Analysis and Study of Game Algorithm using Program Language Scratch

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Abstract: We develop a game using a programming language scratch and analyze the algorithms applied to the game. We analyze scratch application environment, design scratch game story analysis and game stage analysis design. Through the algorithm analysis design of the scratch game program, we apply the game algorithm using scratch and analyze the scalability and efficiency of the game algorithm by algorithm processing and algorithm coding by game stage. We study the logic circuit of the algorithm that increases interest in software education through the game development and develop the game stage through game algorithm research. This study will be used as basic data for software education and Research and Development (R&D).

Key words: Scratch, game, algorithm, program, software training, logic circuit

INTRODUCTION

There is no border in the cyber-world where the internet is connected. In the cyber world, information is utilized as well as real business processing. In the cyber world connected by mobile AI (Artificial Intelligence) and IoT (Internet of Things), the limits of reality and game are blurred.

In particular, South Korea is the world's ICT (Information and Communication Technology) power house and the world's number one in terms of high-speed internet use (Poushter *et al.*, 2018). Products such as smartphones and semiconductors are securing the world market and the game industry based on Korean wave is continuously developing.

However, SW is relatively weak compared to the development of HW in communication system and information processing system for cyber world. Therefore, the government is strengthening SW research and development. Through SW research and development and SW education we are trying to expand the ICT and ICBM (Internet of Things, Cloud, Big data, Mobile) of the 4th industrial revolution.

Scratch is used for SW research and utilization. In other words by using scratch, we are strengthening software education in school and after school education and it is necessary to study SW application after SW education.

Scratch is an educational programming language officially announced by the Lifelong Kindergarten Group of MIT Media Lab in 2005. Programming languages are module-based, easy to learn and have programming language features that educators and educators can use to their advantage (Anonymous, 2018).

If educators and trainees study through game programs, the effect of education is higher. The important thing when playing a game program is an algorithm. If the algorithm is developed, the characters appearing in the game are changed and the game method can be diversified to produce many games. Game users can also enjoy a variety of games which can bring excitement and pleasure. Therefore, it is necessary to study algorithms for games (Ouahbi *et al.*, 2015).

Literature review
Status of scratch application: Web-based learning activities integrated with the scratch tool are used for programming learning and scratch programming is also being used for scientific activities. It is used to improve creative problem-solving ability by teaching scratch programming that links Arduino.

Scratch education status: Programming education Estonia is a country that discovered the value of creative SW development early on and taught computer programming from the age of 7-19 for the first time in the world. Estonia is considered the most established country in Europe. The UK has designated the year of code in 2014 and has implemented coding and programming education as a core curriculum. Since, the development of the computer science curriculum in the early 2000, the United States has

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made up the contents of education centered on computing thinking and released the revised edition (Marcelino *et al.*, 2018). In Korea, computer regular education started in 1990 but it was completely abolished in 2008. Currently, some of the contents of programming and algorithm application are taught in information which is a high school subject according to the choice of general high school except for special high school. Recognizing the necessity of introducing SW education recently, the ministry for the future and the Ministry of Education announced the plan for elementary and middle school SW education in 2018.

MATERIALS AND METHODS

Game algorithm design using sctatch
Analyze and configure scratch environment: Scratches are written in the language Smalltalk based on Squeak. Unlike programming languages like C++, C #, visual basic, etc., scratch is a programming language easily accessible to beginners who try to program for the first time because blocks are dragged and coded like blocks. Scratch can be created, remixed and collaborated with this reference (Anonymous, 2018a, b). In addition, scratch is a programming language that is fun, educational and easy for beginners to learn by using block-based programming to create stories, games, art and simulations (Anonymous, 2018a, b).

Scratch game story analysis design: The game name is Gainvader and it is a game that raises the score by matching bat with lightning. Sprites of the game used crab, bat. Move the crab using the left and right arrow keys. Pressing the space key will cause the crab's lightning to move up and disappear when it touches the wall. If you hit bat your score will increase by 1 point and the bat's arrow speed will decrease. Bat gets lightning shot by crab and bat gets smaller. When crab gets hit by an arrow hit by bat crab's life is reduced and when crab's life goes to zero, game over is executed.

Scratch game sprite analysis design: Scratch can design an algorithm for each sprite to take advantage of the algorithm you created when you changed or added sprites. Scratch can create a storytelling game, so, you can design various algorithms by creating the nature and story of each sprite. By using the designed algorithms, you can create various interesting games and you can utilize the existing algorithms while creating several games.

RESULTS AND DISCUSSION

Application of game algorithm using sctatch
Algorithm applied by game stage processing: Figure 1 shows that when the bat's arrow matches the bat's arrow algorithm, the life of the crab is reduced and when the crab's life is zero, the game is over. When the lightning of a crab matches a bat, the size of the bat is reduced.

