UI Analysis For Dual Player Tic-Tac-Toe Android Application Game Using Unity Game Engine

Satheesh Kumar.K[1], Gowtham.SB[2], Kovendhan.S[3], Vaitheeswaran.M[4]
[1]Assistant Professor, Dept of Computer Science Engineering
[2, 3 ,4]Dept of Computer Science Engineering
[1, 2, 3, 4] University College of Engineering,Thirukkuvali,Tamilnadu.

Abstract- *The player who succeeds in placing three of their marks in a diagonal, horizontal, or vertical row is the winner. Tic-Tac-Toe game can be played by two players where the square block (3 x 3) can be filled with a cross (X) or a circle (O). The game will toggle between the players by giving the chance for each player to mark their move. When one of the players make a combination of 3 same markers in a horizontal, vertical or diagonal line the application will display which player has won, whether X or O. In this paper, we implement a 3x3 tic-tac-toe game in application. The game is programmed, designed in using UNITY GAME ENGINE. The Unity is a cross-platform game engine developed by Unity Technologies software. Players can toggle between the symbols (ie. X/O) allowing each player a turn to play the game. The program will update after each player makes their move and check for the conditions of game as it goes on. Overall program works without any bugs and is able to use.*

Keywords- Algorithm, Android Application C# programming, User Interface, Multi Player, Tic Tac Toe.

I. INTRODUCTION

It is basically a two players game but modern computing has made it possible for a single person to play the game against the computer. The concept of artificial intelligence has been used and an algorithm has been designed that uses fuzzy logic to determine the position of the next occurrence of O during the computer's turn. The entire game has been designed using javascript and HTML and CSS render the frontend view.

GAME PLAY:

In order to win the game, a player must place three of their marks in a horizontal, vertical, or diagonal row. Players soon discover that the best play from both parties leads to a draw. Hence, tic-tac-toe is most often played by young children, who often have not yet discovered the optimal strategy. Because of the simplicity of tic-tac-toe, it is often used as a pedagogical tool for teaching the concepts of good sportsmanship and the branch of artificial intelligence that deals with the searching of game trees.

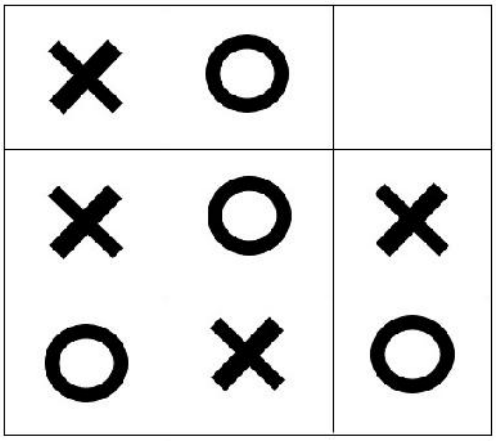


Fig. 1. Tic tac toe game

COMBINATORICS:

When considering only the state of the board, and after taking into account board symmetries (i.e. rotations and reflections), there are only 138 terminal board positions. A combinatorics study of the game shows that when "X" makes the first moveevery time, the game outcomes are as follows:

91 distinct positions are won by (X)
44 distinct positions are won by (O)
3 distinct positions are drawn (often called a "cat's game")

II. LITERATURE SURVEY

TITLE: CONNECT 4
AUTHOR: ALLEN

Allen (1990) was the first to solve the Connect 4 game. In his paper Expert Play in Connect-Four, he broadly categorised the two styles of expert gameplay into Positional and Combinatorial. In Positional gameplay, strategic positions on the board are taken up as quickly as possible so as to ensure a late game win. On the other hand, Combinatorial gameplay relies on creating a series of directly playable threats to achieve victory.

```
  a b c d e f g
6 . . . . . . .
5 . . . . . . .
4 . . . X . . .
3 . . . X X . .
2 X . . O O . .
1 O . . X O . .
```

POSITIONAL GAMEPLAY

On the other hand, Combinatorial gameplay relies on creating a series of directly playable threats to achieve victory.

```
  a b c d e f g
6 . . . . . . .
5 . . . O . . .
4 . . . X . . O
3 . . O X . . O
2 . . X O X . X
1 . . O X O . X
```

COMBINATORIAL GAMEPLAY

Allen established the concept of major, minor and useless threats, which are the last or second last squares in a Four-in-a-row to be taken up and threats that will never be taken up in actual gameplay respectively. He goes on to elaborate that minor threat can lead to victory and that all threats that are directly above an opponent's threats are useless. Lastly, he plotted the "Joseki" game trees, which are game trees of perfect play.

