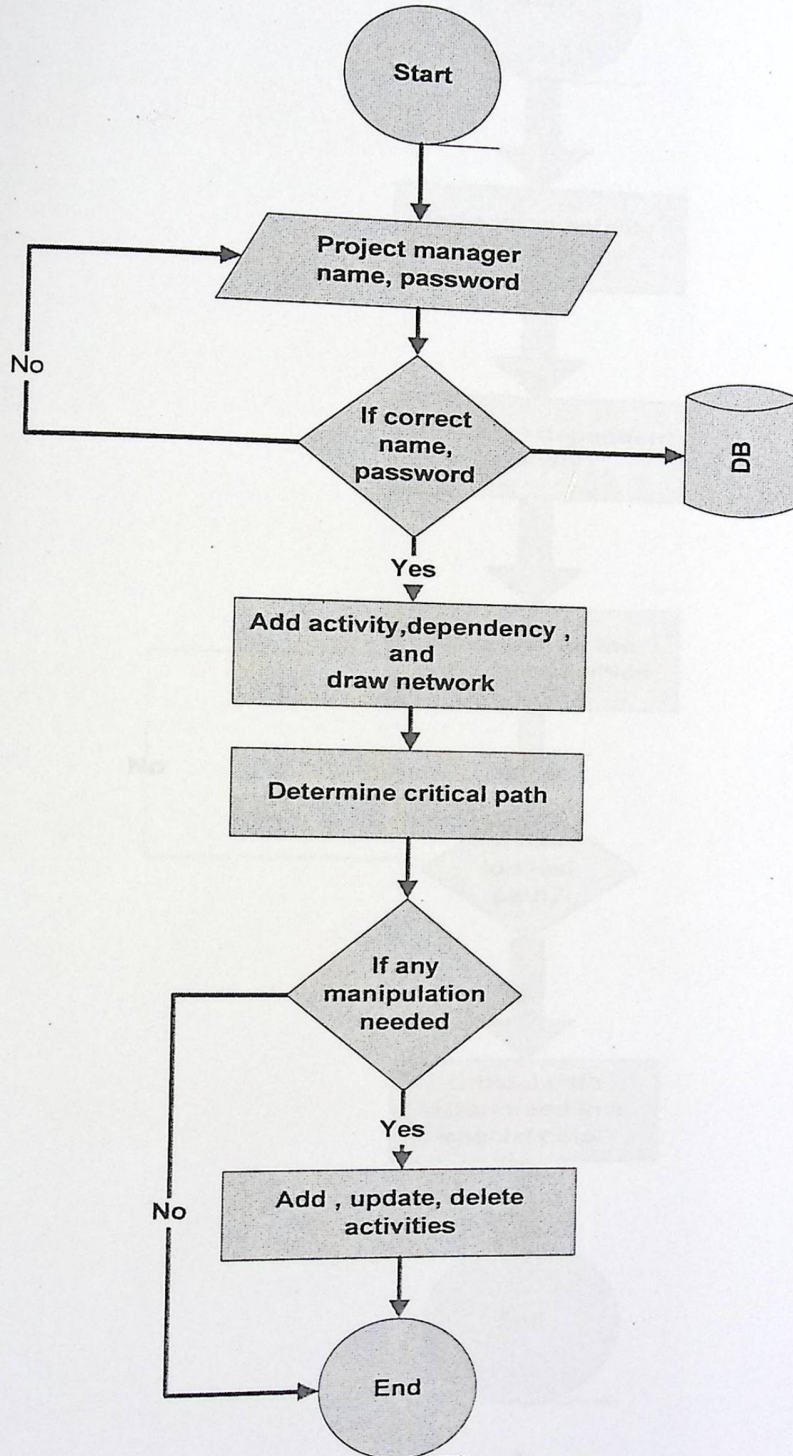

Figure 4.3 login manager and his permission in the project

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Figure 4.4 show flow chart for determine critical path, when insert correct manager name and password , can draw the network and determine critical path.
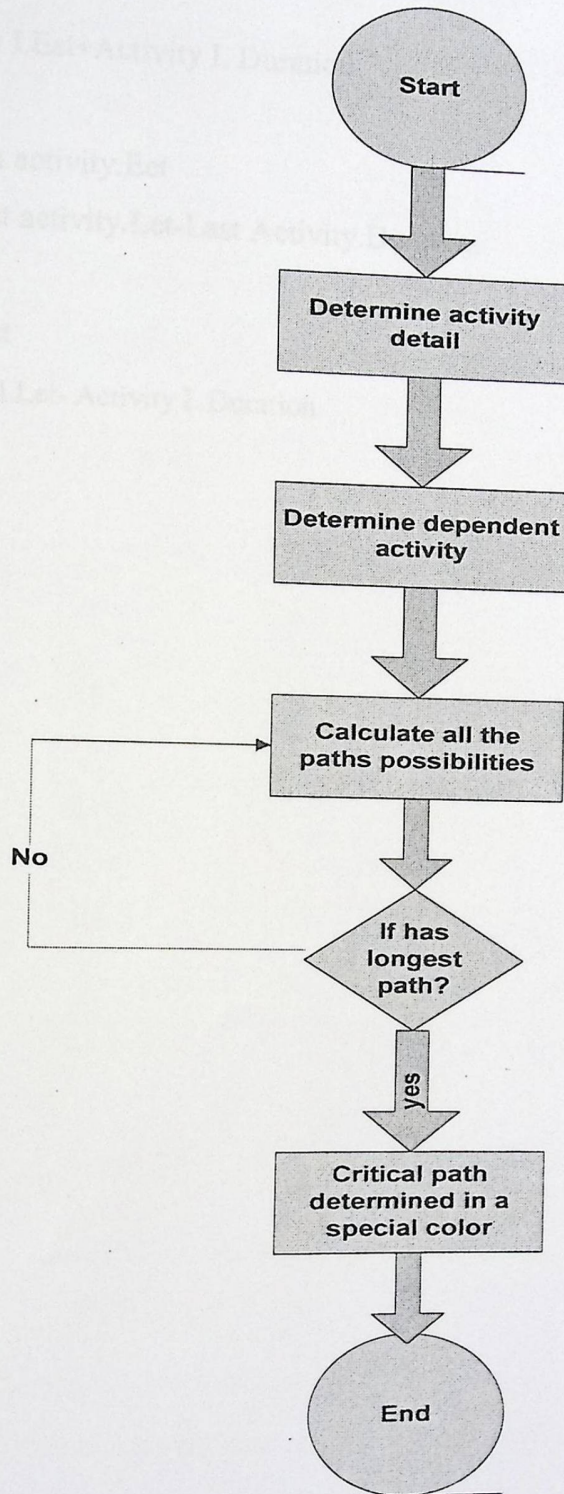
Figure 4.4 Critical path

