Abstract—Open source hardware development platform called Arduino has been widely used due to its various examples for science and engineering education. Many students and beginners who have no experience and knowledge of electronic engineering or programming languages still feel a considerable barrier in using hardware based programming. However, graphic based programming languages such as Scratch 2.0, Ardublock can be an effective examples of engineering education for them. Therefore, we proposed hardware toolkit control system using graphic based programming languages to lower the barriers to entry-level students.

Keywords—Graphic Based Programming languages; Hardware Control System; Education Programming; Arduino;

I. INTRODUCTION

Up to this day, the programming education expands the regular elementary school curriculum using an open hardware. But the programming languages based on text like a C or JAVA is hard to start for students or beginners without electronic engineering and programming knowledge even if the Arduino is one of the commonly used open hardware[1]. For such a problem, the text based programming language was being changed to the graphic based language for the programming education recently[2].

In this paper, the open hardware for programming education was developed for the lowering of barriers to entry of the beginners and students. Besides, hardware control methodology and education curriculum suggested the graphic based programming language.

II. OPEN SOURCE HARDWARE, EDGE

A. Development of Open Source Hardware for a beginner

Arduino is one of the open hardware used the most education[3]. Therefore, development board was designed according to the Arduino’s pin for the convenience of the education and the compatibility of the traditional teaching methods. In the design process, input and output devices like a MIC, CDS, RGB LED, and LED were built into the board. and It was including port for the motor control and analog and digital I/O pin for educational identity. Figure 1 shows board layout about the EDGE proposed in this paper. EDGE means educational deformable graphic ensemble.

Fig. 1. Components of Open Source Hardware Kit, EDGE

B. Graphic Based Programming languages

The graphic based programming is a trend that is used actively. Until now the Ardublock which developed by Media Lab in the MIT and the Entry which developed in Korea made to control Scratch with Arduino are mostly used actively. There are mentioned as the examples. The graphic based programming language’s function was consisted of the visual block[4]. It means that private blocks has to be developed for controlling the hardware. Figure 2 shows private blocks of three other programs for the control of board in this paper.
This paper analyzed the characteristic of the typical graphic based programming languages such as Scratch, Entry, and Ardublock and then was applied with exclusive blocks for the hardware control[5][6][7]. The blocks were divided into controlling the digital I/O device and the analog I/O device.

C. Hardware Control System

The monitoring program and exclusive protocol was developed for the control and the duplex communication of the link between graphic based language program tool and hardware in this paper. The communication of the monitoring program as based on Bluetooth between the program and hardware. Hardware control system was designed for the compatibility of controlling a wide variety of graphic based programming language. The concept of monitoring program is shown in Figure 3.

Developed protocol can be linked with text based programming language of C++, C, JAVA, and etc. Figure 4 shows connection between the device and the hardware protocol’s method of communications.

III. CONCLUSION

This paper presented a new open hardware board for the coding education that remedies the programming education’s shortcomings about the difficult approach and used existing graphic based programming languages for the control. The design of hardware was planned for the educational compatibility with Arduino as well as a wide variety of I/O devices was built into the board for educational identity. A method for controlling the hardware was applied with private blocks of the typical graphic based programming languages such as Scratch, Ardublock, and Entry. Also, the exclusive program tool and protocol were developed for the connection between the device and the hardware so that was controlled with using the blocks of graphic based programming language. And it was confirmed that the programming method became substantially simple compared with previous methods.

REFERENCES