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E-OTHELLO: THE DEVELOPMENT OF AN ELECTRONIC-HARDWARE VERSION OF TRADITIONAL OTHELLO BOARD GAME

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ABSTRACT

Othello is a traditional game that can be trace back to year 1830s where the objective of the game is to have own pieces occupied the board. The board game has been declining rapidly as gaming technology getting more advances. This is because video games are preferred by the Gen-Z because it is more interactive. There are many electronic-software versions of this board game but the game popularity is still declining as the electronic-software version is not interactive and just a conversion of the board game. The objective of the development of electronic-hardware based of this board game is to give a twist of the old board game in which the user can have the feeling of playing a hardware board game and yet experienced the interactive of an electronic version (such as playing on smartphone app). The proposed schematic and flowchart are explained concisely. The simulation and actual results are presented and the finding shows that the E-OTHELLO performs as expected.

Keywords: electronic board game, othello, reversi, board game.

INTRODUCTION

The history of the game Othello itself is an interesting as the game itself, the game was known as Reversi which was claimed to be invented in 1883 in England [1]. Several improvements had been done from the initial Reversi for the board game to suite for international tournament level; the name itself also had been change to Othello. The acceptance of the board game was at its peak in 1980s [2]. Then, there is a continuous decline in the consumption of all board games since the introduction of video game in late 1980s. According to Telegraph Website, the decline is due to video game which is more visually appealing, interactive and designed to be addictive [3]. Yet in the same article highlights the positive points of the board game which the author recommends the parents to select board game over video game [3].

This project attempts to develop an electronic-hardware-based Othello board game. The electronic board game is develop using electronic components such as Red-Green Light Emitted Diodes (RG LED), joysticks and a pushbutton. Arduino Mega is used as the electronic controller for storing the codes that coordinates the LEDs, rules of the game, and the user score. The Othello pieces are replaced with RG LEDs where red and green represents different player, while a no light LED means there is no piece being place on the board. The player places the piece using joystick where the blinking LED indicates the player turn and the position where the player wants to place the piece and the permanent light-up LEDs. A pushbutton is place for user to press to end the game and determine the winner.

There are many software-based Othello game in different video game platforms like Reversi for Microsoft-based Operating System [4], arcade-based Nintendo's Othello [2], and Android-based Othello [5]. Based on the literatures survey done, none had attempted to design an electronic-based Othello board game. This is no surprise as many might think the project is more a hobbyist project rather than an academic study.

METHODOLOGY

Figure-1 shows the top view of the proposed board game where there are 64 RG LEDs to represents players' chips, two joysticks for the player to control the movement of the chip, and a push button to end and reset the game.

Figure-1. Condition when wheel zigzag gets over block.

Figure-2 shows the circuit construction of the proposed electronic board game where the main components are the RG LEDs, shift registers used to coordinate the RG LEDs, and Arduino Mega as the controller for the board game. Other than that there also buzzer to produce suitable sounds which greatly assists the player, push button to stop and reset the game, and joysticks for player to move and place the piece. Notice

that eight RG LEDs are connected to two shift registers (IC74595). This is necessary in order to reduce number of Arduino pins used from 128 pins to 48 pins. The shift register also helps to easier coordinate the RG LEDs by representing the on/off of the RG LEDs by its corresponding number.

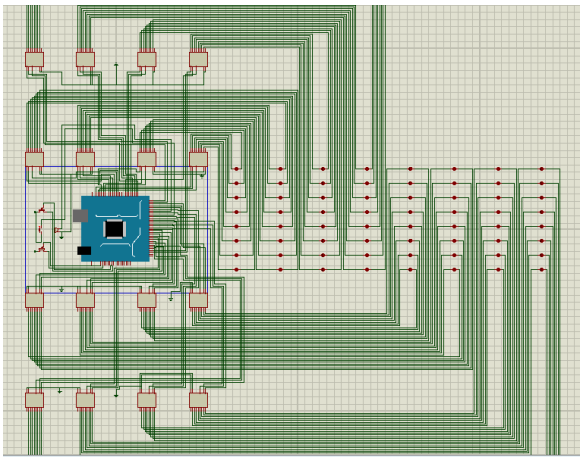


Figure-2. Schematic diagram of Reversi/Othello Electronic Game.

Figure-3 shows the flowchart of E-OTHELLO where at the beginning of the game, the score of both players are initialise to two. The corresponding RG LEDs at the middle of the board game. Then, the first player turns to start where a green LED will blink at the bottom right of the first player. The green LED will move according to the instruction given using the first player joystick. Once, the first player presses the joystick button, Arduino Mega will check whether the location select does not violate the rule of the game, if not, then adjustment is done where the green LED will be permanently located to the location and any changes of opponent red LEDs to green LEDs will be executed according to Othello's rules. when the user presses the joystick.

