Design and Implementation of Ayo Olopon Game

[1]Babatunde, A.N.,
Department of Computer, Library and Information Sciences,
Kwara State University, Malete, Nigeria.
drealphdthesisemail@gmail.com
+2348060373361

Abikoye, O.C., Mabayoje, M.A., Akintola, G.A. & Oderemi, C.
Department of Computer Science
University of Ilorin
Ilorin, Nigeria.
Kemi_adeoye@yahoo.com, mmabayoje@gmail(yahoo).com
+2348034544437, +2348063185885

ABSTRACT

The difficulty encountered with the present manual mode of the "Ayo olopon" game is majorly on the tools used in playing it. The game utilizes the earth as the board of the game and uses stones, leaves as other parameters in playing it. Though some still use boards carved from wood and seeds but there is still a problem with portability. This research which is centred on automating the "Ayo olopon" game is inevitable because of the increasing need for system automation. There are many difficulties associated with the existing manual approach of playing the "Ayo olopon" game which ranges from loss or misplacing of seeds to inaccuracy in scores calculation due to human errors. This system is designed to efficiently handle the entire process of the game play. Two algorithms were implemented for the game manipulation. The first for handling the incrementing of the next cell while the other an entire play turn. Out of the diverse rules for the game play, one was selected and implemented. With the proposed system, "Ayo olopon" game playing is more efficient when compared to its present mode of play. The study outlined the concepts of the analysis and design methodology of the proposed system, compares it with the existing system and explains the design and implementation of the system using Microsoft C# as its programming language on the Visual Studio.NET platform serving as the Integrated Development Environment (IDE). The research was tested using the Windows operating system and worked successful.

Keywords :- Ayo Olopon, Mancala Games, Cell, Seeds.

1. INTRODUCTION

The computer era has led to increase in communication among individuals and organization. It has led to the concept referred to as globalization which involves the integration of the world into a unit (Mittra, 2013), where people from different background can transfer their products and idea to other parts of the globe. Since the world has become so linked together and has become an inseparable part, international trades have been ongoing, different nations export and in return importing goods and services from other countries. Countries which were traditionally known for specific things are today, experts in other things and most times letting their own trade-mark slip off. For instance, Nigeria as a nation which was known for its massive agricultural supply such as cocoa, palm oil etc., in her 1950s has left this tradition in pursuit of other things.

Africans from time immemorial are known for their creative art skills and their diverse rich cultural heritage. These art skills transcend to their indigenous games they created in early times and still these days play for fun. Scholars used these concepts to prove the western world wrong when they classified Africans as people with reduced intelligence quotient (IQ), whereas most of these indigenous games were created when there was no civilisation and these games are still smart enough to compete in this civilised generation. Games of these kinds include draught and also "Ayo Olopon" which is the center of this research work. The difficulty encountered with the African indigenous games in time past were the tools used in playing the games, while most utilised the earth as the board of the game, and stones, leaves as other parameters used in playing it. As time passed by, these tools were upgraded to carved wooden tools which aided its movement from one location to another. The environment today has become so digitised that there is not a single aspect of human endeavour that has not been touched by the computer. One field in which the use of computer has brought a great improvement is the game world, in trying to get moves attached to our environment there is a need to digitise these traditional games so as to be able to export African creativity to the world.

Ayo traditional game is found in the common manual form, with physical boards and counters, but with everything becoming digitalized nowadays, the trend has moved to having these games online and playing them on a personal computer without the need of any physical boards.

2. RELATED WORKS

Akinyemi, Longe, Olugbara and Oyelami (2013) presented a computer simulation process of decision making in playing Ayo game. A simple Heuristic Decision Making (HDM) approach was presented in the paper which is computationally efficient and predicts best move within a very short time. It has the tendency to incorporate new play strategies in form of fictitious play or expert instruction, thus it becomes sensitive to its mistakes/weaknesses and can change tactics at any point in time.

Clark, Tanner-Smith, Killingsworth and Bellamy (2013) carried out a systematic Review about Digital Games for Learning. The research study gives a detailed review of previous researches done on Games as a whole. Sauro and Kindlund (2005) developed a method to increase the meaningfulness and strategic influence of usability data. Data from four summative evaluations indicates that the model provided a versatile method that can be used to develop a single, standardized and summated score for analyzing and reporting usability metrics. Aarseth (2003) promoted the methodology for the aesthetic study of games. The research brings out a major three characteristics of every game, the Game-play (the players' actions, strategies and motives), Game-structure (the rules of the game, including the simulation rules) and Game-world (fictional content, topology/level design, textures etc.).The research centered on rules that should guide the analyst as well as a developer in game development laying a set of methods that could be exhibited but still considered the view of the developer.

Khan (2003) illustrated the combinatorial nature of the Ayo game played in the south- western part of Nigeria. The researcher was able to classify the Ayo game as a combinatorial game by analyzing the rules taken by the two players involved in the game play. Broline and Loeb (1995) studied certain common unbalanced Ayo end game position and show how they are related to the positions in Tchoukaillon from which a win is possible. The paper focused on the study of the determined position in Ayo and position in Tchoukaillon from which a total win is possible.