Algorithm to calculate critical path:

Walk list head

Activity 1.Eet= Activity Est + Activity1.Duration

Activity I. Est=pre .Eet

Activity .Eet=Activity I.Est+Activity I. Duration

Walk list back

Last activity.Let= Last activity.Eet

Last activity . Lst=Last activity.Let-Last Activity.Duration

Activity I.Let=suc.Lst

Activity I . Let=suc.Lst

Activity I.Lst=Activity I.Let- Activity I .Duration

4.3 Database Dictionary

Table 4.1 Database Dictionary

Table name	Field name	Type	Length	Description	Required	Key
Activities	Activityno	Int	11	Activity number	Yes	PK
Activity	Activity name	nvarchar	50	Activity name	Yes	
Activity	Details	nvarchar	250	Details activity	Yes	
Activity	Duration	decimal	18,2	Duration for each activity	Yes	
Activity	Cost	decimal	18,2	Cost of each activity	Yes	
Activity	Est	Int		Earliest start time	Yes	
Activity	Eet	Int		Earliest end time	Yes	
Dependencies	activitynofrom	Int		Activity number from	Yes	PK,FK
Dependencies	ActivityNoTo	Int		Activity number to	Yes	PK
Users	username	nvarchar	15	User or admin name	Yes	PK
Users	Password	nvarchar	15	User or admin password	Yes	

4.4 User Interface Design and Validations:

This section shows and discuss sample user interface screens of the system (focusing on user input/output section).the two selected screen s presented here are:

Login screen(shows in figure 4.5).

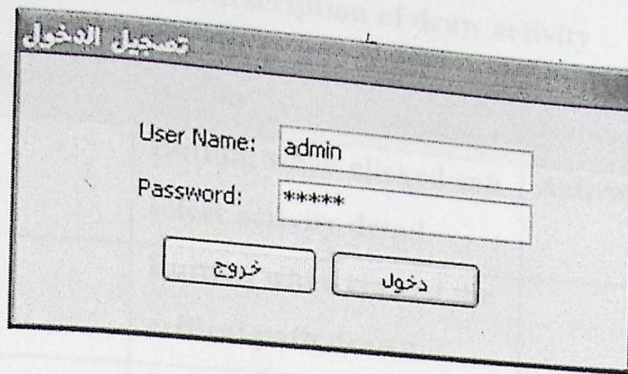Draw activity screen(shows in figure 4.6)

Figure 4.5 login screen

Table 4.2 description of login screen.

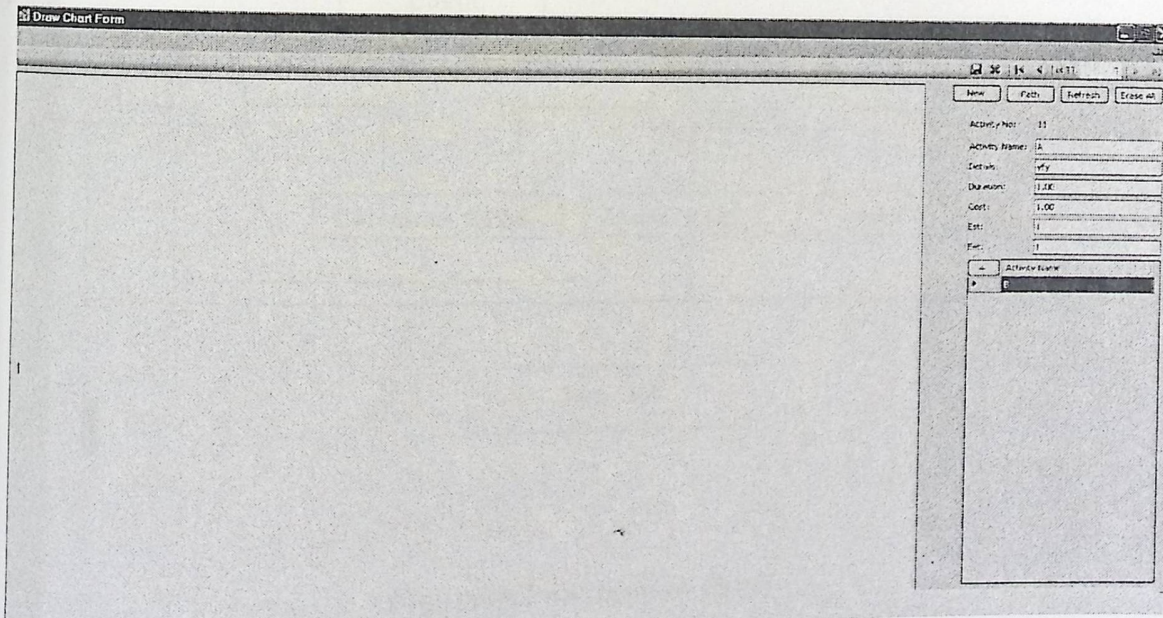| Field	Action	Database
User name	Text field to input username	
Password	Text field to input password	
login	Button when clicked, system authenticate the user and takes to main page	Activities
Logout	Button when clicked , logout from the program	

Figure 4.6 Draw activity

Table 4.3 description of draw activity

Field	Action	Database table
New	Button, when clicked can select activity detail	Activity
Path	Button, when clicked the critical path drawn	
Refresh	Button when clicked can return the last update	
Erase all	Button when clicked all activities clean	

