SUDAN UNIVERSITY OF SCIENCE & TECHNOLOGY

COLLEGE OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SYSTEMS AND NETWORK

SUDANESE TRADITIONAL CARD GAME HAREEG

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Sudanese Traditional card game Hareeg

PREPARED BY:
MOHAMMED ABDALRAHMAN

KHALID ALWALID SIDDIG

AHMED MORTADA ABDALRAHMAN

SUPERVISOR:
Mrs. LEENA HEYDER ALDOSOGI

……………………………………………….

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((وما توفيقى إلا بالله عليه توكلت وإليه أنيب))

الحمد لله الذي تفرد بالوحدانية ذاتا وصفة وفعلا من لا إله غيره يعبد بحق وهو المنفرد بالإيجاد و الإعدام.نحمده أبرز العالم من العدم الى الوجود على وفق العلم والإرادة سبحانه تنزه عن كل شريك ونظير وشبيه ومثيل وتنزه عن كل نقص واتصف بكل كمال.

والصلاة و السلام على من لا نبي بعده الناطق بالصدق السراج المنير سيد ولد ادم اجمعين سيدنا محمد من أرسله الله لكافة العالمين بشير و نذيرا وعلى آله سفن النجاة وكواكب أهل الأرض وصحبه أهل العلم والعمل الذين نصروا دين الله بالسيف والمال والأرواح والتابعين لهم بإحسان إلى يوم الدين.

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ABSTRACT

Games industry became one of the most growing markets in IT field everybody have at least one smart device in his home and many games installed in it.

We developed a Sudanese traditional card game called (Hareeg) using Unity3D Game Engine for both computers and android devices, Unity is one of the best and powerful games engines that aim to help programmers and developers to develop the games much faster and more realistic.

We also developed an AI to make the player able to play against it and we aim also we make a simple tutorial that show player How to play and game rules.

المستخلص

ان مجال تصميم الالعاب اصبح من اكثر واسرع مجالات تقنية المعلومات نمواً وتطوراً بسبب انتشار الحواسيب و الهواتف الذكية وزيادة أداء المعالجات الرسومية ووسيلة لنشر ثقافات الشعوب المختلفة.

تم تطوير لعبة الورق السودانية " حريق" بإستخدام محرك الالعاب(Unity3D) للهواتف الذكية (اندرويد) وايضاً لأجهزة الحاسب والذي يعد احد افضل واسرع المحركات والذي يهدف لمساعدة المبرمجين والمصممين في تصميم الالعاب بشكل اسرع واكثر واقعية .
وتتضمن اللعبة ذكاء اصطناعي يمكّن الحاسب من اللعب ضد المستخدم كما تحتوى على برنامج تعليمي (Tutorial) لطريقة اللعب ومعرفة قواعد اللعبة.

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LIST OF KEY TERMS

Term	**Description**
2D	Two-dimension
3D	Three-dimensional
Edutainment	Refers to Education and entertainment, these games are often created with the intention of being placed in a classroom in order to help students better connect and understand traditional subject material, like science, math, and history.
Advergaming	Advergaming refers to the practice of using a video game to advertise a product.
handheld	A handheld game console is a small, portable self-contained video game console with a built-in screen, game controls, and speakers.

LIST OFABBREVIATION

Abbreviation	Meaning
PDAs	personal digital assistants
DOF	degree-of-freedom
AI	artificial intelligence
APIs	application programming interfaces
NPC	non-person controlled
G4C	Games for Change
GDP	Gross Domestic Product
ESA	Entertainment Software Association’s
CCG	collectible card video game
SDK	software development kit
MSIL	Microsoft Intermediate Language
XAML	Extensible Application Markup Language

CHAPTER 1 : INTRODUCTION

1.1 INTRODUCTION

The world of industry and design video games World wide of imagination and ideas which transforms imagination and ideas into real animation also wished for the manufacturer and designer, a world in which the designers and makers of games try to achieve their dreams in front of their eyes they see the truth, but, unfortunately, this wide world is not confined to only those employed in large companies or in a special team to design video games, and most of them probably almost all of them in foreign countries far away from us. We who play their games and come to some of us amazing ideas and perhaps even more amazing each and probably most of us wish to turn these ideas and imagination into reality seen working in front of his eyes .But we Sudanese and others around the world and all of the thought and wished making a video game is unaware of what needs to making a video game, such as those we see are working on the computer, such as:

Windows, Mac and Linux or on the Internet or on a tablet computer, such as: iPad and Windows 8 Tablet Samsung Galaxy Tab or on mobile, such as: IPhone, Samsung Galaxy and BlackBerry

Or on Video game consoles, such as: PlayStation and Xbox and Wii[1].

1.2 PROBLEM BACKGROUND

- Severe shortage suffered by the Sudanese culture, Due to the lack of Published in other countries in the world with desired level.
- Lack of expertise in this field to the lack of sufficient encouragement and support from the authorities Responsible.
- Absence of Sudanese Universities of Games Design curriculum.

1.3 RESEARCH HYPOTHESIS

- Use of modern technologies in the development and design of Games.
- Production of games carrying Sudanese customs and traditions as a model to be deployed globally.
- Providing a suitable environment for innovators in this field and to encourage them to work in.
- Effective participation in global markets and the competition.

1.4 RESEARCH OBJECTS

The main objectives of this research are:

- To learn some of game development
- To enrich the content of the Sudanese in the design of Games
- Learn to develop games with modern game engines
- Inspire interest in history and culture

1.5 RESEARCH SIGNIFICANT

Contribute improving the Sudan content in games design, and the important goal of researches in this trend are to encourage Sudanese developers in the field of game design and dealing with the modern game engines .

1.6 SCOPE OF THIS RESEARCH

Developing a Sudanese traditional card game, that works in windows environment and android smart phones. It can modify them to work in more than one environment.

1.7 STRUCTURE OF THERESEARCH

Research includes in addition to this chapter the following chapters:

- Chapter Two

  In chapter two there have three chapters, in section one the talking will be on general overview of computer games, game history, type of games, game development process, game engine and a video game genres.

  In section two we are talking about games and impact on society, section three literature reviews.
- Chapter Three

  In section 1 we talk about tools and techniques, section 2 a tour of unity main windows.
- Chapter Four

  In this chapter we discuss the analysis of the game.
- Chapter Five

  In this chapter we represent the implementation of “hareeg”.
- Chapter Six

In this chapter we mention the result, recommendation and conclusion.

CHAPTER 2

SECTION 1 : Computer Games

2.1.1 INTRODUCTION

A computer game is an interactive entertainment running on computers, game consoles or some electronic devices, such as mobile phones and PDAs. Typically, a computer game accepts input from game players through keyboard, mouse, joystick or various types of game controllers to let the players control and interact with game objects. On the other hand, a computer game offers game players different forms of feedbacks, including visual, audio and tactile, which are revealed through computer / TV monitor, speaker and force-feedback game controllers, respectively. Technically, developing a computer game is very challenging as it involves not only tremendous artwork furnishings from animators or artists, but more critically, it demands the hard core supports from different disciplines of computer science to address various technical issues. In this section, we will take a look of the development in computer games. In particular, we will discuss the technical issues in game development[2]

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2.1.2 GAME HISTORY

Computer game has a long history, in which we can trace back its root from 1947, when Thomas T Goldsmith Jr and Estle Ray Mann designed the first game for playing on a cathode ray tube in US. Here, we are not intended to elaborate the full computer game history. Instead, we focus on the technological evolution of computer game and technical issues arisen during the change. During 1960s to 1970s, games developed were simple, primitive and mainly in two-dimension (2D). Many games, in particular of different types, were developed. Two of the most unforgettable examples are Space Invaders and Pac-Man. In addition, handheld game devices were also developed, despite most of them are hard coded to run only a single game. For game playing, game players used simple button controllers, keyboards or joysticks to control their game characters. The main forms of feedback were offered through screen displays with limited color and resolution as well as simple sound outputs. In 1980s, there was a major growth in computer game technologies. For hardware, a variety of personal computers and game consoles were developed. For software, three-dimensional (3D) games and network games were first developed. In addition, different forms of input and output devices were developed. These included color monitors, sound cards and various types of gamepads. They offer game players better game feedbacks and greater flexibility in controlling game characters. In 1990s, games developed planted the seeds of today’s game development. Many classic game types, including first-person shooters (FPS), real-time strategy (RTS), daily life simulators and graphical multiplayer games, were developed during this period. Also, there was a trend for developing 3D games. Nowadays, many new games are developed based on these classic games. The major difference of the new games from the classic ones is that the new games are mainly in 3D. Hence, hardware graphics accelerators were urged to develop to support real-time rendering of 3D game content. To take the advantage that human visual sense has a dominate influence of a game player to determine whether a game is good or not, game companies put their very first priority in enhancing the graphics output for their games. They put advanced graphics content, such as high detailed 3D models, texture images and various special effects, into the games. Besides, multimedia elements, such as videos and songs, are also used to enrich the game content.

However, such arrangement increases the complexity of the hardware requirement of running computer games. It also demands the development of efficient algorithms to manage such a variety of game content. To optimize both the man-power and time spent in game development, game developers begin to make use of ready-made game engines, which comprise many useful tools to support general game functions, to build their games. When we go through the history of computer games, we note that during the early stage, games were mainly simple and small. They could be generally handled by simple computation and graphics processing power. Hence, there was not really any stringent requirement putting on the development of these games. Later, when game developers turned their focus to 3D games, working out both hardware and software solutions in supporting real-time rendering of 3D graphics has subsequently become a critical part of game development. Besides, game physics and game artificial intelligence (AI) also played an important part of the games. While game physics provides support to collision detection and motion control of game characters, game AI offers autonomy to the non-person controlled game characters to govern how these characters are behaved in the game environment. Recently, as multiplayer online games begin to dominate the game market, issues including network latency, system scalability and security are turned out consequently. Eventually, these make the game development facing various technological design issues from different disciplines in computer sciences [2].

2.1.3 TYPE OF GAMES

2.1.3.1 2D and 3D Games

Technologically, computer games can be broadly categorized into 2D and 3D games. 2D games generally manage the game environment into a logical 2D space, where the game objects can be moving and interacting around. Practically, a majority of 2D games, such as Pac-Man, Load-Runner and Mario, can be implemented using a simple tile-based concept [3]. It is by partitioning the game environment into cells, which are hosted in a 2D array. Then, different states can be assigned to individual array element to logically represent different game objects and game scene elements in the game environment. When some objects are moving around in the game environment, the corresponding elements of the 2D array are then updated to reflect the change. To render game objects or game scene elements, it can be done as easy as using simple graphics primitives, such as line, point and polygon, or alternatively, using picture images to present the game objects or game scene elements in a more impressive and realistic way.

As the successor of 2D games, 3D games offer greater attractions to game players in terms of game interaction and visual effect. The game environment of such games is hosted in a 3D space. As one more dimension is provided, game players have been offered with a greater degree-of-freedom (DOF) in controlling their game characters and interacting with other game objects. They can also navigate and interact in the game environments with a variety of camera views. In addition, the 3D setting of these games also gives a variety of advanced computer graphics effects a sufficient environment for implementation, which can then be visualized by the game players. Examples of the graphics effects range from some low-level graphics techniques, such as lighting and shadowing, to some high-level graphics techniques, which cover a wide variety of natural phenomenon simulations [4]. In addition, computer animation techniques [5] can also be employed to make the game objects move in a realistic way. Unlike 2D games, which can natively be displayed by most of the 2D display controllers, 3D games need a rendering process to covey 3D game content to present on 2D display devices. In light of supporting interactive game playing, the rendering process must be carried out with a frame rate of 25-60 frames per second, which means 25-60 pictures should be produced within every second for the relevant portion of the game content for display purpose. To support such performance, the rendering process is often needed to carry out by hardware graphics accelerators [2].

2.1.3.2 Multiplayer Online Games

Multiplayer online games have been developed as early as in the late 1980s. The uniqueness of this game type is that it connects people from geographically dispersed locations to a common game environment for game playing. One of the early developed online games was the Modem Wars, which was a simple 2D game designed for the personal computer - Commodore 64. The game connected two game players using modems into a shared game environment. During game playing, game players can interactively move the game items around the game environment to attack any enemy items located within certain pre-defined range. Despite the game design was simple, it set a good starting for the multiplayer online game development.

Nowadays, multiplayer online games become one of the most popular game types. Unlike the old days, instead of running such games on peer computers and connecting the game machines through modems, the new online games are generally hosted in some server machines running on the Internet, which are referred as game servers.

Game players from different geographical locations can connect to the games through some broadband network connections using their preferred game platforms, which can be a computer or a game console. Such game platforms are referred as game clients. The first commercial multiplayer online game of this type was, Meridian 59, published in 1996 by 3DO.

