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E-CONGKAK: THE DEVELOPMENT OF AN ELECTRONIC CONGKAK BOARD GAME TO PROMOTE TRADITIONAL BOARD GAME TO YOUNGER MALAYSIAN GENERATION

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ABSTRACT

Congkak board game has been a traditional board game played among Malaysian. Unfortunately, like any other traditional games, there is a great decline of interest among younger Malaysia generation due to popularity of multimedia-based games. The objective of this project is to improvise the traditional board game by developing an electronic based board game that gives the interactive element those most multimedia-based games, yet keep the traditional kinesthetic and human to human element. The project uses Arduino Mega as controller, seven segment displays to indicates number of marbles in each hole, and push button for the user to select which hole to select. A survey consists of six questions was done among the young Malaysians to verify whether the electronic board game is better than the traditional board game. The result indicates that the electronic board game proved to be popular among the young generation.

Keywords: congkak, kinesthetic, traditional board game, Arduino.

1. INTRODUCTION

Congkak is a board game that had been played among the Malays for generations. This board game is a variation of Mancala game. The word Mancala refers to the terms of "count and capture" in Arabic [1]. Although the board game comes from Arabic word, the board game origin is said to be from Africa [1]. Congkak is the name given by the Malaysian for this board game and the word Congkak roots to back to the word "congak" which means counting silently. As the name suggested, the most important skill required to win this board game is to be able to perform mathematical calculation in one person head.

One might argued that this traditional board game is obsolete compared to the more complex video game yet there are several articles that shows Mancala has it significant important to be retain. An article written by J. Retschitzki and heavily recommends the use of Mancala board game for elementary school students. The research found that the mancala board game suitable for the drill of counting and arithmetic operation [2]. D. Barker inspired by Mancala board game and use the board game concept as a methodology to measure the farmers' attitudes and environmental images [3]. P. Latorre mentioned that the concept of "harvesting" in most of modern real strategy games is fundamentally based on the Mancala game principle [4].

Congkak is the two-rank version of Mancala which consists of two ranks. Each rank usually has seven holes, and each hole has seven pebbles. There also two holes of located at the end of the ranks. These holes represent the point collected by each player. There is a great decline of interest among the Malaysians on Congkak and traditional board games in general. The main contributor to this decline is the rise of multimedia-based

game such as video games, computer games and smartphone games which are more interactive and designed to keep the gamer attention.

The objective of this project is to improvise the traditional board game by developing an electronic based board game that gives the interactive element those most multimedia-based games, yet keep the traditional kinesthetic and human to human element. By doing so, the author hope that the board game able to promote this traditional game by improvising the board game to cater the interest of younger generation. This should align with [8], whereby learning engineering should be fun.

The only documented attempt on creating an electronic version of Mancala is done by David Piggott in year 2009. The author created an electronic version of Bantumi (a variation of Mancala) called iBantumi [5]. iBantumi consists of two ranks, five holes and each pebble represented by an LED. E-Congkak deviates from the iBantumi where E-Congkak is based on the rules of Congkak and in term of hardware representation, the seven segment LED to represent number of pebbles. Detail explanation of E-Congkak will be done in the Methodology section.

2. METHODOLOGY

The proposed electronic Congkak board game, E-Congkak is a simplified version of the actual Congkak board game where Table-1 indicates clearly the differences. Traditional Congkak board game consists of two ranks, seven holes for each rank, and seven pebbles per hole, while E-Congkak slightly miniature in order to reduce the game time and the complexity. In the traditional Congkak board game both players start simultaneously initially while E-Congkak only allows player one to start first. E-Congkak also does not

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implement the "Tikam" rule in which the player can collect the opposite rank hole's pebbles when the player end his turn given that the player had visited each hole of board game.