4. 5 Navigation Chart:

show how to accesses the system from the beginning of project and how to traveling from the pages .
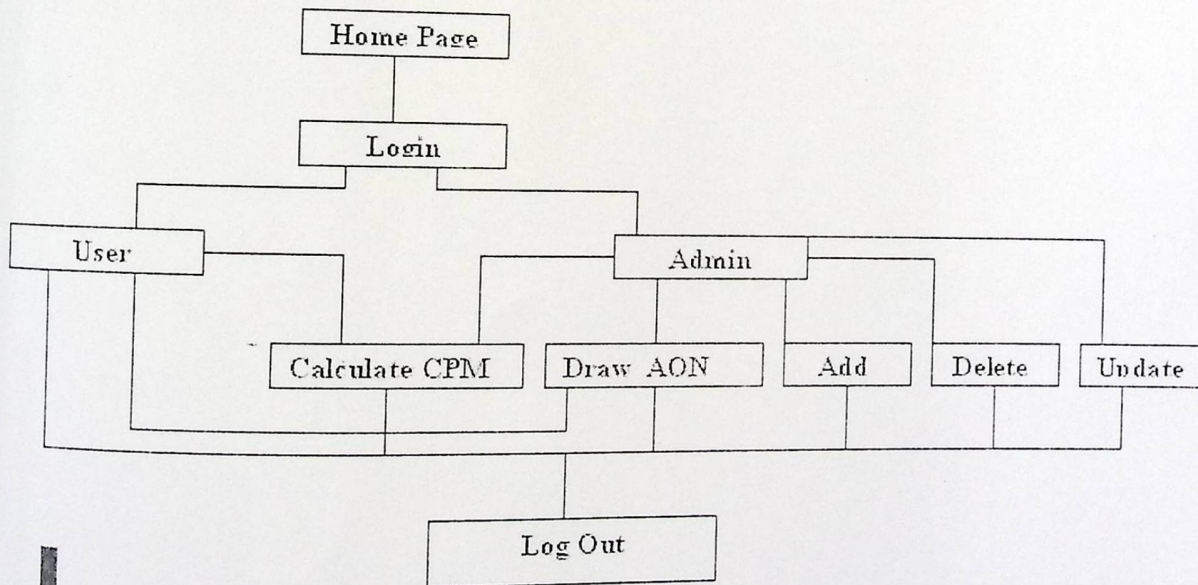
4.3 Navigation Chart:

Figure 4.7 navigation chart

Chapter five
Implementation

5.1 Introduction.

5.2 Esatblishment of development environment.

5.2.1 Hardware environment.

5.2.2 Software environment.

5.3 database implementation.

5.4 Coding.

5.5 Supporting Software

5.6 Operating the system

5.1 Introduction:

In this chapter will describe the coding and implementation processes , and the environment that use in the system.

The development of our system needs a set of software and hardware to meet the predefined requirement found in a platform configured to be suitable for the deployment process.

This system is windows application depend on a number of software needs t be installed to accomplish this system

These program are Microsoft visual studio 2008,Microsoft windows XP, also Microsoft Visio to design interface and flowchart.

This chapter describes these software and hardware used in the system for the operation phase and how they are installed and prepared for work the database and web interfacing and the interface implementation.

5.2 Establishment of development environment :

5.2.1 Hardware environment:

For the system development we use the following hardware:

1) PC Compaq 610:

. 2.87 GHz Speed.

.1.99 GB RAM.

.20GB H.D.D

2) one printer.

3) Flash memory 16GB.

5.2.2 Software environment:

For the system development we use the following software:

1) Microsoft windows XP professional

We use this operating system because our system is built on Microsoft visual studio .net 2008 programming and this language depends on this type of operating system.

2) Microsoft visual studio .net 2008

We use this technology to create web application ,making complete error handling and provide data access tool.

Why use Visual studio 2008?

- o We prefer to use it because of :

- o Ease of use.

- o Reduce development time.

- o Debugging support.

- o Provide suitable interface.

- o Compatibility with windows environment.

- o Compatibility with database.
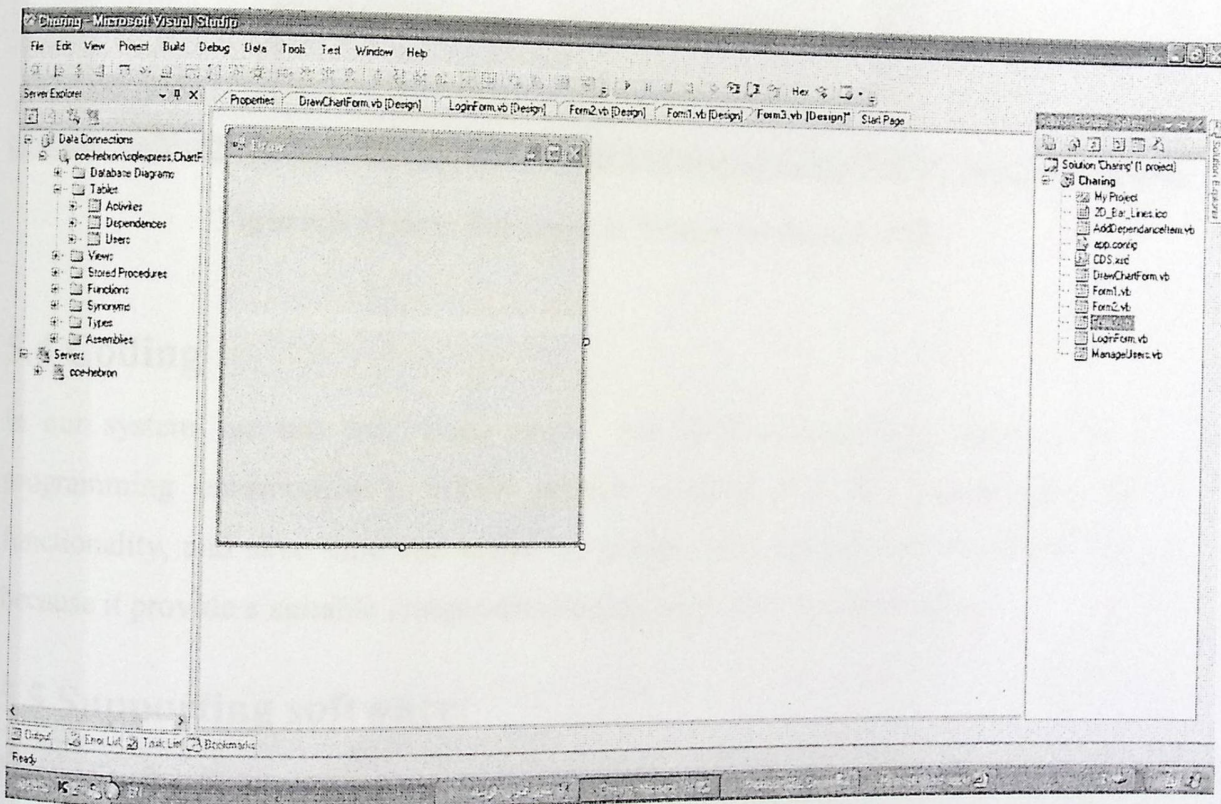
Figure(5-1): Visual studio.net 2008 new application