2.1.3.3 Handheld Games

In contrast to computer-based or game console-based games, handheld games are run on machines with small machine size. It allows people to carry along anywhere and play around with it at any time when they are free. Generally, such machines can be referred to dedicated handheld game consoles, personal digital assistants (PDAs) or mobile phones. Due to the hardware limitation, such game devices are often suffered from small in screen size and limited in processing power and storage space, as well as the problem of short battery life. These problems do not only impose difficulties to handheld game development, they also make some people reluctant to play handheld games. Fortunately, these shortcomings have been addressing or have ways to work around during recent years.

The first handheld game console is Tic Tac Toe, which was made in 1972. Similar to most of the early handheld game consoles, it came with one hard-coded game only. This limitation had been lasting until 1979, when the first handheld game console with changeable cartridges, Microvision, was developed. In general, as handheld game consoles at that period were suffered from the problems of small in screen size and limited in battery life, handheld games had not received a truly great success. Until the release of Game Boy from Nintendo [6] in 1989, which came with a monochrome display with improved resolution, used re-chargeable batteries and had a long list of game cartridges for game players to pick and play, handheld games became to attract significant amount of game players. More importantly, Game Boy virtually set the “design standard” for today’s game consoles. In addition, in 1998, the color display version of Game Boy was released to further improve the attractiveness of handheld game consoles. Nevertheless, up till the release of Game Boy and its color display version, as the processing power of the handheld game consoles was still quite limited, most of the games developed for the handheld game consoles were still essentially 2D games.

On the other hand, similar to dedicated handheld game consoles, PDAs and mobile phones are also featured with high mobility, this makes such devices become alternate platforms for handheld games. More importantly, from the business point of view, putting games on essential devices, such as PDA or mobile phones, is favorable as this frees people from investing or carrying addition game devices for entertainment. In addition, mobile phones and modern PDAs also natively come with network capability to provide a critical support for running online games. However, before PDAs and mobile phones become substantial handheld game devices, the technical problems of these devices, such as small in screen size and limited in storage space, which could also be found in dedicated handheld game consoles, must be solved[2].

2.1.4 GAME DEVELOPMENT PROCESS

Nowadays, making a game no longer focuses only on working out the game logic or game features and the graphical display for the game. Depending on the resource availability and the business strategy of a game company, a variety of associated tasks may also involve in the modern game development process. These tasks include game hardware and software development, media construction, localization and even the handling of the cultural and social issues [2]:

2.1.4.1 Game Hardware:

This refers to the development of game consoles and game input / output devices. Such development may usually introduce new attractions to game players. It also offers game companies niches in developing proprietary hardware specific games or obtaining license fee from developers who develop games on such game hardware. However, as developing game hardware usually requires quite a significant amount of investment in terms of man-power, time and money, only large game companies can afford such development.

2.1.4.2 Game Software:

Game software refers to the technical part of the game development process. It involves the development of various game software components, which may include some hard core game functionality, such as game content management and rendering, game animation, game artificial intelligence (AI) and game physics. In addition, it may also involve the development of game networking and game security, which depends on the type of the game for development.

2.1.4.3 Media Construction:

Media construction refers to the artistic part of the game development process. It involves the development of game content by using different types of media, which may include image, 2D/3D graphics model, audio, video and motion capture information. As media offers the presentation of game content, which determines how game players perceive a game, media construction becomes an inevitable part of the game development process. Nowadays, many game companies have been investing a significant amount of resources for the media construction process.

2.1.4.4 Localization:

Localization is the process to turn a computer game into a country or a target market specific version. This helps a computer game to boarder its market share and helps introduce country or market specific attractions to the game players. The localization process can be done as simple as by conveying the language of the user interface and the textual content of a game. In a more complicated way, we may further change the game characters or other game media content to a country or market specific ones. Furthermore, we may even consider altering the storyline of a computer game to suit the culture or custom of the country or target market specific game players

2.1.4.5 Cultural and Social Issues:

During recent years, there is a rising concern in the cultural and social effect of computer games on our human, especially, on the youngsters. On the one hand, more and more people are getting addicted to computer game playing, particularly after the release of multiplayer online games.

This likely has a bad effect to the academic performance of addicted student game players. It may also significantly reduce the amount of time for people to participate in social activities. On the other hand, the release of game titles with violent and sexual game content imposes negative ethical effect to the young people. Although there is not a consensus on the handling of the cultural and social issues of computer games, the game companies should try their best to maintain a good attitude in addressing these issues during the game development process.

2.1.5 GAME ENGINE

Making computer game is a complicated task. From the hardware perspective, when constructing a game, game developers may need to deal with a wide range of hardware and software platforms as well as work hard on a number of game components. More specifically, a computer game may need to be designed running on different game platforms, including computer, game consoles, which are usually controlled by different operating systems.

Even under the same hardware platform, the game may need to be rendered by different graphics accelerators, and relied on different graphics application programming interfaces (APIs) to drive the graphics accelerators.

From the software perspective, when developing a computer game, game developers typically need to work on a number of game components, in which the most essential ones include game content management and rendering, game animation, game artificial intelligence (AI) and game physics. Working out these components generally involves a lot of efforts and is very time consuming.

To minimize the complexity of game development by hiding the differences in various game platforms and help game developers put their focus on developing high level game logics and game features, game engine has been developed, which comprises a set of basic game building blocks and provide a high-level and unified abstraction for both low-level graphics APIs and hardware game platforms. With the help of game engine, the investment of game development, in terms of time, man power and cost, can significantly be reduced. Reputable examples of game engine include Unreal Engine [7]. In practice, there are not any standards or rules to govern the exact game components to be included in a game engine. Game engine developers have a great flexibility to select the appropriate set of components to make their own engines. However, there are some major game components that are essential to most of the games and hence, should better be included to develop a game engine[2]:

- **Game content management and rendering**:

  Game content management and rendering is one of the most core parts of a computer game. It comprises techniques to manage game content in a way to support efficient content retrieval and processes for making the game content to be displayable on the output device of the game. For game content management, most of the game engines adopt a scene graph approach, where the game objects and the graphics primitives are hierarchically maintained with a tree structure. As such tree structure implicitly links up the game objects according to their spatial relationship, this provides sufficient information for a game to pick out closely located game objects to support game rendering and game object interaction evaluation. On the other hand, for game content rendering, particularly when dealing with 3D game content, there will be a significant amount of processes as well as a variety of options to go through for converting game content from the 3D representation into the 2D one for display.

- **Game AI:**

  Game AI [8] is a way to give “lives” to the non-person controlled game characters (NPCs) of the game environment, it directs the way of the NPC to interact with the game environment or other game objects. Putting different game AI to a NPC can assign different behaviors to the NPC. In fact, one of the major reasons for computer game to be so attractive is that game players can find different challenges and funs when play against the NPCs inside the game environment. To implement game AI, two major options are available:

  1. **Reactive techniques** are widely adopted in many computer games, as they are fully deterministic .Examples of these techniques includes scripts, rule-based systems and finite-state machines. Such techniques take in some given game parameters or game states, which are then evaluated through pre-defined rules to produce deterministic results. Practically, reactive techniques are good for implementing high-level tactical decisions.
  2. **Planning techniques**, in contrast, are non-deterministic. From a given situation, multiple actions can be taken depending on the current goal or some

selected factors. A planning algorithm can scan through the possible options and find the sequence of actions that matches the goal or the selected factors. For instance, A* is the most reputable example of planning techniques. Practically, planning techniques are good at helping search best possible path for a game object to navigate in the game environment.

- **Game Physics[9]:**

Game physics is developed based on the laws of physics to govern how each individual game object reacts with the game environment or other game objects. It also offers a way to support the simulation of some natural phenomenon. Typically, the reaction of a game object can be determined using mass, velocity, friction, gravity or some other selected physical properties. In practice, game physics can be natively applied to help generate realistic response for the collision or interaction of the game objects. Alternatively, game physics can be applied to drive the motion of a large amount of tiny particles for simulating some natural phenomenon, such as the flow of smoke and water, fire blaze, snow and cloud.

2.1.6 VIDEOGAME GENRES

Is a specific category of games related by a similar gameplay characteristic .Genres are not usually defined by the actual content of the game or its medium of play, but by its common challenge.

Although computer games mainly provide entertainment and fun, it also improves hand/eye coordination and problem-solving skills. Each game has its own strategy, action and fantasy that make each game unique and interesting .However the classification is a fuzzy concept, as many games are hybrids that fall into more than one class. For example, Doom can be classified either as a maze game or an action game, while Monopoly can be classified as a board game or strategy game. The different types of computer games are briefly described as follows [10]:

2.1.6.1 Card Games

They are computerized versions of traditional card games, or games which are essentially like card games in that they are primarily card-based (such as solitaire). Examples of card games include Blackjack, Bridge, Casino, Solitaire and Video Poker.

2.1.6.2 Board Games

They are adaptations of classic board games. Examples of board games include Chess, Checkers, Backgammon, Scrabble and Monopoly.

2.1.6.3 Puzzles

Puzzle games aim at figuring out of a solution, which often involves solving enigmas, navigation, learning how to use different tools, and the manipulating or reconfiguring of objects. Mastermind and Tetris are examples of puzzle games.

2.1.6.4 Maze

Maze games require the successful navigation of a maze. Mazes can be viewed in different ways. For example, they may appear in an overhead view (as in Pac-Man), or first-person perspective (as in Doom).

2.1.6.5 Fighting

Fighting games involve characters who fight usually hand-to-hand, in one-to-one combat situations. The fighters are usually represented as humans or animated characters. Fighting games include Street Fighter, Avengers and Body Slam.

2.1.6.6 Action

Action games involve the human player shoots at a series of opponents or objects.

Traditional action games include Space Invaders, Asteroids, etc. The recent popular action games are Doom, Quake, Descent, Half-Life and Unreal that involve the human player to control a character in a virtual environment to save the world from the forces of evil by using deadly force.

2.1.6.7 Adventure

Adventure games are different from action games. They emphasize more on the story, plot and puzzle solving rather than simply catching, shooting, capturing, or escaping. The human player must solve puzzles while adventuring. Characters are usually able to carry objects, such as weapons, keys, tools, etc. The settings of these games often evoke a particular historical time period and place, such as the middle ages or Arthurian England, or are thematically related to content-based types such as Science Fiction, Fantasy, or Espionage. Examples of adventure games include Adventure, Zork, Haunted House, Raiders of the Lost Ark and Superman.

2.1.6.8 Role Playing

In role playing games, players can take on different types of character. The character’s description may include specifics such as species, race, gender, and occupation, and may also include various abilities, such as strength and dexterity. In the virtual game world, the player goes on quests, fights monsters and improves the capability of the character on strength and magic. Example games include Diablo, Dungeons & Dragons and Ultima.

Many role playing games are also networked games that allow more than one player to play and interact in the same game world over the network such as the Internet or LAN (Local Area Network). Everquest and Ultima Online are networked role playing games.

2.1.6.9 Strategy

Strategy games emphasize the use of strategy as opposed to fast action or the use of quick reflexes. Traditional strategy games include Chess, Monopoly, and Othello. In recent popular strategy games such as Age of Empire, Warcraft and Close Combat, the player can control many combat units to do battle against one or more opponents. In these games, the player needs to resolve the problem of resource allocation, and organization of defenses and attacks.

2.1.6.10 Sports

Sports games are adaptations of existing real-world sports or variations of them. The most popular sports games include American Football, Baseball, Boxing, Fishing, Soccer, Tennis, Volleyball and Golf.

2.1.6.11 Simulation

There are two types of simulation games: management simulation and training simulation. Management simulation games refer to those games in which players must manage the use of limited resources to build or expand some kind of community, institution or empire. Example management simulation games include Railroad Tycoon; SimAnt, and SimCity. For training simulation games, it refers to games that attempt to simulate a realistic situation, for the purpose of training. Through the game simulation, it helps the player to develop some physical skills, such as steering as in driving and flight simulation games. Example training simulation games include Police Trainer, Gunship and Flight Unlimited.

2.1.6.12 Platform

It is believed that the platform genre began in 1981 with the release of the games Donkey Kong and Space Panic. Games within this genre are usually identified by navigating environments that require timing and jumping in order to reach a destination while avoiding and/or disposing of enemies. Many of these, like Donkey Kong, have a series of screens, each with its own individual pattern of challenges. As companies began to develop platform games for home consoles and computers instead of arcade machines (i.e. Super Mario Bros for the Famicom and Nintendo Entertainment system), they took advantage of the evolving processors and greater memory capacity by transcending individual screens and utilizing actively side-scrolling worlds.

2.1.6.13 Hybrids

It's important to recognize that many games are not limited to a single genre. Some are the combination of two or more game types. In fact, as gaming evolves, we see lines blurred between genres more frequently than not. Since the introduction of 3D gaming, the action/adventure genre has grown dramatically. It is practically a catch-all category that incorporates 3D games with real time combat and puzzle-solving in a fairly cohesive storyline. Many of these games are also first-person-shooters. Some are 3D platform titles. And most survival horror titles qualify as Action/Adventure games too. Another example of a hybrid is Myst. It is both an adventure game and a puzzle game. However, it is most certainly not an Action/Adventure game.

