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الجامعة الإسلامية – غزة  
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# **Memory match educational game for sign writing**

A Graduation Project Presented to the  
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To

everyone helped us in completing this work.

# Abstract

As smartphones have easy and exciting functionality that facilitate many things to human beings, including people with disabilities and especially people with hearing disabilities, who face the problem in understanding the written language of ordinary people.

There are some solutions have been emerged for this problem; such as computer application that help hearing impaired to learn signwriting, which is visual symbols that represents any sign language in the world and facilitates their communications, but they were not enough.

In this project, we trying to solve the problems by proposing Anamil Natiqa game for Arab deaf and dumb people. The game consist in a memory match educational game which facilitates learning signwriting with an entertaining way, by matching words/numbers/pictures with their signwriting translations.

To develop the game, we use agile software process because it focus on high-quality development, testing, and collaboration.

The game will help to spread signwriting and spread it among deaf and ordinary people. This would help to have better integration and communication of deaf group in the society, as well as it will help deaf in their educational life.

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## List of abbreviations:

	Abbreviation	Definition
1	SL	Sign language
2	XP	Extreme programming
3	API	Application program interface
4	APK	Android Package Kit
5	SW	SignWriting



# **Chapter (1)**

## **“Introduction”**

For a long time, people with special needs suffered from many problems in their daily life because of their injury cases of disability that may be medical, mental or psychological disability. In this project, we target hearing disabilities group, whose auditory system does not do its functions normally, so that they cannot hear the different sounds which range in terms of degrees, and the strong degrees of hearing impairment causes deafness.

Deaf-mute is a term which was used historically to identify a deaf and dumb person who cannot speak an oral language or have some degree of speaking ability, but he/she chose not to speak because of the lack of attention and the emergence of abnormal sounds from them when they try to pronounce, that causing embarrassment to them among people and reduces their ability to exchange information and ideas with others. These are the major problems in their communication with other speaking people.

Sign language (SL) is a natural way of communication of speech and/or hearing-impaired people, signs have always been part of human communications that can involve simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions which corresponds to a specific meaning.[1]

Signing has always been part of human communications that the use of gestures or signs is not tied to an ethnicity, age or gender. For thousands of years, deaf people have created and used signs among themselves. These signs were the only form of communication is used primarily by deaf people, it is also used by others, such as people who can hear, but cannot physically speak like Infants that are using gestures as a primary means of communication until their speech muscles are mature enough to articulate meaningful speech. Within the variety of cultures of deaf people all over the world, signing evolved to form complete and sophisticated languages that have been learned and elaborated by succeeding generations of deaf children.[2]

As in oral language, sign language is not universal; it varies for each country, or even for regions. Sign language in the Arab World has recently been recognized and documented.[3] Many efforts have been made to establish the sign language used in individual countries, including Jordan, Egypt, and the Gulf States, by trying to standardize the language and spread it among members of the deaf community and interested people. Such efforts produced many sign languages, almost as many as Arabic-speaking countries, yet with the same sign alphabets.[4] Gestures used in Arabic Sign Language Alphabets are depicted in figure.



Figure 1.1: Arabic sign language alphabets.[5]

The problem of hearing loss is the most frequent sensory deficit in human populations and have several reasons that increased rapidly over the years (as shown in figure 1.2). The figure displays the percentages of deaf worldwide over the years, affecting more than 500 million of people in the world according to statistics in 2015 between the ages of 1-75 years, including more than 50% deaf in Asia. (As shown in Figure 1.3).[6]

The majority of people with disabling hearing loss live in low- and middle-income countries; approximately one-third of people over 50 years of age are affected by disabling hearing loss. The prevalence in this age group is greatest in South Asia, Asia Pacific and sub-Saharan Africa.

### Percentage of Deaf Worldwide

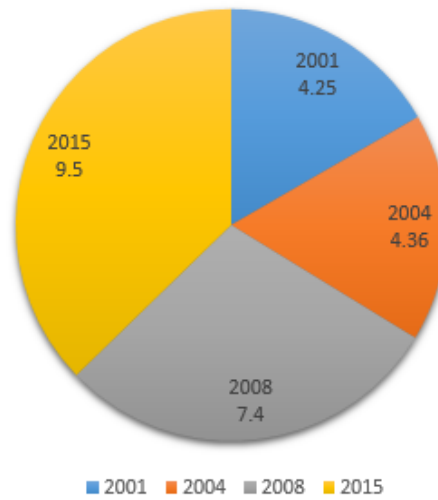


Figure 1.2: percentage of deaf people worldwide over years.

### Worldwide Deafness (Millions)

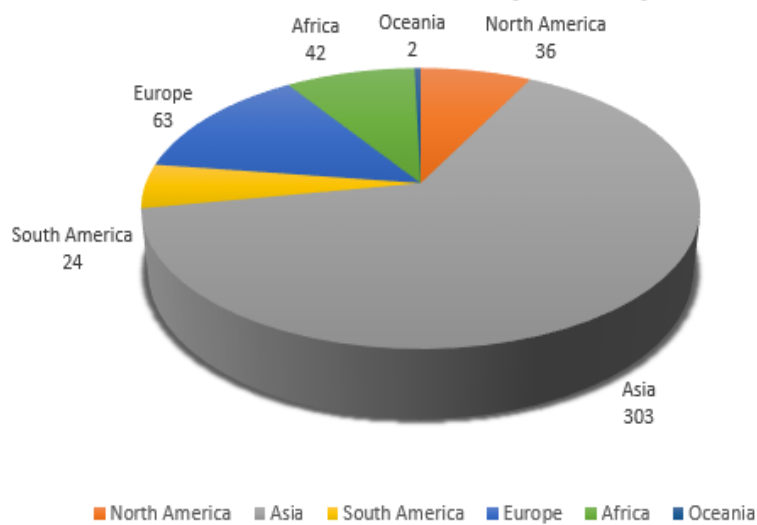


Figure 1.3: Millions of deaf people spread over the continents.

Deaf suffer from understanding the ordinary written language. This makes some difficulties in their education. That is way signwriting emerged.

**Sutton SignWriting, or SignWriting (SW)** is a system of writing sign languages which represents any sign language in the world, it using visual symbols, visually iconic and shapes of the characters to display the forms of hand, movements and facial expressions; that does not follow a sequential order like the letters that make up written English words. (As shown in figure 1.4)[7]

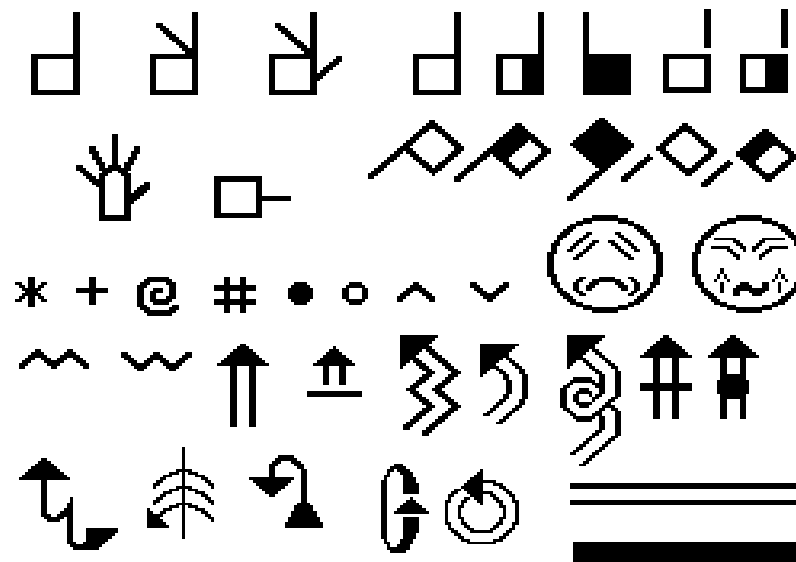


Figure 1.4: signwriting example.[8]

The idea of sign-writing began by (William Stokoe 1960). At this time it's called as a (Stokoe Notation) that did not receive an acceptance despite the publication of his own book; Then in 1974, American Valerie Sutton was asked to prepare a complete system of sign-writing and physical gestures that was named at the time as a (Sutton System).