Allen's findings gave us an intuition about the styles of play in Connect 4 and some vital concepts such as useless threats. The fact that "not all threats are created equal" was taken into consideration when we tabulated the odd and even threats in our analysis.

TITLE: INTRODUCING A SET OF HEURISTIC RULES FOR TIC-TAC-TOE
AUTHOR: ALLIS 1988

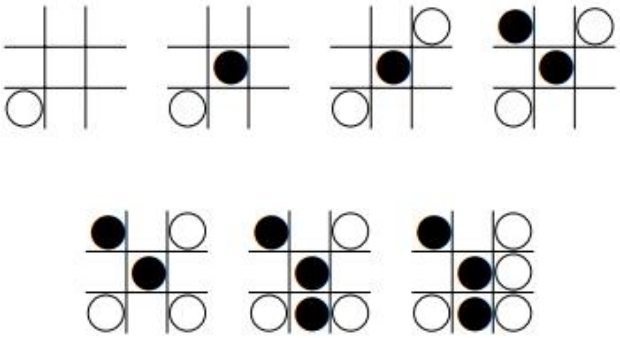
Allis (1988) solved the game independently. He found out that a brute-force approach was unfeasible due to the complexity of the game and many computer limitations back then. For example, given that each square can be either empty, white or black; the total possible number of states for the grid is 3^42. After subtracting the illegal states, the total possible number of states for the grid is 7.1 x 10^13.Therefore, a knowledge-based approach was adopted in his research paper, which involved the analysis of various strategic rules and tactics that can ensure a win for one of the players or a draw for both. After all, if these rules can be proven correct, it will not be necessary to evaluate a large number of positions to know the result of the game in perfect play.

Allis touched on the concepts of heuristics by introducing a set of heuristic rules for Tic-Tac-Toe, which hold similarities with general algorithms for Connect 4.

The rules are as follows:

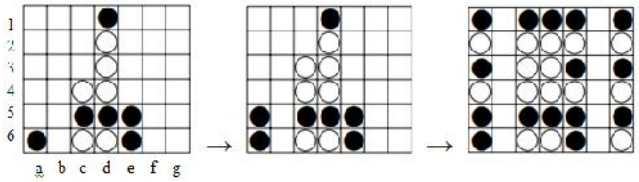
1. If there is a winning move, make it.
2. If the opponent can win at a square by his next move, play that move.
3. Taking the central square is more important than taking other squares.
4.Taking corner squares is more important than taking squares on the edges.

He then went on to demonstrate the weakness of heuristic rules by showing how a player loses despite using them. Through six different scenarios, he came to the conclusion that the best threats for White are odd threats while the best threats for Black are even threats.



OCCURRENCE OF ZUGZWANG

Zugzwang, a situation where a player is forced to make a move which he would rather not make, is a very important concept in Connect 4.



CONTROL OVER THE ZUGZWANG BY BLACK

In the above scenario, Black has two even threats in b2 and f2. Thus, White will not fill up b1 and f1 as doing so

will allow Black to win. In response, Black may employ a strategy known informally as ‘play follow up’, which means to play in the same column that White has just played in. This will lead to the third scenario where all the columns except b and f are filled up. Thus, White will be forced to fill up either b1 or f1. In either case, Black will win. In this example, Black is the controller of the Zugzwang as he is able to guide the way odd and even squares are divided. Black has the initial control over the Zugzwang as he is able to play follow up once he has the even threats.