SECTION 2 :Games impact on society

2.2.1INTRODUCTION

The following video game statistics show that games are a more prevalent part of Americans' lives than ever.

Perhaps the most important question, then, is: statistically, who plays video games? The numbers might be surprising[11]. The ESA's 2014 research concludes:

- 59% of Americans play video games.
- There is an average of two gamers in each game playing U.S. household.
- The average U.S. household owns at least one dedicated game console, PC, or Smartphone.
- 51% of U.S. households own a dedicated game console, and those that do own an Average of two.

2.2.2IMPROVING EDUCATION

Educators recognize the impact of entertainment software and utilize games as a teaching device in a growing number of classrooms and business settings. More than just play, games helps impart knowledge, teach life skills, and reinforce positive habits in students of all ages. Video games belonging to a category often called 'edutainment' (education and entertainment) are becoming a growing part of the industry. These games are often created with the intention of being placed in a classroom in order to help students better connect and understand traditional subject material, like science, math, and history.

Games for Change (G4C)[13], created in 2004, is a nonprofit organization that hopes to organize developers, teachers, and gamers in order to create and distribute games meant to serve humanitarian and educational efforts. Though many video games promoted by Games for Change belong to the category of edutainment, they also develop and distribute games for the general gaming populace; games that raise awareness about worldwide issues. Many which explore topics like gender and race, human rights, sanitation, poverty, immigration [12] .

2.2.3IMPROVING HEALTH

The health of people is serious business. In a relatively short time, entertainment software has become a valuable partner in that cause. Computer and video games now serve as tools in the fight to preserve well-being, heal the injured, and train the professionals who respond to medical emergencies.

A March 2014 study from the UnitedHealth Group echoed these findings. Researchers found that giving children active video games to play while they follow a weight management program boosts their moderate and vigorous activity levels. The kids who played active video games also lost more weight than children who only followed the weight management program [14].

2.2.4IMPROVING THE ECONOMY

The video game industry is one of the fastest growing sectors in the U.S. economy. According to research firm Gartner, global video game sales will reach $111.1 billion by 2015. In 2013, computer and video game companies posted strong overall sales in the United States, with revenues exceeding $21 billion as entertainment software companies delivered well-paying jobs and revenue to state and local economies across the nation. Worldwide, sales in 2013 topped $93 billion, according to Gartner, due in part to the growth in mobile game play and the release of the eighth generation of game consoles [15].

2.2.4.1 Industry Sales

In 2013, video game companies sold 160 million units, leading to an astounding $15.4 billion in software revenue and $21.53 billion overall. Seventeen years earlier, the U.S. entertainment software industry accounted for a modest 74.1 million units sold and $2.6 billion in sales revenue.

The nation's growing appetite for video game content also sparked sales of consoles and related accessories, which generated more than $6.1 billion in 2013. These consoles enable consumers to enjoy their favorite games and allow them to access and enjoy other forms of entertainment media. PlayStation's PS Network, Microsoft's Xbox Live, and the Nintendo Network boast a total of approximately 142 million users, and each major console is increasingly serving as a home entertainment hub. Microsoft Xbox Live supports hundreds of titles and offers more than 35 different music, TV, and movie services including Netflix, YouTube, ESPN, and HBO Go.

2.2.4.2 U.S.Economic Impact

A study conducted by Economists Incorporated, Video Games in the 21st Century: The 2014 Report, detailed the impact that computer and video game companies have on America's economy. The report stated:

- From 2009 to 2012, the interactive entertainment software industry grew at an annual rate of nearly 10 percent. Over the same period, the entire U.S. economy only grew by 2.4 percent.
- The video game industry added nearly $6.2 billion to the U.S. Gross Domestic Product (GDP) in 2012.

The U.S. video game industry also continues to function as a vital source of employment. Currently, video game companies directly and indirectly employ more than 146,000 people in 36 states. The average compensation for direct employees is $94,747, resulting in total national compensation of more than $4 billion.

2.2.5IMPROVING ART

Today, video games are not only works of art themselves – they influence other art forms. Games now show on big screens at movie theatres and earn recognition at film festivals; composers of game scores are now nominated for Grammys; and acclaimed film and television directors are entering the world of video game design.

In 2012, the Smithsonian Institution's American Art Museum opened "The Art of Video Games," an exhibition showcasing the evolution of video games as an artistic medium, with a focus on striking visual effects and the creative use of technologies. The exhibition is currently on a tour of 10 U.S. cities, including Boca Raton, Florida; Seattle, Washington; Phoenix, Arizona; and Syracuse, New York, which will continue through 2016. The Smithsonian added that game company's Flower and Halo 2600, a version of Microsoft's iconic Halo game designed for the Atari 2600, to its permanent collection as well.

The recognition of video game art has also spread to the U.S. government. The National Endowment for the Arts, a federal agency that supports artists and art organizers across the U.S., includes interactive games among projects that are eligible for “Arts in Media” grants, along with media produced for the Internet and interactive and mobile technologies[16].

2.2.6GAMES AND FAMILY LIFE

The generation that grew up playing the Atari and humming the tune of Nintendo’s Super Mario Brothers has entered adulthood, and many have children of their own. As this generation and the video game industry mature, these men and women are continuing to play video games – and their children and parents are joining them[17].

2.2.6.1 FUN FOR EVERY GENERATION

According to the Entertainment Software Association’s (ESA), the average gamer is 31 years old and has been playing for 14 years. Industry research reveals some other interesting demographic facts about gamers:

- Women – 48 percent of all players are women. Adult women represent a greater portion of the game-playing population (36 percent) than boys age 17 or younger (17 percent).
- Social – 62 percent of gamers play games with others either online or in person. Of those, 77 percent play with others at least one hour per week. A majority of gamers play games with their friends or family members: 18 percent play with parents, 42 percent play with friends, 14 percent play with their spouse or significant other, and 32 percent play with other family members.
- Mobile – 44 percent of gamers play games on their smartphone, and 33 percent play on their wireless device.

2.2.6.2 MONITORING VIDEO GAME CONTENT

Parents take an active role in reviewing the computer and video games their children play. According to ESA’s research, 95 percent of parents pay attention to the content of the games their children play, and 91 percent are involved in the purchase or rental of games.

Many parents also take advantage of parental controls that are included in game consoles, and 87 percent of parents believe that the parental controls available on all new video game consoles are useful. For example, on Sony's handheld PlayStation Vita and its PlayStation 4 console, parents can block games and movies they do not want their children to view[18].

2.2.7GAMES AND ADVERTISING

As the video game playing population expands and diversifies, in-game advertisements and advergames are expanding as well.

2.2.7.1 DYNAMIC ADVERTISING

Advances in technology now allow in-game advertising to be more interesting and entertaining. Many of today's in-game ad campaigns use dynamic advertising, which can be changed over time and tailored to geographical location or time of day, allowing more flexibility for time-critical campaigns.

Dynamic advertising also allows ad companies to track and receive information from a player's console about the advertisement. Advertisers can record data such as time spent looking at the advertisements, the most-viewed advertisements and viewing angles to determine the most successful ads, which provides valuable insights for future campaigns[19].

2.2.7.2 ADVERGAMING

Advergaming refers to the practice of using a video game to advertise a product. Usually, the games feature a company's products. According to Jupiter Media Metrix Research, 50 percent of recipients who receive an advergame will play it for an average of 25 minutes.

Food and beverage companies also use video game advertising to attract customers. Kraft Foods launched an online social game, 'What's Your Hunger Tude', to market its new product "Ritz Crackerfuls" to a younger market. The choose your own adventure-style game takes about 90 seconds to play and encourages players to share their experience to their friends, further increasing Kraft's reach.

Section 3 : Literature Review

2.3.1 INTRODUCTION

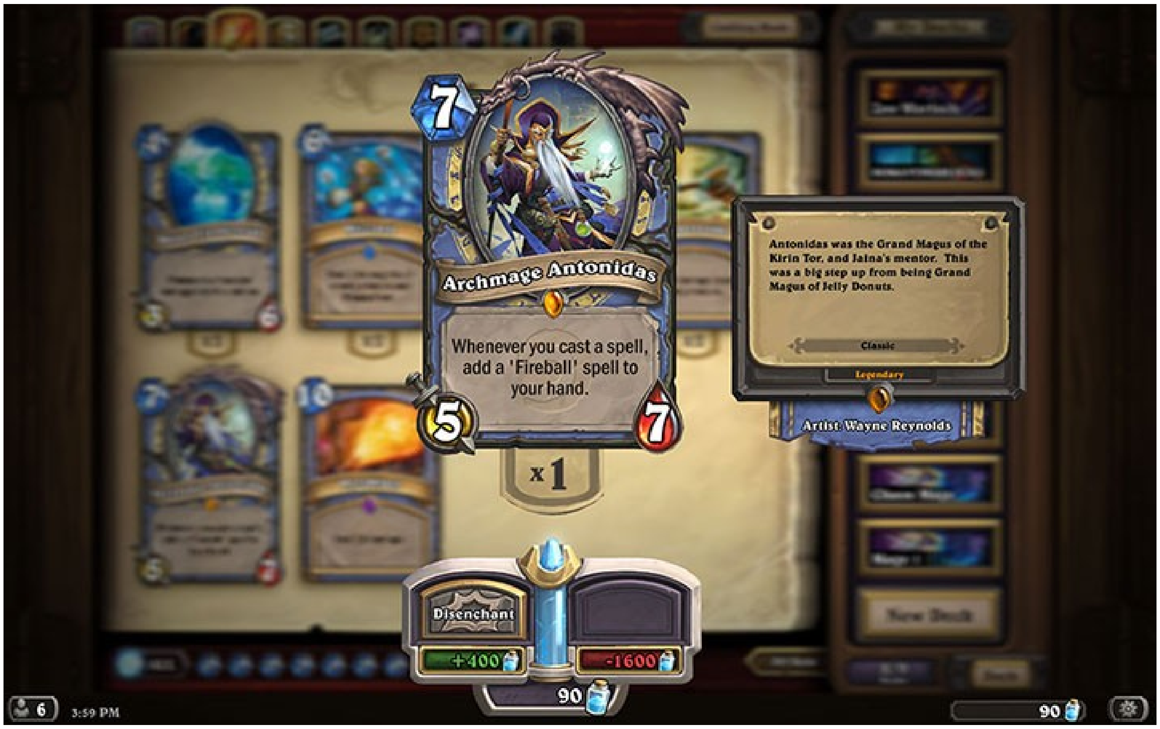
There are a lot of games and programs that produced using the unity3D games engine mostly in the United States, China, India and Europe, and some of these games companies gain high profits and the valuable prizes.In this section we'll show some of these studies as models for the use of this engine

2.3.2 RUMMY

Rummy is a type of card game played with 2,3 or 4 players. It involves a full deck of 52 cards with the order of the cards being A,2,3,4,5,6,7,8,9,10,J,Q,K. normally you play until the first person gets 500 points , but you can play to whatever point you want to[20] .

2.3.3 HEARTHSTONE: HEROES OF WARCRAFT

Hearthstone: Heroes of Warcraft is a collectible card video game (CCG), also developed and published by Blizzard Entertainment, released worldwide on March 11, 2014. Hearthstone builds upon the lore of the Warcraft series, using characters, creatures, and relics from the series. Initially released for Microsoft Windows and OS X personal computers, Hearthstone also supports iOS and Android devices, and features cross-platform play, allowing users on any device to compete with each other, restricted only by geographical region account limits.



Whenever you cast a spell, add a 'Fireball' spell to your hand.

Antonidas was the Grand Magus of the Kirin Tor, and Jaina's mentor. This was a big step up from being Grand Magus of Jelly Donuts.

Figure 2.1: Hearthstone: Heroes of Warcraft [21].

2.3.4 TEMPLE RUN TRILOGY

Temple Run Trilogy is a set of three games made for mobile platforms iOS, Android and Windows Phone, where the player basically does only one thing – runs away from things. First published in 2011, the game became an instant hit. In the game, a player has stolen a treasure from a temple, and now has to run away from "demonic monkeys" who are after him, trying to get it back. Talk about Indiana Jones

The game is endless, meaning the player either falls off the temple, or gets eaten by the monkeys. The goal is to last as long as you can.

Figure 2.2: Temple Run[22].

2.3.5 CALL BREAK

Call Break is a strategic trick-based card game played by four players with a standard deck of 52 playing cards. The game is widely popular in Nepal and some places in India.
In Call Break the term "hand" is used instead of trick, and "Call" is used instead of bid. After each deal player have to make a "Call" or "bid" for the number of hands he/she can capture, and the objective is to capture at least that many hand in a round, and try to break other player i.e. stop them from getting their Call. After each round, points will be calculated and after five rounds of play each players five rounds points will be added as a total points and player with highest total point will win.
Call break supports iOS and Android devices and web player.