5.3 Data base implementation:

The database in our system is implemented using sql server 2000 enterprise manager with the following properties :

- o Microsoft SQL server management tool /database name : ChartProDB

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- Database is normalized to insure that the table and the relationship between them do not contain any database problem.
- Database creation :all tables have primary and foreign key to insure that the relations are correct.
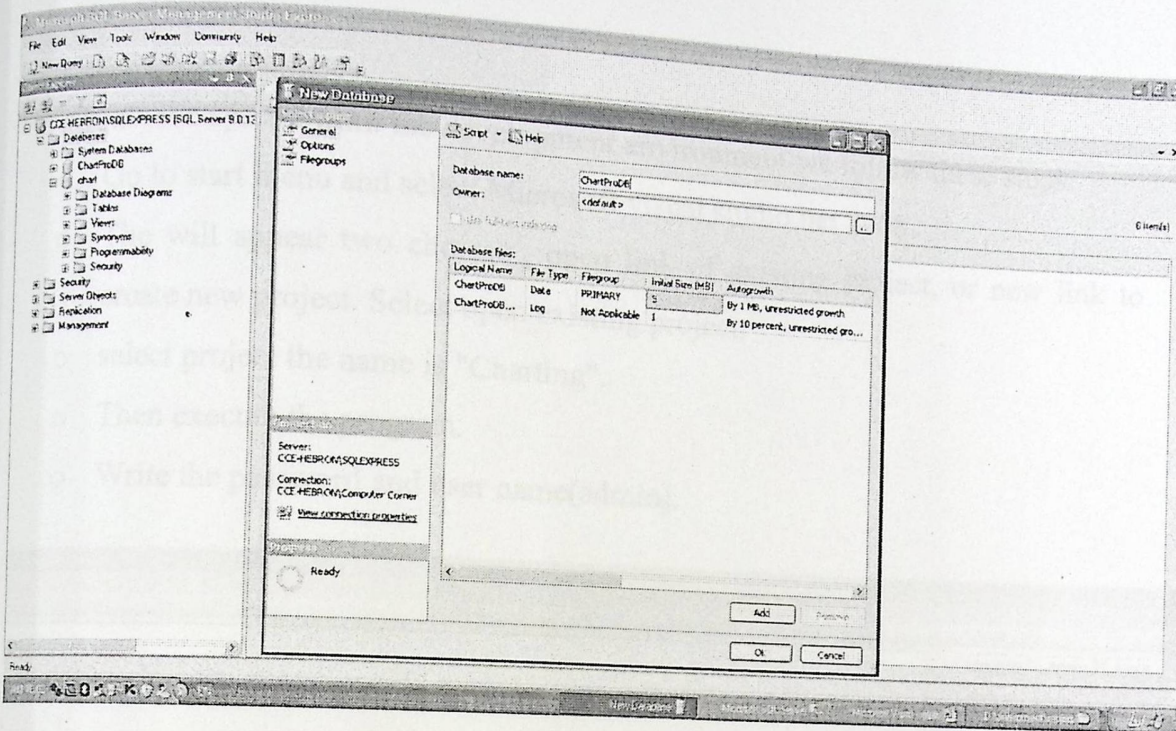
Figure(5-2):new database in Visual studio.net 2008

5.4 Coding :

In our system we use the visual studio .net 2008 programming language as a programming environment , which provide a good way for programming the functionality, and save time and effort for design the graphical user interface(GUI), because it provide a suitable component(button, label, text box, and table).

5.5 Supporting software:

Many of software programs are used to support the system:

1. Microsoft Visio that used to draw the flowchart, context diagram, data flow diagram.

2. Microsoft visual studio .net 2008 used to create forms and coding.

3. Microsoft SQL server Management studio express used for creating tables and database .

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5.6 Operating the system:

There are many steps should be taken before the system operate

- o Setting up the .net framework
- o Building the system database.
- o Create the database connection.

To execute the system from the development environment we follow these steps:

