Rabbit and carrot electronic board game: the development of an educational kit that test student knowledge in flowchart concept

Muhammad Adam Husaini[1], Muhammad Izzat Zakwan Mohd Zabidi[1*], A Shamsul Rahimi A Subki[1], Amar Faiz Zainal Abidin[1], Mohd Haniff Harun[1], Nor Hafizah Hussin[1], Siti Fatimah Sulaiman[2], Nur Aiman Hanis Hasim[3], Kamarua Adzha Kadiran[4]

[1)] Faculty of Electrical & Electronics Engineering Technology, Universiti Teknikal Malaysia Melaka
[2)] Faculty of Electronic & Computer Engineering, Universiti Teknikal Malaysia Melaka
[3)] Faculty of Mechanical & Manufacturing Engineering Technology, Universiti Teknologi MARA, Malaysia.
[4)] Faculty of Electrical Engineering, Universiti Teknologi MARA, Kampus Pasir Gudang, Johor, Malaysia.

[*]Corresponding e-mail: izzat.zakwan@utem.edu.my

Keywords: educational kit; flowchart; programming

ABSTRACT – Flowchart is basically used for the construction of a program flow which plays the most important role in creating a project. The main purpose of this project is to design a project that can help primary student to get exposed with flowchart knowledge by using the educational kit. The concept of the educational kit is to use different value of resistor to construct the flow chart. The project uses Arduino Mega as controller, 3.2" TFT LCD display to display the map of the game, push button for the user to run the flowchart and buzzer to add effects to the answered questions whether or not it is correct or wrong. A survey consist of ten questions were given out to primary school students around Johor Bahru to determine the usefulness and suitability of the game board for the primary school students.

1. INTRODUCTION

According to Joiner Assocs [1] "A flowchart is a formalized graphic representation of a logic sequence, work or manufacturing process, organization chart, or similar formalized structure. The purpose of a flow chart is to provide people with a common language or reference point when dealing with a project or process". Flow chart is a useful tool in creating a program because it makes a process easy to understand the flow of a system. Based on MindTools.com [2], "Using just a few words and some simple symbols, it shows clearly what happens at each stage and how this affects other decisions and actions. Student finds this flowchart is hard to understand because it has different symbol used for a certain process that make them unable to identify the function of the whole flowchart. As LucidChart.com [3] states that, "Flow charts are simple diagrams that map out a process, so that you can easily communicate it to other people. It is also can be used to define and analyze a process, build a step-by-step picture of it, and then standardize or improve it". If the flowchart is constructed with the wrong flow, it causes the program not working properly as well leaves bad impression to the developer of the program. There is a similar concept project which was created by Alan Carey [4], a third year student from the university which he had created an electronic quiz game. His project displays the questionnaire game that asked questions and followed by four possible answers.

The main purpose of this project is to design a prototype that can help primary student to get exposed with flowchart knowledge by using the kit.

2. METHODOLOGY

In order to complete this project, the first step was to understand the research background regarding the flowchart. The study also includes on current project that operates the same process as this kit. The overall project flow includes circuit simulation using Proteus Software, transfer the design into PCB board and design a complete prototype. In this project, it consists of three stages of process that is input, control and output stage. The first stage is input stage whereby the variable resistor (R2) is used for each command that will be used in the flowchart. Next, the control stage is located between input and output stage. Arduino Mega 2560 microcontroller is located in the control stage where it acts as a brain that controls all the input and output of the project. Arduino microcontroller has been used for most of the project previously as stated in [5-10]. Lastly, the output stage is represented by buzzer, LED and TFT LCD. During this stage, the components will produce the expected output based on the input that inserted by the user.

Figure 1 Rabbit & carrot flowchart enhancement kit hardware prototype.

3. RESULTS AND DISCUSSION

The prototype built is then presented to 50 primary students. All 50 students have tried and find the potential of this project where they were agreeing that this kit is possible to sell to targeted user. The students were

interviewed in (the layman version) of the 10 questions of the survey as in Table 1, after being given a 30 minutes of demonstration and playing session with the kit before answering the questionnaire.

Table 1 Survey questions.