However, he also deduced that it is possible for White to take over control of the Zugzwang

A good understanding of Zugzwang allowed us to derive some heuristic rules that will guide players on how to seize control of the Zugzwang to win the game

TITLE: TIC-TAC-TOE PLAYED AS A WORD GAME
AUTHOR: WORD WAYS

In Problem 48 in Your Move (McGraw-Hill, 1971), David Silverman described a linguistic version of tic-tac-toe consisting of a stockpile of the words ARMY, CHAT, FISH, GIRL, HORN, KNIT, SOUP, SWAN and VOTE. Players alternately select words, and the first to collect three words sharing a common letter is the winner. In the single-letter analogue of Silverman's game, players draw alternately from a stockpile of nine different letters; the first to select the letters forming one of a specified list of nine words is the winner. To make it easy to remember these words, they can be written in the form of a 3-by-3 word square in which both diagonals are also words. Squares are easy to find if you allow abbreviations, acronyms, proper names or foreign words. However, I'm half-convinced that there is no solution with common everyday words. It's almost spooky how you can find seven words but not the eighth.

N	O	S
E	A	T
W	R	Y

A	R	E
S	I	N
P	O	D

H	O	P
E	A	R
S	K	Y

B	E	D
O	A	R
W	H	Y

F	L	U
A	I	R
T	E	N

D	O	S
E	A	T
W	R	Y

WORD GAME

In the first square, the first word can be used in a sentence such as "The NOS have it summarizing a vote. Change the N to L, and the W to D, and the first word, LOS, is the first half of Los Angeles. If given names are allowed, consider the second square with RIO. The third square uses the contraction HE'S; the sixth uses DOS, as in the phrase "dos and don'ts". There must be dozens or even hundreds of squares using words from, say, the Official Scrabble Players Dictionary, but these invariably employ less-familiar words than the ones in the squares above.

Ross Eckler generated an interesting set of squares which all use the French word EAU, found in English phrases like "eau de cologne" or "eau de vie":

F	O	G
E	A	U
D	R	Y

H	O	G
E	A	U
P	R	Y

I	O	G
E	A	U
T	R	Y

L	O	B
E	A	U
T	R	Y

F	O	B
E	A	U
D	R	Y

G	O	B
E	A	U
T	R	Y

WORD GAME 2

III. SOFTWARE USED

UNITY GAME ENGINE

Unity is equally suited to creating both 2D and 3D games. When you create a new project in Unity, you have the choice to start in 2D or 3D mode. You may already know what you want to build, but there are a few subtle points that may affect which mode you choose. The choice between starting in 2D or 3D mode determines some settings for the Unity Editor - such as whether images are imported as textures or sprites. Don’t worry about making the wrong choice though, you can swap between 2D or 3D mode at any time regardless of the mode you set when you created your project. 3D games usually make use of three-dimensional geometry, with materials and textures rendered on the surface of these objects to make them appear as solid environments, characters and objects that make up your game world. The camera can move in and around the scene freely, with light and shadows cast around the world in a realistic way. 3D games usually render the scene using perspective, so objects appear larger on screen as they get closer to the camera. For all games that fit this description, start in 3D mode. Many 2D games use flat graphics, sometimes called sprites, which have no three-dimensional geometry at all. They are drawn to the screen as

flat images, and the game's camera has no perspective. For this type of game, you should start the editor in 2D mode. Tic -Tac -Toe Application in this paper use this 2D mode. Some 2D games use 3D geometry for the environment and characters, but restrict the gameplay to two dimensions. For example, the camera may show a "side scrolling view" and the player can only move in two dimensions, but game still uses 3D models for the obstacles and a 3D perspective for the camera. For these games, the 3D effect may serve a stylistic rather than functional purpose. This type of game is also sometimes referred to as "2.5D". Although the gameplay is 2D, you will mostly be manipulating 3D models to build the game so you should start the editor in 3D mode. We also used some panels in this game although it was a 2D game.