- o Go to start menu and select Microsoft visual studio.net 2008.
- o The will appear two choices , open link of existing project, or new link to create new project. Select open existing project.
- o select project the name is "Charting".
- o Then execute the program.
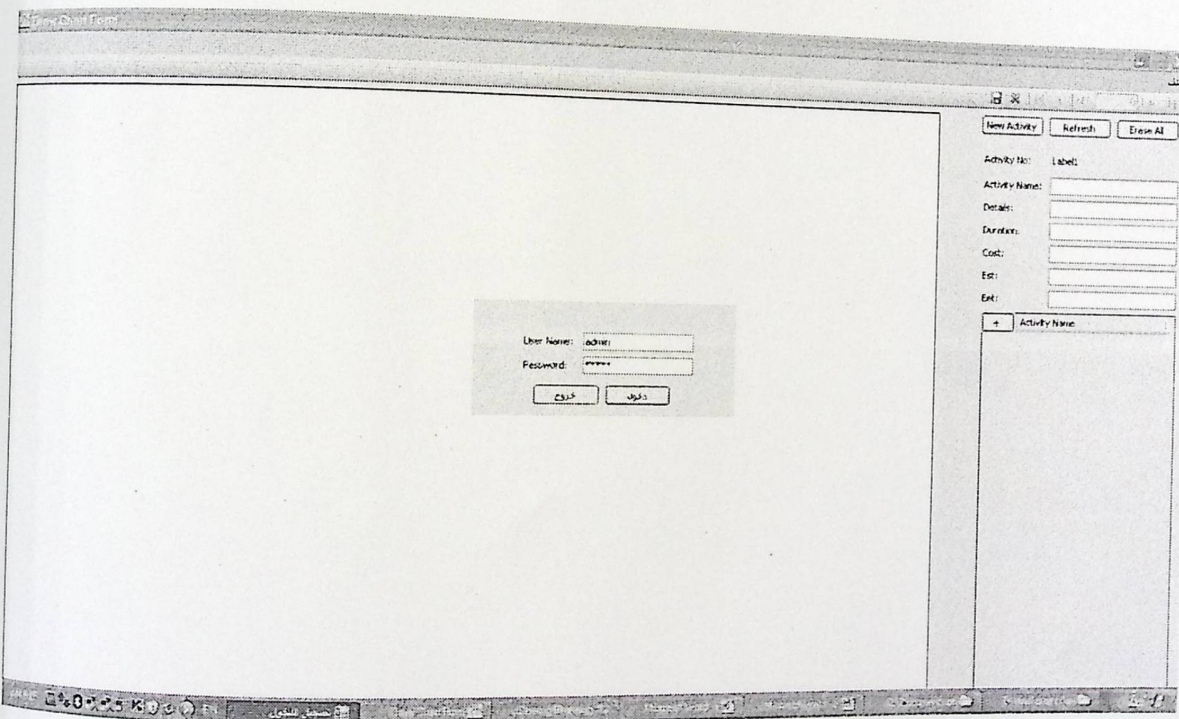- o Write the password and user name(admin).

Figure (5-3) execute system through name and password

Chapter Six
System testing

6.1 Unit and form testing

6.2 System Testing

6.3 Acceptance testing

After ending the stage of application and programming the system , it will put under testing to ensure it meet the design and functional requirement.

The importance of the testing is in the showing the dependence of units and forms in addition of the integration and acceptance testing.

In this chapter will go through the four stages of testing :

- **Unit and form testing.**
- **Integration testing**
- **System testing.**
- **Acceptance testing.**

6.1 Unit and form Testing

In this test will test every unit in the system units in apart of the other units to prove that it works in a correct way.
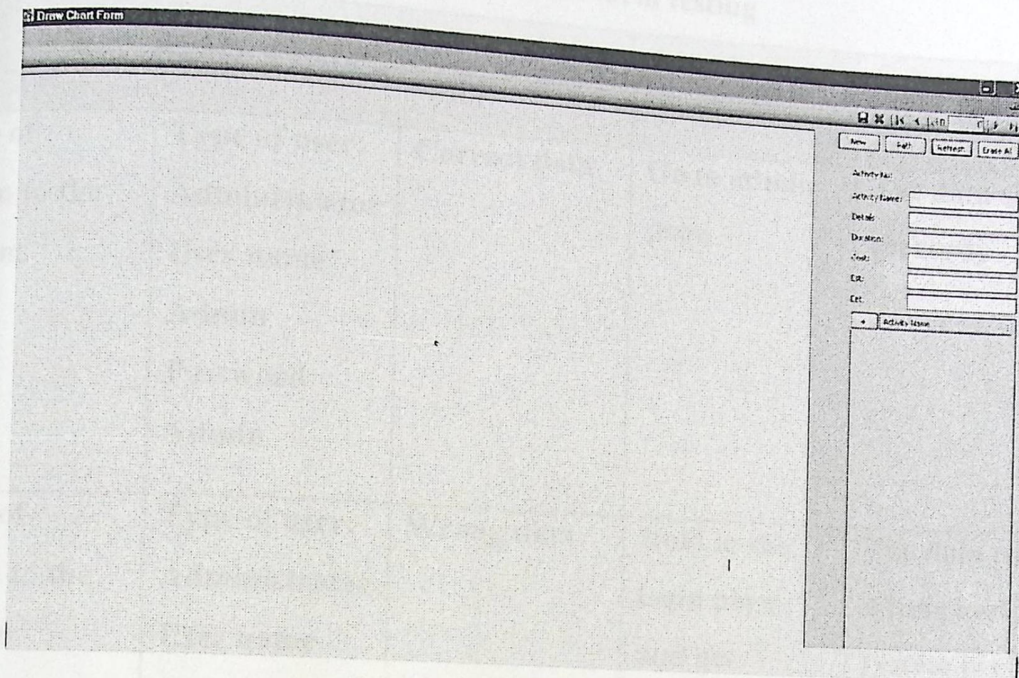

