Palestine Polytechnic University

College of Engineering and Technology
Electrical and Computer Engineering Department

Graduation Project

Facebook Multiplayer Game

Project Team

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Abstract

With the increase of internet usage, especially social networks that their effects have appeared in various aspects of life (social, political, etc.), and they were able to attract users all over the world. Also after their games had recorded a huge number of users. It was necessary to study these platforms and take Facebook as a case study. Also to study games development tools; to take one of them to create our game and connect it with Facebook.

In our project we studied Facebook development tools that help us in the process of game integration with Facebook. Also we studied games development tools and we compared them. Part of our project was to clarify how multiplayer games work, and we took the two-players games as a case study.

After finishing our project we were able to create an HTML5-multiplayer game, also we were able to connect it with Facebook, using the tools mentioned above.

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Chapter One "Introduction"

1.1. Overview

In this chapter we will introduce an introduction about our project which contains: general idea of the project, project objectives, project importance, related works, time schedule, estimated cost, and road map.

1.2. General idea of the Project

Our project is a multiplayer game, the project allow the users to enter the game to play with another users. Each user enters the system looking for player and send them request to play, and do chatting. This game then will be uploaded on Facebook; to enable Facebook users to play and chat with each other.

Each user will has scores; the other users of Facebook can see them. Our system is working on two main ideas; using modern game development tools, and using Faceboook platform to publish the game.

1.3. Project objectives

- To show how social network works and how to design a multiplayer game. All of that will be clear in the project documentation.
- To design and implement multiplayer game over social networks mainly (Facebook).
- To search and survey the concept how games work.
- To select a game design and implement it on Facebook.

1.4. Project importance

- To show how social networks work and how to design multiplayer game.
- A lot of multiplayer games lovers, visit games websites to connect them with other peoples to play with, they have to play with people they don't know anything about them

except their nicknames, and no relation connect them. This might lead to make the game less competitive and less entertaining.

- It uses a developed web programming language HTML5. Our project consider as real application using this new web language.

1.5. Related Works

In this section we will preview some applications examples that are related to the project main idea.

1.5.1. Tic Tac Toe

Tic Tac Toe is a multiplayer Facebook game which allows Facebook users to play with their friends and others, connected or not connected to Facebook. This application can show the users all their online friends, and other Facebook online users. But they can't choose one of these users unless they are of their friends, the game is like gambling. The users will not start playing if they don't agree on the coins that everyone should pay. In this game users can chat with each other.

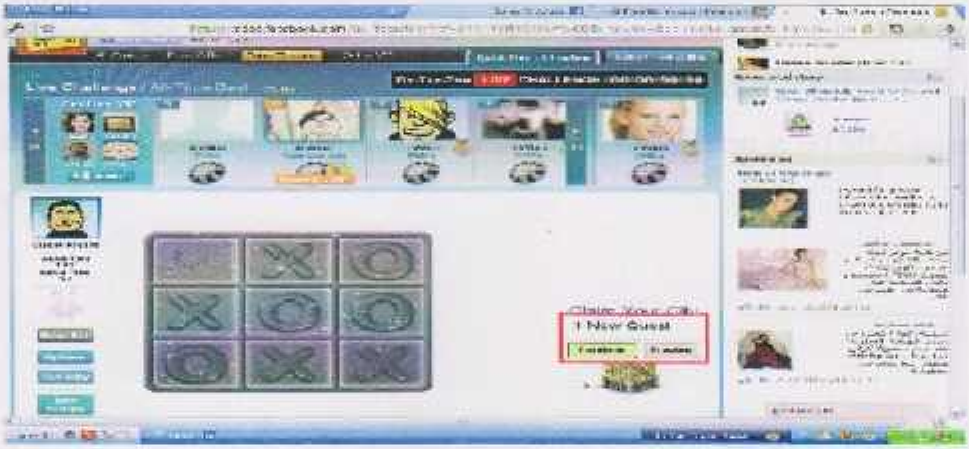


Figure 1.1 Tic Tac Toe game

1.5.2. Happy Farm

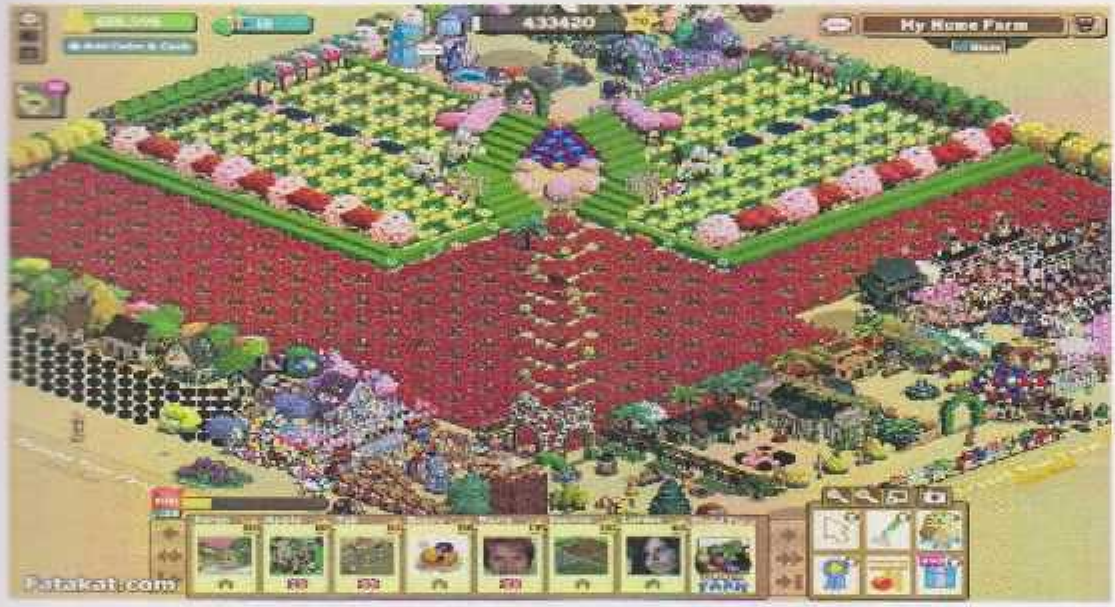


Figure 1.2 Happy Farm game

Happy Farm is a Facebook social game, designed by Zynga Company. It has 23 million daily active users. This game creates a virtual world for users, each user can enter the game, and he can build homes, implant, and so on. All of that to get coins and increase his level. Happy Farm uses huge databases to hold all users data .Happy Farm is HTML5 game with some Flash.

1.5.3. Eight Pool

Multiplayer game, enables the user to move the balls using the stick, the user can control the playing speed. User can search for online user and be ready to play using search online users or online friends. The game is programmed in Java script and runs entirely inside your browser. There are no large flash or Java applets to be installed first. The game is based on gambling. Each user has coins and by gambling he\she can increase or decrease them. Also the user can use his credit to play with real money.

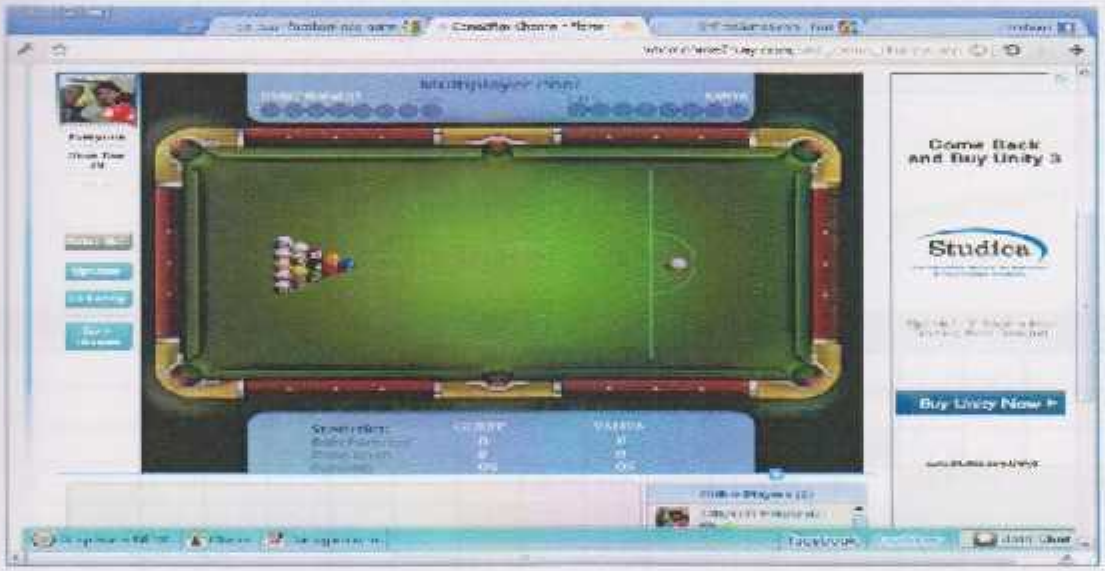


Figure 1.3 Eight pool game

1.6. Time Schedule

In this section we will preview system schedule for the developers. Taking in consideration the time given for delivery the system, and dependences between tasks.

Table 1.1 Tasks description (first semester)

Task ID	Task description
T1.1	Deciding the project idea.
T1.2	Collecting information, literature review and related theory.
T1.3	System analyses and software engineering.
T1.4	System design.
T1.5	Writing documentation.
T1.6	Presentation.

Table 1.2 Time plan (first semester)

Task/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
T1.1	▨	▨	▨														
T1.2				▨	▨	▨	▨										
T1.3								▨	▨	▨	▨	▨					
T1.4													▨	▨	▨	▨	▨
T1.5						▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		
T1.6																	▨

Table 1.3 Tasks description (second semester)

Task ID	Task description
T2.1	Project component implementation.
T2.2	Project component testing.
T2.3	Integrity testing.
T2.4	System review and feedback.
T2.5	Requirements refinements.
T2.6	Writing documentation.

Table 1.4 Time plan (second semester)

Task/Week	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
T1.4	▨	▨	▨												
T2.1	▨	▨	▨	▨	▨										
T2.2		▨	▨	▨	▨										
T2.3											▨	▨	▨	▨	
T2.4					▨	▨	▨	▨							
T2.5	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	
T2.6					▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	

1.7. Estimated cost

In this section we will preview the system cost estimation in term of system Hardware, system Software, and other resources.

1.7.1 Software resources

The following table contains the software that will be used in our system and their costs.

1.7.1.1 Development Software Cost

Table 1.5 Software resources cost.

Software component	Cost
Microsoft Windows XP	Available
Adobe Dream Weaver CS5.5	Available
Microsoft office 2007	Available
Server Domain	$80
Total	$80

1.7.1.2 Operational Software Cost

No additional software is needed to operate the system.

1.7.2 Hardware Resources

The following tables contain the main requirements for our system and their costs.

1.7.2.1 Development Hardware Cost

Table 1.6 Hardware resources cost

Hardware Component	Cost
1 PC with CPU 2.6 GHz, 40GB HDD, 512k RAM, monitor, keyboard and mouse	$700
Printing Cost	$100
Total	**$800**

1.7.2.2 Operating Hardware Cost

Table 1.7 Operating Hardware cost

Hardware Component	Operational Cost
1 PC with CPU 2.6 GHz, 40GB HDD, 512k RAM, monitor, keyboard and mouse	$150
Total	**$150**

1.7.3 Other Resources

The following table contains other resources will used in our project and their costs.

Table 1.8 Other resources cost

Resources	**Cost**
Transportation	$100
Internet	$300
Total	**$400**

1.7.4 Total Cost

Table 1.9 Total development cost

Resources	Cost
Software resources	$80
Hardware resources	$800
Other resources	$400
Total	$1280

1.8. Road Map

The project consists of seven chapters, each chapter talks about a specific area of the project.

Chapter one: "Introduction", this chapter gives an introduction about the project problem statements, project objectives, project importance, and project time plan and cost.

Chapter two: "Theoretical background", this chapter talks about Facebook development tools that are project needs, and a survey contain the game development tools, a comparison between them, and which one we are going to use.

Chapter three: "Project analysis", this chapter shows the project requirements, project block diagram, requirements analysis, analysing model design options that is used in project design.

Chapter four: "Project design", this chapter shows the architectural design, game design and sequence diagram.

Chapter five: "Project implementation and testing", this chapter shows the project codes and implementation steps to reach our final goal, and testing under various conditions.

Chapter six : "Conclusion and future work", this chapter shows conclusions and results achieved after implementing the entire project and gives suggestions for future system developing.

2

Chapter Two
"Theoretical Background"

2.1. Introduction

Several years ago, Facebook merely used for exchanging news, photos and videos with family and friends every day. And it was used as a marketing platform; people used it for marketing their products through Facebook advertisement, until Kevin Partner suggested establishing promotional games on Facebook. And now with about 800 million users on Facebook, it became more interesting to create a game and share it with these huge users of network. [14]

In this chapter are trying to survey the most used game development tools, and the basic tools that Facebook platform provides to the developers to create a powerful social game. We had a problem in gathering Facebook tools; because most of books that talk about it are old and Facebook every week has new features. So we decided to collect these tools from the Facebook official website to ensure that these tools are modern and can really be used to develop a social game.

2.2. Development Tool Definition

Is simply the set of libraries ,features and all the software used to create, debug, maintain and support certain application or program .[12]

2.3. Facebook Development Tools

Facebook provides a lot of development tools to create, manage and debug your application.

2.3.1 Creating and Managing Your Application Tools

2.3.1.1 Developer Application

This tool allows you to create and manage a Facebook application. It gives a list of the applications you can create.

- Websites: allow you to use Facebook in your website, to make it more social. A lot of websites such as yahoo and hotmail messenger have used this application. Facebook gives the website maker all the possible help to use its objects, characteristics and the social base that Facebook has.

- Applications on Facebook: allow you to build an application on Facebook, such as pages and games. This lets you use the Facebook social experiences, and its native functionality such as requests and book marks. This allows you to make your own space for your users.

- Mobile applications: by using this tool you can make your mobile web applications more social.

2.3.1.2 Insights

Provides analytics on your Facebook page, APP, website, to see how the users interacting with your content. The application developer uses this tool to improve their businesses and create better experiences on Facebook.

2.3.2 Debugging

The tools to accomplish this task are:

2.3.2.1 Access Token Tool

Access token: sequence of chars the application get it when the user allow it to reach his information (when the application is authorized), this token is secret and unique for each user. This enables the developer to interact with graph API on behalf of Facebook users.

By this tool the developer can put the URL of his page and get the helpful information about his markups from Facebook. And put the access tokens of his application to know when it expires and the user of that token.

2.3.2.2 Chang Log

Facebook make sure to inform the developers about all developments, enhancements and changes to improve their applications. Facebook "push" new code to the production center every week by this tool help the developers to test their application and change it prior to that code.

2.3.2.3 Debugger

Help the developer to debug his open graph protocol page. Open graph protocol enables the integration between the web page and the social graph. If the developer has a problem with any of social plugging (e.g. like button) he can use the debugger, to determine the problem, and this tool will give a full report about the problems.

2.3.2.4 Test User API's

Test user: its user account associated with an application, created for purpose of testing the functionality of that application (not real account), it can be used for manual or automated testing the developer can create up to 500 test users. Test users are exempt from Facebook spam of fake account selection system to insure that you can test your application without warring about getting disabled.