IV. ALGORITHM

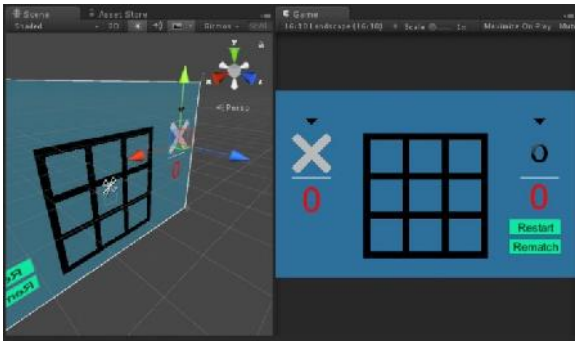
1. Creating 3x3 UI buttons.
2. Making sprits on X and O.
3. Assigning Objects to scripts
4. Display result.

Creating UI buttons:

Buttons are one of the most commonly used UI components. They are very easy to customize and quick to configure to complement any art style to match an application. Buttons feature publicly exposed on click functions that allow interactions to be performed without any actual scripting involved. Buttons make calling functionality simple as well. If a Canvas is already present in the Hierarchy, right-click the Canvas and select UI > Button If a Canvas is not present in the Scene, it will be automatically created and set as a parent of the Button A Button consists of two components: the Button itself, and a child Text component. By default, the text component is standard Unity UI text

Making sprits on X and O:

Sprites are simple 2D objects that have graphical images (called textures) on them. Unity uses sprites by default when the engine is in 2D mode. When viewed in 3D space, sprites will appear to be paper-thin, because they have no Z-width



Assigning Objects to scripts:

The Unity Analytics Integration script can be attached to any Game Object in any Scene in your game to initialize the Unity Analytics SDK. We recommend you attach the script to a Game Object in the first Scene of your game to ensure you begin capturing as much user engagement data as possible. Drag your script from the Projects tab and drop it on the Main Camera Game Object. In the Inspector window, with Main Camera selected, you should see that the script was assigned to the Main Camera as a Component.

We can also add a script to a Game Object by selecting the Game Object in your Hierarchy and adding the desired script Component to it in the Inspector.

Display Result:

The game object is assigned to the scripts which is in scripts folder Game controller import settings tab has game objects. Game controller import settings is imported by c# scripts.

Procedure ()

1. Set a 2 players
2. [Define data structure]
3. Create controller get data form players1&2
4. Make logic and validate [Validate logic].
5. Display the result state.

V. CONCLUSION

Motivation is essential for learning. Games are motivating by nature and the willingness to win a direct competition is a guarantor for engagement. From the results of the implementation and tests that have been carried out, some conclusions can be drawn as the results of testing the game have run smoothly so that shows that the implementation of the Tic Tac Toe game system using UNITY GAME ENGINE Based on the results of the usage test by the Game Experience

Questionnaire, most respondents feel the Tic Tac Toe Math game is fun. Added sound effects and user interface has been developed. Also testing the effectiveness of computer-based learning media, the Tic Tac Toe Math game gets positive result Certainly, with time, new updates and modifications to the algorithm shall definitely improve the gameplay.

VI. FUTURE ENHANCEMENT

Using the photon plugin enableing the payers to play the multiplayer through wifi system. Photon Unity Networking (PUN) is a Unity package for multiplayer games. Flexible matchmaking gets your players into rooms where objects can be synced over the network. ... The fast and (optionally) reliable communication is done through dedicated Photon server(s), so clients don't need to connect one to one.

Adding AI features to the game system if the player 2 is not available AI techniques used for creating believable game characters using her internationally acclaimed teaching style and knowledge from over 25 years researching and working with games, computer graphics and artificial intelligence.

REFERENCES

[1] Sai Ho Ling, Hak Keung Lam,Playing Tic-Tac-Toe Using Genetic NeuralNetwork with Double Transfer Functions Journal of Intelligent Learning Systems and Applications, 2011, 3, 37-44 doi:10.4236/jilsa.2011.31005Published Online February 2011

[2] Rajani, N.F.; Dar, G.; Biswas, R.; Ramesha, C. K., "Solution to the Tic-Tac-Toe Problem Using Hamming Distance Approach in a Neural Network," Intelligent Systems, Modelling and Simulation (ISMS), 2011 Second International Conference on, vol., no., pp.3,6, 25-27 Jan. 2011

[3] D. B. Klitsner and B. P. Clemens, "Electronic tictac-toe game having three function control," ed:Google Patents, 2003.