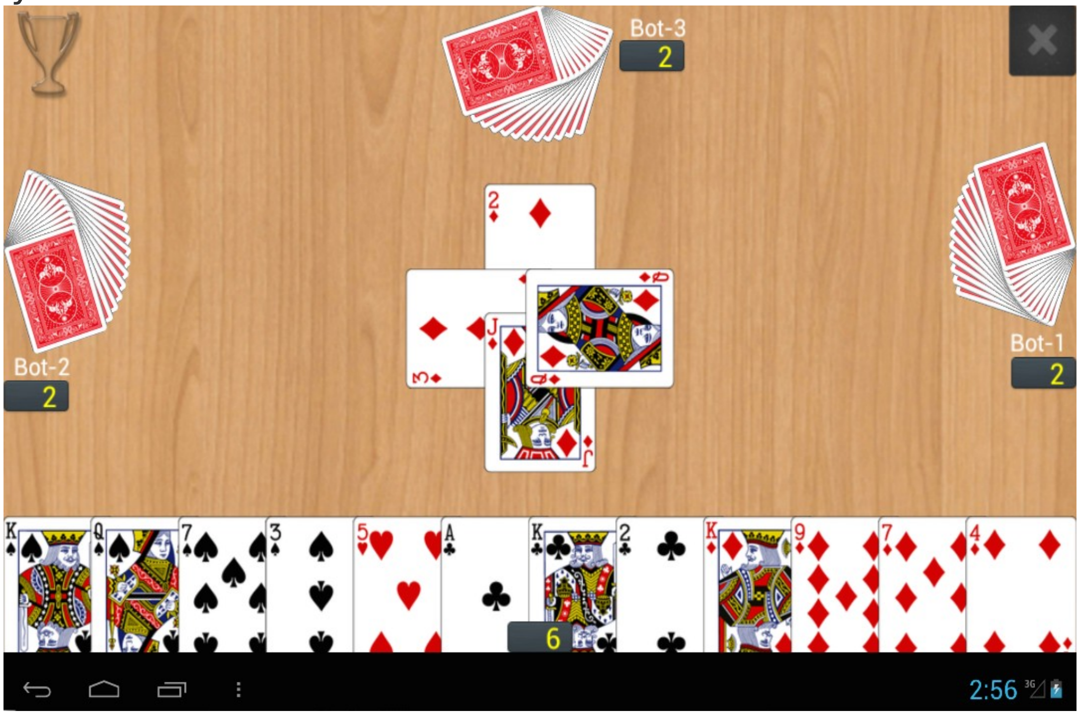


Figure 2.3: Call Break [23].

2.3.6 KERBAL SPACE PROGRAM

Kerbal Space Program (KSP) is a space flight simulation video game developed and published by Squad for Microsoft Windows, OS X, Linux, PlayStation 4, Xbox One, and Wii U. The game revolves around Kerbals, little green humanoid aliens, who build space ships to get into orbit, or to land on other planets. It focuses on real physics, meaning constructing a proper space ship and sending it to outer space is an extremely challenging and fun task, the game offers hours and hours of great fun.

Figure 2.4: Kerbal Space Program [24].

CHAPTER 3 : TOOLS AND TECHNIQUES,UNITY MAIN WINDOWS

SECTION 1: TOOLS AND TECHNIQUES

3.1.1 INTRODUCTION

This chapter discusses the tool and technologies used in the study.

3.1.2 UNITY

Unity is a cross-platform game engine developed by Unity Technologies and used to develop video games for PC, consoles, mobile devices and websites. First announced only for OS X, at Apple's Worldwide Developers Conference in 2005, it has since been extended to target 21 platforms.It is the default software development kit (SDK) for the Wii U.

3.1.2.1 What Unity Is

Unity is a 2D/3D engine and framework that gives you a system for designing game or app scenes for 2D, 2.5D and 3D. I say games and apps because I've seen not just games, but training simulators, first-responder applications, and other business-focused applications developed with Unity that need to interact with 2D/3D space. Unity allows you to interact with them via not only code, but also visual components, and export them to every major mobile platform and a whole lot more—for free. (There's also a pro version that's very nice, but it isn't free. You can do an impressive amount with the free version.) Unity supports all major 3D applications and many audio formats, and even understands the Photoshop .psd format so you can just drop a .psd file into a Unity project. Unity allows you to import and assemble assets, write code to interact with your objects, create or import animations for use with an advanced animation system, and much more[25].

3.1.2.2 What Unity Isn't

Unity by default isn't a system in which to design your 2D assets and 3D models (except for terrains). You can bring a bunch of zombies into a scene and control them, but you wouldn't create zombies in the Unity default tooling. In that sense, Unity isn't an asset-creation tool like Autodesk Maya or 3DSMax, Blender or even Adobe Photoshop. There's at least one third-party modeling plug-in (ProBuilder), though, that allows you to model 3D components right inside of Unity; there are 2D world builder plug-ins such as the 2D Terrain Editor for creating 2D tiled environments, and you can also design terrains from within Unity using their Terrain Tools to create amazing landscapes with trees, grass, mountains, and more[25].

3.1.2.3 Characteristics

3.1.3.1 Unity3D give the developers just about everything they need to build games in one packages. Unity 3D's Pro edition is $1500 per user; there's also free version with bit functionality, but can still be used to build and sell games.

3.1.3.2 Unity Technology may be an unsung name among the general public, but game developers know that it is the most widely used and fastest growing game development platform available today. Big game titles including "Fallout Shelter," "Temple Run," "Monument Valley," "BattlestarGalactica Online," "Assassin's Creed: Identity" and "Hearthstone: Heroes of Warcraft" are made with Unity.

3.1.3.3 Unity decreases the necessary complexity of game code and also increases developer comfort and capability primarily because it’s based on the high level programming language C#.

3.1.3.4 Uinty3D is that it's crazy fast. I'm not talking about performance here, but about development speed. You have:

- Unified asset pipeline. No need to spend time on resource subsystem at all, no buggy import routines to write and fix: just drop a file into folder, and it works.
- Integrated level editor. No need to spend time on level tools: just get straight to business.
- Great tweaking and debugging support: all your gameplay variables are shown right as you play, and can be changed on the fly too - and all this without writing a single line of code. Pause the game anytime, or step through code one statement at a time.
- Quite comprehensive library of ready-made components. Rendering, sound, physics, controls - a lot of "boilerplate" code is already written.
- Mono as a script host. While one can argue about merits of C# as a language, Mono's base class library offers a wealth of functions. Collections, I/O, multithreading, and insanely expressive LINQ all speed up development considerably.

3.1.3.5 Another reason Unity has become so popular is its ability to deploy to a wide variety of target platforms, using the same code and assets.Unity currently supports four main categories: Mobile, Desktop, Web and Consoles. For mobile devices, Unity can build for iOS, Android, BlackBerry and Windows Phone 8. On the desktop, executables can be created for Windows, Widows Store, Mac OS X and Linux (explicitly supported on Ubuntu, but known to work fine on other distributions).

3.1.3.6 Unity's Growing Market

Unity is increasing our market share in the rapidly growing gaming industry, generating Unity’s massive expansion in real terms. The key mobile gaming market, which Unity continues to expand into and dominate, is growing even faster.

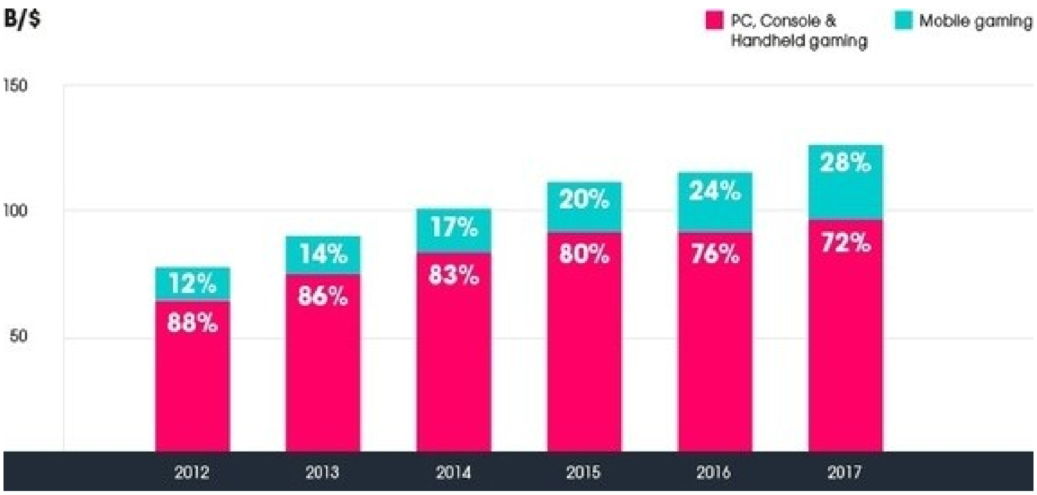


Figure 3.1: Video game market revenue worldwide, 2011-2017, US$ billions[26].

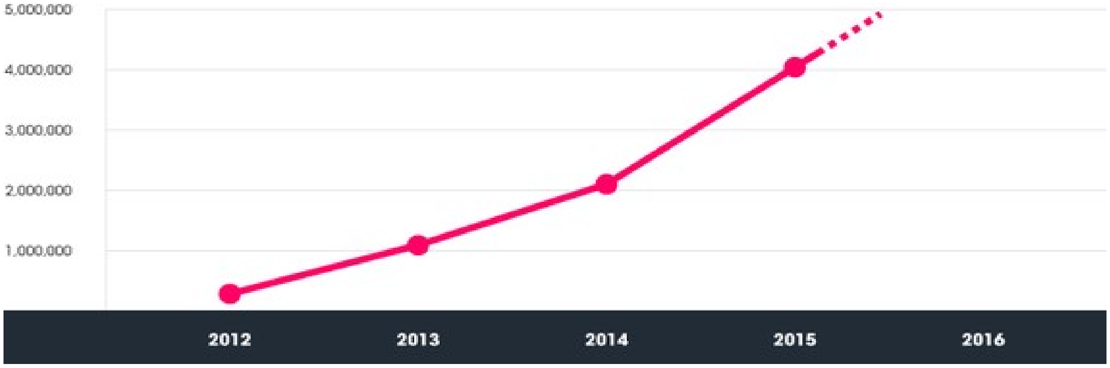


Figure 3.2: Registered Unity developers - 2012-2015[27].

3.1.3.7 Thirty-four percent of top games are made with Unity

The Unity game engine is far more popular amongst developers than any other third-party game development software. The proportion of developers relying on Unity as their primary development tool and using Unity is growing all the time.

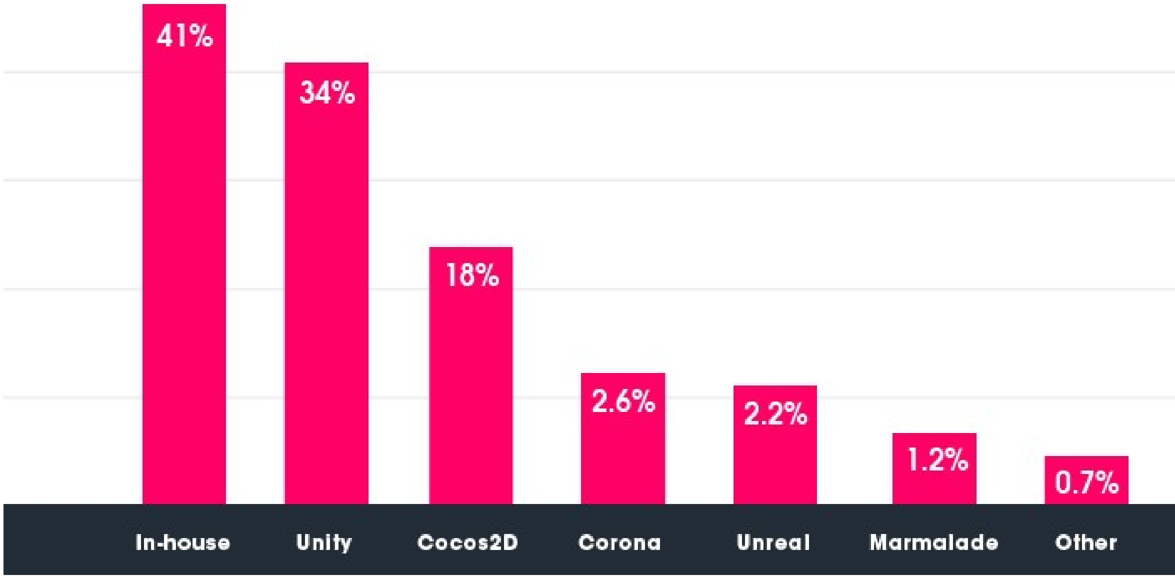


Figure 3.3: **34% of top 1000 free mobile games are Made with Unity [27].**

Unity customers include Coca-Cola, Disney, Electronic Arts, LEGO, Microsoft, NASA, Nexon, Nickelodeon, Square Enix, Ubisoft, Obsidian, Insomniac and Warner Bros. From large and small studios to independent professionals, more and more developers are moving to Unity.