Table-1. Differences between E-Congkak and traditional Congkak.

| Features	E-Congkak	Traditional Congkak
Number of holes per rank	Five	Seven
Number of pebbles per hole	Five	Seven
Both players start simultaneously at the beginning of the game	No	Yes
Implement "Tikam" rule	No	Yes

The block diagram of E-Congkak as shown in Figure-1, the main component of E-Congkak consists of Arduino Mega as the micro-controller. Arduino is the main controller that has been used in previous project as stated in [9-12]. The use of Arduino Mega instead Arduino Uno because Arduino Mega has more digital pins which are required to cater as the output pin to display the seven-segment displays. The direction of the arrow shows the direction of the signal. For each hole, Arduino will send signal to IC74595: Shift Register instead of a more conventional way which is using IC7446: BCD-to-7-Segment Decoder. The main purpose of using IC74595 instead sending signal straight from Arduino to 7-Segment is to reduce the use of digital pins [6]. The total Arduino digital pins used to send data is 12 pins instead of 96 pins for IC7446 configuration, and 192 pins for direct connection configuration.
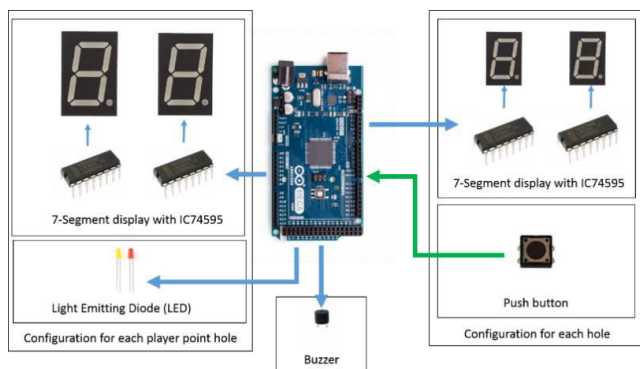
Figure-1. Block diagram of E-Congkak.

Each hole is represented by two seven-segment displays as there is possibility of each hole will have more than 10 pebbles. The total pebbles on the board are 50 pebbles thus two seven-segment displays are adequate to display the maximum value of the pebbles. A push button is use on each hole to for the player to press if the player decides to select the hole. Two LEDs are used to indicate

the player turn, while a buzzer is use to give the effect of the pebble had been picked up and place in each hole. Figure-2 shows the top view of the simulation circuit of E-Congkak, while Figure-3 shows the hardware implementation of E-Congkak.
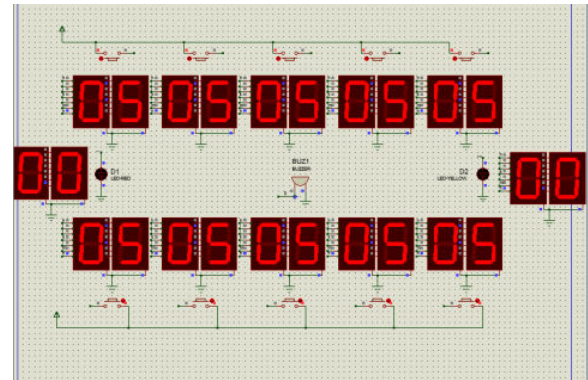
Figure-2. E-Congkak's circuit simulation.

Figure-3. E-Congkak's hardware implementation.

First, when E-Congkak board is turn on, the yellow LED for first player is light up. The first player can choose which hole he wants to start by press the push button corresponds to it. When the push button has been press, the seven segment of the chosen hole will blink twice then continuously display zero to represent that the pebbles of the hole have been picked up. The blinking effect to attract the player attention in order to give the player the sense of effect the pebbles had been picked up. Then, the next hole in the clockwise order will update by one which give the impression of that one of the pebbles had been placed to that hole. The seven segment displays correspond to the hole will update by incrementing the value by one. This process is repeated to the following holes in clockwise order until player one turn ends. The larger seven segments on end of each rank represent the points accumulated by the player. Every time this hole is updated, the program also will check if the value is greater than 25, the buzzer will make a pleasant sound which indicates the player had won the game. This is because a player is consider to win the game when he had collected more than half (25 pebbles) of the total pebbles on the

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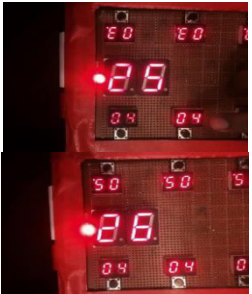
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board (50 pebbles). The game will be reset after it. If the value is not greater than 25, it will proceed the game.