2.3.3 Graph API Explorer Tool

Graph API: it's the core of Facebook platform, presents the social graph (people and the connections they have to everything they care about) in a simple way. Uniformly representing objects in the graph (e.g.: people, photos, events and pages) and the connections between them (e.g.: friend relationship shared contents, and photo tags). Every object in the graph has a unique ID, but the developer can deal with objects names instead of their IDs.

And this tool gives the easiest way to learn how to deal with the graph API and how to create connections between Facebook application objects. [1]

2.3.4 Application Security Tool

Facebook provides tools, features and modes to make the application more secure.

2.3.4.1 Sandbox Mode

When the developer tests the application, he places it into Sandbox Mode. This hides the application entirely from all users who are authorized to see the application. When the application is in Sandbox Mode the developer can't call any API on behalf users who can't se the application.

2.3.4.2 Application Roles

The developer can add a user to the application with one of four different roles: Administrator, Developer, Tester or Insights user. Each role provides a different set of permissions to the user. This provides greater security for the application and opens it up to less harm in the situation that the user's account is compromised.

- **Administrator**

Administrators have complete access to the application. They can change all application settings, reset the application secret, delete the application, and view credits in insights. Administrators can also add or remove other users to the application and change their permissions. All developers currently added to applications have these permissions so they will get the Administrator permissions. Administrators of applications should only add other users as administrators if they are fully trusted and must have full control of the application.

- **Developer**

Developers have access to the application and all its technical settings that are needed to run, edit and test the application. Developers can modify all technical settings for the application. They can also see insights for the application. Unlike Administrators however, they cannot:

- Reset app secret key
- Delete an application
- Add or remove other users as developers, testers or administrators

- **Tester**

Testers can only test the application in sandbox mode. They cannot edit any app settings, give other users access to the application or access insights. The tester role is the most harmless and hence should be used for all users who need to test the application in sandbox mode. In live mode all users will have test access to the application. Note that a user does not have to be verified to be added as a tester to an application.

- **Insights User**

Users with insights user role can only access insights for that application. They cannot access the application in sandbox mode and do not have access to any developer settings.

2.3.4.3 Application settings security

Sometimes the application could be taken over by an imposter who comes in and changes the application settings. This problem can be handled adding sitting security.

- **White list of IP addresses for updating settings**

Facebook allow the developer to specify a white list of IP addresses. This helps from attacks by insuring that only the developers using the company IP addresses can update the settings. The developer can specify a comma separated list of IP addresses or a range of IP addresses: 1.2.3.4, 1.2.3.5-67. Once this list is specified, any application update request coming from a non-whit list IP address is rejected.

- **Update Notification**

In the event that such a takeover does take place, Facebook have built a notification system to expedite discovery and recovery from such takeovers. This notifies relevant individuals when any application settings are changed using the Developer application UI or the associated API method. The notification contains information about what change was made and by whom. The app can register an email address to which these notifications should be sent in the advanced tab of app settings.

- **Server white-list**

Facebook enables the developer to restrict the API calls to come from a set of white-listed servers. [1]

2.4 Game Development Tools

It's a software application that helps and facilitates making computer game and handle some task like the conversion of assets (such as 3D model) into format require by a game, level editing and script compilation. Our project is create a game on Facebook (Multiplayer game), and there are a lot of game development tool, we made a search about them and found the most common game development tools.

- Adobe flash.
- Html5.
- Unity development tool.
- Classical tools: java, c++, and so on.

2.4.1 Adobe Flash

It is a platform used to build, distribute, monetize and play some of the best game on the web. It's also used in mobile phone and other devices, and contains two runtime:

- Adobe flash player.
- Adobe AIR.

2.4.1.1 Adobe flash player

It is software or platform used for viewing animation and video using computer program such as a web browser. You can build your game once and look the same whether your user using internet explorer, Firefox and any other browser. Flash player in the content has been compiled into SWF to create game as SWF.

Flash player is licensed free charge and the download size is relatively small, no additional cost involved for end users to start playing game.. There are many feature build in flash player like:

- Stage 3D accelerated graphics.
- Native 64 bit support.
- H.264/Avc software encoding for camera, and other features.

2.4.1.2 Adobe AIR

It is similar to flash player in term of cost, licensed free of charge and need for SWF, But the difference between them that the flash player enable you to view SWF content in the browser but Adobe Air let you run the content outside the browser .

2.4.1.3 SWF (Shock Wave Flash)

It is format to deliver vector graphics, text, video and sound over the internet and it is supported by adobe player and AIR. It is designed to be an efficient binary delivery format not a format for exchanging graphics between graphics editor.

Two development tool for creating SWF base on game:

- Adobe flash CS 5.5 professional.
- Adobe flash builder 4.5.

- **Adobe Flash CS 5.5**

It is environment for creating content that played back in flash player. With flash CS 5.5 professional no programming is needed to create rich graphics and animation you can use an extensive set of drawing and shape tool and effect to create amazing vector graphics.

- **Adobe Flash Builder 4.5**

It's a developer-depend on Integrated Development Environment (IDE). The difference between it and flash CS5.5, the flash CS5.5 is attractive for graphics designers but flash builder 4.5 it is attractive for coder.[11]

2.4.2 HTML5

Flash player have been occupied the web game world for the last years; because flash have all the tools to create an attractive a powerful games with video and audio features that it has. But flash games need a plugging and installations to work properly on your browser, also flash not supported everywhere (like Iphone, Ipad).

In 2006 the World Wide Web Consortium (W3C) and the web hypertext application technology working group (WHATWG) cooperated to produce a new language to support games and they produced HTML5. [8]

2.4.2.1 HTML5 Definition

Stands for (Hyper Text Markup Language 5) it's the new generation of HTML, it contains a completely new tags plus Classical Style Sheet (CSS3) and highly optimized browser JavaScript engines. [8]

2.4.2.2 HTML5 Features

- Opens source and completely free.
- Contains canvas element for drawing.
- Canvas is 2D drawing surface. low level pixel manipulation or high level function to grow paths ,images, circles ,etc. and it need to be hardware accelerated
- Video and audio elements for multimedia playback .audio for background music, volume control, etc, before, flash was use to add audio to the game, but now this element is used for this task.
- Reduces the need for external plugging (like flash).
- Local SQL database.
- Even though html5 is not yet an official standard and no browsers have a full html5 support; but all major browsers (safari, Firefox, opera, chrome, IE9) continue to add new html5 features to their latest versions.
- 2D/3D graphics: html5 support 2D/3D games using JavaScript engines.

- JavaScript engines help in : asset management ,animation ,physics and keyboard /mouse input.[8]

2.4.2.3 HTML5 JavaScript Engines

Html5 literally has thousands of libraries to help you construct the game you want to develop. Here we just will talk about some of these frameworks:

1) **Impact js:** it's a java script game engine that allows you to develop html5 games in no time. This engine is highly recommended because it's the fastest of its generation.

2) **Lime js:** it's an html5 game frame work for building fast, native experiences for all modern touch screens desktop browsers. [4]

3) **Akihabara HTML5/js game frame work:** it's a set of libraries, tools to create games runs in your browser without any flash plugging .It's used for fast game developing. This engine is supported on Google chrome, Safari, Firefox, Opera and IE9. [5]

4) **Rocket engine:** built by and for professional game developer. No plugging required. It works in every major browser, no canvas tag support, works in every major browser .It can help in creating a Facebook games. [7]

5) **Game Query:** JavaScript game engine for query. It helps to make JavaScript game development easier by adding some simple game-related classes. It is still in its early stage of development. [3]

6) **Effect games:** provides free online tolls for building, sharing and playing your browser based games. Effect engine supports Mac OSX, windows, Linux, and all modern browsers including IE, Firefox, Chrome, Safari and Opera. [6]

2.4.2.4 HTML5 Drawbacks

- Older browser doesn't support it. So when you use html5 you need to ensure that you have a modern one (Chrome, Safari, Firefox, etc).

- Canvas element have some problems in browsers supporting .even in modern browsers, it needs hardware acceleration.

2.4.3 Unity Development Tool

Multiplatform game development tool, used to develop games for Windows, Macintosh, Wii, PS3, Xbox360, Web, Iphone, Ipad, Android. It has a lot of features that make it a powerful game development tool. It gives a full control over the game components; every simple detail can be controlled and seen by the game developer. It provides a new image effects, sound filters, all movement simulations to make the reality simulation perfect in games and designs. It supports animations, 2D/3D graphics and powerful audio manager.

Unity has a local database, but it needs a special plugging to work on the web. It enables the developer to program the servers and clients sides for full web applications. [2]

2.4.4 Classical Tools

Classical development tools refers to c, c++, c#, java, etc. these tools can be used to develop games. C and c++ uses Allegro 4/5 as main libraries in developing games and multimedia programming. Allegro 5 supports Unix/Linux, Windows (MSVC, Min GW), Mac OSX, Iphone, but only support 2D graphics. Allegro 4/5 handle common, low level tasks such as creating windows, accepting user input, loading data , drawing images, playing sound.[9]

C# uses Silverlight graphics to develop games which is a powerful tool for creating pc and web games, but it needs a special plugging to work on the web. [10]

Java uses Light Weight Java Game Library (LWJGL) to create games, this library provides developers access to high performance cross platform libraries such as Open GL(open graphics library), Open CL (open computing language) and Open AL (open audio library), allowing for 3D games.[13]

2.5 Game Development Tools Comparison

Table 2.1 Game tools comparison

	HTML5	Flash	Unity	Classical
Web support	Supported only by the modern browsers(Chrome, Safari, Firefox, IE9).	Supported by all browsers.	Supported by all browsers.	Supported by all browsers.
Web special plugins	No plugins	Need plugins	Need plugins	Need plugins
Database	Local database	No local database	Local database	No local database
3D Games	Support	Support	support	c/c++ do not support
Iphone, iPod games support	Support	Do not support	support	Support

3

Chapter Three
"System Analysis"

3.1 Requirement

3.1.1 User Requirement

- The system must have a graphical user interface (GUI), to show the user how to use the system.
- The user can play with his friends or other Facebook users.
- The user must be informed about his online friends.
- The user needs to send invitation to his/her friends.
- The user must choose one of his/her friends to play with him.
- The GUI must show the user his/her scores and how many times did he/she played and win.
- The user may chat other Facebook users.
- User controls the game by mouse.

3.1.2 System Requirement

3.1.2.1 Functional Requirement

- When the user uses the system to reach her/his public information then the user information will be recorded in the system database.
- The system must keep track of all changeable objects in the game it means whenever any user change an object from the game this change must be saved.

3.1.2.2 Non-Functional Requirement

- Performance: the system must work with high performance.
- Usability: the system GUI must be contain all the information that helps and leads the users in his dealing with the game.
- Security: the system must ensure a security browsing for the game.

3.2 How the System Works

In our project Facebook user use this system to search for other Facebook user and for his/her friends, and plays with them, chatting and compete each other to get high scores, all of that using new game technology.

3.3 General Block Diagram

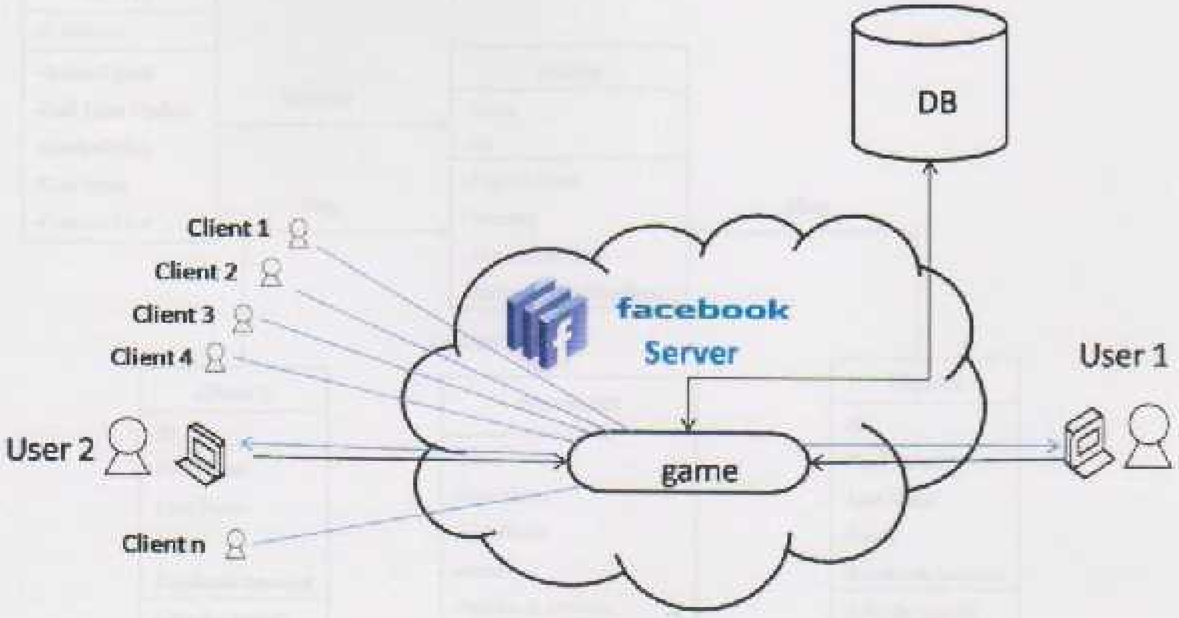


Figure 3.1 System general block diagram

3.4 UML Class Diagram

In this diagram display how the component of the system integrated with each other.

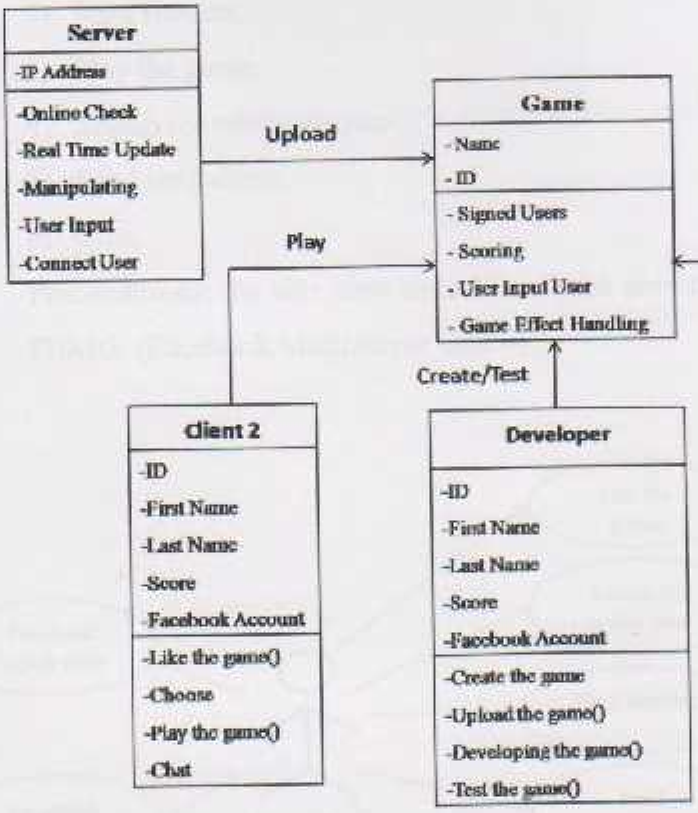


Figure 3.2 UML Class Diagram

3.5 Use Cases

The system has three actors, that do certain function, they are: Developer, User and Server.