3.1.3 C#

C# (pronounced "C sharp") is a programming language that is designed for building a variety of applications that run on the .NET Framework. is an elegant and type-safe object-oriented language that enables developers to build a variety of secure and robust applications that run on the .NET Framework. You can use C# to create Windows client applications, XML Web services, distributed components, client-server applications, database applications, developing video games , C# can only be used to develop games that are played on Microsoft platforms or Windows platforms, and much, much more.

3.1.3.1 Characteristics

1. C# has got rid of the complexities and problems of languages such as Java and C++ .
2. C#, as part of the .NET framework, is compiled to Microsoft Intermediate Language (MSIL), which is a language similar to Java's bytecode. MSIL allows C# to be platform independent and runs using just in time compiling. Therefore programs running under .NET gain speed with repeated use. Furthermore, because the other languages that make up

the .NET platform (including VB and Cobol) compile to MSIL, it is possible for classes to be inherited across languages. The MSIL, like bytecode, is what allows C# to be platform independent.

Unity is based on Mono, which is a public domain version of C#.

3.1.4 VISUAL STUDIO IDE

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services.

3.1.4.1 Characteristics

1. Is a suite of tools for creating software, from the planning phase through UI design, coding, testing, debugging, analyzing code quality and performance, deploying to customers, and gathering telemetry on usage. These tools are designed to work together as seamlessly as possible.
2. Supports IntelliSence technology, IntelliSense is Microsoft's implementation of code completion .These features help you to learn more about the code you are using, keep track of the parameters you are typing, and add calls to properties and methods with only a few keystrokes [28].
3. You can use Visual Studio to create many kinds of applications, from simple store apps and games for Mobile clients, to large, complex systems that power enterprises and data centers. You can create
    - Apps and games that run not only on Windows, but also Android and iOS.
    - Websites and web services based on ASP.NET, JQuery, AngularJS, and other popular frameworks
    - Games and graphics-intensive applications for a variety of Windows devices, including Xbox, using DirectX.

3.1.5 ADOBE PHOTOSHOP

Adobe Photoshop is an image editing software developed and published by Adobe Systems for Windows and OSX. Photoshop is considered one of the leaders in photo editing software. The software allows users to manipulate, crop, resize, and correct color on digital photos. The software is particularly popular amongst professional photographers and graphic designers.

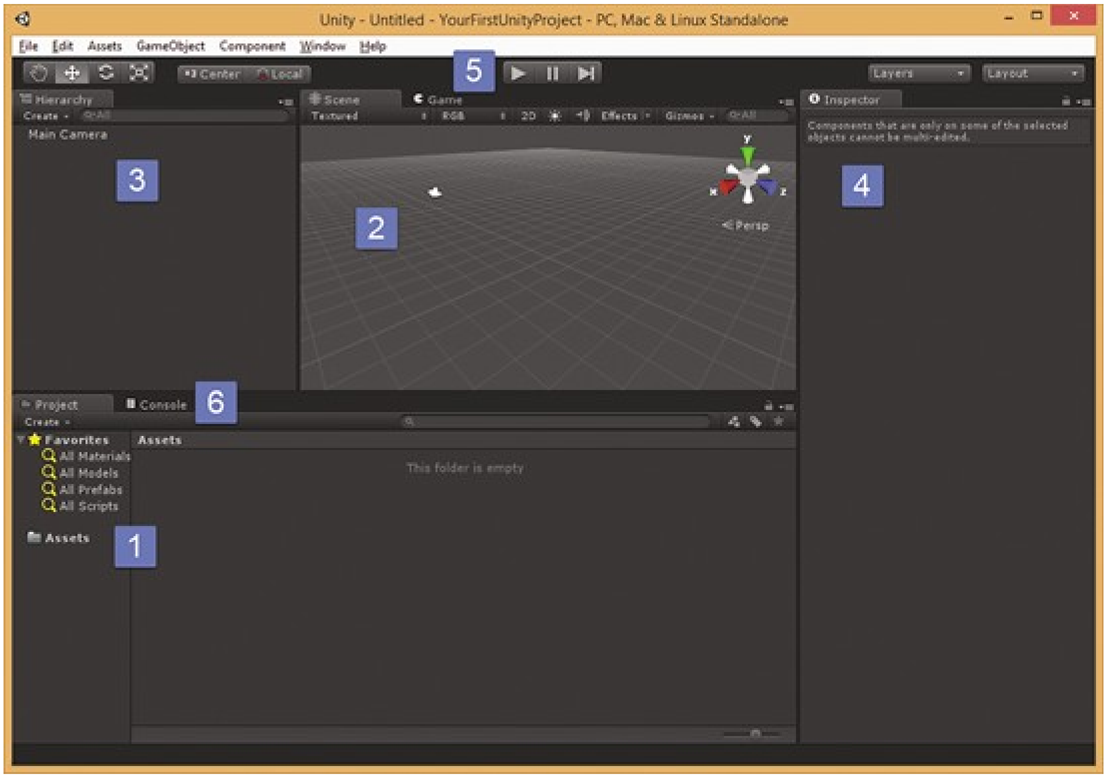
3.1.6 PENCIL

A simple progam that help drawing diagrams like flow charts ,use cases,etc. and websites and mobile application UI prototypes.

SECTION 2 :UNITY MAIN WINDOWS

3.2.1 The Main Windows

This section provides a tour of the most common editor windows, and how to make use of them.



Components that are only on some of the selected objects cannot be multi-edited.

This folder is empty

Figure 3.4:The Default Unity Window

3.2.1.1 The Project Windows (1)

All the files in your project .You can drag and drop from Explorer into Unity to add files to your project.

Project Structure and Importing Assets

Unity projects aren't like Visual Studio projects. You don't open a project file or even a solution file, because it doesn't exist. You point Unity to a folder structure and it opens the folder as a project. Projects contain Assets, Library, ProjectSettings, and Temp folders, but the only one that shows up in the interface is the Assets folder, which you can see in Figure 3.5

The Assets folder contains all your assets—art, code, audio; every single file you bring into your project goes here. This is always the top-level folder in the Unity Editor. But make changes only in the Unity interface, never through the file system.

The Library folder is the local cache for imported assets; it holds all metadata for assets. The ProjectSettings folder stores settings you configure from Edit | Project Settings. The Temp folder is used for temporary files from Mono and Unity during the build process.

I want to stress the importance of making changes only through the Unity interface and not the file system directly. This includes even simple copy and paste. Unity tracks metadata for your objects through the editor, so use the editor to make changes (outside of a few fringe cases). You can drag and drop from your file system into Unity, though; that works just fine.

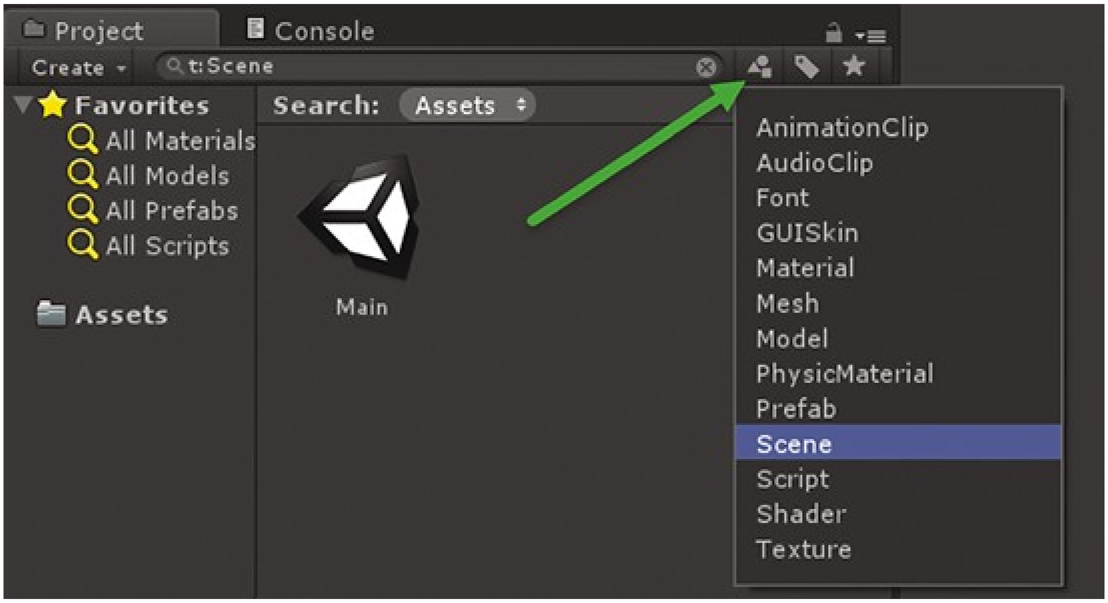
3.2.1.2 The Scene View (2)

The currently open scene. Of important mention is the Game tab next to the Scene tab. This tab activates when you click play and your game starts to run in this window. This is called play mode and it gives you a playground for testing your game, and even allows you to make live changes to the game by switching back to the Scene tab. Be very careful here, though. While the play button is highlighted, you're in play mode and when you leave it, any changes you made while in play mode will be lost. I, along with just about every Unity developer I've ever spoken with, have lost work this way, so I change my Editor's color to make it obvious when I'm in play mode via Edit **|** Preferences **|** Colors **|** Play mode tint.

About Scenes

Everything that runs in your game exists in a scene. When you package your game for a platform, the resulting game is a collection of one or more scenes, plus any platform-¬dependent code you add. You can have as many scenes as you want in a project. A scene can be thought of as a level in a game, though you can have multiple levels in one scene file by just moving the player/camera to different points in the scene. When you download third-party packages or even sample games from the asset store, you typically must look for the scene files in your project to open. A scene file is a single file that contains all sorts of metadata about the resources used in the project for the current scene and its properties. It's important to save a scene often by pressing Ctrl+S during development, just as with any other tool.

Typically, Unity opens the last scene you've been working on, although sometimes when Unity opens a project it creates a new empty scene and you have to go find the scene in your project explorer. This can be pretty confusing for new users, but it's important to remember if you happen to open up your last project and wonder where all your work went! Relax, you'll find the work in a scene file you saved in your project. You can search for all the scenes in your project by clicking the icon indicated in Figure 3.5 and filtering on Scene.


t:Scene

Search: Assets

Figure 3.5 **Filtering Scenes in the Project**

In a scene, you can’t see anything without a camera and you can’t hear anything without an Audio Listener component attached to some GameObject. Notice, however, that in any new scene, Unity always creates a camera that has an Audio Listener component already on it.

3.2.1.3 The Hierarchy Windows (3)

All the game objects in the scene. Note the use of the term GameObjects and the GameObjects dropdown menu.

The All-Important GameObject

Virtually everything in your scene is a GameObject. Think of System.Object in the .NET Framework. Almost all types derive from it. The same concept goes for GameObject. It’s the base class for all objects in your Unity scene. All of the objects shown in **Figure 3.6** (and many more) derive from a GameObject.

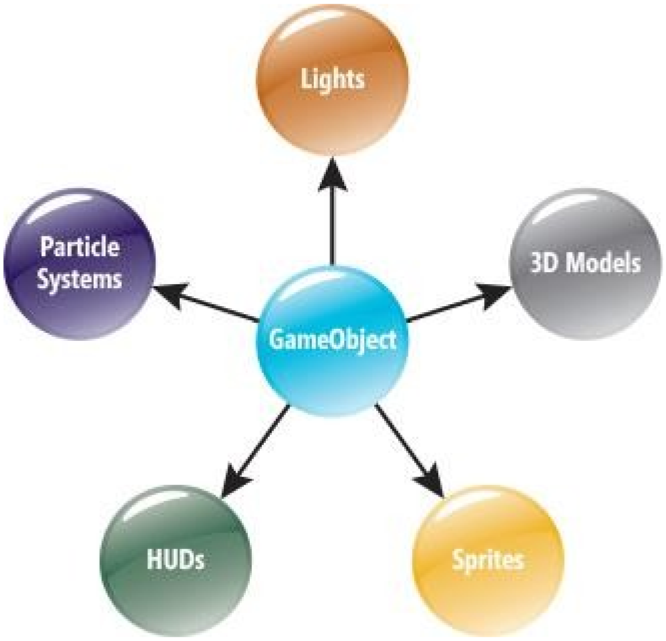
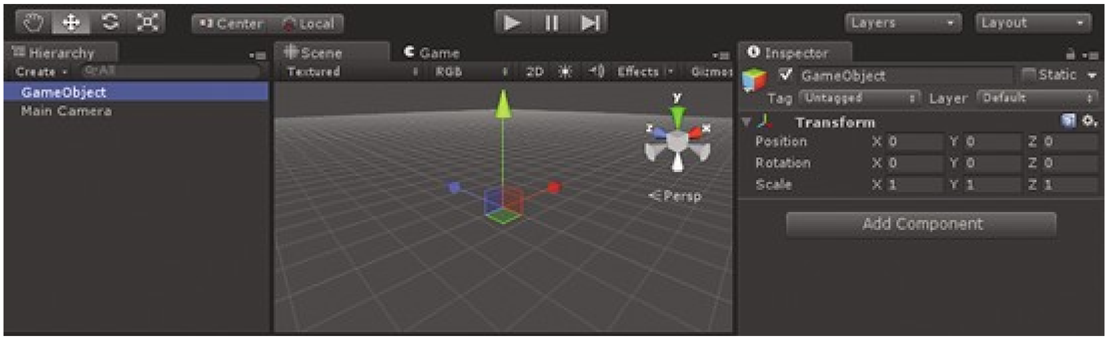


Figure 3.6GameObjects in Unity

A GameObject is pretty simple as it pertains to the Inspector window. You can see in Figure 3.7that an empty GameObject was added to the scene; note its properties in the Inspector. GameObjects by default have no visual properties except the widget Unity shows when you highlight the object. At this point, it's simply a fairly empty object.