At the beginning of this system, the signs were written manually, as it took a lot of time to complete a specific task. In 1987 the first computational software (Sign Writer) appeared that used to write signwriting using computer that was a watershed at this time.

And because of deaf's weak level in writing spoken language, such as Arabic, English and other languages; The idea of sign-writing was a revolutionary idea that responded to the challenge in their world, which is to teach them to write their own language so they had the belief that there is no way to write their language, and this become the opposite to their belief.

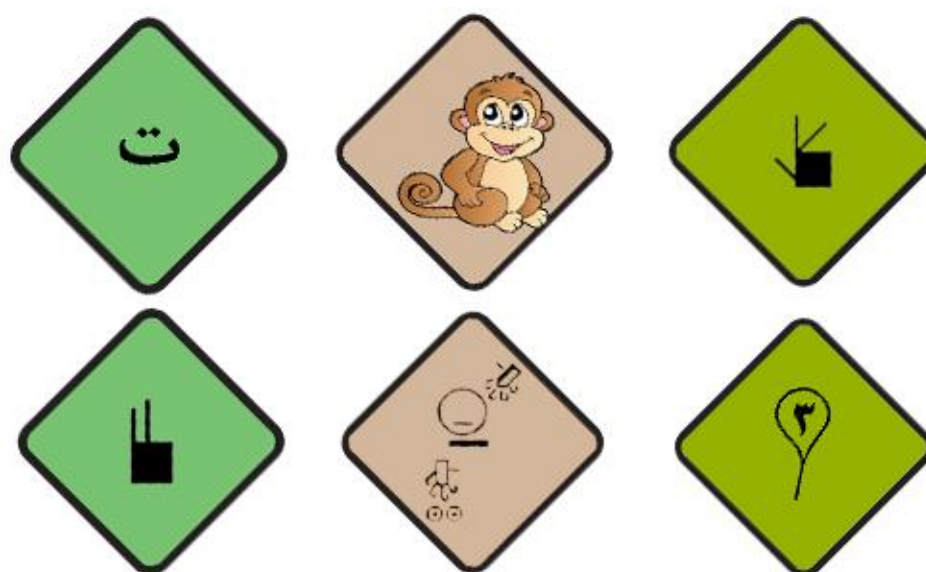


Figure 1.5: Arabic signwriting example.

This was the basic problem for the deaf people groups in their normal, practical and learning life, arise when a deaf person wants to communicate with deaf and non-deaf person by writing, this meaning that signwriting is very important to learn deaf.

In recent days, because of evolution technologies that we are living it nowadays, the spread of personal computers and smartphones and the increasing of using applications and games in many domains that it's not only for entertainment that we can benefit from it in (education, business and communication e.g.); To exploit the wide spread of mobile devices, we decided to develop a game for mobile platform that can be considered as an educational game to help the deaf group to learn to write their own language, which it will reduce many of their problems in their communications with each other or with other speakers by writing.

So we think to develop an educational game to help deaf and dumb people to learn sign-writing in an entertaining way, and try to spread the concept of sign-writing, which did not meet the supposed spread until now.

## 1.1 About Anamil Natiqa game:

It's a memory match educational game that targets all people especially deaf and dumb people who want to learn signwriting.

The game provides the basics of signwriting in educational and entertaining way, in our game we use used a (Saudi dictionary), because there is no Palestinian dictionary

certified for signwriting and the Saudi dictionary is the most enriching compared with the remaining dictionaries of the Arab world, which contains 677 words translated into signwriting until these times.

## **1.2 Statement of the problem:**

The main problem is that deaf and dumb groups hardly understand the written language that the ordinary people used it in their daily life.

To help these people to learn and use sign-writing, which is much understandable for them, we developing an educational game that aims to teach deaf and ordinary people the sign-writing of the deaf, that our game facilitate their understanding to this language by an entertaining way.

## **1.3 Objectives:**

### **Main objective**

The primary objective of our project is to develop an educational game on mobile platform that targets all persons needed to learn the basics of sign-writing with entertainment way, deaf and dumb people in particular cases.

### **Specific objectives**

The specific objectives of our project are:

- Use the Saudi signwriting dictionary in our game.
- Divide the game into stages each stage have one or more level.
- Design card face and back.
- Implement main functionality in the game (match matched cards).
- Implement the functions of random cards and score count in each level.

## 1.4 Importance of the project:

Our game is very important because it can produce the basics of Arabic sign-writing in entertainment way to help deaf and dumb people to learn it easily, which can provide benefits for deaf group and for our team as following:

- **For users (players):**

- **Educational:** produce to the player many categories written in signwriting like (letters, numbers, names of animals, plants and many more) which facilitates learning for the player.
- **Entertainment:** The excitement side is achieved by encouraging to win after gaining the highest score with lowest number of attempts and move between different levels.

- **For our team:**

- Get more experience in unity c# game development.
- Ability to write professional reports.
- Economic benefits by advertising revenue.

## 1.5 Scope and limitations of the project:

In our memory match educational game we target deaf and dumb people in particular that they wanted to learn the basics of sign-writing.

It is not our primary goal to make a dictionary of words, because of that in our project we used the Saudi dictionary that has limited words, and will be limited to android platform in the current phase.



# **Chapter (2)**

## **“Related works”**

In this chapter according to our search, study and review we will review some applications related to our project across different platforms, then summarize the features and limitations for each application.

- **Web-based**

- 1- **MemoSign Game:**

MemoSign is a web based game; which focused on Tunisian dictionary. The game contains four levels; it is comprised 8 pairs of cards. The player just must turn over pairs of matching cards, which have the same meaning, with the least possible trials.

Blue cards hold SignWriting notations, while green cards hold their description in written language. When the player flips a card that holds a SignWriting notation, the virtual signer starts the interpretation of its notation content in visual-gestural modality. The game is over when all the cards have been matched.[9]




Figure 2.1: MemoSign game.

## 2- Deafsign game:

Is a puzzle educational game that runs on the web only, it's consists of 4 sections 5 words for each section, which contains images of sign language and multiple options corresponds each image (as a questions); so that the main idea of Deaf Sign game is to choose the appropriate and correct option that indicate to the sign language exist in the image. If the answer that chosen is correct this indicated to (:) symbol, if the chosen answer is wrong then this indicated to (X) symbol.[10]


Choose the correct answer for each question.

---

1 

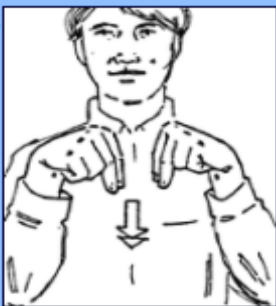
<input type="text"/>	A	Hair
<input type="text"/>	B	Cat
<input type="text"/>	C	Face
<input type="text"/>	D	Dog
<input type="text"/>	E	Hands

---

2 

<input type="text"/>	A	Two
<input type="text"/>	B	Fingers, nails
<input type="text"/>	C	Deaf, Deaf person
<input type="text"/>	D	Nose
<input type="text"/>	E	Hand, Fingers

---

3 

<input type="text"/>	A	Rabbit
<input type="text"/>	B	Cat
<input type="text"/>	C	Dog
<input type="text"/>	D	Mouse
<input type="text"/>	E	Parrot

Figure 2.2: deaf sign puzzle game.