3. METHODOLOGY

We conducted interviews firstly and discovered that the "Ayo Olopon" game have different forms of play which is dependent on the locality where it is been payed. Different rules are involved in the game played. In this paper, the application developed is based on the rule below:

3.1 Game Rule

The start player selects a seed from within his six cells and moves in an anticlockwise order dropping one per cell as he progresses, if he drops his last seed into an empty cell, he stops and allows the next player play. Also if he drops his last seed into a cell that contains 3 seeds beforehand, hence making it 4, he stops and takes the 4 seeds and places them among his winning seeds. Else if he drops his last seed aside the earlier mentioned option, he packs all and continues to play. While the play is going on, at any instance of a "4 seed in a cell", the owner of the cell takes the seeds. The game continues until 8 seeds are left, then the next person that wins a seed of 4 takes all. This is the rule applied in the development of this application.

3.2 Prototype of Ayo Game

Following the architecture described above, the game design for the prototype simulation of the Ayo game was developed using C# in Visual Studio. The game is split into 12 cells, 6 to the north and the other 6 to the south. All the cells are embedded in a rectangular board as seen below

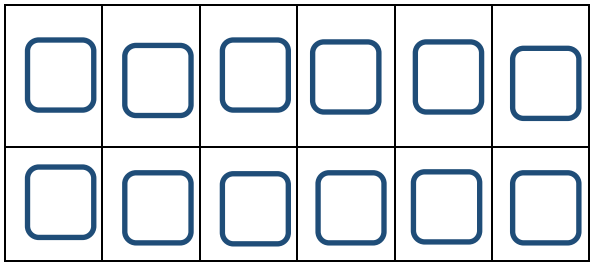

Figure 3.3: model of an empty board

To play the game, the first player would have to choose a cell (south or north), but by default, north is chosen. The player to the north will be assigned player 1 and he/she starts the game.

3.2.1 Initial State

The initial state of the game has the following properties

a) All cells have 4 seeds each, hence total number of seeds are 48
b) Both players' score is initialized to zero (0).

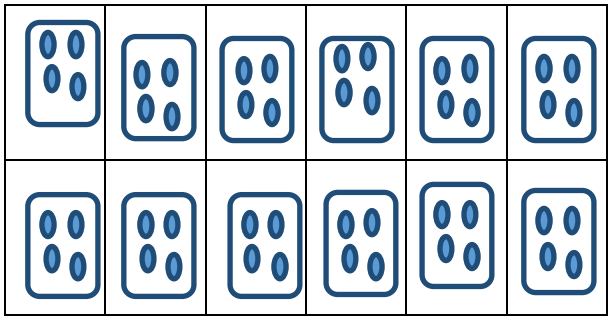

Figure 3.3: model of the initial state

3.2.2 Final State

The final state of the game has the following properties

a) All the cells in the board are empty.
b) Both players have scores that when summed up gives 48.
c) A winner is decided by the score of the player. i.e the player with the highest score wins

In between the initial state and the final state of the game involves the following

a) **Successor function:** The successor function is the action taken by either of the player that results in a new state of the game.
b) **State space:** The state space is the set of states in totality that can be reached by the game when a successor function is applied.
c) **Path:** The path is the trend that the player follows from the initial state to the final state by both players.
d) **Path cost:** the path cost is the effect of the path that the user follows, could result in a win or a loss.

3.3 System Psuedo Code

Based on the above rule, two algorithms were implemented; the first to handle the increment of a cell when the preceding cell is selected by a player. While the other algorithm handles the flow of a player's turn.

The pseudo code are listed below

3.3.1 Pseudo-Code for Incrementing the Next Cell

```
Start process
get cell_number
        set next_cell = cell_number + 1
        if next_cell = 12 then
                set next_cell = 0
        end if
        for i = 0 to 18
                if next_cell = i then
                        increment i by 1
                        set number of seeds in next_cell to i
                        exit loop
                end if
        next i
End process
```

3.3.2 Pseudo-Code for a Complete Turn Play

```
Start process
get cell_number
        if cell_number = 12 then
                set cell_number = 0
        end if
        for i = 0 to 18
                if cell_number = i then
                        cell_number =0
                        incrementNext(cell_number)
                end if
                exit loop
        next i
End process
```

4. RESULT AND DISCUSSION

The developed system was significantly efficient with its entire module functioning well after several testing at all levels of testing. The results are computed based on the number of seeds won by each player. Anytime a player wins 4 seeds, 4 points is added to his existing score.

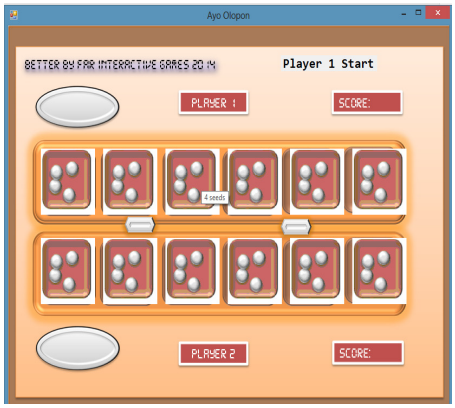

Figure 4.1: Start state

The figure 4.1 shows the start state of the game, here all cells are filled with 4 seeds each.