GameObject
Main Camera

☑ GameObject

Tag Untagged Layer Default

Transform

Position	X 0	Y 0	Z 0
Rotation	X 0	Y 0	Z 0
Scale	X 1	Y 1	Z 1

Figure 3.7**: A Simple GameObject**

A GameObject has a Name, a Tag (similar to a text tag you'd assign via a FrameworkElement.Tag in XAML or a tag in Windows Forms), a Layer and the Transform (probably the most important property of all).

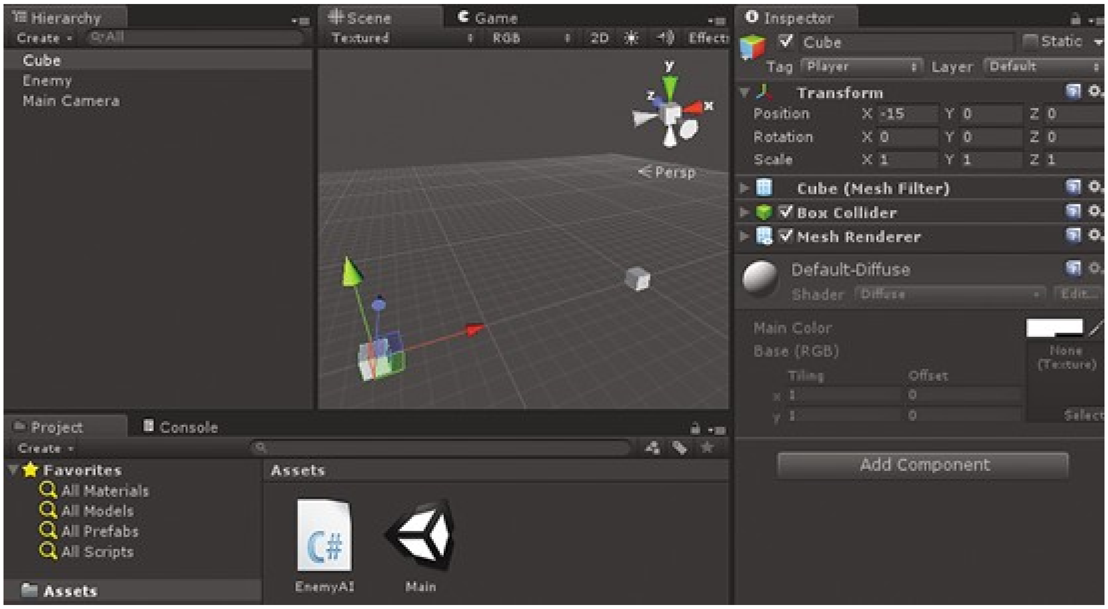
The Transform property is simply the position, rotation and scale of any GameObject. Unity uses the left-hand coordinate system, in which you think of the coordinates of your computer screen as X (horizontal), Y (vertical) and Z (depth, that is, coming in or going out of the screen).

In game development, it's quite common to use vectors, which I'll cover a bit more in future articles. For now, it's sufficient to know that Transform.Position and Transform.Scale are bothVector3 objects. A Vector3 is simply a three-dimensional vector; in other words, it's nothing more than three points—just X, Y and Z. Through these three simple values, you can set an object's location and even move an object in the direction of a vector.

3.2.1.4 The Inspector Windows (4)

The components (properties) of the selected object in the scene .Components You add functionality to GameObjects by adding Components. Everything you add is a Component and they all show up in the Inspector window. There are MeshRender and SpriteRender Components; Components for audio and camera functionality; physics-related Components (colliders and rigidbodies), particle systems, path-finding systems, third-party custom Components, and more. You use a script Component to assign code to an object. Components are what bring your GameObjects to life by adding functionality, akin to thedecorator pattern in software development, only much cooler.

I'll assign some code to a new GameObject, in this case a simple cube you can create via GameObject | Create Other | Cube. I renamed the cube Enemy and then created another to have two cubes. You can see in Figure 3.8 I moved one cube about -15 units away from the other, which you can do by using the move tool on the toolbar or the W key once an object is highlighted.



☑ Cube
Tag Player Layer Default

Position	X -15	Y 0	Z 0
Rotation	X 0	Y 0	Z 0
Scale	X 1	Y 1	Z 1

Default-Diffuse
Shader Diffuse
Main Color
Base (RGB) None (Texture)

	Tiling	Offset
x	1	0
y	1	0

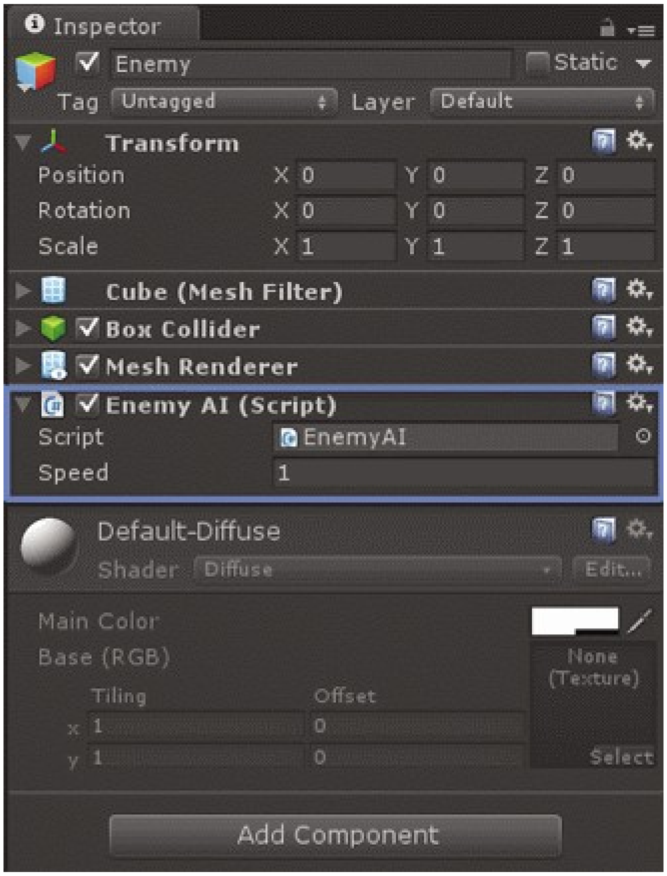
Figure 3.8:Current Project with Two Cubes

The code is a simple class that finds a player and moves its owner toward it. You typically do movement operations via one of two approaches: Either you move an object to a new position every frame by changing its Transform.Position properties, or you apply a physics force to it and let Unity take care of the rest.

Doing things per frame involves a slightly different way of thinking than saying "move to this point." For this example, I'm going to move the object a little bit every frame so I have exact control over where it moves. If you'd rather not adjust every frame, there are libraries to do single function call movements, such as the freely available iTween library.

The first thing I do is right-click in the Project window to create a new C# script called EnemyAI. To assign this script to an object, I simply drag the script file from the project view to the object in the Scene view or the Hierarchy and the code is assigned to the object. Unity takes care of the rest.

Figure 3.9shows the Enemy cube with the script assigned to it.



☑ Enemy □ Static
Tag Untagged Layer Default

Transform
Position X 0 Y 0 Z 0
Rotation X 0 Y 0 Z 0
Scale X 1 Y 1 Z 1

Cube (Mesh Filter)
☑ Box Collider
☑ Mesh Renderer
☑ Enemy AI (Script)
Script EnemyAI
Speed 1

Default-Diffuse
Shader Diffuse

Main Color
Base (RGB)
Tiling Offset
x 1 0
y 1 0
None (Texture)

Figure 3.9**The Enemy with a Script Assigned to It.**

3.2.1.5 The Toolbar (5)

To the far left are Pan, Move, Rotate, Scale and in the center Play, Pause, Advance Frame. Clicking Play plays the game near instantly without having to perform separate builds. Pause pauses the game, and advance frame runs it one frame at a time, giving you very tight debugging control.

3.2.1.6 The Console (6)

This window can become somewhat hidden, but it shows output from your compile, errors, warnings and so forth. It also shows debug messages from code; for example, Debug.Log will show its output here.

CHAPTER 4 : HAREEG GAMEPLAY AND AI ANALYSES

4.1 Hareeg Game Play Description And Analyses

The game consist of multiple rounds every round start by each player (com and the player) draw 14 card and the player will draw an extra card , the main goal of the game is to try to discard all the cards in your hand (player hand) to the down slots before the opponent (AI) do , in order to do that there are some rules you should play by them because if you break any rule you will get a fault that may end up making you lose the hole match .

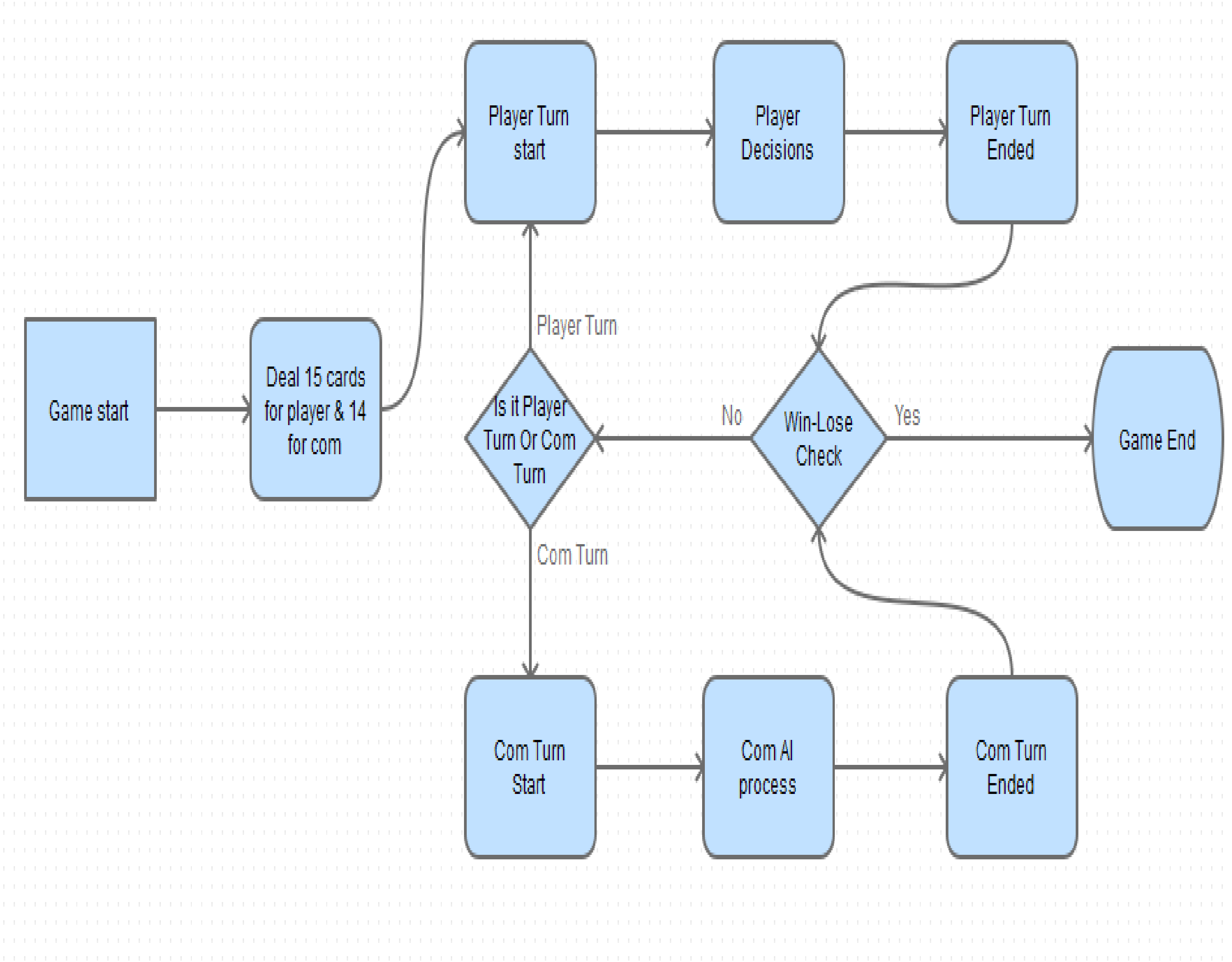


Figure 4.1 Play Flow & Game State Loop

After each round the game count each player current score, the score determined by counting the cards left in each round end, example: if the opponent had 4 cards left in his hand then his score will be 4 this round and if he win the next round he we get a (-1) so his score will be 3 and if he made a (fault) his score goes up (+3) in this case he will be 6. To win the match you should keep your score below (31) the first player reach 31 will considered a loser (burned) and the other player will declared winner.