Figure 2 shows the crab's lightning algorithm in which the size of the bat is reduced and the score is increased by one point when crab's lightning fits bat. Also, the arrow speed of the bat decreases.

Algorithm coding by game stage: Figure 3 shows the arrow coded block screen of the bat. When the arrow of the bat touches the crab, the life of the crab is reduced. When the life of the crab is zero, the game over is executed.

Figure 4 is a lightning coded block of crabs. When a crab's lightning touches a bat, the score increases by 1 point and the bat's arrow speed decreases.

Algorithm applied by game stage: Figure 5 shows the execution of an invader game using an algorithm.

Extensibility and efficiency analysis of game algorithm: The sprite of crabs and bats can be changed to other kinds of sprites and the lightning tools and bat arrows of crabs can be changed to other tools.
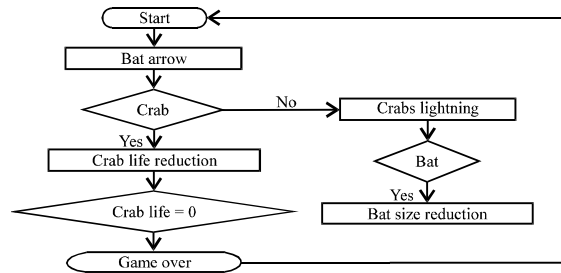

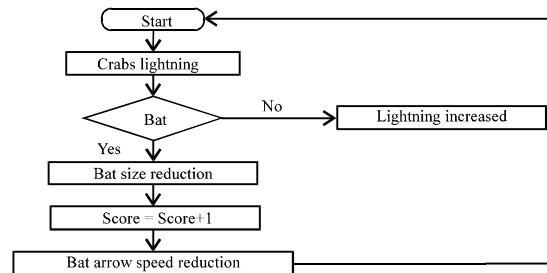Fig. 1: Flow chart of bat arrow algorithm

Fig. 2: Flow chart of crab's lightning algorithm

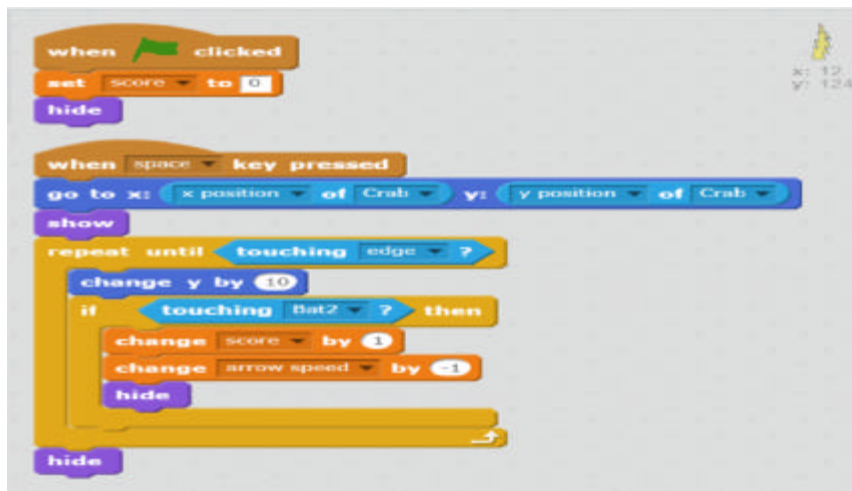Fig. 3: Bats arrow coded block screen

Fig. 4: Lightning coding block screen of crabs

Fig. 5: Gamer application screen with algorithm applied

You can expand the game in stages to increase the number of bats, speed up the bat and set the game's lightning to fire continuously to improve game efficiency.

CONCLUSION

Scratch is a block-based programming language. You can create games using scratch which is a fun, educational and easy to learn programming language for beginners. It is a program language that is suitable for SW programs. In this study we analyze the game situation using scratch, make a game directly and design and analyze game algorithm. Scratch application environment analysis and composition and scratch game story analysis in designing the invader game and sprite, crab, bat were designed. Crab scores the light by matching the bat to the lightning and when Bat catches the lightning shot by crab, the bat is reduced in size and scored. When crab gets hit by an arrow hit by bat, crab's life is reduced and when crab's life goes to zero, game over is executed. In this study, we have studied the algorithm of game stage, algorithm of game stage and coding of game. Once the game algorithm is established it can be changed from extensibility to other sprites and the lightning tool of the crab can be changed with other tools. By expanding the stage you can increase the efficiency of the game by changing the screen and adjusting the angle of the lightning. In this study, game algorithm design and algorithm summarization through game analysis is useful as an algorithm that can change sprites of various games and change game phase.

In later studies, SW seems to need an extended study using the programming language of scratch and the embedded chip game utilizing the Arduino HW sensor.

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