3.5.1 User

- Scenario:
  1) Registration.
  2) Send request.
  3) Play the game.
  4) Search for online players.
  5) Send invitations.
  6) Chat.
- Preconditions: the user must have a Facebook account.

  FBMG: (Facebook Multiplayer Game).

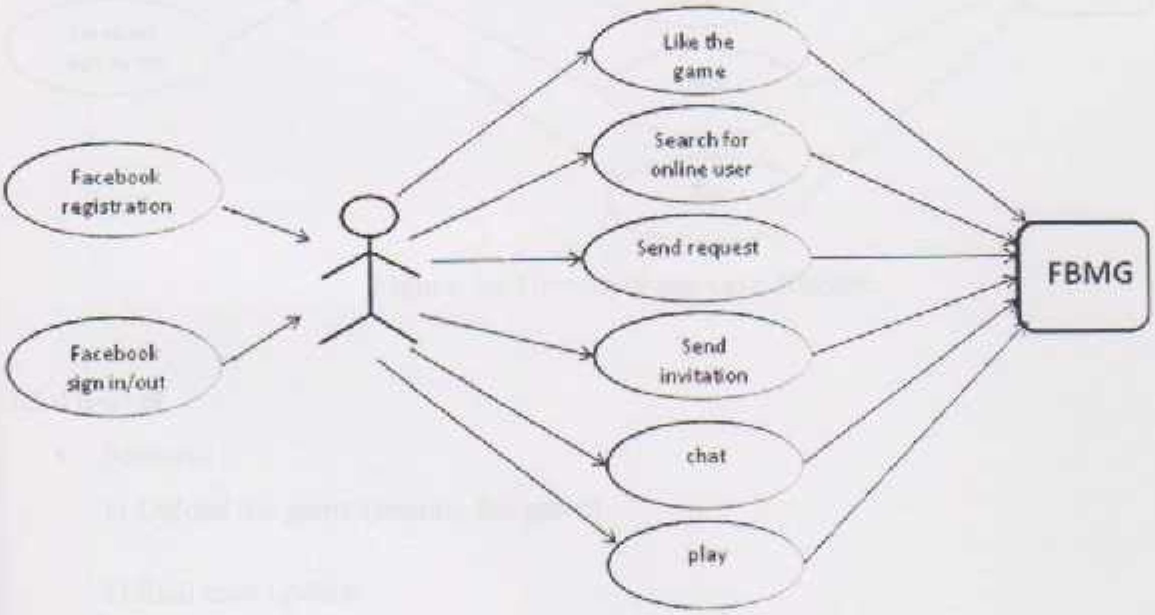


Figure 3.3 user use case diagram

3.5.2 Developer

- Scenario:
  1) Create the game.
  2) Test the game.
  3) Play the game.
  4) Develop the game.
  5) Send the first invitations.
  6) Chat.
- Precondition: the user must have a Facebook account.

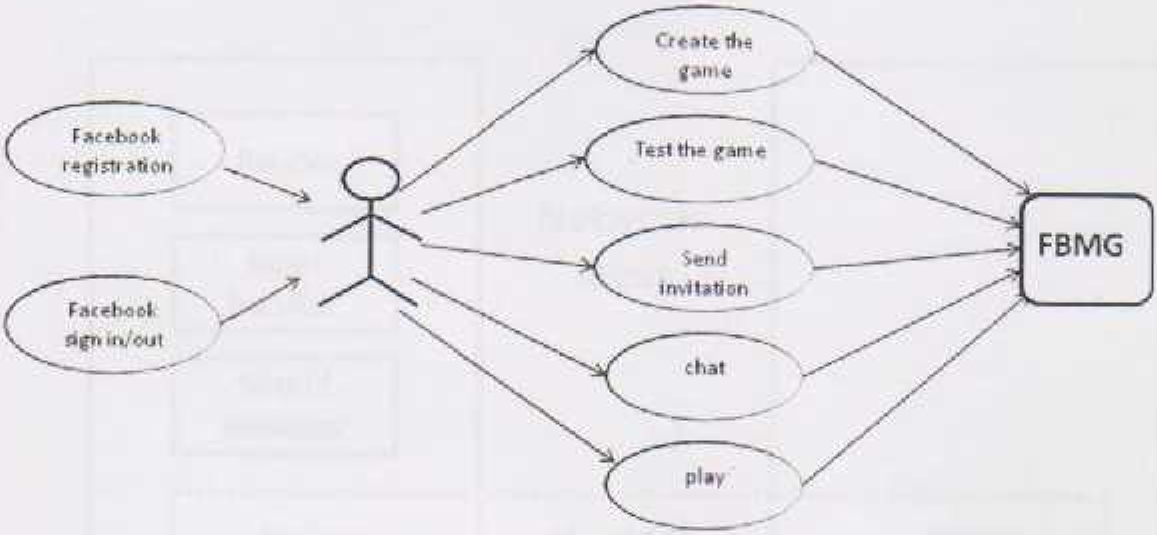


Figure 3.4 Developer use case diagram.

3.5.4 Server

- Scenario :

  1) Upload the game (contain the game).

  2) Real time update.

  3) Online status check.

3.6 Requirement Analysis

Basically, the system is consisting of client side (user side) and server side. client side have the GUI, input handler, sound manager and the game engine which is a simple state machine whose primary function is to compute the game new state. Sound manager handles play back of both sound effect and back ground music. Input handler, handles mouse events and finger touch on mobiles.

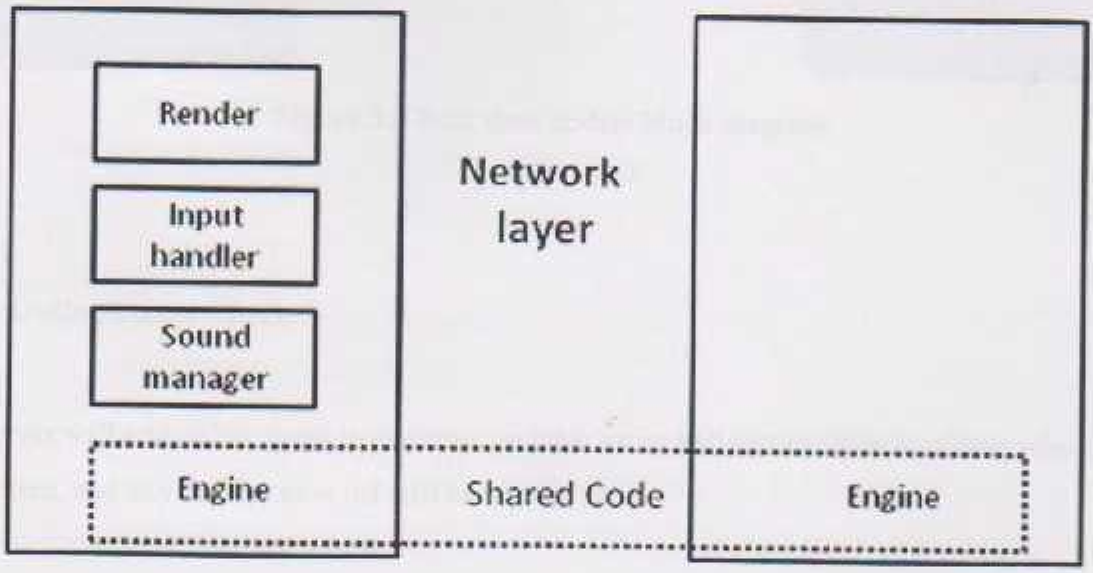


Figure 3.5 client _server block diagram

3.6.1 Real Time Update

The server should be able to transmit changes between users in real time. If client A made a change, the server directly sends a snapshot to client B and gives it the new data.

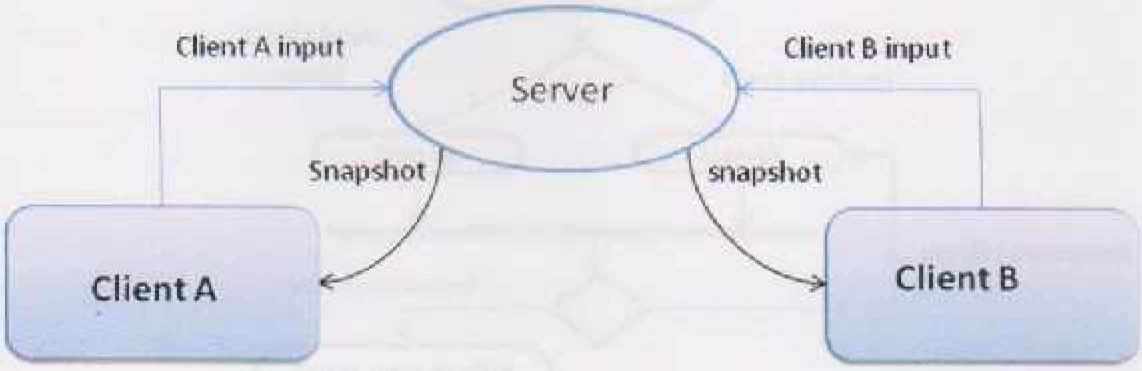


Figure 3.6 Real time update block diagram

3.6.2 Online Status Check

The server will add online users in an array, and this array will be available to clients who use the system, and any one become off will be out the array.

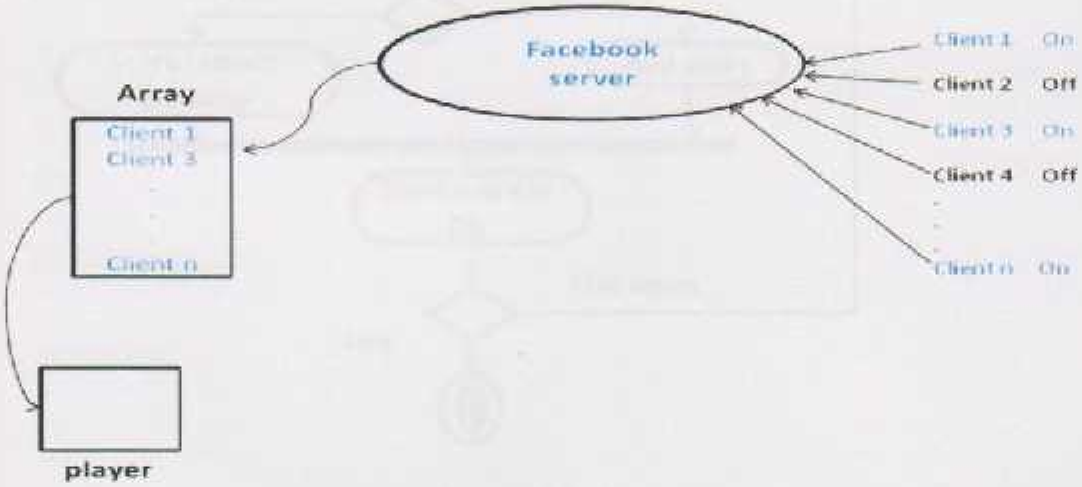


Figure 3.7 Online status check block diagram

3.7 Activity Diagram

This activity diagram shows how the user accesses the system and play.

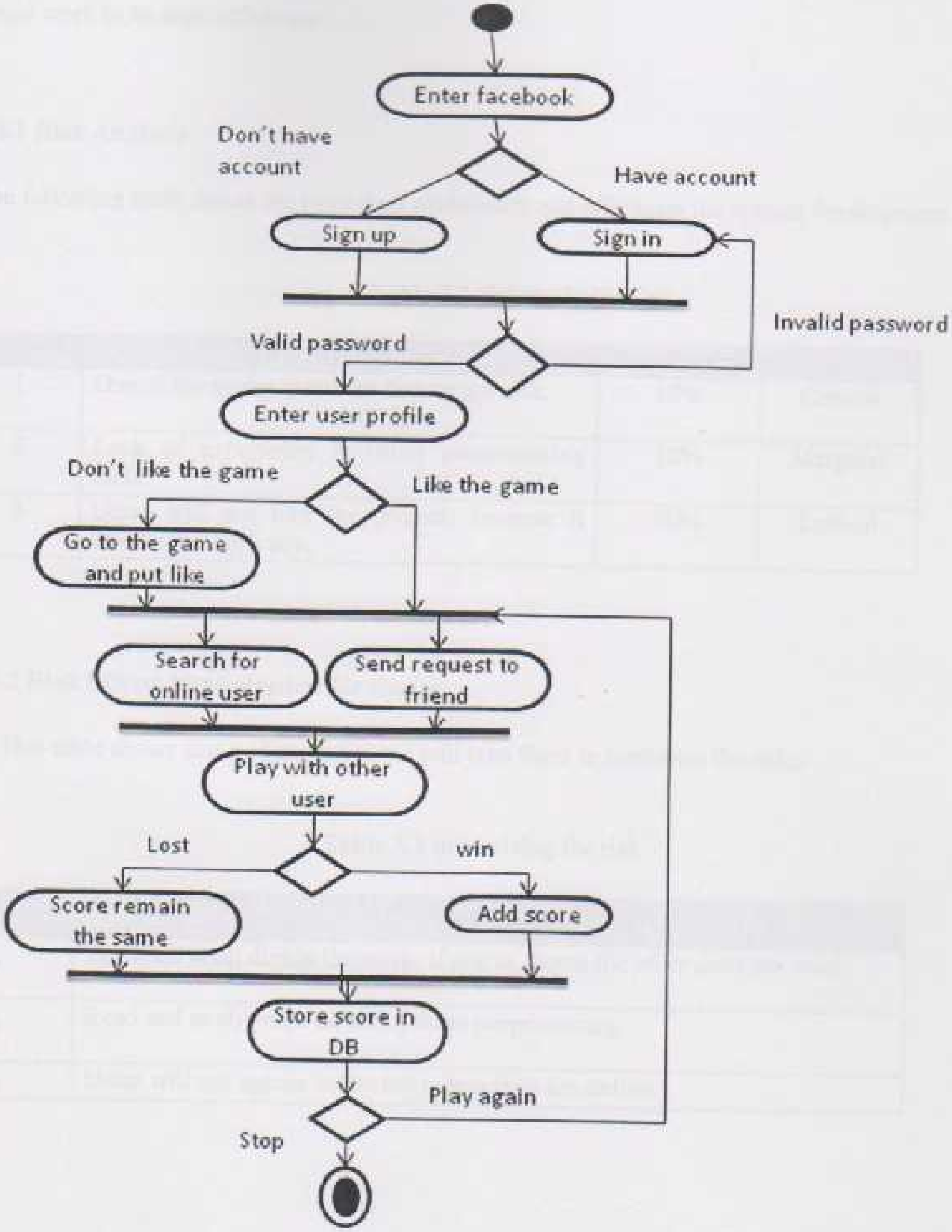


Figure 3.8 Activity Diagram

3.8 Project Risk Management

The project may face some problem and risk that we have to declare in the early time of the project designing and manipulation, and we must avoid those problems so that the system could work in its high efficiency.

3.8.1 Risk Analysis

The following table shows the risks their probability and effects on the system development.