## •Mobile-based

### 1- Memory Game for Deaf Children:

Is a memory game involves making deaf children relate images, signs, written signs and words in Portuguese with each other. The child goes by the levels 1, 2 and 3 of each stage. There are three stages:

- The first stage is Gif Picture present animal sign language with a picture of an animal.
- The second stage is the Gif picture present animal sign and the corresponding SignWriting.
- The third stage is the SignWriting / Portuguese word.

Each module has 3 difficulty levels from easiest to hardest. Each level has a number of cards in the game. If the child can win in level 1, level 2 is enabled to play. If the child wins level 2, level 3 is enabled.

The memory game has a score. Hitting all the cards, the player receives a message of congratulations and move on to the next level.[11]

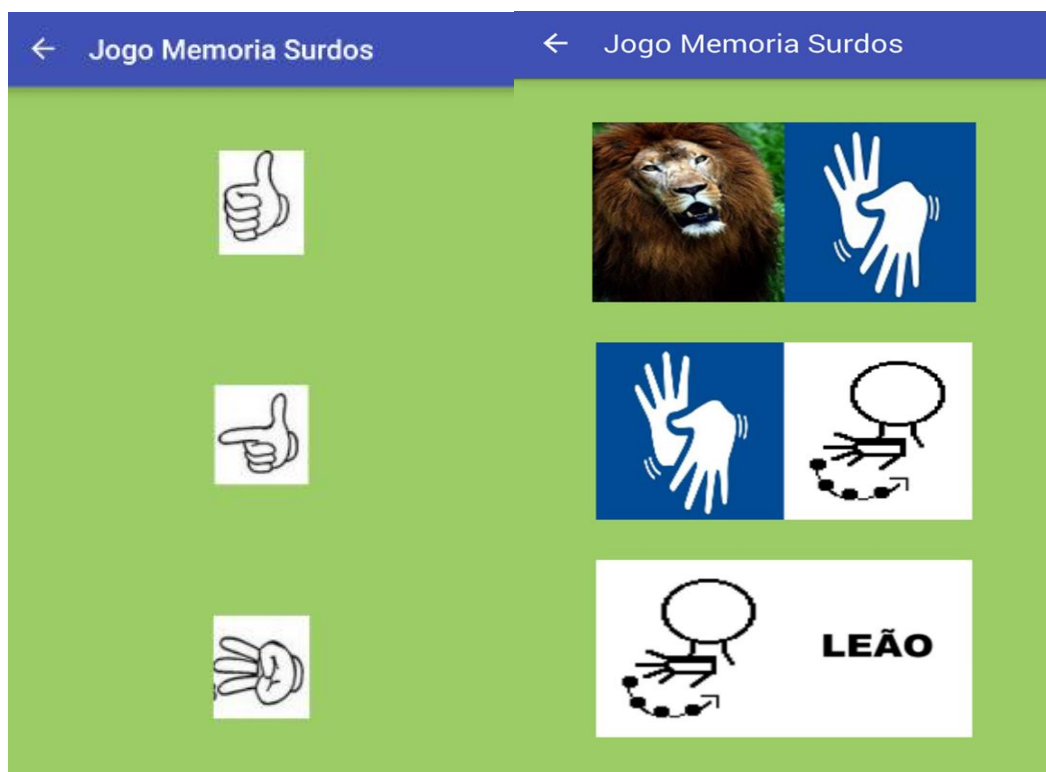


Figure 2.3: Memory Game for Deaf Children (modules & levels).

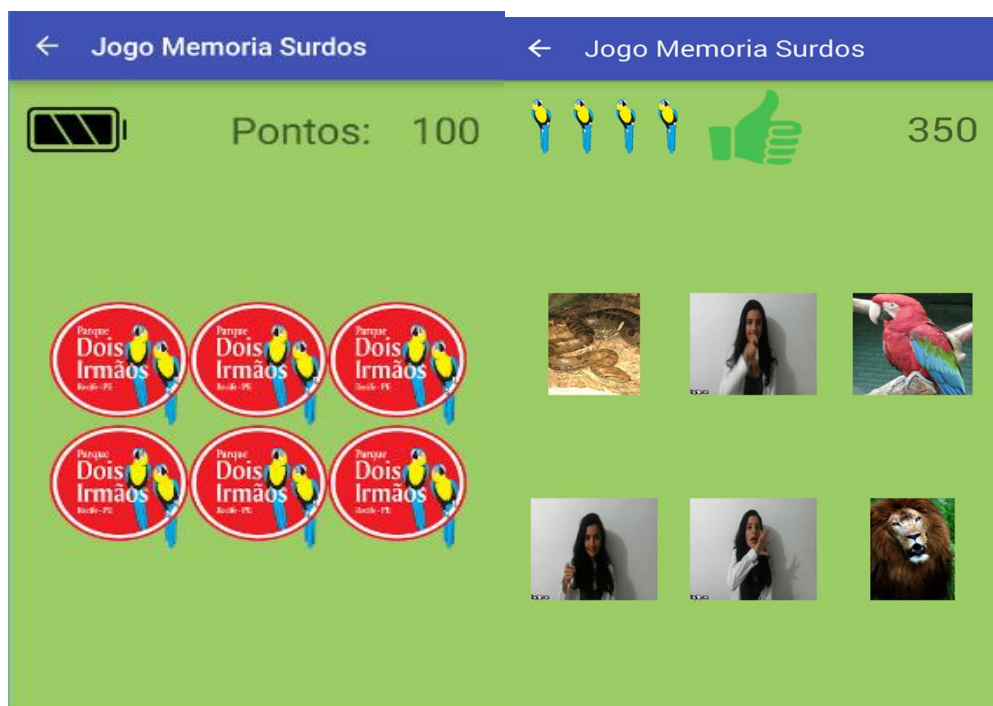


Figure 2.4: Memory Game for Deaf Children (cards).

- Table 1.2 describes the main differences between all related works that produced previously:

Application name	Dictionary used	Stages number	Have levels within stages?	Have a time?	Have a score?	platform support
<b>MemoSign game</b>	Tunisian & American dictionary	Four stages	no	yes	yes	web
<b>Deaf sign game</b>	American dictionary	Four stages	no	no	yes	web
<b>Memory Game for Deaf Children</b>	Portuguese dictionary	Three stages	yes, three levels for each stage	no	yes	Android
<b>our Game</b> (أنامل ناطقة)	Saudi dictionary	Three stages complete and other stages Under preparation	yes, many levels for each stage	no	yes	Android, and other platforms in the future

Table 1: comparison between related work and our project.

# **Chapter (3)**

## **“Planning & Management”**

This chapter covers planning aspects and system management that we followed it in the project lifecycle. But before that, we provide a description of our game in the next section.

## 3.1 Our game:

It's a memory match educational game that targets all people who want to learn signwriting specialty for deaf groups.

The game provides the basics of signwriting in educational and entertaining way, which focused on (Saudi dictionary).

The game divided into several stages:

- Alphabet stage: which exploits 28 words (character) from the Saudi dictionary.
- Number stage: which exploits 10 words (numbers) from the Saudi dictionary.
- Animal stage: which exploits 13 words (animals) from the Saudi dictionary.

Each stage contains one or more levels (level1, level2 ...) each level contains a number of cards, which includes two types:

1. The card that contains a representative or illustrative image (for example, the letter A, the image of an animal or plant).
2. The card that contains the translation in signwriting.

The basic idea of the game is to match two cards so that the open card corresponds to the second. With each match between two cards, the score is calculated so that the highest score is obtained when all cards are correctly matched with the lowest number of attempts, the player can win when all cards are matched correctly before end the number of allowed attempts then the player receives a message of congratulations and move on to the next level if wanted.