Next, the second players turn to start where a red LED will blink at the bottom right of the second player. Similar to what the first player experienced, the red LED will move according to the instruction given using the second player joystick. Once, the second player press the joystick button, again, Arduino Mega will check whether the location select does not violate the rule of the game, if not, then adjustment is done where the red LED will be permanently located to the location and any changes of opponent green LEDs to red LEDs will be executed according to Othello's rules. If any of the user violates the rule when locating the LED, Arduino will reset the position of the blinking LED to the bottom right of the location. If the bottom right of the location has been occupied, the blinking LED is set to next left location that is available. The process is repeated until the game is finished or the pushbutton is being pressed.

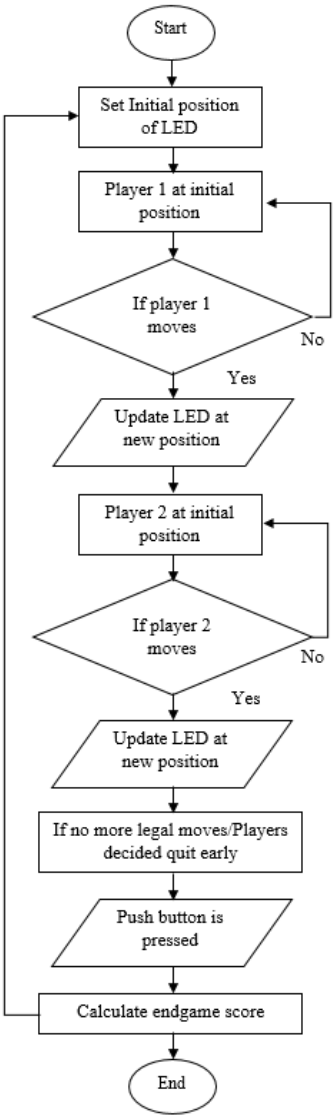


Figure-3. Flowchart of E-OTHELLO**.**

Once of this criteria met, Arduino Mega will arrange the LEDs according to the colours and players can easily determine who is the winner based on that. Every action will follow by a suitable sound that comes from a buzzer which had been codes with different frequencies and delays.

RESULT AND DISCUSSIONS

In order to decrease the cost and time of the prototype build up, the circuit is designed and simulated using Proteus software in order to obtain simulated results. Figure-4 shows the initial setup of the board when the project is started. The green LEDs represent the first player's chips and the red LEDs represent the second player's chips.

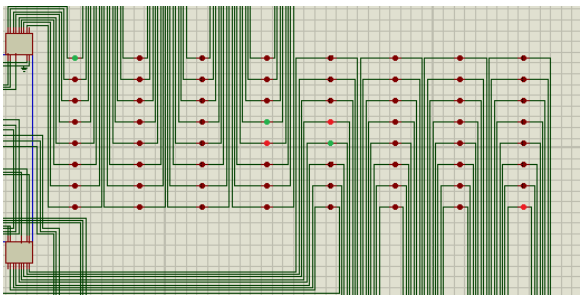


Figure-4. Introduction of the game.

In Figure-5, when player one green chip moves and captures player two red chips, it will update the board's condition.

After player one turn ends, player two will make his move. Player two's red chip moves and captures player one green chip. This as illustrated in Figure-6.

Figure-7 shows that the chip can also be put diagonally in order to capture opponent's chips.

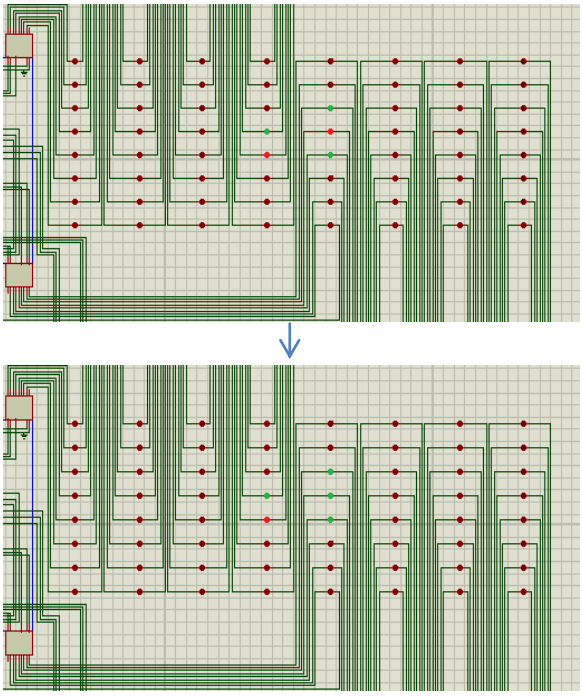


Figure-5. Player one movement and capturing.