Table 3.1 risk analysis

Risk ID	Risk Description	Probability	Impact
1	One of the group members dies or get sick.	10%	Critical
2	Lack of experience in using programming tools.	30%	Marginal
3	Users will not like the project; because it attacks their privacy.	30%	Critical

3.8.2 Risk Effects Minimization Strategies

This table shows some of strategies we will take them to minimize the risks.

Table 3.2 minimizing the risk

	How to minimize
1.	The team must divide the work, if one is absent the other does his work.
2.	Read and study more on using these programming.
3.	Users will not appear in the list unless they are online.

3.9 Design Options

We have a lot of design options we have to make a decision about taking them or a combination of them in project design:

-In user interface, the user just can send invitations to his/her friends who don't know about the game.

-The user can invite any one on Facebook whether he/she is a friend or not. By writing the user name and send the invitation directly.

-The system will not show all online users on the screen and it will choose one of those users to be an opponent, without showing their names or pictures.

-The user can pick one of the online users and decide with whom he/she want to play. The system just will notice him/her about the online users and he/she has the right to choose.

-The users with the highest scores will appear on other user's interfaces. To encourage players to do their best and move on in the game.

4

Chapter Four "System Design"

4.1 Introduction.
4.2 Architectural Design
4.3 Data Flow Architecture
4.4 Game Design
4.5 Database Design
4.6 Component Level Design

4.1. Introduction

This chapter involves the issues related with system architectural design, component level design and user interface design

4.2. Architectural Design

Based on the previous analysis, we had a clear view about the project tasks, and how system components should work. The system main functions shown in figure 4.1 below and these functions need to be well designed to achieve the project goals.

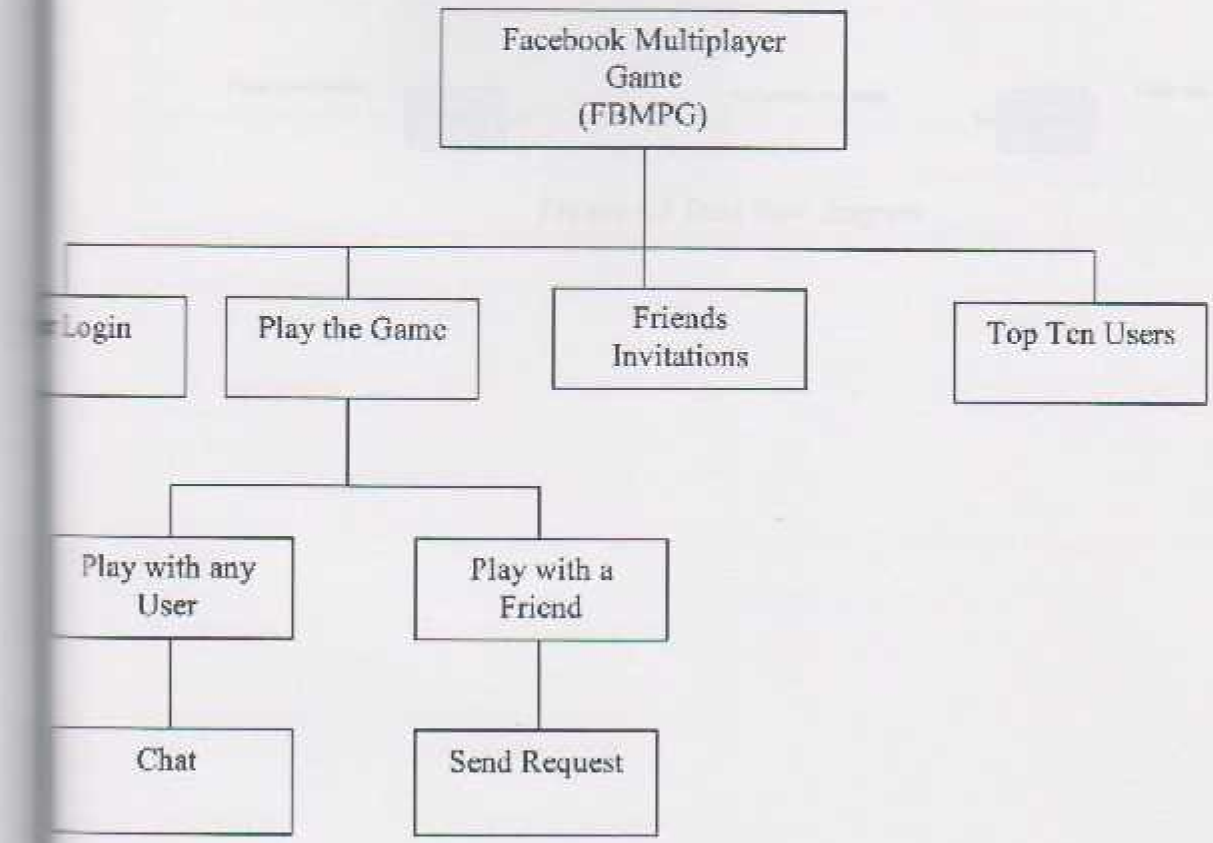


Figure 4.1 system architecture

4.3 Data Flow Diagram

Figure 4.2 shows the data flow diagram of two players game.

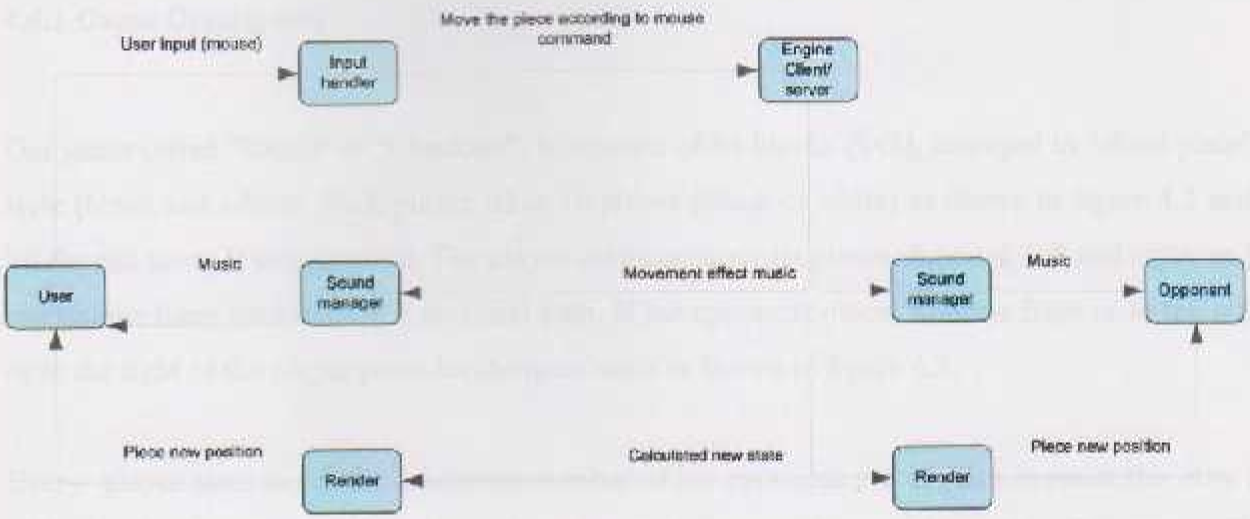


Figure 4.2 Data flow diagram

4.4. Game Design

4.4.1 Game Description

Our game called "Dama" or "Checkers". It consists of 64 blocks (8x8), arranged in "chess plate" style (black and white). Each player takes 16 pieces (black or white) as shown in figure 4.2 and he/she can move it using mouse. The player only can move its pieces: forward, left and right, and can't move them backward in a diagonal path. If the opponent pieces become front or to the left or to the right of the player piece he/she must eat it as shown in figure 4.3.

Every player aims to eat the maximum number of his opponent pieces, also to reach the row (A)for black player and row (H) for white players; because when piece reach those areas it will become a "King piece", then it can move in all directions (forward, left, right and backward) and eat all the opponent pieces in its way.

4.4.2 Scoring

The player wins when he/she eats all the opponent pieces. Then he/she takes one score, and takes no scores if he/she loses or withdraws after playing starts.

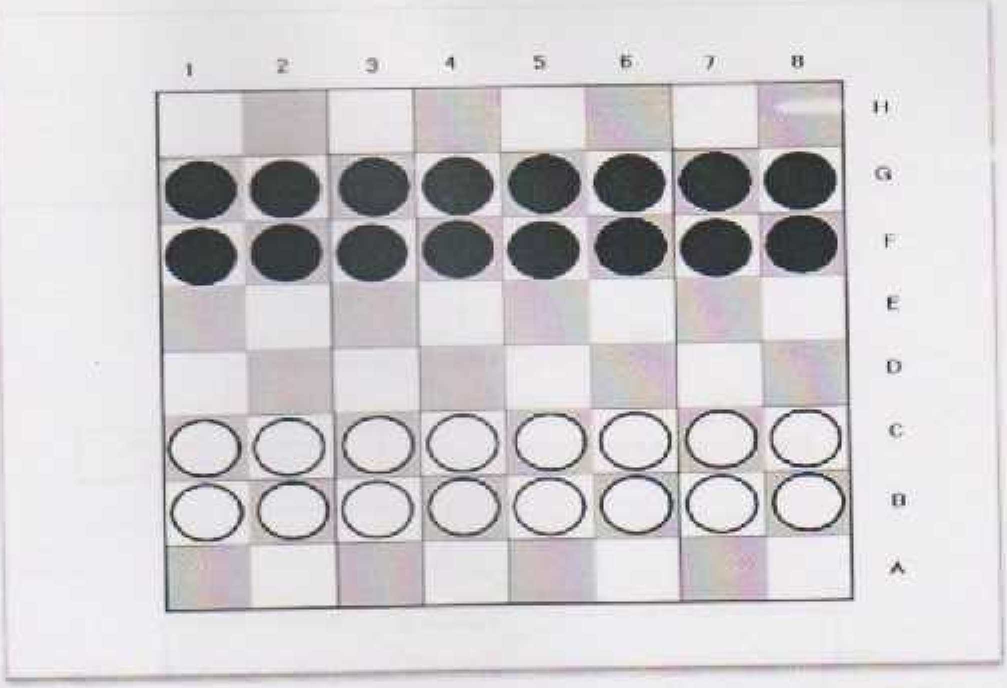


Figure 4.3 Dama game

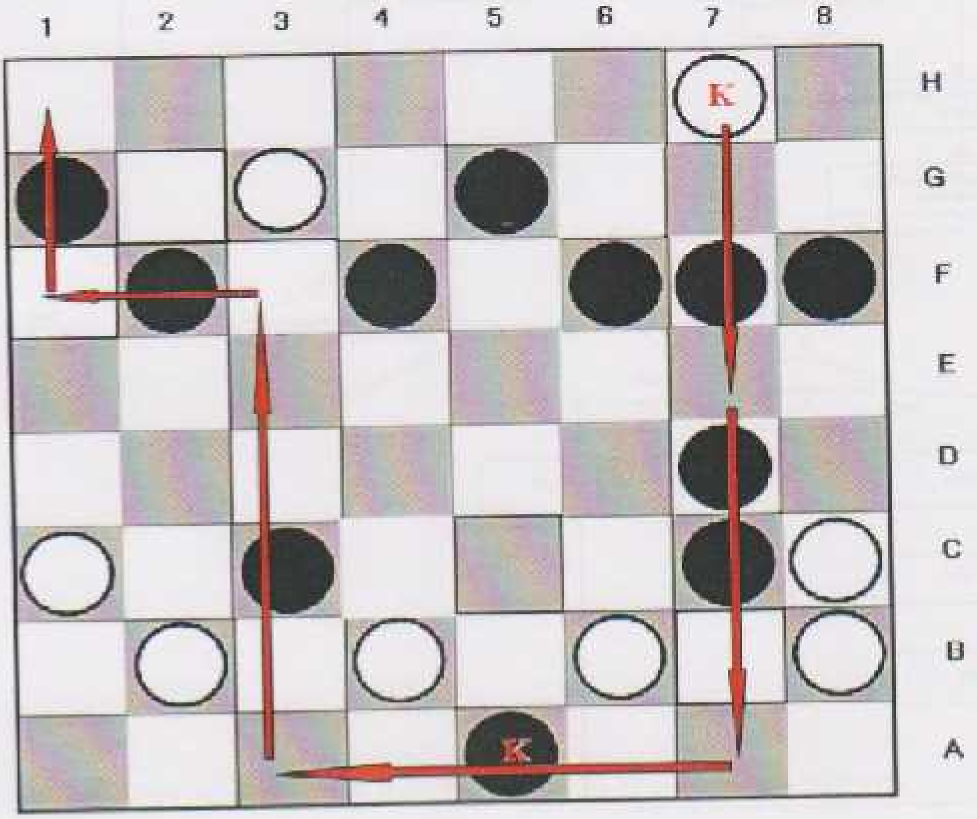


Figure 4.4 king piece

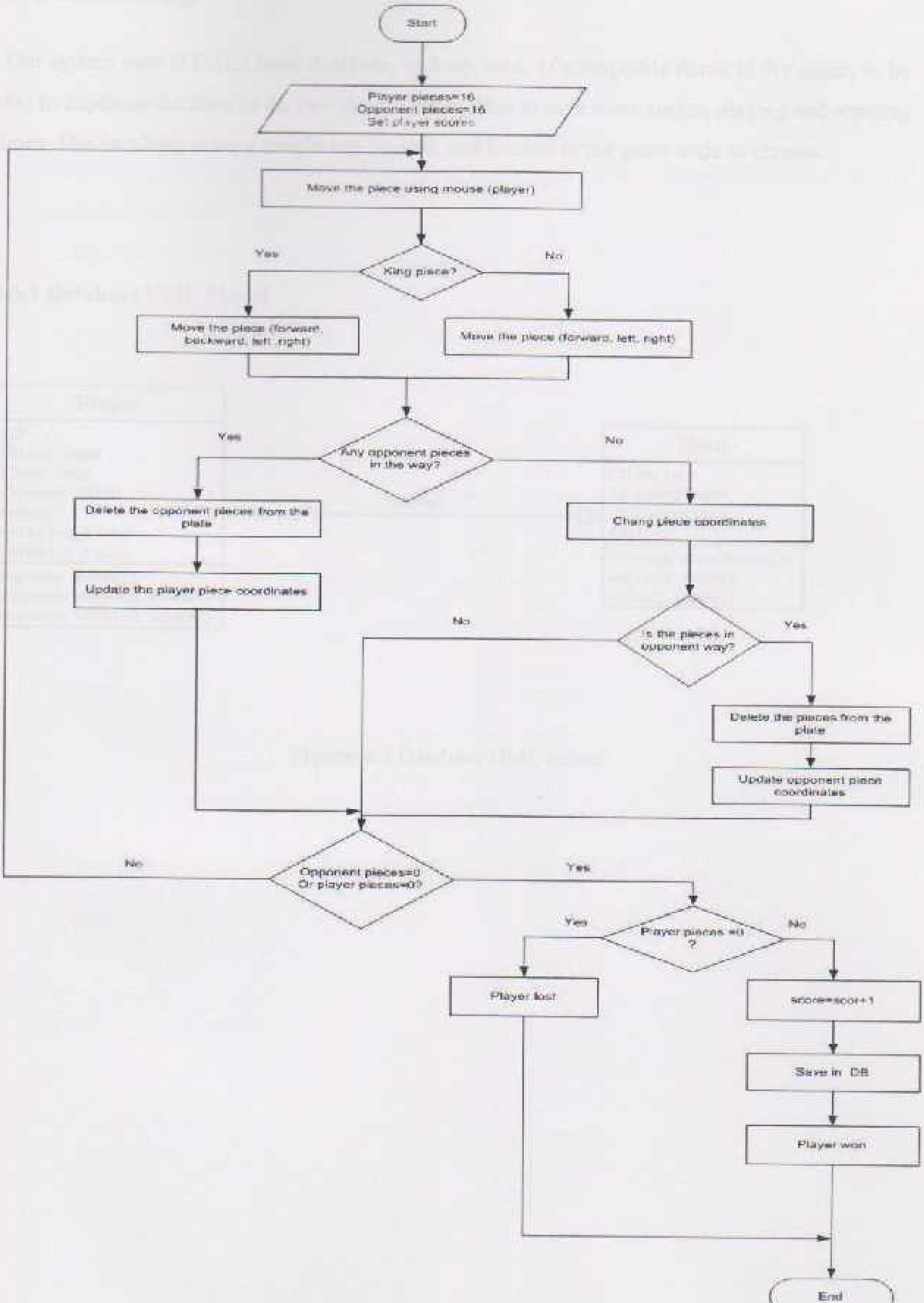

Start
Player pieces=16
Opponent pieces=16
Set player score=
Move the piece using mouse (player)
Yes
No
King piece?
Move the piece (forward, backward, left, right)
Move the piece (forward, left, right)
Yes
No
Any opponent pieces in the way?
Delete the opponent pieces from the plate
Update the player piece coordinates
Chang piece coordinates
No
Yes
Is the pieces in opponent way?
Delete the pieces from the plate
Update opponent piece coordinates
No
Yes
Opponent pieces=0
Or player pieces=0?
Yes
No
Player pieces =0
?
Player lost
score=scor+1
Save in DB
Player won
End

