

A Development of CAROL: Computer-less Programming Learning Materials for Children

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Abstract: CAROL is a name combining COLOR and CAR. This work is a computer-less programming learning materials for children using some kinds of color blocks (Red, Green, Blue, Yellow, Orange, Purple). This work consists of a programming board, a vehicle robot and color blocks. In particular, a function is assigned for each color. For example, the blue block has a forward function, the red block has a backward function and so on. By combining them on the programming board, the users (learners) can decide the behavior of the vehicle robot, which moves actually. Furthermore, when the sound sensor equipped the vehicle robot detects clapping sound, the subroutine function of the programming board is called. Thus the complicated move of the vehicle robot can be realized by using the subroutine function. By using the CAROL, the users can learn not only the concept of sequential processing and conditional branch which are the basis of programming, but also how to logical thinking. Furthermore, CAROL can be treated by a 3-year-old child with a sense of mind, because the users do not need a computer for learning with CAROL. Thus children can be interested in the foundation of programming from an early age. This work can be one of the solutions for the programming education at elementary school next coming 2020.

1. Background and Purpose

Toward the programming education at elementary school scheduled to start from 2020, the study for programming from a young age becomes important. Furthermore, a demand for computer-less learning materials also becoming high, because there are many parents who resist children's use of computers and tablets.

The purpose of this work is to develop the learning materials to learn the basics of programming from a 3-year-old children without using the computer.

2. Concept and Idea

In order to learn programming without using a computer, we focused on color. Therefore, we came up with a system that

prepared several color blocks to which motion was allocated and arranged them in order. We also came up with a vehicle robot to perform the motion. We thought that this system could produce simple programming learning materials.

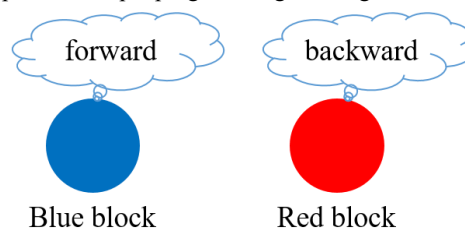


Fig.1 A conceptual sketch of color block.

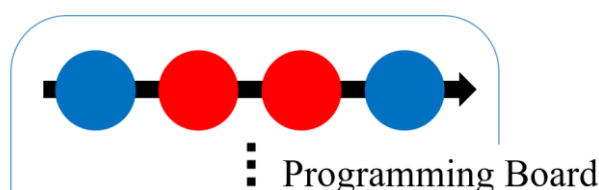


Fig.2 An example of how to use programming board.

Fig.1 shows a conceptual sketch of the color blocks. In

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this example, forward motion is assigned to the blue block and backward motion is assigned to the red block. When blocks are arranged as shown in Fig.2, vehicle robot performs forward, backward, backward and forward movements. This operation is executed sequentially from left to right on the programming board.

Furthermore, we thought to make the functions in the program using several sensors. For example, we decided to employ the sound sensors and distance sensors. When there is a response to these sensors, subroutine function of the programming board is called.

3. Design and Functions

In order to realize the concepts and ideas, we produced CAROL shown in Fig.3 to 5. Fig.3 shows a color blocks. In this work, the motion of the color blocks is as shown in the Fig.3. Fig.4 shows a programming board. It consists of main function, sensor function (subroutine), transmission switch and sensor change switch. Programming is performed by placing color blocks in order on this board.

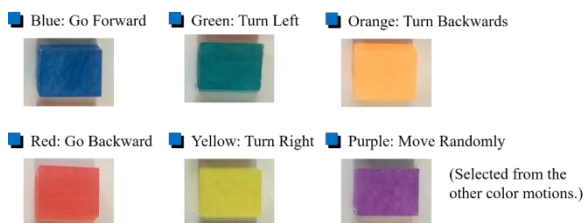


Fig.3 Color Blocks.

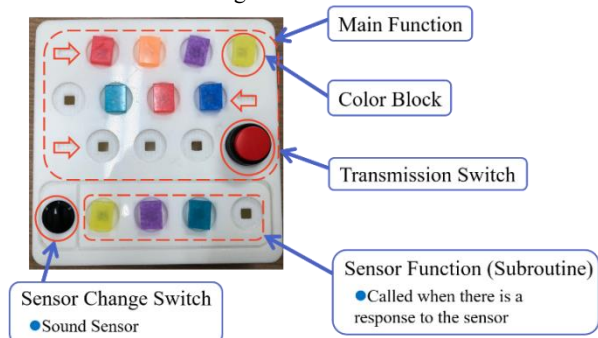


Fig.4 Programming Board.

Fig.5 shows a vehicle robot. It operates based on the signal received from the programming board. For example,

when color blocks are arranged as shown in Fig.4, the motions of Fig.6 are performed.

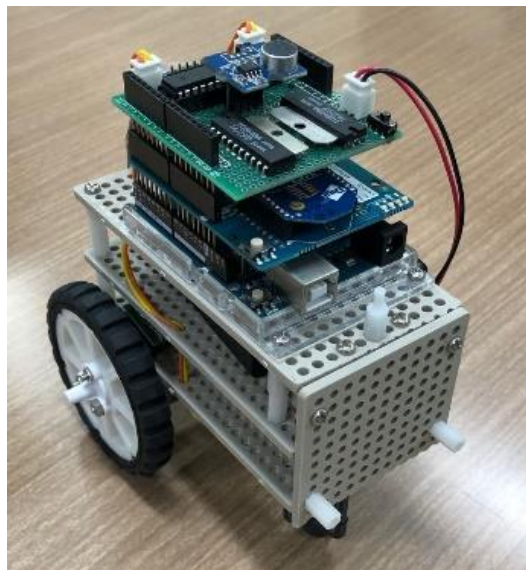


Fig.5 Vehicle Robot.

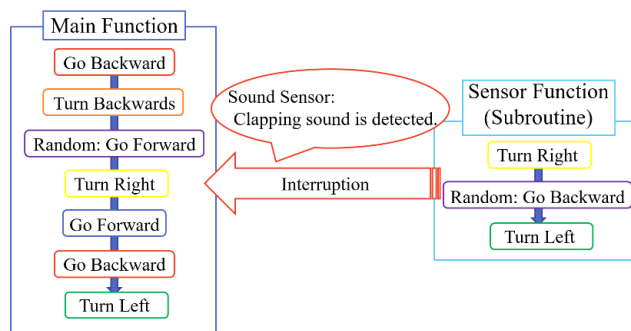


Fig.6 An example of the motions.

4. Problems and Future Work

The subroutine function is only a sound sensor, we would like to add a distance sensor and so on.

We would like to use more kinds of color blocks and create various motion patterns.

We would like to mount LED in the programming board, LED make it easier to understand the current status of the execution and also make learning easier.