[4] T. G. Daly, "Game and gaming machine having tic-tac-toe type feature," ed: Google Patents, 2016

[5] S. Garg and D. Songara, "The winner decision model of Tic-Tac-Toe game by using multi-tape turing machine," International Conference on Advances in Computing, Communications and Informatics, Sep 2016, pp. 573-579.

[6] S. Jain and N. Khera, "An intelligent method for solving TIC-TAC-TOE problem", International Conference on Computing, Communication & Automation, pp. 181-184, 2015.

[7] S. Karamchandani, P. Gandhi, O. Pawar and S. Pawaskar "A Simple Algorithm for Designing an Artificial Intelligence Based Tic-Tac-Toe Game", International Conference on Pervasive Computing, pp1-4, 2015.

[8] A. Singh, K. Deep and A. Nagar "A 'Never-loose' Strategy to Play the Game of Tic-Tac-Toe", International Conference on Soft Computing & Machine Intelligence, pp. 1-4, 2014.

[9] S. H. Ling and H. K. Lam "Playing Tic-Tac-Toe Using Genetic Neural Network with Double Transfer Functions" Journal of Intelligent Learning Systems and Applications, vol 3, pp. 37-44, Feburary 2011.

[10] S. Sriram, R. Vijayarangan, S. Raghuraman and X. Yuan "Implementing a No-Loss State in the Game of Tic-Tac-Toe using a Customized Decision Tree Algorithm" International Conference on Information and Automation, pp. 1211 – 1216, June 2009.

[11] H. Mohammadi, N.P.A. Browne, A.N. Venetsanopoulos, and M.V. Santos, "Evolving Tic-Tac-Toe Playing Algorithms Using Co-Evolution, Interactive Fitness and Genetic Programming." International Journal of Computer Theory and Engineering, vol no. 5, pp. 797-801, 2013.

[12] A. Bhatt, P. Varshney, and K. Deb, "In search of no-loss strategies for the game of Tic-Tac-Toe using a customized genetic algorithm." In Proceedings of Genetic and Evolutionary Computation conference, pp. 889-896, July 2008.

[13] Thomas Abtey and SUNY Oswego "A Tic-Tac-Toe Learning Machine Involving the Automatic Generation and Application of Heuristics".

[14] M. V. D. Steeg, M. M. Drugan and M. Wiering, "Temporal Difference Learning for the Game Tic-Tac-Toe 3D: Applying Structure to Neural Networks," IEEE Symposium Series on Computational Intelligence, pp. 564-570, 2015.

[15] Reinhold Scherer, Andreas Schwarz, and Gernot R. Muller-Putz "Lets play Tic-Tac-Toe: A Brain-Computer Interface case study in cerebral palsy", 2016 IEEE International Conference on Systems, Man, and Cybernetics • SMC 2016

[16] Batyatin Maksim, Wermann Pavel1 ,Volodchenko Irina, Suhov Mikhail, Chizhova Margarita "Development of a Software Library for Game Artificial Intelligence", School of Electronic Engineering and Computer Science South Ural State University Chelyabinsk, Russia 1 vermanpg@susu.ru

[17] Muhammad H. Garry1 ,YuniYamasari, Supeno Mardi Susiki Nugroho, Mauridhi H. Purnomo "Design and Implementation Serious Game "Tic Tac Toe Math"" , 2019 International Conference of Computer Engineering, Network, and Intelligent Multimedia (CENIM)

[18] Drazen Draskovic, Milos Brzakovic, Bosko Nikolic, "A comparison of machine learning methods using a two

player board game", University of Belgrade, School of Electrical Engineering, Department of Computer Engineering and Informatics, drazen.draskovic@etf.bg.ac.rs