So that the player can move to the next level only after winning in the first level, if the number of attempts ended without matching all cards, the player failed which can receives a message to replay the level lost if he wanted. Finally, the score will be stored for ranking.

## 3.2 Planning & Management

### 3.2.1 Methodology:

In our project the following steps were taken to achieve the objectives of it:

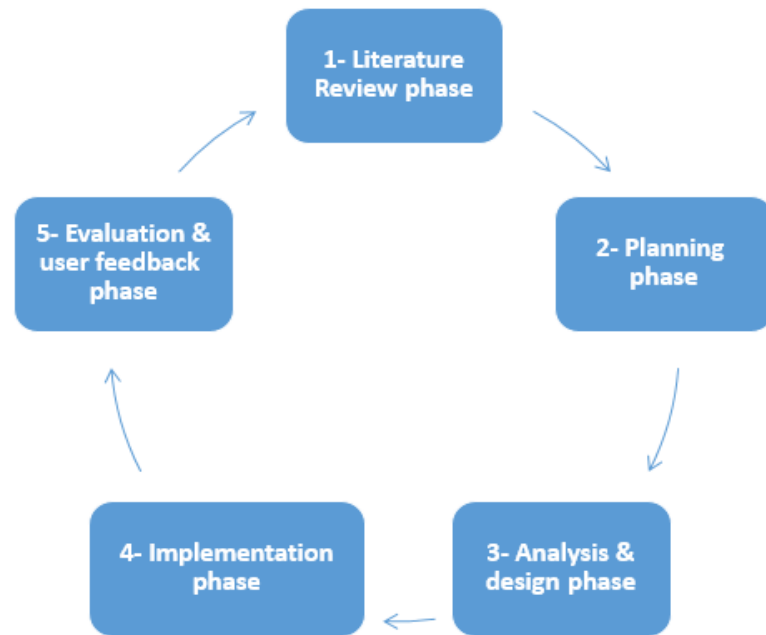


Figure 3.1: Methodology phases.

#### 1. Literature Review:

A number of researches and studies of sign writing, deaf people and their acceptance for sign writing have been reviewed, related works have been explored and compared with our project.

#### 2. planning:

We planned to complete three stages (alphabets / numbers / animals) initially in the current phase. And the dictionaries were compared then the Saudi dictionary was chosen to use it.

That the unity game engine and c# was chosen to program the game.



### 3. Analysis and design:

We made comparison between all signwriting Arab dictionaries and the Saudi dictionary was selected. The game idea was analyzed and initially designed on (Uxpin site).

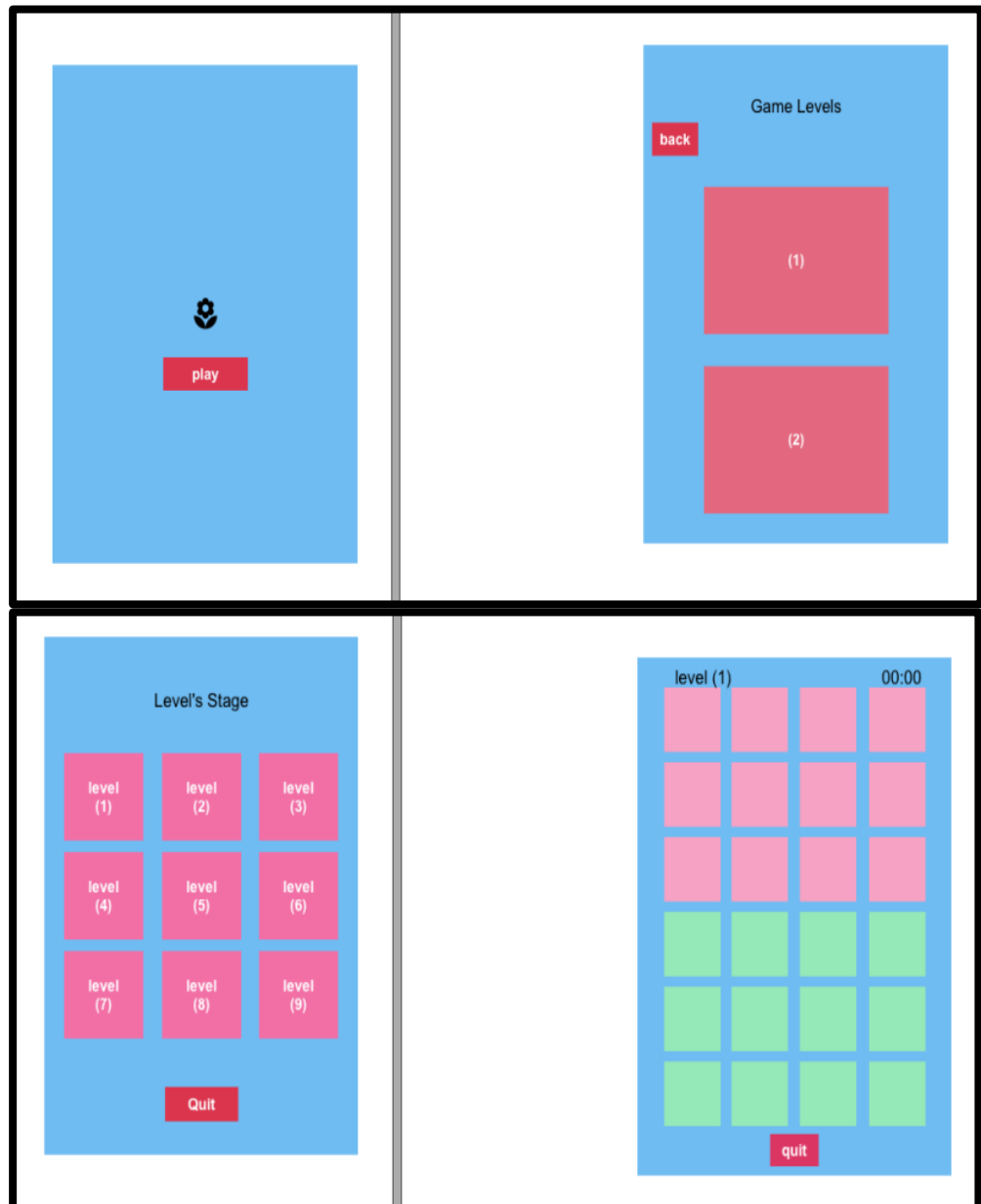


Figure 3.2: storyboard.

#### 4. Implementation phase:

- At this stage the game was actually implemented using xp methodology.

**XP methodology:** is a type of agile software development which is intended to improve software quality, efficiency, flexibility and responsiveness to changing customer requirements, differs from traditional methodologies primarily in placing a higher value on adaptability than on predictability.[12]

XP methodology have more advantages that focuses on timely delivery of final products and the programmer can solve problems through discussions inside of the team and create simple code that can be improved at any moment.

Figure 3.3 show the XP lifecycle.