Figure 4.5 Game flowchart

4.5. Database Design

Our system uses HTML5 local database, to keep track of changeable items in the game; to be able to duplicate the state in the two client's sides. Also to save users scores, playing and winning times. The data base is very simple and limited, and located in the game code as classes.

4.5.1 Database UML Model

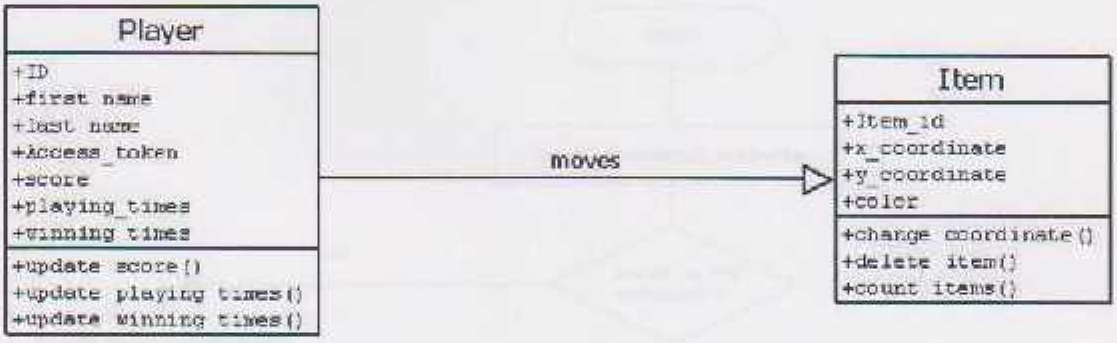


Figure 4.7 Database UML model

4.6. Component Level Design:

The system has several components which appear in figure 4.8, each component design can be shown using a flowchart.

- **User Login**

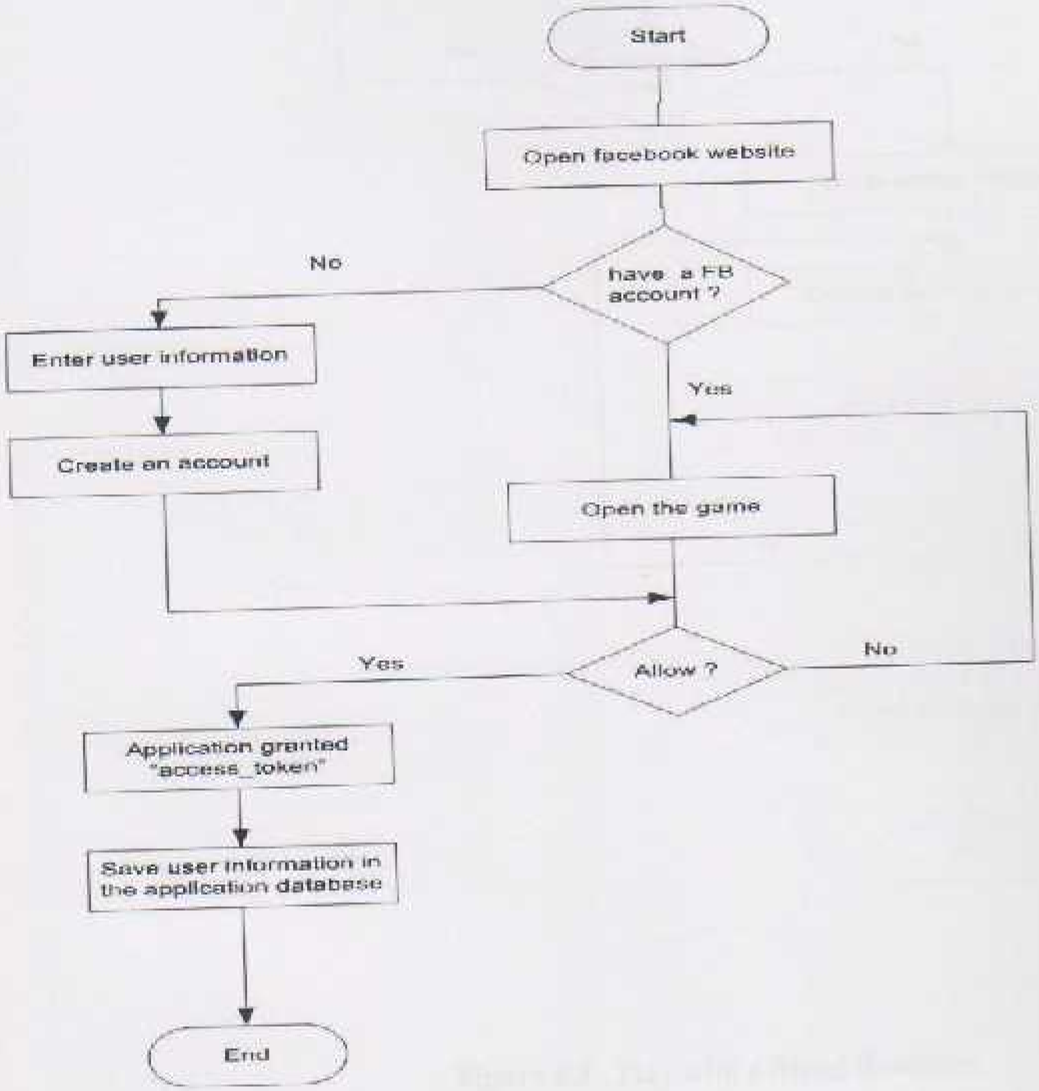


Figure 4.8 User login flow chart

- **Play With Friend**

Figure 4.9 shows play with friends process.

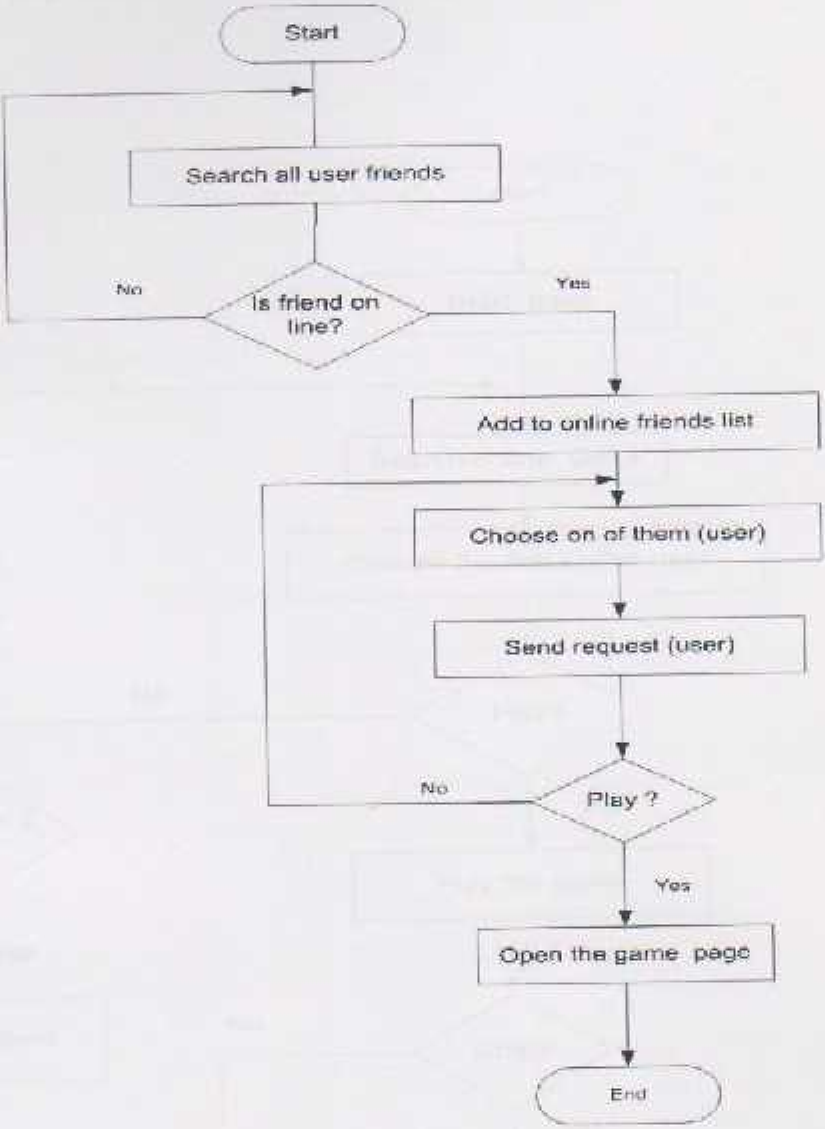


Figure 4.9 Play with a friend flowchart

- **Play with Anyone.**

Figure 4.10 shows play with another Facebook users process.

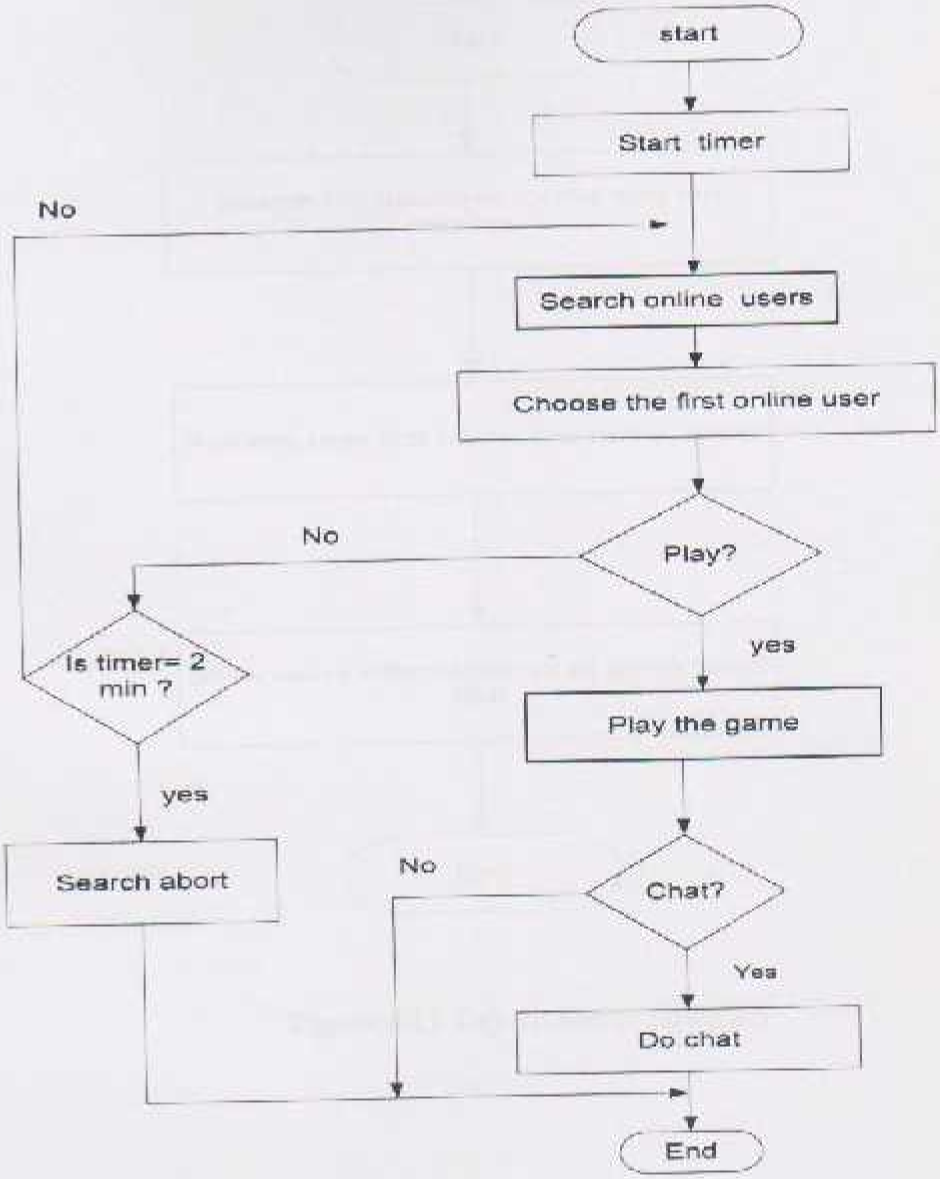


Figure 4.10 Play with anyone flowchart

- **Top ten scores.**

Figure 4.11 shows getting the top ten users who have the highest scores in the game.