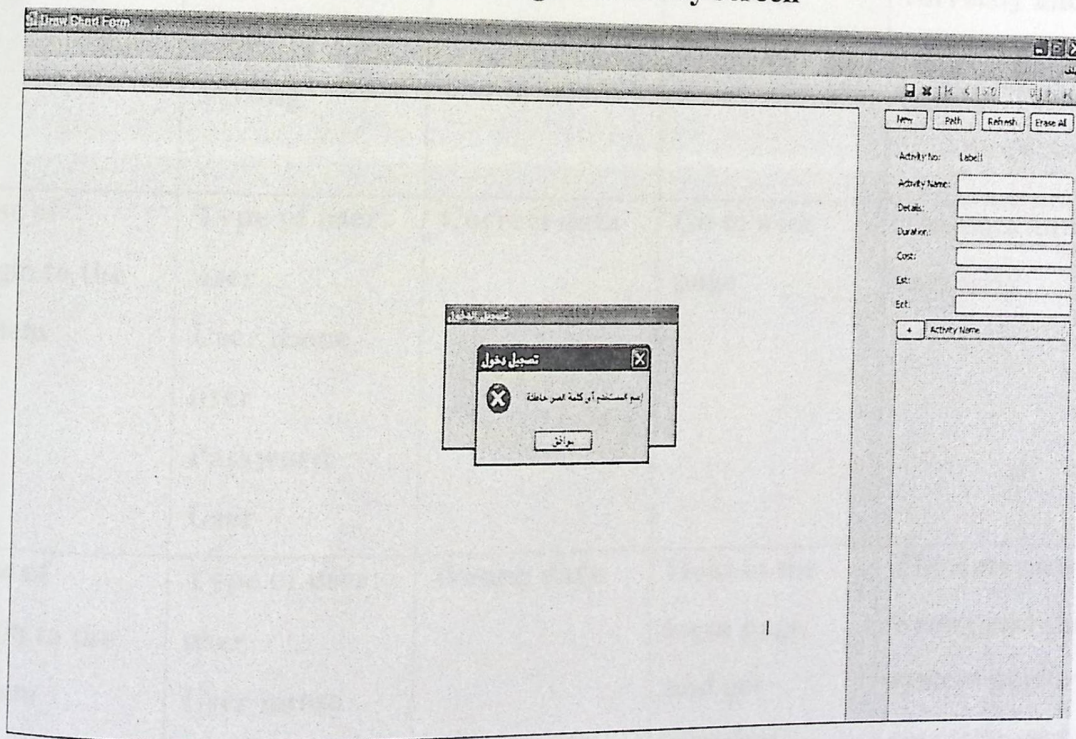**Figure 6.1:Login correctly screen**

Figure6.2: Login incorrect admin or user password screen

Example of the cases examine login

In the first case we test login correctly in figure 6.1

In the second case we test login in incorrect user or admin password in figure 6.2

Table6.1: unit and form testing

State	Input	Expected result	Actual Result	Comment
Case of Login to the system	Type of user: Administrator User name Admin Password Admin	Correct data	Go to admin page	The data entered correctly
Case of Login to the system	Type of user: Administrator User name Admin Password Wrong	Wrong data	Hold in the login page and get warning message	The data entered wrong and the system performed correctly and don't entered to any where
Case of Login to the system	Type of user: user User name user Password User	Correct data	Go to user page	The data entered correctly
Case of Login to the system	Type of user: user User name user Password Wrong	Wrong data	Hold in the login page and get warning message	The data entered wrong and the system performed correctly and don't entered to any where

6.2 Integration testing

In this testing stage the integration of the different part of the system will be show by testing the interaction of these part. For example of the parts tested for integration are:
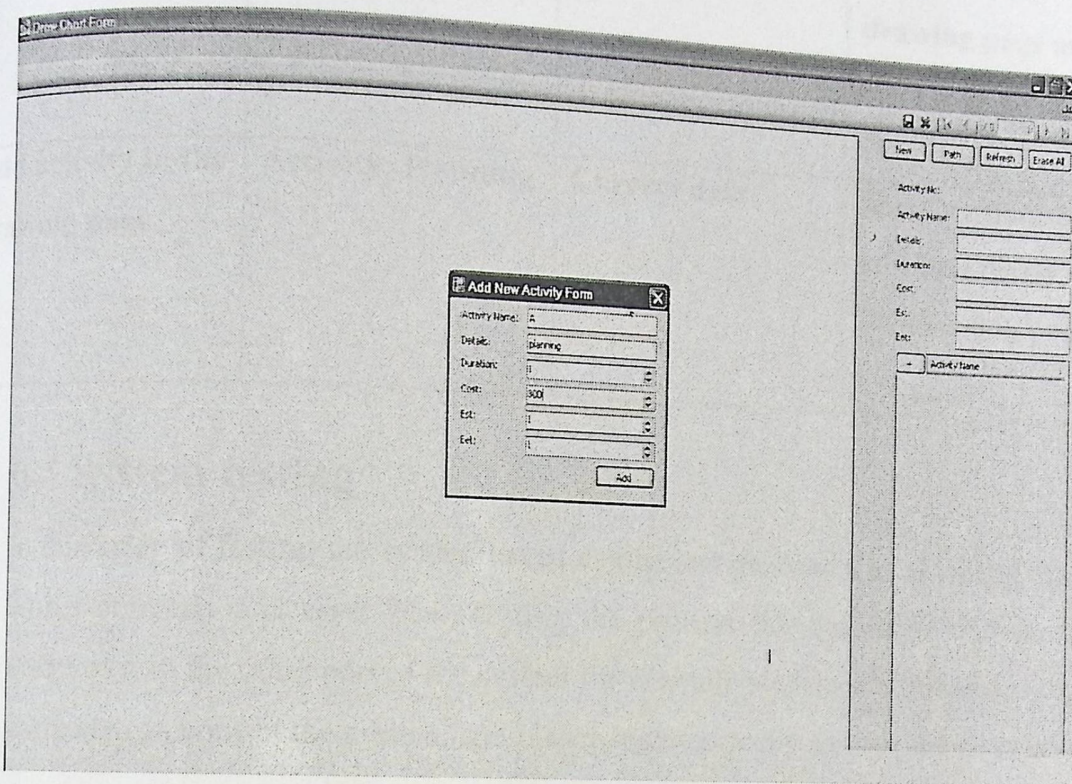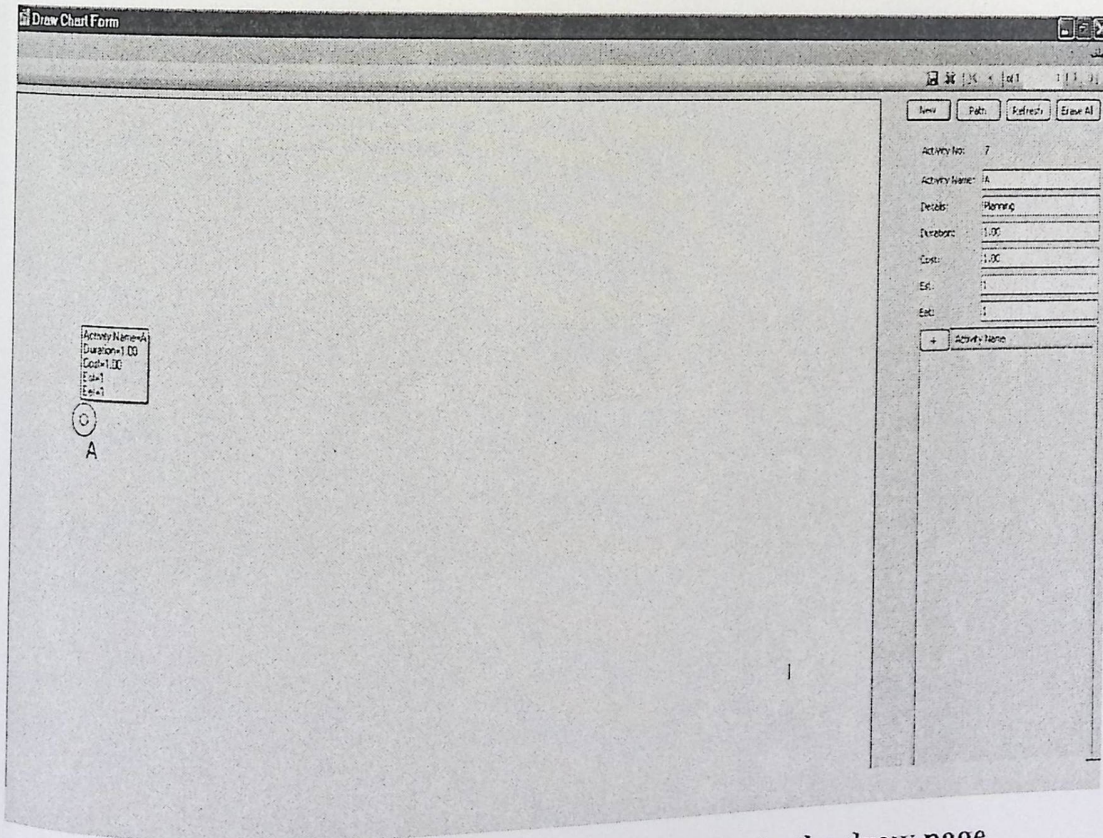