Next, red LED of the second player is light up. The second player also had to make a choice which hole he wants to choose by pressing the corresponding push button. Similar procedure as mentioned in the previous paragraph will occur until either one player won the game. Once the winner is identified, the game will be reset after it. Table-2 shows the possible scenario of the game play with supporting evidence. Note that in Figure-3, player one location is at the bottom of the image and player two is on top of the image. For player one, hole number one is the most right of player one while hole number five is the most left of player one. Meanwhile, for player two, hole number six is the most right of player two while hole number 10 is the most left of player two. Video of the demonstration of the E-Congkak can be seen at Malaysia Innovation Channel [7].

Table-2. Scenario of the E-Congkak gameplay.

No	Scenario	Expected result	Actual result
1	The game just started and player one select hole one	LED (yellow) player one is turn on. Seven segments hole one will blink twice, and becomes zero. Seven segments hole two, three, four, five and six, each will blink twice and value will increment by one. Since the seven segment last pebble insert to the player one point-hole, player one can continue the game by choosing a new hole.	As expected result. Image below shows the hardware implementation.
2	Player one turn has ended. Player two decide to choose hole six.	LED (red) player two is turn on. Seven segments hole six will blink twice, and becomes zero. Seven segments hole seven, eight, nine, and 10, each will blink twice and value will increment by one. The game will continue until player two turns end.	As expected result. Image below shows the hardware implementation.
3	When player one obtained more than 25 points/pebbles	The seven segments player one point-hole will blink twice increment value by one, the buzzer will produce a sound of music. The game will reset automatically in a minute time.	As expected result. Image below shows the hardware implementation. Top image before the increment, bottom image shows after the increment.
4	When player two obtained more than 25 points/pebbles	The seven segments player two point-hole will blink twice increment value by one, the buzzer will produce a sound of music. The game will reset automatically in a minute time.	As expected result. Image below shows the hardware implementation. Top image before the increment, bottom image shows after the increment. Note that in both images player two is at the bottom.

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3. RESULTS AND DISCUSSIONS

The prototype built is then presented to 30 primary school students (15 male and 15 female) that are in Standard 2 in order to obtain feedback. All 30 students chosen have never played Congkak before. The students are asked the first six questions of the survey (as shown in Table-3) before the students are paired in two and given a 30 minutes demonstration sand playing session with the traditional Congkak. Then the students are given time to try out E-Congkak. After that the students are given opportunity to play with the mobile-phone version of Macala. Then, a survey is done to find whether E-Congkak is more appeal to younger Malaysian generation (as shown in Table-3). Note that the survey is done by university student volunteer who verbally interview the primary students and fill up the questionnaire accordingly.

Table-3. List of questions of the survey.

Beginning of the session		
Question No.	Question	Question type
1	Have you ever play video game?	Yes/No question
2	Why do you like playing video game?	Multiple answer question
3	Choose board game that you have play before	Multiple answer question
4	What is the most interesting board game you ever play?	Multiple choice question
5	Have you heard about Congkak before?	Yes/No question
6	Choose reason why you never play Congkak although you have heard about it	Multiple answer question
After the session		
Question No.	Question	Question type
7	Is traditional Congkak game is interesting?	5-scale Linkert scale question
8	Is E-Congkak is interesting?	5-scale Linkert scale question
9	Is mobile-based Macala is interesting?	5-scale Linkert scale question
10	Among three version of Congkak/Macala, which is the most interesting version?	Multiple choice question