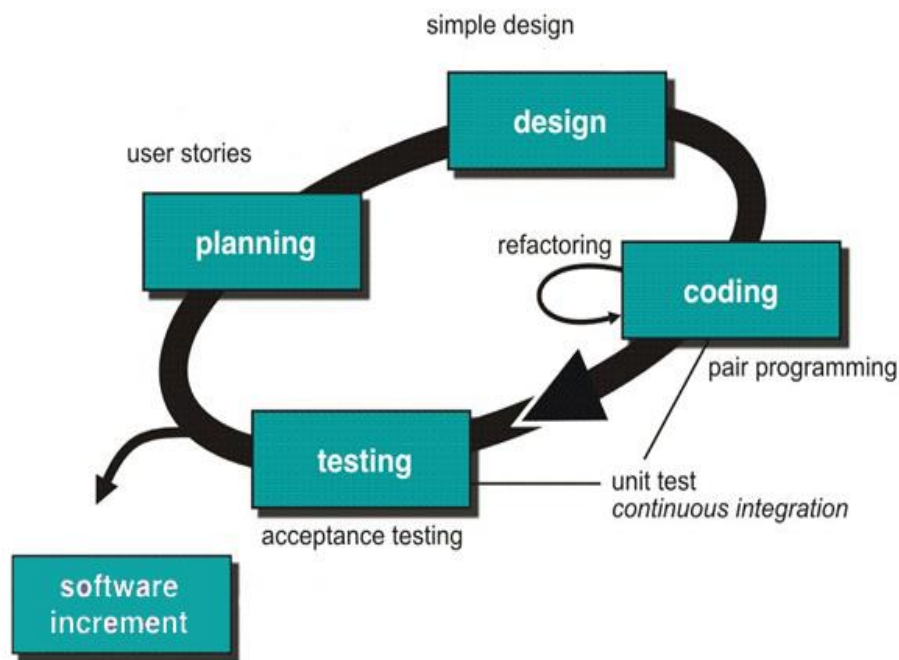


Figure 3.3: Extreme programming (XP) life cycle.

- And we developed the game using unity engine with C-Sharp programming language

#### 5. Evaluation and user feedback:

Will explain in chapter (6).

## 3.2.2 Task Management:

### 3.2.2.1 Time Table:

Table 3.1 shows the Time table of the project phases and their corresponding estimated time. Dates in Table 3.1: Time Table for the work are using the date format M/D/Y.







Task Mode ▼	Task Name ▼	Duration ▼	Start ▼	Finish ▼
	Research study	42 days	Fri 2/10/17	Sun 4/9/17
	Literature review	16 days	Mon 7/10/17	Sat 7/29/17
	Iteration1	7 days	Sun 4/30/17	Sun 5/7/17
	Iteration2	7 days	Wed 5/10/17	Thu 5/18/17
	Iteration3	22 days	Wed 5/31/17	Thu 6/29/17
	Write document	7 days	Fri 6/30/17	Sun 7/9/17

Table 2: Time table for the work.

### 3.2.2.2 Gantt chart:

Figure 3.4 illustrates the project's Gant Chart.

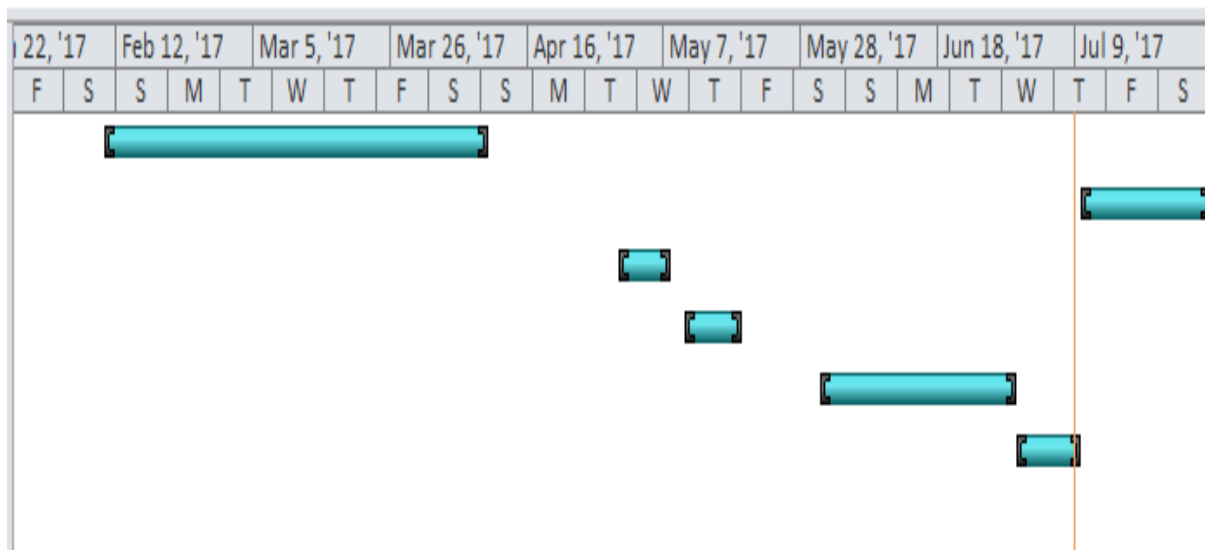


Figure 3.4: Gantt chart for the work.

### 3.2.3 Project iterations:

#### Iteration 1:

Table 3 presents the tasks of the first iteration of our project.

Duration	7 Days
Start date	April 30, 2017
Due date	May 7, 2017
Tasks	<ul style="list-style-type: none"><li>- Collect related work</li><li>- Create game's storyboard</li><li>- Choose the first stage</li><li>- Design alphabets stage cards using Photoshop.</li></ul>
Un completed tasks	-

Table 3: iteration1.

#### Iteration 2:

Table 4 presents the tasks of the second iteration of our project.

Duration	7 Days
Start date	May 10, 2017
Due date	May 18, 2017
Tasks	<ul style="list-style-type: none"><li>- Design the main screen</li><li>- Choose each level's cards</li><li>- Design alphabets stage using unity</li><li>- Flip cards.</li></ul>

Un completed tasks	-
--------------------	---

Table 4: iteration2.

### Iteration 3:

Table 5 presents the tasks of the third iteration of our project.

Duration	1 month
Start date	May 31, 2017
Due date	June 29, 2017
Tasks	<ul style="list-style-type: none"> <li>- Matching cards</li> <li>- create numbers and animal stages</li> <li>- Making card randomization</li> <li>- Making score for each level</li> </ul>
Un completed tasks	-

Table 5: iteration3.

# **Chapter (4)**

## **“Analysis”**

This chapter consists of two sections, and covers the main aspects of the game analysis. The first section describes the analysis represented in terms of use case diagrams and the second section provides state machine diagram.

## 4.1 Use case diagrams:

### 4.1.1 Actors:

There is one actor in the project namely player, the player gain access to the game by downloading the apk from Google play store.

### 4.1.2 Player Use Case:

The Use-Case diagram for the player is shown in Figure 4.1. As can be seen from the diagram, that we have one actor for the project (player) that can access to different use cases such as play the game by choosing any category who want to play and moves between levels. (as shown in table3)

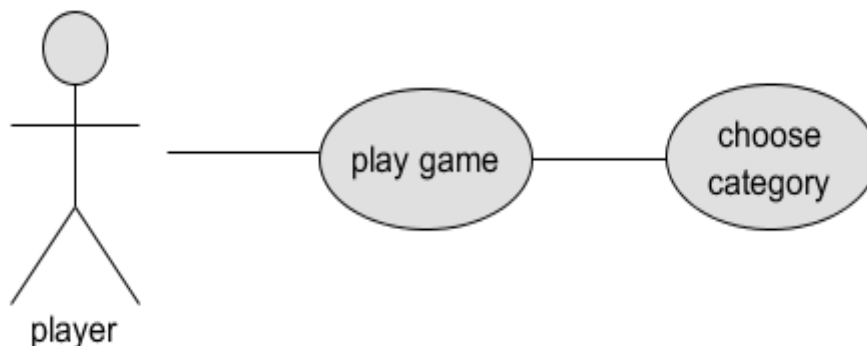


Figure 4.1: Player use case.

<b>ID</b>	<b>Use case ID</b>
<b>Name</b>	Play Game
<b>Description</b>	In this use case player can play the game by choosing any category who want to play and moves between levels.
<b>Preconditions</b>	The game apk should be installed on the device
<b>Postconditions</b>	Player can play game (Flip cards, match cards and move between levels).
<b>Normal Flow</b>	1- Start game. 2- Choose stage. 3- Start level. 4- Flip cards. 5- Match cards. 6- Either win or failed. 7- Move between levels.
<b>Alternative Flow</b>	-
<b>Exceptions</b>	When game apk is not installed on the device.