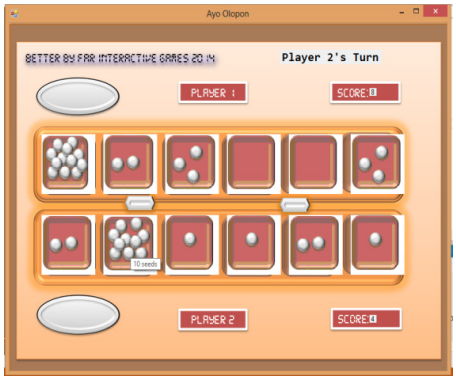

Figure 4.2: State after a turn

Figure 4.2 shows the output after the first turn of the game played which is played by player 1

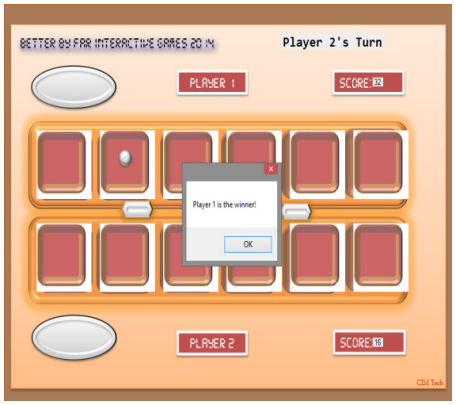

Figure 4.3: Player one win

Figure 4.3 shows when there is a win by the player 1

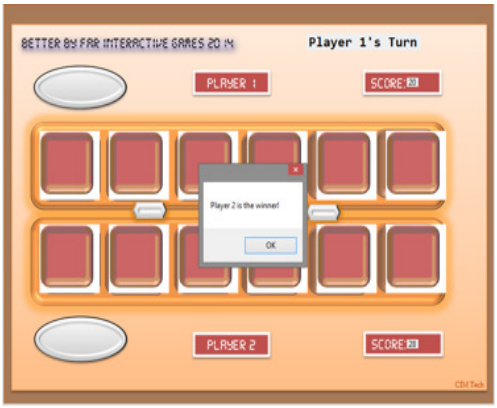

Figure 4.4: Player two win

Figure 4.4 shows when there is a win by the player 2

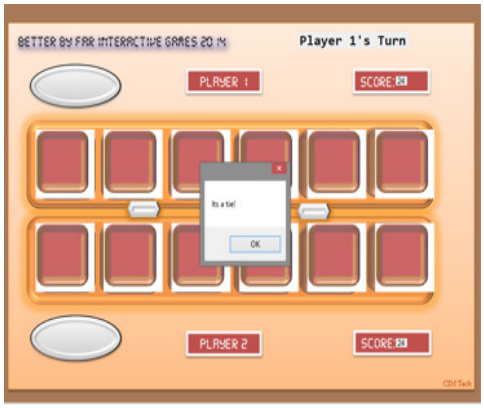

Figure 4.5: A tie

Figure 4.5 shows when the game ended in a tie

5. CONCLUSION

African games have gained lots of attention at international level inviting scholars to place comment on the beauty of these games of which the "Ayo Olopon game" stands out strong. In order to expand the reach of the "Ayo Olopon game", the above research is a detailed analysis of its computerized approach. Due to time and resource constraints, the developed application was not built to allow two remote computers to play via a network, which would be added in subsequent versions of the research.

REFERENCE

1. Stapleton, A. J. (2004). Serious Games: Serious Opportunities. Paper presented at the Australian Game Developers' Conference, Academic Summit, Melbourne, VIC.
2. Raybourn, E. M. (2008). Simulation Experience Design Method for Serious Game. Lockheed Martin Company. United State Department of Energy.
3. Akinyemi I. O., Longe H. O. D., Olugbara O. O. and Oyelami O. M. (2013). An Empirical Judgment of Computer Simulated Ayo Game for Decision Making. International Journal of Scientific &Engineering Research, Volume 4, Issue 8.
4. Khan, S. U. (). Combinatorial Games: Ayo. Department of Computer Science and Engineering, University of Texas at Arlington.
5. Broline, D. M. and Loeb, D. E. (2008). The Combinatorics of Mancala-Type Games: Ayo, Tchoukaillon, and $1/\pi$.
6. Aerseth, E. (2003). Playing Research: Methodological approaches to game analysis. University of Bergen.
7. Lark, D. B., Tanner-Smith, E. E., Killingsworth, S. and Bellamy, S. (2013). Digital Games for Learning: A Systematic Review and Meta-Analysis. SRI International.
8. Clark, D., Tanner-Smith, E., Killingsworth, S., Bellamy, S. (2013). Digital Games for Learning: A Systematic Review and Meta-Analysis (Executive Summary). Menlo Park, CA: SRI International.
9. Oderanti, F. O. (2011). Fuzzy Decision Making System and the Dynamics of Business Games. Heriot-Watt University, Edinburgh, United Kingdom