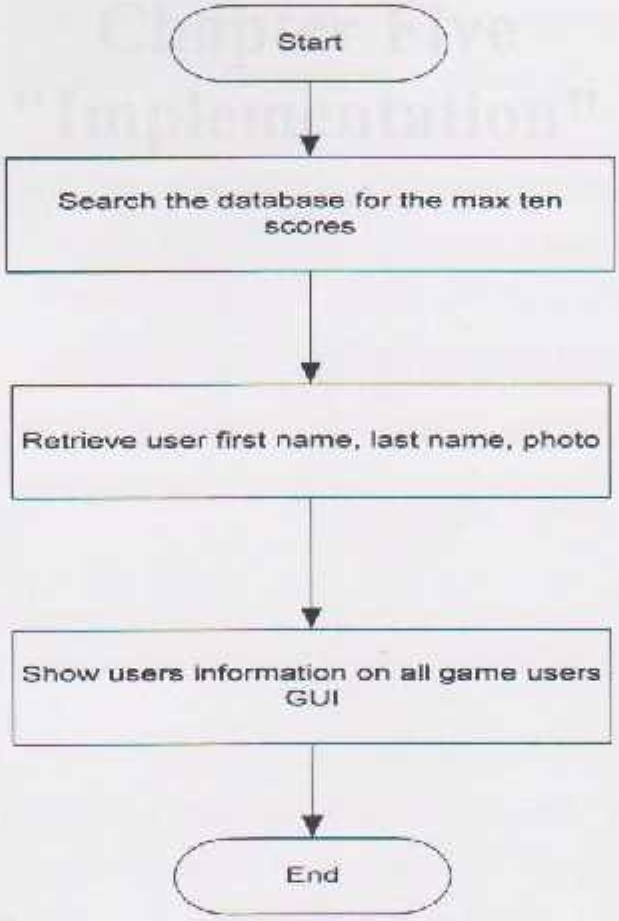

Start
Search the database for the max ten scores
Retrieve user first name, last name, photo
Show users information on all game users GUI
End

Figure 4.11 Top ten scores flowchart

5

Chapter Five "Implementation"

5.1 Overview
5.2 Implementation
5.3 Description of project
5.4 Uploaded into Facebook

5.1 Overview

In this chapter we will talk about implementation of the system which include the language which we used, the Graphical User Interface (client side) and the output of necessary GUI.

5.2 Implementation

We decided to choose HTML5 language as implementation language for the software system because of its feature, and because our system requirements are possible to implement using HTML5 language

We added sound for every movement of the game, the game contents and users score stored in local storage. And also we use Dream Waver as editor for the game. Dream Waver: it is a program gives integral environment to hold and create a website or a game and give us all the tools to make the game, and easily create My SQL database to hold the users permanent data.

5.3 Description of project

5.3.1 Dama game

This game was implemented using HTML5, at client side we used (jquery.js) library, canvas and audio HTML5 elements, but at server side we used PHP language and MYSQL database to save users, show online users, save scores and connect two users with each other. Also we used HTML5 local storage to store pieces color, x_ coordinate, y_ coordinate, king state, store players scores, player turn and the whole game.

Not all the browsers support HTML5 local storage, so we put the condition if (support local storage), if the browser supports so the local storage code will work.

```
function saveGame()
{
  // Check to see if the browser supports local storage and save the current state of the game
  if (supportsLocalStorage()) {
    localStorage["dama.game.in.progress"] = gameInProgress;
    localStorage["dama.player.one.score"] = playerOneScore;
    localStorage["dama.player.two.score"] = playerTwoScore;
    localStorage["dama.piece.tracker"] = JSON.stringify(pieceTracker);
    localStorage["dama.whos.turn.is.it"] = WHOS_TURN_IS_IT;

  }
}
```

The above code save every changeable argument in the game in the local storage. Local storage reduces the need for MY SQL database; because using databases in games needs a huge manipulation compare with simple local storage code.

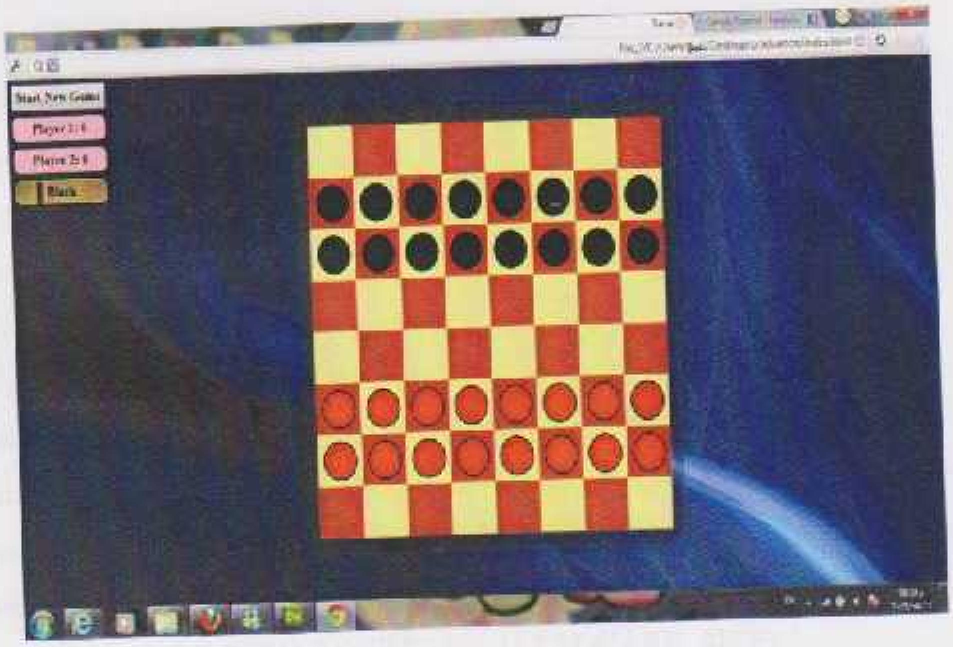


Figure 5.1 Game page

```
function drawBoard()
{
   for(var i = 1; i < 9; i++) {
      for(var j = 1; j < 9; j++) {
         // Draw square using the column and row numbers i and j
            drawSquare(i,j);
      }
   }

   // Add event listeners to check for clicks on the board
   board.addEventListener("mousedown",clickPiece,false);
}

function drawSquare(x,y)
{
   var color;

   // Switch between black and red squares depending on the location
   if(((x % 2 == 0) && (y % 2 == 0)) || ((x % 2 == 1) && (y % 2 == 1))) {
      color = BLACK1;
   } else if(((x % 2 == 0) && (y % 2 == 1)) || ((x % 2 == 1) && (y % 2 == 0))) {
      color = RED1;
   }

   // Draw square using the column and row numbers col and row and color c
   boardContext.beginPath();
   boardContext.fillStyle = color;
   boardContext.moveTo((x - 1) * SQUARE_SIZE,(y - 1) * SQUARE_SIZE);
   boardContext.lineTo(x * SQUARE_SIZE,(y - 1) * SQUARE_SIZE);
   boardContext.lineTo(x * SQUARE_SIZE,y * SQUARE_SIZE);
   boardContext.lineTo((x - 1) * SQUARE_SIZE,y * SQUARE_SIZE);
   boardContext.lineTo((x - 1) * SQUARE_SIZE,(y - 1) * SQUARE_SIZE);
   boardContext.closePath();
   boardContext.fill();
}
```

The above functions used to draw the game board.

```
function drawPieces()
{
  // Draw all pieces in tracking array
  for(var i = 0; i < pieceTracker.length; i++) {
    boardContext.beginPath();
    boardContext.fillStyle = pieceTracker[i].color;
    boardContext.lineWidth = 5;
    boardContext.strokeStyle = BLACK;
    boardContext.arc((pieceTracker[i].col - 1) * SQUARE_SIZE + (SQUARE_SIZE * 0.5) +
0.5,(pieceTracker[i].row - 1) * SQUARE_SIZE + (SQUARE_SIZE * 0.5) +
0.5,(SQUARE_SIZE * 0.5) - 10,0,2 * Math.PI,false);
    boardContext.closePath();
    boardContext.stroke();
    boardContext.fill();

    // Add a "crown" if the piece is kinged
    if(pieceTracker[i].king) {
      boardContext.beginPath();
      boardContext.lineWidth = 2;
      boardContext.strokeStyle = "#FFFFFF";
      boardContext.arc((pieceTracker[i].col - 1) * SQUARE_SIZE + (SQUARE_SIZE * 0.5) +
0.5,(pieceTracker[i].row - 1) * SQUARE_SIZE + (SQUARE_SIZE * 0.5) +
0.5,(SQUARE_SIZE * 0.5) - 30,0,2 * Math.PI,false);
      boardContext.closePath();
      boardContext.stroke();
    }
  }
}
```

The drawPieces() function used to draw the pieces on the board.

5.3.2 GUI (Graphical User Interface)

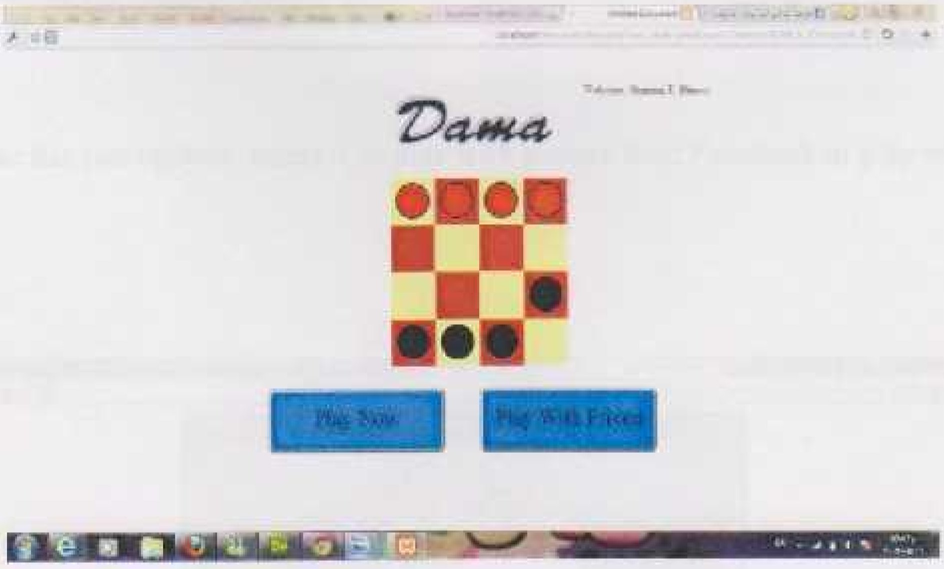


Figure 5.2 First player main page

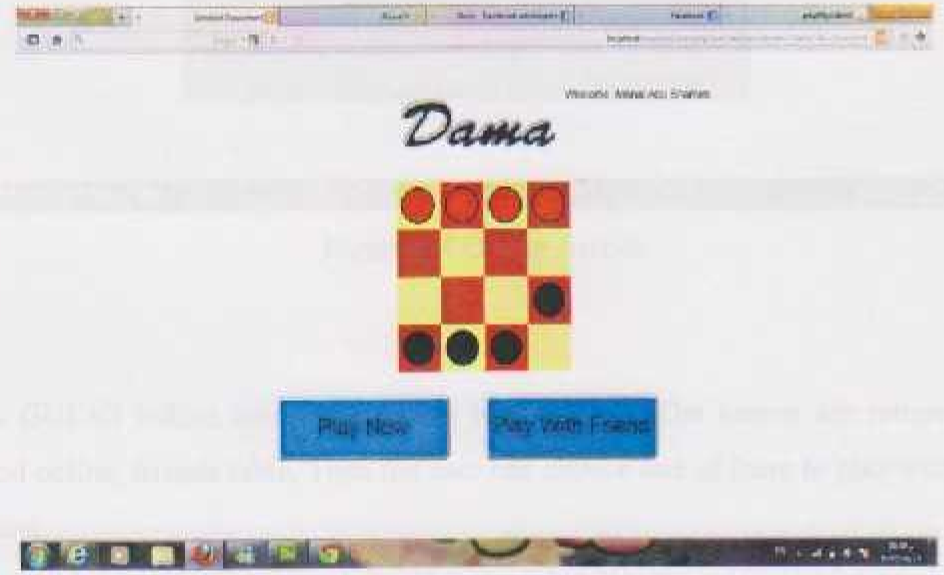


Figure 5.3 second player main page

This is the home page, when the user login the game, his/her name appears at the top right of the page. When the user login in the game, first the program check if he/she already registered in the game. If not; his name will be added to the database for permanent store. Also every user enter the game site, he/she directly inserted into database table called (online_users) for temporary storage, to appear in online friends list of his/her friends, or appear in online players list of other Facebook users. Using this table the other player can send play requests to that user, and he/she check the request column every 5 seconds to see if there is any one wants to play with him/her.

The user has two options, whether to play with anyone from Facebook or play with a friend.

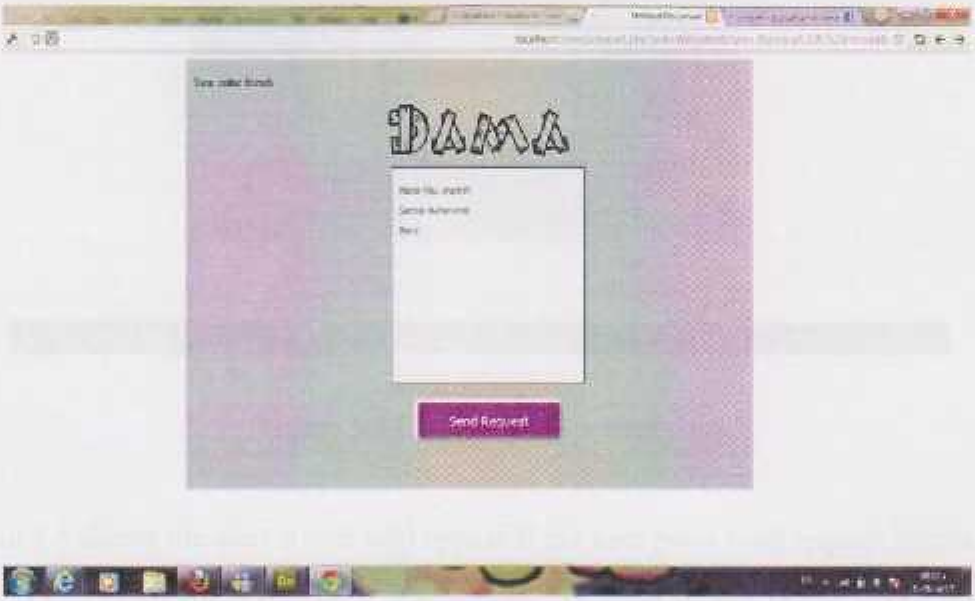


Figure 5.4 Online friends

In this GUI all online friend are shown in this page. The names are retrieved from the database and online_friends table. Then the user can choose one of them to play with, by sending a play request.

```
<?php
$mynam=$_SESSION['username'];
mysql_select_db($database_db_inic, $db_inic);
$query="SELECT session_name FROM online_friends WHERE session_name <>'$mynam'";

$result= mysql_query($query);
```

```
while(Srow = mysql_fetch_array(Sresult))
{
        echo "<p class= 'user' style='cursor:pointer'>".Srow['session_name']."</p>";}?>
```

The above PHP code used to echo online friends on the defined place for that.