Table 6: paly game use case table.



## 4.2 State machine diagram:

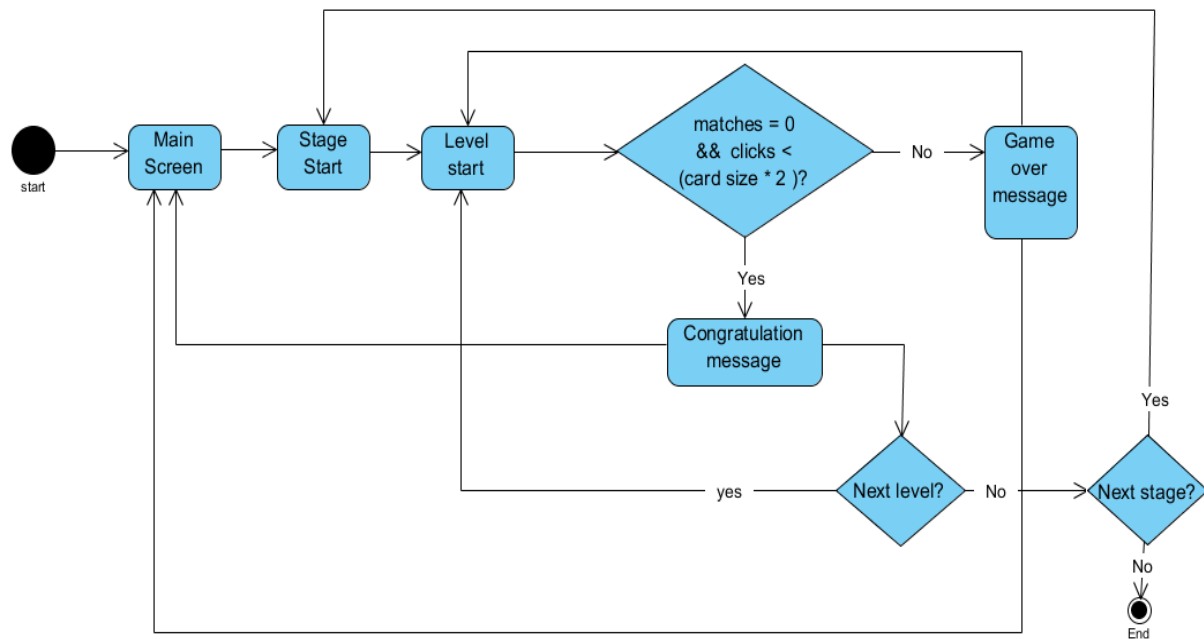


Figure 4.2: State machine diagram.

In this subsection we describe the behavior of the game using this state machine diagram by represent it as a series of events that can occur in one or more possible states; where the player starts the game on the main screen and then move to the stages screen by clicking on play button where the player can choose the stage he wants to play after that the player can starts in the first level of the chosen stage.

Where the player can play and match the cards correctly... If (the number of matches equals to 0) and (the number of clicks on the cards less than the number of cards in the level \* 2), then a congratulation message is appear as a result of winning in the level and from this screen the player can either move to the next level after press on next level button if there is a next level or back to the main screen if he want that.

If there is no next level, the player can see whether if there is a new stage or not, if he finds a next stage, he can move to it if he want that, if the player does not find a next stage, he can go out of the game.

If the number of matches exceeded the number of allowed attempts in the level or the number of clicks on the cards exceeded the number of cards level \* 2, the player loses and a better luck message will appear, then the player can re-play the level or go to the main screen if he wanted to.

# **Chapter (5)**

## **“Design”**

This chapter contains three main sections, which covers the main aspects of game design and architecture.

## 5.1 Deployment diagram:

In this section we describe the architecture of the system as deployment (distribution) of software artifacts to deployment targets, which represents concrete elements of the game in the physical world.<sup>(11)</sup>

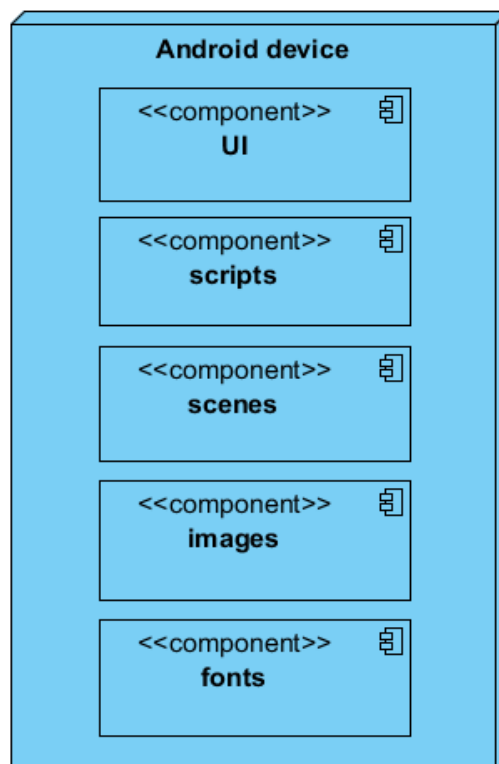


Figure 5.1: Deployment diagram.

## 5.2 Component diagram:

In this section we describe the components used to make the functionalities of the project using this component diagram.

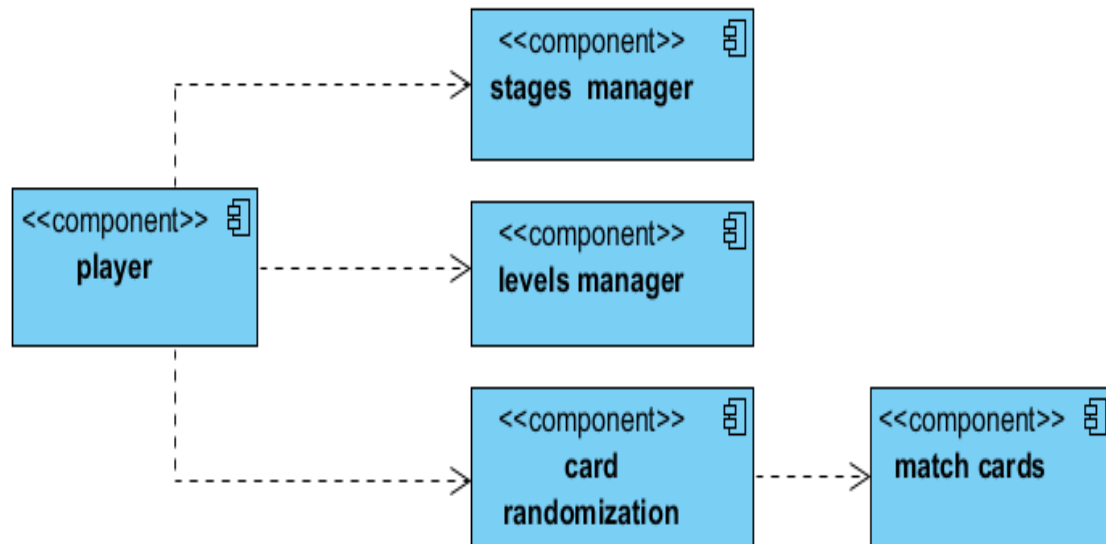


Figure 5.2: Component diagram.

### 5.3 Class diagram:

In this section we describe the structure of our game by showing the project's classes, their attributes, operations (or methods), and the relationships among objects.