### Question 1: Have you ever play video game?

The purpose of including this question in the survey is to understand the respondents' background on video game. It can be clearly seen in Figure-4 that 97% of the respondents have played video game before especially on mobile. This shows that the respondents are technology savvy.
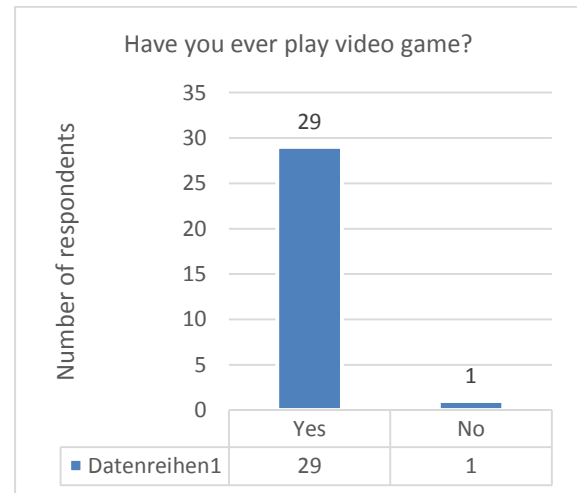
Figure-4. Respond for question 1.

Question 2: Why do you like playing video game?

This question is multiple answer question which means a respondent can select more than one answer. Figure-5 concluded that the main reason respondent played video game is due to the nice animation. Based on the interview, most of the respondents said they enjoy interact with the game characters.
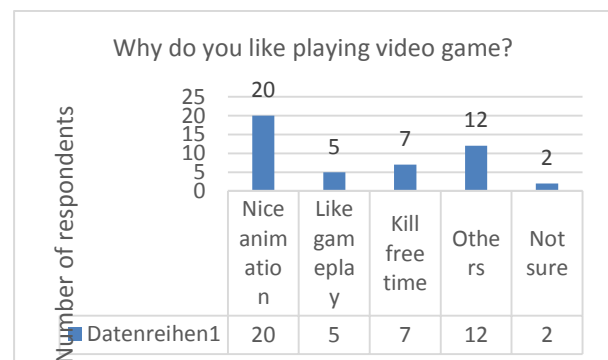
Figure-5. Respond for question 2.

Question 3: Why do you like playing video game?

Similar to Question 2, this question is multiple answer question which means a respondent can select more than one answer. Figure- concluded that the majority of the respondents (83% of them) had play Snake & Ladder board game. One thing to notice also, there is respondents who play all the main board games except Chinese checkers. Five respondents who answered others are referring to the Monopoly board game. Note also that all respondents had at least played one board game in their entire life.
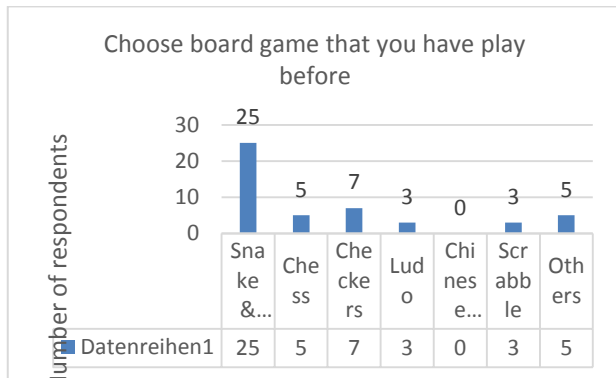
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Figure-6. Respond for question 3.

Question 4: What is the most interesting board game you ever play?

This question is multiple choice question which to identify the most popular board game. Figure-7 concluded that 67% respondents love Snake & Ladder board game. Another interesting finding from the survey 5 out 5 respondents who played Monopoly loves the board game.
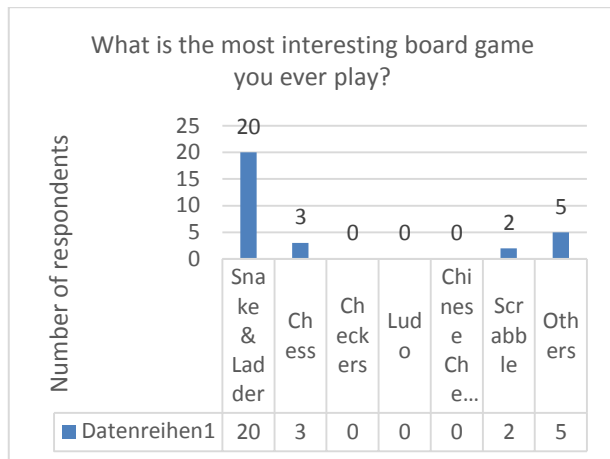

Figure-7. Respond for question 4.