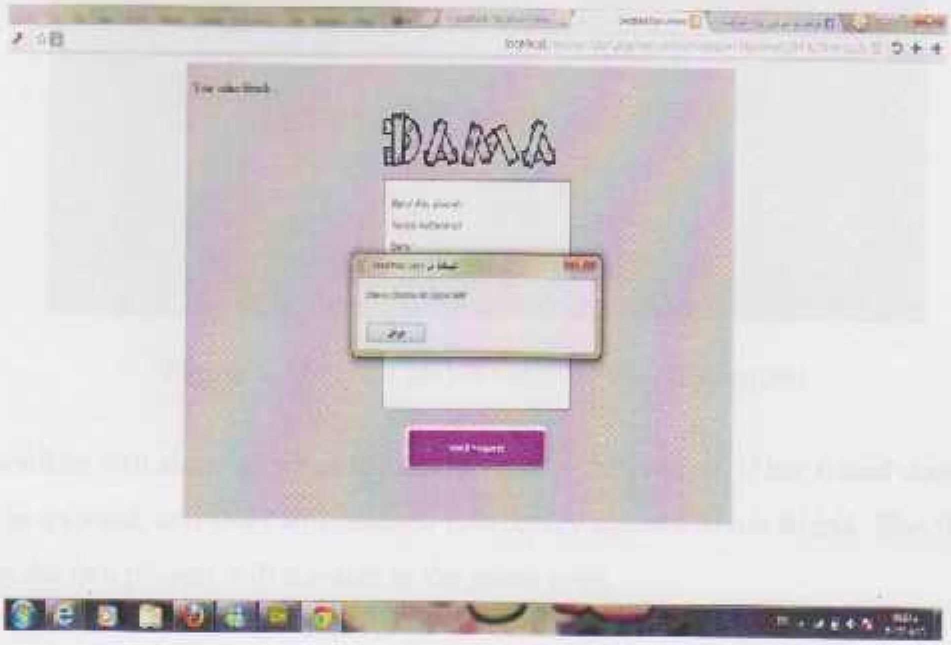


Figure 5.5 Choose an opponent alert

Figure 5.5 shows the alert which will appear if the user press send request button without choosing any one of the listed names of her friends. She must choose one to play with. Now the first player chooses the second player, who is her friend, to play with.

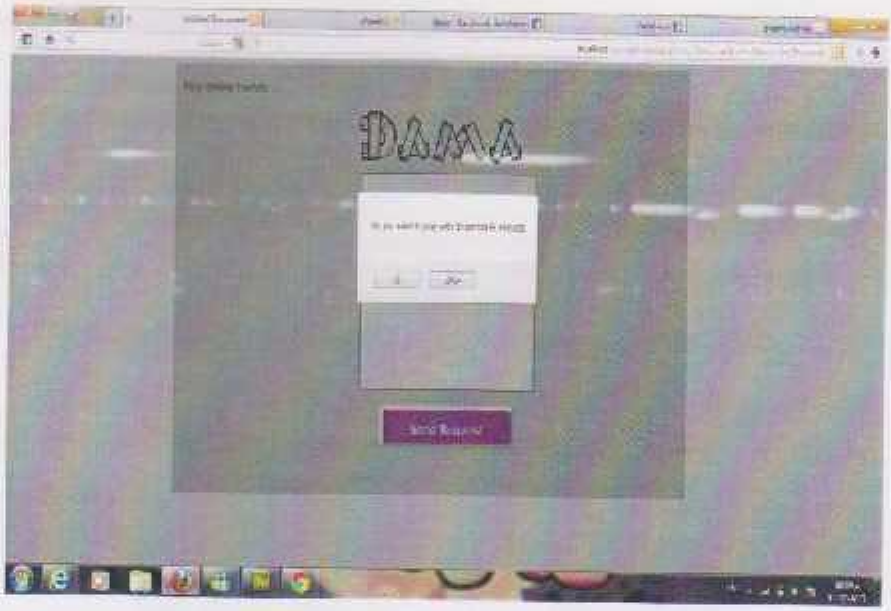


Figure 5.6 Second player receives the play request

This confirm will show up when the friend receive the request, if her friend choose (No), so the request is rejected, and (No) will inserted into replay column of her friend. Else if she choose (yes) button the two players will transfer to the game page.

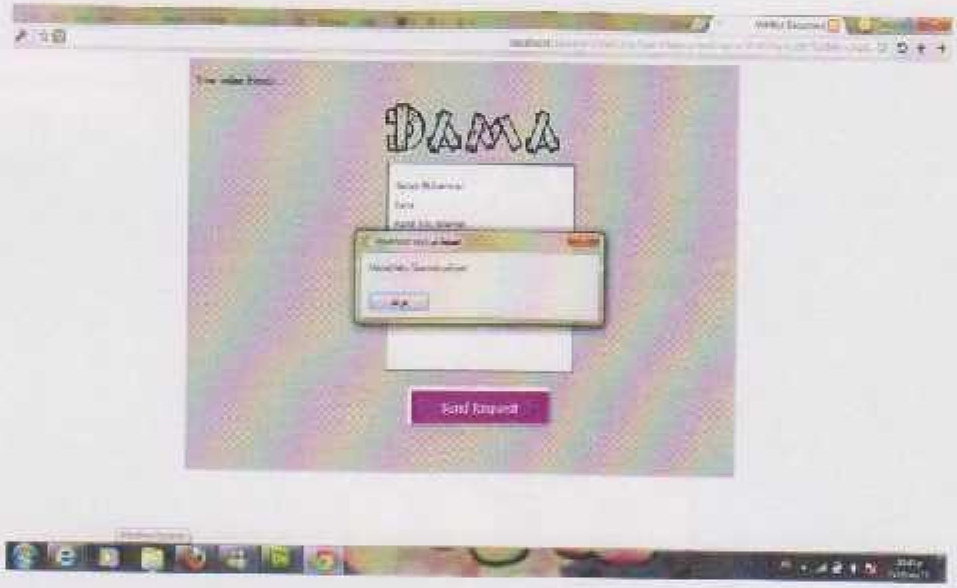


Figure 5.7 request refused alert

The same scenario happens when he choose to play now but with another users (not friends).

This page where two users want to play. Each user has a name, turn, score and sixteen pieces with a color.

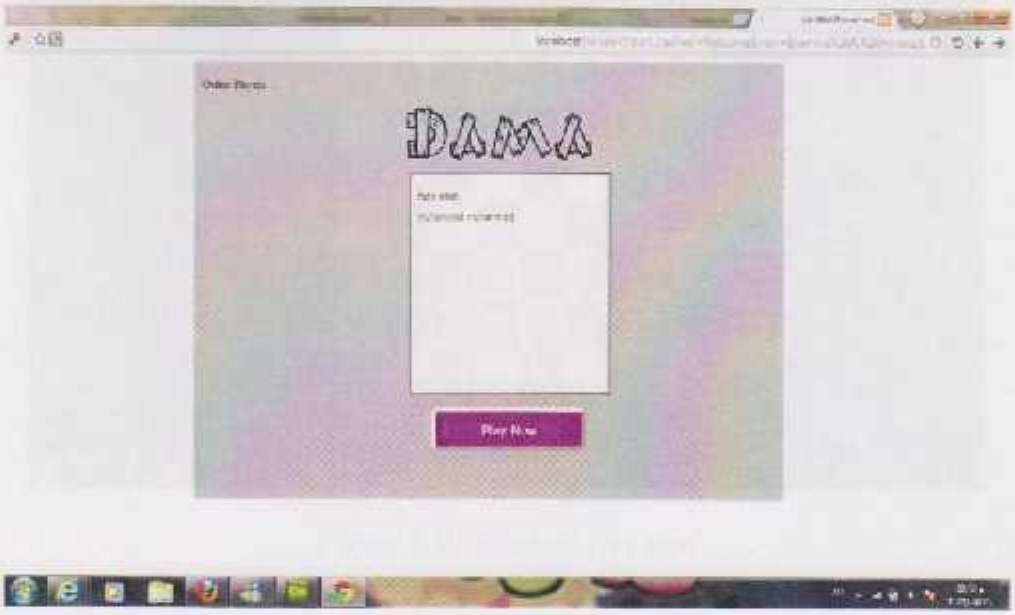


Figure 5.8 Online players

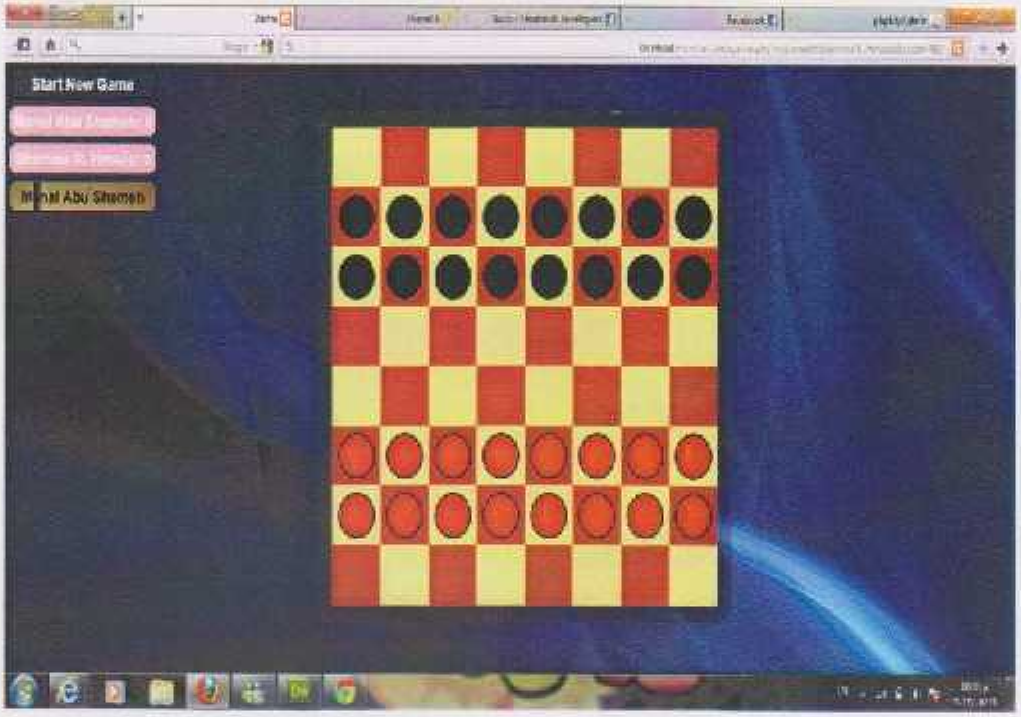


Figure 5.9 Game page

Now the two players are in the game, the first player starts to play with black pieces like in figure 5.10.

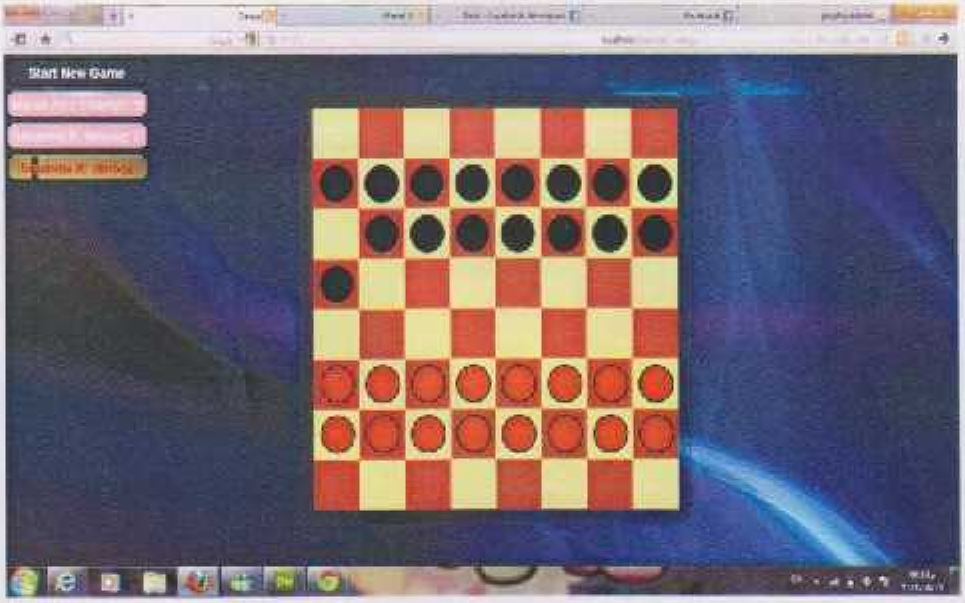


Figure 5.10 Black player turn

After the first player had finished the first move, the second player can play with her red pieces as shown in figure 5.11.

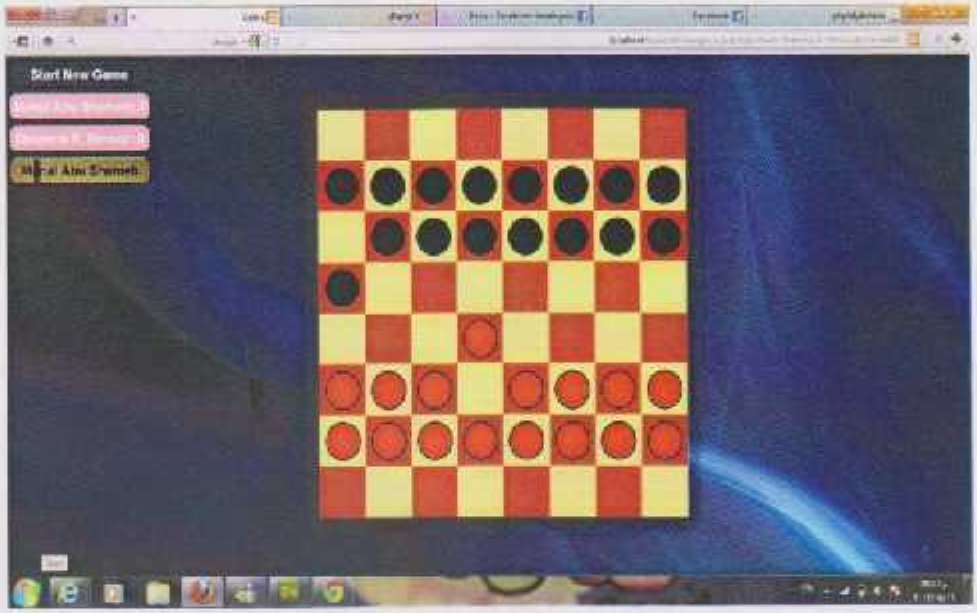


Figure 5.11 Red player turn

When one of the players wins, her name appears in an alert box and her score will increment by one and updated in the database.