There are so many rules that are beyond the scope of this research and we covered it in (Game Tutorial) inside the game.

4.2 Analysis of Hareeg AI

4.2.1 Game Theory:

Definition: A game is said to be a game of perfect information if every player has enough information to compute all possible games from the current game state (all combinations of legal moves leading to the end of the game). (A game without perfect information is said to have imperfect information).

Example: The game of Chess is of perfect information whereas the game of trumps is not as no player can see which cards are in another player's hand and therefore cannot compute which moves will be legal by the next player.

Definition: A game is said to be deterministic if there is no element of chance involved in the game. (A game is non-deterministic if there is an element of chance)

Example: Chess is a deterministic game whereas backgammon is non-deterministic. [29]

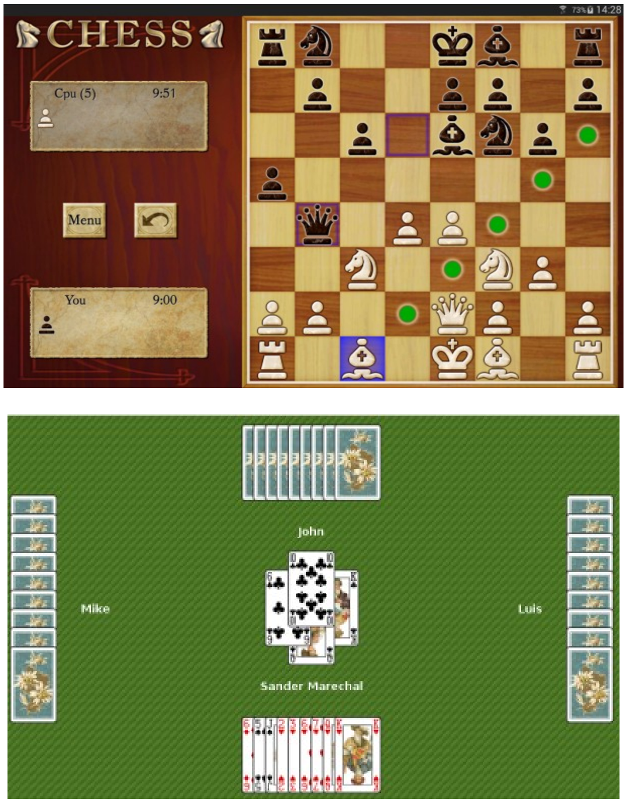


Figure 4.2Perfect information VS Imperfect information

4.2.1 Applications and Limitations of Perfect Information Games

Game Playing has been viewed as important to AI as the techniques which arise from it are applicable in other areas. For example, the techniques employed to play a game of Chess successfully. However, these usually have very specific use cases meaning that whenever something new is needed the algorithm must be tailored to the job in hand. For this reason General Game Playing is seen as important. If we can find an algorithm which adapts to the task at hand then surely this can be applied in other areas and as it is much more general, one solution should cover a much wider collection of tasks.[29]

4.2.2 General Game Playing with Imperfect Information

Any card game where players have hands which are unseen by the other players are imperfect information games. In fact most card games involve some degree of imperfect information. Therefore this project requires General Game Playing with imperfect information..[29]

4.2.3 Hareeg AI

As we said earlier most cards games are (non-deterministic & Imperfect Information) game , so the AI is consist of rules and statistical probability functions based what information the computer AI know from the playground ex : (Com Hand , player down zone slots , throw zone).

The things that the computer wouldn't know are what cards does the player have in his hand? And what card he will draw next form the deck? , so it's matter of chance and probability to know what the next card is.

This is an example of the probability in the game (see Figure 4.3) is that there are 4 cards only from the same one deck that have same face and different suits, so there is only one King and his suit is diamond left ether in the deck or has already been thrown by the player or Ai or the computer Ai already have this card (King of diamond's) in his hand.

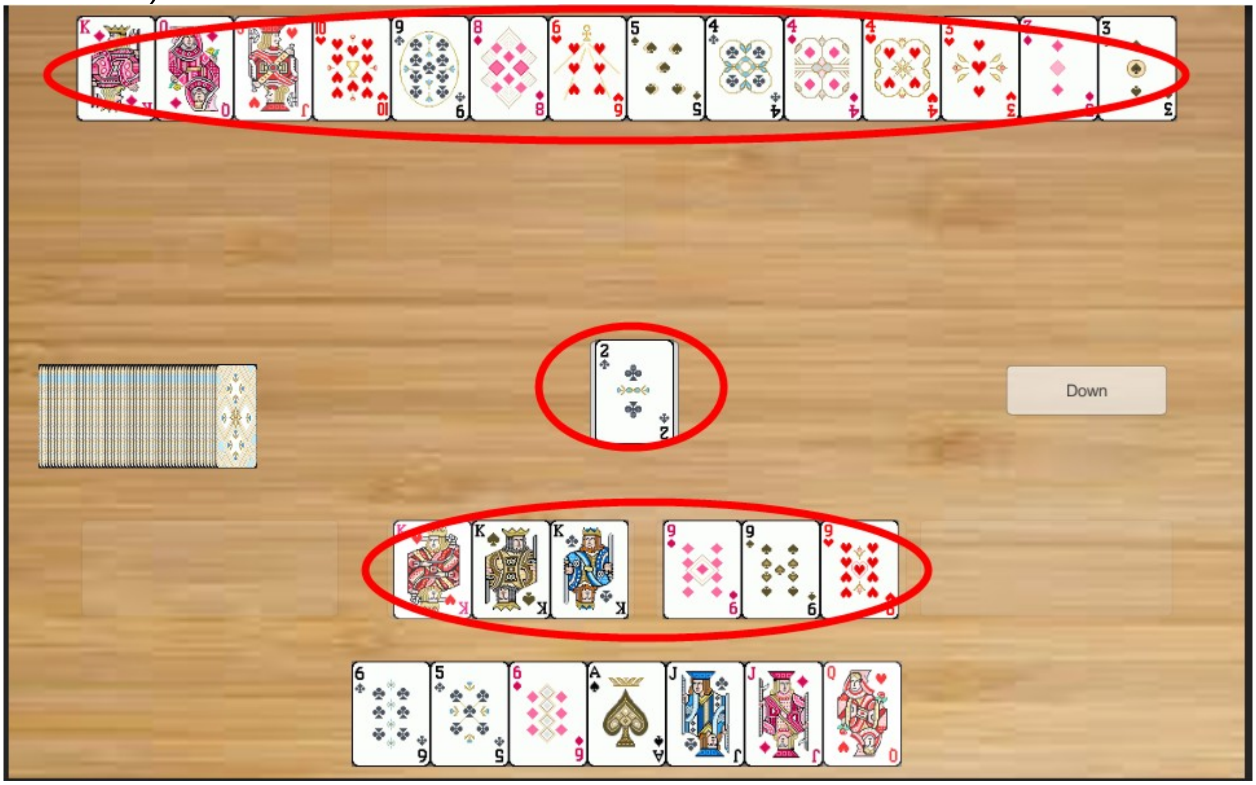


Figure 4.3 What Com Ai Know

By knowing this information's and the game rules the computer AI will decide which card he will throw and which he will make a down with it .

4.3 AI Algorithms

The AI is consisting of rules and statistical probability functions that make the computer choose what his next move is.

An example below is algorithms the make the computer determine wither he take the player thrown card or draw a new card.

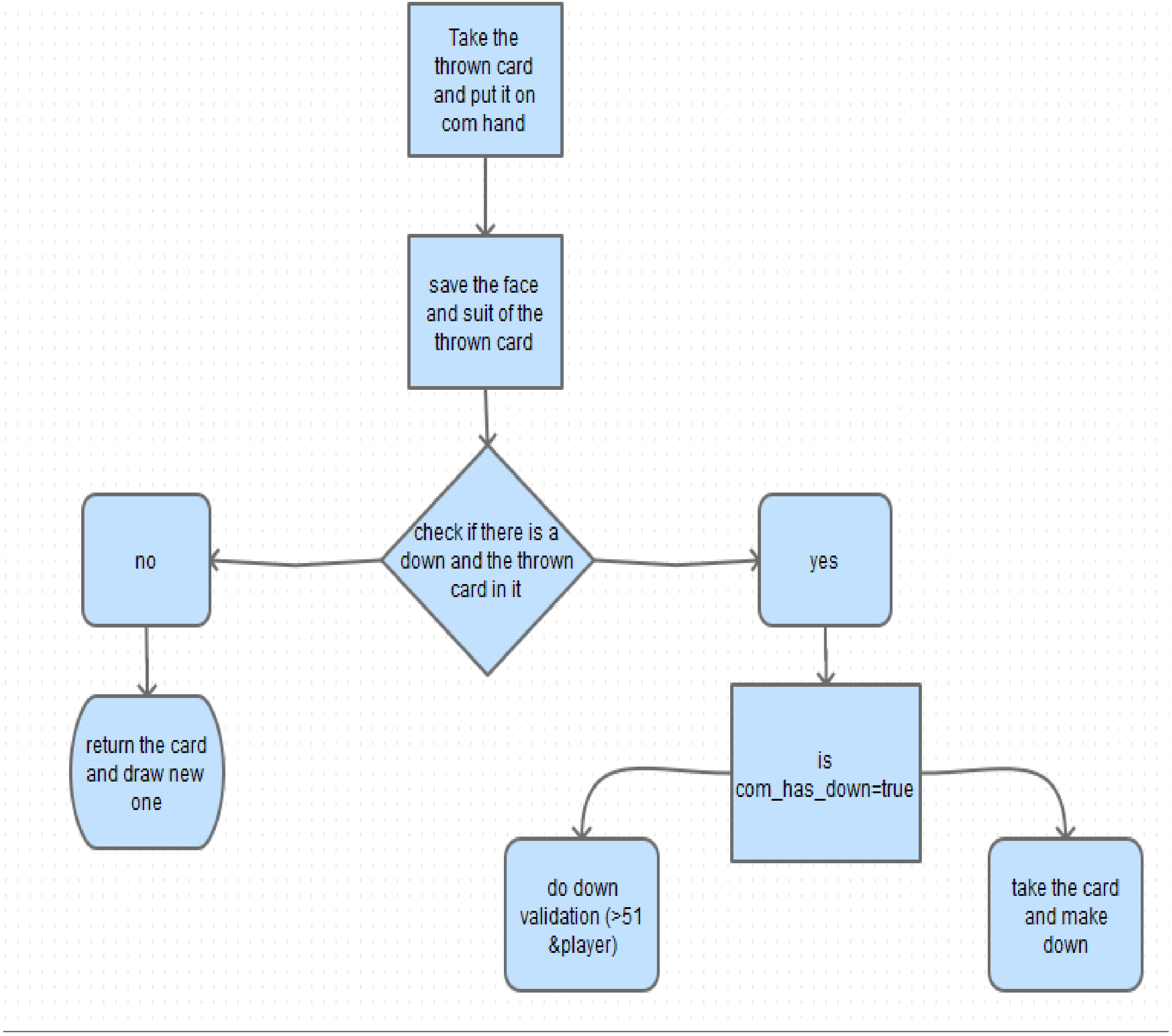

Take the thrown card and put it on com hand
save the face and suit of the thrown card
check if there is a down and the thrown card in it
no
yes
return the card and draw new one
is com_has_down=true
do down validation (>51 &player)
take the card and make down

Figure 4.4 Take Player Card Algorithm

CHAPTER 5 : IMPLEMENTATION

5.1 Introduction

This Chapter explains and gives real idea about the implementation of the research.

5.2 The Main Interface

The Main Interface provide choices to be selected by player, like starting a new game, show high scores , run tutorial, configure the game or exit the game. Figure (5.1) shows the element of The Main Interface.