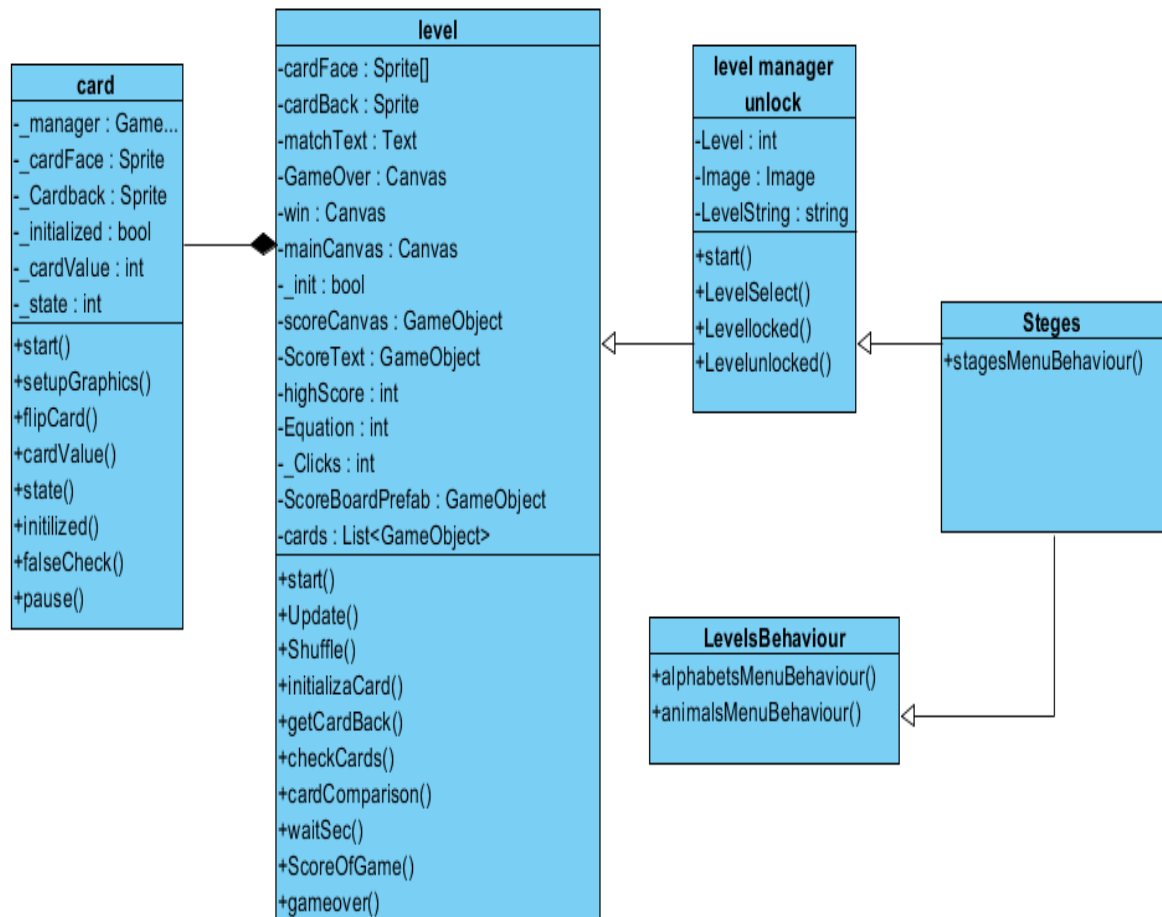


Figure 5.3: Class diagram.

# **Chapter (6)**

## **“Implementation, testing and evaluation”**

## 6.1 Tools, equipment and methods:

The tools that were used in the development of the game:

- **Unity:** is a free and cross-platform game engine that we used it to create a successful and useful educational game using c# programming language.
- **Smart phone (device):** that used to test and perform the application during the testing phase.
- **Arabic support for unity API:** because of unity doesn't support an Arabic we used this API (Arabic support for unity) to write an Arabic text.
- **MS Project Professional 2013:** Ms Project is a project management software program, developed and sold by Microsoft, which is designed to assist a project manager in developing a plan, assigning resources to tasks, tracking progress, managing the budget, and analyzing workloads.
- **Uxpin site:** is a fast and easy site for ux-design, making prototype and presentations.
- **Photoshop:** Adobe Photoshop is a professional image editing software package that can be used by everyone who is interested in the graphics design.
- **Visual Paradigm:** (VP-UML) is a UML CASE Tool supporting UML 2, and provide all features we need for system architecture, project management and modeling.[13]
- **Trello:** web-based project that we used it to manage our project and its tasks.
- **Slack:** is a cloud-based used for team collaboration tools and services.

## 6.2 Final interfaces:

In this section we shown the interfaces design for our game.



Figure 6.1: Main screen.

As shown in the figure 6.1, this is the main screen of the game containing two buttons: one for start to play the game and move to stages screen and the second for exit from the game.





Figure 6.2: Game stages.

After pressing on play button in the main screen the stages screen is opened to ability to choose the stage that the player want to play. As shown in the figure 6.2



Figure 6.3: The levels for each stage.

When the player choose the stage that he want to play, he can choose the level that he stopped there. (As shown in figure 6.3)



Figure 6.4: First level for alphabets stage.

After the level was chosen by the player, he can to start play the level, flipping cards, and trying to match it correctly to move between levels. (As shown in figure 6.4)

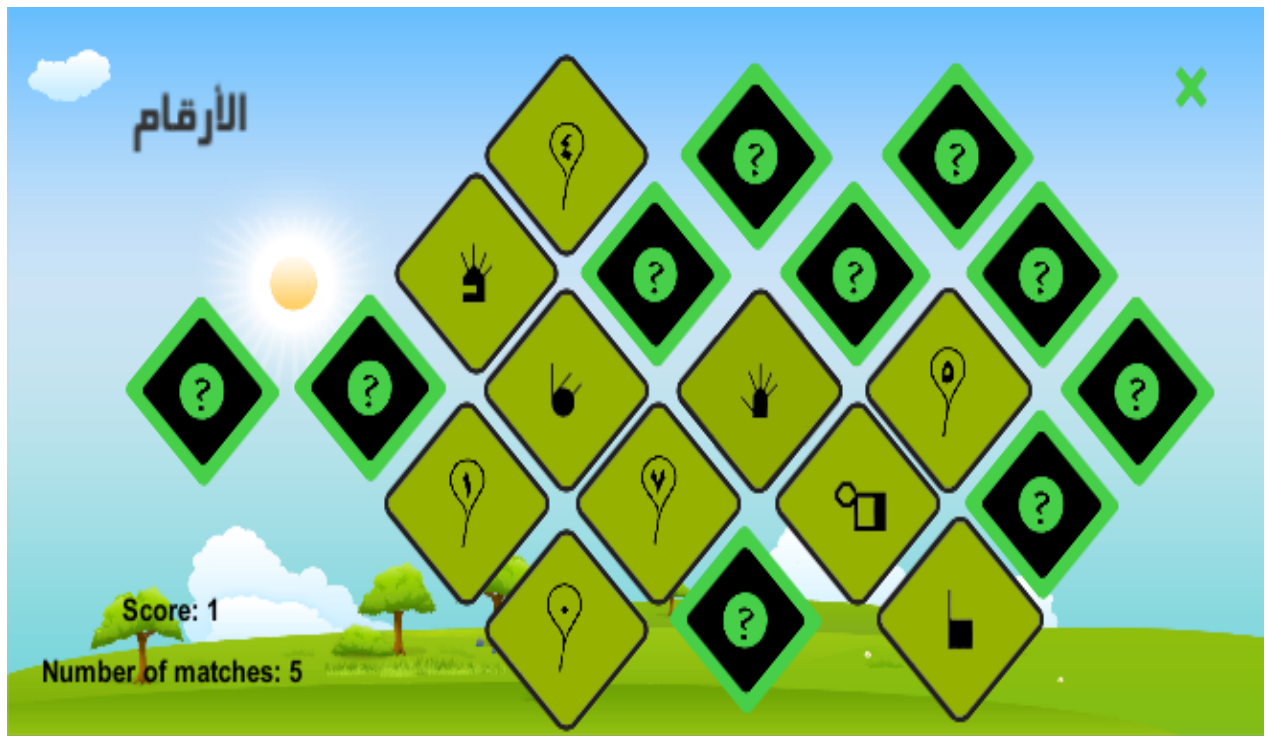


Figure 6.5: Number level.