Question 5: Have you ever heard about Congkak before?

This question is a yes/no answer question. Figure-8 shows the distribution of the respondents who heard about Congkak before is equal to number of respondents who have not heard about Congkak before.

Question 6: Choose reason why you never play Congkak although you have heard about it?

This question is a leading question to Question 5, therefore there is only 15 respondents answered this question. Figure-9 shows that the two main reasons why the respondents do not play Congkak are never have the opportunity and they do not find Congkak are interesting.
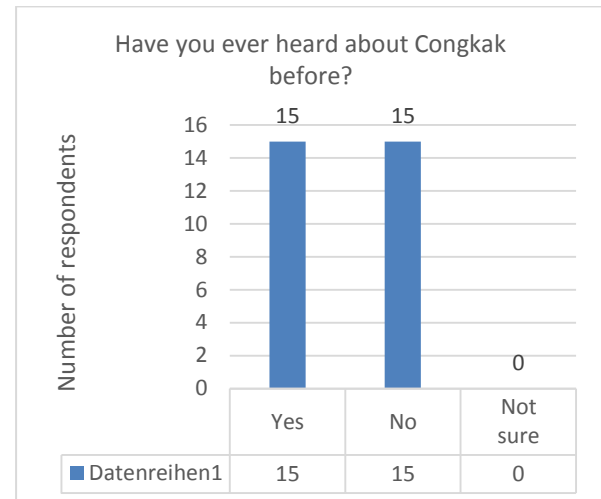

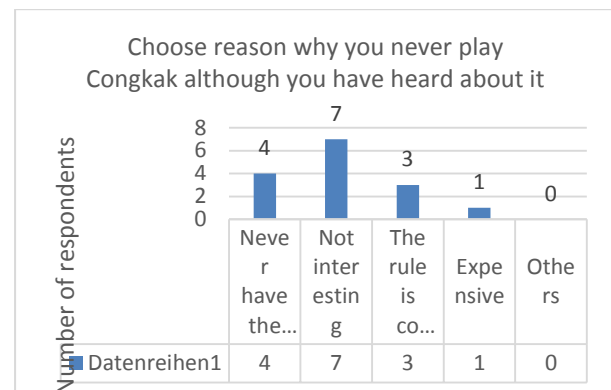**Figure-8.** Respond for question 5.

Figure-9. Respond for question 6.

Question 7: Is traditional Congkak game is interesting?

This question is a 5-scale Linkert-scale question. The question is asked by the volunteer to the respondents and based on the respond obtained the volunteer decided the suitable answer representing the respond given. Figure-10 shows majority has a neutral feeling on the game does explain that there is lack of interest on the board game.
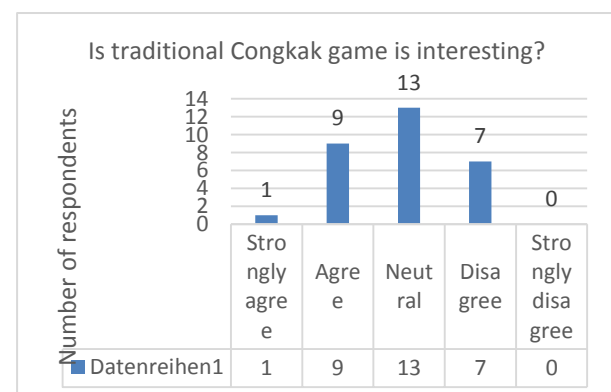

Figure-10. Respond for question 7.

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Question 8: Is E-Congkak game is interesting?