Question No.	Question
Q1	During simulation, is the Rabbit & Carrot Flowchart Enhancement Kit can give true answer according to connection?
Q2	Is the kit suitable to test student knowledge?
Q3	Rabbit & Carrot Flowchart Enhancement Kit can be a highly interactive activity during class session?
Q4	Rabbit & Carrot Flowchart Enhancement Kit can help student to improve their hands-on skill?
Q5	Students gained better understanding after answering the entire questions in Rabbit & Carrot Flowchart Enhancement Kit?
Q6	Do you think that this kit can increase students' cognitive skills?
Q7	Students prefer to learn Flowchart by using this kit rather than in theoretical way?
Q8	This educational kit can help educator to easily teach student about simple flowchart?
Q9	Students can operate this educational kit without the guidance of educator/ teacher?
Q10	Do you think this Rabbit & Carrot Flowchart Enhancement Kit is marketable in industry?

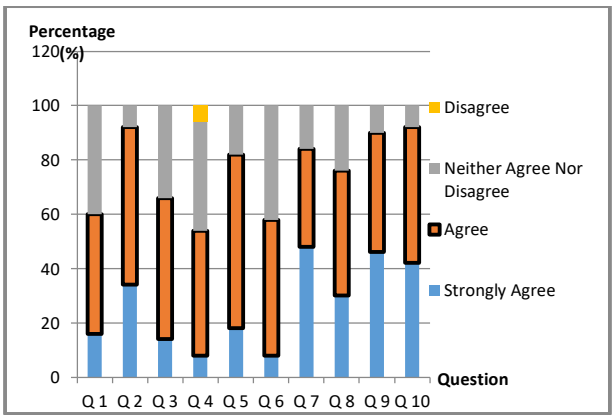

Figure 2 Stacked chart for questionnaire results.

Based on Figure 2, for Q1, it can be seen that 44% of the respondent agreed that this kit turn out to give the true answer according to the input command that they have inserted into the slot besides there are 16% more strongly agreed. Meanwhile for Q2, 58% had totally agreed that this kit has the ability to test students' knowledge mainly primary school students besides 34% of them strongly agreed the same. For Q3, 52% of the respondents had agreed with that and 14% strongly agreed. Besides that, from Q4, 6% of respondent disagreed the project can improve their hands-on skill. On top of that 46% had agreed and 8% strongly agreed with those elements presented by this kit. Other than that, for Q5, it can be seen that 64% that of the respondents agreed that they were able to gain better understanding after answering the entire questions in Rabbit and Carrot Flowchart Enhancement Kit besides there are 18% more strongly agreed. For Q6, 50% of the students had totally agreed that this kit has the ability to increase students' cognitive skills besides 8% of them strongly agreed the same. 48% of the students had agreed and 36% of them had strongly agreed in Q7. Based on Q8, it can be seen that 46% of the respondents agreed that this educational kit able to help educator to easily teach students about simple flowchart besides there are 30% more strongly agreed the same. Next, for Q9, 46% of the students stated that they had strongly agreed and 44% agreed on students can operate the educational kit without the guidance of educator. Lastly, for Q10, 42% of the students had strongly agreed that the kit is marketable in industry besides 50% more had agreed.

4. CONCLUSIONS

As a conclusion, the flowchart enhancement kit project which targeted for educational purpose is successfully designed, validated and collect data with the aims to help the primary school students to get exposed with flowchart knowledge. Besides, it could help them to improve their knowledge in programming. The kit can be used and observed physically as a hands-on kit and it is an interesting hands-on kit where students can try it by themselves.

5. ACKNOWLEDGEMENT

The authors would like to thank Faculty of Electrical & Electronic Engineering Technology, UTeM for sponsoring this work.

REFERENCES

[1] Joiner Assocs., Inc. Staff. (2002). Flowchart Plain and Simple, Oriel Incorporated Publication.

[2] *MindTools.com. Flowchart Process*. Retrieved: August 15, 2016, from https://www.mindtools.com/pages/article/newTMC_97.htm

[3] *LucidChart.com. Function of Flowchart.* Retrieved: July 15, 2016, from https://www.lucidchart.com/pages/what-is-a-flowchart-tutorial

[4] Alan Carey. *Electronic Quiz Game.* Retrieved: Sept 18, 2013, from https://www.youtube.com/watch?v=IiIw7l-CQ2c

[5] Mustapa, R. F., Abidin, A. F. Z., Amin, A. A. N. M., Nordin, A. H. M., & Hidayat, M. N. (2017). Engineering is Fun: Embedded CDIO Elements in Electrical and Electronic Engineering Final Year Project. *Proceeding of the IEEE 9th International Conference on Engineering Education*.