Figure 6.3 test adding a new activity

Figure 6.4 Showing that the adding activity in the draw page

Table 6.2 Integration testing

State	Input	Expected result	Actual result
Adding a new activity	Activity : Planning	Correct data	Adding the activity to the drawing page and store it in the database
Add activity in the drawing page	Activity: Planning	Correct data	Showing that the adding activity in the drawing page

6.3 System testing

in this stage of testing the system tested as one independent unit to ensure that it works correctly and error free. Testing the process the system do and see the effect of it in the other part of the system for example we tested if the admin login correctly can control the system, and if user login correctly can see the chart only.
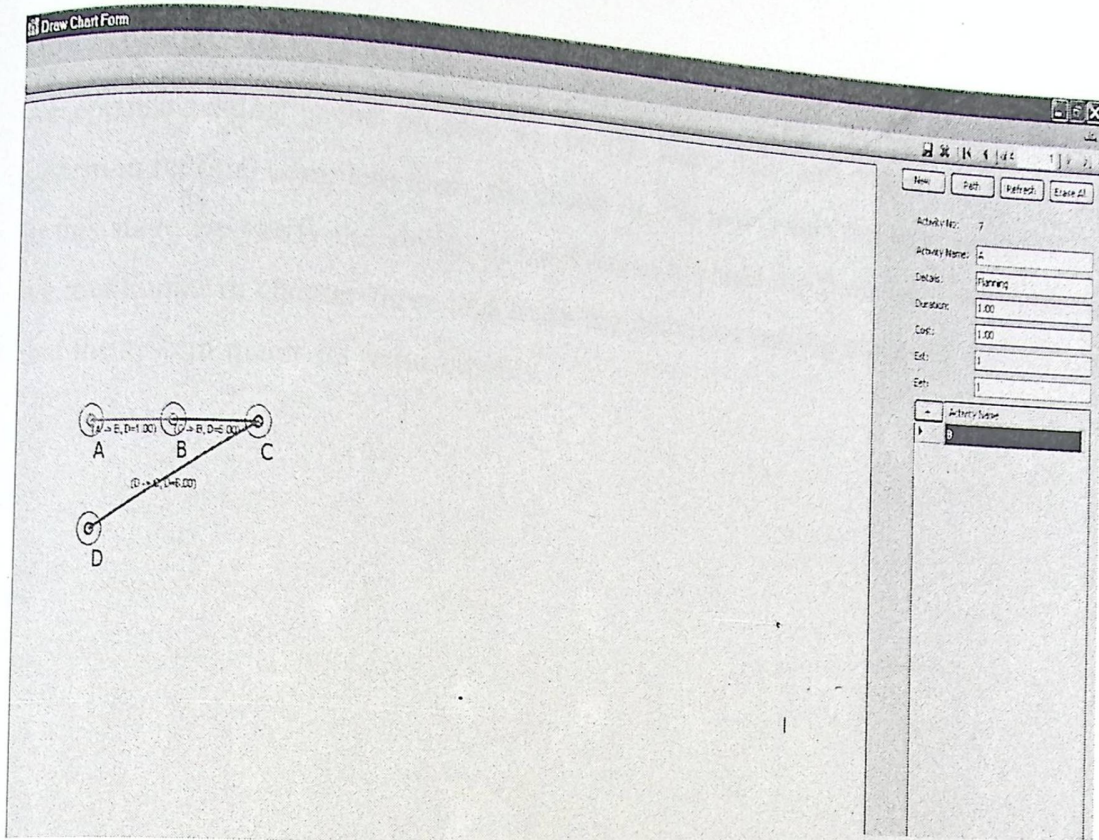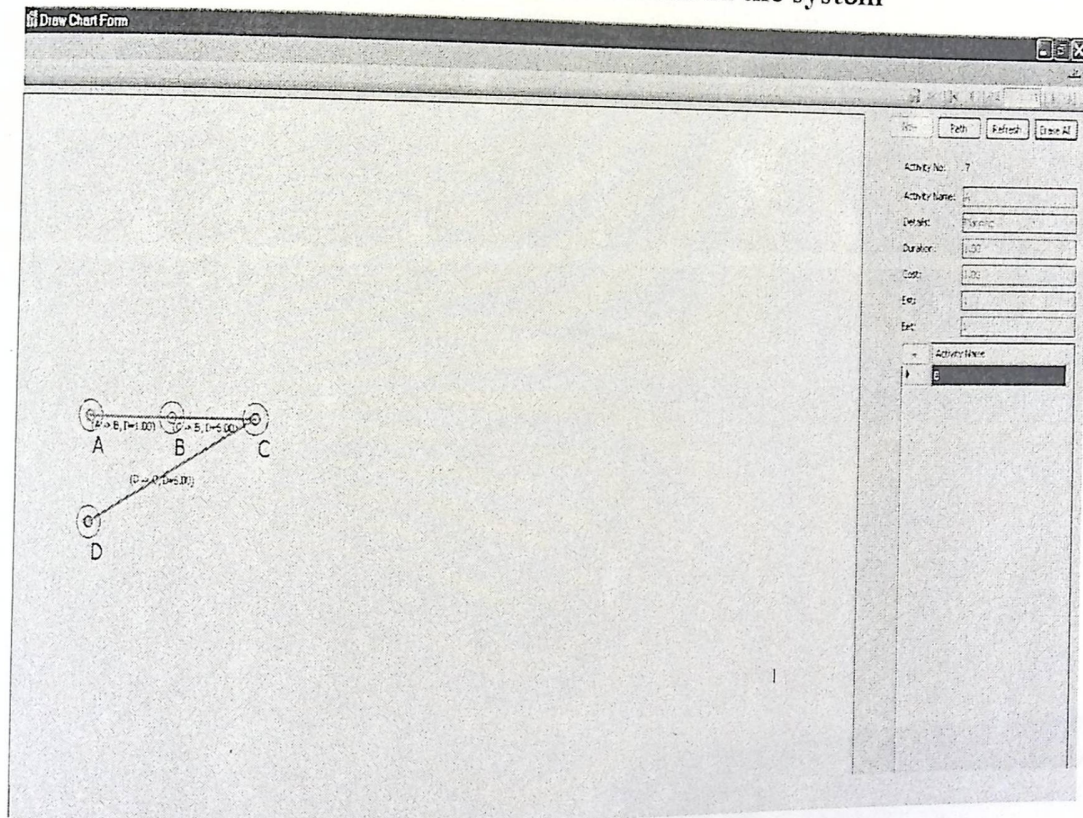
Figure 6.5 admin authorization in the system