Figure 6.5 display number level.



Figure 6:6: pet's animal level.

This figure 6.6 display the first level in animal stage (pet's level).



Figure 6.7: predator's animal level.

This figure 6.6 display the second level in animal stage (predator's level).

## 6.3 Coding:

In this section we shown the code of main functions in our game.

```
public void flipCard()
{
    if (_state == 0)
    {
        _manager.GetComponent<Level1>().addCheckedCard(this);
        _state = 1;
    }
    else if(state == 1)
    {
        _state = 0;
    }
    if (_state == 0 && !Do_NOT)
        GetComponent<Image>().sprite = _cardBack;
    else if (_state == 1 && !Do_NOT)
        GetComponent<Image>().sprite = _cardFace;
}
```

Figure 6.8: Flip card function.

```
void cardComparison(List<int> c)
{
    card.Do_NOT = true;
    int x = 0;
    _Clicks += 2;
    gameover();
    if ((cards[c[0]].GetComponent<card>().cardValue == 1 && cards[c[1]].GetComponent<card>().cardValue == 2) ||
        (cards[c[0]].GetComponent<card>().cardValue == 3 && cards[c[1]].GetComponent<card>().cardValue == 4))
    {
        x = 2;
        _matches--;
        matchText.text = "Number of matches: " + _matches;
        if ((_matches == 0) && (_Clicks < (cards.Capacity * 2)))
        {
            StartCoroutine(waitSec());
            ScoreOfGame();
        }
    }
    else
    {
        if (lastTry)
        {
            GameOver.enabled = true;
        }
    }
    for (int i = 0; i < c.Count; i++)
    {
        cards[c[i]].GetComponent<card>().state = x;
        cards[c[i]].GetComponent<card>().falseCheck();
    }
}
```

Figure 6.9: match cards function.

```

public List<T> Shuffle<T>(List<T> list)
{
    RNGCryptoServiceProvider provider = new RNGCryptoServiceProvider();
    int n = list.Count;
    while (n > 1)
    {
        byte[] box = new byte[1];
        do provider.GetBytes(box);
        while (!(box[0] < n * (Byte.MaxValue / n)));
        int k = (box[0] % n);
        n--;
        T value = list[k];
        list[k] = list[n];
        list[n] = value;
    }
    return list;
}

void inicializaCard() // card population
{
    cards = Shuffle(cards);
    for (int id = 0; id < 2; id++) // 2= match between 2 cards
    {
        GameOver.enabled = false;
        win.enabled = false;
        for (int i = 1; i < 3; i++) // 3= number of matches
        {
            cards[0].GetComponent<card>().cardValue = 1;
            cards[1].GetComponent<card>().cardValue = 2;
            cards[2].GetComponent<card>().cardValue = 3;
            cards[3].GetComponent<card>().cardValue = 4;
        }
    }
    foreach (GameObject C in cards)
        C.GetComponent<card>().setupGraphics();
    if (!_init)
        _init = true;
}

```

Figure 6.10: shuffle (random) cards.

## 6.4 Testing:

A test was performed after a completion for each iteration, that the version has been checked whether it contains errors or not.



## **6.5 Evaluation:**

Dr. Mohamed Abu Shaira at University of Tabuk in Saudi Arabia ensures that he will help us to test our project with Saudi deaf people and children; then a questionnaire will be conducted and collect the opinions and feedbacks from testing people about the game to ensure that the game is free from errors and it's easy to play.

# Chapter (7)

## “Conclusion and future work”

We proposed (Anamil Natiqa game) which is an educational game for deaf and dumb people that allows them to learn their own signwriting and it's basics with entertaining way. Anamil Natiqa focused on Saudi dictionary that has limited translated words.

we developed Anamil Natiqa game to be more easy to play and to help spread the signwriting between deaf groups and normal society, this is done by developing main three categories until now (Alphabets, number and animals), each containing a number of levels.

The player can start playing Anamil Natiqa game by matching each card with its translated signwriting card. The game helps to learning signwriting more easier with entertaining way.

**For future work**, other categories such as (school subjects/ Tools/ foods/ shapes/ Flowers/ colors/ religious/ Countries/ Sports/ Fruits and Vegetables) will be supported, the game will be published for all platforms and lots of signwriting dictionaries will be focused on and taken into consideration in the game.

## Bibliography:

- (1) En.wikipedia.org. (2017). Sign language. [online] Available at: [https://en.wikipedia.org/w/index.php?title=Sign\\_language&oldid=788769542](https://en.wikipedia.org/w/index.php?title=Sign_language&oldid=788769542) [Accessed 1 Jul. 2017].
- (2)(3) “Arabic Sign Language Translation System On Mobile Devices,” (2017). [Online]. Available at: [http://paper.ijcsns.org/07\\_book/200801/20080136.pdf](http://paper.ijcsns.org/07_book/200801/20080136.pdf) [Accessed 1 Jul. 2017].
- (4) Ncbi.nlm.nih.gov. (2017). “Arabic sign language: a perspective. - PubMed ”. [online]. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/15778217> [Accessed 1 Jul. 2017].
- (5) Google.ps. (2017). arabic sign language alphabet - Google Search. [online] Available at: <https://www.google.ps/search?sa=G&hl=en-PS&q=arabic+sign+language+alphabet> [Accessed 9 Jul. 2017].
- (6) Eonmeditech.com. (2017). Hearing Loss India conductive, Ossicles reconstruction. [online] Available at: <Http://www.eonmeditech.com/hearing-loss.html> [Accessed 3 Jul. 2017].

- (7) En.wikipedia.org. (2017). SignWriting. [online] Available at: <https://en.wikipedia.org/w/index.php?title=SignWriting&oldid=786191267>
- (8) [Accessed 2 Jul. 2017].  
Google.ps. (2017). signwriting - بحث Google. [online] Available at: <https://www.google.ps/search?q=signwriting> [Accessed 9 Jul. 2017].
- (9) Egresearch.info. (2017). Learning Version of Match Game For Deaf Learners. [online] Available at: <http://www.egresearch.info/edugame/memosign/> [Accessed 30 May. 2017].
- (10) Deafsign.com. (2017). Caption Buster. [online] Available at: <http://www.deafsign.com/ds/puzzles/section1.htm> [Accessed 4 Jul. 2017].
- (11) Play.google.com. (2017). Cite a Website - Cite This For Me. [online] Available at: <https://play.google.com/store/apps/details?id=com.ufrpe.android.deafmemorygame&r=1> [Accessed 6 Jul. 2017].
- (12) En.wikipedia.org. (2017). Extreme programming. [online] Available at: [https://en.wikipedia.org/wiki/Extreme\\_programming](https://en.wikipedia.org/wiki/Extreme_programming) [Accessed 5 Jul. 2017].
- (13) Uml-diagrams.org. (2017). UML deployment diagrams overview, common types of deployment diagrams - manifestation diagram, specification and instance level deployment diagram.. [online] Available at: <http://www.uml-diagrams.org/deployment-diagrams-overview.html> [Accessed 6 Jul. 2017].