Similar to the previous question, this question is a 5-scale Linkert-scale question. The question is asked by the volunteer to the respondents and based on the respond obtained the volunteer decided the suitable answer representing the respond given. Figure-11 shows majority has agreed that E-Congkak is interesting.
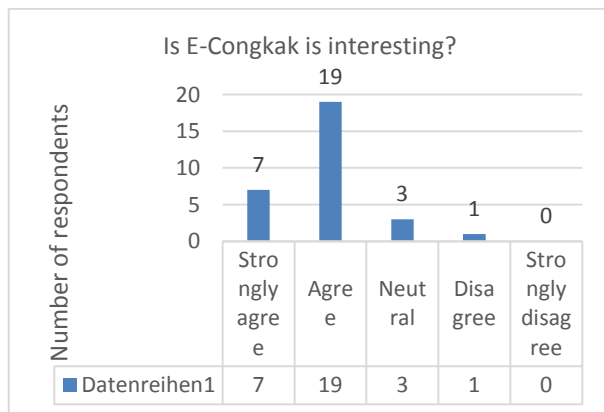

Figure-11. Respond for question 8.

Question 9: Is mobile-based Macala game is interesting?

Similar to the previous question, this question is a 5-scale Linkert-scale question. The question is asked by the volunteer to the respondents and based on the respond obtained the volunteer decided the suitable answer representing the respond given. Figure-12 shows that although majority agreed mobile version of Macala is interesting but there are two respondents disagreed.
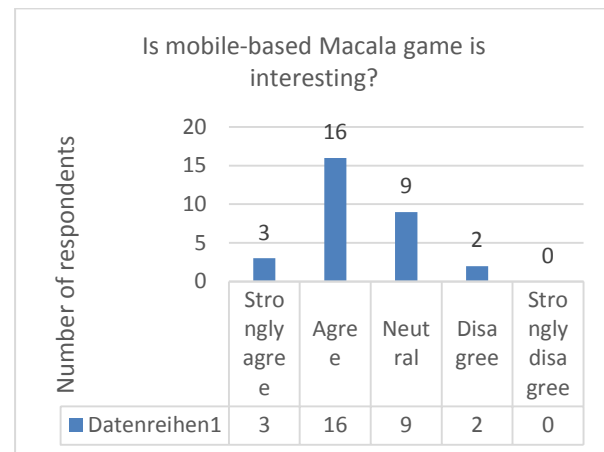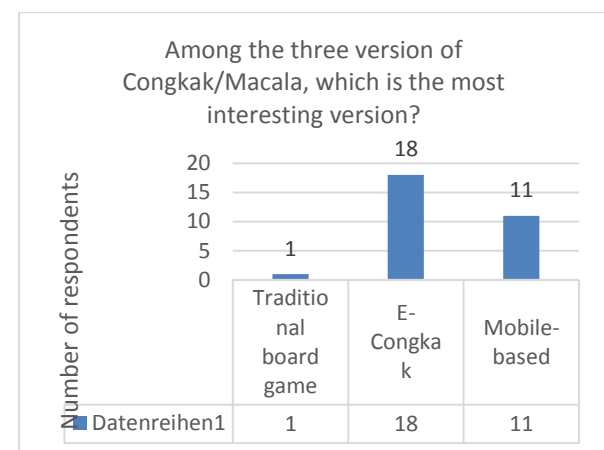
Question 10: Among the three version of Congkak /Macala, which is the most interesting version?

This question is a straight forward question asking the respondents to decide whether E-Congkak is superior compared to other versions. Based on Figure-13, 60% respondents choose E-Congkak and 36% choose the mobile version. This question validates the previous three questions. Although, it predicted that E-Congkak is better than traditional Congkak but it is a surprise to see that E-Congkak is considered more interesting than the mobile version.

Figure-12. Respond for question 9.

Figure-13. Respond for question 10.

4. CONCLUSIONS

This paper presented the development of the electronic-based of the traditional Malay board game, Congkak. Details had of the hardware and software had been explained. The prototype had been tested to the target users. The finding of the survey indicates that the respondents prefer E-Congkak compared to the mobile version and the traditional board game.

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