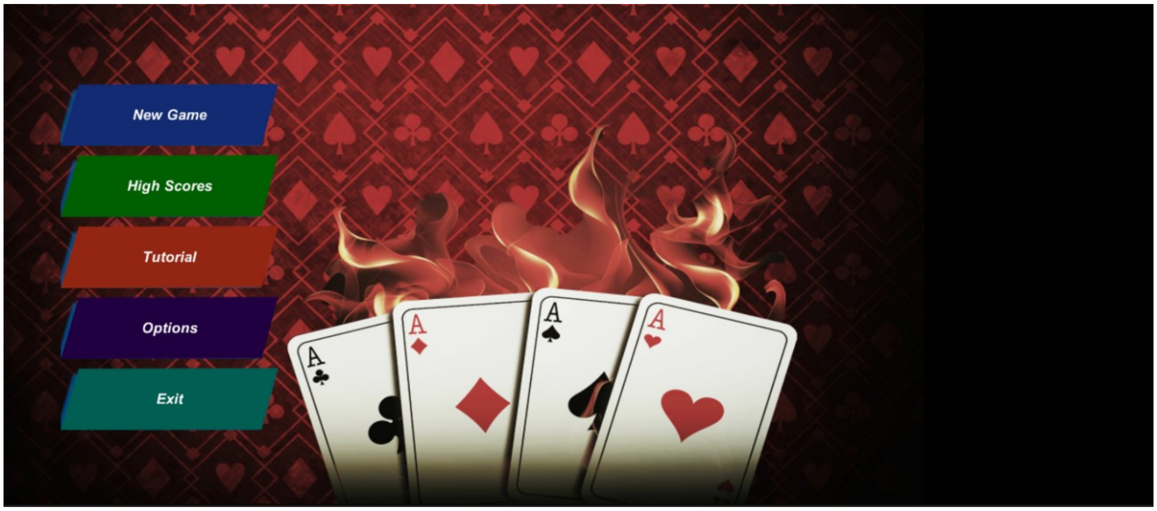
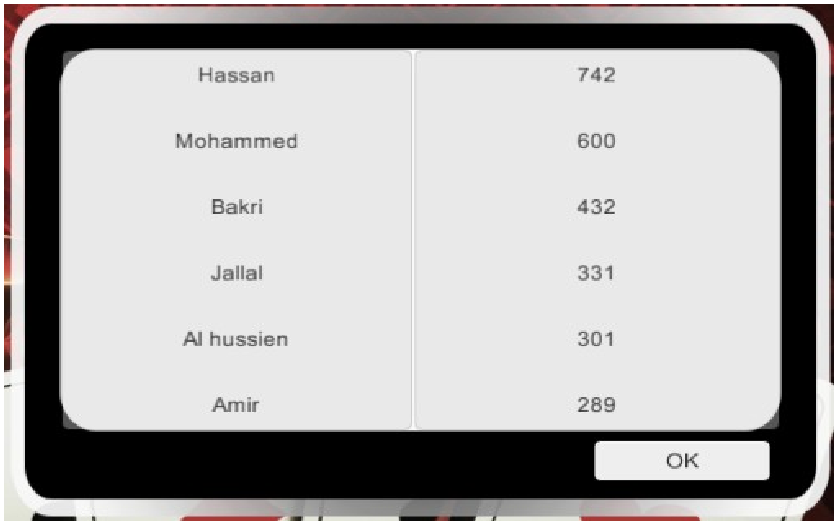


Figure (5.1): The Main Interface

The Main Interface include :

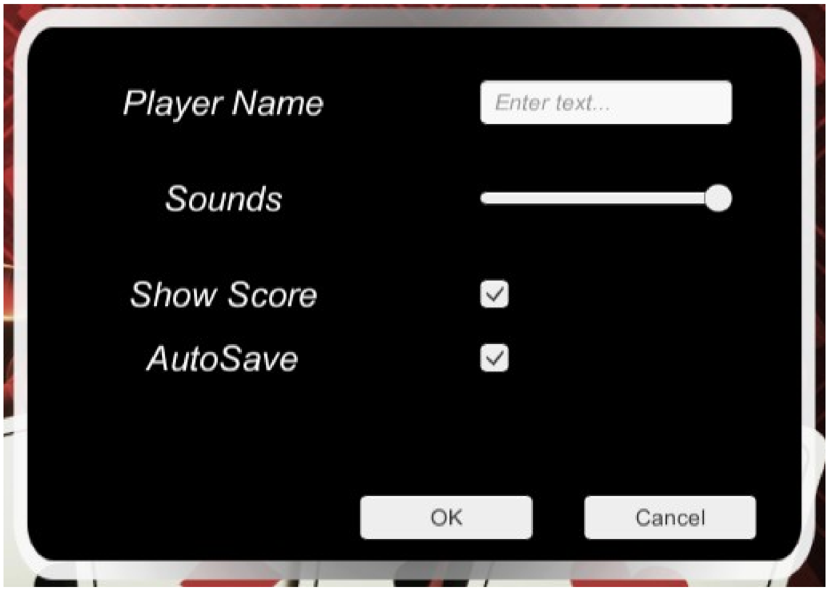
- New Game: for start Playing. It leads player to Game play as in Section 5.3 .
- High Scores: for showing player result. Figure (5.2) shows high score window.



Hassan	742
Mohammed	600
Bakri	432
Jallal	331
Al hussien	301
Amir	289

Figure (5.2): High Score window

- Tutorial: for learning how-to-play. The player will be directed to tutorial as in Section 5.4 .
- Option: for game configuration. Figure (5.3) shows Option window.



Player Name Enter text...

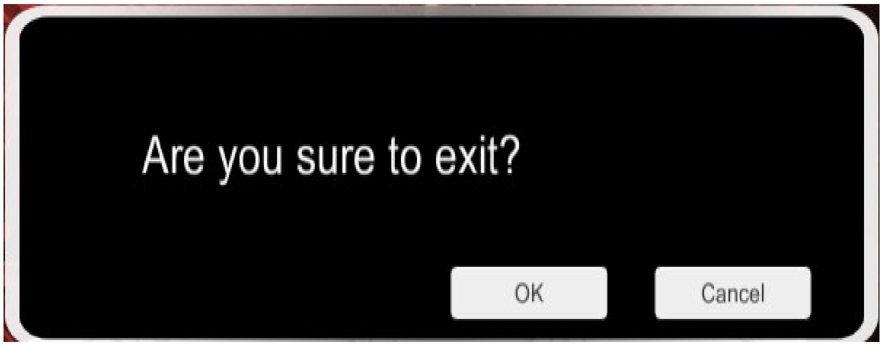
Sounds

Show Score ☑

AutoSave ☑

Figure (5.3): Option window

- Exit: for closing the game. Figure (5.4) shows Exit window.



Are you sure to exit?

Figure (5.4): Exit window

5.3 The Game Play

The Game Play Represent the heart of the game. It is the place of Playing. The game running depends on series of player actions, like dragging card into throw Zone in the Middle and click on the deck to draw and press **button "Down"** to start down mode or **right click** in windows or **multiple touch** in android and if player want to make a down he will select multiple cards and click one of the four down slots as represented in figure (5.5).

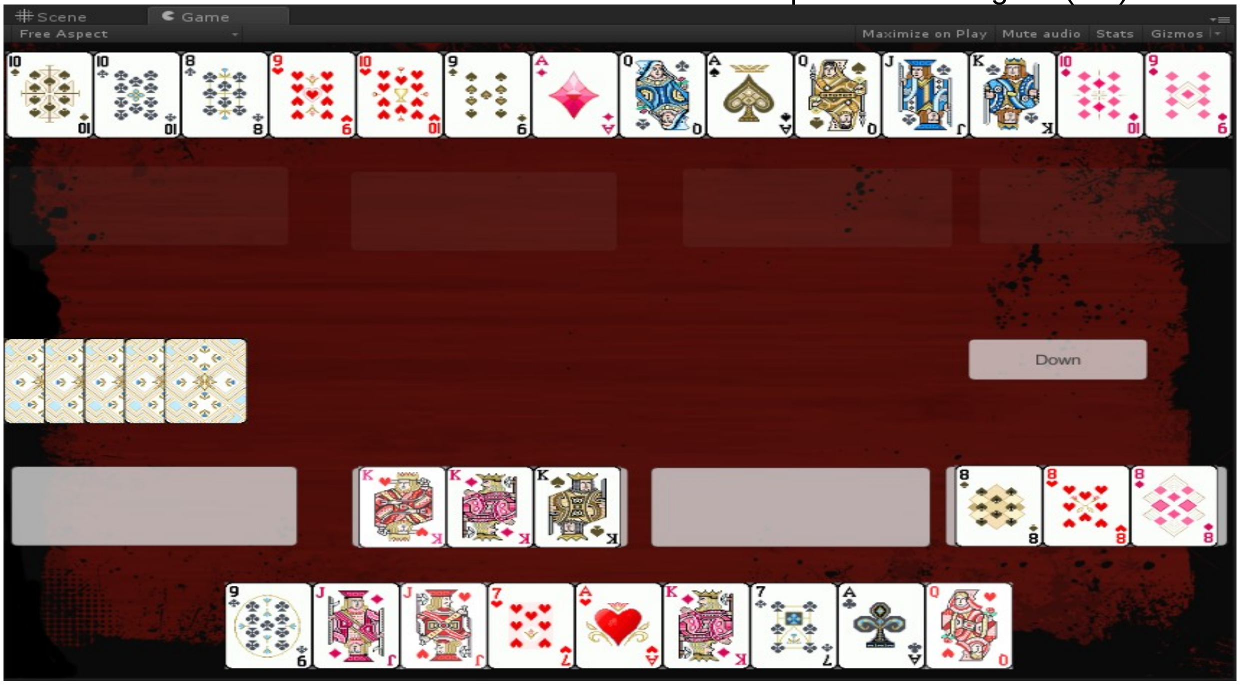
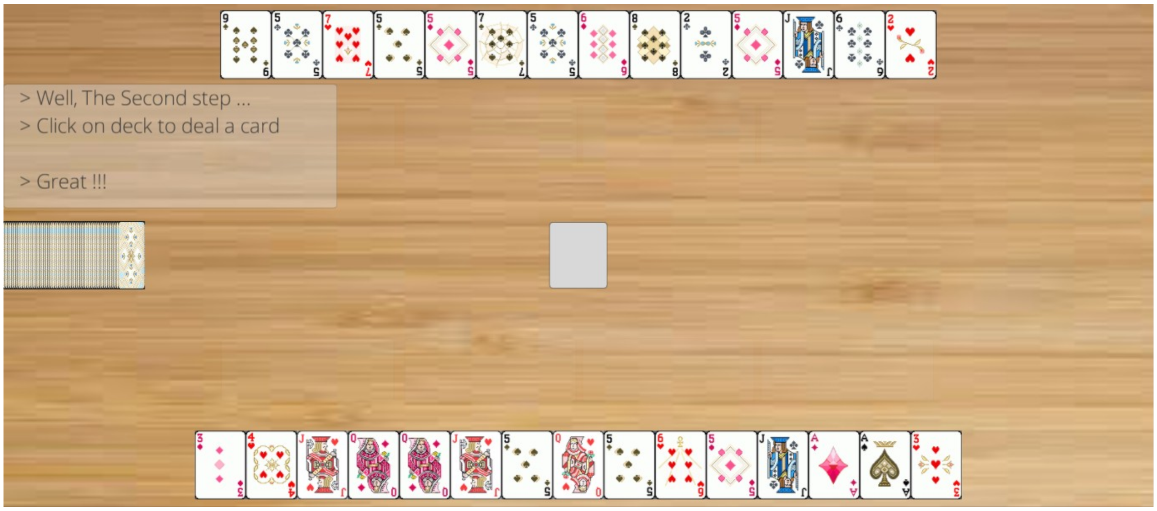


Figure (5.5): The Game Play

5.4 Tutorial

The Objective of tutorial is teaching the player HOW-TO-PLAY game by series Instructions and interaction with the player. Figure (5.6) shows Tutorial.



> Well, The Second step ...
> Click on deck to deal a card

> Great !!!

Figure (5.6): Tutorial

CHAPTER 6 : Result and recommendation

6.1 Introduction

We discuss in this chapter the result that the research gained at the end and recommendation to improve the idea of research and the conclusion.

6.2 Results

1-We learn more about game development and C# and Unity3D game engine.
2- We develop “hareeg” game for both Android and PC.

6.3 Recommendation

To improve the research and achieving our goals We recommend to :

1- The game convert into multiplayer via Internet and local network
2- Add different AI levels (Hard, Normal, Easy).
3- To encourage more students into learning more about game development and if it possible make an introduction course about game development.

6.4 Conclusion

Game Industry became one of the main industries on IT field, it’s a very big an complex field that start growing since the 60’s ,we developed a traditional Sudanese card Game called “hareeg” with AI feature to make the player able to play against computer, we start by writing about the history and types of games and the different tools we used in development and we also analyzed the game development process along side with AI and the UI of the game.

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