Ogata, H. et al. (Eds.) (2015). Proceedings of the 23rd International Conference on Computers in Education. China: Asia-Pacific Society for Computers in Education

ICT in teaching aids design: Interactive Jigsaw Puzzle

Chu-Yu CHENG[a], Zong-Xian YIN[b*], & Chia-Pin KAO[c]
[a]*Department of Creative Product Design, Southern Taiwan University of Science and Technology, Taiwan*
[b]*Department of Computer Science and Information Engineering, Southern Taiwan University of Science and Technology, Taiwan*
[c]*Department of Child Care & Education, Southern Taiwan University of Science and Technology, Taiwan*
*yinzx@stust.edu.tw

Abstract: The study is to construct an interactive jigsaw puzzle system. Our goals are to use the information and communication technology in development of child teaching aids. We had designed and implemented the electronic puzzle block. The block used microcontroller to control the patterns and wireless connection to transfer data with computers. Children can rotate and connect the blocks, which can be used to learn geometries in three-dimensional spatial relationships. The change of patterns will attract children's attention, which can increase their motivation and fun in learning.

Keywords: ICT tool, e-learning, embedded system, multimedia, Jigsaw Puzzle

1. Introduction

Traditional cardboard jigsaw puzzles had limited patterns and cards. People easily feel boring of the games. Computer jigsaws provide more interesting ways of playing the games. However, children can solely use mouse clicking the icons and cannot learn how to build up the jigsaws by their hands. The study developed an interactive jigsaw puzzle system and the electronic puzzle block. Children can rotate or connect the blocks to learn geometries in three-dimensional spatial relationships.

2. System Architecture

Our system includes two parts: the puzzle block and the console application. Figure 1 is a diagram of how to operate our system. Teachers first select a graph in the console application, as shown in Figure 1(a). The console application separates the graph into several geometric patterns and sends them randomly to the blocks. In Figure 2(b), students then bring the blocks together to build up the graph. In Figure 2(c), the blocks send their neighbor blocks information back to the console application. The console application can automatically compute whether students complete the graph.

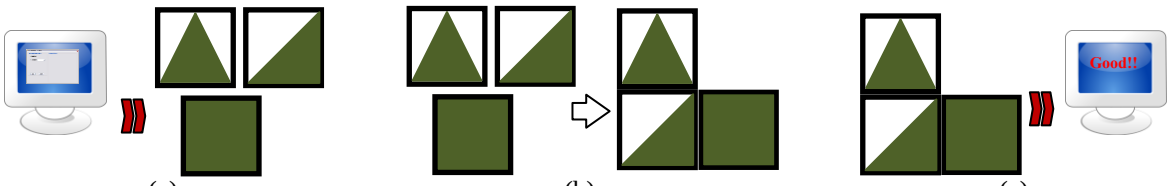

Figure 1. diagram of operation of the proposed system

2.1 Puzzle Block

The puzzle block has three layers. The first layer has 8x8 LED, which is used to display the geometry patterns. The connection ports are located in each side of the layer. They are used to connect neighbor blocks and communicate with them. The microcontroller is located in the second floor, and the third layer contains wireless communication module and batteries. The microcontroller is responsible for communication and display. The wireless communication module is used to data exchange with computer.

2.2 Console Application

The console application can be installed in a personal computer. Several graphs and their component patterns are pre-defined in the console application. User selects one graph, and the console application then sends the component patterns to the puzzle blocks. When each puzzle block sends its neighbors' information back, the console application has to construct their related positions and compute the answer.

3. Results and Discussion

Figure 2 is the blocks with different geometry patterns. Users can rotate them and connect with other blocks at each side. The left photo in Figure 3 is from the console application. The console application can monitor and show blocks' related positions. The photo in the right is the correct result of the blocks.

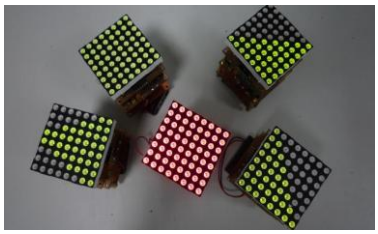

Figure 2. puzzle block can display many geometry patterns

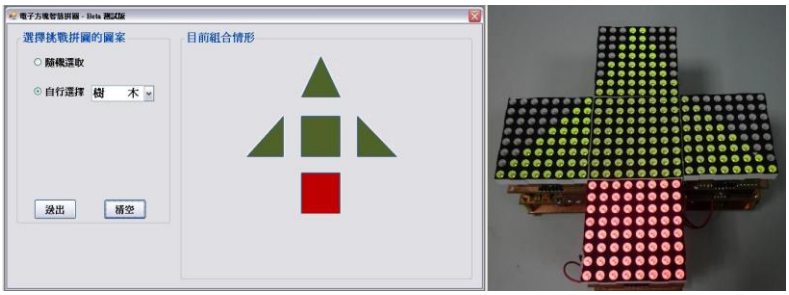

Figure 3. demonstration of system operations

In the future work, we will try to reduce size of the microcontroller and utilize OLED in order to obtain more various and fine patterns. In addition, we also are going to establish function of animation in the puzzle block, that we can develop more interesting games for the system.

References

Alci, B., & Canca, D. (2011). Change of students' problem-solving appraisal in higher education according to gender. *Procedia Social and Behavioral Sciences, 15*, 3179-3184.

Levav-Waynberg, A., & Leikin, R. (2012). The role of multiple solution tasks in developing knowledge and creativity in geometry. *The Journal of Mathematical Behavior, 31*(1), 73-90.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*, 54 -67.