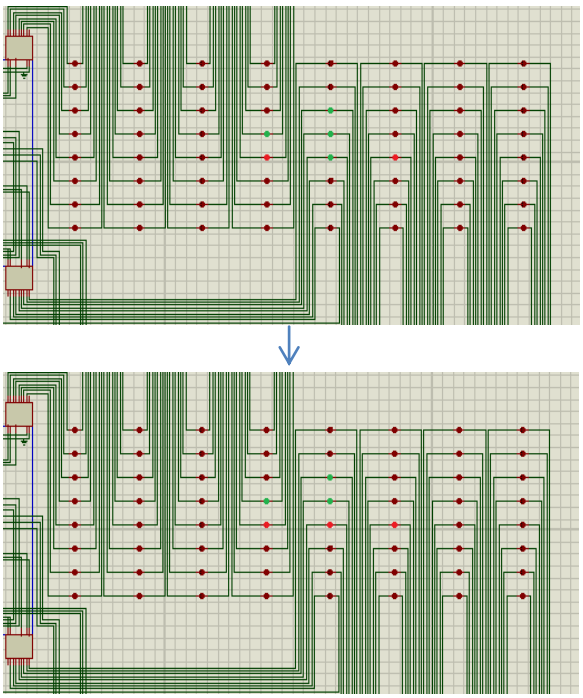


Figure-6. Player two movement and capturing.

Figure-7 shows that the chip can also be put diagonally in order to capture opponent's chips. In Figure-8, if a player put their chips on the wrong place, the LED will reset itself to its initial position. This applies for both players.

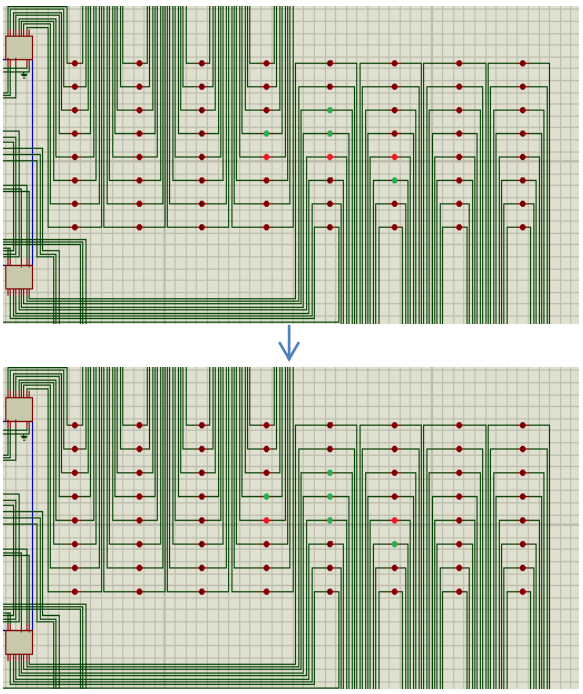


Figure-7. Capturing the chips diagonally.

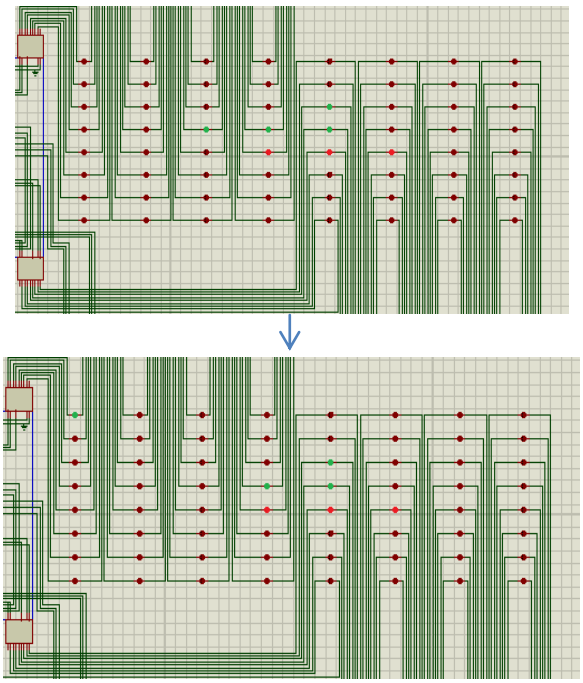


Figure-8. If a player places the chips at the wrong position.