Figure 6.6 user authorization in the system

6.4 Acceptance testing

Acceptance testing is the process where the users test and see the information system in its final complete form, the result of this test is that the user accept it. In this stage we verify the ability of the system to meet the functional requirement we mentioned in chapter three and from the previous testing stage we figured out that the system meets its requirements.

Chapter seven

System Maintenance

7.1 Backup

7.1.1 Automatic backup

7.2 System upgrading

7.3 MySql Maintenance

The maintenance stage is the final stage of the system life cycle ,in this stage the system will put under full maintenance and modification to meet the requirement of the system environment .

In this stage the system will be ready to work in real environment , there is many things to consider in order getting the system suitable to work in the environment and for preventing problems which can happen during the installation process .

In this chapter we will clarify the maintenance process and the propose plan to maintain the system .

Running the system in the real environment there is a possibility to system failure or errors incidence which must be avoiding it .

The user during the running the system haven't enough information in case of any error appears in the process , so we must put a plan to prevent errors . that's including:

7.1 backup

7.1.1 automatic backup

To backup scheduling database automatically , we can use "schedule task" on windows platform .

On windows :schedule task

- Start->Programs->Accessories->System Tools->schedule tasks.
- Right-click on an empty spot in the scheduled task window and select new ->scheduled task (also accessible via file ->new ->scheduled task)
- Name the new task
- Double-click the new task to open the properties window (or file->Properties)
- Under the task tab, enter the same command that you used to test the script above.
- Go to the schedule tab and enter when and how often the task should run . the schedule defaults to run once daily and should be fine for basic usage , but feel free tweak as needed .

- The rest of the fields can be left as-is ,unless you are an ace and know what you are doing.
- Click ok and we are done!

7.2 System Upgrading

In the process of using the system a new requirement will be appear so the upgrading is a necessity . in the upgrading stage we will clarify the new requirement and work to meet these requirement and work to meet these requirements .

7.3 MySql Maintenance

The database is the most important part in scheduling system because it consist of all system tables . in the other hand the security is an important part to provide the authorization and authentication to each user to access the database.

Chapter Eight
Conclusion and Recommendation

8.1 What has been achieved from project goals?

8.2 Direction for future work?

In a world full of technologies the necessity of using these technologies in daily life increase in a high rate, in order to develop the MS project , and in easier way the chart can change when the project manager update any activity dynamically.

8.1 What has been achieved from projects goals ?

1. In perfect way project manager can list all activities and detail of activities(Activity name, duration, cost, Est, Eet), that may face in the project .
2. Project manager can determine the dependencies between activities.
3. the system show activity on node(Network|), and determine critical path on the draw screen.
4. project manager in easier way can add, delete, update any activity.
5. the user can watch AON, CPM.

8.2 Direction for future work?

1. Search about the relationship between the length of time and the duration of the activity.
2. Show how the panel change dynamically depend on the number of activity will put.
3. Show how the cost affect on the project.

References:

1. Billows. D.(2007), "project management planning".

2. Brown .C and Dehayes .D and Hoffer .J and Perkins. W " Management information technology".

3. Demeulemeester .E ,Lambrechts. O, Herroelen .W. (2005)," Proactive and reactive strategies for resource –constraint project scheduling with uncertain resource availabilities ", Department of Decision Sciences and Information Management, Research Center for Operations Management Faculty of Economics and Applied Economics, Katholieke Universiteit Leuven (Belgium)

4. Elkyari .A and Guret. G and Jussien. N.(2003) study of " stable solutions for dynamic project scheduling problem".

5. Griffith. A. (2005)," scheduling practices and project success".

6. Shumsky.R. (2003) and Griffith. A. (2005), "note in project scheduling", University of Rochester.

7. Šeda .M. (2007) and Shumsky.R. (2003) and Griffith. A. (2005) " flexible heuristics for project scheduling with limited resources", PROCEEDINGS OF WORLD ACADEMY OF SCIENCE, ENGINEERING AND TECHNOLOGY VOLUME 24 OCTOBER 2007 ISSN 1307-688 PWASET VOLUME.

8. Moead and Mahmod .(2005), "management information technology"

9. www.amazon .com.

10. http://www.codeproject.com/KB/recipes/CriticalPathMethod.