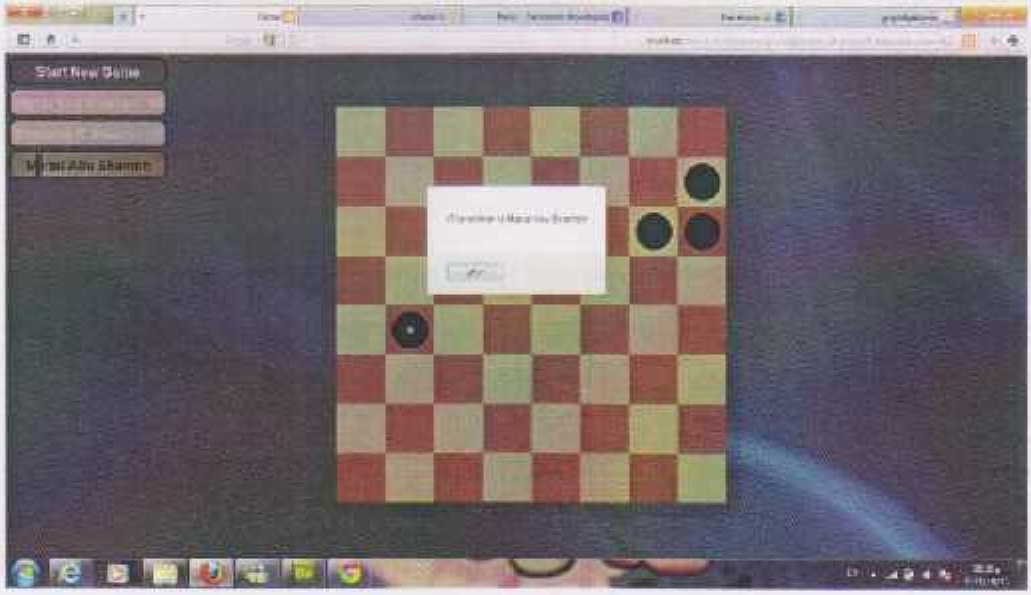


Figure 5.12 winner player

5.3.3 Upload the game into Facebook

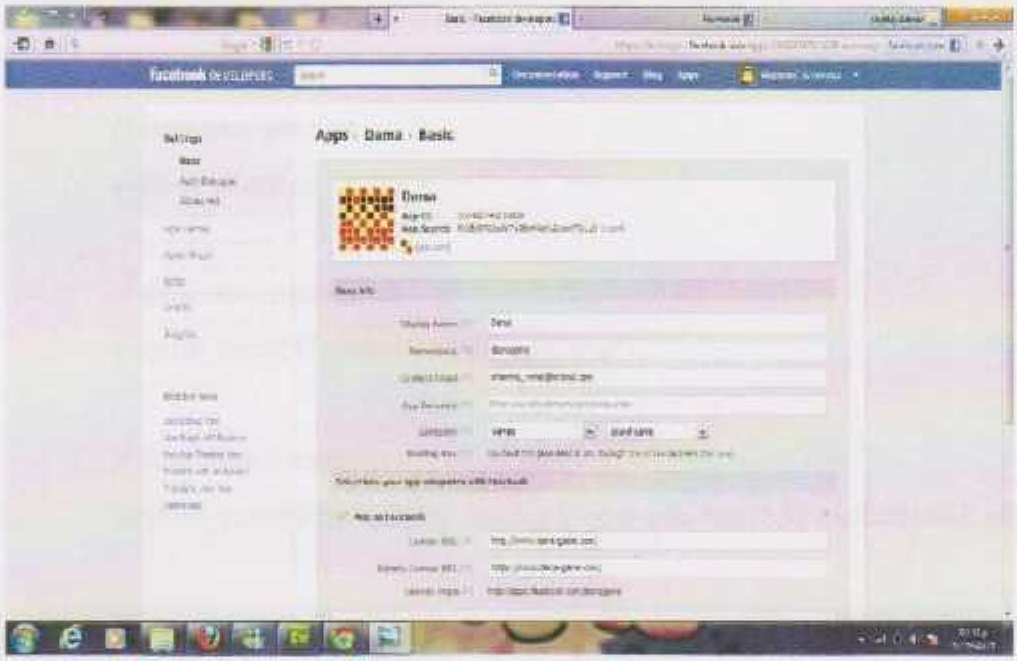


Figure 5.13 Create new Application on Facebook.

In this page we created an application and uploaded our game to Facebook. Our application has an ID= 330420747010229 and a secret.

- **Namespace**: The names of the application which will be appear in the URL game. Facebook users can reach the Dama game by using the URL game: https://apps.facebook.com/damagame/.
- **Canvas URL:** it's the domain or the URL of the game outside Facebook.
- **Source canvas URL:** https (Http source): it's a combination of the http with SSL TLS protocol; it provides incepted communication to prevent eavesdropping, and to securely identify the web server with which you are communicating.[15]

Without https, Facebook cannot show or deal with the application, so when we search on the application. Facebook gives users warning that it can't open this application, because it's not secure.

User can open the application but after reset his/her security settings and disable the secure browsing but this will affect his/her account badly.

- **Authenticating the Application**

```
<?php
// start user session
session_start();

// database connection
require_once('Connections/db_inic.php');

// facebook library
require_once('FBphpSDK/facebook-php-sdk-6c82b3f/src/facebook.php');

// app id
$app_id = '330420747010229';
```

```
// app secret
$app_secret = 'f015d6723a9b7128b60a9121dcf70118';

// namespace
$app_namespace = 'damagame';

// app hosting url
$url = 'https://www.dama-game.com /';

// app facebook url
$fb_url = 'https://apps.facebook.com/'.$app_namespace.'/';

// facebook page url
$page_url = 'http://www.facebook.com/pages/Dama-Game/416964965004068';

// facebook object
$facebook = new Facebook(array(
'appId'  => $app_id,
'secret' => $app_secret,
));

// get user id (and check if the user is logged in)
$uid = $facebook->getUser();
if (!$uid) {
// get log-in page url
$login_url = $facebook->getLoginUrl(array(
'scope' => '',
'redirect_uri' => $fb_url
));
// redirect user to log in page
exit('<script type="text/javascript">top.location.href =
"'.$login_url.'";</script>');
}
```

```
// get user info from facebook
try {
$user_info = $facebook->api('me?fields=name,first_name,friends', 'GET');
//echo "<pre>".print_r($user_info, true)."</pre>";
$_SESSION['username'] = $user_info['first_name'];
} catch (Exception $e) {
//exit($e->getMessage());
}

// save user to database
if ($user_info) {
// get user information from database
$query = "SELECT * FROM user_info WHERE id = '$uid'";
$result = mysql_query($query, $db_inic) or die(mysql_error());
$user_row = mysql_fetch_assoc($result);
if (!$user_row) {
// user does not exist, so insert
$query_in = "INSERT INTO user_info (id, name) VALUES (
'".mysql_real_escape_string($user_info['id'])."',
'".mysql_real_escape_string($user_info['name'])."'
)";
mysql_query($query_in, $db_inic) or die(mysql_error());
} else {
// update name if different
if ($user_info['name'] != $user_row['name']) {
$query_up = "UPDATE user_info SET name =
'".mysql_real_escape_string($user_info['name'])."'";
mysql_query($query_up, $db_inic) or die(mysql_error());
}

}
}
?>
```

The above code used to authenticate and integrate Dama game with Facebook platform, and take the users information: Id, name, and put them in the game database. Also used to create a page for the game; to talk about it and lead the users to Dama game application. Figure 5.14 shows the game page on Facebook.

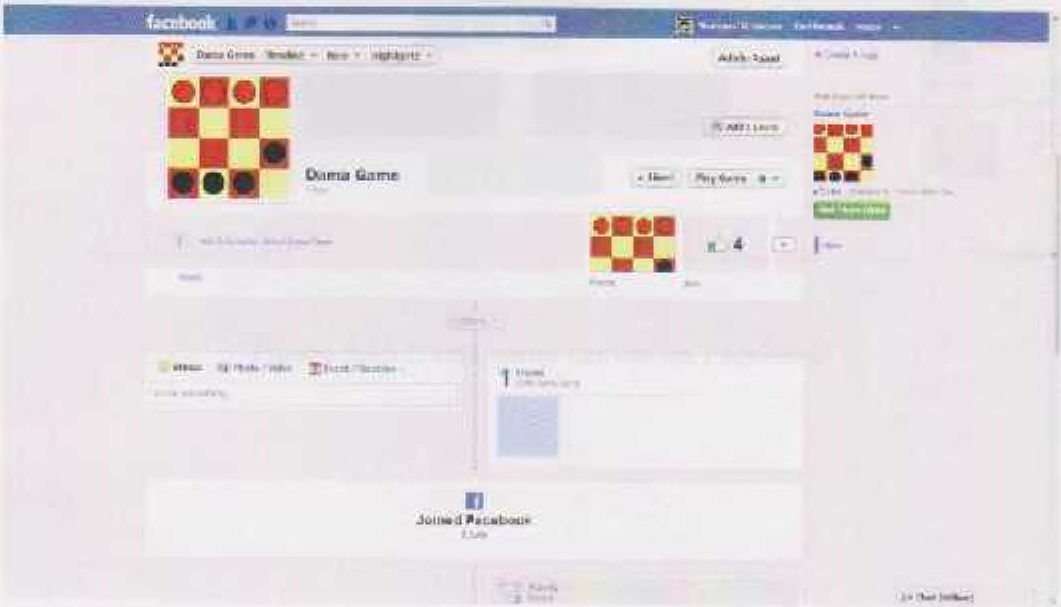


Figure 5.14 Dama game page

As we can see in the figure, there is a like button and play game button, the first used to like the page and the second is used to enter the game and start playing.

When user clicks on play game button the game canvas will appear, in this canvas the Dama game application works, the Facebook user name and photo appear at the top of the game canvas. An invite button added to the application to allow the users to invite their friends to play the game. Figure 5.15 shows the Dama game start page or canvas page on Facebook.

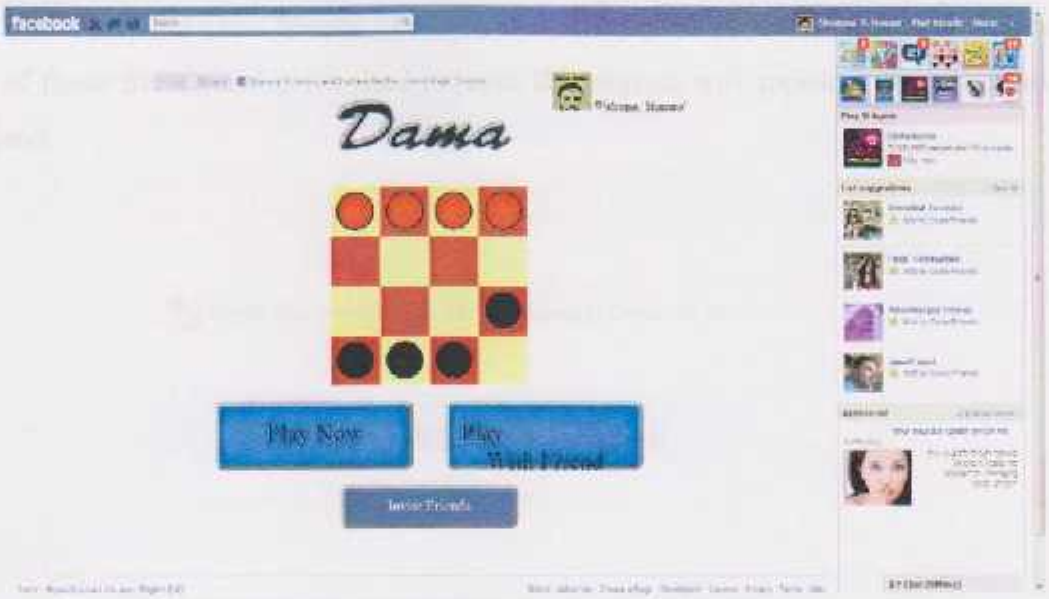


Figure 5.15 Dama game canvas on Facebook

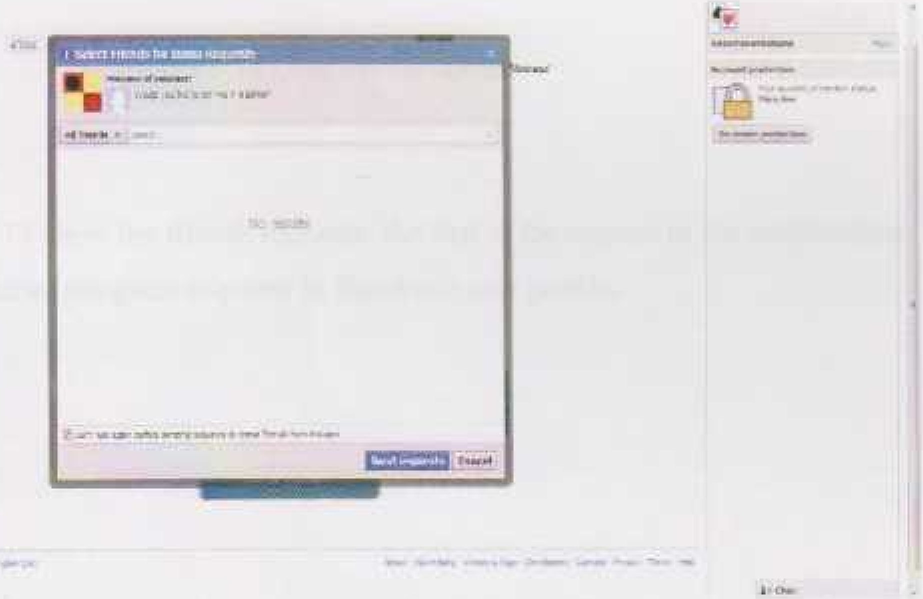
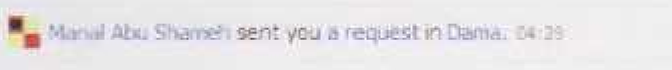


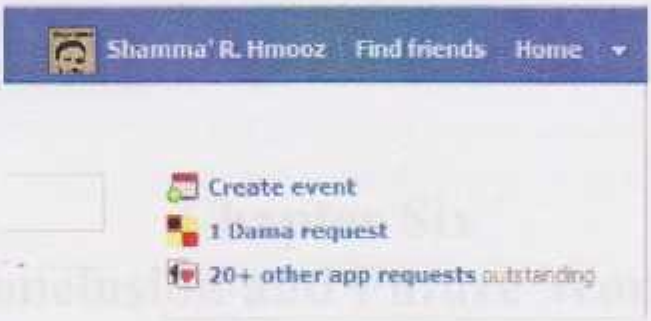
Figure 5.16 Facebook friends

Figure 5.16 shows the users friends list, to send invitations to his/her friends. User chooses one or more of those friends and press send request, this request will appear at the notification list of that friend.



Manal Abu Shameh sent you a request in Dama. 04:29

Figure 5.17 Friend game request



Create event

1 Dama request

20+ other app requests outstanding

Figure 5.18 User events corner

Figures 5.17 and 5.18 show the friends requests, the first is the request in the notifications list, the second figure shows the game requests in Facebook user profile.

6

Chapter Six "Conclusion and Future Works"

6.1 Overview
6.2 Conclusions
6.3 Future Works

6.1 Overview

In this chapter we'll talk about conclusions that we got from our project and future works that can improve the result obtained from our work.

6.2 Conclusion

There are some conclusions that are appeared through working with this project that will be pointed to:

1. Using HTML5 in web programming and games is easier than using other web languages especially with using of local storage.
2. Facebook environment and programming language is different from other web programming languages, but it gives the tools to integrate with the web applications.
3. Creating web multiplayer games is more complicating than single player game. Multiplayer games need a database to connect users and track the results of the game. But with single player game the local storage will be enough to do the entire job, and no need to use SQL database.

6.3 Future work

There are a lot of things should be added to improve the functionality of the game:

1. At the game design level, some animation could be added to improve the look of the game to attract users.
2. More strict rules should be applied on the game. For example any pieces of opponent pieces should be taken if it lies in front or beside the player pieces.
3. Facebook secure mode is not enough to protect users information in the game, so more security should be applied on the game code, using one of user authentication algorithm.

4. Scoring system could be more complicated, like making it depends on the time or on other factors.
5. Allow other users to enter to the game as spectators not as players.

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