When the game reaches its end, that is when both players have no moves left, the pushbutton is pressed to calculate the results of the winner. In the case of Figure-9, if the players decided to end the game early, the pushbutton can also be pressed to calculate the score.

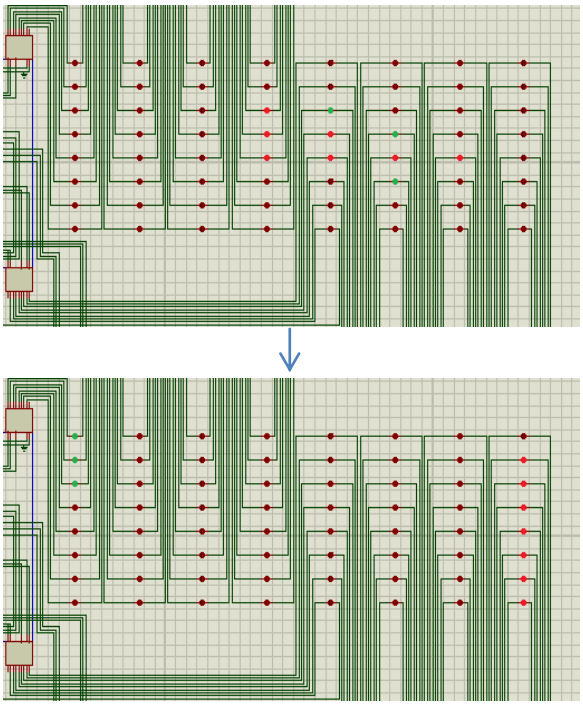
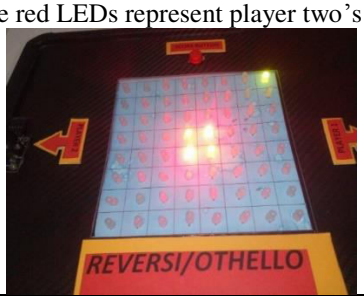
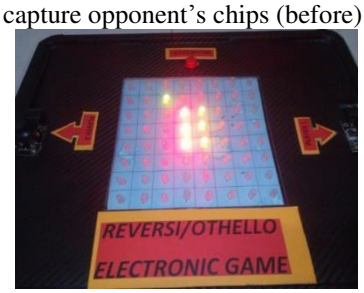
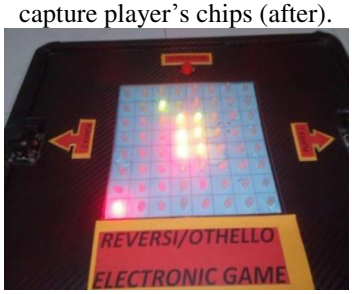
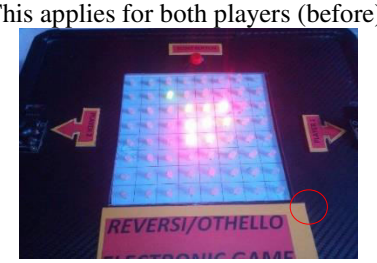
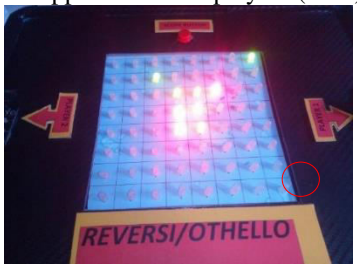


Figure-9. The endgame**.**

Table-1 shows the hardware implementation which is identical to the software simulation. It is necessary to perform testing in order to verify the functionality of the board game.

Table-1. Result obtained through testing of the hardware.

No.	Scenario & Result
1.	The introduction when the project is started. The green LEDs represent player one's chips and the red LEDs represent player two's chips. 
2.	When player one (green chips) moves and before capturing player two (red chip). 
3.	After player one captures player two, it will update the board's condition. After player one turn end, player two will make his move. 
4.	Player two (red chip) moves and before capturing player one (green chip). The board's condition is updated. 
5.	After player two captures player one's chip, it will update the board's conditions. After player two turn end, player one will make his move again.

	
4.	The chips can also be put diagonally in order to capture opponent's chips (before). 
	The chips can also be put diagonally in order to capture player's chips (after). 
5.	If a player put their chips on the wrong place, the LED will reset itself to its initial position. This applies for both players (before). 
	If a player put their chips on the wrong place, the LED will reset itself to its initial position. This applies for both players (after). 
6.	The game reaches its end when both players have no move left or the pushbutton is pressed, the board will arrange the players chips.

CONCLUSIONS

This paper presents the development of the electronic-hardware-based Othello board game called E-OTHELLO. The circuit and the flowchart of the proposed method are presented concisely. The result of the simulation and hardware are obtained and discussed.

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